

Technical Training and Certification Program



EFT-

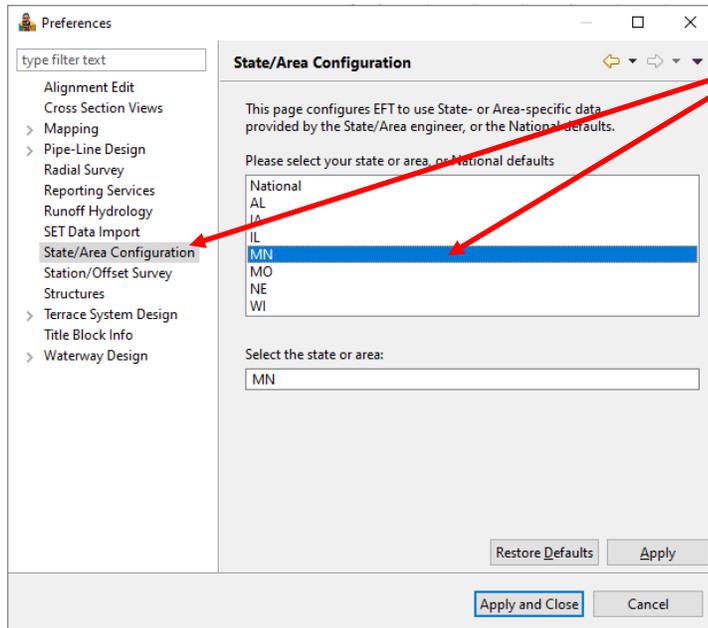
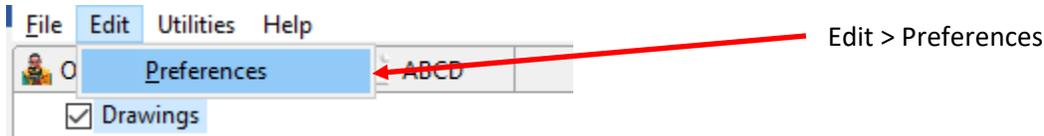
Waterway Design Tool



Workflow

Updated August 2023

Preferences



Preferences you need to change:
State/Area Configuration – Select MN

(Note, the next time you open this screen, the box will be blank again. This is okay, as long as you selected it once.)

Preference you might want to change:

SET Data Import – Select PNEZD

Terrace System Design – Terrace Type Select WASCOB

 Runoff Storage – Caldwell Method, 24 hours

Title Block Info – Enter your information

Waterway Design – Initial Q Fraction (%) Enter 100

 Channels – Enter typical Waterway Channel dimensions

 Vegetal – Stability Retardance Class - Typically D

 Vegetal Cover – use vegetation with a 0.87 value

 Capacity Retardance Class – Typically C or B

Note: If you notice yourself changing the same parameters on each design, go back into the Preferences and see if you can set those to reduce repetitive data entry.

Once you have your Preferences Set > Apply and Close

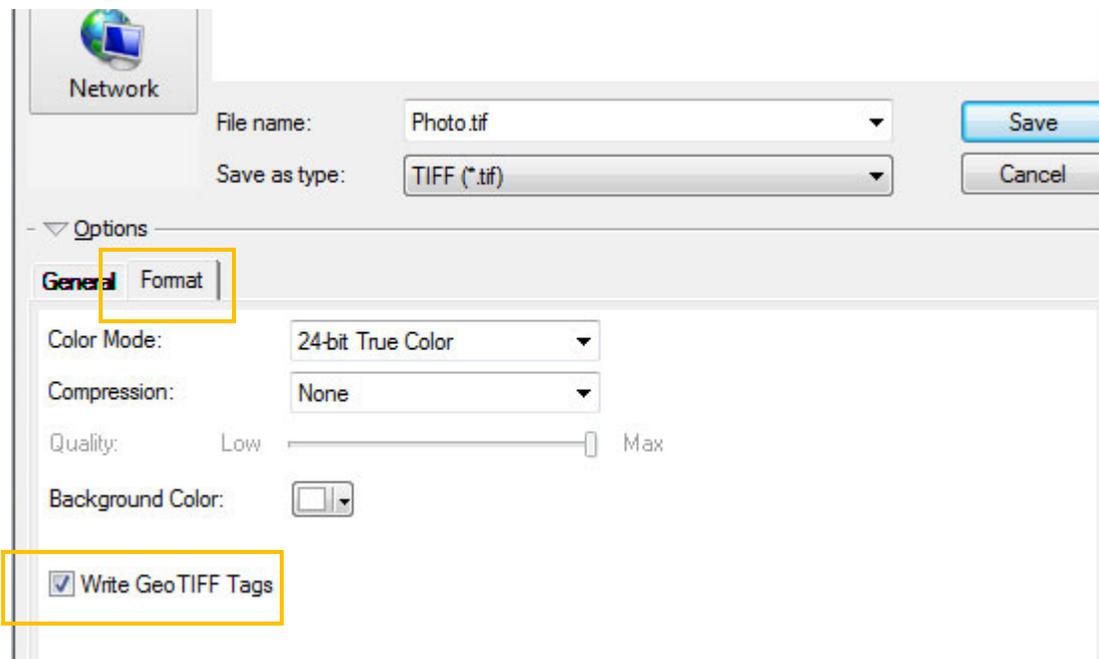
Close EFT

Open EFT

Create Background Image

In ArcMap

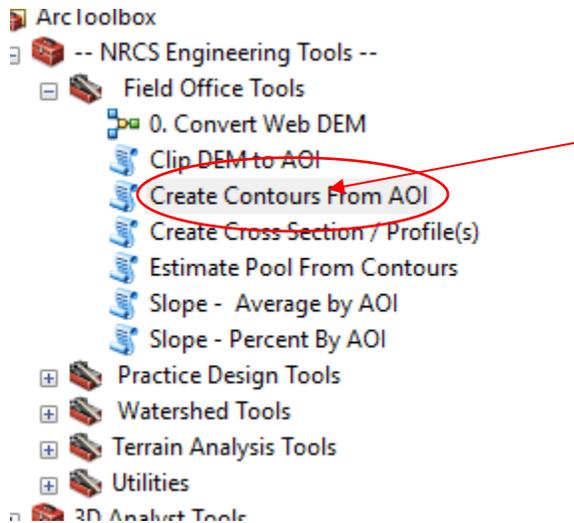
- a. Zoom into the area that you would like to display as a background image (your entire screen's viewable extents will be exported, including any visible layers.)
- b. Click "File" menu – Export Map
- c. Specify Save Location
- d. Enter File Name
- e. Save as type: TIFF (*.tif)
- f. Under "Options":
 - i. Click the Format tab
 - ii. Select 'Write Geo TIFF Tags'
- g. Select Save



This reference guide covers the method for exporting a DEM from ArcMap for use in Engineering Field Tools. This ground surface can be used in preliminary planning of conservation practices including waterways, terraces, and water and sediment control basins. This step, as well as Importing the DEM step, is only needed where the user wants to utilize LiDAR as opposed to using a survey in EFT.

The process is the same in ArcGIS Pro, but with different looking menus.

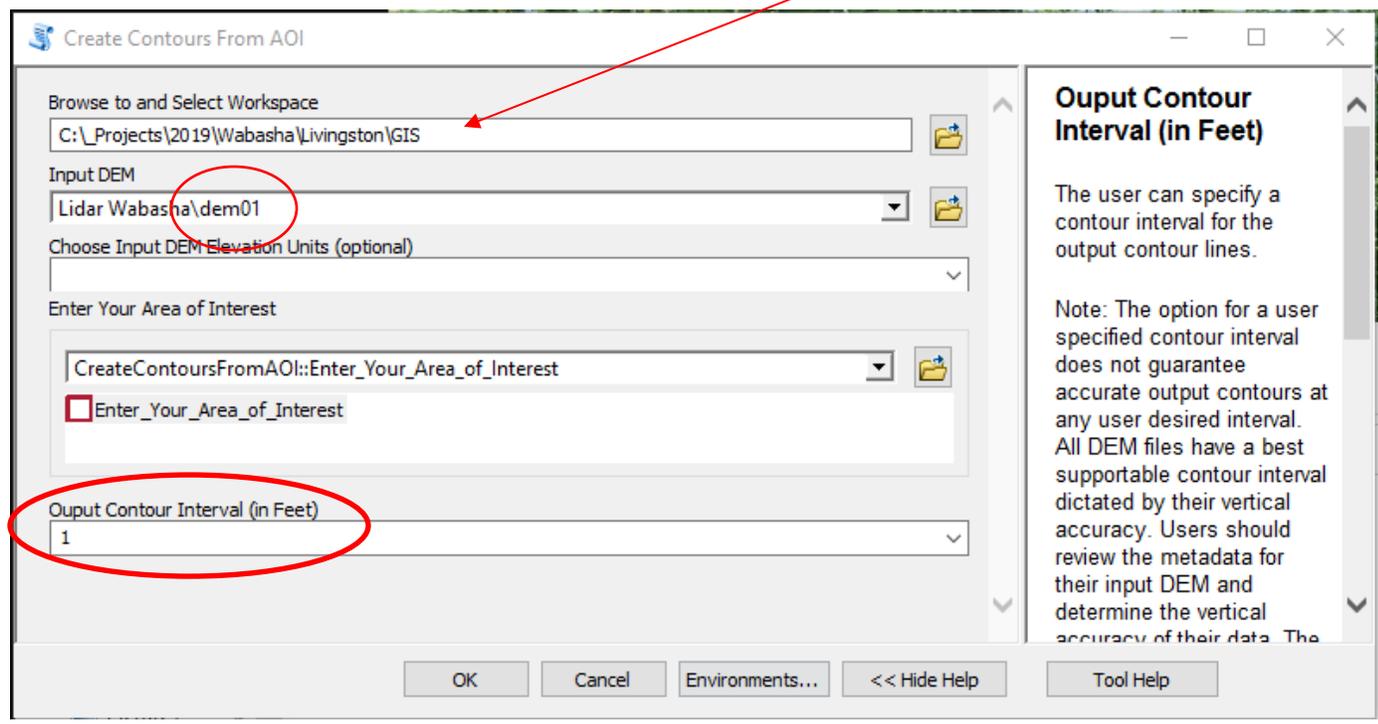
Creating a GIS DEM for EFT



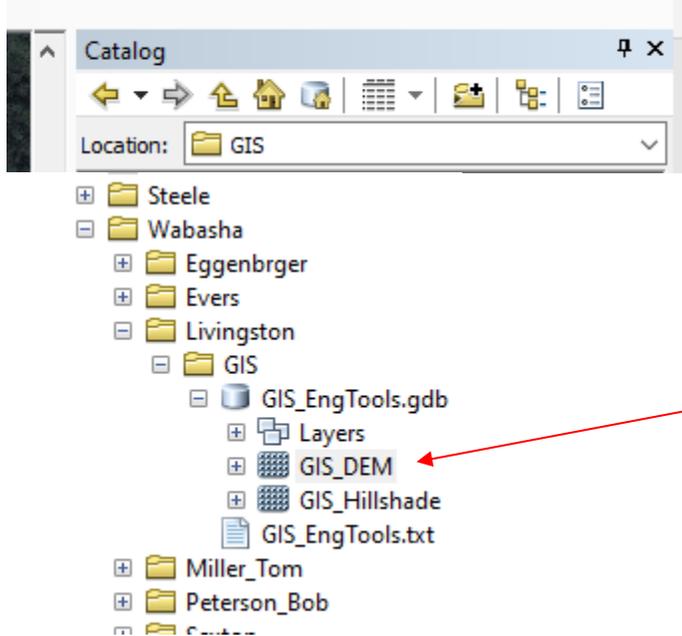
When in ArcMap access the NRCS Engineering Tools toolbox and double click on the Create Contours from AOI.

Below is an screenshot with the information completed to complete the tool. ****Pay special attention to the red circled areas. Note: **Use a 1m DEM** for the Input DEM.

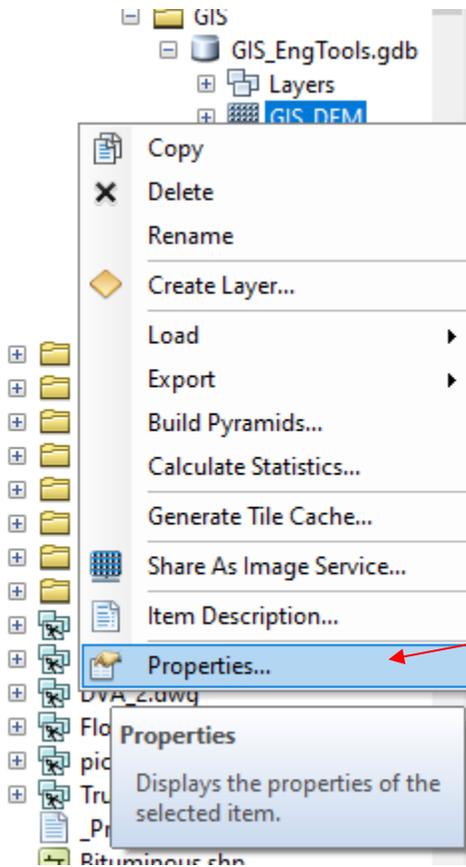
Folder to save files



In ArcCatalog, browse to the newly created geodatabase:



This tool creates a GIS_DEM that may need to have some adjustments done for units.



Right click on the GIS_DEM and select properties.

Scroll down in the resulting dialogue box on the **General** tab. Left click the Edit button in the **Spatial Reference** row.

