

Canadian Water Quality Index

Help Manual

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1 Introduction

1.1 Welcome to the CWQI

Welcome to the world of water quality!

Water quality indexing is a means for one to start with raw data from the field to produce results which relate to you, in as much detail as you could desire. It will provide you with information on just how good your water is for a broad range of applications.

We have endeavoured to bring you all the information you require in order to get the most out of the CWQI application through this help file. To navigate through the file you can use links contained within the file itself, the table of contents, the index, the keyword search and/or the browser navigation buttons ("Back", "<<" and ">>") of the help file.

For more information regarding the Water Quality Index, see the CCME Homepage or contact Kyla Brake at kbrake@gov.nl.ca

1.2 Using the CWQI

The CWQI program is an interactive calculator which has been designed in Visual Basic for Applications around the platform of Microsoft Excel by the Water Resources Management Division of the Department of Environment and Conservation, Government of Newfoundland and Labrador.

In order to properly use the CWQI you will need Excel 2000 SR-1 or later. Excel users should note that the security setting should be set to no stricter than Medium. To change your security setting simply open Excel and select "Tools>Options" from the menu. In the options window select the Security tab and alter the setting as desired.

With a medium security setting you will be prompted by Excel asking if you wish to Enable Macros each time you open a worksheet which contains source code. To use this model you will need to enable macros.

2 CWQI Excel Components

2.1 Section Overview

Within this chapter you will find specialized information regarding all of the available pages you will see and interact with during your use of the CWQI Calculator.

Simply select the page you wish to know more about and read on!

Jump to page:

Start Page

Criteria Page

Data Page

Report Page

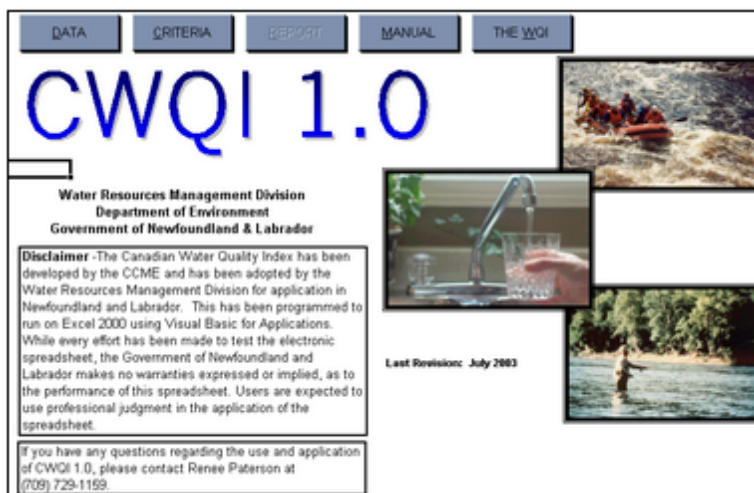
The Manual

The WQI

2.2 Page Descriptions

2.2.1 Start Page

When you first open the CWQI this is what you will see:



This page provides you with a method to manoeuvre to all of the main pages of the application via the buttons located at the top of the page as you can see below. These buttons are present on most of the pages of the CWQI.



As you can see above the Report page is not accessible when the program is initially opened. This is because we have yet to run the calculator to generate results and access to the Report page is not available until there are results to report. Once you have computed CWQI values for data you will be allowed to access the Report page from here as well as the other pages of the application.

2.2.2 Criteria Page

The Criteria page is where you define the guidelines which will be used to evaluate the water quality for the data you supply on the Data page.

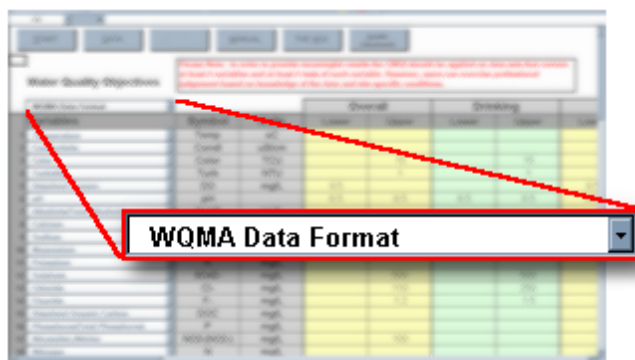
Water Quality Objectives

Please Note: In order to provide meaningful results the CWQI should be applied on datasets that contain at least 4 variables and at least 4 rows of each variable. However, users can exercise professional judgement based on knowledge of the data and site specific conditions.

Variables	Symbol	Units	Overall		Drinking		Low
			Lower	Upper	Lower	Upper	
1 Temperature	Temp	oC					
2 Conductivity	Condi	uS/cm					
3 Color	Color	TCU		15		15	
4 Turbidity	Turb	NTU		1		1	
5 Dissolved Oxygen	DO	mg/L	8.5		8.5		9
6 pH	pH		6.5	8.5	6.5	8.5	5
7 Alkalinity (Total Alkalinity)	ALKT	mg/L					
8 Calcium	Ca	mg/L		1000			
9 Sulfate	Na	mg/L		200		200	
10 Magnesium	Mg	mg/L		0.2			
11 Potassium	K	mg/L					
12 Sulfate	SO42-	mg/L		500		500	
13 Chloride	Cl-	mg/L		110		250	
14 Fluoride	F-	mg/L		1.2		1.5	
15 Dissolved Organic Carbon	DOC	mg/L					
16 Phosphate (Total Phosphate)	P	mg/L					
17 Nitrate (NO3-)	NO3-(NO2-)	mg/L		100			
18 Nitrite	N	mg/L					

Data Formats

You may have the option of choosing from a number of data type formats for your data. Simply select the appropriate type from the drop down list illustrated below.

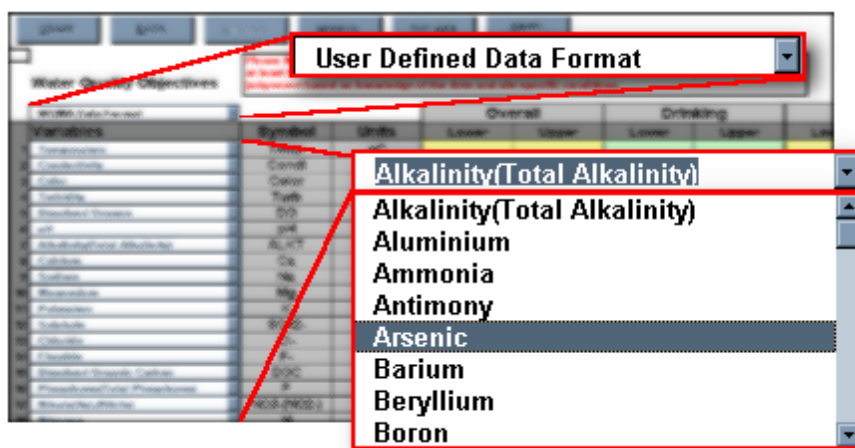


If your data is not stored in any of the available formats you can either:

1. Modify the order of your data so that it follows the order of an available predefined format, or
2. Modify the criteria table so that it follows the order of your data.

Variables

The order of the variables as listed on this page must match the order of your data if you wish to generate an accurate analysis of water quality (see Entering Data). Each of the available format types mentioned above will have its own particular variable list order. If you wish, you may also be able to select a user defined data format which will allow you to modify your variable list as you see fit. With this option you can select each variable individually using the pull down selection boxes given.



Most of the available lines for variables have one of these boxes which allow you to select from over 50 commonly used variables. Simply scroll and/or select the item you desire for that particular variable to lock it in place.

Once you have the desired variable order set for your data you may want to alter the individual acceptable limits or criteria values. Each variable has an available upper and

For each index of the criteria you can set your desired range for each rank and/or alter the number of available ranks for the CWQI to fall into by altering the table as desired. The value listed for each rank defines the minimum score required (lower bound) for a result to fall into that category. Note that Poor is fixed as the worst possible ranking.

