Mill and Narrows Creek Monitoring

Report 2017

Mill/Harrop Creek

Report Prepared For:

The Harrop Proctor Watershed Protection Society

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Mill and Narrows Creeks Monitoring Summary Report for 2017 – April, 2018

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Background

This report reviews monitoring data and findings on Mill (Harrop) Creek and Narrows Creek for the Harrop-Proctor Community Co-Operative. The Co-Operative holds a Community Forest License which lies within Mill and Narrows Creek watersheds. The water monitoring program was initiated in 1999 to obtain baseline data, characterize water quality and assess changes associated with climate and development activities in the watersheds managed by the Co-Operative. The following information documents findings from July 2017 to April, 2018. However, some charts were take in previous years as illustrations. Narrows and Mill creeks have been monitored since 1999 and 2002 respectively.

The program

The structure of the present monitoring program is based on recommendations given in " Monitoring Guidelines to Evaluate the Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska" by L.H. MacDonald. Sample frequency was based on recommendations of local scientists and forest hydrologists in Canada and Idaho State, USA. The program relies on manual reading of instream flow gauges. The gauges are calibrated by creek channel metering using a Price Current meter (RIC standard procedures) at intervals of 6 to 12 inches across the stream and 4-5 metering sessions cross channel per year. Regression formulas that are consistent with the manual method are used to calculate stage-discharge tables to three decimal places. In 2017, deviations for each calculated discharge ranged from 3.8 – 29.5 % (average 17.0%) for Mill Creek and 2.9 – 19.9% (average 14.5%) for Narrows Creek (see hydrometric summary). A stage discharge curve was developed for each creek. Strategic collection of 23 water samples for both creeks based on the following criteria:

- collect during and after storm events and/or heavy rain
- collect more samples during spring freshet and fall rain events
- collect when creek water appears turbid
- keep samples cool and dark prior to delivery to lab within one week

In addition to flow readings, samples were tested for suspended solids when turbidity readings were greater that 0.5 NTU. Two samples from each creek were tested for confirmed coliforms, fecal (thermotolerant) coliforms and E.coli bacteria. The frequency of sample collection for these parameters as recommended in the B.C. Ministry of Environment Water Quality Guidelines specifies five samples over thirty days during late summer. Water temperature readings were taken hourly using Hobo Temp Pro data loggers. In November, 2017, Hobo MX 2001 loggers were installed on both creeks. These devises measure water level and temperature. The water levels were related to hydrometric measurements for flow.

All physical and microbiological tests were performed at Passmore Laboratory Ltd. and follow methods outlined the "Standard Methods for Examination of Water and Wastewater" published by the American Public Health Association 23^{t} edition, 2017. Passmore Laboratory Ltd. is certified by the Provincial Enhanced Water Quality Assurance Program (EWQA) and participates in reviews through the University of British Columbia Clinical Microbiology Proficiency Testing (CMPT) Program.

Credit goes to Lloyd Johnson who read the gauges and collected samples during 2017. Lloyd's strategic sampling helped to identify important readings in 2017.