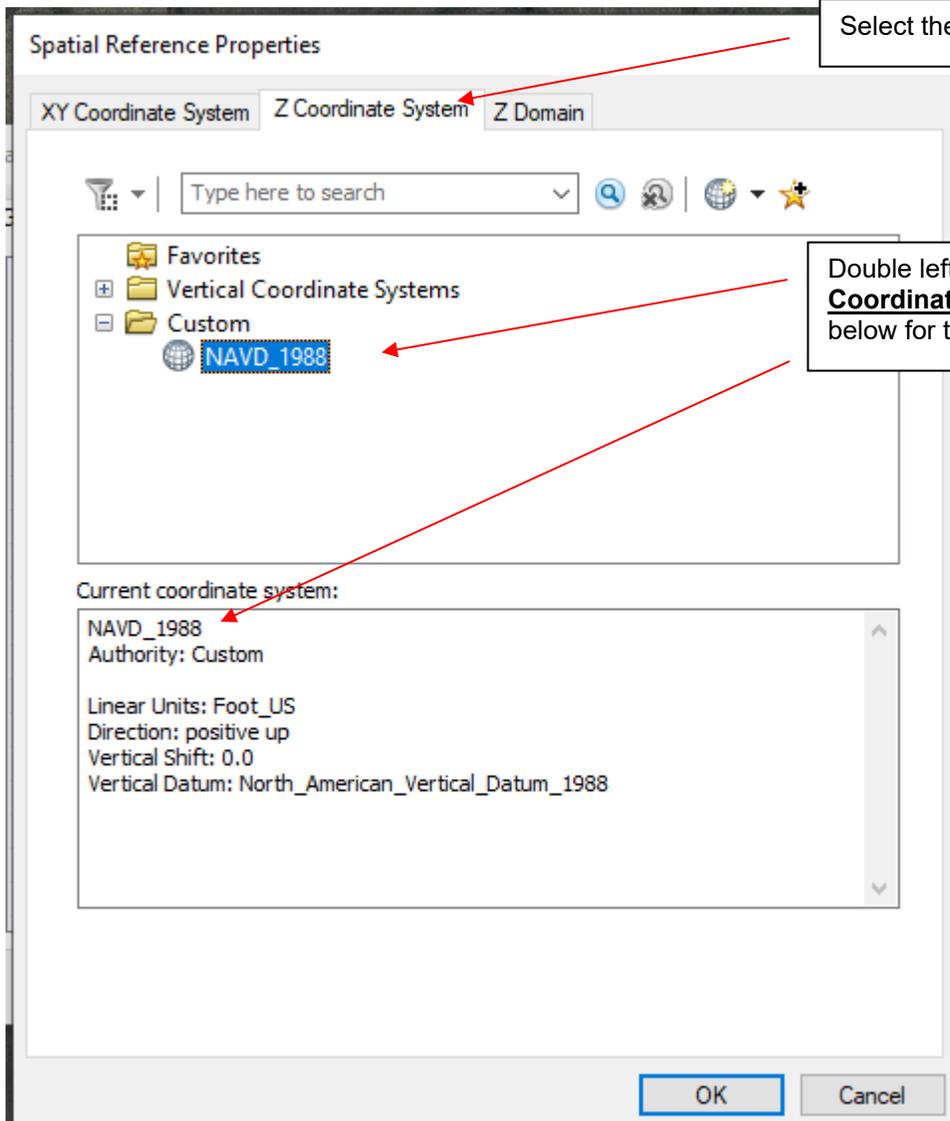
Raster Dataset Properties

General Key Metadata

Property	Value
Left	555753.732276
Right	556366.732276
Bottom	4895930.23583
Spatial Reference	Edit...
XY Coordinate System	NAD_1983_UTM_Zone_15N
Linear Unit	Meter (1.000000)
Angular Unit	Degree (0.0174532925199433)
False_Easting	500000
False_Northing	0
Central_Meridian	-93
Scale_Factor	0.9996
Latitude_Of_Origin	0
Datum	D_North_American_1983
Vertical Coordinate S...	NAVD_1988
Linear Unit	Foot_US (0.304801)
Vertical_Shift	0
Direction	positive up
Datum	North_American_Vertical_Datum_1988

OK Cancel Apply

Check Vertical Coordinate System. This needs to say **Meters**. If not, complete next two steps.



Select the **Z Coordinate System** tab.

Double left click on the **Current Coordinate System**. Reference the box below for the current system used.

Vertical Coordinate System Properties

General

Name: NAVD_1988

Datum

Geoid-based

Name: North_American_Vertical_Datum_1988

Spheroid/Ellipsoid-based

Name: 1_Ceres_2015

Spheroid

Name: 1_Ceres_2015

Semimajor Axis: 470000

Semiminor Axis: 470000

Inverse Flattening: 0

Linear Unit

Name: **Foot_US**

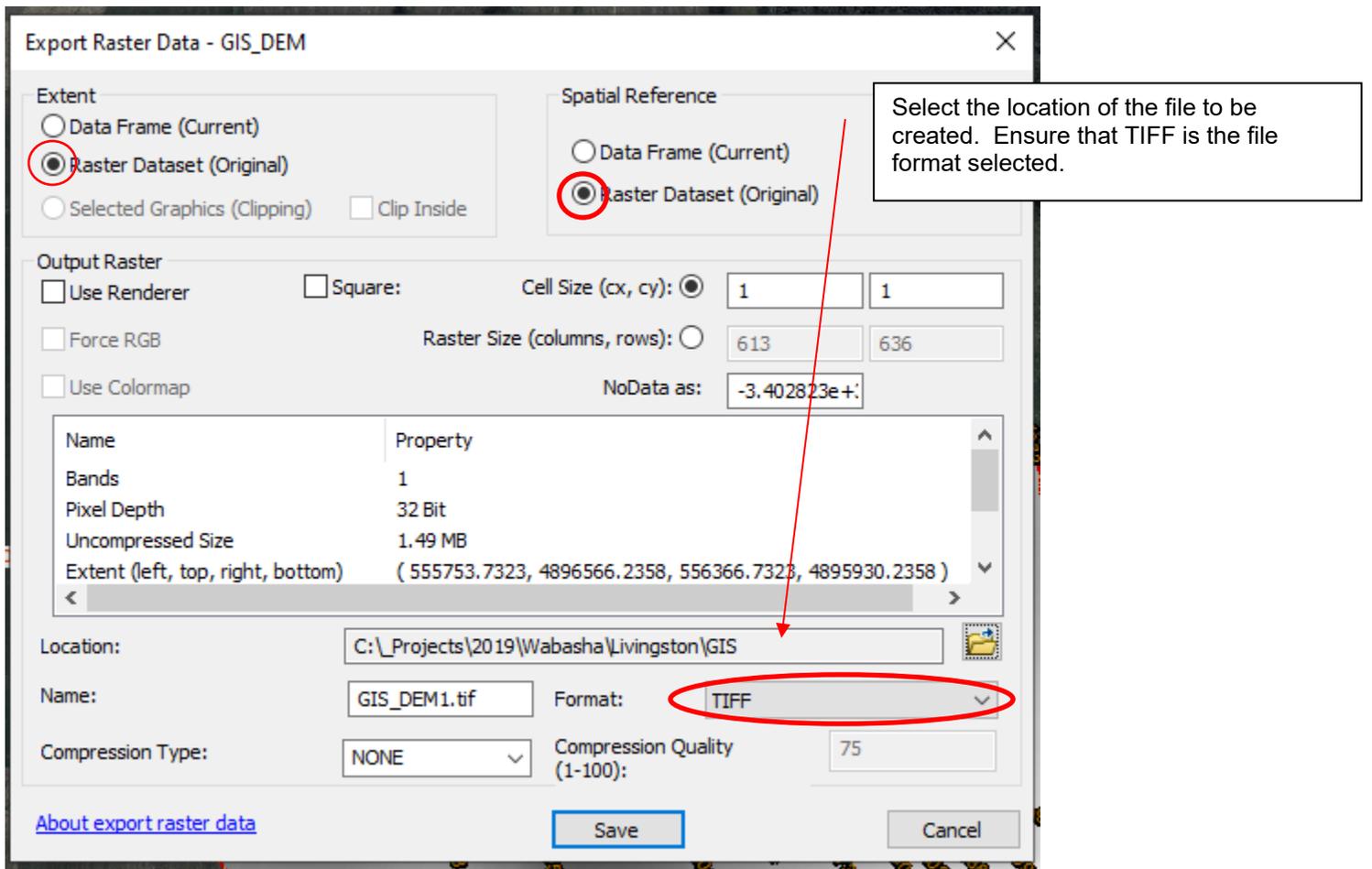
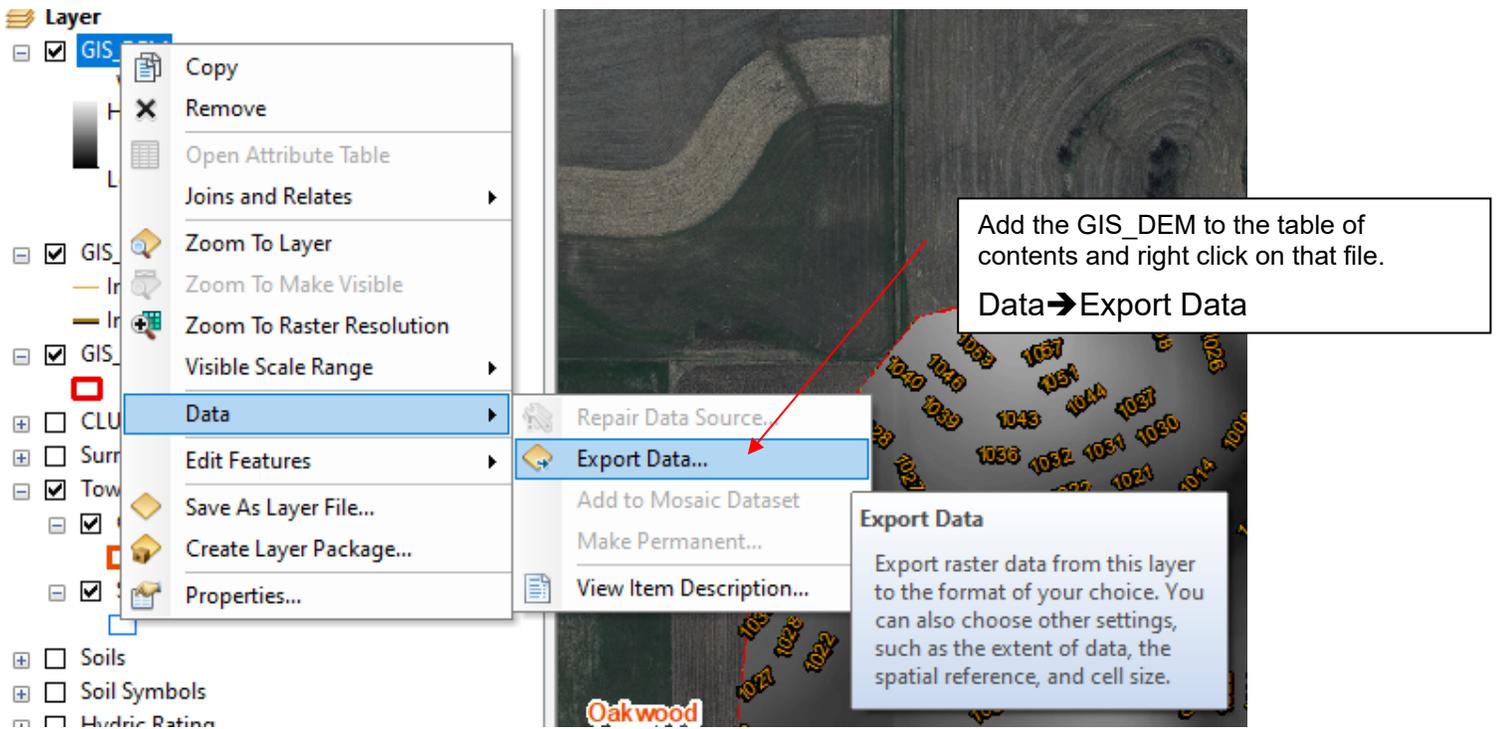
Meters per unit:

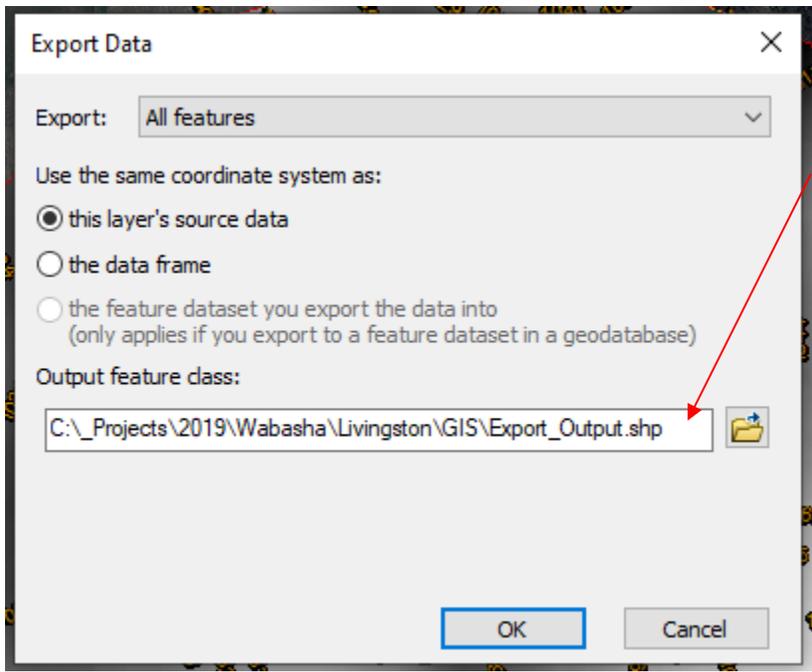
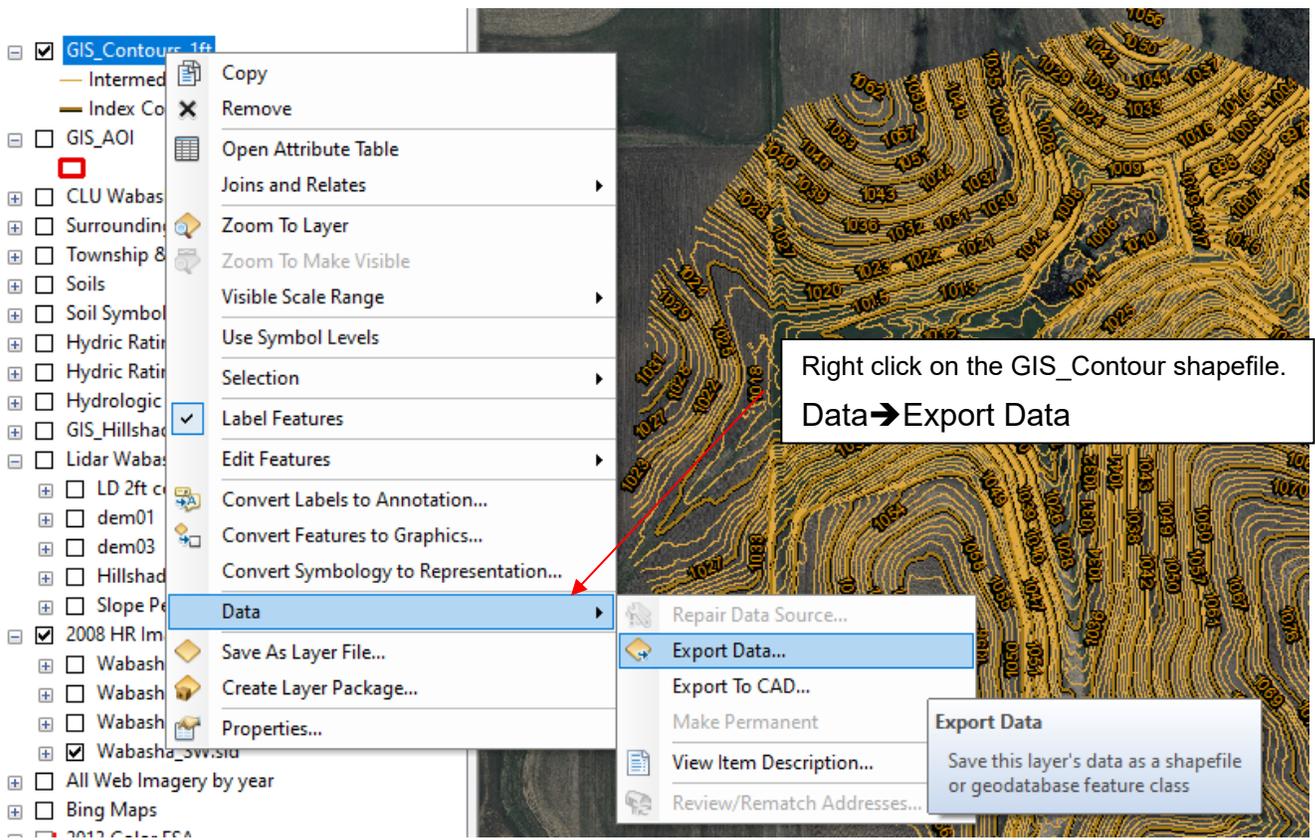
Parameters

