Mt. Washington Remediation, Phase 1 Progress Report

Prepared for:

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Mt Washington Remediation, Phase I

Progress Report

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1 Introduction

SRK Consulting (Canada) Inc. (SRK) has prepared this progress report on the development of a remediation plan for the abandoned copper mine on Mount Washington.

In 2003 a unique partnership was formed between industry, government and the public with a goal to seek long term solutions to ensure a healthy ecosystem and a sustainable fishery on the Tsolum River. The partners consist of representatives from Timber West (landowner), Tsolum River Restoration Society (local community), Pacific Salmon Foundation, the Mining Association of BC, Department of Fisheries and Oceans Canada and the BC Ministry of Environment.

This report provides a summary of the Phase 1 activities carried out to date, the current status of the project and a road map forward including a project schedule and project deliverables. The activities to date include an initial site visit by SRK and the project control team on September 14, 2006, a presentation by SRK to the Tsolum River Partnership followed by a second site visit on September 28, 2006 and a workshop held in Vancouver on November 1, 2006. The objective of the September 28, 2006 meeting was to introduce the SRK project team to the Partnership and to explain SRK's approach to the project.

Figures 1 to 2 provide maps of the study area.

2 Site Visits

The initial site visit occurred on September 14, 2006 and involved Diane Ramage (Pacific Salmon Foundation), Wayne White (Tsolum Restoration Society), Margaret Wright (Department of Fisheries and Oceans), Peter Healey and Daryl Hockley from SRK.

The second visit occurred following the project kick off meeting held at the Mount Washington Ski resort on September 28, 2006. The participants include members of the project steering committee and three engineers from SRK. The Steering Commiteee comprised individuals from MOE, the MEMPR, DFO, TRRS, and the Mining Association of BC.

Both visits provided an opportunity for the partnership members to not only meet the project team but also to see first hand earlier remediation work that had been carried out on the site. This work include the soil (glacial till) cover that was placed over the east dump in the north pit in 1988 and 1989, the north pit surface water diversions installed in 1989 and the experimental covers that were place in select areas in the pit between 1990 and 1993.

3 Workshop

The one day workshop was held on November 1, 2006 at the offices of SRK Consulting. Daryl Hockley from SRK facilitated the workshop. Presentations were made by SRK and MOE to provide the participants with some background information on the reduction in total copper concentrations in both Pyrrhotite Creek and the Tsolum River as a result of the earlier and more recent remedial work undertaken.

The objective of the workshop was to:

- Ensure that all possible remediation methods are considered;
- Review new data and assemble any information that would help in the evaluation of the possible remediation methods
- Select a preferred method or combination of methods; and
- If there is insufficient information, determine which additional information is needed to support further progress.

4 Current Status

Water quality data collected at both Branch 126 and in the Tsolum River at Murex Creek has indicated that the early reclamation work carried out in the late 80's and early 90's combined with the Spectacle Lake wetland constructed in 2003 has resulted in substantial improvement to the copper loadings in the Tsolum River (08HB089) as shown in Figures 3 and 4. Figures 5 and 6 show the improvements over time to copper concentrations at Branch 126 (08HB091). However, although the wetland has made significant improvements to the water quality in the Tsolum, the wetland is considered to be only part of the solution as wetlands have a finite lifespan as a treatment option. Therefore an alternative long term solution is still needed.

The November workshop concluded with a preferred method and a number of contingencies. However, in order to evaluate these methods, it was agreed that additional information would need to be obtained and further analysis would need to be carried out in order to demonstrate the practicality and effectiveness of the methods selected. The preferred method that came out of the workshop was the construction of a flow equalization reservoir in the vicinity of Pyrrhotite Lake. The copper concentrations in Tsolum River exhibit a distinct seasonal character. They are consistently high during the spring freshet, low during the summer baseflow period and quite variable during the fall and winter. Averaged over long periods of time (i.e., a week or more), the copper concentrations in the fall and winter tend to be significantly lower than during the spring freshet. The provision of an equalization reservoir at Pyrrhotite Lake has the potential of reducing the higher concentrations experienced in the river. The reservoir, it is hoped, would achieve this by storing a portion of the contaminated runoff from the mine during spring freshet for subsequent release during the remainder of the year. It is anticipated that the bulk of the releases from storage would have to be made during

the fall and winter months, when dilution flows are relatively large in the receiving environment. The summer months typically experience the lowest flows of the year and therefore offer only limited capacity to receive releases from the reservoir (i.e., it wouldn't take much of a release from the reservoir during the summer to cause unacceptably high concentrations in the river).

