

# ROAD DEVELOPMENT REPORT

**Cutblock: TS1** 

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### Introduction

The following report summarizes the road construction required to build TA568E and associated spurs for cutblock TS1. A detailed road reactivation plan for roads TA560, TA568, and TA568D has been attached to Appendix 8 of this report.

All new roads are marked with printed black on pink "Road Centerline" ribbon. Stations are marked with double pink ribbons and white ribbons and pink metal tags. Culverts are marked with pink "Culvert" ribbon on the high and low sides of right of way.

Detailed road designs have been completed for all of the proposed roads, see Appendix 3. The majority of roads will be toe rock construction, see Table 1 for Construction Summary. All culverts require armoring with coarse rock ballast as seen in the best practice recommendations for road works in a community watershed, see Appendix 6 for further recommendations.



### **Safety Highlights**

### **Steep Road Grades**

Road segments with gradients > 18% have been identified on the Harvest and Road Instruction Plan Maps, they are as follows:

#### TA568

- 0-137m
- 386-433m
- 811-867m
- 1660-1720m

#### **TA568D**

- 0-273m
- 650-708m
- 970-1236 m

#### **TA568E**

- 0-120m

Prior to commencing log hauling operations the contractor must perform a risk assessment of the current conditions and adjust hauling activities to fit the traction conditions. Hauling for TS1 will not be permitted when ice and or snow is on the logging roads leading to or in the given setting (very low traction level). This has been determined using FERRIC step grade decent guidelines. The Ministry of Transportation guidelines are to be followed once hauling on the highway.



### **Rainfall Shutdown**

Cutblock TS1 is within Rainfall Shutdown Area "5"

Shutdown Criteria: Activities must shut down if: The total rainfall reaches 58 mm in 24 hours. Onsite rain gages should be used and monitored daily. Start-Up Criteria: Activities may start-up when: The total rainfall is equal to or less than 30 mm in 24 hours. Refer to the Return to Work guide in the tender document for more information. Adequate recovery time should be given before building operations commence after a shutdown (see Appendix 5 for more details).

### **Falling of Snags and Danger Trees**

There are minimal snags and danger trees within cutblock TS1. The following is to be followed if dealing with snags and danger trees:

In accordance with the Cutting Permit Authority and Work Safe BC Regulations, all snags and danger trees that endanger workers within a distance of 50m outside the cutblock boundaries, or within one and a half tree lengths, (whichever is greater), are approved for falling under these harvest instructions. All danger trees and snags outside the cutblock boundaries that are required to be felled must be recorded on a map and provided to AVCF once falling has been completed. AVCF will be notified immediately if danger trees and/or snags are identified in groups and removal will result in the cut block boundary being substantially impacted. Felled snags and danger trees up to 50m outside of the falling boundary meeting utilization specifications will be recovered. EXCEPTION- Wildlife Tree Patch (WTP) areas and OLD Growth Management Areas (OGMAs) - Snags or danger trees can be felled within a WTP for safety reasons although only the portion of the felled snag or danger tree that falls outside the WTP can be recovered.



#### **Recreational Use**

A small winter cabin has been constructed by a local recreationalist. The cabin is to be protected during all operations and has been identified on the harvest and road construction maps. Spur TA568E3 is to be constructed for the purpose of accessing this trail. Adequate signs are to be posted to inform the public user groups of active blasting, logging and hauling during operations.

### **Road Construction**

All road locations have been chosen to maximize logging deflection and hoe chucking distances. Road building costs will be minimized by utilizing natural benches. Road measure up will be necessary post road construction to ensure the correct ground types and percentage of drilling or blasting is assigned. All roads profiles are to be followed to ensure step grades are minimized, see Appendix 3 for profiles.

There are no sections of full bench end-haul. A portion of heavy rock exists on TA568E for 19m. Excess material is to be side casted by the road building hoe behind or ahead of the road prism from station 0+760. There is no shortage of suitable material for road building. The majority of roads have been deemed to be toe rock. Multiple quarry locations exist and are to be identified by the road building contractor during road construction.

All stream crossing for the proposed roads are to be armored with coarse rock material to minimize sedimentation. This is to maintain the natural drainage pattern of the streams and ensure sedimentation is minimized within the Sproat Lake Watershed.



**Table 1: Road Construction Summary** 

Road	Start	End	Total (m)	Construction	Comments
	Station	Station	, ,	Trans	
TA568D1	0.000	Station 0+013	13	Туре	Cut and Fill Construction
TASOSDI	0+000		_	MR	Cut and Fill Construction
	0+013	0+023	10	HR	Cut and Fill Construction
	0+023	0+052	29	MR	Cut and Fill Construction
	0+052	0+078	26	TR	Cut and Fill Construction
	0+078	0+087	9	MR	Cut and Fill Construction
TA568D2	0+000	0+030	30	TR	Cut and Fill Construction
	0+030	0+040	10	MR	Cut and Fill Construction
	0+040	0+187	147	TR	Cut and Fill Construction
TA568D2A	0+000	0+031	31	TR	Cut and Fill Construction
TA568E	0+000	0+379	379	TR	Cut and Fill Construction
	0+379	0+445	66	LB	Local Material for Ballast
	0+445	0+532	87	TR	Cut and Fill Construction
	0+532	0+552	20	MR	Cut and Fill Construction
	0+552	0+733	181	TR	Cut and Fill Construction
	0+733	0+751	18	MR	Cut and Fill Construction
	0+751	0+770	19	HR	Cut and Fill Construction
					Side cast material ahead
					and behind of station
					0+760 to avoid end-haul
	0+770	0+811	41	TR	Cut and Fill Construction
	0+811	0+849	38	LB	Local Material for Ballast
TA568E1	0+000	0+115	115	TR	Cut and Fill Construction
TA568E2	0+000	0+047	47	TR	Cut and Fill Construction
	0+047	0+091	44	LB	Local Material for Ballast
	0+091	0+106	15	TR	Cut and Fill Construction
	0+106	0+121	15	MR	Cut and Fill Construction
	0+121	0+159	38	TR	Cut and Fill Construction
TA568E3	0+000	0+075	75	TR	Cut and Fill Construction
Total LB					148m
Total TR					1212m
Total MR					114m
Total HR					29m
	•				
Total Road					1503m



**Table 2: Culvert Summary** 

Road Name	Station	Riparian Class	Culvert/WBC Size (mm)
TA568E	0+076	NCD	600
TA568E	0+149	NCD	600
TA568E	0+197	NCD	600
TA568E	0+316	S4	600
TA568E	0+350	S4	600
TA568E	0+527	NCD	600
TA568E	0+552	NCD	600
TA568E	0+597	-	600
TA568E	0+652	-	600
TA568E	0+811	NCD	600
TA568D1	0+040	-	600
TA568D2	0+030	S4	600
TA568E1	0+062	-	600
TA568E2	0+047	-	600
Total CMP's			14



## **Riparian Management Area Infringements**

**Table 3: RMA Infringements** 

Case	Road	Sections	Stream and	RMA	Infringement
			Stream Class		
1	TA568D2	0+030	Stream 7 (S4)	30	Crossing
2	TA568D2	0+095	Stream 8 (S4)	30	Crossing
3	TA568E1	0+115	Stream 3 (S4)	30	10m
4	TA568E	0+316	Stream 5 (S4)	30	Crossing
6	TA568E	0+350	Stream 5A (S4)	30	Crossing

### **RMA Infringement Rationale**

Case 3, RMA infringement on TA568E1 cannot be avoided as the end landing to this spur is necessary to yard the wood surrounding FC 18 to FC 20. All other RMA infringements are stream crossings that cannot be avoided or would be impractical to avoid.

# **Required Permits and Notifications**

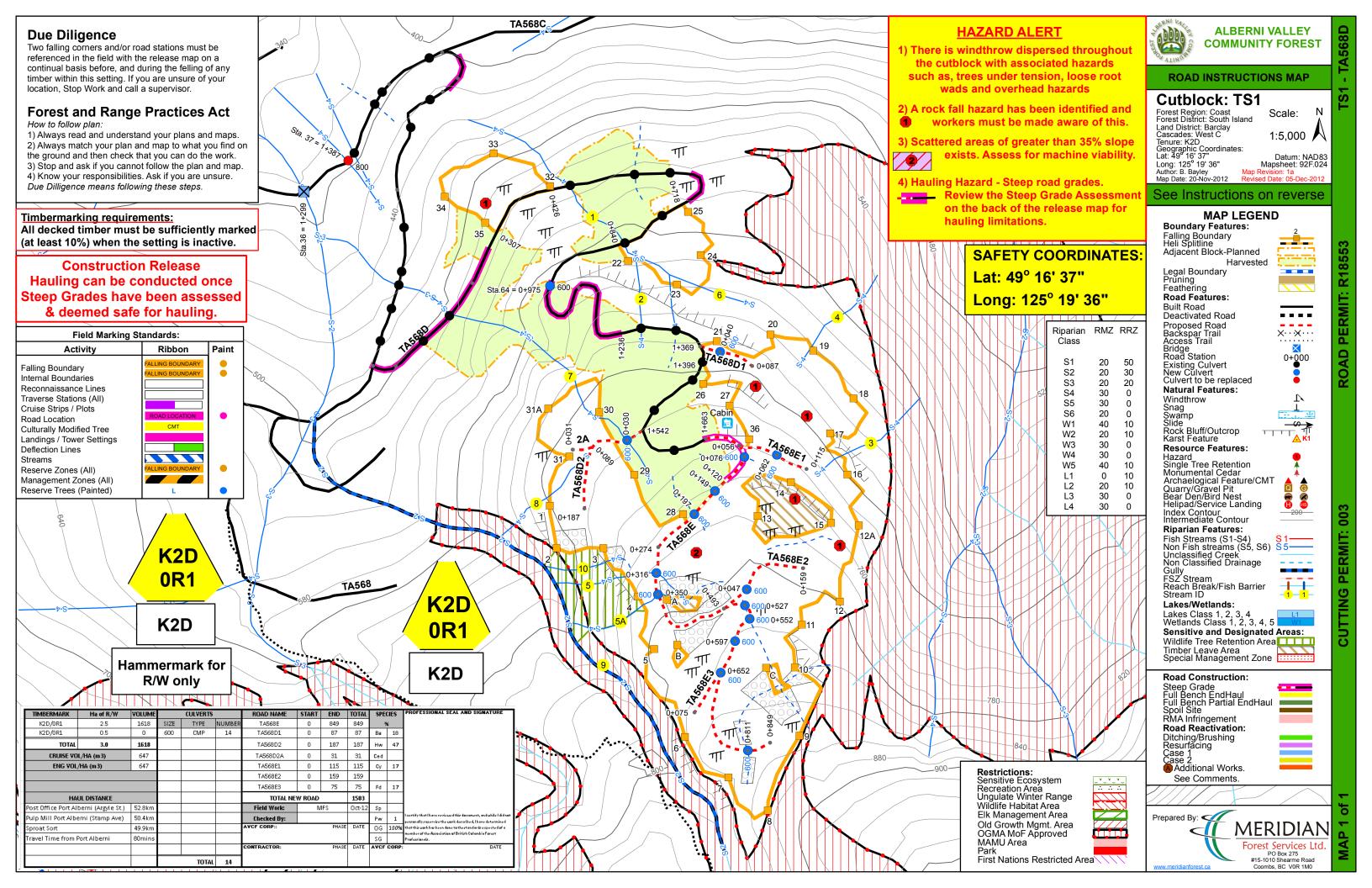
Affected water licensees or affected water purveyors must be notified at least 48 hours before commencement of road construction, re-activation or deactivation in a community watershed.

All of the roads described in this report are under permit at this time. Road Permit number R18553 amendment #4 has been approved, see Appendix 7.



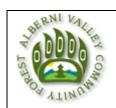
**Appendices** 

**Appendix 1: AVCF CP 003 Road Instruction Map** 





# **Appendix 2: Road Instructions**



### **ROAD INSTRUCTIONS – OPENING#TS1**

**ACCESS ROAD: TA568D CUTTING PERMIT: NO. 3** TIMBERMARK: K2D 0R1

### RAINFALL SHUTDOWN CRITERIA

Cutblock TS1 is within Rainfall Shutdown Area "5

Shutdown Criteria: Activities must shut down if: The total rainfall reaches 58 mm in 24 hours. Onsite rain gages should be used and monitored daily.

Start-Up Criteria: Activities may start-up when: The total rainfall is equal to or less than 30 mm in 24 hours. Refer to the Return to work guide in the tender document for more information.

Adequate recovery time should be given before building operations commence after a shutdown.

ROAD NAME	START STATION	END STATION	TYPE OF WORK/COMMENTS
TA568E	0+000	0+849	New Construction
TA568D1	0+000	0+087	New Construction
TA568D2	0+000	0+187	New Construction
TA568D2A	0+000	0+031	New Construction
TA568E1	0+000	0+115	New Construction
TA568E2	0+000	0+159	New Construction
TA568E3	0+000	0+075	New Construction

ROAD NAME	STATION	RIPARIAN ID	RIPARIAN CLASS	DEBRIS TRANSPORT POTENTIAL	CULVERT/ BRIDGE SIZE	DESIGNED PEAK FLOW	Special instructions for operations within or adjacent to RMA
TA568E	0+076	-	NCD	Low	600	Q-100	
TA568E	0+149	-	NCD	Low	600	Q-100	
TA568E	0+197	-	NCD	Low	600	Q-100	
TA568E	0+316	5	S4	low	600	Q-100	
TA568E	0+350	5A	S4	Low	600	Q-100	
TA568E	0+527	-	NCD	Low	600	Q-100	
TA568E	0+552	-	NCD	Low	600	Q-100	OPENING TS1 LIES WITHIN THE SPROAT LAKE COMMUNITY
TA568E	0+597	-	-	-	600	X-Drain	WATERSHED. ALL STREAM CROSSINGS ARE TO BE ARMORED WITH
TA568E	0+652	-	-	-	600	X-Drain	COARSE ROCK MATERIAL TO MINIMIZE THE TRANSPORT OF FINES
TA568E	0+811	-	NCD	Low	600	Q-100	DOWN STREAM.
TA568D1	0+040	-	-	-	600	X-Drain	
TA568D2	0+030	7	S4	Low	600	Q-100	
TA568E1	0+062	-	-	-	600	X-Drain	
TA568E2	0+047	-	-	=	600	X-Drain	

#### **GENERAL INSTRUCTIONS**

All employees, supervisors and contractors associated with these Harvest Instructions shall be fully advised of their contents and requirements.

All litter including cable, oil buckets, grease tubes, newspapers, and lunch garbage is to be placed in appropriate garbage containers and removed from the site for proper disposal concurrent with all operations.

### ADDITIONAL INSTRUCTIONS

- [1] R/W clearing widths to be 20 meters unless a larger width is required for safety or otherwise prescribed.
- [2] Prior approval must be obtained from AVCF if falling beyond right-of-way clearing is required for spoil sites or quarries.
- [3] Proposed cross-drain culvert locations are approximate. Site specific installation to within ±25m is acceptable. Installation beyond this distance constitutes a 'change of plan' and requires prior approval from AVCF.
- [4] Equipment must not be fuelled or serviced within the riparian management area (RMA) of a stream, lake or wetland. Do not park any equipment within an RMA overnight. [5] Affected water licensees or affected water purveyors must be notified at least 48 hours before commencement of road construction, re-activation or deactivation in a community watershed.

invasive species during early establishment. Grass seed exposed soil on or adjacent to roads, trails, and landing sites as soon as possible following harvest.

- RMA distances: STREAMS: S1 70 meters, S2 50 meters, S3 40 meters, S4 30 meters, S5 30 meters, S6 20 meters, LAKES: L1 10 meters, L3 30 meters, WETLANDS: W1, W5 50 meters, W3 30 meters.
- [6] Avoid quarry locations within the RMA of any stream; where avoidance is not practical, quarries may be located within the RMA of a S6 stream if no impacts (i.e. increased sedimentation) will occur to the stream. All other
- streams (i.e. S1 to S5) require prior approval from AVCF before a quarry may be located within its RMA. Do not deck or process wood within RMA's. [7] Cultural Resources: If an unidentified cultural heritage resource is encountered within the cutblock during any harvesting phase, operations will cease in the immediate vicinity of the feature and AVCF shall be notified
- [8] Wildlife Resources: In the event any unidentified bear dens or raptor nest trees are encountered during falling, but before the tree has been cut, the faller will go elsewhere for the day and report this potential wildlife tree to a AVCF Supervisor. Fallers are not to return to the vicinity of the wildlife tree until notification from AVCF has been given. If the discovery of a bear den or potential nest tree occurs while the tree is being felled, the decision to proceed is at the faller's discretion in regards to safety and Worksafe BC requirements. If it is unsafe to leave the tree partially cut, the faller will complete falling the tree and report the incident to AVCF.
- [9] Fish Streams: Due to the close proximity of fish streams immediately downstream of the cutblock, ensure a high level of diligence is maintained regarding stream bank protection, in-stream woody debris disturbance and protection of stream banks at designated crossings.
- [10] Invasive Plants: Broom occurs along sections of TA568. Follow FSP measures for invasive plants. Cut and remove plants in association with road reactivation, clean machinery as required. Monitor and treat broom and other

### **FALLING of SNAGS and DANGER TREES**

In accordance with the Cutting Permit Authority and WorkSafe BC Regulations, all snags and danger trees that endanger workers within a distance of 50m outside the cutblock boundaries, or within one and a half tree lengths, (whichever is greater), are approved for falling under these harvest instructions. All danger trees and snags outside the cutblock boundaries that are required to be felled must be recorded on a map and provided to AVCF once falling has been completed. AVCF will be notified immediately if danger trees and/or snags are identified in groups and removal will result in the cutblock boundary being substantially impacted. Felled snags and danger trees up to 50m outside of the falling boundary meeting utilization specifications will be recovered.