2.2.3 Data Page

The Data page is where you initiate all CWQI calculations. Along the top of the page you can see that there are more navigation buttons to let us manoeuvre to other pages. Here is an example of what you will see when you view the Data page:

	Date	Group	Temp (°C)	Condl (µS/cm)	Color (TCU)	Turb (JTU)
1	12/23/00	1	44.1	24	0.47	
2	12/24/00	1	37.6	28	0.65	
3	12/25/00	1	47.2	29	0.39	
4	12/26/00	1	32	21	0.75	
5	12/27/00	1	31	34	0.67	
6	12/28/00	1	42.6	23	0.48	
7	12/29/00	1	40.2	25	0.36	
8	12/30/00	1	43.8	24	0.61	
9	12/31/00	1	28	5	0.87	
10	1/1/01	1	42.9	21	0.26	
11	1/2/01	1	43.4	16	0.36	
12	1/3/01	1	41.6	25	0.72	
13	1/4/01	1	39.9	24	0.39	

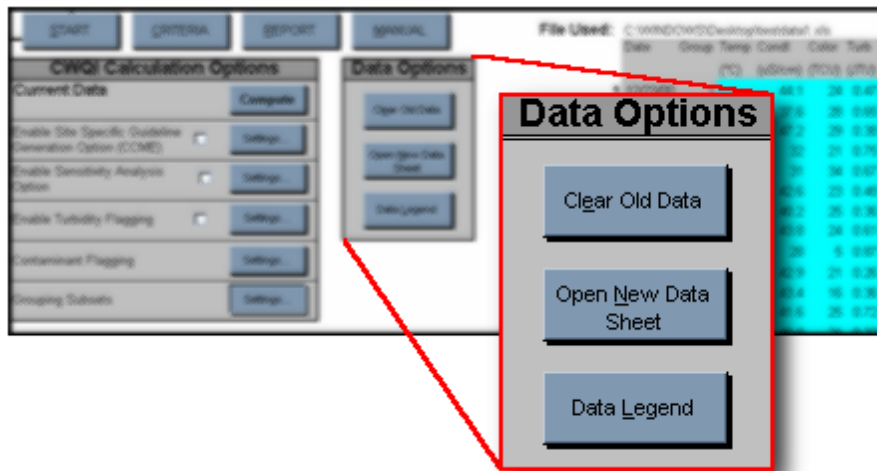
Data

On the right side of the screen you will see that there is some sample test data already entered into the calculator; here it is enlarged:

	Date	Group	Temp (°C)	Condl (µS/cm)	Color (TCU)	Turb (JTU)
1	12/23/00	1	44.1	24	0.47	
2	12/24/00	1	37.6	28	0.65	
3	12/25/00	1	47.2	29	0.39	
4	12/26/00	1	32	21	0.75	
5	12/27/00	1	31	34	0.67	
6	12/28/00	1	42.6	23	0.48	
7	12/29/00	1	40.2	25	0.36	
8	12/30/00	1	43.8	24	0.61	

This is the general format of input data as it should exist in the calculator. The top two rows should be reserved for labels which describe the data. The first column of your data should contain the dates of each sample while the second column is unspecified. This column can be anything you want and it can be used in grouping (see Grouping Subsets) to help split your data into distinct groups such as season or site. These sections of the data which have a generally defined format are shaded grey whereas the data portion of the file is shaded in blue. This shading is done automatically when you enter a data file using the available command button and is done on the first calculation of the CWQI when data is entered manually (see below).

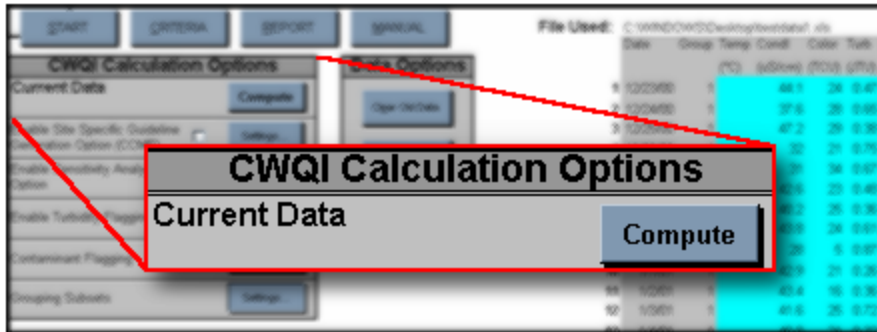
There are several ways to enter data into the data sheet. You can load in an existing Excel data sheet using the Open New Data Sheet button or you can type it in manually using the data option buttons available.



For more information on data entry see Entering Data.

Computing Data

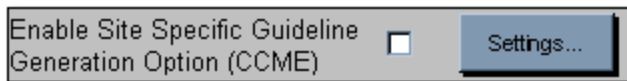
Once you have your data entered (see Data and Entering Data), correct guidelines set (see Criteria Page) and the options you wish to use selected (see below) you are ready to compute the CWQI. Simply press the Compute button at the top of the CWQI Calculation Options section to compute your data and generate your results.



Site Specific Guidelines

Not all critical values for criteria are simple values. Some levels will be dependant upon the amount of other variables present. For instance, varying the hardness of the water can also affect the acceptable amount of aluminum. For this reason several variables can have dynamic guideline values which will vary depending upon measurements found within the test data file. Using this option allows the calculator to adjust the acceptable level of any selected variables accordingly.

To enable this option simply ensure that the check box shown contains a check mark. Below is what you will see when the option is NOT enabled.



Clicking on the settings button for this option will display the following window.

Site Specific Aquatic Guideline Generation

Column Reference Values (Beginning with 1)

Aluminum	20	Lead	34
Cadmium	24	Magnesium	10
Calcium	8	Nickel	33
Copper	27	pH	6
DOC	15		
"Protection of Aquatic Life" Index Reference Value	3		
"Overall" Index Reference Value	1		

(Set both of the above entries to the same value if you do not have an overall index)

Apply AGG to the following parameters (foundation parameter list paraenthsized)

- Aluminum (pH, DOC)
- Cadmium (Hardness - Ca, Mg)
- Copper (Hardness - Ca, Mg)
- Lead (Hardness - Ca, Mg)
- Nickel (Hardness - Ca, Mg)

Select All

Current Data Format

WQMA DW

Other

OK

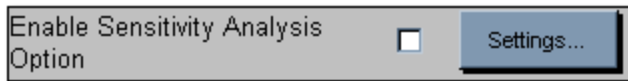
In the top right section of this window you can select on which combination of variables you wish to use site specific guideline generation. The bottom right section of the window allows you to specify the format of your data. If your data is in WQMA or DW format then the Column reference values (left side of window) will be defined for you. If however your data is not in either of these format and you wish to use this option then you must specify for the application where your data is located for each variable in the list. In the example picture above you can see that the value for pH is given as 6; this is because pH is the sixth variable in the format of our data (WQMA). You must also specify your index values for Aquatic and Overall. In the above picture we can see that Overall was the first index to be tested while the third index for testing was Aquatic (this order is defined on the Criteria Page). If you wish to use this option and you do not have an Overall index simply set its reference value to the same value as Aquatic.

For more information about guidelines and their derivation please refer to the CCME Homepage.

