

Section 5-1

Androscoggin River (Androscoggin River Watershed Council)

Refer to Chapter 4 of this document for information about sampling methods, sampling sites, and quality assurance.

Overview

The upper Androscoggin River and tributaries are monitored by the Androscoggin River Watershed Council (ARWC). The ARWC focuses on the upper part of the Androscoggin River and began participating in the New Hampshire Volunteer River Assessment Program (VRAP) in 2007. ARWC joined the Maine Volunteer River Monitoring Program (VRMP) in 2012 thus extending sampling locations into the Androscoggin River in Maine.

The Androscoggin River is the third largest river in the state. It has a length of 177 miles and drainage area of 3,450 square miles (2,730 sq. mi. in Maine). The headwaters are Umbagog Lake in New Hampshire. From there it flows into New Hampshire and then back into Maine through the towns of Gilead and Bethel. It continues flowing through the towns and cities of Bethel, Rumford, Mexico, Dixfield, Jay, Livermore Falls, Lewiston, Auburn, Lisbon, Lisbon Falls, Durham, Brunswick, and Topsham where it joins the Kennebec River at Merrymeeting Bay.

The Androscoggin River is assigned Class B from the Maine/New Hampshire boundary to its confluence with the Ellis River. It is assigned Class C from the confluence with the Ellis River to Merrymeeting Bay. Unless otherwise assigned, tributaries of the Androscoggin from the Maine-New Hampshire state border in Gilead to and including the Ellis River are Class A. The Sunday River is assigned Class A.

The “DEP 2010 Integrated Water Quality Monitoring and Assessment Report” lists segments of the river in 6 categories:

- **Category 2** (Rivers and Streams attain some of the designated uses: no use is threatened; and insufficient data or no data and information is available to determine if the remaining uses are attained or threatened (with presumption that all uses are attained)).
 - Several rivers (Ellis, Swift, Dead, Little Androscoggin segments) and minor tributaries.
- **Category 3** (Insufficient data and information to determine if designated uses are attained (with presumption that one or more uses may be impaired));
 - Rangeley segment, Sunday River, Nezinscot River segments and several small streams
- **Category 4-A** (Rivers and streams impaired or threatened for one or more designated uses with a TMDL completed, but insufficient new data exists to determine that attainment has been achieved (Impaired use other than mercury)):
 - Main stem, upstream of Gulf Island Dam (cause is algae blooms, BOD, DO, phosphorus, TSS)
 - Androscoggin River-Lewiston-Auburn, CSO affected (cause is *E. coli*)

- Little Androscoggin River-Mechanic Falls (cause is *E. coli*)
- **Category 4-B** (Rivers and Streams impaired or threatened for one or more designated uses – other pollution control requirements are reasonably expected to result in attainment of standards in the near future):
 - Androscoggin River various segments (Cause is dioxin)
- **Category 5-A** (Rivers and streams Impaired by pollutants other than those listed in 5-B through 5-D (TMDL required)):
 - Sabattus River segments and numerous small streams
- **Category 5-D** (Rivers and Streams impaired by “legacy pollutants”):
 - Androscoggin River segments (Cause is PCBs)

The Androscoggin River has a long history of industrial and municipal use over the last 200 years.¹ Beginning in the early 1800s, many dams were constructed for mills, primarily in the lower part of the river. By the late 1800s, many textile and lumber mills were in operation, mostly from Lewiston to Brunswick. Pulp and paper mills that are still in operation today were established in the late 1800s in New Hampshire, Rumford, and Jay. Beginning in the late 1920s, Central Maine Power built hydroelectric dams that impounded much of the river from Lewiston to Livermore Falls. Some of these uses continue today. “Along its course to the sea, the river is repeatedly dammed. It receives discharges from industrial and municipal sources, as well as polluted runoff from a variety of sources.”² Specific problems include mill discharges, combined sewer overflows (CSOs), dam impacts (28 dams exist), and historical sediment toxics.

The goals of Androscoggin River Watershed Council’s participation in the VRMP are to provide information on current watershed conditions and develop baseline data for long term water quality monitoring efforts. In addition, ARWC may identify specific existing or emerging water quality problems in which to focus best management practices. In 2012, volunteers monitored one site on the Androscoggin mainstem and one site on Sunday River. It is anticipated that over time, additional monitoring sites on the river and tributaries will be added.

¹ Maine Rivers Website- Androscoggin River Profile

² Androscoggin River Alliance Website-Androscoggin River slideshow

Methods

The volunteers monitored the Androscoggin River in 2012 at one non-approved stations [ML-1] and the Sunday River at one approved station [SR-1]. (Table 5-1-1 and Figure 5-1-1).

Table 5-1-1: Androscoggin River Watershed Council Sampling Sites

VRMP Site ID	Organization Site Code	Sample Location	Class
Androscoggin River-A1087-ARWC	ML-1	Moran's Landing	B
Sunday River-ASY02-VRMP	SR-1	Route 2 Crossing	A

Monitoring was conducted biweekly from June through September. At each site, the monitors made direct measurements of water temperature and dissolved oxygen using a handheld YSI 550A or YSI ProODO Optical meter. Specific conductance was measured using an Oakton ECTestr 11+ pen. Water samples were collected for turbidity at one site and analyzed using a New Hampshire VRAP turbidity meter.

