

I. COMPUTER SETUP

- A. Ensure computer time code is set to a 24-hour clock.
 1. Open Control Panel
 2. Open Regional Settings
 3. Under Time tab, set value to "H:mm:ss"
- B. Set up directory and database.
 1. Create a directory using the name of the Wx station and number such as *Station Number_Station Name*.
 2. Copy the "WRCC to FW9 A2k.mdb" to that directory. Rename to "*Station Number_Station Name_WRCCtoFW9.mdb*". Check to ensure the database is set up to automatically Compact and Repair - Tools, Options, General tab, ensure checkbox is checked for "Compact on Close".
 3. Copy the "WRCCtoFW9_Tracking.xls" file to that directory. Rename to *Station Number_Station Name_WRCCtoFW9_Tracking.xls*".
 4. Move the *.fwx file downloaded from WIMS into the directory and change the extension to ".txt".
 - a. Download data via KCFast, full year, as early as WRCC data is available.
 - b. Eliminate any non-standard characters from filename such as "!" and "-".
 5. Move the weather station data obtained from the Western Region Climate Center (WRCC) into the directory and ensure the extension is ".txt".
 - a. To obtain WRCC data – go to <http://www.raws.dri.edu/>
 - (1) Select state, station, Data Lister
 - (2) Set dates (10 yrs is probably the maximum range before an error will occur).
 - (3) Enter password obtained from WRCC (OR – "wrcc18", WA – "wrcc21")
 - (4) Data format – Columnar format (.txt – Win/PC)
 - (5) Date format – YYYY-MM-DD hh:mm
 - (6) Submit – save data to WRCC directory
 - b. Using a word processing program (i.e. WordPad), delete the header and footer rows. Search the file for ": " (colon and a space). Header rows are at the beginning of a change in data, such as when an instrument was added. For the most part, data is in the same columns, and these header rows can be deleted. This should be checked prior to deleting.

II. DATABASE SETUP

- A. Open the *Station Number_Station Name_WRCCtoFW9.mdb* MS Access database.
 1. Link WRCC data. File, Get External Data, Link Tables. Drill down path to where file is located. Change "Files of type:" to "Text Files (*.txt;*.csv;*.tab;*.asc)", Select File (click on Link or double-click file). Click on Advanced, click on Specs..., select the "WRCC Import Specification", Open, OK, Next, Next, Next, change Linked Table Name to "WRCC", Finish, Yes to overwrite existing file.
 2. Link WIMS_FWX data. File, Get External Data, Link Tables, Select File. Use the Advanced option, selecting the "FWX IMPORT" specification, name table "WIMS_FWX".
 3. Open each linked table, write the starting record date, ending record date, and total number of records into the "... WRCC to FW9 Tracking.xls" workbook.

III. QUALITY CONTROL HOURLY DATA, FORM 100.

- A. STEP 1: Execute Control (Click on icon). The code will automatically:
 1. Runs query "010 - Empty WIMS_FWX Dates" – Empties records out of table, maintains the Date as Primary Key (not allowing duplicates).
 2. Runs query "020 - WIMS_FWX Dates": Appends WIMS_FWX data with the addition of a Date field to the WIMS_FWX_Dates table. If records with duplicate dates exist in WIMS_FWX table, only the first record will be appended, the record with the duplicate date will not be appended.
 3. Runs query "120 – Empty WRCC_QCEstimate": Empties records out of table.
 4. Runs query "140 - Append WRCC to WRCC_QCEstimate": Writes to source and code fields for each existing field entering the source as "WRCC" and the code as "0".
 5. Runs query "150 - Append Missing Hours to WRCC_QCEstimate": Appends records for missing hours writing all date and time fields, blank (null) values for observation fields; and writes "Missing" in the source fields and "1" in the code fields. This results in WRCC_QCEstimate having a record for each hour from the earliest date to the last date.
 6. When the code has completed, the WRCC_QCEstimate form will open. Write the total number of records indicated on the form into the "... WRCC to FW9 Tracking.xls" workbook.

