



Citizen's Environmental Monitoring Program

Anchorage Creeks Monitoring Summary 2010—Editor's Introduction

Editor: Thom Eley, Ph.D.

Volunteer monitors provide an early warning system for pollutants.



Figure 1. Our monitors endeavor to ensure that Anchorage's creeks remain one of Anchorage's treasures! Unfortunately, this lovely spot has been partially destroyed during a culvert replacement. (Photo courtesy of Cherie Northon)

MISSION

The mission of Anchorage Waterways Council is to protect, restore, and enhance the waterways, wetlands, and associated uplands of Anchorage.

This mission is based upon the desire to protect, restore, and enhance the waterways, wetlands, and associated uplands of Anchorage for current and future generations. Our members believe that environmentally healthy watersheds are a vital part of the high quality of life that we enjoy in Anchorage. We also believe that the beautiful creeks of Anchorage need a group specifically dedicated to advocating for their health and well being. The Municipality of Anchorage (MOA) consists of 25 watersheds of about 1727 mi² (4473 km²) which contain approximately 2,161 miles (3,478 km) of creeks and rivers.

The Anchorage Waterways Council (AWC) is pleased to present its water quality monitoring data for 2010. The water quality monitoring program, officially known as the Citizen's Environmental Monitoring Program, began on February 1, 1998, when Bob Shipley (Figure 2) sampled water from the South Fork of Campbell Creek, a site now known as MaSFCam10v. Many have pondered why Bob chose February of all months to start a monitoring program, but Bob, like several of other monitors, is from hardy Norwegian stock that eschews warm weather and prefers to put his hands in 0° C (32° F) water than any warmer water.

Disclaimer: These analyses are not designed to assess whether the water in a particular creek or river is safe for human consumption. Anchorage Waterways Council (AWC) assesses water only for compliance with State Water Quality Standards for surface water for "growth and propagation of fish, shellfish, other aquatic life, and wildlife." Even if the water quality measurements meet State of Alaska Water Quality Standards, not all contaminants are measured nor are there standards for every possible contaminant (e.g. Giardia, other bacteria, etc.). Therefore, even if the water quality is rated good or excellent based on AWC analyses, the Anchorage Waterways Council is not implying the water is safe for humans, pets or livestock to drink or safe for contact recreation.



Figure 2. Bob Shipley—the legendary first AWC water Quality monitor, Board member, and volunteer extraordinaire. (Photo courtesy of Cherie Northon)

Who is Bob Shipley? Bob is noted for being our first creek monitor and volunteer extraordinaire. Bob, like several of our monitors, is from hardy Norwegian stock. On 1 February 1998, Bob jumped into his sauna after beating himself severely with spruce boughs. After a nice sauna he jumped into the South Fork of Campbell Creek at 10 mile, and while cooling in the water, he made the first water quality measurements. Bob Shipley has lived in Anchorage for 34 years. He has a degree in biology from Colorado State University. Bob worked for agencies in both Colorado and Alaska in applied environmental sciences until he retired in 1993. His lifetime interest in ecosystem biology led to his joining the AWC Board in 1998 and has stayed for nine years as a board member and issues committee chair. Bob has biked all over Anchorage and the world, and is a noted cross-country skier. Lastly, at the annual Creek Cleanup Celebration, Bob is our Certified Food Protection Manager!

Uncommon commitment keeps monitors busy testing water quality

Acknowledgements

The 25+ monitors as well as your humble editor would like to give their heartfelt thanks to the following individuals for their continued support:

Bob Mitchell—he does so many things for the monitoring program that it would take pages to list them. *Zulu Bravo*

Monitoring Technical Advisory Committee: *Liz Rocha, Chair, Birgit Hagedorn, Isaac Watkins, Scott McKim, Becky Shaftel, and Cherie Northon*

Board of the Anchorage Waterways Council: *Pete Pritchard (President), Bob Shipley (VP), Molly Welker (Sec.), Christine Geis (Treas.), Sydney Treuer, Sammie Freeman Shephard, Anna Boslough, Elizabeth Rocha, Craig Valentine, Dave Trudgen, Scott McKim, Isaac Watkins and Birgit Hagedorn*

