Section 5-3
Cold Brook and Whitten Brook (Skowhegan Conservation Commission)

Cold Brook and Whitten Brook

Cold Brook

Cold Brook originates east of Russell Road, flows into an impounded section (Cold Brook Pond) bordered by three commercial shopping malls, flows under Route 201, meanders adjacent to the North Gate Industrial Park, the retired Town of Skowhegan Landfill, and a forested area before it discharges to the West Branch of Wesserunsett Stream. The brook is 5.89 miles long (mainstem) and its watershed encompasses approximately 4774 acres including residential, commercial, industrial and undeveloped land. The statutory class of Cold Brook is Class B.

Whitten Brook

Whitten Brook originates in an undeveloped forest located northwest of Coburn Avenue in Skowhegan. It meanders for 0.6 miles parallel to Spring Street before it enters a small impounded area adjacent to an old shoe factory that is currently being used as a warehouse and storage facility. It then flows under Russell Street where it joins its northern branch that originates near Robinson Court. It continues to flow another 0.5 miles in a southerly direction, crossing underneath Spring Street, Summer Street, Bennett Avenue, Pleasant Street and finally Elm Street where it discharges into the Kennebec River upstream from Weston Dam. The brook is 1.11 miles long (mainstem) and its watershed encompasses approximately 304 acres including residential, commercial, industrial and undeveloped land. The statutory class of Whitten Brook is Class B.

Whitten Brook is listed by DEP as impaired due to non-attainment of aquatic life criterion and habitat, as well as nonattainment of bacteria criterion. The cause of impairment is stormwater runoff from impervious surfaces and roads within the watershed. The Town of Skowhegan and Maine DEP conducted a multi-year effort to assess the impacts to the brook's water quality that culminated in the placement of two bioretention cells designed to decrease the water quality impacts of high flow events. In March 2011, a watershed management plan that identifies the problems, priorities and actions needed to improve the water quality was completed.

Monitoring History

• The Maine DEP Biological Monitoring Program has been monitoring Cold Brook since 1997 and Whitten Brook since 2002. This data is available on DEP's website.

• The Maine DEP monitored Whitten Brook in 2006 for bacteria, dissolved oxygen and toxics.

• The Skowhegan Conservation Commission joined the Maine Volunteer River Monitoring Program (VRMP) in 2014.

Methods and Sampling Sites

Volunteers monitor Cold Brook at two sites on the mainstem. Volunteers monitor Whitten Brook at three sites on the mainstem and one site on the Northern tributary. All of the sites are VRMP approved sites.

Monitoring is conducted weekly from May/June to September. Monitors take measurements of water temperature, dissolved oxygen, and conductivity using a YSI meter.

Table 5-3-1: Cold Brook and Whitten Brook sampling sites.

VRMP Site ID	Organization Site Code	Sample Location	Class
Cold Brook-KWSCB27-VRMP	CB-2	Route 201	B
Cold Brook-KWSCB06-VRMP	CB-3	Steward Hill	B
Whitten Brook-KWB06-VRMP	WB-1	Russell Street - Above	B
Whitten Brook-KWB05-VRMP	WB-2	Russell Street - Below	B
Whitten Brook-North Branch-KWBNB02-VRMP	WB-3	North Branch	B
Whitten Brook-KWB01-VRMP	WB-4	Pleasant Street	B