In addition to the flow equalization reservoir method, the workshop participants concluded that several contingency methods would also be assessed. These would include a possible upgrade of the existing surface diversion ditch upstream of the pit, the placement of some reasonable cover or combination of covers over the entire area of the pit and batch lime treatment with an in-line mixer located upstream of the Pyrrhotite Lake. Although the Spectacle Lake wetland is considered a short term solution, it was felt that it could still be a contingency polishing pond.

5 Phase I Work Plan

5.1 General

In phase I, SRK will evaluate the different methods discussed above and prepare a conceptual design report for the preferred option. The report would provide preliminary layouts based on available basemaps and a conceptual level cost estimate to assist in decision making process heading into Phase II. At the outset of the project, it was originally hoped that phase I of the project would be completed by December 31, 2006. However, as the workshop was not held until November 1, 2006 and as it was felt that a rigorous hydrological evaluation of the flow equalization approach was needed, SRK has contracted a senior hydrologist to develop a mass balance model to examine the effectiveness of this method. As a result, the Phase I report is now planned for distribution to the Partnership one week prior to the next meeting which scheduled for January 23, 2007.

The following sections provide a brief overview of the work currently underway.

5.2 Mass Balance Model

SRK is examining the potential effectiveness of an equalization reservoir with the aid of a mass balance model. The model estimates copper concentrations at two key points within the upper Tsolum River catchment, namely: i) the outlet of the proposed equalization reservoir at Pyrrhotite Lake; and ii) Tsolum River just downstream of Murex Creek. The main input to the model will be two daily records of flow and associated copper loading. The first record will characterize the inflows from Pyrrhotite Creek to the equalization reservoir. The other will represent the flow and copper loading generated by the remainder of the upper Tsolum River catchment, defined as the incremental area between Pyrrhotite Lake and a point on Tsolum River some 500 m downstream of Murex Creek. Flows and concentrations at the outlet of the equalization reservoir will be estimated by application of the continuity equation (i.e., inflow – outflow = change in storage). The ability to specify different reservoir capacities and reservoir operating rules will be incorporated into the model. Conditions in Tsolum River will be estimated by adding the simulated outflows from the

equalization reservoir to the record representing the flow and copper loading from the remainder of the upper Tsolum River catchment.

The inputs to the model will be estimated using the daily streamflow records and water quality grab samples for Pyrrhotite Creek at Branch 126 and for Tsolum River below Murex Creek. In basing the model inputs on historical data, the output from the model will essentially represent what the conditions would have been in the Tsolum River had the equalization reservoir been in place at the time. To find a suitable historical period for the modelling, the complete records of data at the two monitoring stations will be scrutinized to find a year-long period where, at both stations, the flow record is complete, or nearly so, and the water sampling frequency is high. One candidate period that meets these criteria is April 2002 to March 2003. Adoption of this period for the modelling would have the added advantage of representing conditions after the benefits of the initial mine remediation were realized but before rerouting of Pyrrhotite Creek through the wetland. To facilitate operation of the model, it will be necessary to create a continuous record of daily copper concentration for the two monitoring locations. This will require patching periods of missing water quality data. Various techniques are available for doing this, such as linear interpolation between adjacent water quality samples or application of empirical relationships between concentration and discharge. The patched concentration records will be checked for consistency between the two water quality sampling locations. For example, estimated concentrations in Pyrrhotite Creek must not lead to chemical loadings that are larger than observed downstream in Tsolum River.

To illustrate the potential effectiveness of the equalization pond, a graph will be created for each model run. Each graph will show two lines, one representing conditions prior to and the other after construction of the equalization pond. The former condition will be characterized by the historical record of copper concentrations while the latter will be estimated by the model output.

