



Summer Temperature Management Program Overview Manual

Rio Tinto Alcan



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- This report is based on facts and opinions contained within the referenced documents, including the results of any data collection programs carried out in relation to this report. We have attempted to identify and consider facts and documents relevant to the scope of work, accurate as of the time period during which we conducted this analysis. However, the results, our opinions, or recommendations may change if new information becomes available or if information we have relied on is altered.
- We applied accepted professional practices and standards in developing and interpreting data. While we used accepted professional practices in interpreting data provided by Rio Tinto Alcan or third party sources we did not verify the accuracy of any such data.
- This report must be considered as a whole; selecting only portions of this report may result in a misleading view of the results, our opinions, or recommendations.

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1.0 Introduction

The Nechako River Summer Water Temperature and Flow Management Project (the Project) was designed and developed in 1982 and was successfully implemented in 1983. Since 1988, water temperature and flow management projects have been carried out under the auspices of the Nechako Fisheries Conservation Program (NFCP).

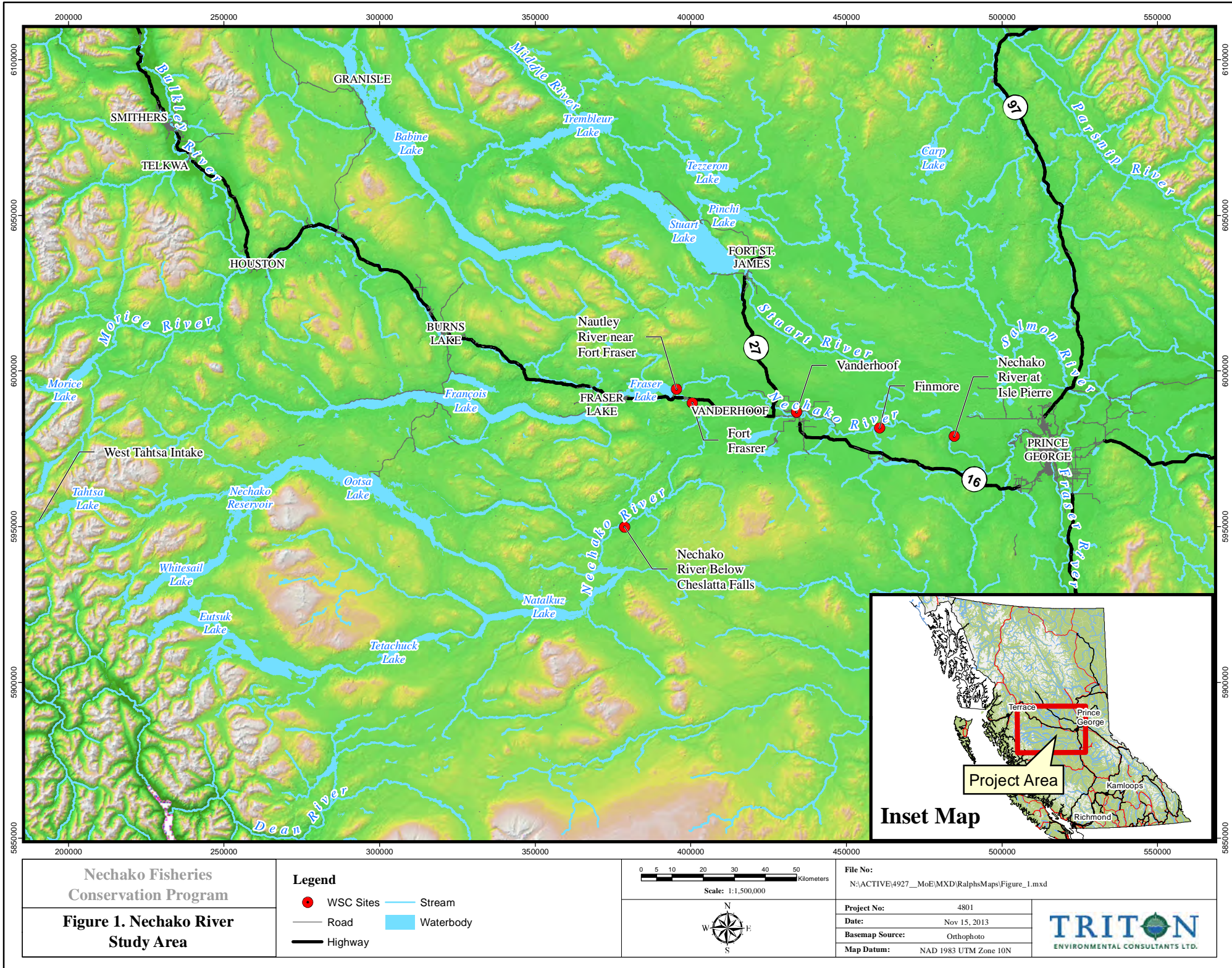
The overall goal of the Summer Temperature Management Program (STMP) is to manage Nechako River flows so that water temperatures remain within a specified temperature range to protect the river's salmon runs from July 20 to August 20 (the control period). Water in the Nechako River is regulated by the Skins Lake Spillway (SLS) and is controlled by Rio Tinto Alcan (RTA). As part of the 1987 Settlement Agreement, RTA is responsible for maintaining and operating the "models" and the "decision protocol" to ensure temperatures remain within the acceptable range. The model and decision protocol are described in further detail in the sections below.

The STMP is a computer-based project which uses an unsteady-state water temperature and flow routing model designed to compute the water flows and temperatures in the Nechako River using observed and predicted future meteorological conditions. Modelling of flows and water temperatures in the Nechako River is performed daily during the entire operational period (July 10 to August 20). Daily operations follow the protocol defined in the 1987 Settlement Agreement, and involve the collection of water temperature and river stage and discharge data from several locations in the study area and the use of five-day meteorological forecasts.

River water temperatures are managed through the release of additional water from RTA's Skins Lake Spillway (Figure 1). Water released from the spillway flows through Cheslatta River and Lake and joins the Nechako River below Cheslatta Falls. The routing of flows through this section of the watershed, and the consequent time lag, requires that large SLS releases must be made to ensure the scheduled discharges in the Nechako River below Cheslatta falls are reached in a timely manner (within the forecast period).

The operational period includes 10 days for system start-up (July 10 to July 19), to initialize the databases required to schedule the SLS releases necessary to meet project water temperature objectives during the water temperature control period (July 20 to August 20). Nechako River discharges are increased in this initial period from spring flows to the minimum cooling flow of 170 m³/s (6,000 cfs) required below Cheslatta Falls. This is done by increasing SLS discharges in several steps over four days, for safety reasons.

Once the flow in the Nechako River at Cheslatta Falls has reached 170 m³/s (typically by July 18), the SLS cooling water releases are to be limited to a minimum and maximum of 14.2 m³/s (500 cfs) and 453 m³/s (16,000 cfs), respectively.



The maximum SLS release of 453 m³/s (16,000 cfs) was established as a practical maximum to account for the flow lag through the Cheslatta and Murray lakes system to ensure flow in the Nechako River was increased as rapidly as possible during warming conditions. The minimum SLS release of 14.2 m³/s (500 cfs) allows for a saving of water during cool meteorological conditions, and provides a minimum flow in the Cheslatta River upstream of Cheslatta Lake. Within the forecast period, the SLS releases are managed such that flow in the Nechako River below Cheslatta Falls does not drop below 170 m³/s (6,000 cfs) and does not exceed 283 m³/s (10,000 cfs).

The following provides a summary of the typical SLS release schedule required for the STMP, currently being used, and a description of the procedure used to determine the cooling water releases required during the operational period.

| <u>Date (approximate)</u> | <u>Skins Lake Spillway Release</u> |
|---------------------------|--|
| April 1 to July 10 | 49.0 m ³ /s (1,730 cfs) (NFCP spring base release) |
| July 11 | increased to 136 m ³ /s (4,802 cfs) |
| July 13 | increased to 227 m ³ /s (8,000 cfs) |
| July 18 to August 17 | 170 m ³ /s (6,000 cfs) plus additional cooling releases as required (may begin July 16) |
| August 17 | decreased to 14.2 m ³ /s (500 cfs) |
| September 1 | increased to approximately 31 m ³ /s (1,100 cfs) (Chinook Salmon spawning flow) |

The following provides a more detailed description of the typical SLS release regime currently being used during the STMP:

- The spring release is increased from 49.0 m³/s (1,730 cfs) to 227 m³/s (8,000 cfs) in two steps (on July 11 and July 13) to surcharge the Cheslatta/Murray lakes system, and then decreased to 170 m³/s (6,000 cfs) on July 18 such that flow in the Nechako River below Cheslatta Falls (Water Survey of Canada [WSC] gauging station #08JA017) is not less than 170 m³/s (6,000 cfs) by July 20 for the STMP, as required by the 1987 Settlement Agreement.
- Because the STMP protocol is based on a five-day forecast, the SLS release could be increased to a maximum allowable on July 16 as this is the first day that releases can influence water temperatures for the start of the operational period of July 20.
- The increase in SLS release to 227 m³/s (8,000 cfs) may occur prior to July 11 based on the migration timing of Sockeye Salmon.

- SLS releases above the base release of 49.0 m³/s (1,730 cfs) during July and August are cooling water releases as required by the 1987 Settlement Agreement, and are not included in the calculation of the Annual Water Allocation (AWA) of 36.8 m³/s (1,300 cfs) from the SLS (see Appendix 1 for details on the AWA).
- SLS cooling water releases between a minimum of 14.2 m³/s (500 cfs) and a maximum of 453 m³/s (16,000 cfs) during July and August are to be managed such that flow in the Nechako River below Cheslatta Falls (at WSC gauging station #08JA017) does not drop below 170 m³/s (6,000 cfs) and does not exceed 283 m³/s (10,000 cfs).
- The requirement for additional cooling water releases is dependent on forecasted meteorological conditions.
- For forecasted warming conditions, the SLS release is to be increased directly to 453 m³/s (16,000 cfs) to increase Nechako River flow as rapidly as possible.
- For forecasted cooling conditions, the SLS release is to be decreased directly to 14.2 m³/s (500 cfs) to optimize water use.
- Typically by August 16 or 17, the large cooling water releases are no longer required as they will not influence temperatures in the Nechako River above the Stuart River confluence between August 18 and August 20 (due to the flow lag in the river system). The SLS release is then decreased to 14.2 m³/s (500 cfs) to reduce the flow in the Nechako River below Cheslatta Falls by early September to reach the Chinook Salmon fall spawning discharge. However, if water temperatures remain elevated (near 20°C), releases at the SLS may be maintained at 170 m³/s until August 20 and then decreased.
- On or near September 1, the SLS release is increased to the Chinook Salmon fall spawning release (approximately 31.1 m³/s or 1,100 cfs), which is calculated as the release required to fully achieve the Annual Water Allocation of 36.8 m³/s (1,300 cfs) as defined in the 1987 Settlement Agreement.

Throughout the project operational period, water temperatures in the Nechako River are calculated daily for the previous day, the current day, and each of the next four days. Forecast water temperature predictions are tabulated and reviewed daily to identify trends in water temperature changes. The trend analysis helps deal with the uncertainty in forecasting meteorological conditions over the forecast (5 day) period. These trends are the same as those used in the water temperature and flow management projects since 1984.

The following three trends in water temperature changes are reviewed on a day-by-day basis:

1. Observed trend; calculated from observed mean daily water temperatures measured in the Nechako River above Stuart River each day. The difference in observed water temperatures for the previous two days is extrapolated over the next 5 days to determine the observed water temperature trend.

2. Predicted trend; calculated from the predicted water temperatures for the previous day and the following five days. These data represent the predicted trend.
3. Forecast trend; calculated from the difference between the current five-day and previous five-day predictions for the same calendar days. Differences between forecasted data on coincident dates for the current day and the next two days only are averaged and added to the 5th day predicted temperature to determine the trend in forecasted temperatures.

