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COLUMBIA RIVER TREATY  
HYDROMETEOROLOGICAL COMMITTEE

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**2004  
ANNUAL  
REPORT**



MAY 2005



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HYDROMETEOROLOGICAL COMMITTEE

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## Introduction

The Columbia River Treaty Hydrometeorological Committee (CRTHMC) was established in September 1968 by the Entities. The Committee is responsible for planning and monitoring the operation of data facilities in accord with the Treaty. It also assists the Entities in matters related to hydrometeorological and water supply forecasting.

This report summarizes Committee activities during the 2004 operating year. The Annual Report focuses on:

- action taken on proposed changes to the hydrometeorological network
- updates to CRT communications and data storage systems
- updates to data exchange requirements
- updates to forecasting procedures
- miscellaneous activities of the Committee

The Committee began issuing regular Annual Reports in 2001. General background information on Committee activities contained in the 2001 and 2002 annual reports is now presented in a separate supplemental document. The

supplement contains general information that does not typically change from year to year. Appendices in the 2004 supplemental document include:

- Appendix A – Introduction to the Committee terms of reference
- Appendix B – Terms of reference for the CRTHMC
- Appendix C – Process for reviewing hydrometeorological data networks
- Appendix D – List of contributors of hydrometeorological data
- Appendix E – Data communication and storage systems
- Appendix F – Data exchange reports
- Appendix G – Treaty studies, models, and forecast requirements

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## Acronyms

- AEC - Actual Energy Capability
- AER - Actual Energy Regulation
- AOP - Assured Operating Plan
- BC Hydro - British Columbia Hydro and Power Authority
- BPA - Bonneville Power Administration
- CBT - Columbia Basin Telecommunications
- CROHMS - Columbia River Operational Hydrometeorological Management System
- CRT - Columbia River Treaty
- CRTHMC - Columbia River Treaty Hydrometeorological Committee
- CRTOC - Columbia River Treaty Operating Committee
- CWMS - Corps Water Management System
- CWS - Columbia Winter Specified
- DOP - Detailed Operating Plan
- EC - Environment Canada
- ESA - Endangered Species Act
- ESP - Ensemble Streamflow Prediction
- FCOP - Flood Control Operating Plan
- FRO - Fall runoff, used in Libby water supply forecasting procedure
- FTP - File Transfer Protocol

HYDSIM - Hydrologic Simulation model  
     MSC - Meteorological Service of Canada, Environment Canada  
     MSRM - BC Ministry of Sustainable Resource Management  
     NRCS - Natural Resources Conservation Service  
     NWPP - Northwest Power Pool  
     NWRFC - Northwest River Forecast Center, US National Weather Service  
     NWSRFS - National Weather Service River Forecast System  
 Operating Year - August 1 to July 31 (CRTOC)  
     PEBCOM - Permanent Engineering Board Engineering Committee  
     PNCA - Pacific Northwest Coordination Agreement  
     POP - CRT Principles and Procedures Document  
     QPF - Quantitative Precipitation Forecast  
     RCS - Regional Climate Station  
     RFS - River Forecast System  
     RODS - BPA's Real-time Operations Dispatch and Scheduling  
     SNOTEL - SNOwpack TELemetry, NRCS snow pillow and climate data network  
     STP - Single Trace Procedure (NWRFC procedure using ESP)  
     SSARR - Streamflow Synthesis and Reservoir Regulation hydrologic model  
     TSR - Treaty Storage Regulation study  
     UBCWm - University of British Columbia Watershed Model  
     USACE - US Army Corps of Engineers  
     USBR - US Bureau of Reclamation  
 Water Year - October 1 to September 30 (CRTHMC)  
     WLAP - BC Ministry of Water, Land, and Air Protection  
     WSC - Water Survey of Canada, Environment Canada  
     WSF - Water Supply Forecast

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H Y D R O M E T E O R O L O G I C A L C O M M I T T E E

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## 2004 Annual Summary

The Hydrometeorological Committee was established in September 1968 by the Entities and is responsible for planning and monitoring the operation of data facilities in accord with the Treaty and otherwise assisting the Entities as needed. The Committee consists of four members as follows:

