



Healthy Estuaries 2020: Towards Addressing Coastal Squeeze in Estuaries

Appendix B: Technical User Guide

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1 REQUIREMENTS

1.1 Software

1.1.1 ESRI ArcMap

The Healthy Estuaries 2020 Toolbox (HET) has been developed using ESRI ArcMap software and will work with version 10.1 and later.

http://www.esri.com/software/arcgis/arcgis10

The toolbox requires extensions:

- 3D Analyst
- Spatial Analyst

1.1.2 Microsoft Excel

The tool links to data stored within an Excel file. The tool requires Microsoft Excel 2010 or later.

1.1.3 Third Party Tools

The toolbox uses the ET Geo Wizard application to perform a number of the geoprocessing tasks.

The tool is designed to work with version 10.2 of ET Geowizards and can be bought from <u>http://www.ian-ko.com/</u>. Follow installation instructions from the supplier.

1.2 Data

Name	Description	Format	
AIMS	Man Made Defences	ESRI Shapefile	
(Asset Information			
Management System)			
Bathymetry	Topology of the estuary floor – best	ESRI Grid or	
	resolution available	ASCI	
Lidar	Topology of the terrain	ESRI Grid or	
		ASCI	
Saltmarsh	Spatial Location of Saltmarsh	ESRI Shapefile	
Geology	Layers of geology for analysis.	WMS (web	
	(http://www.bgs.ac.uk/data/services/wms.ht	mapping	
	<u>ml</u>)	Service) / ESRI	
		Shapefile	
Tidal Datum's	Location and level of tidal ranges (Mean	ESRI Point and	
	High Water Spring tide, Mean High water	Text	
	Neap Tide and mean Low Water Spring		
	Tide.		



2 INSTALLATION

2.1 Files

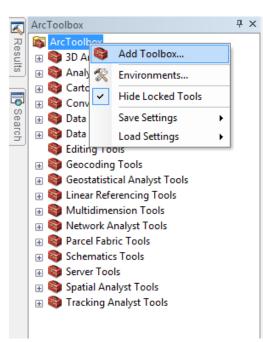
Make a copy of the file below to a folder on your network or local computer e.g. 'E:\Healthy Estuaries 2020\Humber Estuary'.

Name
AllVolume.dbf
🜍 Healthy Estuaries 2020 Toolbox.tbx
🔄 Healthy Estuary Tool.xlsm

2.2 Toolbox

The HET tool has been developed as an ESRI ArcMap Toolbox to add the HET toolbox to your existing toolboxes

- 1. Opening ArcMap.
- 2. Open Toolbox
- 3. Add Toolbox by right clicking on ArcToolbox and selecting Add Toolbox...





4. Navigate to the toolbox location and open.

Add Toolbox		x
Look in: 🔁]Healthy Estuaries 2020 🔹 🛧 🏠 🕼 🕅 🖛 🔛 🖆 🗍) ()
Name	Туре	
Healthy Es	istuaries 2020 Toolbox.tbx Toolbox	
Name:	Healthy Estuaries 2020 Toolbox.tbx Open	۱
Show of type:	Toolboxes	el

5. The toolbox should be displayed in the ArcToolbox Directory as Healthy Estuary

ArcToolbox		×
🚳 ArcToolbox		
🗄 🚳 3D Analyst Tools		
🗄 🚳 Analysis Tools		
🗄 🚳 Cartography Tools		
🕀 🚳 Conversion Tools		
🗄 🚳 Data Interoperability Tools		
🗄 🚳 Data Management Tools		
🜍 Editing Tools		
🗄 🜍 Geocoding Tools		
🗄 🚳 Geostatistical Analyst Tools		
🖃 🜍 Healthy Estuary		
蹄 1. Create Geodatabase		
🔤 10. Healthy Estuary Outputs		
🔤 2. Tide Level Extents		
🔤 3. Create Sections		
🔤 4. Clip Sections		
🔤 5. Section Area		
🔤 6. Tidal Prism Grid		
🔤 7. Tidal Prism		
🔤 8. Tidal Prism Calc		
🔤 9. Tidal Prism Volume		
🗄 🚳 Linear Referencing Tools		
🗄 🚳 Multidimension Tools		
🗄 🚳 Network Analyst Tools		
🕀 🚳 Parcel Fabric Tools		
🕀 🚳 Schematics Tools		
🕀 🚳 Server Tools		
🕀 📦 Spatial Analyst Tools		
🗄 🚳 Tracking Analyst Tools		



3 DATA PREPARATION

3.1 Bathymetry and LiDAR

To undertake the analysis the HET tool requires a topographic surface which incorporates the bathymetric data along with terrain, so those areas with a tidal range that is larger than the bathymetric datasets. The tool does not combine these two datasets so this needs to be undertaken before running the toolbox.

The HET toolbox requires the combined bathymetry and terrain data to be in either an ASCII grid or an ESRI grid format. Bathymetric points can be converted into a grid using ESRI 3D Analyst to create a TIN (Triangulated Irregular Network) and then converted from a TIN to a Grid. See ESRI.com for further help.

The data needs to be to Ordnance Datum and in metres.



4 RUNNING THE TOOLBOX

4.1 Toolbox Usage

The HET toolbox is made up of 10 models; each model requires a user input / data and will output into a central file store and needs to be run in order.

To run the toolbox, double-click the tool within ArcToolbox and select the model which needs to be run.

4.2 Model 1 – Create Geodatabase

This tool creates a blank ESRI geodatabase in a user selected directory with predefined tables to be used in future models. Use the same directory you stored the toolbox, Excel file and dbf file in. (Section 2.1)

The geodatabase will act as the central storage location for the temporary and final files of the process.

1. Double-click the '1. Create Geodatabase' model.

Save GDB Location		*	File GDB Name
E: Healthy Estuaries	s 2020\Humber Estuary		
File GDB Name			No description
Humber			available
		∇	

- 2. Under 'Save GDB Location', enter your selected storage location, e.g. E:\Healthy Estuaries 2020\Humber Estuary.
- 3. Under 'File GDB Name', enter the name of the geodatabase, e.g. for the Humber Estuary enter Humber.
- 4. Click OK to run the model.



Create Geodatabase	٤
Completed	Close
	<< Details
Close this dialog when completed successfully	
Name TEXT # # 50 # NULLABLE REQUIRED #	•
Start Time: Mon Jun 02 13:31:34 2014	
Adding Name to E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb\Waterlevel_Sections	
Succeeded at Mon Jun 02 13:31:35 2014 (Elapsed Time: 1.00 seconds)	
Executing (MLWS): AddField "E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb\Waterlevel_	Sections"
MLWS DOUBLE # # # # NULLABLE REQUIRED #	
Start Time: Mon Jun 02 13:31:35 2014	
Adding MLWS to E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb\Waterlevel_Sections	
Succeeded at Mon Jun 02 13:31:36 2014 (Elapsed Time: 1.00 seconds)	
Executing (MHWN): AddField "E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb\Waterlevel_	Sections"
MHWN DOUBLE # # # # NULLABLE REQUIRED #	
Start Time: Mon Jun 02 13:31:36 2014	
Adding MHWN to E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb\Waterlevel_Sections	
Succeeded at Mon Jun 02 13:31:37 2014 (Elapsed Time: 1.00 seconds)	
Executing (MHWS): AddField "E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb\Waterlevel_	Sections"
MHWS DOUBLE # # # # NULLABLE REQUIRED #	=
Start Time: Mon Jun 02 13:31:37 2014	-
Adding MHWS to E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb\Waterlevel_Sections	
Succeeded at Mon Jun 02 13:31:37 2014 (Elapsed Time: 0.00 seconds)	
Succeeded at Mon Jun 02 13:31:38 2014 (Elapsed Time: 10.00 seconds)	

- 5. A geodatabase will have been created in the folder selected.
- 6. To check the tables have been created view the geodatabase in your ArcCatalog window

Name		Date modified	Туре	Size
퉬 Humber.gdb		02/06/2014 13:31	File folder	
	Catalog		ч ×	
	🗢 🕈 🗢 🟠	8 🖬 🕈 🔛 🖬	>>> >>>	
	Location: 间 Humb	ber.gdb	•	
		Humber Estuary I Humber.gdb	*	
		Healthy Estuaries 2020 To	olb	
	🗉 🧰 HS2			
	🗉 🗄 🗄 Livi	ing Data Portal		
		.670 - SUDS Tool		
	🕀 🕀 🖻 🕀 🗄			
		erborough Health		
		nple.xlsx	=	
			-	
	🖃 🚳 Toolboxes			
	⊞	i Toolboxes		
	🗄 📷 System			
			*	
	∢		P	
	Name			
	🛨 CentreLine			
	-Waterlevel_Sec	tions		
	1			



4.3 Model 2 – Tidal Level Extents

Model 2 creates tidal water level grids of the estuary for:

- Mean High Water Spring Tide;
- Mean High Water Neap Tide; and
- Mean Low Water Spring Tide.

