WATERSHED REVIEW
LAMPREY CREEK WATERSHED

BIOPHYSICAL CHARACTERISTICS OF WATERSHED

Table 1. Summary Information – Watershed Characteristics – (see Figure 1)

Size (km^2)	Dominant BEC Zones	Dominant NDT	Elevation Range (m)	Dominant Surficial Geology	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
239.2	SBS	NDT3	973 - 1557	Medium textured till	1.66	50	55.5	41.9	2.6	0

[1] The entire watershed is divided into 300 m elevation bands of harvestable forest land-base. 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. Dominant soil textures in the watershed

Surficial Geology	**Total area of surficial material in watershed (km^2)**	**Percent in watershed**	**Sensitivity to disturbance (mostly roads, trails and crossings)**
Very Fine Textured Lacustrine	0	0.0	Very High Sensitivity
Fine textured fluvial	1.2	0.5	Very High Sensitivity
Fine textured till	5	2.1	High Sensitivity
Medium textured till	198	82.8	Moderate Sensitivity
Coarse textured till on rolling terrain	35	14.6	Low Sensitivity
Coarse textured fluvial	0	0.0	Moderate Sensitivity
Colluvial	0	0.0	Low Sensitivity
Organic	0	0.0	Very High Sensitivity
Bedrock	0	0.0	Very Low Sensitivity
Eolian	0	0.0	Very High Sensitivity
Marine (including glaciomarine)	0	0.0	Very High Sensitivity

Table 3. Rating of "Sensitivity" of Watershed to Increased Peak Flow at the lower reaches

Rosgen Stream Channel Score	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/disturbed	4	0.75	1.1	0.95	1.1	1	1	3.45	Mod

Table 4. Rating of "Sensitivity" of Watershed to Increased Production of Fine Sediment at lower reaches

Most sensitive fish species in watershed[1]	Species Sensitivity Score	Sensitivity score relative to topography	Sensitivity score relative to lateral connectivity	Sensitivity score relative to climate	Sensitivity Score	Sensitivity Rating
Dolly Varden	5	0.75	1.2	1.1	4.95	Very High

[1]Note: See Figure 2 for generalized distribution of fish species in this watershed.

Table 5. Rating of "Sensitivity" of Watershed to a Loss In riparian Function.

Most sensitive fish species in watershed	Species Sensitivity Score	Sensitivity score relative to loss of LWD	Sensitivity score relative to Aspect	Sensitivity score relative to climate	Overall watershed sensitivity to loss of riparian	Loss of Riparian Sensitivity Rating
Dolly Varden	5	1.25	0.85	1.1	5.84	Extreme

Table 6. Peak Flow Hazard Rating, as indexed by HEDA

Watershed area (km^2)	Total area Pine Leading (km^2)	Total area Pine Mixed (km^2)	Total area harvest (km^2)	Total HEDA from Pine Beetle alone (%)	Total HEDA from logging alone (%)	Total HEDA from logging and Pine Beetle mortality (%)
239.2	36.5	23.5	70.03	10.58	36.14	46.72

Table 6 (continued)

Total area in Agriculture (km^2)	Total area in Agriculture (% of watershed)	Total area in Other Openings[1] (km^2)	Total HEDA with Logging, O and G & Agriculture (%)	HEDA Hazard rating Score (includes Logging, O and G and Agriculture)	HEDA Hazard Rating
0.00	0.00	0.00	46.72	4.50	Very High

[1]Note: This includes Oil and Gas and mining openings

Table 7. 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
239.2	179	179	0	0.7	0.7	0.0	3.7125	High

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

Table 8. Loss of Riparian Function Hazard Rating (See Figures 3 to 7)

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	B5-Stable	241	0.0	Stable
2	C5 - Unstable/disturbed	1143	83.4	Moderately De-stabilized
3	B5-Stable	1150	0.0	Very Stable
4	B5-Stable	1740	0.0	Stable
5	C6- Stable	1980	0.0	Stable
Hazard Scores:			Hazard Rating Score	Hazard Rating
			1.5	Low

Table 9. Risk Rankings for the Different Hazards in the watershed

Watershed Hazard Types	Sensitivity Score	Sensitivity Rating	Hazard Score	Hazard Rating	Risk Score	Risk Rating
Increased Peak Flow	3.45	Mod	4.50	High	15.5	High
Increase in Production of Fine Sediment	4.95	Very High	3.71	High	18.4	High
Reduction in Riparian Function	5.84	Extreme	1.5	Low	8.8	Mod

RECOMMENDATIONS FOR LAND-BASED INVESTMENT ACTIVITIES IN PRIORITY WATERSHEDS

1. Prior to the allocation of permits for treatment activities, the Lamprey Creek watershed management plan should be reviewed and carefully considered in order to determine how any LBI planned activities may affect peak flow risk in the Lamprey Creek watershed.
2. The allocation of permits for treatment activities in the Lamprey Creek watershed should be planned in collaboration with all major licences that operate in the watershed so that the total disturbance does not exceed the peak flow risk threshold set by government for this priority watershed.
3. Maintain long term recruitment of large woody debris (LWD), shade and bank stability by retaining at least 90% of the riparian area. This riparian area refers to the management area measured from the closest streambank to a distance 15m upslope from the streambank on:
    i. S4 streams that are 0.5m or greater in stream channel width, or
    ii. S6 streams that are 0.5m or greater in stream channel width that flow directly into a fish stream.
4. Develop and implement effective erosion and sediment control plans for all stream crossings that are your responsibility, whether you are building them, using them or just maintaining them. The effectiveness of the erosion and sediment control at the stream crossing should be measured using the Water Quality Effectiveness Evaluation methodology developed by the Government of BC[1]
5. Prior to the initiation of any treatment activities, identify the presence of any 'flat-over steep" topography and manage appropriately where needed (Figure 4 and 8). These topographic features can be prone to slope instability when forest cover is removed and localized drainage is not well planned.
6. Consider under-planting as a reforestation treatment as this minimizes the detrimental effects on peak flow risk, compared to completely knocking down the stand.
7. In order to optimize hydrological recovery, planting of all treated sites should be done with the best growing stock appropriate. The selection of appropriate species and planting densities should be done by a qualified professional based in a site specific assessment.
8. Not all of the dead pine stands in the watershed should be targeted for knock down treatments. Some should be left for natural regeneration and biodiversity thus creating a more diverse forest in the future with more age classes, i.e. the presence of dead pine stands in the watershed is not an ecological disaster.

