# WATERSHED REVIEW
# BABCOCK 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 |
| 123.0 | ESSFmv2 / BWBSwk1 | NDT 2 | 911-2029 | Medium textured till | 2.0 | 47.6 | 26.9 | 54.9 | 16.9 | 1.3 |

[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 |
|---|---|---|---|---|---|---|---|---|---|
| F4- Lightly unstable/disturbed | 4.3 | 0.8 | 1.1 | 1 | 1.1 | 1.06 | 1.03 | 4.56 | 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 | 0.75 | 1.2 | 1 | 1.1 | 1 | 4.0 | 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 |
|---|---|---|---|---|---|
| F3-F6 w FP | 4.5 | 0.9 | 0.9 | 3.65 | 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 (%) |
|---|---|---|---|---|---|---|
| 123.0 | 24.7 | 13.18 | 9.61 | 13.26 | 6.27 | 19.53 |

[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 | 19.53 | 1.68 | 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 |
|---|---|---|---|---|---|---|---|---|
| 123.0 | 92 | 56 | 36 | 0.7 | 0.5 | 0.29 | 2.48 | 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 | F4-Stable | 1320 | 0.0 | Lightly De-stabilized |
| 2 | F4-Stable | 1787 | 0.0 | Stable |
| 3 | F4- Lightly unstable/disturbed | 2080 | 0.0 | Lightly De-stabilized |
| 4 | F3-Stable | 1498 | 0.0 | Stable |
| 5 | B3-Stable | 3444 | 0.0 | Stable |
| 6 | B3-Stable | 1499 | 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 | 4.56 | High | 1.68 | Low | 7.6 | Mod |
| Increase in Production of Fine Sediment | 3.96 | High | 2.48 | Low | 9.8 | Mod |
| Loss of Riparian function | 3.65 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| Babcock Creek | 123.0 | High | High | Mod | Very High | 4 | 4 | 3 | 11 | 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)

Babcock Creek Creek watershed, which flows directly into the upper Flatbed Creek, has a flat to rolling topography with some steeper mountainous sections at the back where it rises to Roman Mountain. Elevations in this watershed range between 911 and 2029 m. The watershed is distributed over several 300m elevation bands, with the biggest proportion (48%) being in the elevation band between 1211 and 1511 m. The extent of steep slopes in this watershed is quite low as only 1.3% of the watershed has slopes greater than 60% and only 18% of the watershed has slopes greater than 30% (Table1). The dominant biogeoclimatic zones in this watershed are the ESSFmv2 and BWBSwk1.

The lower mainstem of Babcock Creek is a low gradient, meandering stream with an active floodplain confined by steep valley walls (Figures 5 and 6). Above reach #4 the channel becomes steeper, straighter and more confined (Figures 6 and 7). The surficial geology of this watershed is dominated by a mixture of fine and moderately coarse morainal tills with some coarse textured colluvial rubble in the upper sections (Figure 1 and 2). Much of the lower mainstem reaches have been classified as a stable Rosgen F4 channel type (Table 7, Figures 4 to 8). The mainstem has been well protected from riparian harvesting throughout the watershed (Table 7) and thus has a very low riparian function hazard rating. There is evidence of massive bank failure along reach # 1 which would have contributed very large volumes of sediment to the lower reach.

**Sensitivities, Hazards and Risks in this Watershed**

The overall sensitivity of the watershed to increases in peak flows has been classified as high which is due to the sensitive reach types in the lower watershed (Table 3). It is not classified as very high because the topography is much gentler than the more northern watersheds reviewed in this project. The sensitivity to increases in fine sediments has also been classified as high and this is also because of the sensitive nature of the lower reaches and the steep valley walls potentially contributing sediment (Table 3). 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.

None of the current risk ratings are high which is largely due to low or very low hazard ratings for all three hazard types (Table 8). There are however some mining operations within the upper Babcock watershed which can potentially generate some site specific hazards relative to water management issues.

