

## Indicators and Grades

Indicators were chosen from a long list of parameters routinely analyzed as part of surface water monitoring programs. The following four indicators provided the best overall information with regards to stream health within the NVCA watershed:

- Benthic invertebrate indices
- Total phosphorus<sup>a</sup>
- Total suspended solids<sup>a</sup>
- Fecal bacteria (*E. coli*)<sup>b</sup>

a as measured during baseflow conditions – during storm events, all stations exhibit high levels of these indicators; however, during baseflow, healthy streams quickly return to low levels while high levels persist in unhealthy streams (high correlation with benthic indices)

b fecal bacteria is deemed to be an important indicator for recreational use; however, it is not directly related to ecological health of stream systems. Stream health grading analysis is based on benthic invertebrates, total phosphorus and total suspended solids data only.

A description and definition of each indicator is provided in Table 6 and in each Report Card.

**Table : Description of Surface Water Quality Indicators**

<b>Indicator</b>	<b>Benthic Invertebrate Indices</b>	<b>Total Phosphorus (baseflow,mg/L)</b>	<b>Total Suspended Solids (baseflow;mg/L)</b>	<b>E. coli<sup>a</sup> (CFUs/100ml)</b>
What it measures	The benthic invertebrates (stream bugs) that live on the bottom of the stream.	The amount of phosphorus in the water.	The amount of suspended solids in the water.	The amount of <i>E. coli</i> bacteria in the water.
How it is calculated	By comparing test sites to similar, pristine sites. Sites systematically located within each subwatershed.	Mean baseflow concentrations at downstream terminus of subwatershed from PWQMN	Mean baseflow concentrations at downstream terminus of subwatershed from PWQMN.	Geometric means of 5 samples taken within a 30 day period. Various locations.
Why it is Important	Benthic organisms are excellent water quality indicators. They are relatively immobile and are exposed to the full range of water quality conditions present at a site.	Phosphorus binds to soil particles and is an indicator of soil delivery to streams. It is also found in fertilizers and contributes to algae blooms in streams and lakes. Provincial objective is <0.03 mg/L/ for streams.	Total suspended solids is directly correlated to water clarity. Chronic high concentrations of TSS can affect respiration of aquatic life and impair foraging abilities of sight-feeding organisms.	<i>E. coli</i> bacteria are found in human and animal waste and its present indicates fecal contamination. Provincial guidelines suggest that concentrations should be <100 CFU/100ml for recreational contact (swimming).

Table 7 shows the grading systems used for each surface water quality indicator. For each indicator, the values were separated into five more-or-less equal increments (based on “equal steps” or “statistical spread”) with corresponding grades.

**Table : Surface Water Quality Scoring**

<b>Benthic Indices<sup>a</sup></b>	<b>Total Phosphorus<sup>b</sup> (mg/L)</b>	<b>Total Suspended Solids<sup>c</sup> (mg/L)</b>	<b><i>E. coli</i><sup>d</sup> (CFU/100ml)</b>	<b>Points</b>	<b>Grade</b>	<b>Final PointsGrade</b>	
2.6-3.0	<0.01	<5	≤10	5	A	≥14	A
2.2-2.59	0.01-0.019	5-14	10-100	4	B	11-13	B
1.8-2.19	0.02-0.025	15-19	101-1,000	3	C	8-10	C
1.4-1.79	0.026-0.029	20-24	1,001-10,000	2	D	5-7	D
<1.4	≥0.03	≥25	>10,000	1	F	3-4	F

- a calculated from benthic health mapping where impaired reaches = 1; unimpaired reaches = 3; and below-potential reaches = 2. Score reflects average of all mapped reaches within subwatershed.
- b as measured during baseflow conditions. Provincial Water Quality Objective (MOE, 1994) guidelines suggest that stream concentrations should be <0.03 mg/L.
- c as measured during baseflow conditions. Environment Canada guidelines suggest that TSS should be <25 mg/L to maintain healthy stream conditions
- d based on geometric mean of 5 samples taken over a 30 day period. Not used for stream health scoring.

Final grades were calculated by adding the point scores of the three key stream health indicators (*E. coli* is not included in the final grading). As per the UTRCA report card, each indicator was weighted the same for analysis and grading. Results are provided in Table 8 and Figure 7.

Although several subwatersheds exhibit good to excellent overall health (Grades “A” and “B”), biomonitoring indicates that all subwatersheds have stream sections that are in fair to poor health. Factors resulting in fair to poor health include:

- Online ponds/dams
- Stream alteration (municipal drains)
- Urban impacts
- Water taking
- Sparse riparian vegetation
- Unrestricted livestock access
- Tile drain discharge
- Shoreline/streambank hardening

**Table : Subwatershed Surface Water Quality – Indicator Data, Points and Grades**

Subwatershed	Benthic Indices		Total Phosphorus		Total Suspended Solids		<i>E. coli</i> *		Final	
	Score	Pts	Mg/L	Pts	mg/L	Pts	CFU/100ml	Grade	Pts	Grade
<b>Lower Nottawasaga</b>	1.85	3	0.036	1	13.89	3	300	C	7	<b>D</b>
<b>Middle Nottawasaga</b>	2.08	3	0.022	3	8.29	4	361	C	10	<b>C</b>
<b>Upper Nottawasaga</b>	2.4	4	0.007	5	1.98	5	281	C	14	<b>A</b>
<b>Willow</b>	2.52	4	0.019	4	7.97	4	365	C	12	<b>B</b>
<b>Mad</b>	2.39	4	0.013	4	8.33	4	239	C	12	<b>B</b>
<b>Pine</b>	2.52	4	.022	3	10.4	4	281	C	11	<b>B</b>
<b>Boyne</b>	1.89	3	.022	3	3.61	5	219	C	11	<b>B</b>
<b>Innisfil</b>	1.66	2	.045	1	54.48	1	405	C	4	<b>F</b>
<b>Blue Mountain<sup>a</sup></b>	2.49	4	.009	5	3.91	5	384	C	14	<b>B</b>
<b>Severn Sound Watershed</b>	2.47	4	.007	5	N/A		N/A			<b>B</b>
<b>Outlet<sup>b</sup></b>	<b>1.85</b>	<b>3/C</b>	<b>.036</b>	<b>1/F</b>	<b>13.89</b>	<b>3/C</b>	<b>300</b>	<b>C</b>	<b>7</b>	<b>D</b>

- \* Based on 1990s stream data. Does not reflect beach health. Major beaches (Wasaga Beach, Earl Rowe, Tottenham, New Lowell) are regularly monitored by Park/Health Unit staff and posted if necessary.
- a Although the Blue Mountain watershed is a marginal “A”, water quality sampling reflects Silver Creek and Pretty River only (the two healthiest systems) and does not reflect water quality of Black Ash Creek and Batteaux Creek. Staff recommend that overall health be considered “B” until additional water quality data is collected from these systems.
- b Lower Nottawasaga values were used instead of a watershed average since water quality in the lower river integrates the cumulative effects of land use activities throughout the watershed.