

BRITISH COLUMBIA TIMBER SALES, CHINOOK BUSINESS AREA

PHASE 3 REVIEW OF TSL A94817
BLOCKS G043B4SG & G043C3ZP
ROBERTS CREEK AND STEPHENS CREEK WATERSHEDS

Polar File: 740202
BCTS Contract: 10005-40/PD21TBF001
FINAL REPORT
DECEMBER 2023

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CITATION

Polar Geoscience Ltd. (Polar). 2023. Phase 3 Review of TSL A94817, Blocks G043B4SG & G043C3ZP, Roberts Creek and Stephens Creek Watersheds. Prepared for BC Timber Sales, Chinook Business Area. Polar File No. 740302, BCTS Contract 10005-40/PD21TBF001.



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Re: Phase 3 Review of TSL A94817 in Roberts Creek and Stephens Creek Watersheds

1.0 BACKGROUND & OBJECTIVES

Polar Geoscience Ltd. (Polar) is pleased to submit this summary our field and office review of BC Timber Sales (BCTS), Chinook Business Area (TCH) Timber Sale Licence (TSL) A94817 located within the Roberts Creek¹ and Stephens Creek watersheds (FIGURE 1.1). The scope of this Phase 3 review is to evaluate the site-level hydrologic hazards and risks associated with the two planned blocks G043B4SG and G043C3ZP, and to evaluate how BCTS' harvest plans align with the Phase 1 and 2 recommendations outlined in Polar (2023).

This review was initiated in March 2022, and was conducted in parallel with the higher-level Phase 1 and 2 watershed assessment of the Roberts Creek and Stephens Creek watersheds (Polar, 2023). Although the Phases and 1 and 2 report was not finalized until early December 2023, interim findings and recommendations were regularly communicated to BCTS both verbally and through preliminary drafts of this Phase 3 report. Over the course of the Phase 3 review, BCTS substantially refined its harvest plans, both in August 2022, and again in December 2023. These refinements were, in part, made following Polar's recommendations from Phase 1 and 2 (Polar, 2023), and from recommendations following the field review in Phase 3. For transparency, we report our findings and recommendations from our August 2022 field review, which examined the harvest plan as of August 2, 2022 (FIGURE 1.2). This is followed by our office review of the revised harvest plan as of December 7, 2023 (FIGURES 1.3 and 1.4).

¹ Including the East Roberts Creek basin.

