WATERSHED REVIEW
HUGUENOT 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
111.0	ESSFmv2 / BWBSwk1	NDT 2	1080-2089	Medium textured till	2.7	59.0	32.7	44.8	20.4	2.2

[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/disturbed	4	1	1.1	1	1.1	1.11	1.03	5.54	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 cobble	4	1	1.2	1	1.1	1	5.3	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	0.85	0.9	3.69	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 (%)
111.0	64.3	16.23	0.00	33.34	0.00	33.34

[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	33.34	3.00	Mod

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
111.0	34	27	7	0.3	0.2	0.06	1.65	Low

[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	C4- Lightly unstable/disturbed	530	0.0	Lightly De-stabilized
2	C4- Lightly unstable/disturbed	576	0.0	Lightly De-stabilized
3	C4- Lightly unstable/disturbed	1049	0.0	Lightly De-stabilized
4	C4- Lightly unstable/disturbed	1605	0.0	Lightly De-stabilized
5	C4- Lightly unstable/disturbed	2007	0.0	Lightly De-stabilized
6	C4- Lightly unstable/disturbed	3714	0.0	Lightly De-stabilized
7	C4- Stable	2997	0.0	Stable
8	E4- Lightly unstable/disturbed	1905	0.0	Lightly De-stabilized
9	E4- Lightly unstable/disturbed	1651	0.0	Lightly De-stabilized
10	E4-Stable	2160	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	5.54	Very High	3.00	Mod	16.6	High
Increase in Production of Fine Sediment	5.28	Very High	1.65	Low	8.7	Mod
Loss of Riparian function	3.69	Mod	0.25	Very Low	0.9	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
Huguenot Creek	111.0	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)

Huguenot Creek watershed, located on the border between BC and Alberta, has an area of 111 km^2 and flows directly into Belcourt Creek. The watershed has a generally rolling to lightly mountainous topography with a deeply incised mainstem channel. Elevations in this watershed range between 1080 and 2089 m. The watershed is distributed over two main 300m elevation bands, with the biggest proportion of the watershed (59%) being in the lower elevation band between 1080 and 1380 m. There are some steep slopes in this watershed with 23% of the watershed having slopes greater than 30% and 2% having slopes greater than 60% (Table1). The dominant biogeoclimatic zones in this watershed are the ESSFmv2 and BWBSwk1.

The mainstem of Huguenot Creek is a low gradient meandering channel with a floodplain confined by steep canyon walls that drop below the main plateau (Figure 1, 5 and 6). There is evidence of some slope failures along these canyon walls that appear to contribute significant volumes of sediment directly to the main channel (Figures 5 and 6). The upper reaches meander across an unconfined floodplain and appear to be very active (Figures 7 to 10). The surficial geology of this watershed is dominated by a mixture of fine and moderately coarse morainal tills with some coarser textured colluvial rubble in the upper parts of the watershed (Figures 1 and 2). The lower mainstem reaches have been classified as slightly unstable Rosgen C4 type channels, while the upper reaches have been classified as E4 types (Table 7, Figures 4 to 10). None of the mainstem reaches appear to have been directly disturbed by land-use activities. The mainstem has been well protected from riparian harvesting throughout the watershed (Table 7) and thus has a very low riparian hazard rating.

Sensitivities, Hazards and Risks in this Watershed

The overall sensitivity of the watershed to both increases in peak flows and increases in fine sediments has been classified as very high (Table 2, 3 and 8). This is due to a combination of the very sensitive stream types in the lower reaches, the lack of buffering lakes, the high lateral connectivity and the steep canyon walls that show some signs of slope instability. The overall sensitivity to a 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.

The peak flow hazard is moderate, despite lack of any significant forest harvesting in this watershed. This is because it is assumed that all of the pine in this watershed has been killed by the pine beetle and thus contributes to the Hydrologically Equivalent Disturbed Area (HEDA). A total of about 73% of the watersheds is covered in either pine leading or pine mixed stands (Table 5 and Figure 3). The combination of the high HEDA and the very high sensitivities results in a peak flow risk rating of High (Table 8).