The first round of the model has already been completed. This involved estimating the flow-weighted average total copper concentration (without the benefit of the wetland) in the Tsolum River below Murex. This exercise was carried out to give an indication as to whether the flow equalization method on its own was even feasible. The flow-weighted average concentration was estimated to be 0.016 mg/L. The 30 day average water quality objective for the Tsolum River has been set at 0.007mg/L. Consequently, to achieve this objective, further source control methods such as pit covers or water treatment will be required in addition to the flow equalization method.

Consequently, the next stage of the model development will include source control options at the pit.

5.3 Covers and diversions

SRK will prepare conceptual layouts, quantities and costs for a number of different cover options for the Pit area. Cost will also include annual maintenance.

An upgrade of the upper diversion ditch will also be assessed.

One variation of the flow equalization method that may also be evaluated is the collection and pipeline diversion of the mine site seepage from just below the East dump to Pyrrhotite Lake. This would reduce the volume of water that would need to be stored in the flow equalization reservoir.

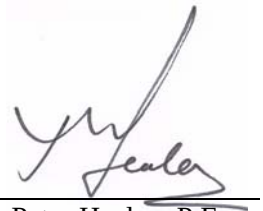
5.4 Water Treatment

Although treatment of the contaminated water from the mine site is not considered a preferred option, batch treatment with an in-line mixer located just upstream of the flow equalization reservoir will be evaluated.

5.5 Base Maps

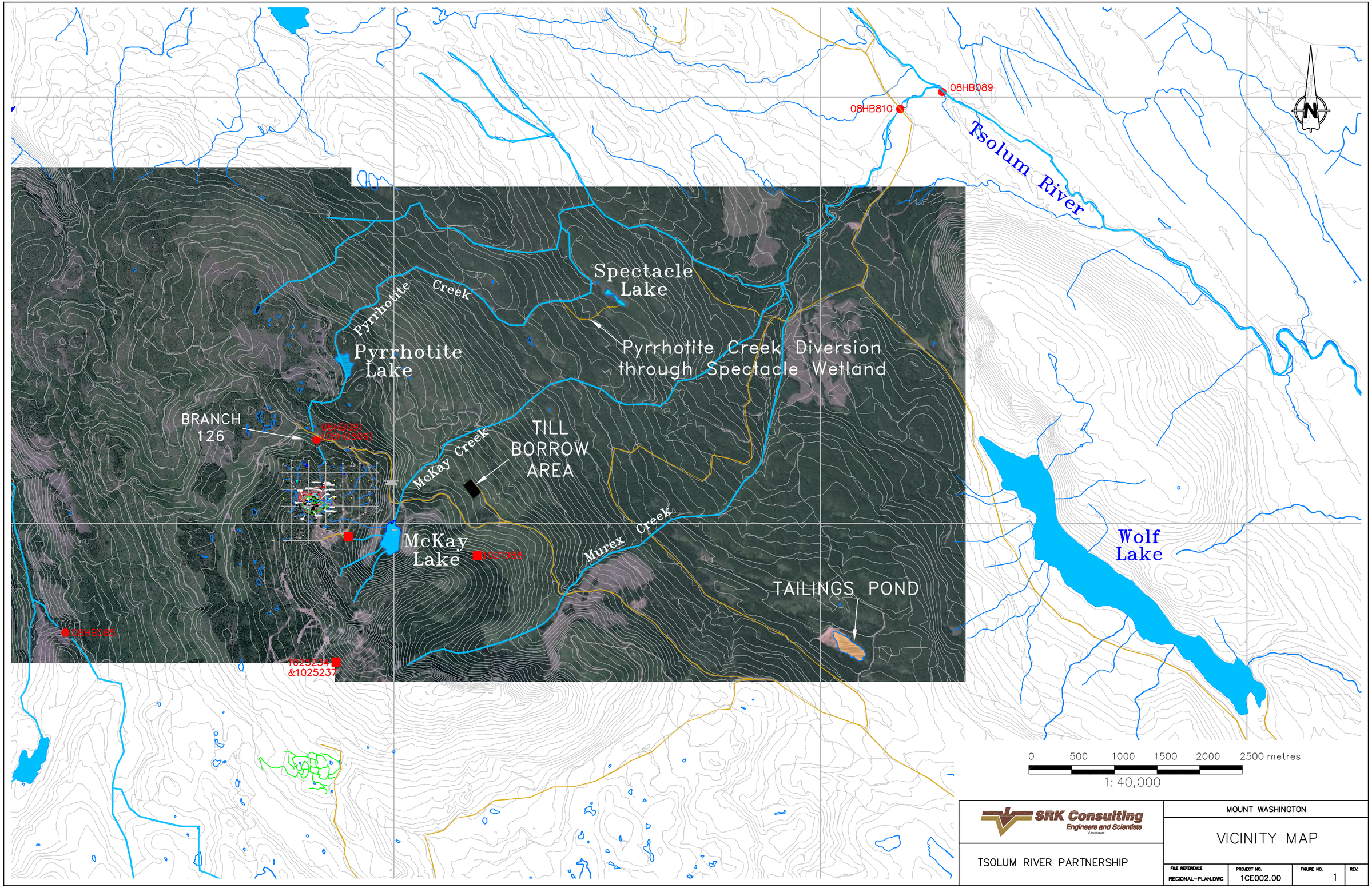
SRK has requested from TimberWest, recent orthophotographs of the mine site to aid in the conceptual design.