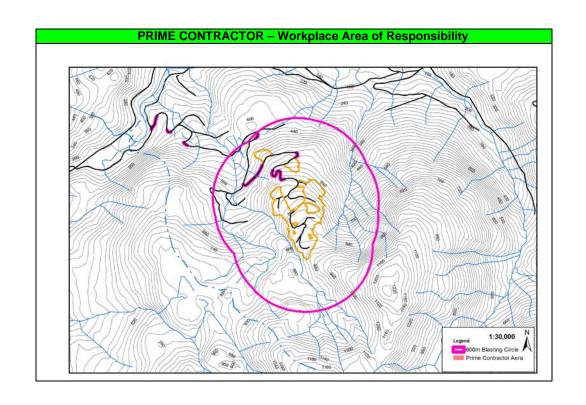
EXCEPTION- Wildlife Tree Patch (WTP) areas and OLD Growth Management Areas (OGMAs) - Snags or danger trees can be felled within a WTP or OGMA for safety reasons although only the portion of the felled snag or danger tree that falls outside the WTP can be recovered.

### **CUTBLOCK BOUNDARY TREATMENTS**

All marked boundary trees except snags and danger trees must remain standing during and after the completion of harvesting. Trees located along and adjacent to the cutblock edges (i.e. within the harvest boundary) that must be felled outside the harvest area must be recovered unless a physical, safety or environmental issue exists (e.g. deep gullies, steep breaks, fish creek, etc.). Trees that cannot be recovered may be left standing, if they are safe to leave, as wildlife trees. These trees must be recorded on a map and provided to AVCF once falling is complete; If unsure how to proceed, contact AVCF.

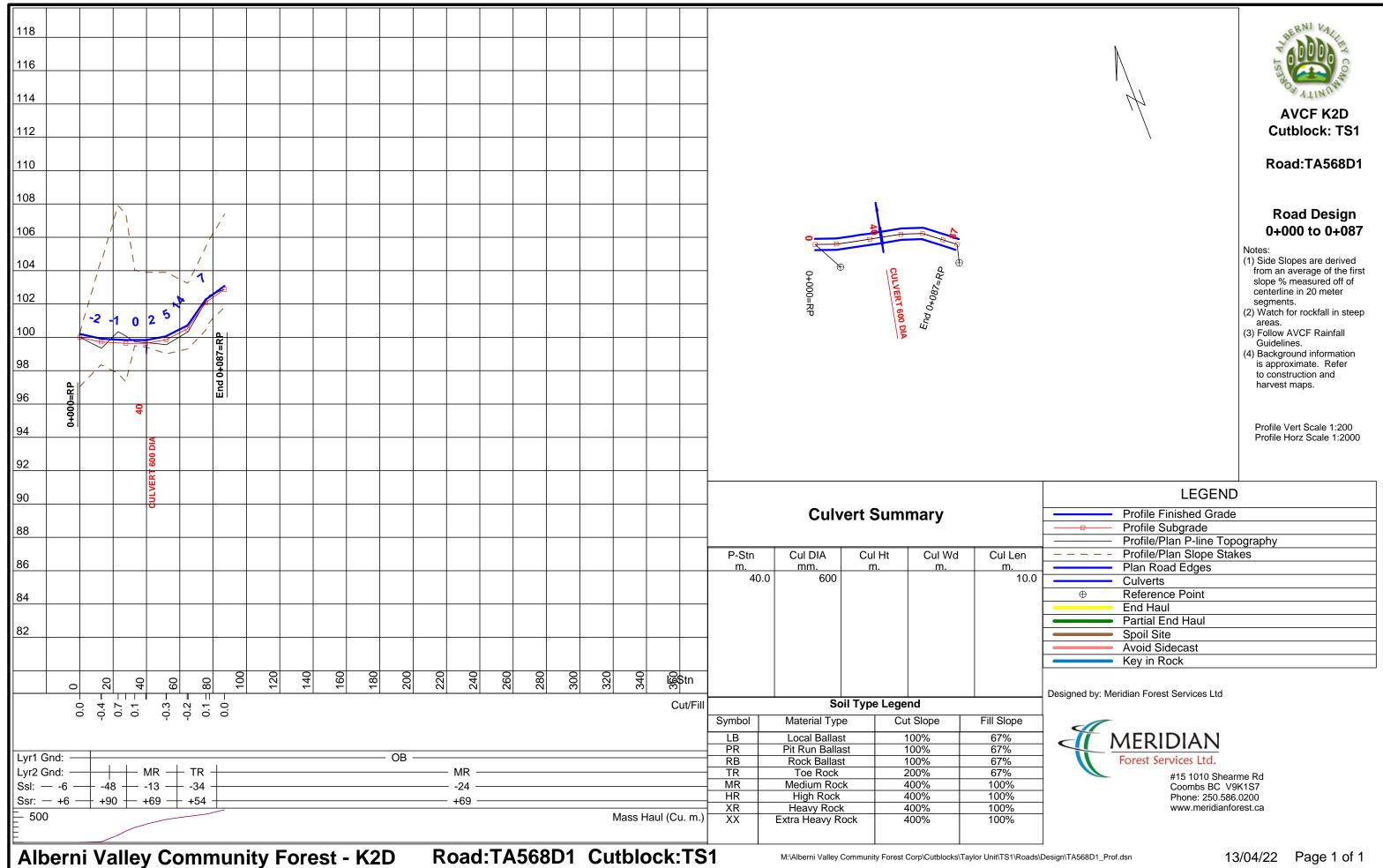
Road and in-block safety hazards associated with block TS1 have been identified on the harvest and road instruction maps. In the event additional in-block safety hazards (temporary or permanent) are encountered or develop during road construction or harvesting phases, a plan must be developed to address the hazard. Any identified permanent hazards must be reported back to AVCF (using Hazard/Issue Report Form).

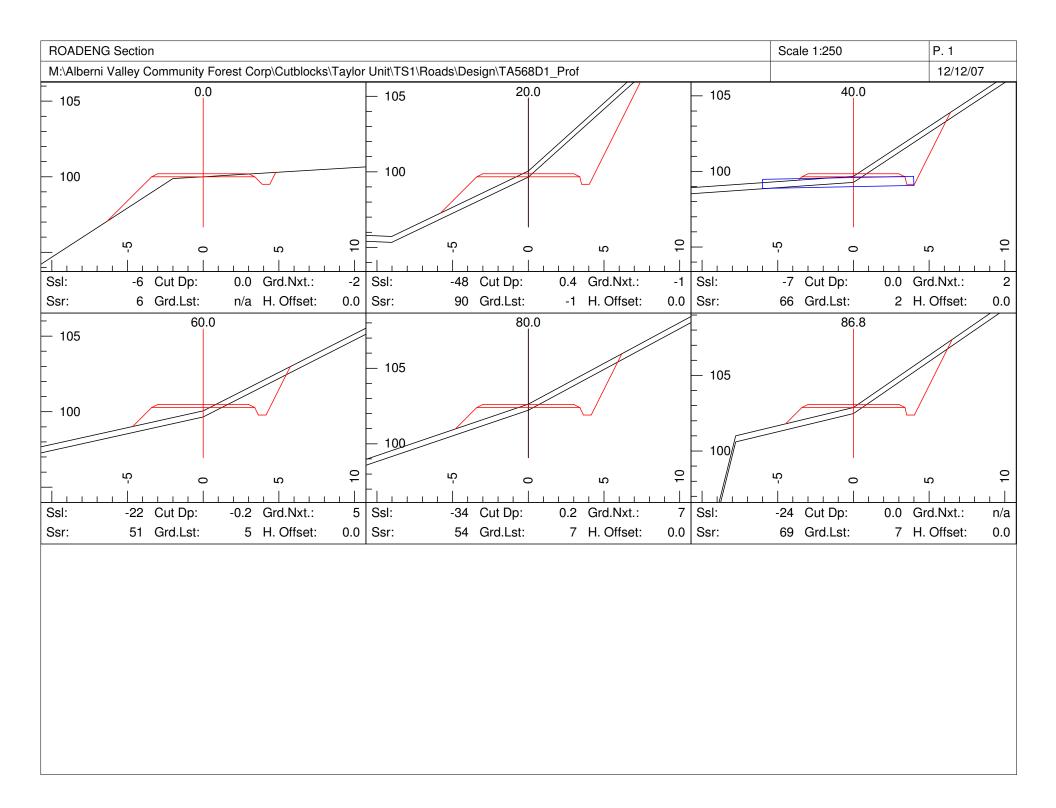
Road segments with gradients > 18% have been identified on the Harvest and Road instruction Plan Map en route to the setting. Prior to commencing log hauling operations the contractor must perform a risk assessment of the current conditions and adjust hauling activities to suit the traction conditions. Hauling for TS1 will not be permitted when ice and or snow is on the logging roads leading to or in the given setting (very low traction level). This has been determined using FERRIC step grade decent guidelines. The Ministry of Transportation guidelines are to be followed once on the highway.