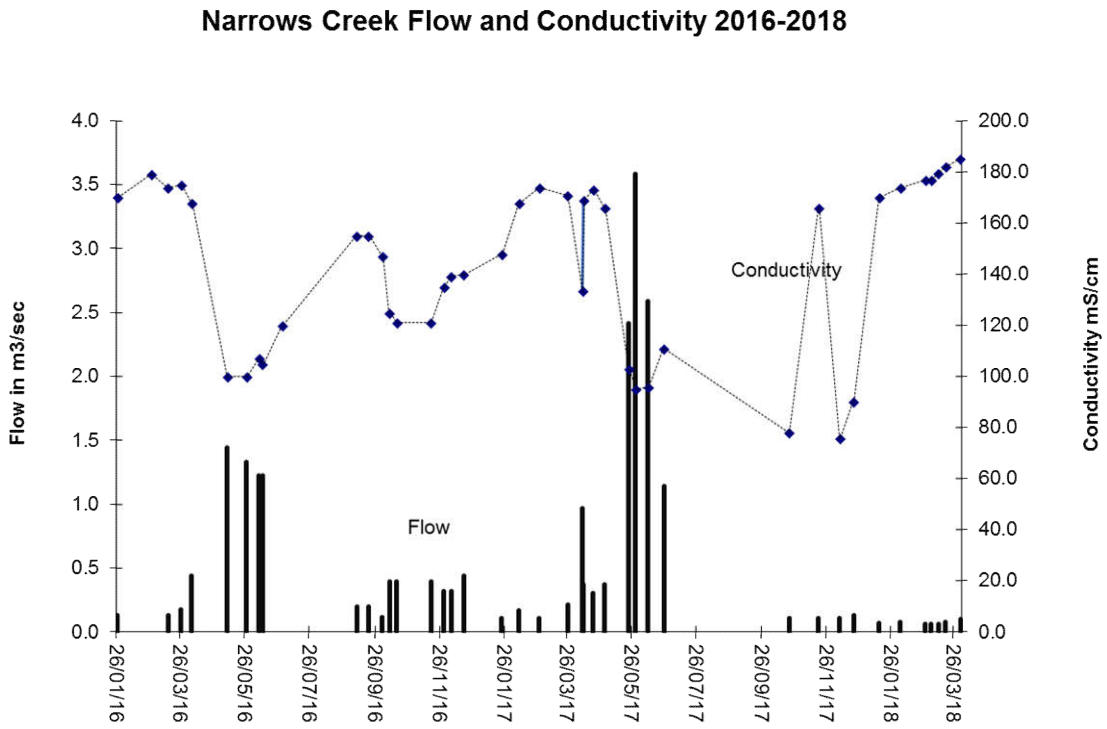
Narrows Creek Historic Data

The following table summarizes Narrows Creek data. No collections taken in 2002 and 2008

Table 1 Narrows Creek							
	Flow		Conductivity		Turbidity	Suspended Sediment	Number
	Maximum m3/sec	Minimum m3/sec	Maximum mmhos/cm	Minimum mmhos/cm	Maximum NTU	Maximum mg/l	Samples (n)
1999		1.86 (12/31)	157 (11/24)	86.2 (6/24)	0.9 (6/24)	9.0 (6/24)	25
2000	2.3 (6/17)	0.09(11/18)	210 (12/15)	74 (6/9)	1.7 (5/3)	3.3 (6/7)	26
2001	2.47 (5/25)	0.07 (2/23)	176 (4/13)	83.2 (5/25)	1.3 (5/25)	4.2 (5/25)	11
2003	3.6 (6/9)	0.158 (3/28)	164 (2/15)	75.4 (6/5)	3.2 (5/30)	30.6 (5/30)	41
2004	1.32 (6/20)	0.08 (12/1)	176 (3/19)	96.6 (6/14)	0.35 (5/5)	3.6 (5/5)	42
2005	1.95 (5/17)	0.099 (4/8)	167 (2/10)	90.5 (5/17)	0.45 (5/17)	1.5 (6/17)	40
2006	5.33 (5/20)	0.122 (2/25)	175 (2/11)	77.9 (5/20)	7.0 (5/20)	64.5 (5/17)	41
2007	3.87 (6/15)	0.087 (3/18)	168 (1/2)	76.7 (6/5)	4.0 (6/5)	58.5 (6/5)	13
2009	3.58 (5/31)	0.04 (3/20)	166 (3/10)	55.5 (5/31)	0.7 (5/31)	8.8 (5/31)	56
2010	2.4 (6/3)	0.134 (2/10)	170 (2/26)	87.9 (6/14)	0.55 (6/14)	5.3 (6/14)	36
2011	4.66 (6/21)	.094(12/10)	181 (4/20)	90.6 (6/21)	3.3 (6/6)	24.5 (5/12)	52
2012	4.0 (6/23)	0.09 (12/10)	180 (4/14)	82.1 (6/23)	8 (6/23)	126 (6/23)	39
2013	3.2 (6/23)	0.02 (10/05)	168 (4/23)	78.1 (5/12)	1.8 (5/08)	23.1 (5/06)	46
2014	2.13 (5/25)	0.08 (1/04)	148(12/06)	55.6 (5/23)	.95 (3/29)	5.1 (3/29)	57
2015	1.33 (6/2)	0.04 (1/1)	182 (1/1)	86.3 (5/11)	6.5 (5/31)	10.3 (5/21)	46
2016	1.4 (5/9)	0.14 (1/26)	179 (2/27)	99.9 (5/9)	0.45 (12/6)		21
2017	3.9 (5/29)*	.06 (3/14)	185 (4/1)	76 (12/08)	6.5 (5/23)*	58.6 (5/23)	23