Parameter
Vertical_Shift
Direction

Foot_US
 Foot_US
 Inch
 Inch_US
 Kilometer
 Link
 Link_Benoit_1895_A
 Link_Benoit_1895_B
 Link_Clarke
 Link_Sears
 Link_Sears_1922_Truncated
 Link_US
 Meter
 Meter_German
 Micrometer
 Mile_US
 Millimeter
 Nanometer
 Nautical_Mile
 Nautical_Mile_US

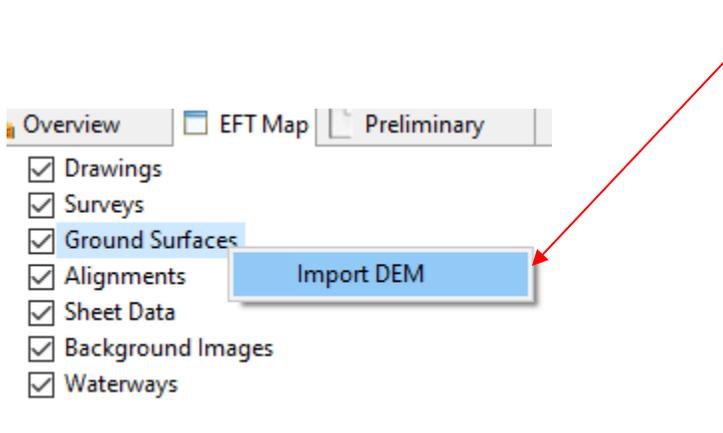
This Linear Unit may need to be changed to Meters. ****If this unit is already meters nothing needs to be completed at this level.





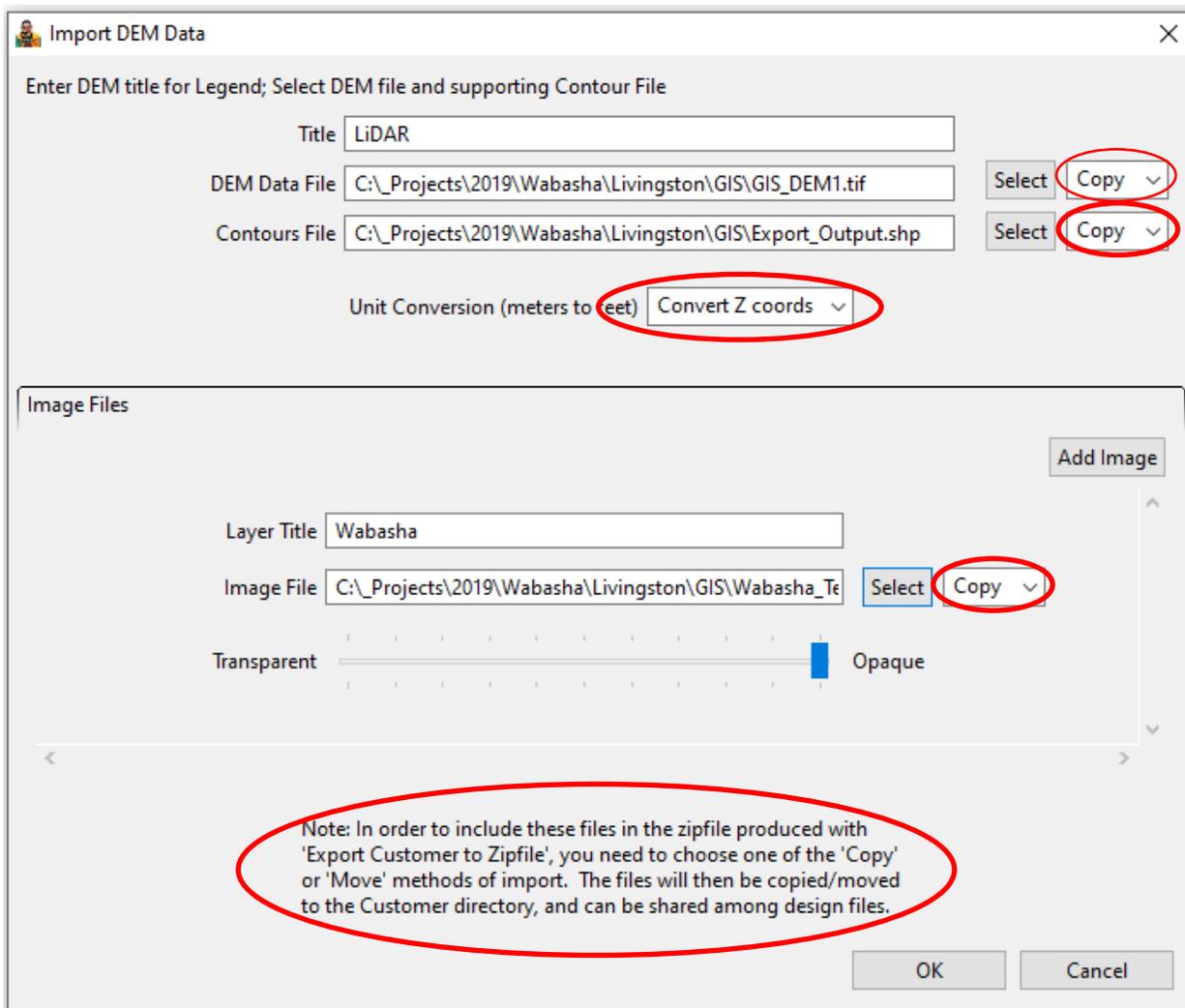
Importing DEM into Engineering Field Tools

Create a new survey, terrace or waterway design in a selected customer/project folder.



Right click on Ground Surfaces.
Select **Import DEM**

Below is a screenshot of the window and fields completed for importing the DEM, Contour shapefile and imagery (if needed).
****Pay special attention to the red circled options.



Import DEM Data

Enter DEM title for Legend; Select DEM file and supporting Contour File

Title: LiDAR

DEM Data File: C:_Projects\2019\Wabasha\Livingston\GIS\GIS_DEM1.tif [Select] **Copy**

Contours File: C:_Projects\2019\Wabasha\Livingston\GIS\Export_Output.shp [Select] **Copy**

Unit Conversion (meters to feet) **Convert Z coords**

Image Files

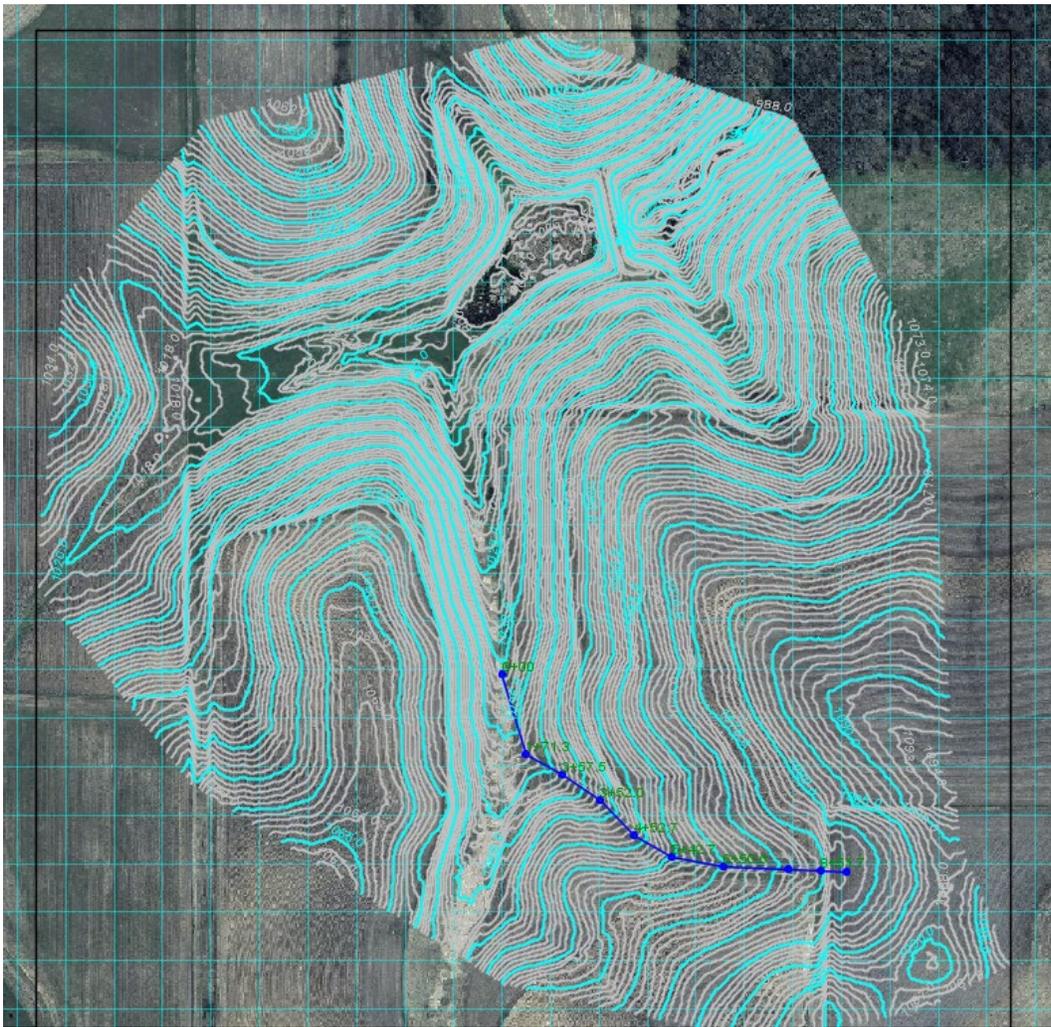
Layer Title: Wabasha

Image File: C:_Projects\2019\Wabasha\Livingston\GIS\Wabasha_Te [Select] **Copy**

Transparent [Slider] Opaque

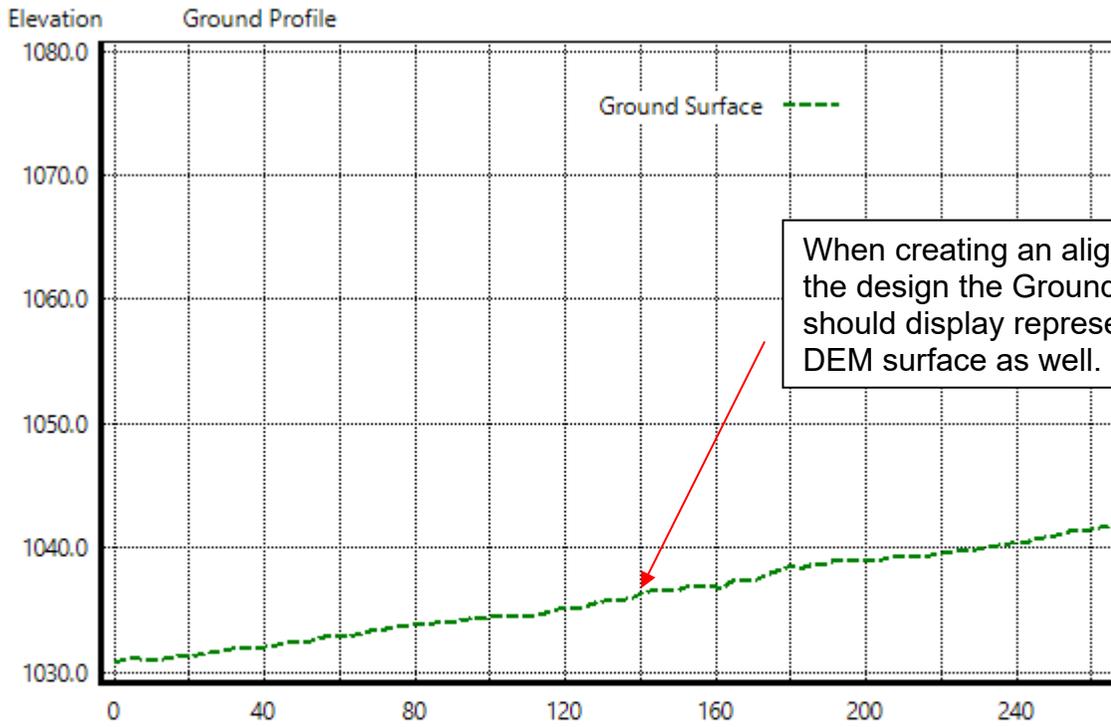
Note: In order to include these files in the zipfile produced with 'Export Customer to Zipfile', you need to choose one of the 'Copy' or 'Move' methods of import. The files will then be copied/moved to the Customer directory, and can be shared among design files.