- B. STEP 2: View “WRCC_QCEstimate Form”. Trim the table to the records logical to work with. Delete earliest (top) and latest (bottom) records where observations were not continuously received or missing a lot of hours for a day. In some of the WRCC data files, data was very inconsistent the first few days of transmission. This isn’t a mandatory step, just cleans up some days that will not likely produce quality observations. If records were deleted, indicate the number of records deleted in the “... WRCC to FW9 Tracking.xls” workbook. Close form.
- C. Execute STEP 3 (Click on icon). The program will automatically conduct a quality control check of the data fields based on:
1. PCumm (Precipitation cumulative, running total inches)
 - a. Impossible Readings: If the hourly value is blank (null) or less than 0 or greater than 100, enters “Missing” in the Source field and “2” in the Code field.
 - b. Unlikely Readings: For all hourly values meeting a following condition, the program enters “CHECK” in the Source field.
 - (1) If the value increased 1” or more in one hour.
 - (2) If the value decreased from the previous hour but did not zero, but is greater than 0.05”.
 2. WSpd (Wind Speed in mph)
 - a. If the hourly value is blank (null), enters “Missing” in the Source field and “2” in the Code field.
 - b. Impossible Readings: For all hourly values meeting a following condition, the program clears (make null) the value, enters “Missing” in the Source field, and enters “2” in the Code field.
 - (1) Hourly value is less than 0 mph or greater than 100 mph.
 - (2) Hourly value was less than 2 mph and remained constant for 18 consecutive hours or more.
 - (3) Hourly value was greater than or equal to 2 mph and remained constant for 12 consecutive hours or more.
 3. WAZmth (Wind Azimuth in degrees)
 - a. If the hourly value is blank (null), enters “Missing” in the Source field and “2” in the Code field.
 - b. Impossible Readings: For all hourly values meeting a following condition, the program clears (make null) the observations, enters “Missing” in the Source field, and enters “2” in the Code field.
 - (1) Hourly value is less than 0 degrees or greater than 360 degrees.
 - (2) Hourly value remained constant for 8 consecutive hours or more.

4. TObS (Temperature in degrees Fahrenheit)
 - a. If the hourly value is blank (null), enters "Missing" in the Source field and "2" in the Code field.
 - b. Impossible Readings: For all hourly values meeting a following condition, the program clears (make null) the values, enters "Missing" in the Source field, and enters "2" in the Code field.
 - (1) Hourly value is less than -60 degrees or greater than 125 degrees.
 - (2) Hourly value remained constant for 24 consecutive hours or more.
 - c. Unlikely Readings: For all hourly observations meeting a following condition, the program enters "CHECK" in the Source field.
 - (1) If the value changed more than 25 degrees from the previous observation.
5. RHObS (Relative Humidity in percent)
 - a. If the hourly value is blank (null), enters "Missing" in the Source field and "2" in the Code field.
 - b. Impossible Readings: For all hourly values meeting a following condition, the program clears (make null) the values, enters "Missing" in the Source field, and enters "2" in the Code field.
 - (1) Hourly value is less than 0 percent or greater than 100 percent.
 - (2) Hourly value remained constant for 36 consecutive hours or more.
 - c. Unlikely Readings: For all hourly values meeting a following condition, the program enters "CHECK" in the Source field.
 - (1) If the value changed more than 50 percent (value of 50, not 50% of the value) from the previous hours value.
 - (2) If the RHObS is less than 1.
6. SolarRad (Solar Radiation in watts/m²)
 - a. If the hourly value is blank (null), enters "Missing" in the Source field and "2" in the Code field.
 - b. Impossible Readings: For all hourly values meeting a following condition, the program clears (make null) the values, enters "Missing" in the Source field, and enters "2" in the Code field.
 - (1) Hourly value is less than 0 or greater than 2000 watts/m².
7. When the code has completed, a text box will display a summary, write these values into the "... WRCC to FW9 Tracking.xls" workbook.

8. Close the Access database to allow it to “Compact and Repair”, which it is set up to do automatically when closed. The size of the database bloats significantly as a result of running the code, running the “Compact and Repair” utility will eliminate the bloat and significantly speed up any future operations. Once the database is closed, re-open it and proceed. Sometimes an error occurs and you will see a message box which says something like it can’t find or it can’t open. Enter OK until Access is completely closed. Use windows explorer and drill down to the directory being used, the “... WRCC to FW9 A2k.mdb” may no longer appear in the directory it was stored in, but there may be a “db1.mdb”. Rename “db1.mdb” to the “... WRCC to FW9 A2k.mdb”, open it, and continue. It seems like this error occurred less if Access was set up to “Compact and Repair” on closing, as opposed to choosing Tools, Database Utilities, Compact and Repair Database, while Access was open.