* as of May, 2018

Chart 1



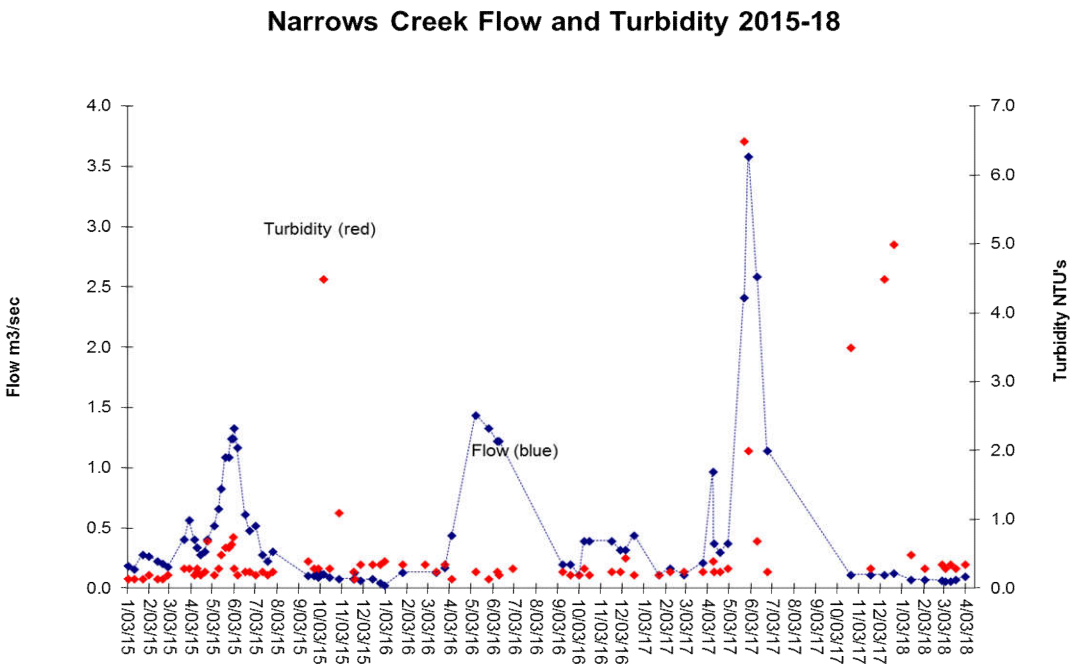
Narrows Creek Flow, Conductivity:

Narrows peak flows normally occur between mid May to mid June and low flows occur in winter to early spring. The high flow reading for 2017 was observed on May 29th at 3.59m3/sec and the low flow reading on March 4th was 0.06m3/sec. The highest conductivity reading (185 m3/sec) was reported on April 1, 2018. The lowest conductivity reading (76mS/cm) was reported on December 8th, 2017. The high flow reading for 2017 was over 2 times as high as seen in 2016.

Between October and December, a spike in conductivity was noted. Readings like this occur during the transition from high to low flows, after a period of low rainfall and dropping water levels followed by rain. Conductivity stabilized again when winter set in.

Narrows Creek Cont.

Chart 2



Narrows Creek Turbidity:

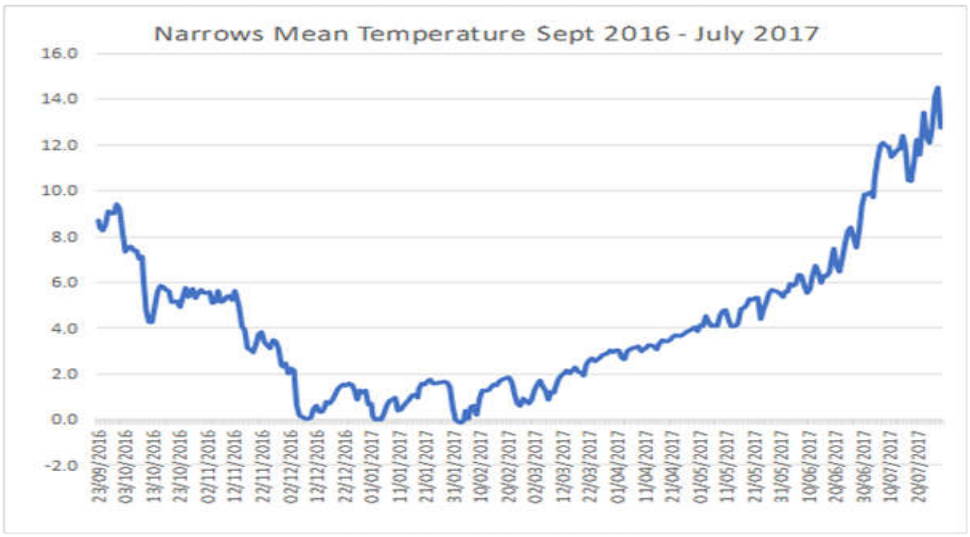
Narrows Creek normally has low turbidity. Samples over 0.5 NTU are rare. In 2015, two were noted. In 2016 no samples were greater than 0.5NTU. In 2017 six samples were greater. See table below

Table 2

Date sample In 2017	Reading in NTUs
May 23	6.5
May 29	2.0
June 10	0.7
October 21	3.5
December 8	4.5
December 21	3.5

Snow (freeze up) came late in December, 2017 and, of note is the fact that two of the high turbidity readings were taken in December. Also, the high flow in 2017 was higher than seen in 2015 and 2016. Regarding recommended levels of turbidity: Provincial Standards state that natural background turbidity should be less than 5 NTU (7).

Chart 3, 4


Narrows Mean Temperature Sept 2016 - July 2017
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
23/09/2016
03/10/2016
13/10/2016
23/10/2016
02/11/2016
12/11/2016
22/11/2016
02/12/2016
12/12/2016
22/12/2016
01/01/2017
11/01/2017
21/01/2017
31/01/2017
10/02/2017
20/02/2017
02/03/2017
12/03/2017
22/03/2017
01/04/2017
11/04/2017
21/04/2017
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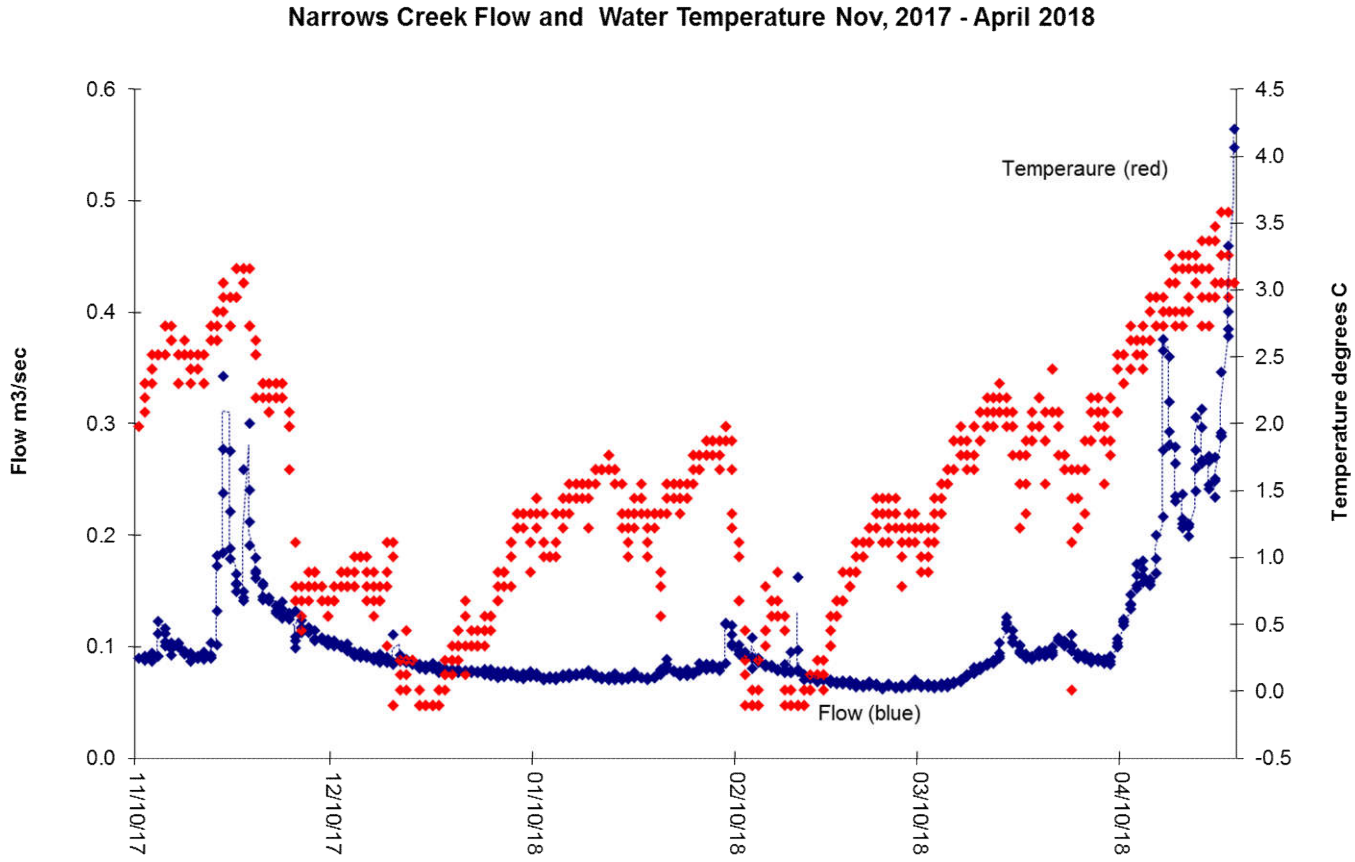
20/06/2017
30/06/2017
10/07/2017
20/07/2017


