Data Quality Assurance (QA) Procedures for:

- **Side Channels**
- **Processing Multiple Wetted Polygons**
- **Directly Uploading Topographic Files and Photos to cm.org**

2016 Field Season

Columbia Habitat Monitoring Program

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Part 1: Review of Topographic Data: Side Channels

In 2014, CHaMP modified how side channels are delineated during topographic post-processing by adding a multi-threaded centerline in the main channel and all qualifying wetted side channels. The objective of this document is to outline the steps used to check the accuracy of side channel delineation within the topographic survey.

Step 1: Identify Sites with Side Channels

Any CHaMP defined qualifying side channel (≥ bankfull elevation for a length ≥ the average bankfull width) identified in the field should have been attributed with a unique segment number. To identify sites with side channels:

1) On champmonitoring.org, go to your Watershed's home page and select the Measurements tab.

2) From the Measurements tab under the Measurement Type dropdown, select Channel Segment.

3) Sort the Segment Number Column from high to low or filter by Segment Number "2". This will give you a list of all sites with a side channel (Figure 1). Alternatively you can download the table so you do not have to return to this page.

Figure 1. Channel Segment measurement data on cm.org listing all sites with at least one side channel. The above table is filtered to where "Segment Number" = 2.

Step 2: Check Centerline Delineation for each Side Channel at a Site

If a qualifying side channel (Large or Small) had continuous flow at the time of survey and both the exit and re-entry of the side channel to the main channel or other side channel were contained in the site, the side channel should have a centerline delineated through it.

The most basic and quickest way to check whether a centerline was drawn for each side channel is to check the topographic images that were submitted during post processing. To do this:

1) In cm.org from your Watershed's page, select the Visit tab and click on the site of interest. Note that if you hold down the Ctrl key while clicking on the Site ID, the page will open in a new tab.

2) Select the Measurements tab and then the Topographic Data tab.

3) Under the RBT Images heading, download and view the "Center Line" or "Long Lines" image (Figure 2). Note that the Long Lines image may be more helpful because it includes the water depth raster but segments can be obscured by the thalweg.
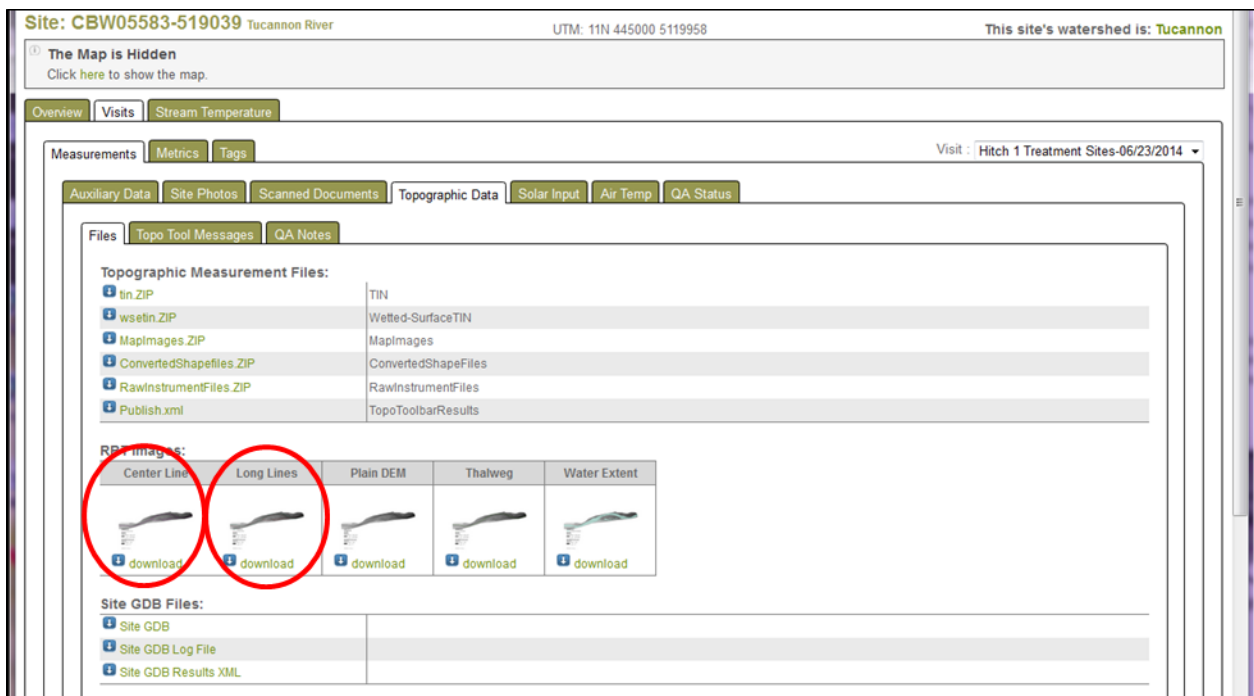
Figure 2. Location of Center Line and Long Lines images used to quickly assess segment centerline delineations at a site.

4) Check first to see that the "Main Channel" centerline runs the entire length of the site and that the number of segments delineated in GIS equals the number of segments identified in the field (Figure 3). Figure 3 shows 4 centerlines. One representing the main channel and three others representing large or small side channel centerlines. These four centerlines match up with the four segments recorded in the auxiliary data which are summarized in the Channel Segment table.
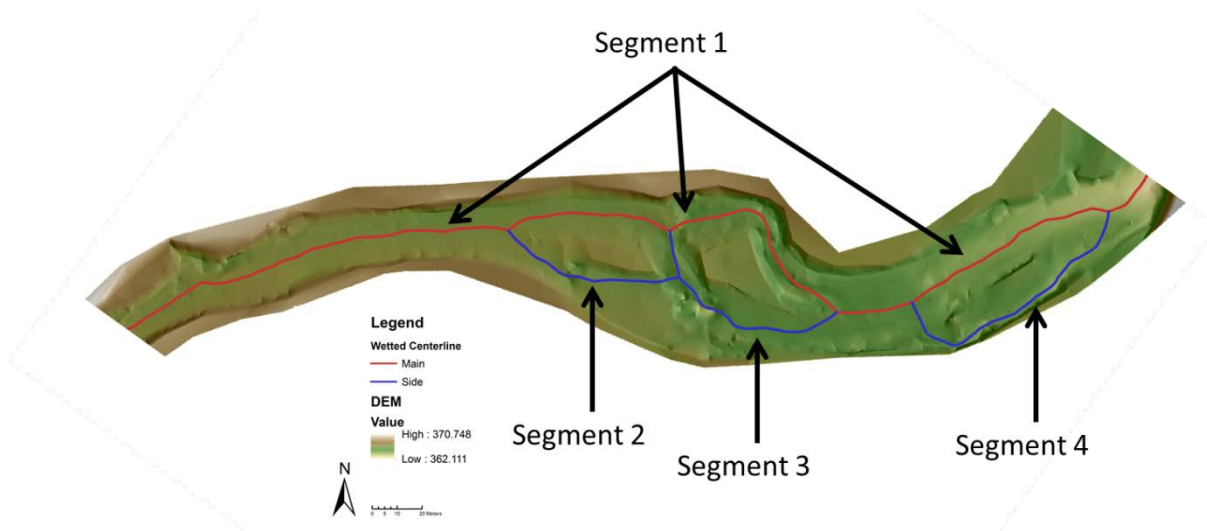
SiteID	Sample Date	Visit ID	Measure #	Crew	Visit Phase	Visit Status	Stream Name	Panel	Channel Segment ID	Segme Numbe	Segment Type	Is Continuous Wet?	Side Channel Length	Side Channel Width	Percen Wetted
051				T		▼		▼				▼			
CBW05583-05165	08/12/201	2999	1932713	Tucannon Cr	Data Collecti	Post Processi	Tucannon River	Rotating Panel 2	1	1	Main Channel	Yes - Continu	-	-	
CBW05583-05165	08/12/201	2999	1932713	Tucannon Cr	Data Collecti	Post Processi	Tucannon River	Rotating Panel 2	2	2	Small Side Channel	Yes - Continu	28.0 m	2.5 m	1
CBW05583-05165	08/12/201	2999	1932713	Tucannon Cr	Data Collecti	Post Processi	Tucannon River	Rotating Panel 2	3	3	Large Side Channel	Yes - Continu	-	-	
CBW05583-05165	08/12/201	2999	1932713	Tucannon Cr	Data Collecti	Post Processi	Tucannon River	Rotating Panel 2	4	4	Small Side Channel	Yes - Continu	78.5 m	3.5 m	1

Figure 3. Center Line image and corresponding segment numbers from the Channel Segment Measurement Type from cm.org.

The RBT cannot delineate centerlines through non-wetted areas. If a centerline is missing, check the Channel Segment table. If the segment is a Large Side Channel, there should be a centerline through it (unless it meets the criterial in Example 1 below). If the side channel is a Small Side Channel and "Is Continuously Wet?" = No (Partially Wet or Dry), no centerline is likely to exist.