This progress report, on Mt Washington Remediation, has been prepared by SRK Consulting (Canada) Inc.



Peter Healey, P.Eng.

Figures



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MOUNT WASHINGTON

VICINITY MAP

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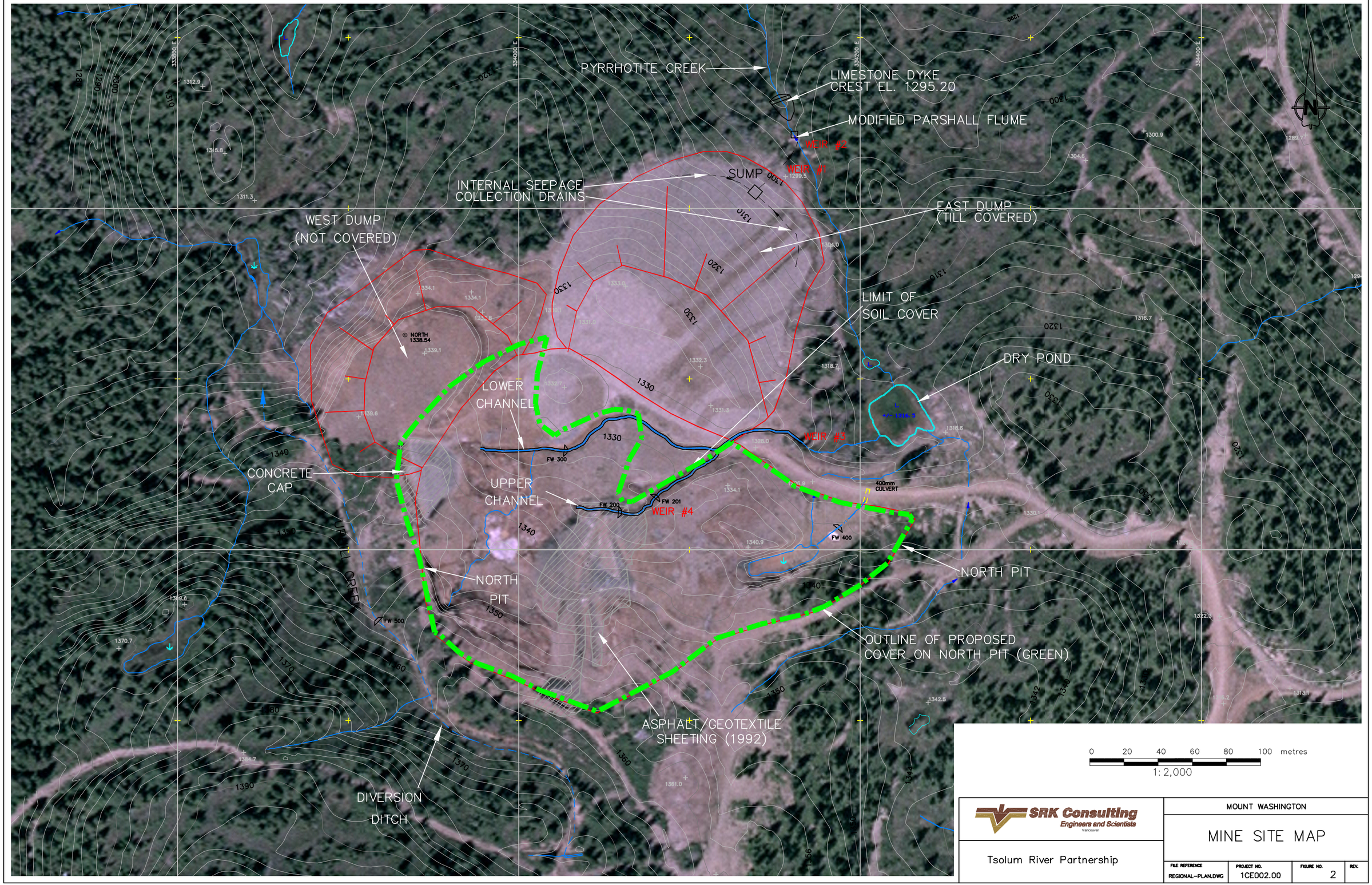