Cold Brook and Whitten Brook Sampling Sites

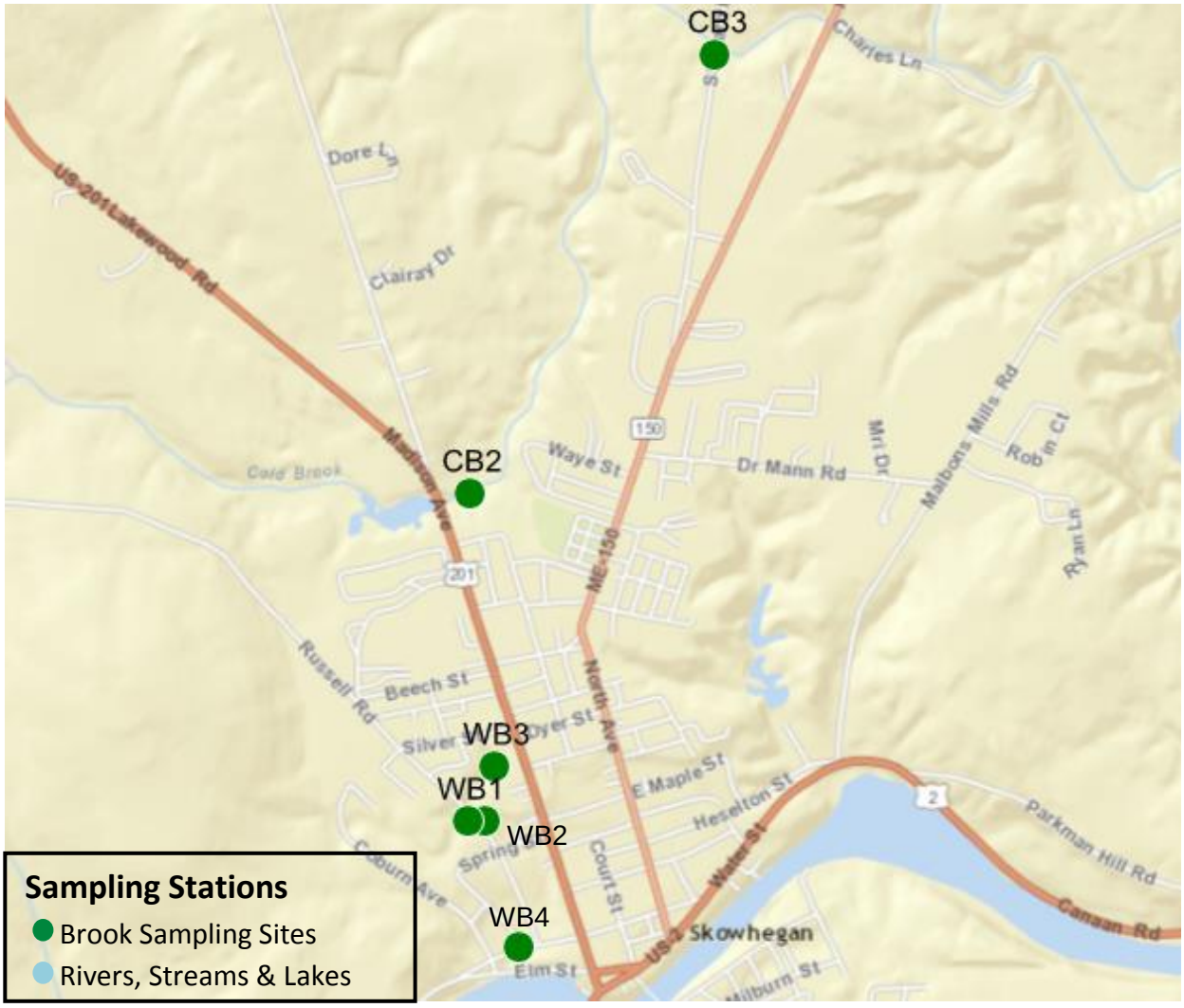


Figure 5-3-1: Map of Cold Brook and Whitten Brook sampling sites.

Results

Refer to Appendix for discussion of individual site data and trends.

Dissolved Oxygen

Dissolved oxygen (DO) levels are generally lowest early in the morning and then increase during the day, peaking mid to late afternoon. Monitors should try to collect some samples early in the morning. Dissolved oxygen is also affected by flow conditions and temperature. During high flow conditions, more oxygen is added to the river from the atmosphere as the water is more turbulent and there is more opportunity for mixing. If flow during the summer months is higher or lower than normal, this will affect the dissolved oxygen.

Class B criteria for dissolved oxygen are a minimum of 7 mg/l (milligrams/liter) or 75% saturation. To meet water quality standards, both concentration and saturation criteria must be met.

2016 Results

Both Cold Brook and Whitten Brook were sampled bi-weekly (nine times) through the sampling season. At sampling site CB-2, the dissolved oxygen (DO) concentration criterion of 7 mg/l was not met for seven sampling dates (late June through September). This site also did not meet the DO percent saturation criterion on the same seven dates. Site CB-3 did not meet criterion for DO concentration on six sampling dates (late June through early September) and did not meet criterion for DO percent saturation on four sample dates. Dissolved oxygen at these sites may in part be natural, since site CB-2 is below a large impounded area and there is a wetland above site CB-3. Dissolved oxygen at these two sites is fair to good.

All of the Whitten Brook sample sites met DO criterion for dissolved oxygen concentration of 7 mg/l. Whitten Brook sites also met criterion for DO percent saturation for all dates. It is surprising that this small urban stream maintains good DO through the season, especially in 2016 which experienced drier conditions and lower flow than normal. The monitors did an excellent job of obtaining early morning measurements. Overall, dissolved oxygen was excellent at Whitten Brook.

Table 5-3-2: A summary of minimum, maximum, and average dissolved oxygen concentration (mg/l) values at Cold Brook and Whitten Brook monitoring sites.

Site	Class	# Sample Points	Mean	Minimum	Maximum	Criterion	# Not Meeting Criterion
CB-2	B	9	6.7	5.0	10.3	7	7
CB-3	B	9	6.6	4.9	8.5	7	6
WB-1	B	9	9.1	8.1	11.4	7	0
WB-2	B	9	9.2	8.3	10.9	7	0
WB-3	B	9	9.3	8.7	10.5	7	0
WB-4	B	9	9.9	9.1	10.9	7	0

Table 5-3-3: A summary of minimum, maximum, and average dissolved oxygen saturation (%) values at Cold Brook and Whitten Brook monitoring sites.

Site	Class	# Sample Points	Mean	Minimum	Maximum	Criterion	# Not Meeting Criterion
CB-2	B	9	70.8	55.4	99.9	75	7
CB-3	B	9	70.9	52.8	85.1	75	4
WB-1	B	9	88.4	81.9	101.5	75	0
WB-2	B	9	88.6	84.0	97.5	75	0
WB-3	B	9	87.8	83.7	100.1	75	0
WB-4	B	9	96.2	93.4	101.5	75	0

Figure 5-3-2: Graph of dissolved oxygen concentrations for Cold Brook sites.

