WATERSHED REVIEW
CHAMBERLAIN CREEK WATERSHED
Draft March 23, 2012

Ministry Contract No: CS12NRH-011

BIOPHYSICAL AND LAND-USE CHARACTERISTICS OF THE WATERSHED

Table 1. Summary Information – Watershed Characteristics – (see Figures 1 and 2)

Size (km^2)	Dominant BEC Zones	Dominant NDT	Elevation Range (m)	Surficial Geology near the Mouth (i.e. sensitive area)	Stream Density (km/km^2)	Biggest % of watershed in same elevation band[1]	Distribution of slope gradients within the watershed (% of watershed)			
							<10% slope	10 to 30% slope	30 to 60% slope	>60% slope
55.0	ESSFmv2 / BWBSmwk1	NDT 2	677-1954	Coarse textured fluvial	2.7	39.2	14.4	41.8	36.0	7.8

[1] The entire watershed is divided into 300 m elevation bands. The less elevation bands there are and the more area is represented by any given single elevation band, then the greater will likely be the effect of forest harvesting on increased peak flows due to the theoretical concept of "synchronization" (i.e. the melt from the cutblocks is synchronized as much of it comes from the same elevation), and the greater sensitivity it will have.

Table 2. Rating of "Sensitivity" of Watershed to Increased Peak Flow at the lower reaches

Rosgen Stream Channel Type	Rosgen Stream Channel Sensitivity Score	Sensitivity score relative to topography	Sensitivity score relative to lateral connectivity	Sensitivity score relative to vertical conductivity	Sensitivity score relative to climate	Sensitivity score relative to flow synchroniza-tion potential	Sensitivity score relative to NDT type	Sensit-ivity Score	Sensitivity Rating
C4- Lightly unstable w disturbed fan	4.2	1.25	1.1	1	1.1	1.03	1.03	6.74	Very High

Table 3. Rating of "Sensitivity" of Watershed to Increased Production of Fine Sediment at lower reaches

Stream Channel Type	Reach Sensitivity Score	Sensitivity score relative to topography	Sensitivity score relative to lateral connectivity	Sensitivity score relative to drainage density	Sensitivity score relative to climate	Sensitivity score relative to soils	Sensitivity Score	Sensitivity Rating
Riffle-pool gravel	5	1.25	1.2	1	1.1	0.9	7.4	Very High

Table 4. Rating of "Sensitivity" of Watershed to a Loss In riparian Function.

Stream Channel Type	Reach Sensitivity Score	Sensitivity score relative to Aspect	Sensitivity score relative to climate	Overall watershed sensitivity to loss of riparian	Loss of Riparian Sensitivity Rating
C3-C6	4.82	0.95	0.9	4.12	Mod

Table 5. Peak Flow Hazard Rating, as indexed by HEDA – current scenario (i.e. no proposed harvesting considered)

Watershed area (km^2)	Total area Pine Leading (km^2)	Total area Pine Mixed (km^2)	Total area harvest (km^2)[1]	Total HEDA from Pine Beetle alone (%)	Total HEDA from logging alone (%)	Total HEDA from logging and Pine Beetle mortality (%)
55.0	6.6	6.65	2.13	9.65	3.12	12.77

[1]Note: This includes openings from VRI database, and non-overlapping openings from RESULTS and FTEN databases.

Table 5 (continued)

Total area in Agriculture (km^2)	Total area in Agriculture (% of watershed)	Total area in Proposed Harvest (km^2)	Total HEDA (%)	HEDA Hazard rating Score	HEDA Hazard Rating
0.00	0.00	0.00	12.77	1.03	Very Low

Table 6. Fine Sediment Hazard Rating, as indexed by the Stream Crossing Density

Watershed area (km^2)	# of x-ings	#of fish bearing X-ings[1]	#of non-fish bearing X-ings	density of x-ings (#/km^2)	Density of fish bearing X-ings (#/km^2)	Density of non-fish bearing X-ings (#/km^2)	Hazard Rating Score	Hazard Rating
55.0	143	34	109	2.6	0.6	1.98	2.64	Mod

[1]Note: The information on stream crossings was provided by MoE and was generated with a GIS model, not fieldwork.