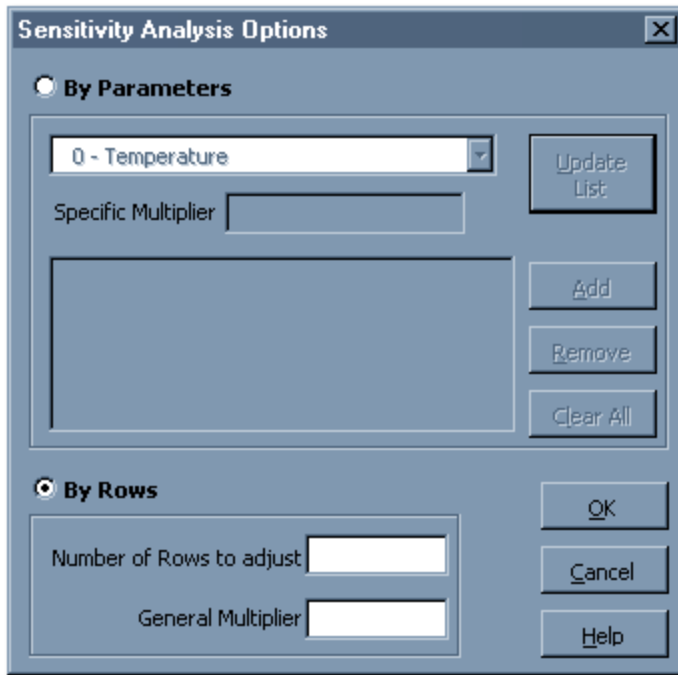
Sensitivity Analysis

Using the sensitivity option allows you to examine how your data would score if it was altered, without having to manually alter your original data.

To enable this option simply ensure that the check box shown contains a check mark. Below is what you will see when the option is NOT enabled.



Clicking on the settings button for this option will display the following window.



As you can see there are two options available for sensitivity adjustments; by variable or by row. Above in our example "By Row" is the currently selected option as its "radio button" is selected, click on the "By Parameter" option to enable the feature.

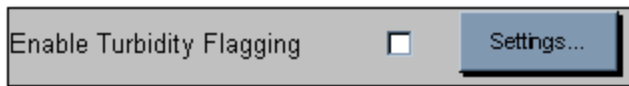
By parameter adjustment allows you to specify a separate multiplier for each variable. Simply select the variable you wish to adjust from the pull down menu, enter the desired multiplier and click the "Add" button. Your selections will be visible when added which then will allow you to remove any unwanted entries by using the "Remove" and "Clear All" buttons.

By row adjustment lets you specify one multiplier which will be used for every variable for the number of rows you specify. For example, enter a value of 10 to have the multiplier applied to the first 10 rows of data. If the number of rows entered is larger than the number of rows in your data file the application will simply apply the multiplier to all rows of data.

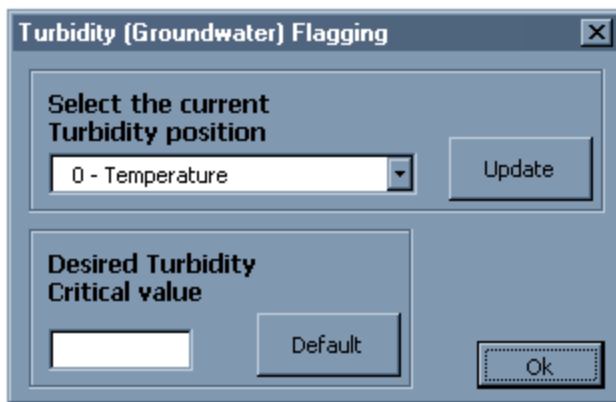
Turbidity Flagging

This option allows you to have a secondary check for the turbidity levels of your data. It can be helpful to alert you to a potential problem with your water supply which should be investigated or monitored.

To enable this option simply ensure that the check box shown contains a check mark. Below is what you will see when the option is NOT enabled.



Clicking on the settings button for this option will display the following window.

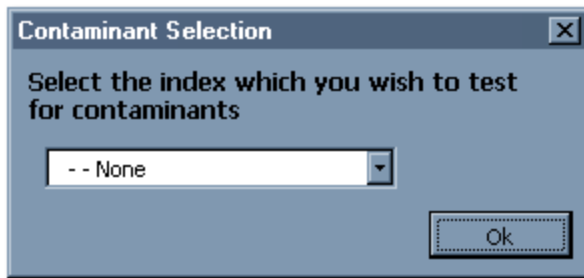


To use this option you must select turbidity from the pull down control in order to point the application to your turbidity values, then give the desired critical value which you do not wish levels to exceed without producing a warning. To ensure that the pull down control contains the most up to date version of your current data format you can click on the "Update" button.

Contaminant Flagging

Contaminants are substances that are known or suspected to cause adverse effects on the health of some people when present in concentrations greater than the established Maximum Acceptable Concentrations (MACs) or the Interim Maximum Acceptable Concentrations (IMACs) of the Guidelines for Canadian Drinking Water Quality, Sixth Edition (GCDWQ).

Clicking on the settings button for this option will display the following window.

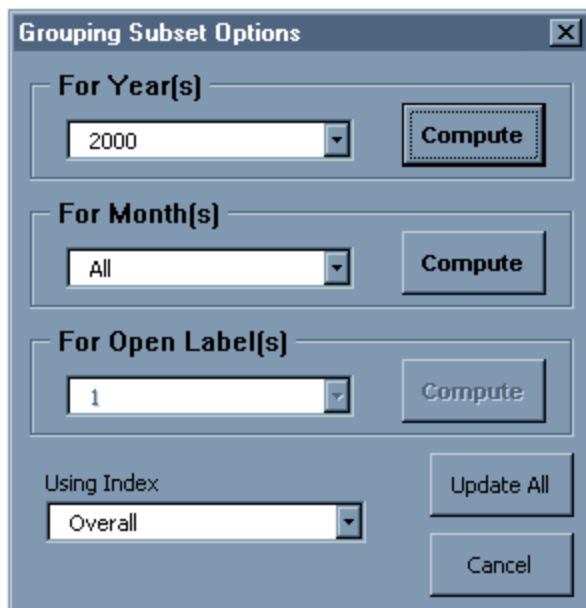


To have the application check the last sample of your data for contaminants select one or all of the indices from the pull down control shown above. A contaminant check will only be performed using data which is tested for each index, i.e. if you have high levels of a contaminant but select the contaminant test on an index which does not use that variable in its CWQI calculations then you will not receive a warning.

Grouping Subsets

Grouping is a way for you to break your data up into smaller pieces in order to analyze small sections or to compare different groups of data within the same data file.

Clicking on the settings button for this option will display the following window.



Clicking on the "Update All" button will read in all of the current information about your data and criteria settings.

To compute CWQI values for a subset or multiple subsets of your data simply select the desired group from the options shown and click on the corresponding "Compute" button. If you wish to test on multiple subsets, as is shown in the months section above, select the "All" item and click on compute. You can also select a single subset of your data as can be seen above in the year section. If there is only one group present for a category of data, as can be seen in the above example for open labels, the options will be disabled as computing for this group would be the same as simply computing from the main data page so the option to group or subset your data is not valid.

If you are computing for multiple subsets ("All" selected) you will also want to specify which index you wish to use for testing. Performing calculations for multiple subsets of data is more complex therefore it will limit the generation of report options (see Grouping Reports). When you click on compute for this operation, you will be prompted to confirm your choices prior to any CWQI calculations.

2.2.4 Report Page

The Report page is where you will be automatically directed whenever you compute the CWQI. Below is a sample of what you will see.

Canadian Water Quality Index 1.0						
Data Summary	Overall	Drinking	Aquatic	Recreation	Irrigation	Livestock
CWQI	66	85	56	100	95	88
Categorization	Fair	Good	Marginal	Excellent	Excellent	Good
F1 (Scope)	50	20	60	0	9	17
F2 (Frequency)	26	15	37	0	1	11
F3 (Amplitude)	19	4	29	0	0	6
Minimal Dataset Requirement of 4 Variables	Met	Met	Met	Not Met	Met	Met
Contaminant Analysis of Last Sample	Not Tested	Passed	Not Tested	Not Tested	Not Tested	Not Tested
<small>Details of any contaminant failures listed at the bottom of this sheet when applicable</small>						
Turbidity Flagging Option	Not Used					
Site Specific Guideline Generation Option (CCME)	Used	Details available in Calculations Summary when applied.				
Sensitivity Analysis Option	Not Used	Details available in Calculations Summary and Sensitivity Data when applied.				
<small>File Used: C:\owq\source\test\data1.xls</small>						
In-depth Report Options	Calculations Summary	WQI Chart	Printed Test Data			
	Data Output					
<p>Please Note: In order to provide meaningful results the CWQI should be applied on data sets that contain at least 4 variables and at least 4 tests of each variable. However, users can exercise professional judgement based on knowledge of the data and site specific conditions.</p>						

As you can see, there is a lot of information available here which summarizes the results of your calculations. However, we have designed the report with the goal of allowing the user to easily extract as much or as little detail as they desire. Below is a summary of all of the information you will see.