OK Cancel



If done correctly, when the cursor hovers over the DEM/Contour Area, the elevation should be displayed in US Survey Feet.





Map Edit Operations

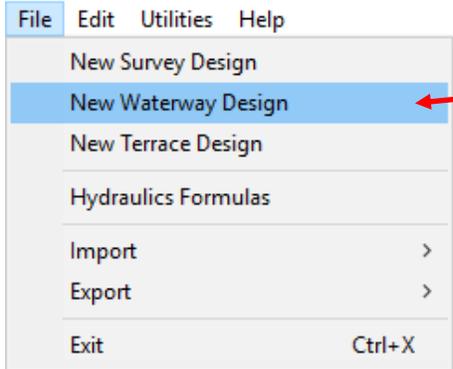
- Sketch Alignment
- Insert Station
- Move Points
- Apply Curves

Alignment Data

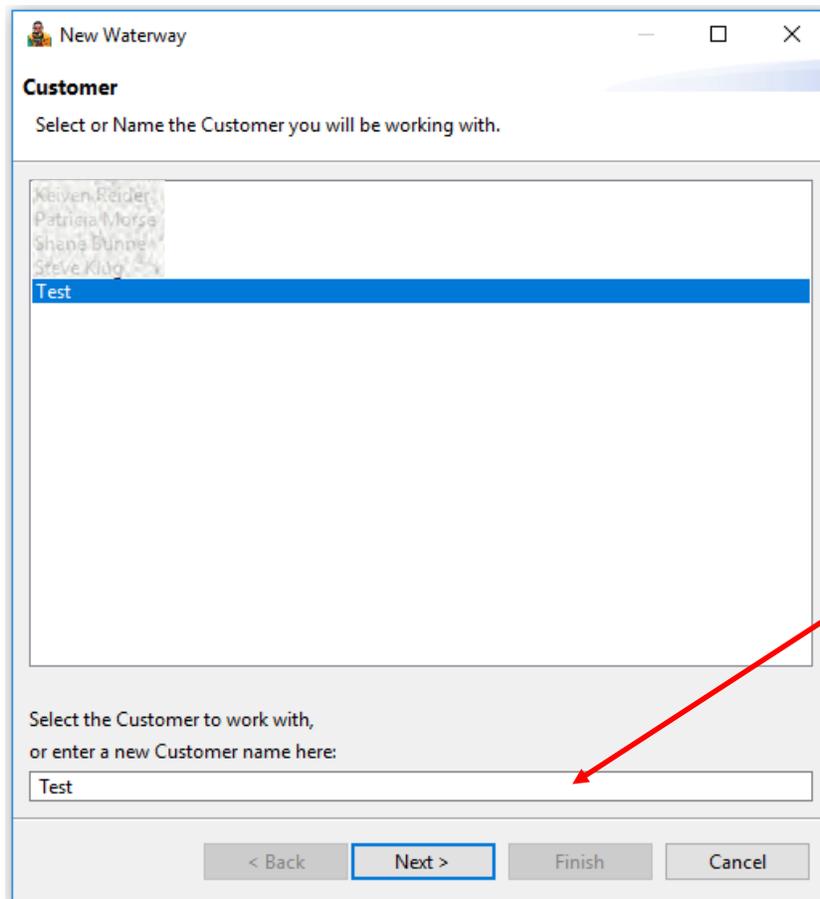
This reference guide covers the design of a waterway and tile using the Engineering Field Tools program as provided by the Natural Resources Conservation Service.

Creating a New Design

 NRCS Engineering Field Tools (4.0.3.5)



File > New Waterway Design



Create a new customer or
select an existing customer.
E.g. Landowner

Next >

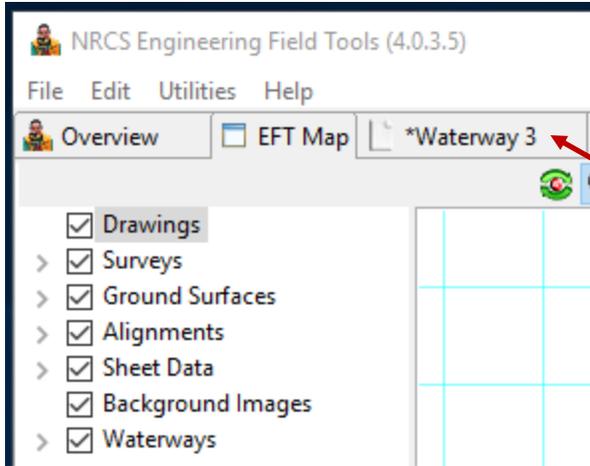
The screenshot shows a window titled "New Waterway" with a "Project" section. The instruction reads "Select or Name the Project you will be working with." Below this is a list box containing "BasinTraining" and "Test 410", with "BasinTraining" selected. Below the list box is a text input field with the text "Waterway". At the bottom of the window are four buttons: "< Back", "Next >", "Finish", and "Cancel".

Select a project from the list to work with.
If you have an existing customer or create a new project. E.g. Location (Township and Section number)

The screenshot shows the same "New Waterway" window, now in the "WaterwayDesign" section. The instruction reads "Enter a new name for the Design you will be working with." Below this is a large empty text input field. Below that is another instruction: "Enter a new WaterwayDesign name below. The above list entries already exist, and cannot be used." Below this is a text input field containing the word "Example". At the bottom of the window are four buttons: "< Back", "Next >", "Finish", and "Cancel".

Enter the name of the design.
E.g. Waterway 3

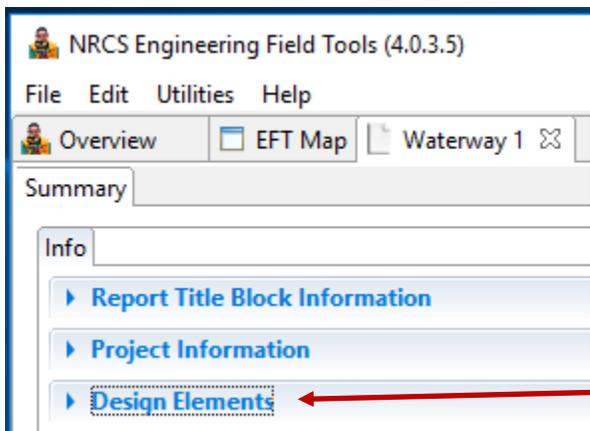
Finish



You will now have three tabs located near the top of the page.

- Overview
- EFT Map
- Project name (Waterway 3)

Click on the project name tab to begin the design.



- Report Title Block Information – Project name, designed, drawn, checked, approved, applicable dates, location of project
- Project Information – Description of the project, benchmark description, and elevation
- Design Elements – Surveys, Alignments, Waterway, Forms

Most of the work will be done in “Design Elements.”

If you complete the Report Title Block as follows:

Info

Report Title Block Information

Name: Larry Van Gundy

Designed By: E. Oolman

Drawn By: E. Oolman

Checked By: _____

Approved By: _____

Practice: Grassed Waterway

Location: Money Creek 5, Houston County

Project Information

Description: Waterway 3

This is how the output will look on your reports.

Waterway Cut Sheet	
Larry Van Gundy	
Grassed Waterway Money Creek 5, Houston County	Project Name: Larry Van Gundy Project Description: Waterway 3 Designed by: E. Oolman Date: 2/20
	Location: Money Creek 5, Houston County Practice: Grassed Waterway Checked by: _____ Date: ____

Importing a survey

Under the Survey window, select **New**

Give the survey a name that you would like to import.

Choose "XYZ" for type of survey to create.

OK

Import Data

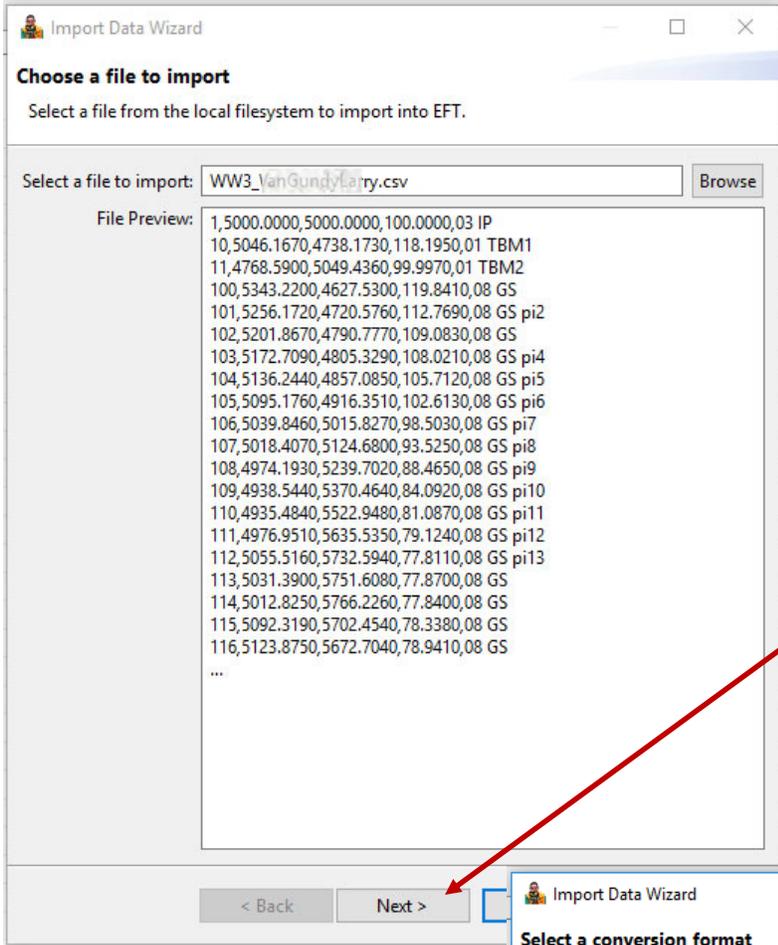
Import Data

Browse to locate *.csv file from desired folder.

Make sure that the file type is set to *.csv.

Open

The image shows a software interface with a 'Design Elements' panel containing a 'Surveys' list. A 'Create New Survey' dialog box is open, prompting for a name (ww3) and a survey type (XYZ). Below this, there are toolbars for 'Point Operations' (Add, Delete, Digitize) and 'Point Translation' (Edit, angle, ΔX, ΔY, ΔZ). An 'Import Data' button is visible in the toolbar. The 'Import Data Wizard' dialog box is also shown, with a 'Choose a file to import' section, a 'Browse' button, a 'File name' field, and a file type dropdown menu set to *.svy;*.txt;*.csv;*.prn;*.pts;*.sdr;. The 'Open' button is highlighted in the wizard dialog.



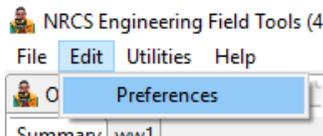
NOTE:
The file preview will show an *example* of the points that you are importing, *not all* the points you are importing.

Next >

Select a conversion format.

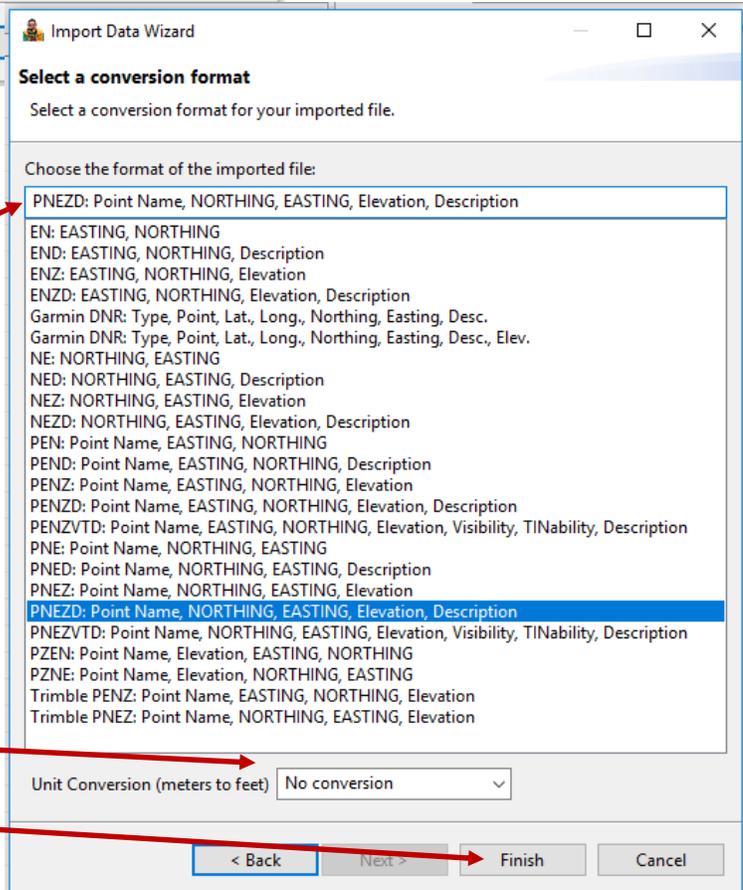
Most electronic survey equipment uses a standard of "PNEZD."

This can be preset in the Preferences.



No conversion

Finish

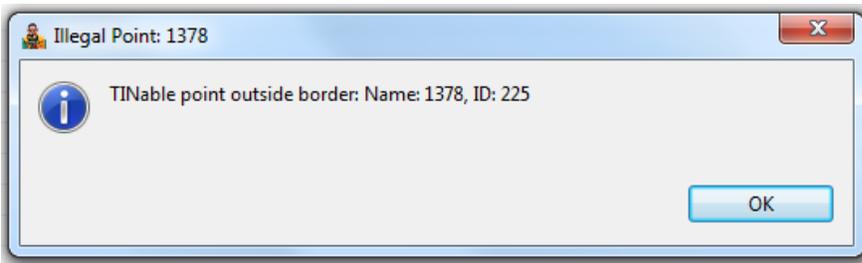


Name	X (Easting)	Y (Northing)	Z (Elevation)	Visible	Tinable	Description
1	1659707.140	16039648.530	1237.957	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	01 TBM-01
2	1659989.552	16036225.800	1260.519	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	01 TBM-02
100	1659642.969	16036329.000	1254.483	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	32 CLDIT...
101	1659609.289	16036349.910	1255.620	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	08 GS
102	1659642.811	16036326.780	1254.988	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	35 BNKL
103	1659645.917	16036325.380	1254.484	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	33 EBL
104	1659655.140	16036319.960	1254.880	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	34 EBR
105	1659658.263	16036317.480	1255.184	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	36 BNKR
106	1659660.662	16036315.890	1255.062	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	28 EFLD

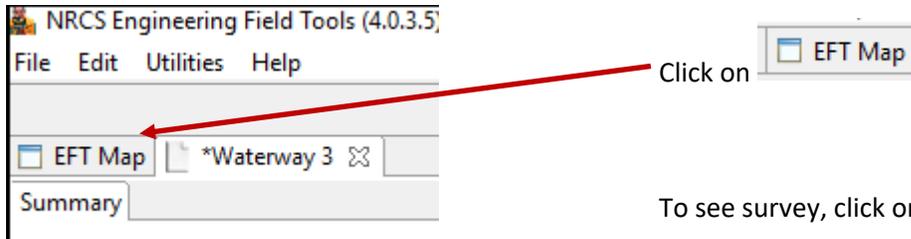
Points will be added to the list in the survey. There are options to make each point visible and tinable. All points that would be included in a surface should be tinable. Benchmarks, IPs, top of pipes, or other structures that do not represent the landscape should **not be** tinable.