[1] http://www.for.gov.bc.ca/ftp/hfp/external/!publish/frep/indicators/Indicators-WaterQuality-Protocol-2009.pdf

Table 10. Table of comments and observations

Comment #1	Terrain is quite flat. Forest harvesting is distributed throughout watershed.
Comment #2	There are sensitive fish species throughout the watershed and Dolly Varden well into the upper reaches of the watershed.
Comment #3	No significant issues with management of landslide prone terrain, other than localized potential problems with flat-over-steep terrain (Figure 4 and 8) and most recent development moving into steeper terrain (Fig 9).
Comment #4	Upper fluvial systems are dominated by E4/wetland complexes that are generally less sensitive to forest harvesting type impacts.
Comment #5	A WQEE survey has already been completed in this watershed and identified that about 7% of stream crossings had erosion and sediment control problems.
Comment #6	There appears to be some accelerated bank erosion and channel aggradation along the C4/C5 type lower reaches. This can only be explained by higher peak flows as there are no landslides or significant riparian logging or riparian disturbances. Thus the main control in this watershed should probably be one of HEDA.
Comment #7	Maintain the peak flow risk level at below a moderate rating with the objective of maintain stream channel integrity if this watershed is designated as a fisheries sensitive watershed.

INTERPRETATIONS AND RECOMMENDATIONS FOR MANAGEMENT STRATEGIES FOR PROTECTION OF FISH RESOURCES WITHIN THIS CANDIDATE FISHERIES SENSITIVE WATERSHED

This watershed has a moderate sensitivity to increased peak flows, very high sensitivities to increases in fine sediment and extreme sensitivities to loss of riparian functions. The watershed has a high risk rating for both the peak flow and the fine sediment hazard. Thus, FSW recommendations will focus primarily on these two issues.

The risk associated with increased peak flows is currently at a high level (Table 9). Given that one of the main objectives of a fisheries sensitive watershed is to protect fish and fish habitat, I recommend the peak flow risk be maintained below a moderate level. Since this watershed already has a high peak flow risk, further stand treatment and forest harvesting activities will have to minimized and possibly curtailed until significant hydrological recovery has occurred on the newer cut-blocks if a low peak flow risk is desired.

The current fine sediment risk rating is at a high, thus it is recommended that a WQEE survey[2] be completed in the Lamprey Creek watershed in order to identify individual stream crossings that may have erosion and sediment control problems and to develop site-specific prescriptions to address any such problems.

The Sustainable Forest Management (SFM) plan for this watershed recognizes the importance of good stream crossing management and the Major Licensees that operate within this watershed use the stream crossing surveys to identify problems and correct the problems when identified[3].

[2] http://www.for.gov.bc.ca/ftp/hfp/external/!publish/frep/indicators/Indicators-WaterQuality-Protocol-2009.pdf
[3] P. Beaudry and Associates Ltd. 2005. Results of the Stream Crossing Quality Index (SCQI) survey for the Lamprey Creek Watershed, Nadina Forest District. Unpublished report prepared for Canfor – Houston.

