Breakwater Construction Progress Tracked Using the Beach Method in CSV

By Rob Baird

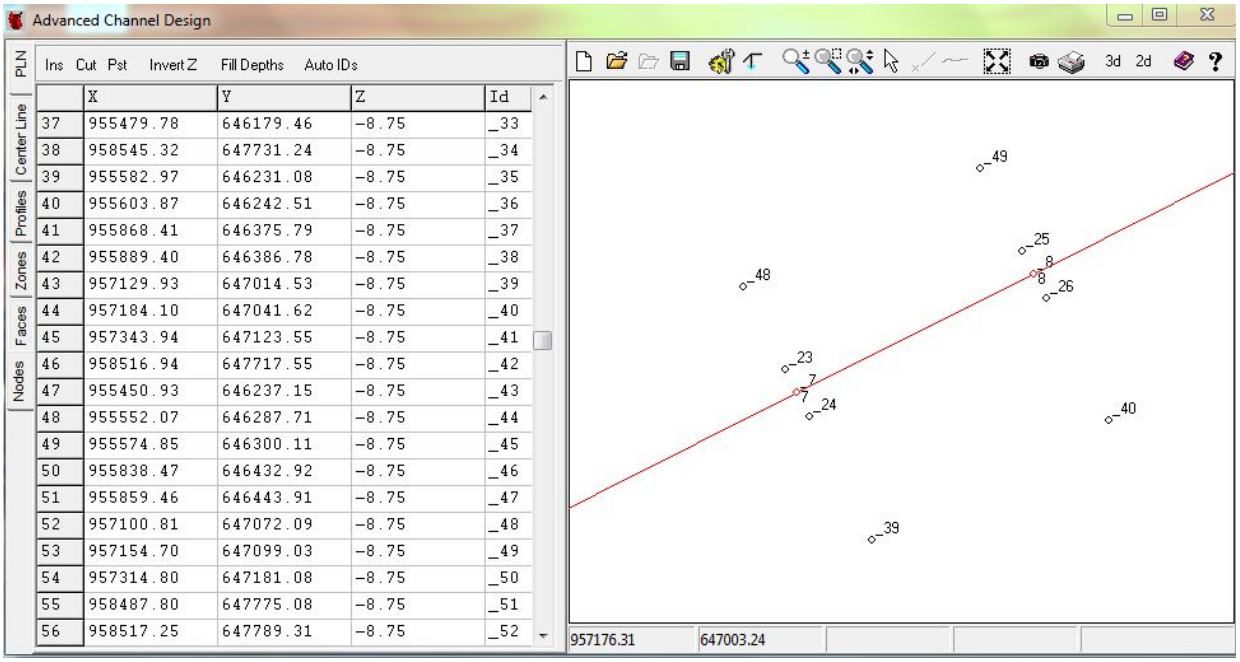
More and more construction companies are using DREDGEPACK® to track the progress of their breakwater renovation projects. The DREDGEPACK® real-time map and profile views of the breakwater provide assistance for the operators of cranes and excavators as they seek to place stone as accurately and efficiently as possible.

In fact, HYPACK® has all of the tools for the job, from the planning stages of the breakwater in ADVANCED CHANNEL DESIGN, to the real-time guidance of DREDGEPACK® during the construction phase, to volume calculations using the Beach Method in CROSS SECTIONS AND VOLUMES (CSV).

Before you start, consult your job specifications for the coordinates for all points you wish to include as part of the breakwater. You will also need an XYZ or matrix from your pre-dredge (pre-construction) survey for later use in this process.

1. **Set up your geodesy in elevation mode**, as this is a requirement for Beach Method work.
2. **Create your breakwater.** It will actually be an inverted channel, most likely featuring a crest on top of the breakwater at a specified elevation. All elevations above the zero vertical reference (waterline) should be entered as positive numbers for your breakwater in ADVANCED CHANNEL DESIGN, while depths should be input as negative “Z” values.
   a. **Enter your coordinates in the “Nodes” tab**.

