

# Customizing QC test thresholds

Version 1 (1/17/2022)

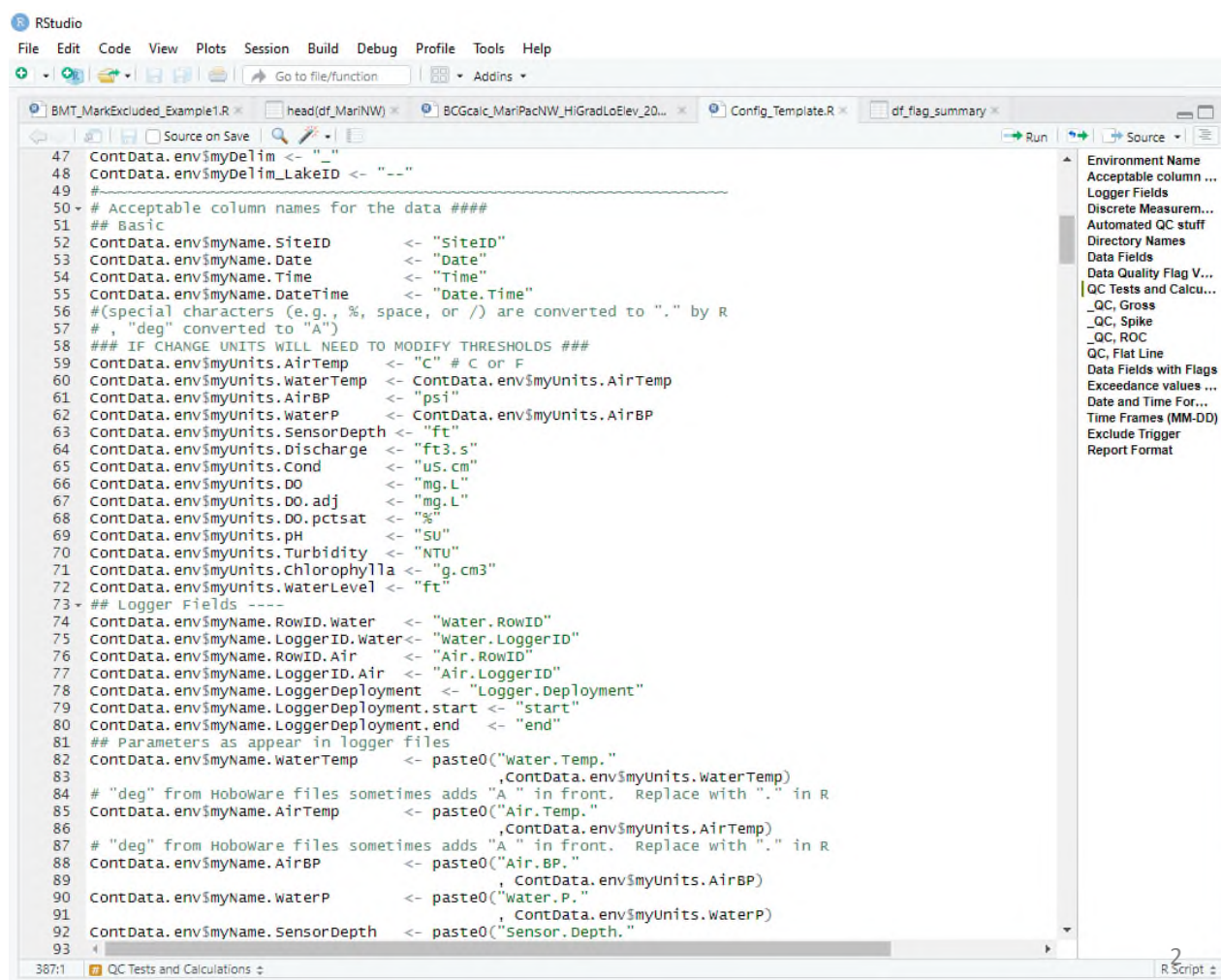
If you decide to change QC test thresholds for a site, you can create and save a customized configuration file for that site and use that customized file each time you run QC reports for that site moving ahead.

## What is the configuration file?

It stores information on parameters, units, QC tests and more.

Users with expertise in R can go into this file and edit or add parameters, change units, change QC test thresholds and more.

If you use the Default settings, you won't need to interact with the configuration file at all.