UNITED STATES SECTION

Nancy L. Stephan, BPA Co-Chair  
Peter Brooks, USACE Co-Chair

CANADIAN SECTION

Eric Weiss, B.C. Hydro, Chair  
Wuben Luo, B.C. Hydro, Member

Although the primary responsibility of the Committee is the planning and monitoring of the operation of the data facilities, a significant part of the 2003-04 year was focused on evaluating the new Libby water supply forecast procedures developed by the Corps of Engineers. The CRTHC provided technical guidance and evaluation of the new procedures, resulting in recommendations to the CRTOC for incorporating the new forecasts into Treaty procedures. Randy Wortman with the Corps of Engineers developed the equations, including two early-season forecast procedures for November and December. After careful evaluation and assessment, the December through June forecast equations were recommended to the CRTOC for adoption. The CRTOC accepted the December through June equations for Treaty procedures in February of 2004. The CRTHC also recommended the Dworshak early season forecast, which was also approved by the CRTOC.

In addition to evaluating the new forecast procedures, the CRTHC took on the responsibility of developing and maintaining the documentation of the forecast procedures for Mica, Arrow, Duncan, Libby, Dworshak, and Hungry Horse (project owner forecast procedures). A compiled notebook was made available to the CRTHC and CRTOC in July of 2004.

The summer of 2004 also marked the completion of the 2000 Level Modified Flows Study which fulfilled the Treaty obligation to update irrigation depletions. Although BPA undertook the development of the study, the data submittal and review of the study was a cooperative effort from all Treaty committees and staff.

In terms of operational issues throughout the year, the Committee dealt with the following:

1. Heavy rainfall in British Columbia during the month of October caused the fall precipitation parameters in the water supply forecast procedures to take on more influence than hydrologically reasonable. A coordinated conference call, including the NW River Forecast Center, resulted in an agreement to use normal values for precipitation rather than the actual observed. The use of normal precipitation for October persisted throughout the water supply season.
2. On several occasions, discrepancies appeared between the observed Canadian streamflow data submitted for TSR purposes and the observed recorded by BC Hydro. Canadian observed values are submitted by BPA. The source of the observed data for the Canadian projects had been the NW River Forecast Center's Runoff processor program. In evaluating the situation, it was found that the Runoff processor did not always have the same data as BC Hydro. In order to determine the problem, BC Hydro began sending daily inflow, outflow and elevation data to the NW River Forecast Center. The issue is still not resolved, however, interim coordination of submittals is in place until the data differences can be eliminated.
3. As part of the ongoing activities, the CRTHC dealt with several data network station changes referred to the Committee by various data collection agencies during the year as described in the next section.

## Station networks

The Committee process for reviewing proposed changes to the operation of stations within the hydrometeorological network is described in Appendix C of the 2004 Supplemental Report. The process is intended to ensure that changes made to the network do not negatively affect the monitoring, planning, and operations of Treaty facilities.

In October 2003, the Canadian Section issued letters to the list of data agencies noted in Appendix D of the 2004 Supplemental Report. The letters requested data collection agencies to notify the Committee of proposed changes in station networks in the Columbia basin.

The Committee was notified of several potential changes to hydrometeorological station networks in operating year 2004. In Canada, the following were referred to the Committee for the following reasons:

- **Gray Creek Upper and Lower snow courses:** June 1 replaced January 1 for sampling purposes.
- **Bush River and Mt. Templeman snow courses:** Avalanches at these two snow courses in 2002 destroyed about five of ten sampling stations. MSRM proposed and BCH agreed to reduce the two snow courses to 5-station courses starting 2004/05 snow season.
- **Kicking Horse:** Added January to schedule
- **Marble Canyon:** Destroyed by fire
- **Grand Forks:** EC station at risk of closure
- **Hedley:** EC station at risk of closure
- **Wasa:** EC station at risk of closure
- **Banff:** New data logger
- **Fernie:** Problems with receiving real-time and monthly precipitation data
- **Record Mt.:** Schedule change

Although there were changes to schedules and threats of loss to the network, only two sites were deemed to have an impact to the Columbia River Treaty hydrometeorological network. Schedule 1 summarizes the Committee's response to the proposed changes to stations in the Canadian portion of the CRT hydrometeorological network in 2004. No changes to stations located in the United States were referred to the Committee.