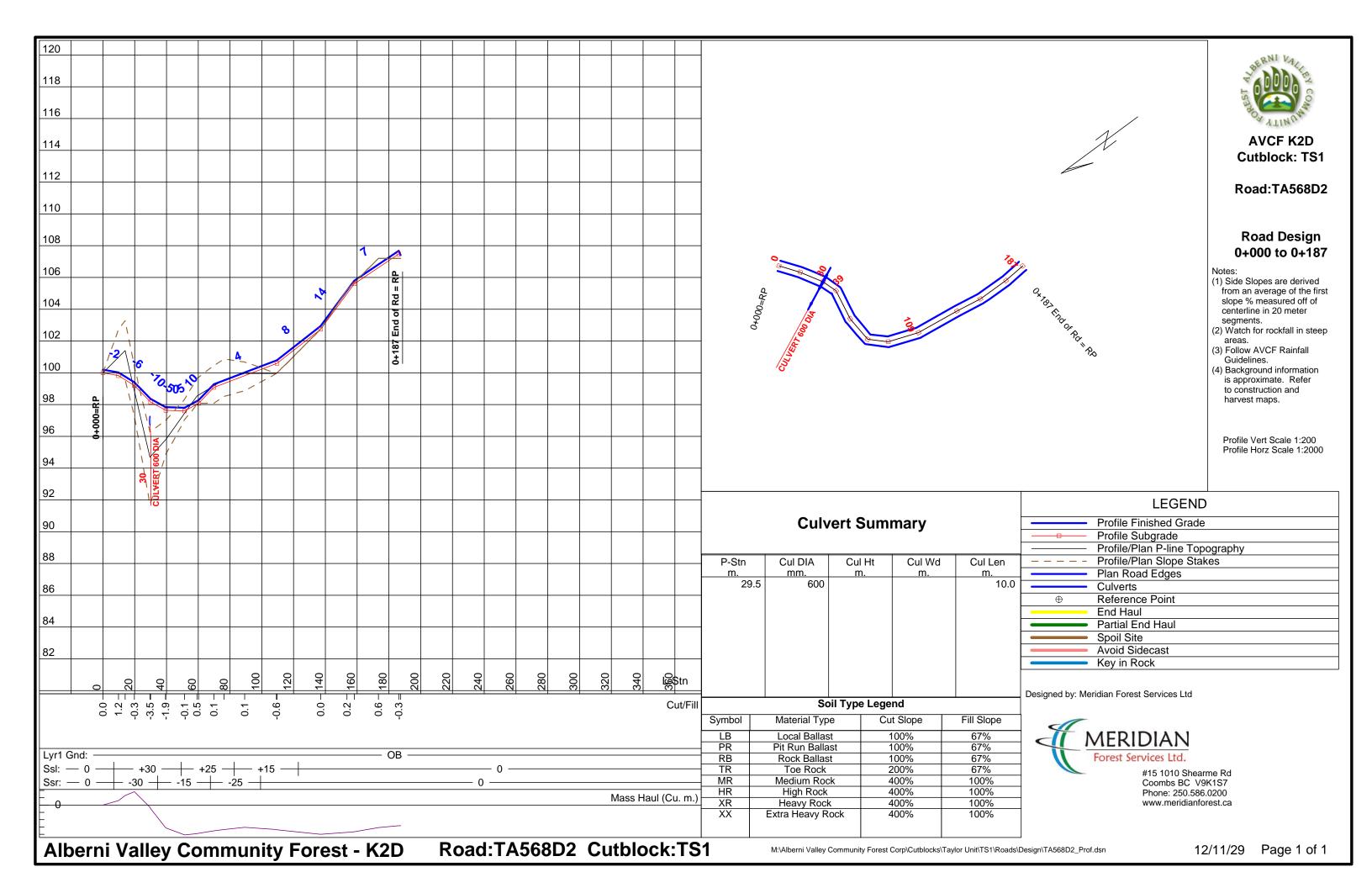


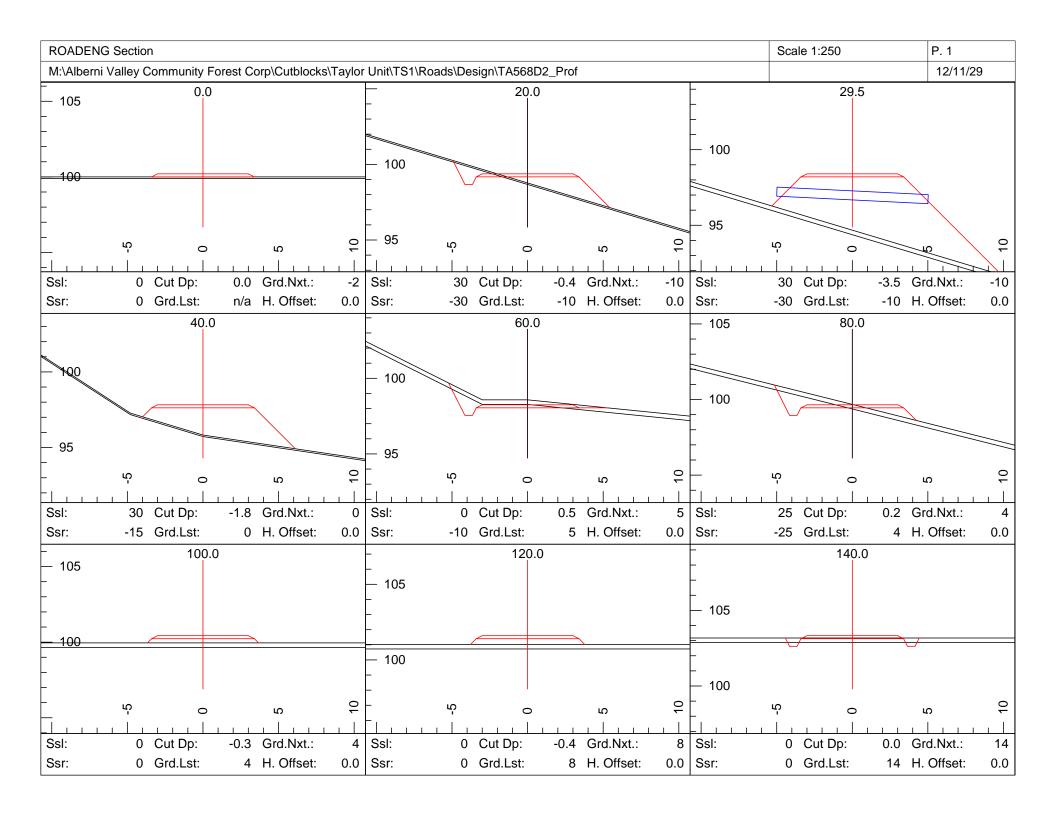
**Appendix 3: Road Profiles** 

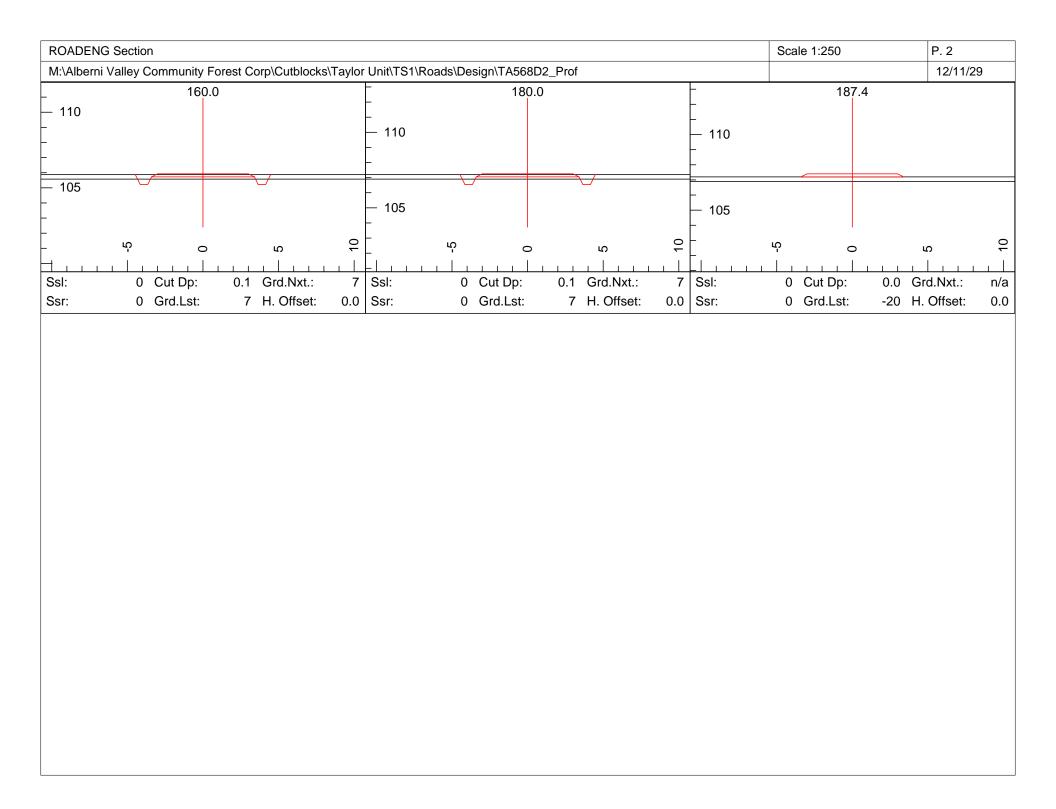




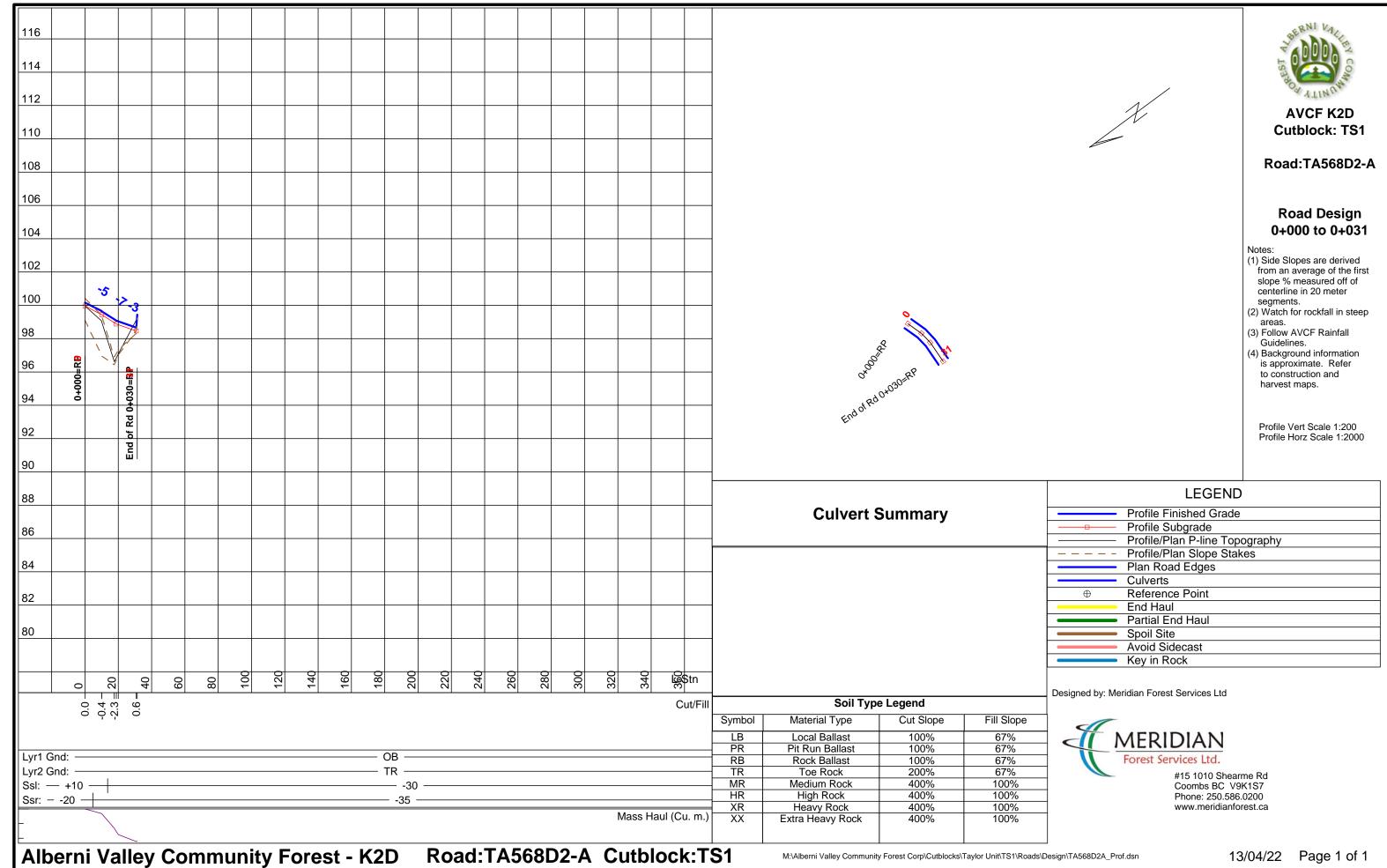
NG Data									P. 1
ni Valley Community F	Forest Corp\Cutblocks\Taylor	Unit\TS1\Roads\Design\TA56	8D1_Prof						13/04/22
P-Stn	Lyr1 Gnd	SsI %	Ssr %	Bank Ht. L	Bank Ht. R m.	SG Cut V. Cu. m.	SG Fill V. Cu. m.	Mass H. Cu. m.	Lyr2 Gnd
m. 0.0	BR	-6	6	m.		71.3	37 O	0.0 11.0 140.2 292.5 360.1 451.0 510.1 569.0	
13.0	OB OB	-6 -21 -48 -7	6 78 90 66	-0.2	4.0	154.6 171.2	25.5	11.0 140.2	
33.0	OB	-7	66	0.2	3.6	171.2	18.8	292.5	
40.0 52.0	OB OB	-7 -13	66 69		3.5	69.1 105.9	15.1	360.1 451.0	
65.0	OB	-22	51		2.0	90.1 91.8 87.2	30.9	510.1	
0.0 13.0 23.0 33.0 40.0 52.0 65.0 77.8 86.8	BR OB	-7 -13 -22 -34 -24	66 69 51 54 69		4.0 7.3 3.6 3.5 3.2 2.0 2.9 3.7	87.2	37.0 25.5 18.8 1.5 15.1 30.9 32.9 15.8	569.0 640.4	
		724			3.1			040.4	

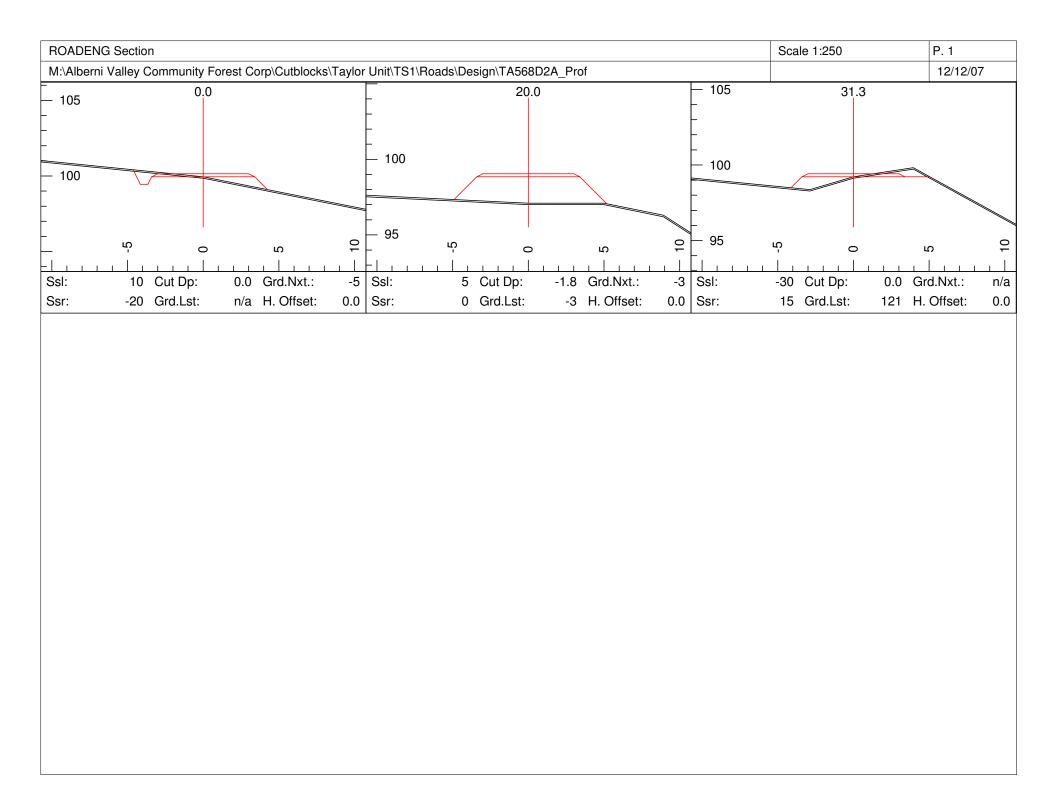




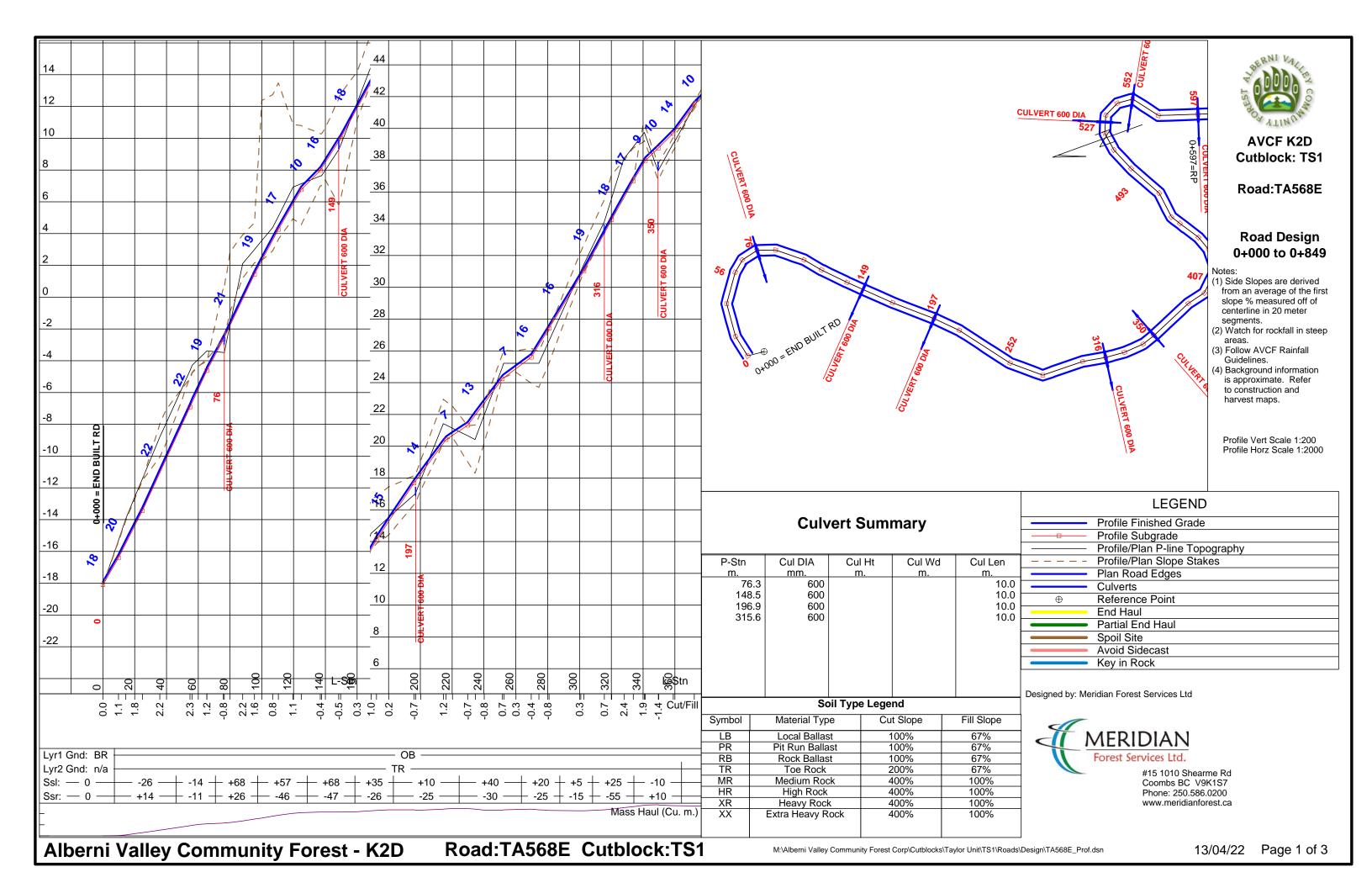


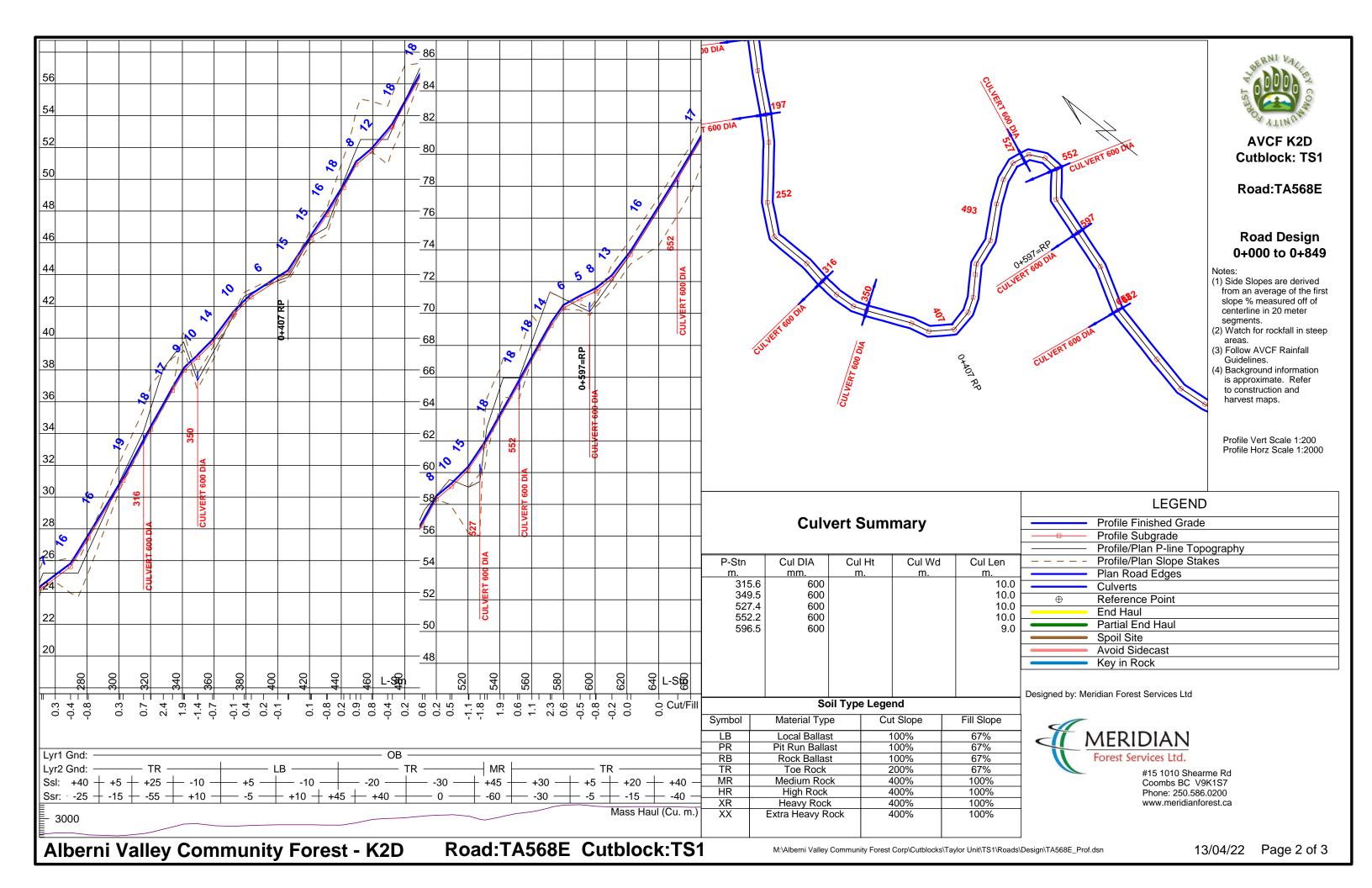
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P-Stn	Lyr1 Gnd	Lyr2 Gnd		Ssr	Bank Ht. L	Bank Ht. R	SG Cut V.	SG Fill V.	Cul DIA	Mass H
m.			Ssl %	Ssr %	m.	m.	Cu. m.	SG Fill V. Cu. m.	mm.	Cu. m
0.0 13.9 29.5 39.5 59.3 76.3 89.3 109.3 137.0 153.6 173.4	OB O	TR TR TR TR MR TR	30 30 30 30	0 -30 -30 -15 -10 -25 -25	3.4	-0.2	128.0	0.0 232.9 279.8 107.7 15.1 15.1 48.1 61.7		
29.5	OB	TR	30	-30 -30	3.4	-0.2	75.6 0.0 27.3 73.2	232.9	600	
39.5	OB	MR	30	-15			0.0	279.8		
59.3	OB	TR	0 25 15	-10	1.0 1.0	-0.2	73.2	107.7		
76.3	OB	TR	25	-25	1.0		48.7 14.2 0.0 29.1 67.1 32.4	15.1		
109.3	OB OB	TR	0	-25 0	0.3		14.2	48.1		
137.0	OB	TR	0	0			0.0	61.7		
153.6	OB	TR	0	0	-0.3 0.1	-0.3 0.1	29.1 67.1	0.0 0.0		
173.4	OB	TR   TR	0	0	0.1	0.1	32.4	7.1		