Narrows Creek Flow and Water Temperature Nov, 2017 - April 2018
Flow m3/sec
Temperature degrees C
Temperaure (red)
Flow (blue)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
11/10/17
12/10/17
01/10/18
02/10/18
03/10/18
04/10/18

Narrows Creek Temperature

Temperature for Narrows in 2017 was measured hourly and converted to "daily mean" in the chart above. The sensor was partially out of the water towards the end of July, 2017. In November, 2017 the Hobo MX 2001 logger was installed and began recording temperature and water level. See chart 4 above. Of note is the difference between Mill and Narrows creeks. Temperature data taken the same day consistently show slightly lower readings for Narrows Creek when compared to Mill.

Narrows Creek Coliforms

Table 3. Narrows Creek Coliforms 2017	Total Coliforms per 100ml	Fecal Colifoms per 100ml	E.coli per 100ml
8/23/2017	35	Less than 1	Less than 1
8/30/2017	Gt 300	1	1
9/6/2017	Gt 279	3	Less than 1
9/20/2017	71	1	1

Gt = greater than

There are no official provincial standards for untreated drinking water. Total coliforms are not associated with human infection but fecal coliforms and E.coli should not be present in drinking water. In 2017, four samples were collected. Two had 1 E.coli and one had 3 fecal coliforms. Based on these findings, it would be advisable to boil or filter the water before drinking during summer months.

