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A HYDROLOGIC ASSESSMENT OF THE  
IMPACT OF THE SWISS FIRE  
ON BUCK CREEK, HOUSTON, B.C.

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## 1. SUMMARY

The Swiss Fire burned approximately 8% of the Buck Creek Watershed. The fire occurred in late May and was of moderate intensity due primarily to high soil moisture levels. The burned area is in the mid to lower region of the watershed. Given the extent, intensity, and location of the burn, no significant increase in the spring snowmelt peak streamflow is anticipated. Given the intensity of the burn, sediment production should not be significant. If standard road drainage and maintenance procedures are taken, the salvage logging operations should not produce a significant increase in sediment levels.

## 2. INTRODUCTION

From May 29 to June 4, 1983, the Swiss Fire burned approximately 18,000 hectares of forest land just south and east of Houston, British Columbia. The area burned includes part of the Buck Creek watershed. This creek flows through the center of Houston. Dykes along the creek have been breached numerous times in the past, causing flood damage to the village. Concern was expressed by the Houston District Council that the Swiss Fire would lead to increased peak streamflows, and thereby increase the risk of flooding (Appendix I).

This report reviews the extent and severity of the burn in the Buck Creek watershed. From this review, an assessment is made of the potential for increases in peak streamflows, sediment production, and summer low streamflows.

### 3. DESCRIPTION OF THE AREA

Buck Creek drains an area of the Nechako Plateau just east of Houston. The watershed has an area of 58,000 hectares, with elevations ranging from 500 to 1564 meters. The general flow of the watershed is east to west. The stream channel is dyked from where it emerges from the hills, through Houston, and right to its junction with the Bulkley River (Figure 1.)

Soil textures in the watershed are variable, with fine to coarse alluvial soils in the valley bottom, to moderately fine glacial tills and medium to coarse colluvial soils on the valley sides. The glacial tills are perhaps the dominant soils in the watershed. Organic deposits and rock outcrops are also present. Over a dozen soils associations have been mapped in the watershed (Runka, 1972).

The Sub-Boreal Spruce (d) subzone (SBSd) is found in the main valley of the Buck Creek. The upper elevational limit is approximately 900 to 950 meters on the west side of the valley and 950 to 1100 meters on the east side. The Sub-Boreal Spruce (e) subzone (SBe) is found above the SBSd, and gives way to the Engelmann Spruce - Subalpine Fir Zone at 1400 meters. (Pojar et al., 1982).

The Buck Creek watershed has had a moderately long history of small scale logging. The logging is generally below 1200 meters. The total logged area is approximately 8% (A. Amonson, pers. com. 1984).

The watershed has a history of forest fires. The older fires now have stands of younger aged forests. One of the more recent fires, the Paul Fire of 1961, burned 6.2% of the watershed (3600 hectares) in the headwaters of Buck Creek (Figure 1). A regeneration survey of the Paul Fire in 1983

Figure 1. Location map of the Buck Creek watershed.

indicated that approximately 75% of the area had successfully regenerated. Much of the remaining 25% has trees that are too scattered to achieve the minimum stocking level of 500 stems per hectare (A. Wolfe, pers. com. 1984).

The Swiss Fire of 1983 burned approximately 5288 hectares along the lower western edge of the Buck Creek watershed. This is 9.1% of the watershed and includes marshes, streams, cleared fields, unburned forest stands within the fire perimeter, and roads. The actual area burned is close to 8% of the watershed. The elevational range of the burn within the watershed is from 800 meters to 1400 meters. The fire occurred in the early spring while soil moisture levels were moderately high. Thus the fire intensity was generally moderate. About 1/2 of the burn is in the SBSd, the other 1/2 is in the SBSe. A summary of the burned area by aspect is presented in Table 1.

Table 1. Area burned by aspect.

Aspect	Area	Percent of Burn
North	392 hectares	7.4%
Northeast	2,576	48.8
East	176	3.3
Southeast	1,152	21.8
South	160	3.0
Southwest	352	6.7
West	224	4.2
Northwest	0	0
Flat	256	4.8
Total	5,288	100%

#### 4. HYDROLOGY

The mean monthly flow for Buck Creek is presented in Figure 2. During most years the peak streamflow occurs in mid to late May as higher elevation (1000 m plus) snowpacks melt (Table 2). The extreme peak flow on record is 75.3 m<sup>3</sup>/sec. and was the result of a rain-on-snow event.

Snowpack data is collected from 2 sites near the Equity Mine site (1300 m. and 1420 m.) (Table 3). The data shows that snowpacks have begun to melt by May 1st, with the melt accelerating through May 15th, and in 3 out of 5 years was gone by June 1st. There are no low elevation snow courses or elevational snowpack transects.

