COLUMBIA BASIN TRUST
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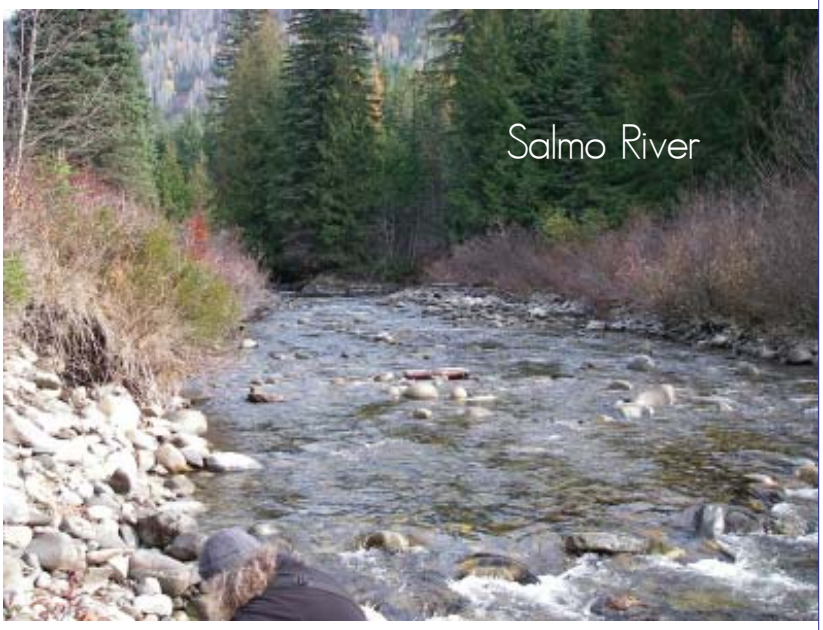
Columbia BasinWatershed Network: Water Quality Monitoring Project


Kimberley Creek


Salmo River

Year 1 -- 2007-2008


Bonanza Creek


Joseph Creek

Acknowledgments

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Columbia Basin Trust - Water Initiatives Program

Organizations

Columbia Basin Trust Water Initiatitves Program
Kootenay River Network-BC - Joseph Creek Community Action Team
Salmo Watershed Streamkeepers Society
Slocan Streamkeepers Society
Mark Creek Recovery - Kim/Cran Branch of Wildsight
Environment Canada
Selkirk College Geospatial Research Centre
College of the Rockies - Continuing Education Department

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Jim and Laura Duncan ● Kootenay River Network-BC ● April 2008

Executive Summary

In response to recommendations from a Water Quality Sampling Workshop hosted by the Columbia Basin Trust Water Initiatives Program in 2006, Kootenay River Network-BC agreed to project manage a pilot project involving four watershed groups; two from the West Kootenay and two from the East Kootenay.

The pilot, or the Columbia Basin Watershed Network – Water Quality Monitoring Project, agreed to adopt Canadian Aquatic Biomonitoring Network (CABIN) protocols for our water quality sampling methods. CABIN is easy to learn and can be implemented for relatively low cost. The CABIN protocol is useful for "red-flagging" any anomalies in the water quality data that individual watershed groups can follow up on.

Our project is also interested in testing the feasibility of long-term monitoring. How possible is it to involve many watershed groups in the Columbia Basin in annual CABIN sampling? In part, the project is testing the feasibility of adopting a core water quality sampling regime that can be used by many watershed groups throughout the Columbia Basin.

The project is also creating an interactive web-based database to house and make accessible water quality data from Columbia Basin watershed groups (See Appendix V and VI). The database is designed to accept historic and non-CABIN data as well. Once completed, the database will reside on the Columbia Basin Trust website.

This report signifies completion of the first year of our five year project. All four groups in the pilot have successfully completed their first year of CABIN sampling (see Appendix I – IV) and data handling and we hope to begin expanding our water quality sampling network during year two.

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Introduction

The idea of an integrated stream monitoring program across the Columbia Basin emerged during a gathering of Basin watershed groups in May 2005.

It all started when the Columbia Basin Trust Water Initiatives Program invited all the Columbia Basin watershed groups to a gathering at Selkirk College, Castlegar in May 2005.

At the end of this weekend symposium a major recommendation from the groups was for training in water quality monitoring.

Water Initiatives followed up with a training weekend in Kimberley in September 2006 at the College of the Rockies. At the end of this weekend four watershed groups agreed to pilot an integrated water quality monitoring program. The four groups include:

- Slocan River Streamkeepers Society
- Salmo Watershed Streamkeepers Society
- Mark Creek Recovery Program through Kim-Cran Branch of Wildsight
- Joseph Creek Community Action Team through Kootenay River Network-BC

Over the following winter the four groups designed a five year water quality monitoring project, with hopes that the project would grow with additional watershed groups and would continue for the foreseeable future.

The three goals of the project are:

1. To develop a model for community-based water quality monitoring
2. To establish accessibility to the water quality data through web technology
3. To link the monitoring program with community water conservation awareness activities

Why involve community watershed groups?
Because Community Watershed groups:

- Commit energy protecting the ecological integrity of their watershed
- Commit time focusing on the health of their watershed
- Commit energy repairing and restoring the ecological integrity of their watershed
- Have a personal stake in the overall health of their watershed.
- Have intimate knowledge about their watershed
- Know the history of their watershed
- Ensure that the water quality data stays alive in the community rather than gathering dust
- Are in the best position to influence politicians making decisions affecting their watersheds
- Can be watchdogs providing early warning of any indicators of risk to their watersheds
- Ensure that recommendations emerging from the water quality data will be implemented
- Will educate others in the community about the importance for caring for their watershed
- Have the highest stake in being the prime advocates for the quality of their watershed

The Monitoring Network can assist watershed groups in:

- Developing science-based water quality monitoring methods
- Storing their monitoring data safely for the long-term
- Sharing their data with their community and beyond

An important feature of our project is its long-term nature. Over time, we will be able to track water quality trends analysis within watersheds in the Columbia Basin.

In April 2007 the Water Initiatives Program of the Columbia Basin Trust agreed to fund the project for five years, pending annual reviews and approvals.

Representatives from the four participating watershed groups attended a four day Environment Canada CABIN training school at College of the Rockies in Cranbrook at the end of April 2007. It was a theory and field school on CABIN sampling methods and data entry.

During the summer, sampling equipment was purchased and contracts were established for water chemistry laboratory analysis and macro invertebrate classification services.

In September and October the four watershed groups completed Year 1 water quality sampling and over the winter they entered the data in the Environment Canada CABIN database.

Phil Chau and Ayisha Yeow of Environment Canada created a schematic design of the project database in February. In April 2008 we signed a contract for the programming of our local web-based database.

In year two and three of our project we will develop ways of expanding the number of partner watershed groups. Increasing the number of partners will increase the knowledge-base of water quality in the Columbia Basin and more data from more places will give an even clearer picture of the emerging trends of water quality in the Columbia Basin.

Monitoring on the South Slocan

Methods

Goal 1: Develop a model for community-based water quality monitoring

Both traditional methods of water quality analysis and the CABIN protocol require standardized scientific procedures and tools. Traditional water quality analysis focuses primarily on physical and chemical parameters, while the CABIN method focuses primarily on biological indicators. Using standardized procedures and instruments ensures the results are scientifically defensible and comparable to other scientific water quality sampling programs. The resulting scientific data can also be applied to water quality regulatory guidelines.

CABIN methods have been developed by Environment Canada over the last 10 years as a monitoring tool that can be used by community watershed groups. Without compromising its scientific base, the CABIN method requires less time and expense to carry out because it is primarily used by community groups as a diagnostic tool. The data will indicate if there are any anomalies in the aquatic community of local streams and this information can be easily conveyed to the BC Ministry of Environment, Environmental Quality Section for follow up.

In the CABIN protocol, monitors take samples of the macro-invertebrate population as well as recording a number of physical and chemical measurements. These physical and chemical parameters are used to place each local stream into a stream class. Within each stream class, Environment Canada personnel have determined what type of macro-invertebrate community can be expected to be found in a healthy system. Thus community groups can compare their stream macro-invertebrate populations with populations found in reference, or undisturbed, streams of like class. If community groups find significant differences in their macro-invertebrate community as compared to those found in the reference streams, they would contact the Environmental Quality Section of the BC Ministry of Environment for further investigation.

In order to use the CABIN method, local watershed groups must be trained by Environment Canada in how to collect data and how to enter data in the CABIN national database. The database allows each watershed group to interpret the data related to their local streams.