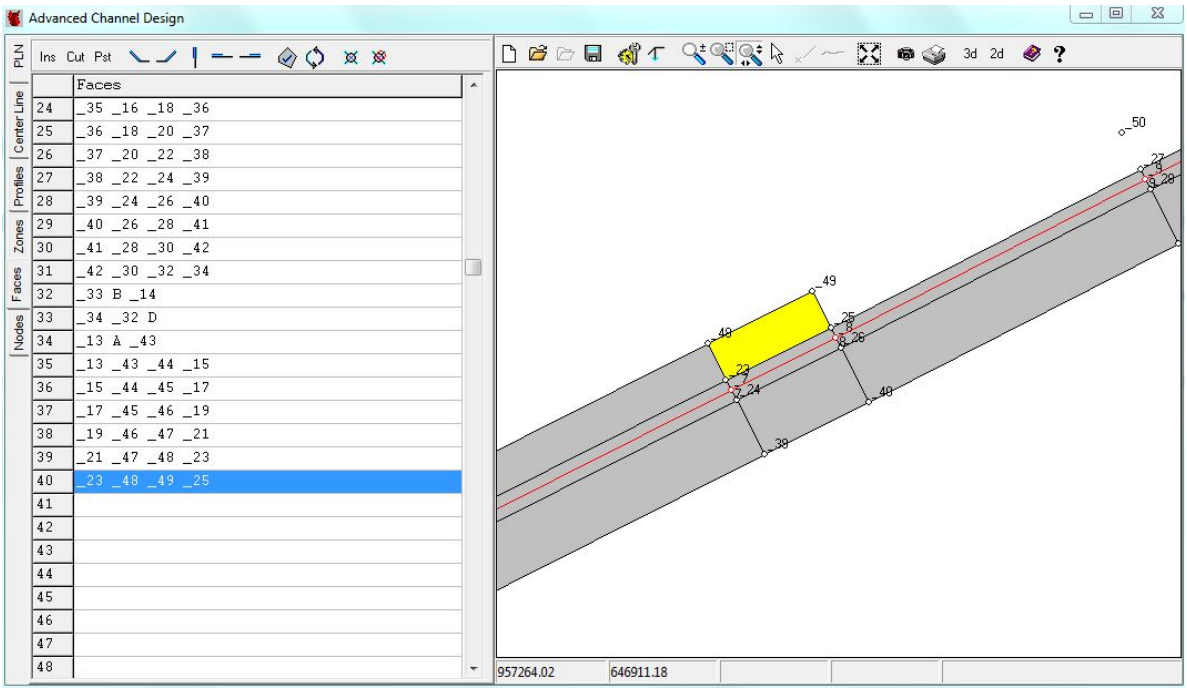
FIGURE 1. Entering the Breakwater Coordinates in the Nodes Tab of ADVANCED CHANNEL DESIGN



	X	Y	Z	Id
37	955479.78	646179.46	-8.75	_33
38	958545.32	647731.24	-8.75	_34
39	955582.97	646231.08	-8.75	_35
40	955603.87	646242.51	-8.75	_36
41	955868.41	646375.79	-8.75	_37
42	955889.40	646386.78	-8.75	_38
43	957129.93	647014.53	-8.75	_39
44	957184.10	647041.62	-8.75	_40
45	957343.94	647123.55	-8.75	_41
46	958516.94	647717.55	-8.75	_42
47	955450.93	646237.15	-8.75	_43
48	955552.07	646287.71	-8.75	_44
49	955574.85	646300.11	-8.75	_45
50	955838.47	646432.92	-8.75	_46
51	955859.46	646443.91	-8.75	_47
52	957100.81	647072.09	-8.75	_48
53	957154.70	647099.03	-8.75	_49
54	957314.80	647181.08	-8.75	_50
55	958487.80	647775.08	-8.75	_51
56	958517.25	647789.31	-8.75	_52