See Health Canada "Bacterial Waterborne Pathogens" : www.hc-sc.gc.ca

Mill Creek Historic Data

Table 4

	Flow		Conductivity		Turbidity	Max Sediment	Number
	Max m3/sec	Min m3/sec	Max mmhos/cm	Min mmhos/cm	NTU	mg/l	Sample (n)
2002			95.8 (8/8)	51.4 (6/17)	1.9 (6/17)	12.6 (5/29)	15
2003	2.8 (6/10)	0.15 (3/8)	119 (9/20)	52.2 (6/10)	2.5 (5/5)	32.1 (10/31)	32
2004	2.6 (5/28)	0.28 (3/13)	111 (1/31)	59.0 (4/16)	0.55 (3/26)	2.7 (6/27)	17
2005	4.2 (5/17)	0.30 (12/10)	106 (4/05)	59.6 (5/17)	0.85 (6/17)	12.6 (6/17)	35
2006	11.8 (5/18)	0.30 (3/29)	115 (10/12)	45.7 (5/18)	13.0 (5/18)	149.0 (5/18)	39
2007	6.9 (6/6)	0.10 (1/10)	119 (9/28)	50.8 (6/6)	1.3 (6/6)	11.4 (6/16)	22
2008	5.6 (6/1)	0.20 (2/24)	115 (3/17)	55.3 (6/1)	0.65 (5/19)	7.4 (5/19)	21
2009	3.2 (5/31)	0.30 (3/4)	154 (11/18)	58.2 (6/16)	0.55 (5/31)	5.5 (5/17)	11
2010	3.3 (6/14)	0.20 (2/9)	137 (8/8)	59.5 (6/14)	0.55 (4/22)	6.7 (6/24)	40