Sampling parameters - Columbia Basin Watershed Network - Water Quality Monitoring Project using the Canadian Aquatic Biomonitoring Network (CABIN) protocol:	
Physical parameters	**Chemical parameters**
- Stream order - Particle type/size in substrate - Embeddedness (estimate of average) - Substrate size (by random method) - Size of surrounding substrate material - Channel measurements - (Slope/Gradient/Cross-Section and Flow) - Stream velocity - Temperature (hourly intervals Jun-Nov)	- pH - Conductivity - Dissolved oxygen - Total suspended solids (turbidity) - Total phosphorous - Metal scan - Nitrogens - Alkalinity - Total and fecal caoliforms
Biological parameters	
- Benthic macro-invertebrate samples acquired through a 3 minute kick net procedure - Habitat types present - Canopy coverage - Macrophyte coverage - Extent of riparian zone	

Local Database

Goal 2: Establish accessibility to the water quality data through web technology

The Environment Canada CABIN database is vital to our project, because it allows us to interpret individual stream data in reference to the entire Columbia Basin. The CABIN database, however, is not accessible to the public.

The most effective way to make local data accessible to the public is through web-technology. Through a web-based interactive database, individuals can see the water quality results of the streams included in our project. Not only will citizens be able to see the data; they will be able to ask questions such as "what are the daily maximum temperatures of a specific stream over the time period they are interested in".

People will also be able to track trends or changes in water quality, flow and temperature of streams in our study over time. The more streams we add to our study, the clearer will become the picture of water quality trends in the Columbia Basin.

The local database will allow for increasing the number of participating watershed groups and it will also allow the entry of historic data collected prior to the start of this project. One other feature of the local database is that it will be able to accommodate different kinds of data. sets such as fish population data.

Five data sets will be able to upload into the local database:

- Habitat Data
- Water Chemistry
- Macro Invertebrate
- Temperature
- Fish count data

The public will be able to get reports including:

- Habitat data - Location, Substrate, Velocity, Channel profile, Flow, Canopy, Riparian
- Temperature – Maximum daily temperatures for sites over chosen time periods
- Flow – by sample site or stream for selected years
- Water Chemistry – Including any of the parameters by site or streams
- Macro Invertebrate – Diversity and abundance of aquatic macro invertebrates
- Fish Data - numbers of species and numbers of individuals - redd count statistics

Selkirk Geospatial Research Centre is a full partner in our project and will be developing systems that will allow the public to access to our water quality data via the CBT interactive map. People will be able to display the map on their computer and will be able to retrieve water quality data by pointing to our sample sites.

The schematic design for the local database is included in Appendix VI, page 28.

The list of local database queries is included in Appendix VII, page 29

Discussion

The first goal of this project was to establish a sampling system that is relatively easy to learn and which ensures a standardized scientific approach to water quality sampling procedures and data entry by participating groups. We adopted the Canadian Aquatic Biomonitoring Network (CABIN) system, which has been developed by Environment Canada as a sampling protocol that can be used by local watershed groups.

It is important that the sampling program does not require large amounts of time to implement, otherwise the project will be difficult to sustain over the long-run and it will be difficult to encourage other groups to join. It is just as important that the project be able to accommodate additional data from any participating group able to carry out much more in-depth sampling of their watersheds.

Although funding for this project covers the CABIN sampling program, it is not meant to support the cost of additional in-depth sampling. The project has instigated a $1,000 discretionary fund for each participating group each year. This money can be used to support additional sampling and to lever fund raising for additional sampling.

We were extremely fortunate receive our CABIN training as one of the last face-to-face classes Environment Canada will do. People wanting to learn the CABIN method from now on must complete the theory part of the course online and then attend a one-day field course put on by Environment Canada.

Although at least two people from participating watershed groups must complete the CABIN training before they can independently collect water quality data and enter it in Environment Canada's CABIN database, members of our Network are keen to mentor groups until they complete the training. Contact the people listed at the bottom of page 10 for additional information.

Goal 2 of this project was to enable public access to our data through web technology. This goal has been largely achieved thanks to Phil Chau and Ayisha Yeow of Environment Canada, who are actively participating in the conceptual and practical creation of the database. Richard Ware, CBT's IT Manager, has given his enthusiastic support to the database project and is keen to house our database on the CBT servers.

The web-based database is a key ingredient of our project and is being designed to accommodate historical and additional data from participating groups. We are automating the database as much as possible so that it will be able to stream data from water quality labs, temperature loggers and taxonomy labs.

Sharing, pooling and integrating water quality and water quality related data through an interactive web-based database is a cornerstone of this project. This collective data will tell the story of water quality trends in the Columbia Basin; the more groups we are able to involve - the better the picture.

The first year of our project can be characterized as establishing the framework, while the second year will be characterized by refining the framework and engaging our communities and other watershed groups in the project.

Goal 3: Link the monitoring program with community water conservation awareness activities

In Year 2, each watershed group partner will be designing and implementing education-outreach activities to engage their communities. Groups will be able to share their education-outreach plans and how effective they are through the watershed network.

Key elements in the education-outreach program include:

- Involvement in water quality sampling
- How data from our project relates to water quality
- Access to our web-based interactive database
- Linking our database to the Columbia Basin Trust geospatial mapping system

Having built the framework of water quality sampling and data storage and retrieval for the project, our next big challenge will be adding new watershed groups.. Much of the work of the project is carried out by volunteer effort. To that end the project must continue to be driven by local groups; if the project adopts a top-down style, we will lose, rather than gain groups.

It is imperative the project continue providing a budget that compensates efforts related to the core sampling, data handling and education-outreach activities. The $1,000 discretionary fund for each group will allow them flexibility to support additional water quality sampling or education-outreach activities.

A significant portion of the budget will be allocated to mentorship and training to ensure quality control and quality assurance of our water quality sampling procedures. We are fortunate to be able to draw on several members of The Coumbia Basin Watershed Network to support these activities as well as Environment Canada staff members.

Conclusion

Although this project is about establishing a way for grass roots watershed groups to be able to carry out scientific water quality sampling in their home watershed and to have their data integrate with data from other watershed groups it has also been an effort in social networking.

The four groups participating in the project are separated by large distances, so much of the planning and establishing of procedures and protocols has been carried out by e-mail and telephone conferencing.

Our integrated water quality sampling program is both innovative and challenging. We owe much gratitude to the Columbia Basin Trust Water Initiatives Program Steering Committee for taking the risk of providing multi-year funding for our project.

Contacts to find out more information about joining our Network...

West Kootenay

Jennifer Yeow passlab4 @ netidea.com
Gerry Nellestjin gerry@streamkeepers.bc.ca

East Kootenay

Jim Duncan waterjim@shaw.ca
Helen Sander kimcran@wildsight.ca

Background

For a stream approximately 10 km in length, nestled in a watershed of a scant 1000 hectares, the Kimberley Creek ecosystem faces a host of challenges. So do the human communities that rely on the ecological services the Kimberley Creek ecosystem provides. Extensive logging is proposed in the steep pine dominated headwater slopes. Decades of fire suppression, mountain pine beetle and the favourable economics of logging close to town play a role. There's little doubt that this logging will have hydrologic and water quality impacts. The community of Meadowbrook relies on Kimberley Creek water quantity and quality -their potable water is pumped from the Kimberley Creek reservoir. Less than 100m downstream of the reservoir the creek enters Morrison Sub and is channelized through a hodgepodge of mix-matched culverts and ditches. These structures can't contain freshet and flooding into Morrison Sub properties and basements is already an annual occurrence. At the downstream end of the subdivision the creek enters a culvert and flows below Kimberley. Somewhere underground the culverted creek picks up metals such as zinc and cadmium. Now throw in the fact that Kimberley Creek supports genetically pure Westslope cutthroat trout (WCT), a provincially blue-listed species at risk, and we can see that this is a creek definitely worth looking at.

Who We Are

The Kimberley Creek CABIN September/October 2207monitoring was carried out by:

- **Karen Paynter** raised her family in Morrison Subdivision along Kimberley Creek. Karen has a local naturalist with an interest in stream ecology and enjoys "messing about and looking at bugs in the creek".
- **Kim Hartling** and her family also live along Kimberley Creek. Kim has a background in environmental education and has worked for as a Bear Aware educator in Kimberley.
- **Helen Sander** is a biologist and has coordinated Wildsight's Mark Creek Recovery Program for the past 8 years. Kimberley Creek is a tributary of the Mark Creek - after flowing through Morrison Subdivision it enters a culvert and flows under Kimberley to Mark Creek. Helen looks forward to the day sometime in the future when Kimberley Creek is "daylighted".
- **Ingrid Liepa** wears far too many hats to describe in this space. To mention a few - she has a background in resource management and law and has championed air quality issues through work with industry, government and as a consultant. She is currently Wildsight's Clean Air and Climate Change coordinator in Kimberley. As a resident of Summer Sub, Ingrid's home's is supplied with water from the Kimberley Creek reservoir (Meadowbrook water supply) with supplementation from a groundwater well when the reservoir is low.
- **Lars Sander-Green** has a background in physics. So far, he's been able to get all of our monitoring equipment running.