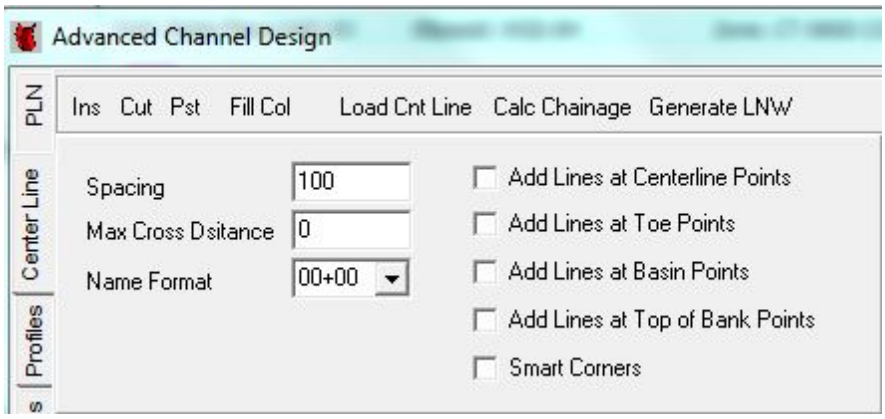
   b. **Connect the nodes in the “Faces” tab**. They must be input in clockwise fashion, with a space between each node.

FIGURE 2. *Defining the Faces of the Breakwater*



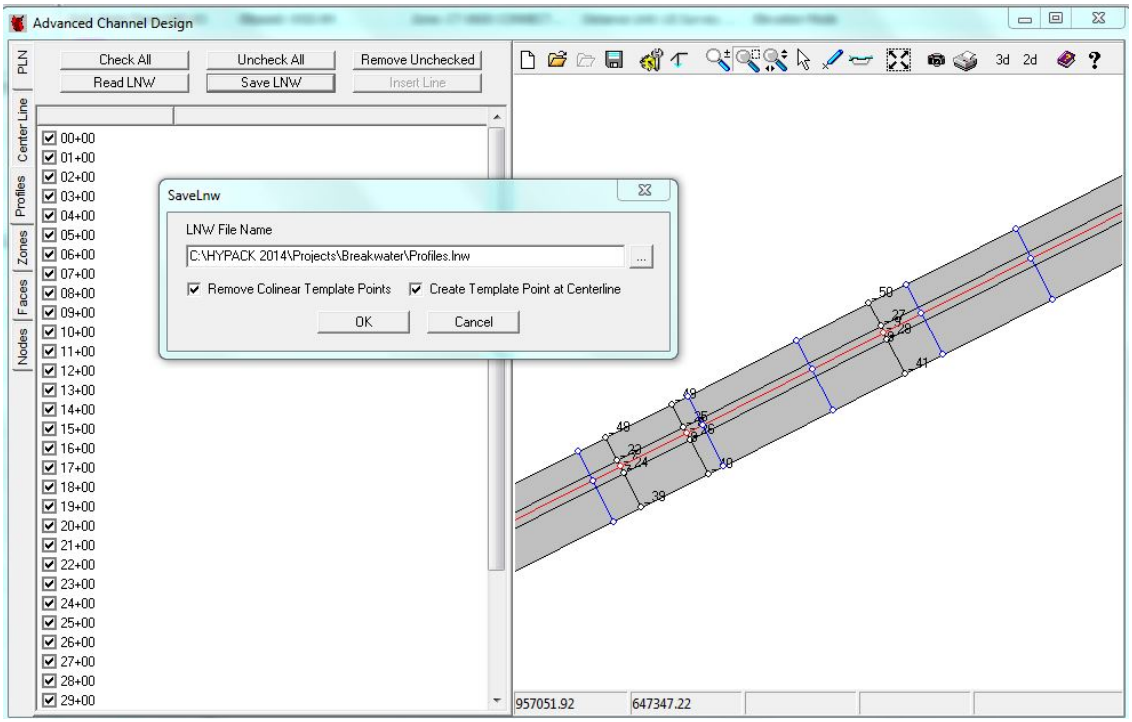
c. **In the Center Line Tab, load the centerline and generate an LNW (planned line file) with template information.**

FIGURE 3. *Center Line Tab of ADVANCED CHANNEL DESIGN*



d. **In the "Profiles" Tab, preview the cross sectional lines, then save the LNW**. Click [Save LNW], name your file and click [OK] to close out of the window and complete the save process.

