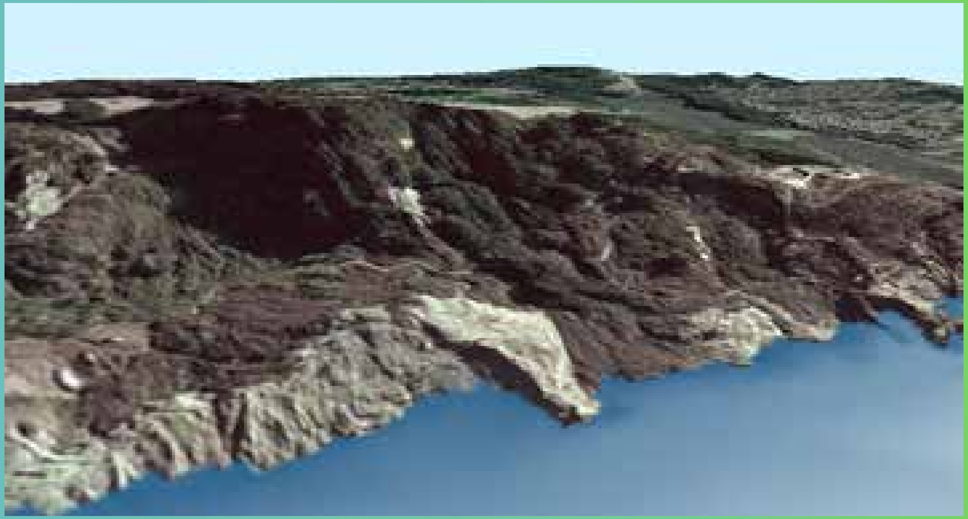
2014 ESRI International User Conference

Exploring an Automated Mapping Methodology for Coastal Runup Zones



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Thursday, June 5, 2014

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Agenda

- Coastal Background
- Purpose
- Approach
- Tool Automation
- Expanded dataset use

Coastal Background

- Steep coastlines may be exposed to flooding hazards generated by large ocean-wave impact at the shore.
- Dominant factor: Wave Runup
- Crucial part of Coastal Study FIS

Definition: Wave Runup

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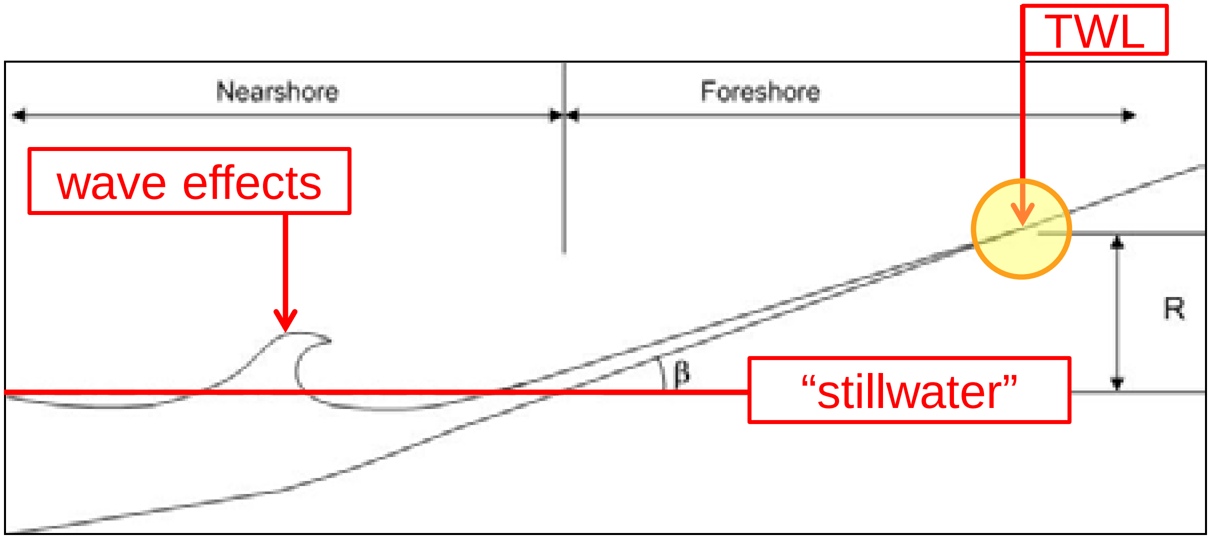
Maximum vertical extent of wave uprush on a beach or structure