The screenshot shows the RStudio environment with the 'Config\_Template.R' file open in the editor. The file contains R code for setting environment variables and parameters for data processing and quality control. The code is organized into sections with comments. The first section defines basic site information like 'SiteID', 'Date', and 'Time'. The second section defines units for various parameters such as temperature, pressure, depth, and discharge. The third section defines logger fields like 'RowID', 'LoggerID', and 'Deployment'. The fourth section defines parameters as they appear in logger files, using 'paste0' to concatenate strings. The status bar at the bottom indicates '387:1 QC Tests and Calculations'.

```
47 ContData.env$myDelim <- "-"
48 ContData.env$myDelim_LakeID <- "--"
49
50 # Acceptable column names for the data ####
51 ## Basic
52 ContData.env$myName.SiteID <- "SiteID"
53 ContData.env$myName.Date <- "Date"
54 ContData.env$myName.Time <- "Time"
55 ContData.env$myName.DateTime <- "Date.Time"
56 #(special characters (e.g., %, space, or /) are converted to "." by R
57 #, "deg" converted to "A")
58 ### IF CHANGE UNITS WILL NEED TO MODIFY THRESHOLDS ###
59 ContData.env$myUnits.AirTemp <- "C" # C or F
60 ContData.env$myUnits.WaterTemp <- ContData.env$myUnits.AirTemp
61 ContData.env$myUnits.AirBP <- "psi"
62 ContData.env$myUnits.WaterP <- ContData.env$myUnits.AirBP
63 ContData.env$myUnits.SensorDepth <- "ft"
64 ContData.env$myUnits.Discharge <- "ft3.s"
65 ContData.env$myUnits.Cond <- "uS.cm"
66 ContData.env$myUnits.DO <- "mg.L"
67 ContData.env$myUnits.DO.adj <- "mg.L"
68 ContData.env$myUnits.DO.pctsat <- "%"
69 ContData.env$myUnits.pH <- "SU"
70 ContData.env$myUnits.Turbidity <- "NTU"
71 ContData.env$myUnits.Chlorophylla <- "g.cm3"
72 ContData.env$myUnits.WaterLevel <- "ft"
73 ## Logger Fields ----
74 ContData.env$myName.RowID.Water <- "Water.RowID"
75 ContData.env$myName.LoggerID.Water <- "Water.LoggerID"
76 ContData.env$myName.RowID.Air <- "Air.RowID"
77 ContData.env$myName.LoggerID.Air <- "Air.LoggerID"
78 ContData.env$myName.LoggerDeployment <- "Logger.Deployment"
79 ContData.env$myName.LoggerDeployment.start <- "start"
80 ContData.env$myName.LoggerDeployment.end <- "end"
81 ## Parameters as appear in logger files
82 ContData.env$myName.WaterTemp <- paste0("Water.Temp.",
83                                           ContData.env$myUnits.WaterTemp)
84 # "deg" from Hoboware files sometimes adds "A" in front. Replace with "." in R
85 ContData.env$myName.AirTemp <- paste0("Air.Temp.",
86                                           ContData.env$myUnits.AirTemp)
87 # "deg" from Hoboware files sometimes adds "A" in front. Replace with "." in R
88 ContData.env$myName.AirBP <- paste0("Air.BP.",
89                                           ContData.env$myUnits.AirBP)
90 ContData.env$myName.WaterP <- paste0("Water.P.",
91                                           ContData.env$myUnits.WaterP)
92 ContData.env$myName.SensorDepth <- paste0("Sensor.Depth.",
93                                           ContData.env$myUnits.SensorDepth)
```

## How do you customize the thresholds?

There are two main options:

- Create a customized configuration file using the interactive functions under the 'Edit thresholds' tab.
- Download the default configuration file\*, open the configuration file in R, or, if you don't have access to R, use Notepad or Notepad ++ to make edits.

\*units in the default file = feet; if you prefer to work in meters, download the lakes configuration file

You can download R from this website: <https://cran.r-project.org/>

You may also want to consider downloading RStudio as well. This is a separate program but is a useful code editor and interface for R. Install it after installing R -

<https://www.rstudio.com/products/rstudio/download/>

If you can't install R on your computer, we recommend use Notepad or Notepad + + (<https://notepad-plus-plus.org/downloads/>); some people prefer Notepad ++ because it has color-coding.