A numerical example of how the trends are calculated is presented in Appendix 2. If two of the three trends indicate that the water temperature in the Nechako River above the Stuart River confluence could potentially exceed 19.4°C (67.0°F) then an increase in the SLS release is required. When this occurs the current day's release is revised and the flow and temperature models are rerun using the modified flow regime. Results of each day's final computer run are subsequently used to initialize water temperatures for the following day's computations.

The following release criteria are used with the three trends identified above to determine the timing and magnitude of the SLS cooling water releases:

1. When two of the three trends show an increase in water temperature in the Nechako River above the Stuart River confluence, and these trends show that the water temperature could potentially exceed 19.4°C (67.0°F) within the forecast period (next 5 days), increase the SLS release according to criteria 2 and 3 below.
2. Operate the SLS such that flow in the Nechako River below Cheslatta Falls ranges between 170 m³/s (6,000 cfs) and 283 m³/s (10,000 cfs) as required, and flow in the Nechako River above the Stuart River confluence does not exceed 340 m³/s (12,000 cfs). It is understood that the flow in the Nechako River below Cheslatta Falls is to be not less than 170 m³/s (6,000 cfs) by the start of the water temperature control period, typically July 20, and is to be reduced to approximately 31.1 m³/s (1,100 cfs) by September 1.
3. At any time of release, increase the SLS from the current level to 453 m³/s (16,000 cfs) directly to achieve the flow changes in the Nechako River as fast as possible. This increase, directly to the maximum allowable release, is required to account for the time delay in passing flow through the Cheslatta and Murray lakes system.
4. During cooling periods when two of three trends in forecasted water temperatures are decreasing and these trends indicate that the water temperature could potentially drop below 19.4°C (67.0°F) within the forecast period (5 days), reduce the SLS release from the current level to 14.2 m³/s (500 cfs). This reduction, directly to the minimum allowable release, is undertaken as part of water use optimization during cool periods when additional cooling water releases are not required.

1.1 Exceptions to the "Rules"

During a typical STMP operating period, events will dictate that a decision will be required to increase (or decrease) the releases at SLS on one day followed by an opposite decision, such as a decrease on a subsequent day, because of a relatively minor change in the weather forecast. In order to avoid these situations, the STMP operators have to examine both the original trend analysis to see if the water temperature trends are just above the decision criteria ($>67^{\circ}\text{F}$). If this is the case, then the 19 day forecast run with the increase in SLS releases should also be examined to determine if implementation of the decision based on the trend analysis could result in the trends being at or $<67^{\circ}\text{F}$ on subsequent days. If this is the case, rather than reversing the decision, one of two alternate decisions should be made:

- Implement the increase in the SLS release on the first day but do not implement the opposite decision on the second day but rather hold the SLS release at the maximum for one further day until a positive or negative trend in the forecasts is established; or
- If there is the possibility that the 5 day forecast would dictate a near term increase in temperatures followed by cooling trend (but would result in water temperature trends $>67^{\circ}\text{F}$ in the short term) then one could hold off on the SLS increase decision for one day to see if a strong trend is established.

Either of these alternate decisions should be reviewed with the supervising manager to ensure the correct interpretation of data analysis has been developed.

2.0 Program Start-up

The STMP begins on July 10 unless otherwise directed by RTA. Prior to program start-up a number of tasks need to be implemented. These include:

- Weather station and water temperature probe installation;
- Data logger installation at the Stuart River confluence;
- Weather forecast monitoring by Environment Canada; and
- Contacting Rom Communications (Rom Comm) for reactivation of data logger communication devices.

Details for each task are described below.

2.1 Weather Station and Water Temperature Probes

Currently there are two locations along the Nechako River, Fort Fraser and Finmore (Nechako River above the Stuart River) (Figure 1), where water temperature data and weather data are recorded using instrumentation installed by Triton and uploaded on a daily basis to the Rom Comm website. Prior to the STMP operational period the equipment will need to be installed; historically this has occurred during low flows in early to mid June. It is necessary that the equipment be installed well in advance of the program start date to provide sufficient time for calibration and to ensure that the equipment is functioning properly.

2.1.1 Finmore

Only water temperature data is collected at the Finmore site and is uploaded to the Rom Comm website via a satellite link. These data are downloaded from the website and used in the daily operation of the STMP.

2.1.2 Fort Fraser

Both water temperature data and weather data are collected at the Fort Fraser station. The weather parameters include: solar radiation, air temperature, wind speed, and relative humidity; data are uploaded to the Rom Comm website via a satellite link. Similarly, water temperature data are collected at this site and uploaded to the Rom Comm website each day. These data are downloaded from the website and used in the daily operation of the STMP.

2.1.3 Rom Comm

Prior to program start-up, Rom Comm will need to be contacted to re-activate the devices. The contacts for Rom Comm are listed in Appendix 3. Once the devices are activated and the equipment is set up, the data can be accessed by visiting http://www.romcomm.net/login_net.aspx. Further details on downloading the data can be found in Appendix 4.

2.2 *Data Logger Installation*

Temperature data loggers need to be installed at the confluence of the Nechako and Stuart rivers. This can be done any time prior to program start-up and removed again before freeze-up.

2.3 *Weather Forecast Monitoring*

A five-day weather forecast is required daily to run the model. Currently the weather forecast is provided by Environment Canada via RTA.

The forecast is downloaded daily via a script provided by Environment Canada. No updates should be needed to download the weather forecast; however, a test run should be completed well in advance of the STMP start date. If problems do arise refer to Appendix 3 for the contacts.

Information in the regional model from Environment Canada is generated every 12 hours from midnight, 00 and 12 GMT.

Each line in the file contains the offset from production time (e.g., 03 – three hours from production time) and the value for the parameters.

3.0 Program Operation

The model can be run from any computer as long as the associated folders are located on the C: drive. These folders include:

- SUMMER
- SUMMOD
- Grib 2

The first operational day of the program is July 10. A trial run can be completed earlier but as the model is set up to commence on July 10 it will not work properly unless the computer's date is set to July 10.

3.1 STMP Daily Steps

Below are the daily steps required to run the STMP model:

1. Begin by running the Environment Canada Grib2 script to obtain the five day forecast.
 - a. In **c:\Grib 2** double click on the **00z_-Grib2_Global_10Days.cmd**.
 - b. This will generate a .csv file in **c:\Grib2\Output** named the date the script was run (e.g., 20130727.csv).
 - c. While the program is running you can continue with the next steps (steps 3 -8).

Notes:

- The script can take more than 20 minutes to run depending on the internet connection.
- If you start the script too early in the morning you will get an error part way through. Exit out of it and start it again.

2. You will know the Grib2 script is complete when the Command Prompt window closes. Once the data is available:
 - a. Open the template file, **Weather Forecast.xlt** in the **c:\Summer** directory and resave it with the current day's date (e.g., July 27_EC.xls) in the **c:\Summer\Weather Summary** folder.
 - b. Open the output file located in **c:\Grib2\Output** with today's date (e.g., **20130727.csv**) and delete the first two lines of data (line 0 and 3). Because the data produced is in GMT the first two lines are not the current day's information but rather the previous day's data. Next insert a line between each of the 8 lines (e.g., a space between offset hour 27 and 30) until you have five days. The last line should be offset hour 123.
 - c. Open the file **Weather Forecast.xlt** in the **c:\Summer** directory and copy each parameter from the five days into the spreadsheet. This will convert the units into units that are compatible with the model.
 - d. Save the file as **Weather_Forecastj27.xls** and print.

20140727.csv - Excel

FILE Home Insert Page Layout Formulas Data Review View Developer INQUIRE AC

Clipboard Font Alignment Number

H10

| | A | B | C | D | E | F | G | H | I | J |
|----|---------------------------|-----------------------------|--|-----------------------------|---------------------------------------|------------------------|---------------------------------|---|---|---|
| | Offset (Hour - GMT) | Tempera ture (Kelvin) | Downward incident solar flux (Joules m-2) | Total Cloud (Percent) | Dew Point temperatur e (Kelvin) | Wind speed (m/s) | Surface Pressure (Pascal) | | | |
| 1 | | | | | | | | | | |
| 2 | 0 | 292.415 | | 48 | 278.985 | 1.45286 | 91956.1 | | | |
| 3 | 3 | 290.772 | 2.72E+06 | 60 | 281.584 | 1.1102 | 91989.3 | | | |
| 4 | 6 | 287.958 | 2.88E+06 | 76 | 281.453 | 1.02658 | 92071.1 | | | |
| 5 | 9 | 285.548 | 2.88E+06 | 0 | 280.752 | 1.13027 | 92090.3 | | | |
| 6 | 12 | 283.201 | 2.88E+06 | 24 | 280.374 | 0.976859 | 92121.7 | | | |
| 7 | 15 | 286.748 | 4.08E+06 | 20 | 281.01 | 1.34153 | 92206.6 | | | |
| 8 | 18 | 291.23 | 8.88E+06 | 36 | 281.828 | 1.45539 | 92240.2 | | | |
| 9 | 21 | 294.275 | 1.65E+07 | 0 | 280.615 | 1.43332 | 92168.1 | | | |
| 10 | 24 | 295.209 | 2.44E+07 | 0 | 279.486 | 1.45327 | 92088.2 | | | |
| 11 | 27 | 293.229 | 2.79E+07 | 32 | 282.731 | 1.00289 | 92095 | | | |
| 12 | 30 | 289.323 | 2.80E+07 | 48 | 282.52 | 1.00623 | 92106.2 | | | |
| 13 | 33 | 286.386 | 2.80E+07 | 0 | 281.267 | 1.20871 | 92070.8 | | | |
| 14 | 36 | 284.321 | 2.80E+07 | 0 | 281.067 | 1.00559 | 92083.7 | | | |
| 15 | 39 | 288.776 | 2.94E+07 | 0 | 284.087 | 1.15283 | 92100.3 | | | |
| 16 | 42 | 294.556 | 3.52E+07 | 0 | 283.523 | 1.45269 | 92031.9 | | | |
| 17 | 45 | 297.785 | 4.38E+07 | 0 | 283.659 | 0.808023 | 91944.3 | | | |
| 18 | 48 | 297.655 | 5.12E+07 | 44 | 283.214 | 0.302327 | 91887 | | | |
| 19 | 51 | 295.152 | 5.34E+07 | 64 | 286.609 | 0.402543 | 91864.1 | | | |
| 20 | 54 | 289.603 | 5.38E+07 | 12 | 285.426 | 0.901038 | 91957.7 | | | |
| 21 | 57 | 286.763 | 5.38E+07 | 8 | 284.389 | 0.95511 | 91947.6 | | | |
| 22 | 60 | 285.218 | 5.36E+07 | 8 | 283.268 | 1.05644 | 91944.5 | | | |
| 23 | 63 | 288.734 | 5.48E+07 | 36 | 283.91 | 1.30724 | 91983.1 | | | |
| 24 | 66 | 294.544 | 6.00E+07 | 20 | 284.363 | 1.45132 | 91948.8 | | | |
| 25 | 69 | 297.808 | 6.80E+07 | 0 | 284.277 | 1.50985 | 91870.5 | | | |
| 26 | 72 | 298.133 | 7.56E+07 | 24 | 284.073 | 1.40762 | 91772.6 | | | |
| 27 | 75 | 293.715 | 7.84E+07 | 20 | 287.736 | 0.711272 | 91747.7 | | | |
| 28 | 78 | 287.728 | 7.84E+07 | 0 | 286.754 | 1.05397 | 91810.3 | | | |
| 29 | 81 | 286.242 | 7.84E+07 | 0 | 285.589 | 0.951196 | 91831.3 | | | |
| 30 | 84 | 285.376 | 7.80E+07 | 0 | 283.889 | 1.10789 | 91952.3 | | | |
| 31 | 87 | 289.109 | 7.96E+07 | 0 | 285.277 | 1.3047 | 92078.9 | | | |
| 32 | 90 | 292.761 | 8.48E+07 | 32 | 284.78 | 1.50623 | 92162.2 | | | |
| 33 | 93 | 295.139 | 9.16E+07 | 8 | 284.254 | 1.50558 | 92149.4 | | | |
| 34 | 96 | 296.459 | 9.96E+07 | 8 | 283.968 | 1.50759 | 92085.2 | | | |
| 35 | 99 | 294.344 | 1.03E+08 | 44 | 285.347 | 1.30875 | 92083.5 | | | |
| 36 | 102 | 290.17 | 1.03E+08 | 24 | 283.681 | 1.5091 | 92126 | | | |
| 37 | 105 | 287.45 | 1.03E+08 | 0 | 284.385 | 0.9577 | 92086 | | | |
| 38 | 108 | 285.85 | 1.03E+08 | 0 | 283.821 | 1.0543 | 92072 | | | |
| 39 | 111 | 289.46 | 1.04E+08 | 0 | 284.698 | 1.3572 | 92029 | | | |
| 40 | 114 | 295.2 | 1.10E+08 | 0 | 285.374 | 1.4057 | 91969 | | | |
| 41 | 117 | 298.35 | 1.18E+08 | 0 | 284.919 | 1.2578 | 91879 | | | |
| 42 | 120 | 298.89 | 1.25E+08 | 36 | 283.485 | 1.4096 | 91761 | | | |
| 43 | 123 | 291.62 | 1.28E+08 | 32 | 286.993 | 0.952 | 91823 | | | |

