

# **Whiteout Solutions**

geospatial technologies

## **Baseline LiDAR & Imagery for Saltmarsh Monitoring**

geoSAP & CT DEEP Data Guide  
Revised 1/2/2025

## Project Background

In the summer of 2023, Whiteout Solution began conducting a high-resolution aerial LiDAR and Imagery survey of all the protected coastal marshland and 100-foot upland buffers across the state of Connecticut. The purpose of this work is to establish a baseline dataset for each of these sites which can be used for planning, designing and conservation efforts today or compared against when future data collection efforts occur.

The project produced several different deliverables, the primary deliverables are elevation datasets and hyperspectral imagery, as well as secondary deliverables including a landcover classification for seven of the most prominent vegetation types.

As a part of the project scope, Whiteout Solutions delivered CT DEEP all the data products through its web application geoSAP. geoSAP is a data delivery application with the intention of simplifying access to large geospatial dataset. Every data product produced as a part of this project can be viewed through geoSAP without requiring the data to be downloaded locally or pulled into a 3rd party desktop software.

This project will generate datasets for over 200 sites across the state of Connecticut and so this guide was created to users access geoSAP and navigate the data.

This dataset contains known gaps that will be surveyed in the spring of 2025. A map with locations for those can be found here: <https://geosap.whiteoutsolutions.com/shared/Xvog8d>

## Data Products

For each of the 200+ saltmarsh sites, the following data product have been provided and are available on geoSAP:

### LiDAR Products:

- Classified Point Cloud (\*.las)(\*.laz) – geoSAP Label - TownName\_SiteNumber\_pc\_classified.laz
- Digital Surface Model/DSM (\*.tif) - geoSAP Label - TownName\_SiteNumber\_dsm\_1ft.tif
- Digital Terrain Model/DTM/DEM (\*.tif) - geoSAP Label - TownName\_SiteNumber\_dtm\_050ft.tif
- Elevation Contour (\*.shp/\*.gsvec) - geoSAP Label - TownName\_SiteNumber\_contours\_1ft.gsvec

### Imagery Products:

- RGB Orthomosaic (\*.tif) - geoSAP Label - TownName\_SiteNumber\_RGB\_ortho.tif
- Indice Imagery - geoSAP Label - TownName\_SiteNumber\_indiceName.tif
  - NDVI (\*.tif)
  - NDRE (\*.tif)
  - NDBSI (\*.tif)
  - NDWI (\*.tif)
  - RTVI core (\*.tif)

### Additional Derived Products:

- Vegetation Land Cover Classification (\*.shp/\*.gsvec) - geoSAP Label - TownName\_SiteNumber\_landcover.gsvec
- Data Accuracy Report - geoSAP Label - TownName\_SiteNumber\_ControlReport.pdf

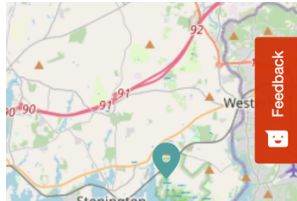
### Product Descriptions:

- **LiDAR:** A remote sensing technology that uses laser pulses to create high-resolution, 3D representations of the Earth's surface and features.
- **DTM (Digital Terrain Model):** Represents the bare-earth surface without vegetation or man-made structures.
- **DSM (Digital Surface Model):** Includes elevations of the terrain and above-ground features like vegetation and buildings.
- **Contours:** Lines representing elevation changes on a map.
- **RGB Orthomosaic:** RGB orthomosaics are very common aerial image that provides a birds-eye-view of an area in full color. These RGB orthomosaics are extremely high resolution allowing you to see the finest details.
- **NDVI (Normalized Difference Vegetation Index):** Measures vegetation health.
- **NDRE (Normalized Difference Red Edge Index):** Monitors chlorophyll content and vegetation stress.
- **NDBSI (Normalized Difference Bare Soil Index):** Identifies areas of bare soil.
- **RTVcore:** A specialized vegetation index focusing on spectral responses for vegetation analysis.
- **Landcover Classification:** One of the most complex and rich datasets that was produced for this project was the vegetation landcover classification that leverages all of the imagery and LiDAR products to generate. The landcover is a representation of the seven primary marsh vegetation types in the Connecticut saltmarsh delineated by polygon boundaries and colored.