The approved site met VRMP requirements for sampling laterally and vertically in the river to obtain well-mixed representative samples. The non-approved site was sampled by wading, but because of the width of the river here- sampling in the VRMP required "center half of flow" is not possible (unless a boat is used).

2012 Androscoggin River Sampling Sites

Androscoggin River Watershed Council

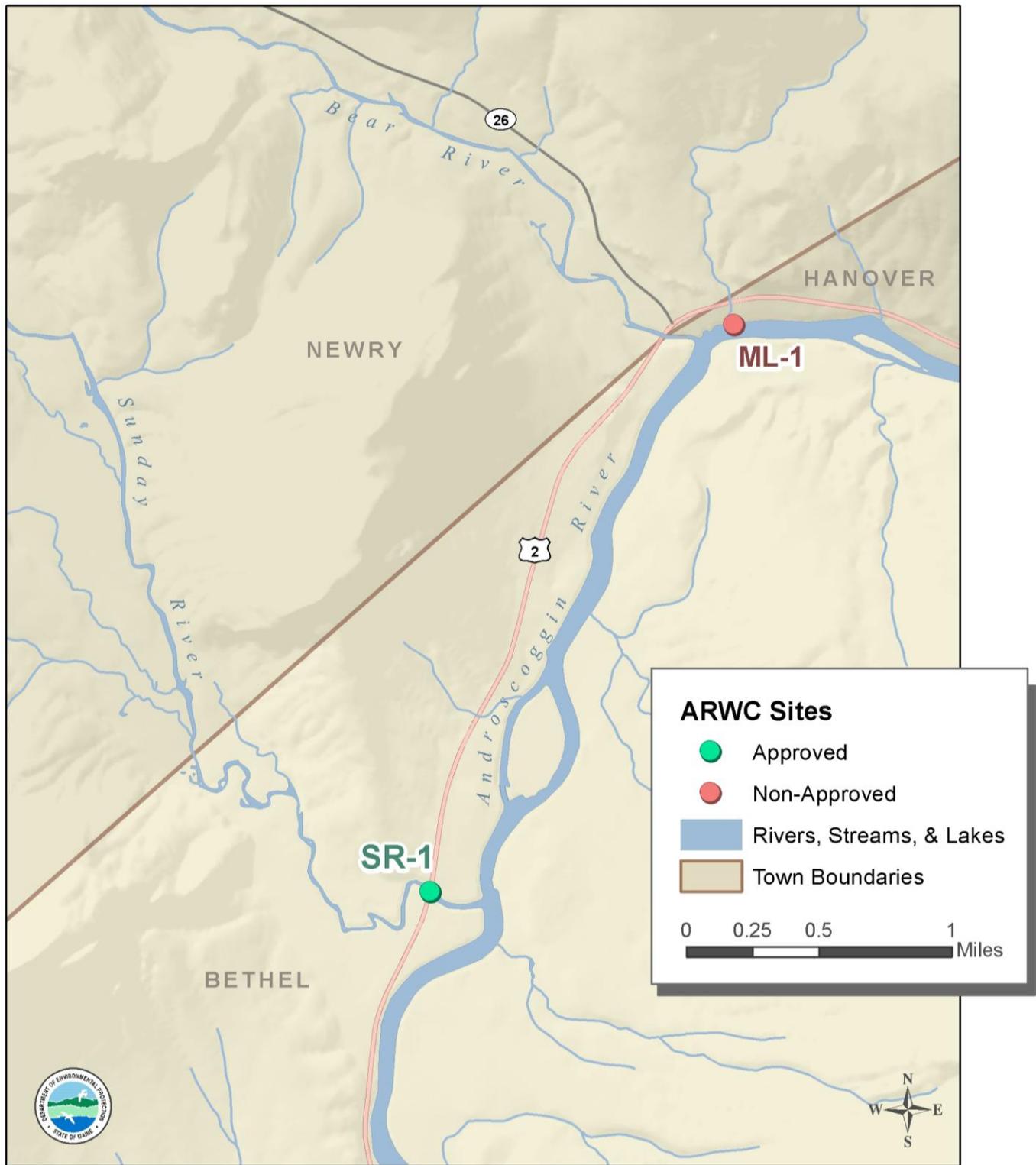


Figure 5-1-1: Map of all Androscoggin River Watershed Council sampling sites.

Results

Refer to Appendices A-1 and A-2 in discussion of individual site data and trends, as well as graphed data (Figures 5-1-5 through 5-1-4), at the end of this section of the report.

Precipitation

Figure 5-1-2 provides a graph of rainfall and sampling dates for the monitoring period. Rainfall data was obtained from Weather Underground (<http://www.wunderground.com>). Weather station choice was based on proximity and station with most complete records. If there was an airport station close by, this was chosen. This information provides an overview of rainfall events and can be useful in interpreting monitoring results for some parameters.