Note- The honorarium/contractors fees for monitoring supplied by the project was split between Karen & Lars who did most of the work.

The Group

As yet our group does not have a formal goal or structure. Helen and Karen took on the CABIN monitoring to give us the opportunity to learn about Kimberley Creek. The value of monitoring is not only in the quantitative data obtained but is in having community members observing the stream. While on a morning walk to chose our monitoring sites we found a pipe with chlorinated water flowing directly into Kimberley Creek. By that afternoon the City had solved the problem by closing a valve. Apparently City water had been flowing into the creek for 6 months.

CABIN Monitoring Site Locations

KMB 01 07- Upstream monitoring site above Meadowbrook Reservoir
KMB 02 07- Mid monitoring site below reservoir & above Morrison Sub
KMB 03 07- Downstream monitoring site below Morrison Sub but upstream of culvert intake. (09/10/07 metals sample taken at this site)

Temperature Monitoring

We focused on the CABIN monitoring (okay… we scrambled to get the CABIN monitoring done) in late September and early October and didn't get the temperature loggers installed in 2007. We'll install these after freshet in 2008. I see assessing temperature over the summer and low flow periods as the most valuable aspect of the monitoring program as we'll be able to draw immediate conclusions on the impact on aquatic life, in particular WCT.

Our Group's Other 2007 Initiatives

- We created a bibliography and obtained existing Kimberley Creek related studies.
- With the help of McKim grade 4 &5's we transplanted 200+ red osier dogwood and willow plugs into one and two gallon pots. The potted shrubs are overwintering on Karen Paynter's property in a fenced in area (protection from deer). These shrubs will be made available to Morrison Sub residents for riparian restoration.
- We reviewed preliminary Kimberley Creek hydrology studies produced by Tembec. We are now looking at the logging plans and have started a dialogue on potential impacts on water quantity and quality with Tembec, the City of Kimberley and the Meadowbrook Improvement District.

Report prepared by Helen Sander
Coordinator, Mark Creek Recovery Program
Wildsight Kimberley/Cranbrook

Kootenay River Network-BC -- Joseph Creek Community Action Team

Kootenay River Network-BC (KRN-BC) is a registered society in British Columbia with Canadian Charitable Status. Because of our historic relationship with Kootenai River Network – Montana, we have a transboundary Board of Directors with members from BC and Montana.

Vision

KRN-BC collaborates with partners to strengthen the sustainability of water resources in the Kootenay River watershed.

Mission

We collaborate with others to encourage understanding and to assist in the conservation of the aquatic resources in the Kootenay Basin.

Creek Science

Creek Science lessons for Grades 4-7 actively engage students in monitoring creeks. The data they collect in the field is interpreted and analysed in their math class. The program includes:

- Grade 4 Velocity (speed of water)
- Grade 5 Channel characteristics (substrate and channel complexity)
- Grade 6 Macroinvertebrates (small organisms living on the creek bottom)
- Grade 7 Flow (calculating the volume of water and graphing the channel profile)

The lessons are integrated with the Instructional Resource Packages and the Intended Learning Outcomes prescribed by the BC Ministry of Education.

Stream Trailer

This converted 5 x 10 utility trailer has been outfitted with a water reservoir, pumps and sand-like substrate that sits in an eight inch deep stream table. With the Stream Trailer we can demonstrate:

- Results of erosion
- Results of removing riparian vegetation
- Impacts of various land uses

Creek Restoration

KRN-BC, through the **Joseph Creek Community Action Team**, coordinated a stream restoration project in the middle of Cranbrook at Kinsmen Park. The project serves as a living laboratory for schools and community groups. The project involved anchoring ten in-stream structures in the Kinsmen Park reach to help build pools and protect the stream bank. We also planted 4,400 trees, shrubs and sedges to augment the creek bank vegetation. After a riparian vegetation workshop with park maintenance workers, a no-cut zone along the creek was established.

Monitoring Kinsmen Park

KRN-BC has coordinated several kinds of on-going monitoring activities to determine effects of our restoration project. These monitoring activities include:

- A bird survey each May and June
- Channel profile studies (Every 5 years)
- Photopoint monitoring (Bi-annual)
- Vegetation surveys (Bi-annual)
- Continuous temperature monitoring (June – November – Annually)
- Canadian Aquatic Biomonitoring Network sampling (Annually in the fall)

Columbia Basin Watershed Network – Water Quality Monitoring Project

KRN-BC is coordinating this project, which currently includes two watershed groups from the West Kootenay and two from the East Kootenay. We hope to expand the network with more groups soon.

The Salmo Watershed Streamkeepers Society (SWSS)

The Salmo Watershed Streamkeepers Society (SWSS) is a skilled and motivated aquatic ecosystem stewardship group focusing their efforts in the Salmo River Watershed and in the Upper Columbia Basin.

HISTORY:

SWSS received its original mandate in May of 1997 as a result of an FRBC funded community driven workshop called "A Jobs and Forest Sector Strategy For the Salmo/Ymir Area (101pgs.)". The workshop was a "community brainstorming" event that identified a number of new employment opportunities in areas of interest for making our area a better place to live. The workshop was attended by approximately 150 people, 15% of the population of the community of Salmo. Streamkeepers was identified as an opportunity to engage in watershed restoration and increase the aquatic health of our river. A group of eight community members came together to draft a constitution and bylaws to formalize the direction of our society. In April of 1998, SWSS became a registered not-for-profit corporation and the following year was awarded federal charitable status.

SWSS operates and their goals and objectives are dictated by the following governing document.

Constitution

1. The name of the society is: The Salmo Watershed Streamkeepers Society.
2. The purpose(s) of the society is (are) to:
    1. Protect and restore streams, streambeds and riparian zones that foster stream dependent biodiversity. We will do so in an environmentally, socially and economically sustainable way, giving residents and visitors alike access to a healthy watershed.
    2. Form collaborative partnerships with private landowners, public agencies, private forestry operations, as well as First Nations, industry and other interested and active groups.
    3. Recruit, train and coordinate an informed, courteous, safety oriented volunteer group to carry out stewardship principles in our watershed.
    4. Promote healthy watershed principles to the public, school groups and others.
    5. Faithfully collect, record and monitor data concerning water quality, flows, invertebrates, fish and other water bound life.
    6. Share our knowledge equally with all.

Bylaws

The bylaws of the society are those set out in Schedule B to the Society Act, with the following variations, deletions and additions.

8. (4) Membership in The Society will be reviewed if a member is acting in an unsafe or discourteous manner while carrying out Streamkeeper duties.

23. (1) No member shall claim any particular political affiliation to be that which is held by The Society

40. (3) It is the duty of the president to assure non-political representation within The Society.

The Salmo Watershed Streamkeepers Society (SWSS)

ACHIEVEMENTS:

SWSS has been very active in the Salmo River Watershed and beyond. Most recently, SWSS has completed a 'living' Watershed-based Fish Sustainability Plan (212 pg.) that has been approved by both the Department of Fishies and Oceans Canada (DFO) and the BC Ministry of Environment (MoE). SWSS, and their coordinator Gerry Nellestijn, were also recognized with an award for "Ecosystem Excellence" by the Frazer Basin Council for the interior of BC. As far as we are aware, SWSS has played a leading or supportive role in every aquatic ecosystem oriented study or monitoring or education or restoration (with the exception of one) project in their watershed. SWSS has just completed a 9 pg 'StoryPole History' of the Salmo River Watershed pointing out milestones in the development of this area and the resulting influence to the river. A photo exhibition and a revolving PowerPoint presentation called "A Year in the Life of the River" will accompany the unveiling of the StoryPole historical display and booklet. The list of awareness activities like 'The Year in the Life of a River' flow from the SWSS multi-faceted awareness campaign "The River Speaks". Projects like 'RiverArt 2000', the 'No Boundaries Concert' held in Spokane Washington. Watershed Radio, the Salmo Secondary School Stream Team and many others have been fun for SWSS and our community.