## Accessing data & basics of geoSAP

geoSAP is Whiteout Solutions' data delivery application where the final data products for this project will be published. Through geoSAP data will be accessible from anywhere, so no special licenses are required to access the data for this review process and for a one-year period after the release of the data.

**Note:** While navigating geoSAP, if you get stuck or find something difficult to understand please click the "Feedback" button and let us know what you're experiencing. Feedback helps us improve the product.



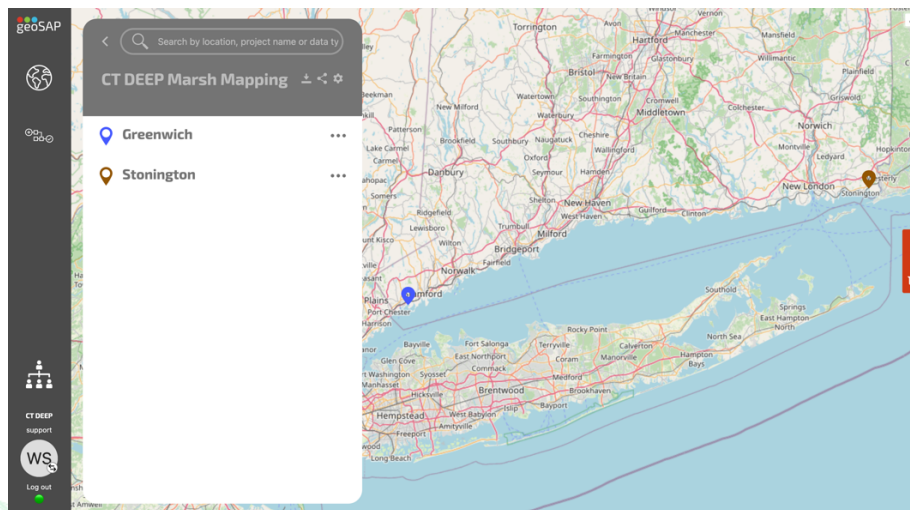
You may also watch a video tutorial with instructions on how use geoSAP here:

<https://www.youtube.com/watch?v=YeVdULNXrrg>

Go to the Connecticut Marsh Mapping project on geoSAP: <https://ctdeep.geosap.io>

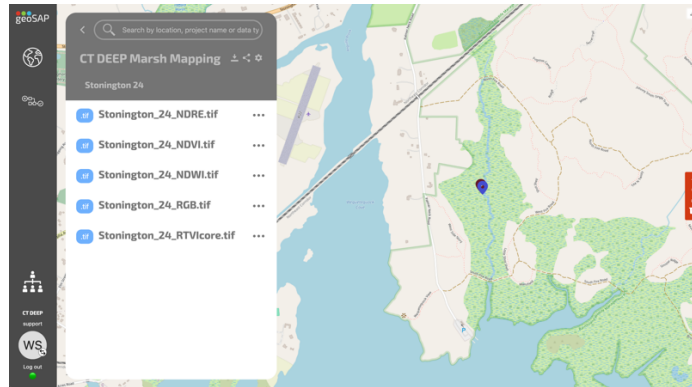
### Project View

1. The first page you will be presented with is the **Project View**, here you will be able to see all of the project sites currently published on geoSAP. Each town with data is represented in the list on the left-hand side, while pins represent those same locations on the map on the right-hand side.