## Option 1 – create a customized configuration file using the features under the ‘Edit thresholds’ tab

The screenshot shows the 'Edit Thresholds' tab of the 'Continuous data QC, summary, and statistics - v2.0.6.9011' application. The browser address bar shows the URL 'tetratech-wtr-wne.shinyapps.io/ContDataQC/'. The application has a navigation bar with tabs: 'Default', 'Evaluate Thresholds', 'Edit Thresholds' (active), and 'Upload Custom Thresholds'. Below the navigation bar, there are instructions for editing thresholds:

- 1. Select a parameter for edit using drop-down
- 2. Edit thresholds using boxes on right
- 3. Save changes (for each parameter)
- 4. Download custom thresholds file

The main content area is divided into two columns. The left column contains a dropdown menu for '1. Select Parameter' with 'Air Temperature' selected. Below it, the 'Parameter Unit: deg C' is shown. A '3. Save your changes' section includes a note 'Note: Save changes for one parameter at a time' and a 'Save changes' button. A '4. Download your custom threshold file' section includes a note 'Note: The downloaded file must be reuploaded' and a 'Download custom thresholds file' button. The right column contains three sections for editing thresholds:

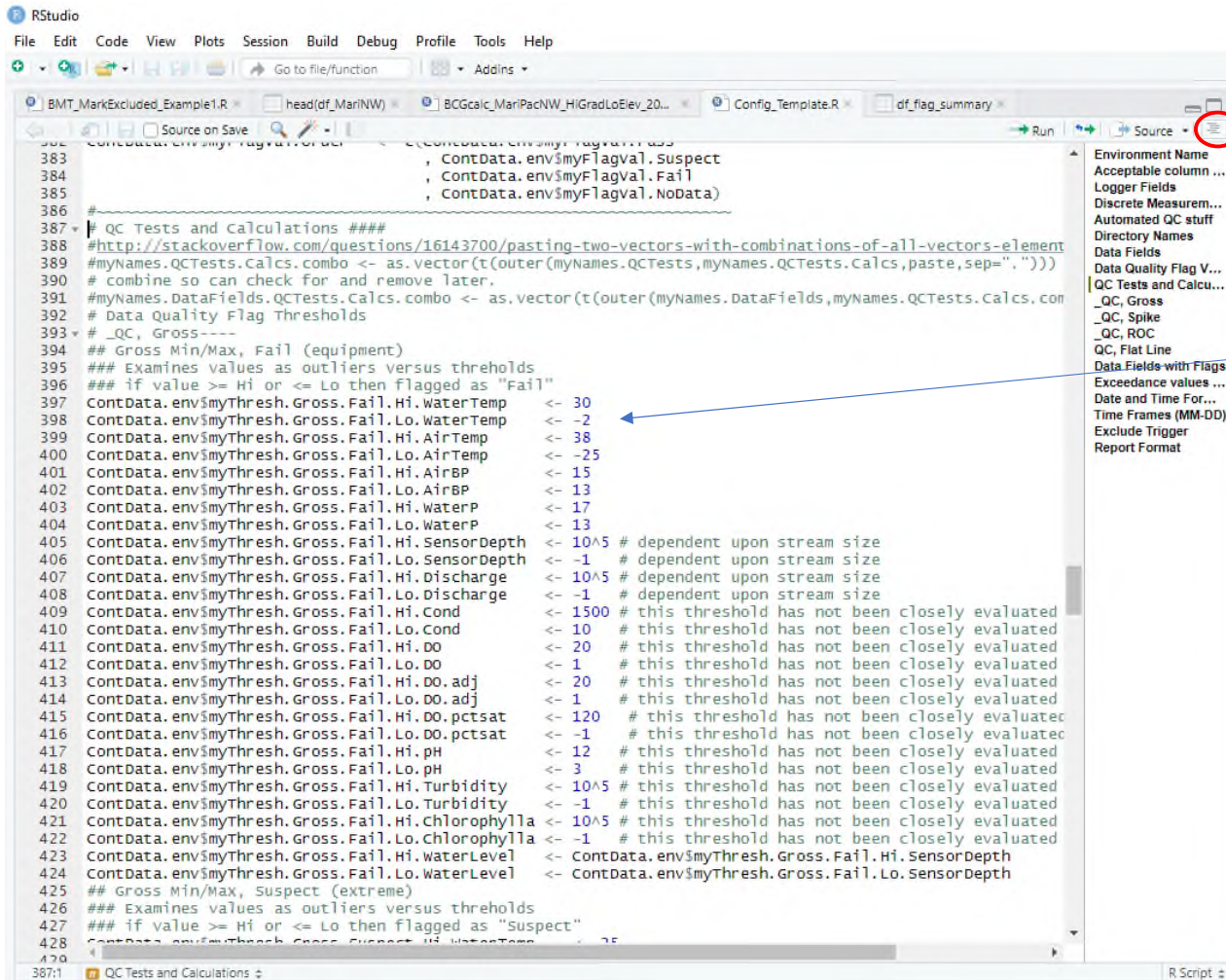
- 2. Edit thresholds:**
  - Gross Range Thresholds:** Test if data point exceeds sensor or user defined min/max. It has four input boxes: 'Fail Max' (38), 'Fail Min' (-25), 'Suspect Max' (35), and 'Suspect Min' (-23).
  - Spike Thresholds:** Test if data point exceeds a user defined threshold relative to the previous data point. It has two input boxes: 'Fail' (10) and 'Suspect' (8).
  - Rate of Change Limits:** Test if data point exceeds a number of standard deviations from the previous data points over a user defined time period. It has two input boxes: 'SDs' (3) and 'Hours' (25).