CWQI Values

The first line in the report table simply gives the CWQI value (both the numeric value and its corresponding rank) of each index tested, as sampled below.

Data Summary	Overall	Drinking
CWQI	66	85
Categorization	Fair	Good

In this example you can see that our data scored a CWQI value of 66 or Fair for the Overall index and 85 or Good in Drinking.

For more information regarding CWQI values, their ranking and interpretation, please refer to The WQI page of the CWQI application or to the CCME Homepage.

CWQI Factor Scores

The value which is assigned to represent the CWQI is composed of three separate components or "Factors". Below is the result of our sample test for the index Overall.

Factor	Score
F1 (Scope)	50
F2 (Frequency)	26
F3 (Amplitude)	19

Although these values can relate much about strengths and weaknesses of the data tested, the derivation of the individual factors of the CWQI is beyond the scope of this help file. For more information regarding CWQI, its derivation and composition please refer to The WQI page of the CWQI application or to the CCME Homepage.

Minimal Datasets

In order for our results to be meaningful, there is a condition enforced upon the calculations which demands that we test at least 4 separate variables for each result. Our next line of results simply relates whether or not this condition was met.

Data Summary	Overall	Drinking	Aquatic	Recreation	Irrigation
CWQI	66	85	56	100	
Categorization	Fair	Good	Marginal	Excellent	
F1 (Scope)	50	20	60	0	
F2 (Frequency)	26	15	37	0	
F3 (Amplitude)	19	4	29	0	
Minimal Dataset Requirement of 4 Variables	Met	Met	Met	Not Met	
Contaminant An...	Passed	Not Tested	Not Tested	Not Tested	

As you can see, our test for the Recreation index failed to test at least four separate variables, therefore we should realize that even though our results show this sample as

scoring perfectly for Recreation, our testing was limited thus our result could have a high margin of error.

Contaminant Analysis

Another option for testing is to check water samples for contaminants. See the Contaminant Flagging section of the Data Page for more information on how to invoke contaminant tests.

Data Summary	Overall	Drinking	Aquatic
CWQI	100	100	100
Contaminant Analysis	Pass	Good	Warning
P1 (Lead)	Not	Not	Not
P2 (Copper)	Not	Not	Not
P3 (Zinc)	Not	Not	Not
P4 (Nitrate)	Not	Not	Not
P5 (Nitrite)	Not	Not	Not
P6 (Ammonia)	Not	Not	Not
Contaminant Analysis of Last Sample	Not Tested	Passed	Not Tested

As can be seen, we ran our sample test with the option of testing only the Drinking index for contaminants and none were found.

Computation Options Summary

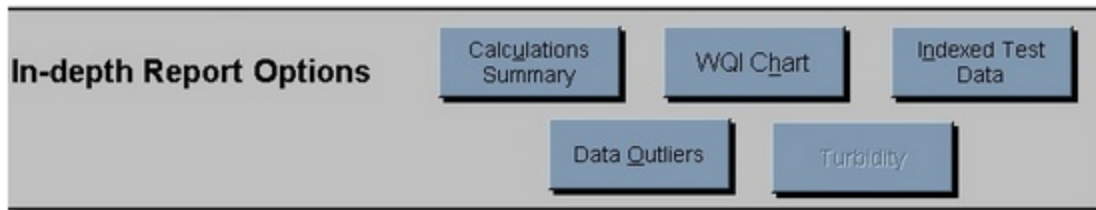
As can be reviewed in the Data Page section, there are several other options available for CWQI calculations. The state of these options is reported in a separate table shown below.

Turbidity Flagging Option	Not Used
Site Specific Guideline Generation Option (CCME)	Used
Sensitivity Analysis Option	Not Used

This review is provided so that, at a glance, you can see what options were used to generate your results and also so that printing this page will capture not only the results but also the state of the calculator which produced these results.

Summary Details Buttons

At the bottom of the Report page you will notice that there are several buttons available as seen below.



These buttons provide navigation to more detailed results based on your calculations. As you can see, not all navigation options are available to us as access to these pages is dynamic in nature. You can see that we do not have access to the Turbidity In-depth Report (its corresponding button is greyed out), this is because we did not invoke the turbidity option for our sample run, as you can see in the computation options summary.

For descriptions of these extra reports, please refer to the *In-Depth Reports* section.



2.2.5 The Manual

This page of the CWQI application provides you with much of the same information which you will find in this help file. It can provide a quick reference to those who are unsure about a procedure without having to refer to this file. The Manual however does not provide any internal navigation features, a search nor pictorial guides.

2.2.6 The WQI

The WQI page of the application is a subset reference to facts about the CWQI which are available from the CCME Homepage.

3 Advanced Topics

3.1 Entering Data

The correct format of data entry is very important to the proper functioning of the CWQI application. Although much effort has been put into ensuring that the program is as forgiving as possible to the user, incorrectly entered data will cause the CWQI to generate invalid results.

When you run the CWQI application for the first time you will notice that there is a sample piece of data present in the Data page. This sample displays the general format which must exist for any data which is to be used for CWQI calculations. For a snapshot of what this data looks like see the Data section of the Data Page.

One of the options available to you to enable entry of your own data is the "Clear Old Data" button of the data sheet. If you click this button you will see that the application will present you with a template for your own data entry as illustrated below:

File Used:

Label Row	Date	Column	Open Column	Param ₁
Units Row				Units ₁
Data Row ₁				

If you wish to enter your data into the application manually this should be your starting point. In the illustration above all of your entered information should be contained within either the grey or blue highlighted cells. The data itself belongs in the blue section while the grey section is reserved for column and row header values such as variable name, variable unit and sample date. The column labeled above as "Open Column" is unreserved and can be used for any label you wish, see the Data section of the Data Page for more information on this column.

If you wish to enter data from an existing MS Excel data sheet it must also follow this general format in order for the CWQI to be allowed to function properly. If you wish to enter data using this option then your source data sheet should follow the format shown below:

Microsoft Excel - testdata1.xls

	A	B	C	D	E	F	G	H
1	Date	Group	Temp (°C)	Condl (uS/cm)	Color (TCU)	Turb (JTU)	DO	PH
2								
3	12/23/00	1		44.1	24	0.47		6.38
4	12/24/00	1		37.6	28	0.65		6.36
5	12/25/00	1		47.2	29	0.38		6.27
6	12/26/00	1		32	21	0.75		6.45
7	12/27/00	1		31	34	0.67		6.12
8	12/28/00	1		42.6	23	0.48		5.98
9	12/29/00	1		40.2	25	0.36		6.31
10	12/30/00	1		43.8	24	0.61		5.99
11	12/31/00	1		28	5	0.87		5.85
12	1/1/01	1		42.9	21	0.26		6.24
13	1/2/01	1		43.4	16			6.3
14	1/3/01	1						
15	1/4/01	1						
16	1/5/01	1						

Having your test data available in this general format allows you to easily enter your data into the calculator by simply using the "Open New Data" button on the Data page. Following this process, the sample data file shown above in Excel is entered into the calculator to produce the following snapshot:

CWQI Calculation Options

File Used: C:\cwqi\source\testdata1.xls

	Date	Group	Temp (°C)	Condl (uS/cm)	Color (TCU)	Turb (JTU)
1	12/23/00	1		44.1	24	0.47
2	12/24/00	1		37.6	28	0.65
3	12/25/00	1		47.2	29	0.38
4	12/26/00	1		32	21	0.75
5	12/27/00	1		31	34	0.67
6	12/28/00	1		42.6	23	0.48
7	12/29/00	1		40.2	25	0.36
8	12/30/00	1		43.8	24	0.61

As can be seen, collecting your data into MS Excel spreadsheet(s) in the proper format prior to using the CWQI is the easiest way to produce fast and accurate results, especially if you have a lot of data to analyze.