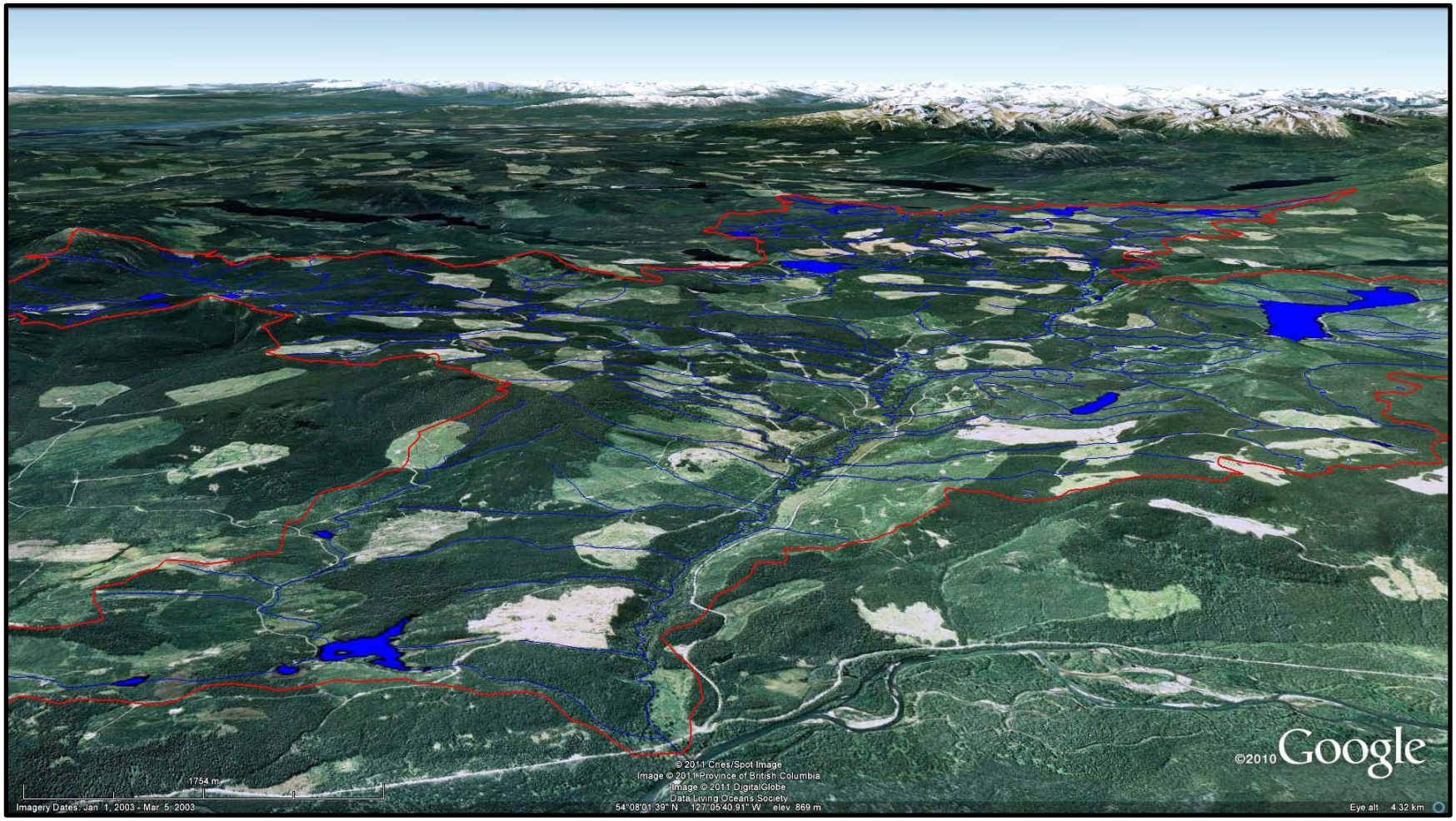

Figure 1. Overview image of Lamprey Creek watershed, looking upstream into the watershed.

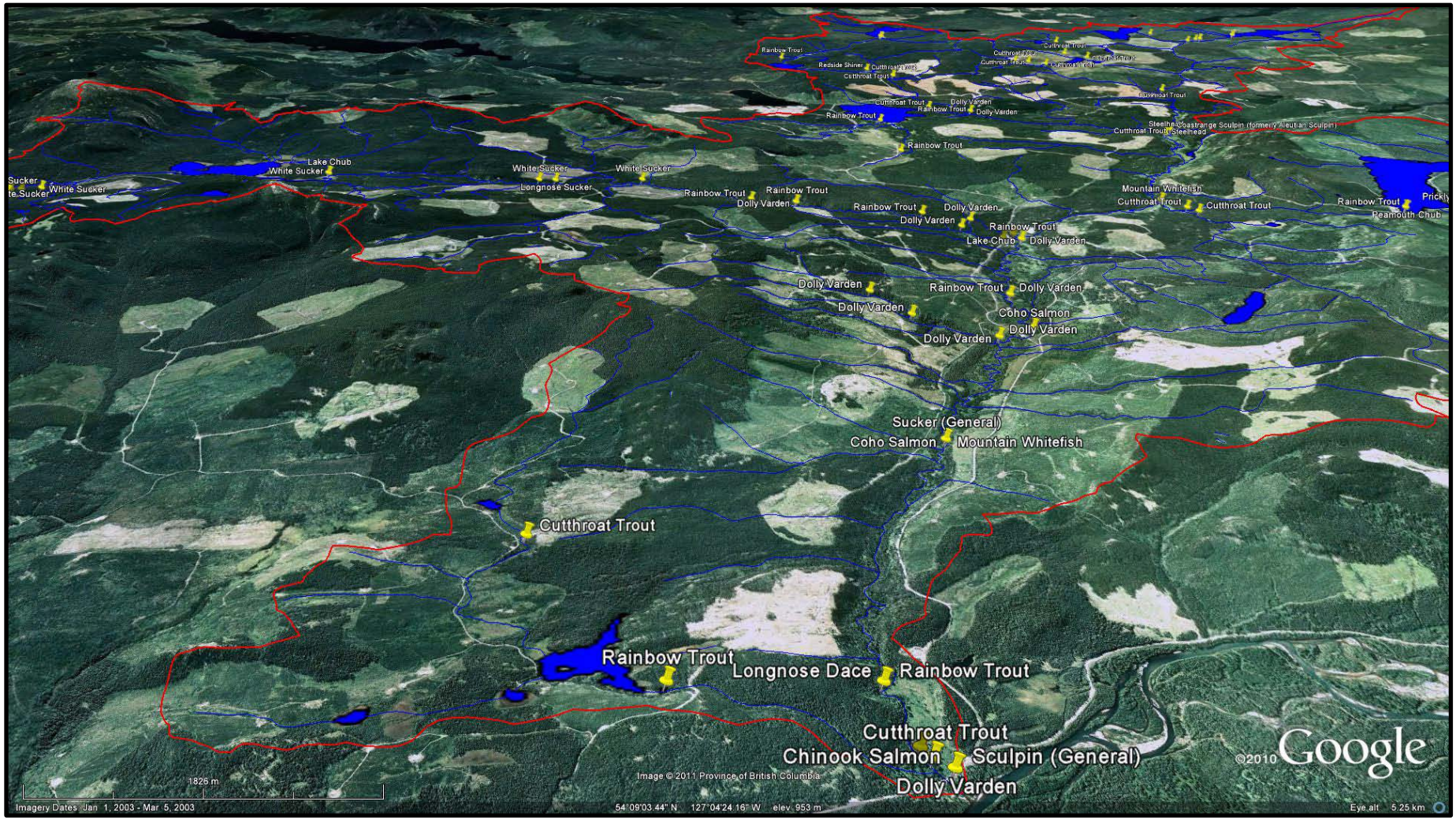

Figure 2. General fish species distribution in the Lamprey Creek watershed.