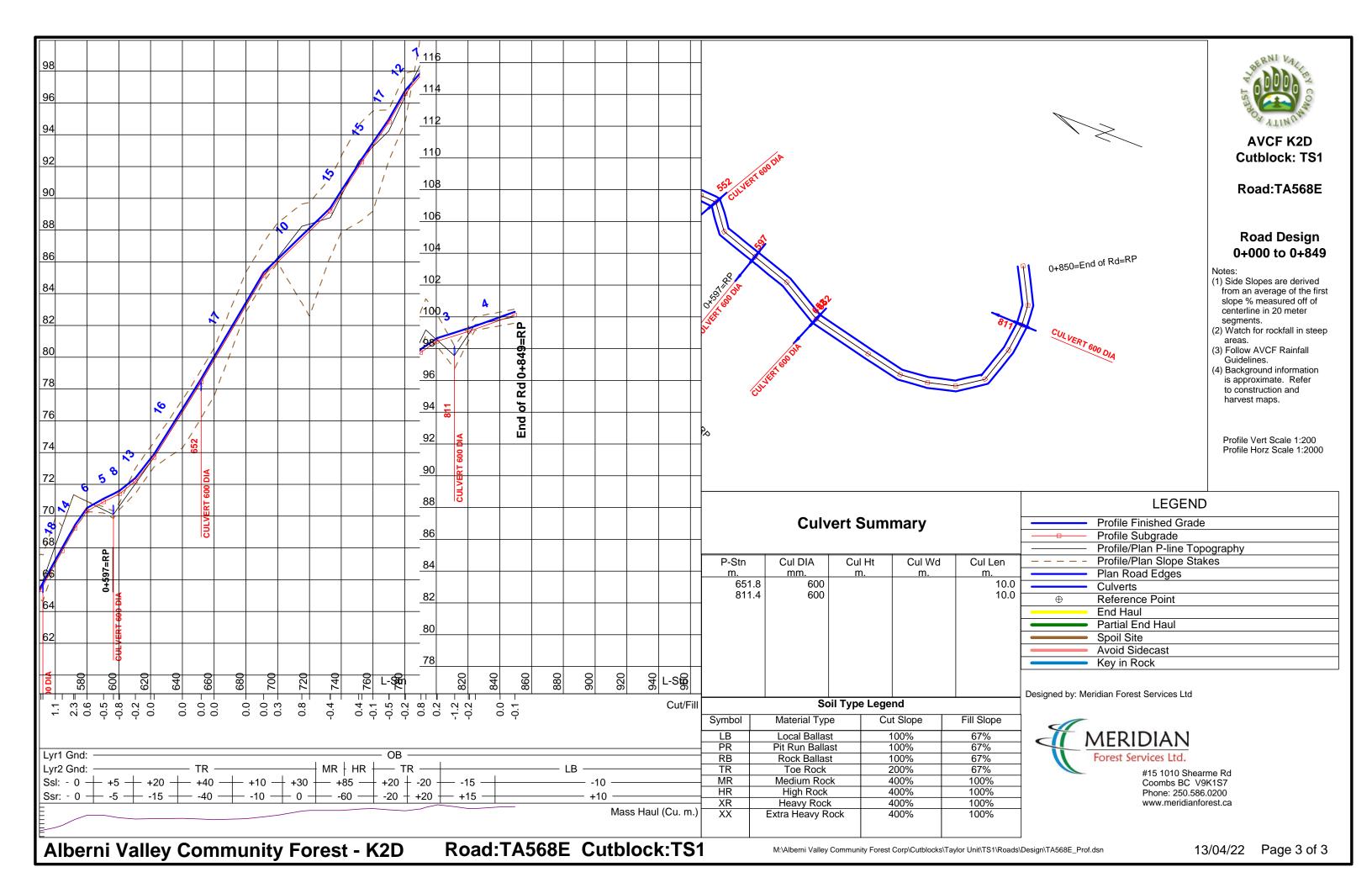


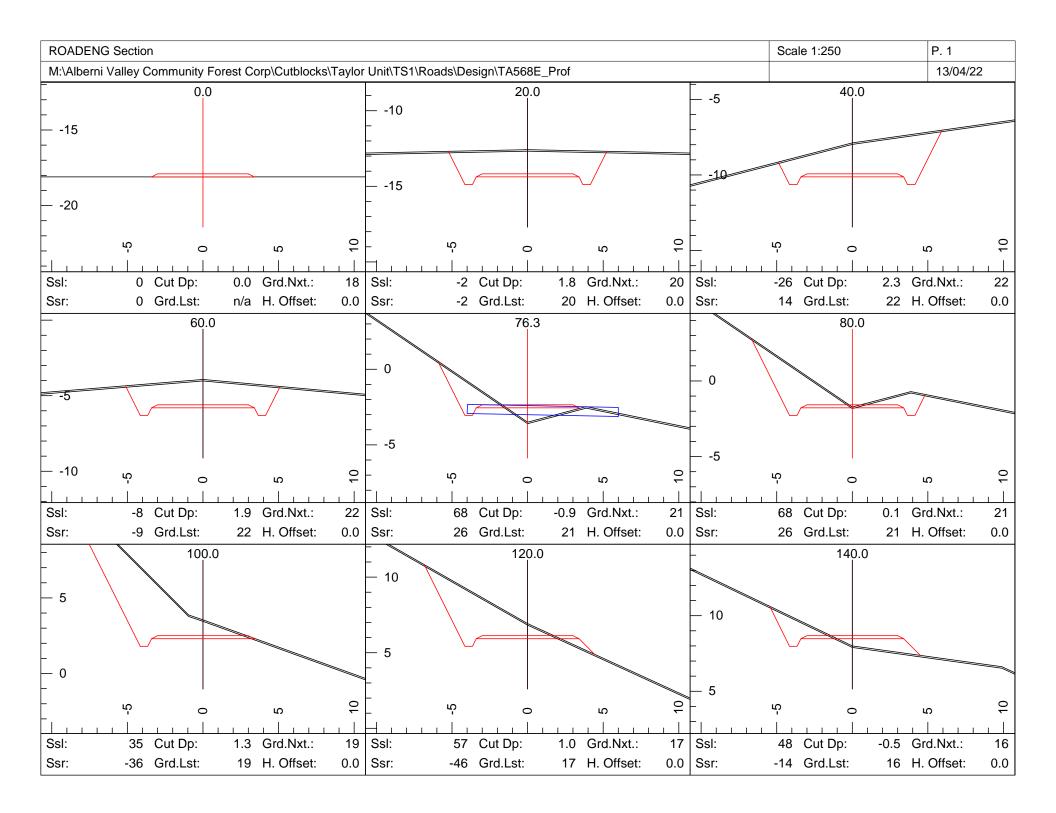


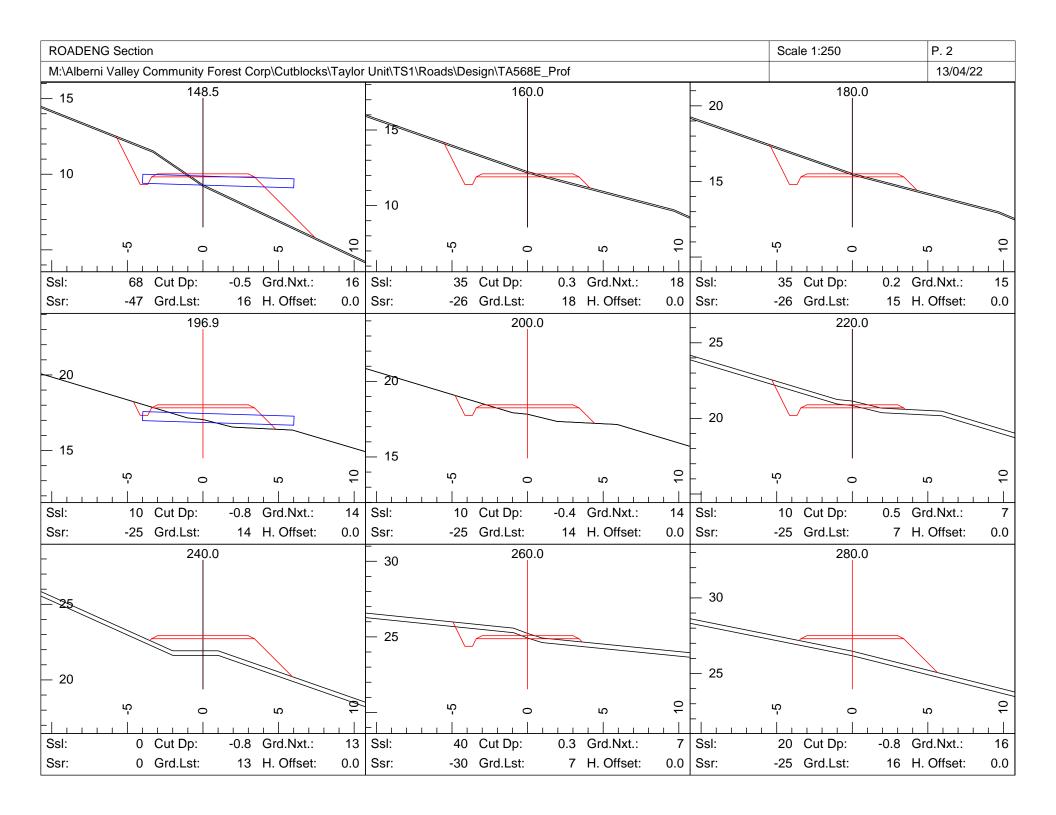
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	y Forest Corp\Cutblocks\1	Taylor Unit\TS1\Roads\Des	ign\TA568D2A_Prof							13/04
P-Stn	Lyr1 Gnd	Lyr2 Gnd		Ssr	Bank Ht. L	Bank Ht. R	SG Cut V.	SG Fill V.	Cul DIA	
m			SsI %	Ssr %	m.	m.	SG Cut V. Cu. m.	SG Fill V. Cu. m.	Cul DIA mm.	Mass H Cu. m.
0.0	OB OB	TR	10 10	-20 -35	0.2		6.9	37.4		
0.0 10.0 17.6 31.3	OB OB OB OB	TR TR TR TR	5	-20 -35 0 15			6.9 0.0 33.5	37.4 102.2 121.1		Ou. III.
31.3	OB	TR	5 -30	15		-0.2	33.3	121.1		
										1