Where to Expect Missing Centerlines
Centerlines should have been delineated for each unique channel segment number at a site. There are some limitations with how the RBT can delineate complex centerlines, which are discussed in the following examples.

Example 1: Side Channel Does Not Form Complete Island Within Site Boundary
Currently, the RBT can only delineate centerlines around qualifying islands that are complete "donuts" contained within the site (e.g., water flows all around island, as seen in the previous image). **Side channels that do not BOTH begin and end within the surveyed area will not have centerlines. There are some rare exceptions where the RBT delineated centerlines in these channels but in a majority of these sites, no centerline will exist in the side channel. Crew members are strongly discouraged to hand delineate centerlines in these situations.**

Figure 4 shows a site where there are two segments. Segment 1 = Main Channel, Segment 2 = Small Side Channel (Continuously Wetted = Yes). No centerline will be delineated down Segment 2 because the channel does not exit the Main Channel within the site boundary.
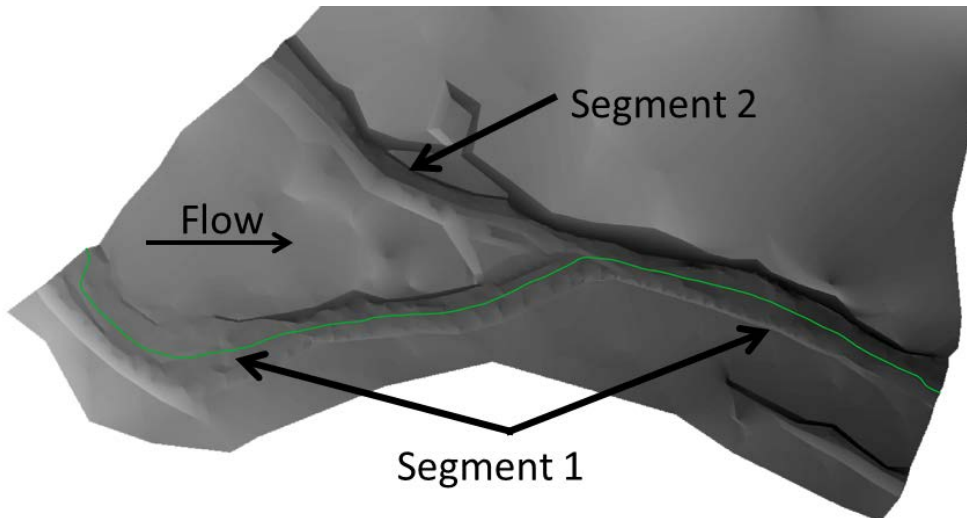
Figure 4. Only the Main Channel centerline will be delineated when a qualifying side channel does not form a complete wetted "donut" at the top or bottom of a site.

Example 2. Small Side Channel Is Not Continuously Wetted

A <u>wetted</u> centerline will not be delineated within a Small Side Channel that is "Partially Wet" or "Dry". Figure 5 shows a site where there are two Segments. Segment 1 = Main Channel, Segment 2 = Small Side Channel (Is Continuously Wet? = No – Partially Wet). No centerline will be delineated down Segment 2 because it is not continuously wet and therefore does not create a full island or "donut" (e.g., island is now considered a peninsula). Note that a centerline will likely be drawn down the side channel for the bankfull centerline delineation.
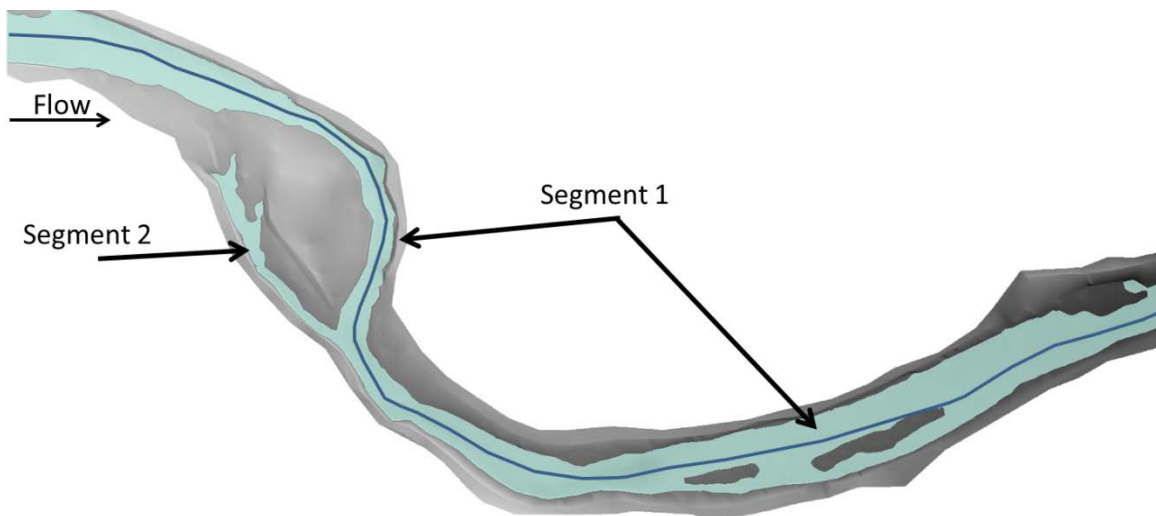
Figure 5. No centerline within Segment 2 (Small Side Channel) will be delineated since the side channel is "Partially Wet".

Special Cases

Special cases: In some cases, getting metric output for 'missing' side channels may be critical. If this is the case for your visit, please contact carol@southforkresearch.org for additional instruction on conducting additional post processing of these sites.

If the number of centerline splits doesn't equal the number of segments at a site, keep track of the visit number and which of the scenarios it falls under. Instructions to repair these are listed in Step 3:

Scenarios:

a) Number of centerline splits equals the number of segments at the site: It's all good, carry on with QA

b) Site has fewer centerlines than segments: continue to Step 3.

c) Site has more centerlines than segments: continue to Step 3.

Step 3: Troubleshooting Missing or Additional Centerlines

If the review of images against sites that should have side channels identifies sites with more or fewer centerlines than expected, you'll need to troubleshoot these in the original 2015 Survey Geodatabase that was created during Topo Process. These can be downloaded from the cm.org from the Data Upload page.

Note that **ALL** Large Side Channels should have a centerline through them unless they meet Example 1 listed above.

Survey Has Fewer Centerline Features than Channel Segments

If during the review of a site the number of centerlines is less than the number of segments and neither of the two examples above apply, further investigation is needed. The following scenarios outline potential explanations regarding why there may be fewer centerlines than Segments.

Example 1. Side Channel Not Filled In with Water

Even if a Small Side Channel is continuously wet throughout its course ("Is Continuously Wet?" = Yes), it may not have been captured effectively with the topographic survey. When this happens, dry spots may appear along the course of the side channel or there may not be any water in the side channel at all. In Figure 6 below, the entrance to the Small Side Channel (Segment 3) was not surveyed to the level of detail required to capture this feature, so the channel entrance does not fill in with water. Therefore, a centerline was not delineated through the side channel because it would cross dry land. Note that we know it is a side because the island was correctly captured with *mw* points.
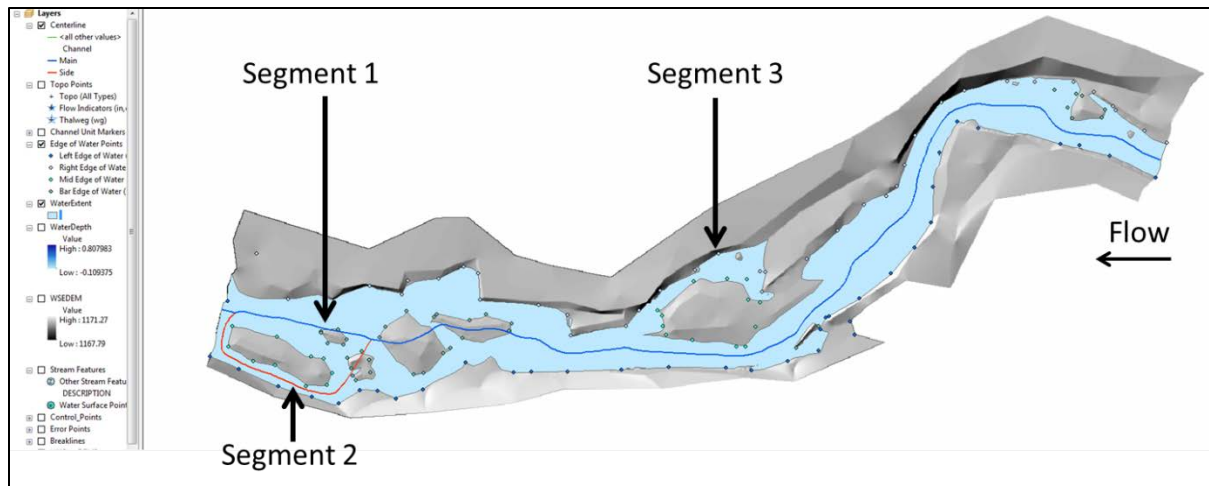
Figure 6. Segment 3 (Small Side Channel) does not have a centerline even though it was "Continuously Wetted" due to a lack of topographic detail where it exits the main channel.