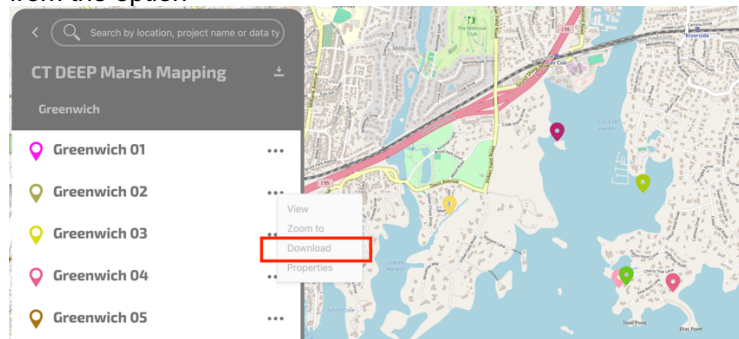


2. Upon your first visit a guide will appear to help walk you through core features of the application. Follow those steps to familiarize yourself with the **project view** and how to navigate and view the available data.
3. When you're ready drill down into a specific project site
  - a. Click the town and then click again on the specific site within the town to get to the data. Data is delineated by file type, on the left hand side of each file name is a colored bubble with the extension of each file(.pdf, .tif, .las, .gsvec, etc)





- b. If you would like to download the data from the site, click the ellipsis and select download from the option



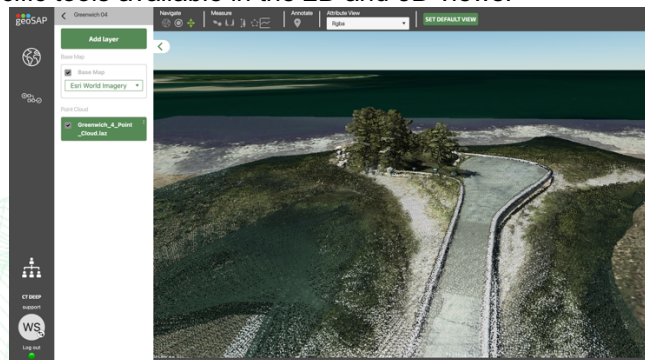
- c. These datasets can be extremely large, for files over 5GB a notification will be presented asking you whether you would like to proceed with the download process. Once a download is initiated the data is zipped and then will begin downloading through your browser, this can take anywhere from a matter of minutes, to many hours depending on the size of the data.

1. Once the data has been download you can load it into any 3<sup>rd</sup> party tool, like QGIS, ArcGIS, CAD softwares and more.

- d. If you would like to view a specific dataset, click the dataset

## Data View

4. Once in the geoSAP **Data View**, you'll be introduced to another guide that will walk you through the specific tools available in the 2D and 3D views.

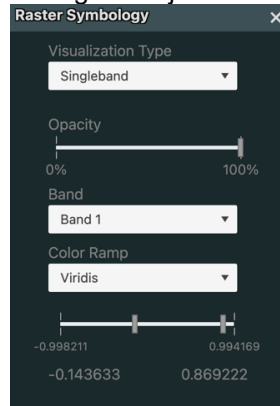


- a. Across the top of geoSAP Viewer you will see a series of tools that can be used to navigate and analyze your data.

- b. 2D Tools are only available for raster and vector data, those tools include a line measurement tool and an area measurement tool:



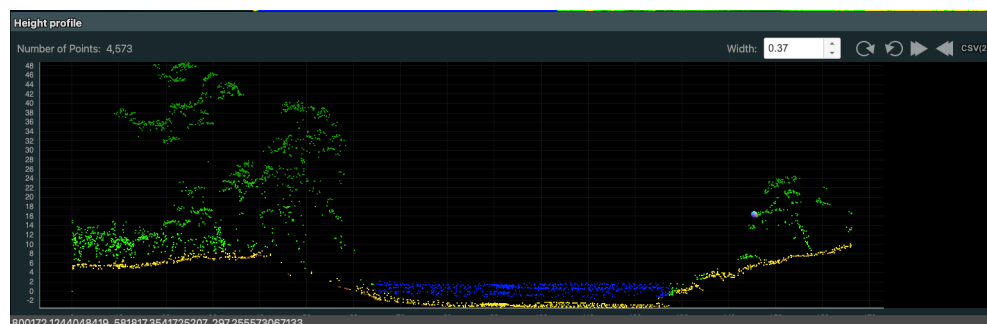
- c. Additionally, you'll find in the 2D view a symbology button which pops up a panel with settings to adjust how the raster and vector data is presented.