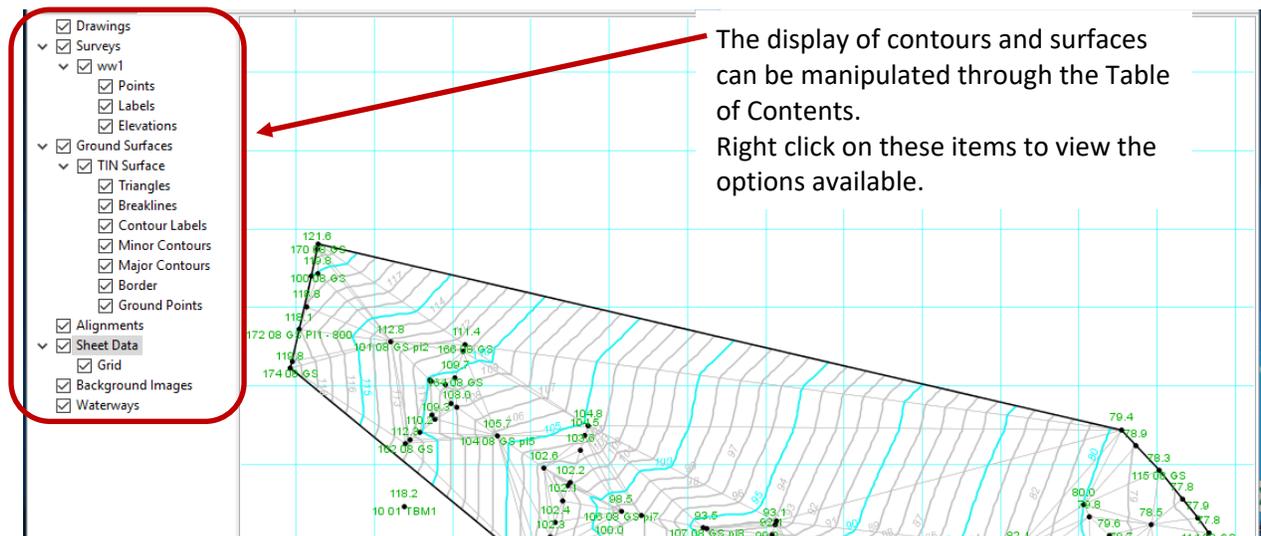
This will close the window.



Potential error:
Click OK and go back into the survey and find the name of the point and uncheck the "Tunable" box for that point. At times there has been more than one point to be modified.



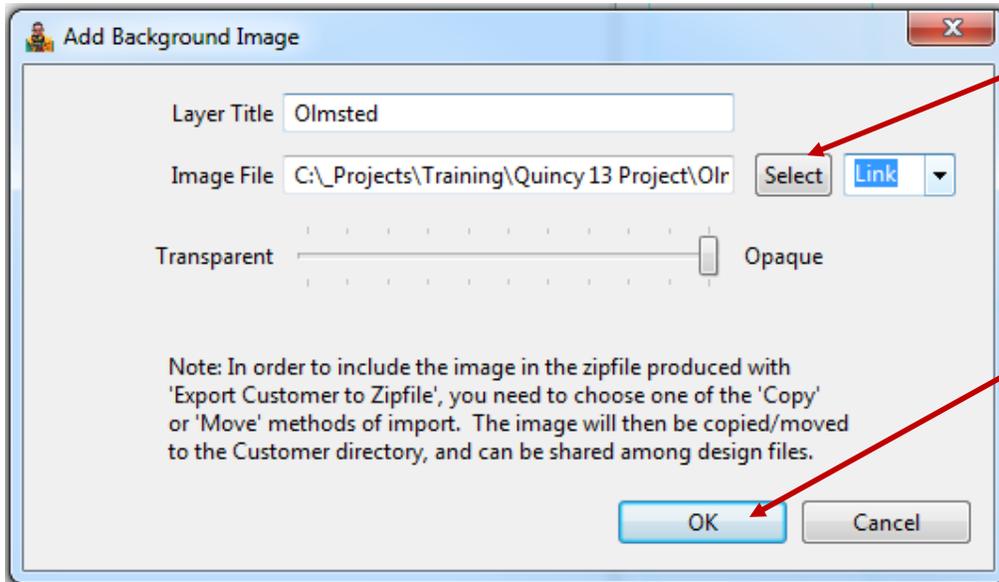
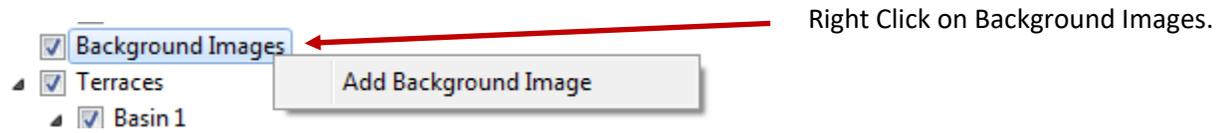
Click on **EFT Map**
To see survey, click on **Full Extent**



The display of contours and surfaces can be manipulated through the Table of Contents. Right click on these items to view the options available.

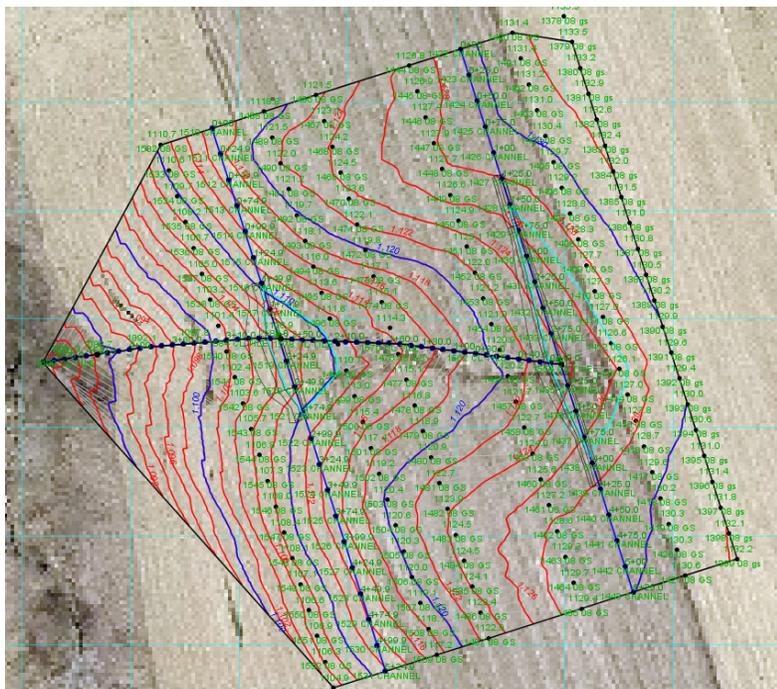
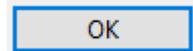
Adding an Image to the Map

To create an image file, reference the section Create Background Image



Browse to image file. You may need to change file type to TIFF to see your file.

Use "Link" or "Copy" to be able share the EFT file with others.



Adding Breaklines

Filter Ground Surface Points

Name	X	Y	Z	Description
1	5000.0	5000.0	100.0	03 IP
10	4738.2	5046.2	118.2	01 TBM1
11	5049.4	4768.6	100.0	01 TBM2
100	4627.5	5343.2	119.8	08 GS
101	4720.6	5256.2	112.8	08 GS pi2
102	4790.8	5201.9	109.1	08 GS
103	4805.3	5172.7	108.0	08 GS pi4
104	4857.1	5136.2	105.7	08 GS pi5
105	4916.4	5095.2	102.6	08 GS pi6
106	5015.8	5039.8	98.5	08 GS pi7
107	5124.7	5018.4	93.5	08 GS pi8
108	5239.7	4974.2	88.5	08 GS pi9
109	5370.5	4938.5	84.1	08 GS pi10

Isolate Points

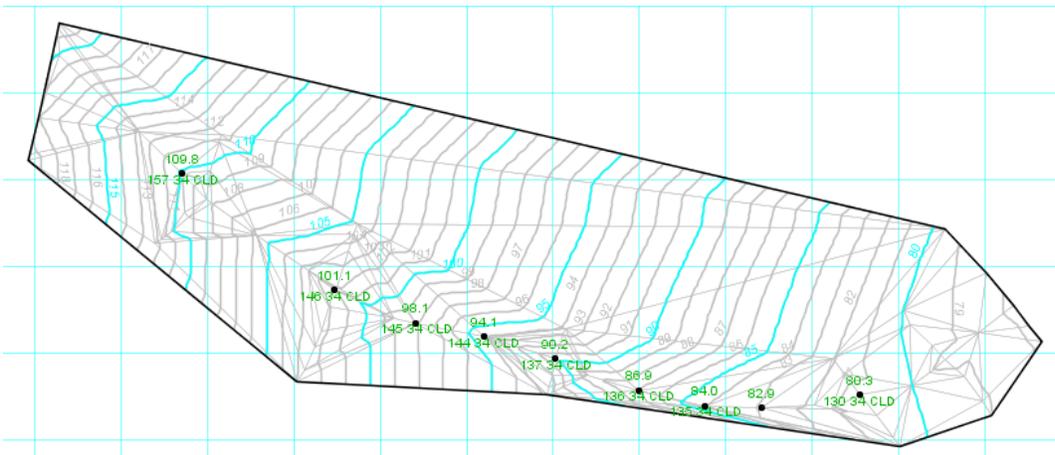
Name Set

Description Set

Apply OK Cancel

Recommendation:

- Filter Ground Surface Points 
- Name the points you want to keep
- Set
- Apply
- Ok



Snap to Point



Add a breakline

To end the breakline, click on the "Add Breakline" to end.



Delete a breakline

If you want to delete a breakline, you need to click on each segment to delete it.

Adding an Alignment

Go back to Waterway Design tab

Under the Alignment window, select **New**

Name your alignment

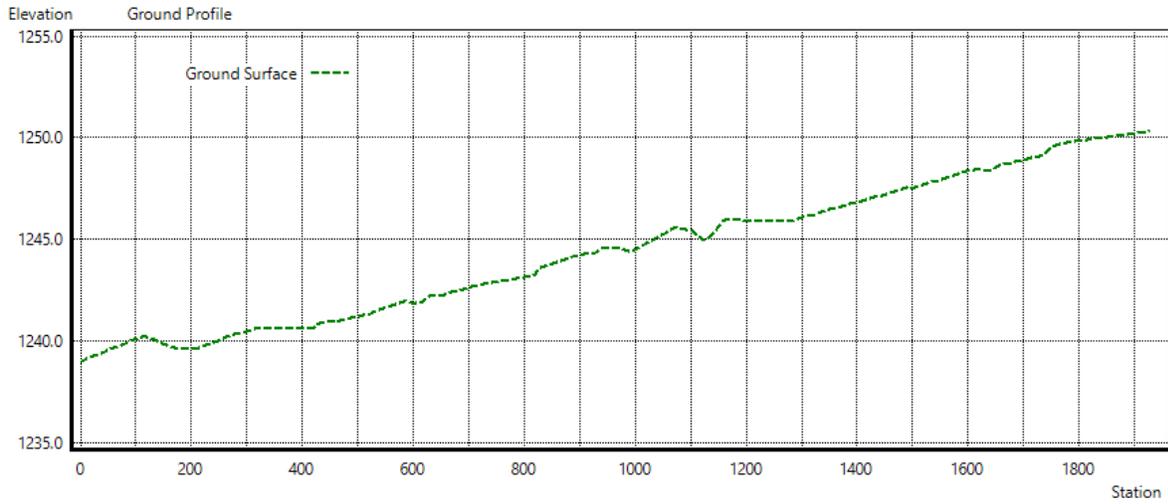
Recommend using the word align or alignment in name.

Sketch Alignment in the middle of the screen

A window appears reminding user that this operation will overwrite any existing alignment.

Click on **EFT Map**

Recommend Filter Ground Surface Points to waterway's PIs and Snap to Point if you have waterway PIs. Sketch the alignment. Double click to end.



Alignment Data

Alignment Name: Waterway CL

Beginning Station: 0+00 Increasing: Yes

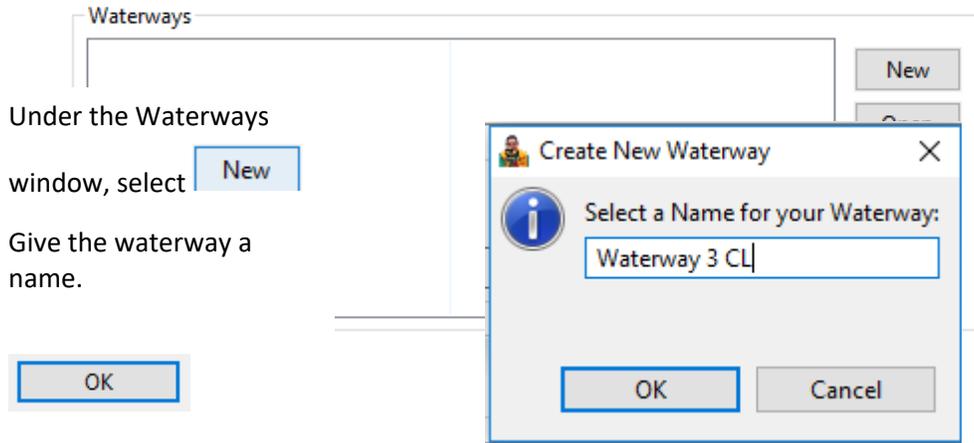
Entry Method: Angle/Distance Coordinates

Beginning X: 0.00 Beginning Y: 0.00

Angle Type	Angle	Distance	Curve Type	Curve Value	To PI Station
Azimuth	0.00	0.00	None	0.00	0+00

Enter the "Beginning Station"

Adding a Waterway Profile (design)



The design will open multiple tabs.