Possible Solutions:

1) Test using the slider to raise the water level to see if the side channel fills in. Be cautious and make sure that you are not raising the water level to a stage that only fits a localized area in detriment to the overall site. It is better to leave the side channel as it is rather than to raise the water level to a point that does not represent the stage at which sampling occurred.

2) Look at the Topographic TIN and assess if the TIN accurately represents the stream topography at the side channel entrance or exit. Look for artificially high TIN facets or artificial dams that may be blocking the flow of water (depth of channel). Use TIN Editing as needed to more accurately define the channel. Then recreate the DEM, Detrended DEM and run the Stage Slider Tool to create a new wetted polygon. New cross-sections and centerlines will likely also need to be delineated.

If the topography seems ok, do not modify the TIN beyond repairing artificial features.

3) If the stage slider still does not produce a wetted polygon that reflects the field conditions, you may manually edit this feature so it accurately reflects the conditions encountered in the field.

Example 2. Island Classified Incorrectly
The perimeter of all qualifying islands completely surrounded by water should have received an *mw* code when surveyed in the field. If this was done correctly, the island should have been automatically identified as a qualifying island during post-processing and a centerline drawn down the side channel and main channel (again, with the exceptions listed above). There are a few possible errors that can occur:

1) If *mw* codes were not used when surveying the perimeter of a qualifying island, the toolbar would not classify the island as qualifying during post-processing and there will not be a

centerline down the side channel unless crew member manually identified island as qualifying during post-processing.

2) If the stage of the water extent was high enough to exclude all of the mw points outside of the island polygon, then the toolbar would not classify the island as qualifying during post-processing, there will not be a centerline down the side channel. The processing crew should have manually designated the island as qualifying using the island tool during post-processing.

3) Likewise, if *mw* codes were used when surveying the perimeter of the qualifying island but during post-processing the user manually designated the qualifying island as non-qualifying, then a centerline will not be drawn down the side channel.

In Figure 7 below, the rodperson forgot to use *mw* point codes (used *br* codes instead) along the perimeter of the island. They did not notice this in post-processing and did not designate feature as a qualifying island using the toolbar so the island was left as non-qualifying. Therefore, no centerline was delineated down the side channel.

Solution(s):

1) Change *br* codes to *mw* codes and rerun all of the steps in the Centerline Tool. **Check to make sure the islands are correctly designated.** Resubmit GDB.

2) Manually designate island as qualifying side channel using the toolbar and rerun the Generate Centerline step in the Centerline Tool. Rerun the Cross-Section tool and resubmit GDB.
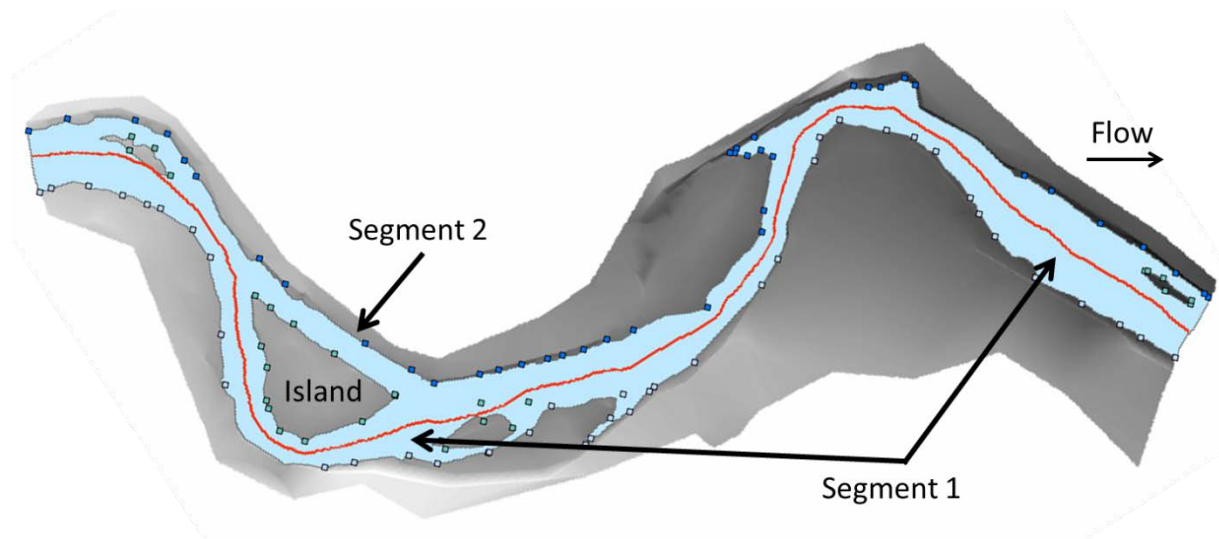
Figure 7. Incorrect use of *br* points around qualifying island (instead of *mw* points) resulting in island being designated as non-qualifying during post-processing.

Site Has More Centerlines than Segments

If during the review of a site the number of centerlines is more than the number of segments and none of the examples above apply, further investigation is needed. The following scenarios outline potential explanations regarding why there may be more centerlines than segment numbers.

Example 1. Island Classified Incorrectly

The most common reason that too many centerlines are at a site is due to misclassifying non-qualifying islands as qualifying. Check to make sure islands have been correctly designated as qualifying or non-qualifying. The centerline tool will draw centerlines around each island designated as "qualifying".

At complicated sites with many small non-qualifying islands, even when *mw* points were surveyed correctly and qualifying islands were designated correctly, the RBT may create additional centerlines around these small features. In Figure 8 below, the centerlines split around many small features in this complex area of stream. In this case a few very small islands were incorrectly designated as qualifying by the RBT (or user). These can be seen in the Wetted Extent Island attribute table.
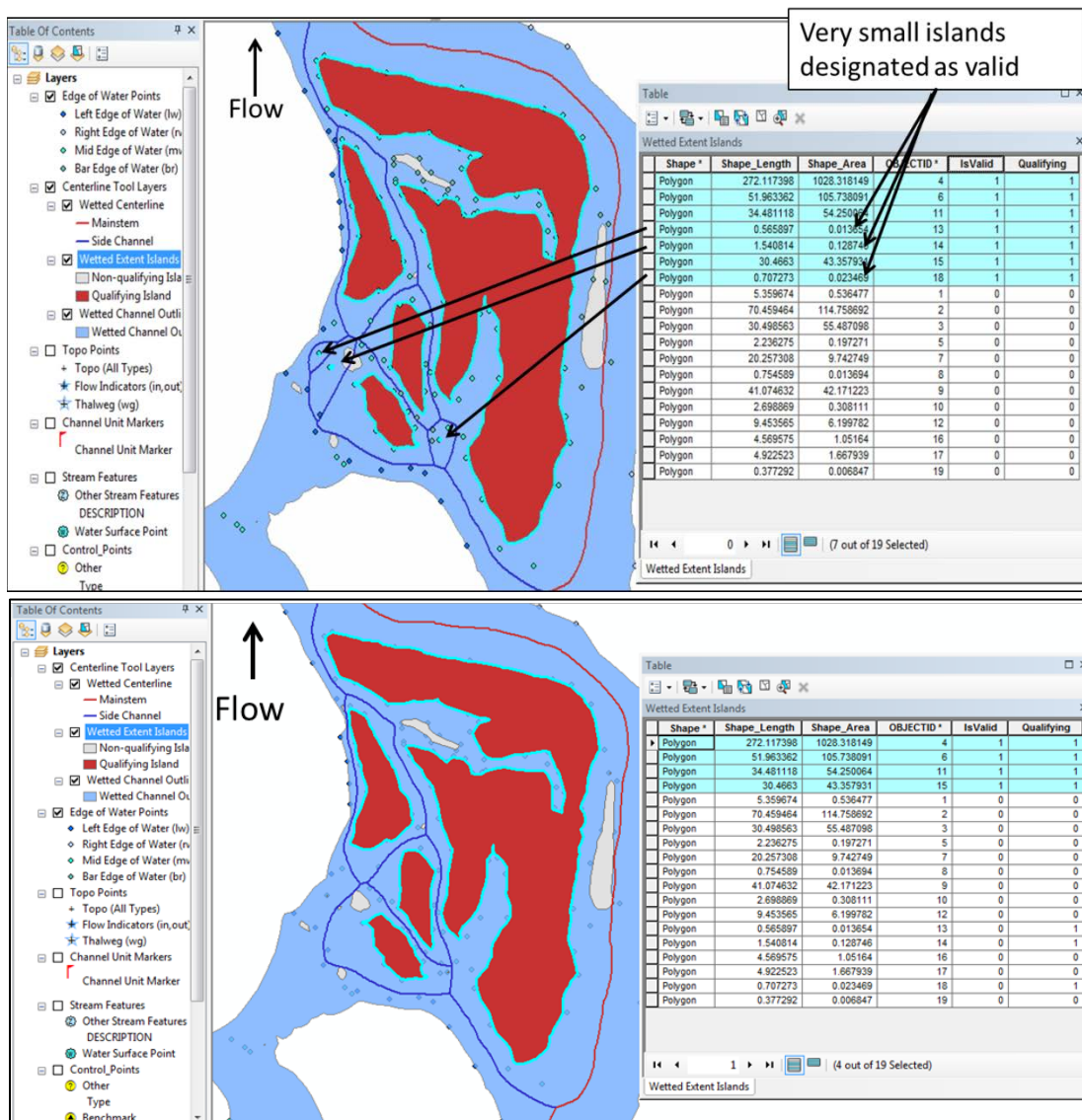