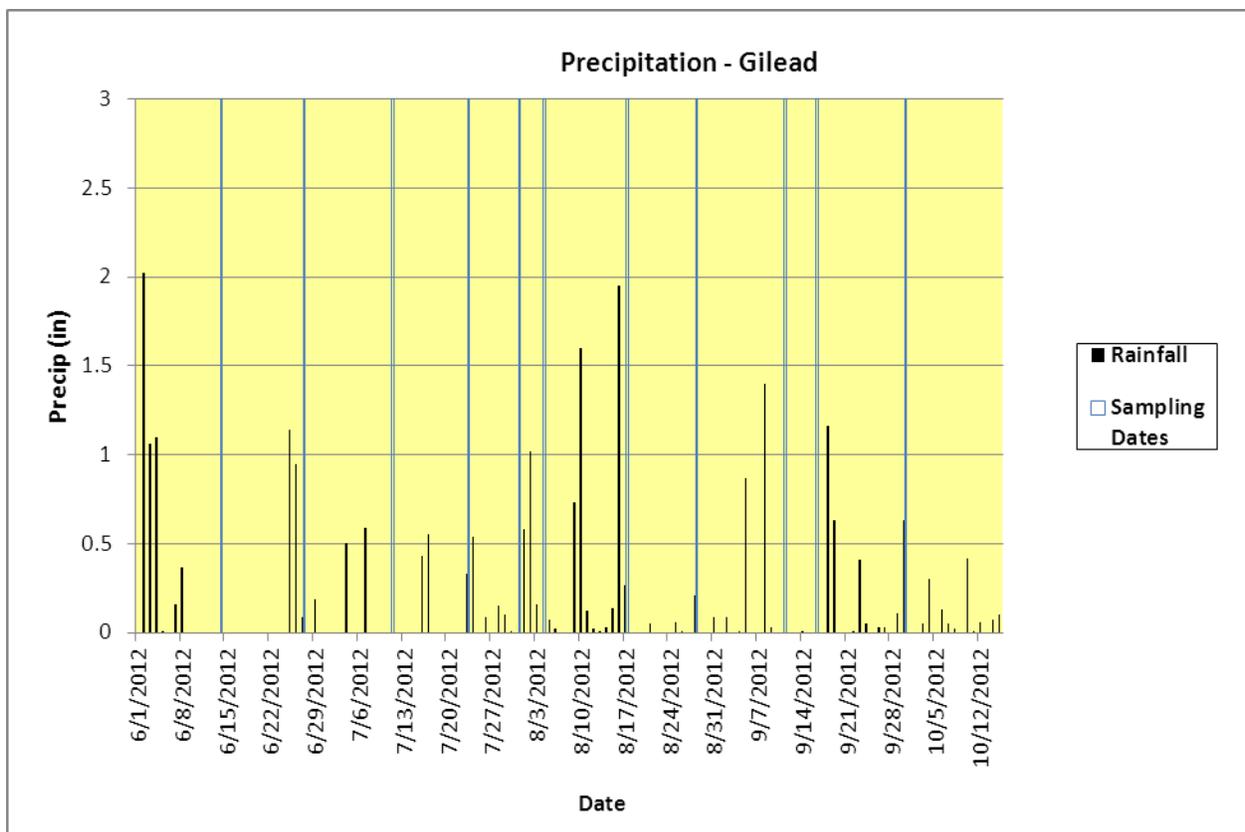


Figure 5-1-2: Seasonal Precipitation Measured at Gilead.

Dissolved Oxygen

Dissolved oxygen (DO) was measured 5-7 times at the two sampling sites (Table 5-1-2 and Table 5-1-3). Monitoring occurred from June through September. Class A and Class B criteria for DO are a minimum of 7.0 mg/l (milligrams/liter) or 75% saturation, whichever is higher. To meet water quality criteria, both concentration and saturation standards must be met.

Table 5-1-2: A summary of minimum, maximum, and average dissolved oxygen concentration values (mg/l) at Androscoggin River Watershed Council monitoring sites.

Site	Approved Site	# of Sampling Events	Minimum Value	Maximum Value	Average Value
ML-1	N	7	7.6	10.9	9.1
SR-1	Y	5	8.3	10.1	9.0

Table 5-1-3: A summary of minimum, maximum, and average dissolved oxygen saturation (%) values at Androscoggin River Watershed Council monitoring sites.

Site	Approved Site	# of Sampling Events	Minimum Value	Maximum Value	Average Value
ML-1	N	7	85.6	105.6	92.8
SR-1	Y	5	85.7	95.3	89.3

Dissolved oxygen concentrations measured at Site ML-1 ranged from 7.6 mg/l to 10.9 mg/l. The lowest readings occurred at the end of July (7.6 mg/l) and end of August (7.7 mg/l). Dissolved oxygen never dropped below the Class B standard of 7.0 mg/. Dissolved oxygen percent saturation ranged from 85.6% to 105.6% and did not go below the Class B standard of 75% saturation.

Dissolved oxygen concentrations measured at Site SR-1 ranged from 8.3 mg/l to 10.1 mg/l. The lowest reading occurred at the end of August (8.3 mg/l). Dissolved oxygen never dropped below the Class A standard of 7.0 mg/l. Dissolved oxygen percent saturation ranged from 85.7% to 95.3% and did not go below the Class A standard of 75% saturation.

Androscoggin River Watershed Council volunteers do a good job of getting out early in the morning to sample. All but one of the samples were taken by 8:15 am. This is the recommended time to sample because DO is lowest at this time of day. Dissolved oxygen is also affected by flow conditions and temperature. During high flow conditions, more oxygen enters the river from the atmosphere as the water is more turbulent and there is more opportunity for re-aeration. Cooler water holds more oxygen.

Water Temperature

Temperature was also measured 5-7 times at the two sampling sites (Table 5-1-4). Monitoring occurred from June through September. 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.

Table 5-1-4: A summary of minimum, maximum, and average water temperature (°C) values at Androscoggin River Watershed Council monitoring sites.