The water level surface grids are used to determine the model extents.

- 1. Identify the location of the tide gauges within the study area.
- 2. If required add the locations to the map.

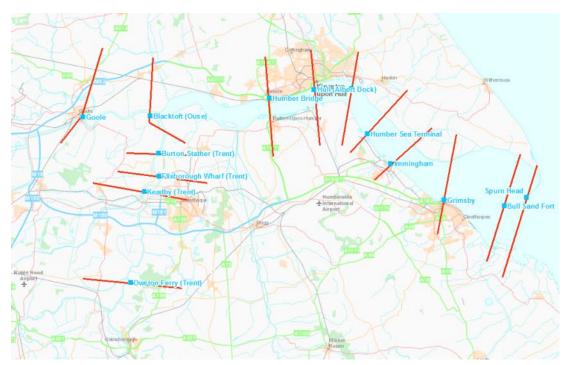


3. Add the Waterlevel_Sections file created from Model 1 into the workspace and start editing.

Name	
- Centrel ine	
Heaterlevel_Sections	

- 4. Create lines perpendicular to the watercourse at each of the tidal datum locations (red lines). Note that as locations of convergence the lines need to cross both watercourse (See Blacktoft)
- 5. Add additional perpendicular lines to the end of the model extent if these extents are not the same as your tidal datum. These lines will be used to produce a TIN of the water levels; as such the arrangements and extents of the lines should cover the entire model.





6. Open the attributes of the lines and populate the Name (optional), MLWS, MHWN and MHWS data to mOAD.

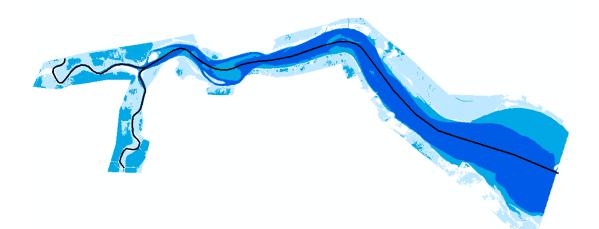
Wa	aterlevel_Section	IS					
	OBJECTID *	Shape *	Shape_Length	Name	MLWS	MHWN	MHWS
Þ	1	Polyline	17184.178476	Spurn Head	-2.7	1.6	3
	2	Polyline	16569.221467	Bull Sand Fort	-2.8	1.6	3
	3	Polyline	14903.456902	Grimsby	-2.7	1.7	3.1
	4	Polyline	12481.930369	Humber Sea Terminal	-2.8	1.8	3.3
	5	Polyline	11430.916378	Immingham	-3	1.9	3.4
	6	Polyline	14005.584701	Hull (King George Dock)	-3.2	2.1	3.7
	7	Polyline	14128.697357	Hull (Albert Dock)	-3.2	2	3.7
	8	Polyline	14698.978958	Humber Bridge	-3	2.1	3.9
	9	Polyline	11093.507876	Burton Stather (Trent)	0.7	2.4	4.1
	10	Polyline	13268.898392	Flixborough Wharf (Trent)	-0.9	2.3	4.1
	11	Polyline	14091.608084	Keadby (Trent)	-0.4	2.6	4.4
	12	Polyline	14651.143851	Owston Ferry (Trent)	<null></null>	2.4	4.3
	13	Polyline	15636.233887	Blacktoft (Ouse)	-1.7	2.5	4.2
	14	Polyline	15543.965797	Goole	-1.1	2.3	4.3

- 7. Stop editing
- 8. Double Click '2 Tide Level Extents' within the toolbox.
- 9. Add the Geodatabase Location (same as before)
- 10. Add the Location of your bathymetry grid.
- 11. Click Ok.



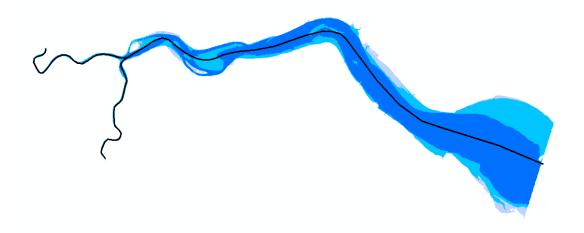
📴 2. Tide Level Extents		
GDB Location	*	GDB Location
E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb		N
Topo_Bathy		No description available
Bathymetry		available
	Ŧ	T
OK Cancel Environments << Hide Help		Tool Help

- 12. The below represents the extents created in the geodatabase as;
 - MLWS
 - MHWN
 - MHWS





13. The tidal extents are typically larger than required, with low lying land from the bathymetry and LiDAR being included. To limit the analysis, the AIMS defence data can be used to clip the polygons.



4.4 Model 3 – Create Sections

This stage of the model creates the section lines which are used as part of the tidal prism calculations and the profiles of the estuary.

The automatic process does require user verification as described in Section 4.3 of the main report.

1. Add the Centreline file generated from Model 1 into the map and start editing.

Name	
- CentreLine	
waterlevel_Sections	_

- 2. Draw the approximate centrelines of the river, starting from the Upstream Extent / Tidal limit down to each confluence.
- 3. At each confluence draw another centreline down the river to the confluence point and meet the previous line.
- 4. Do this for all centrelines required for the estuary
- 5. Attribute up the centrelines in order as in the example below using the Centreline Reference field.





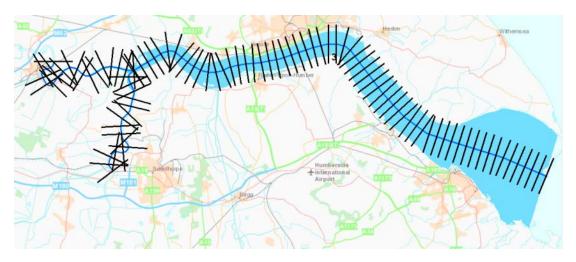
	OBJECTID *	Shape *	Centreline Reference	Shape_Length
۲	1	Polyline	1	17059.489933
	2	Polyline	2	16164.190269
	3	Polyline	3	61170.058734

- 6. Open '3 Create Sections' and add in the geodatabase location.
- 7. The tool defaults the distance to 200m and a width of 1000m. These values are for a typical estuary, for the Humber these numbers had to be increased to a distance of 1000m and a width of 5000m. The distance field needs to be a multiple of 100m.

De 3. Create Sections	-	
GDB Location	-	Distance
E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb		Diotanoo
Distance		No description
1000		available
Width (optional)		
5000		
	-	~
	_	
OK Cancel Environments << Hide Help		Tool Help



8. Add the resulting 'Section' file from the geodatabase to the map and the MHWS polygon.

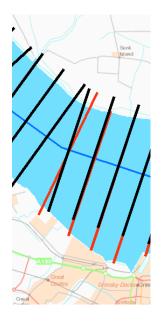


- 9. The section lines need to meet a number of criteria. To meet these criteria the section line may require editing. Start editing the 'Sections' file.
- 10. Extend the sections to the width of the MHWS file, ensuring the centre point is not moved. In the example below the black line is the ordinal section line, which has been extended to the make the red line.

