# SUMMARY REPORT

# Water Quality and Stream Invertebrate Assessments for the C.W. Young Channel, Englishman River, BC, 2008-2015

Report prepared by:

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Based on annual projects conducted by:

Students of Vancouver Island University RMOT 306 (Environmental Monitoring)

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# 1. Background

Vancouver Island University (VIU) has conducted yearly water quality and stream invertebrate assessments on the C.W. Young Channel, Englishman River, BC, since 2008. These projects have been undertaken by 3rd year undergraduate students attending the Environmental Monitoring (RMOT 306) course at Vancouver Island University (VIU), offered as part of the Bachelor of Natural Resources Protection. Students worked under the supervision of the course instructors, Dr. Eric Demers and Dr. John Morgan (Vancouver Island University).

This report summarizes water quality and stream invertebrate results for the C.W. Young Channel for the 8-year period between 2008 and 2015. This report was compiled by Dr. Eric Demers based on yearly student group reports. Some of the data presented here have been summarized in previous annual reports (see VIU 2009, 2010, 2011, 2012).

Logistical support was provided by the Regional District of Nanaimo (RDN) and Fisheries and Oceans Canada (DFO). Funding for field expenses and analytical processing of water samples was provided by the Regional District of Nanaimo and Fisheries and Oceans Canada. ALS Laboratory (Burnaby, BC) provided reduced rates on their analytical services for these projects.

VIU students contributed approximately 1,000 student-hours to these projects, including site visits, project proposal, field sampling, laboratory analyses, and oral and written presentations. Dr. Eric Demers and Dr. John Morgan contributed approximately 100 hours for project management and report compilation.

# 2. Introduction

The C.W. Young Channel is located on the northern bank of the Englishman River on Vancouver Island, BC, within Englishmen River Regional Park. It is approximately 7 km upstream from the Englishman River Estuary in Parksville Bay and begins just below the Morison Creek confluence (Hawkes et al. 2008). The channel is approximately 4,100 metres long and provides off-channel and pond habitat for spawning and rearing Pacific salmon and trout. The entire channel is dependent on surface flow from the Englishmen River.

This report summarizes water quality and stream invertebrate results for the C.W. Young Channel for the 8-year period between 2008 and 2015. Yearly assessments were conducted each fall, during similar time periods between late October and mid-November. Specific objectives for these yearly studies of the C.W. Young Channel included:

- obtain field measurements of water quality at 5 sampling stations during two sampling events (late October; mid-November);
- obtain water samples from each sampling station during two sampling events (late October; mid-November) for detailed laboratory analyses; and,
- collect stream invertebrate samples at 3 sampling stations during one sampling event (late October) for analysis at Vancouver Island University.

# 3. Methods

## 3.1. Study Site

Yearly assessments were conducted at the C.W. Young Channel located along the Englishman River (Figure 1). The original C.W. Young Channel was constructed in 1992 by Fisheries and Oceans Canada (DFO). In 2007, the C.W. Young Channel was lengthened by another 2 km, with the outlet of the channel a few hundred metres upstream of the Top Bridge Crossing. This brought the total length of constructed side channel habitat in the Englishman River to 4,100 m (Hawkes et al. 2008). The channel was built to provide resident and anadromous salmonids with new spawning and juvenile rearing habitat.

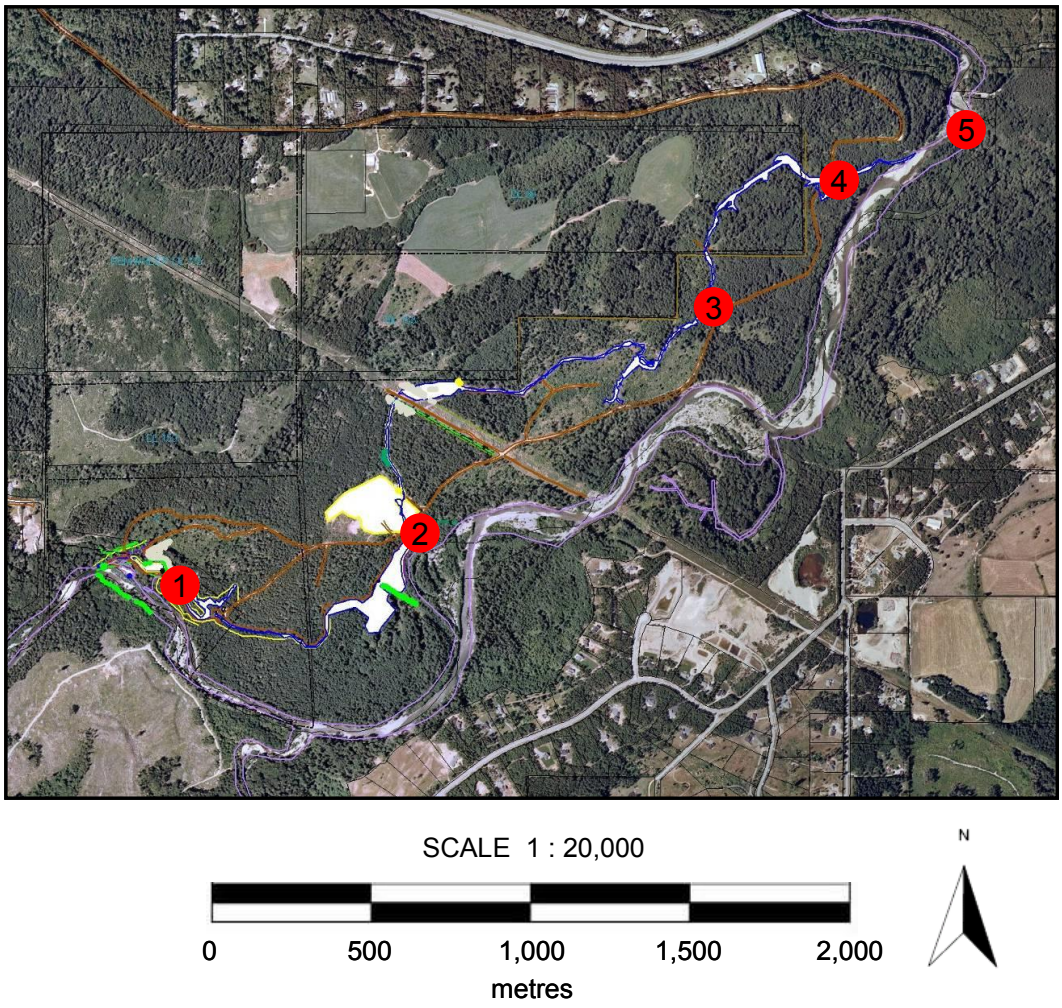


**Figure 1**. Approximate location of the sampling stations used for water quality and stream invertebrate assessments on the C.W. Young Channel and Englishman River, during 2008-2015. The C.W. Young Channel and Englishman River are outlined in blue and purple, respectively. Access roads are outlined in brown. Table 1 provides details of the specific location of each station. Table 2 details the sampling activities conducted at each station. This map was obtained from Hawkes et al. (2008). Map scale is approximated.

### *3.1.1. Sampling Stations*

Five stations were established on the C.W. Young Channel and Englishman River, and these stations were used consistently from 2008 to 2015 (Tables 1 and 2; Figure 1). The location of each station was chosen to provide adequate coverage for the length of the C.W. Young Channel. Stations were numbered from the upstream end to the downstream end of the channel. All stations were easily accessed via footpaths or access road crossings. Station 1 was located 1 m downstream of the steel valve at the upstream entrance into the channel and served as a reference station for initial conditions at channel entry. Stations 2-4 were located at intervals along the channel. Station 5 was located on the main stem of the Englishman River, near the channel outlet. This station served as a reference to compare spatial changes that occur within the channel and in the main river channel.

**Table 1**. Description of the sampling stations used for water quality and stream invertebrate assessments on the C.W. Young Channel and Englishman River, during 2008-2015. All northing and easting coordinates were obtained from Google Earth®, and are based on zone 10U.

| Station | UTM Coordinates | | Distance from Upstream End (m) | General Location |
|---|---|---|---|---|
| | Northing | Easting | | |
| 1 | 5459844 | 405274 | 0 | Upstream channel entrance, 1 m downstream of steel pipe valve |
| 2 | 5459955 | 406147 | 1,250 | Road crossing, start of 2007 channel extension |
| 3 | 5460670 | 407089 | 2,900 | Channel section near access road |
| 4 | 5461051 | 407492 | 3,800 | 1 m downstream of steel sill structure |
| 5 | 5461163 | 407812 | N/A | Main stem Englishman River, near channel outlet |

### *3.1.2. Sampling Schedule*

Field sampling was conducted twice each fall during 2008 to 2015. The first sampling event was conducted during late October or early November (date range: 27 October to 4 November; median date: 30 October). The second sampling event was conducted during mid-November (date range: 17-25 November; median date: 20 November). The first sampling event was usually representative of lower flow conditions, although this varied in some years due to weather conditions. For simplicity, in this report, the first and second sampling events are referred to as the "late October" and "mid-November" sampling events, respectively.

Each year, samples were collected for water quality analyses, microbiology and stream invertebrate assessment. Table 2 lists the specific activities conducted at each station during each sampling event. Microbiology and stream invertebrate assessments were only completed during the late October sampling event.

**Table 2**. Water quality and stream invertebrate sampling activities conducted at each station on the C.W. Young Channel and Englishman River, during 2008-2015. The symbols "A" or "B" indicate whether samples / measurements were taken during the late October or mid-November sampling events, respectively. ALS Lab analyses, microbiology and stream invertebrates were not conducted at the same stations each year (see parentheses).

| Station | Water Quality | | | | Stream Invertebrates |
|---|---|---|---|---|---|
| | Field Measurements | VIU Analyses | ALS Lab Analyses | Microbiology | |
| 1 | A, B | A, B | A, B (All years) | A (All except 2012) | A (All except 2012) |
| 2 | A, B | A, B | A, B (All except 2012) | A (All except 2012) | --- |
| 3 | A, B | A, B | A, B (2008-2012) | A | A (All years) |
| 4 | A, B | A, B | A, B (All except 2012) | A | A (All years) |
| 5 | A, B | A, B | A, B (2012 only) | A | A (Only 2012) |

## 3.2. Water Quality

### *3.2.1. Field Measurements*

Water quality sampling was conducted during both sampling events each year (late October and mid-November). At each sampling station, field measurements of water temperature (to the nearest 0.1$^{o}$C) and dissolved oxygen (to the nearest 0.1 mg/L) were obtained with an YSI 556 MPS or Oxyguard Handy Polaris electronic probe. The electronic probe was placed directly in the channel water.

### *3.2.2. Water Sampling*

During each sampling event, two sets of water samples were collected for laboratory analyses: one set was transported for analysis at Vancouver Island University (VIU), and another set was shipped for analysis by ALS Laboratory, in Burnaby, BC.

Water samples for analysis at VIU were collected from all stations (Table 2). At each station, a clean pre-labelled 500-ml plastic bottle was rinsed 3 times and then used to collect a water sample (Table 3). Samples were obtained while standing on the stream bank or within the stream channel by immersing the containers just below the water surface while facing upstream. Care was taken not to disturb the bottom sediments. All water samples were kept in a cooler and stored at approximately 4ºC. Laboratory analyses were conducted at VIU within 72 hours of sampling.

Samples for analysis by ALS Laboratory were collected from 3-4 stations during both sampling events, and the actual stations used varied between years (Table 2). At each station, water samples were collected in three clean laboratory-supplied and pre-labelled sample containers (Table 3). All samples were obtained while standing on the stream bank or within the stream channel by directly immersing the containers just below the water surface while facing upstream. Care was taken not to disturb the bottom sediments. Samples for analysis of nutrients and total metals were preserved with laboratory-supplied sulphuric acid and nitric acid, respectively. Bottles with preservatives were inversed five times for adequate mixing. All water samples were stored in a cooler on site, and shipped with ice packs within 72 hours for laboratory analyses at ALS Laboratory.

**Table 3**. Sampling containers and preservatives used for water quality samples taken at the C.W. Young Channel and Englishman River, during 2008-2015. All containers and preservatives for analysis by ALS Laboratory were provided by ALS Laboratory, Burnaby, BC.

| Analytical Parameters | Container | Preservative | Analysed by |
|---|---|---|---|
| Total alkalinity, turbidity | 500 ml plastic | None | VIU |
| Conductivity, pH, total hardness | 1 L plastic | None | ALS Laboratory |
| Nutrients | 250 ml amber glass | Sulphuric acid | ALS Laboratory |
| Total metals | 250 ml plastic | Nitric acid | ALS Laboratory |

### *3.2.3. VIU Laboratory Analyses*

Water samples transported to Vancouver Island University were analysed for total alkalinity and turbidity. Total alkalinity (as $CaCO_3$) was measured to the nearest 0.1 mg/L using the HACH AL-DT digital titration method. Turbidity was measured to the nearest 0.01 NTU (Nephelometric Turbidity Units) using a HACH 2100 Potable Turbidimeter.

### *3.2.4. ALS Laboratory Analyses*

Water samples submitted for external analyses were processed as per ALS Laboratory standard analytical procedures. The analytes were: conductivity, pH, total hardness, nutrients (ammonia, nitrite, nitrate, orthophosphate and total phosphorus), and total metals (31 metals). Total phosphorus was not measured in 2008.

### *3.2.5. Quality Assurance / Quality Control*

Throughout this study, measures were taken to ensure that potential contamination of water samples was minimized. This included using only clean and rinsed containers, preserving samples as prescribed by the analytical laboratory, and storing samples in well-labelled containers.

### *3.2.6. Data Analyses – Comparison with Applicable Guidelines*

Water quality results were compared with the applicable provincial water quality guidelines for the protection of aquatic life. The BC Water Quality Guidelines are the maximum allowable concentration (for potential acute effects). All guidelines were obtained from the BC Ministry of Environment, Water Protection Division (http://www.env.gov.bc.ca/wat/wq/).

It is important to note that for some metal parameters, analytical detection limits were above applicable guidelines. These included aluminum, antimony, arsenic, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium and vanadium. For these metals, measured values reported to be below method detection limits cannot be assumed to be below the applicable guidelines.

## 3.3. Microbiology

### *3.3.1. Field Sampling*

Water samples for total and fecal coliform enumeration were collected from all sampling stations during the first sampling event in late October (Table 2), except in 2012 when samples were collected from stations 3-5. At each station, a sterile pre-labelled 120-ml Whirl-Pak® bag was used to collect a 100-ml water sample by directly immersing the bag by hand just below the water surface while facing upstream. All samples were stored in a cooler with ice packs and transported within 72 hours to Vancouver Island University for laboratory analysis.

### *3.3.2. Laboratory Analyses*

In the laboratory, water samples were tested for total coliform and fecal coliform (*Escherichia coli* or *E. coli*) using the m-coliBlue24 membrane filtration method (Millipore Corporation). A 25-ml volume of sample water was filtered through a 47-µm membrane filter (marked with 3-mm gridlines) using a vacuum pump. The filtration apparatus was then rinsed with approximately 5 ml of sterile water. Each membrane filter was then transferred to a Petri plate containing an absorbent pad saturated with m-ColiBlue24 broth. All membrane filters were incubated at 37°C for 20 hours (until bacterial colonies were clearly visible).

Upon completion of the incubation period, membrane filters were then examined for bacterial colonies under a dissection microscope. A red or blue colony represents a total coliform "positive" result. A blue colony specifically represents fecal coliform, while a red colony represents non-fecal coliform. All colonies present on a membrane filter were counted and expressed as CFU (colony forming units) per 100-ml of sample water.

## 3.4. Stream Invertebrates

### *3.4.1. Sampling Stations*

Stream invertebrate samples were collected from stations 1, 3 and 4 during the first sampling event in late October (Table 1; Figure 1), except in 2012 when samples were collected from stations 3-5. The sampling stations were selected based on hydrological characteristics, apparent substrate uniformity, space available for replicate samples, safety, and site access. At the time of sampling, each station consisted of shallow riffles (water depth ~10-25 cm), with water velocity of 0.5-1.0 m/s, and primarily sand and gravel substrate.

### *3.4.2. Invertebrate Sampling*

At each station, three replicate samples (triplicates) were obtained using a Hess sampler and procedures as per the Pacific Streamkeepers (Taccogna and Munro 1995). Each site was approached by walking from downstream. The cylindrical, 34-cm diameter Hess sampler was hand-pressed into the substrate to isolate a circular 0.09-$m^2$ sampling area. All stones and debris 5 cm or larger within the sampling area were held under water in front of the collecting net and rubbed gently by hand to dislodge invertebrates. Cleaned stones and debris were then placed downstream of the sampling area. The streambed was then gently agitated to a depth of 5 cm to loosen any remaining invertebrates. The content of the collecting net was then transferred in a 125-ml plastic sample jar. The net was carefully inspected to ensure all contents were transferred into the sample jar. Samples were stored in a cooler and transported to Vancouver Island University, where laboratory analyses were completed within 72 hours of sampling.

### *3.4.3. VIU Laboratory Analyses*

Laboratory procedures and identification also followed the Pacific Streamkeepers procedures (Taccogna and Munro 1995). The triplicate samples from each station were combined into a single composite sample per station. The contents of all invertebrate sample jars from a station were poured into a shallow white tray. Invertebrates were sorted into apparent taxonomic groups. Identification to the appropriate taxonomic level (as prescribed by the Pacific Streamkeepers procedures) was confirmed using a dissection microscope. The number of invertebrates and the number of distinguishable subgroups within each broad taxonomic group were recorded on a Pacific Streamkeeper Invertebrate Survey Field Data Sheet. From these records, various useful metrics were calculated for each station, including: total density (number per $m^2$), total number of taxonomic groups, predominant taxonomic group, Pollution Tolerance Index, EPT (Ephemeroptera-Plecoptera-Trichoptera) Index, EPT to Total Ratio Index, Predominant Taxon Ratio Index, and overall Site Assessment Rating.

# 4. Results

River discharge can significantly affect water quality results through the differential transport of dissolved and suspended solids. Figure 2 shows that, during most years, discharge in the Englishman River was below the median levels expected at the time of sampling. Exceptions

included high discharge levels during the late October sampling events in 2010 and 2014, and during the mid-November sampling events in 2009 and 2012.

Water flow into the C.W. Young Channel is controlled by an intake valve and, therefore, fluctuations in discharge rate are more restricted than for the mainstem of the Englishman River. However, water flow variations in the river can affect inflowing water quality in the C.W. Young Channel.