Table 7. Loss of Riparian Function Hazard Rating

Reach Number	Rosgen Stream Type	Reach Length (m)	% riparian logged (as interpreted from air photos)	Apparent stability and other comments (as viewed from air photos)
1	E4-Stable onto fan	1610	0.0	Stable
2	C4- Lightly unstable/disturbed	1280	0.0	Lightly De-stabilized
3	C4 - Sig Unstable/disturbed	1550	0.0	Quite Unstable
4	B4- Lightly unstable	1370	0.0	Lightly De-stabilized
5	B4- Lightly unstable	840	0.0	Lightly De-stabilized
6	A3-Stable	2740	0.0	Stable
Hazard Scores:			Hazard Rating Score	Hazard Rating
			0.25	Very Low

Table 8. Risk Rankings for the Different Hazards in the watershed current scenario (i.e. no proposed harvesting considered)

Watershed Hazard Types	Sensitivity Score	Sensitivity Rating	Hazard Score	Hazard Rating	Risk Score	Risk Rating
Increased Peak Flow	6.74	Very High	1.03	Very Low	6.9	Low
Increase in Production of Fine Sediment	7.43	Very High	2.64	Mod	19.6	High
Loss of Riparian function	4.12	Mod	0.25	Very Low	1.0	Very Low

Table 9. Fisheries Sensitive Watershed Score and Rating

Name	Size (km^2)	Peak Flow Sensitivity	Sed Sensitivity Rating	Riparian Sensitivity	Fish Value[1]	FSW Score PF vs Fish	FSW Score Seds vs Fish	FSW Score Rip vs Fish	Overall FSW Score	Overall FSW Rating
Chamber-lain Creek	55.0	Very High	Very High	Mod	High	4	4	2	10	High

[1]Note: The "Fish Values" were assessed and provided by Fisheries Biologists from the Ministry of Forest, Lands and Natural Resource Operations. This report does not describe fish values.

INTERPRETATIONS AND RECOMMENDATIONS FOR MANAGEMENT STRATEGIES FOR PROTECTION OF WATER RESOURCES IN THIS WATERSHED

Brief Watershed Description (Table 1 and Figures 1 and 2)

Chamberlain Creek watershed, which flows directly into the Upper Sukunka River, has a mountainous to steep topography with a large expanse of flatland as it extends across the wide Sukunka floodplain. Elevations in this watershed range between 677 and 1954 m. The watershed is distributed over several 300m elevation bands, with the biggest proportion (39%) being situated in the elevation band between 1,277 and 1,577 m. There is an abundance of steep and very steep slopes in this watershed with 44% of the watershed having slopes more than 30% and 8% of the watershed having slopes greater than 60% (Table1). The dominant biogeoclimatic zone in this watershed is the ESSFmv2 and BWBSwk1.

The lowest reach of Chamberlain Creek is a very low gradient, meandering stream that flows across the wide floodplain of the Sukunka River (Figure 5). Reach #2 is an unconfined wandering channel with some minor signs of disturbance. Reach #3 shows major signs of instability and disturbance as the active channel has become very wide and in-filled with coarse sediments (Figure 5). The mainstem channel reaches above #3 are steeper and much more incised with minimal floodplain (Figure 6). There is a lot of steep terrain that needs to be carefully managed in this watershed. It appears that the lower parts of the watershed were extensively burnt and then rehabilitated (Figure 4). Reaches 2 and 3 have been classified as slightly unstable C4 types with the reaches above that being classed as B4 and A3 (Table 7). It appears that the riparian areas along reaches 1 and 2 may have been disturbed during the post-fire rehabilitation operations, but this is difficult to confirm from the ortho-photos. The surficial

geology in this watershed is dominated by colluvial rubble, and alluvial deposits mostly originating from the Sukunka River.

Sensitivities, Hazards and Risks in this Watershed

The overall sensitivity of the watershed to increases in peak flows has been classified as very high, which is mostly due to the very sensitive nature of the stream channel types, the steep topography and the general lack of peak flow buffering features (Table 2). The overall sensitivity to an increase in fine sediments has also been classed as very high due to the sensitive natures of the lower reaches and the steep topography. The loss in riparian function has been assessed as a moderate because much of the watershed is located in the ESSF biogeoclimatic zone where sensitivities to temperature increases are not as significant.

Both the peak flow and the riparian risks have been classed as low or very low because of the very low hazard ratings. However, the current risk ratings for fine sediment is high because of the combination of a very high sensitivity and a moderate hazard (relatively high stream crossing density) (Table 8).

