National Center for Computational Hydroscience and Engineering (NCCHE)

The University of Mississippi

DSS-WISE™ HCOM:

ASSESSMENT OF HUMAN CONSEQUENCES OF DAM-BREAK FLOODS

Release Date:
January 23, 2019

DEVELOPED, OPERATED AND MAINTAINED BY

NATIONAL CENTER FOR COMPUTATIONAL HYDROSCIENCE AND ENGINEERING
THE UNIVERSITY OF MISSISSIPPI
for

FEMA

What is DSS-WISE HCOM?

DSS-WISE HCOM is an analytical module for assessing human consequences of dam-break floods. It is provided under DSS-WISE Web portal as a post-processing companion module for web-based automated dam-break analysis tool DSS-WISE Lite. **DSS-WISE HCOM does not require any additional input from the user**. When user clicks on a button in Status and Results page, DSS-WISE HCOM uses the results provided by DSS-WISE Lite and population data from 2010 census and LandScan USA nighttime and daytime population data by Oak Ridge National Laboratory (ORNL) to provide four types of analysis:

1. Flood Hazard Mapping for humans
    a) Flood hazard mapping for population caught outdoors
    b) Flood hazard mapping for population caught indoors

1. Mapping of Potentially Lethal Flood Zones (PLFZ) for humans
    a) PLFZ for children
    b) PLFZ for adults

3. Analysis of the evolution of inundation areas by hazard classes

4. Analysis of Population at Risk (PAR) numbers by interfacing results from DSS-WISE Lite with population data
    a) Nighttime PAR using LandScan USA nighttime population
    b) Daytime PAR using LandScan USA daytime population
    c) PAR analysis using 2010 census block data

What Are the Results Files Generated by DSS-WISE HCOM?

DSS-WISE HCOM produces a rich results package containing three types of results files:

1. a PDF report with text, tables and maps presenting a summary of the results produced by DSS-WISE HCOM

2. a Microsoft Excel file containing the following analysis results
   a) Project Summary
   b) Hazard Categories
   c) Tabular data and stacked bar chart showing evolution of inundation area as a function of both time and flood hazard category
   d) Tabular data and stacked bar chart showing evolution of nighttime PAR as a function of both time and flood hazard category
   e) Tabular data and stacked bar chart showing evolution of daytime PAR as a function of both time and flood hazard category
   f) Tabular data for all 2010 census blocks completely or partially affected by the inundation

What Are the Results Files Generated by DSS-WISE HCOM? (continued)

3. a series of shape files as listed below
   a) ESRI shapefile of polygon type containing the polygons of flood hazard categories for people caught outdoors.
   b) ESRI shapefile of polygon type containing the polygons of flood hazard categories for people caught indoors.
   c) ESRI shapefile of polygon type containing the polygons of potentially lethal flood zones (PLFZs) for adults and children.
   d) ESRI shapefile of polygon type containing the polygons of nighttime population density computed from LandScan USA
   e) ESRI shapefile of polygon type containing the polygons of daytime population density computed from LandScan USA
   f) ESRI shapefile of polygon type containing the 2010 census block polygons completely or partially filled by the inundation along with computed statistics of flood parameters within each area.

What Kind of Input Data is Needed?

DSS-WISE HCOM requires the results of a successful DSS-WISE Lite simulation launched on or after **January 21, 2019**. These simulations contain various additional results files that are used by DSS-WISE HCOM. Thus, although DSS-WISE HCOM is released on **January 23, 2019**, users should be able to go back and launch DSS-WISE HCOM analysis for their simulations on or after **January 21, 2019**.

No other input data is needed. The 2010 census data at the census block level and the gridded nighttime and daytime population data needed for the PAR analysis are stored in the DSS-WISE Web system.

How Do I Launch a DSS-WISE HCOM Analysis?

DSS-WISE Lite Analysis is launched from the new version of the status and results page, which has been released together with the DSS-WISE HCOM on January 23, 2019. For successful simulations launched on or after **January 21, 2019**, the Status and Results page displays a one click button ("Calculate HCOM") to launch DSS-WISE HCOM analysis. If the button is not displayed, the DSS-WISE HCOM analysis cannot be launched for that simulation.

DSS-WISE HCOM analysis can only be launched once for a given DSS-WISE Lite simulation. The results are made available for download as a zip file. However, it is also possible to list and download the individual files from the status and results page.

Step by step instructions for the new status and results page are provided as part of this document. These instructions also explain how to launch DSS-WISE HCOM and how to download the results.

Updated Names of Files Generated by DSS-WISE Lite

The naming convention for all files generated by DSS-WISE Lite has been changed to be more consistent.

No	File Name	Description
1	xxxx_DSS-WISE_Lite_Final_Report.pdf	Automatically generated report in PDF format
2	xxxx_Inundation_Extent_3_mi.shp	ESRI shapefile of polygon type of the inundation extent when flood front reaches 3 mi
3	xxxx_Inundation_Extent_7_mi.shp	ESRI shapefile of polygon type of the inundation extent when flood front reaches 7 mi (if flood front reaches 7 mi)
4	xxxx_Inundation_Extent_15_mi.shp	ESRI shapefile of polygon type of the inundation extent when flood front reaches 15 mi (if flood front reaches 15 mi)
5	xxxx_Inundation_Extent_60_mi.shp	ESRI shapefile of polygon type of the inundation extent when flood front reaches 60 mi (if flood front reaches 60 mi)
6	xxxx_Flood_Arrival_Time_hr_polygons_upto_final.shp	ESRI shapefile of polygon type of the flood arrival times at predefined times
7	xxxx_Hmax_ft_polygons_upto_final.shp	ESRI shapefile of polygon type of the flood depths at predefined times
8	xxxx_DEM_ft.tif	Raster file of computational mesh with elevations in ft.
9	xxxx_Hmax_ft_upto_final.tif	Raster file of maximum flood depth D_{max} in ft.
10	xxxx_Arrival_Time_hr_upto_final.tif	Raster file of flood arrival time in hrs
11	xxxx_Input_Shapes.zip xxxx_breachpoint.shp xxxx_reservoirs.shp xxxx_structures.shp xxxx_extendedstructures.shp xxxx_bridges.shp xxxx_observationlines.shp	Collection of ESRI shapefiles used in scenario definition. • Location of breach point (point type) • Location of breach point (point type) • Crest lines of structures (polyline type) • Corrections to structure crest lines, if any (polyline type) • Location of bridge points (point type) • Location of observation lines (polyline type)
12	xxxx_Observation_Lines.zip OLIN_0000001.csv ……. OLIN_0000011.csv	Contains csv[1] files of the hydrographs extracted at observation lines (up to 10 user defined and one automatically defined) • csv file for observation line no 1 • ….. • csv file for the last observation line
13	xxxx_Inundation_Extent_Final_yy.yyy_mi.shp	ESRI shapefile of polygon type of the maximum inundation extent
14	xxxx_Inundation_Extent_final_Final_yy.yyy_mi.kmz	KMZ file of the maximum inundation extent for viewing on Google Earth
xxxx Job ID number yy.yyy Maximum distance achieved by the flood front		

(1) Comma separated value file

New Results Files Generated by DSS-WISE Lite

Seven additional files have been added to the final results package.