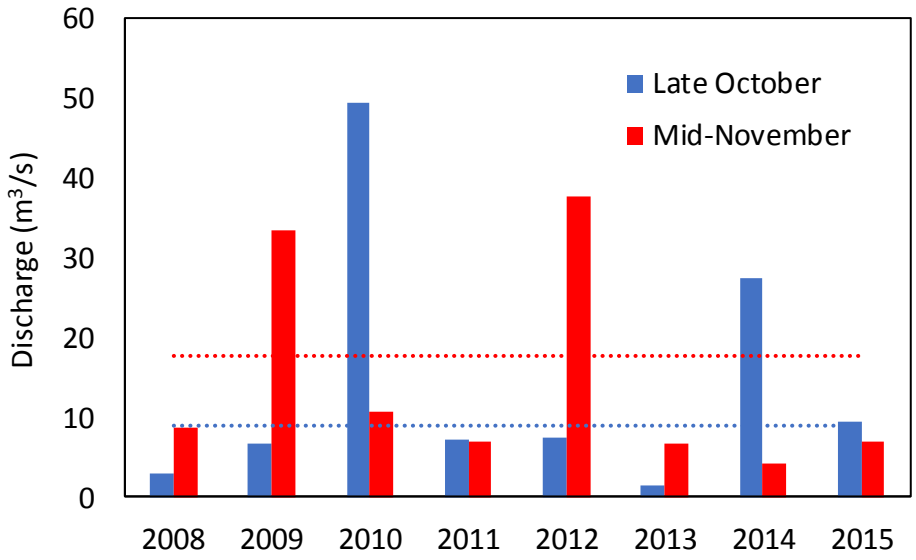


**Figure 2**. Discharge ($m^3/s$) measurements for the mainstem Englishman River at the time of sampling during 2008-2015. The bars display the discharge level on the same dates for the late October (blue) and mid-November (red) sampling events, respectively. The dashed lines display the 36-year median discharge (1979-2015) on 30 October (blue) and 20 November (red), respectively. Hydrometric data retrieved from Environment Canada, Water Survey for station 08HB002 (https://wateroffice.ec.gc.ca/).

## 4.1. Water Quality

In this section, time series for each water quality parameter are presented and described for the 8-year period between 2008 and 2015. Spatial trends among sampling stations are also shown and described where they existed, although many parameters did not exhibit any spatial trend. All water quality data are available in Appendix A (Tables A.1 to A.8).

### *4.1.1. Water temperature*

Water temperature varied between years due to variation in ambient air temperature (Figure 3), although water temperature fluctuations were more pronounced during the mid-November sampling events. Water temperature ranged from 5.5 to 9.0°C during late October and from 1.5 to 7.6°C during mid-November.

There was little temperature variation among stations, with a range consistently <2°C between the warmest and coldest station (as shown by small error bars). Water temperature increased slightly by an average of 0.3-0.4°C with distance downstream within the C.W. Young Channel (i.e., from station 1 to station 4) (not shown).

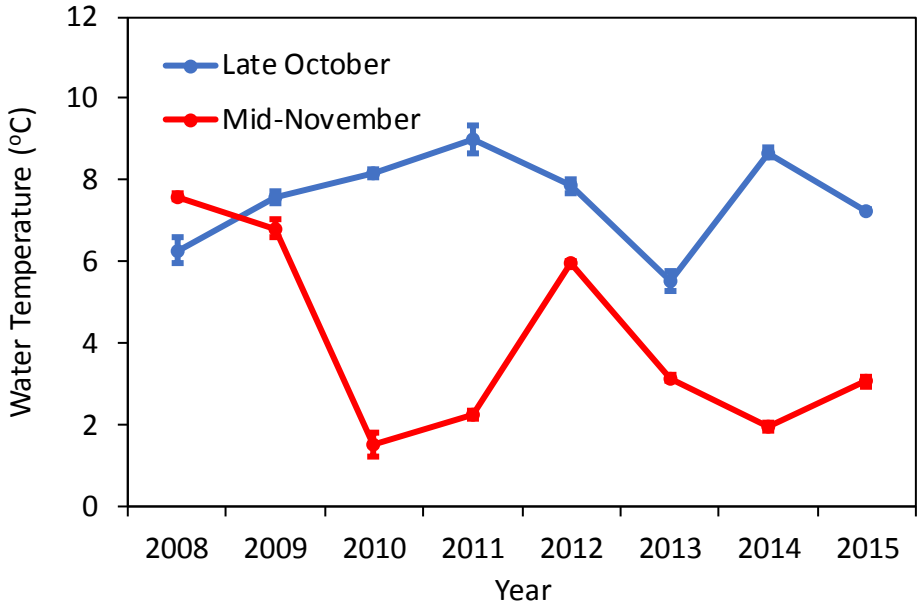


**Figure 3**. Water temperature (°C) measured during two sampling events in 2008-2015 in the C.W. Young Channel and Englishman River. Points show average temperature from five sampling stations. Sampling events were conducted in late October (blue) and mid-November (red) each year. Error bars represent ±1 standard error.

### *4.1.2. Dissolved oxygen*

Dissolved oxygen concentrations varied between years due to variation in water temperature (Figure 4), and fluctuations were more pronounced during the mid-November sampling events as would be expected since the largest temperature variations were also observed then. Dissolved oxygen levels ranged from 10.5 to 13.1 mg/L during late October and from 10.0 to 17.9 mg/L during mid-November. The dissolved oxygen levels during mid-November 2010 and 2014 appeared unusually high and displayed the most variation. These results may have resulted from inappropriate calibration or placement of the oxygen probe in highly turbulent water. However, these measurements were also recorded during the coldest years, when dissolved oxygen concentrations would be expected to be the highest.

Dissolved oxygen levels decreased by an average of 1.0 and 2.3 mg/L with distance downstream within the C.W. Young Channel (i.e., from station 1 to station 4) during late October and mid-November, respectively (not shown). In contrast, dissolved oxygen levels decreased by an average of 0.4-0.5 mg/L in the mainstem of the Englishman River over a similar distance (i.e., between

station 1 and station 5). These decreases coincided with increases in water temperature along the channel, but the extent of the decreases were slightly larger than would be expected based on temperature alone. Overall, dissolved oxygen saturation levels decreased from 103-106% at station 1 to 90-95% at station 4. These slight declines in dissolved oxygen levels may have been due to enhanced ecosystem respiration within the channel.

Dissolved oxygen levels were always above the minimum guideline of 9.0 mg/L for early fish life stages (RISC 1998) (Figure 4). Overall, dissolved oxygen concentrations were always >80% saturation.

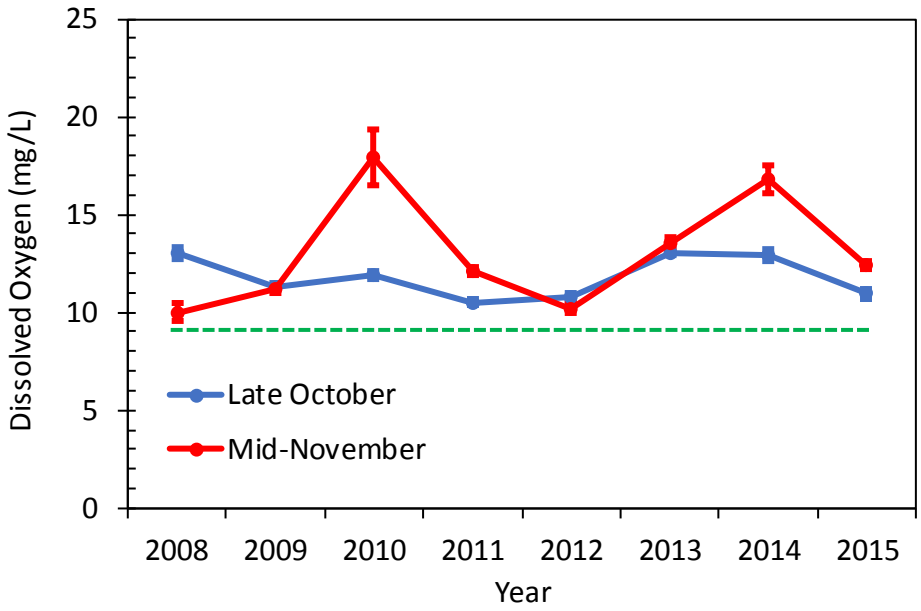


**Figure 4**. Dissolved oxygen concentrations (mg/L) measured during two sampling events in 2008-2015 in the C.W. Young Channel and Englishman River. Points show average concentrations from five sampling stations. Sampling events were conducted in late October (blue) and mid-November (red) each year. The green dashed line represents the minimum guideline of 9.0 mg/L for early fish life stages. Error bars represent ±1 standard error.

### *4.1.3. Conductivity*

Conductivity was generally higher and more variable during late October than during mid-November (Figure 5). Overall, average conductivity ranged from 40 to 89 µS/cm during late October and from 36 to 63 µS/cm during mid-November. There was a weak negative correlation between average conductivity and river discharge ($r$ = -0.54; $df$ = 14; $P$ = 0.04) (Figure 6). Conductivity was highest in late October during years of lower discharge in 2008-2009 and 2011-2013. In contrast, high discharge levels in late October 2010 and 2014 were associated with lower conductivity from the dilution effect.

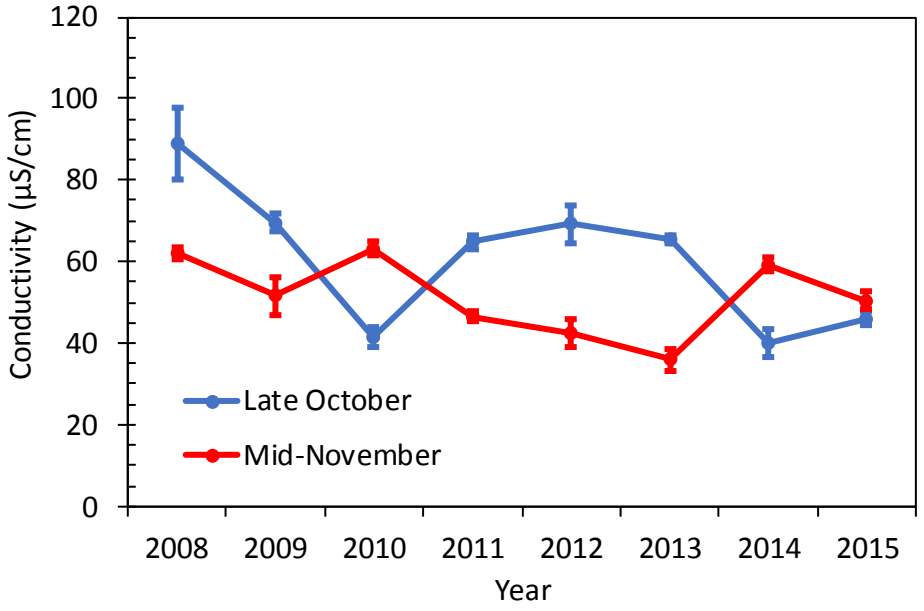


**Figure 5**. Conductivity (µS/cm) measured during two sampling events in 2008-2015 in the C.W. Young Channel and Englishman River. Points show average conductivity from 3-4 sampling stations. Sampling events were conducted in late October (blue) and mid-November (red) each year. Error bars represent ±1 standard error.

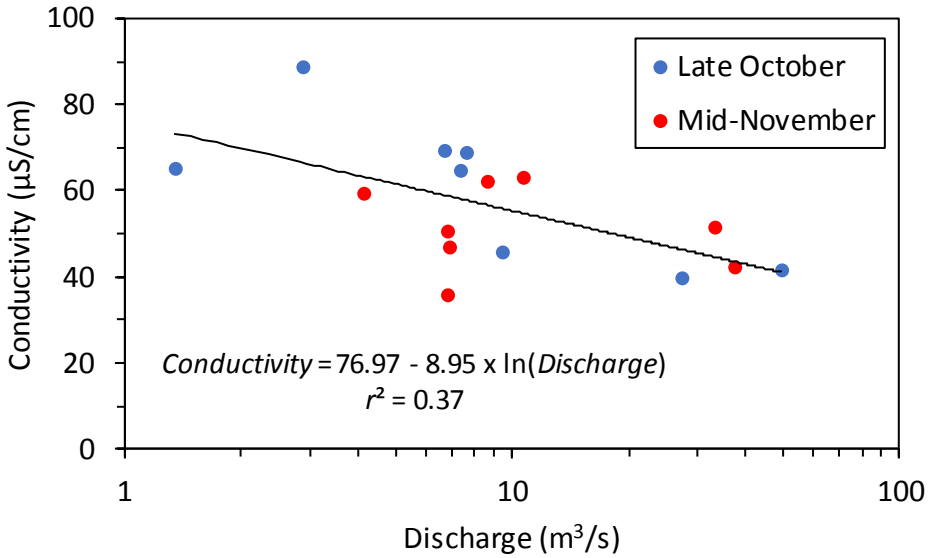


**Figure 6**. Relationship between average conductivity (µS/cm) and discharge ($m^3/s$) measured in the C.W. Young Channel and Englishman River during two sampling events in 2008-2015. Sampling events were conducted in late October (blue) and mid-November (red) each year.

During most years, low discharge levels in early fall are typically associated with higher concentrations of dissolved ions and higher conductivity. The onset of rainy weather in November

often results in a brief pulse in conductivity as dissolved and suspended materials from the watershed are mobilized in the flowing water initially. This is typically followed by a reduction in conductivity resulting from the dilution effect of increased discharge.

There was little spatial variation in conductivity, with a range typically <20 µS/cm among stations in most years (not shown). Conductivity increased by an average of 10-12 µS/cm with distance downstream within the C.W. Young Channel (i.e., from station 1 to station 4). Conductivity increased by an average of 2 µS/cm in the mainstem of the Englishman River over a similar distance (i.e., between station 1 and station 5). The higher variation for late October 2008 resulted from a single elevated result for station 4 (123 µS/cm), which was unusually high and may have been erroneous.

### *4.1.4. pH*

Average pH levels were near neutral throughout this study (Figure 7), and averaged 7.5 and 7.6 during the late October and mid-November sampling events, respectively. There was no clear temporal or spatial trend in pH. Higher variability in mid-November 2009 and 2014 resulted from measurements for a single station slightly higher or lower (by <0.4 pH units) than for other stations. Overall, pH levels were well within the aquatic life criteria of 6.5-9.0 (RISC 1998).

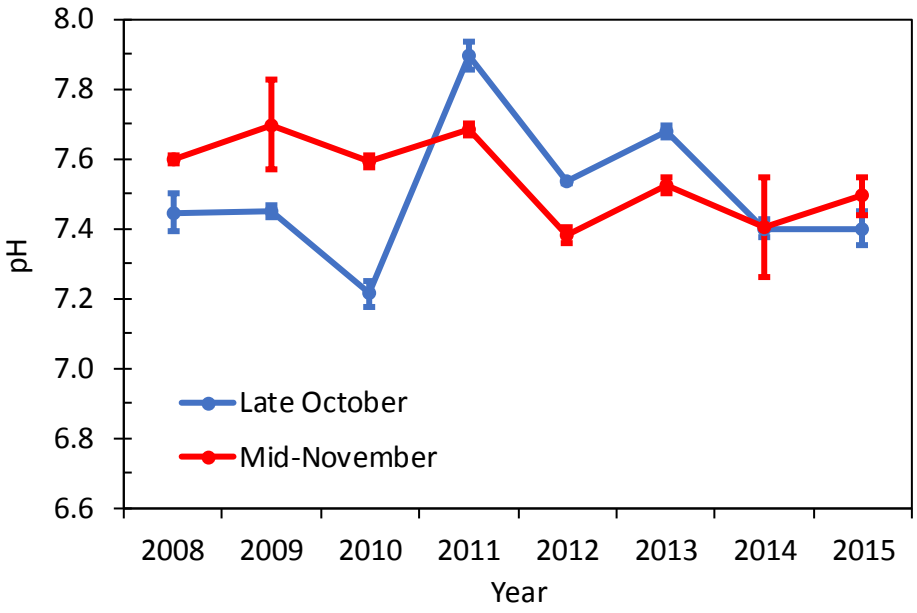


**Figure 7**. Water pH measured during two sampling events in 2008-2015 in the C.W. Young Channel and Englishman River. Points show average pH from 3-4 sampling stations. Sampling events were conducted in late October (blue) and mid-November (red) each year. Error bars represent ±1 standard error.

### *4.1.5. Total alkalinity*

Total alkalinity ranged from 14 to 27 mg/L as $CaCO_3$ during late October and from 17 to 25 mg/L as $CaCO_3$ during mid-November (Figure 8). Like conductivity, alkalinity was more variable during late October than during mid-November, also suggesting that variation in alkalinity was related to river discharge. Alkalinity levels were within the ranges for "moderate" (10-20 mg/L as $CaCO_3$) to "low" (>20 mg/L as $CaCO_3$) sensitivity to acidification (RISC 1998). There was no apparent trend in alkalinity between stations.

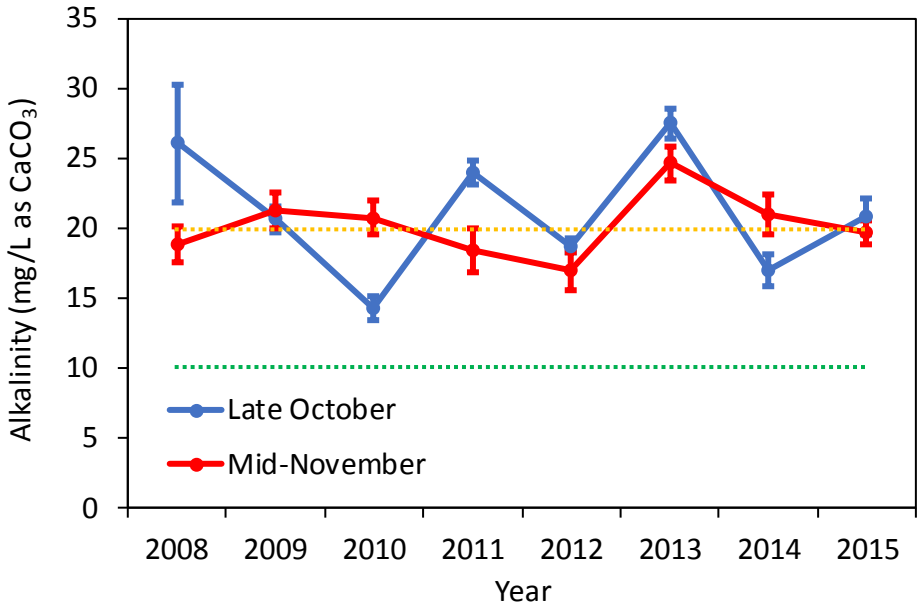


**Figure 8**. Total alkalinity (mg/L as $CaCO_3$) measured during two sampling events in 2008-2015 in the C.W. Young Channel and Englishman River. Points show average alkalinity from 3-4 sampling stations. Sampling events were conducted in late October (blue) and mid-November (red) each year. The green and orange dashed lines represent the maximum levels for high (10 mg/L) and moderate (20 mg/L) acid sensitivity. Error bars represent ±1 standard error.