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 Above and Beyond Those Already Required by FPPR**

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

   a. Maintain peak flow risks to a maximum of a Low level
      i. Current HEDA= 19.5%
      ii. Max HEDA to maintain low risk = 18.1%
      iii. Current risk rating: Moderate
      iv. The amount of recently harvested lands that need to fully recover before further harvesting can occur in order to maintain low risk = 200 ha
      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, 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

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).

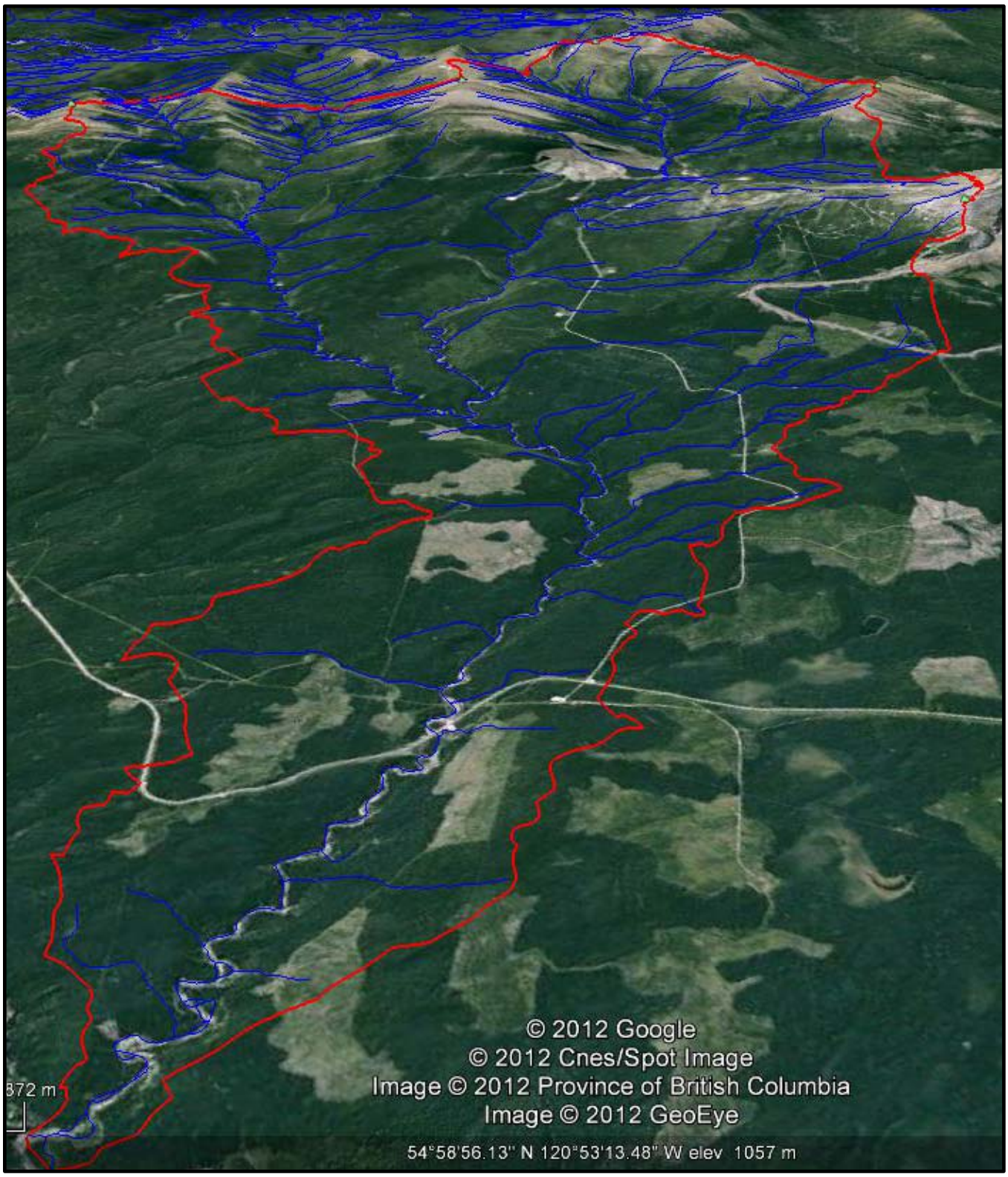


Figure 1. Google earth overview image of Babcock Creek watershed, looking upstream into the watershed.