The current risk ratings for sediment and riparian are moderate and very low, respectively.

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>33%</u>
      ii. Current risk rating= <u>High</u>
      iii. Max HEDA to maintain low risk = <u>15.3%</u>
      iv. Available harvest in green timber to maintain low risk = <u>0 ha</u>. If you want to maintain a low risk because the watershed is identified as Fisheries Sensitive Watershed, then forest harvesting will have to be curtailed in this watershed until the dead pine stands have regenerated and significant hydrological recovery has occurred. That could take decades.
      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 a given value.

2) Risks associated with the accelerated delivery of fine sediments

Given that the current fine sediment sensitivity for this watershed is very high, recommendations are as follows:

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

ii. Any flat over steep terrain that is planned for development should be carefully assessed by a qualified professional and managed accordingly to prevent accelerated slope failures into Huguenot Creek.

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).

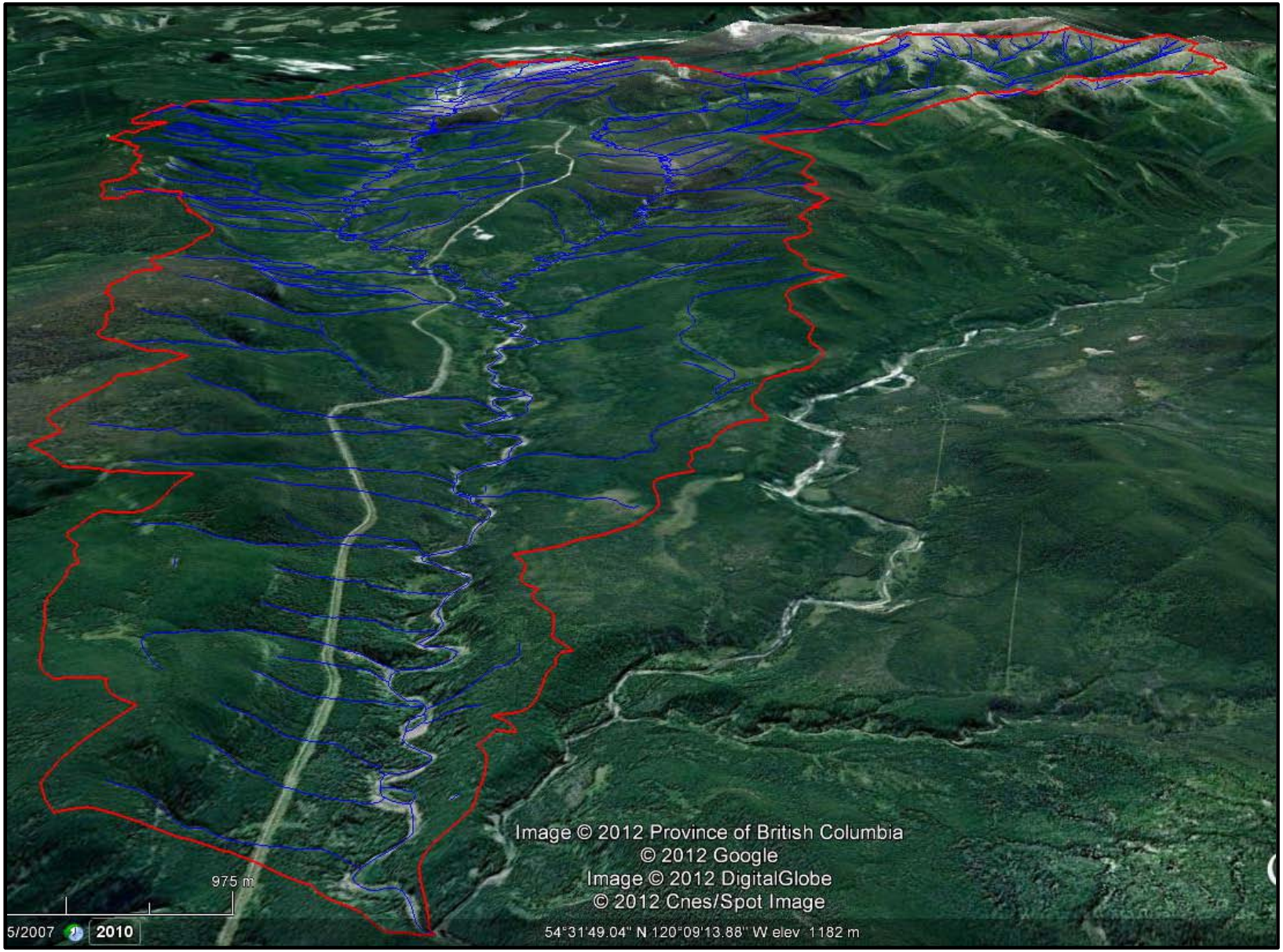

Figure 1. Google earth overview image of Huguenot Creek watershed, looking upstream into the watershed.