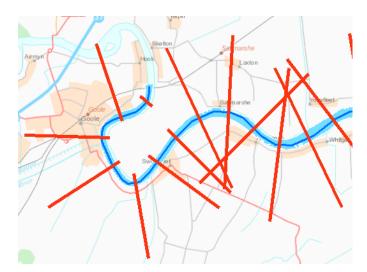




11. Rotate the lines to follow the course of the estuary.

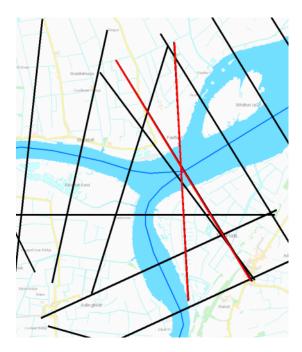


12. Shorten the section lines which cross back onto the estuary; section lines can cross outside the MHWS location

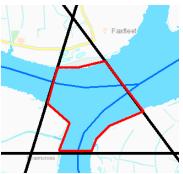




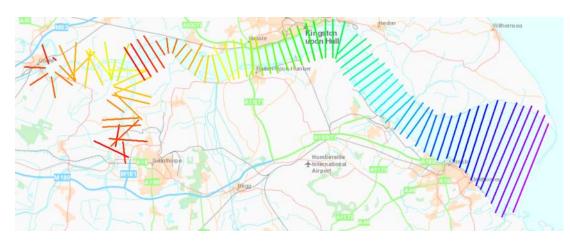
13. Remove all redundant sections or duplicates (red lines).



14. For each confluence a confluence extent will need to be created, this is achieved by removing sections to form an extent similar to the one shown below.



15. Once all edits have been made, review the 'Number' field to ensure the order is correct.





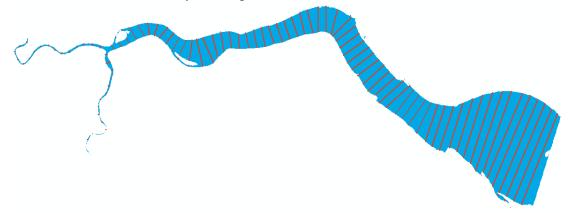
4.5 Model 4 – Clip Sections

This section of the model uses the Sections created from Model 3 and then clips them based on the tidal water levels from model 2. The resulting files are then used to generate the direction of the section, length of the section and the centre point of the section, x and y.

- 1. Open '4. Clip Section' model from the toolbox and add the geodatabase.
- 2. Click 'OK'

4. Clip Sections	
GDB Location	GDB Location
E: \Healthy Estuaries 2020\Humber Estuary\Humber.gdb	No description available
OK Cancel Environments << Hide Help	Tool Help

3. The resulting files are loaded into the geodatabase and the output files are created in the same directory as the geodatabase.





 The resulting files will be stored in the geodatabase and dbf files stored in the root directory called Section_Widths.dbf, Section_Direction.dbf and Section_Centre_Points.dbf.

Se	Section_Centre_Points								
	OID	FID_Sectio	REF	Number	Name	Mid_X	Mid_Y		
Þ	0	7	1	10	1-10	476418.84085	424276.0669		
	1	8	1	20	1-20	475583.663	423796.6356		
	2	9	1	30	1-30	474995.5	423109.53255		
	3	10	1	40	1-40	475355	422201.72505		
	4	11	1	50	1-50	476060.57715	421646.6356		
	5	12	1	60	1-60	476775.4315	422313.5156		
	6	13	1	70	1-70	477356.5	423126.26535		
	7	14	1	80	1-80	478131.28085	423751.1356		
	8	15	1	90	1-90	479084.272045	423869.963		
	9	16	1	100	1-100	479891.5	423386 2367		

Se	Section_Direction					
	OID	CompassA	Name			
F	0	309.225677	1-10			
	1	225	1-100			
	2	187.125419	1-110			
	3	154.334337	1-120			
	4	142.623157	1-130			
	5	170.535481	1-140			
	6	192.057871	1-150			
	7	197.10174	1-160			
	8	341.38835	1-20			
	9	271.909512	1-30			
	10	237.308388	1-40			
	11	170.056239	1-50			
	12	126.359978	1-60			
	13	135.012253	1-70			
	14	154.722203	1-80			
	15	183.012967	1-90			

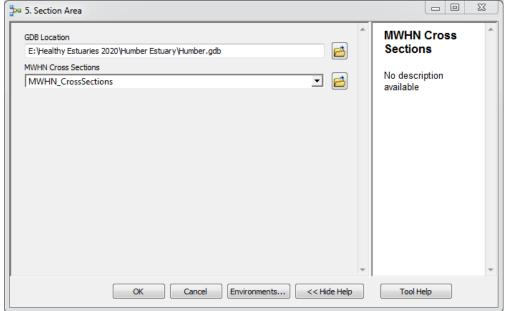
Se	Section_Widths					
	OID	Name	FREQUENCY	SUM_X_Widt		
F	0	1-10	1	212.11635		
	1	1-100	1	255.972655		
	2	1-110	1	253.961342		
	3	1-120	1	367.232336		
	4	1-130	1	288.046195		
	5	1-140	1	317.319473		
	6	1-150	1	320.061483		
	7	1-160	1	377.700367		
	8	1-20	1	260.630029		
	9	1-30	1	207.115011		
	10	1-40	1	216.257357		
	11	1-50	1	202.035026		
	12	1-60	1	234.862901		
	13	1-70	1	239.053221		
	14	1-80	1	283.108147		
	15	1-90	2	248.343293		

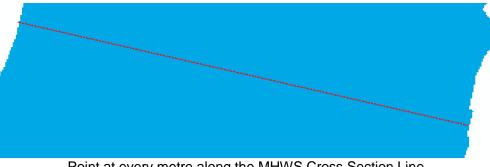


4.6 Model 5 – Section Area

Model 5 calculates the depth at every metre along the sections using the bathymetry grid. The resulting files are then used to create area sections.

- 1. Open '5. Section Area' model from the toolbox and add the geodatabase location.
- 2. Select the MWHN_CrossSections from the geodatabase, click 'Ok'.





Point at every metre along the MHWS Cross Section Line

3. The resulting files will be stored in the geodatabase and a dbf file called Section_Values.dbf will be created in the root directory.

Se	Section_Values									
	OID	Unique_Ref	FREQUENCY	FIRST_Star	FIRST_St_1	FIRST_End_	FIRST_End1	MEAN_Calc_	SUM_Calc_D	COUNT_Uniq
F	0	1-10	212	476501	424208.9982	476336.6817	424343.1356	3.977774	843.288064	212
	1	1-100	255	479982	423476.7367	479801	423295.7367	3.187193	812.734208	255
	2	1-110	254	480752.4314	423024.1356	480720.9296	422772.1356	4.86773	1236.403302	254
	3	1-120	368	481570.5191	423320.1356	481729.5744	422989.1356	3.388725	1247.050808	368
	4	1-130	288	482393	423802.0344	482567.8598	423573.1356	3.91977	1128.893715	288
	5	1-140	318	483398.6567	424142.1356	483450.8357	423829.1356	5.281639	1679.561277	318
	6	1-150	320	484428.8562	424122.1356	484361.9955	423809.1356	5.245123	1678.439445	320
	7	1-160	378	485431.9665	423920.1356	485320.8964	423559.1356	5.06864	1915.94595	378
	8	1-20	260	475625.2533	423673.1356	475542.0727	423920.1356	3.084237	801.901722	260
	9	1-30	207	475099	423106.0819	474892	423112.9832	4.619624	956.262176	207
	10	1-40	216	475446	422260.1272	475264	422143.3229	4.249562	917.905297	216
	11	1-50	202	476043.1333	421746.1356	476078.021	421547.1356	5.660237	1143.367955	202
	12	1-60	235	476680.863	422383.1356	476870	422243.8956	4.394911	1032.803995	235
	13	1-70	230	477272	423210.8015	477441	423041.7292	3.539535	814.092988	230
	14	1-80	284	478070.8362	423879.1356	478191.7255	423623.1356	4.996001	1418.86415	284
	15	1-90	250	479091.7026	424011.1356	479088.0708	423942.1356	4.02438	1006.094998	250



4.7 Model 6 – Tidal Prism Grid

Model 6 generates the tidal prism grid; this is a merge between MLWS and the bathymetric data.