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MOUNT WASHINGTON

MINE SITE MAP

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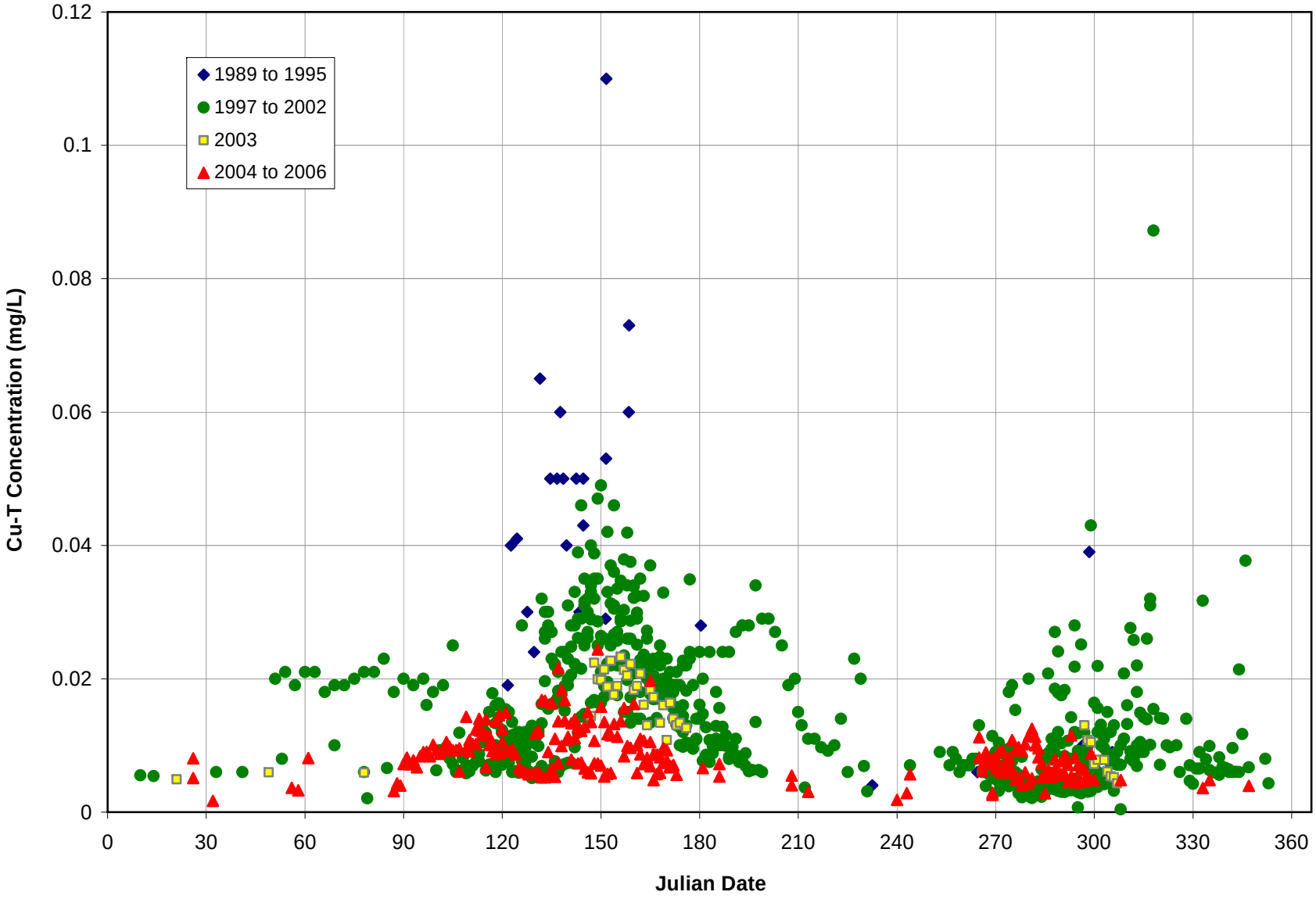