No	File Name	Description
15	xxxx_DVmax_ft2ps_upto_final.tif	Magnitude of maximum specific discharge DV_{max} in ft^2/s
16	xxxx_DVmax_Arrival_Time_hr_upto_final.tif	Raster file of arrival time of DV_{max} in hrs
17	xxxx_Vmax_ftps_upto_final.tif	Raster file of magnitude of maximum velocity V_{max} in ft/s
18	xxxx_H_ft_at_final.tif	Raster file of flood depths (ft.) at the end of the simulation
19	xxxx_DVmax_ft2ps_upto_final.shp	ESRI shapefile of polygon type for the magnitude of maximum specific discharge DV_{max} in ft^2/s
20	xxxx_DVmax_Arrival_Time_hr_upto_final.shp	ESRI shapefile of polygon type for the arrival time of DV_{max} in hrs
21	xxxx_Vmax_ftps_upto_final.shp	ESRI shapefile of polygon type for the magnitude of maximum velocity V_{max} in ft/s
xxxx	Job ID number	

IMPORTANT NEW FEATURE:

The Status and Results page now allows downloading the entire results package as a single zipped file.

New Status and Results Page

The status and results page has been completely redesigned and improved:

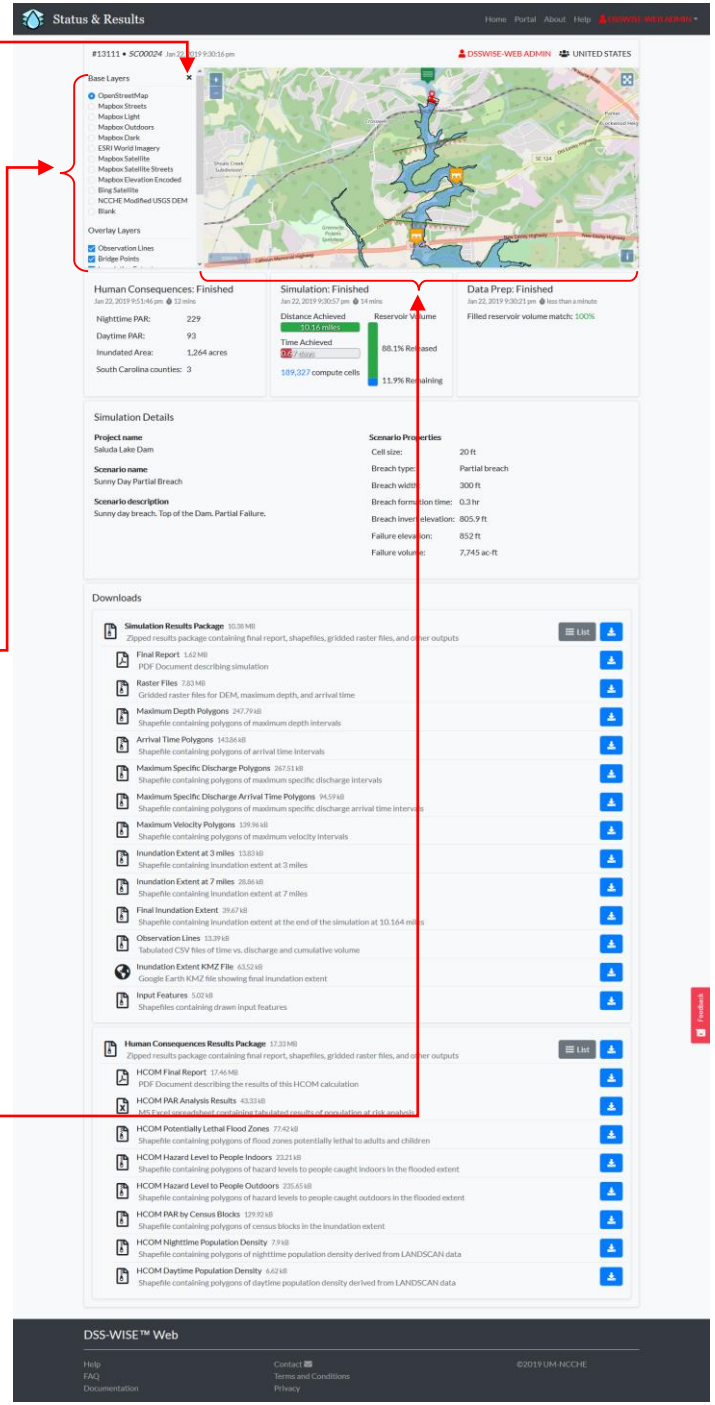
1. The page is now dynamically constructed based on the type of the simulation and the stages of the work progress. Appropriate fields are displayed on the page based on the context by taking into account various status variables such as the type of simulation, work progress, availability of the information, etc.

2. More base layers and overlay layers are provided in a box to the left of the map

3. The box containing base and overlay layers can be hidden (by clicking “x” on the upper right hand corner”) to view the map in a larger area

4. The map area now displays the overlay layers of
   - Observation Lines,
   - Bridge Points,
   - Breached Width,
   - Impounding Structure,
   - Impounding Structure Base,
   - Filled Reservoir, and
   - Simulation Domain Extent

   in addition to Inundation Extent and Breach Center.



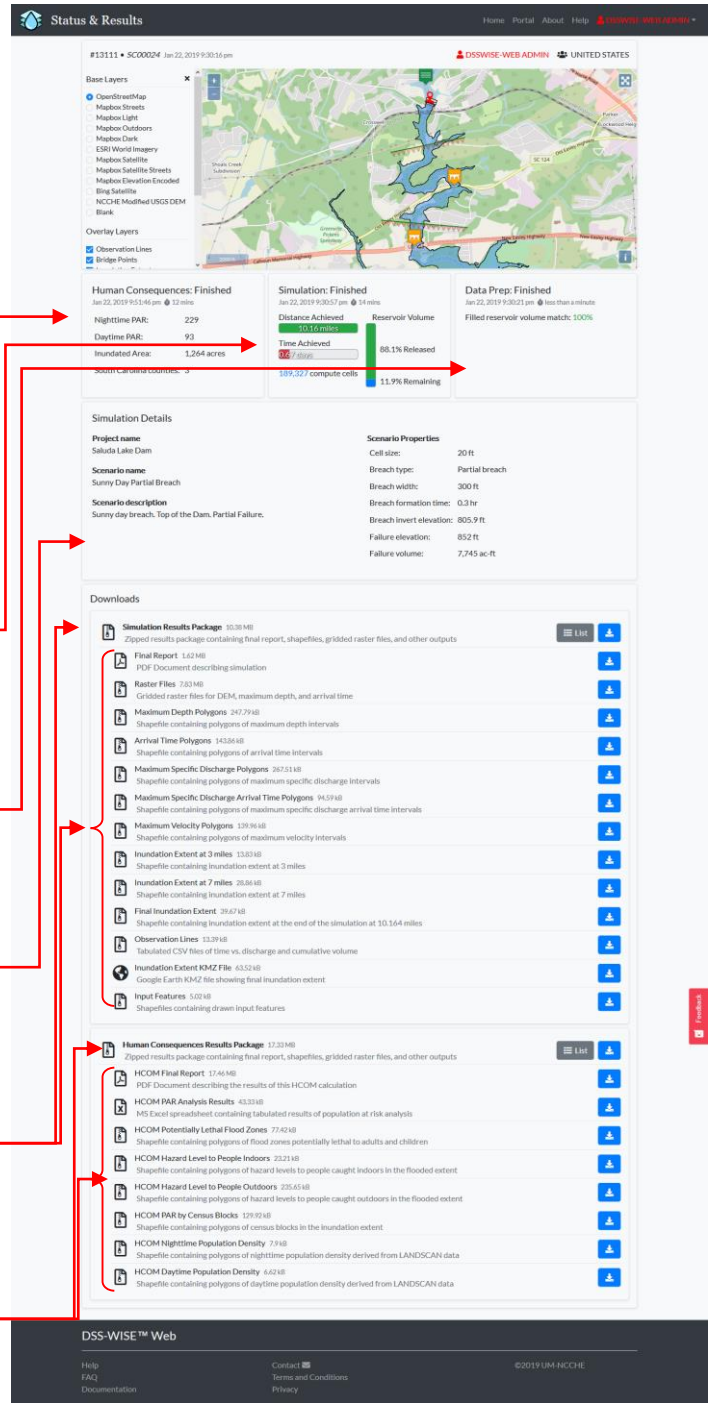
New Status and Results Page (continued)