Remember to save changes for each parameter!

Then, after you finish editing thresholds for all parameters, click the ‘download custom thresholds file’ button.

Save the customized file.

## Option 2 – download and edit the configuration file (either the default file (units = feet) or the lakes file (units = meters))



```
383 ContData.env$myFlagval.Suspect
384 ContData.env$myFlagval.Fail
385 ContData.env$myFlagval.NoData)
386
387 ## QC Tests and Calculations ###
388 #http://stackoverflow.com/questions/16143700/pasting-two-vectors-with-combinations-of-all-vectors-element
389 #myNames.QCTests.Calcs.combo <- as.vector(t(outer(myNames.QCTests,myNames.QCTests.Calcs,paste,". ")))
390 # combine so can check for and remove later.
391 #myNames.DataFields.QCTests.Calcs.combo <- as.vector(t(outer(myNames.DataFields,myNames.QCTests.Calcs,com
392 # Data Quality Flag Thresholds
393 # _QC, Gross---
394 ## Gross Min/Max, Fail (equipment)
395 ### Examines values as outliers versus thresholds
396 ### if value >= Hi or <= Lo then flagged as "Fail"
397 ContData.env$myThresh.Gross.Fail.Hi.WaterTemp <- 30
398 ContData.env$myThresh.Gross.Fail.Lo.WaterTemp <- -2
399 ContData.env$myThresh.Gross.Fail.Hi.AirTemp <- 38
400 ContData.env$myThresh.Gross.Fail.Lo.AirTemp <- -25
401 ContData.env$myThresh.Gross.Fail.Hi.AirBP <- 15
402 ContData.env$myThresh.Gross.Fail.Lo.AirBP <- 13
403 ContData.env$myThresh.Gross.Fail.Hi.WaterP <- 17
404 ContData.env$myThresh.Gross.Fail.Lo.WaterP <- 13
405 ContData.env$myThresh.Gross.Fail.Hi.SensorDepth <- 10^5 # dependent upon stream size
406 ContData.env$myThresh.Gross.Fail.Lo.SensorDepth <- -1 # dependent upon stream size
407 ContData.env$myThresh.Gross.Fail.Hi.Discharge <- 10^5 # dependent upon stream size
408 ContData.env$myThresh.Gross.Fail.Lo.Discharge <- -1 # dependent upon stream size
409 ContData.env$myThresh.Gross.Fail.Hi.Cond <- 1500 # this threshold has not been closely evaluated
410 ContData.env$myThresh.Gross.Fail.Lo.Cond <- 10 # this threshold has not been closely evaluated
411 ContData.env$myThresh.Gross.Fail.Hi.DO <- 20 # this threshold has not been closely evaluated
412 ContData.env$myThresh.Gross.Fail.Lo.DO <- 1 # this threshold has not been closely evaluated
413 ContData.env$myThresh.Gross.Fail.Hi.DO.adj <- 20 # this threshold has not been closely evaluated
414 ContData.env$myThresh.Gross.Fail.Lo.DO.adj <- 1 # this threshold has not been closely evaluated
415 ContData.env$myThresh.Gross.Fail.Hi.DO.pctsat <- 120 # this threshold has not been closely evaluated
416 ContData.env$myThresh.Gross.Fail.Lo.DO.pctsat <- -1 # this threshold has not been closely evaluated
417 ContData.env$myThresh.Gross.Fail.Hi.pH <- 12 # this threshold has not been closely evaluated
418 ContData.env$myThresh.Gross.Fail.Lo.pH <- 3 # this threshold has not been closely evaluated
419 ContData.env$myThresh.Gross.Fail.Hi.Turbidity <- 10^5 # this threshold has not been closely evaluated
420 ContData.env$myThresh.Gross.Fail.Lo.Turbidity <- -1 # this threshold has not been closely evaluated
421 ContData.env$myThresh.Gross.Fail.Hi.Chlorophylla <- 10^5 # this threshold has not been closely evaluated
422 ContData.env$myThresh.Gross.Fail.Lo.Chlorophylla <- -1 # this threshold has not been closely evaluated
423 ContData.env$myThresh.Gross.Fail.Hi.WaterLevel <- ContData.env$myThresh.Gross.Fail.Hi.SensorDepth
424 ContData.env$myThresh.Gross.Fail.Lo.WaterLevel <- ContData.env$myThresh.Gross.Fail.Lo.SensorDepth
425 ## Gross Min/Max, Suspect (extreme)
426 ### Examines values as outliers versus thresholds
427 ### if value >= Hi or <= Lo then flagged as "Suspect"
428 ContData.env$myThresh.Gross.Suspect.Hi.WaterTemp <- 35
429
```