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3. Print the hand data worksheet Excel file which can be found in **c:\Summer\STMP info**. This outlines the data needed to run the model and where it comes from (e.g., Rom Comm website, Water Survey of Canada, etc.).
 - a. Fill out the worksheet by following the next steps (1-3):

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|----|---|------------------------------------|-------------|---------------|---|---------------|-------------|---|---------------|---|------------------|---|---|---|
| 1 | | | | | | | | | | | | | | |
| 2 | STMP Hand Data Entry Work Sheet | | | | | Recorded by | | | | | Date Recorded | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | Use this form to manually record data into prior to data entry into DATAXXX.xls spreadsheet | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | |
| 6 | Rom Comm Temperature Data | | | | | | | | | | | | | |
| 7 | | | | Temp C | | Time | | | | | | | | |
| 8 | | Fort Fraser | Min | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | |
| 10 | | | Max | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | |
| 12 | | | 20:00 Hrs | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | |
| 14 | | | Today's Min | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | |
| 16 | | | | Temp C | | Time | | | | | | | | |
| 17 | | Finmore | Min | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | |
| 19 | | | Max | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | |
| 21 | | | 20:00 Hrs | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | | |
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| 28 | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | |
| 32 | WSC Data - Stage and Flow | | | | | | | | | | | | | |
| 33 | Station ID | Station Name | | | | Date | Time | | Stage | | Flow m3/s | | | |
| 34 | 08JA017 | NECHAKO RIVER BELOW CHESLATA FALLS | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | |
| 36 | 08JC001 | NECHAKO RIVER AT VANDERHOOF | | | | | | | | | | | | |
| 37 | | | | | | | | | | | | | | |
| 38 | 08JB003 | NAUTLEY RIVER NEAR FORT FRASER | | | | | | | | | | | | |
| 39 | | | | | | | | | | | | | | |
| 40 | WSC Data - Temperature | | | | | | | | | | | | | |
| 41 | Station ID | Station Name | | | | | | | | | | | | |
| 42 | 08JA017 | NECHAKO RIVER BELOW CHESLATA FALLS | | | | Mean | | | | | | | | |
| 43 | | | | | | Temp C | | | | | | | | |
| 44 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 46 | | | | | | Min | | | Max | | | | | |
| 47 | | | | | | Temp C | | | Temp C | | | | | |
| 48 | 08JB003 | NAUTLEY RIVER NEAR FORT FRASER | | | | | | | | | | | | |

1

The **Rom Comm Temperature Data** for Fort Fraser and Finmore come from the Rom Comm website (see Appendix 4 for instructions to download the daily **Rom_Comm_logger_data.xls** file).

- Open the downloaded file.
- Find the minimum and maximum temperatures from the **previous day** (e.g., July 26 temperatures will be used for running the model on July 27) and the temperature at 20:00 hrs from the previous day for both Fort Fraser and Finmore (separate tabs in the Excel file).
- Find the current day's minimum temperature (and time) for Fort Fraser.

| | A | B | C | D | E | F | G | H | I |
|-----|-----------------|----------|-----------------|-----------------|-------------|-----------------|-----------------|------|-------------|
| 1 | Date/Time | Temp. °C | Min daily temp. | Max daily temp. | Mean | Spot temp. (°C) | Spot temp. (°F) | Time | Temp. diff. |
| 530 | 7/26/2014 0:00 | 18.124 | | | | | | | |
| 531 | 7/26/2014 1:00 | 17.952 | | | | | | | |
| 532 | 7/26/2014 2:00 | 17.844 | | | | | | | |
| 533 | 7/26/2014 3:00 | 17.782 | | | | | | | |
| 534 | 7/26/2014 4:00 | 17.72 | | | | | | | |
| 535 | 7/26/2014 5:00 | 17.674 | | | | | | | |
| 536 | 7/26/2014 6:00 | 17.659 | | | | | | | |
| 537 | 7/26/2014 7:00 | 17.659 | | | | | | | |
| 538 | 7/26/2014 8:00 | 17.689 | | | | | | | |
| 539 | 7/26/2014 9:00 | 17.813 | | | | | | | |
| 540 | 7/26/2014 10:00 | 17.937 | | | | | | | |
| 541 | 7/26/2014 11:00 | 18.155 | | | | | | | |
| 542 | 7/26/2014 12:00 | 18.217 | | | | | | | |
| 543 | 7/26/2014 13:00 | 18.312 | | | | | | | |
| 544 | 7/26/2014 14:00 | 18.437 | | | | | | | |
| 545 | 7/26/2014 15:00 | 18.469 | | | | | | | |
| 546 | 7/26/2014 16:00 | 18.532 | | | | | | | |
| 547 | 7/26/2014 17:00 | 18.707 | | | | | | | |
| 548 | 7/26/2014 18:00 | 18.739 | | | | | | | |
| 549 | 7/26/2014 19:00 | 18.659 | | | | | | | |
| 550 | 7/26/2014 20:00 | 18.532 | | | | | | | |
| 551 | 7/26/2014 21:00 | 18.359 | | | | | | | |
| 552 | 7/26/2014 22:00 | 18.264 | | | | | | | |
| 553 | 7/26/2014 23:00 | 18.171 | 17.659 | 18.739 | 18.14191667 | | | | |
| 554 | 7/27/2014 0:00 | 18.046 | | | | | | | |
| 555 | 7/27/2014 1:00 | 17.968 | | | | | | | |
| 556 | 7/27/2014 2:00 | 17.906 | | | | | | | |
| 557 | 7/27/2014 3:00 | 17.859 | | | | | | | |
| 558 | 7/27/2014 4:00 | 17.828 | | | | | | | |
| 559 | 7/27/2014 5:00 | 17.828 | | | | | | | |
| 560 | 7/27/2014 6:00 | 17.859 | | | | | | | |
| 561 | 7/27/2014 7:00 | 17.906 | | | | | | | |
| 562 | 7/27/2014 8:00 | 17.983 | | | | | | | |
| 563 | 7/27/2014 9:00 | 17.999 | | | | | | | |
| 564 | 7/27/2014 10:00 | 18.108 | | | | | | | |
| 565 | 7/27/2014 11:00 | 18.202 | | | | | | | |
| 566 | 7/27/2014 12:00 | 18.422 | | | | | | | |
| 567 | 7/27/2014 13:00 | 18.675 | | | | | | | |
| 568 | 7/27/2014 14:00 | 18.946 | | | | | | | |
| 569 | 7/27/2014 15:00 | 18.962 | | | | | | | |
| 570 | 7/27/2014 16:00 | 18.995 | | | | | | | |
| 571 | 7/27/2014 17:00 | 19.139 | | | | | | | |
| 572 | 7/27/2014 18:00 | 19.075 | | | | | | | |
| 573 | 7/27/2014 19:00 | 19.027 | | | | | | | |

2 The WSC Data – Stage and Flow comes from the Water Survey of Canada hydrometric data website (http://wateroffice.ec.gc.ca/index_e.html)

- Under the **Real-time hydrometric data** tab click on the **Map Search** or **Station Search** to locate the following:
 - Latest **current day's** flow (discharge) in m³/s and stage (primary water level) (m) for **08JA017, 08JC001, and 08JB003**.
 - Enter the date, time, river stage, and flow into the datasheet.

3 The WSC Data – Temperature comes from the Water Survey of Canada hydrometric data website (http://wateroffice.ec.gc.ca/index_e.html).

- Under the **Real-time hydrometric data** tab click on the **Map Search** or **Station Search** to locate the following:
 - **Nechako@Irvine's (08JA017)** - mean temperature
 - **Nautley@Fort Fraser (08JB003)** - min/max temperatures
- Choose the parameters needed, water temperature in this case, and list them in table form to get the values. Copy the values from yesterday into an Excel spreadsheet to calculate the required values.

4. Next prepare a new data entry file:
 - a. Open up the template file, **DATAENT.XLT** in the **c:\Summer** directory.
 - b. Resave it with the current date (e.g., **DATAJ27.xls** for July 27).
 - c. Fill in the underlined cells above the shaded cells under "yesterday's water temperatures" section from the **hand data worksheet**.

STMP Hand Data Entry Work Sheet

Recorded by: JS Date Recorded: 08/27/17

Use this form to manually record data into prior to data entry into DATAJ27.xls spreadsheet

Rom Comm Temperature Data

Fort Fraser

Min Temp C: 11.5 Time: 14:00
 Max Temp C: 15.5
 20.00 Hrs Temp C: 15.5
 Today's Min Temp C: 11.5

Pinnore

Min Temp C: 16.5 Time: 14:00
 Max Temp C: 20.5
 20.00 Hrs Temp C: 20.5

WSC Data - Mean Water Level

Station ID Station Name Mean WL
 08JAO17 NECHAKO RIVER BELOW CHESLATA FALLS
 08JCO01 NECHAKO RIVER AT VANDERHOOF
 08JCO02 NECHAKO RIVER AT ISLE PIERRE

WSC Data - Stage and Flow

Station ID Station Name Date Time Stage Flow m/s
 08JAO17 NECHAKO RIVER BELOW CHESLATA FALLS 25-Feb 14:00 1.669 259.7
 08JCO01 NECHAKO RIVER AT VANDERHOOF 25-Feb 0511 2.978 218.6
 08JCO03 NAUTLEY RIVER NEAR FORT FRASER 25-Feb 0511 1.523 26.0

WSC Data - Temperature

Station ID Station Name Mean Temp C Min Temp C Max Temp C
 08JAO17 NECHAKO RIVER BELOW CHESLATA FALLS 17.6 11.5 20.5
 08JCO03 NAUTLEY RIVER NEAR FORT FRASER 15.0 11.5 20.5

DATAJ27.xls - Excel

Yesterday's Water Temperatures

| Station | Min | Max | Mean | Corr. Mean | Init. Temp. | Today's Min | Current Temp. |
|-------------------------------|---------|---------|---------|------------|-------------|-------------|---------------|
| Neck @ Irvine's (08JAO17) | 11.5 °C | 18.7 °C | 18.2 °C | 18.2 °C | 18.5 °C | 17.8 °C | 17.8 °C |
| Neck @ Ft Fraser | 63.8 °F | 65.7 °F | 64.8 °F | 64.8 °F | 65.4 °F | 64.1 °F | 64.1 °F |
| Neck above Stuart (Pinnore) | 18.6 °C | 20.3 °C | 19.4 °C | 19.4 °C | 20.0 °C | 20.0 °C | 20.0 °C |
| Nautley @ Ft Fraser (08JB003) | 60.0 °F | 68.9 °F | 67.0 °F | 67.0 °F | 68.0 °F | 68.0 °F | 68.0 °F |
| Nautley @ Ft Fraser | 8.0 °C | 22.9 °C | 15.5 °C | 15.5 °C | 15.5 °C | 15.5 °C | 15.5 °C |

- d. Fill in the time, river stage, and corrected river flow from the **hand data worksheet**.