D. STEP 4.

1. OPTIONAL - Review query “170 - Append WRCC_QCEstimate Possible Errors” criteria in design view. Edit the criteria (tighter than program code) if appropriate for the station location. This will allow records not indicated as “CHECK” by program code to show up in the “WRCC_QCEstimate Possible Errors Form” providing the opportunity to check the values and to document any changes.
2. Open the Form “WRCC_QCEstimate Possible Errors”. This form contains the fields indicated as “CHECK” in the quality control process, as well as some fields based on criteria in Query 170. {OPTIONAL - If criteria were changed in Query 170, criteria will need to be changed in the heading, conditional formatting, and Count Totals of the form in design view in order for them to be highlighted properly and documented properly}.
3. Open the Form “WRCC_QCEstimate”. Arrange windows so both forms are visible at the same time.
 - a. With the WRCC_QCEstimate form selected, select Find, enter Find What: “CHECK”, Look In: “WRCC_QCEstimate”, Match: “Whole”. Select Find Next and evaluate found fields for possible errors, error could be above or below found field, so it is important to look at values above and below.
 - (1) If field is an error, clear field value. If it is appropriate to estimate a value for the field, the program will do it at the appropriate time, there is no need to enter any values. Record the deletion by going to the “WRCC_QCEstimate Possible Errors” Form, Correction field, and choosing the appropriate entry in the value list (select arrow at right of field), and choosing the appropriate entry. An “X” indicates the valued was cleared. The entries can be edited to better fit what action was taken.
 - (2) If the found field is OK but Source indicates “CHECK”, change Source back to “WRCC” by using the value list with the arrow at the right of the field. Go to the “WRCC_QCEstimate Possible Errors” Form, Correction field, and choose the “OK” in the value list (select arrow at right of field).

- (3) If there is a large section of fields that need to be cleared, such as a sensor error, identify the beginning and ending dates, the update query "Update WRCCQCEstimate Erroneous Obs" can be used to update the values for the selected range with "null". Edit the criteria in Design View to meet the situation. Go to the "WRCC_QCEstimate Possible Errors" Form, Correction field, and choose the "All Down" at the beginning (closest available) date, and the "All Up" at the ending (closest available) date, from the value list (select arrow at right of field).
- b. For values indicated in orange on the report (found by Query 170 and do not have "CHECK" in Source field), use Find, enter Find What: [Date of record], Look In: "Date/Time", Match: "Start of Field". Make appropriate changes and record changes in the "WRCC_QCEstimate Possible Errors" Form.
4. Close the "WRCC_QCEstimate" and "WRCC_QCEstimate Possible Errors" forms.
- E. STEP 5. Execute Control (Click on icon). The program will automatically:
 1. Change Source to "Missing" and Code to "3" for any blank (null) observations that do not have "Missing" in the Source field, this will be the cells cleared in STEP 4.
 2. When the code has completed, a text box will display a summary, write these values into the "... WRCC to FW9 Tracking.xls" workbook.

IV. BUILD HOURLY DATA AND SUMMARIES, FORM 200.

- A. STEP 6. Enter the Station Number and Station Name. These values are written into the final weather data file so follow appropriate naming and numbering conventions.
- B. STEP 7. The program will estimate missing values based on the following criteria, and update the source and code fields as described:
 1. PCumm (Precipitation cumulative, running total inches)
 - a. Fills the consecutive missing hourly observations with the last observation prior to the missing record(s) under the following conditions:
 - (1) If the observation after the missing record(s) is less than the observation prior to the missing record(s) and there are not more than 12 consecutive missing records.
 - (2) If the observation after the missing record(s) is equal to the observation prior to the missing record(s) and there are not more than 96 consecutive missing records.
 - (3) If the observation after the missing record(s) is greater than the observation prior to the missing record(s) by not more than 0.06", and there are not more than 12 consecutive missing records.