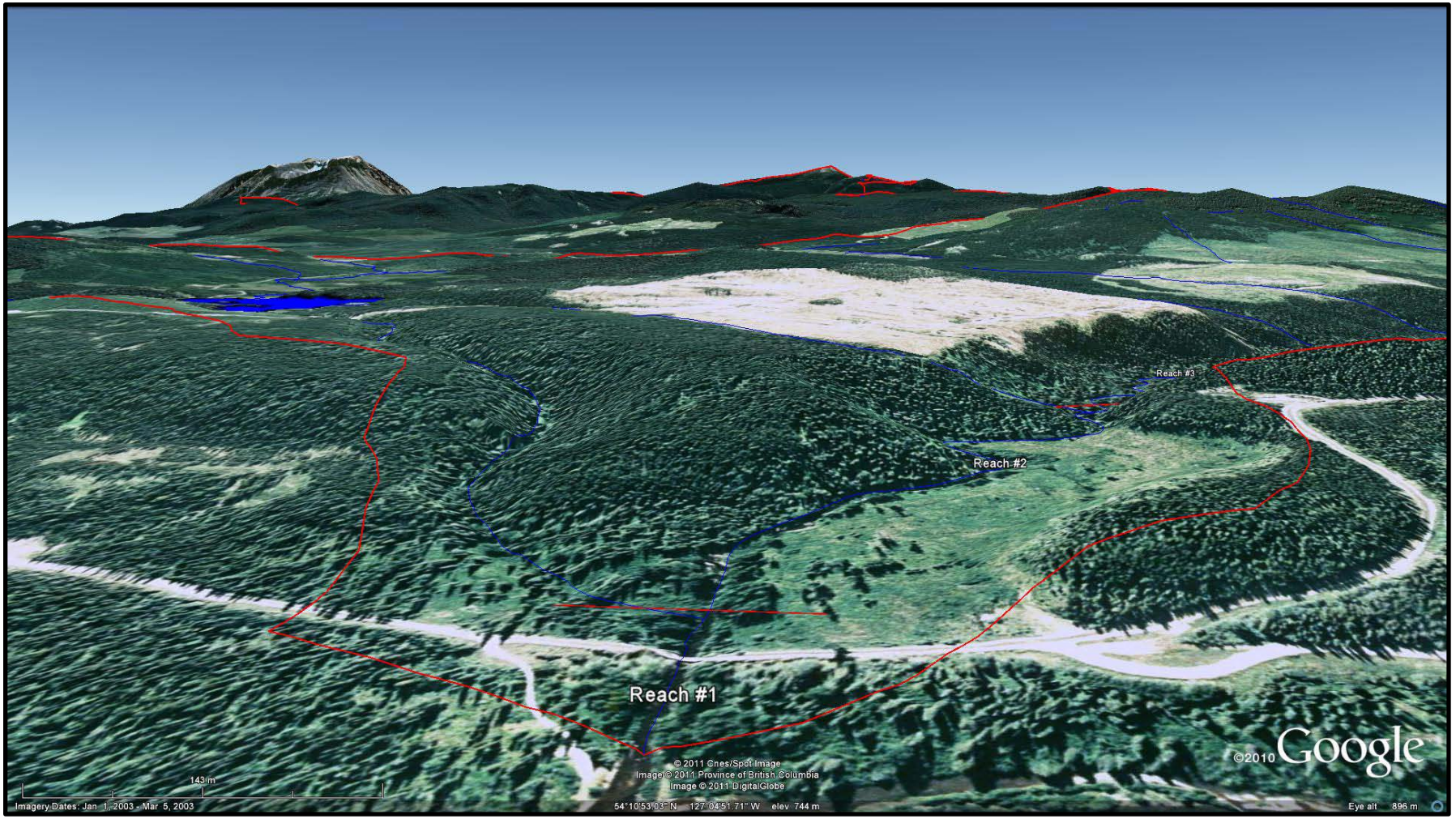

Figure 3. Google Earth image of the two lower reaches of Lamprey Creek, looking up into the watershed.