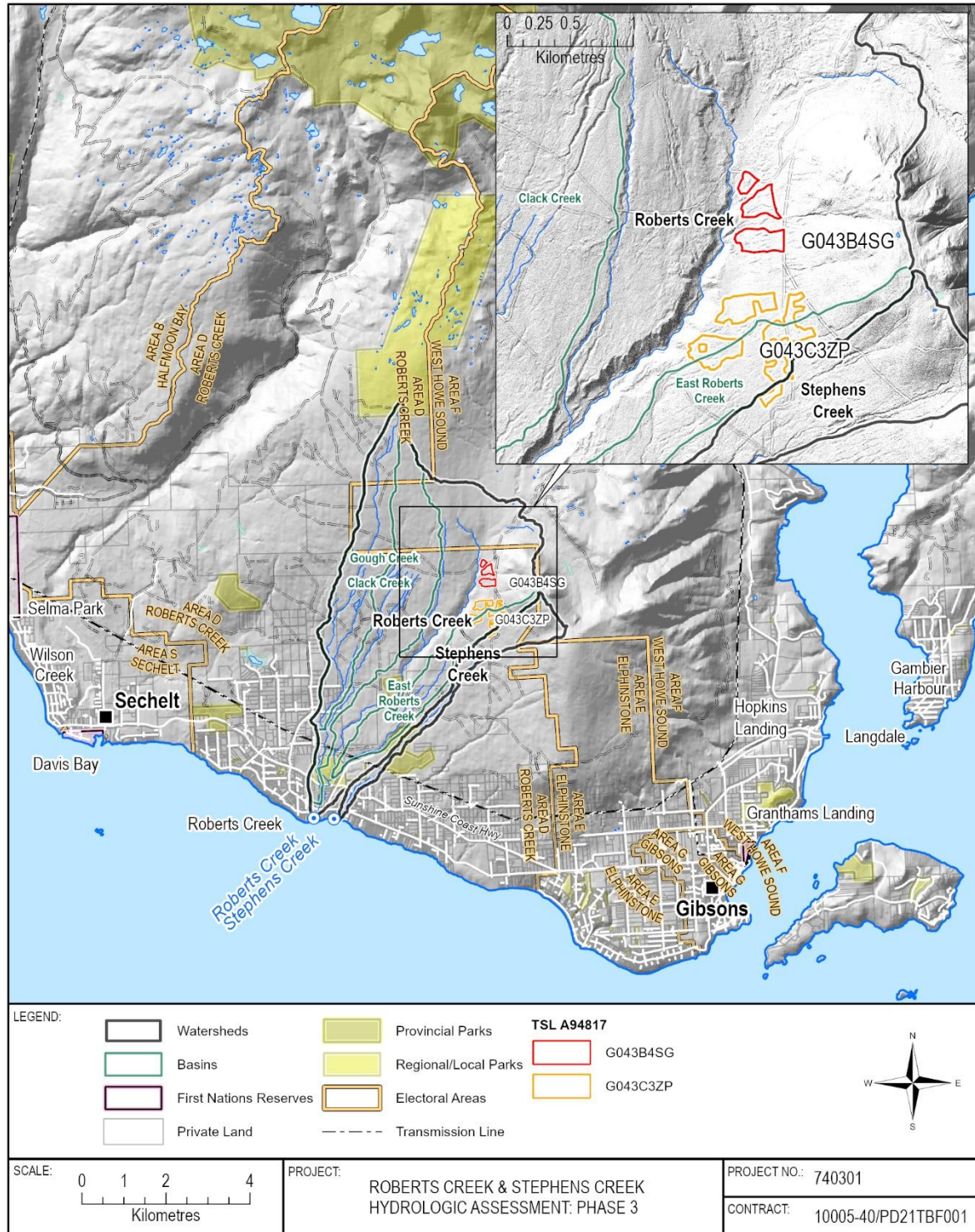


FIGURE 1.1 The assessment watersheds and locations of planned blocks G043B4SG and G043C3ZP of TSL A94817. The harvest plans shown here are current as of December 2023.

Document Name: ArcPro Map Roberts Report Figs

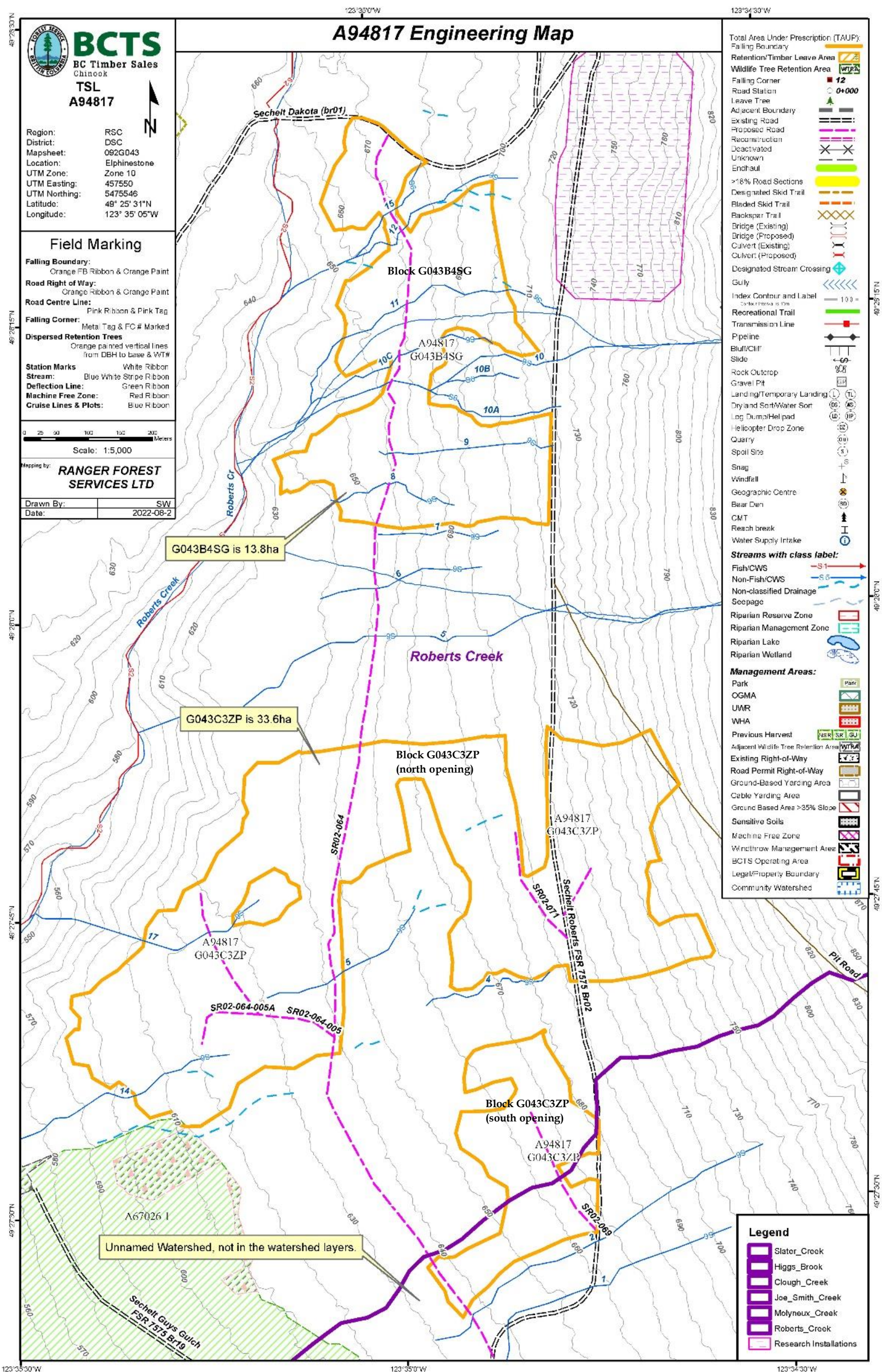


FIGURE 1.2 Harvest plan map for TSL A94817, blocks G043B4SG and G043C3ZP (as of August 2, 2022) that was subject to field review. Map source: BCTS.