Restoration projects, like the Car Body Run and the Yankee Girl Tailings remediation, the 5th largest remediation project in the province, are proud success stories for SWSS. Many other smaller restoration/planting jobs punctuate our history.

The following partial list highlights some of our research achievements:

Scientific Studies SWSS has participated with or initiated/lead or co-funded.

- *Bull Trout Studies in the Salmo River Watershed*. Various Authors. 1999 – 2005.
- *Habitat Assessments and Restoration Prescriptions for the "Upper and Lower Car-body Run" of the Salmo River*. PSlaney Aquatic Science Ltd, December 2004.
- *The Salmo River Watershed-based Fish Sustainability Plan Report, Stage Two: Setting Watershed Priorities*. Bill Green, Gerry Nellestijn, Pat Field, June 2004.
- *Conservation Status of the Main-stem Salmo River Rainbow Trout Population.* John Hagen and James Baxter. 2003.
- *Salmo River Rainbow Trout (Oncorhynchus mykiss): Population Size and Habitat Use – Interim Report*. Baxter Environmental, March 2002.
- *Pre-fertilization Monitoring of the South Salmo River and Sheep Creek.* Scott Decker and Associates. 2002.
- *Aspects of the Biology of Bull Trout (Salvelinus confluentus) in the Salmo River Watershed as Identified through Radio Telemetry (2000/2001 data) and a Watershed Management Plan for the Species*, Baxter Environmental, December 2001.
- *Summary of the South Salmo River Bull Trout Enumeration Project (2000),* Baxter Environmental, March 2001.
- *Bull Trout Studies in the Salmo River Watershed: 2000*, Baxter Environmental/SWSS, March 2001.
- *Assessment of Constructed Non-Sportfish Migration Barrier on the Salmo River Using Radio Telemetry and Floy Tagging*, Baxter Environmental, February 2001.

- *Salmo River – Sites 1 & 2, Fish Habitat and Erosion Protection Works, Construction and Monitoring*, Zimmer & Associates, February 2001.
- *Sheep Creek Bull Trout Spawning Platforms: Feasibility Study*, Baxter Environmental, January 2001.
- *Aspects of the Biology of Bull Trout in the Salmo River Watershed as identified through Radio Telemetry*. James Baxter, Gerry Nellestijn, Baxter Environmental/SWSS. 2000.
- *Salmo River Harlequin Duck Inventory, Monitoring and Brood Habitat Assessment*, Pandion Ecological Research Ltd./SWSS, November 2000
- *Inventory of Mine Tailings and Ponds in the Salmo Watershed*, Lisa Heinbuch, Gerry Nellestijn/SWSS, November 2000.
- *Report on Non-Sportfish Abundance and Migration Patterns in the Salmo River*, James Baxter, Gerry Nellestijn, Baxter Environmental/SWSS, August 2000.
- *Pre-incubation Inventory of Harlequin Ducks in the Salmo River Valley*, Pandion Ecological Research Ltd./SWSS, September 1999.
- *The Place Where We Live – Looking Back to Look Forward*, Historical overview of the Salmo Watershed, authored by the SWAP squad/SWSS, Autumn 1999.
- *Bull Trout Studies in the Salmo River Watershed: 1998 and 1999*, Baxter Environmental, December 1999.

Annually, SWSS members participate in watershed-based fisheries inventory swims, bull trout redd counts, water quality monitoring, temperature monitoring, research, monitoring and restoration projects and various other “The River Speaks” awareness projects.

KEY PLAYERS:

Our membership is presently 67 people of which 11 are key players that together hold expertise in forestry, silva-culture, environmental management, biology, creative graphic design, watershed restoration, agricultural, carpentry and management roles.

Slocan River Streamkeepers

Biological Monitoring, River Restoration and Educational Outreach in the Slocan Valley: Collaboration between Streamkeepers, Biologists and Local High School Students

The Slocan River Streamkeepers (SRS) was founded in February, 2003 and became a fully incorporated Society under the Societies act in May of 2005. The Streamkeepers mission is to "work with the local community to promote awareness of the aquatic environment and engage in restorative and monitoring activities that benefit the Slocan River"

The group appreciated an association with the Columbia Kootenay Fisheries Renewal Partnership and adopted their three pronged approach to community activism as a way to meet their mandate. Hence, the three "pillars" of the Streamkeepers Program are: conducting monitoring and assessment of key aquatic parameters, community education and outreach and engaging in river restoration activities.

Streamkeepers have combined monitoring and assessment work with outreach in their program called "Community Assessment of the Slocan River". Now in its sixth year, this program gathers baseline data related to river conditions including relative stream flow, water temperature and water quality, fish counts, and benthic invertebrates surveys.

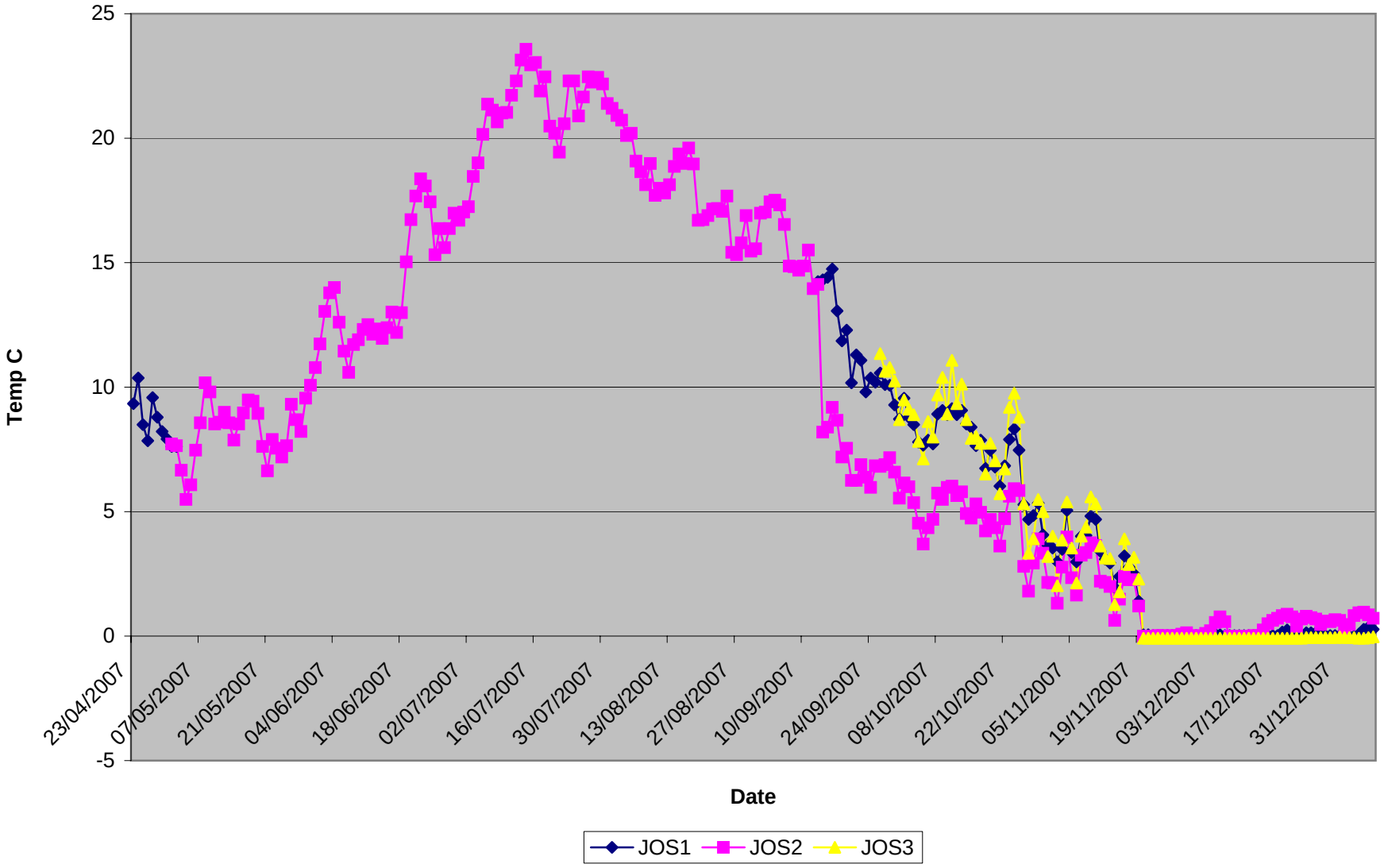
In the Fall, Streamkeepers give presentations at local elementary schools and collect field data in conjunction with the Biology 11 classes at local high schools. The unique "partnership" with students enables them to have a "hands-on" experience sampling and collecting data with different types of equipment and gives an appreciation for science at work. After helping with data collection some of these students also have opportunity to work with Streamkeepers-planting trees beside the river.