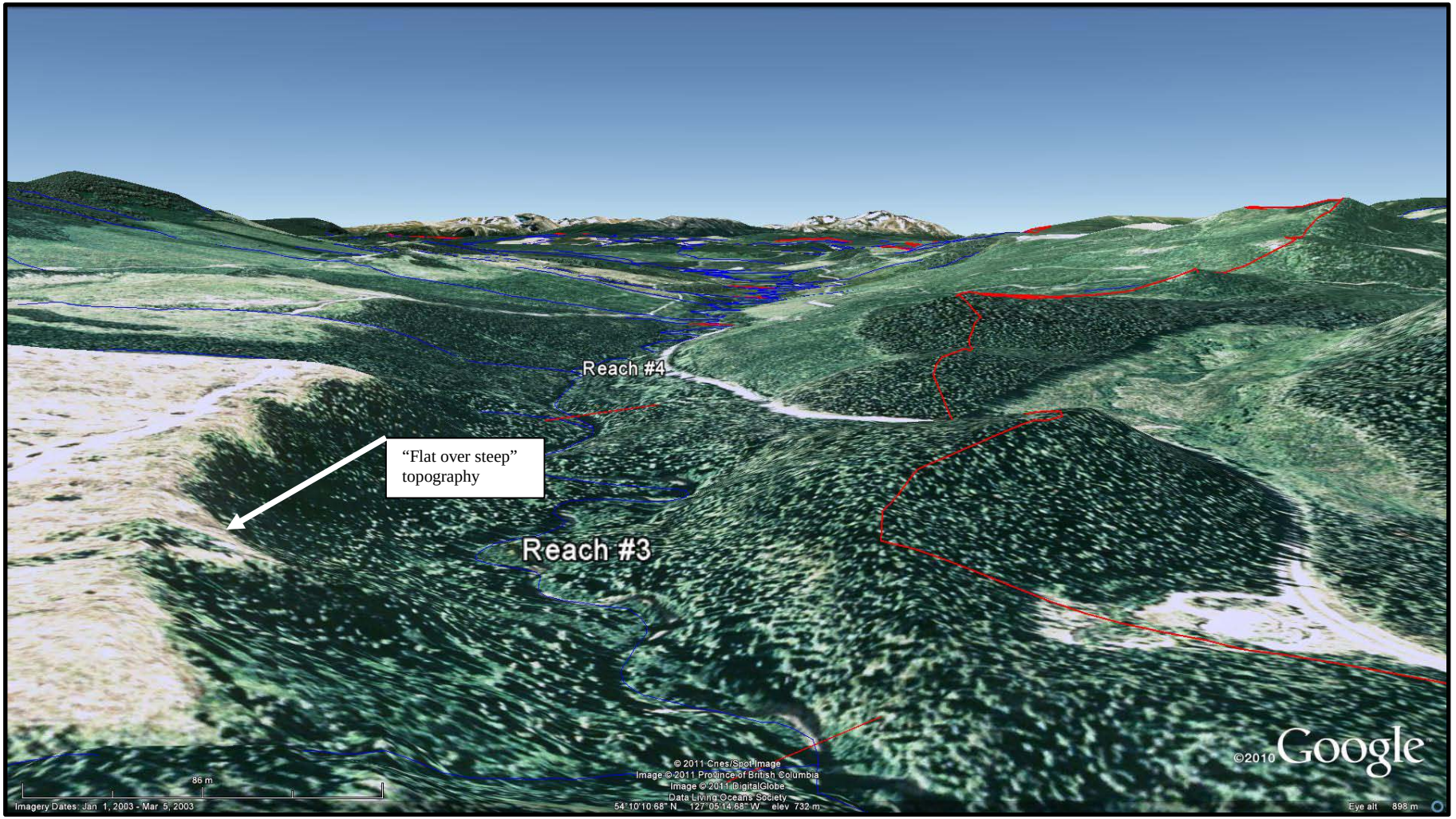

Figure 4. Google Earth image of reaches 3 and 4 of Lamprey Creek, looking up into the watershed.