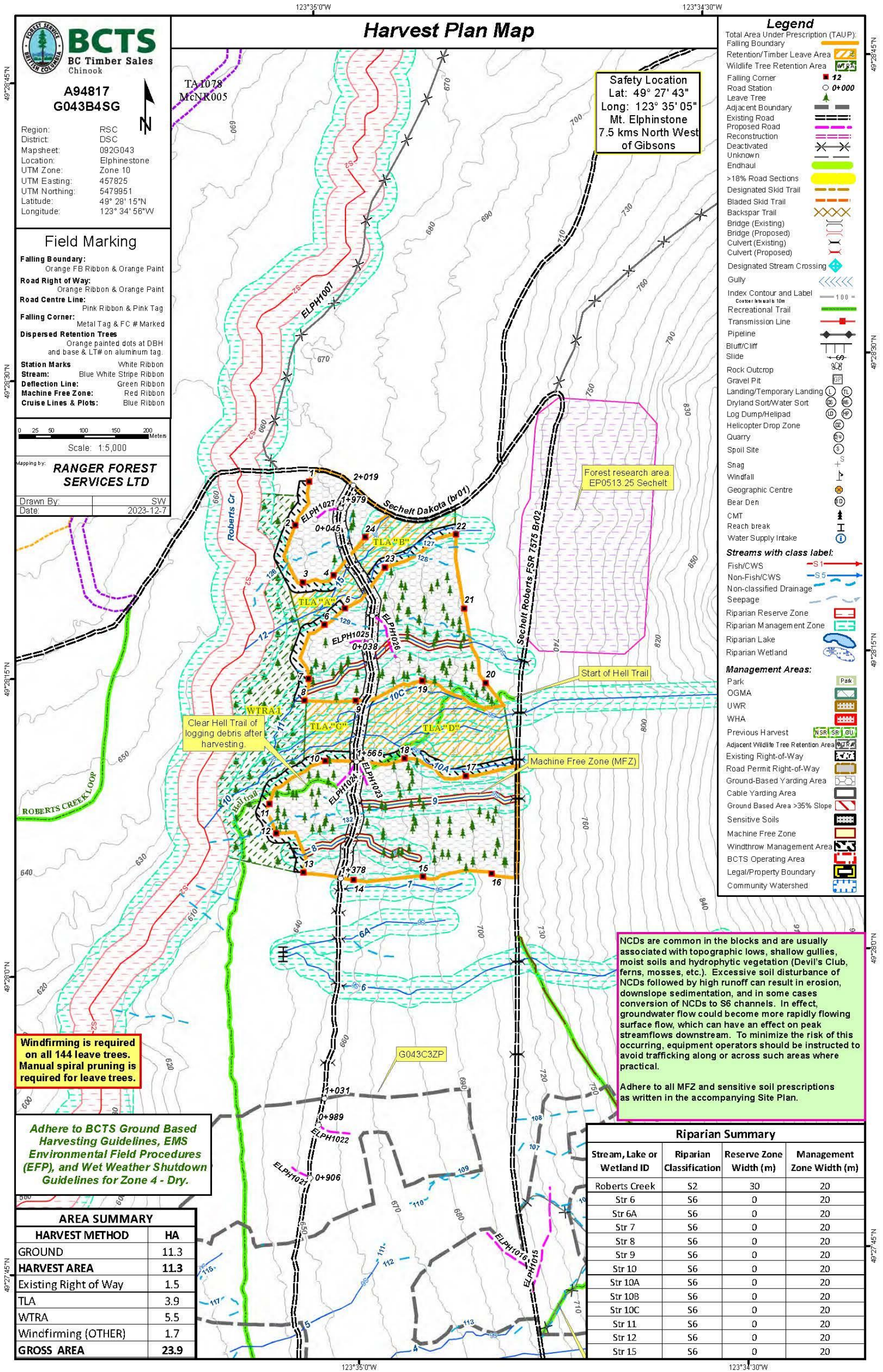


FIGURE 1.3 Harvest plan map for TSL A94817, block G043B4SG (as of December 7, 2023). Map source: BCTS.