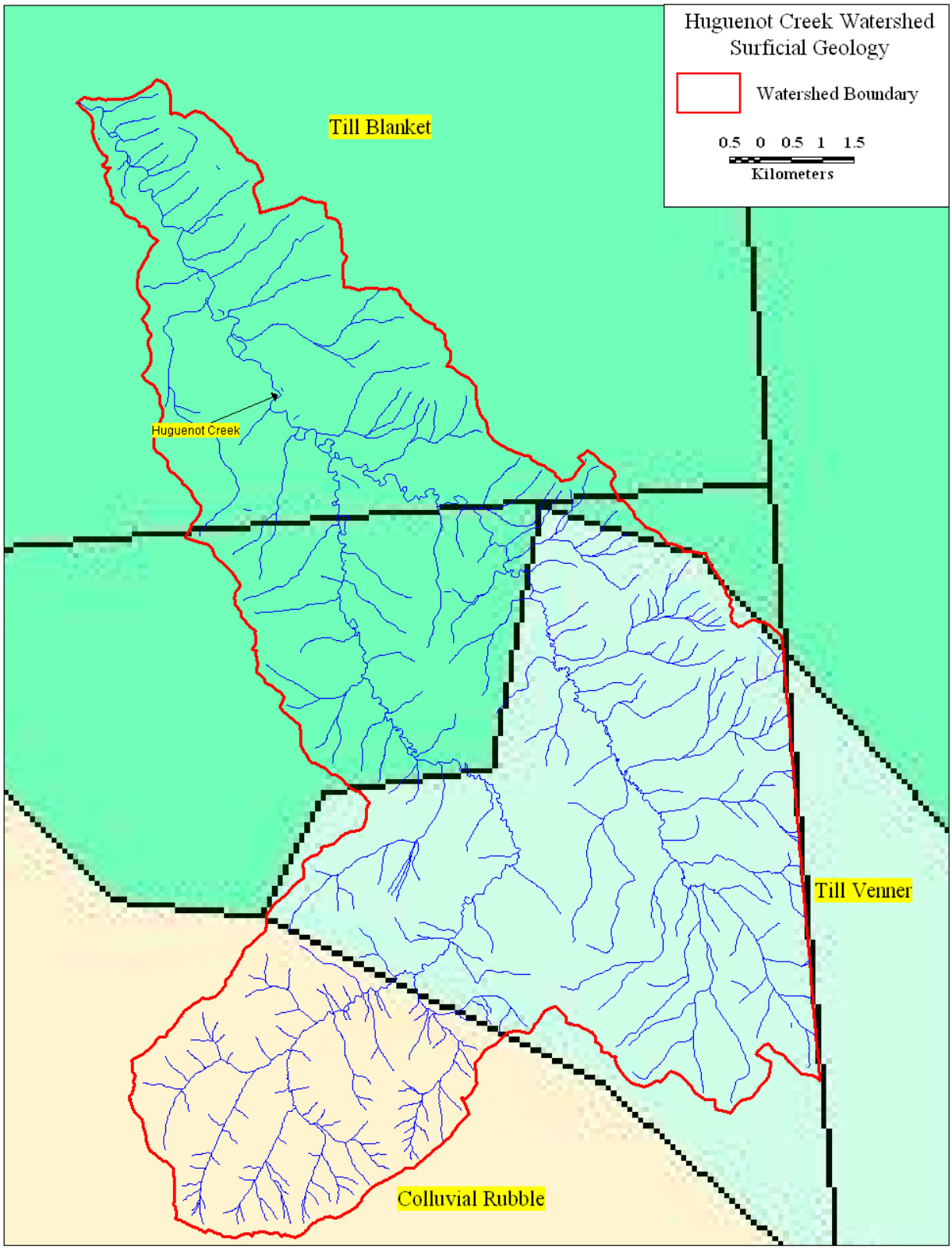

Figure 2. Distribution of dominant surficial geology types in the Huguenot Creek watershed (from 1:5M BC Geological Survey Maps).