In the spring, Streamkeepers count spawning fish and then, in late summer, biologists swim as much of the river as possible to get an accurate count of all the rainbow trout. Fishing is becoming more popular as more folks learn about the Slocan's "world class" fishery and in order to keep fish populations healthy Streamkeepers want to know the river and condition of the fish.

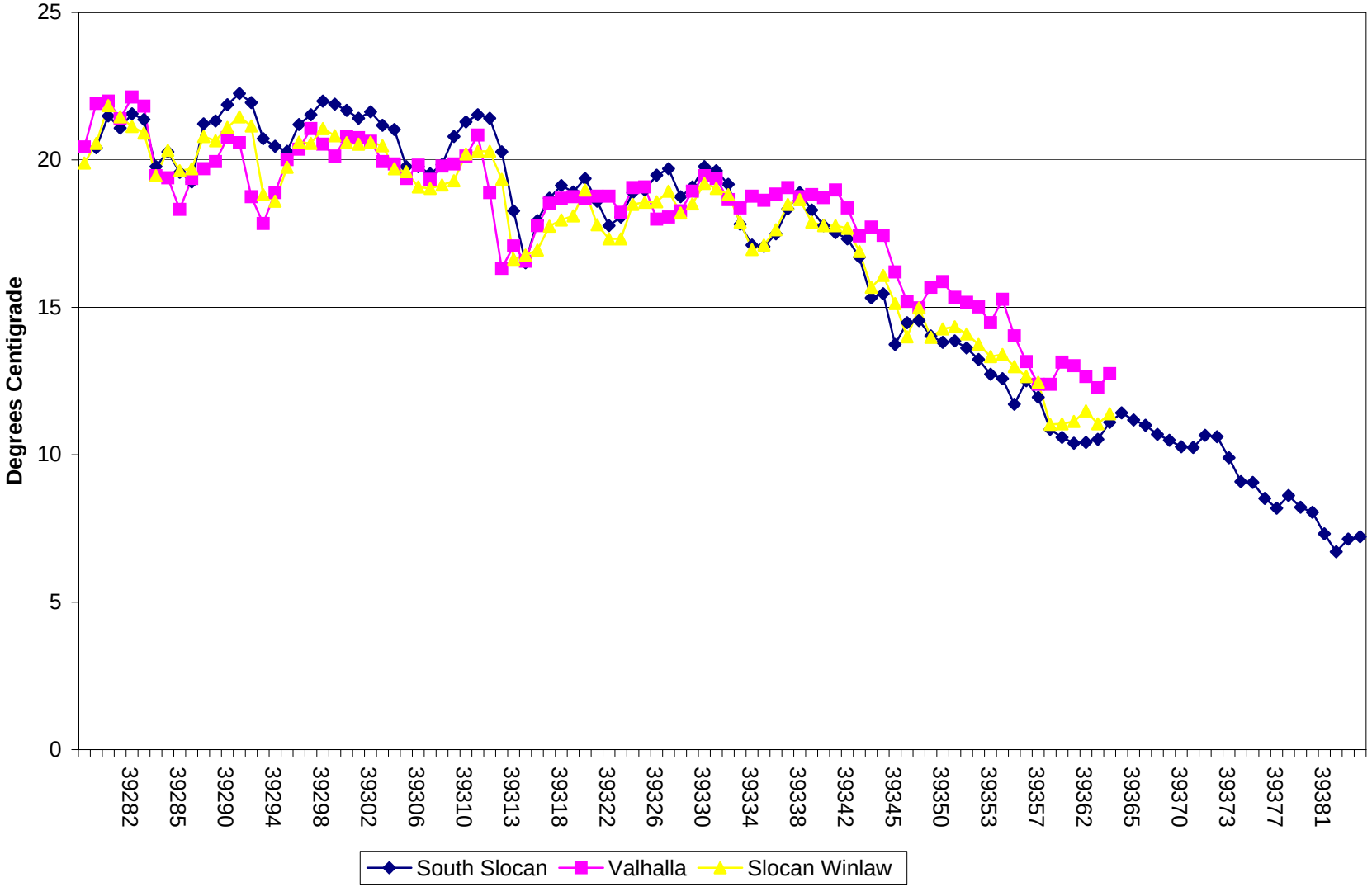
In partnership with the Columbia Power Corporation, Streamkeepers coordinate an intensive riverside tree planting, fencing and bank restoration program. While the mandate of the program is to enhance fish habitat, landowners benefit through conservation of their riverside land and are able to address riverbank erosion issues.

Funding for Streamkeeper programs is provided through the Columbia Basin Trust and the Columbia Power Corporation.

Max Daily Temp JOS1, JOS2, JOS3 M'07-J'08



Maximum Daily Temperatures on the Slocan River, Summer, 2007



DATA	Units	SLOCAN RIVER				SALMO RIVER				WQ Guide***
		Protocol	Bonanza	Valhalla	S Slocan	Protocol	Upp SR	Mid SR	Low SR	
Date (DD/MM/YY)					12/10/2007					
WQ Parameters										
Temperature			7.5	12.5	11.5		5	6.5	6.7	
Dissolved oxygen			-	10	10.5		14	14	4.4	
Misc. Inorganics										
Alkalinity (Total as CaCO3)	mg/L	SM2320B	61.6	41	54.7	SM2320B	33.7	46.7	50.6	
Alkalinity (PP as CaCO3)	mg/L						<0.5	<0.5	<0.5	
Acidity	mg/L		11.4	5.7	2.3					
Bicarbonate (HCO3)	mg/L						41.2	57	61.7	
Carbonate (CO3)	mg/L						<0.5	<0.5	<0.5	
Hydroxide (OH)	mg/L						<0.5	<0.5	<0.5	
Total Calcium	mg/L	ICP			13.3	ICPMS	14	18.6	19.1	
Total Magnesium	mg/L	ICP			1.88	ICPMS	0.92	1.48	2.41	100mg/L s
Nutrients										
Total Nitrogen (N)	mg/L	SM4500NC	0.13	0.1	0.07	SM4500NC	0.09	0.04	0.03	
Total Phosphorus (P)	mg/L	SM4500	0.017	<0.005	<0.005	SM4500	0.01	<0.005	<0.005	
Physical Properties										
Conductivity	uS/cm	SM2510B	144	86.4	91.4	SM2510B	82	107	118	700uS/cm
pH	pH	SM4500H+B	7.6	7.2	6.8	SM4500H+B	7.8	7.9	7.9	6.5-8.5
Total Suspended Solids (TSS)	mg/L	SM2540D	11.4	1	1.8	SM2540D	<4	<4	<4	25*****
Turbidity	NTU		1.4	0.65	0.35					50 NTU****
Metals										
Total Aluminum	ug/L	ICPMS			20	ICPMS		13		0.1 - 0.2
Total Antimony	ug/L	ICPMS			<1	ICPMS		<0.5		6
Total Arsenic	ug/L	ICPMS			<1	ICPMS		0.3		5(proposed)
Total Barium	ug/L	ICPMS			25**	ICPMS		13		1
Total Beryllium	ug/L	ICPMS			<0.2**	ICPMS		<0.1		
Total Bismuth	ug/L	ICPMS			<50**	ICPMS		<1		
Total Boron	ug/L	ICPMS			<8**	ICPMS		<5		5
Total Cadmium	ug/L	ICPMS			0.04	ICPMS		0.19		5
Total Chromium	ug/L	ICPMS			<1	ICPMS		<1		50
Total Cobalt	ug/L	ICPMS			<0.5	ICPMS		<0.5		
Total Copper	ug/L	ICPMS			0.3	ICPMS		<0.2		≤1mg/L AO
Total Iron	ug/L	ICPMS			43**	ICPMS		22		≤0.3
Total Lead	ug/L	ICPMS			<0.5	ICPMS		<0.2		10
Total Lithium	ug/L	ICPMS			<2	ICPMS		<0.5		
Total Manganese	ug/L	ICPMS			4**	ICPMS		1		≤0.05 AO