Figure 8. Small islands incorrectly designated as qualifying by RBT or user during post-processing (top) and correct island designation and centerline delineation (bottom) after reclassification of qualifying islands.

Solution: Designate these features as non-qualifying using the Centerline Tool or change their designation to invalid (= 0) in the attribute table. The lower panel in Figure 8 shows how the centerline should look for this complex section of stream.

Step 4. Review Bankfull Centerline Delineations

It is best to review bankfull centerlines at the same time as wetted centerline review. Note that there aren't any images available that display bankfull centerlines so all reviews must be completed while looking at the Geodatabase.

The number of bankfull centerlines at a site should equal the number of wetted centerlines at a site. Below are common examples that may lead to differences in the number of bankfull centerlines compared to the number of wetted centerlines.

Possible solutions for any of the scenarios below include checking to see that the bankfull stage has been correctly identified, there are no artificial dams in the TIN, and that the WSETIN has also been delineated correctly. If issues are identified, redo bankfull slider toolbar and adjust fit. Do not adjust fit at the detriment to the bankfull stage as a whole. Create new bankfull polygon, bankfull centerlines, and cross-sections.

Fewer Wetted Centerlines than Bankfull Centerlines

1) Partially wet or dry side channel filled in at bankfull – This scenario is the most common cause of having more bankfull centerlines than wetted centerlines. Even if a wetted centerline is not delineated through a partially wet or dry side channel, a centerline should be delineated through this feature at the bankfull stage (Figure 9).
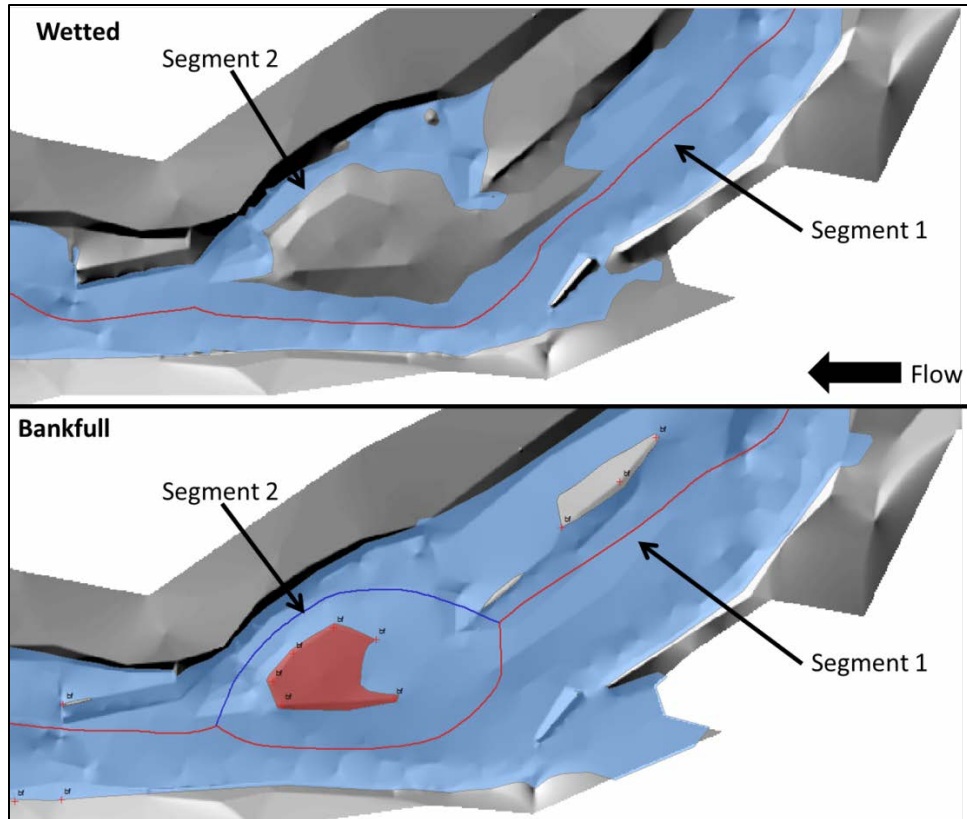
Figure 9. Centerline delineation at bankfull when a centerline cannot be delineated through a partiall
wet or dry wetted side channel.

2) Island at top/bottom of site fills in at bankfull – As mentioned above, if there is an island at the top
or bottom of site that does not form a complete donut then no centerline will be delineated. It is
possible to have an island at the top/bottom of site that does not form a donut at the time of sampling
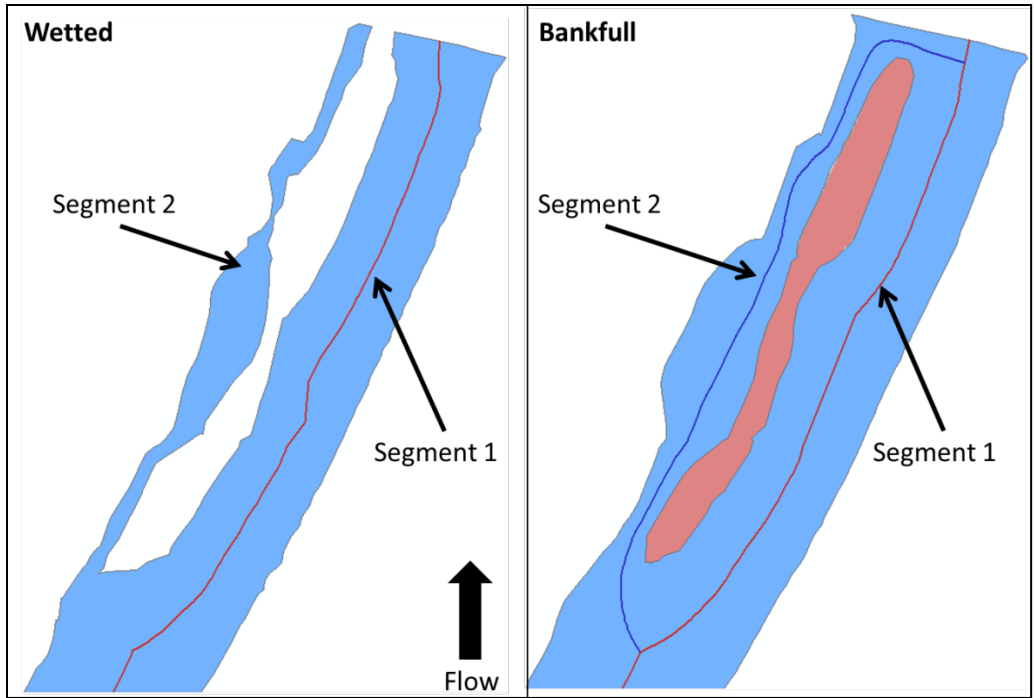but does at the bankfull stage (Figure 10).

Figure 10. Bankfull centerline delineation where island at top or bottom of site fills in at bankfull stage.