Info tab

Waterway Name: Waterway 3 CL

Alignment: **Waterway CL Align**

Seeding Width (ft): 32.0

Construction Benchmark

Set Waterway Benchmark

Elevation: _____

Description: _____

The information tab requires us to choose an alignment from the menu.

Check "Set Waterway Benchmark" to be able to fill out an "Elevation" and "Description".

Hydrology tab

Do **not** use the hydrology.

Check on “Over-ride model output”. Enter the “Peak Flow Q (cfs)”.

Info Hydrology Channel Profile Design

Storm Runoff

Runoff Model: EFH2 Hydrology

Precipitation (in): 1.10

Storm Type: MSE3

Curve Number: 80

Watershed Length (ft): 200.0

Watershed Slope (%): 0.1000

Drained Area (ac): 0.00

Model Outputs

Total Runoff (ac-in): 0.00

Runoff Q (in): 2.45

Qu (cfs/ac-in): 0.950

Peak Flow Q (cfs): 0.00

Simulate

Runoff Allocation Options

Peak Flow Q (cfs): 79.00 Over-ride model output

Initial Q fraction (%): 100.0

Channel tab

This tab is where the planned waterway cross section will be determined. Follow the steps below to draft a final gradeline for the waterway bottom.

Channel Controls

Channel shape – triangular, trapezoidal, parabolic (EFH Chapter 7 page 4 Figure 7-1)

Left Slope (ft/ft) –

Right Slope (ft/ft) -

Min Bed Width (ft) – Bottom width of the waterway

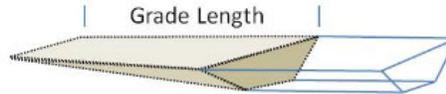
Bottom Dip – No_Dip, V-dip, parabolic-dip (MN EFH Chapter 7 page 7-4.1 and 7-4.15)

Fills Controls – If extra depth is needed (that is, if the channel bottom plus the required depth exceeds the ground elevation), the channel code will compute the location of the corner of the channel, then design a side fill at a slight side slope to a ground intercept. If no ground intercept is found within a reasonable distance, the channel design code will instead design a side-fill berm, ending the side fill at the user-defined berm top width and then sloping back down to ground

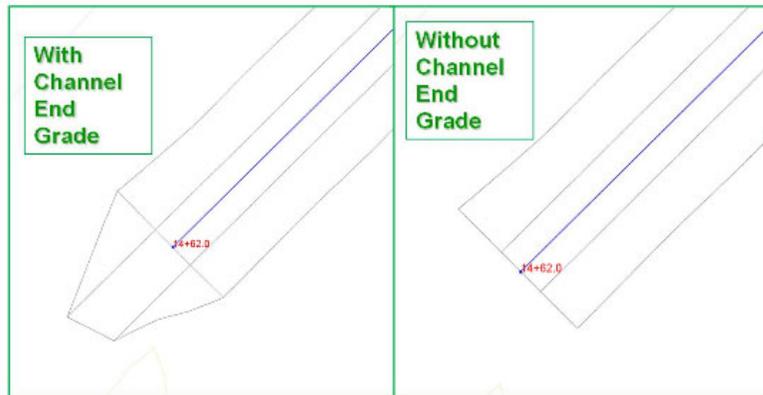
Channel Ends – The values used here will tell EFT to bring the channel up to the original ground over the distance used. This is commonly referred to as a blend reach. It is mostly meant to help generate additional yardage but helps “finish” up the ends graphically to ensure a waterway will fit where you want it, too. It does not find original ground “on grade” from the last station to original ground. It is not included in a stakeout or checkout report/file either.

Channel Ends	Start grade length (ft) 20.0	<input checked="" type="checkbox"/> Grade channel start
	End grade length (ft) 20.0	<input checked="" type="checkbox"/> Grade channel end

Channel End Shape



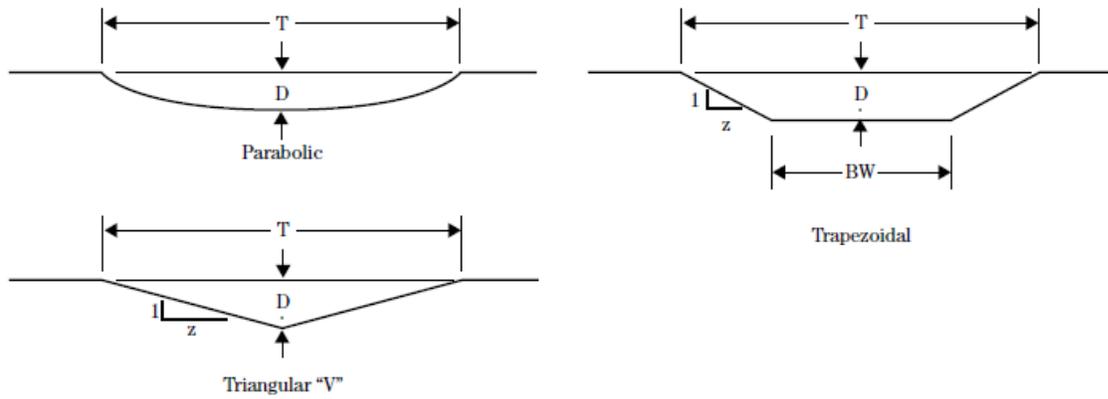
WDT calculates a cut and a fill volume spanning the entire length of the waterway. At the start and end station of the waterway, WDT can calculate cut fill as either the channel blocked off at that point or as graded to natural ground. If **Grade channel start or end** box is checked, WDT extends the channel bottom at the start or end station by the value entered as the **Start grade length** or **End grade length** and sets the bottom of channel elevation at natural ground at that distance.



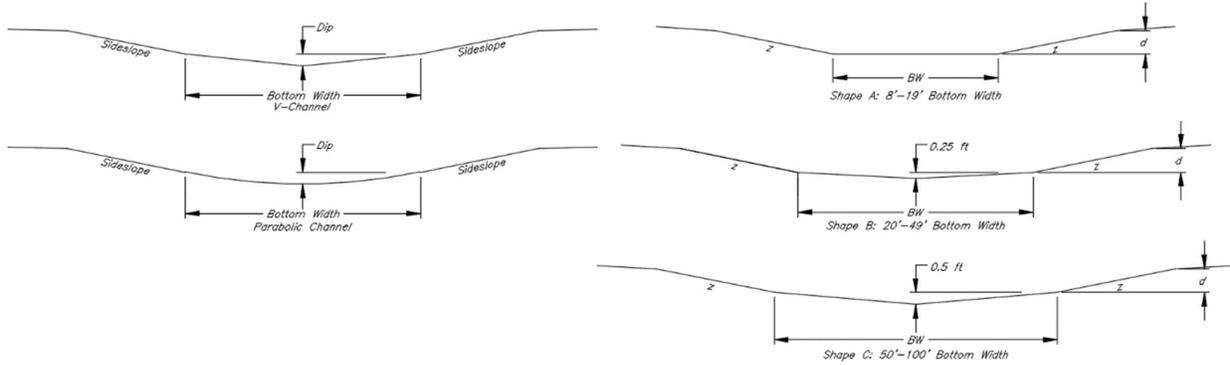
Info	Hydrology	Channel	Profile	Design
------	-----------	---------	---------	--------

Channel Controls	
Channel Shape	TRAPEZOIDAL
Freeboard (ft)	0.00
Left Slope (ft/ft)	10.00
Right Slope (ft/ft)	10.00
Min Bed Width (ft)	14.0
Bottom Dip	NO_DIP
Dip Depth (ft)	0.00
Offsets 1,2,3 (%)	0.0 0.0 0.0
Fill Controls	
Side-fill slope (%)	0.20
Berm top width (ft)	4.0
Side width limit (ft)	100.0
Berm back slope (ft/ft)	4.0
Channel Ends	
Start grade length (ft)	100.0
End grade length (ft)	100.0
<input type="checkbox"/> Grade channel start <input type="checkbox"/> Grade channel end	

Figure 7-1 Typical waterway cross sections



MN EFH Chapter 7 p. 7-4.1 Modified Trapezoidal Sections & p. 7-4.15 Grassed Waterway Shapes for MN



Profile tab

This tab is where the planned waterway bottom grade will be determined. Follow the steps below to draft a final gradeline for the waterway bottom. Tip: When hovering on the profile view the station and elevation can be displayed by turning this option on from the “View Controls” button.

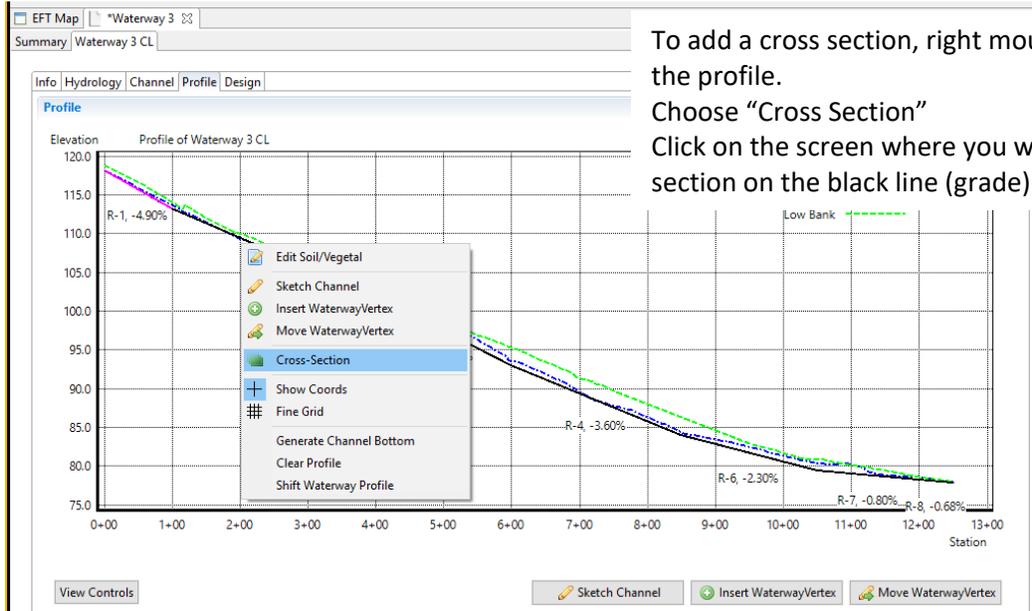
Draw in waterway bottom grade by clicking on the profile view. Double click to end.

Recommendation: Use even stations and elevations to the tenths (0.1')
Click on the station or elevation you would like to change and enter the value.

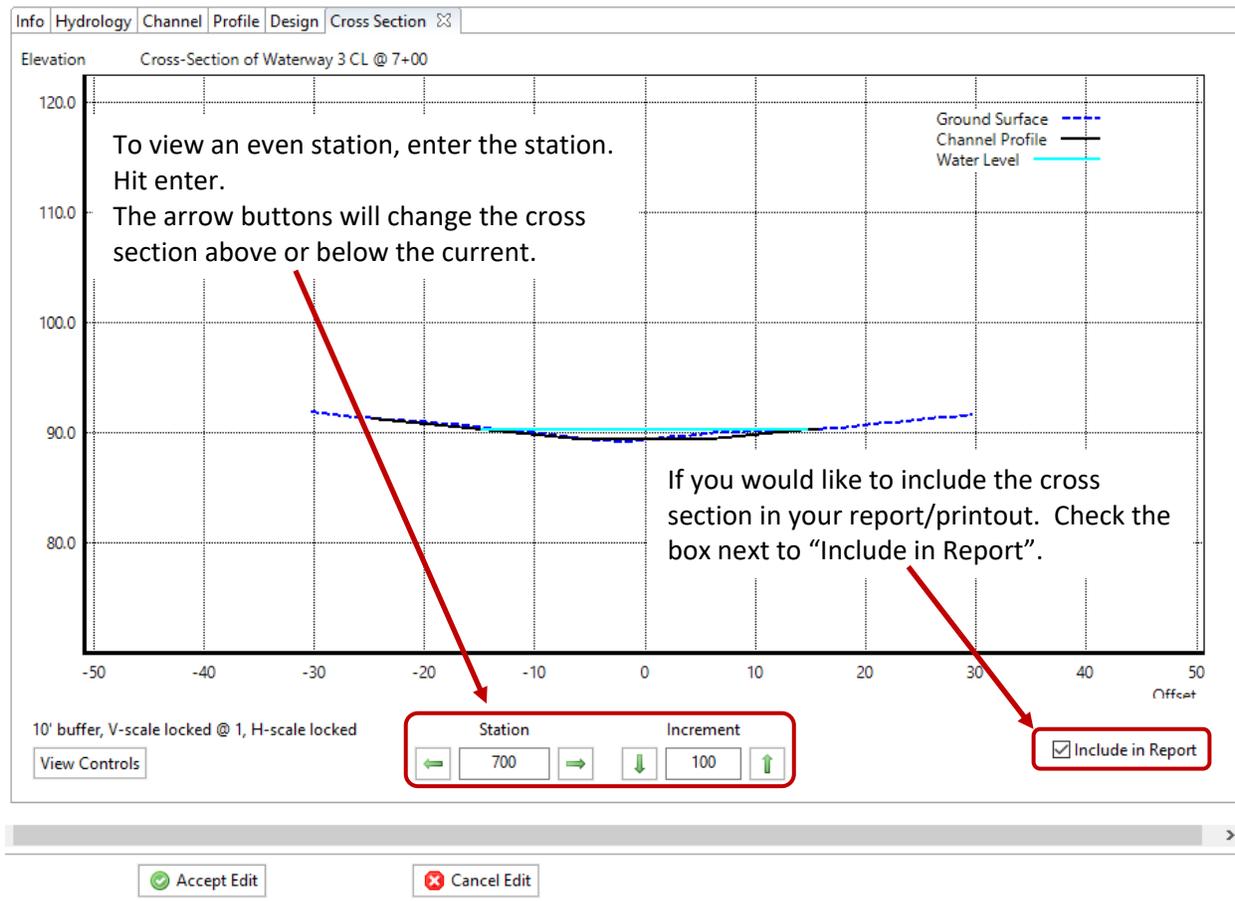
Reach	Start	End	Soil Strength	Veg. Cover	Cover Type	Stability	Capacity
R-1	1+00	2+00	0.050 lb/sq.ft (Erosion Resistant)	0.87	Kentucky Bluegrass	4.44 (D)	5.60 (C)
R-2	2+00	4+00	0.050 lb/sq.ft (Erosion Resistant)	0.87	Kentucky Bluegrass	4.44 (D)	5.60 (C)
R-3	4+00	6+00	0.050 lb/sq.ft (Erosion Resistant)	0.87	Kentucky Bluegrass	4.44 (D)	5.60 (C)
R-4	6+00	9+00	0.050 lb/sq.ft (Erosion Resistant)	0.87	Kentucky Bluegrass	4.44 (D)	5.60 (C)
R-6	9+00	11+00	0.050 lb/sq.ft (Erosion Resistant)	0.87	Kentucky Bluegrass	4.44 (D)	5.60 (C)

If you would like to change any Soil/Vegetal factor for the entire project or reach, click on the **Soil/Vegetal** tab.