Site	Approved Site	# of Sampling Events	Minimum Value	Maximum Value	Average Value
ML-1	N	7	12.8	20.0	16.3
SR-1	Y	5	11.1	20.2	16.0

Temperature measured at Sites ML-1 and SR-1 ranged from 11.1° -20.2°C (Celsius). The lowest values occurred in September with temperatures for the two sites ranging from 11.1°-12.9°C. The readings at Site ML-1 fluctuated with highest readings occurring in late July (19.8°C) and late August (20.0 °C) and dropping in-between. At SR-1, the highest reading occurred in early August (20.2 °C) and then declined after that.

Specific Conductance

Specific conductance was measured 5-7 times at the two sampling sites as well (Table 5-1-5). Monitoring occurred from June through September. 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. Also, discharges from pulp and paper mills upstream can increase the conductivity of the river.

Table 5-1-5: A summary of minimum, maximum, and average specific conductance values (micro-ohms/cm, µS/cm) at Androscoggin River Watershed Council monitoring sites.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
ML-1	N	7	38	61	55
SR-1	Y	5	25	40	33

Specific conductance at all the sites ranged from 25-61 µS/cm. These are all low values.

Turbidity

Turbidity was measured 6 times at Site ML-1. Monitoring occurred from late June to September. The State of Maine does not have turbidity standards. Turbidity is a measure of the amount of suspended materials in the water; including soil particles, algae, plankton, and decaying vegetation. During

precipitation events that are great enough to cause runoff, land use activities (e.g. construction, agriculture, logging) may contribute to increased turbidity.

Table 5-1-6: A summary of minimum, maximum, and average turbidity values (NTU) for at Androscoggin River Watershed Council monitoring sites.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
ML-1	N	6	0.39	4.68	1.3

Turbidity values ranged 0.39 to 4.68 NTU. The highest value occurred during stormflow. All of the values are very low to low.

Discussion and Recommendations

There are numerous sources of pollution and other stresses to the Androscoggin River sites monitored by the Androscoggin River Watershed Council that could potentially have an impact on water quality. Some of those sources of pollution and stress may include:

- Point source pollution (pollution originating from a direct discharge including wastewater treatment plant discharge, combined sewer overflows and overboard discharges).
- Non-point source pollution (e.g., eroded soil, fertilizers, pesticides, heavy metals, petroleum residues, road salt, septic systems, wildlife and pet feces) and polluted stormwater originating from urban impervious surfaces (e.g., streets, parking lots, driveways, rooftops), 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 are characteristic of many wetlands).

The following are recommendations for future monitoring:

- Continue monitoring at existing monitoring sites to develop a long term trend database.
- Expand the number of monitoring sites.