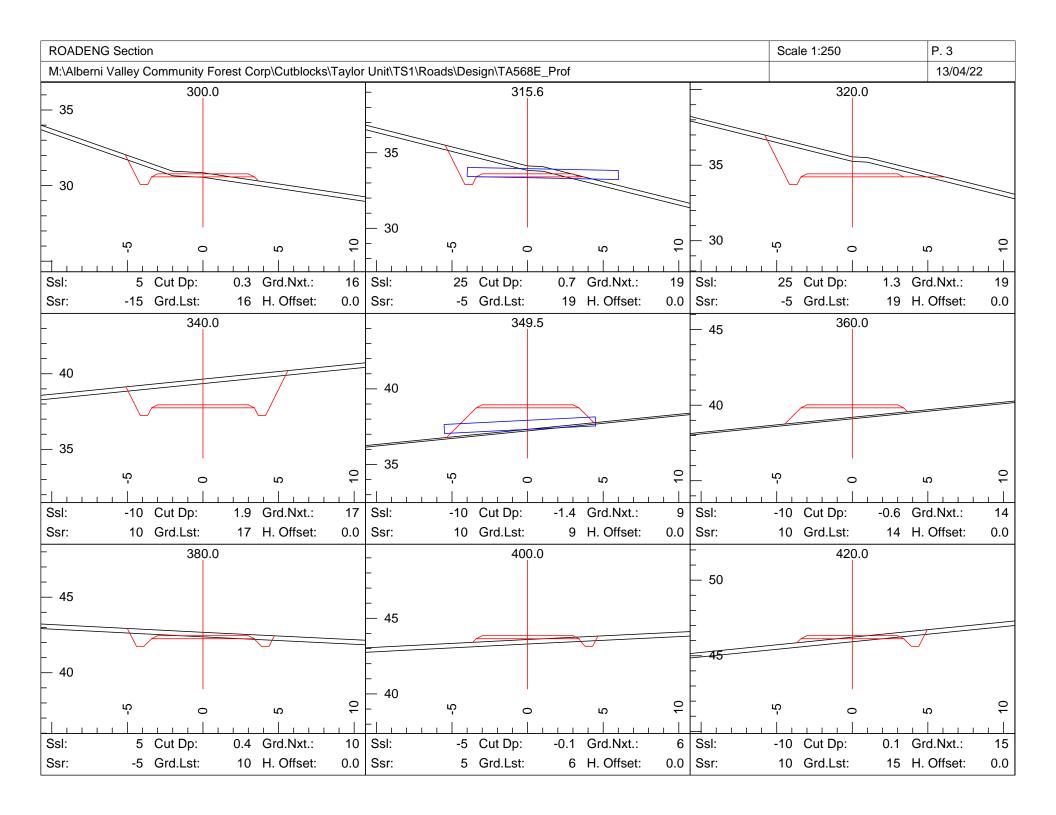


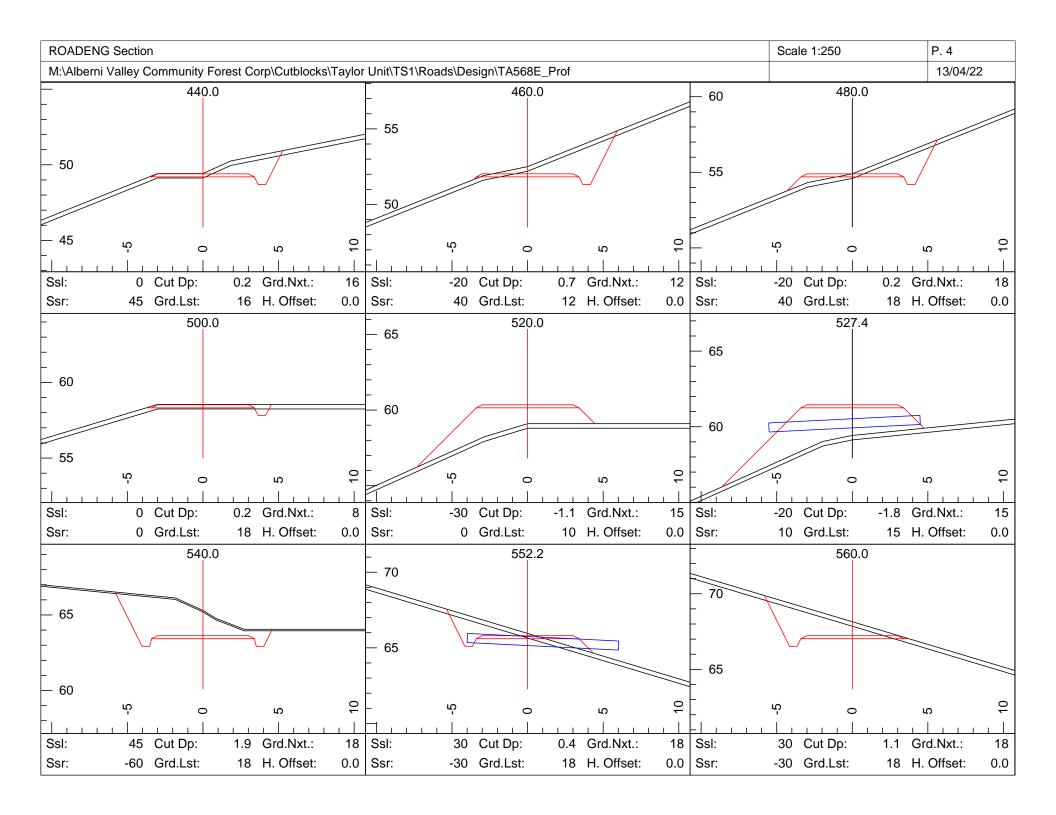


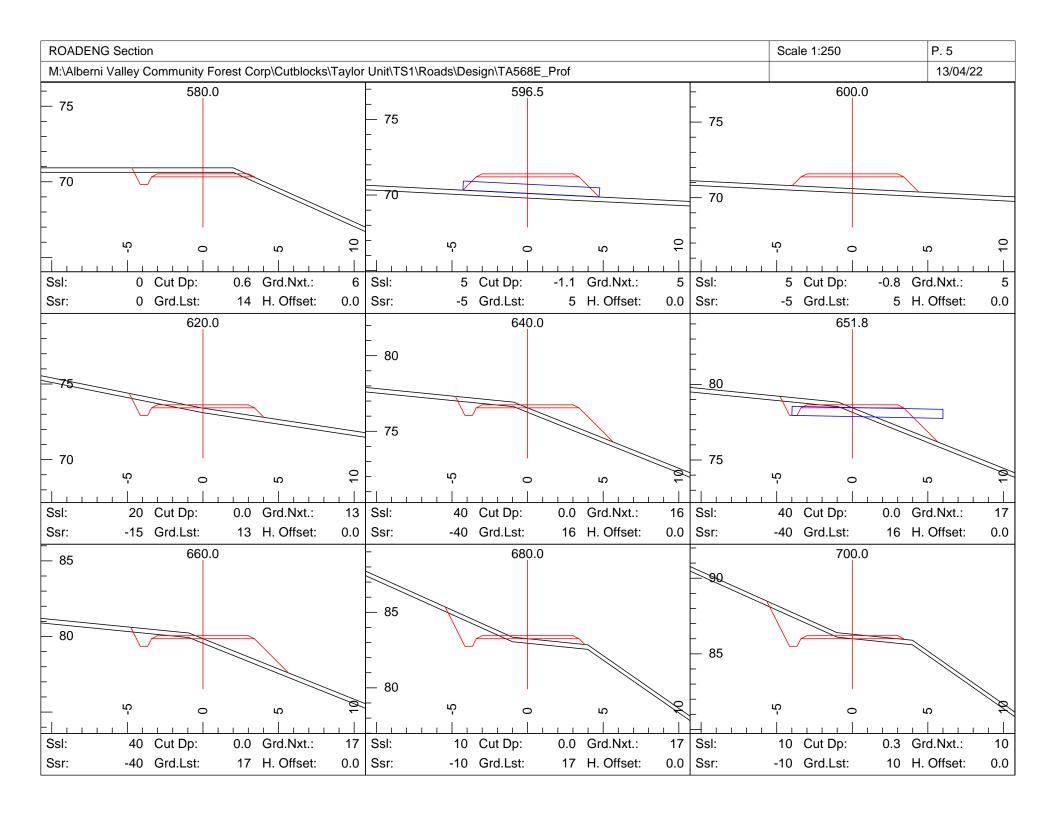


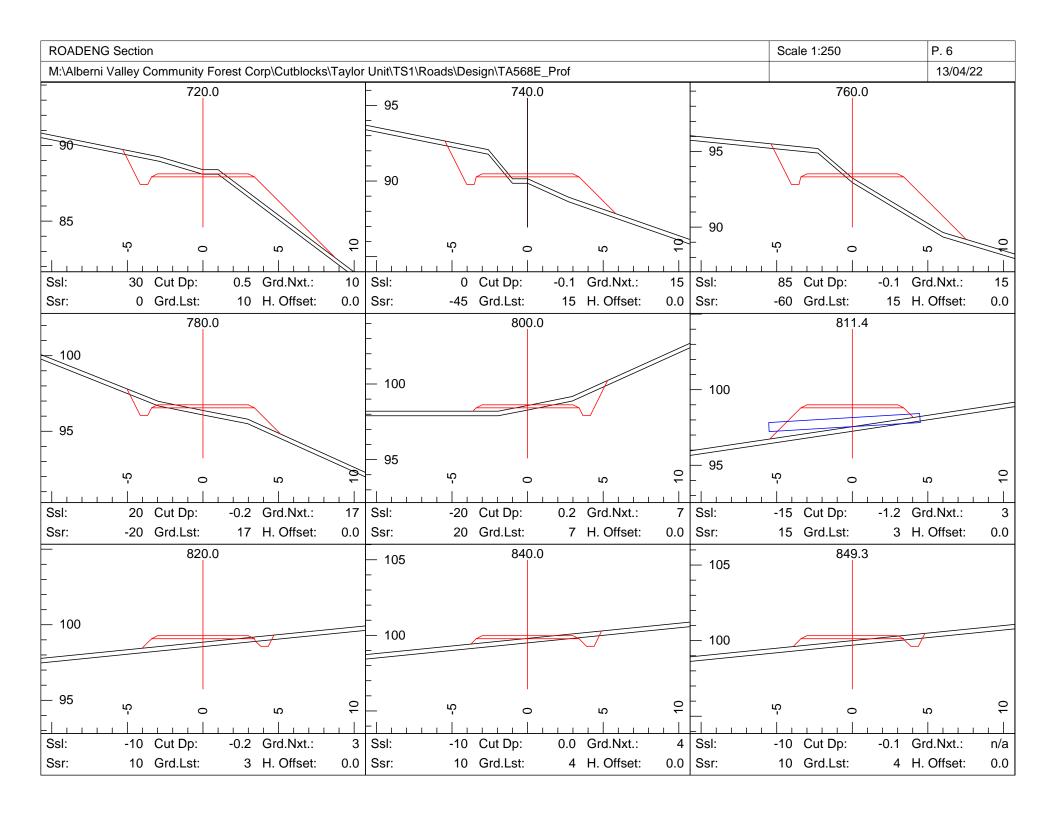




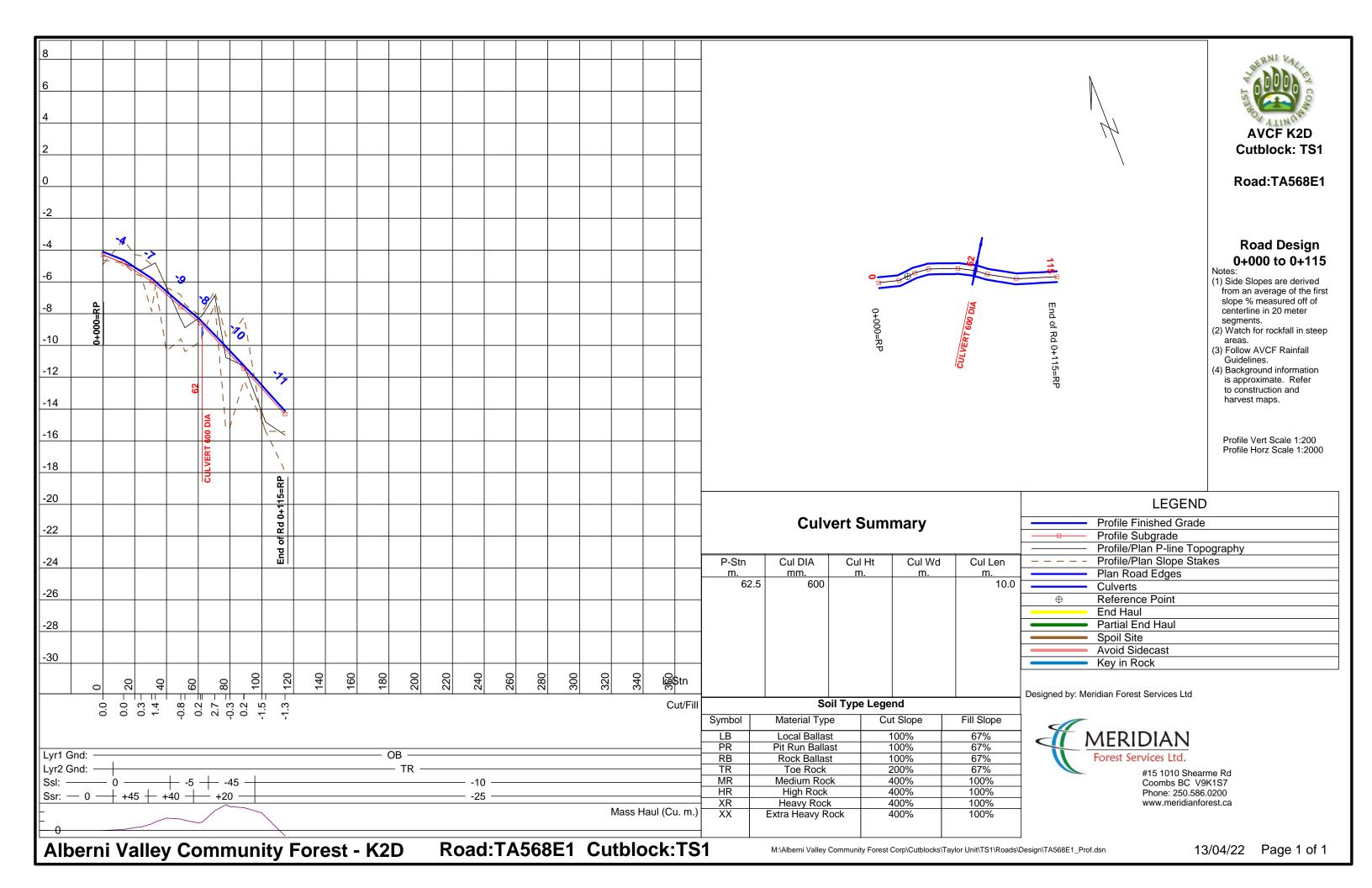


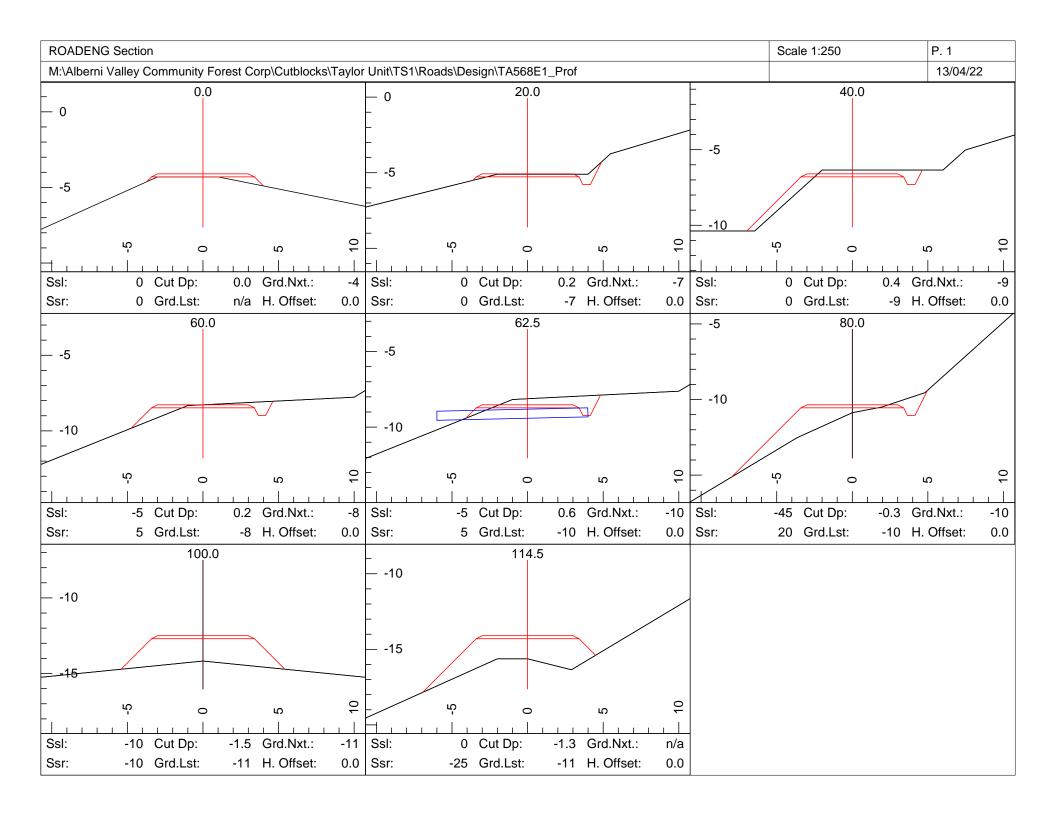




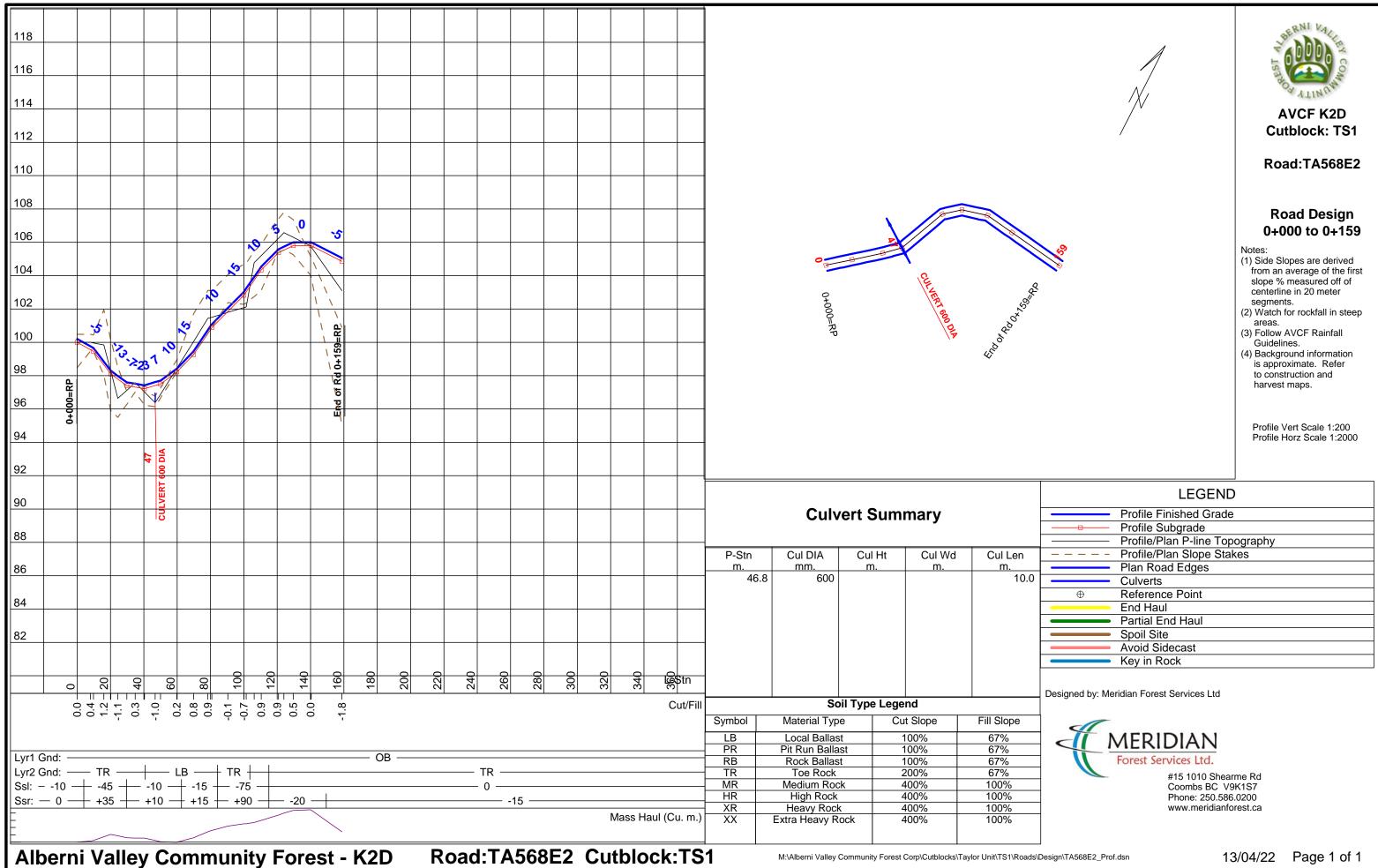


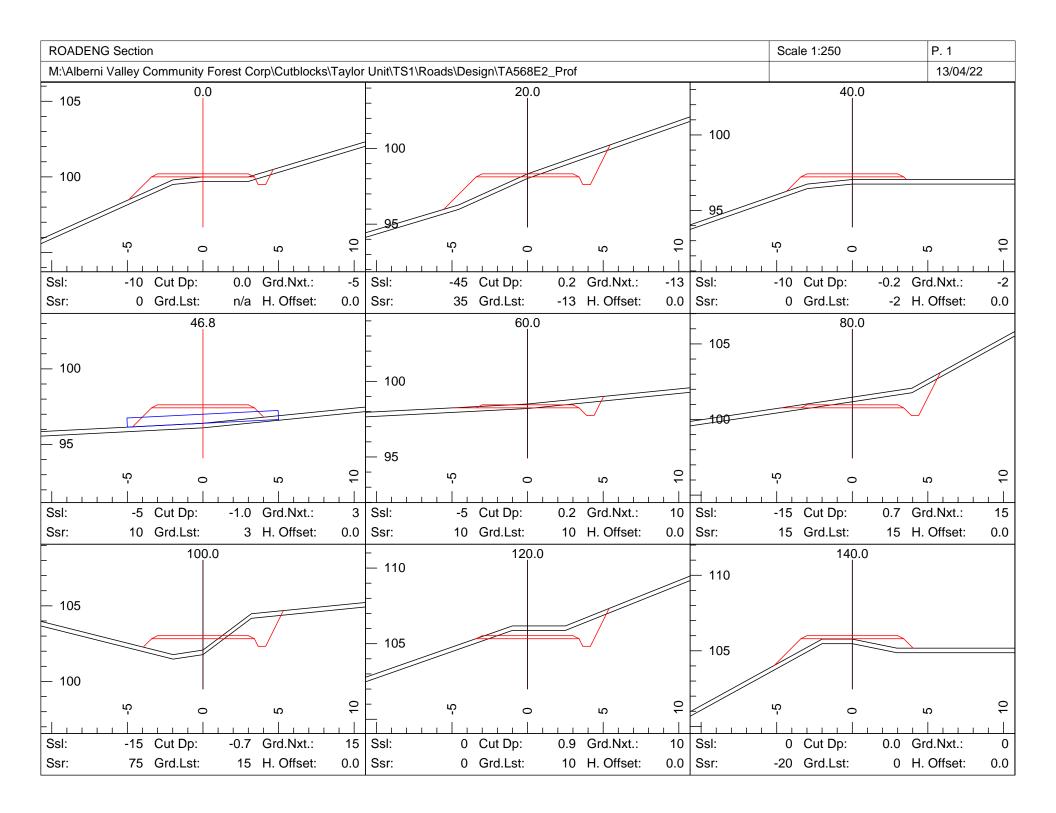
P-Stn	LOIGS! COID/CHIDIOCKS/	Taylor Unit\TS1\Roads\Desi	gn\TA568E Prof							13/04/2
<b></b>	Lyr1 Gnd	Lyr2 Gnd	Ssl %	Ssr %	Bank Ht. L	Bank Ht. R	SG Cut V.	SG Fill V. Cu. m.	Cul DIA	Mass H. Cu. m.
m. 0.0	BR		76	0	m.	m.	Cu. m.		mm.	Cu. III.
14.4	BR OB	TR	-2	-2	1.1	1.1	112.2	0.0		
35.8 56.3	ОВ	TR	-26	14	0.7	2.8 1.5	410.1 442.2	0.0 0.0		
56.3	ОВ	TR	-8	-9	1.6	1.5	139.1	0.0		
65.3	ОВ	TR	-14	-11	0.3	0.4	81.7	10.7		
76.3	OB	TR TR	68	26	2.8		192.4	4.4	600	
88.0	OB	TR	28 35	-18	3.7	1.0	438.9	1.5		
106.9	OB	TR	35	-36	8.7	-0.2	258.6	5.3		
119.6	OB	TR TR TR	57	-46	4.7	-0.2	164.1	43.7		
137.6	OB	IR	48	-14	1.9		53.2 158.9	43.7 59.2 59.2	000	
148.5	OB OB	TR TR	68 35	-47 -26	2.4	-0.2	158.9	59.2	600	
168.9 196.9	OB	TR		-20	2.8	-0.2	146.1 116.2	67.2 42.4	600	
214.4	OB OB	TR	10 10	-25 -25	0.2 2.2	-0.2	116.2	42.4	600	
234.4	OB OB	IR TD	10	-25 0	2.2	-0.2	79.6	86.8		
252.4	OB	TR TR	40	-30	1.2	-0.2	52.2	112.3		
274.4	OB	TR	20	-25	1.2	-0.2	82.9	57.4		
300.8	OB	TR	5	-15	1.0	-0.2	38.2	131.8		
315.6	OB	TR TR	25	-5	1.6	-0.2	94.0 184.0	0.4	600	
327.9	OB	TR	5	-55	2.0	-0.2	184.0	0.0	000	
340.8	OB OB	TR TR	-10	10	0.9	-0.2 -0.2 1.9	223.2	0.0		
349.5	OB	TR	-10	10	0.0	1.0	76.4	48.2 121.3	600	
349.5 379.0	OB OB	LB	5	-5	0.2	-0.3	24.8 37.7	121.3	000	
391.0	OB	LB	5	-5	-0.1	0.0	37.7	0.0		
407.0	OB	LB	-5	5			14.4	10.5		
420.8	OB OB	LB LB	-10	10		0.1	15.0	15.9		
430.8	OB	LB	-10	25		-0.1	13.9	26.1		
445.3	ОВ	LB TR	0	25 45	-0.2	-0.1 1.7	77.9	22.3		
452.1	ОВ	TR	-20	40	-0.2	3.3	88.8	0.0		
469.1	ОВ	TR	-20 -20	40		1.1	169.2	18.4		
492.5	ОВ	TR	0	0	-0.2	0.2 0.0	132.6 55.8	26.5 2.8		
508.4	ОВ	TR	-30	0	-0.2 -0.2	0.0	33.0	84.0		
520.4	ОВ	TR	-30	0			16.3	127.5		:
527.4	OB OB	TR	-20	10			0.0 18.9	42.0	600	:
531.8	ОВ	MR MR	45	-60	2.4	-0.2 0.6	161.8	4.7		
542.2	ОВ	MR	45	-60	3.1	0.6	133.4	3.1		:
552.2	OB	TR TR	30	-30	1.4	-0.2	251.6	4.2	600	
571.5	OB	TR	0	0	1.8	-0.2	135.3	56.6		;
596.5	OB OB	TR TR	5	-5			35.2	56.6 80.7	600	
622.2	OB	IR	20	-15	0.4		75.8	88.8	000	
651.8 691.2	OB OB	TR TR	40	-40 -10	0.2 1.5		136.6	83.7	600	
691.2	OB	IR	10	-10	1.5	0.0	160.9	23.5		
715.1	OB	TR	30	0	1.6	-0.2	114.0	96.1		
733.1	OB	MR HR	0	-45	1.5	0.0	127.8	99.8		
750.9	OB	HR	85	-60	2.1	-0.2	120.9	134.3		
769.9	OB	TR	20	-20	0.2	2.6	112.9	54.3		
793.4 911.4	OB	IK	-20 15	15	0.3	2.0	81.8	63.1	600	
824 3	OB	I B	-10	10		0.3	11.5	55.7	800	
840.3	OB	LB	-10	10		-0.3	52.6	12.3		
793.4 811.4 824.3 849.3	OB OB OB OB	TR LB LB LB	-20 -15 -10 -10	20 15 10 10	0.3	2.6 0.3 -0.2	112.9 81.8 11.5 52.6	54.3 63.1 55.7 12.3	600	