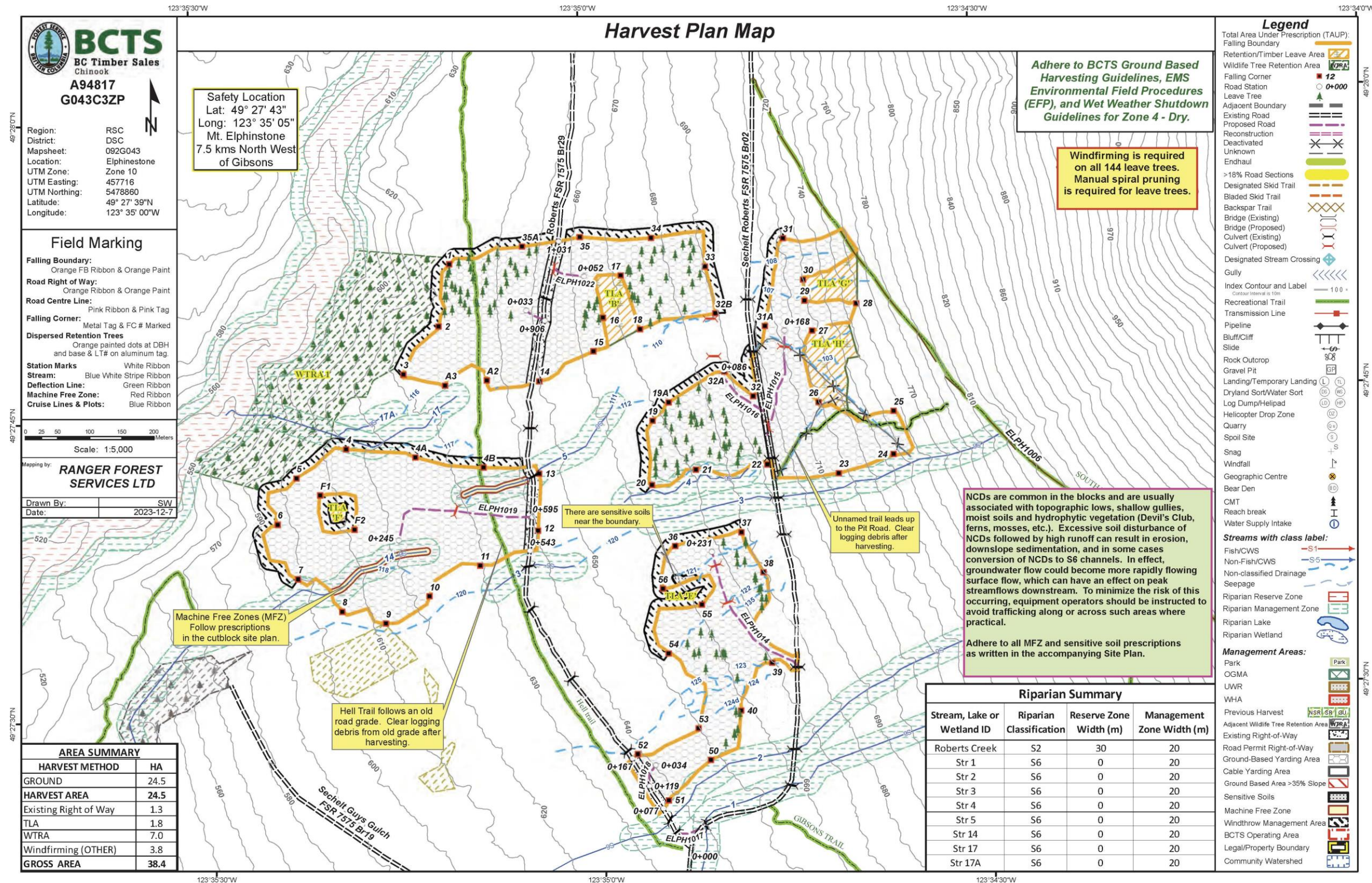


FIGURE 1.4 Harvest plan map for TSL A94817, block G043C3ZP (as of December 7, 2023). Map source: BCTS.

2.0 FIELD METHODS (AUGUST 2022)

TSL A94817 was field reviewed on August 8, 2022 by Lars Uunila, PGeo (Senior Hydrologist & Geoscientist of Record) and Robbie Johnson, GIT (Project Hydrologist) of Polar. Accompanying Lars and Robbie were Pierre Aubin, RPF and Gino Amato, RFT of BC Timber Sales, Chinook Business Area (Powell River). The weather was sunny with temperatures approaching 30°C. Ground conditions were dry and perennial streams were flowing near seasonal lows. Block boundaries and road alignments according to the August 2, 2022 harvest plan (FIGURE 1.2) were field-flagged prior to our review.

The review began in the south opening of G042C3ZP by walking from Sechelt Roberts Forest Service Road (FSR) 7575 Branch 2 in a northwest direction along the lower planned road alignment (near the lower edge of the block), up the center of the block and southeast along the upper planned road alignment. The north opening of G042C3ZP was selectively reviewed along the south and west block boundary and planned road alignment of Sechelt Roberts FSR 7575 Branch 02. Block G043B4SG was reviewed by walking west from Sechelt Roberts FSR 7575 Branch 2 along the south and west block boundary, then following planned road alignment SR02-064 northward to the Sechelt Dakota FSR Branch 01.

3.0 FIELD OBSERVATIONS (AUGUST 2022)

Our main observations from the field review are provided below, organized by block and opening. The comments are referenced to the site plan dated August 2, 2022 (FIGURE 1.2).