### Steps:

- Open the configuration file.
- Navigate to the 'QC tests and calculations' section
  - Tip: If you click on this symbol, the table of contents will appear. Click on 'QC Tests and Calculations' and it will take you to that section of the R code
- Edit the thresholds as desired, which are ordered as follows:
  - Gross Fail
  - Gross Suspect
  - Spike
  - RoC
  - Flat line



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File Home Insert Draw Page Layout Formulas Data Review View Developer Help Nuance PDF Acrobat

Clipboard Font Alignment Number Conditional Formatting Format as Table

H26

	A	B	C	D	E	F	G
1	Gross				New threshold(s)		
2	Analyte	Flag	Limit	Default			
3		Fail	Hi	> 30 deg C			
4	Temperature, Water (deg C)	Fail	Lo	< -2 deg C			
5		Suspect	Hi	> 25 deg C			
6		Suspect	Lo	< -0.1 deg C			
7		Fail	Hi	> 38 deg C			
8	Temperature, Air (deg C)	Fail	Lo	< -25 deg C			
9		Suspect	Hi	> 35 deg C			
10		Suspect	Lo	< -23 deg C			
11		Fail	Hi	> 17 psi			
12	Pressure, Water (psi)	Fail	Lo	< 13 psi			
13		Suspect	Hi	> 16.8 psi			
14		Suspect	Lo	< 13.5 psi			
15		Fail	Hi	> 15 psi			
16	Barometric Pressure, Air (psi)	Fail	Lo	< 13 psi			
17		Suspect	Hi	> 14.8 psi			
18		Suspect	Lo	< 13 psi			
19		Fail	Hi	> 10^5 ft			
20	Sensor Depth or Water Level (ft)	Fail	Lo	< -1 ft			
21		Suspect	Hi	> 1000 ft			
22		Suspect	Lo	< 0 ft			
23		Fail	Hi	> 10^5 ft3/s			
24	Discharge (ft3/s)	Fail	Lo	< -1 ft3/s			
25		Suspect	Hi	> 1000 ft3/s			
26		Suspect	Lo	< -1 ft3/s			
27		Fail	Hi	> 20 mg/L			
28	Dissolved oxygen (mg/L)	Fail	Lo	< 1 mg/L			
29		Suspect	Hi	> 18 mg/L			
30		Suspect	Lo	< 2 mg/L			
31		Fail	Hi	> 1500 uS/cm			
32	Conductivity (uS/cm)	Fail	Lo	< 10 uS/cm			
33		Suspect	Hi	> 1200 uS/cm			
34		Suspect	Lo	< 20 uS/cm			

GrossLimit Spike ROC FlatLine +

Optional but encouraged-

Reference your  
'threshold check' worksheet as you  
work through the edits

Excel file

'ThresholdsCheckWorksheet\_Template\_20220117'

## Make sure you save the customized file!

If you use our recommended folder organizational scheme, put the file into the 'R\_ConfigurationFiles' folder and include the SiteID in the file name (or if you don't do this, save it in a place that you can easily find the next time you run data for that site through the QC tests).