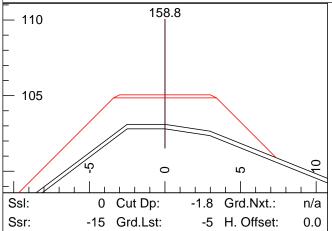


NG Data										P. 1
		Taylor Unit\TS1\Roads\Des								13/04
P-Stn m.	Lyr1 Gnd	Lyr2 Gnd	Ssl %	Ssr %	Bank Ht. L m.	Bank Ht. R m.	SG Cut V. Cu. m.	SG Fill V. Cu. m.	Cul DIA mm.	Mass H Cu. m.
0.0	ОВ		0	0 45			25.9		11111.	Ou. 111.
13.0	OB OB	TR	0	45 0	-0.2	1.3	29.4 57.9	0.4		
33.0	OB	TR	0	0	-0.2 -0.2 -0.2	1.2	57.9	0.9		
51.5	OB	TR	-5	40 5		0.2	72.9 18.8	5.1 0.4 0.9 57.1 40.3	600	
13.0 24.0 33.0 51.5 62.5 70.4 77.4 88.9 102.4 114.5	OB O	TR T	-5 -10	5	-0.2 1.9	1.3 1.0 1.2 0.2 0.6 2.8 0.7 3.0	126.3 99.8 35.6 30.1 0.0	1.4 34.1 65.9 131.3 206.5	600	
77.4	OB	TR	-10 -45	20 20 -10 -25		0.7	99.8 35.6	65.9		
88.9 102.4	OB	TR	-20 -10	-10	-0.2	3.0	30.1	131.3		
114.3	OB		0	-23						

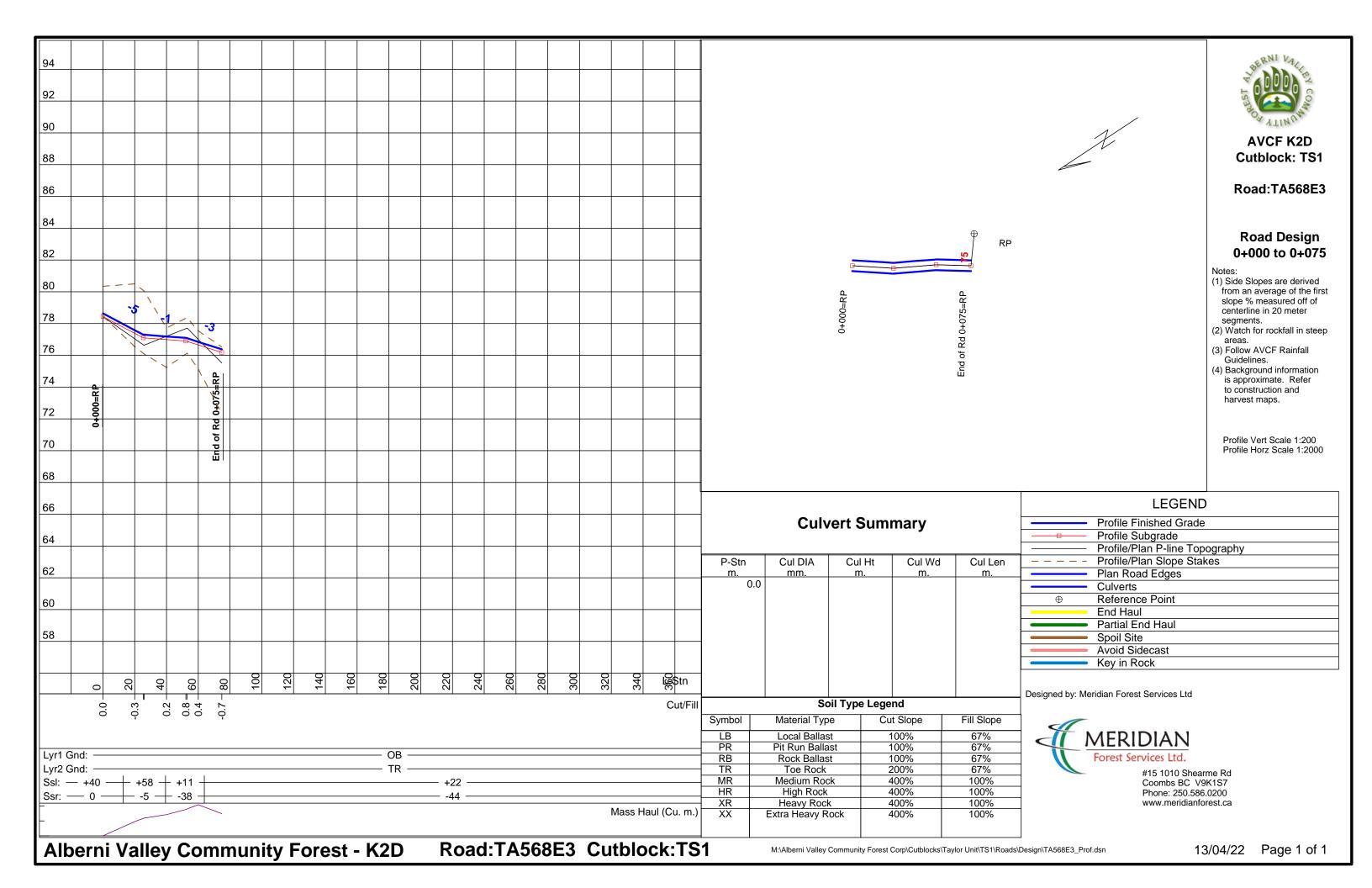


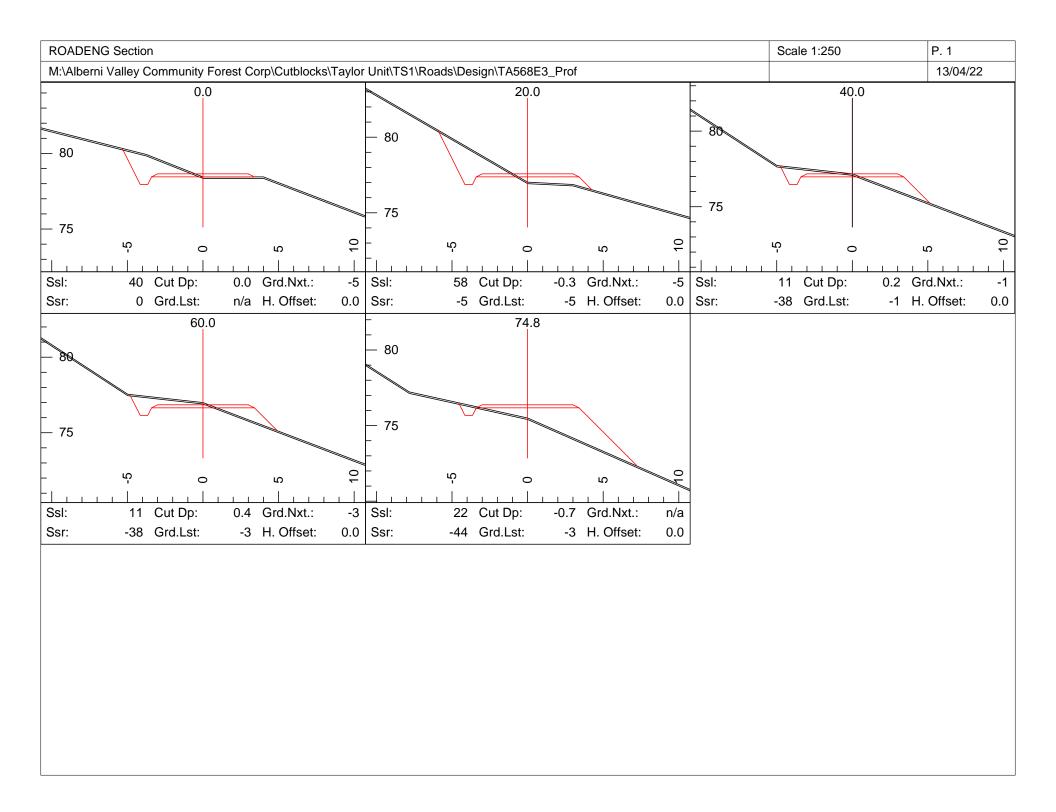


ROADENG Section	Scale 1:250	P. 2	l
M:\Alberni Valley Community Forest Corp\Cutblocks\Taylor Unit\TS1\Roads\Design\TA568E2_Prof		13/04/22	l



<b>ROADENG Dat</b>	а									P. 1
M:\Alberni Valle	y Community Fo	rest Corp\Cutblo	cks\Taylor Unit\	ΓS1\Roads\Desig	n\TA568E2_Pro	f				13/04/22
P-Stn m.	Lyr1 Gnd	Lyr2 Gnd	Ssl %	Ssr %	Bank Ht. L m.	Bank Ht. R m.	SG Cut V. Cu. m.	SG Fill V. Cu. m.	Cul DIA mm.	Mass H. Cu. m.
0.0	ОВ	TR	-10	0	111.	-0.1			111111.	0.0
8.0	OB	TR	-15	10	-0.2	0.4	19.1	6.3		12.8
9.9	OB	TR	-15	10	-0.2	0.5	8.2	0.0		21.0
16.0	OB	TR	-45	35	-0.2	2.7	53.0	0.7		73.3
20.1	OB	TR	-45	35		1.5	37.4	7.8		102.9
24.4	OB	TR TR	-20	0		0.1	13.5	28.5		102.9 87.8
29.7	OB	TR I	-10	0			2.1	33.5		56.4
34.9	OB	TR TR	-10	0		-0.2	4.8 4.8	8.0		53.2
40.3	OB	TR	-10	0			0.0	6.1 32.4		51.8
46.8	OB	LB LB LB	-5	10			0.0	18.7	600	19.4
49.9	OB	LB	-5 -5	10			15.9	21.5		0.7
59.8	ОВ	LB	-5	10		0.2	60.8	0.0		-4.9
69.8	ОВ	LB LB	-15	15	-0.2	1.8	83.0	0.0		56.0
78.4	OB	LB	-15	15	-0.2	2.0	20.4	0.0		139.0
80.8	ОВ	LB TR	-15	15	-0.2	1.6	61.0	1.3		159.4
90.4	ОВ	TR	0	0	0.0	1.7	50.3	18.1		219.1
99.9	OB OB	TR TR	-15 -15	75 75		1.4	6.9	5.7		251.2
101.4	OB	TR	-15	75		1.2	31.5	13.0		252.4
106.1	ОВ	MR	-75	90	-0.2 -0.2	1.2 1.0	35.3	6.0		270.9
110.3	ОВ	MR	-75	90	-0.2	1.0	79.6	8.3		300.2
120.7	ОВ	TR	0	0	-0.2	1.4 1.7	27.5	0.0		371.5
124.0	ОВ	TR	0	0	-0.2	1./	38.0	0.7		399.1
129.5	ОВ	TR	0	0	-0.2	1.0	23.9	16.0		436.3
140.0	ОВ	TR TR	0	-20			0.0	1.0		444.3
140.3 158.8	OB OB	TR	0	-20 -15			0.0	303.2		443.2 140.0





NG Data										P. 1
		Taylor Unit\TS1\Roads\Des								13/04
P-Stn	Lyr1 Gnd	Lyr2 Gnd	SsI %	Ssr %	Bank Ht. L	Bank Ht. R	SG Cut V. Cu. m.	SG Fill V. Cu. m.	Cul DIA	Mass H Cu. m.
m. 0.0	ОВ	TR	70 40	70	m. 1.6	m.	Cu. III.		mm.	Cu. III.
0.0 25.9 52.9 74.8	OB OB OB OB	TR TR TR TR TR	40 58 11 22	0 -5 -38 -44	1.6 2.6 1.2 0.0	-0.2	148.6 115.5 64.4	30.5 53.4 95.7		
74.8	OB	TR	22	-44	0.0	-0.2	64.4	95.7		
										1



### **TS1 Road Development Report**

**Appendix 4: Culvert List Discharge Calculations** 

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#### **Culvert List Discharge Calculation**

Block #: TS1

	Stream # &	average	average HWM				Round Pipe		Wood Br	ox Culvert	Wood Culvert
Road Name and	Class	width at	depth at	Q2	Q10	Q100	Culvert	Round Pipe Culvert		talled	Installed
Station	or X-drain	crossing	crossing	Α	Ac	Ac	Installed	Installed End Area	HEIGHT	LENGTH	End Area
(m)		(r	n)	(m2)	(m2)	(m2)	(mm)	(m2)	(m)	(m)	(m2)
TA568E											
0+076	NCD	0.30	0.05	0.015	0.03	0.05	600	0.28			0.0
0+149	NCD	0.50	0.05	0.025	0.05	0.08	600	0.28			0.0
0+197	NCD	0.30	0.05	0.015	0.03	0.05	600	0.28			0.0
0+316	5 - S4	0.70	0.10	0.07	0.14	0.21	600	0.28			0.0
0+350	5A - S4	0.60	0.10	0.06	0.12	0.18	600	0.28			0.0
0+527	NCD	0.30	0.05	0.015	0.03	0.05	600	0.28			0.0
0+552	NCD	0.20	0.05	0.01	0.02	0.03	600	0.28			0.0
0+597	X-Drain	-	-	0	0.00	0.00	600	0.28			0.0
0+652	X-Drain	-	-	0	0.00	0.00	600	0.28			0.0
0+811	NCD	0.20	0.05	0.01	0.02	0.03	600	0.28			0.0
TA568D1											
0+040	X-Drain	-	-	0	0.00	0.00	600	0.28			0.0
TA568D2											
0+030	7 - S4	0.80	0.10	0.08	0.16	0.24	600	0.28			0.0
TA568E1											
0+062	X-Drain	-	-	0	0.00	0.00	600	0.28			0.0
TA568E2					2.55		0.7.7				
0+047	X-Drain	-	-	0	0.00	0.00	600	0.28			0.0

ALL STREAM CROSSINGS ARE TO BE ARMORED WITH COARSE ROCK MATERIAL TO MINIMIZE THE TRANSPORT OF FINES DOWN STREAM.

	RPF SIGNATURE AND SEA	L.
Prepared By:	Andrew Kenyon Name (Printed)	
Signing RPF:	Andrew Kenyon RPF Name (Printed)	
04/23/2013 Date Signed (dd/mm/yy)	4739 RPF Number	

has been done to the standards expected of a member of the Association of British Columbia Forest Professionals."