5. Separate fields are provided to provide information on input data preparation, DSS-WISE Lite simulation and DSS-WISE HCOM simulation
   - Human Consequences field provides information on the progress of DSS-WISE HCOM. At the end of the simulations some results (nighttime PAR, daytime PAR, inundated area, and number of counties involved) are summarized for quick reference.
   - Simulation field provides information on the progress of DSS-WISE Lite simulation. It displays slide bars of distance achieved and time achieved. A separate display shows dynamically the released and remaining reservoir volumes.
   - Data Prep field provides information on input data. It displays progress of the work. At the end, it gives the percentage of reservoir volume match.

6. Simulation Details (such as Project name, Scenario name, Scenario description, and Scenario properties) are summarized in a separate field.

7. DSS-WISE Lite results can be downloaded in a single zip file. However, it is also possible to display the list of all files and download them individually.

8. DSS-WISE HCOM results can be downloaded in a single zip file. However, it is also possible to display the list of all files and download them individually.



Status and Results Page Immediately After Submitting a Simulation

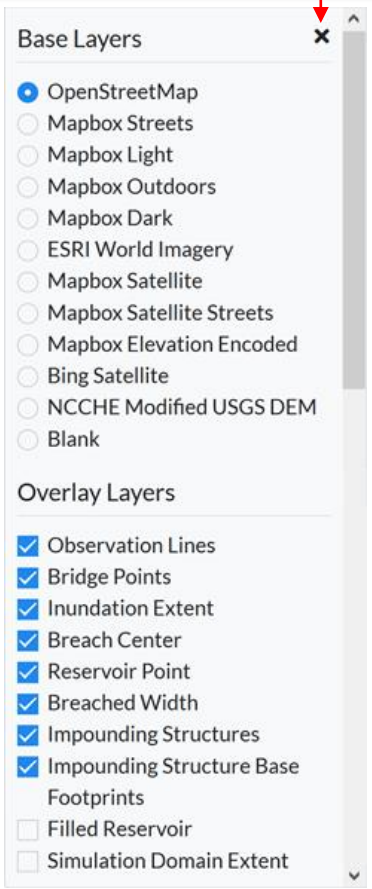
Click on the “x” to hide the left partition to display the map over the entire width.

User name is displayed. Clicking on the arrow displays a button that allows to log out.

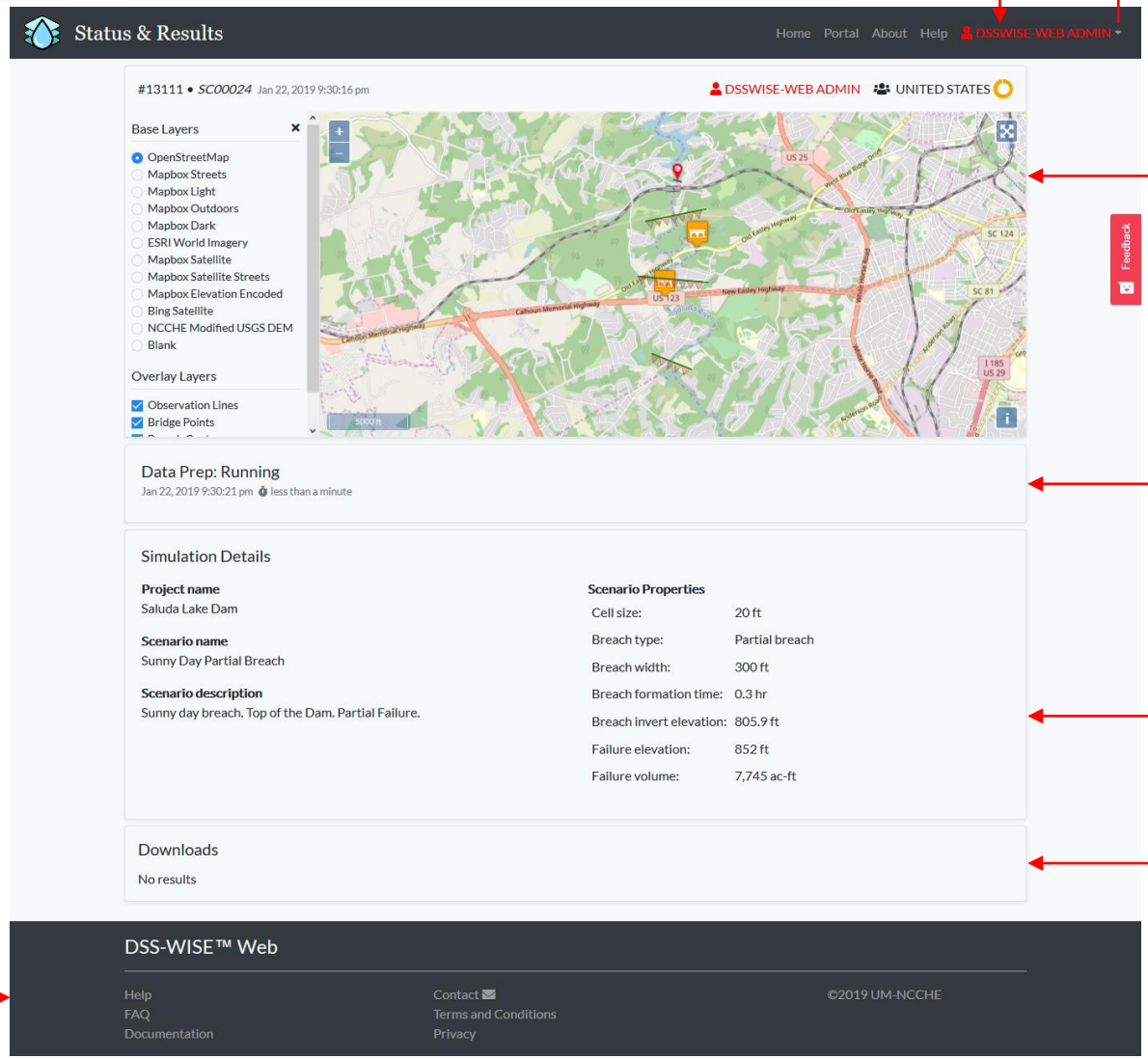
Log Out

The simulation has just been launched. The input data is being prepared automatically.

Large number of Base Layers are now available. Only one base layer can be displayed at any time by clicking on the corresponding radio button.