3) Single island feature becomes two features at bankfull – At times, a single island feature identified in the field as being above bankfull may become two separate features during post-processing (Figure 11). If this is the case, the newly created centerline that cuts island in half should be deleted.
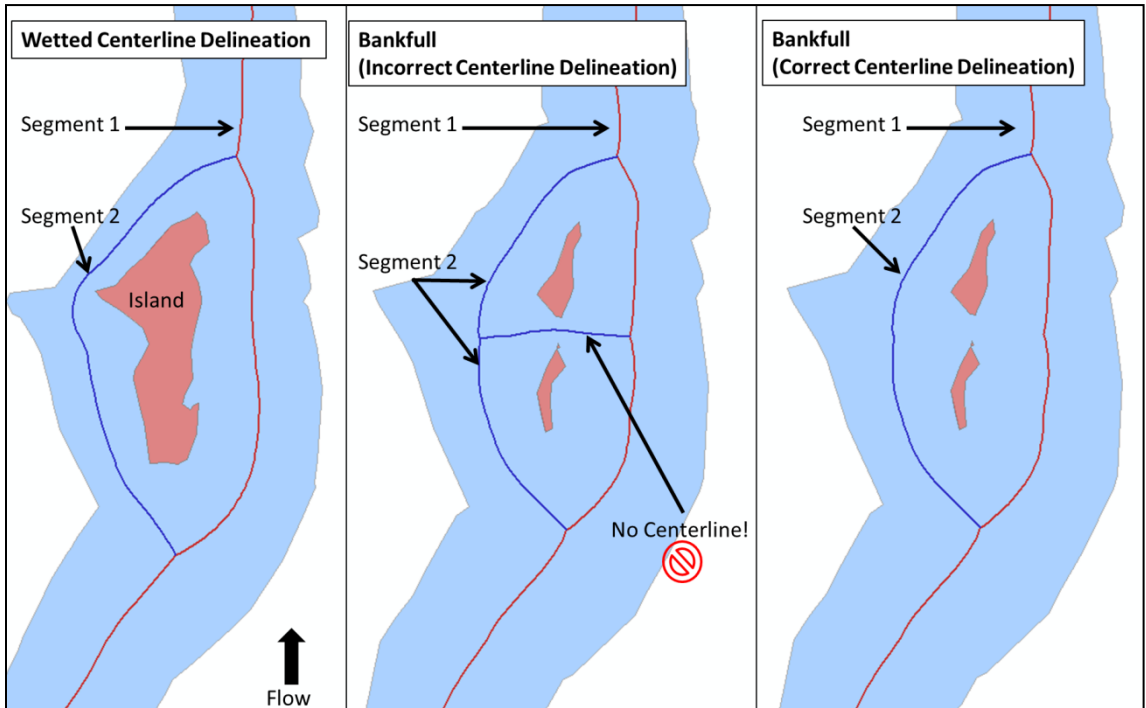
Figure 11. Bankfull centerline delineation for single feature islands identified in the field that become two features at the bankfull stage during post-processing. These features should not have a centerline delineated between them.

4) **Delineation around any small feature or non-qualifying island –** Double check to see if any bankfull centerlines were delineated around boulders or non-qualifying islands (bars). For these scenarios, reclassify islands and rerun cross-section tool.

More wetted centerlines than bankfull centerlines

As mentioned above, the number of wetted centerlines should equal the number of bankfull centerlines. There are scenarios though when the number of wetted centerlines is more than the number of bankfull centerlines.

1) **Island floods at bankfull stage -** The most common scenario where the number of wetted centerlines will be greater than the number of bankfull centerlines is when an island identified in the field gets flooded over at the bankfull stage during post-processing (Figure 12).
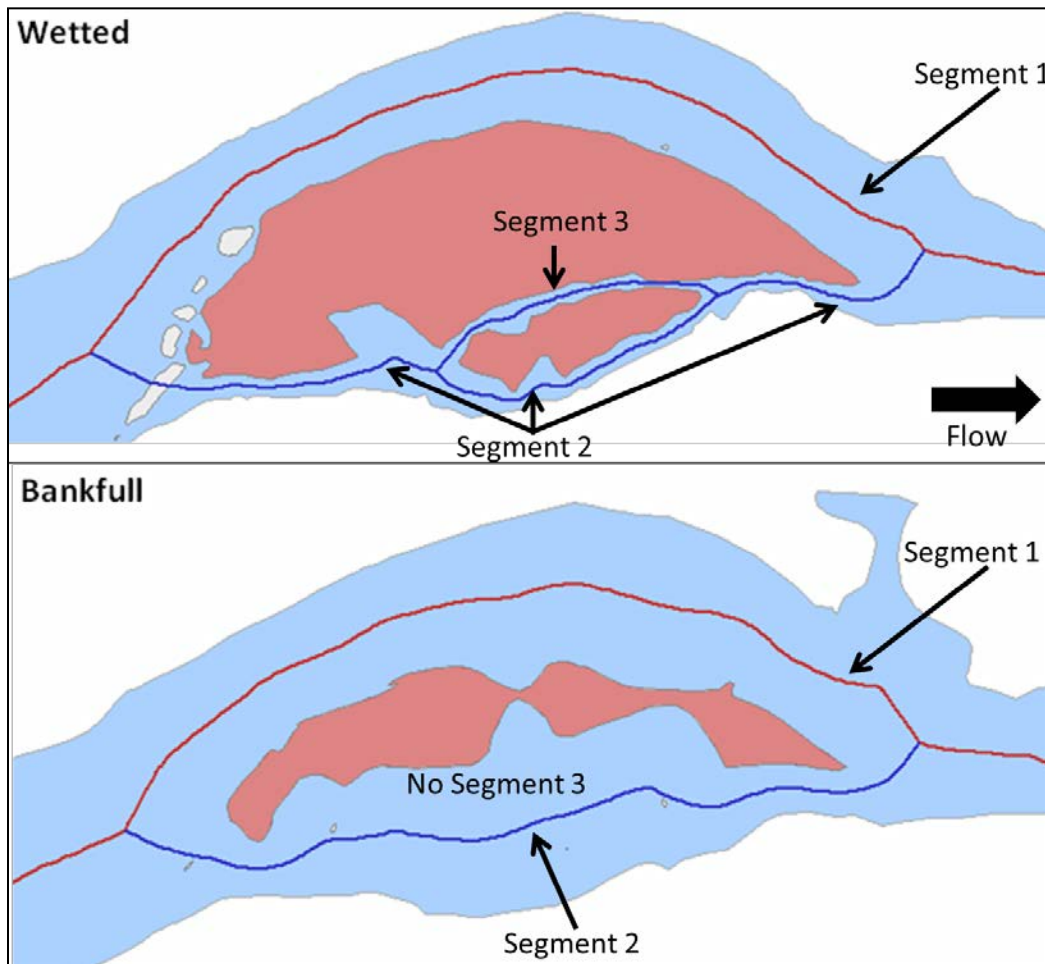
Figure 12. There are fewer bankfull centerlines compared to wetted centerlines do to the flooding of an island at bankfull stage. In this scenario, only one side channel centerline will be retained.

Step 5. Check That Proper Main Channel and Side Channel Centerlines Are Designated

The Centerline Tool differentiates the main channel from all side channel centerlines. Check to see that the main channel is designated correctly by either visually observing the color of the line compared to side channel centerlines (this is an output of the toolbar and images) or opening up the attribute table of the Wetted Centerline feature class and highlighting all channels labeled "Main". The Main Channel centerline should be continuous throughout the site and go through the same channel as the thalweg that was delineated during post-processing.

In Figure 13, the main channel centerline designation is correct at the top and bottom of a site but incorrectly designated as a side channel in the middle of the site.
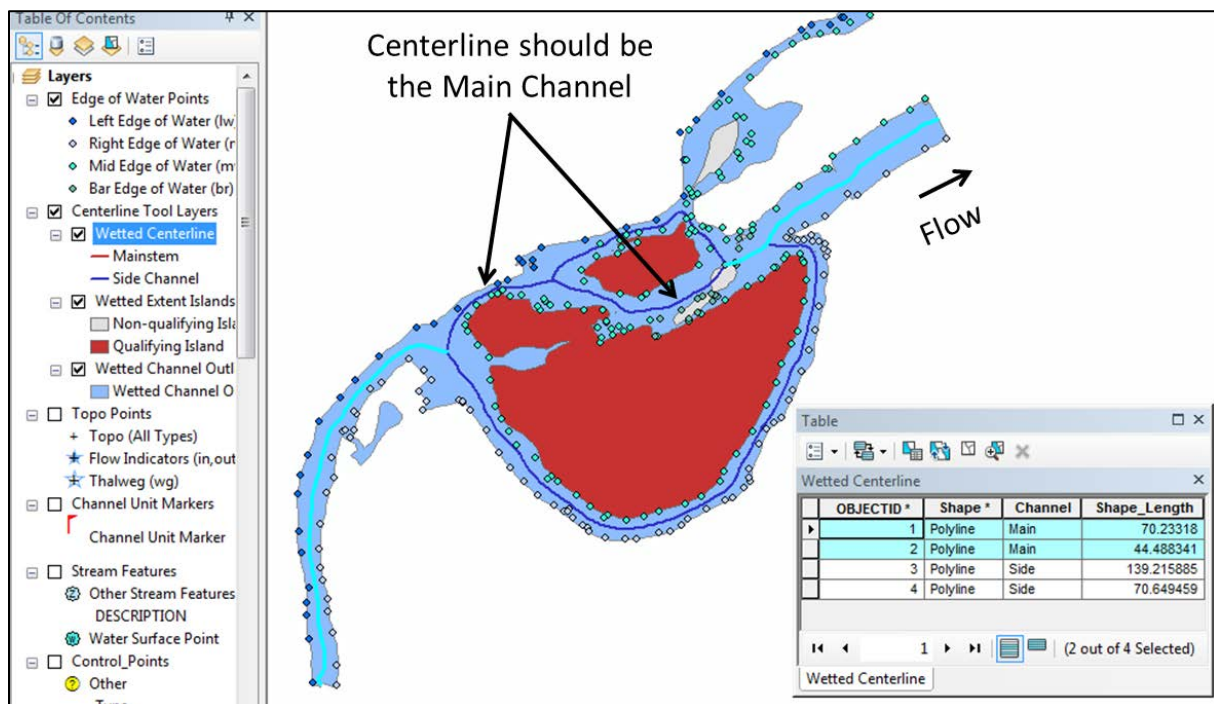

Figure 13. Incorrect designation of Main Channel centerline as a Side Channel.