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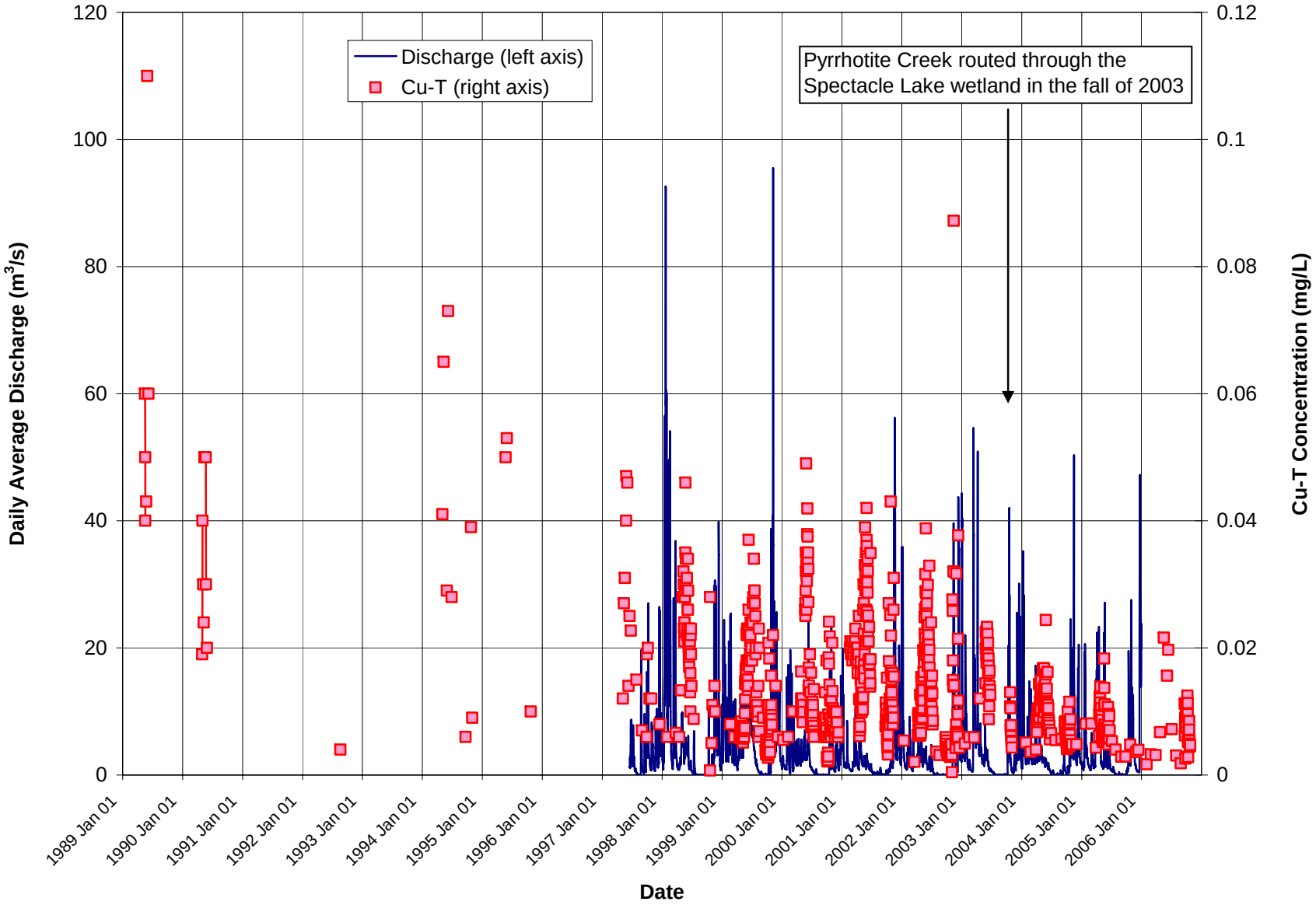