### *4.1.6. Hardness*

Hardness ranged from 18 to 39 mg/L as $CaCO_3$ during late October and from 16 to 28 mg/L as $CaCO_3$ during mid-November (Figure 9). Like conductivity and alkalinity, hardness was more variable during late October than during mid-November, also suggesting that variation in hardness was related to river discharge. Hardness levels were consistently below 60 mg/L as $CaCO_3$, indicating "soft water" as defined by RISC (1998). There was no apparent trend in hardness between stations.

There were significant positive relationships between conductivity, alkalinity and hardness (see Appendix B, Figure B.1). These correlations were expected since each of these parameters represent measures of dissolved ions.

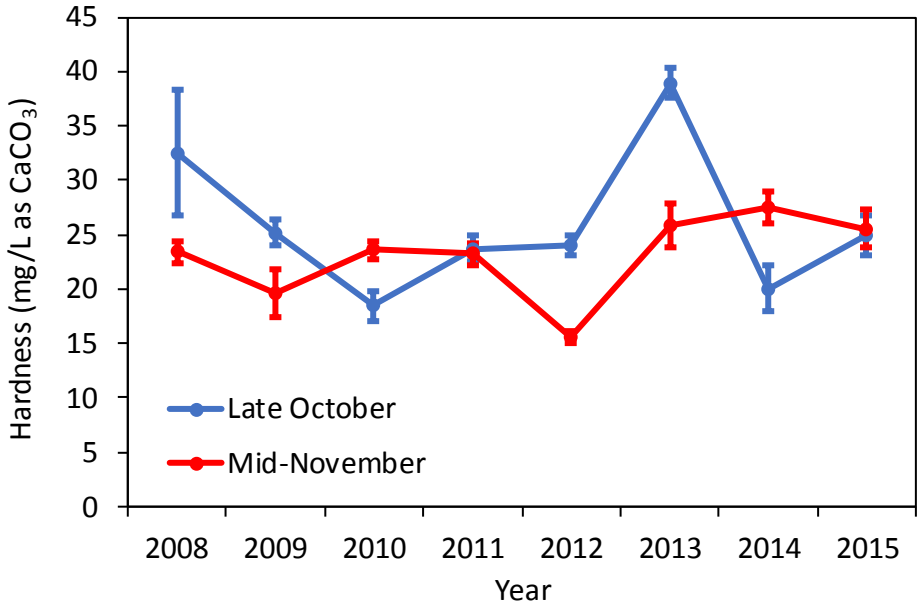


**Figure 9**. Hardness (mg/L as $CaCO_3$) measured during two sampling events in 2008-2015 in the C.W. Young Channel and Englishman River. Points show average hardness from 3-4 sampling stations. Sampling events were conducted in late October (blue) and mid-November (red) each year. Error bars represent ±1 standard error.

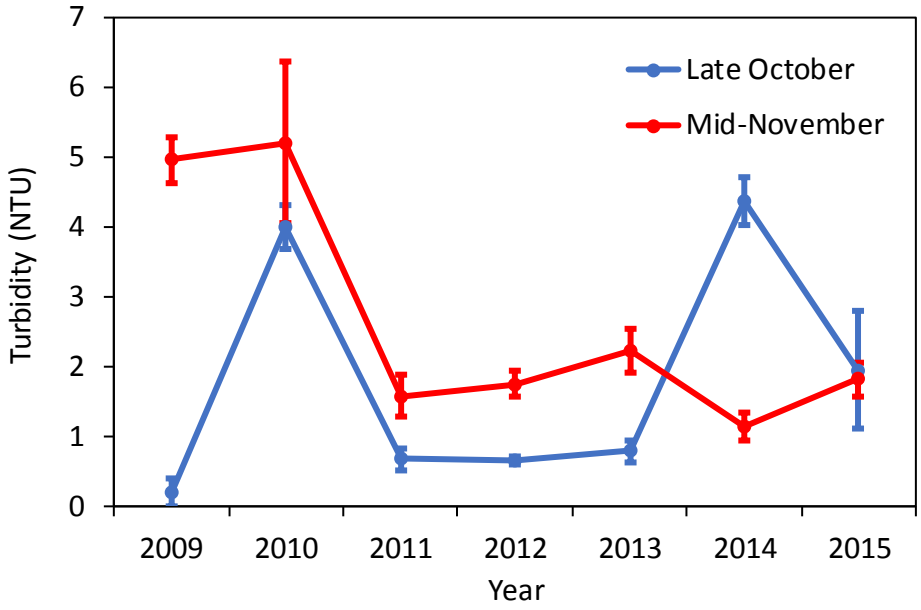


**Figure 10**. Turbidity levels (NTU) measured during two sampling events in 2009-2015 in the C.W. Young Channel and Englishman River. Points show average turbidity from 5 sampling stations. Sampling events were conducted in late October (blue) and mid-November (red) each year. Error bars represent ±1 standard error. No results are available for 2008.

### *4.1.7. Turbidity*

Turbidity levels generally increased between the late October and mid-November sampling events each year (Figure 10). Overall, turbidity ranged from 0.2 to 4.4 NTU during late October and from 1.1 to 5.2 mg/L during mid-November. The higher turbidity levels in mid-October 2010 and 2014 coincided with high discharge events during those years (see Figure 2). Elevated turbidity is often associated with high discharge, where shear stress increases and causes the mobilization of suspended solids. Turbidity levels in mid-November were not as closely associated with river discharge. There was no apparent trend in turbidity between stations.

Overall, average turbidity levels were typically below the site-specific water quality objective of 5.0 NTU proposed by Barlak et al. (2010) for October-December, with the exception of the levels observed in late mid-November 2010 (5.2 NTU).

### *4.1.8. Nitrate*

Nitrate concentrations generally increased between the late October and mid-November sampling events each year (Figure 11). Overall, nitrate levels ranged from 0.01 to 0.09 mg/L during late October and from 0.03 to 0.18 mg/L during mid-November. The higher levels and variation for mid-November 2009 resulted from elevated nitrate results at stations 3 and 4 (0.28 mg/L each). Similar high results were observed in independent samples analyzed at the VIU laboratory (not shown). Therefore, these results appear to be correct, although the cause for these higher results remain unknown.

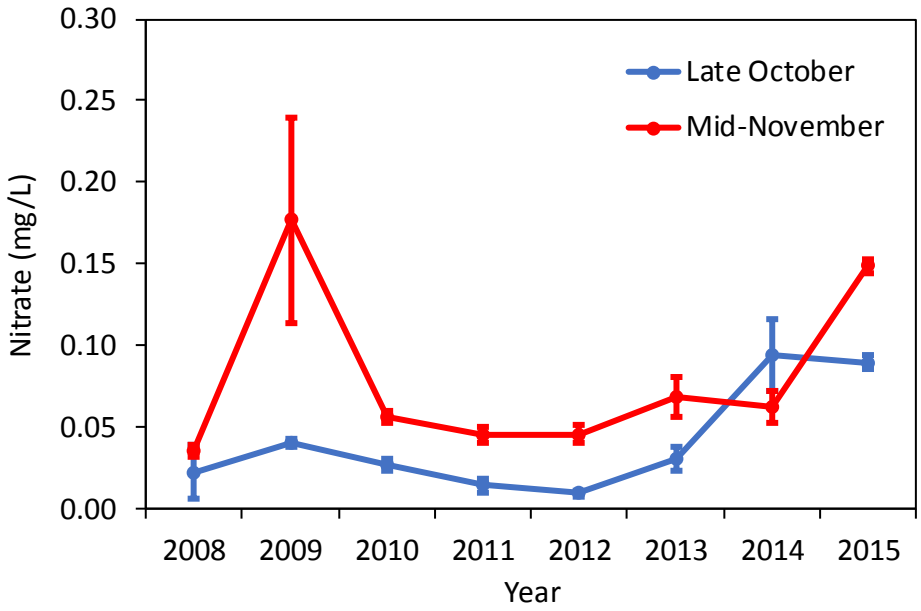


**Figure 11**. Nitrate concentrations (mg/L) measured during two sampling events in 2008-2015 in the C.W. Young Channel and Englishman River. Points show average concentrations from 3-4 sampling stations. Sampling events were conducted in late October (blue) and mid-November (red) each year. Error bars represent ±1 standard error.

There were apparent increasing trends in nitrate levels during the last 3 years surveyed (2013-2015). At this point, it is unclear if these increasing trends are indicative of changes within the C.W. Young Channel or Englishman River. Nitrate is the main form of combined nitrogen found in natural waters and it is the primary form of nitrogen used by plants as a nutrient to stimulate growth. Excessive amounts of nitrogen may result in excessive aquatic plant growth. Continued monitoring of nitrate levels is warranted to determine long-term conditions within the watershed.

### *4.1.9. Total phosphorus*

Total phosphorus concentrations were highly variable between years (Figure 12), and generally increased between the late October (average: 0.007 mg/L) and mid-November (average: 0.010 mg/L) sampling events. Overall, total phosphorus levels ranged from 0.004 to 0.010 mg/L during late October and from 0.005 to 0.016 mg/L during mid-November.

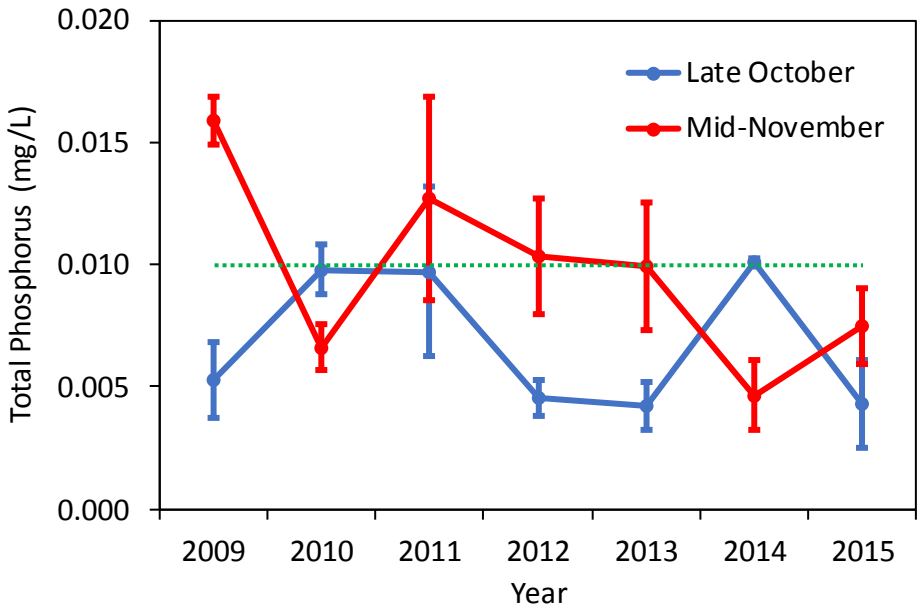


**Figure 12**. Total phosphorus concentrations (mg/L) measured during two sampling events in 2009-2015 in the C.W. Young Channel and Englishman River. Points show average concentrations from 3-4 sampling stations. Sampling events were conducted in late October (blue) and mid-November (red) each year. The green dashed line represents the division between "oligotrophic" water (<0.010 mg/L) and "mesotrophic" water (0.010-0.025 mg/L). Error bars represent ±1 standard error. No results are available for 2008.

Total phosphorus concentrations generally increased with distance downstream within the C.W. Young Channel (Figure 13). Total phosphorus increased by an average of 0.005-0.007 mg/L with distance downstream within the C.W. Young Channel (i.e., from station 1 to station 4). In contrast, total phosphorus increased by <0.002 mg/L in the mainstem of the Englishman River over a similar distance (i.e., between station 1 and station 5). This spatial gradient suggests that ecosystem productivity within and around the C.W. Young Channel may contribute additional phosphorus to

the watercourse. A potential source of phosphorus could include the activity of and eventual decay of spawning salmon.

Overall, total phosphorus levels were within the ranges for "oligotrophic" water (>0.010 mg/L) to "mesotrophic" (0.010-0.025 mg/L) (RISC 1998).

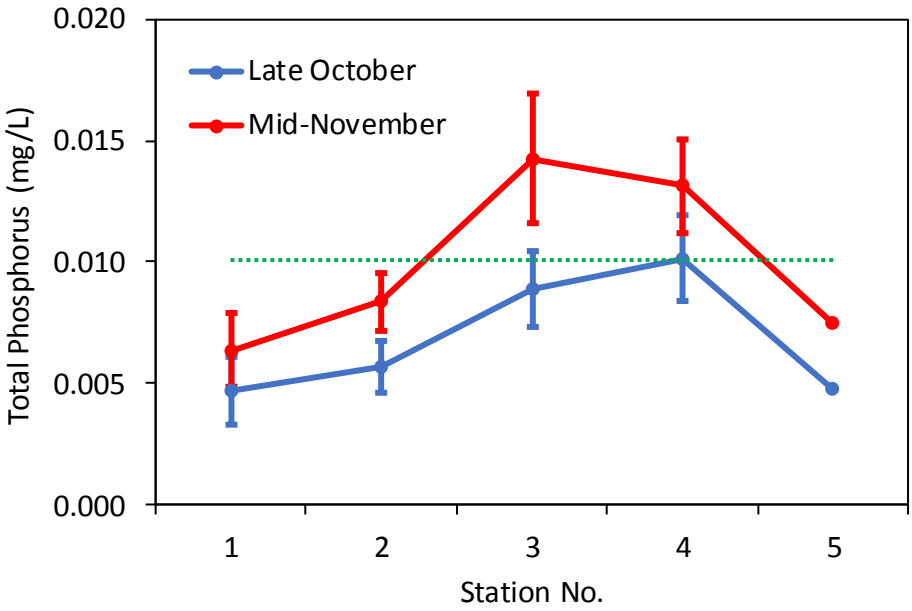


**Figure 13**. Total phosphorus concentrations (mg/L) measured at five stations during two sampling events in the C.W. Young Channel and Englishman River. Points show average concentrations between 2009 and 2015. Sampling events were conducted in late October (blue) and mid-November (red) each year. The green line represents the division between "oligotrophic" water (<0.010 mg/L) and "mesotrophic" water (0.010-0.025 mg/L). Error bars represent ±1 standard error.

### *4.1.10. Total metals*

With the exception of aluminum, all metals with applicable water quality guidelines were below minimum detection limits. Total aluminum concentrations exceeded the applicable guideline for aquatic life (maximum concentration: 0.1 mg/L) during 6 out of the 8 years of this study (Table 4). There was no apparent spatial trend in aluminum concentrations. The aluminum levels measured were only slightly above the water quality guideline. Aluminum is not considered a serious threat to aquatic life, except in areas of acidic inputs.

Total metal analyses measure the combined amount of metals dissolved in water and bound to particles. In general, dissolved metals are more bio-available (hence toxicologically available) than metals that are bound to particles. It is unclear whether the observed elevated aluminum levels represented dissolved metals or metals bound to suspended particles.

**Table 4**. Maximum concentrations of aluminum (mg/L) measured during two sampling events in 2008-2015 at the C.W. Young Channel and Englishman River. The water quality guideline of aluminum for aquatic life is 0.10 mg/L. Note that measured levels below method detection limit (<0.20 mg/L) cannot be assumed to be below the applicable guidelines.

| Year | Late October | Mid-November |
|---|---|---|
| 2008 | <0.20 | <0.20 |
| 2009 | 0.27 | 0.32 |
| 2010 | 0.29 | <0.20 |
| 2011 | <0.20 | <0.20 |
| 2012 | <0.20 | 0.29 |
| 2013 | <0.20 | 0.26 |
| 2014 | 0.49 | <0.20 |
| 2015 | 0.31 | <0.20 |

## 4.2. Microbiology

Total coliform levels fluctuated between years, with levels ranging from 67 CFU / 100 ml (in 2012) to 637 CFU / 100 ml (in 2013) (Figure 14). The proportion of total coliform made up of fecal coliform was relatively low (range: 0-15%). Overall, fecal coliform levels ranged from 0 to 60 CFU / 100 ml. There was no apparent temporal trend in coliform levels, or correlation with other water quality parameters.

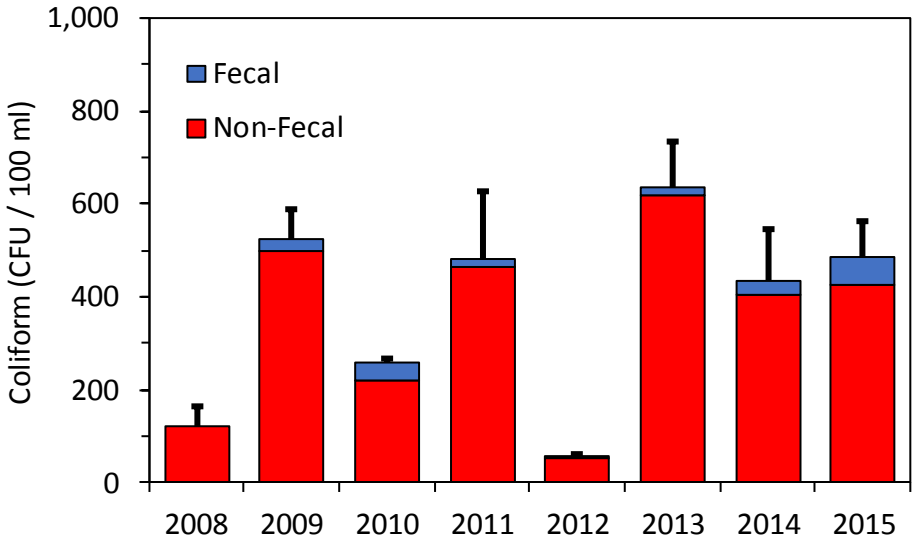


**Figure 14**. Fecal (blue) and non-fecal (red) coliform levels (colony forming unit; CFU / 100 ml) measured during late October in 2008-2015 in the C.W. Young Channel and Englishman River. Bars show average coliform levels from 3-5 sampling stations. Error bars represent ±1 standard error of total coliform (the sum of fecal and non-fecal coliforms).

Total coliform levels generally increased with distance downstream within the C.W. Young Channel (Figure 15). Total coliform levels increased by 98% between station 1 (251 CFU / 100 ml) and station 4 (498 CFU / 100 ml). In contrast, total coliform levels increased by 43% in the mainstem of the Englishman River over a similar distance (i.e., between station 1 and station 5). The proportion of total coliform made up of fecal coliforms was highest at station 4 (10%). This spatial gradient suggests that activity of vertebrate animals within and around the C.W. Young Channel appears to contribute coliforms to the watercourse. A potential source of total coliform may include spawning salmon, while fecal coliforms may come from warm-blooded animals (e.g., waterfowl, beavers, dogs).