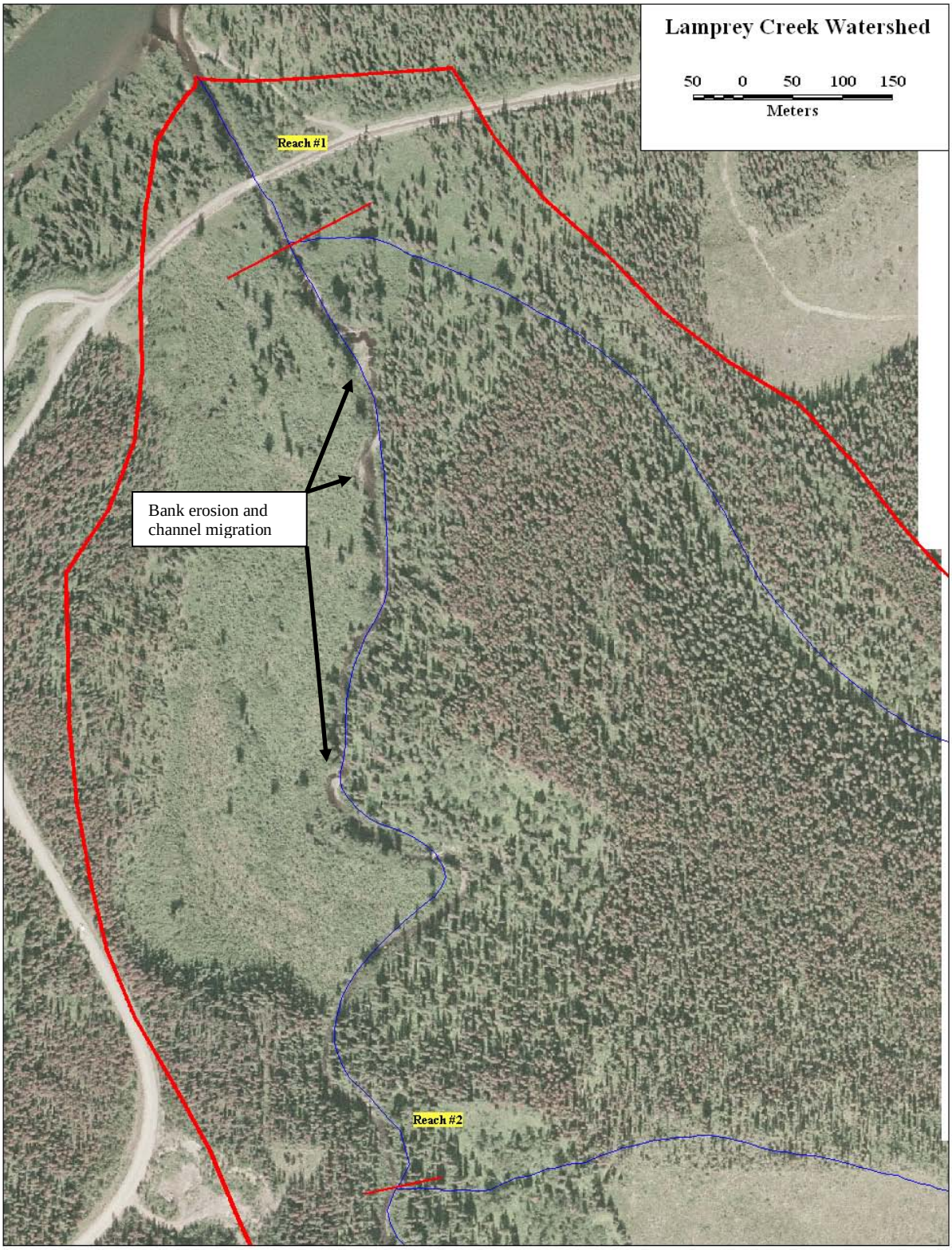

Figure 5. Vertical ortho-photo of reaches 1 and 2 of Lamprey Creek. Note bank erosion and channel migration into cutblock where the riparian forest was removed (left bank).

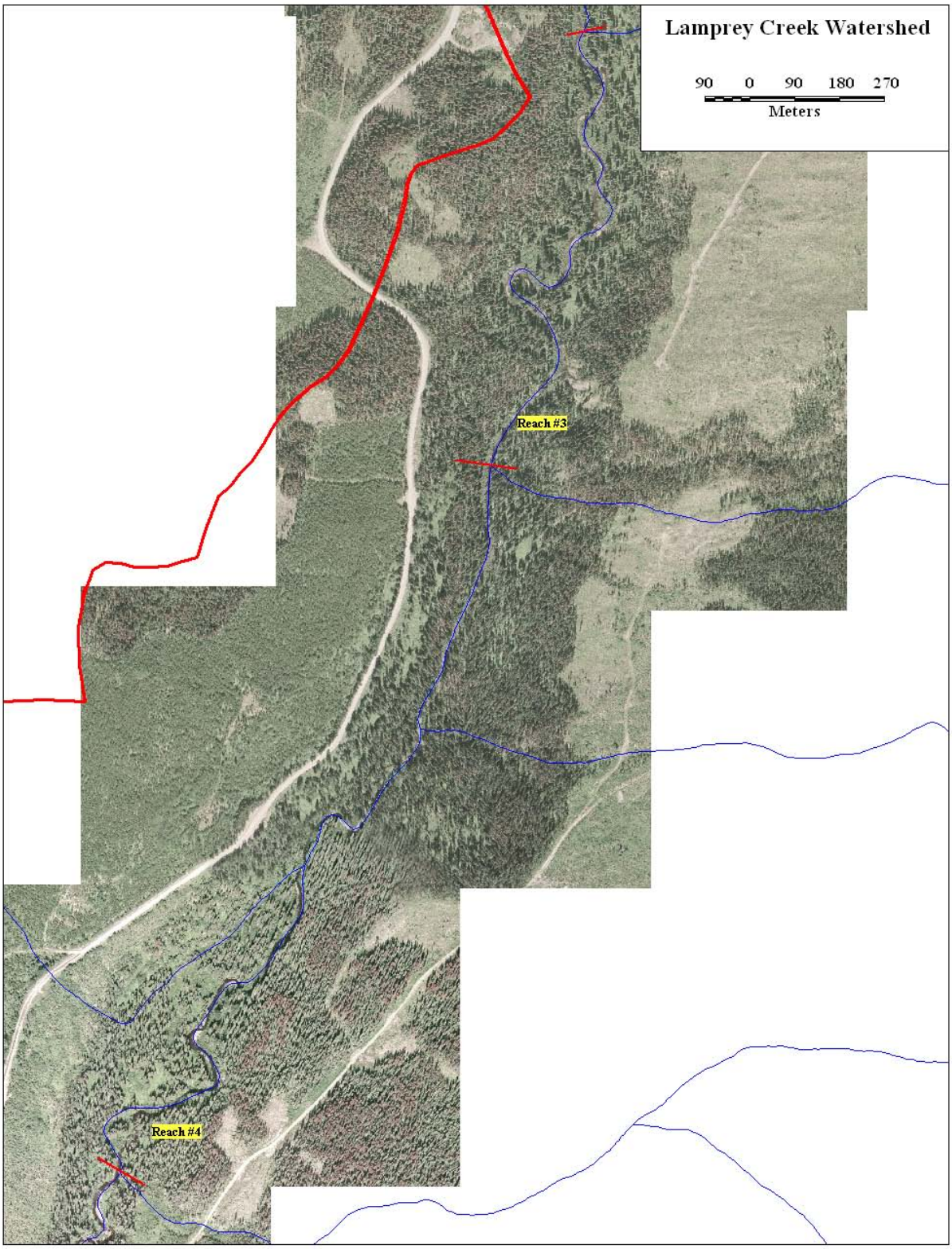

Figure 6. Vertical ortho-photo of reaches 3 and 4 of Lamprey Creek.