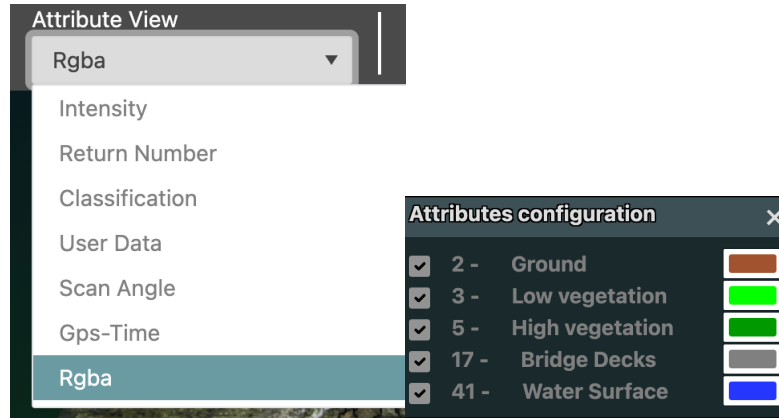
- d. 3D Tools tools are only available with the point cloud data and include navigation tools, measurement tools like the point tool which provides x,y,z coordinates for any given point, height, distance, area tools, a profile/cross section tool, an annotation tool and attribute configuration :



One of the most powerful 3D tools is the profile analysis/cross section tool which allows users to draw a line between two points in a point cloud and see a two-dimensional profile.

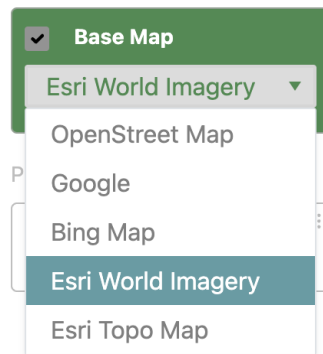


- e. Attribute configurations allow you to change how the 3D data is visualized based on a specific attribute in the data. For instance, a common use would be to view the point cloud with a color ramp or gradient on the points based on elevation, in geoSAP this is typically label, *Elevation Z* in the drop-down menu. All available attributes are listed in the drop-down menu. The default attribute for this project is the classification attribute which allows you to peel back the layers of the data by toggling off things like vegetation, buildings, utilities lines and the water.



- f. On the left-hand side of geoSAP Viewer you'll see a list of layer which should include the data layer you selected in the Project View, as well as the Base Map which you can change by selecting a map from the drop down menu.

Base Map



## Working with Data Products

### *Classified Point Cloud*

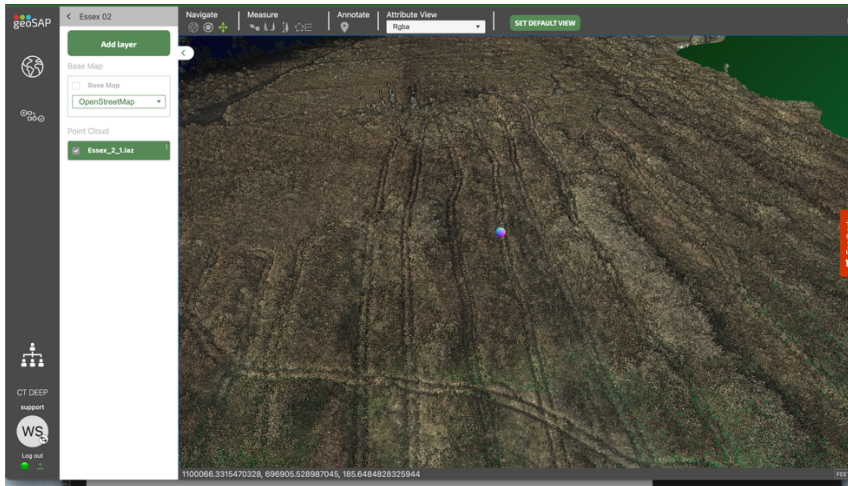
A point cloud is a 3D representation of an environment, with each point in the data representing a elevation point that the LiDAR sensor captured during the aerial survey.