- 1. Open Model '6. Tidal Prism Grid' from the toolbox.
- 2. Add the geodatabase name, the rest of the files required will be generated from the previous model outputs.

🐎 6. Tidal Prism Grid	
GDB Location E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb	GDB Location
	avallaule
	+
OK Cancel Environments << Hide Help	Tool Help

4.8 Model 7 – Tidal Prism

This stage of the model uses the tidal prism grid created in Model 6 and the section lines produced as part of Model 4 to create the tidal prism polygons.

1. Open Model 7 from the toolbox and add the geodatabase path. All other files will be used from previous model outputs.

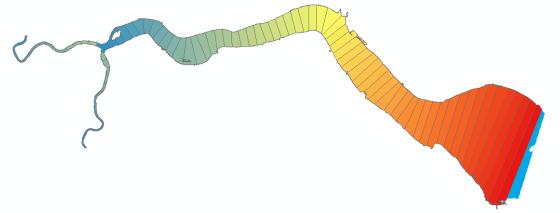
🎥 7. Tidal Prism	
GDB Location	GDB Location
E: \Healthy Estuaries 2020\Humber Estuary\Humber.gdb	No description available
	-
OK Cancel Environments << Hide Help	Tool Help



4.9 Model 8 – Tidal Prism Calc

Model '8. Tidal Prism Calc' uses the MHWS and the section lines to produce polygons to clip the tidal grid into individual files for each section extent.

1. Open Model 8 from the toolbox and add the geodatabase path. All other files will be used from previous model outputs.



Tidal_Polygon layer coloured on the Section Number.

2. Use 'Tidal_polygon' file to review that each section has created a unique polygon for each location. If required clip and rename the appropriate polygons to the downstream section.

P 8. Tidal Prism Calc	
B. Tidal Prism Calc GDB Location E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb	GDB Location
OK Cancel Environments << Hide Help	Tool Help



4.10 Model 9 – Tidal Prism Volume

Model 9 uses the individual grids produced from Model 8 to calculate the tidal prism volume. The results are added to the AllVolumes.dbf file located in the route directory.

- 1. Check that template AllVolumes.dbf file is empty by reviewing the file in ArcCatalog.
- 2. Open Model '9. Tidal Prism Volume' in the toolbox and add the geodatabase location. All additional files have already been created.

🕫 9. Tidal Prism Volume	
GDB Location	GDB Location
E: \Healthy Estuaries 2020 \Humber Estuary \Humber.gdb	No description available
-	-
OK Cancel Environments << Hide Help	Tool Help

Example of AllVolumes.dbf

Т	OID	FREQUENCY	SUM_VOLUME	D_Name
١	0	4	-527502.839661	tp_1_10
ľ	1	4	-1193108.50229	tp_1_100
]	2	4	-1080793.8946	tp_1_110
I	3	16	-1324779.42827	tp_1_120
l	4	3	-1502652.74727	tp_1_130
I	5	2	-1645953.67644	tp_1_140
l	6	9	-1733022.52639	tp_1_150
I	7	3	-2073272.34863	tp_1_160
]	8	2	-1224998.4056	tp_1_20
I	9	3	-1034419.12971	tp_1_30
Ì	10	3	-1015143.81567	tp_1_40
I	11	1	-962738.25	tp_1_50
I	12	1	-1052659.125	tp_1_60
I	13	3	-1246210.14956	tp_1_70
l	14	18	-1388718.87422	tp_1_80
I	15	7	-1272586.87871	tp_1_90
l	16	15	-398917.134086	tp_2_0
I	17	18	-561350.16225	tp_2_10
	18	2	-1411871.58771	tp_2_100
	19	9	-1517986.85406	tp_2_110
l	20	12	-2594762.05375	tp_2_120
l	21	1	-2818057.75	tp_2_130



5 RUNNING THE EXCEL TOOL

5.1 Excel Tool Usage

The Excel Tool is a Microsoft Excel 2010 macro-enabled workbook that uses the output files from the HET tool to calculate the predicted equilibrium depths and widths for each section within the estuary.

The Excel tool outputs this data as text files which are then visualised within ArcMAP.

To run the toolbox, double-click the tool, 'Healthy Estuary Tool.xlsm' located in the directory created in Section 2.1 (e.g., 'E:\Healthy Estuaries 2020\Humber Estuary'), from within Windows Explorer.

When opening the Excel tool for the first time the following message may appear.

Microsoft Excel Security Notice	9	23							
Microsoft Office has identified a potential security concern.									
Warning: It is not possible to determine that this content came from a trustworthy source. You should leave this content disabled unless the content provides critical functionality and you trust its source.									
File Path: C:\tal Squeeze in Estuary Complexes\Healthy Estu	ary To	ol.xlsm							
Macros have been disabled. Macros might contain viruses or other security hazards. Do not enable this content unless you trust the source of this file.									
More information									
Enable Macros	sable N	lacros							

This is normal for Excel workbooks containing macros, so click 'Enable Macros' and the tool will open to display the configuration page.

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	New Delete Previous Next	Protect and Share Workbook protect Protect Share Workbook Workbook >>> Track Changes >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	Share Send Now by IM Share		
A1 + 🤄 🎜					
Royal HaskoningDHV Intencing Society Regetter	Estuaries 2020		NATURAL		
Configuration					
Import Directory				Select	Import Data
Import Files					
Section Direction	Section_Direction.dbf				
Section Centre Points	Section_Centre_Points.dbf				
Section Values	Section_Values.dbf				
Section Widths	Section_Widths.dbf				
Section Tidal Prisms	AllVolume.dbf				
Export Directory				Select	Export Data
Lacey Equation					
Particle Size A (mm) Particle Size B (mm)					
Regime Equation					
description					
constant coefficient (a) constant exponent (b)					

When the Excel tool is opened on subsequent occasions a yellow 'Security Warning' bar may appear at the top of the screen.



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Security Warning Sc A1	ne active content has been disabled. C			NATURAL
Configuration				
Import Directory				
Import Files				
Section Direction	Section_Dire	ection.dbf		

Again, this is normal for Excel workbooks containing macros, so click 'Enable Content'.

5.2 Configuration Tab

The Excel tool needs to be configured before being used so that it knows the locations to use for the import and export files and also what parameters to use in the Lacey and Regime equations.

5.2.1 Import Directory

The import directory is the location of the output files from the HET tool. To add the location click the 'Select' button next to the Import Directory field on the configuration tab.

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Configuration				_
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Import Files				
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Section Centre Points	Section_Centre_Points.dbf			
Section Values	Section_Values.dbf			
Section Widths	Section_Widths.dbf			
Section Tidal Prisms	AllVolume.dbf			
Export Directory			Select	Export Data
Lacey Equation Particle Size A (mm) Particle Size B (mm)				
Regime Equation				
description				
constant coefficient (a) constant exponent (b)				

The following 'Browse for Folder' window will appear. Navigate to the required directory, click on it and then click 'OK'.



Browse for Folder	23
Select Directory	
Elmore, S.E. (Steve)	
⊿ 🖳 Computer	
SDisk (C:)	
a 👝 Removable Disk (E:)	
Healthy Estuaries 2020	
Humber Estuary	
Project (I:)	=
Department (J:)	
Office (K:)	
Global (L:)	
ex-DHV_Projects (R:)	+
OK Car	ncel

The path to the selected directory will appear in the Import directory field.

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Configuration			1000 Contra 100 Contra	
Import Directory	E:\Healthy Estuaries 2020\Humber Estuary		Select	Import Data
Import Files				
Section Direction	Section_Direction.dbf			
Section Centre Points	Section_Centre_Points.dbf			
Section Values	Section_Values.dbf			
Section Widths	Section_Widths.dbf			
Section Tidal Prisms	AlfVolume.dbf			
Export Directory			Select	Export Data
Lacey Equation Particle Size A (mm)				
Particle Size B (mm)				
Regime Equation				
description				
constant coefficient (a)				
constant exponent (b)				

5.2.2 Import Files

The import Files section is pre-populated with the default filenames created by the HET tool. These will only need to be modified if the output files from the HET tool change.