Table 2. Peak Streamflow Data for Buck Creek.

Year	Maximum Instantaneous Flow	Date	Maximum Daily Flow	Date
1973	75.3*m <sup>3</sup> /sec	May 17	72.5m <sup>3</sup> /sec*	May 17
1974	32.6	May 26	32.0	May 26
1975	34.8	May 11	33.7	May 12
1976	61.7	May 11	61.2	May 11
1977	62.0	April 27	59.2	April 27
1978	41.6	June 14	38.5	June 15
1979	68.8	May 3	66.0	May 4
1980	36.5	May 13	36.0	May 13
1981	49.6	May 15	46.8	May 15
1982	58.6	June 2	56.2	June 2
1983	25.2	April 30	24.8	April 30

\* Maximum recorded streamflow

Source: Surface Water Data, Inland Waters Directorate, Water Resources Branch  
 Water Survey of Canada, Ottawa, Canada.

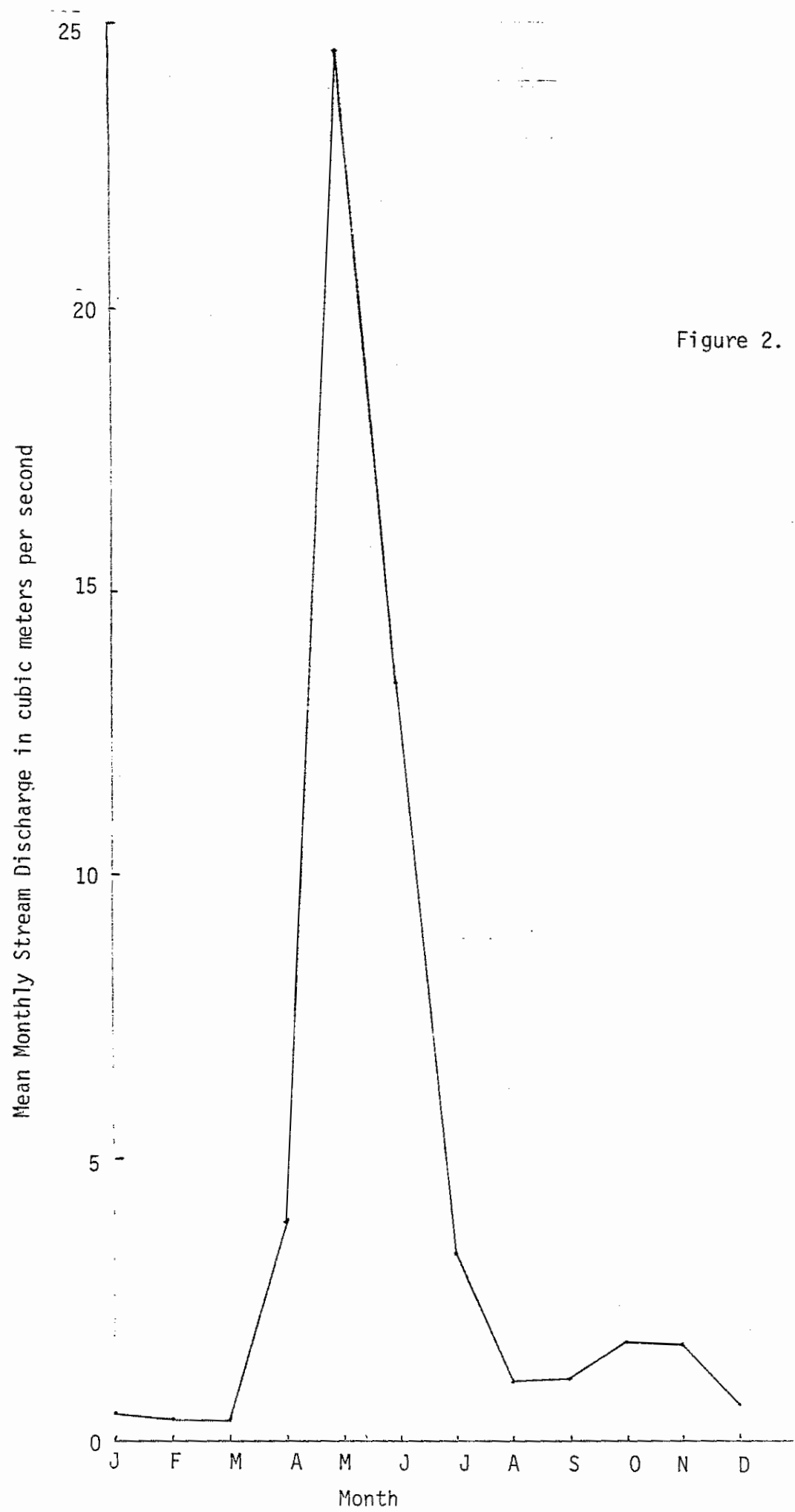


Figure 2. Mean monthly streamflow of Buck Creek. (Source: Water Survey of Canada).