To look at or develop Cross Sections



To add a cross section, right mouse click on the profile.
 Choose "Cross Section"
 Click on the screen where you want a cross section on the black line (grade).



Design tab

Info | Hydrology | Channel | Profile | Design

Simulate Runoff
Design Channel

Total Cut (cy): 0.0
Total Fill (cy): 0.0
Cut/Fill Balance (cy): 0.0
Cut/Fill Ratio: NaN

Channel

Station	Ground Z	Channel Z	Length	Grade	Runoff Q	Added Q	Total Q	Bed Width	Width w/ FB	Depth+FB	Status
0+01.0	118.08	118.05	-	-	0.00	0.00	0.00	N/A	0.00	0.00	Re-run simulation
1+00	113.59	112.80	99.00	5.30%	0.00	0.00	0.00	N/A	0.00	0.00	Re-run simulation
4+00	102.19	102.00	300.00	3.60%	0.00	0.00	0.00	N/A	0.00	0.00	Re-run simulation
6+00	93.52	93.00	200.00	4.50%	0.00	0.00	0.00	N/A	0.00	0.00	Re-run simulation
8+50.0	84.33	84.00	250.00	3.60%	0.00	0.00	0.00	N/A	0.00	0.00	Re-run simulation
10+50.0	80.30	79.40	200.00	2.30%	0.00	0.00	0.00	N/A	0.00	0.00	Re-run simulation
12+00	78.53	78.00	150.00	0.93%	0.00	0.00	0.00	N/A	0.00	0.00	Re-run simulation
12+49.8	77.86	77.86	49.80	0.28%	0.00	0.00	0.00	N/A	0.00	0.00	Re-run simulation

Design Status

Waterway data has changed. Simulate Runoff again to update sim results.

Simulate Runoff

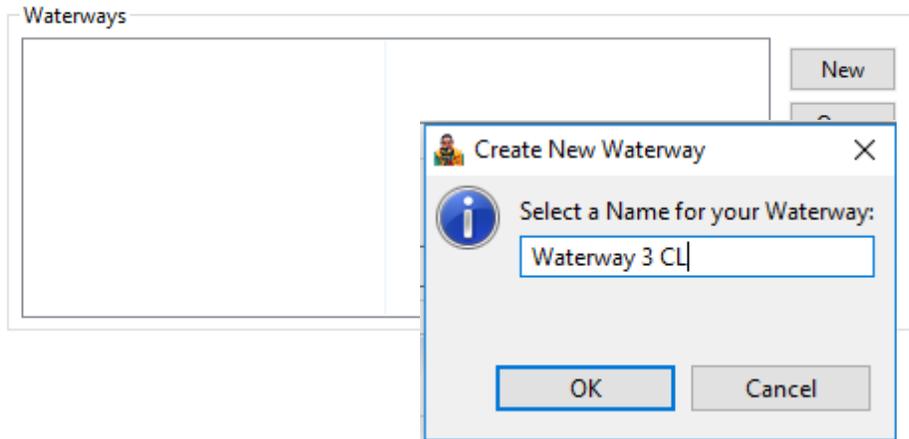
Design Channel

Errors will appear under Design Status

Accept Edit at the bottom of the page.

Adding a Lateral

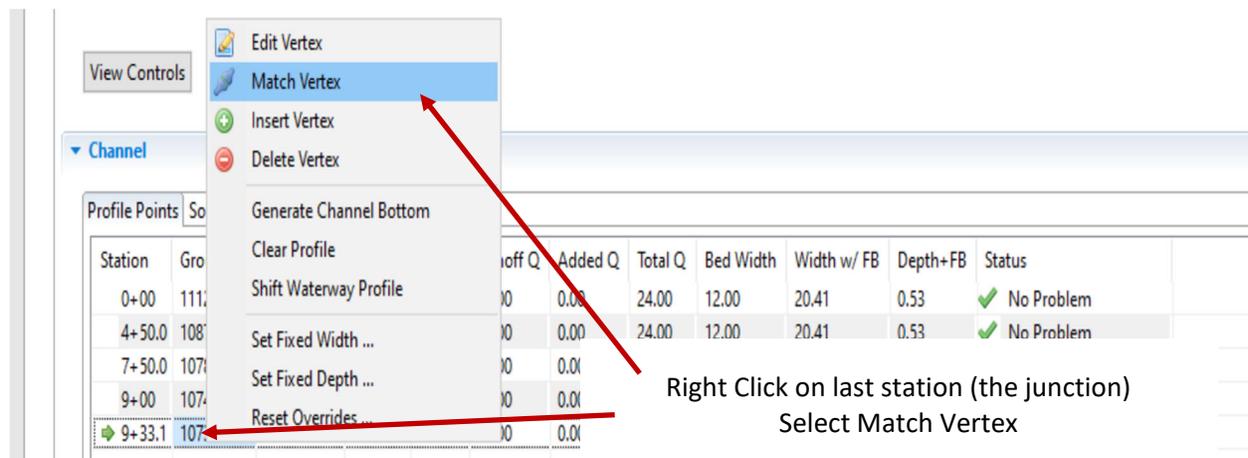
Add Lateral Alignment (See *Adding Alignment* Section)

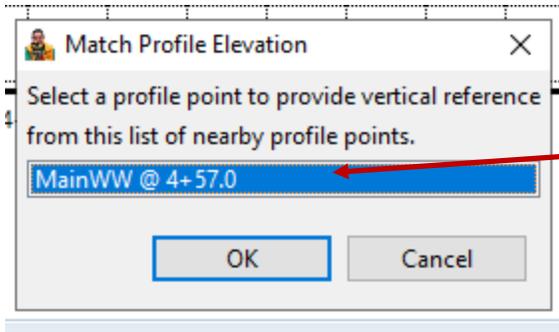


Info Hydrology Channel Profile Design ← The design will open multiple tabs.

Follow the same steps above from the main waterway to complete the lateral: Complete the Info tab (select the lateral’s alignment), Hydrology tab (over-ride model output” using the lateral’s hydrology info), Channel tab, and most of the Profile tab’s steps. After drafting the lateral’s profile, follow these remaining steps:

Profile tab (continued)





Select Station on Main Waterway (if you do not have a station on the main waterway you will need to add it)
Select Ok

Channel

Profile Points		Soil/Vegetal					
Reach	Start	End	Soil Strength	Veg. Cover	Cover Type	Stability	Capacity
R-1	1+00	2+00	0.050 lb/sq.ft (Erosion Resistant)	0.87	Kentucky Bluegrass	4.44 (D)	5.60 (C)
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R-4	6+00	9+00	0.050 lb/sq.ft (Erosion Resistant)	0.87	Kentucky Bluegrass	4.44 (D)	5.60 (C)
R-6	9+00	11+00	0.050 lb/sq.ft (Erosion Resistant)	0.87	Kentucky Bluegrass	4.44 (D)	5.60 (C)

If you would like to change any Soil/Vegetal factor for the entire project or reach, click on the **Soil/Vegetal** tab.

Design tab

Info | Hydrology | Channel | Profile | Design

Simulate Runoff
Design Channel

Total Cut (cy): 0.0
Total Fill (cy): 0.0
Cut/Fill Balance (cy): 0.0
Cut/Fill Ratio: NaN

Channel

Station	Ground Z	Channel Z	Length	Grade	Runoff Q	Added Q	Total Q	Bed Width	Width w/ FB	Depth+FB	Status
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1+00	113.59	112.80	99.00	5.30%	0.00	0.00	0.00	N/A	0.00	0.00	⚠ Re-run simulation
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8+50.0	84.33	84.00	250.00	3.60%	0.00	0.00	0.00	N/A	0.00	0.00	⚠ Re-run simulation
10+50.0	80.30	79.40	200.00	2.30%	0.00	0.00	0.00	N/A	0.00	0.00	⚠ Re-run simulation
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12+49.8	77.86	77.86	49.80	0.28%	0.00	0.00	0.00	N/A	0.00	0.00	⚠ Re-run simulation

Design Status
Waterway data has changed. Simulate Runoff again to update sim results.

Simulate Runoff
Design Channel

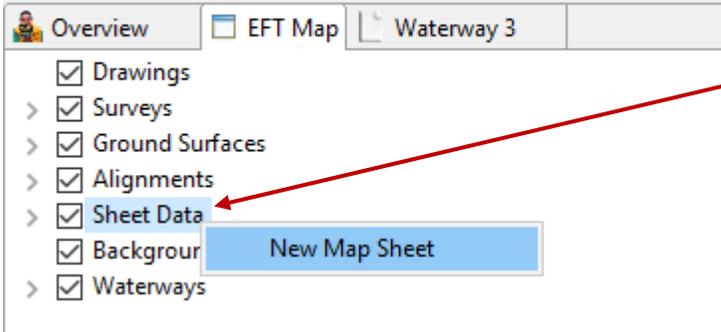
Accept Edit

Errors will appear under Design Status
at the bottom of the page.

Creating a Plan View

NRCS Engineering Field Tools (4.0.3.5)

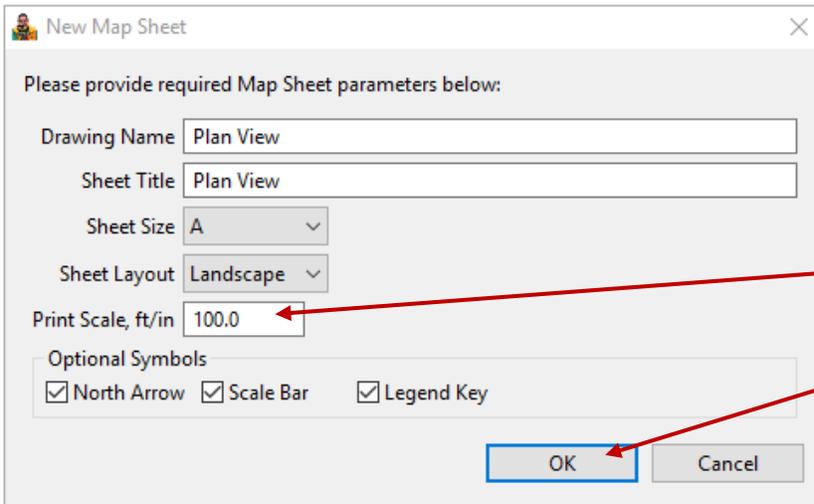
File Edit Utilities Help



Open the **EFT Map** tab.

Right click on "Sheet Data"

New Map Sheet



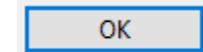
Sheet Size

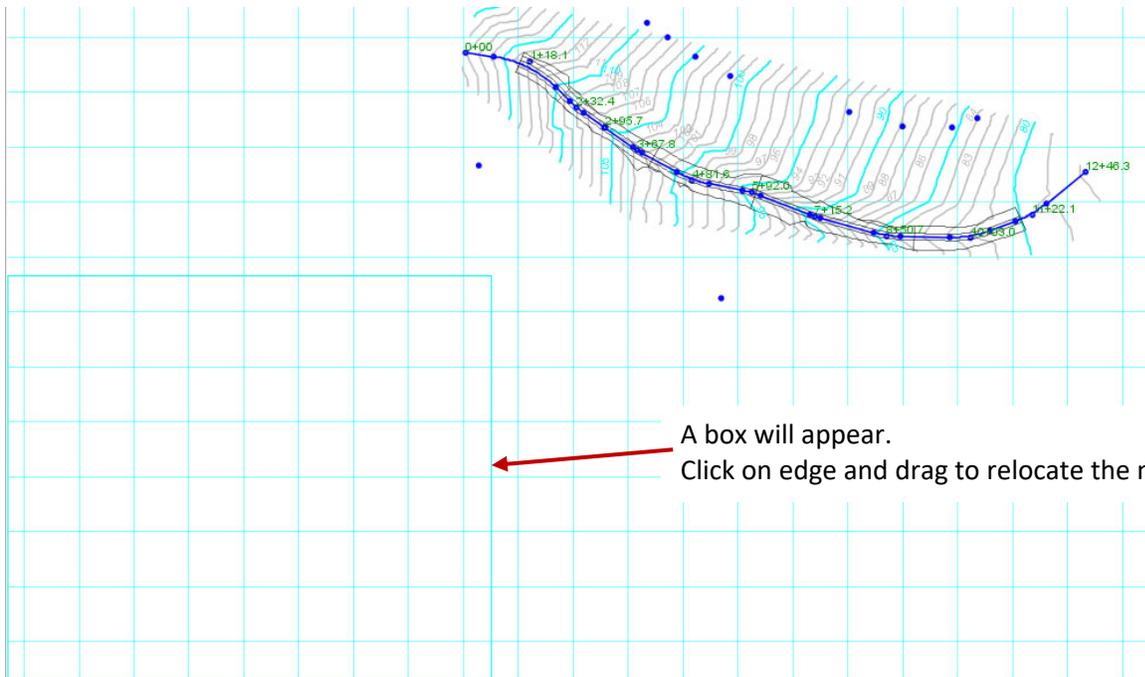
A – 8.5 x11

B – 11 x 17

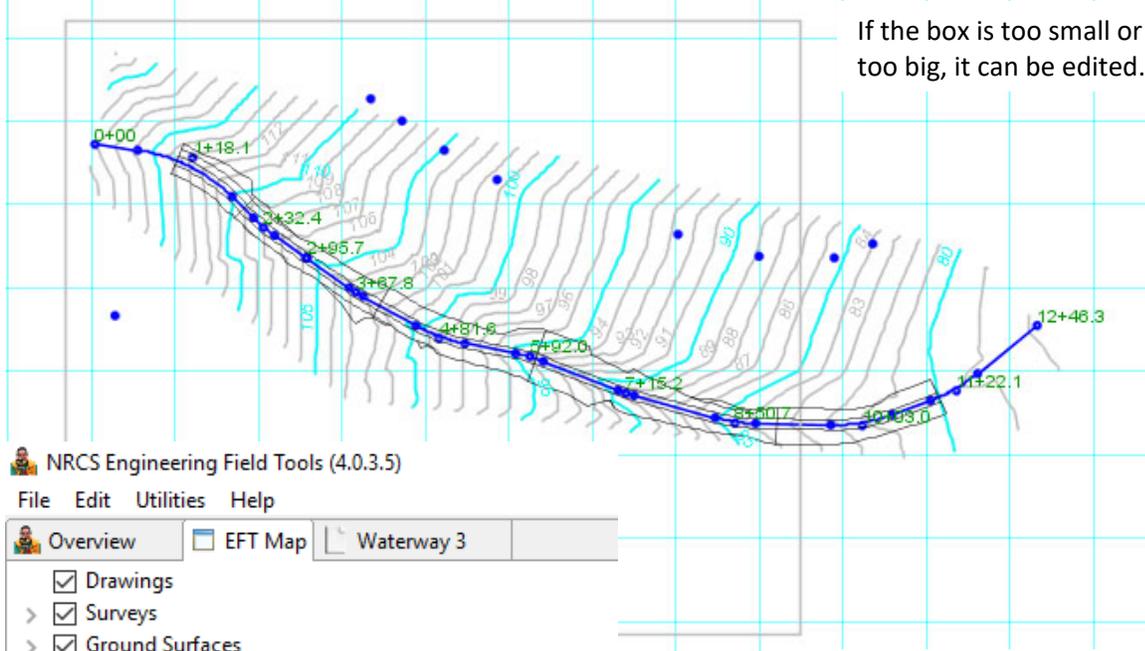
D – 22 x 34

Set the Print Scale





A box will appear.
Click on edge and drag to relocate the map.



