

General Tips:

- Always turn off the ArcMap Editors (Vector or TIN) when finished editing layers before running any tool.
- File Naming best practices for CHaMP:
 - **ONLY USE** underscores “_”, letters and numbers in file names.
 - Do **NOT** start file folder or site names with a number.
 - Keep filenames short and concise.

GIS Setup:

1. Before opening ArcGIS, install CHaMP Topo Processing Toolbar from <http://champtools.northarrowresearch.com>.
2. Open ArcGIS, start a new map document (.mxd) and save it in the Topo folder listed above, using the following naming convention: `sitename_date_crew_total_station`
3. Turn on CHaMP Topo Processing, 3D Analyst, Editor, TIN Editing and Snapping toolbars (Customize/Toolbars).

Instructions to download NAIP imagery

The USDA's National Agriculture Imagery Program (NAIP) provides semi-annual updates of high-resolution (1 to 2 meter) aerial imagery, which can be downloaded and used in ArcMap as a base layer for coordinate transformation, or for general reference. Three-band NAIP imagery is available for free download from the USDA National Resource Conservation Service (NRCS). The imagery is organized by year > state > county.

1. Go to the USDA NRCS Direct Download page: https://gdg.sc.egov.usda.gov/GDGHome_DirectDownload.aspx
2. Click on the link: **2003 - 2016 National Ag. Imagery Program Count Mosaic**
3. Click the year folder (2016 is only available for some states/counties). Please take note that all county FIPS codes are provided in a PDF file in this folder, called **NAIP File Name.pdf**.
4. Within the year folder, click the state abbreviation (note: NAIP imagery is NOT available for all states/counties for every year).
5. In the state folder, choose the zip file with the imagery mosaic you want to download. Within the zip file name, look for a code similar to this: 'or017'. This indicates the state ('or' = Oregon) and the county FIPS code ('017' = Deschutes County).
6. Mouse over the zip file, and either right-click > select 'Download' or click the 'Download' button to the right of the file name, then choose a location to download the NAIP imagery mosaic on your local drive.

Survey Processing Workflow

STEP 1: CREATE SURVEY PROJECT

1. Click the “Create New Survey” button on the top of the workflow manager.
2. Specify the project name, output folder location, site name, watershed, stream name, projection system, visit ID, program, protocol, field season, organization, and survey crew.
3. If this is a first-time visit select “Initial visit” under “Visit Type” otherwise select “Repeat visit”.

STEP 2: PROCESS TOTAL STATION INSTRUMENT FILE

1. Select Instrument model used for your survey.
2. For Nikon total station data, browse and select your raw and job instrument files exported from the instrument. For TopCon total station data, browse and select the “.raw” and “.mjf” instrument files.
3. If your data has date information, select the appropriate dates on which the survey was performed (selecting multiple if necessary) under “Visit Date”. You will be notified with a message if your data has no date information and you should ensure that the “No Data Information” option is selected.
4. Review the Survey Data "Total station instrument file" QAQC checks to note improvements to make in future surveys or fatal flaws in instrument files.

STEP 3: LOAD SURVEY DATA TO PROJECT

1. Specify the Inputs datasets (QAQC_RawPoints.shp), Code Field, and Point Number field.
2. The breakline datasets can found in the *.dxf file (exported separately from the total station).
3. Specify Instrument Type, and Instrument Model.
4. Select Import Coordinate Type (generally “Assumed/Local” for an initial visit, and “Project” if a return visit).

STEP 4: COORDINATE TRANSFORMATION TOOL

1. **If data is already projected (repeat visit that successfully reoccupied the control network), skip ahead to STEP 5. Do not run the transformation tool!**
2. Use the Add Data button to add a base layer to the map
3. Dialog Box 1:
 - a. Specify Coordinate System. Load Benchmarks from Benchmarks.csv file or type them in the boxes (loading from .csv file preferred). Specify the Output workspace.
4. Dialog Box 2:
 - a. Specify which three points are Benchmark 1, 2, and 3. “Attribute Field” should be “Code”. Select an initial hinge point and rotation method.
5. Dialog Box 3:
 - a. Cycle through each transformation and choose the best fit visually (roughly on the stream and in the same direction). Use the residual errors to guide your choice (should be as close to zero as possible).
6. Check the confirmation boxes, save and exit the transformation tool.