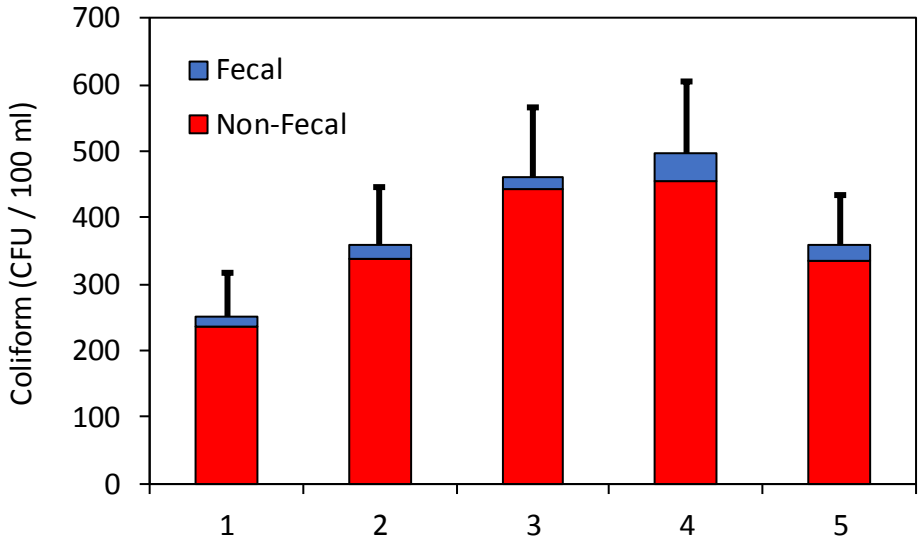


**Figure 15**. Fecal (blue) and non-fecal (red) coliforms (colony forming unit; CFU / 100 ml) measured at five stations during two sampling events in the C.W. Young Channel and Englishman River. Bars show average coliform levels between 2008 and 2014. Error bars represent ±1 standard error of total coliform (the sum of fecal and non-fecal coliforms).

Overall, average fecal coliform results were typically below the site-specific water quality objective of ≤54 CFU / 100 ml proposed by Barlak et al. (2010) for October-November, with the exception of the levels observed in late October 2015 (60 CFU / 100 ml).

## 4.3. Stream Invertebrates

Stream invertebrate densities fluctuated between years, with average levels ranging from 844 animals / $m^2$ (in 2014) to 5,081 animals / $m^2$ (in 2012) (Figure 16). The proportion of stream invertebrates made up of "pollution sensitive" taxa (category 1) was consistently >50%, and ranged from 58% to 90%. Pollution sensitive taxa include mayflies, caddisflies and stoneflies, which are indicators of good water quality. Therefore, their consistent presence in the C.W. Young Channel suggests good water and habitat quality.

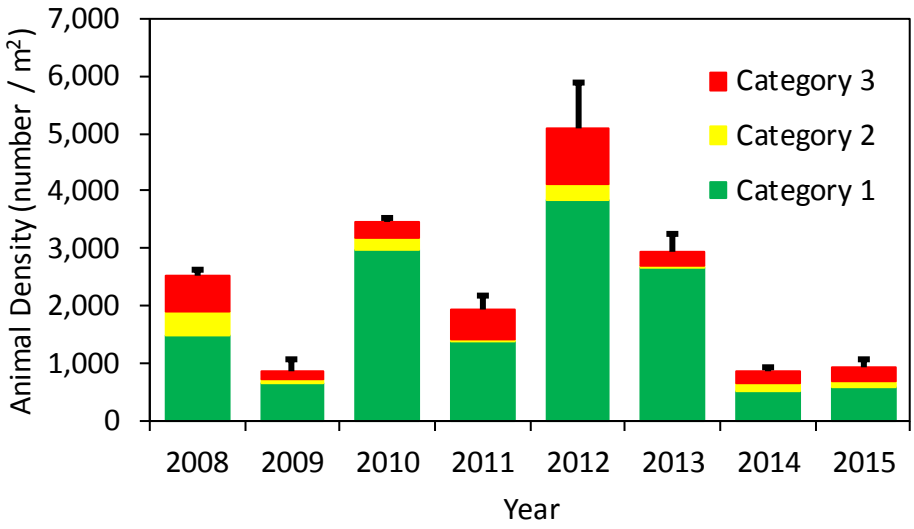


**Figure 16**. Density of stream invertebrates (number of animals / $m^2$) measured during late October in 2008-2015 in the C.W. Young Channel and Englishman River. Bars represent average densities from 3 sampling stations. Colours represent "pollution sensitive" taxa (green; category 1), "somewhat pollution tolerant" taxa (yellow; category 2), and "pollution tolerant" taxa (red; category 3). Error bars represent ±1 standard error of total animal density.

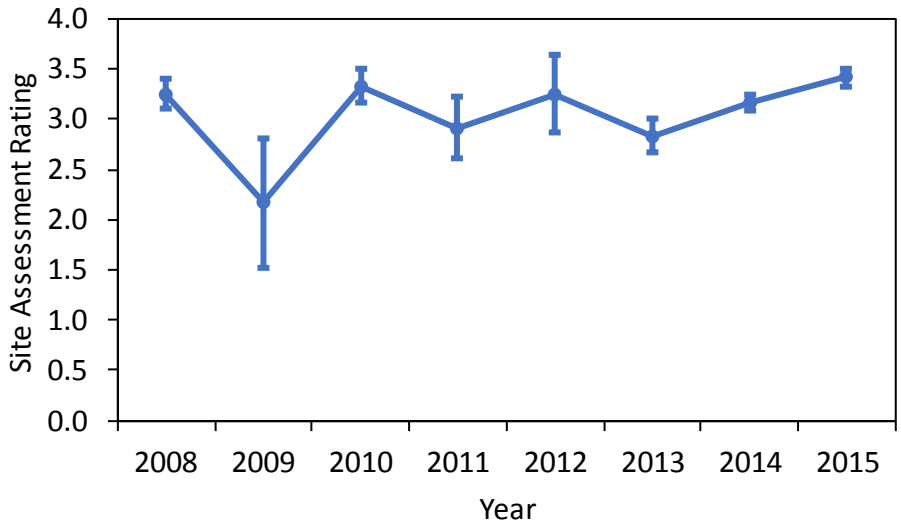


**Figure 17**. Site assessment ratings (range: 1 = "poor", 2 = "marginal", 3 = "acceptable", 4 = "Good") for the stream invertebrates communities assessed during late October in 2008-2015 in the C.W. Young Channel and Englishman River. Points show average ratings from 3 sampling stations. Error bars represent ±1 standard error of site assessment ratings.

Site assessment ratings ranged from 2.2 to 3.4 (out of 4.0), with an overall average of 3.0 from 2008 to 2015 (Figure 17). This average rating suggests that "acceptable" conditions existed for

community abundance and diversity of stream invertebrates during most years. There was no apparent temporal or spatial trend in animal density or site assessment rating, or correlation with water quality parameters. All Invertebrate Survey Field Data Sheets are included in Appendix C (Tables C.1 to C.8).

## 5. Conclusions

Results from this 8-year environmental monitoring program suggest that water quality has remained consistently "acceptable" for the C.W. Young Channel and Englishman River. No obvious deficiency in water quality parameters were observed as part of this monitoring project between 2008 and 2015. With only a few exceptions, all water quality parameters were well within the BC water quality guidelines.

Some results warrant continued monitoring of the C.W. Young Channel and Englishman River. These include: (1) a rising trend in nitrate levels, (2) consistently elevated coliform levels, and (3) aluminum concentrations above BC water quality guidelines. It should be noted that none of these results are suggestive of adverse or deteriorating water quality. Continued monitoring at the same time of year and location, and using consistent methodologies will provide a long-term time series, which will be helpful to detect changes in environmental quality.

## 6. Acknowledgements

This long-term monitoring project would not have been possible without continued interest and support from the Regional District of Nanaimo and Fisheries and Oceans Canada. We would like to acknowledge Joan Michel (Parks and Trails Coordinator, Recreation and Parks Department, Regional District of Nanaimo) for facilitating site access and logistic support. We would also like to acknowledge Margaret Wright (Fisheries and Oceans Canada) for continued support in facilitating this and other monitoring projects.

Long-term monitoring was conducted by students attending the Environmental Monitoring (RMOT 306) course at Vancouver Island University. Students conducted all tasks related to site visits, project proposal, field sampling, laboratory analyses, and oral and written presentations. The following students conducted the yearly monitoring projects:

- 2008: L. Clarke, M. Colwell, and M. Cormie
- 2009: L. Arman, L. Somers, and B. Wiest
- 2010: S. Johnson, B. Krantz, and K. Taekema
- 2011: N. Boss, J. Morris, and O. Van Jarrett
- 2012: S. Lukas, B. Peace, S. Sigal, and B. Wilde
- 2013: G. MacDonald, E. Molsberry, A. Patterson, and R. Segal
- 2014: O. Catherall, M. Lester, M. Rossouw, and T. Yip
- 2015: M. Andres, R. Moulder, G. Small, and T. Temple

The Resource Management and Protection (RMAP) and Biology Departments at Vancouver Island University provided some laboratory supplies, equipment, vehicle and covered fuel expenses. The

Regional District of Nanaimo and Fisheries and Oceans Canada provided funding for analytical processing of water samples. ALS Laboratory provided reduced rates on some of their analytical services for this project and other projects conducted as part of the Environmental Monitoring course. We would also like to acknowledge Amber Springer (ALS Laboratory) for continued support of these monitoring projects.

## 7. References

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RISC. 1998. Guidelines for Interpreting Water Quality Data. Resources Information Standards Committee, Victoria, BC.

Taccogna, G., and K. Munro (eds). 1995. The Streamkeepers Handbook: a Practical Guide to Stream and Wetland Care. Salmonid Enhancement Program, Dept. Fisheries and Oceans, Vancouver, BC.

Vancouver Island University (VIU: L. Clarke, M. Colwell, M. Cormie, and E. Demers). 2009. Water Quality and Stream Invertebrate Assessment for the C.W. Young Channel, Englishman River, BC (Fall 2008). Data Report.

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Vancouver Island University (VIU: S. Johnson, B. Krantz, K. Taekema, and E. Demers). 2011. Water Quality and Stream Invertebrate Assessment for the C.W. Young Channel, Englishman River, BC (Fall 2010). Data Report.

Vancouver Island University (VIU: N. Boss, J. Morris, O. Van Jarrett, and E. Demers). 2012. Water Quality and Stream Invertebrate Assessment for the C.W. Young Channel, Englishman River, BC (Fall 2011). Data Report.

# 8. Appendix A

**Table A.1**. Water quality results for water samples taken from 5 stations at the C.W. Young Channel during fall 2008. All values are expressed in mg/L unless specified otherwise.

| Parameters | 28 October 2008 | | | | | 18 November 2008 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **General / Physical** | | | | | | | | | | |
| Water Temperature (°C) | 6.1 | 5.3 | 6.9 | 6.1 | 7.0 | 7.3 | 7.6 | 7.6 | 7.6 | 7.8 |
| Dissolved Oxygen | 13.8 | 13.3 | 12.3 | 12.4 | 13.5 | 11.2 | 10.6 | 10.0 | 9.4 | 8.7 |
| Conductivity (µS/cm) | 80.7 | 78.1 | 72.4 | 121 | | 62.4 | 63 | 59.6 | 68.4 | |
| pH (pH units) | 7.38 | 7.52 | 7.55 | 7.33 | | 7.61 | 7.60 | 7.56 | 7.62 | |
| Alkalinity | 21.9 | 22.0 | 20.6 | 43.0 | 22.7 | 14.7 | 18.7 | 19.9 | 22.8 | 17.8 |
| Hardness, Total | 28.0 | 26.7 | 25.5 | 49.7 | | 22.9 | 22.3 | 21.9 | 26.4 | |
| **Nutrients** | | | | | | | | | | |
| Bromide (Br) | <0.050 | <0.050 | <0.050 | <0.050 | | <0.050 | <0.050 | <0.050 | <0.050 | |
| Chloride (Cl) | 10.6 | 9.89 | 8.87 | 9.08 | | 5.7 | 5.43 | 5.09 | 5.33 | |
| Fluoride (F) | <0.020 | <0.020 | <0.020 | 0.029 | | <0.020 | <0.020 | <0.020 | <0.020 | |
| Nitrate (as N) | 0.01 | <0.0050 | <0.0050 | 0.07 | | 0.04 | 0.03 | 0.03 | 0.04 | |
| Nitrite (as N) | <0.001 | <0.001 | <0.001 | <0.001 | | <0.001 | <0.001 | <0.001 | 0.0013 | |
| Sulfate ($SO_4$) | 1.460 | 1.390 | 1.280 | 2.010 | | 1.580 | 1.540 | 1.460 | 1.550 | |
| **Coliforms** | | | | | | | | | | |
| Non-fecal (CFU/100 ml) | 20 | 80 | 100 | 270 | 140 | | | | | |
| Fecal (CFU/100 ml) | 0 | 0 | 0 | 0 | 0 | | | | | |
| % fecal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | | | |

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**Table A.1**. (Continued)

| Parameters | 28 October 2008 | | | | | 18 November 2008 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **Total Metals** | | | | | | | | | | |
| Aluminum (Al) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Antimony (Sb) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Arsenic (As) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Barium (Ba) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Berylium (Be) | <0.005 | <0.005 | <0.005 | <0.005 | | <0.005 | <0.005 | <0.005 | <0.005 | |
| Bismuth (Bi) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Boron (B) | <0.10 | <0.10 | <0.10 | <0.10 | | <0.10 | <0.10 | <0.10 | <0.10 | |
| Cadmium (Cd) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Calcium (Ca) | 9.7 | 9.1 | 8.2 | 12.6 | | 7.7 | 7.5 | 7.3 | 8.1 | |
| Chromium (Cr) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Cobalt (Co) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Copper (Cu) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Iron (Fe) | <0.030 | 0.123 | 0.091 | 0.259 | | 0.058 | 0.123 | 0.133 | 0.146 | |
| Lead (Pb) | <0.050 | <0.050 | <0.050 | <0.050 | | <0.050 | <0.050 | <0.050 | <0.050 | |
| Lithium (Li) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Magnesium (Mg) | 0.9 | 0.9 | 1.2 | 4.4 | | 0.9 | 0.9 | 0.9 | 1.5 | |
| Manganese (Mn) | <0.005 | 0.012 | 0.009 | 0.016 | | <0.005 | 0.007 | 0.006 | 0.005 | |
| Molybdenum (Mo) | <0.030 | <0.030 | <0.030 | <0.030 | | <0.030 | <0.030 | <0.030 | <0.030 | |
| Nickel (Ni) | <0.050 | <0.050 | <0.050 | <0.050 | | <0.050 | <0.050 | <0.050 | <0.050 | |
| Phosphorus (P) | <0.30 | <0.30 | <0.30 | <0.30 | | <0.30 | <0.30 | <0.30 | <0.30 | |
| Potassium (K) | <2.0 | <2.0 | <2.0 | <2.0 | | <2.0 | <2.0 | <2.0 | <2.0 | |
| Selenium (Se) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Silicon (Si) | 2.00 | 1.98 | 2.02 | 4.69 | | 2.68 | 2.63 | 2.65 | 3.18 | |
| Silver (Ag) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Sodium (Na) | 4.5 | 4.3 | 3.8 | 4.5 | | 3.3 | 3.1 | 3.0 | 3.2 | |
| Strontium (Sr) | 0.038 | 0.037 | 0.030 | 0.041 | | 0.032 | 0.030 | 0.028 | 0.031 | |
| Thallium (Tl) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Tin (Sn) | <0.030 | <0.030 | <0.030 | <0.030 | | <0.030 | <0.030 | <0.030 | <0.030 | |
| Titanium (Ti) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Vanadium (V) | <0.030 | <0.030 | <0.030 | <0.030 | | <0.030 | <0.030 | <0.030 | <0.030 | |
| Zinc (Zn) | <0.005 | <0.005 | <0.005 | 0.006 | | <0.005 | <0.005 | <0.005 | <0.005 | |

**Table A.2**. Water quality results for water samples taken from 5 stations at the C.W. Young Channel during fall 2009. All values are expressed in mg/L unless specified otherwise.

| Parameters | 4 November 2009 | | | | | 25 November 2009 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **General / Physical** | | | | | | | | | | |
| Water Temperature (°C) | 7.1 | 7.3 | 7.9 | 7.9 | 7.7 | 6.2 | 6.3 | 7.2 | 7.2 | 7.2 |
| Dissolved Oxygen | 12.0 | 11.3 | 11.1 | 11.1 | 11.2 | 12.0 | 11.3 | 10.7 | 11.1 | 11.1 |
| Conductivity (µS/cm) | 64.2 | 55.9 | 59.1 | 56.3 | | 54.8 | 41.7 | 34.6 | 29.4 | |
| pH (pH units) | 7.02 | 7.13 | 7.17 | 7.37 | | 6.44 | 6.71 | 6.71 | 6.85 | |
| Alkalinity | 18.4 | 18.5 | 22.5 | 20.9 | 22.7 | 21.9 | 20.0 | 23.2 | 24.0 | 16.8 |
| Hardness, Total | 25.8 | 20.9 | 22.5 | 20.7 | | 27.0 | 18.1 | 15.2 | 13.1 | |
| Turbidity (NTU) | <1.0 | <1.0 | <1.0 | 1.0 | <1.0 | 5.0 | 4.8 | 4.8 | 6.0 | 5.0 |
| **Nutrients** | | | | | | | | | | |
| Ammonia | <0.020 | <0.020 | <0.020 | <0.020 | | 0.02 | <0.020 | 0.04 | 0.086 | |
| Nitrate | 0.0402 | 0.0438 | 0.0458 | 0.0509 | | 0.0725 | 0.0562 | 0.0231 | 0.0567 | |
| Nitrite | <0.001 | <0.001 | <0.001 | <0.001 | | <0.001 | <0.001 | <0.001 | <0.001 | |
| Orthophosphate | <0.001 | <0.001 | <0.001 | <0.001 | | 0.0018 | 0.0031 | 0.0074 | 0.0018 | |
| Total Phosphorus | 0.0079 | 0.0064 | 0.0055 | 0.0039 | | 0.1220 | 0.0105 | 0.0074 | 0.0172 | |
| **Coliforms** | | | | | | | | | | |
| Non-fecal (CFU/100 ml) | 343 | 333 | 636 | 626 | 555 | | | | | |
| Fecal (CFU/100 ml) | 51 | 24 | 20 | 18 | 16 | | | | | |
| % fecal | 10.7 | 6.7 | 3.0 | 2.8 | 2.8 | | | | | |