2011	4.03 (5/26)	0.27 (3/15)	122 (12/9)	55.9 (6/6)	3.0 (6/6)	8.0 (5/25)	47
2012	7.8 (6/2)	0.217 (9/27)	122 (12/19)	48.4 (6/22)	2.3 (6/07)	42.9 (6/16)	55
2013	10.6 (5/13)	0.366 (9/02)	158 (6/22)	50.0 (5/13)	2.3 (5/12)	37.7 (5/12)	54
2014	3.71 (5/25)	0.149 (1/18)	171 (2/15/)	55.5 (5/25)	2.8 (4/5 & 4/12)	65.9 (4/05)	55
2015	3.7 (6/2)	0.08 (1/1)	131 (5/5)	59.0 (6/6)	0.7 (5/21)	4.8 (5/25)	43
2016	3.27 (5/16)	0.134 (1/1)	111(9/19)	58.7 (5/27)	0.45 (3/14)		22
2017	6.17 (5/29)	0.361 (2/27)	114 (2/27)	55.4 (5/29)	4.5 (5/23)	75.5 (5/23)	23

Mill Creek Flow and Conductivity:

Mill Creek high flow normally occurs between mid May to early June and low flow occurs in Fall to early Spring. The low flow in 2017 at 0.361m3/sec was one of the highest low flow recorded. In 2017, the recorded high flow at 6.17 m3/sec occurred on May 29th

Chart 5

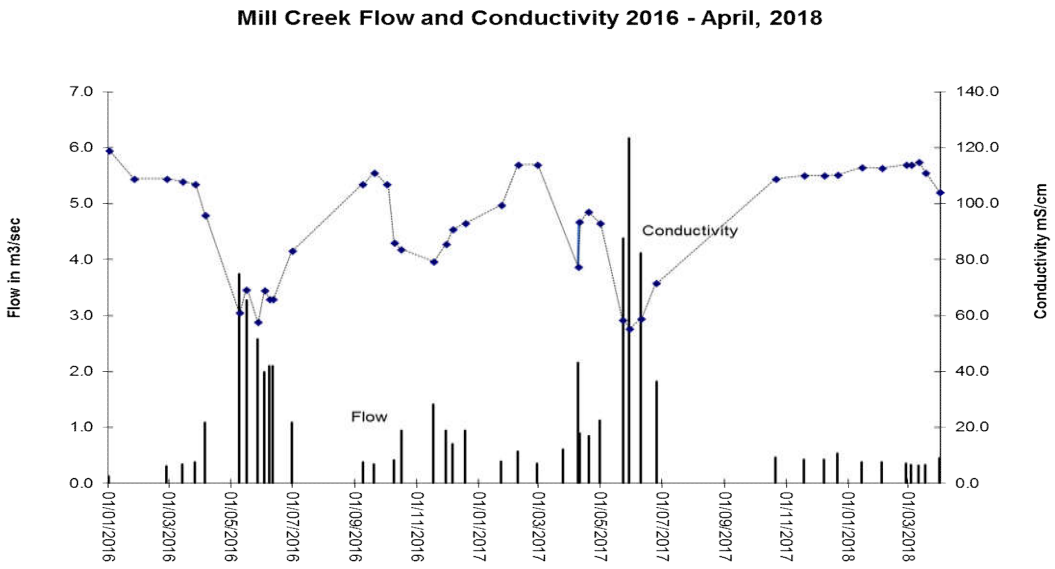
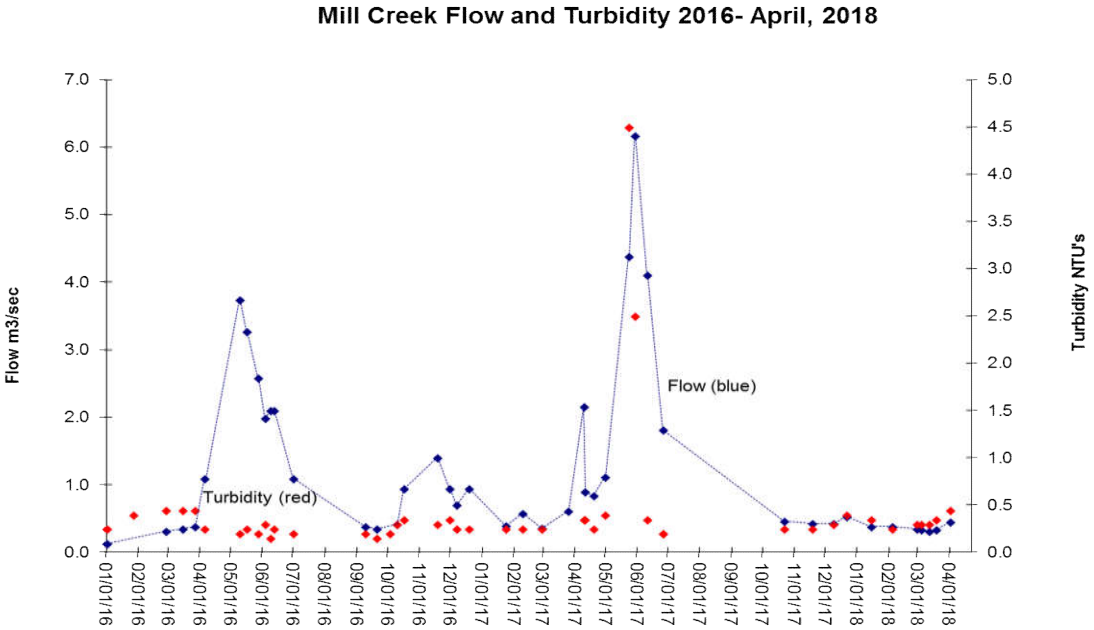