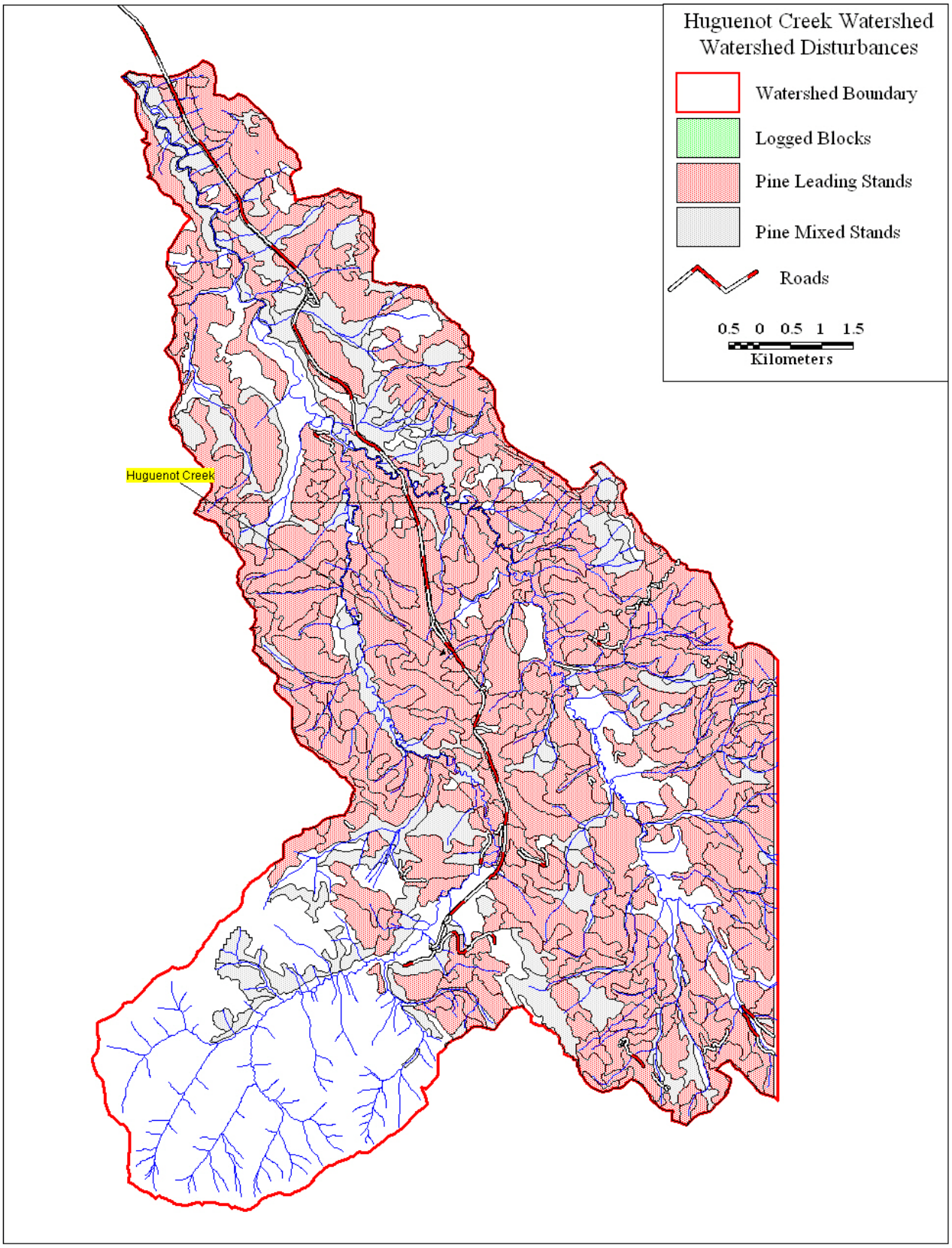

Figure 3. Land-use related and large natural disturbances in the Huguenot Creek Watershed