Executive Director of the Anchorage Waterways Council: *Cherie Northon*

This monitoring program is staffed by highly motivated volunteers who give up 16 of their valuable days to monitor Anchorage Creeks, and they do this out of a sense of love and concern for the creeks—large and small. The monitors are diverse and leaders in their own professional. They include aquatic biologists, wildlife biologists, geologists, teachers, a retired architect in historic preservation, contractors, non-profit employees, consultants, university students and retired individuals. We cannot over emphasize the professionalism and dedication shown by our monitors. I would like to thank them for their outstanding job. Further, the help of the monitors in preparing these annual reports was essential. Without their help, these data could not have been collected and these

reports could not have been written. A more dedicated group of volunteers, I have never seen. They are fantastic!!

In return, the monitors would like to thank the Board of the Anchorage Waterways Council for their continued moral and financial report. A monitoring program is not easy to fund, but the Board has found a way. In addition, some monitors have given their own funding, which is often matched by employers, or found other sources of funding for the program. This is a true sign of dedication. Lastly, I would like to emphasize that **these are the monitor's reports**. They did the hard work of gathering the data in all sorts of weather.



Figure 3. Thom Eley teaching his granddaughter, Kim, how to steer a raft in Eagle River. (Photo courtesy of Cherie Northon)

Who is this editor, Thom Eley? Thom has B.S. and M.S. degrees in wildlife ecology and oceanography from Humboldt State University and a Ph.D. in maritime geography from the University of California Berkeley. He came here in 1974 after the Southeast Asia War Games, and has been here ever since, except for a short departure to earn his Ph.D. and spend a year living in rural Papua New Guinea. Thom is a long time river and creek rat. He has traveled the whole coast of Alaska by boat, ship and icebreaker, and many of the rivers by boat, canoe, and raft. He has had careers as a State of Alaska and Federal wildlife biologist, commercial airplane pilot and flight instructor, university professor, *bon vivant* federal bureaucrat, mapmaker, park ranger, cruise ship naturalist, and the last Federal Indian Scout. Thom and his wife, Cherie, were naturalists on the cruise ship *Golden Princess* which was the largest cruise ship to take tourists into Antarctic waters. Thom also participated in a water quality monitoring project in western China.

Now he is primarily a mapmaker and works with the monitors. His trademark is camouflage trousers which he wears to honor those who went to foreign places for their country and did not return.

Information on the Monitoring Program

The volunteer monitors test creek and river water to obtain quantitative physical and chemical data including: **water temperature**, **turbidity** (clarity), **pH**, **dissolved oxygen** (DO), **water color**, **conductivity**, **total dissolved solids** (TDS), and **bacteria** (*E. coli* & total coliform).

Data Caveat: Our data are collected by citizen volunteers [some are scientists and some are not] who have been trained in a rigorous course in water quality analyses and follow a rigid monitoring protocol. The monitors endeavor to collect and record the best and most accurate data possible within the manufacturers' specifications for all equipment they use. The monitors are recertified annually. Further, the data are QA/QC'd by a qualified individual when the data sheets are turned in to AWC, again when the data are entered by a trained individual into the AWC monitoring database, and lastly after the data have been entered.

The Anchorage Waterways Council's Monitoring Program's goals are:

- ◆ Maintain a motivated volunteer monitoring network committed to preserving the integrity of Anchorage's watersheds.
- ◆ Collection of accurate and reliable water quality data.
- ◆ Act as stewards of their waterways while collecting and reporting valuable information as monitors who can recognize potential pollution and other environmental problems at their monitoring locations.
- ◆ Function as an early warning system alerting agencies to potential water quality threats.
- ◆ Provide volunteers with information about the importance of water quality and encourage them to become involved in local environmental issues.
- ◆ Complement and assist local agencies, such as the Municipality of Anchorage (MOA) with its watershed protection strategies and programs.

Monitoring Program: The AWC's monitoring program began in 1998 by training volunteers to collect water-quality data that is used to identify trends and detect some forms of pollution and by assigning them monitoring sites. Further, these data form a baseline dataset which could be used by teachers, students, researchers, and agencies. Currently, the program has 21 active monitoring sites in the MOA.