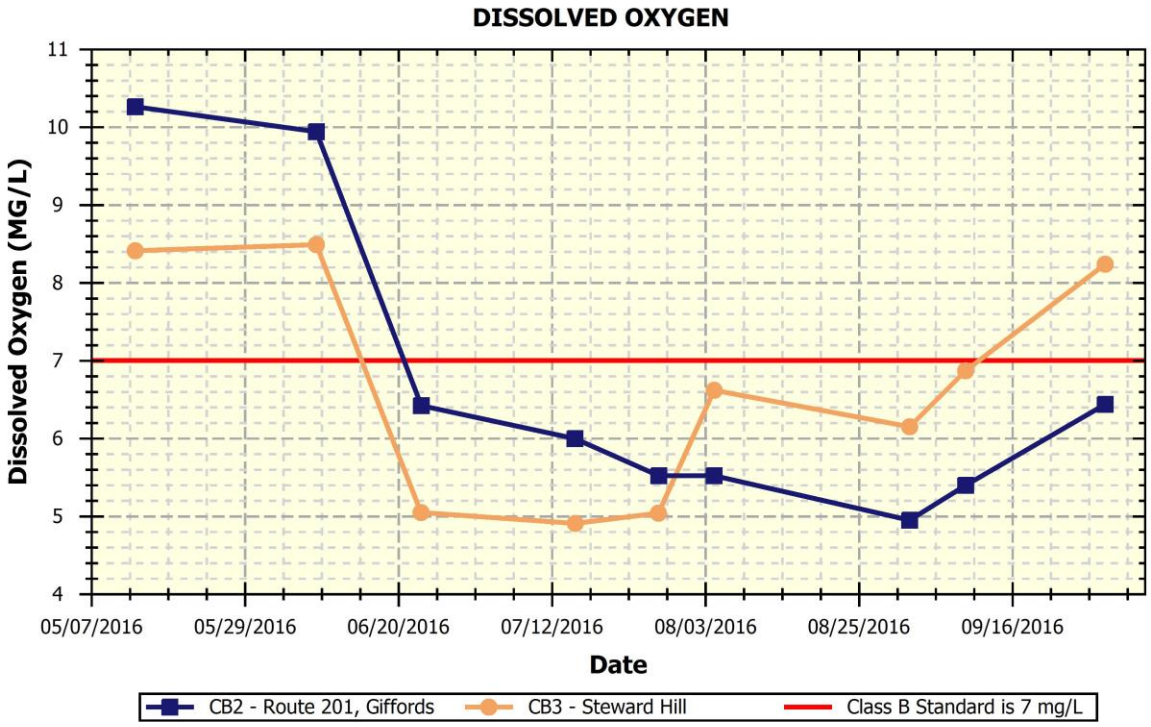


Figure 5-3-3: Graph of dissolved oxygen concentrations for Whitten Brook sites.

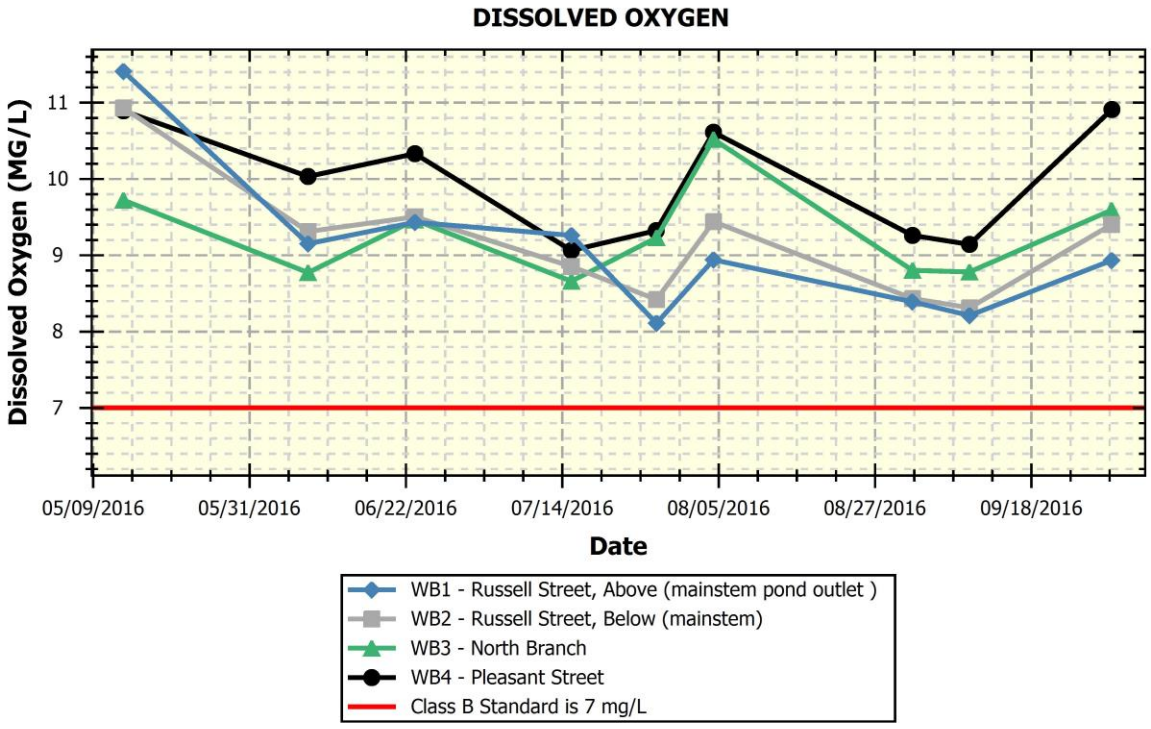


Figure 5-3-4: Graph of dissolved oxygen saturation for Cold Brook sites.