5.2.3 Export Directory

The export directory is the location for the output files from the Excel tool. To add the location click the 'Select' button next to the Export Directory field on the configuration tab.



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54		tuaries 2020	D											
Configuration														
Import Directory		E:\Healthy Es	tuaries 2020\/	Humber	Estuary							Select	Import Da	ata
Import Files														
Section Direction		Section_Dire	ction.dbf											
Section Centre Points		Section_Cent	re_Points.dbl	C.										
Section Values		Section_Valu	es.dbf											
Section Widths		Section_Widt	ths.dbf											
Section Tidal Prisms		AllVolume.dl	þf											
Export Directory												Select	Export D	ata
Lacey Equation														
Particle Size A (mm) Particle Size B (mm)														
Regime Equation														
description														
constant coefficient (a) constant exponent (b)														

The following 'Browse for Folder' window will appear. Navigate to the required directory, click on it and then click 'OK'.

Browse for Folder	23
Select Directory	
Elmore, S.E. (Steve)	*
 Computer SDisk (C:) 	
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Humber Estuary	
Project (I:) Project (J:) Pepartment (J:)	=
▷ ♀ Office (K:)	
> 🚍 Global (L:)	
Projects (R:)	-
OK Can	cel

The path to the selected directory will appear in the Export directory field.



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Royal HaskoningDHV Intercent Society Repetitor	🚱	ries 2020									NATURAL			
Configuration														
Import Directory	E:	\Healthy Estu	uaries 2020\	lumber	Estuary							Select	Import Data	
Import Files														
Section Direction	Se	ection_Direct	ion.dbf											
Section Centre Points	Se	ection_Centre	e_Points.db	6										
Section Values	Se	ection_Value	s.dbf											
Section Widths	Se	ction_Width	s.dbf											
Section Tidal Prisms	AI	IlVolume.dbf												
Export Directory	E	\Healthy Estu	uaries 2020\	tumber	Estuary							Select	Export Data	
Lacey Equation														
Particle Size A (mm) Particle Size B (mm)														
Regime Equation														
description														
constant coefficient (a) constant exponent (b)														

5.2.4 Lacey Equation

The Excel tool calculates three different predicted equilibrium channels. Two are based on the Lacey equation and one is based on the 'Constant Evolution' relationship.

This section of the Configuration tab allows two sediment particle sizes to be entered that are then used to calculate the two predicted equilibrium channels based on the Lacey equation.

The two values should be at either end of the expected particle size distribution for the estuary so that when visualised within ArcMAP the channels will show the expected range in channel width dependent of the particle size.

To enter a particle size, type the value in millimetres into the relevant particle size field.



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N	stuaries 2020			
Configuration				
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Import Files				_
Section Direction	Section_Direction.dbf			
Section Centre Points	Section_Centre_Points.dbf			
Section Values	Section_Values.dbf			
Section Widths	Section_Widths.dbf			
Section Tidal Prisms	Allvolume.dbf			
Export Directory	E:\Healthy Estuaries 2020\Humber Estuary	Select	Export Data	
Lacey Equation Particle Size A (mm) Particle Size B (mm)	0.1 0.2			
Regime Equation				
description				
constant coefficient (a) constant exponent (b)				

5.2.5 Regime Equation

The Regime equation is used within the Excel tool to calculate the cross-sectional area of the channels at each section. The parameters used in this equation vary depending on which estuary type, or estuary group, the estuary being looked at is put into.

To select the type of estuary, or estuary group, click the drop-down arrow at the right of the Regime Equation field.

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Configuration			
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Import Files			
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Section Centre Points	Section_Centre_Points.dbf		
Section Values	Section Values.dbf		
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Section Widths	Section_Widths.dbf		
Section Tidal Prisms	AllVolume.dbf		
Export Directory	E:\Healthy Estuaries 2020\Humber Estuary	Select	Export Data
Lacey Equation			
Particle Size A (mm)	0.1		
Particle Size B (mm)	0.2		
Regime Equation		e l	
description	JK Estuaries Group 2 JK Estuaries Group 3		
constant coefficient (a)	UK Estuaries Group 4 UK Estuaries Group 8 UK Estuaries Group C		
constant exponent (b)	M LK Estuaries	_	

Once a selection has been made the parameters that will be used within the Regime Equation are displayed below the field.



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Configuration			
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Section Centre Points	Section_Centre_Points.dbf		
Section Values	Section_Values.dbf		
Section Widths	Section_Widths.dbf		
Section Tidal Prisms	AllVolume.dbf		
Export Directory	E:\Healthy Estuaries 2020\Humber Estuary	Select	xport Data
Lacey Equation			
Particle Size A (mm) Particle Size B (mm)	0.1 0.2		
Regime Equation	All UK Estuaries		
description	dataset of all UK estuaries		
constant coefficient (a)	0.024		
constant exponent (b)	0.71		

5.3 Import HET Tool Outputs

Once the configuration information has been entered the outputs from the HET tool can be imported.

To start the import process click the 'Import Data' button to the right of the 'Import Directory' field.

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Configuration						
Import Directory	E:\Healthy Estuar	ries 2020\Humber Estuary			Select	Import Data
Import Files						
Section Direction	Section_Direction	n.dbf				
Section Centre Points	Section_Centre_F	Points.dbf				
Section Values	Section_Values.d	lbf				
Section Widths	Section_Widths.c	dbf				
Section Tidal Prisms	AllVolume.dbf					
Export Directory	E:\Healthy Estuar	ries 2020\Humber Estuary			Select	Export Data
Lacey Equation						
Particle Size A (mm)	0.1					
Particle Size B (mm)	0.2					
Regime Equation	All UK Estuaries					
description	dataset of all UK	estuaries				
constant coefficient (a)	0.024					
constant exponent (b)	0.71					

A window will appear once the import process has completed.



Import Data	X
Data imported from E	:\Healthy Estuaries 2020\Humber Estuary
	ОК

Click 'OK'.

5.4 Reaches Tab

The Reaches tab displays each reach along with some summary information. This tab is locked and read only apart from the user input cells highlighted in light blue.

The reach numbers are automatically populated during the import process which enables the total reach length, cumulative observed tidal prism at MHWN and number of sections to be looked up from the imported data.

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		Total Reach	Com. Observed Tidal Prium				Reach No.	imber Con	iguration			Dowstream Length	Upstream Length	Carn. Observed Tida	No. of
Reach Number	Reach Name	Length (m)	MHWN (m*)			8	4		6	7		in Reach (m)	in Reach (m)	Prism in Upstream Reaches MHWN (m ¹	Sections
		16,000	20,278,561									0	0	0	16
2		13,000	14,836,042									0	0	0	14
		60,000	1,442,634,544		2		2					0	0	0	61
		0	0									0	0	0	0
		0	0									0	0	0	0
		0	0			1			1	1	-	0	0	0	0
		0	0								-	0	0	0	0
		0	0									0	0	0	0
		0	0									0	0	0	0

5.4.1 Reach Name

The reach name should be entered so the separate reaches can be easily identified.

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Al	• (* Jr.					Reach No.	imber Con	Granting						
Reach Number	Reach Name	Total Reach Length (m)	Cam. Observed Tidal Prism MHWN (m*)	1		4	5	6	7		Dowstream Leigth in Reach (m)	Opstream Length	Cam. Observed Tidal Prism in Upstream Reaches MHWN (m ³)	No. of Sections
1	Ouse	16,000	20,278,561								0	0	0	16
2	Trent	18,000	14,836,042						1		0	0	0	14
3	Humber	60,000	1,442,634,544		1						0	0	0	61
		0	0								0	0	0	0
		0	0								0	0	0	0
		0	0								0	0	0	0
		0	0								0	0	0	0
		0	0								0	0	0	0
		0	0								0	0	0	D

5.4.2 Reach Number Configuration

The reach number configuration information should also be entered. This is used within the Excel tool to relate the reaches to each other. Once this information has been entered for each reach the tool knows which other reaches are upstream of downstream of it.