A large number of Overlay Layers can be displayed on the map. Multiple overlay layers can be displayed together. The check box can be clicked to turn on and off a layer.



There are no results. The map shows simulation set up details. Numerous base layers and overlay layers are available.

Data Prep field informs that the simulation is running. The start date and time and the direction since the beginning are indicated.

Simulation Details Field displays selected simulation setup data provided by user for convenience.

Download field is empty because there are no results to display yet.

General information box with various links

Status and Results Page After Completion of Input Data Preparation

Simulation field has been added to the page. The field displays the date and time of the beginning of the simulation. It also indicates that the simulation has begun less than a minute ago. Estimated time to completion is provided as 37 minutes. The field displays the bars for

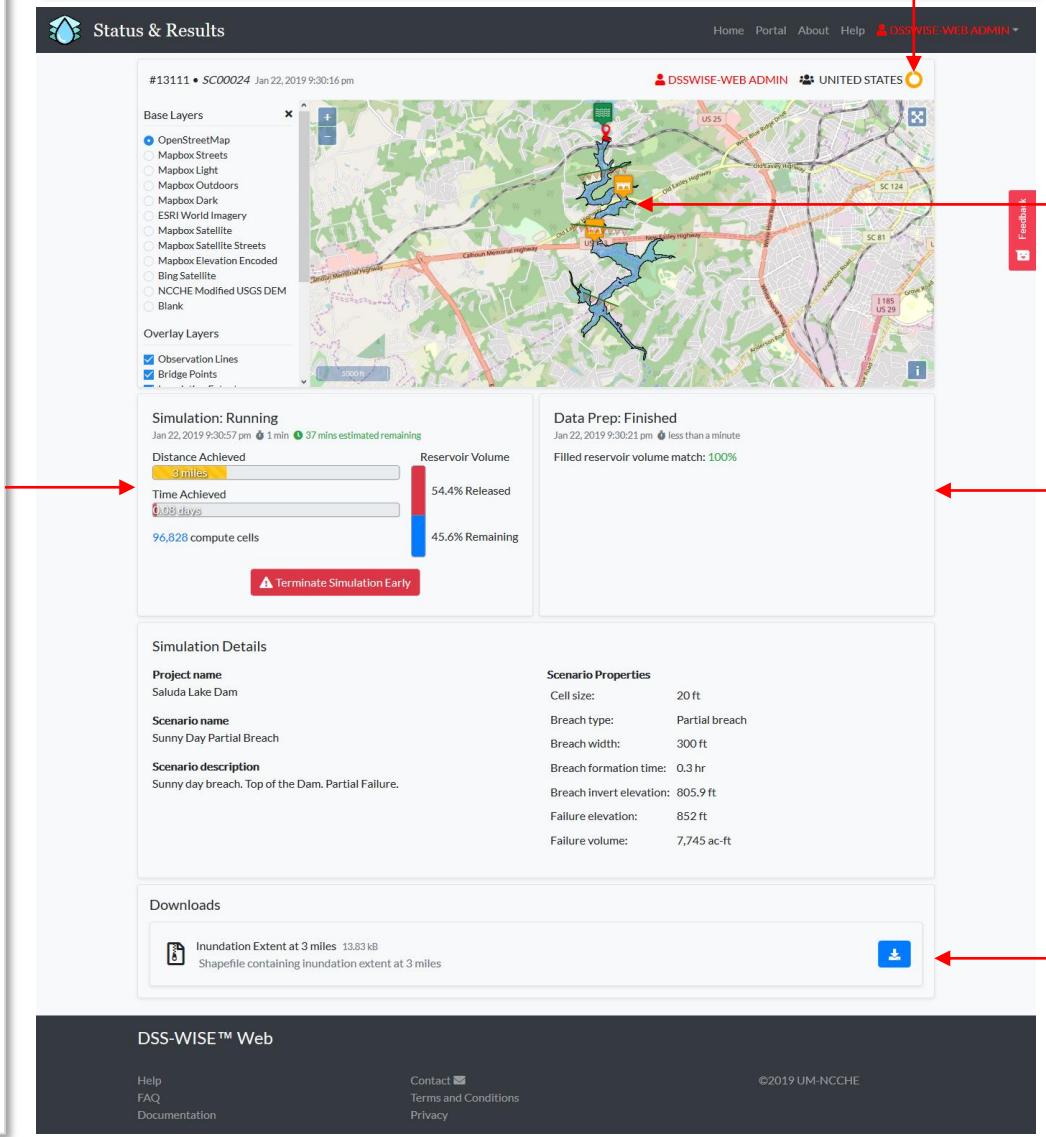
- "Distance Achieved"
  Length of the bar corresponds to the downstream distance specified by the user. Distance already achieved is shown proportionally in color.
- "Time achieved"
  Length of the bar corresponds to the simulation duration specified by the user. Simulation time already achieved is shown proportionally in color.
- "Reservoir Volume"
  The length of the vertical bar represents the failure pool volume. Released and remaining volumes are shown as red and blue bars.

The number of compute cells correspond to number of wet cells that are being computed.

The user can click on the terminate simulation bar to end the simulation any time.

Information on status and results page is updated automatically every 5 minutes.
The yellow circle shows the time to next update

5.00 min
3.75 min
2.50 min
0.75 min



The automated input data preparation has been completed. Simulation is running. The contents of the page will be updated every 5 minutes.

Simulation has already produced results. The flood inundation extent is displayed. The inundation extent will be automatically updated every five minutes

Input data preparation has been successfully completed in less than a minute. The procedure for the estimation of the unknown bathymetry was able to match 100% of the user specified failure pool volume. This is an important number. If this number is significantly smaller than 100%, the user should check the input data. There may be two causes:

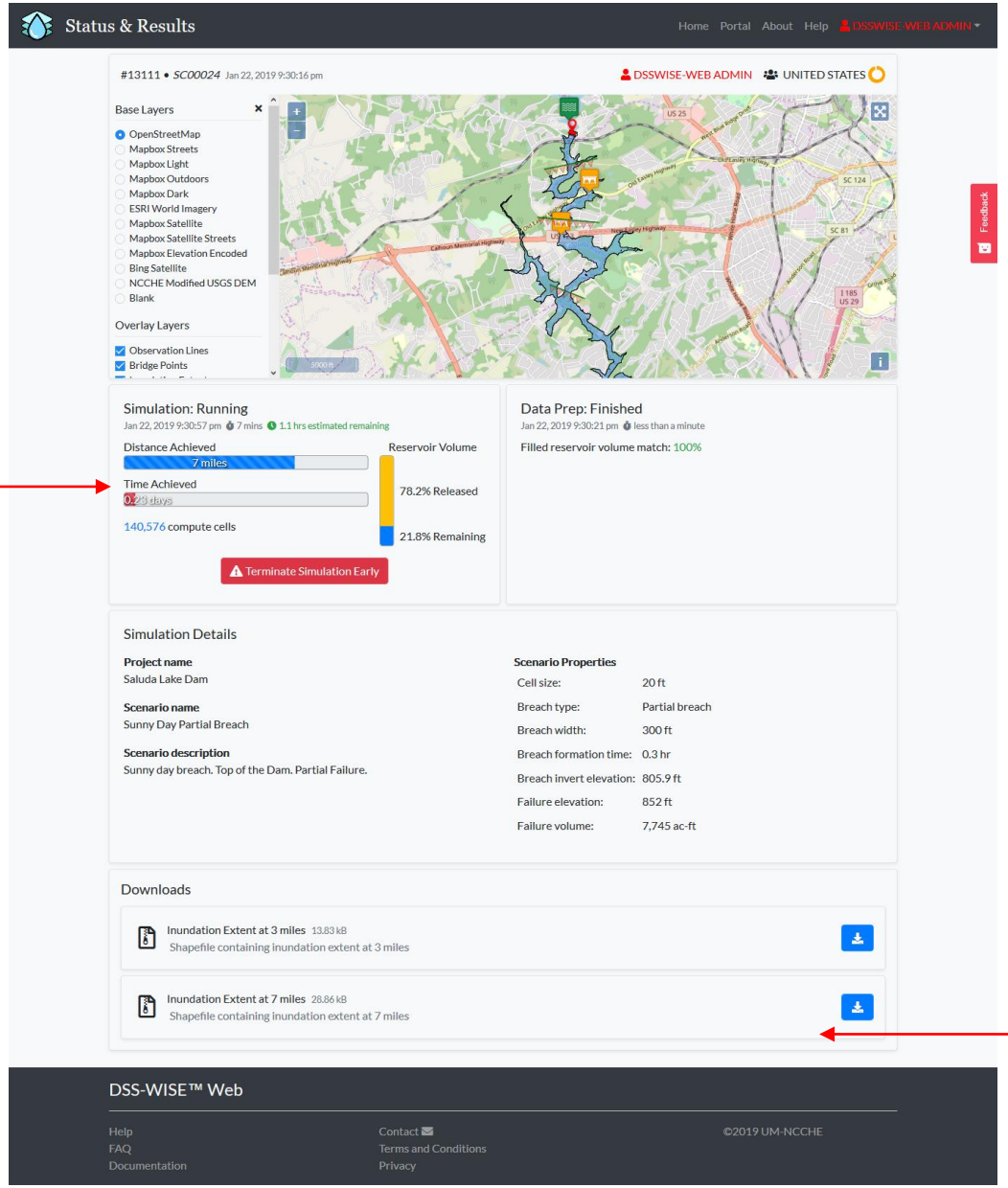
1. an error/inconsistency in the input data provided by the user and/or
2. the data provided by the user is not in agreement with the base layer DEM.

Downloads field displays the intermediate inundation extent when the flood front reached a distance of 3 miles from the breach point. Click blue icon to download.

Status and Results Page During Simulation

Simulation field has progressed. The contents of the Simulation field have been updated.

- The distance covered is 7 miles
- 0.23 days of flood time have been completed thus far
- 78.2% of the initial failure pool volume has been released from the breach. 21.8% of the initial volume is still in the reservoir.
- Inundation area has expanded. The number of inundated cells that are computed has increased to 140,576.
- The simulation has started 7 minutes ago, and
- The time to completion is now estimated as 1.1 hours.



The simulation is still running. The contents of the page are updated every 5 minutes.

The user can also update the web page any time using the controls of the browser he/she is using.

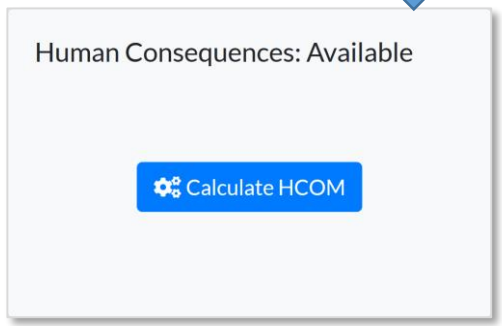
Downloads field displays the intermediate inundation extents when the flood front reached a distance of 3 miles and 7 miles from the breach point. Click on the corresponding blue icon to download the file.

Status and Results Page After DSS-WISE Lite Simulation is Successfully Completed

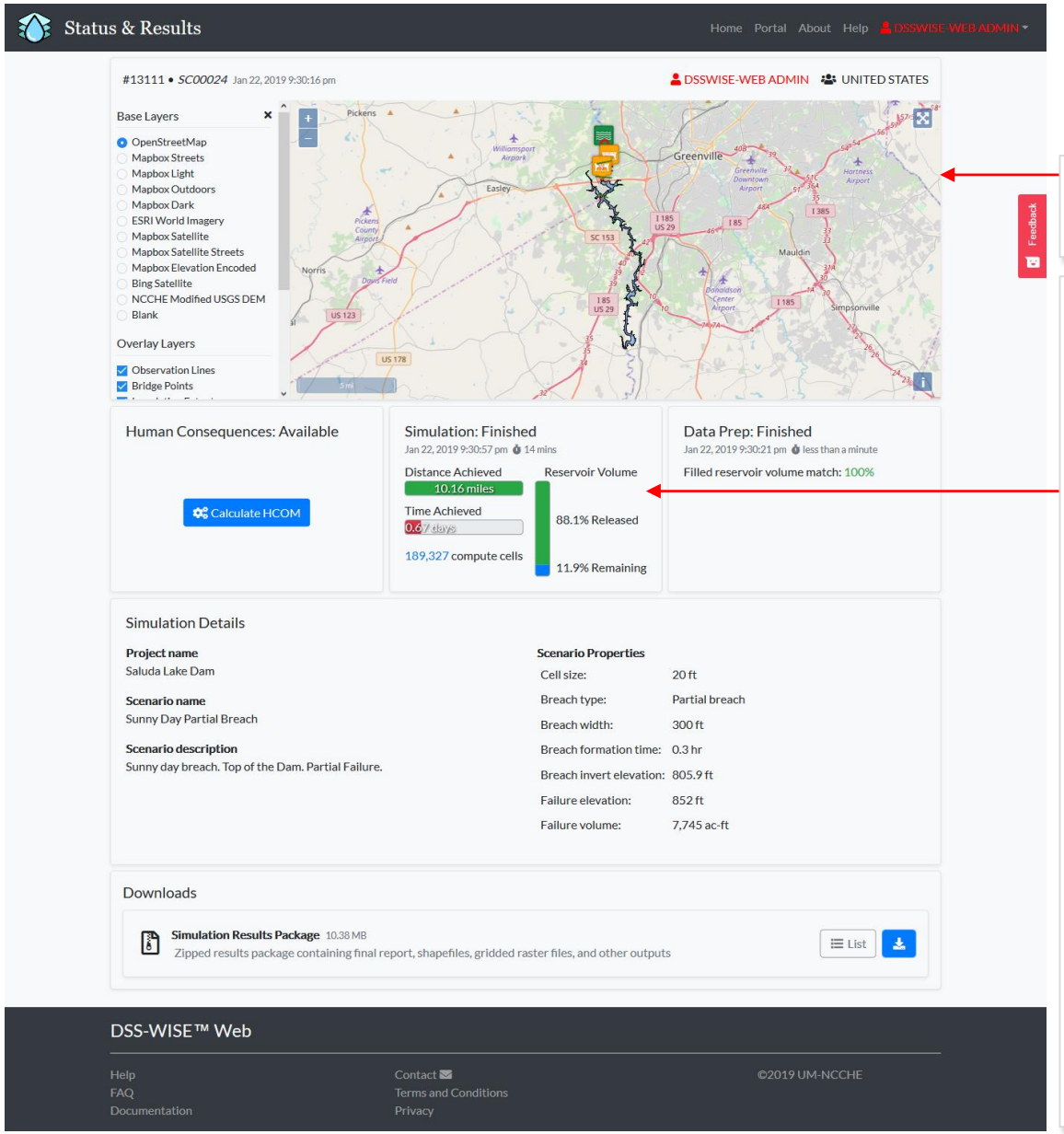
NEW

At the end of the DSS-WISE Lite simulation a new field, entitled "**Human Consequences**" has been added onto the page for launching DSS-WISE HCOM.