### Recommended folder organizational scheme

1. Set up a folder for each site

Site X

2. Within each site folder, set up subfolders (which you can download from the hyperlink above)

- Data0\_Original
- Data1\_RAW
- Data2\_QC
- Data3\_Aggregated
- Data4\_Stats
- FieldForms
- in\_situ
- orig
- photos
- R\_ConfigurationFiles
- SensorFiles
- USGSgauge
- WxStation

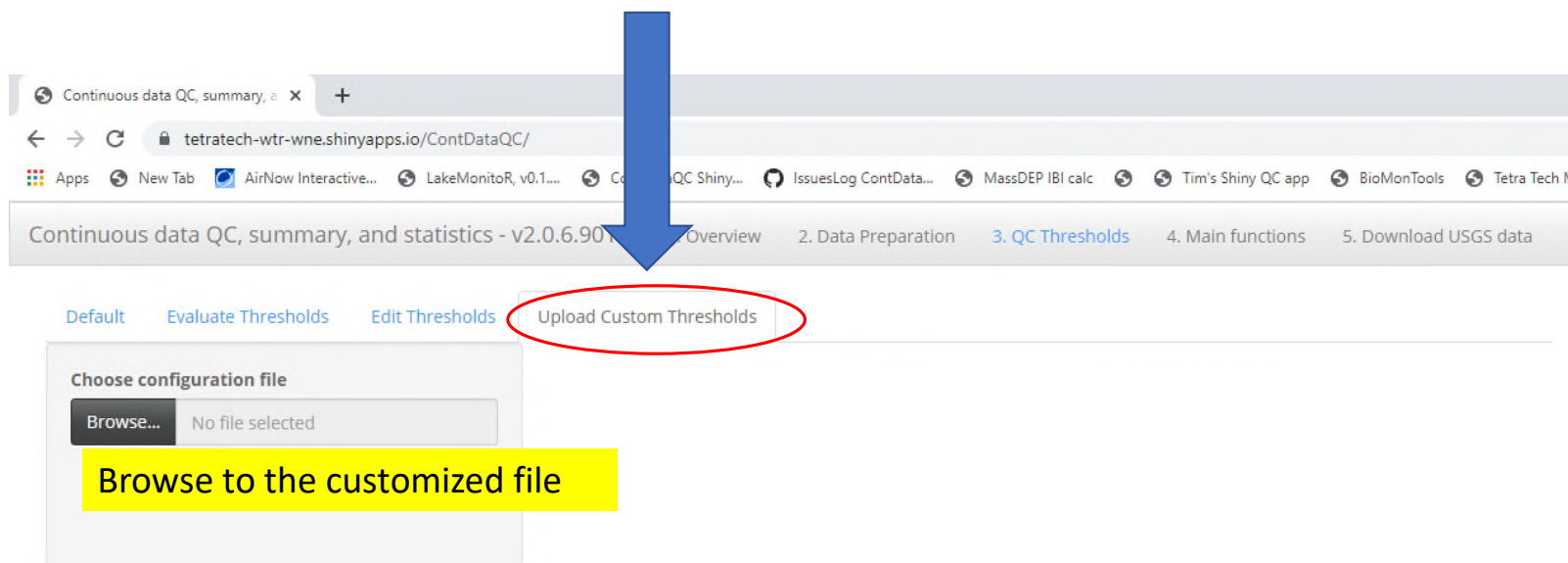
3. Populate folders (see descriptions below)

Example of a customized data file for the site 'Hunting'

R Config\_Hunting

**Make sure you upload the customized configuration file before running the QC tests for your site (otherwise the default thresholds will be used).**

**Go to the 'Upload custom thresholds' tab, browse to the file and then click 'upload.'**





## After generating the QC reports, doublecheck that the correct thresholds were used

Open the Word QC report and verify that the correct thresholds are shown in the 'Thresholds, Quick Reference' section

### *Thresholds, Quick Reference*

Analyte	Flag	Gross	Spike	Rate of Change	Flat Line
Temperature, Water (deg C)	Fail	> 30 deg C or < -2 deg C	>= 1.5 deg C (+/-)	NA	> 30 consecutive measurements within 0.01 units of one another
Temperature, Water (deg C)	Suspect	> 25 deg C or < -0.1 deg C	>= 1 deg C (+/-)	>= 3 standard deviations within 25 hours	> 20 consecutive measurements within 0.01 units of one another
Temperature, Air (deg C)	Fail	> 38 deg C or < -25 deg C	>= 10 deg C (+/-)	NA	> 20 consecutive measurements within 0.01 units of one another
Temperature, Air (deg C)	Suspect	> 35 deg C or < -23 deg C	>= 8 deg C (+/-)	>= 3 standard deviations within 25 hours	> 15 consecutive measurements within 0.01 units of one another

Overall flags by parameter