The monitoring program is based upon four basic concepts.

1. Primary to the program is the **rigorous monitor selection and training**. Monitors should be able to commit two-years to the program. The training is initially accomplished in four phases but other training may occur.
 - ◆ Phases I-III deal with watersheds and creeks, accuracy and precision of data, principles of water quality testing, and familiarization and correct use of the water test methodologies. These phases include water testing in both the laboratory and the field under the mentorship of instructors. Once completing these phases a volunteer becomes certified. Monitors are given a detailed protocol (specific methods) which they must follow as they conduct their tests.
 - ◆ Phase IV is the annual re-certification of monitors. This phase is based on instructors watching monitors conduct water monitoring tests to ensure they are using the proper methods (following the testing protocols) and obtaining accurate and precise results. This recertification acts as a quality control check of monitors and is an essential part of our quality assurance program.

- ◆ Instructors endeavor to go on a monitoring session with each monitor every year or two, and conduct a side-by-side analysis. This gives the instructor the opportunity to assess the monitors' techniques, and then the monitor and instructor can compare their results.
- ◆ Lastly, some monitors are selected as instructors based on their monitoring skills, teaching abilities, and interest. AWC conducts a training program for instructors on an "as needed" basis.

2. **A Quality Assurance Project Plan (QAPP)** gives guidance to ensure that our volunteer data collection methods yield the most accurate and precise results that the measurement technology can provide. Further, the data undergoes a three-phase QA/QC (Quality assurance & Quality control) that includes when the monitors turn in their data sheets, when the data are entered into the database by a trained person, and after the data are in the database.

3. A Monitoring Technical Advisory Committee (MTAC) assures the monitoring is done correctly with the highest data standards possible given the technology that the monitors have available to them.

4. The **data collected** by our volunteers **are available to the public**, teachers, researchers, agencies, and any others who might need it.

The Naming of Collection Sites

Some people are confused by the naming or, more appropriately codifying the collection sites, but it is quite easy. MaShi01v means Municipality of Anchorage, Ship Creek site at 1 mile up the river from the mouth. The "v" means it is monitored by volunteers. Therefore, MaShip01v and MaShi03v are both on Ship Creek with one being 1 mile up river and the other being 3 miles up river.

You may see more complicated names like MaNFEag07v, which you should easily decipher as the North Fork of Eagle River, but 7 miles up from the fork and not the mouth. The most complicated designation is Nicole Neuman's site MaNFLCam02v. You should immediately recognize this as the North Fork of Little Campbell Creek at 2 miles upstream from the mouth of Little Campbell Creek. Fortunately, we do not have any sites on the South Fork of the East Fork of the South Fork of the South Fork of Chester Creek!

The Location of Collection Sites

The AWC monitoring program has 27 sites with 21 active during 2010, and the active sites are shown in Figure 4.