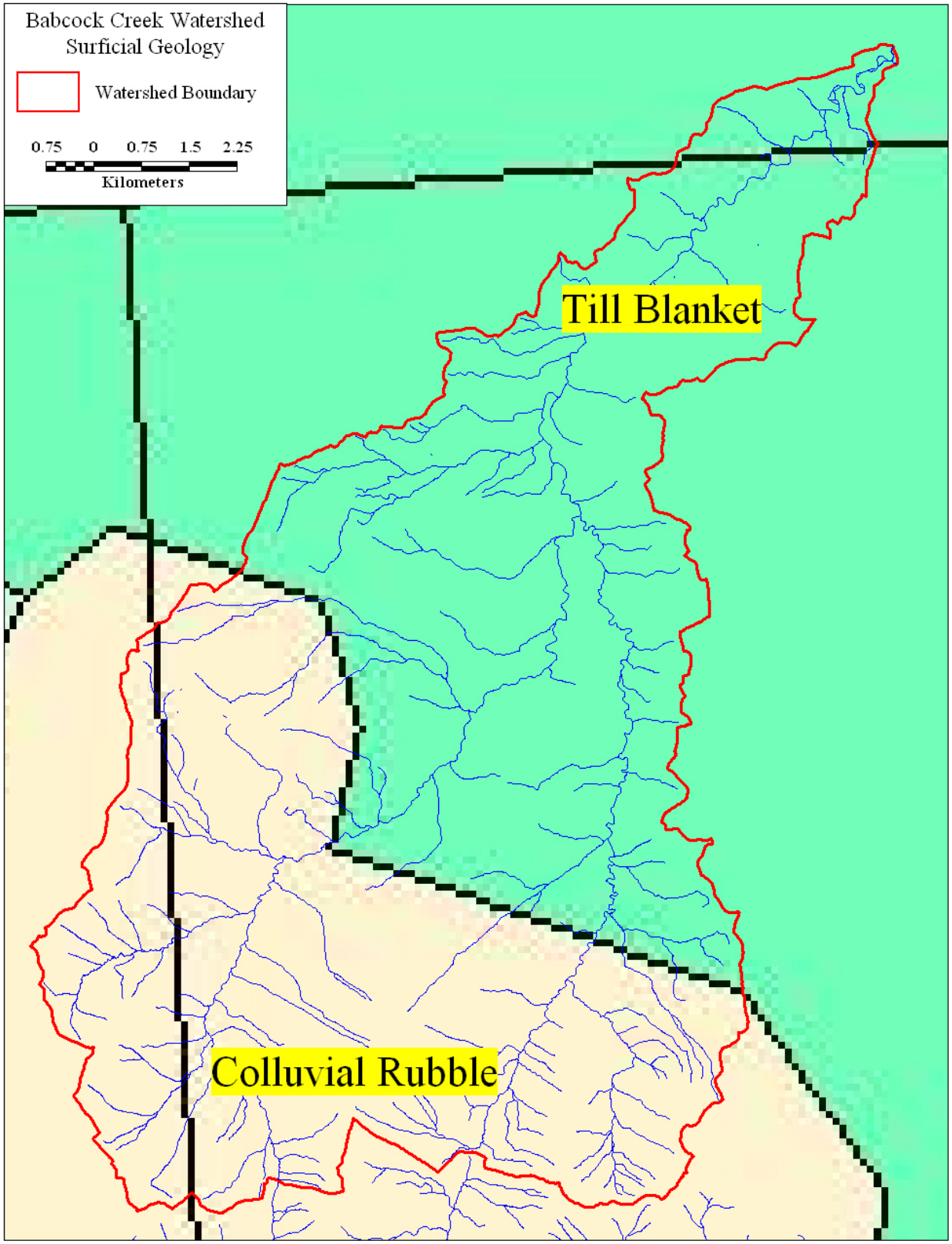


Figure 2. Distribution of dominant surficial geology types in the Babcock Creek watershed (from 1:5M BC Geological Survey Maps).