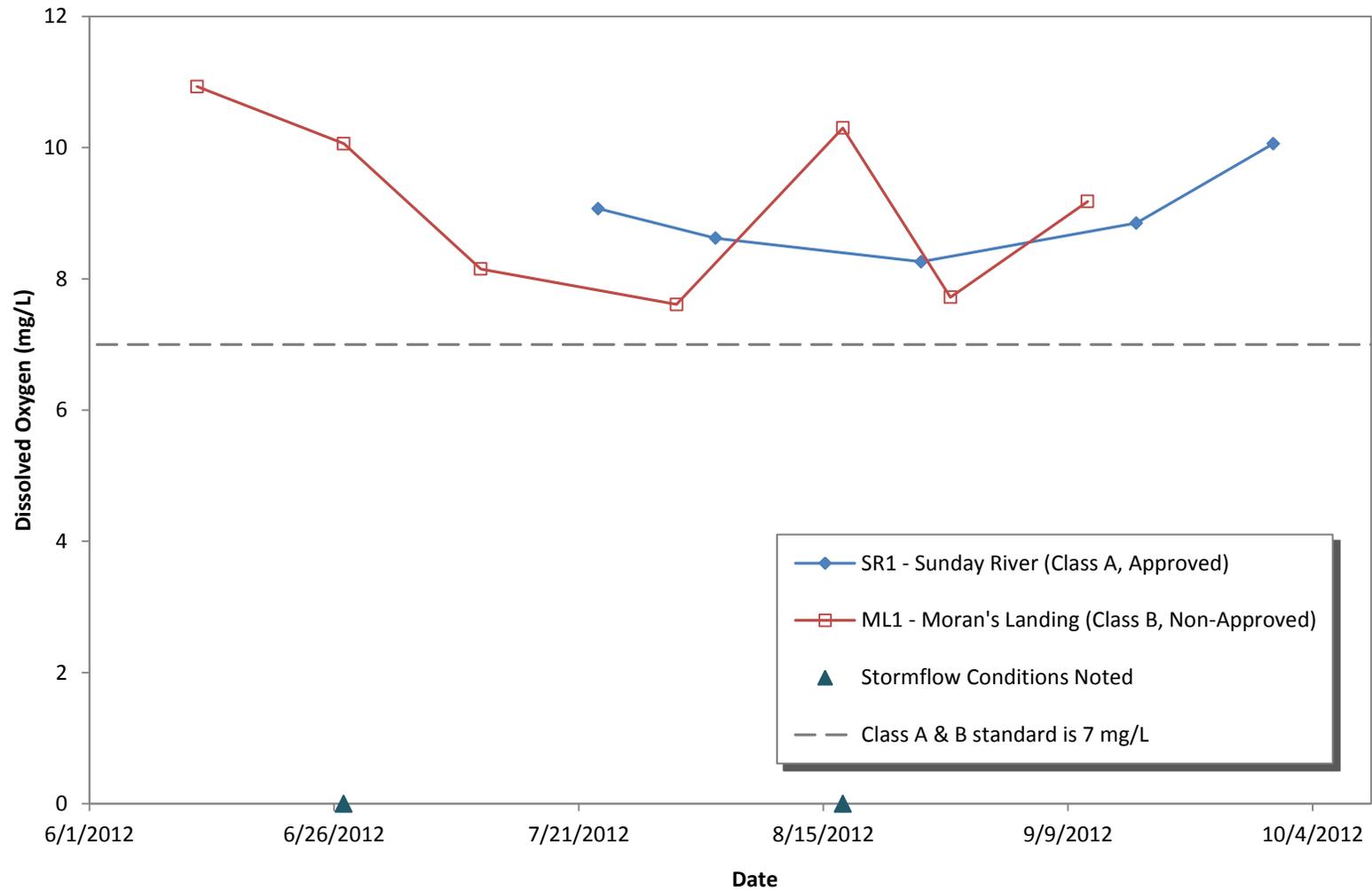


Figure 5-1-3. Dissolved oxygen concentrations at Androscoggin River Watershed Council monitoring sites on the Androscoggin River for 2012

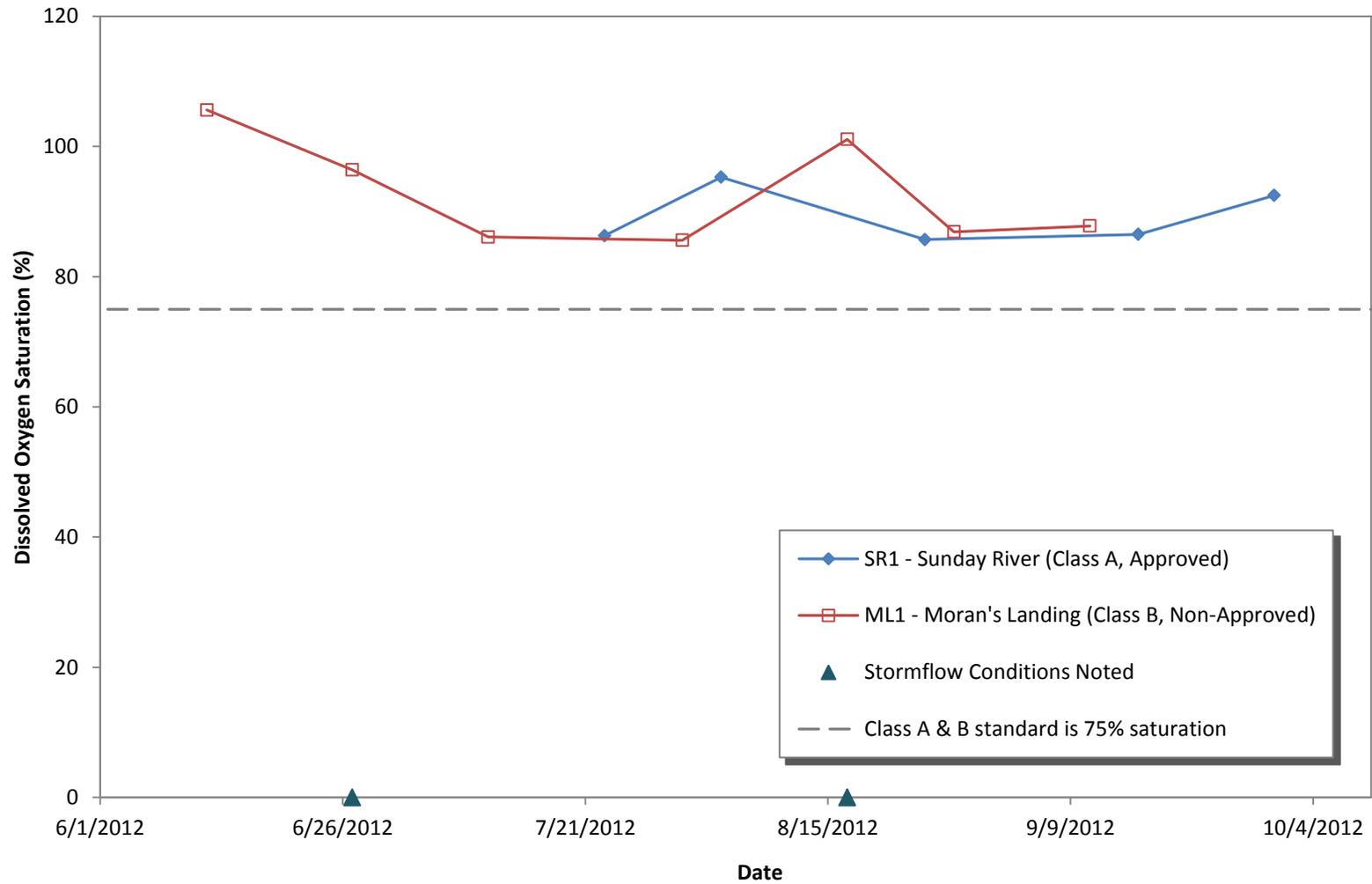


Figure 5-1-4. Dissolved oxygen % saturation at Androscoggin River Watershed Council monitoring sites on the Androscoggin River for 2012