Block G043C3ZP (south opening)

- Southern portion of the opening is located in Stephens Creek Watershed, and the northern portion in East Roberts Creek Basin (within the Roberts Creek Watershed).
- The block is located on gentle hummocky terrain (15-20% slope) (FIGURE 3.1).
- Soils were dry on the date of review; however, some areas of wet ground were noted in the center of the planned block. In these areas, water emerged from the subsurface and typically disappeared back into the subsurface several metres downslope. In fall and winter, more surface runoff may be present, however it is likely diffuse based on the ground conditions observed.
- Relatively low drainage density is noted within the block; some S6 streams and NCDs were identified. We expect seasonal shallow subsurface flow in topographic lows. As a result, future road cuts in such areas may intercept shallow groundwater seasonally.
- One road is planned in the block with a 600 mm culvert crossing of a small (<1 m wide) channel (FIGURE 3.2).
- A 2-3 m wide stream with abundant gravel deposits is present outside of the block along the southern boundary (FIGURE 3.3).



FIGURE 3.1 Gentle hummocky ground in approximate center of planned block. Photo RJ8, August 8, 2022.



FIGURE 3.2 Location of planned road crossing of minor drainage. Photo RJ11, August 8, 2022.



FIGURE 3.3 Fluvially active stream along and outside the southern boundary of Block G043C3ZP (south opening). Photo RJ3, August 8, 2022.

Block G043C3ZP (north opening)

- Southern portion of this opening is located in East Roberts Creek Basin (within the Roberts Creek Watershed); the northern portion is within the Roberts Creek Watershed.
- The block is located on gentle hummocky terrain (15-20% slope) (FIGURE 3.4) that increases in gradient upslope, particularly above Sechelt Roberts FSR 7575 Branch 2.
- Soils were dry on the date of review; however, some areas of wet ground were noted. In these areas, water emerged from the subsurface and typically disappeared back into the subsurface several metres downslope. In fall and winter, more continuous surface runoff is expected.
- Relatively low drainage density is noted within the block; some S6 streams and NCDs were identified. Expect seasonal shallow subsurface flow in topographic lows. As a result, road cuts in such areas may intercept shallow groundwater seasonally.
- Several shallow wide gullies were noted, some showing evidence of surface flow but few have well-defined channels and are identified as NCDs (FIGURE 3.5).
- An S6 stream (labeled "14" on FIGURE 1.2) emerges as a spring in the southwestern portion of the opening. Although dry on the date of the review, the channel is up to 2.0 m wide, partly incised with cobble and gravel bed and laterally stable. Abundant wood was noted along the channel including several cut pieces (FIGURE 3.6).
- An S6 stream (labeled "17" on FIGURE 1.2), flows along a wide gully and was either dry or had some wet areas but not flowing water. The channel has a boulder and cobble bed and appears stable, although minor incision was noted near the block boundary.
- The western portion of the block parallels a broad ravine along which Roberts Creek flows. The block boundary is roughly 20 m from the break in slope at its nearest point, although is setback on average 30-40 m. Spur roads are setback even further; nevertheless, drainage patterns associated with these spur roads should be carefully located and managed to avoid alteration of natural drainage patterns (i.e., focussing runoff downslope towards the gullied terrain).



FIGURE 3.4 Gentle hummocky ground in lower portion of block. Photo PM1, August 8, 2022.



FIGURE 3.5 Moist soils are noted along a shallow gully with no evidence of surface flow. Photo RJ35, August 8, 2022.



FIGURE 3.6 Stream identified at southwest corner of block, August 8, 2022.

Block G043B4SG

- This block is entirely located within the Roberts Creek Watershed, on the eastern side of the creek near the upper end of the incised broad ravine.
- Northern portion of block have an increase in Balsam Fir and increased shrubby ground cover relative to the other blocks noted above.
- The block is located on gentle hummocky terrain.
- Soils were dry on date of the review; however, some areas of moist or wet ground were noted, likely associated with seasonal groundwater seepage areas.
- This block has a higher drainage density within block relative to the others within TSL A94817; most are S6 streams and NCDs, however one stream (labelled “10A” on FIGURE 1.2) is notably active (i.e., downcutting and laterally shifting) and has a channel width near the upper end of S6 streams (i.e., 3 m), and occasionally exceeding 3 m (although only locally).
- A narrow riparian buffer (5 m +/-) is noted along portions of stream 10A. This may pose a windthrow and sediment hazard to the stream. Conveyance of potential sediment to Roberts Creek from stream 10A following possible windthrow is likely.
- One primary road is planned in the block (SR02-064), which continues from block G043C3ZP to the south. This road would connect Sechelt Roberts FSR 7575 Branch 02 with Sechelt Dakota Branch 01. Small spurs from this road are planned. Given the gentle terrain, road cuts are expected to be relatively low, nevertheless planned road may intercept shallow groundwater seasonally.
- Block boundaries are well set back from riparian areas both along Roberts Creek and its classified tributaries.