Chart 6



Characterization of Mill Creek cont. (Turbidity)

In 2017 through early April, 2018, 23 samples were collected and 9 (39%) were less than 0.25 NTUs. Ninety one percent were less than 0.5 NTU. Only two high values: 2.5 NTU's on May 29th and 4.5 NTUs on May 23rd were recorded. See Chart 6 above

Chart 7

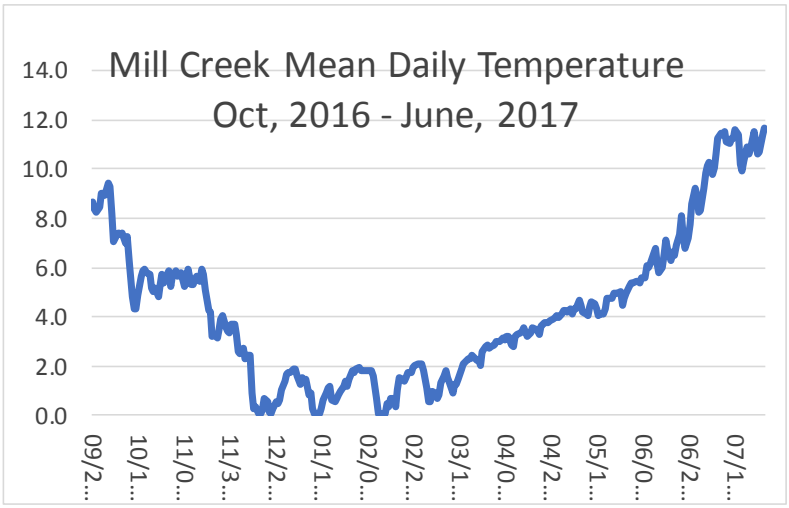
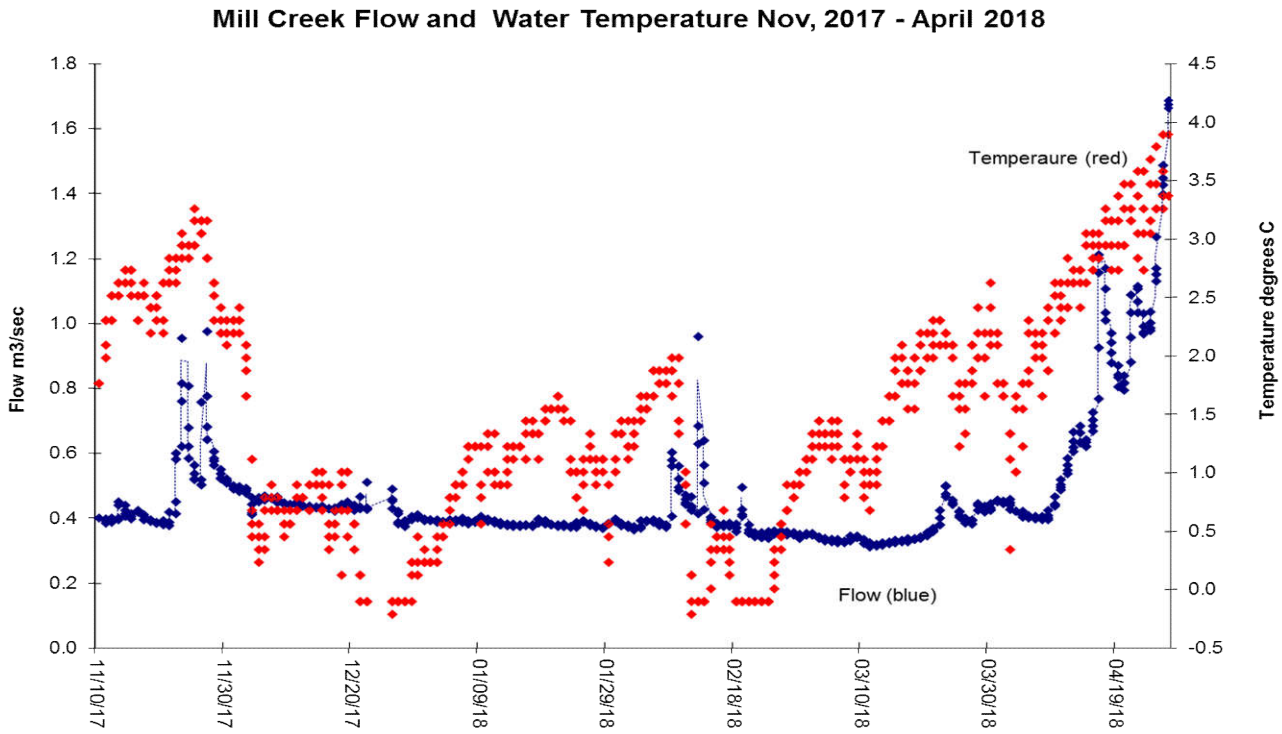


Chart 8



Mill Temperature

There were no readings between July and November, 2017. After that time, the Hobo MX 2001 logger was installed. Mill and Narrows have a very similar temperature regimes. Mill temperature does rise slightly higher as the freshet comes on and lower during mid-winter. This may relate to surface vs ground water source in the watershed. See charts 7 and 8 above. Health Canada recommends an aesthetic objective of 15C for water temperature (5). All readings were well below this value

Mill Creek Coliforms

In year 2017 two samples were collected. One was positive for E.coli and fecal coliforms
Both samples had high total coliforms counts. This is normal for creek surface water.

See Table 4.

Table 5 Mill Creek Coliforms for 2017	Total Coliforms per 100ml	Fecal Colifoms per 100ml	E.coli per 100ml
8/30	Gt 270	Less than 1	Less than 1
8/23	Gt 240	1	1

References

1. Water Survey Canada's website: http://scitech.pyr.ec.gc.ca/waterweb
2. Water quality guidelines from the Provincial Govt's website: http://www.env.gov.bc.ca/wat/wq/BCguidelines/approv_wq_guide/approved.html#1
3. Monitoring Guidelines to Evaluate the Effects of Forestry Activities on Streams in the Pacific Northwest & Alaska, L.H McDonald EPA 910/9-91-001
4. Wildland Water Quality Sampling and Analysis, John D. Stednick
5. Health Canada Website: www.hc-sc.gc.ca
6. Harrop and Narrows Creeks Monitoring Summary Report for 2014, 2015, J. Yeow
7. British Columbia Water Quality Guidelines: Drinking Water Sources Guideline Summary

Respectfully Submitted

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