Wave runup is usually computed for *cliffs*, *bluffs*, *steep dunes, structures*

Mapping Wave Runup

Traditional Approach

- Determine 1% TWL along each transect
- Establish representative reach along each transect (or grouping of transects)
- Manually digitize 1% TWL for each representative reach in a GIS environment, following topographic contours

Traditional Approach: Challenges

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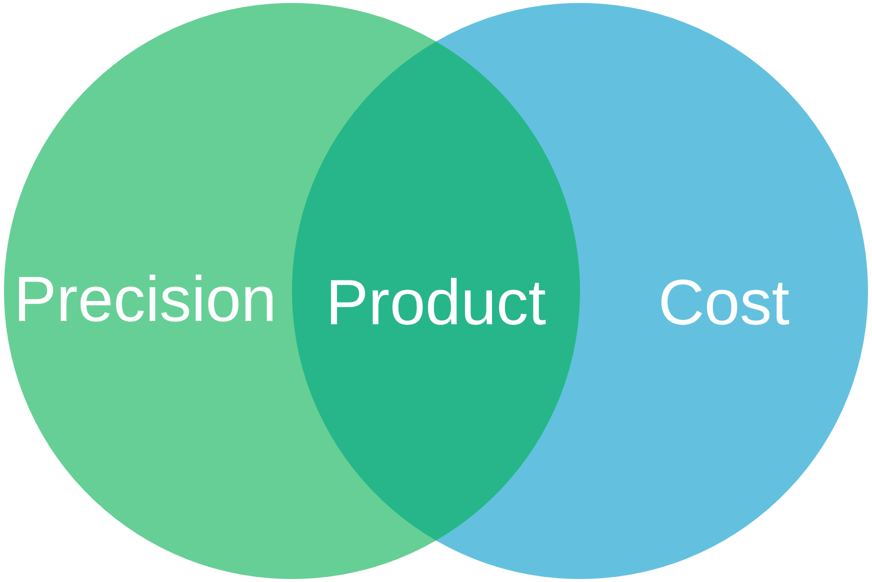
- Manual Digitization
  - Time consuming
  - Subjective
  - Precision required in very steep areas, where contour spacing is tight



- Widely accessible digital GIS products vs. printed products

Traditional Approach: Challenges

1”:1,000’

1”:3,500’

1”:6,000’

Mapping Wave Runup

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New Approach

- Map the 1% runup inundation boundary using an automated approach.
- Reduce time and effort associated with translating the 1D coastal runup analysis into 2D spatial boundaries
- Apply widely-available tools to facilitate data setup, boundary creation, and QAQC