STMP Hand Data Entry Work Sheet

Recorded by: JS Date Recorded: 08/27/17

Use this form to manually record data into prior to data entry into DATAJ27.xls spreadsheet

Rom Comm Temperature Data

Fort Fraser

Min Temp C: 11.5 Time: 14:00
 Max Temp C: 15.5
 20.00 Hrs Temp C: 15.5
 Today's Min Temp C: 11.5

Pinnore

Min Temp C: 16.5 Time: 14:00
 Max Temp C: 20.5
 20.00 Hrs Temp C: 20.5

WSC Data - Mean Water Level

Station ID Station Name Mean WL
 08JAO17 NECHAKO RIVER BELOW CHESLATA FALLS
 08JCO01 NECHAKO RIVER AT VANDERHOOF
 08JCO02 NECHAKO RIVER AT ISLE PIERRE

WSC Data - Stage and Flow

Station ID Station Name Date Time Stage Flow m/s
 08JAO17 NECHAKO RIVER BELOW CHESLATA FALLS 25-Feb 14:00 1.669 259.7
 08JCO01 NECHAKO RIVER AT VANDERHOOF 25-Feb 0511 2.978 218.6
 08JCO03 NAUTLEY RIVER NEAR FORT FRASER 25-Feb 0511 1.523 26.0

WSC Data - Temperature

Station ID Station Name Mean Temp C Min Temp C Max Temp C
 08JAO17 NECHAKO RIVER BELOW CHESLATA FALLS 17.6 11.5 20.5
 08JCO03 NAUTLEY RIVER NEAR FORT FRASER 15.0 11.5 20.5

DATAJ27.xls - Excel

| Date | Time | River Stage | River Stage Correction | Corrected River Stage | Corrected River Flow |
|--------|------|-------------|------------------------|-----------------------|----------------------|
| 25-Feb | 0441 | 1.669 m | 0.000 m | 1.669 m/s | 259.7 m/s |
| 25-Feb | 0511 | 2.978 m | 0.000 m | 2.978 m/s | 218.6 m/s |
| 25-Feb | 0511 | 1.523 m | 0.000 m | 1.523 m/s | 26.0 m/s |

- e. The weather data (shaded cells at bottom of spread sheet) will come from the **Rom Comm** website.
- Click on the Fort Fraser Climate tab and follow the steps in Appendix 4 to create the data (csv) file.
 - Copy yesterday's weather data and paste into the **Weather_Summary.xlt** file which can be found in the **c:\Summer** directory. The highlighted portion on the right side of the spreadsheet will provide you with the values to be entered into the **DATAJ27.xls** file.
 - The cloud cover data is not collected by the weather station and will have to be estimated for the current day and yesterday.
 - Save with the current date (e.g., **Weather_Summary_J27.xls** in the **c:\Summer\Weather Info** directory.

| | A | B | C | D | E | F | G | H | I | J |
|----|--------------------------------|-------------|-------------|----------------------|----------|------------|-------------|-----------------------------|---|---|
| 1 | 7809375768 Fort Fraser Climate | High | Low | | | | Average | | | |
| 2 | Date/Time | Temperature | Temperature | Solar Radiation | Humidity | Wind (Avg) | Temperature | | | |
| 3 | | Degree C | Degree C | Watts/M ² | % | m/s | Degree C | | | |
| 4 | | | | | | | | 3.6 m/s to KPH Conversion | | |
| 5 | 7/26/2014 23:00 | 14.889 | 13.667 | 0 | 90 | 1 | 14.278 | 0.08598 Watts/M2 to Langley | | |
| 6 | 7/26/2014 22:00 | 15.944 | 14.889 | 12 | 83 | 4 | 15.4165 | | | |
| 7 | 7/26/2014 21:00 | 18.889 | 15.944 | 47 | 77 | 4 | 17.4165 | | | |
| 8 | 7/26/2014 20:00 | 19.278 | 18.833 | 161 | 57 | 2 | 19.0555 | | | |
| 9 | 7/26/2014 19:00 | 19.722 | 17.778 | 333 | 56 | 2 | 18.75 | | | |
| 10 | 7/26/2014 18:00 | 19.944 | 17.5 | 388 | 64 | 5 | 18.722 | | | |
| 11 | 7/26/2014 17:00 | 19.722 | 17.944 | 519 | 52 | 6 | 18.833 | | | |
| 12 | 7/26/2014 16:00 | 18.944 | 18.056 | 309 | 59 | 5 | 18.5 | | | |
| 13 | 7/26/2014 15:00 | 19.722 | 18.444 | 423 | 50 | 1 | 19.083 | | | |
| 14 | 7/26/2014 14:00 | 18.444 | 17.444 | 575 | 56 | 2 | 17.944 | | | |
| 15 | 7/26/2014 13:00 | 17.611 | 16.778 | 354 | 57 | 1 | 17.1945 | | | |
| 16 | 7/26/2014 12:00 | 17.056 | 15.444 | 389 | 53 | 1 | 16.25 | | | |
| 17 | 7/26/2014 11:00 | 15.444 | 12.722 | 411 | 60 | 1 | 14.083 | | | |

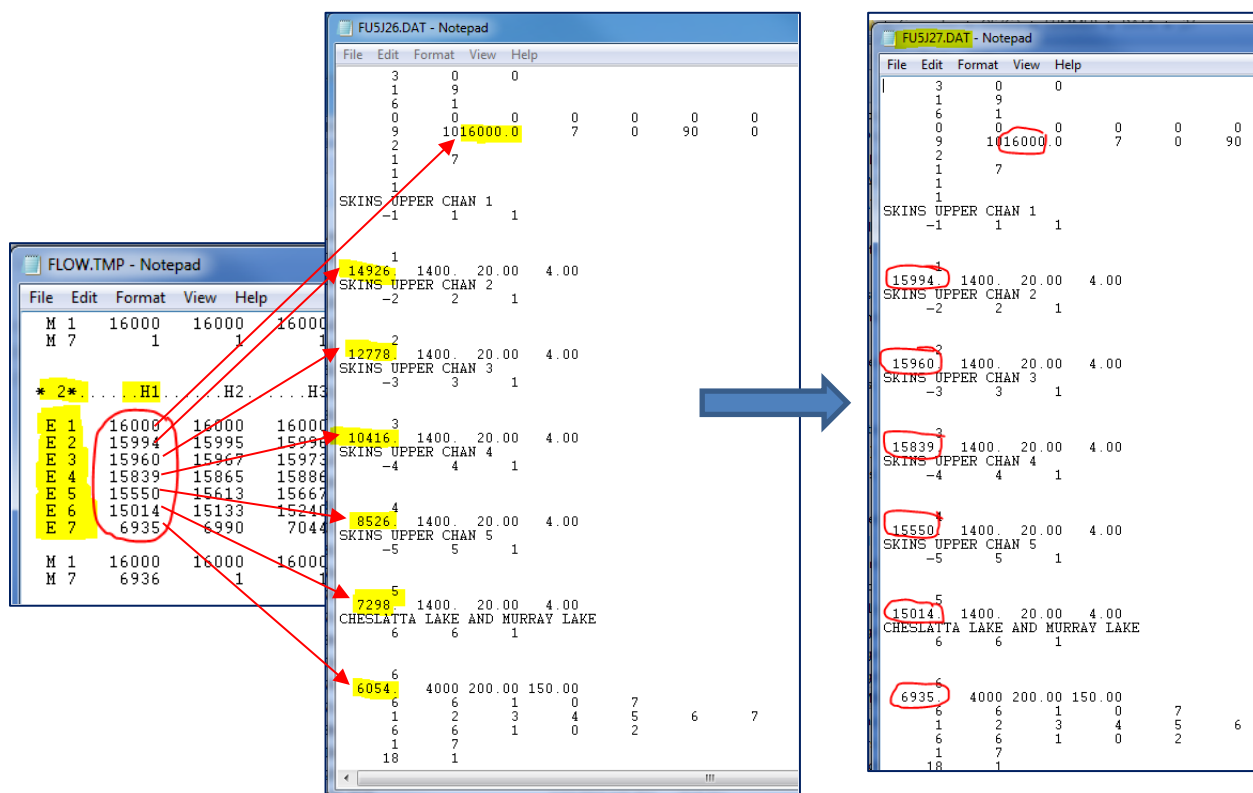
| | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|----|----------------------|----------|---------|-----------|----------|----------|---|---|---|---|---|---|---|---|
| 36 | | | | | | | | | | | | | | |
| 37 | | Air | Rel. | Sol. | Wind | Cloud | | | | | | | | |
| 38 | | Temp. | Hum. | Rad. | Speed | Cover | | | | | | | | |
| 39 | | | | | | | | | | | | | | |
| 40 | Observed Ft. Fraser | 13.13 °C | 72.83 % | 383.47 Ly | 1.58 m/s | 3 tenths | | | | | | | | |
| 41 | | | | | 5.69 kph | | | | | | | | | |
| 42 | Data for Julian Day | 208 | | | | | | | | | | | | |
| 43 | Cloud Est. for Today | 3 tenths | | | | | | | | | | | | |
| 44 | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | |
| 46 | Comments | | | | | | | | | | | | | |
| 47 | | | | | | | | | | | | | | |

5. Browse to the **c:\Summer** directory:
 - a. Open **FU1J26h.dat**; this is the previous day's file, which will have the letter d, h, or i (decrease, hold, or increase) depending on yesterday's decision record (see Appendix 5 for an example. This should be viewed in Windows Notepad.
 - b. Once the file is open, complete the following steps:
 - i. Delete the first two lines of the file. The first two lines represent yesterday's flows.
 - ii. Copy and paste the last two lines of the file in place so that there are 18 lines in total (two lines represent one day) so the file should represent a total of 9 days.
 - iii. Enter the **H1** (Hour 1 from E7) values from Day 2, 3, and 4, from the previous day's **FU6J26.out** file (can be found around page 4 of yesterday's **Flow.tmp** file) at lines 19, 21, and 23 of the FU1 file.
 - iv. Save the file with **TODAY'S** date and **H**, and then exit the file. You save with H because you do not know if you will increase or decrease the flows today. This letter may change once you have finished running the model.

*Note: You must ensure that you edit the correct **FU1** file from the previous day. For example, if you decided on July 26 to increase the flows you would have created a file called **FU1j26i.dat**, therefore the directory will have a **FU1j26h.dat** and **FU1j26i.dat**. When you are running the model the following day (July 27) you must edit the file **FU1j26i.dat**. After editing this file, you must then save it with the new name **FU1j27h.dat**. Note the date change and that the "i" has been replaced with an "h" so that you can run the model.*

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Prepared by Triton Environmental Consultants Ltd.

6. Browse the **c:\Summer** directory and open **FU5j26.dat** (the previous day's file).
 - a. Using the **H1, E1 through E7** values from **DAY 2** (the previous day's **Flow.tmp** printout, approximately page 5) replace the values in rows 5, 15, 21, 27, 33, 39, 45 (refer to Appendix 5 for details).
 - b. Save the file with today's date using 'save as' so both files remain.



Note: It is a good idea at this point to check to make sure you have created all of the appropriately named files in c:\Summer directory. At this point you should have the following files with the current day's date: DATAj27.xls, FU1j27h.dat, and FU5j27.

7. In the **c:\Summer** directory open the **TU2j26.dat** file (Figure 1) and rename it to the current day's date. Use the **Weather Summary** data from Fort Fraser (can also be found at the bottom of the DATAj27.xls file) for the first line of data (yesterday's weather). There will be no data for surface pressure in the Fort Fraser weather summary, instead use the forecasted data from the previous day in **TU2J26.dat**.