When considering both the overall physical sensitivities in this watershed and the fisheries values, the Fisheries Sensitive Watershed (FSW) rating is assessed as High (Table 9).

Suggested Special Management Objectives To Protect Fish Habitat Values <u>Above and Beyond</u> What is Already Required by FPPR

1) Risks associated with an increase in peak flows
   Given that the current peak flow sensitivity for this watershed is <u>very high,</u> recommendations are as follows:

   a. Maintain peak flow risks to a maximum of a <u>Low level</u>
      i. Current HEDA=<u>12.8%</u>
      ii. Max HEDA to maintain low risk = <u>12.9%</u>
      iii. Current Peak Flow risk<u>: Low</u>
      iv. Available harvest in green timber to maintain low risk = 1<u>0 ha</u>
      v. Use the peak flow risk calculator to determine the maximum suggested harvest of different combinations of healthy stands and mountain pine beetle affected stands in order to maintain the risk level below moderate.

2) Risks associated with the accelerated delivery of fine sediments
   Given that the current fine sediment sensitivity for this watershed is high:

   a. Minimize erosion and the delivery of fine sediments at all stream crossings and keep the WQEE stream crossing rating to a maximum of a Low hazard level.
      i. To complete these assessments, use the most recent WQEE protocol which can be found at the following web link: http://www.for.gov.bc.ca/ftp/hfp/external/!publish/frep/indicators/Indicators-WaterQuality-Protocol-2009.pdf

3) Risks associated with a loss in riparian function

Given that the current riparian sensitivity for this watershed is only moderate, no special recommendations are provided for special management objectives above and beyond what is already required by the Forest Planning and Practices Regulations (FPPR).