Paste Forma Clipboard			·····································	Wrap Text Merge & C	oter -	ig • % Nurr	• 1 til 2 ber	e Con	1991	ormat Table -	Styles			Inset Delete Cells	Format 2 Clear -	Sort & Find I Filter - Select Editing
		Total Reach	Cum, Observed Tidal Prism				Reach No	nber Con	iguration				Dowstream Length	Distant least	Cam. Observed Tidal	No. of
Reach Number	Reach Name	Length (m)	MHWN (m*)			3	4		6	7		9	in Reach (m)	In Reach (m)	Prism in Upstream Reaches MHWN (m ¹)	Sections
1	Ouse	16,000	20,278,561										0	0	0	16
2	Trent	18,000	14,836,042							1		1	0	0	0	14
3	Humber	60,000	1,442,634,544								é	-	0	0	0	61
		0	0										0	0	0	0
		0	0										0	0	0	0
		0	0									-	0	0	0	0
		0	0										0	0	0	0
		0	0										0	0	0	0
	ξ	0	0								1	2	0	0	0	D

This section is configured by entering D (downstream of the current reach) or U (upstream of the current reach) into the relevant fields.

Reach Number	Reach Name	Total Reach	Cum. Observed Tidal Prism				
Reacti Nutriber	Neatil Mallie	Length (m)	MHWN (m³)	1	2	3	
1	Ouse	16,000	20,278,561			D	
2	Trent	13,000	14,836,042			D	
3	Humber	60,000	1,442,634,544	U	U		
		0	0				
		0	0				
		0	0				
		0	0				
		0	0				
		0	0				

3 is downstream of 1 3 is downstream of 2 1 & 2 are upstream of 3

Once this section has been configured the downstream length, upstream length and cumulative observed tidal prism in upstream reaches is automatically populated.

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Reach Number	Reach Name	Total Reach	Cum. Observed Tidal Prium				Reach N	umber Con	iguration				Dowstream Length		Cum. Observed Tidal Prism in Upstream	No. of
Property internets	Para la como de la como	Length (m)	MHWN (m*)			3		5	6	7			in Reach (m)	in Reach (m)	Reaches MHWN (m*)	Sections
1	Ouse	16,000	20,278,561			0							60,000	0	0	16
2	Trent	13,000	14,836,042			D							60,000	0	0	14
3	Humber	60,000	1,442,634,544	U	U		1						0	29,000	35,114,602	61
		0	0										0	0	0	0
		0	0										0	0	0	0
		0	0										0	0	0	0
		0	0										0	0	0	0
		0	0										0	0	0	0
	1	D	0			-			· · · · · ·			1	0	0	0	D



5.5 Sections Tab

The Sections tab displays the details of each section. This tab is locked and read only.

The section references are automatically populated by the import process.

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		insert Pa	age Layout Formulas	Data Rev	iew View De	eveloper Ado	i-Ins Acrobat	RHDHV Tools	
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A		• (0		04	Aignment	13	Number	12	
Section Reference	Reach Number	Section Number	Reach Name	Total Reach Length (m)	Upstream Length in Reach (m)	Downstream Length in Reach (m)	Section Angle to RB	Section Centre Point (X)	Section Centre Point (Y)
1-10	1	10	Ouse	16,000	1,000	15,000	309	476418.84085	424276.06690
1-20	1	20	Ouse	16,000	2,000	14,000	341	475583.66300	423796.63560
1-30	1	30	Ouse	16,000	3,000	13,000	272	474995.50000	423109.53255
1-40	1	40	Ouse	16,000	4,000	12,000	237	475355.00000	422201.72505
1-50	1	50	Ouse	16,000	5,000	11,000	170	476060.57715	421646.63560
1-60	1	60	Ouse	16,000	6,000	10,000	126	476775.43150	422313.51560
1-70	1	70	Ouse	16,000	7,000	9,000	135	477356.50000	423126.26535
1-80	1	80	Ouse	16,000	8,000	8,000	155	478131.28085	423751.13560
1-90	1	90	Ouse	16,000	9,000	7,000	183	479084.27205	423869.96300
1-100	1	100	Ouse	16,000	10,000	6,000	225	479891.50000	423386.23670
1-110	1	110	Ouse	16,000	11,000	5,000	187	480736.68050	422898.13560
1_120	1	120	Ouro	16.000	12.000	4 000	15/	491650 04675	400154 60560

5.6 Observed Tab

The Observed tab displays each section along with the observed data. This tab is locked and read only.

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Section Reference	Reach Number	Section Number	Reach Name	Observed Tidal Prism at Section MHWN (m³)	Cum. Observed Upstream Tidal Prism in Reach MHWN (m³)	Cum. Observed Tidal Prism in Upstream Reaches MHWN (m²)	Cum. Observed Tidal Prism MHWN (m ³)	Observed Cross- Sectional Area MHWN (m²)	Observed Width MHWN (m)	Observed Mean Depth MHWN (m)	Observed Mean Depth to Width Ratio MHWN
1-10	1	10	Ouse	527,503	0	0	527,503	843	212	3.98	53.33
1-20	1	20	Ouse	1,224,998	527,503	0	1,752,501	802	261	3.08	84.50
1-30	1	30	Ouse	1,034,419	1,752,501	0	2,786,920	956	207	4.62	44.83
1-40	1	40	Ouse	1,015,144	2,786,920	0	3,802,064	918	216	4.25	50.89
1-50	1	50	Ouse	962,738	3,802,064	0	4,764,802	1,143	202	5.66	35.69
1-60	1	60	Ouse	1,052,659	4,764,802	0	5,817,462	1,033	235	4.39	53.44
1-70	1	70	Ouse	1,246,210	5,817,462	0	7,063,672	814	239	3.54	67.54
1-80	1	80	Ouse	1,388,719	7,063,672	0	8,452,391	1,419	283	5.00	56.67
1-90	1	90	Ouse	1,272,587	8,452,391	0	9,724,977	1,006	248	4.02	61.71
1-100	1	100	Ouse	1,193,109	9,724,977	0	10,918,086	813	256	3.19	80.31
1-110	1	110	Ouse	1,080,794	10,918,086	0	11,998,880	1,236	254	4.87	52.17
1-120	1	120	Ouse	1,324,779	11,998,880	0	13,323,659	1,247	367	3.39	108.37
1-130	1	130	Ouse	1,502,653	13,323,659	0	14,826,312	1,129	288	3.92	73.49
1.140	1	140	Outo	1 645 954	14 926 212	0	16 472 266	1.680	217	5.28	60.08



5.7 Predicted Tab

The Predicted tab displays each section along with the automatically calculated predicted data. This tab is locked and read only.