How to use it:

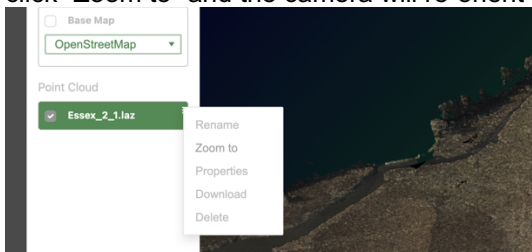
1. Start by opening a point cloud in the 3D viewer from the [Project View](#), any file with .laz is point cloud
2. Once the point cloud has loaded, click any point in the data and drag your mouse to spin around the view

**LAZ** Essex\_2\_1\_pc\_classified.laz

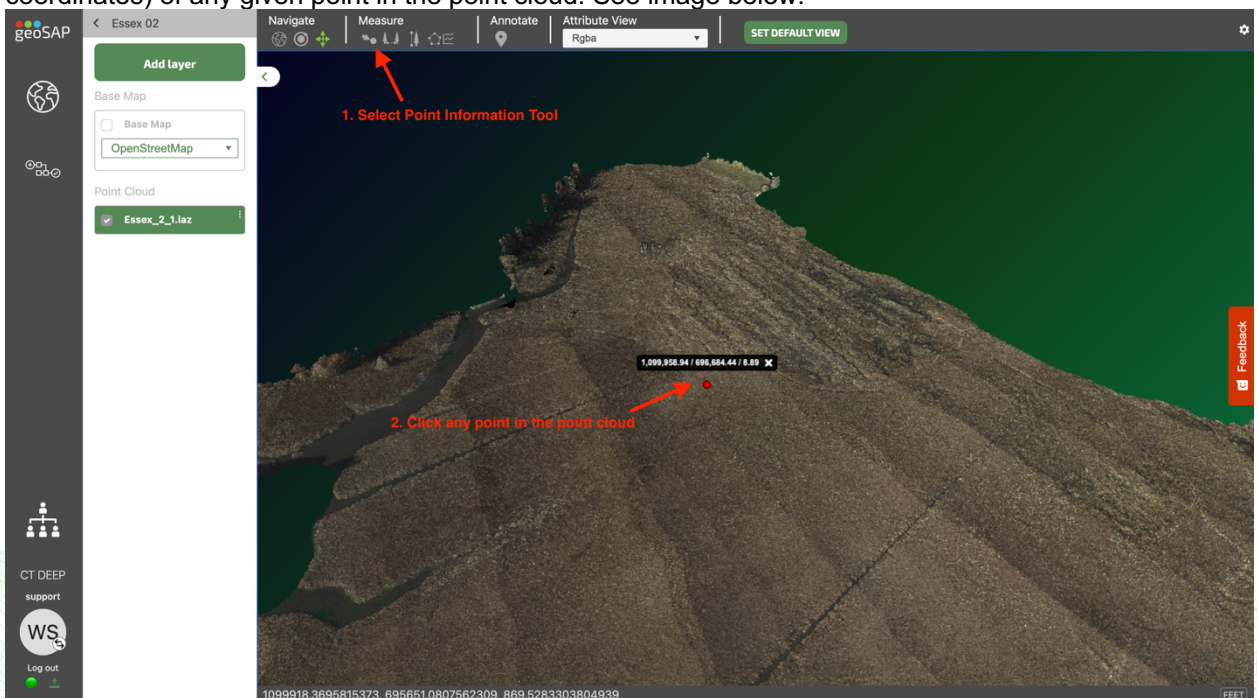




3. To zoom into the data, simply scroll your mouse, you may also double click on any point to zoom into it
4. If you ever get lost in the view, you can click on the 3 ellipses on the layer in the left panel and click "Zoom to" and the camera will re-orient to the default view.