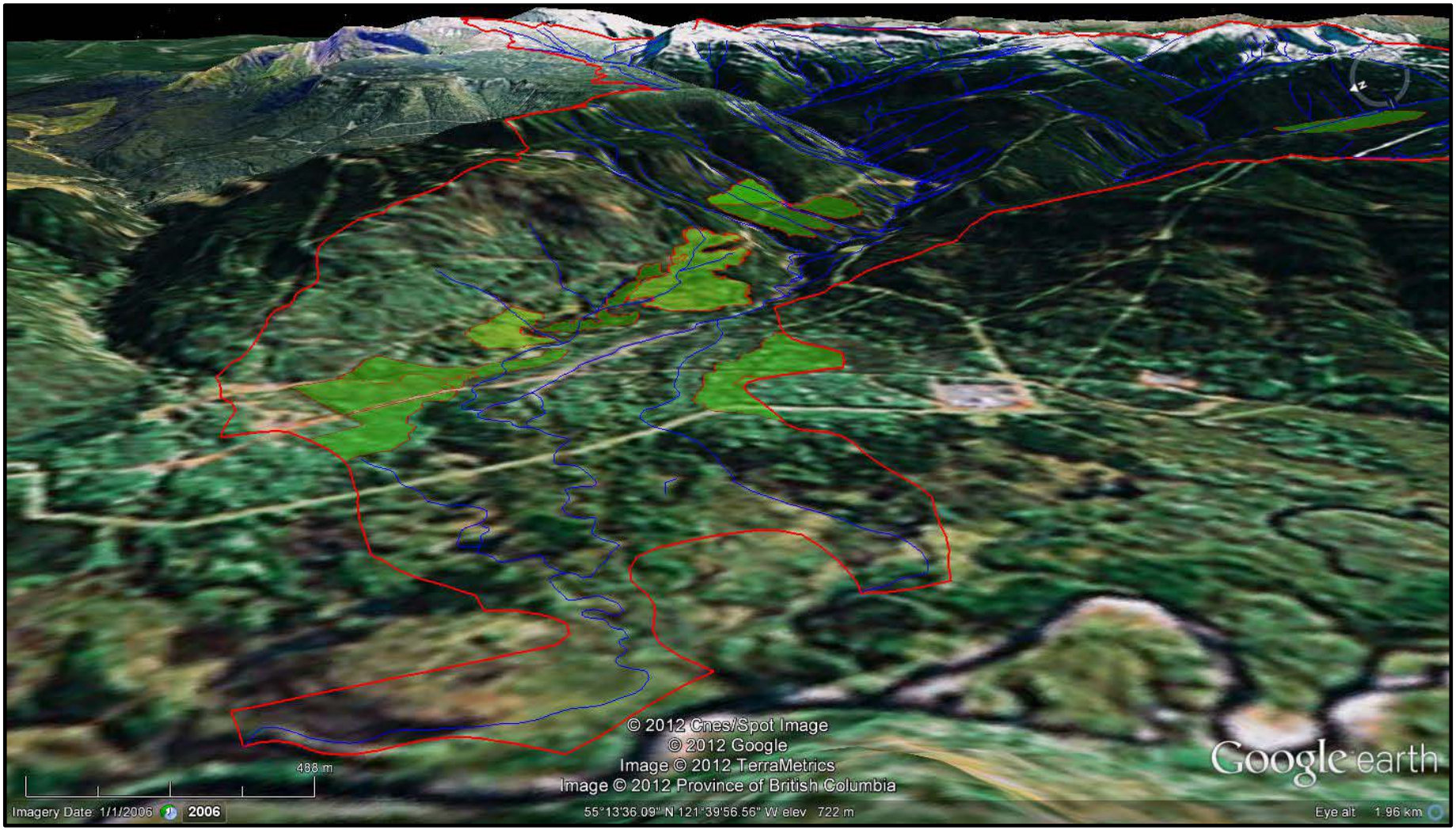

Figure 1. Google earth overview image of Chamberlain Creek watershed, looking upstream into the watershed.