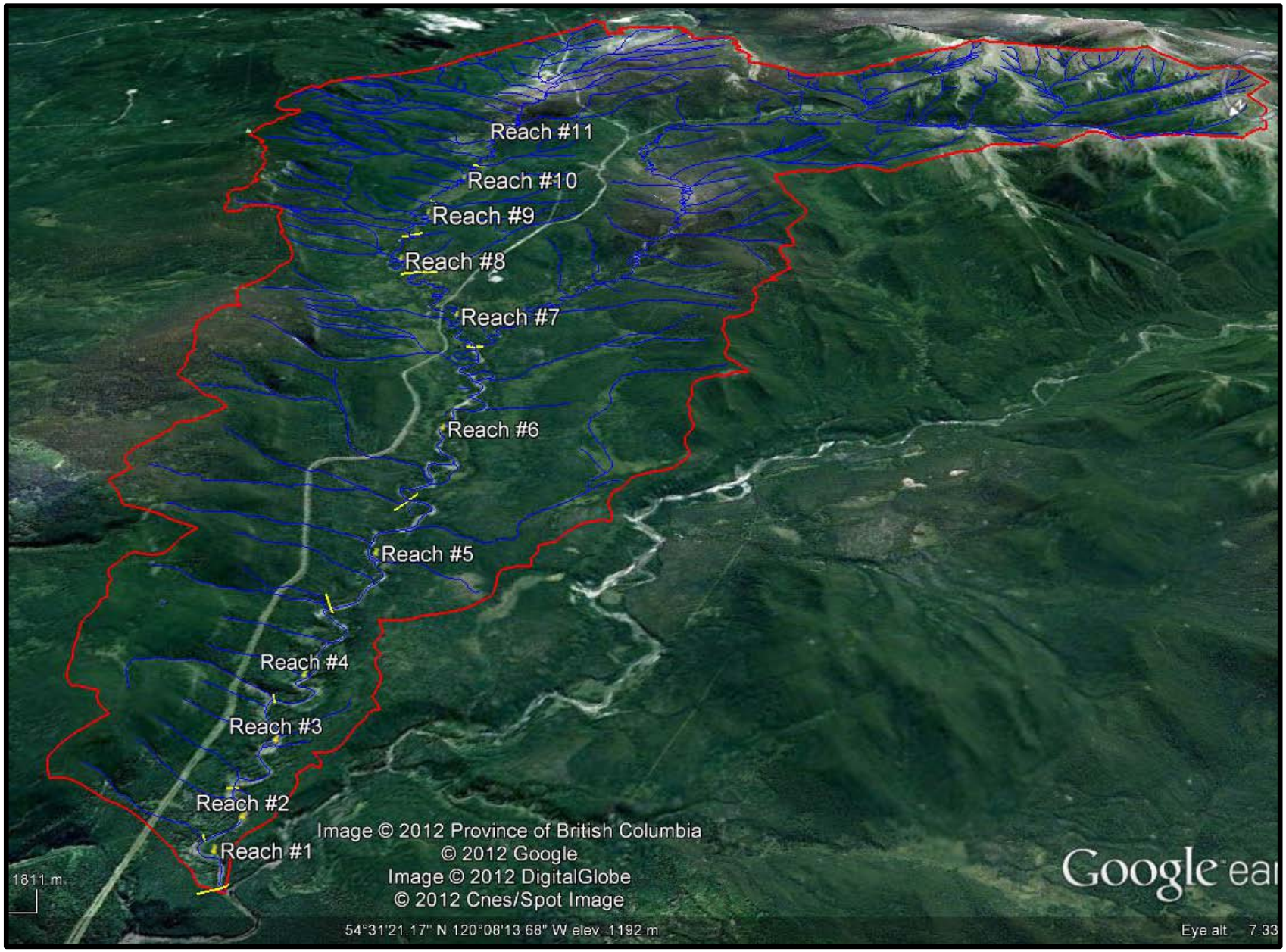

Figure 4. Identification of reaches along the mainstem of Huguenot Creek watershed

Figure 5. Google Earth image looking upstream along Reaches #1, 2 and 3 of Huguenot Creek.