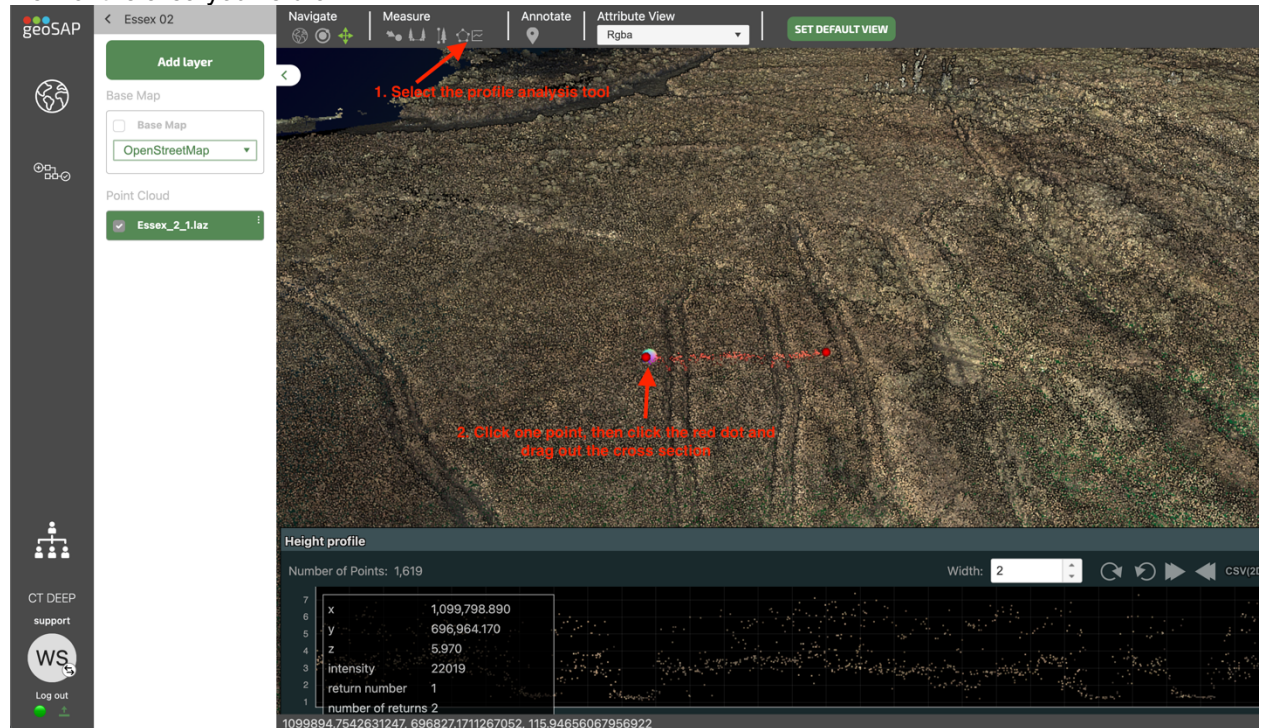
5. The point information tool provides a simple way to get the positioning information (x,y,z coordinates) of any given point in the point cloud. See image below.



6. To understand the terrain better it can help to see the data through a cross section or profile view. Select the profile analysis tool, then click a single point in the point cloud, a red dot will appear,



then click the red dot to drag out the line for the cross section. From there you will see the profile view of the area you've drawn.



## Digital Terrain Model & Digital Surface Model

The digital terrain model(DTM), also known as a bare earth model, is a 2D raster image derived from the lowest ground points in the LiDAR point cloud. The digital surface model(DSM) is similar to the DTM but is derived from the highest points in the LiDAR point cloud.

How to use it:

1. Start by opening a DTM or DSM in a 2D viewer from the [Project View](#), these files will have the name DTM or DSM in them and are label with a .tif extension.