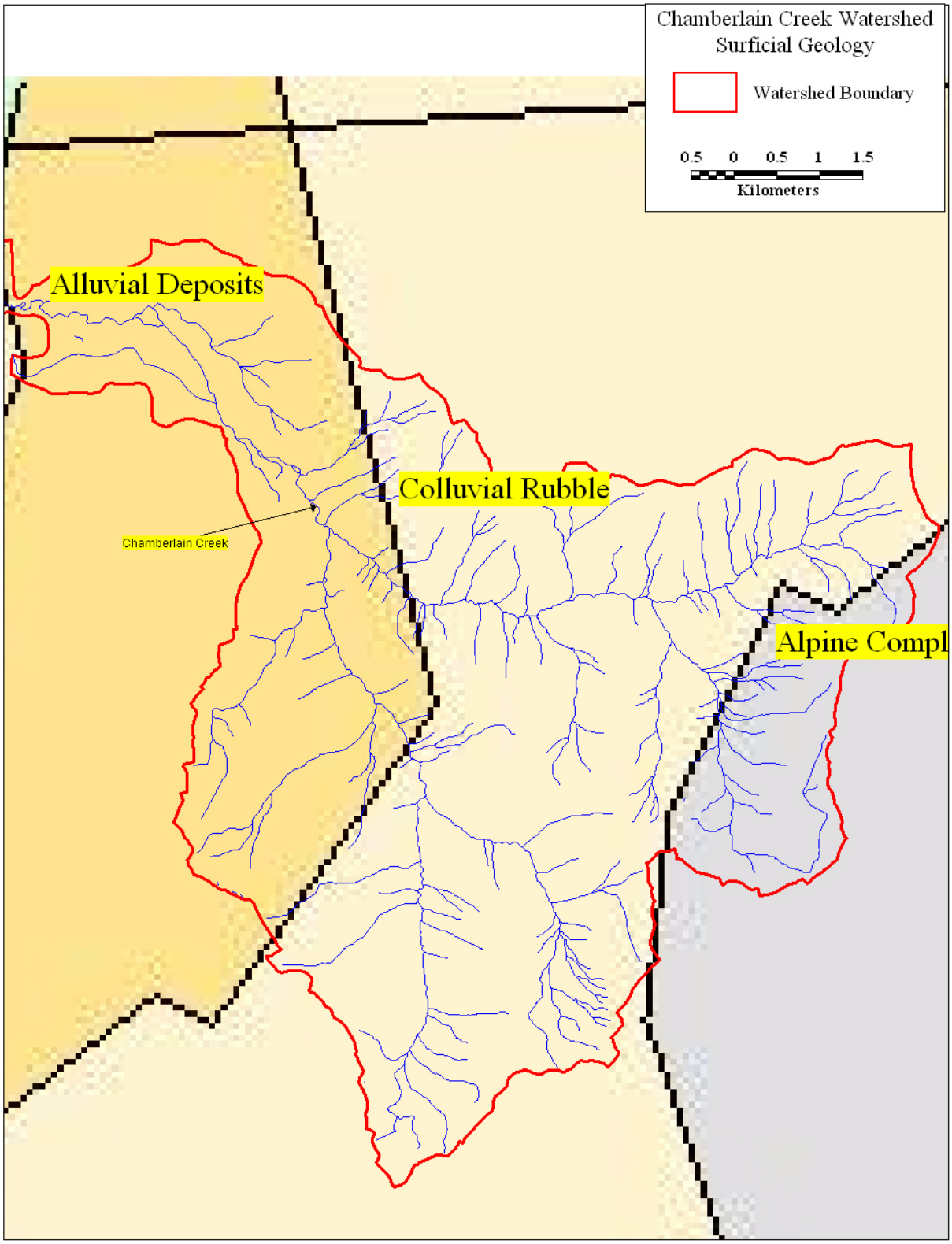

Figure 2. Distribution of dominant surficial geology types in the Chamberlain Creek watershed (from 1:5M BC Geological Survey Maps).