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Historical Water Quality (Cu vs Time) Tsolum River below Murex

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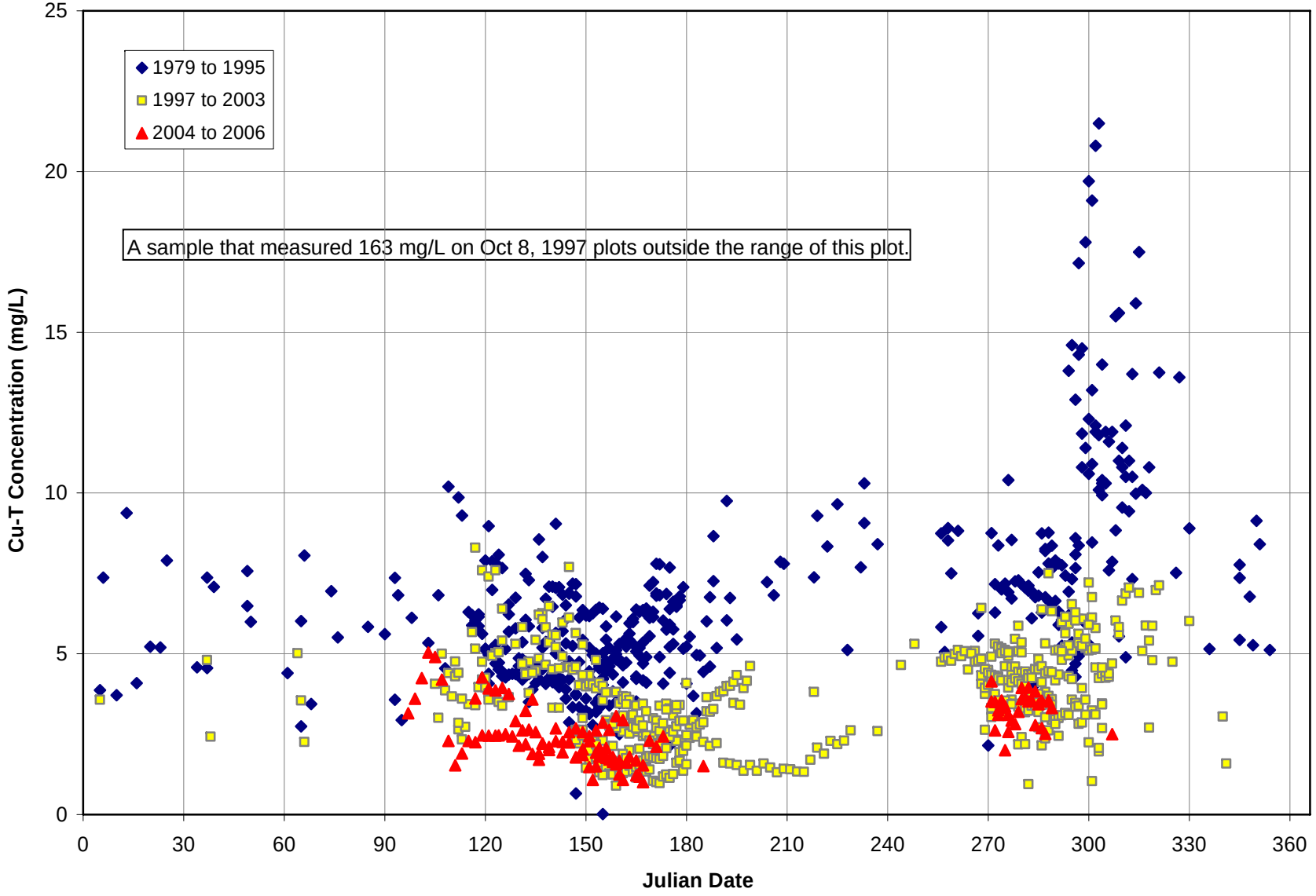