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**Table A.2**. (Continued)

| Parameters | 4 November 2009 | | | | | 25 November 2009 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **Total Metals** | | | | | | | | | | |
| Aluminum (Al) | <0.20 | <0.20 | <0.20 | <0.20 | | 1.93 | 0.25 | 0.35 | 0.53 | |
| Antimony (Sb) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Arsenic (As) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Barium (Ba) | <0.010 | <0.010 | <0.010 | <0.010 | | 0.015 | <0.010 | <0.010 | <0.010 | |
| Berylium (Be) | <0.005 | <0.005 | <0.005 | <0.005 | | <0.005 | <0.005 | <0.005 | <0.005 | |
| Bismuth (Bi) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Boron (B) | <0.10 | <0.10 | <0.10 | <0.10 | | <0.10 | <0.10 | <0.10 | <0.10 | |
| Cadmium (Cd) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Calcium (Ca) | 8.07 | 6.74 | 7.26 | 6.88 | | 7.58 | 5.50 | 4.72 | 3.92 | |
| Chromium (Cr) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Cobalt (Co) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Copper (Cu) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Iron (Fe) | 0.376 | 0.197 | 0.153 | 0.098 | | 2.670 | 0.363 | 0.326 | 0.512 | |
| Lead (Pb) | <0.050 | <0.050 | <0.050 | <0.050 | | <0.050 | <0.050 | <0.050 | <0.050 | |
| Lithium (Li) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Magnesium (Mg) | 1.36 | 0.99 | 1.07 | 0.85 | | 1.97 | 1.06 | 0.83 | 0.79 | |
| Manganese (Mn) | 0.076 | 0.016 | 0.026 | <0.0050 | | 0.093 | 0.031 | 0.039 | 0.009 | |
| Molybdenum (Mo) | <0.030 | <0.030 | <0.030 | <0.030 | | <0.030 | <0.030 | <0.030 | <0.030 | |
| Nickel (Ni) | <0.050 | <0.050 | <0.050 | <0.050 | | <0.050 | <0.050 | <0.050 | <0.050 | |
| Phosphorus (P) | <0.30 | <0.30 | <0.30 | <0.30 | | <0.30 | <0.30 | <0.30 | <0.30 | |
| Potassium (K) | <2.0 | <2.0 | <2.0 | <2.0 | | <2.0 | <2.0 | <2.0 | <2.0 | |
| Selenium (Se) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Silicon (Si) | 3.39 | 2.70 | 2.67 | 2.39 | | 6.57 | 3.62 | 3.26 | 3.33 | |
| Silver (Ag) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Sodium (Na) | 3.3 | 2.7 | 3.1 | 3.0 | | 3.0 | 2.3 | 2.1 | <2.0 | |
| Strontium (Sr) | 0.034 | 0.029 | 0.031 | 0.031 | | 0.034 | 0.023 | 0.020 | 0.018 | |
| Thallium (Tl) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Tin (Sn) | <0.030 | <0.030 | <0.030 | <0.030 | | <0.030 | <0.030 | <0.030 | <0.030 | |
| Titanium (Ti) | <0.010 | <0.010 | <0.010 | <0.010 | | 0.104 | 0.01 | 0.014 | 0.022 | |
| Vanadium (V) | <0.030 | <0.030 | <0.030 | <0.030 | | <0.030 | <0.030 | <0.030 | <0.030 | |
| Zinc (Zn) | <0.005 | <0.005 | <0.005 | <0.005 | | 0.0059 | <0.005 | <0.005 | <0.005 | |

**Table A.3**. Water quality results for water samples taken from 5 stations at the C.W. Young Channel during fall 2010. All values are expressed in mg/L unless specified otherwise.

| | 2 November 2010 | | | | | 23 November 2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **General / Physical** | | | | | | | | | | |
| Water Temperature (°C) | 7.9 | 8.0 | 8.4 | 8.4 | 8.1 | 1.0 | 0.9 | 2.0 | 2.4 | 1.3 |
| Dissolved Oxygen | 12.6 | 11.8 | 11.4 | 11.7 | 12.0 | 21.0 | 19.4 | 18.0 | 12.5 | 18.7 |
| Conductivity (µS/cm) | 118 | 138 | 158 | 148 | | 135 | 146 | 160 | 182 | |
| pH (pH units) | 7.25 | 7.48 | 7.48 | 6.98 | | 7.54 | 7.75 | 7.53 | 7.38 | |
| Alkalinity | 14.0 | 13.6 | 15.2 | 16.8 | 11.6 | 20.4 | 23.6 | 18.0 | 23.2 | 18.4 |
| Hardness, Total | 43.2 | 51.6 | 59.4 | 58.4 | | 48.1 | 53.9 | 60.2 | 68.9 | |
| Turbidity (NTU) | 4.0 | 4.0 | 4.0 | 5.0 | 3.0 | 3.0 | 6.0 | 8.0 | 1.0 | 6.0 |
| **Nutrients** | | | | | | | | | | |
| Ammonia | 0.0065 | <0.005 | 0.0748 | 0.0374 | | 0.0068 | 0.0054 | 0.0088 | 0.0638 | |
| Nitrate | 0.756 | 0.634 | 0.776 | 0.008 | | 0.447 | 0.434 | 0.621 | 0.767 | |
| Nitrite | 0.0011 | <0.0010 | 0.0112 | 0.0017 | | <0.001 | <0.001 | 0.0015 | 0.0093 | |
| Orthophosphate | <0.001 | <0.001 | 0.2260 | 0.1170 | | <0.001 | <0.001 | 0.0527 | 0.0674 | |
| Total Phosphorus | 0.030 | 0.030 | 0.299 | 0.191 | | 0.007 | 0.008 | 0.071 | 0.107 | |
| **Coliforms** | | | | | | | | | | |
| Non-fecal (CFU/100 ml) | 232 | 224 | 225 | 172 | 236 | | | | | |
| Fecal (CFU/100 ml) | 48 | 28 | 24 | 52 | 40 | | | | | |
| % fecal | 17.1 | 11.1 | 9.7 | 23.2 | 14.5 | | | | | |

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**Table A.3**. (Continued)

| | 2 November 2010 | | | | | 23 November 2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **Total Metals** | | | | | | | | | | |
| Aluminum (Al) | 0.62 | 0.60 | 0.89 | <0.20 | | <0.20 | <0.20 | 0.24 | 0.27 | |
| Antimony (Sb) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Arsenic (As) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Barium (Ba) | 0.016 | 0.016 | 0.019 | 0.013 | | 0.011 | 0.012 | 0.012 | 0.014 | |
| Berylium (Be) | <0.005 | <0.005 | <0.005 | <0.005 | | <0.005 | <0.005 | <0.005 | <0.005 | |
| Bismuth (Bi) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Boron (B) | <0.10 | <0.10 | <0.10 | <0.10 | | <0.10 | <0.10 | <0.10 | <0.10 | |
| Cadmium (Cd) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Calcium (Ca) | 13.3 | 15.9 | 17.1 | 16.3 | | 15.2 | 17.0 | 18.1 | 20.7 | |
| Chromium (Cr) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Cobalt (Co) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Copper (Cu) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Iron (Fe) | 0.803 | 0.775 | 1.030 | 0.545 | | 0.233 | 0.225 | 0.316 | 0.472 | |
| Lead (Pb) | <0.050 | <0.050 | <0.050 | <0.050 | | <0.050 | <0.050 | <0.050 | <0.050 | |
| Lithium (Li) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Magnesium (Mg) | 2.42 | 2.92 | 4.05 | 4.26 | | 2.49 | 2.80 | 3.65 | 4.21 | |
| Manganese (Mn) | 0.108 | 0.068 | 0.058 | 0.157 | | 0.056 | 0.033 | 0.034 | 0.020 | |
| Molybdenum (Mo) | <0.030 | <0.030 | <0.030 | <0.030 | | <0.030 | <0.030 | <0.030 | <0.030 | |
| Nickel (Ni) | <0.050 | <0.050 | <0.050 | <0.050 | | <0.050 | <0.050 | <0.050 | <0.050 | |
| Phosphorus (P) | <0.30 | <0.30 | 0.31 | <0.30 | | <0.30 | <0.30 | <0.30 | <0.30 | |
| Potassium (K) | <2.0 | <2.0 | 2.3 | <2.0 | | <2.0 | <2.0 | <2.0 | <2.0 | |
| Selenium (Se) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Silicon (Si) | 4.98 | 5.65 | 6.27 | 2.50 | | 5.29 | 5.61 | 5.92 | 5.12 | |
| Silver (Ag) | <0.010 | <0.010 | <0.010 | <0.010 | | <0.010 | <0.010 | <0.010 | <0.010 | |
| Sodium (Na) | 6.7 | 7.0 | 7.8 | 8.9 | | 7.4 | 6.9 | 7.5 | 7.9 | |
| Strontium (Sr) | 0.045 | 0.054 | 0.073 | 0.090 | | 0.046 | 0.051 | 0.069 | 0.094 | |
| Thallium (Tl) | <0.20 | <0.20 | <0.20 | <0.20 | | <0.20 | <0.20 | <0.20 | <0.20 | |
| Tin (Sn) | <0.030 | <0.030 | <0.030 | <0.030 | | <0.030 | <0.030 | <0.030 | <0.030 | |
| Titanium (Ti) | 0.032 | 0.029 | 0.039 | <0.010 | | <0.010 | <0.010 | 0.013 | 0.013 | |
| Vanadium (V) | <0.030 | <0.030 | <0.030 | <0.030 | | <0.030 | <0.030 | <0.030 | <0.030 | |
| Zinc (Zn) | <0.005 | 0.0056 | 0.0057 | 0.0064 | | <0.005 | <0.005 | <0.005 | <0.005 | |

**Table A.4**. Water quality results for water samples taken from 5 stations at the C.W. Young Channel during fall 2011. All values are expressed in mg/L unless specified otherwise.

| | 30 October 2011 | | | | | 20 November 2011 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **General / Physical** | | | | | | | | | | |
| Water Temperature (°C) | 9.7 | 8.2 | 8.3 | 8.9 | 9.9 | 2.1 | 1.9 | 2.3 | 2.5 | 2.3 |
| Dissolved Oxygen | 10.7 | 10.3 | 10.2 | 10.2 | 11.1 | 12.6 | 12.1 | 11.9 | 11.4 | 12.6 |
| Conductivity (µS/cm) | 24.7 | | 50.3 | 53.3 | | 22.5 | | 46.4 | 44.2 | |
| pH (pH units) | 7.84 | | 7.78 | 7.78 | | 7.25 | | 7.27 | 7.11 | |
| Alkalinity | 21.2 | 22.8 | 24.8 | 25.6 | 25.6 | 16.4 | 19.2 | 15.2 | 24 | 16.8 |
| Hardness, Total | 9.3 | | 15.2 | 16.4 | | 8.1 | | 13.1 | 14.3 | |
| Turbidity (NTU) | 0.33 | 0.60 | 0.93 | 1.08 | 0.39 | 1.49 | 2.64 | 1.75 | 0.83 | 1.15 |
| **Nutrients** | | | | | | | | | | |
| Ammonia | <0.005 | | <0.005 | <0.005 | | <0.005 | | <0.005 | <0.005 | <0.005 |
| Nitrate | 0.037 | | 0.039 | 0.044 | | 0.049 | | 0.054 | 0.057 | 0.037 |
| Nitrite | <0.001 | | <0.001 | <0.001 | | <0.001 | | <0.001 | <0.001 | <0.001 |
| Orthophosphate | <0.001 | | <0.001 | <0.001 | | <0.001 | | <0.001 | <0.001 | <0.001 |
| Total Phosphorus | 0.0024 | | 0.0032 | 0.0132 | | 0.0024 | | 0.0033 | 0.0160 | 0.0024 |
| **Coliforms** | | | | | | | | | | |
| Non-fecal (CFU/100 ml) | 32 | 264 | 658 | 840 | 520 | | | | | |
| Fecal (CFU/100 ml) | 0 | 8 | 28 | 32 | 12 | | | | | |
| % fecal | 0.0 | 2.9 | 4.1 | 3.7 | 2.3 | | | | | |

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**Table A.4**. (Continued)

| | 30 October 2011 | | | | | 20 November 2011 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **Total Metals** | | | | | | | | | | |
| Aluminum (Al) | <0.20 | | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | |
| Antimony (Sb) | <0.20 | | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | |
| Arsenic (As) | <0.20 | | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | |
| Barium (Ba) | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | |
| Berylium (Be) | <0.005 | | <0.005 | <0.005 | | <0.005 | | <0.005 | <0.005 | |
| Bismuth (Bi) | <0.20 | | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | |
| Boron (B) | <0.10 | | <0.10 | <0.10 | | <0.10 | | <0.10 | <0.10 | |
| Cadmium (Cd) | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | |
| Calcium (Ca) | 2.83 | | 4.81 | 5.16 | | 2.44 | | 4.08 | 4.44 | |
| Chromium (Cr) | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | |
| Cobalt (Co) | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | |
| Copper (Cu) | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | |
| Iron (Fe) | 0.070 | | 0.047 | 0.043 | | 0.052 | | 0.061 | 0.066 | |
| Lead (Pb) | <0.050 | | <0.050 | <0.050 | | <0.050 | | <0.050 | <0.050 | |
| Lithium (Li) | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | |
| Magnesium (Mg) | 0.53 | | 0.78 | 0.85 | | 0.50 | | 0.70 | 0.77 | |
| Manganese (Mn) | <0.0050 | | <0.0050 | <0.0050 | | <0.0050 | | <0.0050 | <0.0050 | |
| Molybdenum (Mo) | <0.030 | | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | |
| Nickel (Ni) | <0.050 | | <0.050 | <0.050 | | <0.050 | | <0.050 | <0.050 | |
| Phosphorus (P) | <0.30 | | <0.30 | <0.30 | | <0.30 | | <0.30 | <0.30 | |
| Potassium (K) | <2.0 | | <2.0 | <2.0 | | <2.0 | | <2.0 | <2.0 | |
| Selenium (Se) | <0.20 | | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | |
| Silicon (Si) | 3.04 | | 3.34 | 3.45 | | 2.92 | | 3.13 | 3.12 | |
| Silver (Ag) | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | |
| Sodium (Na) | <2.0 | | 3.3 | 3.5 | | <2.0 | | 2.6 | 2.9 | |
| Strontium (Sr) | 0.014 | | 0.035 | 0.037 | | 0.013 | | 0.028 | 0.031 | |
| Thallium (Tl) | <0.20 | | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | |
| Tin (Sn) | <0.030 | | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | |
| Titanium (Ti) | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | |
| Vanadium (V) | <0.030 | | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | |
| Zinc (Zn) | <0.005 | | <0.005 | <0.005 | | <0.005 | | <0.005 | <0.005 | |

**Table A.5**. Water quality results for water samples taken from 5 stations at the C.W. Young Channel during fall 2012. All values are expressed in mg/L unless specified otherwise.

| | 28 October 2012 | | | | | 20 November 2012 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **General / Physical** | | | | | | | | | | |
| Water Temperature (°C) | 7.3 | 7.8 | 8.1 | 8.3 | 7.8 | 6.0 | 5.8 | 5.7 | 6.0 | 6.2 |
| Dissolved Oxygen | 11.5 | 10.6 | 10.5 | 10.6 | 10.6 | 11.0 | 9.9 | 9.9 | 9.5 | 10.8 |
| Conductivity (µS/cm) | 57.0 | | 71.0 | | 59.7 | 37.9 | | 40.5 | | 34.8 |
| pH (pH units) | 7.52 | | 7.54 | | 7.54 | 7.41 | | 7.39 | | 7.34 |
| Alkalinity | 18.4 | 18.0 | 18.8 | 20.8 | 17.6 | 20.0 | 14.8 | 14.0 | 20.6 | 15.0 |
| Hardness, Total | 22.6 | | 25.9 | | 23.5 | 15.6 | | 16.5 | | 14.7 |
| Turbidity (NTU) | 0.80 | 0.50 | 0.50 | 0.70 | 0.70 | 1.46 | 1.68 | 1.75 | 2.42 | 1.42 |
| **Nutrients** | | | | | | | | | | |
| Ammonia | <0.005 | | <0.005 | | <0.005 | <0.005 | | 0.0247 | | <0.005 |
| Nitrate | 0.0119 | | 0.0092 | | 0.0065 | 0.0525 | | 0.0485 | | 0.0353 |
| Nitrite | <0.001 | | <0.001 | | <0.001 | <0.001 | | <0.001 | | <0.001 |
| Orthophosphate | <0.001 | | <0.001 | | <0.001 | 0.0018 | | 0.0040 | | 0.0010 |
| Total Phosphorus | 0.0032 | | 0.0057 | | 0.0048 | 0.0084 | | 0.0150 | | 0.0075 |
| **Coliforms** | | | | | | | | | | |
| Non-fecal (CFU/100 ml) | | | 48 | 44 | 60 | | | | | |
| Fecal (CFU/100 ml) | | | 7 | 4 | 7 | | | | | |
| % fecal | | | 12.7 | 8.3 | 10.4 | | | | | |

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**Table A.5**. (Continued)

| | 28 October 2012 | | | | | 20 November 2012 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **Total Metals** | | | | | | | | | | |
| Aluminum (Al) | <0.20 | | <0.20 | | <0.20 | 0.20 | | 0.25 | | 0.29 |
| Antimony (Sb) | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | | <0.20 |
| Arsenic (As) | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | | <0.20 |
| Barium (Ba) | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 |
| Berylium (Be) | <0.005 | | <0.005 | | <0.005 | <0.005 | | <0.005 | | <0.005 |
| Bismuth (Bi) | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | | <0.20 |
| Boron (B) | <0.10 | | <0.10 | | <0.10 | <0.10 | | <0.10 | | <0.10 |
| Cadmium (Cd) | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 |
| Calcium (Ca) | 7.80 | | 8.75 | | 7.90 | 5.10 | | 5.37 | | 4.71 |
| Chromium (Cr) | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 |
| Cobalt (Co) | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 |
| Copper (Cu) | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | | 0.024 |
| Iron (Fe) | 0.045 | | 0.144 | | 0.126 | 0.171 | | 0.284 | | 0.269 |
| Lead (Pb) | <0.050 | | <0.050 | | <0.050 | <0.050 | | <0.050 | | <0.050 |
| Lithium (Li) | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 |
| Magnesium (Mg) | 0.76 | | 1.00 | | 0.90 | 0.70 | | 0.75 | | 0.72 |
| Manganese (Mn) | <0.005 | | 0.0062 | | <0.005 | <0.005 | | 0.0086 | | 0.0056 |
| Molybdenum (Mo) | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | | <0.030 |
| Nickel (Ni) | <0.050 | | <0.050 | | <0.050 | <0.050 | | <0.050 | | <0.050 |
| Phosphorus (P) | <0.30 | | <0.30 | | <0.30 | <0.30 | | <0.30 | | <0.30 |
| Potassium (K) | <2.0 | | <2.0 | | <2.0 | <2.0 | | <2.0 | | <2.0 |
| Selenium (Se) | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | | <0.20 |
| Silicon (Si) | 1.98 | | 2.27 | | 2.26 | 2.59 | | 2.59 | | 2.70 |
| Silver (Ag) | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | | <0.010 |
| Sodium (Na) | 3.2 | | 4.7 | | 3.6 | <2.0 | | <2.0 | | <2.0 |
| Strontium (Sr) | 0.0328 | | 0.0391 | | 0.0374 | 0.0193 | | 0.0207 | | 0.0197 |
| Thallium (Tl) | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | | <0.20 |
| Tin (Sn) | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | | <0.030 |
| Titanium (Ti) | <0.010 | | <0.010 | | <0.010 | <0.010 | | 0.011 | | 0.015 |
| Vanadium (V) | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | | <0.030 |
| Zinc (Zn) | <0.005 | | <0.005 | | <0.005 | <0.005 | | <0.005 | | <0.005 |