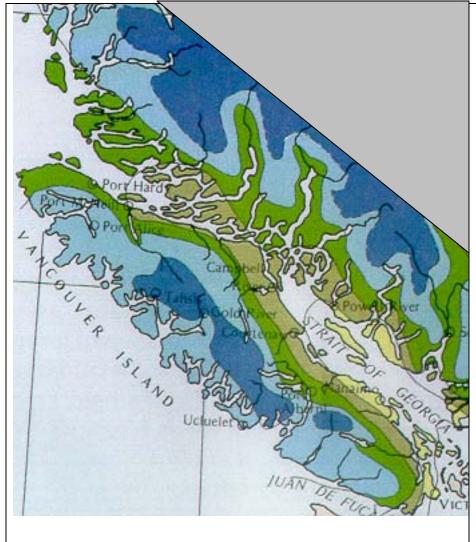
### **TS1 Road Development Report**

**Appendix 5: Wet Weather Shutdown Guidelines** 

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### Wet Weather Shutdown (modified Nov 7, 2006)



Zone	Mean Annual	Shutdown Threshold
	Precip (mm)	(mm/24 hours)
1	750	20
2	1500	40
3	2500	60
4	3000	75
5	3500	90

TABLE B Local Soil Type	Multiplier Factor
Very Erodible (e.g. lacustrine)	0.4
Erodible (e.g. organics, sands)	0.6
Least Erodible (e.g. colluvium, till)	0.8
Bedrock	1.0

TABLE C Slope Modifier	Multiplier
	Factor
0% - 57	1.0
57% - 70%	0.9
71% - 88%	0.8
89% +	0.7

#### **Instructions**:

- 1) Use base shutdown threshold from Table A
- 2) Multiply by Soil Type Modifier from Table B
- 3) Multiply result by Slope Modifier from Table C

Result is rainfall shutdown threshold in millimeters in a 24 hour period

### **Example**

Zone¤	Table·A:·Mean·Annual·¤	Shutdown⋅ Threshold¤
°¤	Precipitation⋅(mm)¤	(mm/24·hours)¤
1¤	750¤	20¤
2¤	1500¤	40¤
3 <b>¤</b>	2500¤	60¤
4m	3000¤	75¤
5¤	3500¤	90¤



TABLE·B·Local·Soil·Type#	Multiplier¤
°¤	Factor
Very·Erodible·(e.g.· lacustrine)¤	0.4¤
Erodible·(e.g.·organics,· sands)¤	0.6¤
Least·Erodible·(e.g.· colluvium,·till)¤	0.8¤
Bedrock¤	1.0¤



TABLE·C·Slope·Modifier#	Multiplier¤		
° <sub>XX</sub>	Factor		
0 %·57¤	1.0¤		
·57 %· -·70 %¤	0.9¤		
71 % ⋅ - 88 % ♯	0.8¤		
89 %⋅+¤	0.7¤		

For Dark Blue Zone 5; 24 Hr Shutdown Criteria = 90 x 0.8 x 0.8 = 58 mm

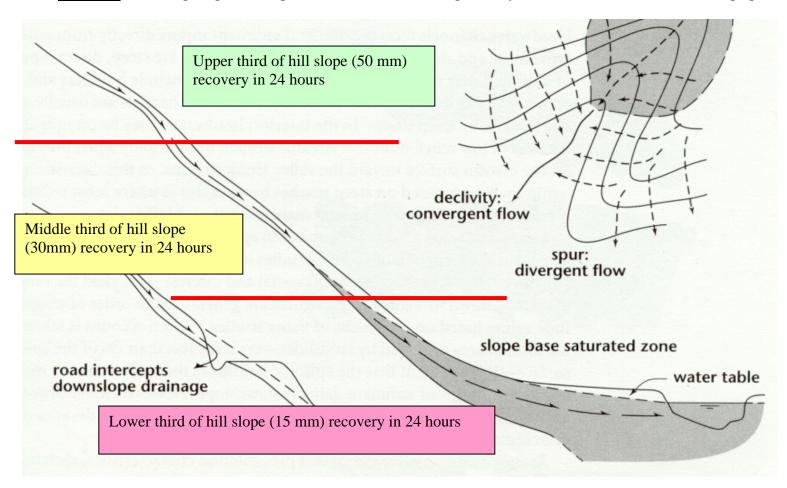
### **Return to Work Estimation Guide**

Water balance returns to normal after a heavy rainfall period subject to a number of variables

- -slope position
- -slope gradient
- -soil type and depth (or proximity to bedrock)

Where a road is located above the worksite, interception by ditch lines may have the effect of increasing the recovery rate for lower slope positions

Using the following sketch as a guide, identify the slope position of the planned activity (upper, middle and lower thirds) In an **average** situation precipitation input is reduced in a 24 hour period by the indicated values based on slope position





### **TS1 Road Development Report**

**Appendix 6: Best Management Practices for a Community Watershed** 

Meridian Forest Services Page 16

# Best Management Practices for Community Watersheds

Refer also to Section 5.2.4 of the AVCF FSP.

<u>Ditch Cleaning</u>: where needed, ditches are to be cleaned when conditions are dry. Ditch spoil is not to be windrowed along the road shoulder. On moderate slopes, the ditch spoil could be thinly spread on the slope below the road, but not heaped or piled against trees. Where the road is on steep slopes, the ditch spoil should be end hauled to a suitable spoil site.

<u>Culvert replacement</u>: Where required culvert replacements are to be done during dry weather (except for emergency repairs or replacements). The inlet and outlet areas on new culverts, and the adjacent fill slopes, are to be armoured to prevent erosion or sloughing into the creek.

<u>Rock Ballasting of road surface</u>: For new road construction, where the road is close to a stream channel, the road surface is to be ballasted with clean rock. The road surface is also to be rock ballasted for 30 meters either side of stream culverts.

Road grading practices: grading is to be avoided during heavy rain.

<u>Shutdown or harvest completion:</u> In preparation for a shutdown for a period longer than 30 days or at a harvest completion, the following measures will be taken:

No excavated or end hauled material will be left piled in such a way as to become unstable during the shutdown period. Spoil sites, piles and fills will be sloped uniformly to prevent instability.

Ditches and culverts will be left clear and functional, with adequate inlet basins to minimize the potential for plugging.

On sections of steep grades, cross ditches and back-up swales will be constructed where needed to minimize ditch erosion

If road construction has reached a drainage course but a drainage structure has not been installed prior to shutdown, the drainage course will be left open and unimpeded.

Where exposed silty soils could erode and enter surface streams or ditches connected to streams, silt fences, hay bales or erosion blankets will be applied as needed for temporary protection.



### **TS1 Road Development Report**

Appendix 7: Road Permit R18553 Amendment #4

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File: 11400-25, R18553, Amendment #4

Alberni Valley Community Forest Corporation 7500 Airport Road Port Alberni, British Columbia V9Y 8Y9

Dear Sir/Madam:

Reference is made to your application dated November 29, 2012 for an amendment of Road Permit (RP) No. R18553 within Alberni Valley Community Forest Licence K2D.

Pursuant to paragraph 1.01 and 2.01 of RP No. R18553, the roads identified in the list below, and the attached map shall form an integral part of the document for RP No. R18553 and should be attached thereto.

This amendment pertains to the construction, maintenance and use of the following roads associated with harvest development within the *Alberni Valley Community Forest Corporation 2011 to 2016*Forest Stewardship Plan approved June 6, 2011:

Licensee	Sec. Designation	Station(from)	Station(to)
Road Name	on Exhibit A Map		
TA568D1	TA568D1	0+000	0+087
TA568D2	TA568D2	0+000	0+187
TA568D2A	TA568D2A	0+000	0+031
TA568E	TA568E	0+000	0+849
TA568E1	TA568E1	0+000	0+115
TA568E2	TA568E2	0+000	0+159
TA568E3	TA568E3	0+000	0+075

Yours truly,

Attachment: Exhibit A Map (ESF 1164476)

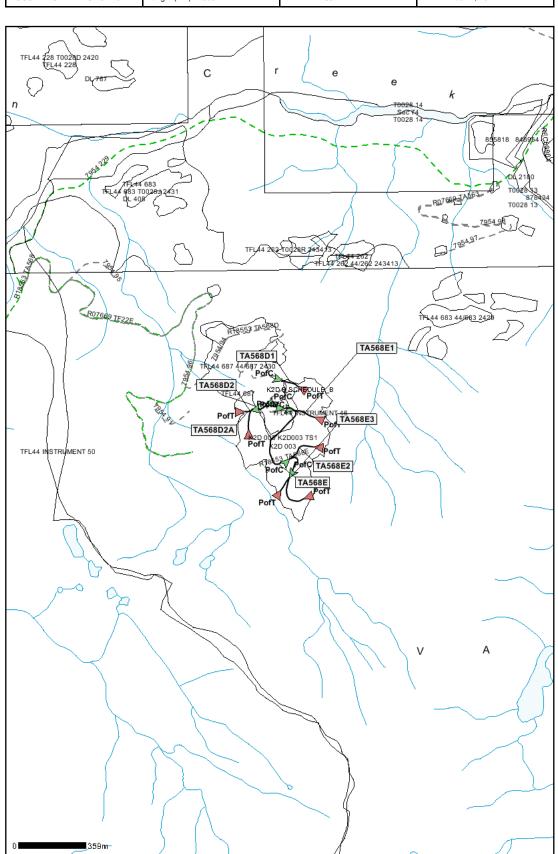


### **EXHIBIT A**



MAP OF: R18553 Amendment # 4 (shown in bold black)					
FOREST REGION : RCO FOREST DISTRICT : DSI	TSA: LAND DISTRICT: CLAYOQUOT DISTRICT	PULPWOOD AGREEMENT :	MGT UNIT TYPE : COMMUNITY FOREST MGT UNIT NO :		
ESF SUBMISSION ID : 1164476 BCGS MAPSHEET NO : 92F.024	SCALE: 1:20000 at A Size Length (Km): 1.503	UTM : 10 NAD : NAD83	DRAWN BY : FTA DATE : Dec 11, 2012		





#### Legend Tenure Application Tenure Road Application Retired Tenure Road P of C P of T Tenure Feature Range TFL Provincial Forest Forest Service Road Highway Municipal Road Non Status Road Recreation Trails Road Permit SUP Road Right of Way Schedule B CP Road Mineral Tenure Points Cities Waterbodies River/Stream Coastline / Island TA568D1 (Length: 0.087 Km, R/W: 75 m PofC UTM10 330777, 5460994 PofT UTM10 330855, 5460960 TA568E1 ( Length: 0.1145 Km, R/W: 75 m

PofC UTM10 330831, 5460835 PofT UTM10 330936, 5460794 TA568E ( Length: 0.8493 Km, R/W: 75 m ) PofC UTM10 330780, 5460847 PofT UTM10 330861, 5460365 TA568D2 ( Length: 0.1874 Km, R/W: 75 m

PofC UTM10 330681, 5460865 PofT UTM10 330585, 5460745 TA568D2A (Length: 0.0313 Km, R.W: 75 m) PofC UTM10 330601, 5460841 PofT UTM10 330570, 5460839

PorT UTM10 330570, 5460839 TA568E2 ( Length: 0.1588 Km, R/W: 75 m ) PorfC UTM10 330707, 5460570

PofC UTM10 330797, 5460579 PofT UTM10 330925, 5460637 TA568E3 ( Length: 0.0748 Km, R/W: 75 m

PofC UTM10 330788, 5460478 PofT UTM10 330744, 5460417



### **TS1 Road Development Report**

**Appendix 8: Road Reactivation Plan** 

Meridian Forest Services Page 18



# **Alberni Valley Community Forest**

### TA560, TA568, TA568D ROAD RECONSTRUCTION PRESCRIPTION

Prepared by:	Brad Bayley, Meridian Forest Services Ltd.					
Assessment date:	October 2 <sup>nd</sup> , 2012 – Brad Bayley, Meridian Forest Services Ltd.					
Standard:	TA560, TA568, TA568D will be reactivated to hauling status. Recommended actions are to be completed to the required road building standards as defined in the <i>Forest Engineering Guidebook</i> , 2002.					
Road Section:	The Point of Commencement (P.O.C) Station 1, 0+000 for TA560 is at HWY 4 approximately 40km West of Port Alberni. The P.O.C for TA568 is at Station 14, 0+921 of TA560. The P.O.C of TA568D is at Station 54, 2+197 of TA568.					
Safety:	Supervisors are required to read and understand findings, recommendations and safety concerns of any report, including this report. Prior to start-up this information must be reviewed, discussed and recorded with the construction crew during the Pre-work inspection.  Some general safety notes are:  • There is no industrial activity and log or equipment hauling in this area.  • Radio communication is on the Sproat Lake repeater. The onsite construction crew may also communicate on their own frequency. The radio frequencies and contact information must be reviewed with all of the construction crews and recorded in the Pre-work inspection report prior to the reconstruction start-up. Any additional construction crews working on the site must also be informed of the correct radio frequencies and procedures.  • Due to the location of the road within the Sproat Lake community watershed, Coastal Rainfall Shutdown Guidelines must be strictly adhered to. The reactivation crew must ensure they minimize the amount of sediment entering watercourses. They should also be aware that periods of intense precipitation may cause instability in freshly excavated cutbanks / fill slopes, even prior to reaching shutdown guidelines. Best practices are to shut down if drainage systems are overflowing or if surface sediments are saturated.					
General Notes:	All the culverts mentioned in this report are field referenced with pink culvert ribbons. See accompanying map for station locations and points.  Construction prescriptions were marked in the field White and Green Ribbon with stations, see accompanying map for prescriptions and this report.  The ditching/brushing prescriptions can be modified or added to at the discretion of the machine operator. Some of the material in the ditches are ideal for road surfacing and may be utilized on the road. All operations are located within the Sproat Lake Community Watershed. All streams are none fish, but have appropriate riparian reserves setbacks as if as fish streams.  The first 594m of road reactivation is located within BC Timber Sales Tenure Area under an approved FSR. It is recommended that discussions with BC Timber Sales should occur prior to initiating any operations.					





# **Alberni Valley Community Forest**

### TA560, TA568, TA568D RECONSTRUCTION – DETAILED PRESCRIPTION

Start Station	End Station	Dist. (m)	Station In	Action	Comments
Station	Station	(111)	Field		
0+000			1		The Point of Commencement (P.O.C) Station 0+000 for TA560 is at HWY 4 approximately 40km West of Port Alberni.
0+000	0+921	921	1-14	Brushing/Ditching	Brushing/Ditching is prescribed for the entire reconstruction length, but the amount of brushing/ditching required will fluctuate over this stretch of road.
0+196			2	Install 600mm CMP	Cross Drain. No Stream
0+237	0+306	69	3-6	Resurfacing Required	
0+237			3	Fill in X-Ditch	~1m deep hole on fill edge.
0+265			4	Remove WBC and Replace with 1000mm CMP & Ford Crossing. Construct ford crossing using locally acquired angular rock of +-50cm to create an interlocking structure and ensure shallow dip to allow hauling while maintaining stream flow. Construction and usage of fords should be restricted during periods of low flow, when creek flows are negligible. It is recommended that road construction crews	S3 Stream



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		in valley comin	
		are familiar with the requirements of ford crossings and that a qualified professional be present onsite to review and verify each ford crossing.  Regardless, ensure that FORDS will be deactivated post harvest to meet current legislation requirements.  Refer to pages 114 – 119 of the Forest Engineering Guidebook for more details on Ford construction. These pages are appended to this document.	
0+281	5	Remove WBC and Replace with 1000mm CMP & Ford Crossing. See comments above regarding construction of the crossing.	S3 Stream
0+306	6	Fill in X-Ditch	Start of Heavy Brush
0+336	7	Existing 600mm CMP (Clean), Fill in X-Ditch	Cross Drain. No Stream
0+370	8	Repair Road Edge	Boulders fell onto road, remove boulders from ditchline



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					1
					and repair fill edge. Re-establish ditchline
0+429			9	Clear for turnout	Clear Alder for pullout, +10m there are two holes in the road to repair (minor) flagged with green ribbon. Establish ditchline. End of Heavy Brush.
0+612			10	Repair road edge	Minor failure on fill edge, pullback P1. Start of minor tension cracks.
0+612	0+737	125	10-11	Minor pullback P1	Minor tension cracks noted, pullback at operators discretion.
0+805			12	Fill in X-Ditch	
0+890			13		Start of Heavy Brush
0+921			14	End of TA560 React	Junction with TA568. Existing 800mm CMP (Good).
0+000			14	Start of TA568 React.	The P.O.C for TA568 is at Station 0+921 of TA560.
0+000	2+197	2197	14 – 54	Brushing/Ditching	Brushing/Ditching is prescribed for the entire reconstruction length, but the amount of brushing/ditching required will fluctuate over this stretch of road.
0+000			14		Start of 20% pitch
0+074			15		End of 20% pitch
0+092			16	Existing 600mm CMP, Fill in X-ditch	Cross Drain. No Stream
0+137			17	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	End of heavy brush/still minor brushing and ditching



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			required
0+161	18	Fill in Waterbar	
0+245	19		Start of heavy brush
0+278	20	Fill in X-Ditch	
0+386	21	Fill in X-Ditch	
0+485	22	Remove old 1x2 WBC and replace with 800mm CMP	S3 Stream, Existing 600mm CMP
0+523	23	Existing 600mm CMP, Fill in X-Ditch	Cross Drain. No Stream. Start of 20% pitch
0+588	24	Fill in X-Ditch	End of 20% pitch
0+653	25	Existing 600mm CMP (Clean), Fill in X-Ditch	Cross Drain. No Stream
0+689	26	Fill in Waterbar	
0+732	27		Start heavy brush



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				replace with 1200mm CMP, will need fill.	
0+867			29	Existing 600mm CMP (Clean), Fill in X-Ditch	Cross Drain. No Stream
0+892			30	Existing 800mm CMP (Good), Fill in X-Ditch, install ditchblock.	Cross Drain. No Stream
0+948			31	Existing 900mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
0+974			32	Existing 1200mm CMP (Clean), Fill in X-Ditch	S4 Stream
0+974	1+010	36	32 - 33	Minor Surfacing	
1+010			33	Existing 800mm CMP (Clean), Fill in X-Ditch	Cross Drain. No Stream
1+105			34	Existing 800mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
1+209			35	Existing 900mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
1+299			36	Install Guard Rails	12.2m Concrete Bridge, Install new guard rails and bridge approach signs. S2 Stream. Needs load rating
1+387	1+402	15	37-38	Resurfacing	Will need to resurface this section when WBC and Logs in road prism get removed.