The screenshot displays an Excel spreadsheet titled "Weather_Summary_J27.xlsx" and two Notepad files, "TU2J26.DAT" and "TU2J27.DAT".

The Excel spreadsheet shows a table with the following columns: Date/Time, High, Low, Solar Radiation, Humidity, Wind (Avg), and Average. The data is for 7/26/2014. The table is as follows:

| Date/Time | High | Low | Solar Radiation | Humidity | Wind (Avg) | Average |
|-----------------|----------|----------|----------------------|----------|------------|----------|
| | Degree C | Degree C | Watts/M ² | % | m/s | Degree C |
| 7/26/2014 23:00 | 14.889 | 13.667 | 0 | 90 | 1 | 14.278 |
| 7/26/2014 22:00 | 15.944 | 14.889 | 12 | 83 | 4 | 15.4165 |
| 7/26/2014 21:00 | 18.889 | 15.944 | 47 | 77 | 4 | 17.4165 |
| 7/26/2014 20:00 | 19.278 | 18.833 | 161 | 57 | 2 | 19.0555 |
| 7/26/2014 19:00 | 19.722 | 17.778 | 333 | 56 | 2 | 18.75 |
| 7/26/2014 18:00 | 19.944 | 17.5 | 388 | 64 | 5 | 18.722 |
| 7/26/2014 17:00 | 19.722 | 17.944 | 519 | 52 | 6 | 18.833 |
| 7/26/2014 16:00 | 18.944 | 18.056 | 309 | 59 | 5 | 18.5 |
| 7/26/2014 15:00 | 19.722 | 18.444 | 423 | 50 | 1 | 19.083 |
| 7/26/2014 14:00 | 18.444 | 17.444 | 575 | 56 | 2 | 17.944 |
| 7/26/2014 13:00 | 17.611 | 16.778 | 354 | 57 | 1 | 17.1945 |
| 7/26/2014 12:00 | 17.056 | 15.444 | 389 | 53 | 1 | 16.25 |
| 7/26/2014 11:00 | 15.444 | 12.722 | 411 | 60 | 1 | 14.083 |

The "TU2J26.DAT" Notepad file shows weather data for Fort Fraser, including temperature, solar radiation, humidity, wind speed, and cloud cover. The data is as follows:

| Temp (C) | Rad (LY) | CC (TTHS) | DPT (C) | SPD (KH) | SPR (KPA) | RH (%) | DD | MM | YY |
|----------|----------|-----------|---------|----------|-----------|--------|----|----|----|
| 15.12 | 458.62 | 0.30 | 06.94 | 18.45 | 91.590 | 59.08 | 25 | 07 | 14 |
| 14.63 | 499.04 | 0.50 | 06.79 | 03.55 | 91.910 | 60.77 | 26 | 07 | 14 |
| 16.95 | 605.16 | 0.31 | 09.45 | 04.43 | 92.180 | 62.46 | | | |
| 18.81 | 635.76 | 0.11 | 10.53 | 03.46 | 92.070 | 58.59 | | | |
| 18.91 | 602.29 | 0.09 | 12.17 | 04.72 | 91.770 | 66.32 | | | |
| 18.57 | 630.98 | 0.10 | 10.99 | 04.83 | 91.950 | 62.13 | | | |

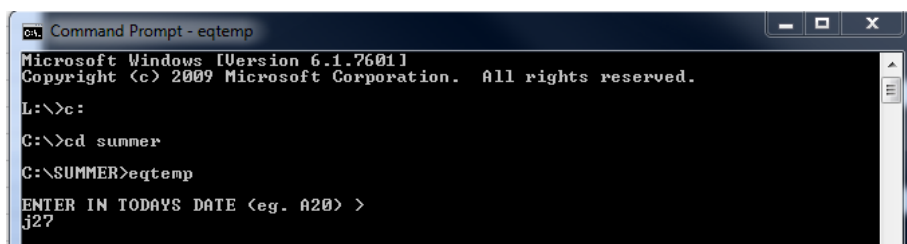
The "TU2J27.DAT" Notepad file shows weather data for Fort Fraser, including temperature, solar radiation, humidity, wind speed, and cloud cover. The data is as follows:

| Temp (C) | Rad (LY) | CC (TTHS) | DPT (C) | SPD (KH) | SPR (KPA) | RH (%) | DD | MM | YY |
|----------|----------|-----------|---------|----------|-----------|--------|----|----|----|
| 13.13 | 383.47 | 0.30 | 07.69 | 05.70 | 91.910 | 72.83 | 26 | 07 | 14 |
| 16.67 | 667.30 | 0.24 | 08.03 | 04.42 | 92.140 | 56.78 | 27 | 07 | 14 |
| 18.74 | 608.99 | 0.20 | 10.24 | 03.30 | 92.010 | 57.50 | | | |
| 18.81 | 597.51 | 0.16 | 11.68 | 04.18 | 91.900 | 64.33 | | | |
| 17.88 | 573.61 | 0.12 | 11.98 | 04.57 | 92.020 | 70.50 | | | |
| 19.12 | 611.85 | 0.12 | 11.67 | 04.46 | 91.970 | 62.73 | | | |

The "TU2J27.DAT" Notepad file also includes a "Daily Weather Summary" section with average values for temperature, solar radiation, humidity, wind speed, cloud cover, and dew point temperature.

| Avg. Temp °C | Total Daily Solar Rad (Langley) | Avg. Humidity % | Avg. Wind Speed KPH | Avg. Cloud Cover | Cloud Est. for Today | Dew Point Temperature |
|--------------|---------------------------------|-----------------|---------------------|------------------|----------------------|-----------------------|
| 13.13 | 383.47 | 72.83 | 5.70 | 3 | 3 | 7.692771 |

8. Open the DOS Command Prompt to run the **equilibrium** temperature model. You can access the Command Prompt by clicking the Start menu and entering "cmd" into the search field. To run the model you will need to be in the **c:/Summer** directory. To get to the root directory type "cd\" and this will take you to the root directory regardless of your location. If the root directory is not the c: directory you can change it by typing "c:" and this will take you to the c: directory and then type **cd summer** and this will take you to the **c:\Summer** directory. Once you are in the **c:\Summer** directory begin the model by typing **eqtemp** (enter):
 - a. Enter **Current date** when prompted (e.g., j27)
 - b. Exit DOS



```
Command Prompt - eqtemp
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

L:\>cd C:
C:\>cd summer
C:\SUMMER>eqtemp
ENTER IN TODAYS DATE <eg. A20> >
j27
```

- c. In the **c:\Summer** directory, open the **Eqtemp.tmp** file and print. This file should be one page that lists the weather forecast at the top (check for any numbers that seem incorrect), followed by the mean daily equilibrium temperatures for Days 1 to 5.

9. Open the **STMP2014.xls** file in the **c:\Summer** directory and enter the following data in the main table (first tab):
 - a. **Current day's** flows in cubic feet per second (cfs) - last 3 lines of the **STMP2014.xls** file in **blue**, from the **DATAJ27.xls** file.

| | Date | Time | River Stage | River Stage Correction | Corrected River Stage | Corrected River Flow |
|-----------------------------|--------|------|-------------|------------------------|-----------------------|-------------------------|
| Nech @ Irvine's (08JA017) | 27-Jul | 0441 | 1.660 m | 0.000 m | 1.660 m/s | 259.7 m ³ /s |
| Nech @ Vanderhoof (08JC001) | 27-Jul | 0511 | 2.978 m | 0.000 m | 2.978 m/s | 218.6 m ³ /s |
| Nantley (08JB003) | 27-Jul | 0511 | 1.523 m | 0.000 m | 1.523 m/s | 26.0 m ³ /s |

| | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
|--|------|------|------|------|------|------|------|------|------|------|------|----|----|
| Flow in the Nech River @ Irvine's (below CF) Current Day (cfs) | 4246 | 6095 | 7331 | 6780 | 5905 | 5600 | 5643 | 5676 | 5658 | 7267 | 9171 | | |
| Flow in the Nechako River at Vanderhoof Current Day (cfs) | 4347 | 4949 | 6258 | 7856 | 7873 | 7163 | 6762 | 6690 | 6708 | 6718 | 7220 | | |
| Flow in the Nantley River at F.F. Current Day (cfs) | 1118 | 1097 | 1085 | 1056 | 1033 | 1033 | 1028 | 1056 | 978 | 937 | 918 | | |

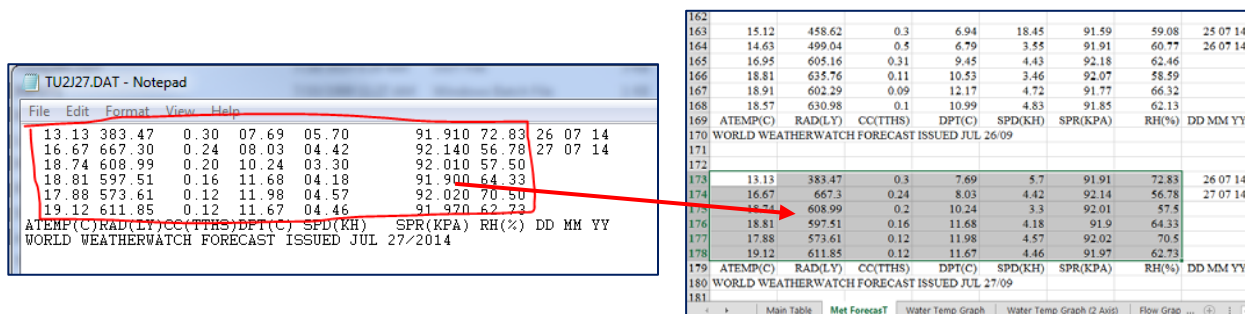
- b. Observed water temperatures from the **Previous day** (this includes the **red values** and the bolded **black** row of values for the Nechako above Stuart River), from the **DATAJ27.xls** file. These are the bolded mean and corrected mean values on the **DATAJ27.xls** spreadsheet.

| Station | Min | Max | Mean | Corr. Mean | Init. Temp. | Corr. Init. Temp. | Today's Min | Today's Max | Current Temp. |
|--------------------------------|---------|---------|---------|------------|-------------|-------------------|-------------|-------------|---------------|
| Nech @ Irvine's (08JA017) | | | 17.6 °C | 17.6 °C | | | | | |
| Nech @ Ft. Fraser | 17.7 °C | 18.7 °C | 18.2 °C | 18.2 °C | 18.2 °C | 18.5 °C | 17.8 °C | 17.8 °C | |
| Nech above Stuart (Framwood) | 65.8 °F | 65.5 °F | 64.8 °F | 64.8 °F | 64.4 °F | 64.1 °F | 64.1 °F | 64.1 °F | |
| Nantley @ Ft. Fraser (08JB003) | 8.0 °C | 22.9 °C | 15.5 °C | 15.5 °C | | | | | |

| | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Previous Day's Observed Water Temperature | 64.8 | 65.5 | 64.8 | 64.8 | 64.8 | 64.8 | 64.8 | 64.8 | 64.8 | 64.8 | 67.0 |
| Current Day's Skin Lake Spillway Release at Day (cfs) | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| Previous Day's Observed Water Temperature (°F) | 67.6 | 66.8 | 65.5 | 65.0 | 64.7 | 64.4 | 64.7 | 64.9 | 64.7 | 64.9 | 63.7 |
| Previous Day's Observed Water Temperature (°F) | 70.8 | 70.7 | 67.9 | 65.9 | 65.9 | 65.9 | 65.8 | 66.4 | 67.0 | 67.0 | 64.8 |
| Previous Day's Observed Water Temperature (°F) | 70.3 | 67.4 | 61.7 | 61.9 | 59.6 | 62.8 | 62.2 | 63.5 | 60.7 | | |

- c. **Current day's** release at the spillway (which will be yesterday's release value).