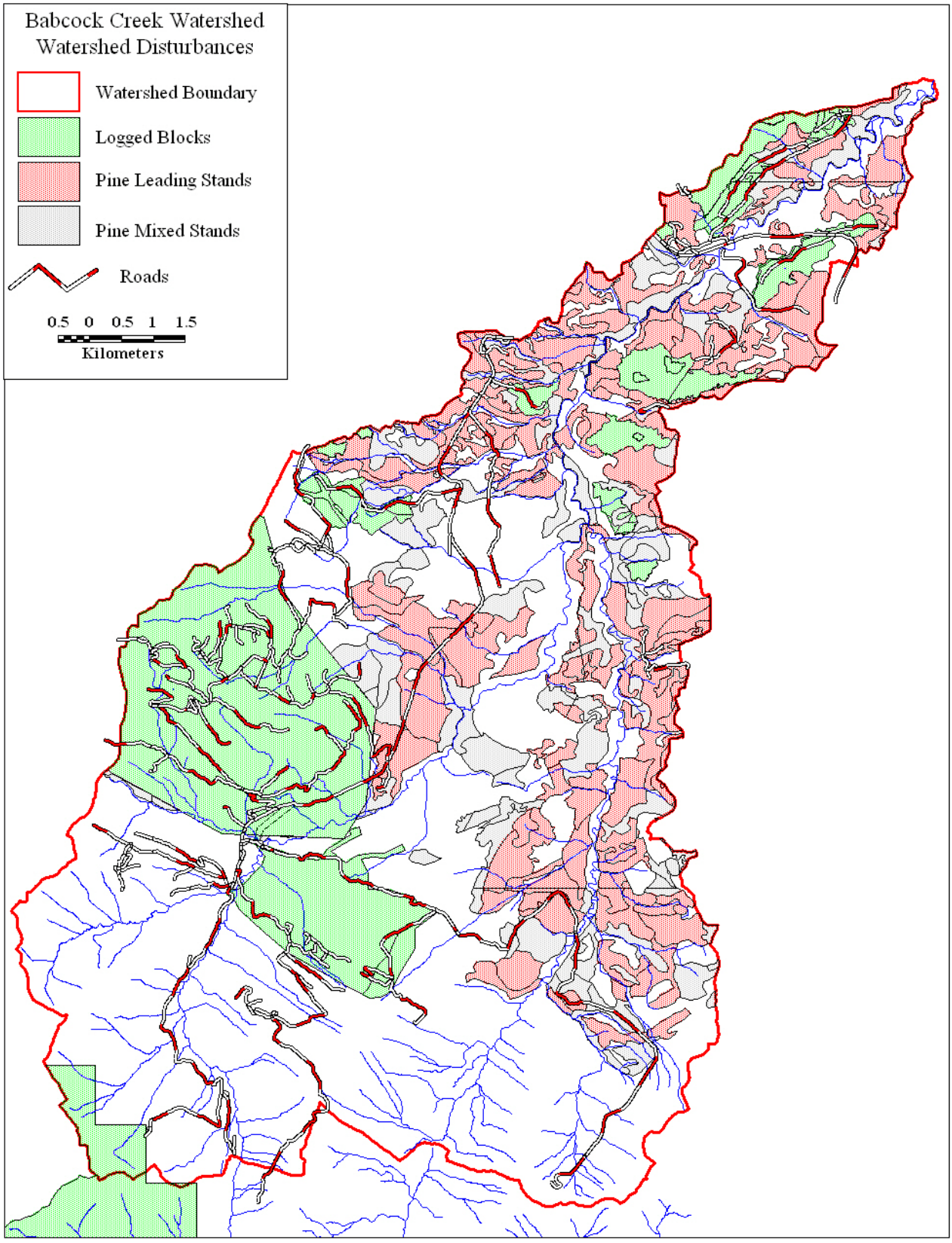


Figure 3. Land-use related and large natural disturbances in the Babcock Creek Watershed


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


Figure 5. Google Earth image looking upstream along Reach #1 and 2 of Babcock Creek.