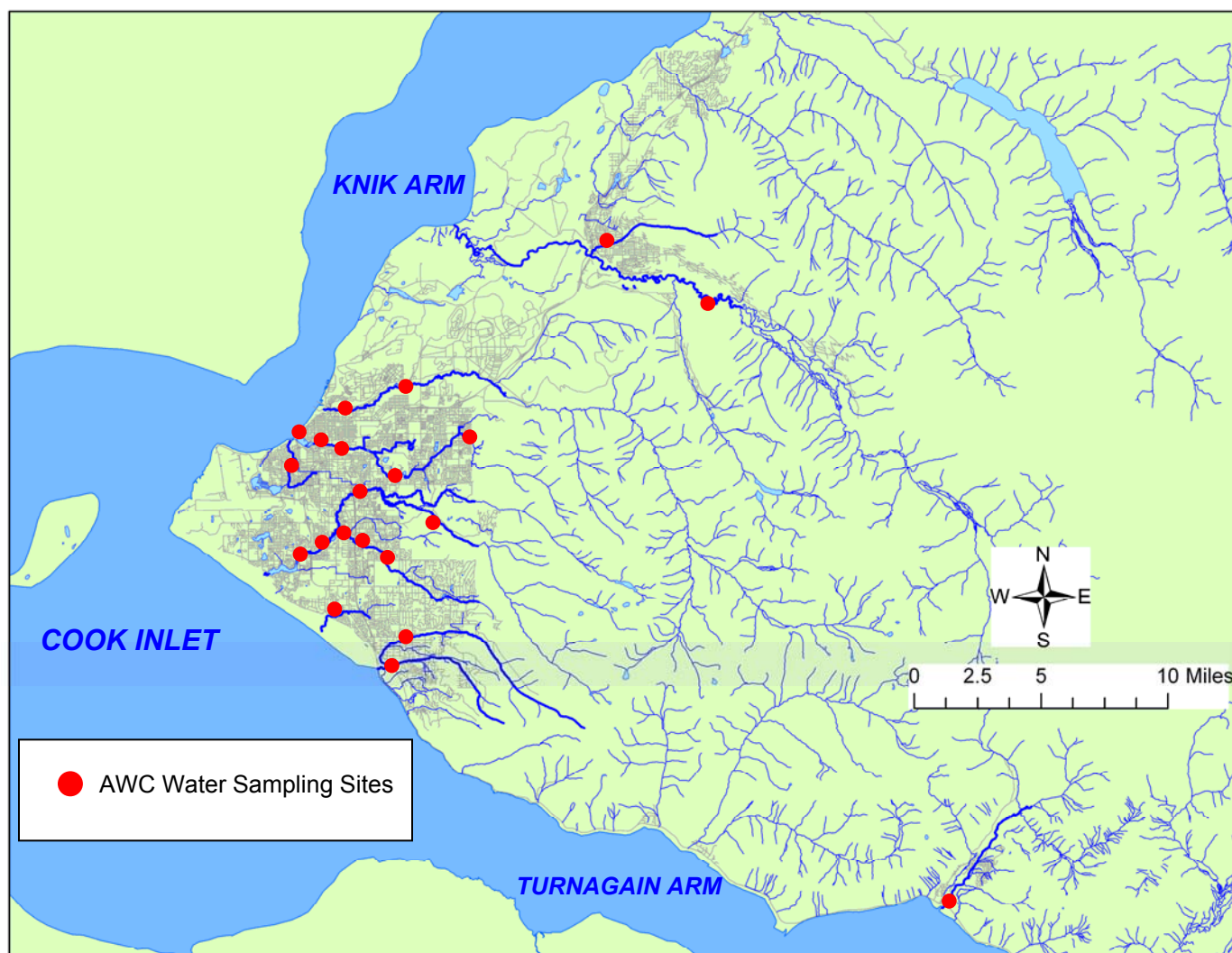


Figure 4. Anchorage Waterways Council water quality monitoring sites monitored in 2010. (Cartography by Thom Eley)

Water Quality Indicators¹

"The water quality indicators are the key measures which provide a snapshot of creek conditions."

The following water quality indicators were measured by Anchorage Waterway Council monitors during the 2010 sampling season.

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¹ The editor would like to thank Dr. Birgit ASET (Applied Science, Engineering, and Technology Laboratory) Lab Manager at the University of Alaska Anchorage for reviewing the descriptions of the water quality indicators.

rigid monitoring protocol. The monitors endeavor to collect and record the best and most accurate data possible within the manufacturers' specifications for all equipment they use. The monitors are recertified on a regular basis. Further, the data are QA/QC'd by a qualified individual when the data sheets are turned in to AWC, again when the data are entered by a trained individual into the AWC monitoring database, and lastly after the data have been entered.

Water Temperature: Water temperature is a very important factor for aquatic life and is one of the most important parameters we test. It controls the rate of metabolic and reproductive activities, and determines which fish species can survive. Temperature also affects the concentration of dissolved oxygen and can influence the activity of bacteria and toxic chemicals in water. Respiration of organisms is temperature-related; respiration rates can increase by 10% or more per 1° C temperature rise. Therefore, increased temperature not only reduces oxygen availability, but also increases oxygen demand, which can add to physiological stress of organisms. Water temperature is primarily affected by air temperature, amount of riparian vegetation, and flow rate.