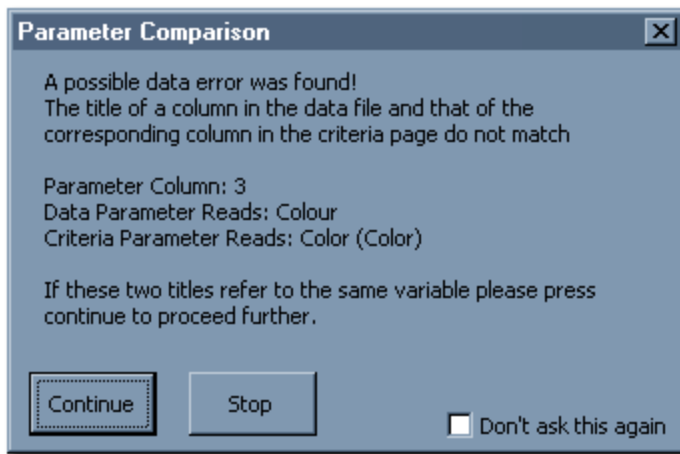
The last step in ensuring you get accurate results from the CWQI is to ensure your data

format order matches the order of the criteria you supply to the application on the Criteria page.

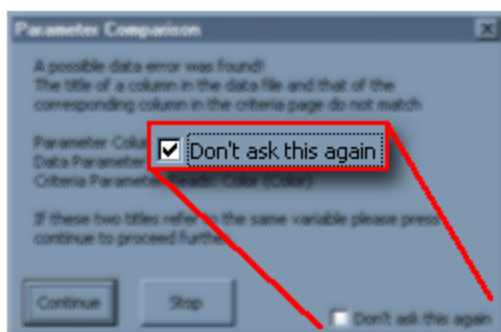
Variables are tested in the order they appear, from one to the next; there is no searching for matching variables performed. When you compute your data to generate CWQI results the

program will perform a simple analysis of the data versus the criteria list supplied. If the program finds any cases where it cannot resolve if the data variable heading matches the criteria

listing, it will prompt you to determine if there is a match or not. Here is a sample of that prompt:

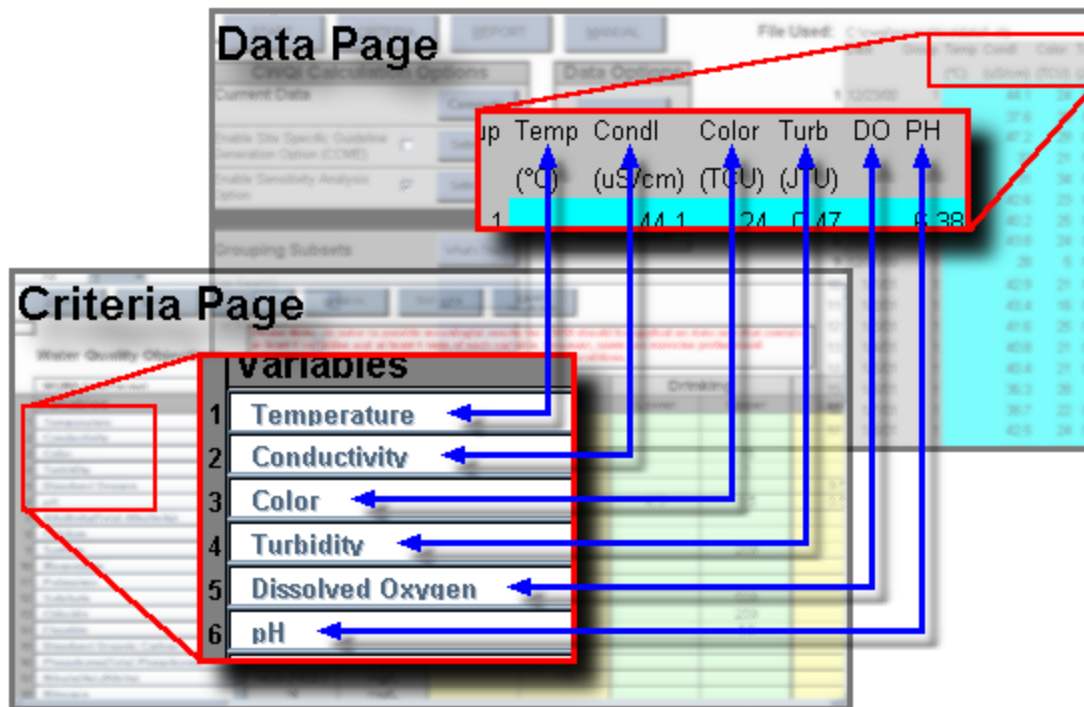


Here you see that the Data page variable was listed as "Colour" (the British spelling) whereas the Criteria page variable was listed as "Color" (the American spelling) for the third variable. As the program cannot decipher whether or not these two items represent the same data, it will prompt the user for verification of either a data entry error or a valid match. If the two listed items are the same, you can click on the "Continue" button. If they represent two distinctly different variables, you should click on "Stop", which will halt the current CWQI calculation process. If you are sure that your data matches other than some textual difference(s), click on the check box on the bottom right corner of the window.



Checking this box will cause the application to stay all checks for dissimilar entries during the life of that particular instance of the program (closing and reopening the program will again enable the function), therefore it is best not to check this box unless you are certain that your data and your criteria match.

To illustrate what is meant by matching the order of your data and the criteria, consider the following picture:



Here you can see that we have a data set and a criteria list which are in agreement (at least for the first six variables). Cutouts from the Data page and the Criteria page show that we have the same order of variables in both sources of information, illustrated by the blue arrows. In order for the application to be able to produce valid results, it is crucial that this matching order exists throughout your data. If the given example were run there would be no prompt for variable comparison confirmation, so the application does exercise some intelligence when it comes to this comparison.

3.2 In-Depth Reports

In-Depth Reports of your results are available through buttons located at the bottom of the Report page. They provide you with more detail about your data than can be viewed from the Report page itself.

Calculation Summary

This page is designed to provide much more detail about the CWQI calculation results and to give a source for spotting the strengths and weakness of your data. Here is an example of what you will see:

Back

CANADIAN WATER QUALITY INDEX 1.0
C:\WINDOWS\Desktop\testdata1.xls

Summary of Results

	Overall	Drinking	Aquatic	Recreation	Irrigation	Livestock
Number of variables tested	18	15	10	1	11	12
Number of variables that failed	9	3	6	0	1	2
Variables with most failed tests	pH	pH	pH	None	Chromium	Color
Variables with highest nse	Aluminum	Color	Aluminum	None	Chromium	Color

Variables that failed the objectives	Temp	Cond	Color	Turb	DO	pH	ALKT	Ca
Overall	N/A	N/A	Had Failure(s)	Had Failure(s)	No Failures	Had Failure(s)	N/A	No Failure
Drinking	N/A	N/A	Had Failure(s)	Had Failure(s)	N/A	Had Failure(s)	N/A	N/A
Aquatic	N/A	N/A	N/A	N/A	No Failures	Had Failure(s)	N/A	N/A
Recreation	N/A	N/A	N/A	N/A	N/A	No Failures	N/A	N/A
Irrigation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Livestock	N/A	N/A	Had Failure(s)	N/A	N/A	N/A	N/A	No Failure