If the box is too small or too big, it can be edited.

NRCS Engineering Field Tools (4.0.3.5)
File Edit Utilities Help

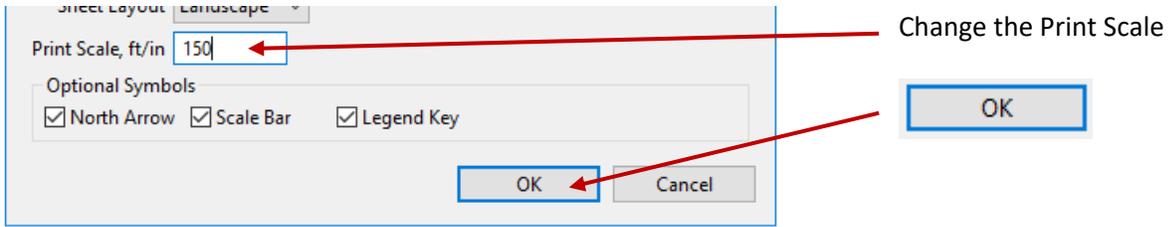
Overview EFT Map Waterway 3

- Drawings
- > Surveys
- > Ground Surfaces
- > Alignments
- ▼ Sheet Data
 - Plan View
 - Grid
 - Background
 - > Waterways

Layer Properties
Preview Sheet
Edit Params

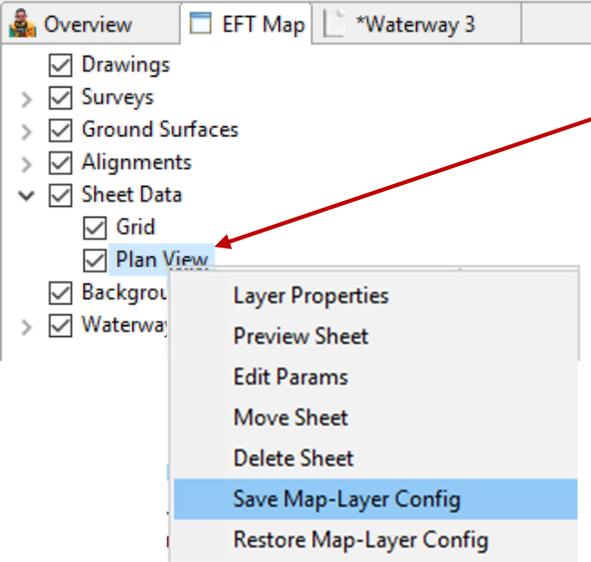
Editing the Sheet
Right click on the drawing

Edit Params



NRCS Engineering Field Tools (4.0.3.5)

File Edit Utilities Help



Previewing the Sheet

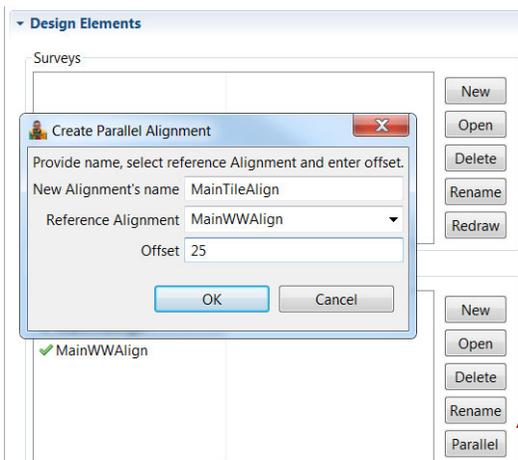
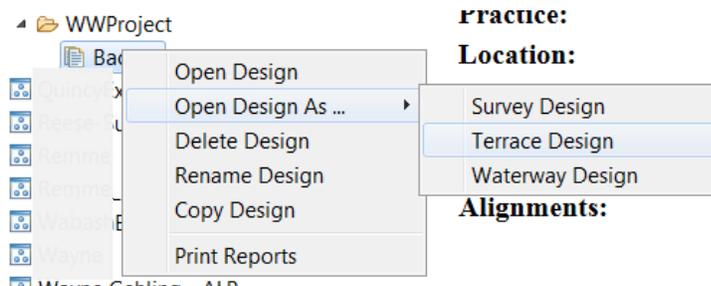
Right click on the drawing

Save Map-Layer Config

Preview Sheet

Designing Support Tile

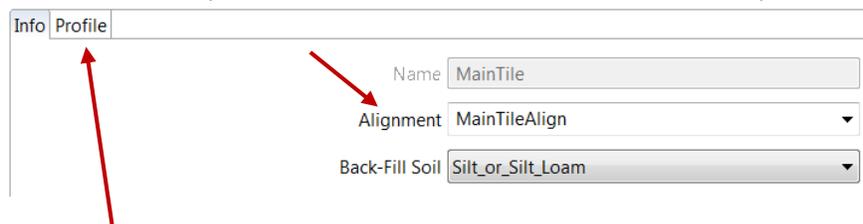
Close the current waterway design. From the Overview tab, right click on the same project to reopen it, but choose Open Design As > Terrace Design. You'll have access to your original waterway's alignments and now the UnderGround Outlet design element.



Create your tile alignment, either by the same method as above using New and Sketch Alignment to manually draw it, or offset your existing waterway centerline alignment to parallel the waterway.

To offset your centerline alignment, use the Parallel button in the Alignments design element. Use an appropriate offset distance for the tile location. Negative is left of the alignment, positive values are right of the alignment, when looking at ascending alignment stations.

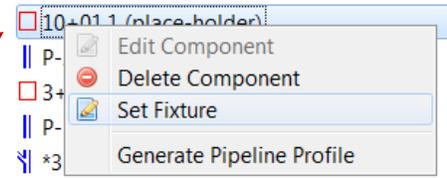
Start your tile design. In the UnderGround Outlets element choose New and name it. On the Info tab, select the corresponding tile alignment. Choose the Backfill USDA soil type in the area of your tile installation. You may need to use the most restrictive if you have several soil types. Reference PS 606, Table M-3. Set PipeLine Defaults as the minimum tile diameter you would like to use.



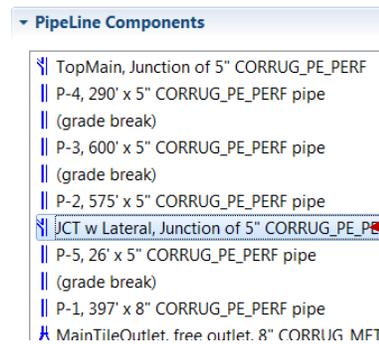
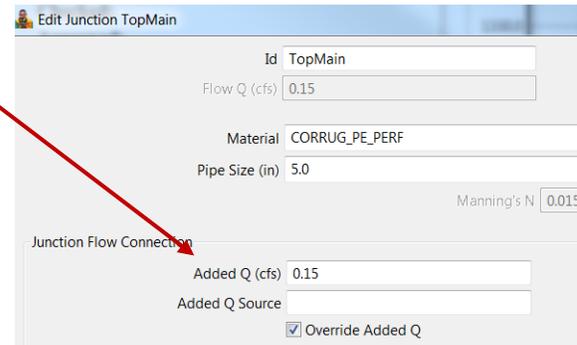
In the Profile tab, draw the tile flowline using Sketch Pipe. *Design Tip: you'll need to maintain tile cover and depth to meet the practice standard. If tile stations and waterway stations are approximately the same, you can use the EFT waterway cut sheet's channel elevations to determine appropriate tile flow line elevations.*

Each “click” along the profile and the tile ends should be identified as certain fixtures.

Right click the red box for the top of your tile and choose Set Fixture and set as a Junction. Type in an ID and adjust the station, elevation, and pipe material and size if needed.



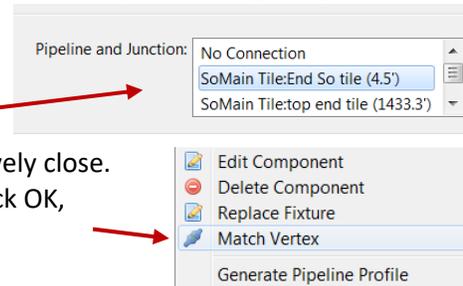
Click the Override Added Q to enter the tile discharge. Use drainage calculators or charts (e.g. EFH Fig. 14-42) to determine the Q. Base this on the area drained (lateral effect or waterway area) using the appropriate drainage coefficient.



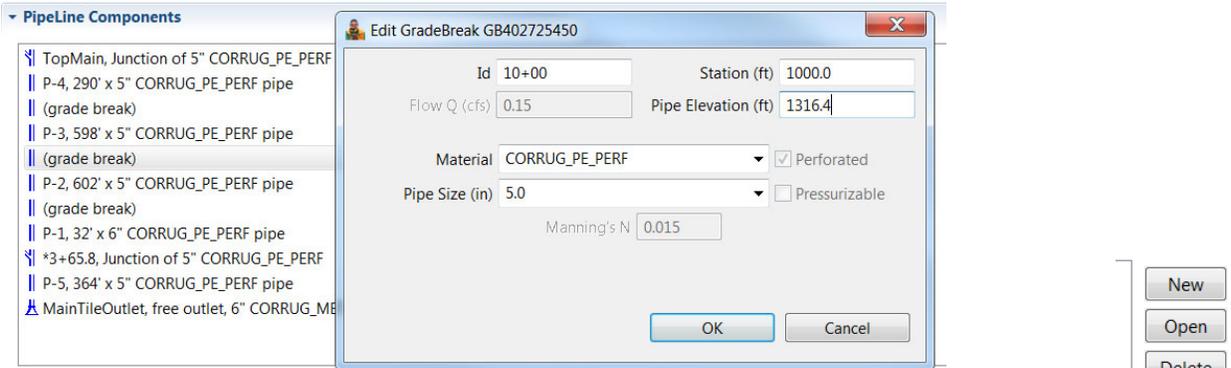
Insert a Junction anywhere you anticipate a lateral tile entering in.

Right click the red box for the bottom end of your tile, choose Set Fixture, and set as a Standard Outlet if your tile ends here. Edit the appropriate details (e.g. corrugated annular pipe, animal guard).

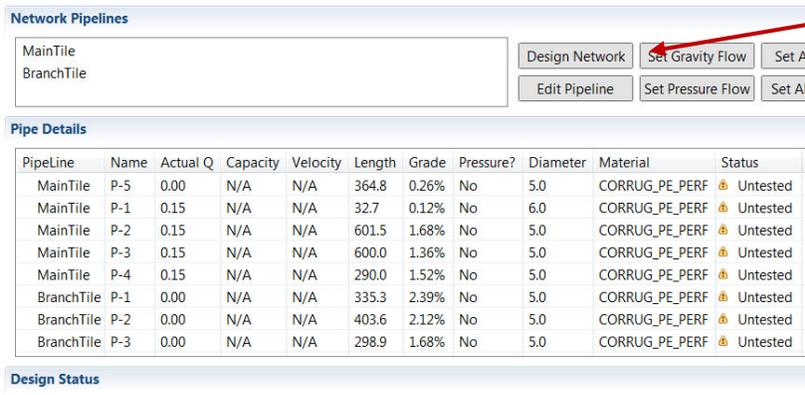
However, if this outlet connects into another tile within EFT, Set Fixture as a Junction (see diagram, next page). Choose the corresponding end/junction of the other tile in the Pipeline and Junction table (if designed, it will appear in the table) to “connect” them. Edit the station to get the two junctions relatively close. Edit the pipe elevation or, if the other tile has been designed, click OK, re-right click on this Junction and choose Match Vertex to match elevations of the two junctions.



All other red boxes can bet set as Grade Breaks. Once set as a grade break, you can right click again to open the Edit Component window and adjust stations and elevations (normally, round-off values)

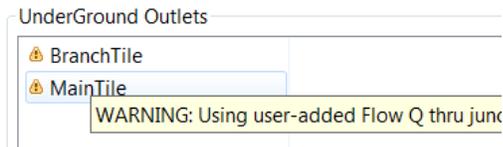


Once all pipeline components are labeled and edited, click Accept Edit at the bottom. To test the tile, from the UnderGround Outlet design element, choose Simulate.



Choose Design Network. Any subsequent errors can be addressed by clicking Edit Pipeline to make changes to the design. The program will show warnings or increase diameters where flow exceeds the default's capacity.

A successful design will show green checks and No Problem in the status column.



Click Accept Edits. Even with a successful design, the UnderGround Outlets element will show a warning that there has been a user entered Q.

Tile Design Concepts

Plan view of EFT profile junctions and ends