WATER QUALITY ANALYSIS - CB WATERSHED NETWORK - WATER QUALTIY MONITORING PROJECT

DATA	Units	SLOCAN RIVER				SALMO RIVER				
		Protocol	Bonanza	Valhalla	S Slocan	Protocol	Upp SR	Mid SR	Low SR	
Total Mercury	ug/L	ICPMS			<0.01*	ICPMS		<0.02		1
Total Molybdenum	ug/L	ICPMS			<5**	ICPMS		1		
Total Nickel	ug/L	ICPMS			<8**	ICPMS		<1		
Total Phosphorous	mg/L				<0.1**	ICPMS		<0.005		
Total Selenium	ug/L	ICPMS			<1	ICPMS		0.3		10
Total Silicon	ug/L	ICPMS			2870**	ICPMS		3590		
Total Silver	ug/L	ICPMS			<0.1	ICPMS		<0.02		
Total Strontium	mg/L	ICPMS			0.177**	ICPMS		92		
Total Thallium	ug/L	ICPMS			<0.1	ICPMS		<0.05		
Total Tin	mg/L	ICPMS			<0.02**	ICPMS		<5		
Total Titanium	ug/L	ICPMS			<3**	ICPMS		<5		
Total Uranium	ug/L	ICPMS			0.5	ICPMS		0.2		20
Total Vanadium	ug/L	ICPMS			<5**	ICPMS		<5		
Total Zinc	ug/L	ICPMS			9**	ICPMS		15		5
Total Zirconium	ug/L	ICPMS			<5**	ICPMS		<0.5		
Total Calcium	mg/L	ICPMS			13.3**	ICPMS		18.4		
Total Magnesium	mg/L	ICPMS			1.88**	ICPMS		1.46		100s
Total Potassium	mg/L	ICPMS			<1**	ICPMS		0.75		
Total Sodium	mg/L	ICPMS			1.37**	ICPMS		1.3		≤200
Total Sulphur	mg/L	ICPMS			2.2**	ICPMS		<3		
Dissolved Calcium	mg/L	Atom Spect				EPA 200.8	14	18.6	19.1	
Dissolved Magnesium	mg/L	Atom Spect				EPA 200.8	0.92	1.48	2.41	
Calculated										
Hardness	mg/L	calc	153.9	51.3	51.3(40.8 Mx)			51.8		80 - 100
Dissolved Hardness							38.6	52.6	57.5	

RDL=Reportable Detection Limit

* Mercury by CVAA
** analysis by ICP
*** Guidelines for Canadian Drinkig Water Quality, except where noted
**** Recreation water quality guidelines
***** Aquatic Life Guidelines
italic figures = analysis by Passmore Lab

Water Quality Analysis

DATA	Units	JOSEPH CR				KIMBERLEY CR				WQ Guide
		Protocol	JOS 01 07	JOS 02 07	JOS 03 07	Protocol	Site 1	Site 2	Site 3	
Date (DD/MM/YY)			05/11/2007	05/11/2007	05/11/2007		09/10/2007	09/10/2007	09/10/2007	
WQ Parameters										
Temperature			6.5	9.5	9.25		6.3	5.9	5.3	
Dissovled oxygen			15	15	13		12	11	13	
Misc. Inorganics										
Alkalinity (Total as CaCO3)	mg/L	SM2320B	120	140	170		96.4	102	103	
Alkalinity (PP as CaCO3)	mg/L		<0.5	<0.5	0.8		<0.5	<0.5	<0.5	
Acidity	mg/L									
Bicarbonate (HCO3)	mg/L		150	170	210		118	124	126	
Carbonate (CO3)	mg/L		<0.5	<0.5	0.9		<0.5	<0.5	<0.5	
Hydroxide (OH)	mg/L		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	
Total Calcium	mg/L	ICP					25.9		26.9	
Toal Magnesium	mg/L	ICP					8.95		9.42	100mg/L s
Nutrients										
Total Nitrogen (N)	mg/L	SM4500NC	0.07	0.07	0.57		0.1	0.39	0.14	
Total Phosphorus (P)	mg/L	SM4500	<0.005	0.016	0.019		<0.005	0.005	0.012	
Physical Properties										
Conductivity	uS/cm	SM2510B	240	270	400		197	207	207	700uS/cm
pH	pH	SM4500H+B	8.3	8.3	8.3		8.1	8.1	8.1	6.5-8.5*****
Total Suspended Solids (TSS)	mg/L	SM2540D	<4	21	5		<4	<4	4	
Turbidity	NTU									50 NTU****
Metals										
Total Aluminum	ug/L	ICPMS			115				39	0.1 - 0.2
Total Antimony	ug/L	ICPMS			<0.5				<1	6
Total Arsenic	ug/L	ICPMS			0.4				<1	5(proposed)
Total Barium	ug/L	ICPMS			56				23**	1
Total Beryllium	ug/L	ICPMS			<0.1				<0.2**	
Total Bismuth	ug/L	ICPMS			<1				<50**	
Total Boron	ug/L	ICPMS			11				10**	5
Total Cadmium	ug/L	ICPMS			<0.01				<0.01	5
Total Chromium	ug/L	ICPMS			<1				<1	50
Total Cobalt	ug/L	ICPMS			<0.5				<0.5	
Total Copper	ug/L	ICPMS			0.5				0.3	<1mg/L AO
Total Iron	ug/L	ICPMS			193				73**	<0.3
Total Lead	ug/L	ICPMS			0.5				<0.5	10
Total Lithium	ug/L	ICPMS			<5				<2	
Total Manganese	ug/L	ICPMS			13				3*	<0.05 AO

WATER QUALITY ANALYSIS - CB WATERSHED NETWORK - WATER QUALTIY MONITORING PROJECT

DATA	Units	JOSEPH CR				KIMBERLEY CR				WQ Guide
		Protocol	JOS 01 07	JOS 02 07	JOS 03 07	Protocol	Site 1	Site 2	Site 3	
Total Mercury	ug/L	ICPMS			<0.02				<0.01*	1
Total Molybdenum	ug/L	ICPMS			<1				<5**	
Total Nickel	ug/L	ICPMS			<1				<8**	
Total Phosphorous	mg/L				0.019				<0.1**	
Total Selenium	ug/L	ICPMS			<0.1				<1	10
Total Silicon	ug/L	ICPMS			4680				627**	
Total Silver	ug/L	ICPMS			<0.02				<0.1	
Total Strontium	ug/L	ICPMS			96				71**	
Total Thallium	ug/L	ICPMS			<0.05				<0.1	
Total Tin	ug/L	ICPMS			<5				<20**	
Total Titanium	ug/L	ICPMS			<5				<3**	
Total Uranium	ug/L	ICPMS			1.3				0.4	20
Total Vanadium	ug/L	ICPMS			<5				<5*	
Total Zinc	ug/L	ICPMS			<5				<5*	5
Total Zirconium	ug/L	ICPMS			<0.5				<5*	
Total Calcium	mg/L	ICPMS			49.2				26.9**	
Total Magnesium	mg/L	ICPMS			14.8				9.42**	100s
Total Potassium	mg/L	ICPMS			1.71				2**	
Total Sodium	mg/L	ICPMS			12.4				3.84**	<200
Total Sulphur	mg/L	ICPMS			<3				2.8**	
Dissolved Calcium	mg/L	Atom Spect								
Dissolved Magnesium	mg/L	Atom Spect								
Calculated										
Hardness	mg/L	calc			184		102	105	108	80 - 100
Dissolved Hardness										