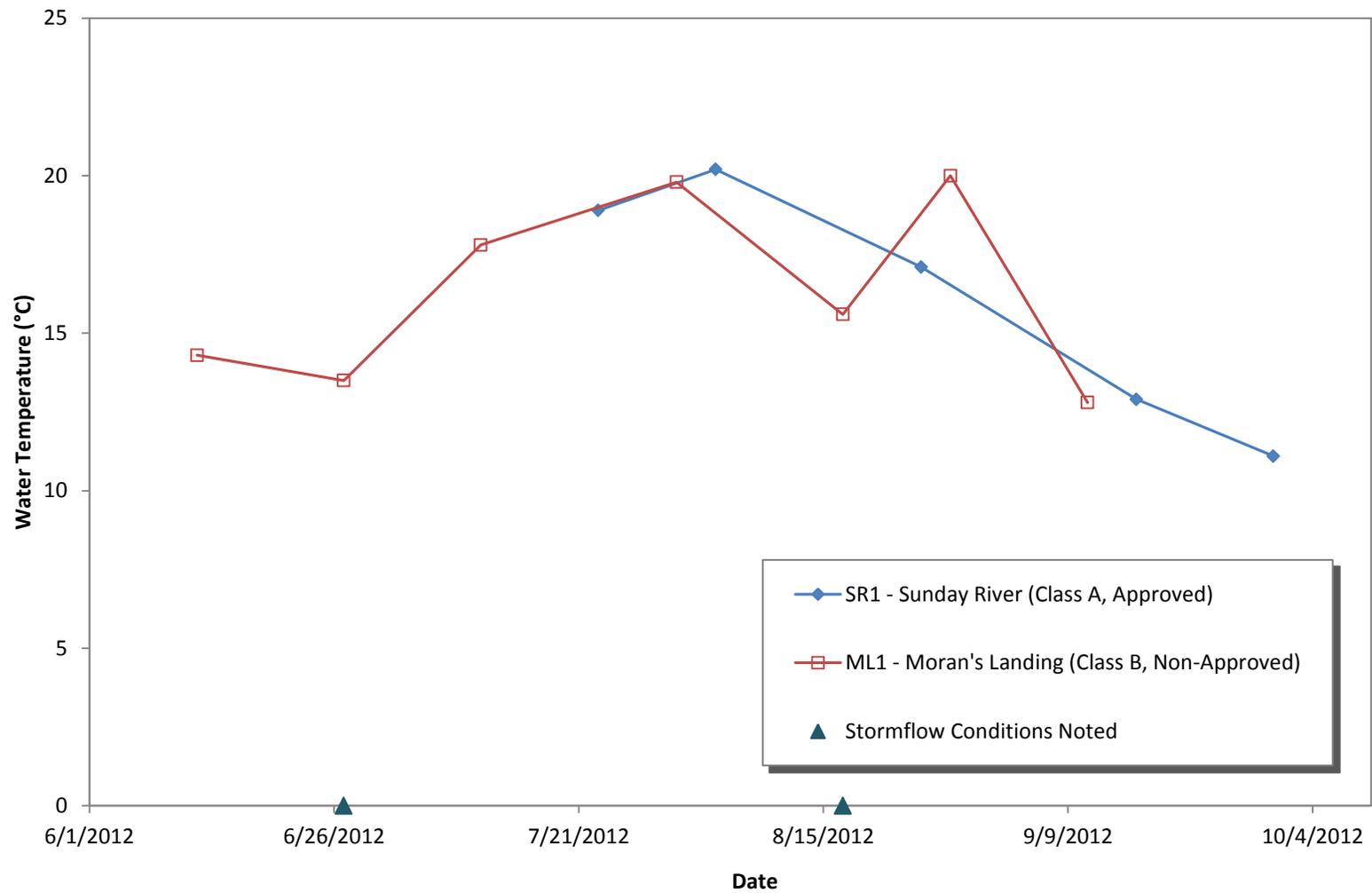


Figure 5-1-5. Water temperatures at Androscoggin River Watershed Council monitoring sites on the Androscoggin River for 2012