Efficiency

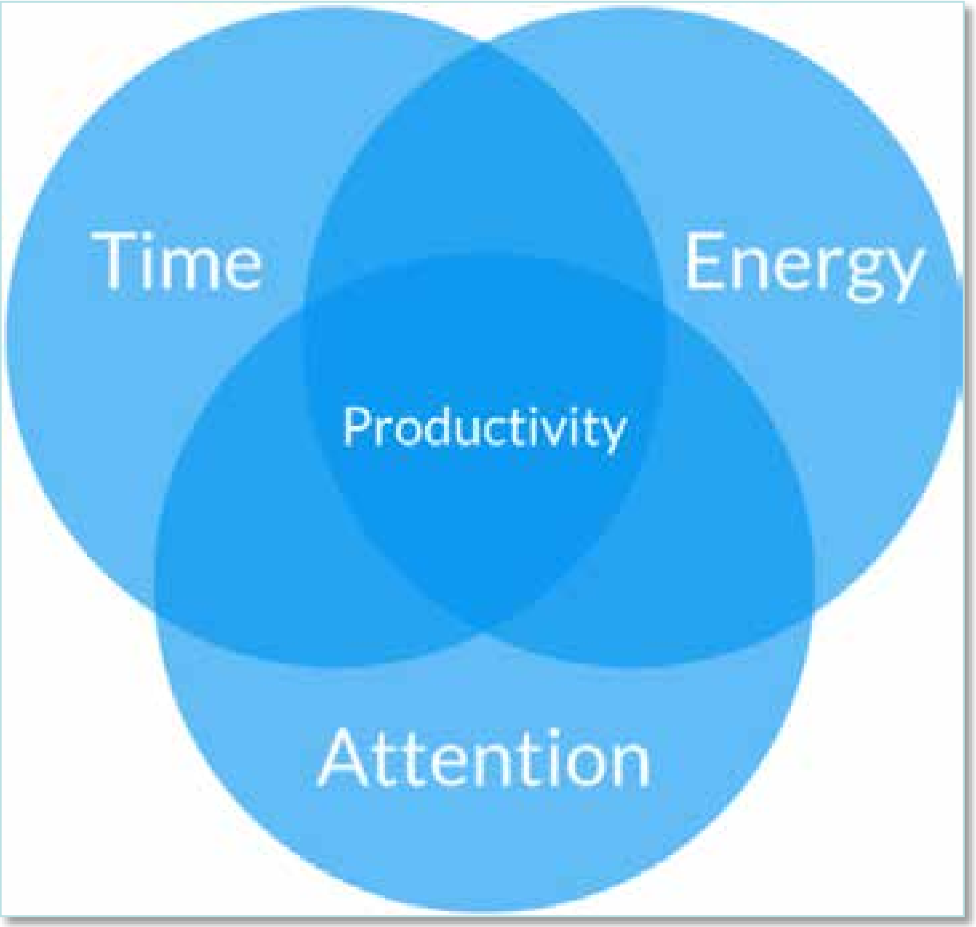
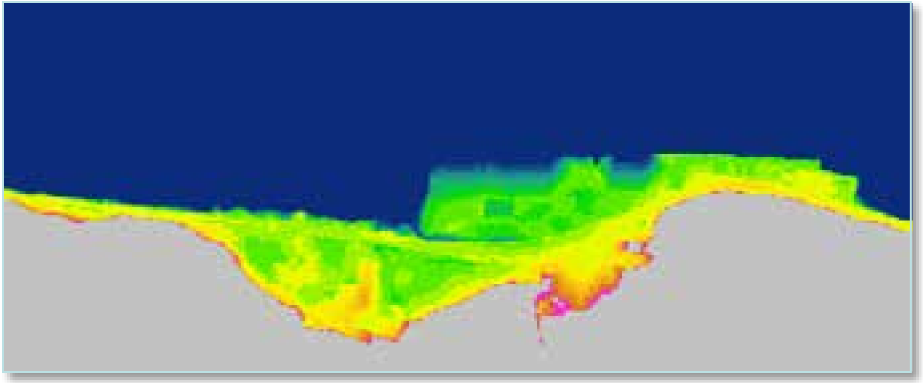


Image: Lifehacker *http://lifehacker.com/10-lessons-i-learned-from-a-year-of-productivity-experi-1584800618*

Approach

- Inputs:
  - Terrain: DEM
  - Coastal Transects: Lines
  - Runup Reaches: Polys



- Media:
  - DEM + GDB
- Software:
  - Spatial Analyst (calc, conversion)
  - WTA

Approach

- Using the (general) analysis runup elevations, a "bounding polygon" is established that fully covers the area of interest