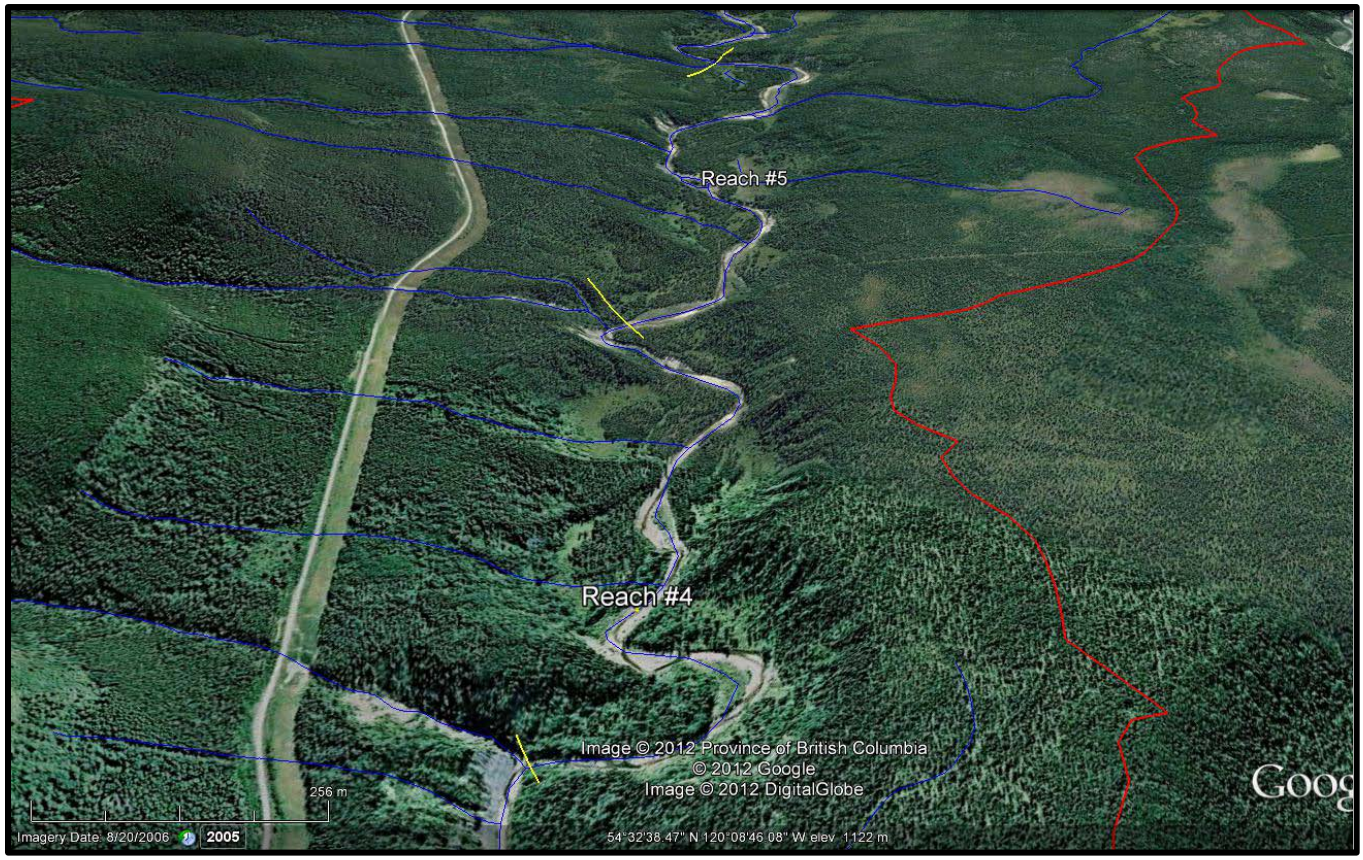

Figure 6. Google Earth image looking upstream along Reach #4 and 5 of Huguenot Creek.

Figure 7. Google Earth image looking upstream along Reach #6 of Huguenot Creek.

Figure 8. Google Earth image looking upstream along Reach #7 of Huguenot Creek.