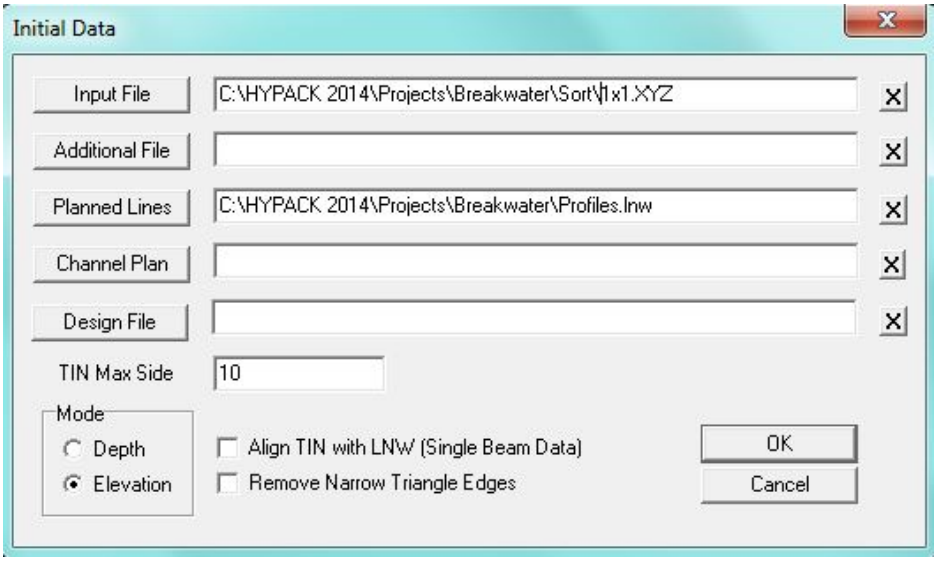
FIGURE 4. *Saving the Planned Lines*



This LNW with template information will be used later in CSV to help us look at the breakwater cross sections vs. the pre-dredge survey.

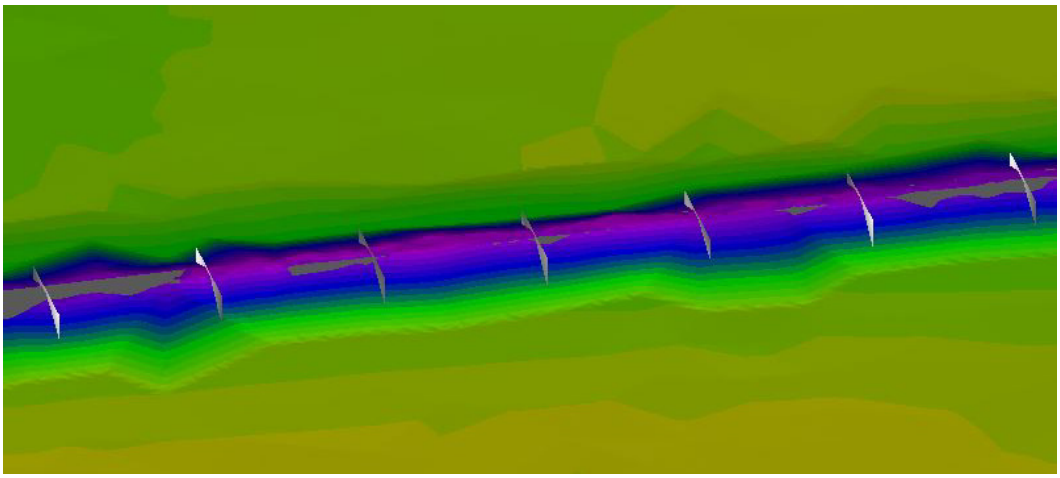
3. **Export edited ALL format files from TIN MODEL**. This requires a pre-dredge survey which covers all of the construction area.
   a. **Open TIN MODEL and build a TIN model with the XYZ (or matrix file) from your pre-dredge survey and the LNW from ADVANCED CHANNEL DESIGN**.