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Historical Water Quality (Cu vs Julian Date) Branch 126

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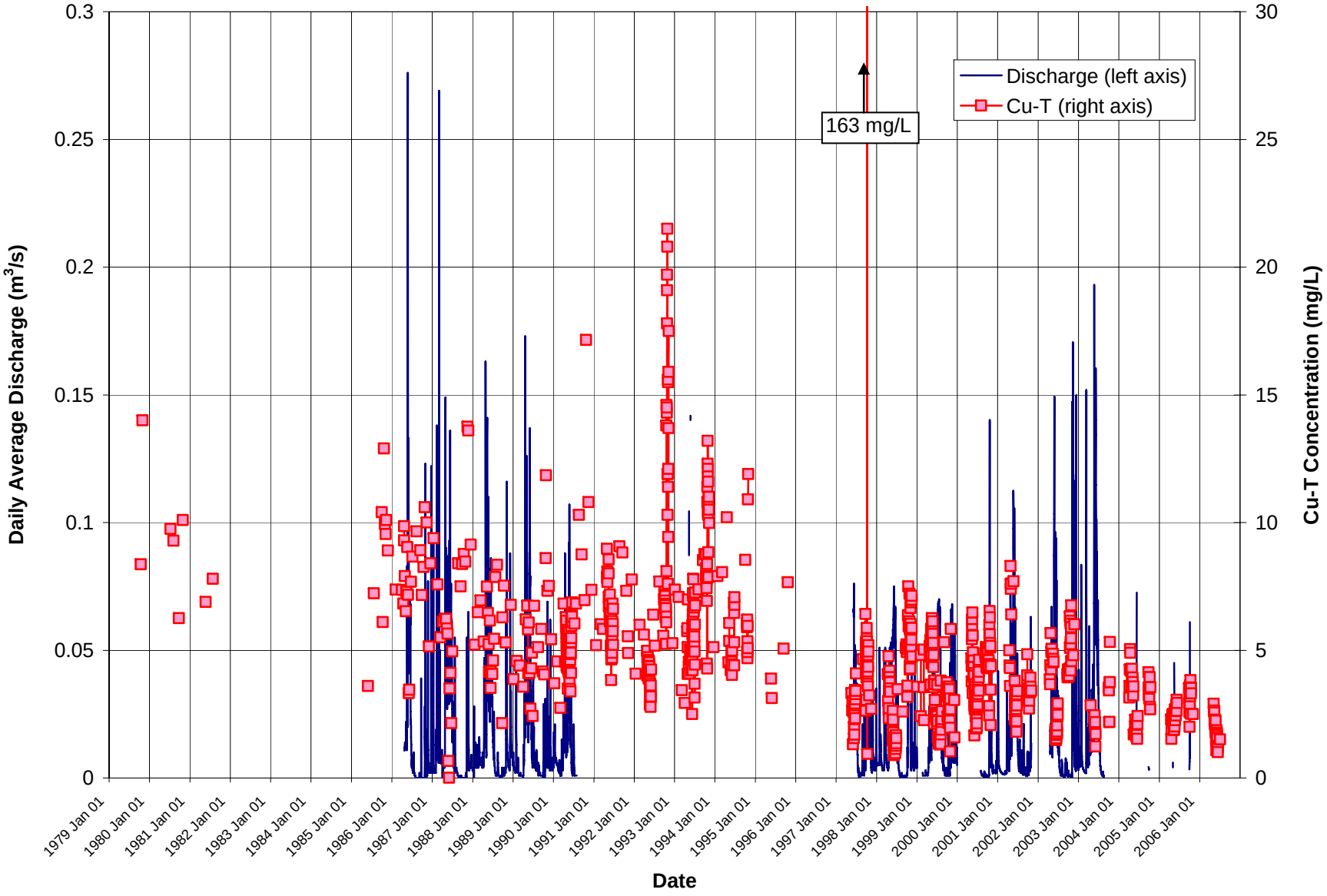

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