RDL=Reportable Detection Limit

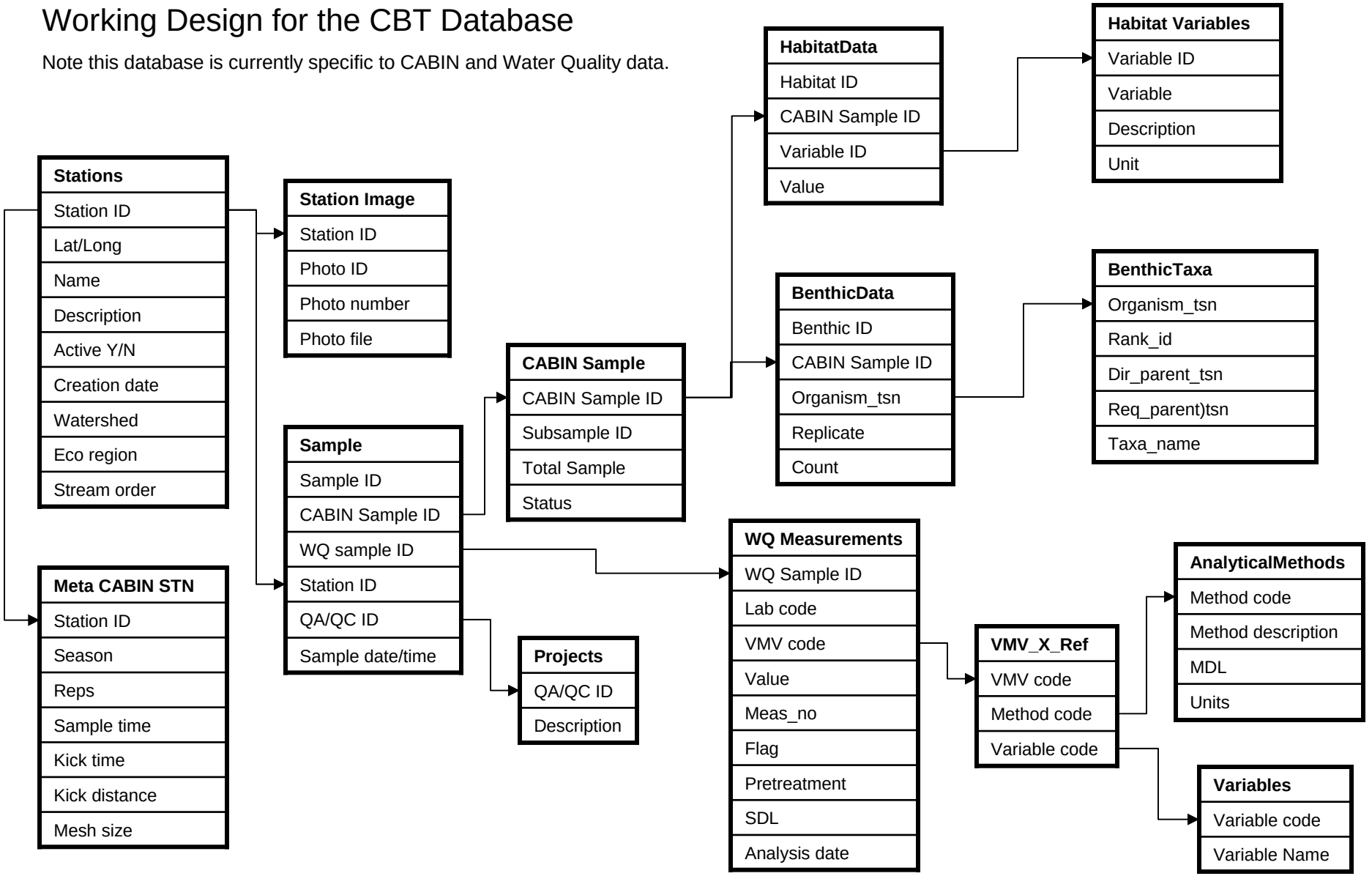
* Mercury by CVAA
** analysis by ICP
*** Guidelines for Canadian Drinking Water Quality, except where noted
*** Recreation water quality guidelines
**** Aquatic Life Guidelines
italic figures = analysis by Passmore Lab

KRN-CBT Benthos 2007												
Data are adjusted for subsampling												
Stream	**Joseph Creek**	**Joseph Creek**	**Joseph Creek**	**Kimberley Creek**	**Kimberley Creek**	**Kimberley Creek**	**Salmo River**	**Salmo River**	**Salmo River**	**South Slocan**	**Vlahalla Slocan**	**Bonanza Creek**
Site	**JOS0107**	**JOS0207**	**JOS0307**	**KMB0107**	**KMB0207**	**KMB0307**	**Mid**	**Upper**	**Lower**			
Rep								**2nd Kick**				
Date	**09-25-2007**	**09-23-2007**	**09-25-2007**	**10-09-2007**	**10-03-2007**	**10-09-2007**	**10-26-2007**	**10-27-2007**	**10-28-2007**	**09-28-2007**	**10-09-2007**	**10-03-2007**
Percent Subsampled	**9.00**	**8.00**	**2.00**	**38.02**	**6.00**	**9.00**	**11.00**	**1.00**	**12.00**	**100.00**	**100.00**	**100.00**
Device	**kick net**	**kick net**	**kick net**	**kick net**	**kick net**	**kick net**				**Kicknet**	**Kicknet**	**Kicknet**
Habitat	**riffle**	**riffle**	**riffle**	**riffle**	**riffle**	**riffle**				**Riffle**	**Riffle**	**Riffle**
EcoAnalysts Sample ID	**5109.2-1**	**5109.2-2**	**5109.2-3**	**5109.2-4**	**5109.2-5**	**5109.2-6**	**5109.2-7**	**5109.2-8**	**5109.2-9**	**5109.1-1**	**5109.1-2**	**5109.1-3**
Abundance Measures												
Corrected Abundance	5754.98	6675.00	27650.00	1585.89	5834.50	3988.49	2899.71	36400.00	2815.54	238.00	224.00	301.00
EPT Abundance	4588.43	2875.00	13200.00	331.38	4184.17	2310.88	1872.54	20800.00	924.63	137.00	156.00	213.00
Dominance Measures												
Dominant Taxon	Heptageniidae	Elmidae	Chironomidae	Chironomidae	Lepidostomatidae	Capniidae	Heptageniidae	Chironomidae	Chironomidae	Chironomidae	Ephemerellidae	Glossosomatidae
Dominant Abundance	1233.21	3600.00	11950.00	902.09	1933.72	699.93	945.36	14000.00	1266.16	66.00	111.00	65.00
2nd Dominant Taxon	Baetidae	Lepidostomatidae	Ephemerellidae	Elmidae	Elmidae	Heptageniidae	Psychodidae	Taeniopterygidae	Naididae	Baetidae	Hydropsychidae	Baetidae
2nd Dominant Abundance	1122.11	2037.50	6950.00	215.66	716.81	633.27	736.29	8500.00	449.82	44.00	37.00	50.00
3rd Dominant Taxon	Ephemerellidae	Hydropsychidae	Lepidostomatidae	Heptageniidae	Heptageniidae	Elmidae	Ephemerellidae	Heptageniidae	Lepidostomatidae	Ephemerellid	Chironomidae	Chironomidae
3rd Dominant Abundance	755.48	275.00	4100.00	71.01	700.14	566.61	354.51	4700.00	241.57	29.00	30.00	42.00
% Dominant Taxon	21.43	53.93	43.22	56.88	33.14	17.55	32.60	38.46	44.97	27.73	49.55	21.59
% 2 Dominant Taxa	40.93	84.46	68.35	70.48	45.43	33.43	57.99	61.81	60.95	46.22	66.07	38.21
% 3 Dominant Taxa	54.05	88.58	83.18	74.96	57.43	47.63	70.22	74.73	69.53	58.40	79.46	52.16
Richness Measures												
Species Richness	23.00	15.00	18.00	33.00	28.00	25.00	19.00	21.00	20.00	22.00	13.00	27.00
EPT Richness	15.00	9.00	8.00	17.00	15.00	9.00	12.00	15.00	11.00	13.00	6.00	14.00
Ephemeroptera Richness	4.00	3.00	3.00	4.00	4.00	4.00	5.00	4.00	5.00	4.00	2.00	4.00
Plecoptera Richness	6.00	3.00	2.00	6.00	4.00	3.00	3.00	4.00	4.00	3.00	0.00	4.00
Trichoptera Richness	5.00	3.00	3.00	7.00	7.00	2.00	4.00	7.00	2.00	6.00	4.00	6.00
Chironomidae Richness	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Oligochaeta Richness	2.00	0.00	2.00	4.00	1.00	5.00	1.00	0.00	2.00	1.00	0.00	1.00
Non-Chiro. Non-Olig. Richness	20.00	14.00	15.00	28.00	26.00	19.00	17.00	20.00	17.00	20.00	12.00	25.00
Rhyacophila Richness	1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00
Community Composition												
% Ephemeroptera	55.21	4.49	29.29	7.46	23.71	27.58	52.66	23.08	17.75	32.35	50.00	31.23
% Plecoptera	19.11	1.31	1.63	4.15	11.43	23.40	5.96	28.30	4.14	1.68	0.00	4.65
% Trichoptera	5.41	37.27	16.82	9.29	36.57	6.96	5.96	5.77	10.95	23.53	19.64	34.88
% EPT	79.73	43.07	47.74	20.90	71.71	57.94	64.58	57.14	32.84	57.56	69.64	70.76
% Coleoptera	7.14	53.93	3.62	13.60	12.29	14.21	0.00	1.65	0.59	3.78	12.95	8.64
% Diptera	12.36	2.81	44.67	59.04	3.14	10.58	32.60	41.21	49.41	32.77	14.73	17.28
% Oligochaeta	0.39	0.00	3.62	1.66	2.57	7.52	0.63	0.00	16.27	0.42	0.00	0.33
% Baetidae	19.50	0.00	3.80	0.33	6.00	4.46	0.94	4.12	4.73	18.49	0.00	16.61
% Brachycentridae	0.00	2.62	1.81	1.16	0.29	0.28	0.31	0.27	0.00	5.46	0.00	3.32
% Chironomidae	9.85	1.12	43.22	56.88	2.57	6.41	6.27	38.46	44.97	27.73	13.39	13.95
% Ephemerellidae	13.13	3.00	25.14	1.82	0.29	4.46	12.23	5.22	7.40	12.18	49.55	6.31
% Hydropsychidae	0.39	4.12	0.00	0.00	0.00	0.00	0.31	0.27	2.37	7.14	16.52	3.65
% Odonata	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
% Perlidae	1.74	0.94	0.90	0.17	0.00	0.00	0.00	0.00	0.89	0.42	0.00	1.33
% Pteronarcyidae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
% Simuliidae	0.00	0.00	0.18	0.00	0.00	3.34	0.00	0.27	0.00	4.20	0.45	0.66
Functional Group Composition												
% Filterers	0.39	6.74	1.99	2.99	2.29	6.41	0.63	1.10	2.37	16.81	16.96	7.64
% Gatherers	52.12	58.61	79.57	75.29	29.14	40.11	52.35	51.10	75.15	63.03	77.23	46.84
% Predators	11.58	2.62	1.27	8.96	6.29	5.01	5.96	1.65	3.55	7.56	3.57	6.31
% Scrapers	23.17	1.12	0.54	5.80	18.86	22.01	32.60	15.11	4.44	1.68	1.79	29.90
% Shredders	12.74	30.90	16.64	6.30	42.29	26.18	7.84	31.04	14.50	5.88	0.00	9.30
% Piercer-Herbivores	0.00	0.00	0.00	0.50	1.14	0.00	0.63	0.00	0.00	5.04	0.45	0.00
% Unclassified	0.00	0.00	0.00	0.17	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00
Filterer Richness	1.00	2.00	2.00	2.00	3.00	3.00	2.00	4.00	1.00	3.00	2.00	3.00
Gatherer Richness	8.00	5.00	7.00	10.00	6.00	11.00	7.00	6.00	8.00	6.00	4.00	7.00
Predator Richness	7.00	4.00	3.00	11.00	9.00	4.00	4.00	2.00	6.00	7.00	4.00	10.00
Scraper Richness	3.00	1.00	2.00	2.00	3.00	2.00	1.00	3.00	1.00	2.00	2.00	3.00
Shredder Richness	4.00	3.00	4.00	6.00	5.00	4.00	4.00	6.00	4.00	3.00	0.00	4.00
Piercer-Herbivore Richness	0.00	0.00	0.00	1.00	2.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00