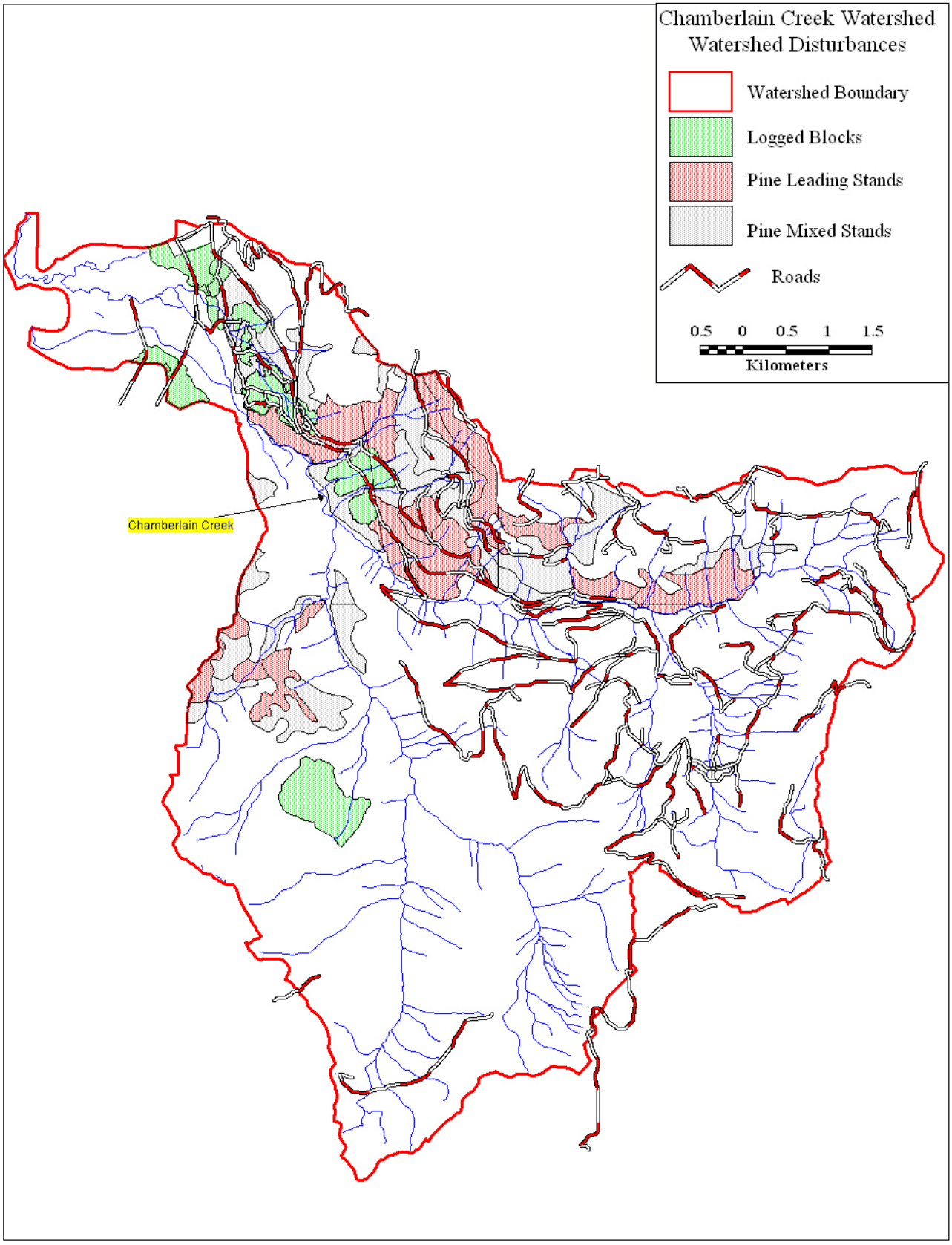

Figure 3. Land-use related and large natural disturbances in the Chamberlain Creek Watershed

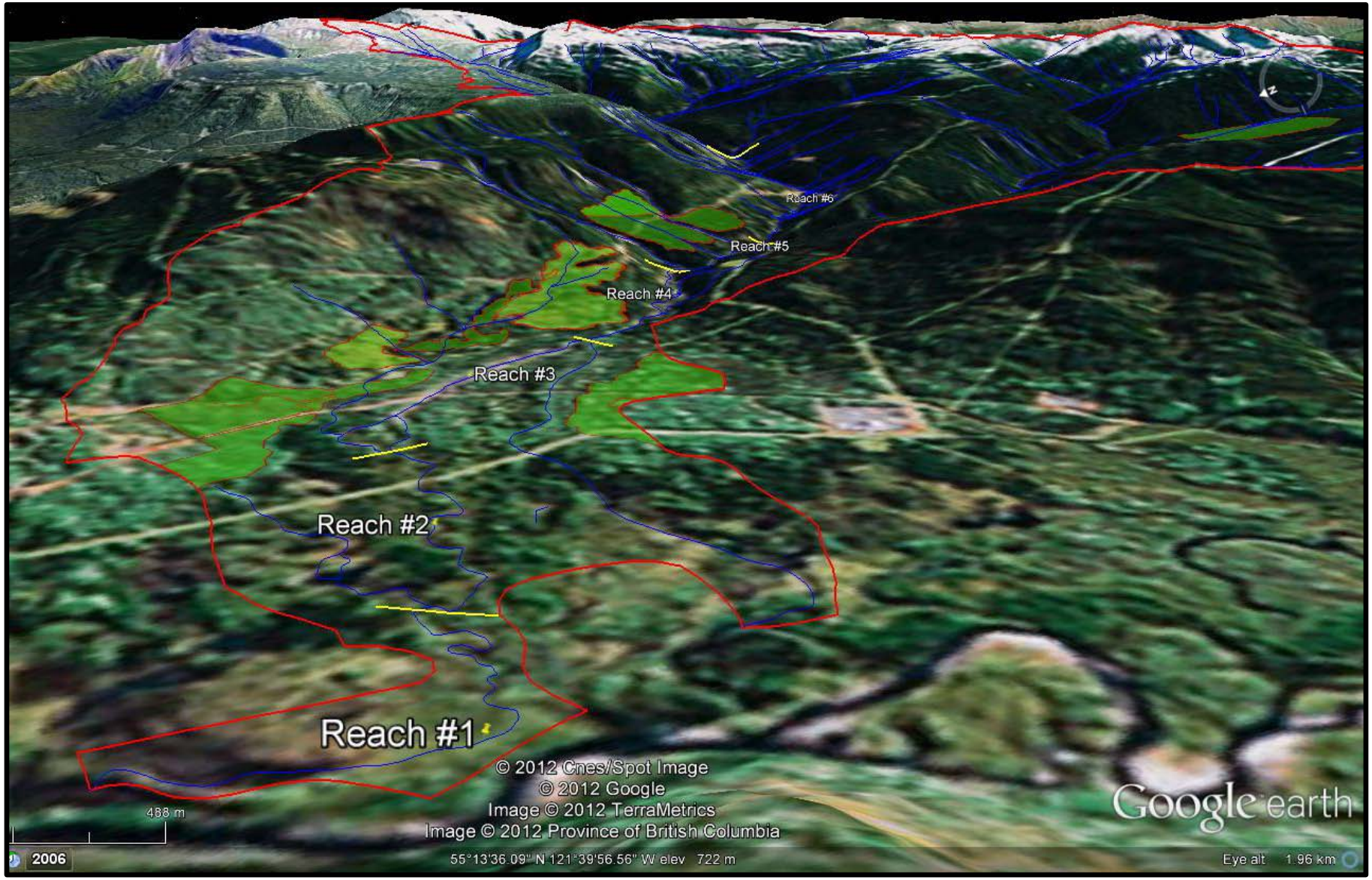

Figure 4. Identification of reaches along the mainstem of Chamberlain Creek watershed