At this point, you can begin using the Validate Data Tool to look for errors in your data.

STEP 5: MANUALLY REVIEW ALL SURVEY POINTS AND LINES.

1. Open Error Points and Lines attribute table and repair codes, delete bad points, and assess issues.
2. Review points and lines to make sure they are coded properly (left/right banks, bars, islands, top/toe banks, etc.).
 - a. Use **Validate Description Codes** tool if a code has been changed.
3. Edit Breaklines so they are connected where they need to be, and that Hard Breaklines do not cross.
 - a. Use **Add Z Values to Breaklines** Tool if changes are made to the breaklines.

STEP 6: CREATE SURVEY EXTENT POLYGON

1. Set the Hull Tolerance (in meters). Use larger values (15-20) for larger sites (> 120m to 600m long) and smaller values (5 to 10) for smaller sites (< 120m long).
2. Set the Snap Tolerance (1-5m) to include points along higher density sections of the survey (in channel). Run the tool.
3. Rerun the tool if there are a significant amount of errors (lots of jagged edges, oversimplified edges or points grouped into separate polygons). Adjust the Hull Tolerance as needed to produce a single, smooth polygon around all points.
4. Manually edit the Survey Extent polygon as needed (Editor Toolbar)
 - a. Review Survey Extent polygon to make sure all points and lines are within extent of survey extent polygon
 - b. Check the cross-channel transects at top/bottom of site as polygons are often wider than extent of points.

STEP 7: CREATE A TOPO TIN FROM SURVEY POINTS

1. Run tool. A TIN will be added to the Map.
2. Review TIN for cross channel dams, dams at end of surveys, bust/sink points.
3. Review and repair all breaklines (look for crossed breaklines and elevation anomalies/odd triangulation features adjacent to breaklines).
4. Edit TIN by adding/deleting nodes (TIN editing Toolbar) or connecting TIN nodes as needed.
5. Use Review TIN Integrity/Survey Editing Tool to generate the Survey Editing Report. Provide Response to Questions.

STEP 8: CONVERT TOPO TIN TO DEM

1. Run Tool. The DEM and Hillshade layer will be added to the Map.

STEP 9: DETREND DEM

1. Run tool. The Detrended DEM will be added to the Map.

STEP 14: CREATE A THALWEG

1. Run tool. Review thalweg to ensure it generally follows the field-collected thalweg (wg) points and that it passes close to in/out points. Wg points are NOT used in thalweg generation; thalweg line won't always intersect points.
2. Rerun thalweg tool with different pool weights or manually edit if needed.

STEP 10: CREATE WETTED POLYGONS

1. Make sure Detrended DEM is specified.
2. Click Add Reference Points, select Edge_of_water points. Click Refresh.
3. Move slider to flood stream to best align with edge of water points.
4. Save wetted polygon. Make manual edits to polygon if needed.
5. Refresh and review Validation window for errors.

STEP 11: CREATE WETTED CENTERLINE

1. Click Generate Islands. Confirm qualifying islands in the map are red and all others grey. Use buttons to reassign qualifying status or reset to original state. (Note qualifying status here is only for centerline layout, not metrics).
2. Click Generate Centerline (may take several minutes). Review after centerline is added to the map:
 - a. Centerline should generally run down the center of each qualifying channel segment.
 - b. Centerlines may pass through non-qualifying islands, bars, boulders or other small dry patches.
 - c. Check centerline: do not skew at the ends of the survey. If they do, manually edit the centerline (Editor toolbar).
 - d. Ensure ends of centerlines are inside water extent polygon. Manually edit if needed.
3. Refresh and review Validation window errors.