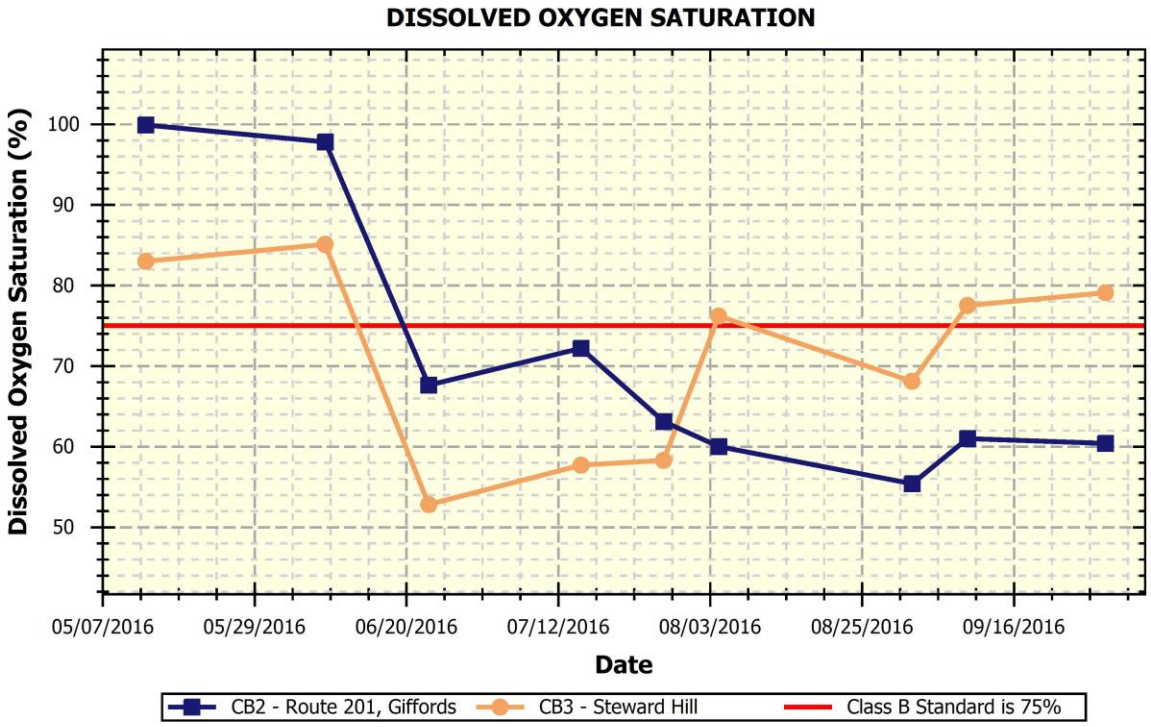
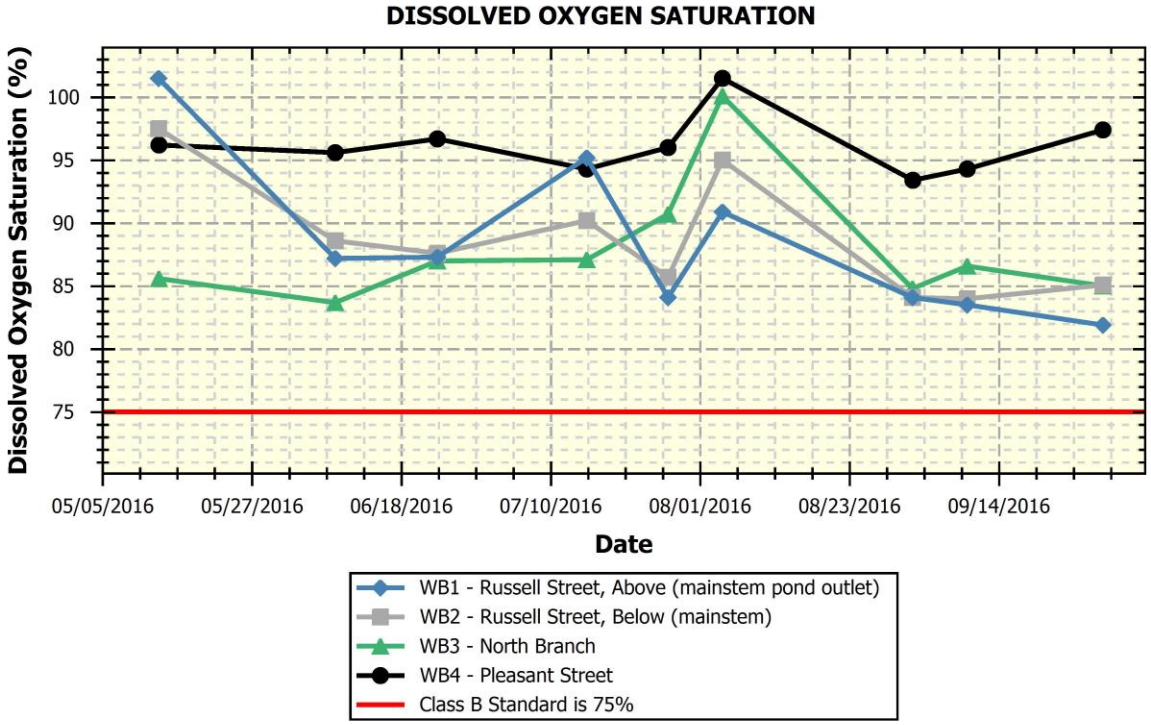


Figure 5-3-5: Graph of dissolved oxygen saturation for Whitten Brook sites.



Water Temperature

Maine's Regulations Relating to Temperature (06-096 CMR Chapter 582) require that discharge of pollutants not raise the temperature of any river and stream above the EPA criteria for indigenous species (23 °C maximum and 19 °C weekly average) or 0.3 °C (0.5 °F) above the temperature that would naturally occur outside a mixing zone established by the Board of Environmental Protection. Pollutant is defined in statute as many things including dirt and heat. For tidal waters, discharge of pollutants may not raise the temperature more than 4 °F (2.2 °C) or more than 1.5 °F (0.8 °C) from June 1 to September 1, and may not cause the temperature of any tidal waters to exceed 85 °F (29 °C) at any point outside a mixing zone established by the Board of Environmental Protection.

2016 Results

Temperature at the Cold Brook sampling sites was somewhat higher than in 2015. Temperatures from July to early September were in the 20 ˚C - 24 ˚C (Celsius) range, which is high. Overall, temperatures at Cold Brook are fair-good. Temperature at Whitten Brook was cold at all the sites throughout the season with maximum temperatures of 17 ˚C. Sites WB-1, WB-2 and WB-4 are very similar. Site WB-3 (north branch) is the coolest, being 2 - 3 ˚C cooler throughout most of the summer. Overall, temperature at Whitten Brook is excellent.

Table 5-3-4: A summary of minimum, maximum, and water temperature (°C) values at Cold Brook and Whitten Brook monitoring sites.

Site	Class	# Sample Points	Mean	Minimum	Maximum	Criterion	# Exceeding Criterion
CB-2	B	9	18.2	12.5	23.4	n/a	n/a
CB-3	B	9	18.8	13.3	23.4	n/a	n/a
WB-1	B	9	14.2	10.2	16.9	n/a	n/a
WB-2	B	9	13.9	10.0	16.5	n/a	n/a
WB-3	B	9	12.8	9.5	15.4	n/a	n/a
WB-4	B	9	14.3	9.8	17.3	n/a	n/a

Figure 5-3-6: Graph of water temperature for Cold Brook sites.