Number of Tests (Number of Failures)	Temp	Cond	Color	Turb	DO	pH	ALKT	Ca
Overall	N/A	N/A	19 (18)	19 (1)	No Data	19 (19)	N/A	19 (8)
Drinking	N/A	N/A	19 (18)	19 (1)	N/A	19 (19)	N/A	N/A
Aquatic	N/A	N/A	N/A	N/A	No Data	19 (19)	N/A	N/A
Recreation	N/A	N/A	N/A	N/A	N/A	19 (8)	N/A	N/A
Irrigation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Livestock	N/A	N/A	19 (18)	N/A	N/A	N/A	N/A	19 (8)

Tables entries above with less than 4 tests are highlighted in red

Statistical Summary of Data	Temp	Cond	Color	Turb	DO	pH	ALKT	Ca
Minimum	20.0000	5.0000	5.0000	0.2000		5.0000		0.4000
Maximum	47.2000	34.0000	1.2000			6.4500		1.3700
Mean	39.9536	23.1679	0.5800			6.1616		0.8753
Median	40.0000	24.0000	0.5700			6.2300		0.8500
Standard Deviation	4.9057	5.8603	0.2340			0.1780		0.2190

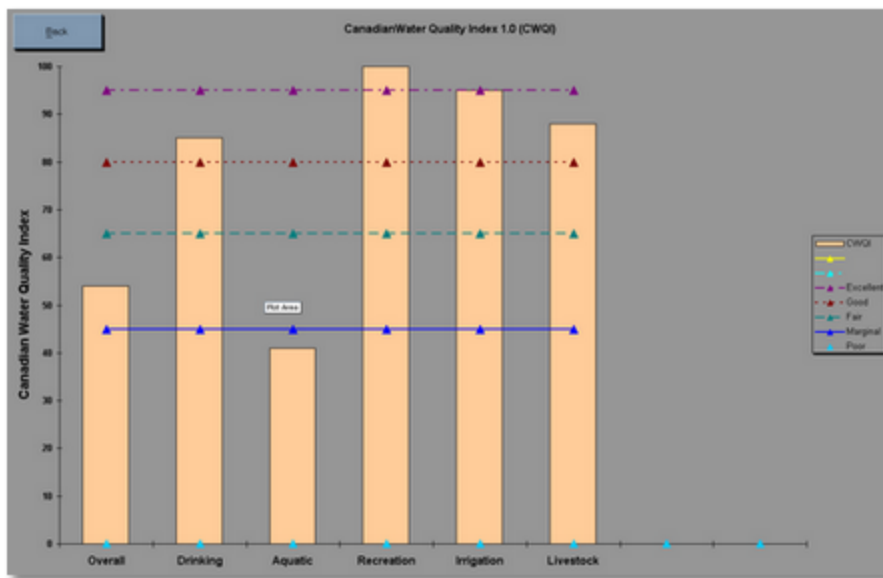
Site Specific Aquatic Guidelines	Not Used
Aluminum	

The tables provided within this page are as follows:

- Summary of results
This table presents the following information:
 1. Number of variables (parameters) tested for each index - how many individual variables were used in calculations to determine the CWQI,
 2. Number of variables that failed for each index - how many individual variables had at least one piece of data fail,
 3. Variable(s) with the most failed tests for each index - which variable's data had failed the most total times,
 4. Variable(s) with the highest NSE (normalized sum of excursions) for each index - which variable's data had failed by the largest normalized total amount.
- Variables that failed the objectives - displays which variables for each index had at least one failure.
- Number of tests (number of failures) - displays the number of tests performed and the number of failures encountered for each variable for each index.
- Statistical summary of data - displays the minimum, maximum, mean, median and standard deviation for each variable of the test data.
- Site specific aquatic guidelines - displays any guidelines which were calculated based on user requests, see the Site Specific Guidelines section of the Data Page

WQI Chart

This page provides you with a graphical representation of your results. Here is an example of the WQI Chart.



As you can see the CWQI score of each index is displayed on an overlay of the given ranks.

Indexed Test Data

This page provides you with a copy of the input data which is highlighted showing each pass and fail of the data supplied for each index.

Overall

Date	Group	Temp (°C)	Cond (µS/cm)	Color (TCU)	Turb (NTU)	DO (mg/L)	PH	Alk (mg/L)	Ca (mg/L)	Na (mg/L)	Mg (mg/L)	K (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	DOC (mg/L)	P (mg/L)	Nitrate (mg/L)	N (mg/L)	Si (mg/L)	Al (mg/L)	As (mg/L)	Ba (mg/L)	Be (µg/L)	Cd (mg/L)	Cr (mg/L)	
1	12/23/00	1	44.1	24	0.47	6.38	1.14	4.1	1.14	5.8			2	10.1	0.025	3.7	0.01										
2	12/24/00	1	37.6	28	0.65	6.36	1.11	4.1	1.37	4.1			3.2	6.9	0.02	0.04											
3	12/25/00	1	47.2	29	0.38	6.27	1.37	4.1	1.37	4.1			2.4	7	0.02	0.03											
4	12/26/00	1	32	21	0.75	6.45	0.73	4.1	1.73	4.1			2.4	6.8	0.03	0.01											
5	12/27/00	1	31	34	0.67	6.12	0.69	3.86	1.12	5.8			2.8	5.1	0.03	0.01											
6	12/28/00	1	42.6	23	0.40	5.90	0.96	5.7	1.16	5.2			2.1	9.6	0.03	3	0.01										
7	12/29/00	1	40.2	25	0.36	6.31	0.95	4.1	1.16	5.2			2.7	9.7	0.03	2	0.01										
8	12/30/00	1	43.8	24	0.61	5.99	0.65	5.5	1.07	6.16			2.8	9.6	0.03	3.2	0.01										
9	12/31/00	1	20	5	0.87	5.95	0.90	4.39	1.07	6.16			2.3	7.8	0.02	0.005											
10	1/1/01	1	42.9	21	0.26	6.24	0.8	5.9	1.16	5.2			2.5	9.9	0.025	2.8	0.01										
11	1/2/01	1	43.4	16	0.36	6.32	1.16	5.2	1.4	7.1			1.4	7.1	0.005	3.7	0.005										
12	1/3/01	1	41.6	25	0.72	5.83	0.89	5.5	1.16	5.2			2	9.9	0.025	3.5	0.005										
13	1/4/01	1	40.8	21	0.32	5.94	0.92	4.72	1.16	5.2			2	9.5	0.025	3.2	0.005										
14	1/5/01	1	40.4	21	0.30	6.09	0.87	5.11	1.16	5.2			1.5	9.3	0.025	3	0.005										
15	1/6/01	1	36.3	28	1.2	6.23	1.07	5.16	1.16	5.2			1.6	7.2	0.025	4.1	0.005										
16	1/7/01	1	38.7	22	0.73	6.07	0.84	4.4	1.16	5.2			1.8	7.3	0.025	2.5	0.005										
17	1/8/01	1	42.5	24	0.83	6.1	0.84	4.04	1.16	5.2			1.4	7.8	0.025	1.9	0.005										
18	1/9/01	1	45.2	20	0.35	6.29	0.48	5.31	1.16	5.2			1.5	8.5	0.005	3.4	0.005										
19	1/10/01	1	40.8	29	0.63	6.25	0.68	4.3	1.16	5.2			2.9	9	0.025	1.6	0.01										

Drinking

Date	Group	Temp (°C)	Cond (µS/cm)	Color (TCU)	Turb (NTU)	DO (mg/L)	PH	Alk (mg/L)	Ca (mg/L)	Na (mg/L)	Mg (mg/L)	K (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	DOC (mg/L)	P (mg/L)	Nitrate (mg/L)	N (mg/L)	Si (mg/L)	Al (mg/L)	As (mg/L)	Ba (mg/L)	Be (µg/L)	Cd (mg/L)	Cr (mg/L)		
1	12/23/00	1	44.1	24	0.47	6.38	1.14	4.1	1.14	5.8			2	10.1	0.025	3.7	0.01											
2	12/24/00	1	37.6	28	0.65	6.36	1.11	4.1	1.37	4.1			3.2	6.9	0.02	0.04												
3	12/25/00	1	47.2	29	0.38	6.27	1.37	4.1	1.37	4.1			2.4	7	0.02	0.03												
4	12/26/00	1	32	21	0.75	6.45	0.73	4.1	1.73	4.1			2.4	6.8	0.03	0.01												

These displays can help you see if there are any patterns to the strength and weakness of your data.