Step 6: Check Cross-Sections at Side Channel Junctions

Cross-sections are generated perpendicular to both the Main Channel centerline and all side channel centerlines. Check to see if any cross-sections that are part of a side channel centerline extend into the main channel. This often occurs at locations where the side channel centerline splits off of the main channel centerline.

If a cross-section stemming from a side channel centerline extends into the main channel, make that cross-section invalid. Conversely, if any main channel centerline extends an inappropriate distance into a side channel, make that cross-section invalid. Figure 14 below provides an illustration of how cross-sections should be designated near main/side channel junctions.
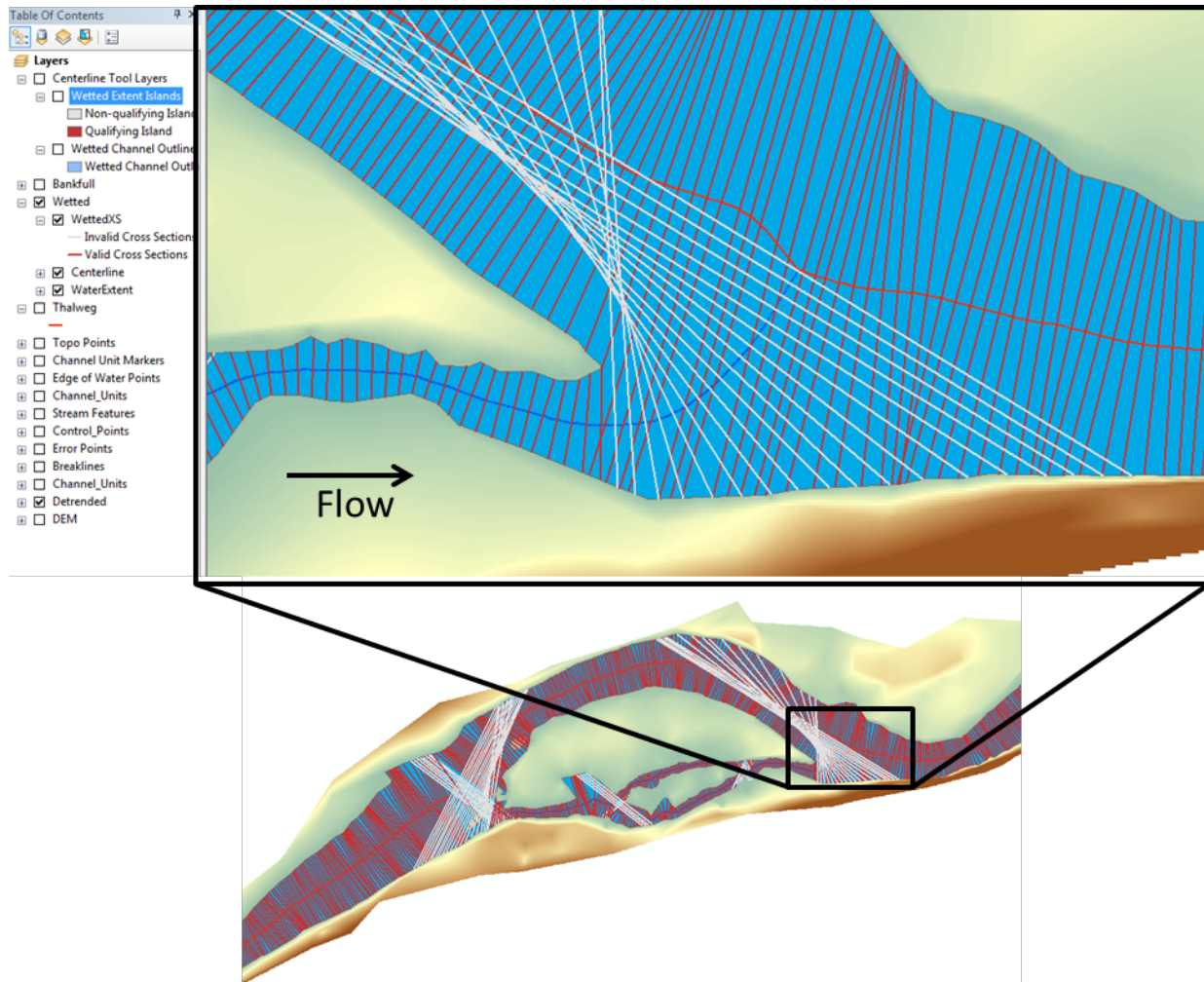
Figure 14. Correct procedure for invalidating cross-sections from side channels that extend into the main channel near side channel junctions.

Step 7: Check Channel Unit Delineations

Channel Unit Miss-Classification or Digitization

If channel unit classification names were joined to the channel unit attribute table in GIS, open the attribute table. If not, under the Measurements tab, navigate to the Channel Unit table for a particular site. With this information, check to see that channel units were delineated in the correct segment.

It is also very useful to consult with the site maps for proper channel unit delineation and side channel designation.

Example 1. Incorrect Side Channel Unit Delineation

In Figure 15, the Segment 2 centerline was delineated correctly but Channel Unit 2 which is in Segment 2 spans both the main channel and the side channel. The same channel unit cannot be in two different segments. The boundary for both unit 1 and 2 was not delineated correctly.
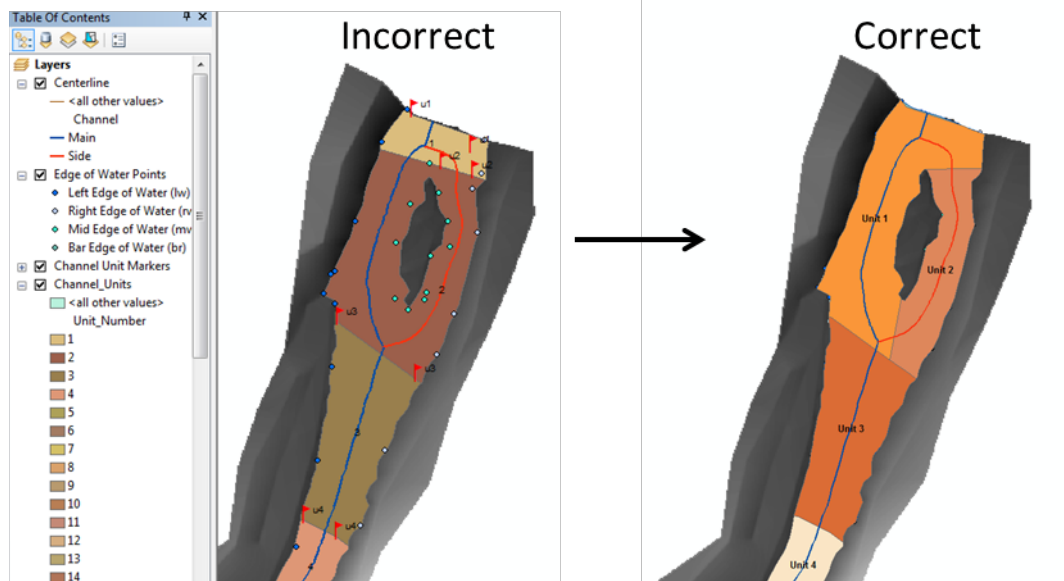
Figure 15. Incorrect and correct channel unit delineation on either side of qualifying island.

Step 8: Document Repair in QA Status/Notes Page of Topographic Data Page

Since updates to RBT are ongoing, we strongly suggest noting which surveys have EXPECTED missing side channels, as described in Step 2. These visits may be reprocessed in the future if updates to RBT are made to accommodate these scenarios. Note that the visit will still pass QA and promotion with 'missing' side channels.

Summary

Use the above examples as guidance for validating centerline delineations and designations as well as cross-section and channel unit delineations. These examples may not be the exact same scenario as your situation but should help you make decisions about what the proper results should (and should not) look like.