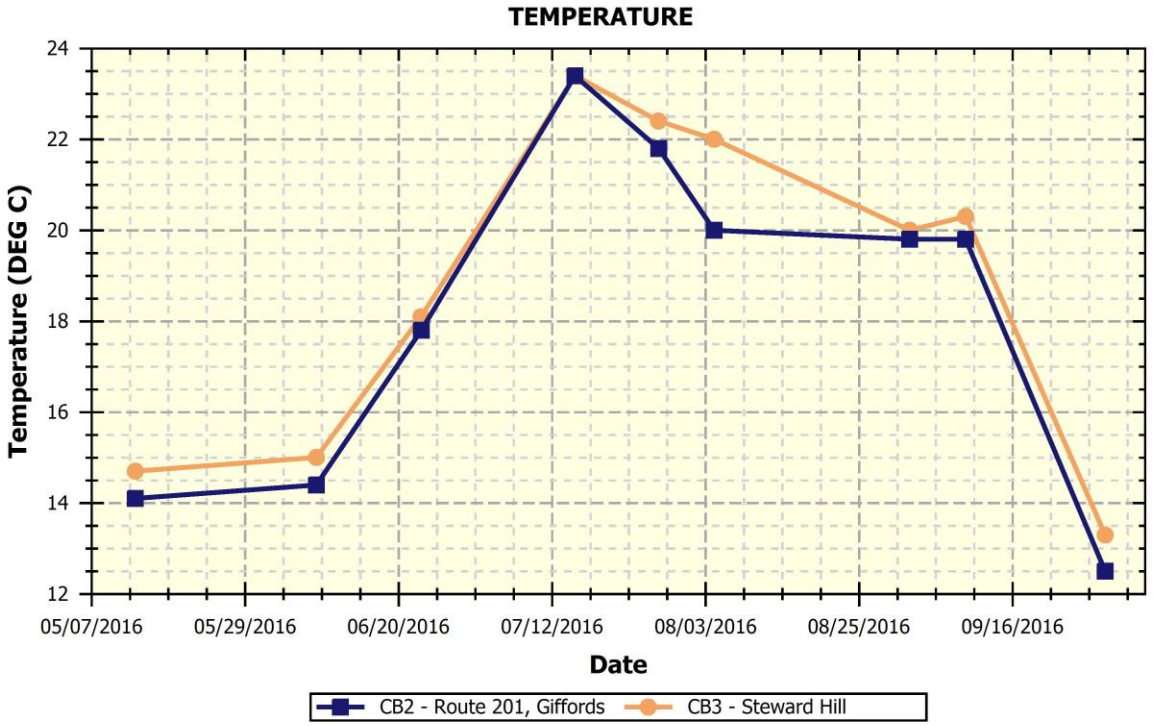
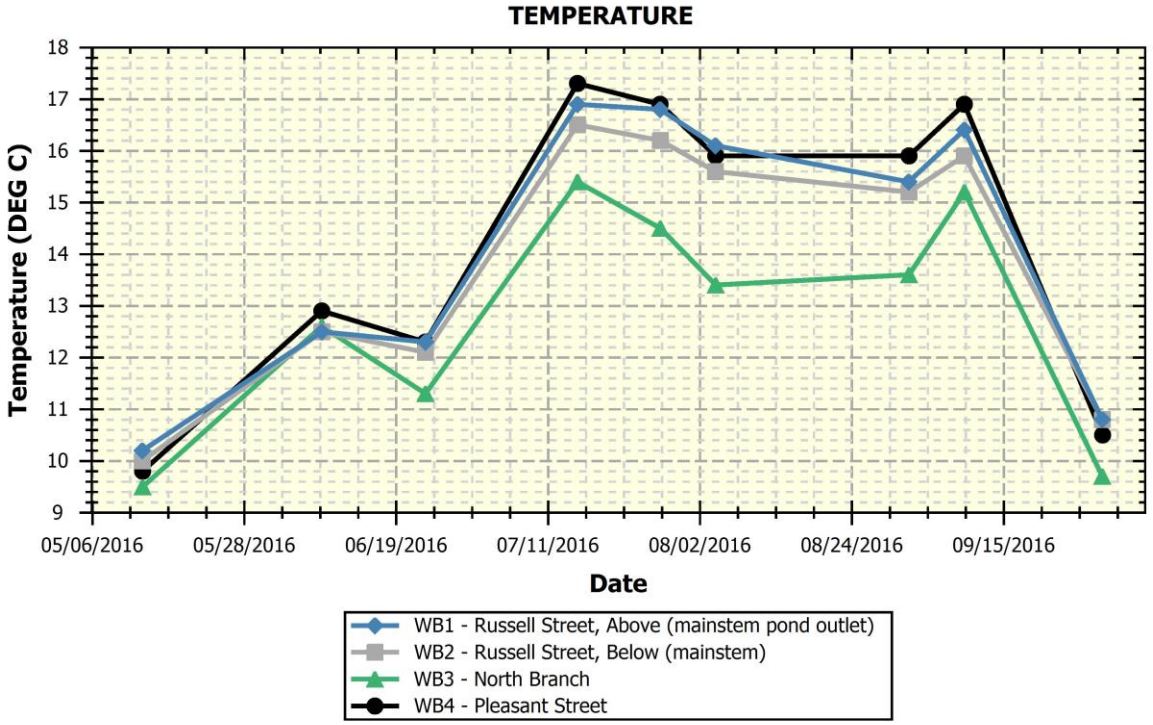


Figure 5-3-7: Graph of water temperature for Whitten Brook sites.



Specific Conductance

Specific conductance is related to the amount of dissolved materials in the water. While there are no numerical standards, a relationship exists between conductivity and chloride which has numerical criteria. In general, streams located in urban areas tend to have high specific conductance due to polluted urban stormwater runoff. This may also in large part be due to salt buildup in surface and groundwater from road maintenance practices.