4.0 FINDINGS AND RECOMMENDATIONS FOLLOWING AUGUST 2022 REVIEW

The harvest areas according to the August 2, 2022 plans are presented for the catchments above the eight points-of-interest (POIs)² in TABLE 4.1. Blocks G043B4SG and G043C3ZP are located above POIs 1, 2, 7 and 8 and cover areas of 13.8 ha and 33.6 ha, respectively.

ECAs in the Phase 1 and 2 assessment (Polar, 2023) were determined for the catchments above the eight POIs note above. ECA recommendations were also presented with the goal of limiting incremental increases in peak flow hazard at POIs downstream of BCTS Chart, while maintaining ECAs below 20% (i.e., a low peak flow hazard) for the portion of each watershed within BCTS’ chart area. An additional recommendation from Polar (2023) states that in order to maintain low peak flow hazard, ECA should also remain below 15% for the portion of each watershed unit above 800 m elevation³. Maximum additional ECAs consistent with these recommendations are presented in TABLE 4.2.

² The POIs referred to in herein are presented in FIGURES 6.1 and 6.2 of Polar (2023).

³ TSL A94817 is completely below 800 m elevation and not subject to this recommendation.

The Phase 1 and 2 report also recommended the BCTS consider alternative silvicultural⁴ approaches to minimize the incremental increases to current peak flow hazards. This includes small openings⁵, strip cuts or individual tree selection.

TABLE 4.1 Preliminary areas⁶ for planned blocks G043B4SG and G043C3ZP above the points-of-interest (POIs) in the assessment area⁷. These areas are based on the August 2, 2022 site plan (FIGURE 1.2).

Assessment Watershed	POI #	POI	Drainage Area (ha)	Planned Block G043B4SG Area (ha)	Planned Block G043C3ZP Area (ha)	Total Planned Block Area (ha)
Roberts Creek	1	Roberts Creek at the mouth	2,662.5	13.8	31.4	45.2
	2	Roberts Creek at BCTS Boundary	808.2	13.8	19.7	33.5
	3	Clack Creek at the confluence with Roberts Creek	1,251.4	-	-	-
	4	Clack Creek at BCTS Boundary	402.5	-	-	-
	5	Gough Creek at the confluence with Clack Creek	589.8	-	-	-
	6	Gough Creek at BCTS Chart Boundary	523.6	-	-	-
	7	East Roberts Creek at confluence of Roberts Creek	310.5	-	11.6	11.6
Stephens Creek	8	Stephens Creek at the mouth	255.4	-	2.2	2.2
Total harvested area (ha):				13.8	33.6	56.9

With consideration of summer low flows, maintaining net opening size to less than 8 ha⁸ and implementing partial harvest silviculture systems (i.e., thinning) is recommended by Polar (2023). Additionally, for S4, S5, and S6 streams, a management zone is recommended within gullies or draws, and these areas should be prioritized for relatively high retention levels in order to minimize changes in riparian water demands via evapotranspiration.

BC Timber Sales has, to a large extent, incorporated Polar’s draft Phase 1 and 2 recommendations into its site-level plan dated August 2, 2022. This includes a considerable reduction in block area for TSL A94817 (relative to the original planning shapes in March 2022) to reduce the incremental increase in ECA, promote shade and reduce wind speeds. It also includes minimizing new road alignments, and where possible locating such roads on gentle slopes to minimize road cuts and the potential for shallow groundwater interception.

⁴ The ECA recommendations assume a clearcut silviculture system. If a selective harvest silviculture system is used, ECAs are scaled based on the values in **Error! Reference source not found.** of Polar (2023).

⁵ If more than one opening is associated with a single cutblock, the space between openings should be large enough such that the adjacent opening is sufficiently buffered from wind and solar radiation.

⁶ The reported planned block areas are based on site plans as of August 2, 2022, and do not incorporate the planned 15% basal area retention.

⁷ Refer to Polar (2023) for description of the points-of-interest.

⁸ If more than one opening is associated with a single cutblock, the space between openings should be large enough such that the adjacent opening is sufficiently buffered from wind and solar radiation.

With regards to peak flow hazard, projected ECA post-development (August 2, 2023 plans) remain below the recommended 20% threshold above all eight POIs (FIGURE 4.2).

TABLE 4.2 *Maximum additional ECA to avoid incremental increase in peak flow hazard. POIs 3 and 5 are not presented since conditions above POI 4 constrain those above POI 3 and those above POI 6 constrain those above POI 5. ECA increases with planned development are based on the site plan of August 2, 2022.*

Assessment Watershed	POI #	POI	Recommended additional ECA within BCTS chart area to avoid incremental increase in peak flow hazard	Current ECA above POI (ha / %)	ECA increase with planned development, according to August 2, 2022 site plan (ha / %)	Projected ECA post-development (ha / %)
Roberts Creek	1	Roberts Creek at the mouth	≤ 185.6 ha overall AND	346.9 13.0%	45.2 +1.7%	392.1 14.7%
	2	Roberts Creek at BCTS Boundary	≤ 102.8 ha above POI 2	58.9 7.3%	33.6 +4.2%	92.5 11.4%
	4	Clack Creek at BCTS Boundary	≤ 35.8 ha above POI 4	44.7 11.1%	-	44.7 11.1%
	6	Gough Creek at BCTS Chart Boundary	≤ 19.0 ha above POI 6	80.2 15.3%	-	80.2 15.3%
	7	East Roberts Creek at confluence of Roberts Creek	≤ 15.3 ha above POI 7	46.8 15.1%	11.6 +3.7%	58.4 18.8%
Stephens Creek	8	Stephens Creek at the mouth	≤ 18.7 ha overall	32.0 12.5%	2.2 +0.9%	34.2 13.4%