FIGURE 5. *Building your Predredge TIN Model*



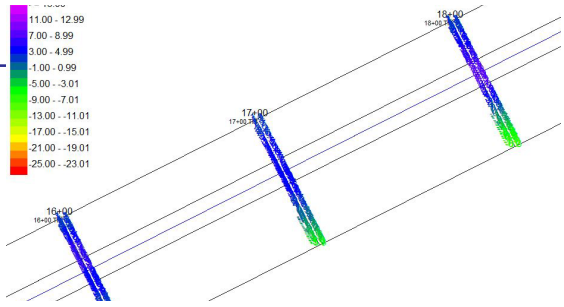
b. Take a look at the different views to **ensure that you have full coverage and can see the LNW cross sections across your breakwater**. Figure 6 shows a zoomed-in 3D view in TIN MODEL:

FIGURE 6. *Previewing your TIN Model and Section Lines*



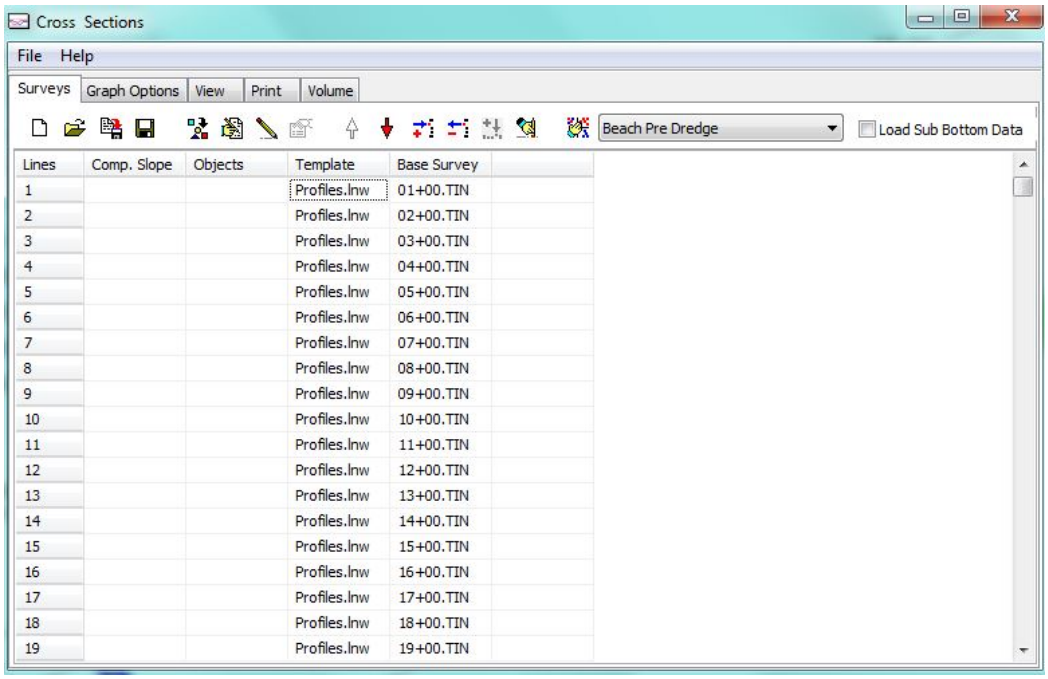
c. **Export the ALL format files from where the planned lines cut the TIN model**, and load them into the Shell to take a quick peek:

FIGURE 7. *Previewing Your ALL Format Data in the HYPACK® Shel*



4. **Open CROSS SECTIONS AND VOLUMES** and do the following:
   a. **Load your log of ALL format files** (with TIN extension as default) as the Base Survey.
   b. **Load the LNW from ADVANCED CHANNEL DESIGN as your Template.**

FIGURE 8.



c. **Configure your viewing options in the "Graph Options" tab** to your liking. Remember to select "Elevation Mode" to properly display your breakwater.

d. **In the View tab, check out your cross sections**— the pre-dredge survey against the breakwater templates:

FIGURE 9. *Viewing your Breakwater Against your Predredge Data*

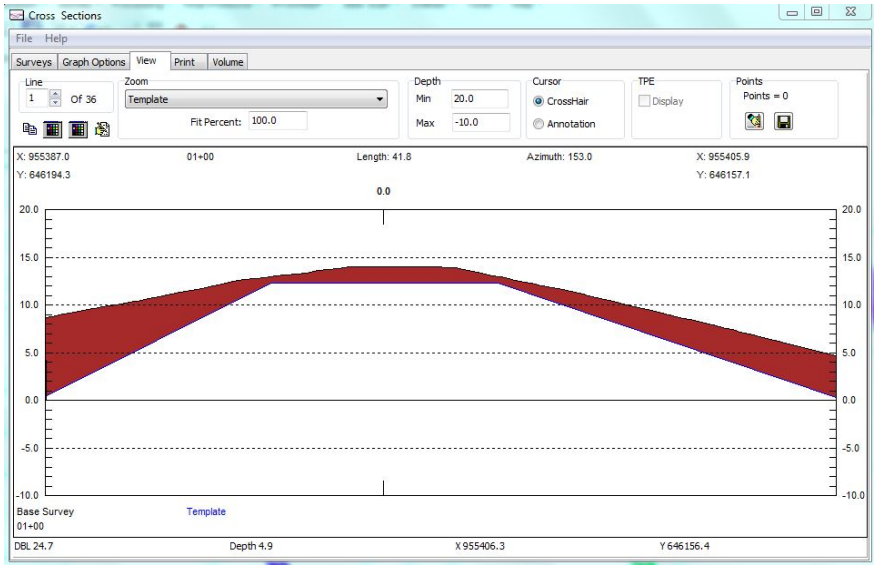
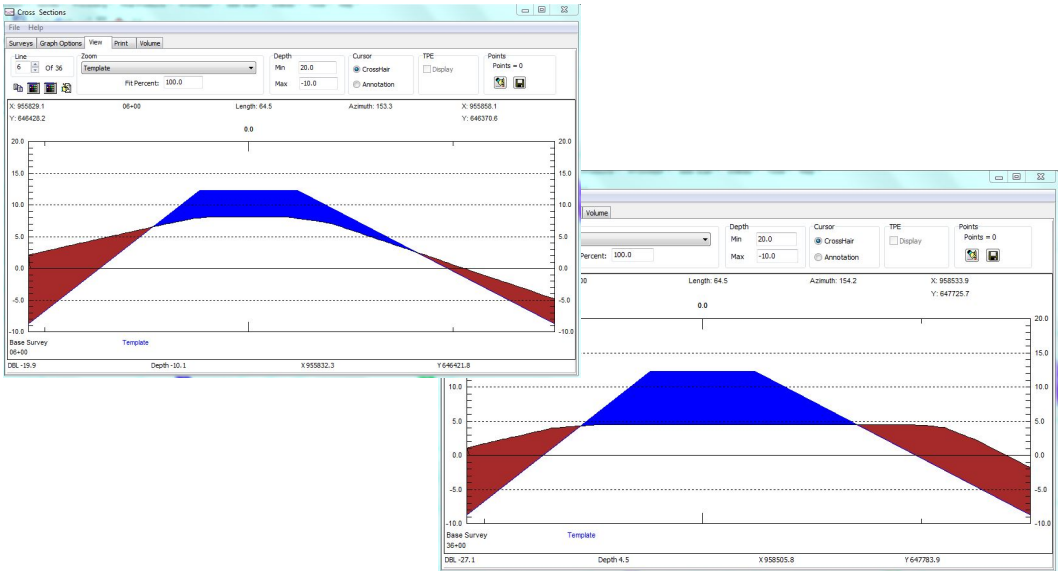
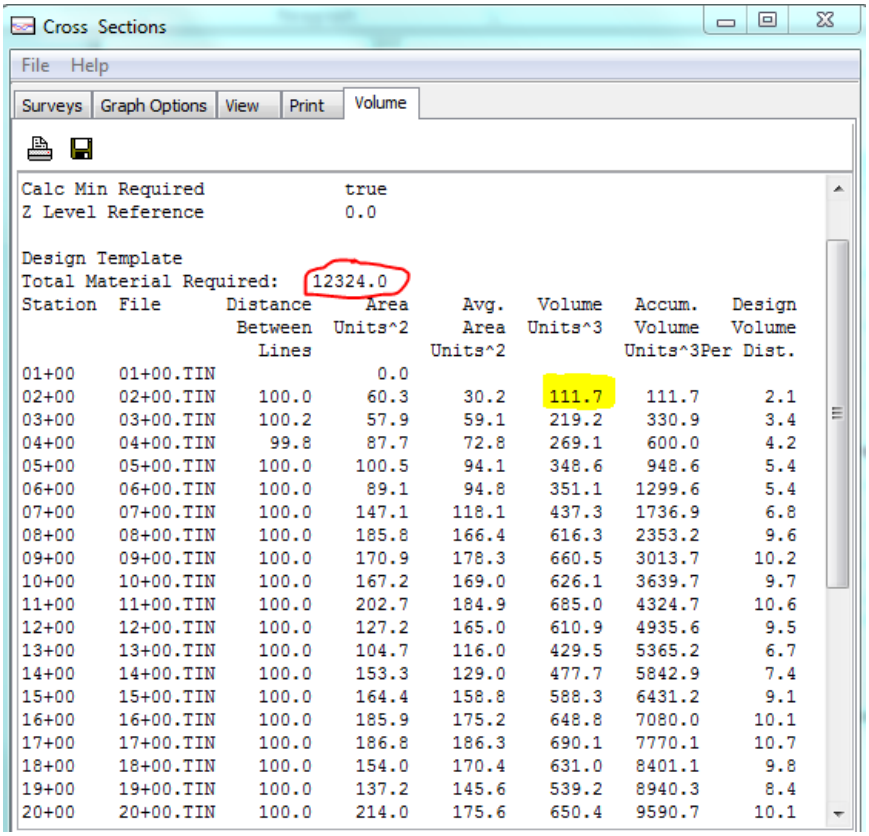