**Table A.6**. Water quality results for water samples taken from 5 stations at the C.W. Young Channel during fall 2013. All values are expressed in mg/L unless specified otherwise.

| | 30 October 2013 | | | | | 20 November 2013 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **General / Physical** | | | | | | | | | | |
| Water Temperature (°C) | 4.9 | 5.1 | 5.6 | 5.6 | 6.4 | 2.8 | 3.2 | 3.3 | 3.3 | 3.1 |
| Dissolved Oxygen | 13.4 | 12.7 | 13.0 | 12.9 | 13.3 | 14.6 | 12.9 | 13.1 | 13.0 | 14.1 |
| Conductivity (µS/cm) | 118 | 116 | | 119 | | 64.1 | 64.6 | | 77.4 | |
| pH (pH units) | 7.69 | 7.64 | | 7.70 | | 7.55 | 7.48 | | 7.54 | |
| Alkalinity | 27.2 | 26.0 | 25.2 | 27.6 | 31.2 | 23.6 | 22.4 | 22.2 | 27.2 | 27.6 |
| Hardness, Total | 37.8 | 37.4 | | 41.6 | | 23.6 | 24.1 | | 29.9 | |
| Turbidity (NTU) | 1.38 | 0.55 | 0.71 | 0.63 | 0.64 | 2.04 | 1.62 | 3.43 | 1.78 | 2.19 |
| **Nutrients** | | | | | | | | | | |
| Ammonia | <0.005 | 0.0099 | | 0.0084 | | <0.005 | 0.0096 | | 0.0294 | |
| Nitrate | 0.0259 | 0.0202 | | 0.0444 | | 0.0538 | 0.0584 | | 0.0921 | |
| Nitrite | <0.001 | <0.001 | | 0.0014 | | <0.001 | 0.0014 | | 0.0032 | |
| Total Nitrogen | 0.064 | 0.069 | | 0.103 | | 0.157 | 0.167 | | 0.227 | |
| Orthophosphate | <0.001 | <0.001 | | 0.0018 | | 0.0018 | 0.0025 | | 0.0076 | |
| Total Phosphorus | 0.0027 | 0.0040 | | 0.0060 | | 0.0059 | 0.0091 | | 0.0148 | |
| **Coliforms** | | | | | | | | | | |
| Non-fecal (CFU/100 ml) | 456 | 608 | 804 | 864 | 368 | | | | | |
| Fecal (CFU/100 ml) | 12 | 12 | 8 | 40 | 12 | | | | | |
| % fecal | 2.6 | 1.9 | 1.0 | 4.4 | 3.2 | | | | | |

(Continued on next page)

**Table A.6**. (Continued)

| | 30 October 2013 | | | | | 20 November 2013 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **Total Metals** | | | | | | | | | | |
| Aluminum (Al) | <0.20 | <0.20 | | <0.20 | | <0.20 | 0.26 | | <0.20 | |
| Antimony (Sb) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Arsenic (As) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Barium (Ba) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Berylium (Be) | <0.005 | <0.005 | | <0.005 | | <0.005 | <0.005 | | <0.005 | |
| Bismuth (Bi) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Boron (B) | <0.10 | <0.10 | | <0.10 | | <0.10 | <0.10 | | <0.10 | |
| Cadmium (Cd) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Calcium (Ca) | 12.9 | 12.7 | | 13.1 | | 7.84 | 7.92 | | 8.97 | |
| Chromium (Cr) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Cobalt (Co) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Copper (Cu) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Iron (Fe) | 0.033 | 0.097 | | 0.145 | | 0.107 | 0.339 | | 0.243 | |
| Lead (Pb) | <0.050 | <0.050 | | <0.050 | | <0.050 | <0.050 | | <0.050 | |
| Lithium (Li) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Magnesium (Mg) | 1.38 | 1.39 | | 2.16 | | 0.98 | 1.04 | | 1.82 | |
| Manganese (Mn) | <0.005 | 0.0063 | | 0.0065 | | <0.005 | 0.0125 | | 0.0086 | |
| Molybdenum (Mo) | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | |
| Nickel (Ni) | <0.050 | <0.050 | | <0.050 | | <0.050 | <0.050 | | <0.050 | |
| Phosphorus (P) | <0.30 | <0.30 | | <0.30 | | <0.30 | <0.30 | | <0.30 | |
| Potassium (K) | <2.0 | <2.0 | | <2.0 | | <2.0 | <2.0 | | <2.0 | |
| Selenium (Se) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Silicon (Si) | 2.98 | 2.97 | | 3.52 | | 3.02 | 3.31 | | 3.57 | |
| Silver (Ag) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Sodium (Na) | 8.4 | 8.3 | | 7.9 | | 3.7 | 3.6 | | 3.8 | |
| Strontium (Sr) | 0.0602 | 0.0587 | | 0.0565 | | 0.0341 | 0.0342 | | 0.0355 | |
| Thallium (Tl) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Tin (Sn) | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | |
| Titanium (Ti) | <0.010 | <0.010 | | <0.010 | | <0.010 | 0.014 | | <0.010 | |
| Vanadium (V) | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | |
| Zinc (Zn) | <0.005 | <0.005 | | <0.005 | | <0.005 | <0.005 | | <0.005 | |

**Table A.7**. Water quality results for water samples taken from 5 stations at the C.W. Young Channel during fall 2014. All values are expressed in mg/L unless specified otherwise.

| | 27 October 2014 | | | | | 17 November 2014 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **General / Physical** | | | | | | | | | | |
| Water Temperature (ºC) | 8.4 | 8.3 | 8.8 | 8.8 | 9.0 | 2.1 | 1.7 | 1.8 | 2.0 | 2.1 |
| Dissolved Oxygen | 13.5 | 13.5 | 13.2 | 11.6 | 12.8 | 17.2 | 16.9 | 15.3 | 15.4 | 19.1 |
| Conductivity (µS/cm) | 44.4 | 44.4 | | 60.3 | | 71.5 | 67.9 | | 79.1 | |
| pH (pH units) | 7.41 | 7.35 | | 7.44 | | 7.59 | 7.12 | | 7.50 | |
| Alkalinity | 14.9 | 15.1 | 15.2 | 19.9 | 19.8 | 18.3 | 19.6 | 18.4 | 25.0 | 23.6 |
| Hardness, Total | 17.8 | 18.0 | | 24.2 | | 26.2 | 25.9 | | 30.4 | |
| Turbidity (NTU) | 4.40 | 3.56 | 4.99 | 5.23 | 3.58 | 1.24 | 0.80 | 0.71 | 1.09 | 1.86 |
| **Nutrients** | | | | | | | | | | |
| Ammonia | 0.0070 | 0.0135 | | 0.0280 | | <0.005 | 0.0084 | | 0.0165 | |
| Nitrate | 0.0711 | 0.0720 | | 0.139 | | 0.0528 | 0.0508 | | 0.0813 | |
| Nitrite | <0.001 | <0.001 | | 0.0015 | | <0.001 | <0.001 | | <0.001 | |
| Total Nitrogen | 0.301 | 0.238 | | 1.78 | | 0.098 | 0.132 | | 0.177 | |
| Orthophosphate | 0.0014 | 0.0026 | | 0.0036 | | <0.001 | 0.0024 | | 0.0050 | |
| Total Phosphorus | 0.0099 | 0.0103 | | 0.219 | | 0.0020 | 0.0053 | | 0.0067 | |
| **Coliforms** | | | | | | | | | | |
| Non-fecal (CFU/100 ml) | 136 | 160 | 616 | 520 | 576 | | | | | |
| Fecal (CFU/100 ml) | 8 | 20 | 44 | 28 | 60 | | | | | |
| % fecal | 5.6 | 11.1 | 6.7 | 5.1 | 9.4 | | | | | |

(Continued on next page)

**Table A.7**. (Continued)

| | 27 October 2014 | | | | | 17 November 2014 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **Total Metals** | | | | | | | | | | |
| Aluminum (Al) | 0.29 | 0.29 | | 0.49 | | <0.20 | <0.20 | | <0.20 | |
| Antimony (Sb) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Arsenic (As) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Barium (Ba) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Berylium (Be) | <0.005 | <0.005 | | <0.005 | | <0.005 | <0.005 | | <0.005 | |
| Bismuth (Bi) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Boron (B) | <0.10 | <0.10 | | <0.10 | | <0.10 | <0.10 | | <0.10 | |
| Cadmium (Cd) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Calcium (Ca) | 5.72 | 5.80 | | 7.01 | | 8.73 | 8.66 | | 9.34 | |
| Chromium (Cr) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Cobalt (Co) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Copper (Cu) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Iron (Fe) | 0.354 | 0.391 | | 0.708 | | 0.164 | 0.135 | | 0.147 | |
| Lead (Pb) | <0.050 | <0.050 | | <0.050 | | <0.050 | <0.050 | | <0.050 | |
| Lithium (Li) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Magnesium (Mg) | 0.86 | 0.86 | | 1.63 | | 1.06 | 1.05 | | 1.71 | |
| Manganese (Mn) | 0.0078 | 0.0140 | | 0.0175 | | <0.005 | 0.0061 | | 0.0061 | |
| Molybdenum (Mo) | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | |
| Nickel (Ni) | <0.050 | <0.050 | | <0.050 | | <0.050 | <0.050 | | <0.050 | |
| Phosphorus (P) | <0.30 | <0.30 | | <0.30 | | <0.30 | <0.30 | | <0.30 | |
| Potassium (K) | <2.0 | <2.0 | | <2.0 | | <2.0 | <2.0 | | <2.0 | |
| Selenium (Se) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Silicon (Si) | 3.24 | 3.24 | | 3.81 | | 3.20 | 3.17 | | 3.52 | |
| Silver (Ag) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Sodium (Na) | 2.2 | 2.2 | | 2.6 | | 4.2 | 4.1 | | 4.1 | |
| Strontium (Sr) | 0.0201 | 0.0205 | | 0.0236 | | 0.0367 | 0.0356 | | 0.0358 | |
| Thallium (Tl) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Tin (Sn) | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | |
| Titanium (Ti) | 0.017 | 0.013 | | 0.024 | | <0.010 | <0.010 | | <0.010 | |
| Vanadium (V) | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | |
| Zinc (Zn) | <0.005 | <0.005 | | <0.005 | | <0.005 | <0.005 | | <0.005 | |

**Table A.8**. Water quality results for water samples taken from 5 stations at the C.W. Young Channel during fall 2015. All values are expressed in mg/L unless specified otherwise.

| | 4 November 2015 | | | | | 25 November 2015 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **General / Physical** | | | | | | | | | | |
| Water Temperature (°C) | 7.2 | 7.2 | 7.3 | 7.2 | 7.3 | 3.1 | 3.1 | 2.7 | 2.9 | 3.5 |
| Dissolved Oxygen | 11.6 | 10.7 | 10.6 | 10.4 | 11.4 | 12.8 | 12.1 | 12.2 | 11.9 | 12.9 |
| Conductivity (µS/cm) | 62.9 | 62.2 | | 73.4 | | 67.0 | 66.3 | | 78.7 | |
| pH (pH units) | 7.50 | 7.34 | | 7.36 | | 7.46 | 7.42 | | 7.60 | |
| Alkalinity | 19.4 | 21.6 | 20.5 | 25.0 | 17.6 | 18.8 | 19.4 | 19.1 | 23.1 | 18.0 |
| Hardness, Total | 22.9 | 23.3 | | 28.6 | | 23.8 | 23.7 | | 29.1 | |
| Turbidity (NTU) | 0.68 | 1.39 | 5.26 | 1.60 | 0.80 | 1.81 | 2.44 | 2.12 | 1.72 | 0.98 |
| **Nutrients** | | | | | | | | | | |
| Ammonia | <0.005 | <0.005 | | 0.0256 | | <0.005 | 0.0113 | | 0.0255 | |
| Nitrate | 0.0939 | 0.0812 | | 0.0932 | | 0.143 | 0.146 | | 0.157 | |
| Nitrite | <0.001 | <0.001 | | <0.001 | | <0.001 | <0.001 | | <0.001 | |
| Total Nitrogen | 0.161 | 0.156 | | 0.236 | | 0.259 | 0.315 | | 0.302 | |
| Orthophosphate | <0.001 | <0.001 | | 0.0034 | | 0.0021 | 0.0036 | | 0.0059 | |
| Total Phosphorus | <0.002 | 0.0030 | | 0.0078 | | 0.0051 | 0.0070 | | 0.0104 | |
| **Coliforms** | | | | | | | | | | |
| Non-fecal (CFU/100 ml) | 424 | 696 | 464 | 304 | 232 | | | | | |
| Fecal (CFU/100 ml) | 4 | 64 | 20 | 168 | 44 | | | | | |
| % fecal | 0.9 | 8.4 | 4.1 | 35.6 | 15.9 | | | | | |

(Continued on next page)

**Table A.8**. (Continued)

| | 4 November 2015 | | | | | 25 November 2015 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameters** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| **Total Metals** | | | | | | | | | | |
| Aluminum (Al) | <0.20 | <0.20 | | 0.31 | | <0.20 | <0.20 | | <0.20 | |
| Antimony (Sb) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Arsenic (As) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Barium (Ba) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Berylium (Be) | <0.005 | <0.005 | | <0.005 | | <0.005 | <0.005 | | <0.005 | |
| Bismuth (Bi) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Boron (B) | <0.10 | <0.10 | | <0.10 | | <0.10 | <0.10 | | <0.10 | |
| Cadmium (Cd) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Calcium (Ca) | 7.85 | 7.98 | | 8.88 | | 7.80 | 7.75 | | 8.72 | |
| Chromium (Cr) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Cobalt (Co) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Copper (Cu) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Iron (Fe) | 0.042 | 0.106 | | 0.426 | | 0.117 | 0.219 | | 0.238 | |
| Lead (Pb) | <0.050 | <0.050 | | <0.050 | | <0.050 | <0.050 | | <0.050 | |
| Lithium (Li) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Magnesium (Mg) | 0.79 | 0.83 | | 1.55 | | 1.04 | 1.06 | | 1.77 | |
| Manganese (Mn) | <0.005 | 0.0055 | | 0.0115 | | <0.005 | 0.0068 | | 0.0067 | |
| Molybdenum (Mo) | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | |
| Nickel (Ni) | <0.050 | <0.050 | | <0.050 | | <0.050 | <0.050 | | <0.050 | |
| Phosphorus (P) | <0.30 | <0.30 | | <0.30 | | <0.30 | <0.30 | | <0.30 | |
| Potassium (K) | <2.0 | <2.0 | | <2.0 | | <2.0 | <2.0 | | <2.0 | |
| Selenium (Se) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Silicon (Si) | 2.50 | 2.61 | | 3.38 | | 3.41 | 3.43 | | 3.84 | |
| Silver (Ag) | <0.010 | <0.010 | | <0.010 | | <0.010 | <0.010 | | <0.010 | |
| Sodium (Na) | 2.9 | 2.9 | | 3.2 | | 3.9 | 3.8 | | 3.9 | |
| Strontium (Sr) | 0.0300 | 0.0307 | | 0.0335 | | 0.0339 | 0.0335 | | 0.0347 | |
| Thallium (Tl) | <0.20 | <0.20 | | <0.20 | | <0.20 | <0.20 | | <0.20 | |
| Tin (Sn) | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | |
| Titanium (Ti) | <0.010 | <0.010 | | 0.016 | | <0.010 | 0.011 | | 0.010 | |
| Vanadium (V) | <0.030 | <0.030 | | <0.030 | | <0.030 | <0.030 | | <0.030 | |
| Zinc (Zn) | <0.005 | <0.005 | | <0.005 | | <0.005 | <0.005 | | <0.005 | |

# 9. Appendix B

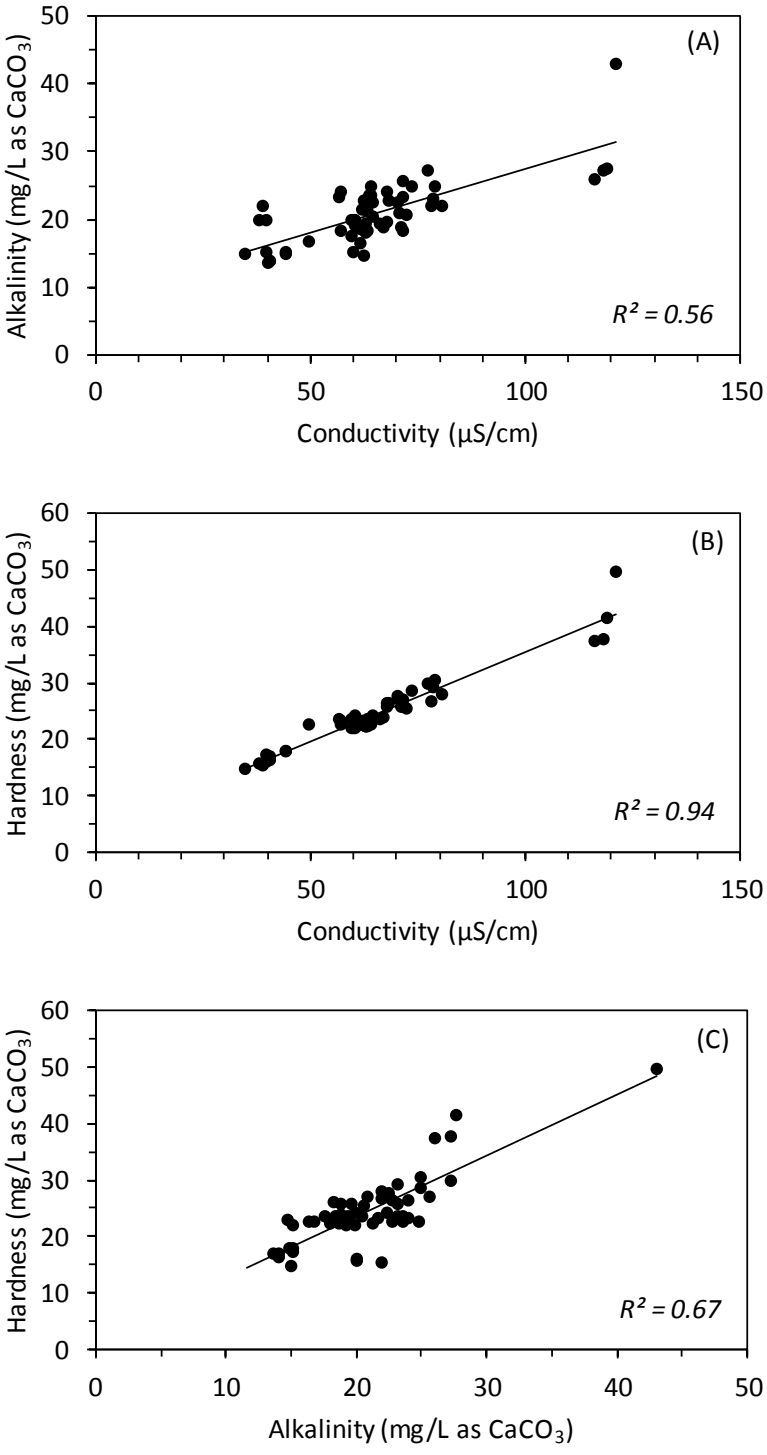


**Figure B.1**. Linear relationships between (A) alkalinity and conductivity, (B) hardness and conductivity, and (C) harness and alkalinity measured at five stations in the C.W. Young Channel and Englishman River during two sampling events in 2008-2015.