2016 Results

Specific conductance at the two Cold Brook sites followed similar patterns with conductivity being in the 300-600 µS/cm range for July through September. The exception was the last sample date when CB-2 was 1001 µS/cm. In 2016, the below site was generally higher than the above site which is the opposite of previous years. Conductivity is poor to fair.

Specific conductance at Whitten Brook sampling sites WB-1, WB-2, and WB-4 were similar. Overall values here were moderate, ranging from 109-269 µS/cm range. Specific conductance was generally always high at site WB-3 (north branch) with values ranging from 365-651 µS/cm. Conductivity on the main stem is good for an urban stream and poor at site WB-3.

Table 5-3-5: A summary of minimum, maximum, and specific conductance (µS/cm) values at Cold Brook and Whitten Brook monitoring sites.

Site	Class	# Sample Points	Mean	Minimum	Maximum	Criterion	# Exceeding Criterion
CB-2	B	9	517	115	1001	n/a	n/a
CB-3	B	9	343	136	537	n/a	n/a
WB-1	B	9	172	109	208	n/a	n/a
WB-2	B	9	204	123	263	n/a	n/a
WB-3	B	9	556	365	651	n/a	n/a
WB-4	B	9	230	141	269	n/a	n/a

Figure 5-3-8: Graph of specific conductance for Cold Brook sites.

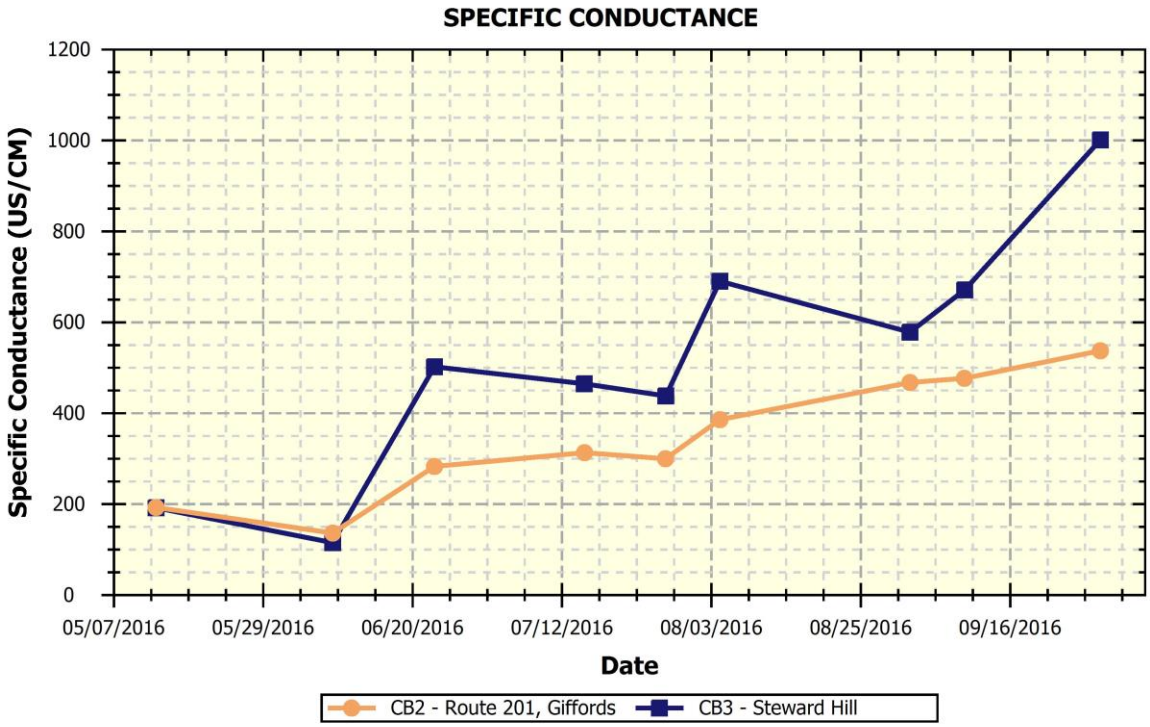
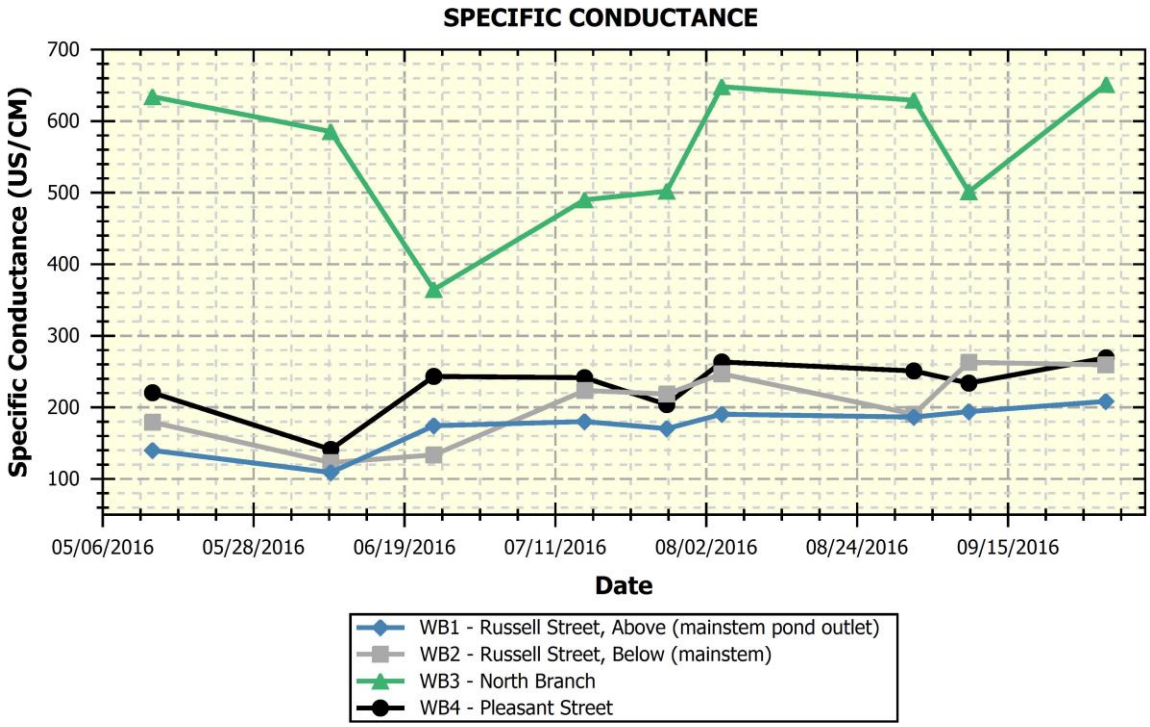