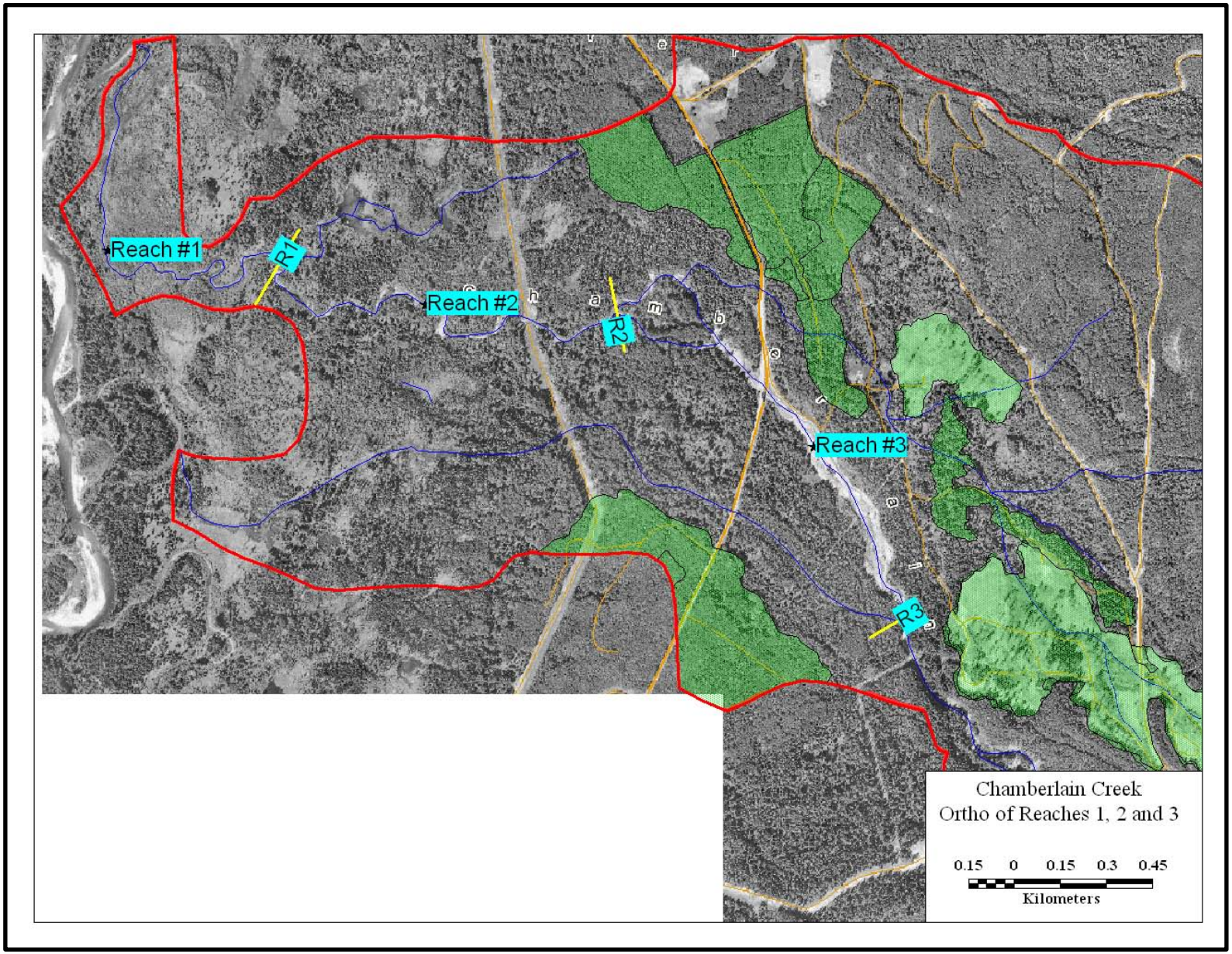

Figure 5. Vertical ortho-photo image of Reaches #1, #2 and #3 of Chamberlain Creek.