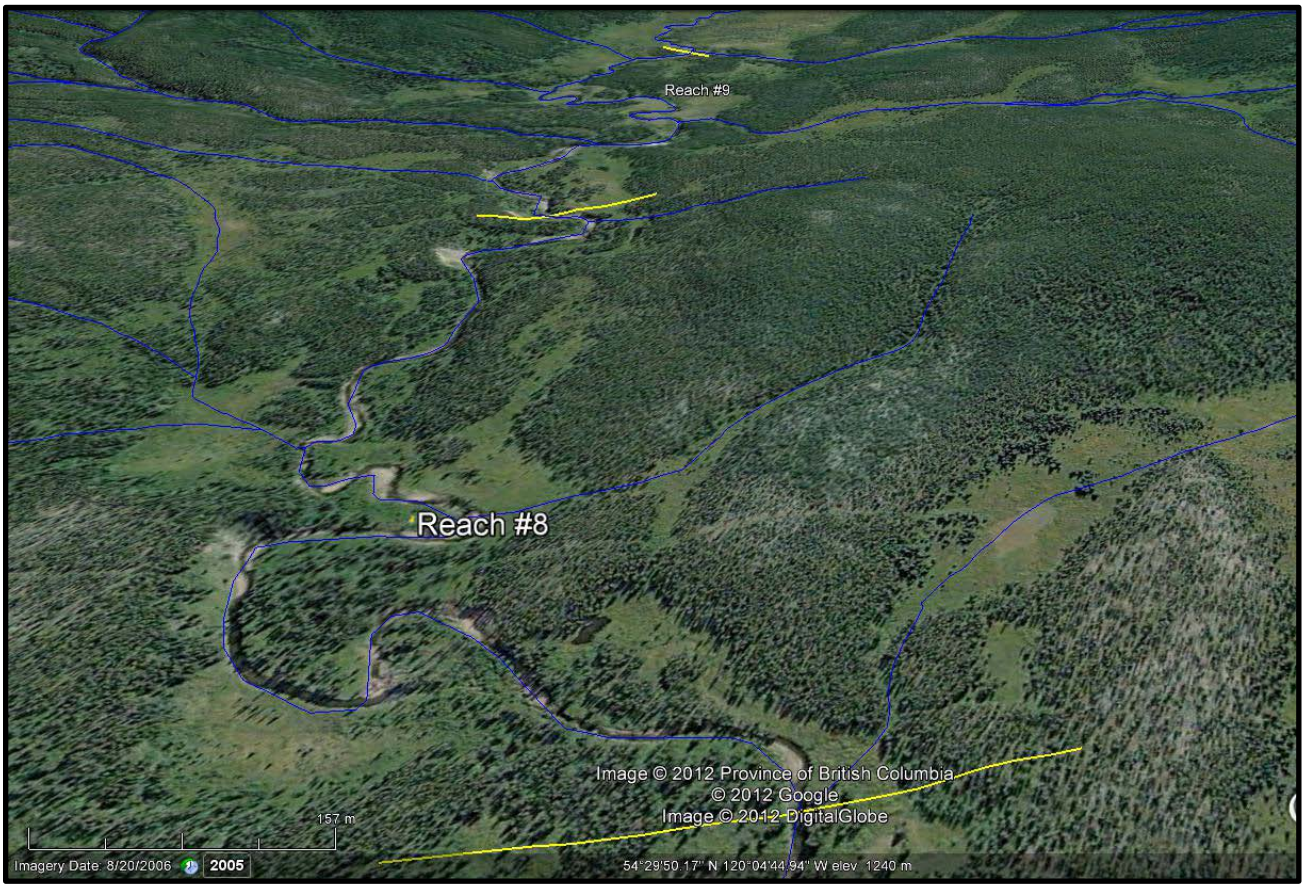

Figure 9. Google Earth image looking upstream along Reaches #8 and 9 of Huguenot Creek.