- Use complete coverage from seaward extents to inland elevations

Approach

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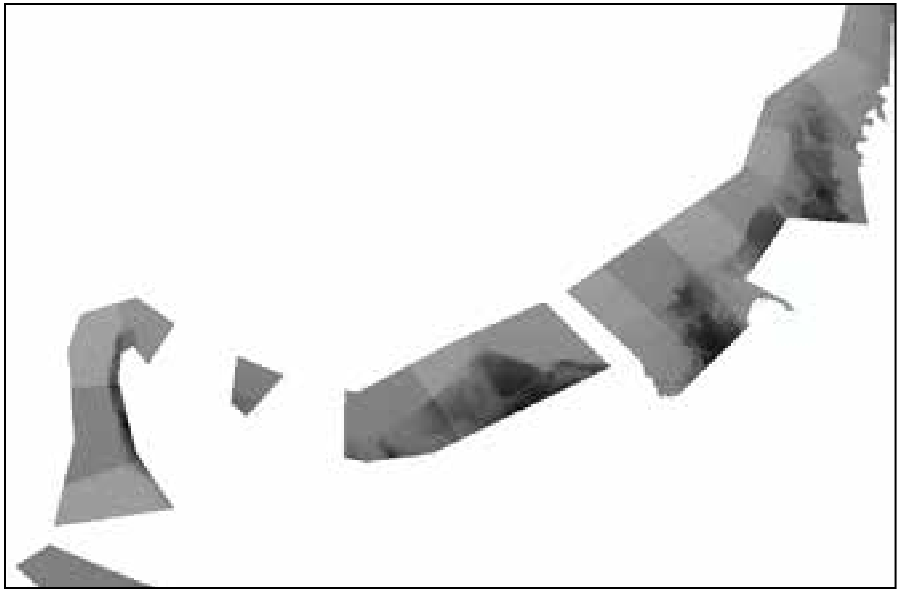
- Bounding polygon is divided using the Runup Reach locations, and the resulting individual polygons are joined with the coastal analysis BFE values

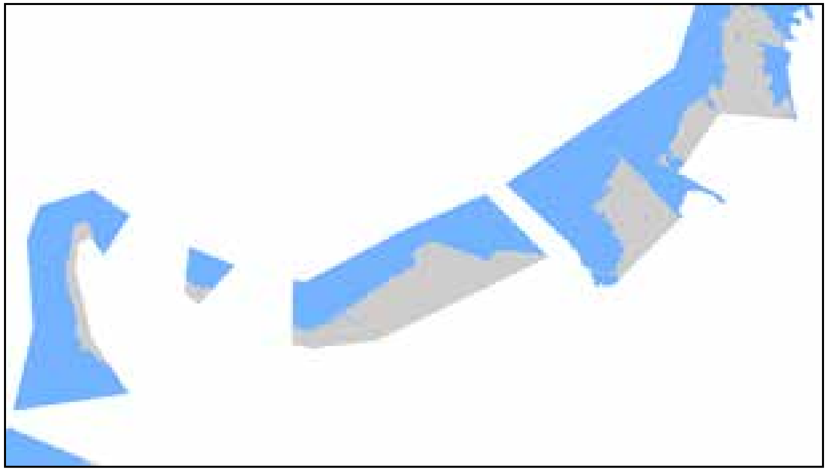
Approach

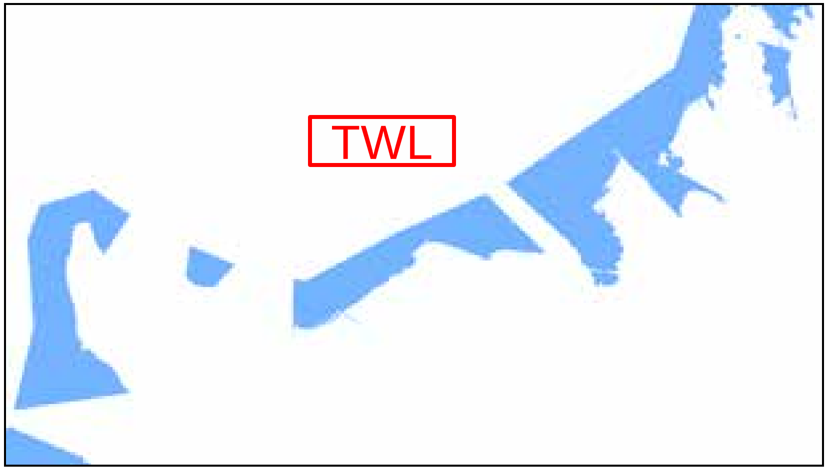
- This result is converted into a flat WSEL raster, from which the ground raster is subtracted.
- The result is an “initial depth” raster:



Approach

- This raster is reclassified to clarify and visualize the results
  - – Greater-Than-Equal-To Depth (1, 0)
  - – Remove 0 values





Approach

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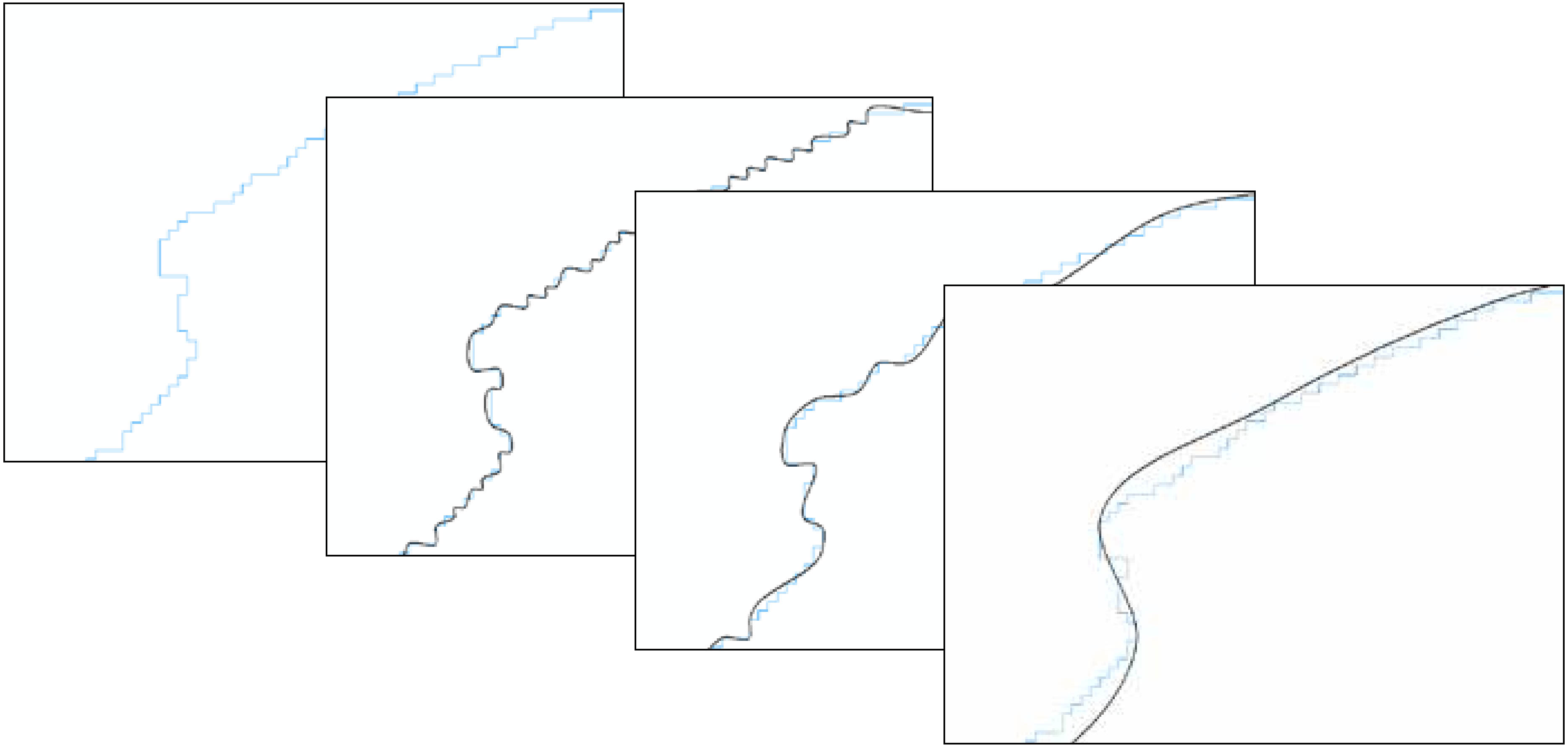
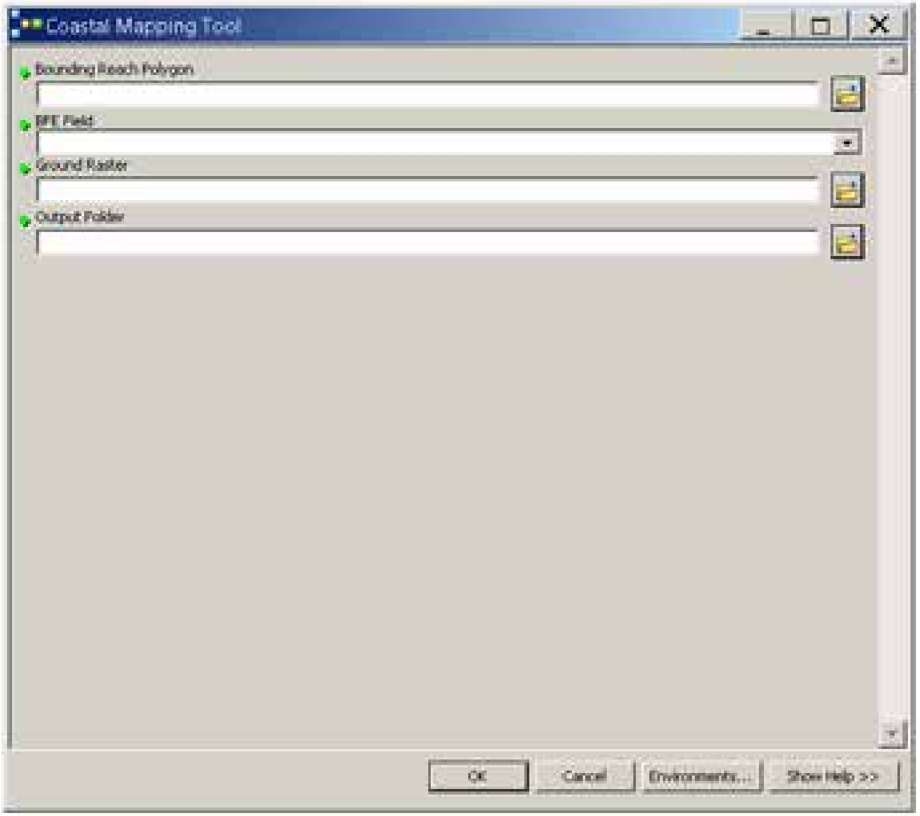
- Polygon results