Clicking on the blue "Calculate HCOM" button launches DSS-WISE HCOM to asses human consequences of the flood computed by DSS-WISE Lite.



Downloads field display the final results package as a zipped file. By clicking the blue icon all results can be downloaded as a single zipped file. Clicking on the "List" button displays the list of results files in the package. The listed files can be downloaded individually.



DSS-WISE Lite simulation is finished. The system is ready for launching DSS-WISE HCOM simulation.

Since the simulation is completed, the map displays the maximum inundation map.

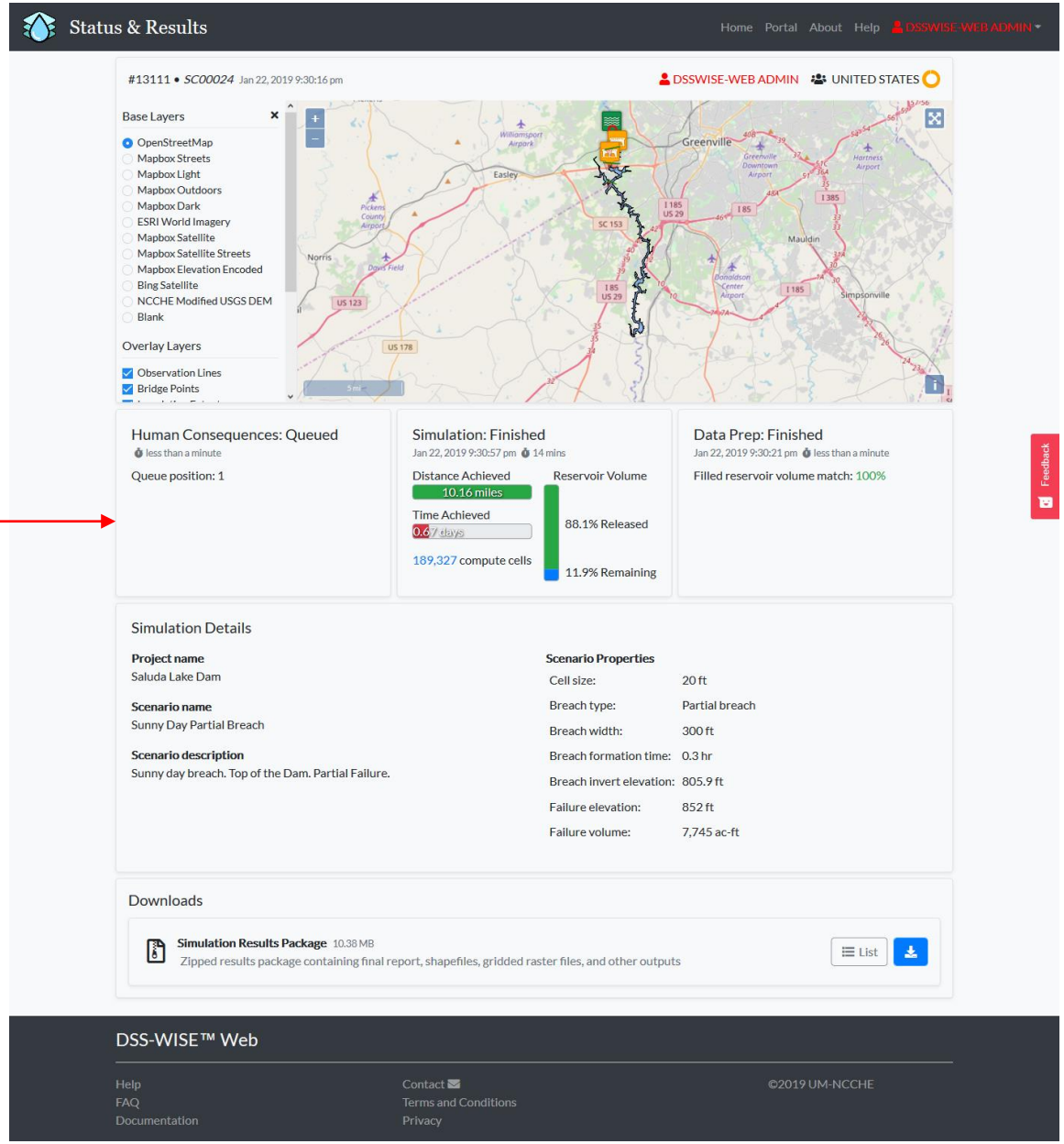
Simulation is finished. The contents of the Simulation field have been updated to provide final statistics:

- The distance covered is 10.16 miles, which is a little longer than the user specific downstream distance.
- Since the flood tip reached the downstream distance specified by the user, the simulation ended after computing 0.67 days of flood time.
- 88.1% of the initial failure pool volume has been released from the breach. 11.9% of the initial volume is still in the reservoir. The user should check if this remaining volume is expected based on the specified breach invert elevation.
- Maximum number of inundated cells is displayed as 140,576.
- The simulation was completed in 14 minutes.

Status and Results Page After DSS-WISE HCOM Analysis is Launched

The user has launched DSS-WISE HCOM by clicking on “Calculate HCOM” button less than a minute ago.

“Human Consequences” field has been updated to indicate that the human consequences analysis is queued. The job has the first position in the queue.