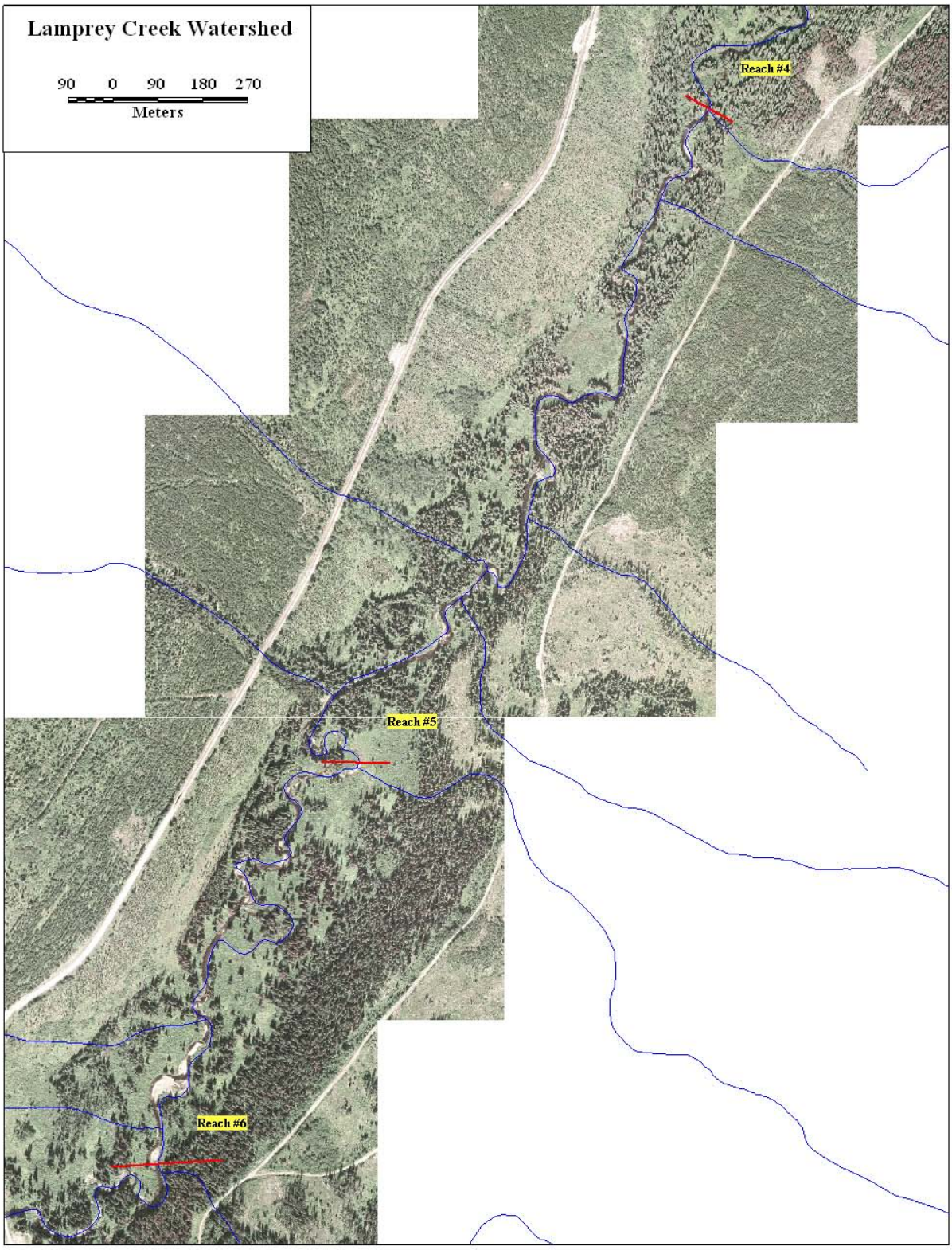

Figure 7. Vertical ortho-photo of reaches 5 and 6 of Lamprey Creek.