- d. Press **control-R**, when the cursor is on a blank cell anywhere in the spreadsheet. This will open the weather forecast file in Excel (a message may pop up stating the **TU2j27.dat** file cannot be found. Click ok and it should open up anyways). Copy the data and paste it into the Met Forecast tab in **STMP2014.xls** for the current day.



The Notepad window displays the following data from TU2j27.DAT:

| ATMP(C) | RAD(LY) | CC(TTHS) | DPT(C) | SPD(KH) | SPR(KPA) | RH(%) | DD | MM | YY |
|---------|---------|----------|--------|---------|----------|-------|----|----|----|
| 13.13 | 383.47 | 0.30 | 07.69 | 05.70 | 91.910 | 72.83 | 26 | 07 | 14 |
| 16.67 | 667.30 | 0.24 | 08.03 | 04.42 | 92.140 | 56.78 | 27 | 07 | 14 |
| 18.74 | 608.99 | 0.20 | 10.24 | 03.30 | 92.010 | 57.50 | | | |
| 18.81 | 597.51 | 0.16 | 11.68 | 04.18 | 91.900 | 64.33 | | | |
| 17.88 | 573.61 | 0.12 | 11.98 | 04.57 | 92.020 | 70.50 | | | |
| 19.12 | 611.85 | 0.12 | 11.67 | 04.46 | 91.970 | 62.73 | | | |

The Excel spreadsheet shows the 'Met Forecast' tab with the following data:

| ATMP(C) | RAD(LY) | CC(TTHS) | DPT(C) | SPD(KH) | SPR(KPA) | RH(%) | DD | MM | YY |
|---------|---------|----------|--------|---------|----------|-------|----|----|----|
| 13.13 | 383.47 | 0.3 | 7.69 | 5.7 | 91.91 | 72.83 | 26 | 07 | 14 |
| 16.67 | 667.3 | 0.24 | 8.03 | 4.42 | 92.14 | 56.78 | 27 | 07 | 14 |
| 18.74 | 608.99 | 0.2 | 10.24 | 3.3 | 92.01 | 57.5 | | | |
| 18.81 | 597.51 | 0.16 | 11.68 | 4.18 | 91.9 | 64.33 | | | |
| 17.88 | 573.61 | 0.12 | 11.98 | 4.57 | 92.02 | 70.5 | | | |
| 19.12 | 611.85 | 0.12 | 11.67 | 4.46 | 91.97 | 62.73 | | | |

- e. Press **control-E**, when the cursor is on a blank cell anywhere in the spreadsheet. Answer **NO** to "print decision record" and **YES** to "print temperature predictions".

10. Return to the command prompt and run **INPUTS**. Type *inputs*, hit enter, and type the following data at the prompts:
 - a. Enter today's date.
 - b. Enter yesterday's date.
 - c. Enter yesterday's date in month, day (mm,dd) format (e.g., 07,26 for July 26).
 - d. **Yesterday's** flow at Irvines in cfs (taken from the **Previous** day's **DATAJ26.xls** – double-check inputs file from the previous day).
 - e. Cheslatta correction factor – "1"
 - f. **Today's** Nautley flow in cfs (taken from **DATAJ27.xls**)
 - g. **Yesterday's** mean temperature at **Irvines**, followed by "2,9", followed by **Nautley** Yesterday's mean temperature – in °F
 - DOS Format Example: **Irvine temp,2,9,Nautley temp**
 - h. 1 – 5 day estimates, Irvine temps (taken from the Prediction record file)
 - start at the current day
 - temperatures separated by commas
 - i. 1 – 5 day estimates, Nautley temps (take from the Prediction record file)
 - start at the current day
 - temperatures separated by commas
 - j. Initialization temperature for Fort Fraser and Nechako above Stuart (Finmore) preceded by the number 20, separated by commas – from **DATAJ27.xls** file
 - DOS Format Example: **20, Fort Fraser corr. init. temp, Nechako above Stuart (Finmore) corr. init. temp.**
 - k. In the **c:\Summer** directory open **inputs.tmp**
 - Check the numbers to make sure they are correct.
 - Print.

Excel spreadsheet showing data for DATA06 - Excel. The table includes columns for Date, Time, River Stage, Corrected River Stage, and Corrected River Flow.

| | Date | Time | River Stage | Corrected River Stage | Corrected River Flow |
|------------------------------|--------|------|-------------|-----------------------|-------------------------|
| Nech. @ Irvine's (08JA017) | 10-Feb | 0241 | 1.498 m | 0.000 m | 1.498 m ³ /s |
| Nech. @ Vanderhoof (08JC001) | 10-Feb | 0206 | 2.786 m | 0.000 m | 2.786 m ³ /s |
| Nautley (08JB003) | 10-Feb | 0206 | 1.530 m | 0.000 m | 1.530 m ³ /s |

Excel spreadsheet showing data for DATA27 - Excel. The table includes columns for Station, Min., Max., Mean, Corr. Mean, Init. Temp., Corr. Init. Temp., Today's Min., and Current Temp.

| Station | Min. | Max. | Mean | Corr. Mean | Init. Temp. | Corr. Init. Temp. | Today's Min. | Current Temp. |
|--------------------------------|---------|---------|---------|------------|-------------|-------------------|--------------|---------------|
| Nech. @ Irvine's (08JA017) | | | 17.6 °C | | | | | |
| Nech. @ Ft. Fraser | 17.7 °C | 18.7 °C | 18.2 °C | 18.2 °C | 18.5 °C | 18.5 °C | 17.8 °C | 17.8 °C |
| Nech. above Stuart (Finmoore) | 65.5 °F | 68.5 °F | 67.0 °F | 67.0 °F | 68.0 °F | 68.0 °F | 68.0 °F | 68.0 °F |
| Nautley @ Ft. Fraser (08JB003) | 8.0 °C | 22.9 °C | 15.5 °C | 15.5 °C | | | | |

Command Prompt

```

C:\SUMMER>inputs

ENTER IN TODAYS DATE (eg. A20) >
j27

ENTER IN YESTERDAYS DATE (eg. A19) >
j26

YESTERDAYS DATE IS <MM,DD> >
07,j26

YESTERDAYS FLOW @ IRVINES <CFS> >
7267

CHESLATTIA FALLS CORRECTION FLOW <CFS> >
1

TODAYS NAUTLEY FLOW <CFS> >
918

YEST IRVINES TEMP-IFCONT-INITSEC-YEST NAUTLEY T >
63.7,2.9,59.8

1st TO 5th DAY ESTIMATES FOR IRVINES TEMPS >
63.9,63.9,63.9,63.9,63.9

1st TO 5th DAY ESTIMATES FOR NAUTLEY TEMPS >
59.8,59.8,59.8,59.8,59.8

INITIALIZATION TEMP TIME - F.F. TEMP - N.A.S. T >
20,65.4,68

Stop - Program terminated.

C:\SUMMER>

```

Decision Record
2014 Summer Water Temperature and Flow Management Project

Source water temperatures have been predicted by Triton as indicated below:

| Date | July 27 | July 28 | July 29 | July 30 | July 31 | August 1 |
|------------------------------------|---------|---------|---------|---------|---------|----------|
| Equilibrium Temperature (°F) | 76.9 | 76.8 | 75.0 | 78.3 | 74.0 | 79.4 |
| Response Temperature (°F) | 85.6 | 80.4 | 71.4 | 74.3 | 74.7 | 77.9 |
| Nechako River below C.F. Temp (°F) | 63.7 | 63.9 | 63.9 | 63.9 | 63.9 | 63.9 |
| Nautley River Temperature (°F) | 59.8 | 59.8 | 59.8 | 59.8 | 59.8 | 59.8 |

Above predictions of source water temperatures are based upon calculated response temperatures.

11. Return to the command prompt and run **Flow** (type *flow* and hit enter).
 - a. Enter today's date.
 - b. Enter today's flow pattern (h, i, or d). It will always be "h" unless you have a scheduled gate change for the current day.
 - c. Type **fd** and it will prompt you for the above values again.

```

Command Prompt - flow
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

L:\>c:
C:\>cd summer
C:\SUMMER>flow
FU13.DAT
FU14J27d.OUT
FU14J27h.OUT
FU14J27i.OUT
FU14J28h.OUT
FU1exia.DAT
FU1F12D.DAT
FU1J26h.DAT
FU1J27d.DAT
FU1J27h.DAT
FU1J28h.DAT
11 file(s) copied.

ENTER IN TODAYS DATE (eg. A20) >
J27
ENTER IN TODAYS FLOW PATTERN (H,I,D) >
H
C:\SUMMER>fd

ENTER IN TODAYS DATE (eg. A20) >
j27
ENTER IN TODAYS FLOW PATTERN (H,I,D) >
h

```

- d. In **c:\Summer** open the **flow.tmp** file
 - Check the data for accuracy.
 - Print.
- e. Circle the H1 values (E1 to E7) from day 2 (*2*) of the printout (~fifth page), as well as the H1 (E7) values on Day 3 and Day 4 – these will be used tomorrow to update the FU1 and FU5 files.

The image shows two screenshots of a Notepad window displaying the FLOW.TMP file. The left screenshot shows the first page of the file, and the right screenshot shows the fifth page. Both screenshots display a table of data with columns labeled H1 through H9. The H1 column is highlighted in yellow, and the values for E1 through E7 are circled in red.

| | H1 | H2 | H3 | H4 | H5 | H6 | H7 | H8 | H9 |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| E 1 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 |
| E 2 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 |
| E 3 | 15999 | 15999 | 15999 | 15999 | 15999 | 15999 | 15999 | 15999 | 15999 |
| E 4 | 15998 | 15998 | 15998 | 15998 | 15998 | 15998 | 15998 | 15998 | 15998 |
| E 5 | 15991 | 15992 | 15993 | 15994 | 15995 | 15996 | 15997 | 15997 | 15997 |
| E 6 | 15971 | 15975 | 15979 | 15982 | 15984 | 15987 | 15989 | 15990 | 15992 |
| E 7 | 8233 | 8264 | 8335 | 8385 | 8436 | 8486 | 8535 | 8585 | 8634 |
| M 1 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 |
| M 7 | 8233 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| | H1 | H2 | H3 | H4 | H5 | H6 | H7 | H8 | H9 |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| E 1 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| E 2 | 10044 | 10015 | 10012 | 10029 | 10063 | 10011 | 10160 | 10135 | 10100 |
| E 3 | 10239 | 10198 | 10164 | 10136 | 10112 | 10092 | 10076 | 10063 | 10052 |
| E 4 | 10687 | 10589 | 10504 | 10430 | 10367 | 10312 | 10265 | 10224 | 10190 |
| E 5 | 11403 | 11241 | 11093 | 10961 | 10842 | 10736 | 10642 | 10558 | 10484 |
| E 6 | 12000 | 12088 | 11869 | 11703 | 11521 | 11372 | 11226 | 11092 | 10971 |
| E 7 | 9687 | 9703 | 9718 | 9731 | 9743 | 9754 | 9763 | 9772 | 9780 |
| M 1 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| M 7 | 9687 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| | H1 | H2 | H3 | H4 | H5 | H6 | H7 | H8 | H9 |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| E 1 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| E 2 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| E 3 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| E 4 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| E 5 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| E 6 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| E 7 | 9687 | 9687 | 9687 | 9687 | 9687 | 9687 | 9687 | 9687 | 9687 |
| M 1 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| M 7 | 9687 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