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-	Renter	-	Reachiliance					Mariada Servit	Real-submitte	Palace Mirriell (co ⁴)	Aven full faith (m ²)	Particle Size (met)	Predicted Mean Depth (re)	Predictor Water	Particle See (res)	Production Mean Englishing	instated with				Precisive Neur	Produced W
-30	- 1	10	Ouse	3.00	15.000	15,000	20.278.561	1.217,822	0	1,217,822	502	0.300	2.14	235	6.20	191	254	502	1.98	212.12	1.07	
-20	-1	20	Ouse	3.00	14,000	25,000	20,278,561	1,468,974		1,468,974	.574	0.100	2.27	252	6.20	2.08	283	574	3.08	260.63	2.61	
-50	- 1	30	Oute	5.00	11,000	38,000	20,278,561	1.771,921		1,771,921	036	0.300	2.42	271	6.20	2.25	304	036	4.62	207.12	3.82	
40	1	40	Ouse	3.00	12,000	25,000	20,278,561	2,117,545	0	2,537,345	749	0.300	2.57	291	0.20	2.30	326	745	4.25	215-26	3.04	
1-50	1	\$0	Oute .	8.00	11,000	28,000	20,278,561	2,578,330		2,578,190	#16	0.300	2.74	818	6.20	2.44	850	\$54	3.65	202.04	4.90	
-40	1	60	Ouse	1.00	10.000	15,000	20,278,563	1,109,818		1,109,818	977	0.100	2.91		6.20	2.68	376	977	4.39	254.86	4.28	1.000
-70	1	72	Oute	3.00	9,000	25,000	20,278,561	3.751,157		3,751,157	1,117	0.300	5.10	360	6.20	2.78	454	1,217	3.54	239.05	4.07	
-80	1	80	Ouse	3.00	8,000	16,000	20,278,561	4534,758	9	4,524,758	1,276	0.300	3.30	347	6.23	294	434	1,276	5.00	283.13	4,76	
-90	1	90	Ouse	5.00	7,000	29,000	20,278,561	5,457,901	0	5,457,901	1,457	0.100	5.51	410	0.20	5.15	455	L/451	4.02	148.34	4.80	
- 100	1	150	Quise	3.00	6,000	38,000	20,278,563	6,543,485		4,582,485	1,645	0.300	2,73	440	6.20	3.33	500	1,645	2.27	255.97	4.55	
1-138	1	110	Ouce	3.00	\$,000	26,000	20,278,561	7,911,198		7,941,196	1,902	0.300	2.97	479	6.20	154	\$37	1,902	-6.87	253.96	6.05	
1-120	6 4	120	Oute .	3.00	4,000	35,000	20,278,561	9.578,954		8,578,904	2,172	0.300	4.22	515	6.20	376	577	2,172	5.39	367.23	4.48	1.4
1-130	1	130	Ouse	1.00	1,000	36,000	20,278,561	11554,376		21,554,375	2,482	0.300	4.49	553	6.20	4.01	620	2,482	1.92	288.05	1.81	1
0-048	- 1	190	Oute	5.00	2,000	29,000	20,278,561	15,917,217		13,957,257	2,855	0.300	4.78	595	6.20	4.28	000	2,855	5.28	517.52	8.87	
1-150	1	150	Quer	3.00	1,000	35,000	20,278,561	10.011,517		26,811,517	3,239	0.300	3.08	637	6.20	4.53	715	9,239	3.25	323.06	-7.29	
1-160	1	190	Oube	3.00	0	16,000	20,278,561	20,278,541		29,278,541	3,700	0.100	5.41	684	6.20	4.82	767	8,700	\$.07	177.70	7.05	1.1.1
2-0	2	0	Trent .	1.00	11,000	18,000	14,836,042	718,843		793,628	\$17	0.300	1.81	194	C-20	1.62	218	352	:175	208.03	1.74	1
2-30	2	30	Trent	1.00	12,000	33,000	14,836,042	930,372	0	990,372	415	0.300	196	212	6.23	174	218	415	1.95	104.66	2.79	
5-20	- 2	20	Trent	<3.00	11,000	15,000	14,836,042	1,171,867	.0	1,171,867	489	0.300	2.11	232	6.20	1.88	250	489	181	111.13	1.83	
-30	- 2 -	30	frent .	3.00	\$0,031	23,000	14,898,042	1416,040		1,476,048	378	0.300	2.28	203	6.20	2.09	283	576	2.21	110.30	1.09	
1-40	2	45	Trent	3.00	9,000	13,000	14,836,042	1,809,182		1,859,182	678	0.100	2.46	276	6.20	2.13	329	678	1.88	213.42	2.40	1 1 1
- 50	12	50	Trent	8.00	8,000	13,000	14,896,042	2,3+1,747	4	2,341,757	750	0.300	2.65	301	6.20	2,17	818	299	2.05	226.54	2.69	
-40	2	60	Trent	100	7,000	33,000	14,856,042	3,010,636	4	2,969,616	941	0.100	2.86	119	6.20	2.55	100	941	1.78	201.11	1.88	1.1.1
-70	-2	70	Trent	3.00	6,000	15,000	14,836,042	3.715,243	0	3,715,248	1,109	0.300	3.09	359	6.22	2.75	428	1,109	2.58	195.92	1.82	
-80	- 2	80	Trent	3.00	3,000	13,000	14,838,042	4.679,903		4,879,903	1.308	0.300	3.33	392	6.20	2.97	440	1,306	1.94	258.45	3.35	
-90	2	90	Trent.	3.00	4,000	13,000	14,856,042	5,894,281		5,894,281	1,539	0.100	3.60	428	6.20	9,21	460	1,559	4:00	503.67	4.50	
-900	- 2	100	Trent	3.00	2,000	33,000	14,836,042	7,424,251		7,424,255	1,813	0,300	3.86	467	6.20	2.46	524	1,813	4.23	290.43	5.07	
-138	2	110	Trent	3.00	2,000	13,000	14,894,042	9,553,858	0	4,251,353	2,116	0.300	4.19	\$10	6.20	1.74	572	2,334	12.5	141.85	1.90	1.1
1.176	1.0	150	Read	8.00	1,000	18,000	14,894,042	11 778 470		11 776 430	2516	0.100	4.62	617	6.33	4.04	404	2 614	1.65	618.57	1.44	

5.8 Export Excel Tool Output Files

To start the export process click the 'Export Data' button to the right of the 'Export Directory' field.

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Configuration			
Import Directory	E:\Healthy Estuaries 2020\Humber Estuary	Select	Import Data
Import Files			
Section Direction	Section_Direction.dbf		
Section Centre Points	Section_Centre_Points.dbf		
Section Values	Section_Values.dbf		
Section Widths	Section_Widths.dbf		
Section Tidal Prisms	AllVolume.dbf		
Export Directory	E\Healthy Estuaries 2020\Humber Estuary	Select	Export Data
Lacey Equation			
Particle Size A (mm) Particle Size B (mm)	0.1 0.2		
Regime Equation	All UK Estuaries		
description	dataset of all UK estuaries		
constant coefficient (a)	0.024		
constant exponent (b)	0.71		

A window will appear once the export process has completed.



Export Data	22
Data exported to E:\Healthy Est	uaries 2020\Humber Estuary
	ОК

Click 'OK'.

The Excel tool creates four output files which are used in the visualisation of the predicted equilibrium channels within ArcMAP. These file name will vary depending on the inputs but will always start with 'A_', 'B_' and 'C_'

A_All UK Estuaries - Lacey (Particle Size 0.1mm).txt B_All UK Estuaries - Lacey (Particle Size 0.2mm).txt C_All UK Estuaries - Constant Evolution.txt

5.8.1 A_All UK Estuaries - Lacey (Particle Size 0.1mm).txt

This file contains the predicted channel data relating to the Lacey equation with particle size A.

Section_Ref	Reach	Section	Width	LB_X	LB_Y	RB_X	RB_Y
1-10	1	10	235	476509.8782	424201.7507	476327.8035	424350.3831
1-20	1	20	252	475623.9392	423677.0376	475543.3868	423916.2336
1-30	1	30	271	475130.9421	423105.017	474860.0579	423114.0481
1-40	1	40	291	475477.4726	422280.3257	475232.5274	422123.1244
1-50	1	50	313	476033.5918	421800.5603	476087.5625	421492.7109
1-60	1	60	336	476640.2904	422413.0046	476910.5726	422214.0266
1-70	1	70	360	477229.1025	423253.7173	477483.8975	422998.8134
1-80	1	80	387	478048.649	423926.1202	478213.9128	423576.151
1-90	1	90	416	479095.1947	424077.4806	479073.3494	423662.4454
1-100	1	100	446	480049.2917	423544.0284	479733.7083	423228.445
1-110	1	110	479	480766.4047	423135.9158	480706.9563	422660.3554
1-120	1	120	515	481538.5933	423386.5743	481761.5002	422922.6969
1-130	1	130	553	482312.6818	423907.1742	482648.178	423467.9958
1-140	1	140	593	483375.9516	424278.3343	483473.5409	423692.9369
1-150	1	150	637	484461.9921	424277.2572	484328.8596	423654.014
1-160	1	160	684	485477 0574	121066 6899	485275 8055	122112 2813



5.8.2 B_All UK Estuaries - Lacey (Particle Size 0.2mm).txt

This file contains the predicted channel data relating to the Lacey equation with particle size B.