- (4) Writes the number of consecutive hours filled into the Source field such as "Fill x Hrs", adds 3 to the value in the code field.
 - b. Fills the missing values by linear interpolation between the last value prior to the missing record(s) and the first value after the missing record(s) under the following conditions:
 - (1) If the observation after the missing record(s) is greater than the observation prior to the missing record(s) by not more than 0.3" and there are not more than 12 consecutive missing records.
 - (2) Writes the number of consecutive hours filled into the Source field such as "LI x Hrs", and adds 3 to the value in the code field.
 - c. Counts the groups of missing records that do not meet any of the criteria above.
2. WSpd (Wind Speed in mph)
 - a. Fills the missing values by linear interpolation between the last value prior to the missing record(s) and the first value after the missing record(s) under the following conditions:
 - (1) If there are not more than 3 consecutive missing records.
 - (2) If the observations before and after the missing record(s) is not more than 3 mph and there are not more than 12 consecutive missing records.
 - (3) Writes the number of consecutive hours filled into the Source field such as "LI x Hrs", and adds 3 to the value in the code field.
 - b. Counts the groups of missing records that do not meet any of the criteria above.
3. WAZmth (Wind Azimuth in degrees): No estimations.
4. TObS (Temperature in degrees Fahrenheit)
 - a. Fills the consecutive missing hourly observations with the last observation prior to the missing record(s) under the following conditions:
 - (1) If the observations before and after the missing record are equal and there is only 1 missing record.
 - (2) Writes the number of consecutive hours filled into the Source field such as "Fill x Hrs", adds 3 to the value in the code field.
 - b. Fills the missing values by linear interpolation between the last value prior to the missing record(s) and the first value after the missing record(s) under the following conditions:
 - (1) If the two observations before the missing record(s), the two observations after the missing record(s), and the one observation before and one observation after all have the same trend, all increasing, or all decreasing; and there are not more than 8 consecutive missing records.

- (2) Writes the number of consecutive hours filled into the Source field such as "LI x Hrs", and adds 3 to the value in the code field.
 - c. Counts the groups of missing records that do not meet any of the criteria above.
5. RHObs (Relative Humidity in percent)
 - a. Fills the consecutive missing hourly observations with the last observation prior to the missing record(s) under the following conditions:
 - (1) If the observations before and after the missing record are equal and there is only 1 missing record.
 - (2) Writes the number of consecutive hours filled into the Source field such as "Fill x Hrs", adds 3 to the value in the code field.
 - b. Fills the missing values by linear interpolation between the last value prior to the missing record(s) and the first value after the missing record(s) under the following conditions:
 - (1) If the two observations before the missing record(s), the two observations after the missing record(s), and the one observation before and one observation after all have the same trend, all increasing, or all decreasing; and there are not more than 8 consecutive missing records.
 - (2) Writes the number of consecutive hours filled into the Source field such as "LI x Hrs", and adds 3 to the value in the code field.
 - c. Counts the groups of missing records that do not meet any of the criteria above.
6. SolarRad (Solar Radiation in watts/m²): No estimations.
7. Summary of Code variable:
 - 0 WRCC – Value originated from WRCC data and was not found to be Impossible or Erroneous.
 - 1 Missing – Not included in the WRCC original dataset.
 - 2 Impossible – An original WRCC value that is found to be impossible.
 - 3 Erroneous – An original WRCC value found to be erroneous by hand.
 - 4 Missing Estimated – a Missing (1) value that was estimated.
 - 5 Impossible Estimated – an Impossible (2) value that was estimated.
 - 6 Erroneous Estimated – an Erroneous (3) value that was estimated.
- C. STEP 8. This program will create daily data for each hour (calculate 25 hr TMax, TMin, RHMax, RHMin, and PDur, PAmt) tabulating the number of missing hourly values in each calculation, build appropriate data fields for W98 format, and bring forward Missing/Error/Estimate for each value type. Execute Step 8 by clicking icon. Program will:
 1. Calculate TMax, TMin, RHMax, and RHMin for previous 24 hours and current hour, total of 25 hours, for each hourly record.