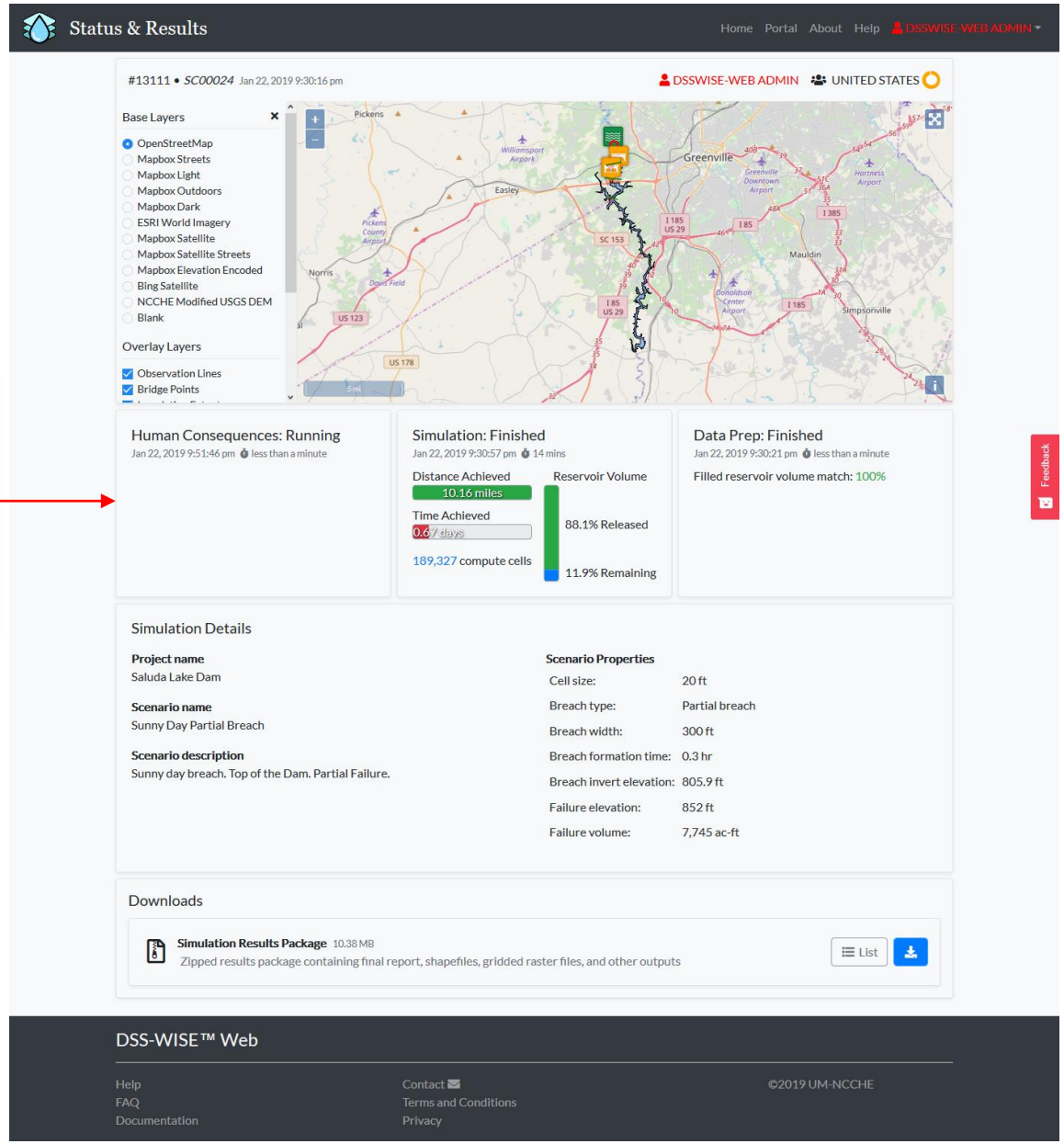


DSS-WISE HCOM Analysis has just been launched and occupies the first position in the queue.

Status and Results Page While DSS-WISE HCOM Analysis is Running

DSS-WISE HCOM analysis has been running less than a minute.

The field has been updated to show the start date and time of the HCOM analysis.



DSS-WISE HCOM Analysis is running.

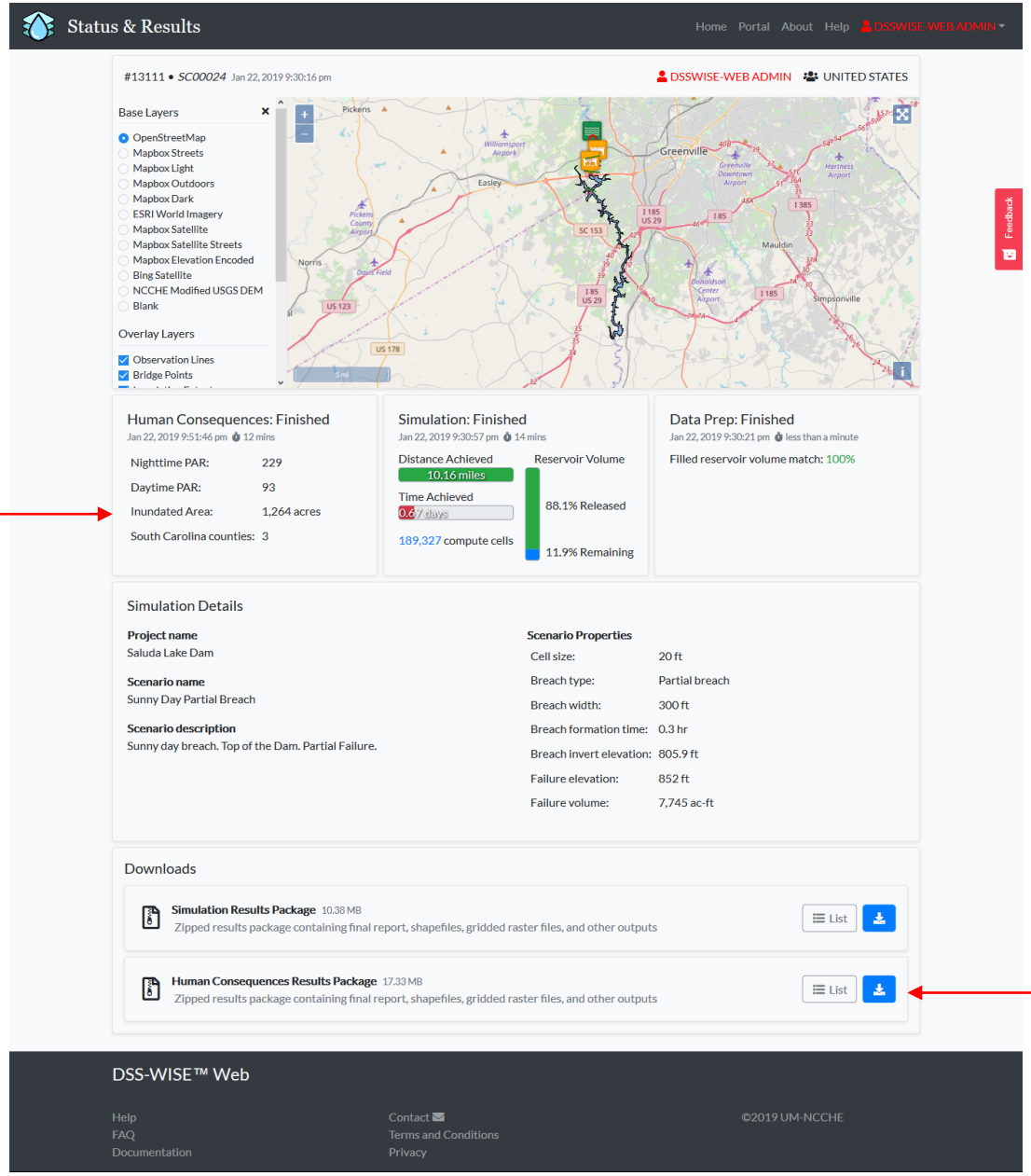
Status and Results Page After DSS-WISE HCOM Analysis is Successfully Completed

DSS-WISE HCOM analysis is successfully completed in 12 minutes.

The field has been updated to highlight some of the key results:

- Nighttime population at risk (PAR) was found to be 229 people based on the LandScan USA gridded population data.
- Dayttime population at risk (PAR) was found to be 93 people based on the LandScan USA gridded population data.
- Total inundation area (based on the DSS-WISE Lite simulation reaching 10.16 miles from the breach point) is 1,264 acres.
- The inundation area concerns three counties.

IMPORTANT NOTE: For a given DSS-WISE Lite, the DSS-WISE HCOM analysis can only be launched once. The results remain available for download indefinitely.



DSS-WISE HCOM Analysis is completed.

Since both DSS-WISE Lite and DSS-WISE HCOM runs have been completed, the Status and Results page show the final results and the page is no longer updated every 5 minutes.