Section_Ref	Reach	Section	Width	LB_X	LB_Y	RB_X	RB_Y
1-10	1	10	264	476520.9	424192.7	476316.8	424359.4
1-20	1	20	283	475628.8	423662.5	475538.5	423930.7
1-30	1	30	304	475147.4	423104.5	474843.6	423114.6
1-40	1	40	326	475492.3	422289.8	475217.7	422113.6
1-50	1	50	350	476030.3	421819.2	476090.8	421474.1
1-60	1	60	376	476623.9	422425.1	476926.9	422202
1-70	1	70	404	477213.7	423269.2	477499.3	422983.4
1-80	1	80	434	478038.6	423947.3	478223.9	423554.9
1-90	1	90	466	479096.5	424102.6	479072	423637.3
1-100	1	100	500	480068.4	423563.1	479714.6	423209.3
1-110	1	110	537	480770	423164.7	480703.4	422631.5
1-120	1	120	577	481525.1	423414.7	481775	422894.6
1-130	1	130	620	482292.4	423933.8	482668.5	423441.4
1-140	1	140	665	483370	424313.8	483479.5	423657.5
1-150	1	150	715	484470.1	424315	484320.8	423616.3
1 160	1	160	767	105100 0	404106.0	105363 6	100070

5.8.3 C_All UK Estuaries - Constant Evolution.txt

This file contains the predicted channel data relating to the 'Constant Evolution' relationship.

Section_Ref	Reach	Section	Width	LB_X	LB_Y	RB_X	RB_Y
1-10	1	10	164	476482.2	424224.3	476355.4	424327.8
1-20	1	20	220	475618.8	423692.3	475548.5	423901
1-30	1	30	171	475081.2	423106.7	474909.8	423112.4
1-40	1	40	195	475437.1	422254.4	475272.9	422149
1-50	1	50	175	476045.5	421732.7	476075.7	421560.6
1-60	1	60	229	476683.4	422381.3	476867.5	422245.8
1-70	1	70	275	477259.4	423223.4	477453.6	423029.2
1-80	1	80	269	478073.9	423872.7	478188.7	423629.6
1-90	1	90	300	479092.2	424019.7	479076.4	423720.2
1-100	1	100	366	480020.8	423515.5	479762.2	423257
1-110	1	110	315	480756.2	423054.4	480717.1	422741.9
1-120	1	120	485	481545	423373.3	481755.1	422936
1-130	1	130	427	482350.8	423857.3	482610.1	423517.9
1-140	1	140	413	483390.8	424189.2	483458.7	423782.1
1-150	1	150	445	484441.9	424183	484349	423748.3
1-160	1	160	525	185153 6	123990 6	125299.2	123188 2



6 VISUALISAING THE OUTPUTS

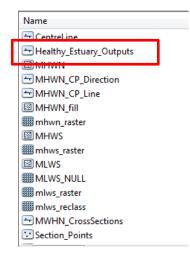
6.1 Model 10 – Healthy Estuary Outputs

The final toolbox model produces the outlines of the healthy estuary tool. The tool uses a centre point within the estuary and uses the distance and angle from the excel tool for each section line.

- 1. Open the toolbox and run Model 10.
- 2. Input the location of the geodatabase and the text files, with the proceeding values A, B and C into the A, B and C input boxes.

10. Healthy Estuary Outputs rev1		
GDB Location	^	10. Healthy
E:\Healthy Estuaries 2020\Humber Estuary\Humber.gdb		Estuary Outputs
A		rev1
E: \Healthy Estuaries 2020\Humber Estuary \A_All UK Estuaries LaceyParticleSizeA 0.1mm.txt		
в		
E:\Healthy Estuaries 2020\Humber Estuary\B_All UK Estuaries LaceyParticleSizeB 0.2m.txt		
c		
E:\Healthy Estuaries 2020\Humber Estuary\C_All UK Estuaries ConstantEvolution.txt		
	Ŧ	
OK Cancel Environn	ments	Tool Help

3. The model exports the Healthy_Estuarty_ouputs to the Geodatabase.

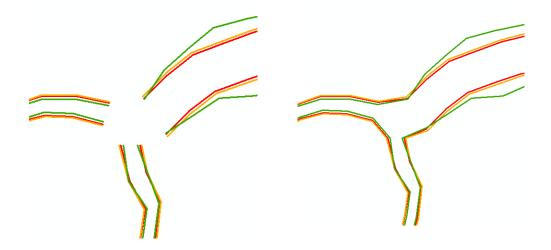




4. Load the Healthy_Estuary_ouputs inot ArcMAP and Symbalise on the Name Field.

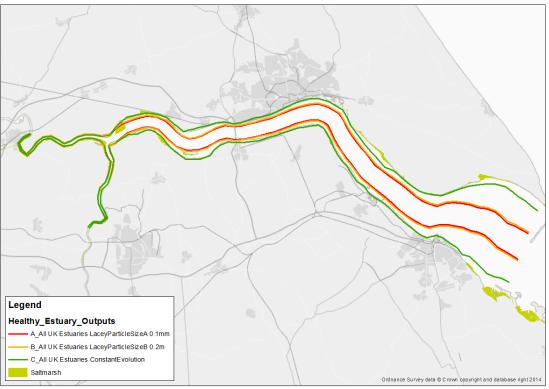


5. The Model cannot interpolate between the reaches so this will require a manual intervention. See before and after below.

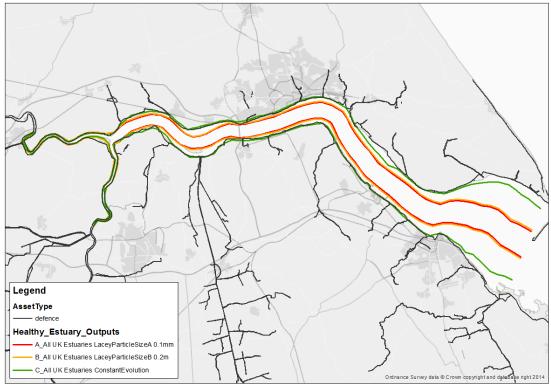




6. The Healthy Estuary outputs can be used alongside other data such as the BGS geology, Saltmarsh extent and Aims Data to make comparisons.

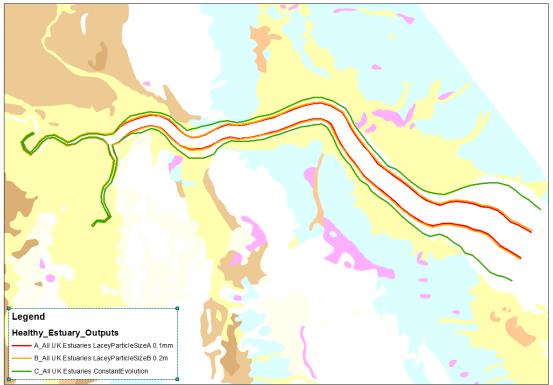


Outputs with Slatmarsh

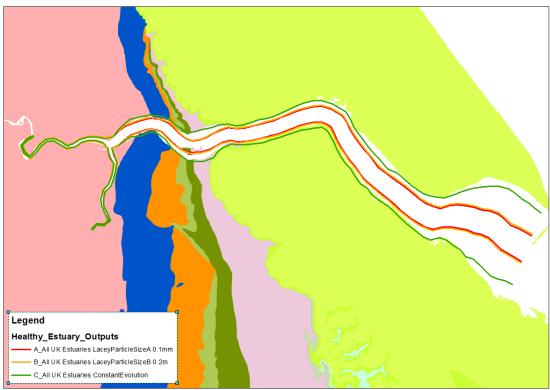


Output with Environment Agency AIMS data





GBR BGS 1:625k scale Superficial Deposits Lithostratigraphy (including Lithomorphogenetic units)



GBR BGS 1:625k scale Bedrock Lithostratigraphy (including Lithogenic units)