Figure 5-3-9: Graph of specific conductance for Whitten Brook sites.



Discussion and Recommendations

There are numerous sources of pollution and other stresses to the Cold Brook and Whitten Brook sites monitored by the Skowhegan Conservation Commission that could potentially have an impact on water quality. Some of these sources of pollution and stress may include:

- Non-point source pollution (e.g., septic systems, eroded soil, fertilizers, pesticides, heavy metals, petroleum residues, road salt, wildlife and pet feces) and polluted stormwater originating from urban impervious surfaces (e.g., streets, parking lots, driveways, roofs), agriculture, and forestry.
- Ponds and impoundments (which often create more pond-like aquatic habitat conditions that may have higher water temperatures and lower dissolved oxygen concentrations than free-flowing waters).
- Natural effects of wetlands (such as contributing waters to a stream/river that have low dissolved oxygen levels due to the decomposition of large amounts of organic matter, respiration of abundant plant matter, and low re-aeration rates that is characteristic of many wetlands).

The following are recommendations for future monitoring:

- **The monitors should continue to include early morning measurements for dissolved oxygen. It is important to get some values early in the morning (before 8:00 am), particularly during the warmer summer months. Over a 24 hour period, the lowest readings occur in the early morning and highest readings in mid to late afternoon. This occurs because oxygen is used**

up during the night due to plant respiration and during the day, plant life is photosynthesizing.

- **Further assessment of possible pollution sources contributing to high conductivity in Cold Brook might be investigated. In 2016, conductivity was higher at the downstream station.**
- **Good dissolved oxygen and temperature in Whitten Brook is encouraging. It would be worthwhile to do an assessment of aquatic life and habitat to determine if these are the primary stressors for Whitten Brook. DEP will be monitoring aquatic life in the Kennebec Basin in 2017 and should make sure that Whitten Brook is included.**
- **Continue monitoring at all stations to develop a long term trend database.**

Appendix A-1

* Sampling depths are only reported for Tier 1 VRMP sites.

** "NA" = normal environmental sample ; "D" = field duplicate; "D.O." = dissolved oxygen; "Spec. Cond" = specific conductance; "TSS" = total suspended solids'