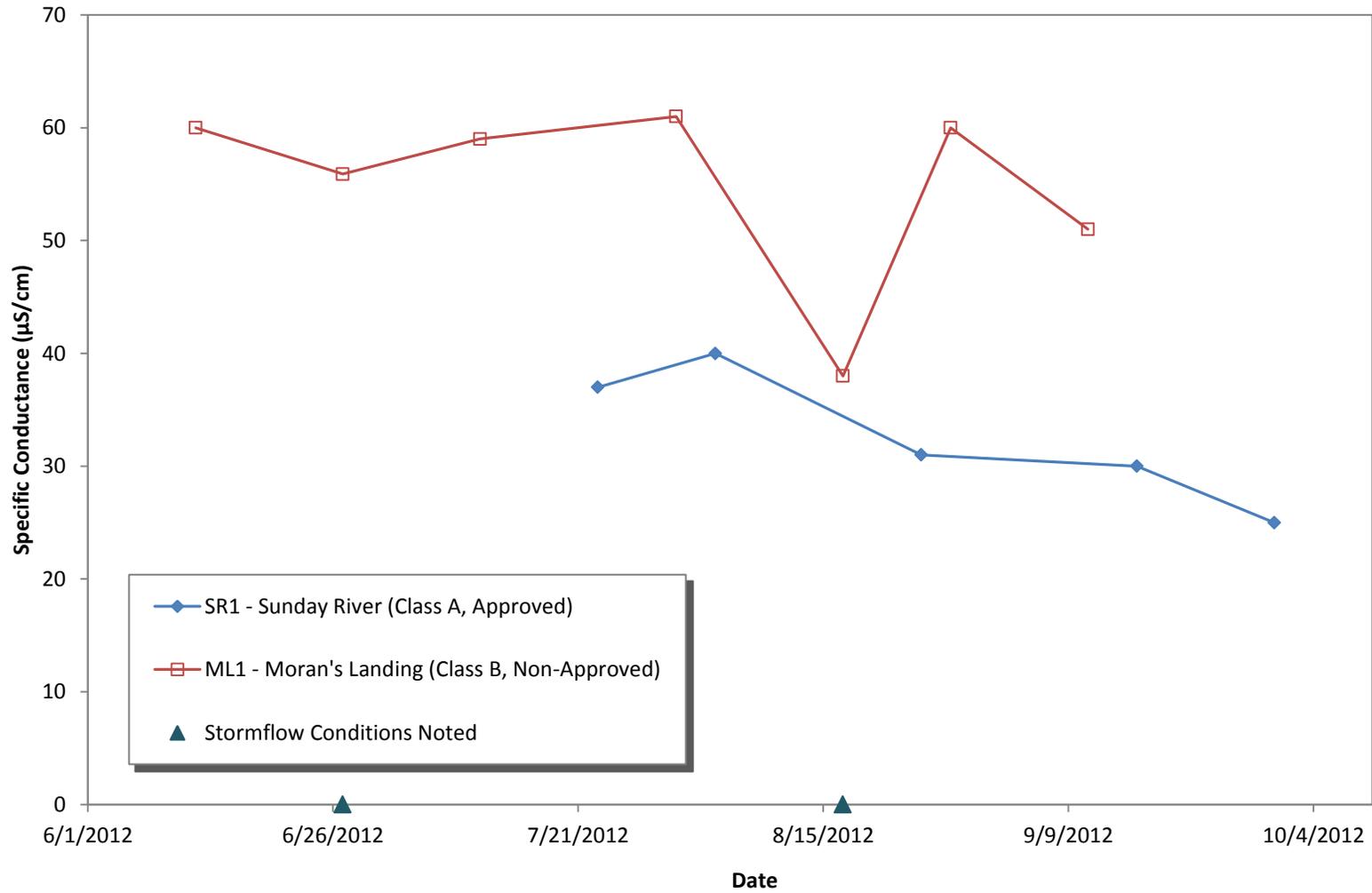


Figure 5-1-6. Specific conductance at Androscoggin River Watershed Council monitoring sites on the Androscoggin River for 2012

Appendix A-1. 2012 water quality data for "Approved" and "Non-Approved" sites. Non-Approved sites do not yet meet official VRMP sample location criteria and/or require further inspection and review.

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

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

Refer to Appendix A-2 for observational data and quality assurance/quality control (QA/QC) notes.

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)	Turbidity (NTU)	** TSS (MG/L)	E Coli Bacteria (MPN/100ML)	Enterococci (MPN/100ML)
------------------------	--------------	------	------	--------------------------	----------------	------------	--------------------	------------------	----------------	------------------------	-----------------	-----------------	---------------	-----------------------------	-------------------------

Androscoggin River, Androscoggin River Watershed Council - Approved Sites:

SR-1	SUNDAY RIVER - ASY02 - VRMP	7/23/2012	7:45 AM	N			18.9	86.3	9.07	37					
SR-1	SUNDAY RIVER - ASY02 - VRMP	8/4/2012	7:00 AM	N			20.2	95.3	8.62	40					
SR-1	SUNDAY RIVER - ASY02 - VRMP	8/25/2012	7:30 AM	N			17.1	85.7	8.26	31					
SR-1	SUNDAY RIVER - ASY02 - VRMP	9/16/2012	7:50 AM	N			12.9	86.5	8.85	30					
SR-1	SUNDAY RIVER - ASY02 - VRMP	9/30/2012	9:00 AM	N			11.1	92.5	10.06	25					

Androscoggin River, Androscoggin River Watershed Council - Non-Approved Sites:

ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	6/12/2012	8:10 AM	N			14.3	105.6	10.93	60					
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	6/27/2012	8:00 AM	N			13.5	96.4	10.06	55.9		0.79			
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	7/11/2012	7:50 AM	N			17.8	86.1	8.15	59		0.59			
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	7/31/2012	7:40 AM	N			19.8	85.6	7.61	61		0.47			
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	8/17/2012	7:20 AM	N			15.6	101.1	10.3	38		4.68			
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	8/28/2012	7:36 AM	N			20	86.9	7.72	60		0.72			
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	9/11/2012	7:35 AM	N			12.8	87.8	9.18	51		0.39			
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	6/27/2012	8:00 AM	D			13.6	95.8	10.02	55.8		1.94			

Appendix A-2. 2012 observational data and quality assurance/quality control (QA/QC) notes for "approved" and "non-approved" sites.
 ** "N" = normal environmental sample; "D" = field duplicate; "L" = lab duplicate; "D.O." = dissolved oxygen; "Spec. Cond" = specific conductance; "Turb"= turbidity
 Refer to Appendix A-1 for water quality data