# 10.Appendix C

**Table C.1**. Invertebrate Survey Field Data Sheet completed for triplicate stream invertebrate samples collected at Stations 1, 3 and 4 on the C.W. Young Channel during 2008.

**INVERTEBRATE SURVEY FIELD DATA SHEET** (Page 1 of 2)

| Stream Name: | C.W. Young Channel, Englishman River | | Date: 28 October 2008 |
|---|---|---|---|
| Station Name: | **Station 1** | | Flow status: Low |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ | |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 30 | 3 |
| | Mayfly Nymph (EPT) | 97 | 3 |
| | Stonefly Nymph (EPT) | 24 | 2 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 151 | 8 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | 19 | 2 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 19 | 2 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 98 | 1 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | | |
| | Planarian (flatworm) | 1 | 1 |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | 1 | 1 |
| **Sub-Total** | | 100 | 3 |
| **TOTAL** | | 270 | 13 |

**Table C.1**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 270

**DENSITY:** Invertebrate density per square metre:

270 ÷ 0.27 = 1000

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Aquatic Worm (oligochaete)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 22-17 | 16-11 | <11 |

3 x D1 + 2 x D2 + D3

3 x __8__ + 2 x __2__ + __3__ = 31

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-5 | 0-1 |

EPT4 + EPT5 + EPT6

__3__ + __3__ + __2__ = 8

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.75 | 0.25-0.50 | 0-0.25 |

(EPT1 + EPT2 + EPT3) / CT

(__30_ + __97_ + __24_) / _270_= 0.56

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 13

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0-0.40 | 0.40-0.60 | 0.60-0.80 | 0.80-1.0 |

Col. C for S3 / CT

__98_ / _270_= 0.36

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 3 |
| EPT To Total Ratio | 3 |
| Predominant Taxon Ratio | 4 |

| Average Rating |
|---|
| 3.50 |

**Table C.1**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: | C.W. Young Channel, Englishman River | | Date: 28 October 2008 |
|---|---|---|---|
| Station Name: | **Station 3** | | Flow status: Low |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ | |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 18 | 2 |
| | Mayfly Nymph (EPT) | 95 | 2 |
| | Stonefly Nymph (EPT) | 38 | 1 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 151 | 5 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | 16 | 2 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 16 | 2 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 13 | 1 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | 1 | 1 |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 14 | 2 |
| **TOTAL** | | 181 | 9 |

**Table C.1**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 181

**DENSITY:** Invertebrate density per square metre:

181 ÷ 0.27 = 670

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayphly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 22-17 | 16-11 | <11 |

3 x D1 + 2 x D2 + D3

3 x __5__ + 2 x __2__ + __2__ = 21

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-5 | 0-1 |

EPT4 + EPT5 + EPT6

__2__ + __2__ + __1__ = 5

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.75 | 0.25-0.50 | 0-0.25 |

(EPT1 + EPT2 + EPT3) / CT

(__18_ + __95_ + __38_) / _181_= 0.83

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 9

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0-0.40 | 0.40-0.60 | 0.60-0.80 | 0.80-1.0 |

Col. C for S3 / CT

__95_ / _181_= 0.52

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 3 |
| EPT Index | 3 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 3 |

| Average Rating |
|---|
| 3.25 |

**Table C.1**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: | C.W. Young Channel, Englishman River | | Date: 28 October 2008 |
|---|---|---|---|
| Station Name: | **Station 4** | | Flow status: Low |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ | |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 3 | 1 |
| | Mayfly Nymph (EPT) | 63 | 2 |
| | Stonefly Nymph (EPT) | 25 | 1 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | 4 | 1 |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 95 | 5 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | 3 | 1 |
| | Clam, Mussel | | |
| | Cranefly Larva | 5 | 2 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | 72 | 2 |
| | Watersnipe Larva | | |
| **Sub-Total** | | 80 | 5 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 42 | 1 |
| | Blackfly Larva | | |
| | Leech | 3 | 1 |
| | Midge Larva (chironomid) | 8 | 1 |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 53 | 3 |
| **TOTAL** | | 228 | 13 |

**Table C.1**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 228

**DENSITY:** Invertebrate density per square metre:

228 ÷ 0.27 = 844

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Scud (amphipod)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 22-17 | 16-11 | <11 |

3 x D1 + 2 x D2 + D3

3 x __5__ + 2 x __5__ + __3__ = 28

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-5 | 0-1 |

EPT4 + EPT5 + EPT6

__1__ + __2__ + __1__ = 4

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.75 | 0.25-0.50 | 0-0.25 |

(EPT1 + EPT2 + EPT3) / CT

(__3_ + __63_ + __25_) / _228_= 0.40

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 13

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0-0.40 | 0.40-0.60 | 0.60-0.80 | 0.80-1.0 |

Col. C for S3 / CT

__72_ / _228_= 0.32

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 2 |
| EPT To Total Ratio | 2 |
| Predominant Taxon Ratio | 4 |

| Average Rating |
|---|
| 3.00 |

**Table C.2**. Invertebrate Survey Field Data Sheet completed for triplicate stream invertebrate samples collected at Stations 1, 3 and 4 on the C.W. Young Channel during 2009.

**INVERTEBRATE SURVEY FIELD DATA SHEET** (Page 1 of 2)

| Stream Name: | CW Young Channel | | Date: | 4 November 2009 |
|---|---|---|---|---|
| Station Name: | **Station 1** | | Flow status: | Moderate |
| Sampler Used: | Number of replicates | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates | | |
| Hess | 3 | 0.09 x 3 = | 0.27 | $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 3 | 1 |
| | Mayfly Nymph (EPT) | 133 | 3 |
| | Stonefly Nymph (EPT) | 20 | 1 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 156 | 5 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | | |
| | Crayfish | | |
| | Damselfly Larva | 1 | 1 |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | 20 | 2 |
| | Watersnipe Larva | | |
| **Sub-Total** | | 21 | 3 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 14 | 1 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | 1 | 1 |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 15 | 2 |
| **TOTAL** | | 192 | 10 |

**Table C.2**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 192

**DENSITY:** Invertebrate density per square metre:

192 ÷ 0.27 = 711

**PREDOMINANT TAXON:**
Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 22-17 | 16-11 | <11 |

3 x D1 + 2 x D2 + D3

3 x 5 + 2 x 3 + 2 = 23

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 3 + 1 = 5

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 3 + 133 + 20 ) / 192 = 0.81

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 10

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

133 / 192 = 0.69

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 3 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 2 |

| Average Rating |
|---|
| 3.25 |

**Table C.2**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young Channel | | Date: 4 November 2009 |
|---|---|---|
| Station Name: **Station 3** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | | |
| | Mayfly Nymph (EPT) | | |
| | Stonefly Nymph (EPT) | | |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 0 | 0 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | | |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 0 | 0 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 18 | 1 |
| | Blackfly Larva | | |
| | Leech | 1 | 1 |
| | Midge Larva (chironomid) | | |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 19 | 2 |
| **TOTAL** | | 19 | 2 |

**Table C.2**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 19

**DENSITY:** Invertebrate density per square metre:

19 ÷ 0.27 = 70

**PREDOMINANT TAXON:**
Invertebrate group with the highest number counted (Col. C): Aquatic Worm (oligochaete)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 22-17 | 16-11 | <11 |

3 x D1 + 2 x D2 + D3

3 x 0 + 2 x 0 + 2 = 2

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

0 + 0 + 0 = 0

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 0 + 0 + 0 ) / 19 = 0.00

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 2

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

18 / 19 = 0.95

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 1 |
| EPT Index | 1 |
| EPT To Total Ratio | 1 |
| Predominant Taxon Ratio | 1 |

| Average Rating |
|---|
| 1.00 |

**Table C.2**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young Channel | | Date: 4 November 2009 |
|---|---|---|
| Station Name: **Station 4** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| Category 1<br>Pollution Intolerant | Caddisfly Larva (EPT) | | |
| | Mayfly Nymph (EPT) | 15 | 2 |
| | Stonefly Nymph (EPT) | 1 | 1 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 16 | 3 |
| Category 2<br>Somewhat Pollution Tolerant | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | 2 | 1 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 2 | 1 |
| Category 3<br>Pollution Tolerant | Aquatic Worm (oligochaete) | 5 | 1 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | | |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 5 | 1 |
| **TOTAL** | | 23 | 5 |

**Table C.2**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 23

**DENSITY:** Invertebrate density per square metre:

23 ÷ 0.27 = 85

**PREDOMINANT TAXON:**
Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 22-17 | 16-11 | <11 |

3 x D1 + 2 x D2 + D3

3 x 9 + 2 x 1 + 1 = 12

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

0 + 2 + 1 = 3

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 0 + 15 + 1 ) / 23 = 0.70

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 5

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

15 / 23 = 0.65

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 2 |
| EPT Index | 2 |
| EPT To Total Ratio | 3 |
| Predominant Taxon Ratio | 2 |

| Average Rating |
|---|
| 2.25 |

**Table C.3**. Invertebrate Survey Field Data Sheet completed for triplicate stream invertebrate samples collected at Stations 1, 3 and 4 on the C.W. Young Channel during 2010.

**INVERTEBRATE SURVEY FIELD DATA SHEET** (Page 1 of 2)

| Stream Name: | CW Young | | Date: | 2 November 2010 |
|---|---|---|---|---|
| Station Name: | **Station 1** | | Flow status: | Moderate |
| Sampler Used: | Number of replicates | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates | | |
| Hess | 3 | 0.09 x 3 = | 0.27 | $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 5 | 1 |
| | Mayfly Nymph (EPT) | 47 | 2 |
| | Stonefly Nymph (EPT) | 228 | 3 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 280 | 6 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | | |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | 42 | 1 |
| | Watersnipe Larva | | |
| **Sub-Total** | | 42 | 1 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 12 | 2 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | | |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 12 | 2 |
| **TOTAL** | | 334 | 9 |

**Table C.3**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 334

**DENSITY:** Invertebrate density per square metre:

334 ÷ 0.27 = 1237

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Stonefly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 22-17 | 16-11 | <11 |

3 x D1 + 2 x D2 + D3

3 x 6 + 2 x 1 + 2 = 22

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-5 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 2 + 3 = 6

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 5 + 47 + 228 ) / 334 = 0.84

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 9

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

228 / 334 = 0.68

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 3 |
| EPT Index | 3 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 2 |

| Average Rating |
|---|
| 3.00 |

**Table C.3**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young | | Date: 2 November 2010 |
|---|---|---|
| Station Name: **Station 3** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 20 | 2 |
| | Mayfly Nymph (EPT) | 78 | 3 |
| | Stonefly Nymph (EPT) | 163 | 3 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 261 | 8 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | 10 | 4 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | 1 | 1 |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 11 | 5 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 15 | 3 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | | |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 15 | 3 |
| **TOTAL** | | 287 | 16 |

**Table C.3**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 287

**DENSITY:** Invertebrate density per square metre:

287 ÷ 0.27 = 1063

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): 163

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 22-17 | 16-11 | <11 |

3 x D1 + 2 x D2 + D3

3 x 8 + 2 x 5 + 3 = 37

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-5 | 0-1 |

EPT4 + EPT5 + EPT6

2 + 3 + 3 = 8

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 20 + 78 + 163 ) / 287 = 0.91

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 16

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

163 / 287 = 0.57

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 3 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 3 |

| Average Rating |
|---|
| 3.50 |

**Table C.3**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young | | Date: 2 November 2010 |
|---|---|---|
| Station Name: **Station 4** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 18 | 1 |
| | Mayfly Nymph (EPT) | 127 | 2 |
| | Stonefly Nymph (EPT) | 115 | 3 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 260 | 6 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | 1 | 1 |
| | Clam, Mussel | | |
| | Cranefly Larva | 3 | 2 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 4 | 3 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 45 | 1 |
| | Blackfly Larva | | |
| | Leech | 2 | 1 |
| | Midge Larva (chironomid) | | |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | 1 | 1 |
| | True Bug Adult | | |
| | Water Mite | 1 | 1 |
| **Sub-Total** | | 49 | 4 |
| **TOTAL** | | 313 | 13 |

**Table C.3**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 313

**DENSITY:** Invertebrate density per square metre:

313 ÷ 0.27 = 1159

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 22-17 | 16-11 | <11 |

3 x D1 + 2 x D2 + D3

3 x 6 + 2 x 3 + 4 = 28

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-5 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 2 + 3 = 6

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 18 + 127 + 115 ) / 313 = 0.83

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 13

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

127 / 313 = 0.41

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 3 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 3 |

| Average Rating |
|---|
| 3.50 |

**Table C.4**. Invertebrate Survey Field Data Sheet completed for triplicate stream invertebrate samples collected at Stations 1, 3 and 4 on the C.W. Young Channel during 2011.

**INVERTEBRATE SURVEY FIELD DATA SHEET** (Page 1 of 2)

| Stream Name: | CW Young | | Date: | 30 October 2011 |
|---|---|---|---|---|
| Station Name: | **Station 1** | | Flow status: | Moderate |
| Sampler Used: | Number of replicates | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates | | |
| Hess | 3 | 0.09 x 3 = | 0.27 | $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 38 | 2 |
| | Mayfly Nymph (EPT) | 76 | 3 |
| | Stonefly Nymph (EPT) | 61 | 2 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 175 | 7 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | 4 | 1 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | 1 | 1 |
| **Sub-Total** | | 5 | 2 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 107 | 1 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | 4 | 1 |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | 5 | 2 |
| **Sub-Total** | | 116 | 4 |
| **TOTAL** | | 296 | 13 |

**Table C.4**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 296

**DENSITY:** Invertebrate density per square metre:

296 ÷ 0.27 = 1096

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Aquatic Worm (oligochaete)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 7 + 2 x 2 + 4 = 29

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

2 + 3 + 2 = 7

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 38 + 76 + 61 ) / 296 = 0.59

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 13

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

107 / 296 = 0.36

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 3 |
| EPT To Total Ratio | 3 |
| Predominant Taxon Ratio | 4 |

| Average Rating |
|---|
| 3.50 |

**Table C.4**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young | | Date: 30 October 2011 |
|---|---|---|
| Station Name: **Station 3** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| Category 1<br>Pollution Intolerant | Caddisfly Larva (EPT) | 3 | 1 |
| | Mayfly Nymph (EPT) | 157 | 3 |
| | Stonefly Nymph (EPT) | 10 | 1 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 170 | 5 |
| Category 2<br>Somewhat Pollution Tolerant | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | | |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 0 | 0 |
| Category 3<br>Pollution Tolerant | Aquatic Worm (oligochaete) | 1 | 1 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | | |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | 2 | 1 |
| **Sub-Total** | | 3 | 2 |
| **TOTAL** | | 173 | 7 |

**Table C.4**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 173

**DENSITY:** Invertebrate density per square metre:

173 ÷ 0.27 = 641

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 5 + 2 x 0 + 2 = 17

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 3 + 1 = 5

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 3 + 157 + 10 ) / 173 = 0.98

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 7

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

163 / 287 = 0.91

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 3 |
| EPT Index | 3 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 1 |

| Average Rating |
|---|
| 2.75 |

**Table C.4**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young | | Date: 30 October 2011 |
|---|---|---|
| Station Name: **Station 4** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| Category 1 | Caddisfly Larva (EPT) | | |
| | Mayfly Nymph (EPT) | 14 | 2 |
| | Stonefly Nymph (EPT) | 1 | 1 |
| | Dobsonfly (hellgrammite) | | |
| Pollution Intolerant | Gilled Snail | 9 | 1 |
| | Riffle Beetle | | |
| | Water Penny | | |
| Sub-Total | | 24 | 4 |
| Category 2 | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | | |
| | Crayfish | | |
| Somewhat Pollution Tolerant | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | 2 | 1 |
| | Watersnipe Larva | | |
| Sub-Total | | 2 | 1 |
| Category 3 | Aquatic Worm (oligochaete) | 17 | 1 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | 6 | 1 |
| | Planarian (flatworm) | | |
| Pollution Tolerant | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| Sub-Total | | 23 | 2 |
| TOTAL | | 49 | 7 |

**Table C.4**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 49

**DENSITY:** Invertebrate density per square metre:

49 ÷ 0.27 = 181

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Aquatic Worm (oligochaete)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 4 + 2 x 1 + 2 = 16

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-5 | 0-1 |

EPT4 + EPT5 + EPT6

0 + 2 + 1 = 3

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 0 + 14 + 1 ) / 49 = 0.31

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 7

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

17 / 49 = 0.35

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 2 |
| EPT Index | 2 |
| EPT To Total Ratio | 2 |
| Predominant Taxon Ratio | 4 |

| Average Rating |
|---|
| 2.50 |

**Table C.5**. Invertebrate Survey Field Data Sheet completed for triplicate stream invertebrate samples collected at Stations 1, 3 and 4 on the C.W. Young Channel during 2012.