Organization Site Code	VRMP Site ID	Date	Time	** Sample Type Qualifier	* Sample Depth	Depth Unit	Water Temp (DEG C)	** D.O. Sat. (%)	** D.O. (MG/L)	** Spec. Cond. (US/CM)	Salinity (PPTH)	Turb-idity (NTU)	Total Diss. Solids (MG/L)	** TSS (MG/L)	E Coli Bacteria (MPN/ 100ML)	Entero-cocci (MPN/ 100ML)
Cold Brook & Whitten Brook- Skowhegan Conservation Commission: Approved Sites																
CB2	COLD BROOK - KWSCB27 - VRMP	5/13/2016	5:56 AM	NA			14.1	99.9	10.3	191.8						
CB2	COLD BROOK - KWSCB27 - VRMP	6/8/2016	5:39 AM	NA			14.4	97.8	9.9	114.7						
CB2	COLD BROOK - KWSCB27 - VRMP	6/23/2016	6:00 AM	NA			17.8	67.6	6.4	502						
CB2	COLD BROOK - KWSCB27 - VRMP	7/15/2016	7:10 AM	NA			23.4	72.2	6.0	464.5						
CB2	COLD BROOK - KWSCB27 - VRMP	7/15/2016	7:10 AM	D			23.4	72.1	6.0	464.9						
CB2	COLD BROOK - KWSCB27 - VRMP	7/27/2016	6:40 AM	NA			21.8	63.1	5.5	437.8						
CB2	COLD BROOK - KWSCB27 - VRMP	7/27/2016	6:40 AM	D			22.0	63.3	5.5	438.7						
CB2	COLD BROOK - KWSCB27 - VRMP	8/4/2016	6:07 AM	NA			20.0	60.0	5.5	690						
CB2	COLD BROOK - KWSCB27 - VRMP	9/1/2016	6:07 AM	NA			19.8	55.4	5.0	578						
CB2	COLD BROOK - KWSCB27 - VRMP	9/9/2016	6:55 AM	NA			19.8	61.0	5.4	671						
CB2	COLD BROOK - KWSCB27 - VRMP	9/29/2016	6:51 AM	NA			12.5	60.4	6.4	1001						
CB3	COLD BROOK - KWSCB06 - VRMP	5/13/2016	5:44 AM	NA			14.7	83.0	8.4	192.4						
CB3	COLD BROOK - KWSCB06 - VRMP	6/8/2016	5:25 AM	NA			15.0	85.1	8.5	136.4						
CB3	COLD BROOK - KWSCB06 - VRMP	6/23/2016	5:50 AM	NA			18.1	52.8	5.1	282.5						
CB3	COLD BROOK - KWSCB06 - VRMP	7/15/2016	7:25 AM	NA			23.4	57.7	4.9	312.8						
CB3	COLD BROOK - KWSCB06 - VRMP	7/27/2016	6:30 AM	NA			22.4	58.3	5.0	299.8						
CB3	COLD BROOK - KWSCB06 - VRMP	8/4/2016	5:49 AM	NA			22.0	76.2	6.6	385.7						
CB3	COLD BROOK - KWSCB06 - VRMP	8/4/2016	5:49 AM	D			21.9	75.5	6.6	390.3						
CB3	COLD BROOK - KWSCB06 - VRMP	9/1/2016	5:52 AM	NA			20.0	68.1	6.2	467						
CB3	COLD BROOK - KWSCB06 - VRMP	9/9/2016	6:40 AM	NA			20.3	77.5	6.9	476.6						
CB3	COLD BROOK - KWSCB06 - VRMP	9/29/2016	6:35 AM	NA			13.3	79.1	8.2	537						
WB1	WHITTEN BROOK - KWB06 - VRMP	5/13/2016	6:10 AM	NA			10.2	101.5	11.4	139.7						
WB1	WHITTEN BROOK - KWB06 - VRMP	6/8/2016	5:50 AM	NA			12.5	87.2	9.2	108.7						
WB1	WHITTEN BROOK - KWB06 - VRMP	6/23/2016	6:25 AM	NA			12.3	87.3	9.4	174						
WB1	WHITTEN BROOK - KWB06 - VRMP	7/15/2016	6:50 AM	NA			16.9	95.2	9.3	180.1						
WB1	WHITTEN BROOK - KWB06 - VRMP	7/27/2016	6:05 AM	NA			16.8	84.1	8.1	170.2						
WB1	WHITTEN BROOK - KWB06 - VRMP	8/4/2016	6:19 AM	NA			16.1	90.9	8.9	190.3						
WB1	WHITTEN BROOK - KWB06 - VRMP	9/1/2016	6:20 AM	NA			15.4	84.1	8.4	186						
WB1	WHITTEN BROOK - KWB06 - VRMP	9/9/2016	7:05 AM	NA			16.4	83.5	8.2	193.6						
WB1	WHITTEN BROOK - KWB06 - VRMP	9/29/2016	7:03 AM	NA			10.8	81.9	8.9	208						
WB2	WHITTEN BROOK - KWB05 - VRMP	5/13/2016	6:20 AM	NA			10.0	97.5	10.9	179.2						
WB2	WHITTEN BROOK - KWB05 - VRMP	6/8/2016	5:56 AM	NA			12.5	88.6	9.3	122.7						
WB2	WHITTEN BROOK - KWB05 - VRMP	6/23/2016	6:35 AM	NA			12.1	87.6	9.5	133.4						
WB2	WHITTEN BROOK - KWB05 - VRMP	7/15/2016	7:00 AM	NA			16.5	90.2	8.9	223.4						
WB2	WHITTEN BROOK - KWB05 - VRMP	7/27/2016	6:17 AM	NA			16.2	85.7	8.4	218.4						
WB2	WHITTEN BROOK - KWB05 - VRMP	8/4/2016	6:26 AM	NA			15.6	95.0	9.4	246.5						
WB2	WHITTEN BROOK - KWB05 - VRMP	9/1/2016	6:27 AM	NA			15.2	84.1	8.4	190						
WB2	WHITTEN BROOK - KWB05 - VRMP	9/9/2016	7:20 AM	NA			15.9	84.0	8.3	262.9						
WB2	WHITTEN BROOK - KWB05 - VRMP	9/29/2016	7:09 AM	NA			10.8	85.1	9.4	259						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	5/13/2016	6:30 AM	NA			9.5	85.6	9.7	634						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	6/8/2016	6:04 AM	NA			12.6	83.7	8.8	585						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	6/23/2016	6:30 AM	NA			11.3	87.0	9.5	364.5						

Organization Site Code	VRMP Site ID	Date	Time	** Sample Type Qualifier	* Sample Depth	Depth Unit	Water Temp (DEG C)	** D.O. Sat. (%)	** D.O. (MG/L)	** Spec. Cond. (US/CM)	Salinity (PPTH)	Turb-idity (NTU)	Total Diss. Solids (MG/L)	** TSS (MG/L)	E Coli Bacteria (MPN/ 100ML)	Entero-cocci (MPN/ 100ML)
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	7/15/2016	6:55 AM	NA			15.4	87.1	8.7	489.7						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	7/27/2016	6:12 AM	NA			14.5	90.7	9.2	502						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	8/4/2016	6:35 AM	NA			13.4	100.1	10.5	648						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	9/1/2016	6:37 AM	NA			13.6	84.8	8.8	629						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	9/9/2016	7:15 AM	NA			15.2	86.6	8.8	501						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	9/29/2016	7:17 AM	NA			9.7	85.0	9.6	651						
WB4	WHITTEN BROOK - KWB01 - VRMP	5/13/2016	6:42 AM	NA			9.8	96.2	10.9	220.4						
WB4	WHITTEN BROOK - KWB01 - VRMP	6/8/2016	6:16 AM	NA			12.9	95.6	10.0	141.1						
WB4	WHITTEN BROOK - KWB01 - VRMP	6/23/2016	6:40 AM	NA			12.3	96.7	10.3	243						
WB4	WHITTEN BROOK - KWB01 - VRMP	7/15/2016	6:40 AM	NA			17.3	94.3	9.1	241.1						
WB4	WHITTEN BROOK - KWB01 - VRMP	7/27/2016	5:55 AM	NA			16.9	96.0	9.3	203.7						
WB4	WHITTEN BROOK - KWB01 - VRMP	8/4/2016	6:48 AM	NA			15.9	101.5	10.6	263						
WB4	WHITTEN BROOK - KWB01 - VRMP	9/1/2016	6:50 AM	NA			15.9	93.4	9.3	250.6						
WB4	WHITTEN BROOK - KWB01 - VRMP	9/9/2016	7:25 AM	NA			16.9	94.3	9.1	233.6						
WB4	WHITTEN BROOK - KWB01 - VRMP	9/29/2016	7:29 AM	NA			10.5	97.4	10.9	269						