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1+387	37	Remove 2x5 WBC and replace with 800mm CMP.	S4 Stream
1+402	38	Remove logs from road prism ontop of an Existing 1200mm CMP (Good)	S4 Stream  The stream of the s
1+485	39	Existing 600mm CMP (Good), Fill in X-Ditch	NCD/Cross Drain. No Stream
1+508	40	Existing 600mm CMP (Clean), Fill in X-Ditch	Cross Drain. No Stream
1+524	41		End of heavy brush
1+601	42	Existing 600mm CMP (Clean), Fill in X-Ditch	Cross Drain. No Stream
1+623	43		Junction left. Start 20% pitch
1+688	44	Repair Ditchline	End of 20% pitch
1+720	45	End Brushing and Ditching	
1+744	46	Existing 600mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
1+807	47	Existing 600mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
1+910	48	Start Brushing/Ditching	
1+970	49	Existing 800mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
2+041	50	Existing 800mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream



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2+062	51	Existing 1200mm CMP (Good), Fill in X-Ditch	S3 Stream
2+101	52	Existing 800mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
2+155	53	Existing 800mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
2+197	54	End of TA568 Reactivation	End of TA568 Reactivation
0+000	54	Start of TA568D Reactivation	The P.O.C of TA568D is at Station 54, 2+197 of TA568.
0+038	55	Fill in X-Ditch, Repair Ditchline	
0+097	56	Existing 600mm CMP (Damaged), if cannot repair then replace. Fill in X-Ditch	Cross Drain. No Stream



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0+154	57	Existing 900mm CMP (Damaged), if cannot repair then replace with 800mm CMP. Fill in X-Ditch	S4 Stream  The stream of the s
0+217	58	Fill in X-Ditch	
0+247		Fill in X-Ditch	
0+454	59	Existing 800mm CMP (Clean), Fill in X-Ditch	S4 Stream. Start 20% pitch
0+557	60	Existing 600mm CMP (Clean), Fill in X-Ditch	Cross Drain. No Stream
0+613	61	Existing 600mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
0+755	62	Existing 600mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream. End 20% pitch
0+830	63	Existing 800mm CMP (Clean) and Ford, Fill in X-Ditch	S4 Stream 1 Station 11
0+975	64	Install 600mm CMP, Repair Ditchline	Cross Drain. No Stream
1+092	65	Repair Ditchline, Remove rock on road	No ditchline present.
1+266	66	Existing 600mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
1+321	67	Existing 800mm CMP (Good), Fill in X-Ditch	S4 Stream 1 Station 1
1+369	68		Falling Boundary Stations 21-1
1+395	69	Existing 600mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
1+427	70	Existing 600mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream
1+505	71	Existing 600mm CMP (Good), Fill in X-Ditch	S4 Stream
1+606	72	Existing 600mm CMP (Good), Fill in X-Ditch	Cross Drain. No Stream

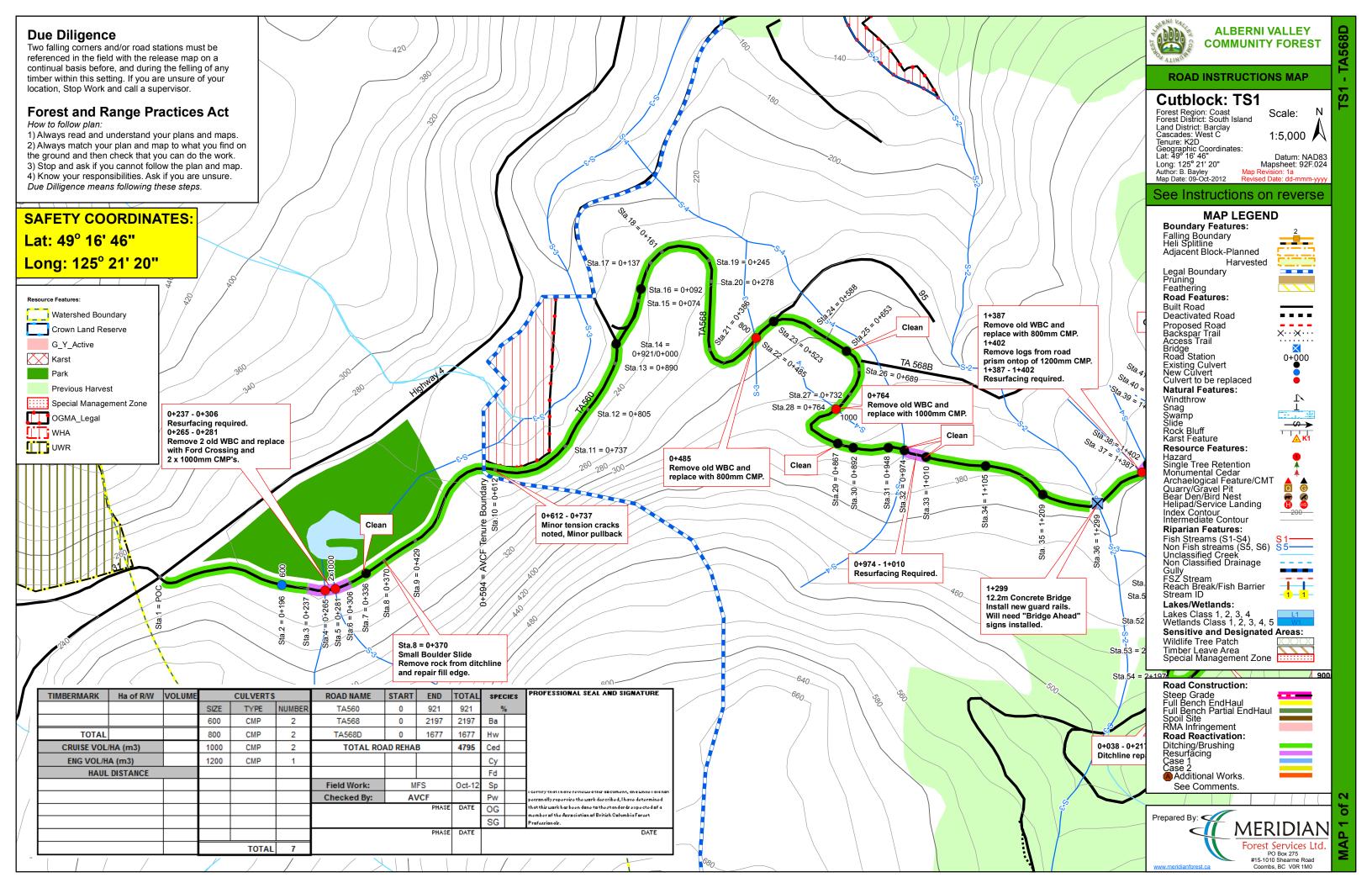


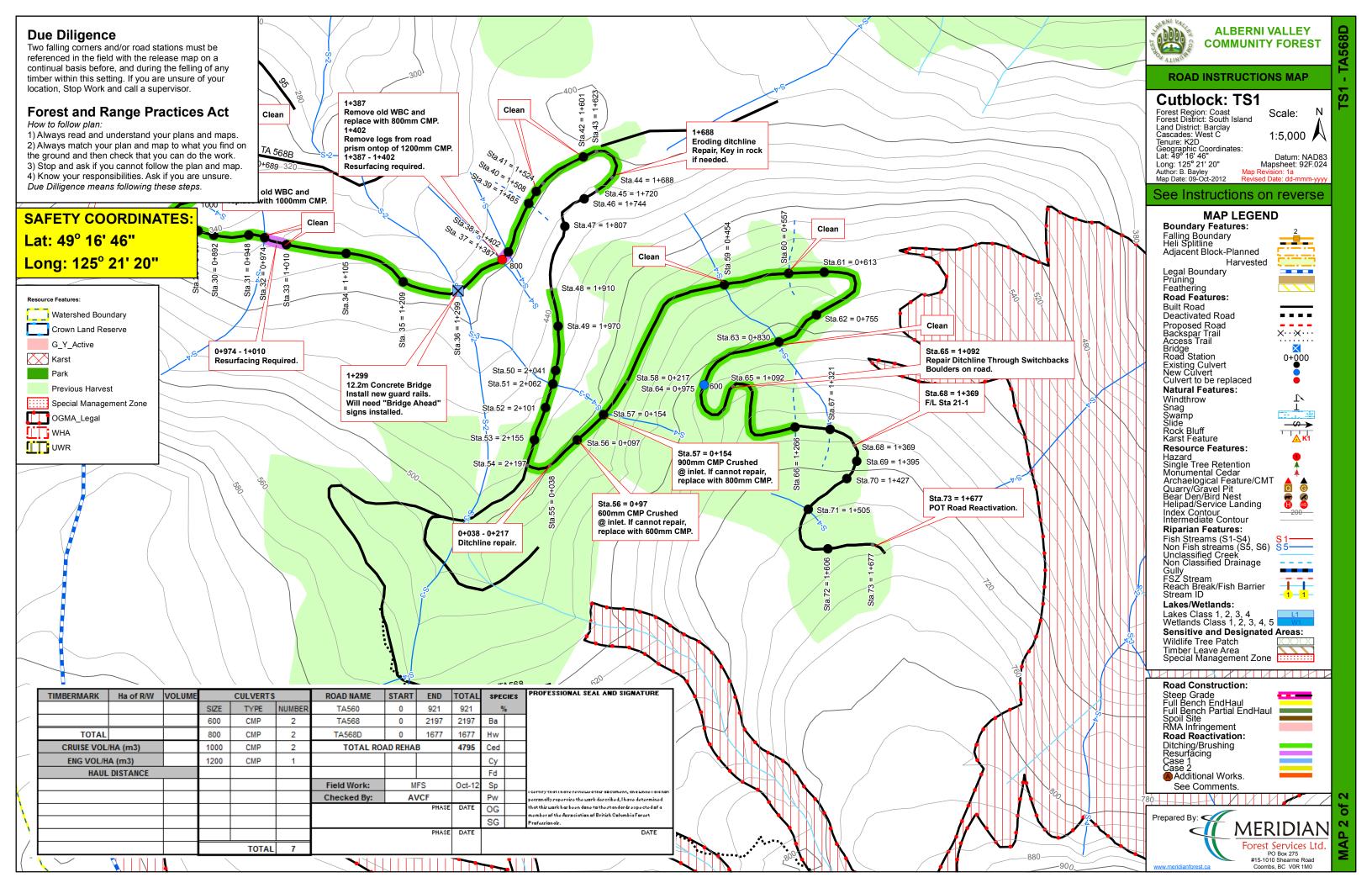
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1+677	73	End of Reactivation	End of TA568D Reactivation.

Action	Culvert Size	Length (m)	Number of Units
Install	600mm CMP	10	2
		12	
	800mm CMP	10	2
		12	
	1000mm CMP	10	2
		12	
	1200mm CMP	10	1
		12	
Brushing	TA560, TA568, TA568D	Brushing as required, Amounts	
		will fluctuate.	
Ditching	TA560, TA568, TA568D	Minor ditch cleaning	
		throughout.	
Pullback	TA560, TA568, TA568D	125 meters	
Resurfacing	TA560, TA568, TA568D	120 meters	
Grading	TA560, TA568, TA568D	4795 meters	_







### Ford design and construction on non-fish streams

A ford is a dip in a road constructed to facilitate crossing a stream. The objective of a ford is to maintain drainage and provide a safe, erosion-free, and storm-proof crossing that requires little or no maintenance. In the past, inappropriate location and design of fords, and uncontrolled use, has led to a number of negative environmental impacts. These include increased sediment delivery to streams, and degraded water quality downstream.

In isolated locations where maintenance equipment may not be available on a continuing basis, properly designed and constructed fords require little maintenance, are storm-proof, and can be effective in reducing adverse impacts in drainage systems that are prone to debris torrents (Figure 21). Fords may also be considered for areas of low traffic and intermittent use. They should be considered as alternatives to bridges or culverts only where the crossings will not result in negative environmental impacts and where traffic use is confined to low-flow periods. A ford would not normally be considered if the crossing is expected to be subjected to extensive or year-round traffic.

### Ford planning

Fords should be identified in the planning stage of road development to ensure that the required design and measures will include appropriate road grades leading into and out of the stream crossing.

- Prior to planning a ford, the stream should be evaluated to ensure that it
  is not a fish stream. Refer to the Fish-stream Crossing Guidebook for
  limitations on the use of fords on fish streams.
- When planning a ford, and establishing design criteria, determine if any
  of the following possible user safety restrictions (or combination of
  restrictions) will apply to the stream crossing:
  - the design vehicle will be able to cross the ford only during certain months of the year
  - the design vehicle will not be able to cross the ford during periods of specific maximum stream flows
  - only certain types of vehicles will be able to cross the ford
  - only certain specific road uses will be considered (such as industrial use only).

Each proposed ford design is unique, but the objectives of any design are to:

- pass the design peak flow
- minimize downstream erosion of the stream
- prevent sediment input into the stream from the approaches and associated ditches

- provide a suitable road profile to accommodate safe passage of the design vehicle
- ensure that the stream remains in its channel and cannot be diverted down the road or ditches
- ensure that the ford will either pass channel debris—the preferable option—or trap it

Non-standard crossing situations may require installation of weirs and other energy-dissipating structures upstream and downstream. Under these situations, design by a professional engineer, and agency consultation, may be required.

### Ford design

For a ford, the road profile should dip into and out of the stream, creating a concave shape sufficient to ensure that the stream cannot be diverted away from its natural channel and down the road.

- Ensure that the anticipated design vehicle can negotiate vertical curves at the proposed ford. Where it is practical to do so, approaches should be at right angles to the stream.
- Check the debris flow history of the stream channel
  - on air photos
  - on terrain stability maps or terrain stability field assessments
  - in the field.

For further information, refer to the *Gully Assessment Procedures Guidebook*.

- If there is a debris flow problem, decide whether the ford should be designed to:
  - trap the debris, or
  - allow the debris to pass over the ford—the preferred option. If the
    debris is to be trapped, specialist consultation may be required to size
    the catchment basin.

The size and shape of the largest cobbles or boulders in the stream channel indicates the minimum size of rock required to resist movement when the stream is in flood, and thus provides a guide to the minimum size of rock to be used to construct the ford. The more angular the rock (such as shot rock), the more resistant it will be to moving.

In some situations, the use of a ford may be restricted to low-flow periods when the flow is subsurface. A low-flow culvert can be designed and installed to pass the anticipated low flow. With this design, peak flows and

debris would flow over the top of the ford and some increased annual maintenance may be necessary. The running surface material should be of a size to resist erosion.

Design methods are available for determining flow rates through voids in rock fills. Such voids may plug, so the dip in the road profile should be designed to accommodate the  $Q_{100}$  peak flow, plus any anticipated debris.

### Design approval requirements

Sketches of the ford design should be prepared, showing:

- the road profile, extending at least 50 m at each end beyond the wetted perimeter at Q<sub>100</sub> peak flow
- · the width and depth of the wetted surface during:
  - those months when use of the road is anticipated
  - Q<sub>100</sub> peak flow level and an estimate of debris volumes to be passed or trapped
  - annual low-flow level, or the flow levels for the periods of anticipated use
- the range and average size of the material in the stream channel and its shape (angular, semi-angular, or rounded)
- the minimum width of the road running surface required to accommodate anticipated traffic
- the requirements for any erosion-resistant materials for the road running surface, such as shot rock and concrete cross-ties, including use of any geosynthetics, to help separate different types and gradations of road fill materials
- the rock source, size, and volume requirements
- the length, width, and depth of the upstream catchment basin if one is proposed
- the type and dimensions of the low-flow culvert, if one is proposed
- · the length of apron to be surfaced with erosion-resistant material.

#### Ford construction

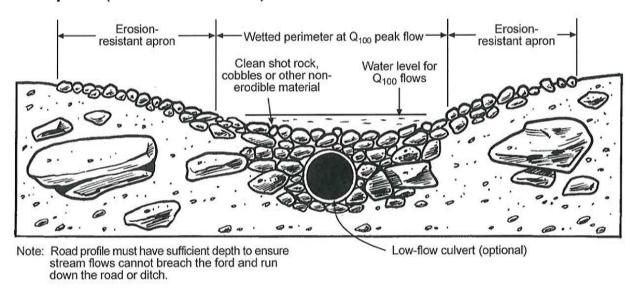
For low-flow streams, or for those that are dry in the summer, a properly designed and constructed ford should allow the stream flow to pass around and between the subsurface rock. For this, place the larger-size rock across the base and lower portion of the ford cross-section. For perennial streams where appropriate rock sizes are unavailable, consider the following alternatives:

- Construct a broad catchment basin, or upstream weirs, to slow the stream flow velocity and thus reduce the size of rock required for the ford to resist the erosion forces.
- For steeper-gradient streams, build up the downslope portion of the ford by positioning log cribs, gabions, lock blocks, etc. to contain the rock fill for the ford. In most situations, this will flatten the stream gradient at the crossing, thus reducing the stream velocities and permitting the use of smaller-size rock.

To prevent sediment delivery where approach drainage cannot be directed away from the stream, and to prevent sediment tracking by equipment and vehicles, the following procedures should be considered:

- · armouring ditches with non-erosive material
- · directing runoff into sediment basins or other sediment trapping device
- capping the road surface with erosion-resistant material on either side of the ford for an appropriate distance to protect the road and minimize sediment delivery to the stream.

#### Road profile (stream cross-section)



### Road cross-section (stream profile)

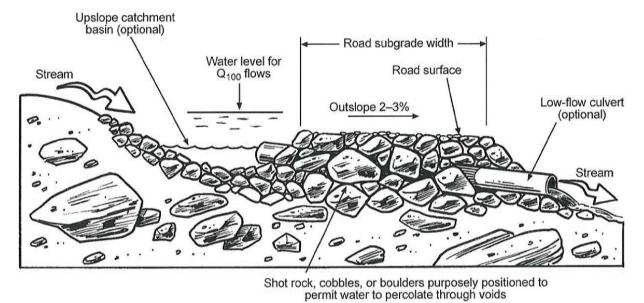


Figure 21. Plan and profile of a ford crossing.

### Ford operating constraints

Once a ford is constructed, its use should be controlled to ensure that the integrity of the structure is maintained and that any potential adverse impacts on the environment are minimized.

- Nothing that could destroy the running surface of the ford should be dragged or skidded across it.
- Vehicles using the ford should be in good working order and not leaking fuel, hydraulic fluids, lubricating oil, or cargo.
- All excess soil should be removed from heavy equipment before it crosses a watercourse.
- The ford should not be used if the water depth is greater than the axle
  height of the vehicle. It may be appropriate to install a water-depth gauge
  clearly visible from the road.
- Should a ford become unsafe for traffic during high water, measures should be taken to warn and exclude users for that period.

#### Ford maintenance

Properly designed and constructed fords are usually low maintenance, storm-proof structures. Nevertheless, the following activities may be required:

- Fords should be inspected at a frequency commensurate with the risk to users.
- Running surfaces, approach grades and aprons, ditches, and catchment basins should be properly maintained.

### Suggestions for further reading

American Iron and Steel Institute. 1991. *Handbook of Steel Drainage and Highway Construction Products*. Canadian edition. W.P. Reyman Associates, Inc. New York, N.Y.

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	1999. Forest Service Bridge Design and Construction
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Nagy, M.M., J.T. Trebeth, G.V. Wellborn, and L.E. Gower. 1980. Log Bridge Construction Handbook. Forest Engineering Research Institute of Canada (FERIC), Vancouver, B.C.