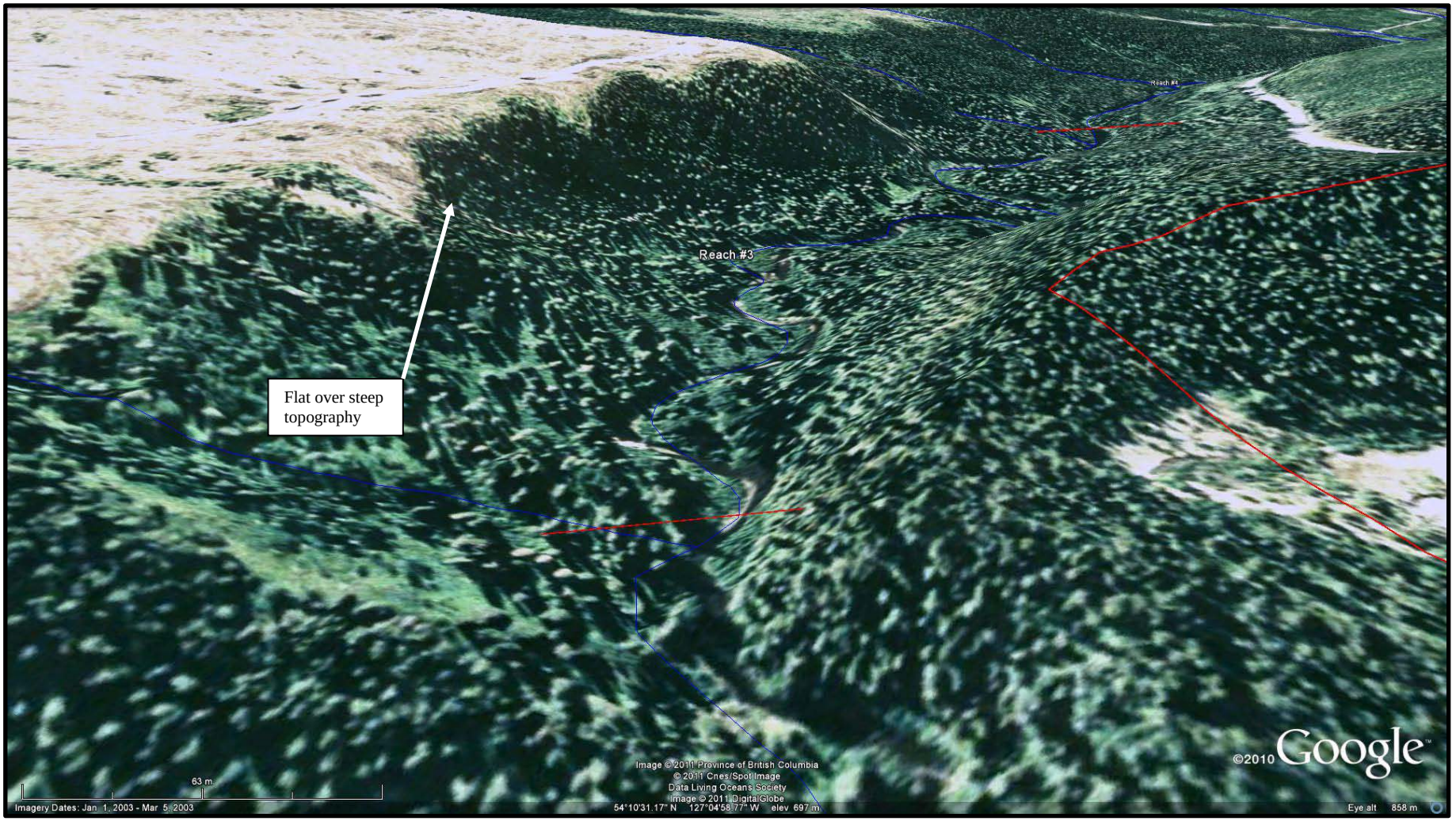

Figure 8. Example of "flat-over steep" terrain along Reach #3 of Lamprey Creek.

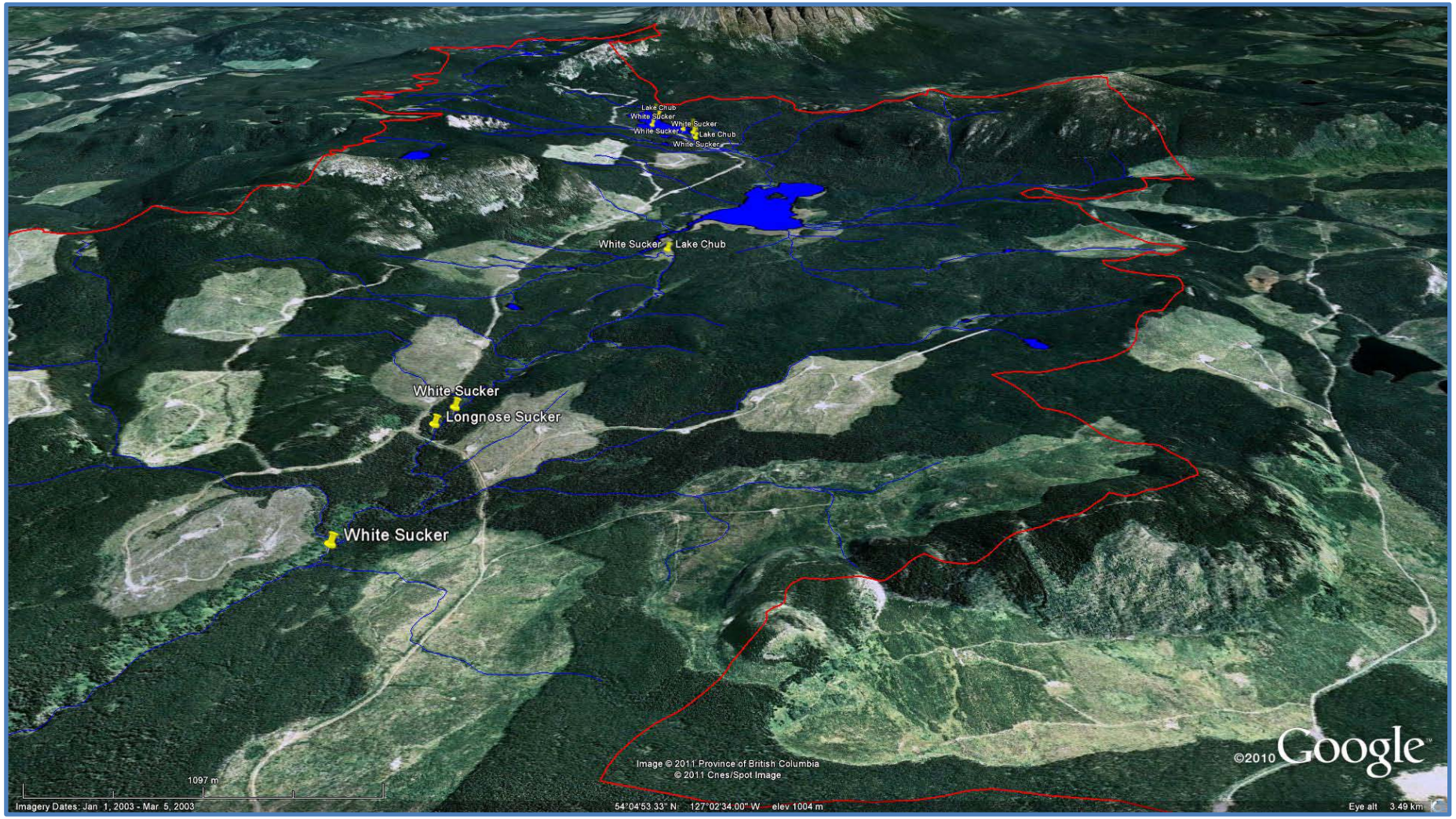

Figure 9. Forest harvesting slowly progressing into steeper areas of the watershed.