**INVERTEBRATE SURVEY FIELD DATA SHEET** (Page 1 of 2)

| Stream Name: | CW Young | | Date: | 28 October 2012 |
|---|---|---|---|---|
| Station Name: | **Station 3** | | Flow status: | Moderate |
| Sampler Used: | Number of replicates | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates | | |
| Hess | 3 | 0.09 x 3 = | 0.27 | $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 8 | 2 |
| | Mayfly Nymph (EPT) | 523 | 5 |
| | Stonefly Nymph (EPT) | 145 | 4 |
| | Dobsonfly (hellgrammite) | 1 | 1 |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 677 | 12 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | 11 | 3 |
| | Crayfish | | |
| | Damselfly Larva | 3 | 1 |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | 1 | 1 |
| **Sub-Total** | | 15 | 5 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 2 | 1 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | 43 | 3 |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | 7 | 1 |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 52 | 5 |
| **TOTAL** | | 744 | 22 |

**Table C.5**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 744

**DENSITY:** Invertebrate density per square metre:

744 ÷ 0.27 = 2756

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 12 + 2 x 5 + 5 = 51

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

2 + 5 + 4 = 11

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 8 + 523 + 145 ) / 744 = 0.91

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 22

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

523 / 744 = 0.70

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 4 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 2 |

| Average Rating |
|---|
| 3.50 |

**Table C.5**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young | | Date: 28 October 2012 |
|---|---|---|
| Station Name: **Station 4** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1** | Caddisfly Larva (EPT) | 4 | 2 |
| | Mayfly Nymph (EPT) | 219 | 4 |
| | Stonefly Nymph (EPT) | 102 | 3 |
| | Dobsonfly (hellgrammite) | 2 | 1 |
| **Pollution Intolerant** | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 327 | 10 |
| **Category 2** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | 13 | 1 |
| | Crayfish | 2 | 1 |
| **Somewhat Pollution Tolerant** | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | 48 | 1 |
| | Watersnipe Larva | | |
| **Sub-Total** | | 63 | 3 |
| **Category 3** | Aquatic Worm (oligochaete) | 102 | 3 |
| | Blackfly Larva | 3 | 1 |
| | Leech | | |
| | Midge Larva (chironomid) | 88 | 1 |
| | Planarian (flatworm) | | |
| **Pollution Tolerant** | Pouch and Pond Snails | 6 | 1 |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 199 | 6 |
| **TOTAL** | | 589 | 19 |

**Table C.5**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 589

**DENSITY:** Invertebrate density per square metre:

589 ÷ 0.27 = 2181

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 10 + 2 x 3 + 6 = 42

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

2 + 4 + 3 = 9

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 4 + 219 + 102 ) / 589 = 0.55

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 19

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

219 / 589 = 0.37

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 4 |
| EPT To Total Ratio | 3 |
| Predominant Taxon Ratio | 4 |

| Average Rating |
|---|
| 3.75 |

**Table C.5**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young | | Date: 28 October 2012 |
|---|---|---|
| Station Name: **Station 5** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 1 | 1 |
| | Mayfly Nymph (EPT) | 13 | 3 |
| | Stonefly Nymph (EPT) | 16 | 2 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 30 | 6 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | | |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 0 | 0 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 9 | 1 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | | |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 9 | 1 |
| **TOTAL** | | 39 | 7 |

**Table C.5**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 39

**DENSITY:** Invertebrate density per square metre:

39 ÷ 0.27 = 144

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Stonefly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 6 + 2 x 0 + 1 = 19

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-5 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 3 + 2 = 6

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 1 + 13 + 16 ) / 39 = 0.77

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 7

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

16 / 39 = 0.41

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 3 |
| EPT Index | 3 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 3 |

**Average Rating**: 3.25

**Table C.6**. Invertebrate Survey Field Data Sheet completed for triplicate stream invertebrate samples collected at Stations 1, 3 and 4 on the C.W. Young Channel during 2013.

**INVERTEBRATE SURVEY FIELD DATA SHEET** (Page 1 of 2)

| Stream Name: | CW Young | | Date: | 30 October 2013 |
|---|---|---|---|---|
| Station Name: | **Station 1** | | Flow status: | Moderate |
| Sampler Used: | Number of replicates | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates | | |
| Hess | 3 | 0.09 x 3 = | 0.27 | $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| | Caddisfly Larva (EPT) | | |
| **Category 1** | Mayfly Nymph (EPT) | 275 | 2 |
| | Stonefly Nymph (EPT) | 16 | 1 |
| | Dobsonfly (hellgrammite) | | |
| **Pollution Intolerant** | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 291 | 3 |
| | Alderfly Larva | | |
| **Category 2** | Aquatic Beetle | | |
| | Aquatic Sowbug | 1 | 1 |
| | Clam, Mussel | | |
| | Cranefly Larva | 6 | 1 |
| | Crayfish | | |
| **Somewhat Pollution Tolerant** | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 7 | 2 |
| | Aquatic Worm (oligochaete) | 52 | 3 |
| **Category 3** | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | | |
| | Planarian (flatworm) | | |
| **Pollution Tolerant** | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 52 | 3 |
| **TOTAL** | | 350 | 8 |

**Table C.6**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 350

**DENSITY:** Invertebrate density per square metre:

350 ÷ 0.27 = 1296

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 3 + 2 x 2 + 3 = 16

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

0 + 2 + 1 = 3

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 0 + 275 + 16 ) / 350 = 0.83

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 8

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

275 / 350 = 0.79

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 2 |
| EPT Index | 2 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 2 |

| Average Rating |
|---|
| 2.50 |

**Table C.6**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young | | Date: 30 October 2013 |
|---|---|---|
| Station Name: **Station 3** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 1 | 1 |
| | Mayfly Nymph (EPT) | 320 | 3 |
| | Stonefly Nymph (EPT) | 17 | 2 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 338 | 6 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | 4 | 1 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | 1 | 1 |
| | Watersnipe Larva | | |
| **Sub-Total** | | 5 | 2 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 2 | 1 |
| | Blackfly Larva | | |
| | Leech | 2 | 1 |
| | Midge Larva (chironomid) | | |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 4 | 2 |
| **TOTAL** | | 347 | 10 |

**Table C.6**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 347

**DENSITY:** Invertebrate density per square metre:

347 ÷ 0.27 = 1285

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 6 + 2 x 2 + 2 = 24

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 3 + 2 = 6

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 1 + 320 + 17 ) / 347 = 0.97

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 10

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

320 / 347 = 0.92

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 3 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 1 |

| Average Rating |
|---|
| 3.00 |

**Table C.6**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young | | Date: 30 October 2013 |
|---|---|---|
| Station Name: **Station 4** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 11 | 1 |
| | Mayfly Nymph (EPT) | 70 | 3 |
| | Stonefly Nymph (EPT) | 4 | 1 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 85 | 5 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | 1 | 1 |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | 3 | 1 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 4 | 2 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | | |
| | Blackfly Larva | | |
| | Leech | 2 | 1 |
| | Midge Larva (chironomid) | 1 | 1 |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 3 | 2 |
| **TOTAL** | | 92 | 9 |

**Table C.6**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 92

**DENSITY:** Invertebrate density per square metre:

92 ÷ 0.27 = 341

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 5 + 2 x 2 + 2 = 21

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-5 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 3 + 1 = 5

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 11 + 70 + 4 ) / 92 = 0.92

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 9

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

70 / 92 = 0.76

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 3 |
| EPT Index | 3 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 2 |

| Average Rating |
|---|
| 3.00 |

**Table C.7**. Invertebrate Survey Field Data Sheet completed for triplicate stream invertebrate samples collected at Stations 1, 3 and 4 on the C.W. Young Channel during 2014.

**INVERTEBRATE SURVEY FIELD DATA SHEET** (Page 1 of 2)

| Stream Name: | CW Young | | Date: | 27 October 2014 |
|---|---|---|---|---|
| Station Name: | **Station 1** | | Flow status: | Moderate |
| Sampler Used: Hess | Number of replicates 4 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 4 = 0.36 $m^2$ | | |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 6 | 1 |
| | Mayfly Nymph (EPT) | 33 | 3 |
| | Stonefly Nymph (EPT) | 9 | 2 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 48 | 6 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | 12 | 3 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 12 | 3 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 32 | 3 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | 5 | 2 |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | 6 | 3 |
| **Sub-Total** | | 43 | 8 |
| **TOTAL** | | 103 | 17 |

**Table C.7**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 103

**DENSITY:** Invertebrate density per square metre:

103 ÷ 0.36 = 286

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 6 + 2 x 3 + 8 = 32

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 3 + 2 = 6

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 6 + 33 + 9 ) / 103 = 0.47

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 17

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

33 / 103 = 0.32

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 3 |
| EPT To Total Ratio | 2 |
| Predominant Taxon Ratio | 4 |

| Average Rating |
|---|
| 3.25 |

**Table C.7**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: | CW Young | | Date: | 27 October 2014 |
|---|---|---|---|---|
| Station Name: | **Station 3** | | Flow status: | Moderate |
| Sampler Used: Hess | Number of replicates 4 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 4 = 0.36 $m^2$ | | |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | | |
| | Mayfly Nymph (EPT) | 63 | 2 |
| | Stonefly Nymph (EPT) | 15 | 2 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 78 | 4 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | 10 | 2 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | 1 | 1 |
| | Fishfly Larva | | |
| | Scud (amphipod) | 7 | 1 |
| | Watersnipe Larva | | |
| **Sub-Total** | | 18 | 4 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 1 | 1 |
| | Blackfly Larva | | |
| | Leech | 2 | 2 |
| | Midge Larva (chironomid) | 1 | 1 |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 4 | 4 |
| **TOTAL** | | 100 | 12 |

**Table C.7**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 100

**DENSITY:** Invertebrate density per square metre:

100 ÷ 0.36 = 278

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 4 + 2 x 4 + 4 = 24

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

0 + 2 + 2 = 4

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 0 + 63 + 15 ) / 100 = 0.78

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 12

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

63 / 100 = 0.63

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 2 |
| EPT To Total Ratio | 4 |
| Predominant Taxon Ratio | 2 |

| Average Rating |
|---|
| 3.00 |

**Table C.7**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young | | Date: 27 October 2014 |
|---|---|---|
| Station Name: **Station 4** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 4 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 4 = 0.36 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 1 | 1 |
| | Mayfly Nymph (EPT) | 8 | 2 |
| | Stonefly Nymph (EPT) | 1 | 1 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 10 | 4 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | 3 | 1 |
| | Clam, Mussel | | |
| | Cranefly Larva | | |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | 3 | 1 |
| | Watersnipe Larva | | |
| **Sub-Total** | | 6 | 2 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | 2 | 2 |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | 4 | 2 |
| | Planarian (flatworm) | 1 | 1 |
| | Pouch and Pond Snails | 3 | 1 |
| | True Bug Adult | | |
| | Water Mite | | |
| **Sub-Total** | | 10 | 6 |
| **TOTAL** | | 26 | 12 |

**Table C.7**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 26

**DENSITY:** Invertebrate density per square metre:

26 ÷ 0.36 = 72

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 4 + 2 x 2 + 6 = 22

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-5 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 2 + 1 = 4

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

(1 + 8 + 1) / 26 = 0.38

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 12

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

8 / 26 = 0.31

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 3 |
| EPT Index | 2 |
| EPT To Total Ratio | 2 |
| Predominant Taxon Ratio | 4 |

| Average Rating |
|---|
| 2.75 |

**Table C.8**. Invertebrate Survey Field Data Sheet completed for triplicate stream invertebrate samples collected at Stations 1, 3 and 4 on the C.W. Young Channel during 2015.

**INVERTEBRATE SURVEY FIELD DATA SHEET** (Page 1 of 2)

| Stream Name: | CW Young | | Date: | 4 November 2015 |
|---|---|---|---|---|
| Station Name: | **Station 1** | | Flow status: | Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ | | |

| Column A Pollution Tolerance | Column B Common Name | Column C Number Counted | Column D Number of Taxa |
|---|---|---|---|
| **Category 1** | Caddisfly Larva (EPT) | 1 | 1 |
| | Mayfly Nymph (EPT) | 6 | 1 |
| | Stonefly Nymph (EPT) | 5 | 1 |
| | Dobsonfly (hellgrammite) | | |
| **Pollution Intolerant** | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 12 | 3 |
| **Category 2** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | | |
| | Crayfish | | |
| **Somewhat Pollution Tolerant** | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 0 | 0 |
| **Category 3** | Aquatic Worm (oligochaete) | | |
| | Blackfly Larva | | |
| | Leech | 2 | 1 |
| | Midge Larva (chironomid) | 4 | 1 |
| | Planarian (flatworm) | | |
| **Pollution Tolerant** | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | 2 | 1 |
| **Sub-Total** | | 8 | 3 |
| **TOTAL** | | 20 | 6 |

**Table C.8**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 20

**DENSITY:** Invertebrate density per square metre:

20 ÷ 0.27 = 74

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 3 + 2 x 0 + 3 = 12

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 1 + 1 = 3

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 1 + 6 + 5 ) / 20 = 0.60

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 6

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

6 / 20 = 0.30

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 2 |
| EPT Index | 2 |
| EPT To Total Ratio | 3 |
| Predominant Taxon Ratio | 4 |

| Average Rating |
|---|
| 2.75 |

**Table C.8**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young | | Date: 4 November 2015 |
|---|---|---|
| Station Name: **Station 3** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 1 | 1 |
| | Mayfly Nymph (EPT) | 6 | 2 |
| | Stonefly Nymph (EPT) | 5 | 2 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 12 | 5 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | | |
| | Cranefly Larva | | |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | | |
| | Watersnipe Larva | | |
| **Sub-Total** | | 0 | 0 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | | |
| | Blackfly Larva | | |
| | Leech | 2 | 1 |
| | Midge Larva (chironomid) | 4 | 2 |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | 2 | 1 |
| **Sub-Total** | | 8 | 4 |
| **TOTAL** | | 20 | 9 |

**Table C.8**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 20

**DENSITY:** Invertebrate density per square metre:

20 ÷ 0.27 = 74

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 5 + 2 x 0 + 4 = 19

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-4 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 2 + 2 = 5

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 1 + 6 + 5 ) / 20 = 0.60

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 9

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

6 / 20 = 0.30

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 3 |
| EPT Index | 3 |
| EPT To Total Ratio | 3 |
| Predominant Taxon Ratio | |

| Average Rating |
|---|
| 3.00 |

**Table C.8**. (Continued)

## INVERTEBRATE SURVEY FIELD DATA SHEET (Page 1 of 2)

| Stream Name: CW Young | | Date: 4 November 2015 |
|---|---|---|
| Station Name: **Station 4** | | Flow status: Moderate |
| Sampler Used: Hess | Number of replicates 3 | Total area sampled (Hess, Surber = 0.09 $m^2$) x no. replicates 0.09 x 3 = 0.27 $m^2$ |

| Column A<br>Pollution Tolerance | Column B<br>Common Name | Column C<br>Number Counted | Column D<br>Number of Taxa |
|---|---|---|---|
| **Category 1**<br>**Pollution Intolerant** | Caddisfly Larva (EPT) | 3 | 1 |
| | Mayfly Nymph (EPT) | 16 | 2 |
| | Stonefly Nymph (EPT) | 15 | 2 |
| | Dobsonfly (hellgrammite) | | |
| | Gilled Snail | | |
| | Riffle Beetle | | |
| | Water Penny | | |
| **Sub-Total** | | 34 | 5 |
| **Category 2**<br>**Somewhat Pollution Tolerant** | Alderfly Larva | | |
| | Aquatic Beetle | | |
| | Aquatic Sowbug | | |
| | Clam, Mussel | 2 | 1 |
| | Cranefly Larva | 1 | 1 |
| | Crayfish | | |
| | Damselfly Larva | | |
| | Dragonfly Larva | | |
| | Fishfly Larva | | |
| | Scud (amphipod) | 4 | 2 |
| | Watersnipe Larva | | |
| **Sub-Total** | | 7 | 4 |
| **Category 3**<br>**Pollution Tolerant** | Aquatic Worm (oligochaete) | | |
| | Blackfly Larva | | |
| | Leech | | |
| | Midge Larva (chironomid) | 13 | 2 |
| | Planarian (flatworm) | | |
| | Pouch and Pond Snails | | |
| | True Bug Adult | | |
| | Water Mite | 6 | 1 |
| **Sub-Total** | | 19 | 3 |
| **TOTAL** | | 60 | 12 |

**Table C.8**. (Continued)

## INVERTEBRATE SURVEY INTERPRETATION SHEET (Page 2 of 2)

### SECTION 1 - ABUNDANCE AND DENSITY

**ABUNDANCE:** Total number of organisms from cell **CT**: 60

**DENSITY:** Invertebrate density per square metre:

60 ÷ 0.27 = 222

**PREDOMINANT TAXON:**

Invertebrate group with the highest number counted (Col. C): Mayfly Nymph (EPT)

### SECTION 2 - WATER QUALITY ASSESSMENTS

**POLLUTION TOLERANCE INDEX:** Sub-total number of taxa found in each tolerance category.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >22 | 17-22 | 11-16 | <11 |

3 x D1 + 2 x D2 + D3

3 x 5 + 2 x 4 + 3 = 26

**EPT INDEX:** Total number of EPT taxa.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| >8 | 5-8 | 2-5 | 0-1 |

EPT4 + EPT5 + EPT6

1 + 2 + 2 = 5

**EPT TO TOTAL RATIO INDEX:** Total number of EPT organisms divided by the total number of organisms.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| 0.75-1.0 | 0.50-0.74 | 0.25-0.49 | <0.25 |

(EPT1 + EPT2 + EPT3) / CT

( 3 + 16 + 15 ) / 60 = 0.57

### SECTION 3 - DIVERSITY

**TOTAL NUMBER OF TAXA:** Total number of taxa from cell **DT**: 12

**PREDOMINANT TAXON RATIO INDEX:** Number of invertebrate in the **predominant taxon** (S3) divided by CT.

| Good | Accpetable | Marginal | Poor |
|---|---|---|---|
| <0.40 | 0.40-0.59 | 0.60-0.79 | 0.80-1.0 |

Col. C for S3 / CT

16 / 60 = 0.27

### SECTION 4 - OVERALL SITE ASSESSMENT RATING

**SITE ASSESSMENT RATING:** Assign a rating of 1-4 to each index (S4, S5, S6, S8), then calculate the average.

| Assessment Rating | |
|---|---|
| Good | 4 |
| Accpetable | 3 |
| Marginal | 2 |
| Poor | 1 |

| Assessment | Rating |
|---|---|
| Pollution Tolerance Index | 4 |
| EPT Index | 3 |
| EPT To Total Ratio | 3 |
| Predominant Taxon Ratio | 4 |

| Average Rating |
|---|
| 3.50 |