Approach

- Smoothing tolerances

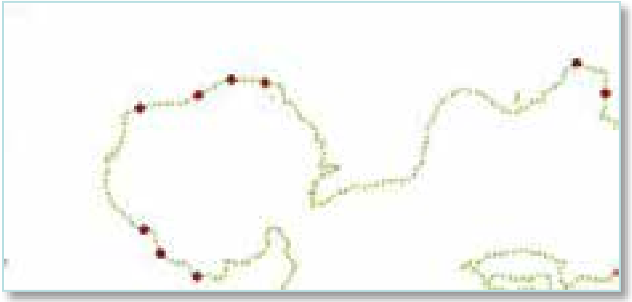


Toolbox Automation



QAQC

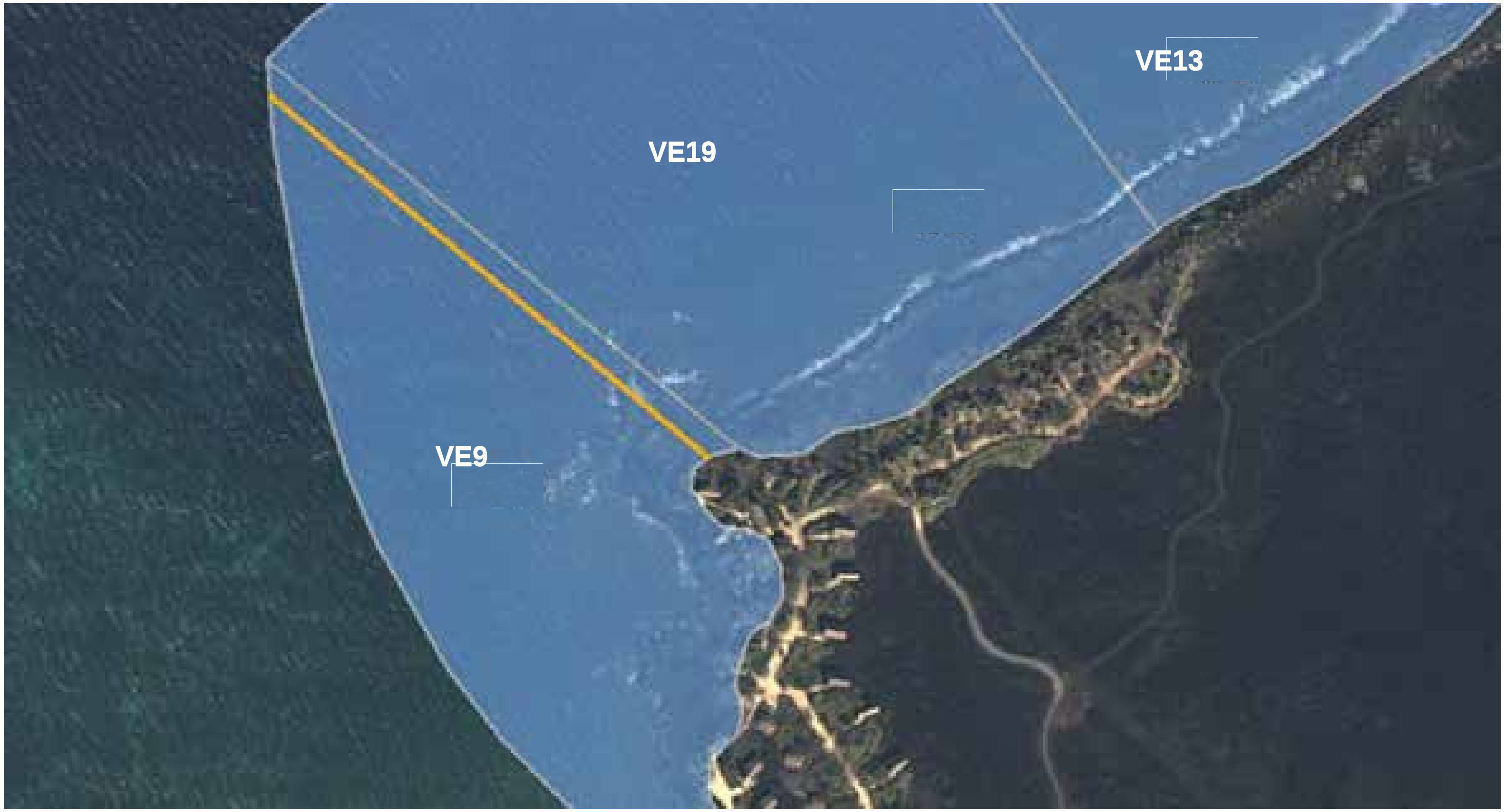
- Compare TWL results to original TIN
  - Applicable where the boundary intersects the terrain
  - Not applicable where the boundary is manually mapped according to special circumstances such as AO Zones in overtopped areas, or where the runup TWL is capped.



Analysis and Mapping Refinement

- In some areas, due to the coastal geomorphology, or due to the coastline orientation, reach delineation may be subject to engineering judgment Analysis and Mapping Refinement.
- Because of the “one-click” nature of the Tool, the Coastal Engineer/Scientist can use this to refine reach boundaries.

Analysis and Mapping Refinement



Analysis and Mapping Refinement

- As in the process above, use the Greater-Than Equal-To approach to find variable depths

3D Visualization

Conclusion

- Good cost-benefit ratio for creating Tool
- With the basic input of the 3 data elements, the Tool can be run repeatedly, during analysis and to prepare mapping.
- Anticipate traditional mapping tasks during analysis; increase efficiency during both analysis and mapping.

Questions?

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