Data Outliers

This page highlights for you data which is outside the "norm" using several different methods.

Normal Range: Mean Plus and/or Minus Two Standard Deviation

Date	Group	Temp (°C)	Cond (µS/cm)	Color (TCU)	Turb (NTU)	DO (mg/L)	PH	Alk (mg/L)	Ca (mg/L)	Na (mg/L)	Mg (mg/L)	K (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	DOC (mg/L)	P (mg/L)	Nitrate (mg/L)	N (mg/L)	Si (mg/L)	Al (mg/L)	As (mg/L)	Ba (mg/L)	Be (µg/L)	Cd (mg/L)	Cr (mg/L)		
1	12/23/00	1	44.1	24	0.47	6.38	1.14	4.1	1.14	5.8			2	10.1	0.025	3.7	0.01											
2	12/24/00	1	37.6	28	0.65	6.36	1.11	4.1	1.37	4.1			3.2	6.9	0.02	0.04												
3	12/25/00	1	47.2	29	0.38	6.27	1.37	4.1	1.37	4.1			2.4	7	0.02	0.03												
4	12/26/00	1	32	21	0.75	6.45	0.73	4.1	1.73	4.1			2.4	6.8	0.03	0.01												
5	12/27/00	1	31	34	0.67	6.12	0.69	3.86	1.12	5.8			2.8	5.1	0.03	0.01												
6	12/28/00	1	42.6	23	0.40	5.90	0.96	5.7	1.16	5.2			2.1	9.6	0.03	3	0.01											
7	12/29/00	1	40.2	25	0.36	6.31	0.95	4.1	1.16	5.2			2.7	9.7	0.03	2	0.01											
8	12/30/00	1	43.8	24	0.61	5.99	0.65	5.5	1.07	6.16			2.8	9.6	0.03	3.2	0.01											
9	12/31/00	1	20	5	0.87	5.95	0.90	4.39	1.07	6.16			2.3	7.8	0.02	0.005												
10	1/1/01	1	42.9	21	0.26	6.24	0.8	5.9	1.16	5.2			2.5	9.9	0.025	2.8	0.01											
11	1/2/01	1	43.4	16	0.36	6.32	1.16	5.2	1.4	7.1			1.4	7.1	0.005	3.7	0.005											
12	1/3/01	1	41.6	25	0.72	5.83	0.89	5.5	1.16	5.2			2	9.9	0.025	3.5	0.005											
13	1/4/01	1	40.8	21	0.32	5.94	0.92	4.72	1.16	5.2			2	9.5	0.025	3.2	0.005											
14	1/5/01	1	40.4	21	0.30	6.09	0.87	5.11	1.16	5.2			1.5	9.3	0.025	3	0.005											
15	1/6/01	1	36.3	28	1.2	6.23	1.07	5.16	1.16	5.2			1.6	7.2	0.025	4.1	0.005											
16	1/7/01	1	38.7	22	0.73	6.07	0.84	4.4	1.16	5.2			1.8	7.3	0.025	2.5	0.005											
17	1/8/01	1	42.5	24	0.83	6.1	0.84	4.04	1.16	5.2			1.4	7.8	0.025	1.9	0.005											
18	1/9/01	1	45.2	20	0.35	6.29	0.48	5.31	1.16	5.2			1.5	8.5	0.005	3.4	0.005											
19	1/10/01	1	40.8	29	0.63	6.25	0.68	4.3	1.16	5.2			2.9	9	0.025	1.6	0.01											

Normal Range: 90th Percentile Data

Date	Group	Temp (°C)	Cond (µS/cm)	Color (TCU)	Turb (NTU)	DO (mg/L)	PH	Alk (mg/L)	Ca (mg/L)	Na (mg/L)	Mg (mg/L)	K (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	DOC (mg/L)	P (mg/L)	Nitrate (mg/L)	N (mg/L)	Si (mg/L)	Al (mg/L)	As (mg/L)	Ba (mg/L)	Be (µg/L)	Cd (mg/L)	Cr (mg/L)		
1	12/23/00	1	44.1	24	0.47	6.38	1.14	4.1	1.14	5.8			2	10.1	0.025	3.7	0.01											
2	12/24/00	1	37.6	28	0.65	6.36	1.11	4.1	1.37	4.1			3.2	6.9	0.02	0.04												
3	12/25/00	1	47.2	29	0.38	6.27	1.37	4.1	1.37	4.1			2.4	7	0.02	0.03												
4	12/26/00	1	32	21	0.75	6.45	0.73	4.1	1.73	4.1			2.4	6.8	0.03	0.01												

These tables are helpful in finding anomalies within your data without having to study each measurement.

Turbidity

This page will summarize the results of a turbidity test.

C:\WINDOWS\Desktop\testdata1.xls

	Date	Group	Temp (°C)	Condl (uS/cm)	Color (TCU)	Turb (JTU)	DO	PH	Alk (mg/l)	Ca (mg/l)	Na (mg/l)	Mg (mg/l)	K (mg/l)	Sulphate (mg/l)	Chloride (mg/l)
1	12/23/00	1	44.1	24	0.47	6.38	1.14	5.8							
2	12/24/00	1	37.6	28	0.65	6.36	1.11	4.1							
3	12/25/00	1	47.2	29	0.38	6.27	1.37	4.1							
4	12/26/00	1	32	21	0.75	6.45	0.73	4.1							
5	12/27/00	1	31	34	0.67	6.12	0.69	3.86							
6	12/28/00	1	42.6	23	0.48	5.98	0.56	5.7							
7	12/29/00	1	40.2	25	0.36	6.31	0.85	4.1							
8	12/30/00	1	43.8	24	0.61	5.99	0.65	5.5							
9	12/31/00	1	28	5	0.87	5.85	0.98	4.39							
10	1/1/01	1	42.9	21	0.26	6.24	0.8	5.9							
11	1/2/01	1	43.4	16	0.36	6.32	1.16	6.27							
12	1/3/01	1	41.6	25	0.72	5.83	0.89	5.5							
13	1/4/01	1	40.8	21	0.32	5.94	0.92	4.72							
14	1/5/01	1	40.4	21	0.38	6.09	0.87	5.11							
15	1/6/01	1	36.3	28	1.2	6.23	1.07	5.16							
16	1/7/01	1	38.7	22	0.73	6.07	0.84	4.4							
17	1/8/01	1	42.5	24	0.83	6.1	0.84	4.04							
18	1/9/01	1	45.2	20	0.35	6.29	0.48	5.31							
19	1/10/01	1	40.8	29	0.63	6.25	0.68	4.3							

Data which passed and failed the turbidity tests specified by the user will be highlighted within this table, letting you find failures at a glance. In the above example the calculator was run with the turbidity flagging option turned on and a value of 1.0 set as the critical value. For more information please refer to the Turbidity Flagging Option section of the Data Page.

3.3 Sensitivity Reports

Enabling the sensitivity analysis option will produce a different set of reports than normal. If you are familiar with the general form of CWQI reports, none of the results presented through sensitivity will be new to you. For more information on using the sensitivity option, see the Sensitivity Analysis section of the Data Page.

When you use sensitivity you will simply find that there will be two versions of each report feature; a pre-sensitivity set of results and a post-sensitivity set. Below is an example of what you will see when you use this option to generate results.