Hydrogen Potential (pH): pH is a measure of the acidity or alkalinity of a solution and is ranked on a scale from 1.0 to 14.0. Acidity increases as pH gets lower. pH affects many chemical and biological processes in the water. For example, different organisms flourish within different ranges of pH. The greatest variety of aquatic animals prefer a range of 6.5-8.0. The pH values outside of this range reduce the diversity in the stream because it stresses the physiological systems of most organisms and can reduce reproduction. Changes in acidity can be caused by atmospheric deposition (e.g., acid rain), surrounding rock and soils, and certain wastewater discharges.

Dissolved Oxygen: Dissolved Oxygen (DO) is found in microscopic bubbles of oxygen that are mixed in the water and occur between water molecules. Stream systems produce and consume oxygen. Oxygen enters the water by absorption directly from the atmosphere or by aquatic plant and algae photosynthesis. Oxygen is consumed in the water by respiration of aquatic animals, decomposition of organic matter, and various chemical reactions. Levels of dissolved oxygen are closely related to water temperature; the colder the water, the more oxygen can be dissolved in the water. Therefore, DO concentrations at one location are usually higher in the winter than in the summer. DO levels are also affected by flow rate as the turbulence of the water enhances mixing with air, the type and number of aquatic organisms, and the number of dissolved and suspended solids. While nutrients do not have a direct affect on DO, they do increase plant growth which increases consumption of oxygen. DO is one of the most important indicators of a waterbody's ability to support aquatic life. It is essential for the basic metabolic processes of animals and plants inhabiting our rivers and streams. Fish "breathe" by absorbing dissolved oxygen through their gills. When oxygen levels fall too low, fish and many other marine organisms are stressed and cannot survive.



Figure 5. Birgit Hagedorn

Who is Birgit Hagedorn? Birgit is the manager of UAA's ASET Laboratory, which is a state-of-the-art quantitative analytical facility. It is designed to accommodate a range of analytes in diverse matrices to support multidisciplinary research. Birgit is from Germany, and received her Ph.D. from the University of Heidelberg in Isotope Geochemistry/Geochronology. Her research interests are in low temperature geochemistry, and physical and chemical processes in periglacial [land near but not covered by glaciers] landscapes. Her fieldwork has taken her to Antarctica, northeast India, Greenland, Svalbard and Siberia as well as more exotic places such as Jewel Lake and the Meadow Street sedimentation basin in Anchorage. Birgit is on the Board of Directors of the Anchorage Waterways Council and is a member of the Monitoring Technical Advisory Committee. AWC, and particularly the monitoring program, is lucky to have Birgit's expertise and she is a patient teacher for us non-chemists! Thanks Birgit from the Monitoring Program!

Conductivity and Total Dissolved Solids

an electric current and a direct measure of ions such as chloride, nitrate, sulfate, and phosphate, magnesium, and calcium cations (ions that are affected primarily by the geology of the area). Streams that run through areas with granite bedrock, which is composed of more inert materials that do not dissolve easily, have lower conductivity. On the other hand, streams that run through areas with carbonate soils tend to have higher conductivity because the carbonates dissolve very easily and they can dominate stream chemistry. In addition high conductivity can also be caused by anthropogenic sources such as failing septic systems, discharge from sewage treatment and industrial plants, human-caused and agricultural runoff, mining, residential runoff, leaching of contaminants, and point and point source water pollution.

Total Dissolved Solids (TDS) is a measure of the combined content of all inorganic and organic substances contained in a liquid in: molecular, ionized or micro-granular (colloidal sol) suspended form. Total dissolved solids must be small enough to survive filtration through a sieve the size of two micrometers. TDS is used as an indication of aesthetic characteristics of drinking water and as an aggregate indicator of the presence of a broad array of chemical contaminants. The primary sources for TDS in waters are agricultural, mining, and residential runoff, leaching of soil contamination and point source water pollution discharge from industrial or sewage treatment plants.