STEP 12: CREATE WETTED CROSS SECTIONS

1. Run tool to create Wetted cross sections. This may take a few minutes.
2. Review cross sections. Assign excessively long cross sections, or those not representative of typical channel width to Invalid (grey) status using +/- toggles.

STEP 13: DIGITIZE CHANNEL UNIT POLYGONS

1. Run tool, then click on the Channel Units (Field) layer in the Table of Contents
2. Start a Vector Edit Session (Editor Toolbar). Use the Create Features window to select a Unit Number.
3. Roughly digitize the channel unit polygons LARGER than water surface extent polygon (in width across stream), but make sure they are DETAILED within the water surface polygon. Avoid overlapping polygons and gaps between units.
4. When done tracing a unit, double click OR right click/finish sketch. Stop Editing and Save when done with all units.
5. Use **Verify and Clip Channel Units** Tool to join ChannelUnit.csv attributes and clip to channel units to wetted extent.

STEP 14: CREATE STREAM SURFACE TIN, DEM and WATER DEPTH

1. Run tool. Generates Water Surface TIN (WSETIN), DEM, and Water Depth raster.
2. Review WSETIN for bust points (should be obvious due to low gradient of surface). If found, edit Edge of Water Points and rerun tool.

STEP 15: CREATE BANKFULL POLYGONS

1. Make sure Detrended DEM is specified.
2. Click Add Reference Points, select bankfull points. Click Refresh.
3. Move slider to flood stream to best align with bankfull points. Likely a looser fit than with wetted extent.
4. Save bankfull polygon. Make manual edits to polygon if needed.
5. Refresh and review Validation window for errors.

STEP 16: CREATE BANKFULL CENTERLINE

1. Click Generate Islands. Confirm qualifying islands in the map are red and all others grey. Use buttons to reassign qualifying status or reset to original state. (Note qualifying status here is only for centerline layout, not metrics).
2. Click Generate Centerline (may take several minutes). Review after centerline is added to the map:
 - a. Centerline should generally run down the center of each qualifying channel segment.
 - b. Centerlines may pass through non-qualifying islands, bars, boulders or other small dry patches.
 - c. Check centerline: do not skew at the ends of the survey. If they do, manually edit the centerline (Editor toolbar).
 - d. Ensure ends of centerlines are inside bankfull polygon. Manually edit if needed.
3. Refresh and review Validation window errors.

STEP 17: CREATE BANKFULL CROSS SECTIONS

1. Run tool to create bankfull cross sections. This may take a few minutes.
2. Review cross sections. Assign excessively long cross sections, or those not representative of typical channel width to Invalid (grey) status using +/- toggles.

STEP 18: GENERATE ERROR AND ASSOCIATED SURFACES

1. Create Slope Raster
2. Create Point Density Raster
3. Create Interpolation Error Raster
4. Create 3D Point Quality Raster, if using a ChaMP Total station.
5. Create Roughness Height raster using ChannelUnit.csv file from Ipad.
6. Create Survey Error Raster from all Associated Surfaces.

STEP 19: VALIDATE DATA

1. Refresh Validation Panel.
 - a. Review all validation checks-green means good, warning means review, red means error and requires resolution.

STEP 20: ADD A NOTE TO SURVEY

1. Use this tool to include a log entry about the survey or processing any time during the workflow.

STEP 19: GENERATE MAP IMAGES

1. Run tool. Map images are 'quick' maps of topographic products that may be useful for later data review or sifting through sites.

STEP 20: PUBLISH FINAL SURVEY

1. Specify 'publish' if your data is error-free, or 'review' if there is a validation issue with your survey and another GIS analyst will review the data.
2. Specify the TopoTIN (and products derived from it) that will be included in the publish.
3. Click OK to Publish.
4. Zip up the contents of the folder and name it TopoData.zip and upload to champrmonitoring.org
5. Survey processing is complete!