Table 3. Snow Survey Data.

Year	Jan. 1	Feb. 1	Mar. 1	April 1	May 1	May 15	June 1
Water Equivalent in mm.							
Equity Silver Mine (1420 meters)							
1977	--*	--	--	295	239	--	--
1978	160*	--	234	315	302	--	--
1979	--	236	336	318	310	286	162
1980	126	196	240	324	286	0	0
1981	138	174	252	258	356	280	0
1982	172	258	330	398	388	368	172
1983	130	232	276	298	212	--	0
Lu Lake (1300 meters)							
1977	--	--	--	371	295	--	--
1978	117	--	201	224	--	--	--
1979	--	213	288	276	286	205	114
1980	125	260	203	225	195	0	0
1981	96	134	172	170	224	165	0
1982	116	218	324	314	352	310	126
1983	104	184	204	210	180	--	0

\* indicates no snow data collected.

From discussions with local people, it appears that snow has left the SBS(d) and the lower elevations of the SBS(e) (i.e., below 1000 m) before peak streamflows occur in Buck Creek. Thus it is the higher elevations (1000 m. plus) that provide the rapid snowmelt water for the peak streamflows.

## 5. DISCUSSION

Wildfires can have an effect on peak streamflows, timing of peak flows, water quality, and summer low flows. The most noticeable changes occur in watersheds which have had a severe burn over a large percent of their watersheds (Cheng, 1980; Helvey, 1980; Tiedemann et al., 1979). In the case of Buck Creek, the Swiss Fire was of moderate intensity and burned a small percent of the watershed. This indicates that the overall effect on streamflow should be small. A factor that further reduces the effect is the location of the burn - essentially lower elevations and close to the mouth of the stream. In the burned area, snowmelt will be faster and will occur earlier than before the fire<sup>1</sup>. Thus snowmelt runoff will occur prior to the general snowmelt that causes the peak streamflows in Buck Creek. The burn will, in effect, desynchronize snowmelt runoff. Peak flows should be reduced, albeit insignificantly. If on the other hand, the Swiss Fire had occurred in the headwater areas, the peakflows could have been increased through synchronization of snowmelt. However, discussions with long term residents indicated that peakflows were not increased following the Paul Fire, a situation that should have synchronized snowmelt and increased peakflows. This perhaps indicates that in order for a burn to have a significant effect on peak flows, a higher percent of a watershed must be burned.

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<sup>1</sup> Snowmelt will be faster in the burn, but should not be 'catastrophic' because of the range of aspects (Table I). Almost 60% of the burn has northerly to easterly aspects - these areas receive some degree of topographic shading and have lower unit area intensities of solar radiation.

The elimination of vegetation by fire reduces the transpirational water losses. For this reason, summer low streamflows are increased. This will be most noticeable in the creeks draining the Swiss Fire (e.g., Jawbone Creek), but given the extent of the burn, increases in summer low flows in Buck Creek may go unnoticed. One runoff factor that has not gone unnoticed this winter is the seepage from road banks and small streams in the burn area. This is due to: the higher soil moisture levels because the trees were not transpiring last summer; the more rapid snowmelt in the burned area; and unseasonably high temperatures<sup>1,2</sup>. Given more normal winter temperatures, the icing and road drainage problems would not be as great, but until vegetation has become re-established, more water will flow off the burned area.

The potential for increased sediment levels in Buck Creek is moderately low. This expectation is based on the moderate intensity of the burn, and absence of apparent signs of major slope stability problems<sup>3</sup>. Further, water bars were constructed on the perimeter cat trail and the trail was grass seeded. If drainage is adequate on the salvage logging roads, landings, and mill sites, and if operations cease before spring break-up, sediment production from salvage operations should be minimal.

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- 1 The unseasonable weather has led to seepage and icing problems on other stretches of roads in the Houston area not affected by the Swiss Fire.
  - 2 An additional and perhaps hypothetical factor for more water on roads could be that the significant increase of traffic due to salvage logging operations has "driven the frost down" deeper than normal below the roads. The solid ice below roads would act as a dyke, stopping normal slope drainage. Thus, free soil moisture would be forced to go over, rather than under a road.
  - 3 Buck Creek has a relatively wide floodplain in the burned area. Just downstream, the valley narrows and the creek is actively undercutting the till slopes along the eastern bank. As a result, the banks are slumping. Similar slumping is apparent above the Buck Creek road just upstream of the first bridge. Had these areas burned, slumping would have increased because of increased soil moisture levels and reduced root strength.