KRN-CBT Benthos 2007												
Data are adjusted for subsampling												
Stream	Joseph Creek	Joseph Creek	Joseph Creek	Kimberley Creek	Kimberley Creek	Kimberley Creek	Salmo River	Salmo River	Salmo River	South Slocan	Vlahalla Slocan	Bonanza Creek
Site	JOS0107	JOS0207	JOS0307	KMB0107	KMB0207	KMB0307	Mid	Upper	Lower			
Rep								2nd Kick				
Date	09-25-2007	09-23-2007	09-25-2007	10-09-2007	10-03-2007	10-09-2007	10-26-2007	10-27-2007	10-28-2007	09-28-2007	10-09-2007	10-03-2007
Percent Subsampled	9.00	8.00	2.00	38.02	6.00	9.00	11.00	1.00	12.00	100.00	100.00	100.00
Device	kick net	kick net	kick net	kick net	kick net	kick net				Kicknet	Kicknet	Kicknet
Habitat	riffle	riffle	riffle	riffle	riffle	riffle				Riffle	Riffle	Riffle
EcoAnalysts Sample ID	5109.2-1	5109.2-2	5109.2-3	5109.2-4	5109.2-5	5109.2-6	5109.2-7	5109.2-8	5109.2-9	5109.1-1	5109.1-2	5109.1-3
Unclassified	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Diversity/Evenness Measures												
Shannon-Weaver H' (log 10)	1.03	0.57	0.72	0.80	1.02	1.14	0.87	0.84	0.84	1.01	0.67	1.07
Shannon-Weaver H' (log 2)	3.44	1.89	2.39	2.66	3.38	3.77	2.89	2.78	2.78	3.34	2.21	3.56
Shannon-Weaver H' (log e)	2.38	1.31	1.65	1.84	2.34	2.61	2.00	1.93	1.93	2.31	1.53	2.47
Margalef's Richness	2.54	1.59	1.66	4.34	3.11	2.89	2.26	1.90	2.39	3.84	2.22	4.56
Pielou's J'	0.76	0.48	0.57	0.53	0.70	0.81	0.68	0.63	0.64	0.75	0.60	0.75
Simpson's Heterogeneity	0.87	0.61	0.72	0.65	0.84	0.90	0.80	0.77	0.75	0.86	0.69	0.88
Biotic Indices												
% Indiv. w/ HBI Value	99.61	99.81	100.00	97.35	98.29	99.16	97.81	100.00	99.11	94.96	98.66	98.01
Hilsenhoff Biotic Index	3.20	2.89	3.72	4.95	2.81	3.65	4.75	3.88	4.76	3.92	2.74	2.91
% Indiv. w/ MTI Value	1.93	0.19	4.16	7.46	18.29	37.88	4.08	2.20	19.23	5.88	4.02	24.92
Metals Tolerance Index	1.60	0.00	4.96	2.82	2.17	1.53	0.92	2.25	4.37	3.71	3.33	2.28
% Indiv. w/ FSBI Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Sediment Biotic Index	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
FSBI - average	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
FSBI - weighted average	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
% Indiv. w/ TPM Value	72.01	64.61	74.32	85.90	39.43	67.69	57.37	88.19	63.91	58.40	94.64	67.44
Temp. Pref. Metric - average	3.57	3.20	2.72	2.45	2.39	2.00	2.26	3.10	2.80	2.82	3.00	2.63
TPM - weighted average	6.42	5.90	5.78	5.39	5.94	6.06	5.63	6.65	5.34	5.45	6.04	6.09
Karr BIBI Metrics												
Long-Lived Taxa Richness	2.00	1.00	1.00	4.00	3.00	2.00	1.00	3.00	1.00	1.00	1.00	1.00
Clinger Richness	14.00	8.00	8.00	15.00	15.00	10.00	9.00	15.00	9.00	14.00	7.00	15.00
% Clingers	84.36	66.10	36.53	29.52	52.00	72.14	52.98	56.87	23.67	60.50	81.70	75.08
Intolerant Taxa Richness	12.00	7.00	5.00	12.00	10.00	8.00	8.00	11.00	8.00	9.00	2.00	11.00
% Tolerant Individuals	0.12	0.02	0.01	0.65	0.02	0.66	2.93	0.01	0.04	0.44	0.00	1.02
% Tolerant Taxa	13.04	6.67	11.11	12.12	3.57	16.00	10.53	4.76	5.00	4.55	0.00	7.41
Coleoptera Richness	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00

Working Design for the CBT Database

Note this database is currently specific to CABIN and Water Quality data.



Queries for Columbia Basin Watershed Network Database

Temperature:

- Show temperature data by site and over designated time
- Create graphs showing Maximum, Minimum and Mean daily temperatures
    - At a sample site
    - Over designated time by sample sites
- Show sensitivity temperature limits by designated fish species
    - By sample site
    - Over designated time

Flow – Volume of water (m^3/second)

- Over designated time (within a sample year or between sample years)
    - By sample site
    - Compare sample sites within single streams

Benthic Macro-Invertebrates

- List species and number of individuals within species found at each sample site
- Abundance Measures
- Dominance Measures
- Richness Measures
- Community Composition by Percentage
- Functional Group Composition by Percentage and Richness
- Diversity/Evenness Measures
- Biotic Indices
- Karr BIBI Metrics

Water Chemistry

- Show graph of each parameter over time at each sample site
    - Indicate water quality guideline
- Show Reported Detectable Limits

Location

- Query UTM and/or Lat-Long of each site

Fish Data

- Show species and number of individuals within species found on each float over designated time
- Show redd count statistics by sample site over designated time

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* These queries are subject to modification