- a. Counts and records the number of hours missing Temp or RH within the 25 hour period.
 - b. If there are more than 6 hours of missing data in the 25-hour period, Min and Max will not be calculated, field will remain blank (null).
2. Calculate PDur (number of hours precipitation occurred) and PAmt (amount of precipitation in thousandths that occurred during the period) from PCumm.
- a. Counts and records the number of hours missing PCumm within the 24 hour period.
 - b. If there are more than 12 missing hours of PCumm data in the 24-hour period, PDur and PAmt will not be calculated, fields will remain blank (null).
3. Select an Observation for each day by changing Type to "O".
- a. Finds the next record where the time is between 1231 and 1330 hours (this is considered 1300).
 - b. Changes the Type to "O" If the record includes Temp, RH, TMax (will have TMin if has TMax), RHMax (will have RHMin if has RHMax), PDur, and PAmt.
 - c. If any of the indicated values (Temp, RH, TMax, RHMax, PDur, and PAmt) are missing, evaluates the records in the following order for the first record which contains all of the indicated values: 1400, then 1500, then 1200, then 1100. The first record found containing the indicated values will have the Type changed to "O", then the program will proceed to the next day.
 - d. If none of the five hours evaluated contains all of the indicated values, but the 1300 hour record does have Temp, RH (missing TMax, TMin, and/or RHMax, RHMin), the program will evaluate if the missing Max and Min can be estimated based on the following criteria:
 - (1) TMax, TMin estimation: Difference between Temp and TMax is calculated for the observation (not record, observation has type = "O") one before and for the observation one after, the two differences are averaged, then the average difference is applied to the current Temp as an estimate of TMax. If there is a series of continuous days requiring estimation, it will only estimate the last one. The same process is applied for TMin. The value "48" is entered into the Missing TObs field for this record.
 - (2) RHMax, RHMin estimation: Difference between RH and RHMax is calculated for the observation (not record, observation has type = "O") one before and for the observation one after, the two differences are averaged, then the average difference is applied to the current RH as an estimate of RHMax. If there is a series of continuous days requiring estimation, it will only estimate the last one. The same process is applied for RHMin. RHMax and RHMin estimations are limited to not exceed 100 or be less than 0. The value "48" is entered into the Missing RHObs field for this record.

- e. If the 1300 hour record does have Temp, RH; Type will be changed to "O", regardless of whether or not the TMax/TMin or RHMax/RHMin was estimated or is missing, or if PDur or PAmt is missing.
4. Runs query "215 - Update WxObsData_W98 SOW with WIMS_FWX". Writes SOW from WIMS_FWX for each day SOW exists in WIMS_FWX and an observation (Type = "O") exists in WxObsData_W98 that does NOT have a SOW.
5. Estimates a SOW for observations (Type = "O") where there was not a SOW in any of the tables evaluated in the previous queries. Estimates the SOW based on:
 - a. If Precipitation occurred during the Observation hour or three previous hours, SOW is recorded as "6", CodeSOW is recorded as "4".
 - b. If Precipitation occurred during the previous 24 hours but did NOT occur during the Observation hour or three previous hours, SOW is recorded as "2", CodeSOW is recorded as "4".
 - c. If NO Precipitation occurred during the previous 24 hours, SOW is recorded as "0", CodeSOW is recorded as "4".
6. When the code has completed, a text box will display a summary, write these values into the "... WRCC to FW9 Tracking.xls" workbook.
7. Click to Print all Reports icon will send all reports to the printer, just an option.

V. REPORT DESCRIPTIONS

A.

VI. EXPORT QUALITY CONTROL DATASET.

- A. Open query "900 - Export WxObsData_W98". Record beginning and ending dates, and total number of records in the "... WRCCtoFW9.xls" workbook. Close query but have it highlighted, select File, Export, File Type = *.txt, Advanced, Specs = "WxObsData_W98 Export Specification", File Name = QChr_StationID_StationName_begindatetoenddate. Copy exported file to location where FireFamily WxData files are stored, change extension to "fw9".
- B. Open query "910 - Export WxObsData_W98_Obs". Record beginning and ending dates, and total number of records in the "... WRCC to FW9.xls" workbook. Close query but have it highlighted, select File, Export, File Type = *.txt, Advanced, Specs = "WxObsData_W98 Export Specification", File Name = QCObs_StationID_StationName_begindatetoenddate. Copy exported file to location where FireFamily WxData files are stored, change extension to "fw9".

VII. OPTIONAL FOR SETTING DATABASE TO EVALUATE ANOTHER STATION

- A. Form: "300 – Empty ALL Tables". Intended if the database is going to be transferred to process another stations data. Recommend copying the database to a different directory, then open the database and execute the program.