Organization Site Code	VRMP Site ID	Date	Time	** Sample Type Qualifier	Flow	Stage	Air Temp (°C)	Sample Location	Current Weather	Air Condition	Past 24HR Weather	Habitat	Tide Stage	Water Appearance	Comments
------------------------	--------------	------	------	--------------------------	------	-------	---------------	-----------------	-----------------	---------------	-------------------	---------	------------	------------------	----------

Androscoggin River, Androscoggin River Watershed Council - Approved Sites:

SR-1	SUNDAY RIVER - ASY02 - VRMP	7/23/2012	7:45 AM	N	BASE FLOW	LOW	15.56	WADING	CLOUDY	CALM	CLEAR, CLOUDY, PARTLY CLOUDY	RIFFLE		CLEAR	WADEABLE/1.5 FT BELOW SURFACE
SR-1	SUNDAY RIVER - ASY02 - VRMP	8/4/2012	7:00 AM	N	BASE FLOW	LOW		WADING	CLEAR, FOGGY	CALM	CLEAR, CLOUDY	RIFFLE		CLEAR	WADEABLE/1.5 FT BELOW SURFACE
SR-1	SUNDAY RIVER - ASY02 - VRMP	8/25/2012	7:30 AM	N	BASE FLOW	LOW	17.4	WADING	PARTLY CLOUDY	CALM	CLEAR, PARTLY CLOUDY	RIFFLE		CLEAR	WADEABLE/1.5 FT BELOW SURFACE
SR-1	SUNDAY RIVER - ASY02 - VRMP	9/16/2012	7:50 AM	N	BASE FLOW	LOW	4.444	WADING	CLEAR	BREEZE	CLEAR, PARTLY CLOUDY	RIFFLE		CLEAR	WADEABLE/1.5 FT BELOW SURFACE
SR-1	SUNDAY RIVER - ASY02 - VRMP	9/30/2012	9:00 AM	N	BASE FLOW	MED	13.7	WADING	LIGHT RAIN, MOSTLY CLOUDY	CALM	LIGHT RAIN, MOSTLY CLOUDY	RIFFLE		CLEAR	WADEABLE/1.5 FT BELOW SURFACE

Androscoggin River, Androscoggin River Watershed Council - Non-Approved Sites:

ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	6/12/2012	8:10 AM	N	BASE FLOW	MED	15.56	WADING	PARTLY CLOUDY	CALM	PARTLY CLOUDY	RUN		CLEAR	SET D.O. METER TO 600' ELEVATION. WADEABLE/MID-DEPTH SAMPLE NOT IN CENTER OF FLOW-LARGE RIVER. DID ZERO D.O. CHECK WITH NH SOLUTION=0.13 MG/L.
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	6/27/2012	8:00 AM	N	STORM FLOW	HIGH	16.11	WADING	CLOUDY, LIGHT RAIN	STRONG WIND	HEAVY RAIN, LIGHT RAIN	RUN		CLEAR	D.O. METER CALIBRATED TO 700' ELEVATION. WADEABLE/MID-DEPTH SAMPLE NOT IN CENTER OF FLOW-LARGE RIVER. DID ZERO D.O. CHECK=0.06 MG/L.
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	7/11/2012	7:50 AM	N	BASE FLOW	MED	12.78	WADING	CLEAR	CALM	CLEAR	RUN		CLEAR	D.O. METER CALIBRATED TO 700' ELEVATION. WADEABLE/MID-DEPTH SAMPLE NOT IN CENTER OF FLOW-LARGE RIVER.
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	7/31/2012	7:40 AM	N	BASE FLOW	LOW	17.22	WADING	FOGGY	CALM	CLEAR, PARTLY CLOUDY	RUN		CLEAR	WADEABLE/MID-DEPTH SAMPLE NOT IN CENTER OF FLOW-LARGE RIVER.
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	8/17/2012	7:20 AM	N	STORM FLOW	HIGH	14.44	WADING	FOGGY	CALM	CLEAR, PARTLY CLOUDY	RUN		TURBID	SAMPLING FOLLOWED 2 DAYS OF HEAVY RAIN WADEABLE/MID-DEPTH SAMPLE NOT IN CENTER OF FLOW-LARGE RIVER.
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	8/28/2012	7:36 AM	N	BASE FLOW	MED	19.44	WADING	MOSTLY CLOUDY	CALM	CLEAR, MOSTLY CLOUDY	RUN		CLEAR	WADEABLE/MID-DEPTH SAMPLE NOT IN CENTER OF FLOW-LARGE RIVER.
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	9/11/2012	7:35 AM	N	BASE FLOW	MED	11.67	WADING	CLEAR	BREEZE	CLEAR, PARTLY CLOUDY	RUN		CLEAR	WADEABLE/MID-DEPTH SAMPLE NOT IN CENTER OF FLOW-LARGE RIVER.
ML-1	ANDROSCOGGIN RIVER - A1087 - ARWC	6/27/2012	8:00 AM	D				WADING							D.O. METER CALIBRATED TO 700' ELEVATION. WADEABLE/MID-DEPTH SAMPLE NOT IN CENTER OF FLOW-LARGE RIVER. DID ZERO D.O. CHECK=0.06 MG/L.