12. Return to the command prompt and run **temp** (type *temp* and hit enter).
 - a. Enter today's date (j27).
 - b. Enter the flow pattern (h, i, or d). It will always be "h" unless you have a scheduled gate change for the current day.
 - c. Enter yesterday's date (j26).
 - d. Enter the day before yesterday's date (j25).
 - e. Type **td** and it will prompt you for the above values again.

```

C:\SUMMER>temp
ENTER IN TODAYS DATE <eg. A20> >
j27
ENTER IN TODAYS FLOW PATTERN <H,I,D> >
h
ENTER IN YESTERDAYS DATE <eg. A19> >
j26
ENTER IN THE DAY BEFORE YESTERDAYS DATE <eg. A18> >
j25
C:\SUMMER>td

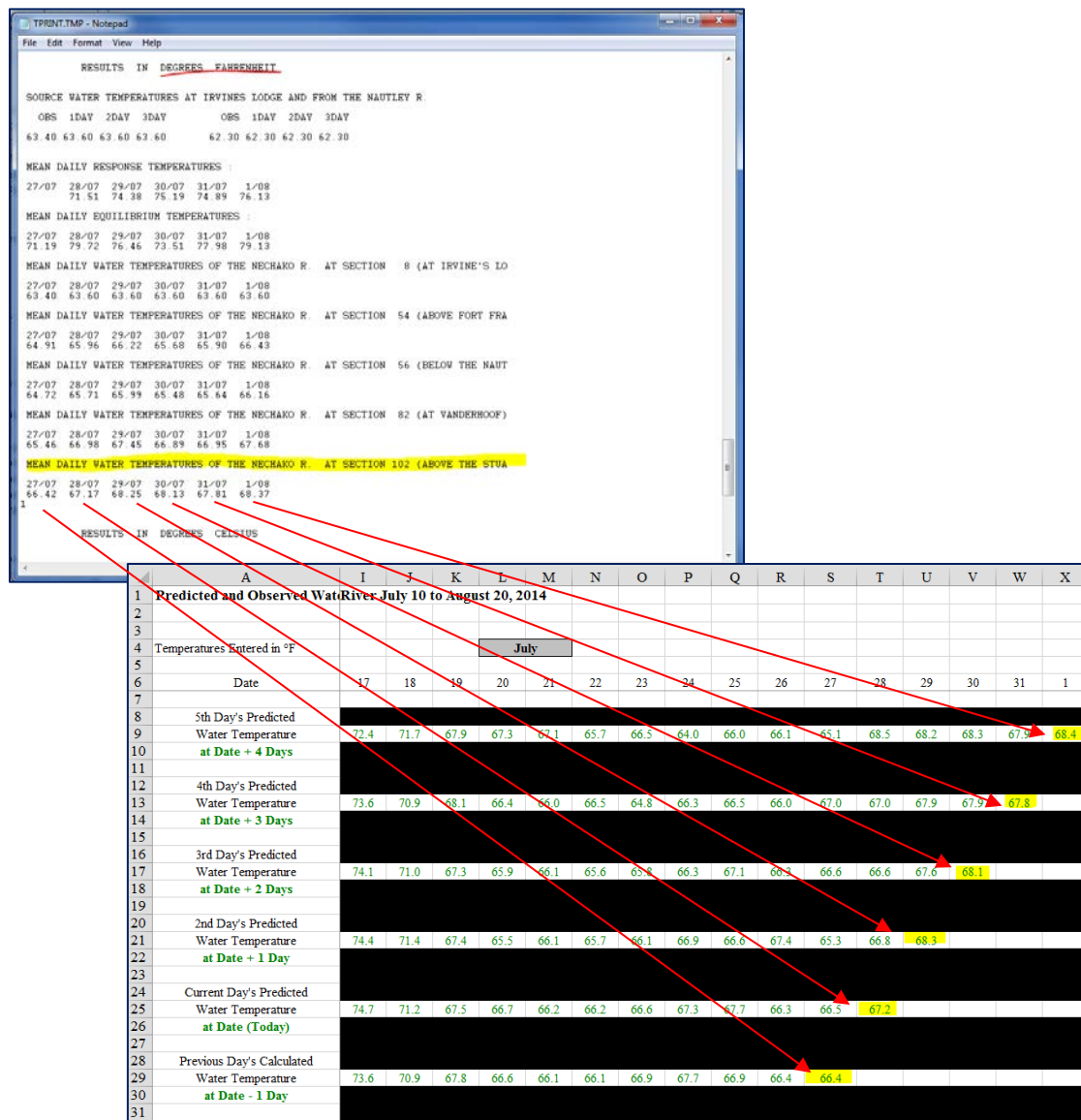
ENTER IN TODAYS DATE <eg. A20> >
j27
ENTER IN TODAYS FLOW PATTERN <H,I,D> >
h
ENTER IN YESTERDAYS DATE <eg. A19> >
j26
ENTER IN THE DAY BEFORE YESTERDAYS DATE <eg. A18> >
j25

```

- f. In **c:\Summer** open the **tprint.tmp** file
 - Check the data for accuracy of entry; look at the correction factors, they should be <2.0.
 - Print.
 - Go to the last or second to last page in this document and underline the mean daily water temperatures (in °F) at the Nechako River at Section 102 ABOVE THE STUART RIVER; these values will be used in the **STMP2014.xls** file.

Note: If you are getting really big correction factors in the **tprint.tmp** file, go into the **TU5** file (e.g., **TU5j27.dat**) and at approximately line 22 there should be the number 46 followed by another number. That number should be "0", not a negative number. Correct it if necessary and run the temp model again.

13. Open **STMP2014.xls** and enter the following data:
 - a. Enter the water temperature data (as specified above from the **tprint.tmp** file) in the appropriate cells (green values at the top of the spreadsheet) for the Nechako River above the Stuart River, starting with yesterday's date and advancing four days into the future (values are entered diagonally).



b. Press **control-E**, when the cursor is on a blank cell anywhere in the spreadsheet – answer **YES** to print the decision record and **No** to print the tables and graphs.

14. If the model suggests an increase or decrease, run the flow and temp models again with the suggested release values and generate a new Decision Record with the recommended change. If the predicted temperatures are at or near 67°F, consider delaying the suggested change until the results are calculated the next day. If the predicted results remain above 67°F prepare a gate change request form (template can be found in **c:\Summer\Gate Change Orders** folder), pdf, and email to the necessary contacts (see Appendix 3 for list). They will phone you to ask for the password.

15. If the decision record suggests an increase or decrease, you must run the model again (flow and temp models) with the suggested release values. This prepares the files for the next day's calculations. You will need to edit the **FU1** file with the suggested increase or decrease prior to running the flow and temp model.
16. If you need to assess the results of the recommended flow change, run the 19 day model. The 19 day will provide flow data for the following 18 days. This is done to ensure flows do not exceed or drop below the recommended limits.
 - a. In **c:\Summer** open the **FU1F19d.dat** file and follow the steps in **5(b)**. There will be 38 lines in this file as it represents 19 days of flow predictions (the FU1J27.dat file only has 18).
 - b. In **c:\Summer** open the **FU5F19.dat** file and follow the steps in **6(a)**.
 - c. Open the command prompt and type **flow19d** (enter) to run the model.
 - d. In **c:\Summer** open **flow19.tmp** file and review the E7 values (these are the predicted flows at the Nechako River below Cheslatta Falls (NRBCF) on the specified day with the first three lines (E1, E2, E7) being the previous day, the second set of three lines being the current day, etc.). Check if they exceed 10,000 or drop below 6,000 cfs at Cheslatta. If they do, change the day/time of the gate change to keep the water levels between the recommended flows.
17. Run the pkzip STORE program. This will remove the .tmp files and store the current day's data.
 - a. In command prompt type **STORE mdd mdd mdd** (e.g., J27, J26, J25) – where the first day is the current day, followed by the previous two days.
 - b. Follow the remaining prompts.
 - c. The data will be stored as a zip file with the current date in **c:\Summer\Data**.

Note: Prior to running the STORE program, save a copy of the current day's Summer directory on the m: drive so there will be a back-up of the day on the network.

APPENDIX 1

ANNUAL WATER ALLOCATION

Currently Triton has the responsibility for monitoring the release of water from Skins Lake Spillway (SLS) to ensure that Rio Tinto Alcan (RTA) meet their obligations under the 1987 Settlement Agreement. Their obligation, as set out in the agreement (available on the NFCP website (www.nfcp.org)) is to release an annual average of 36.8 m³/s plus the water needed for managing water temperatures in July and August. The time period from which the average is calculated is April 1 to March 31.

Reservoir releases are typically managed in the following way:

1. At the start of the water year (April 1), the NFCP maintains the SLS release at the same rate as during the preceding fall/winter period until there are leads in the ice surrounding Murray and Cheslatta lakes. This normally occurs during the last two weeks of April (in 2014 this occurred on April 18 but has been known to happen towards the end of the month).
2. Once the ice leads are open, the NFCP will typically direct RTA to increase the release to 49 m³/s. This release is maintained through the remainder of April, all of May and June and into July until the start of the Summer Temperature Management Plan (STMP) on July 10 or 11. However, for calculation of the Annual Water Allocation (AWA), it is assumed that the “base release” of 49 m³/s is maintained until late August and the end of the STMP (about August 18 to 20). All releases between July 10 and August 20, greater than 49 m³/s are attributed to the STMP.
3. At the end of the STMP, SLS releases are normally lowered to ~14.2 m³/s and maintained at that rate until the 2nd or 3rd of September to bring the discharges in the Nechako River below Cheslatta Falls down to the fall spawning rate of ~30 – 32 m³/s. This latter rate is the one that is calculated by Triton and provided to RTA to ensure that the remaining volume of water in the AWA is released by March 31. The procedure for doing this is discussed below.
4. Through the year, and especially during the fall and winter, Triton needs to check that the discharges in the Nechako River below Cheslatta Falls (see the Water Survey of Canada (WSC) realtime data record for this site) remain at or greater than the requested release at the SLS. If this is not the case for more than a few days following a requested change in discharge, then we should be checking daily in order to identify what is referred to as an anomaly. If we see one, Justus Benckhuysen of RTA should be contacted and the situation monitored every couple of days. If needed, he may ask that we go on site to actually measure the rate of release at SLS and in the river downstream of Cheslatta Falls.

Procedure for calculating the average AWA.

1. Each month RTA prepares a file giving the rate of release from the SLS, river discharge and water temperature data that they gather from both their own and WSC sources. This data is forwarded to Triton as well a series of other personnel within RTA, BCH, and the Provincial Government. Currently this is emailed to Clyde Mitchell and is forwarded to Jen Bond (a request should be made to have this file emailed to the person updating the spreadsheet).

2. When this file is received each month, copy it over (data only function as there are macros and formulas embedded in the file) to a master spreadsheet. This routine operation should take only a few minutes each month but it is important to maintain as it is the basic data you work from.
3. In order to calculate the AWA we will make two calculations:
 - a. The theoretical amount:
 - i. The number of days multiplied by the directed release (the winter average, the spring-summer 49 m³/s, etc., multiplied by the number of days at that level. This will give you the cumulative volume released to date in m³/s-days. The average from the remainder of the year can then be calculated by multiplying 36.8 m³/s by 365 and subtracting it from the cumulative total and then dividing by the remaining number of days in the year. This is really only done once, in the first few days of September.
 - b. The actual amount:
 - i. Using the data provided monthly by RTA, determine the average release for the water year (April 1 – March 31) by calculating the average rate over the year. In doing this you have to make allowance during the STMP when releases are >49 m³/s by substituting 49 m³/s into the data string (I usually add a column to the data file to do this so that the original data string is preserved).
 - ii. In late August, when the release is <49 m³/s, use the lower rate. And during the fall and winter, use the reported rate during this period as the discharge may be slightly greater than or less than the directed rate as they have to “average” the directed rate over this period but want to make sure they are slightly more than the required average over the year.

Additional information may be requested by RTA and the NFCP near the end of the calendar year for the NFCP Steering Committee Briefing Document. The requested information comes from both the AWA and the STMP. The information is as follows:

1. Summary of the current years STMP program and a graph representing the mean daily temperatures in the Nechako River above the Stuart River confluence (Finmore). See template “STMP Summary Report”.
2. Flow control summary which outlines the SLS releases for the water year and an estimate of what mean annual discharge will be for that year. Refer to the NFCP Steering Committee Briefing Report – Flow Control.
3. Flow discrepancy summary which, if applicable, investigates the discrepancy between the flow records for the SLS and the Nechako River below Cheslatta Falls. Refer to the NFCP Steering Committee Briefing Report – Flow Discrepancy Project.