It is strongly encouraged that you use all lines of evidence available to you while conducting side channel quality assurance. Useful resources include site maps, measurement tables, site photos, and of course, crew members. If you run into any unique problem or need assistance, please contact Kelly at kelly@southforkresearch.org or Carol at carol@southforkresearch.org.

Part 2: Processing Multiple Wetted Polygons in the CHaMP Topo Toolbar

Since the 2015 CHaMP field season, multiple wetted polygon features were allowed in addition to the main wetted polygon that defines the primary wetted channel. This allows the topographic survey to preserve other wetted areas within the bankfull channel for inclusion in a few metric calculations (i.e. wetted area, wetted volume bankfull area, and bankfull volume). Although allowance of multiple wetted polygons in CHaMP surveys can facilitate processing of partially dry sites, site sampling criteria as described in the CHaMP protocol still apply.

Here we describe the criteria that must be met in order to successfully process a survey through the 2015 CHaMP Topo Toolbar and RBT 2015.

Rules for Features

WaterExtent Polygon Feature Class

There are several structural changes to the Water Extent Polygon feature class. If the 2015 Topo Toolbar is used to generate the Water Extent Polygon then these conditions will be handled when the feature class is generated. If a survey was processed by a 2011-2014 Toolbar, these conditions must be manually reviewed and updated OR a new Water Extent polygon can be generated using the 2015 Toolbar.

- Must contain a text field (length 50) in the attribute table named "ExtentType".
- Must be in the "Projected" feature dataset in the Survey GDB.
- Should not be Z or M enabled or contain multipart features.

Main Wetted Polygon

- The survey **MUST** contain <u>one</u> (and only one) main continuous wetted polygon feature that runs through the entire site, top to bottom.
- The Main Wetted Polygon must contain the attribute "Channel" in the "ExtentType" field in the attribute table. Only one polygon feature should have this attribute.
- The Main Wetted Polygon should contain all side channels that were wetted at the time of the survey. Dry Side channels can be outside of the Main Wetted Polygon if they were dry during the survey.
- Remove tiny holes (area < 0.5 m^2). Other dry patches can remain as non-qualifying islands (in WIslands Feature class). The Topo Toolbar should generally take care of these, but if you notice them, remove them.
- The Main Wetted Polygon should contain the In/Out points, thalweg, appropriate number of centerlines, cross sections, etc.
- Most, if not all, of the area of the Main Wetted Polygon should have a corresponding channel unit polygon, i.e. the channel units feature class should cover the Main Wetted Polygon.

Other (non-Main) Wetted Polygons

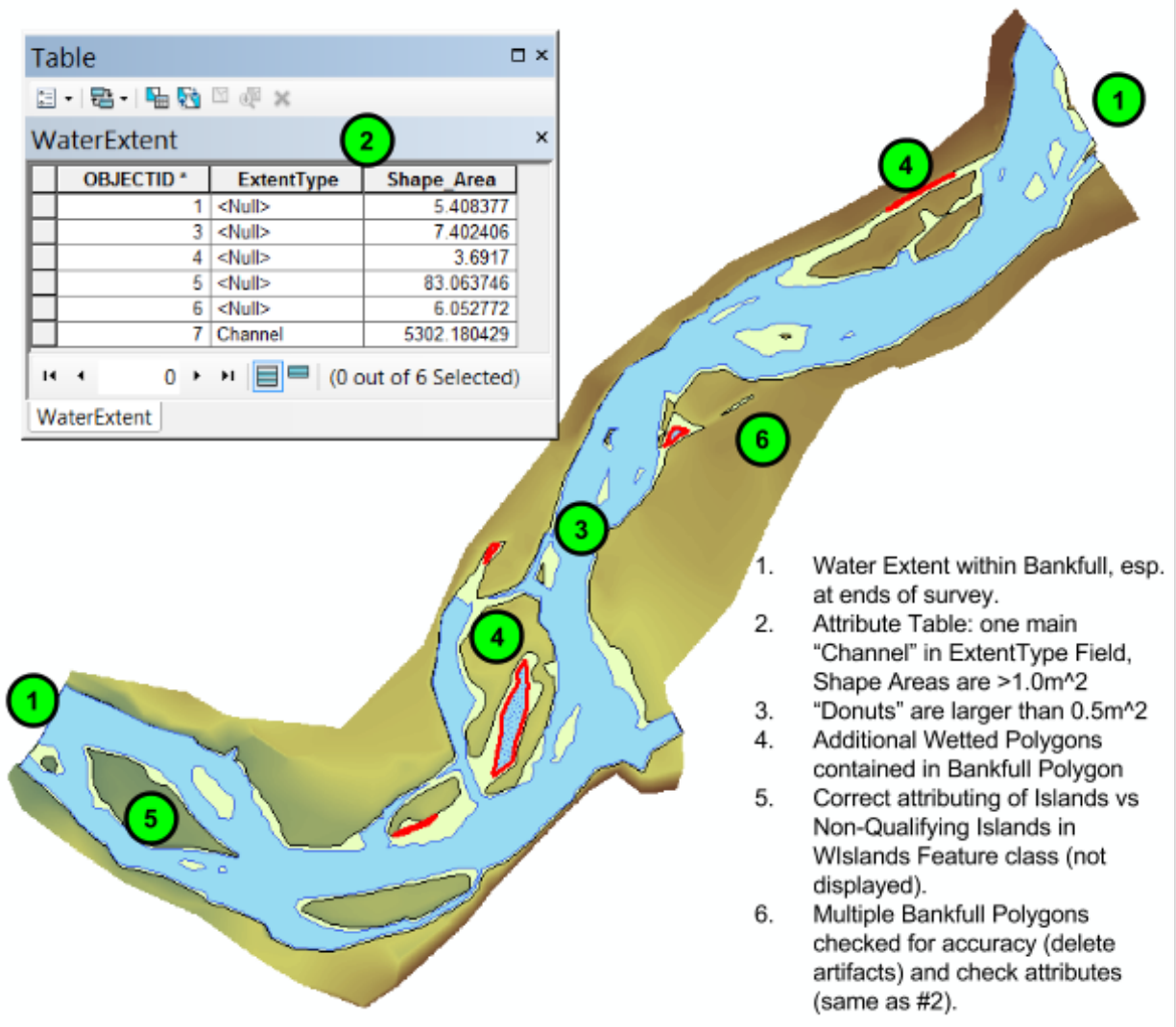- All non-main wetted polygon features must be completely within the Bankfull Polygon(s)

- Each non-main wetted polygon feature should have a value of NULL' (aka be blank) in the "ExtentType" field in the attribute table. NULL is the default value when the feature class is generated by the Topo Toolbar.
- All non-main wetted polygon features with an area <1.0 m^2 should be deleted.
- Non-main wetted polygon features should not contain in/out points, thalweg, centerlines, or cross sections.
- Non-main wetted polygons may contain dry patches, but these should not have corresponding features in the Wetted Island Feature class
- Channel units are generally not associated with non-main wetted polygons unless they are part of a partially wet small side channel. Channel units outside of the main wetted polygon feature will not be included in any metric derived from centerlines or cross sections (these features only exist in the wetted main polygon feature).

Bankfull Polygon

- Each Survey should contain **One and Only One** Main Bankfull Polygon, with the "ExtentType" attribute of "Channel".
- Multiple Bankfull Polygons are permitted, however all additional bankfull polygons should be checked for accuracy: Please remove any artificial polygons that do not represent the true bankfull extent.
- All wetted polygons (main and non-main) must be contained within the bankfull polygon extent.
  - Any Portion of a wetted polygon area that falls outside the bankfull polygon will trigger a validation error and must be manually edited to correct this.
  - Sometimes this error is difficult to troubleshoot. Check the top/bottom of the survey, as well as Islands for places where the wetted polygon might cut outside of the bankfull polygon.
  - Ideally, the Main Wetted Polygon should be within Main Bankfull Polygon.

Example

The following figure illustrates a valid Multiple Wetted/Bankfull Polygon survey arrangement, with descriptions on why each part of the survey is valid. Use this figure as a guide for QA process.

OBJECTID *	ExtentType	Shape_Area
1	<Null>	5.408377
3	<Null>	7.402406
4	<Null>	3.6917
5	<Null>	83.063746
6	<Null>	6.052772
7	Channel	5302.180429

(0 out of 6 Selected)

1. Water Extent within Bankfull, esp. at ends of survey.
2. Attribute Table: one main "Channel" in ExtentType Field, Shape Areas are >1.0m^2
3. "Donuts" are larger than 0.5m^2
4. Additional Wetted Polygons contained in Bankfull Polygon
5. Correct attributing of Islands vs Non-Qualifying Islands in WIslands Feature class (not displayed).
6. Multiple Bankfull Polygons checked for accuracy (delete artifacts) and check attributes (same as #2).