With reference to the conservation of summer low flows, the blocks on the August 2, 2022 plans exceed the recommendation presented in Polar (2023) to limit net opening sizes⁹ to less than 8 ha for each planned block. To meet this recommendation, BCTS would need to either 1) reduce the overall planned block areas or 2) split the planned blocks into several smaller openings, such that adjacent openings are sufficiently buffered from wind and solar radiation.

Based on our August 2022 review, site-level hydrologic risks are low, however, we have identified the following recommendations to conserve stream and riparian features and further minimize downstream risks:

1. Establish machine free zones (MFZs) 5 m wide on each side of S6 streams within the blocks and minimize, where practical, crossings of S6 streams by heavy equipment.
2. NCDs are common in the blocks and are usually associated with topographic lows, shallow gullies, moist soils and hydrophytic vegetation (Devil’s Club, ferns, mosses, etc.). Excessive soil disturbance of NCDs followed by high runoff can result in erosion, downslope sedimentation, and in some cases conversion of NCDs to S6 channels. In effect, groundwater

⁹ This excludes road rights-of-way.

flow could become more rapidly flowing surface flow, which can have an effect on peak streamflows downstream. To minimize the risk of this occurring, equipment operators should be instructed to avoid trafficking along or across such areas where practical.

3. Stream "10A" in block G043B4SG is an active S6 channel with evidence of downcutting and lateral shifting, partly in response to windthrow along the riparian zone. Currently, the block boundary west of the planned road crossing of SR02-064 is less than 5 m from the channel. To minimize the risk of windthrow and channel disturbance, we recommend widening the buffer to a minimum of 15 m or wider if determined through a windthrow assessment.

5.0 FINDINGS AND RECOMMENDATIONS FOLLOWING DECEMBER 2023 REVISIONS

In response to our recommendations on the August 2022 site plan (noted in Section 4.0), BCTS further refined its plans to better align with the Phase 1 and 2 recommendations outlined in Polar (2023). The following summarizes these changes presented on FIGURES 1.3 and 1.4.

5.1 Equivalent Clearcut Area (ECA)

The harvest plans as of August 1, 2022 maintained ECAs below 20% and thus posed a low peak flow hazard for Roberts Creek¹⁰, East Roberts Creek and Stephens Creek (i.e., the watershed units in which TSL A94817 is located). Revisions to the harvest plans as of December 1, 2023 resulted in a further reduction in opening sizes and overall area of harvest. As shown in in TABLE 4.1 and TABLE 5.1, planned block G043B4SG was reduced from a total area of 13.8 ha to 12.4 ha¹¹, and planned block G043C3ZP was reduced from a total of 33.6 ha to 25.8 ha¹². This results in a decrease in the incremental change in ECA and total ECA post-development. As shown in TABLE 4.2 and TABLE 5.2, the incremental change in ECA above the four POIs where harvest is located is reduced by 0.2% to 1.0% depending on POI. The total ECAs post-development will remain below 20%, thus maintaining a low peak flow hazard.

5.2 Conservation of summer low flows - upland areas

For the conservation of summer low flows, Polar (2023) recommends limiting net opening sizes in each block to less than 8 ha. The December 2023 harvest plans include three openings of planned block G043B4SG ranging from 1.62 ha to 6.11 ha, and four openings for planned block G043C3ZP ranging from 4.52 ha to 7.56 ha. Each opening has also been separated by a minimum distance of 2 tree heights in order to buffer each opening from wind and solar radiation. Further, 144 leave trees have been field marked and flagged in each block, which will be subject to windfirming.

¹⁰ Including the POIs at the mouth of Roberts Creek at the mouth and at the BCTS boundary.

¹¹ Block G043B4SG consists of three openings.

¹² Block G043C3ZP consists of four openings.

TABLE 5.1 Revised areas¹³ for planned blocks G043B4SG and G043C3ZP above the points-of-interest (POIs) in the assessment area¹⁴. These areas are **based on the December 1, 2023 site plan** (FIGURES 1.3 and 1.4).