APPENDIX 2

NUMERICAL EXAMPLE OF WATER TEMPERATURE TREND CALCULATION

Numerical Example of Water Temperature Trend Calculation

From data for July 16 date of operation (Table A1).

1. Observed Trend

The observed trend is up by 0.6°C from 17.9°C (J14) to 18.5°C (J15). Take the previous day's recorded temperature 18.9°C (J15) and extrapolate the trend for five days at +0.6°C. The observed trend shows that the water temperature could potentially reach $17.9^{\circ}\text{C} + 5(+0.6^{\circ}\text{C}) = 20.9^{\circ}\text{C}$.

2. Predicted Trend

The predicted trend is the difference between the previous day's calculated water temperature (J15) and the fifth day predicted water temperature (J20). The predicted trend is down from 18.7°C to 18.5°C with the potential to reach 18.5°C.

3. Forecast Trend

The forecast trend for the current day of July 16 is based on the first, second and third day forecasts.

| | | | | |
|---------|--------------|---|------|-------|
| July 16 | 19.2 to 17.6 | = | down | 1.6°C |
| July 17 | 18.8 to 17.8 | = | down | 1.0°C |
| July 18 | 18.9 to 18.0 | = | down | 0.9°C |

Mean of 3 differences = down 1.2°C

This mean of -1.2°C is added to the fifth day predicted water temperature to give 18.5°C
+
(-1.2°C) = 17.3°C.

Table A1
Predicted and Recorded Mean Daily Water Temperatures in the Nechako River above the Stuart River Confluence, 2010

| JULY | | | | | | | | | | | |
|---|------|--------------------------|---------------------------|-------|-------|-------|-------|-------|-------|---------------------------|-------|
| Date | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 5th Day's Predicted Water Temperature at Date + 4 Days | | | | | 17.6 | 18.9 | 20.2 | 19.4 | 20.2 | 19.3 | 18.5 |
| 4th Day's Predicted Water Temperature at Date + 3 Days | | | | 18.3 | 18.0 | 19.6 | 19.0 | 19.6 | 18.9 | 18.4 | |
| 3rd Day's Predicted Water Temperature at Date + 2 Days | | | 19.6 | 18.3 | 18.9 | 18.3 | 19.2 | 18.8 | 18.0 | | |
| 2nd Day's Predicted Water Temperature at Date + 1 Day | | 20.5 | 19.9 | 19.0 | 17.6 | 18.7 | 19.2 | 17.8 | | | |
| Current Day's Predicted Water Temperature at Date | 20.8 | 21.3 | 20.1 | 17.3 | 18.1 | 19.3 | 17.6 | | | | |
| Previous Day's Calculated Water Temperature at Date - 1 Day | 20.9 | 21.5 | 20.0 | 17.2 | 18.2 | 18.7 | | | | | |
| Previous Day's Recorded Water Temperature at Date - 1 Day | 21.1 | 21.6 | 21.6 | 19.7 | 17.9 | 18.5 | | | | | |
| Current Day's Skins Lake Spillway Release at Date (m ³ /s) | 49.0 | 49.0 to 136.0 @ 0800 hrs | 136.0 to 226.5 @ 0800 hrs | 136.0 | 226.5 | 226.5 | 226.5 | 226.5 | 226.5 | 226.5 to 453.0 @ 0800 hrs | 453.0 |

APPENDIX 3

PROJECT CONTACTS

| Role | Name | Phone | E-mail |
|--|------------------------|--------------------------------------|---------------------------------|
| Rio Tinto Alcan | | | |
| Project Manager/Nechako Operations Coordinator | Justus Benckhuysen | 250-567-0351 (c) 250-567-5105 (o) | Justus.benckhuysen@riotinto.com |
| Supervisor Power Operations | Jeff Burkitt | 250-639-6440 (c) 250-639-8410 (o) | Jeff.burkitt@riotinto.com |
| Manager Projects and Watershed | Mike Long | 250-639-4226 (c) 250-639-8769 (o) | Mike.long@riotinto.com |
| Power Operations Coordinator | Javier Garcia | 250-639-4284 (c) 250-639-8656 (o) | Javier.Garcia@riotinto.com |
| Spillway Control | Ken Hanson | 250-694-3532 (o) | |
| | Kitimat Control Centre | 250-639-8458 (o) | |
| Weather Forecast | | | |
| IT/Technical Help | Jonathan Gobeil | 418-699-2111 ext. 3455 | Jonathan.gobeil@riotinto.com |
| Manager | Bruno Larouche | | Bruno.larouche@riotinto.com |
| Rom Comm | | | |
| Systems Developer | Roger Kelly | 250-860-3762 | rkelly@romcomm.com |
| Systems Developer | Michael DeGroot | 250-860-3762 | Mdegroot@romcomm.com |
| Billing/Invoicing | Courtney Davies | 250-860-3762 ext. 200 | courtney@romcomm.com |
| Water Survey of Canada (Environment Canada) | | | |
| Manager | Lynne Campo | 604-664-9324 (o) | Lynne.campo@ec.gc.ca |
| Hydrometric Technologist | Theo Mlynowski | 250-561-5970 (o) 250-552-0005 (c) | Theo.Mlynowski@canada.ca |

APPENDIX 4

ROM COMMUNICATIONS

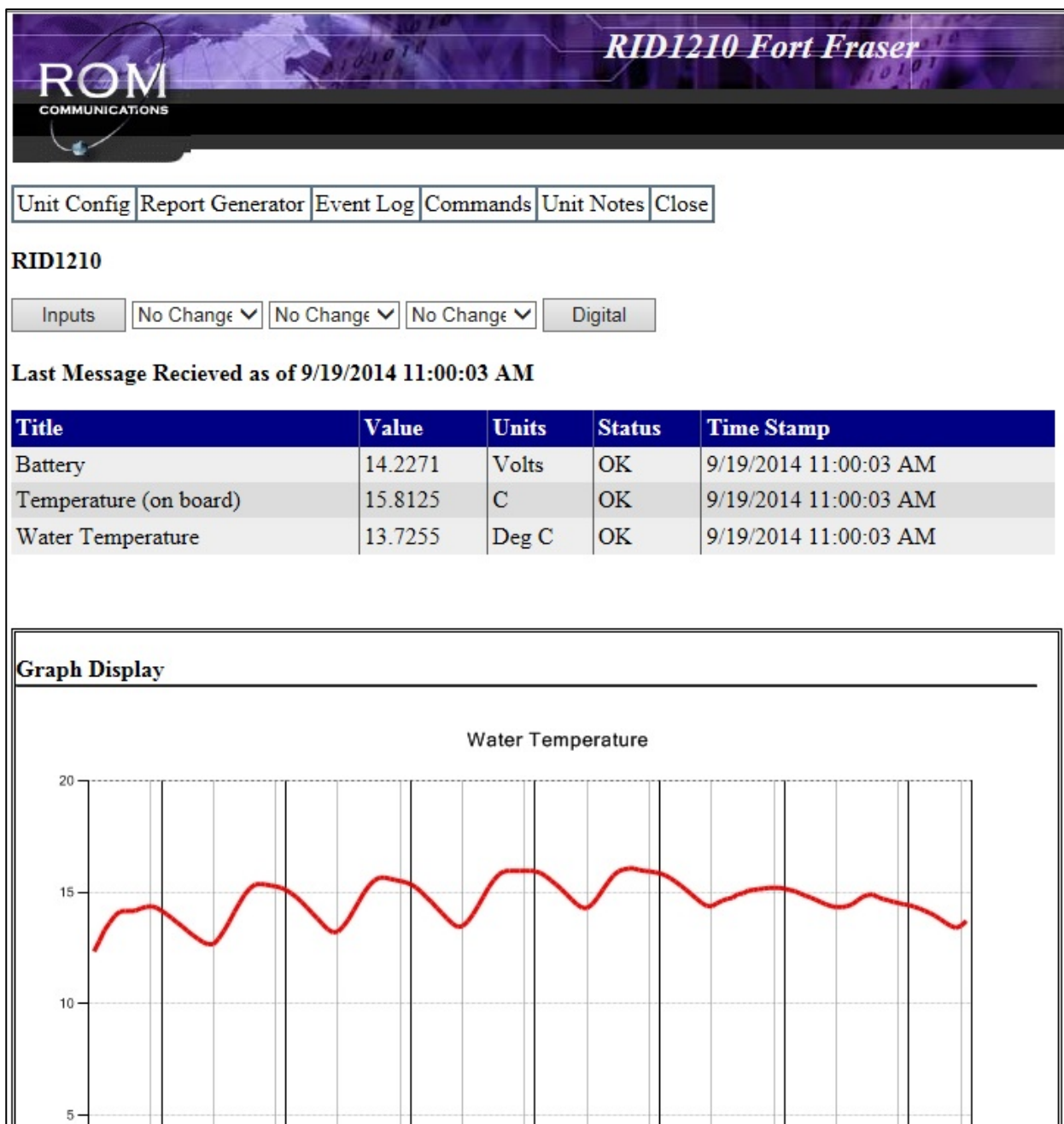
The water temperature data and weather data are accessed via the Rom Communication website (<http://data.romcomm.com/>).

Username: nechako

Password: nechako

To retrieve the data follow the steps below:

1. Click on one of the locations (Fort Fraser Climate, RID1210 Fort Fraser, RID806 Finmore) and that will bring you to the "Unit Page".



2. Next click on "Report Generator" and under the tab "Reports" click on "Generate Report" while holding down the CTRL and Alt keys.

ROM COMMUNICATIONS *Report Generator*

Reports Unit Page

New Report
Delete Report
Generate Report

ld down
or ALT
when
generating a report.
This bypasses the
POPUP blockers in
your browser.

Your Reports

data

Report Type: Text Available Data: Battery Add

Report Time: All Data Remove

Save Report Settings

3. A .csv file will be created with the data required.
Repeat the procedure until you have downloaded all three reports.

APPENDIX 5

EXAMPLES OF FILES USED IN PROGRAM

Example of FU1 File

| | | | | | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 |
| 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 |
| 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 |
| 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 |
| 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 |
| 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 |
| 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 |
| 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 |
| 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 |
| 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 | 500.0 |
| 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 |
| 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 |
| 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 |
| 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 |
| 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 |
| 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 |
| 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 |
| 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 |
| 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 | 6000.0 |
| 9100.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 7972.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 6982.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

The first line, first column (highlighted blue) represents the SLS release at 1:00 am on the previous day. The second line, first column (highlighted green) represents the SLS release at 13:00 the previous day.

Lines 3 and 4 represent the current day and so on, until you have a total of 9 days.

The yellow highlighted values are those that are replaced as outlined in Step 5(iii).

Example of FU5 File

```

3 0 0
1 9
6 1
0 0 0 0 0 0
9 10 500.0 7 0 90 0
2
1 7
1
1
SKINS UPPER CHAN 1
-1 1 1
1
1 2 2
1
765. 1400. 20.00 4.00
SKINS UPPER CHAN 2
-2 2 1
2 3 3
2
1117. 1400. 20.00 4.00
SKINS UPPER CHAN 3
-3 3 1
3 4 4
3
1329. 1400. 20.00 4.00
SKINS UPPER CHAN 4
-4 4 1
4 5 5
4
1489. 1400. 20.00 4.00
SKINS UPPER CHAN 5
-5 5 1
5 6 6
5
1874. 1400. 20.00 4.00
CHESLATA LAKE AND MURRAY LAKE
6 6 1
6 7 7
6
9100. 4000 200.00 150.00
6 6 1 0 7

```

Highlighted values are those that are to be replaced as outlined in Step 6.