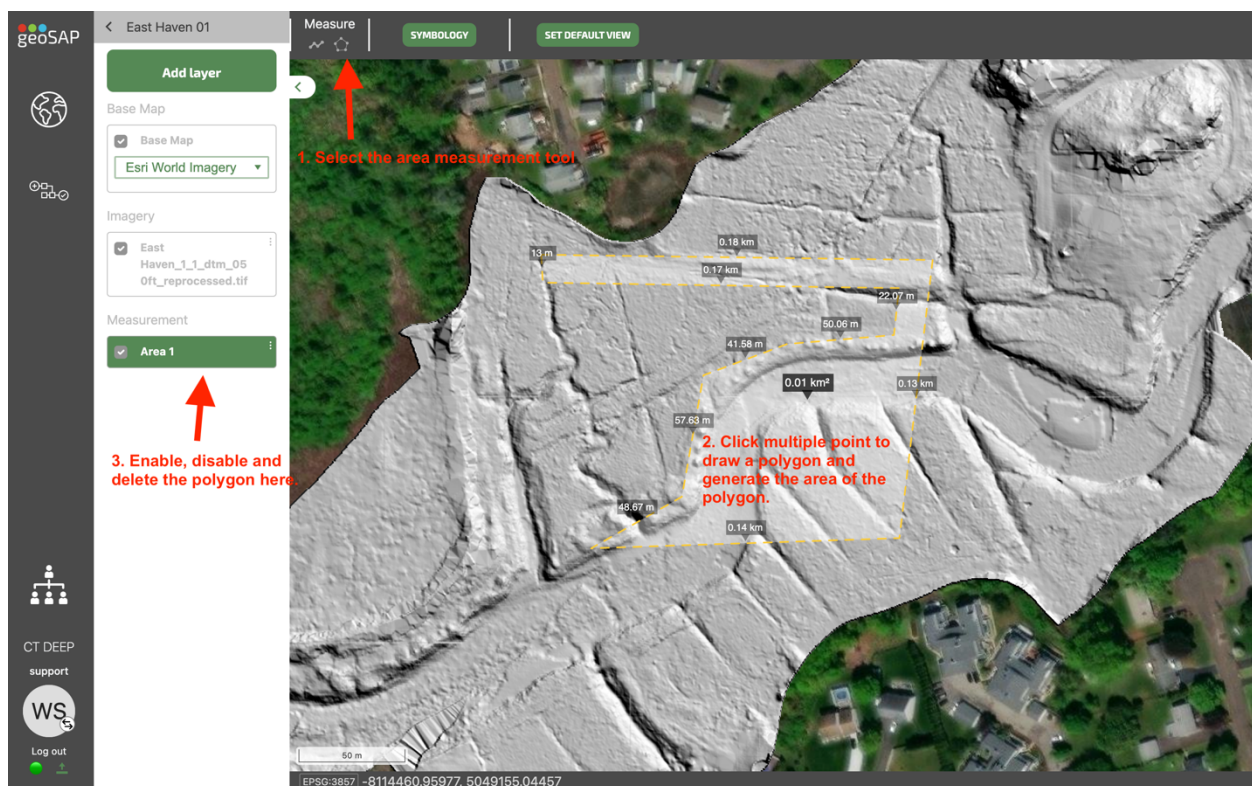
**GTIF** Essex\_2\_1\_dtm\_050.tif

2. Once the DTM/DSM has loaded, click any point in the data and drag your mouse to navigate around the image.
3. To zoom into the data, simply scroll your mouse, you may also double click on any point to zoom into it
4. If you ever get lost in the view, you can click on the 3 ellipses on the layer in the left panel and click "Zoom to" and the camera will re-orient to the default view.
5. The default values of the DTM/DSM are elevation, so with a simple click anywhere in the dataset, you'll be presented with a tool tip that showcases the elevation value of the point.





- The measurement tools allow you to quickly find calculate the distance or area of any part of the data. To use those tools, click the line or polygon tool, then click any point in the image to start drawing a line/polygon. Once you've completed drawing the line/polygon double click a point to end the drawing. geoSAP will calculate the the dimension in real time.



## RBG Orthomosaics

RBG orthomosaics are very common aerial image that provides a birds-eye-view of an area in full color. These RBG orthomosaics are extremely high resolution allowing you to see the finest details.

How to use it:

- Start by opening an RGB Ortho in a 2D viewer from the [Project View](#), these files will have the name RGB Ortho in them and are label with a .tif extension.

**GTIF** Groton\_3\_3\_RGB\_Ortho.tif

- Once the RGB Ortho has loaded, click any point in the data and drag your mouse to navigate around the image.