Assessment Watershed	POI #	POI	Drainage Area (ha)	Planned Block G043B4SG Area (ha)	Planned Block G043C3ZP Area (ha)	Total Planned Block Area (ha)
Roberts Creek	1	Roberts Creek at the mouth	2,662.5	12.4	24.3	36.7
	2	Roberts Creek at BCTS Boundary	808.2	12.4	13.4	25.8
	3	Clack Creek at the confluence with Roberts Creek	1,251.4	-	-	-
	4	Clack Creek at BCTS Boundary	402.5	-	-	-
	5	Gough Creek at the confluence with Clack Creek	589.8	-	-	-
	6	Gough Creek at BCTS Chart Boundary	523.6	-	-	-
	7	East Roberts Creek at confluence of Roberts Creek	310.5	-	10.9	10.9
Stephens Creek	8	Stephens Creek at the mouth	255.4	-	1.5	1.5
Total harvested area (ha):				12.4	25.8	47.6

TABLE 5.2 Maximum additional ECA to avoid incremental increase in peak flow hazard. POIs 3 and 5 are not presented since conditions above POI 4 constrain those above POI 3 and those above POI 6 constrain those above POI 5. ECA increases with planned development are **based on the site plan of December 1, 2023**.

Assessment Watershed	POI #	POI	Recommended additional ECA within BCTS chart area to avoid incremental increase in peak flow hazard	Current ECA above POI (ha / %)	ECA increase with planned development, according to December 1, 2023 site plan (ha / %)	Projected ECA post-development (ha / %)
Roberts Creek	1	Roberts Creek at the mouth	≤ 185.6 ha overall AND	346.9 13.0%	+36.7 +1.4%	383.6 14.4%
	2	Roberts Creek at BCTS Boundary	≤ 102.8 ha above POI 2	58.9 7.3%	+25.8 +3.2%	84.7 10.5%
	4	Clack Creek at BCTS Boundary	≤ 35.8 ha above POI 4	44.7 11.1%	-	44.7 11.1%
	6	Gough Creek at BCTS Chart Boundary	≤ 19.0 ha above POI 6	80.2 15.3%	-	80.2 15.3%
	7	East Roberts Creek at confluence of Roberts Creek	≤ 15.3 ha above POI 7	46.8 15.1%	+10.9 +3.5%	57.7 18.6%
Stephens Creek	8	Stephens Creek at the mouth	≤ 18.7 ha overall	32.0 12.5%	+1.5 +0.6%	33.5 13.1%

¹³ The reported planned block areas are based on site plans as of August 2, 2022, and do not incorporate the planned 15% basal area retention.

¹⁴ Refer to Polar (2023) for description of the points-of-interest.

5.3 Riparian protection along classified streams

Substantial revisions have been made in the December 2023 harvest plan to further protect riparian function along classified streams. Such protection includes the removal of substantial portions of block G043B4SG to exclude the riparian zone of streams 10¹⁵, 12 and 15¹⁶ (FIGURE 1.3), establishing machine free zones (MFZs) a minimum of 5 m on either side of other S6 streams, and emphasizing on the harvest plan map the need to avoid machine trafficking on non-classified drainages (NCDs) and maintaining advanced regen or mature timber in MFZs where practicable. Further, to reduce the likelihood of windthrow, a windthrow assessment will be conducted along opening edges and wind firming treatment will be completed as required (Aubin, pers. comm., 2023).

These additional measures will further reduce the likelihood of adversely affecting low flows by minimizing effects on current riparian structure and function, and reducing the sediment risks associated with blowdown and heavy equipment traffic.

5.3 Road construction

According to BCTS, proposed Roberts FSR 7575 Br 29, used to access TSL A94817, will become a permanently maintained road. Overall, this road and a few of the short spurs throughout the planned blocks are located on gentle terrain. As shown in the December site plans, maintaining natural drainage patterns is a management objective, and as such, drainage infrastructure will be established according to field conditions.

5.3 Terrain stability

A terrain stability assessment (TSA) has been conducted for both of the planned blocks (Onsite Engineering Ltd., 2023). Recommendation included the removal a small area from the south-western corner of planned block G043B4SG, which has been addressed in the December 2023 harvest plan map, and wind firming as reflected on the December 2023 harvest plan maps.

¹⁵ Includes stream 10A, which was identified during field review to require an additional riparian buffer than plans of August 2, 2023 had identified.

¹⁶ This excludes the right-of-way for Roberts FSR 7575 Br29.

6.0 CLOSURE

Based on our field and office reviews, BCTS has developed a harvest plan that minimizes site-level hazards and risks associated with TSL A94817 Blocks G043B4SG and G043C3ZP, and is aligned with the higher-level recommendations of Polar (2023).

We trust that this review completes our assignment to your satisfaction. If you have any further questions, please contact the undersigned.

Yours truly,

Polar Geoscience Ltd.

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7.0 REFERENCES

- Amato, G. 2022. Personal communication with L. Uunila of Polar Geoscience Ltd. Operational Technologist, BC Timber Sales, Chinook Business Area, Powell River, BC.
- Aubin, P. 2023. Personal communication with L. Uunila of Polar Geoscience Ltd. Practices Forester, BC Timber Sales, Chinook Business Area, Powell River, BC.
- Onsite Engineering Ltd. 2003. Terrain Stability Assessment, Cutblocks G043C3ZP and G043B4SG (TSL 94817). Prepared for BC Timber Sales, Chinook Business Area.
- Polar Geoscience Ltd. (Polar). 2023. Roberts Creek and Stephens Creek Watershed Assessment: Phases 1 & 2. Prepared for BC Timber Sales, Chinook Business Area. Polar File No. 740301.