Footnote: Houston is located on a double floodplain - of both the Bulkley River and Buck Creek. Historically much of the area was frequently flooded. The lack of floods in recent years can be attributed to: reduced snowpacks in the region; improved dyking along both the Bulkley River and Buck Creek; and perhaps a gradual lowering of the water table (more flood water is going into ground water recharge than to above ground flooding). Regardless of vegetation changes brought about by farm clearing, clearcutting, mining and wildfires, if the "good old" snowpacks return to the Buck Creek and upper Bulkley Watersheds, Houston's dyking system will be heavily taxed. For this reason I recommend that the District of Houston contact the Inspector of Dykes, Water Management Branch, Ministry of the Environment, 737 Courtney Street, Victoria, B.C. V8V 1X5.

## 6. ACKNOWLEDGEMENTS

Bill Dungate, Wid Smith, and Lee Rose provided much helpful local information. Scott Lindeburgh, Ministry of Forests, assisted with office and field work. Arnold Amonson, Jim Munn, and Rod DeBoice, Ministry of Forests, provided details on the Swiss Fire, watershed history, and assisted with fieldwork. Paul Pashnik, Ministry of Forests, provided further details of the Swiss Fire. Bob Patterson, Equity Silver, provided snowpack data and information on peakflow generation. Don Reksten and Peter Woods, Ministry of the Environment, provided input on the generation of peakflows and comments with regards to dyking.

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APPENDIX 1

NOV 21 1983  
District of  
Houston

# DISTRICT OF HOUSTON

P.O. BOX 370 -  
HOUSTON, BRITISH COLUMBIA, VOJ 1Z0  
TELEPHONE 845-2238

OUR FILE: 114  
YOUR FILE:

14 November 1983

Pronvince of British Columbia  
Ministry of Forests  
Parliament Buildings  
Victoria, British Columbia  
V8V 1X4

RECEIVED

Attention: Hon. T.M. Waterland

MINISTER OF FORESTS

Dear Sir:

Re: Bank Protection, Buck Creek, Houston, B.C.  
District Lot 622, Range 05, Coast District

At this time, we would like to request funds for the improvement of our present dyke at the above location.

Haivng conferred with both your Ministry and the Ministry of Highways, it was agreed that the Swiss Fire has created quite a hazard. Due to approximately 42,000 acres of trees being burnt, there is no longer any coverage on the mountains. Buck Creek is 60% fed from these mountains. In the event of a heavy spring runoff, the possibility of our present dyke failing is expected as a normal spring runoff has our dykes at their capacity.

It should be noted that in the event of a failure, this water course would quickly flood the downtown core area and progress to the Avalon area. Ground conditions behind the dyke make emergency repairs during high water impossible.

It is therefore imperative that the problem areas identified, be improved as recommended.

The estimated cost of construction would be in the order of \$60,000.00.

Should you require any further information, please do not hesitate to contact myself or Jim Griffiths our Superintendent of Public Works.

Any assistance you could provide towards obtaining this funding would be greatly appreciated.

Yours truly,

*G. Beaudette*  
Gary Beaudette  
Alderman

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NOV 21 1983

/bas

# DISTRICT OF HOUSTON

P.O. BOX 370 -  
HOUSTON, BRITISH COLUMBIA, VOJ 120  
TELEPHONE 845-2238

OUR FILE: 113

YOUR FILE: 890-1-9

12 January 1984

Province of British Columbia  
Ministry of Forests  
Parliament Buildings  
Victoria, British Columbia  
V8V 1X4

Attention: T.M. Waterland, Minister

Dear Sir:

Re: Bank Protection, Buck Creek, Houston, B.C.  
District Lot 622, Range 05, Coast District

At this time, we would like to express our concerns and reinstate our position on the above noted.

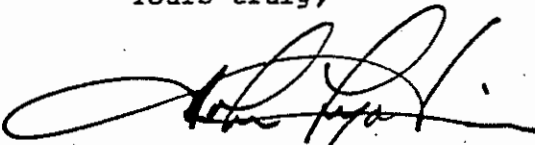
We feel that the flooding of Hatzic Valley is relative to our situation as caused by the Swiss Fire and outlined in our previous letter.

It is therefore imperative that the problem areas identified, be improved.

Should you require any further information, please do not hesitate to contact the writer or Mr. Jim Griffiths our Superintendent of Public Works.

Any assistance you could provide towards obtaining this funding, would be greatly appreciated.

Yours truly,



John Lyotier  
Alderman

/bas