## **Communication and data storage systems**

CBT, other communication systems, and CROHMS are described in Appendix E of the 2004 Supplemental Report. The CBT system, operated by the USACE in Portland, is the primary communications system for transmitting data from the Columbia River Treaty hydrometeorological network. Agencies, including the NWRFC, USACE, and BC Hydro, also use other communication systems to exchange data. CROHMS is the central system for collecting and re-distributing hydrometeorological data used to support the operations of Treaty projects.

In 2004, the USACE reported that the new USACE Local Receiving Ground Station (LRGS) was installed and replaced DOMSAT for receiving all satellite-fed DCP data. DOMSAT was replaced in early November. LRGS is a Linux-based application. The USACE reported that they purchased five new computers for the Regional Water Control Data System, in which CROHMS resides. USACE will also migrate from HEC's DSS database to CWRM, which is an ORACLE database by January 2004. CROHMS is contained within this system.

## Data exchange

Appendix F of the 2004 Supplemental Report describes current data exchange reports. Data exchanged among operational projects and entity agencies may be categorized according to the type of data and the frequency of transmission. Types of data include project data, weather and streamflow data, forecasts, as well as reports and messages. The frequencies of transmission may be hourly, daily, or monthly.

In addition to the standard reporting, there were additional data exchange issues which arose during 2004. The issues are summarized as follows:

- BC Hydro reported that for the Donald and East Creek gages, there was a decode error. The correction was passed on to the USACE.
- Responding to a request from the NWRFC through the CRTOC, BC Hydro provided up-to-date stage-storage curves for Canadian projects in August 2004.
- With agreement from the CRTHC, BC Hydro discontinued 8 a.m. outflow readings for Mica and Arrow into CROHMS.
- BC Hydro added EC's Glacier Rogers Pass daily data to CROHMS feed.
- USACE noted that sending revised ("R" coded) data to CROHMS without an indication of what revision took place can be confusing. BC Hydro agreed not send data if it is missing.
- BC Hydro set up more direct data feeds via their FTP site during 2004, including EC monthly data and various climate data.
- BC Hydro's PSOSE group to provide inflow estimates over long holiday weekends.

Also during 2004, there continued to be a problem with differing observed monthly inflows provided by the NWRFC and that used by BC Hydro for Canadian Treaty projects. The primary difference was at Arrow. In trying to resolve this difference, issues regarding revised data, inflow calculations, and data quality were reviewed. To try to resolve this issues, BC Hydro began sending daily inflow values for Arrow to the NWRFC each week. At the end of 2004, the differences were not entirely resolved.

## Forecasting

The Committee is involved with various Treaty planning studies and models from time to time. These studies and models and associated forecasting requirements are described in Appendix G of the 2004 Supplement Report.

### **LIBBY VOLUME FORECAST PROCEDURES**

Re-development of the Libby statistical volume runoff forecast procedures was a continuing topic throughout the first half of 2004. After providing comments, revising equations, and working through station issues, the CRTHC recommended to the CRTOC that the December early season forecast and the January through April forecast procedures were technically sound in terms of their hydrological and statistical development. The CRTOC adopted the December, January, February, March, and April procedures on February 11, 2004 for Treaty purposes. With further work on the May and June procedure, the CRTHC also recommended to the CRTOC that the May and June forecast

procedures were technically sound in terms of their hydrological and statistical development. The CRTOC adopted the May and June on April 26<sup>th</sup>, 2004.