START DATA CRITERIA MANUAL THE WQI

CANADIAN WATER QUALITY INDEX 1.0
File Used: C:\WINDOWS\Desktop\testdata1.xls

Original Data Summary	Overall	Drinking	Aquatic	Recreation	Irrigation	Livestock		
CWQI	54	86	41	100	96	89		
Categorization	Marginal	Good	Poor	Excellent	Excellent	Good		
F1 (Scope)	50	20	60	0	9	17		
F2 (Frequency)	30	15	44	0	1	11		
F3 (Amplitude)	56	4	71	0	0	6		
Minimal Dataset Requirement of 4 Variables	Met	Met	Met	Not Met	Met	Met		
Contaminant Analysis of Last Sample	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested		
Turbidity Flagging Option	Not Used							

Calculations Summary Ignored Test Data Data Outliers Sensitivity Data

Sensitivity Data Summary	Overall	Drinking	Aquatic	Recreation	Irrigation	Livestock		
CWQI	41	79	32	17	88	83		
Categorization	Poor	Fair	Poor	Poor	Good	Good		
F1 (Scope)	61	27	70	100	18	17		
F2 (Frequency)	37	19	46	100	8	15		
F3 (Amplitude)	74	17	84	27	2	20		
Minimal Dataset Requirement of 4 Variables	Met	Met	Met	Not Met	Met	Met		
Contaminant Analysis of Last Sample	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested		
Turbidity Flagging Option	Not Used							

Calculations Summary Ignored Test Data Data Outliers Sensitivity Data Sensitivity Data

As you can see above, we have two separate tables displaying results, as well as two groups of buttons for in-depth reports; one for the original set of data and one for the sensitivity altered results. One thing that is not available unless you use sensitivity analysis, is the Sensitivity Data button. This button takes you to a page where your resultant sensitivity data is displayed, with data which has been altered through the sensitivity process highlighted for you.

Another difference you may notice is contained within the Calculations Summary page.

Statistical Summary of Original Data		Temp	Candl
Minimum			26.0000
Maximum			
Mean			
Median			40.0000
Standard Deviation			4.9057

Statistical Summary of Original Data

Sensitivity Analysis By Row		Input Values
Data Multiplier		2.000
Number of Data Rows Used in Analysis		20

Sensitivity Analysis By Row

Statistical Summary of Sensitivity Data		Temp	Candl
Minimum			56.0000
Maximum			
Mean			
Median			81.6000
Standard Deviation			9.8114
Multiplier			

Statistical Summary of Sensitivity Data

Here you will now be able to find the settings that you used to generate this sensitivity analysis. If you used "By Row" sensitivity you will notice that a table in the Calculations Summary page contains your options as shown in the example below.

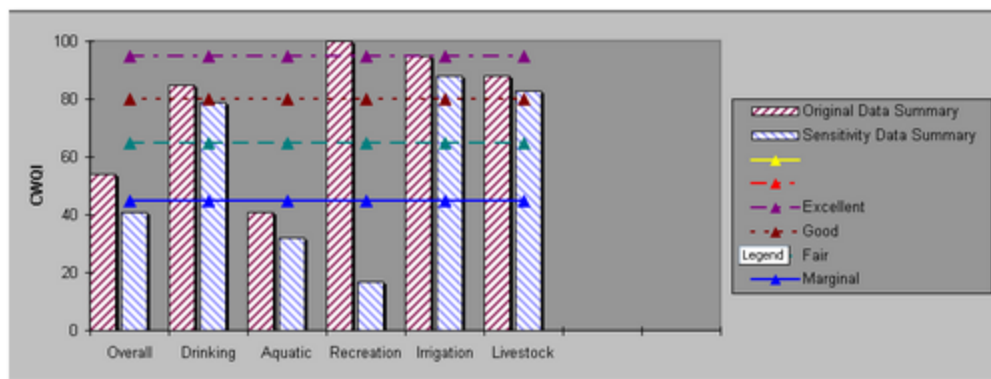
Sensitivity Analysis By Row	Input Values
Data Multiplier	2.000
Number of Data Rows Used in Analysis	20

If you use "By Parameter" sensitivity however, you will find your settings contained within a second Statistical Summary of Data table located within the Calculations Summary page as shown below.

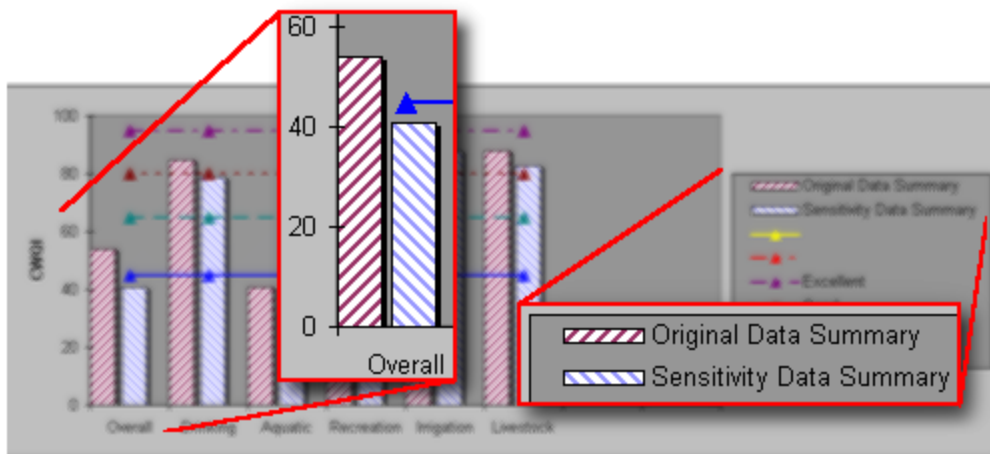
Statistical Summary of Sensitivity Data	Temp	Condl	Color	Turb
Minimum		30.8000	2.5000	0.18
Maximum		51.9200	17.0000	2.00
Mean		43.9479	11.5789	2.00
Median		44.8800	12.0000	2.00
Standard Deviation		5.3962	2.9302	0.18
Multiplier	1.2000	1.1000	0.5000	0.7000

This second statistical summary table gives you the same information as the original one plus it shows you what the multiplier for each variable was (if any) in order to generate the new set of test data.

You will also see that the WQI Chart looks different, not only is it contained within the Report page itself, but it also contains both pre- and post-sensitivity results as is shown below.



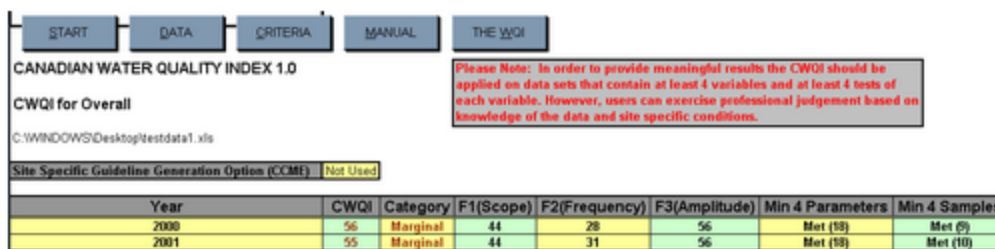
As you can see, the same results are available here as are available during a calculation where sensitivity is not used, there's simply two versions of everything, one for the original data and one for the altered data.



3.4 Grouping Reports

Using the Grouping option can produce a different set of reports than normal. If you are familiar with the general form of CWQI reports, none of the results presented through grouping will be new to you. For more information on using groups see the Grouping Subsets section of the Data Page.

Unless you wish to compare multiple subsets of your data, the reports generated will be the same as those presented without invoking the grouping options (see Report Page). If however you wish to compare multiple subsets of your data at the same time, your report will look like the illustration below.



As you can see there is much less resultant data available. This is due to the fact that the presentation of a full set of results, as you would get normally without grouping, would be too confusing to effectively display and analyze.