Figure 6. Google Earth image looking upstream along Reaches #3 and 4 of Babcock Creek.

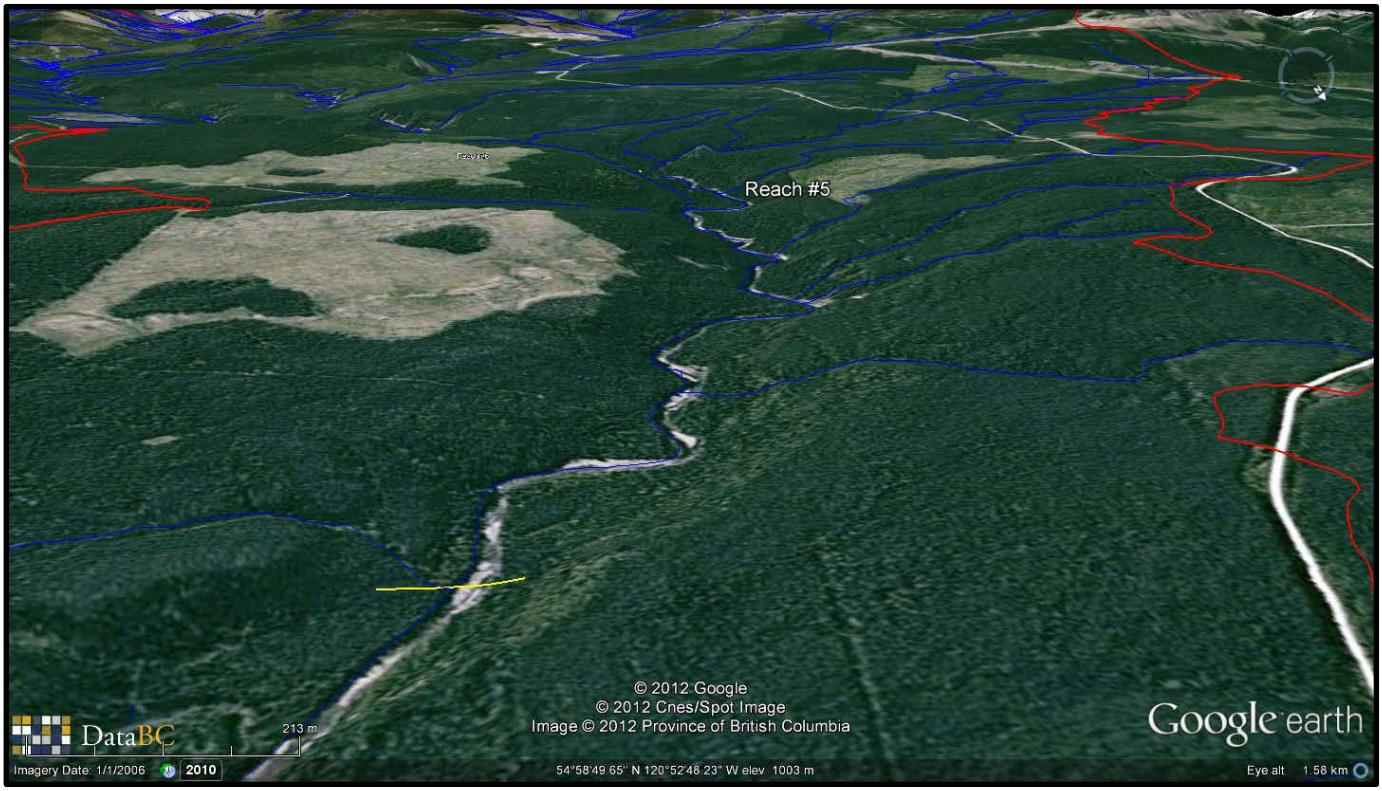


Figure 7. Google Earth image looking upstream along Reach #5 of Babcock Creek.