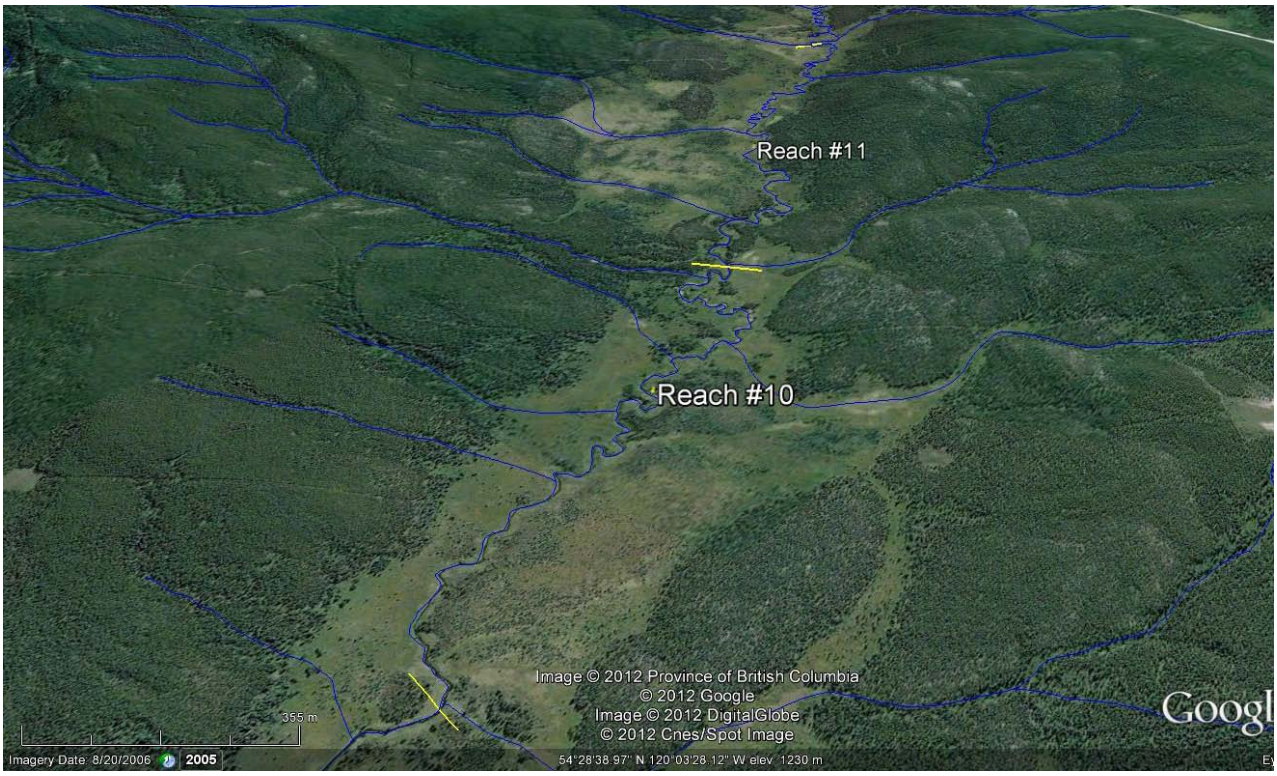

Figure 10. Google Earth image looking upstream along Reach #10 and 11 of Huguenot Creek.