Part 3: Uploading Repaired Topographic Files to cm.org

Step 1. Post-process and Publish Topographic Files

Repair the Topographic Data using CHaMP Topo Tools and ArcGIS as needed. Once your data has passed the Topographic Data Validation, publish* (or republish**) your topographic files to the 6 topo folders.

* If publishing from a location other than the Topo folder generated by the CHaMP Broker, make sure to create a "Published" folder in the same location as the data you are working with.

**If republishing data, make sure the hidden "Published" folder in your Topo folder is empty. If publish

Step 2. Prepare Files for Upload

Topographic files must initially be uploaded using the CHaMP Data Broker. If the topographic files "require attention" or need repairs after the files were initially uploaded via the CHaMP Data Broker, then the modified files can be uploaded directly to the www.CHaMPMonitoring.org.

You will need to compress the six topographic folders (in the Published Folder) into six zip files and then compress those 6 zip files plus the "Publish.xml" into a single zip file for the visit.

a. Compress each of the six folders into separate zip files:
- Survey.gdb (you do not need to rename the survey gdb)
- ConvertedShapefiles
- MapImages,
- RawInstrumentFiles
- tin
- wsetin

b.   Compress those 6 zip files plus the "Publish.xml" into a single zip file for the visit.
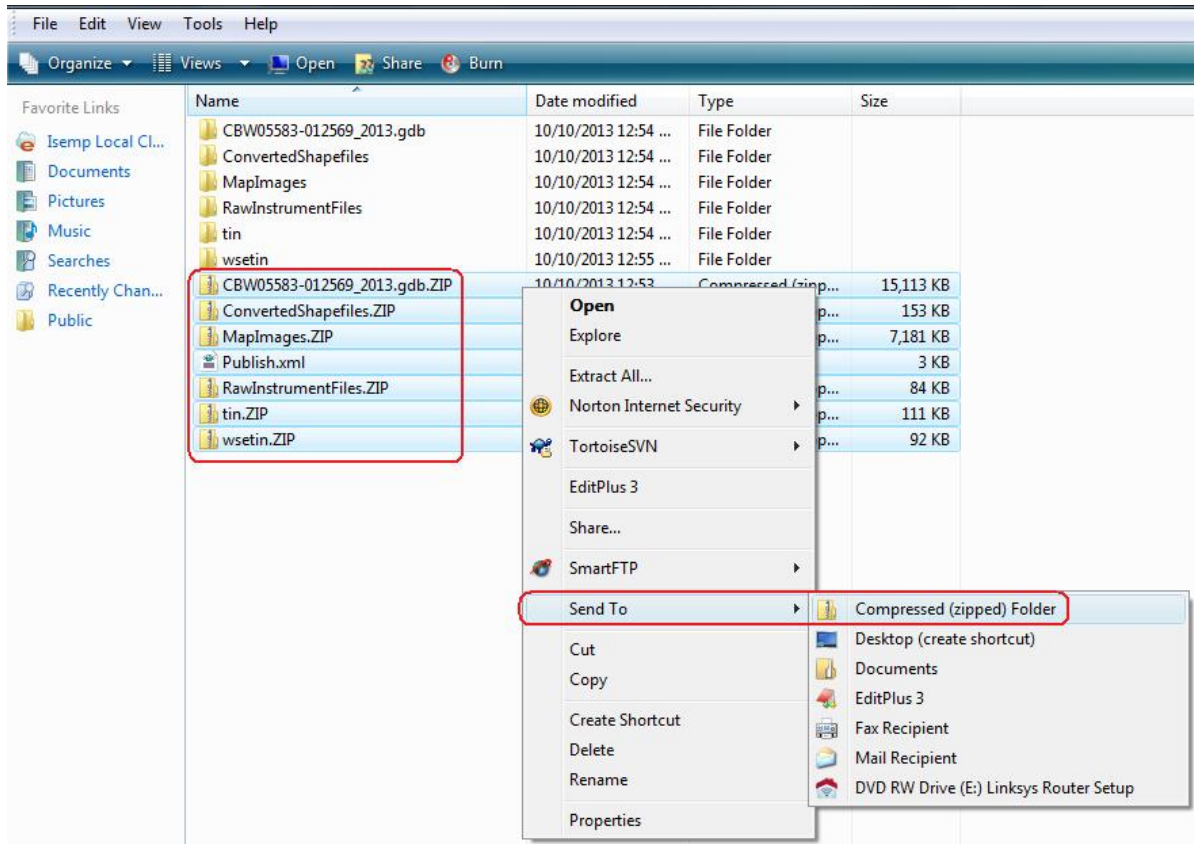
c.   Use the following naming convention for the zip file.

   • Topo_SiteID_VisitID.zip (e.g. "Topo_CBW05583-003113_1519.zip"). Visit IDs are assigned to surveys when data is uploaded from the Data Broker. A Visit ID can be found by reviewing the table on the Visit tab for your watershed and filtering by the survey date and site name (Visit ID is one of the columns in the table).

Step 3. Upload Files to CM.org

a.   Select your watershed from the Watersheds menu and go to Watershed Details Page
b.   Make sure you are in the correct Field Year.
c.   Go to Field Support Tab tab
d.   Go to Data Check-In tab
e.   In the left-most column locate the blue up arrow

f. Click the file upload arrow

g. In the "Upload New Data" Dialog box, select "Topographic Data" from the [Type] dropdown menu
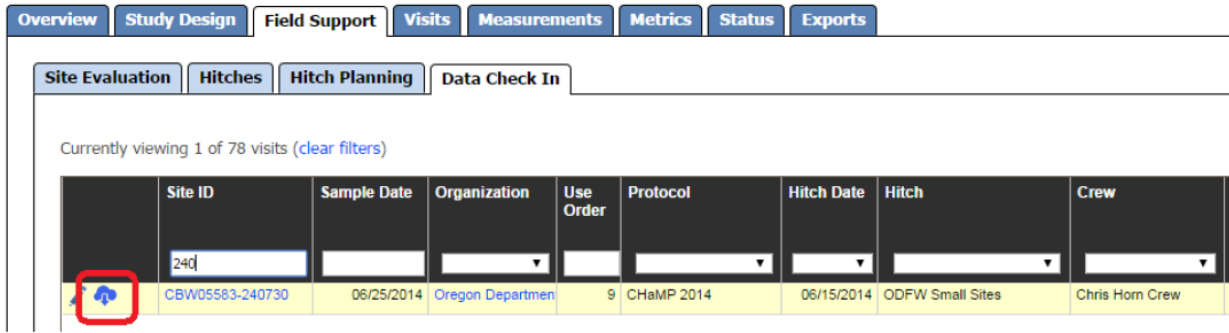
h. Then, click "Choose File", browse to the zip file, and click open.

i. Review the summary of the files to be uploaded.

j. Then, click the Process button.

k. Files will be uploaded and processed in approximately two hours.

Part 4: Uploading Site Photos to cm.org

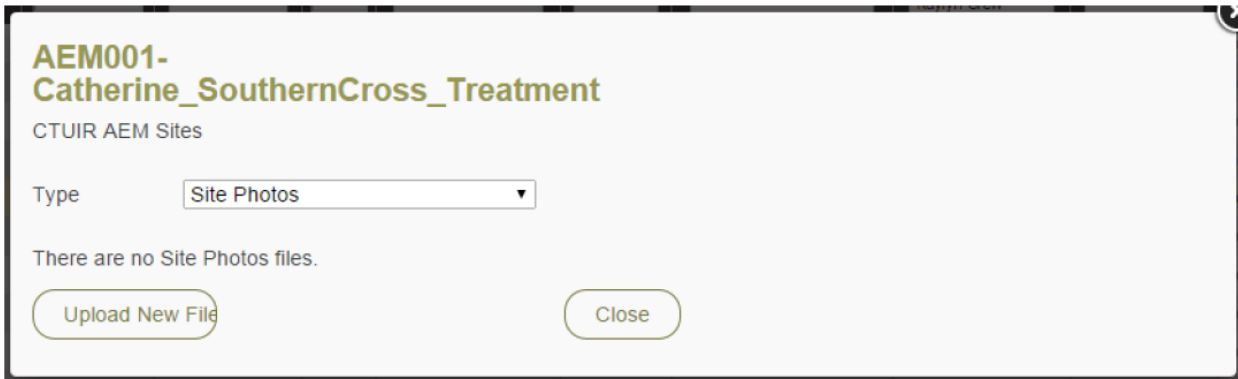Step 1. Compress all .jpeg images into a single zip file for a visit

Step 2. From the "Data Check In" tab, click the blue cloud upload icon for your visit

Step 3. From the popup window, select "Site Photos" from the Type dropdown

Step 4: Select the "Upload New File" button.

- You will be asked to upload a new zip file of the replacement images.