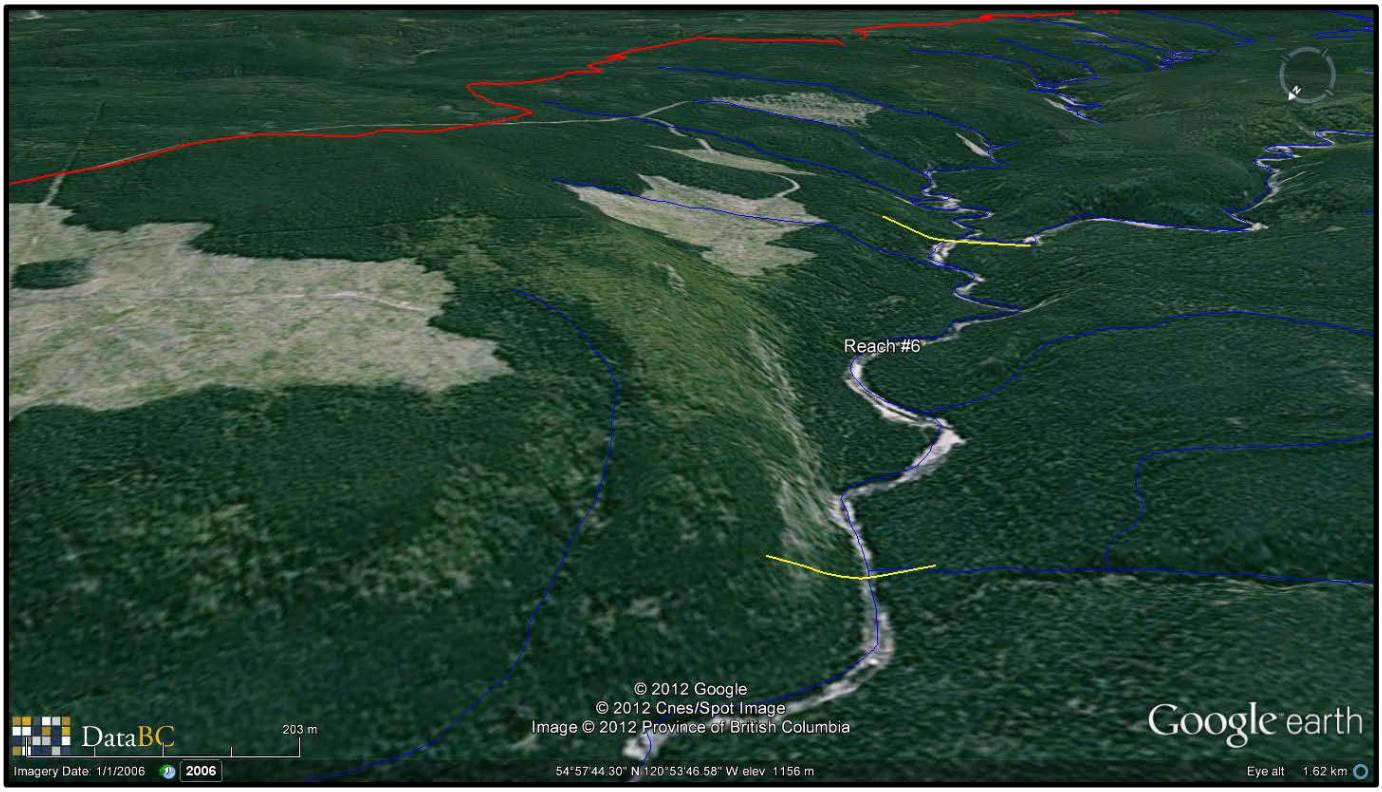


Figure 8. Google Earth image looking upstream along Reach #6 of Babcock Creek.