FIGURE 10. *Additional Sections*



e. **View the volume calculations in the "Volumes" tab** to see the volume of stone required in between stations (first such area shown in yellow in the following image), as well as the total amount required to fill the entirety of the breakwater (circled in red).

FIGURE 11. *Volumes Calculations*



Calc Min Required true
Z Level Reference 0.0

Design Template
Total Material Required: 12324.0

Station	File	Distance Between Lines	Area Units^2	Avg. Area Units^2	Volume Units^3	Accum. Volume Units^3	Design Volume Per Dist.
01+00	01+00.TIN		0.0				
02+00	02+00.TIN	100.0	60.3	30.2	111.7	111.7	2.1
03+00	03+00.TIN	100.2	57.9	59.1	219.2	330.9	3.4
04+00	04+00.TIN	99.8	87.7	72.8	269.1	600.0	4.2
05+00	05+00.TIN	100.0	100.5	94.1	348.6	948.6	5.4
06+00	06+00.TIN	100.0	89.1	94.8	351.1	1299.6	5.4
07+00	07+00.TIN	100.0	147.1	118.1	437.3	1736.9	6.8
08+00	08+00.TIN	100.0	185.8	166.4	616.3	2353.2	9.6
09+00	09+00.TIN	100.0	170.9	178.3	660.5	3013.7	10.2
10+00	10+00.TIN	100.0	167.2	169.0	626.1	3639.7	9.7
11+00	11+00.TIN	100.0	202.7	184.9	685.0	4324.7	10.6
12+00	12+00.TIN	100.0	127.2	165.0	610.9	4935.6	9.5
13+00	13+00.TIN	100.0	104.7	116.0	429.5	5365.2	6.7
14+00	14+00.TIN	100.0	153.3	129.0	477.7	5842.9	7.4
15+00	15+00.TIN	100.0	164.4	158.8	588.3	6431.2	9.1
16+00	16+00.TIN	100.0	185.9	175.2	648.8	7080.0	10.1
17+00	17+00.TIN	100.0	186.8	186.3	690.1	7770.1	10.7
18+00	18+00.TIN	100.0	154.0	170.4	631.0	8401.1	9.8
19+00	19+00.TIN	100.0	137.2	145.6	539.2	8940.3	8.4
20+00	20+00.TIN	100.0	214.0	175.6	650.4	9590.7	10.1