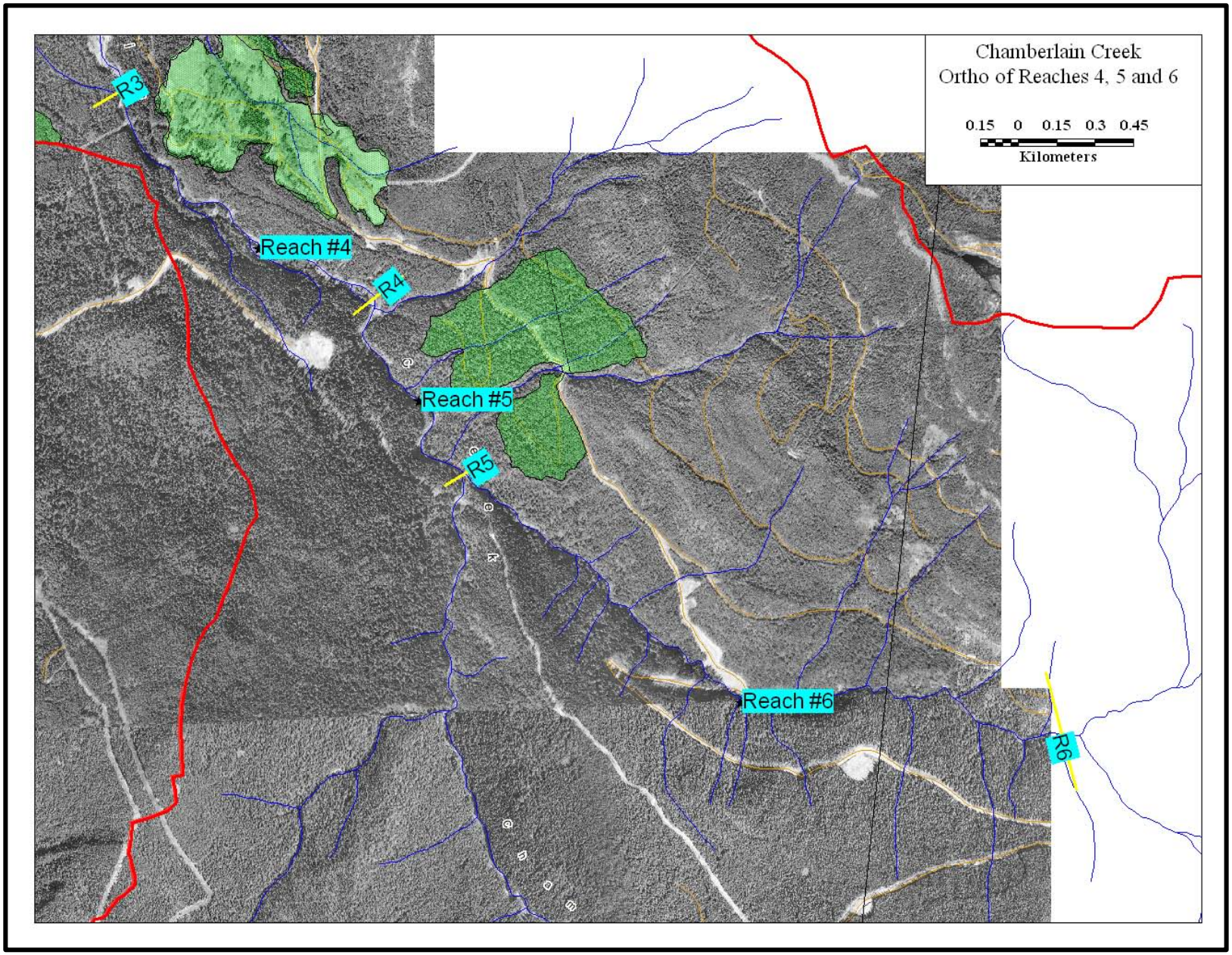

Figure 6. Vertical ortho-photo image of Reaches #4, #5 and #6 of Chamberlain Creek.