### **DWORSHAK VOLUME FORECAST PROCEDURES**

Although the Dworshak early season (November and December) water supply forecast procedures were developed in 1995 by the Columbia River Water Management Group Forecast Committee, the forecast procedures had never been officially accepted for use by the CRTOC for TSR purposes. The CRTHC reviewed the forecast procedures and recommended to the CRTOC that they were technically sound in terms of their hydrological and statistical development. The CRTOC adopted both the November and December forecast procedures for Treaty purposes in February of 2004.

### **TREATY VOLUME RUNOFF FORECAST PROCEDURE NOTEBOOK**

Due to confusion through the 2004 season concerning documentation of official forecast procedures, the CRTHC decided to compose a notebook of the official documentation of a Treaty volume runoff forecast procedures. The notebooks were distributed to CRTHC members and CRTOC members for future reference. As forecast procedures are updated, the notebook will also be updated in order to maintain a consistent record of forecast procedures.

## **HEPEX WORKSHOP**

Eric Weiss attended the HEPEX conference in Reading, England in March of 2004. HEPEX (Hydrological Ensemble Prediction Experiment) is intended to bring the international hydrological community together with the meteorological community to demonstrate how to produce reliable hydrological ensemble forecasts that can be used with confidence by the emergency management and water resources sectors to make decisions. Eric provided the CRTHC a summary of his concerns and issues regarding ESP that he intended to bring forward at the HEPEX conference in order for the CRTHC to add or comment on his description of the issues facing ESP use. Eric provided a summary report to the CRTHC upon his return. Although the international elevation of ESP forecasting was important, Eric suggested a regional forecast group and workshop would potentially be more beneficial to the CRTHC and the region.

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**Miscellaneous activities**  
The Committee reviewed the draft of the 2004 Annual Report via e-mail during the second week of May, and finalized the report mid May in time for delivery at the CRTOC on May 19<sup>th</sup>.

## **EDUCATIONAL BRIEFINGS**

On occasion the CRTHC arranges for educational briefings to provide its members with information on various issues and topics impacting the Committee's work. During the 2004 water year, the CRTHC arranged for several briefings. The first was an overview provided by BC Hydro on its new data quality control process. BC Hydro developed a spreadsheet application to quality control hydrometeorological data required for its daily and ESP

forecasting. At the same time, BC Hydro also provided an overview and demonstration of its River Forecast System used to prepare daily and seasonal ESP inflow forecasts. The model uses the UBC Watershed Model as its engine. Later in the year, Pam Kingsbury from BPA provided the Committee with an overview of the AER/TSR process. Pam also discussed the impacts of water supply forecasts on AER/TSR results.

### **2000 MODIFIED FLOW STUDY**

The 2000 Level Modified flow study was completed in June of 2004, copies of the documentation and split month data were provided to CRTHC members, CRTOC members, and all PNCA parties.



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## **Schedule 1 Changes to the hydrometeorological network in 2004**

The following pages document changes to the Columbia River Treaty Hydrometeorological Network in operating year 2004. Reports for Canadian stations include:

- **Marble Canyon (2C05) and Vermilion River No.3 (2C20) snow courses:**

Marble Canyon snow course was used in the 2004 new Libby forecast procedures. However this snow course was destroyed in the 2003 forecast fire which completely changed the characteristics of the snow course. The CRTHC initiated studies to look at the impact of substituting the Marble Canyon with another snow course. The Vermilion River No.3 snow course which was inactive at the time was found to have very high correlation with the Marble Canyon snow course with correlation coefficient greater than 0.9. The impact of using Vermilion as an estimator for Marble Canyon in the new Libby equations was also found to be insignificant. The CRTHC agreed to approach the BC MWLAP to re-activate Vermilion River No.3 and because of the prompt actions the

Vermilion snow course was activated on time for the 2004/05 forecasting season.

- **Fernie precipitation site:**

Fernie climate station has not reported to Environment Canada since June 2004. Fernie precipitation data is used in the water supply forecasting procedures for Libby. Environment Canada has been in contact with the observers, and are hopeful that the new online data entry system for observers that Environment Canada is implementing in April 2005 will make it easier for Fernie to submit their data. As of the end of the 2004 water year, this issue had not been resolved.

No changes were reported in 2004 for stations in the United States.