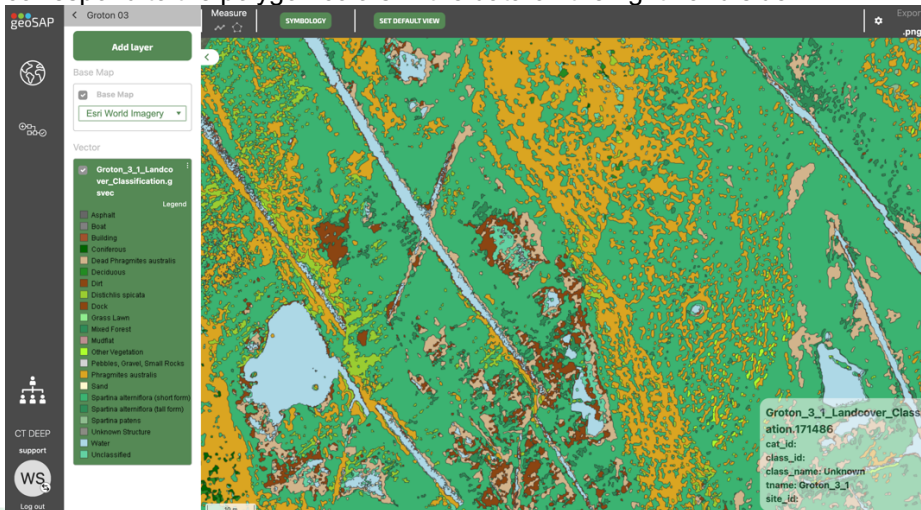
3. To zoom into the data, simply scroll your mouse, you may also double click on any point to zoom into it
4. If you ever get lost in the view, you can click on the 3 ellipses on the layer in the left panel and click "Zoom to" and the camera will re-orient to the default view.
5. Similar to the DTM/DSM, you utilize the measurement tool to measure distance and area of any location on the image. Reference #6 in the DTM/DSM instructions above for more details.

## Landcover Classification

One of the most complex and rich dataset that was produced for this project was the vegetation landcover classification that leverages all of the imagery and LiDAR products to generate. The landcover is a representation of the seven primary marsh vegetation types in the Connecticut saltmarsh delineated by polygon boundaries and colored.

How to use it:

1. Start by opening a Landcover in a 2D viewer from the [Project View](#), these files will have the name Landcover in them and are label with a .gsvec extension.
2. Once the Landcover has loaded, click any point in the data and drag your mouse to navigate around the image.
3. To zoom into the data, simply scroll your mouse, you may also double click on any point to zoom into it
4. If you ever get lost in the view, you can click on the 3 ellipses on the layer in the left panel and click "Zoom to" and the camera will re-orient to the default view.
5. Similar to the DTM/DSM and RGB Orthos you can utilize the measurement tool to measure distance and area of any location on the image. Reference #6 in the DTM/DSM instructions above for more details.
6. The species list can be seen in the legend in the left hand side bar and have colors that correspond to the polygon colors in the data on the right hand side.



7. Click any of the polygons in the data and a small box will appear in the lower right hand side which will provide additional information about that polygon, including the species.

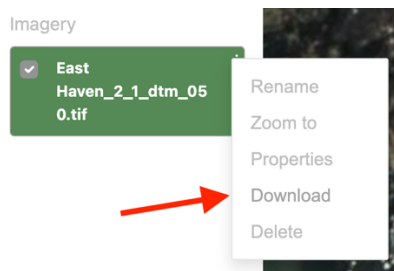




## Downloading Data

For many users, there will be a need to download data to utilize in 3<sup>rd</sup> party software. All data in the Connecticut Salt Marsh Mapping project are available to download through geoSAP.

To download data, navigate to [Data Viewer](#) for a specific file then click on the 3 ellipses on the layer in the left panel and click "Download". geoSAP will zip the data and download through your browser



## Questions?

If you have questions about the data or geoSAP, please contact us at [support@whiteoutsolutions.com](mailto:support@whiteoutsolutions.com)

If you have questions about the project and would like more information, please contact [min.haung@ct.gov](mailto:min.haung@ct.gov)