Nitrate-Nitrogen and Orthophosphates: Nitrogen is required by all organisms for the basic processes of life to make proteins, to grow, and to reproduce. Nitrogen is very common and found in many forms in the environment. Inorganic forms include nitrate (NO₃), nitrite (NO₂), ammonia (NH₃), and nitrogen gas (N₂). Organic nitrogen is found in the cells of all living things and is a component of proteins, peptides, and amino acids. Nitrogen is continually recycled throughout the environment in its various forms in the "Nitrogen Cycle". Nitrate, nitrite, and ammonia are common forms of nitrogen in water.

Sources of nitrates include wastewater treatment plants, runoff from fertilized lawns and croplands,

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outhouses and failing septic systems, animal waste, acid rain deposition, and industrial discharges that contain corrosion inhibitors. Excessive concentrations can be harmful to humans and wildlife. Together with phosphorus, nitrogen concentrations in excess amounts can lead to eutrophication, causing dramatic increases in aquatic plant growth such as phytoplankton which leads to lowering of oxygen content below tolerance limits for higher aquatic life forms. It therefore can cause changes in the types of plants and animals that live in a water body.

Phosphorus is an essential nutrient for the plants and animals that make up the aquatic food web. Since phosphorus is a nutrient in short supply in the typically clay-rich soils of Southcentral Alaska and in most fresh water, even a modest increase in phosphorus can set off a whole chain of undesirable events in a water body. There are many sources of phosphorus, both natural and human. These include soil and rocks, wastewater treatment plants, runoff from fertilized lawns and croplands, outhouses and failing septic systems, animal waste, runoff from disturbed land areas, drained wetlands, water treatment, mining, and commercial cleaning chemicals.

Phosphorus may exist in an inorganic or organic form and may be in a dissolved or particulate phase. Phosphorus is most commonly found in the Orthophosphate (an acid) form. There are various types of tests for measuring the different forms in which phosphorus can exist. We report our results as mg/L of dissolved orthophosphate) which reflects only part of the total phosphorous present in the water.

Turbidity: Turbidity, or water clarity, is a measure of how much of the light traveling through water is scattered by suspended particles. Any material mixed and suspended in water will reduce its clarity and make the water turbid. Such materials can come from various sources, both natural and anthropogenic. High turbidity levels can be disruptive to aquatic systems in various ways including: (1) interfering with the passage of light through water (resulting in reduced photosynthetic activity), (2) clogging the gills of some fish species, (3) causing an increase in water temperature since suspended particles absorb more heat (resulting in a reduction of dissolved oxygen because warmer water holds less oxygen), and (4) smothering fish eggs and benthic macro-invertebrates.

Escherichia coli: *Escherichia coli* (*E. coli*) are gram negative rod-shaped bacterium that is commonly found in the lower intestines of endothermic animals (warm-blooded). Although some forms of *E. coli* have been associated with food poisoning, they are a normal part of the flora of the gut, and they produce Vitamin K which is beneficial to their hosts. Their ability to survive outside the body for periods of time makes them excellent indicator organisms for the presence of fecal contamination. Fecal material can contain pathogenic organisms such other bacteria, viruses, protozoans, and parasites. Fecal contamination is an important cause of the spread of such diseases as typhoid fever, dysentery, and cholera. Humans are not the only source of *E. coli*. In the Anchorage area, dog poop is a major contributor along with that from moose, goose, duck, muskrat, beaver, and a number of other endothermic animals.

Our sampling of *E. coli* is done by collecting 1 and 5 ml sample of water, which are put in a sterile vile containing Coliscan®. Coliscan® is a medium that encourages the growth of *E. coli* bacteria colonies. The samples mixed with Coliscan® are taken back to the monitor's home, and both of the samples are poured into separate Petri dishes and incubated from 24 to 48 hours. The number of bacteria colonies are then counted and recorded. The State of Alaska assesses *E. coli* with a more complex and expensive method so our data cannot be directly compared. The State has no standards for *E. coli* numbers in waters used for the growth and propagation of fish, shellfish, other aquatic life, and wildlife. State standards do apply to water used for drinking, aquaculture, and contact recreational purposes.

Respectfully submitted,

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& Water Quality Monitor