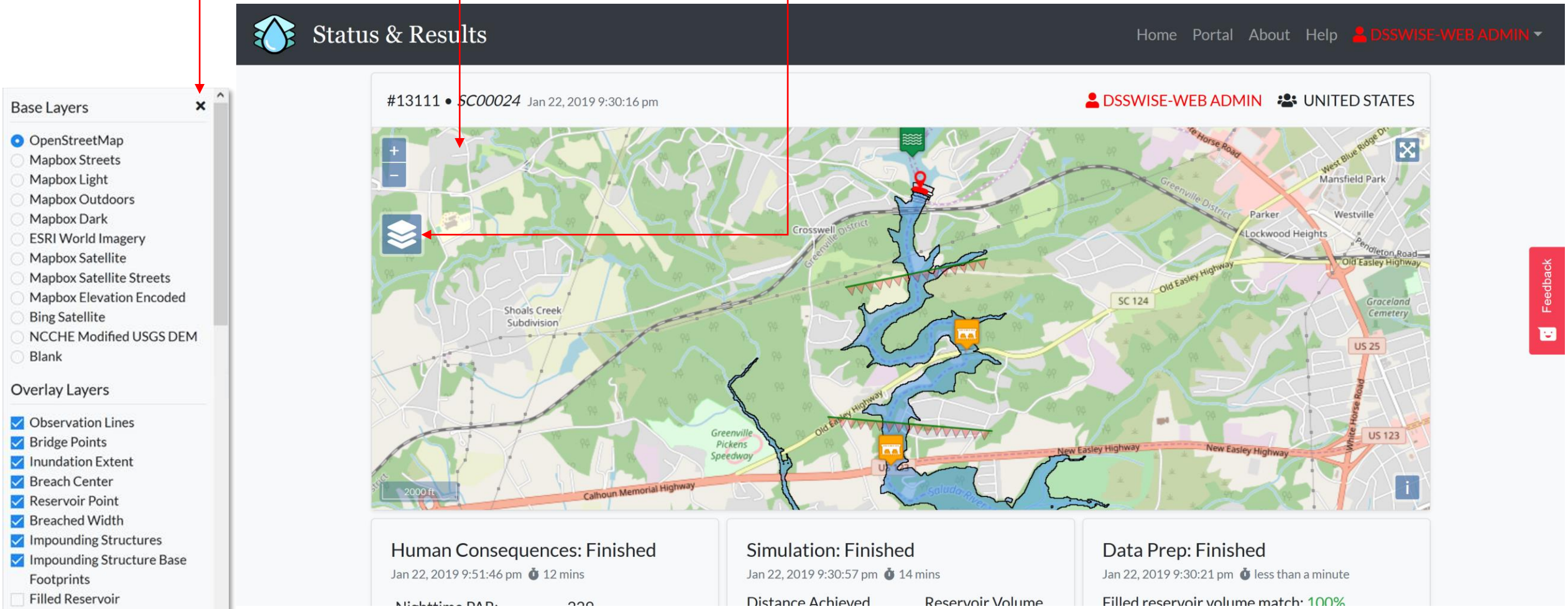
Downloads field now display also the final results package for DSS-WISE HCOM as a zipped file. By clicking the blue icon all DSS-WISE HCOM results can be downloaded as a single zipped file. Clicking on the “List” button displays the list of results files in the package. The listed files can be downloaded individually.

Status and Results Page: Hiding Layers Panel to Display a Larger Map

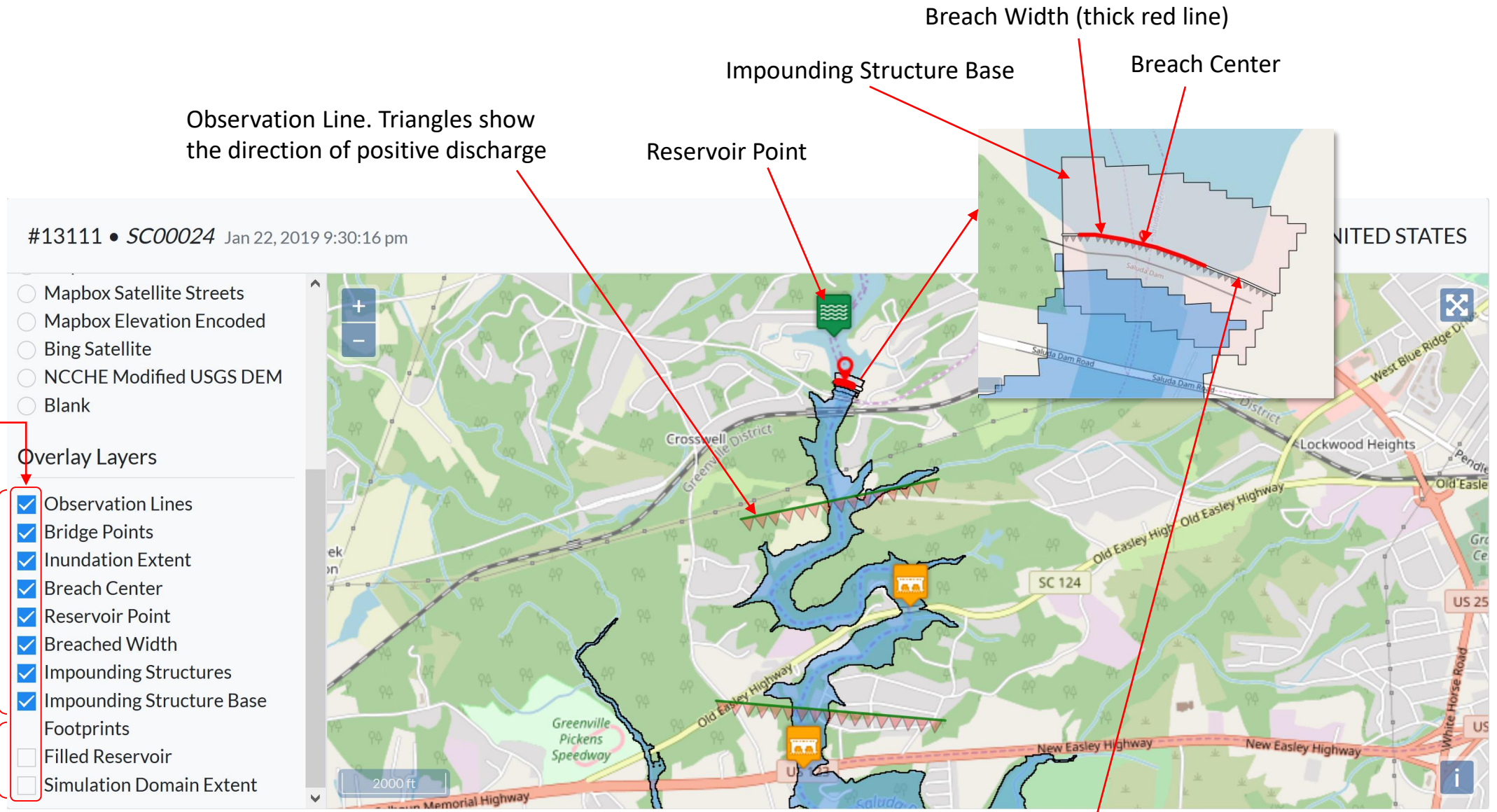
Clicking on “x” hides the layers panel

Map is now displayed over the entire width

To bring back the layers panel, click on this icon



Status and Results Page: Overlay Layers that can be Displayed on the Map



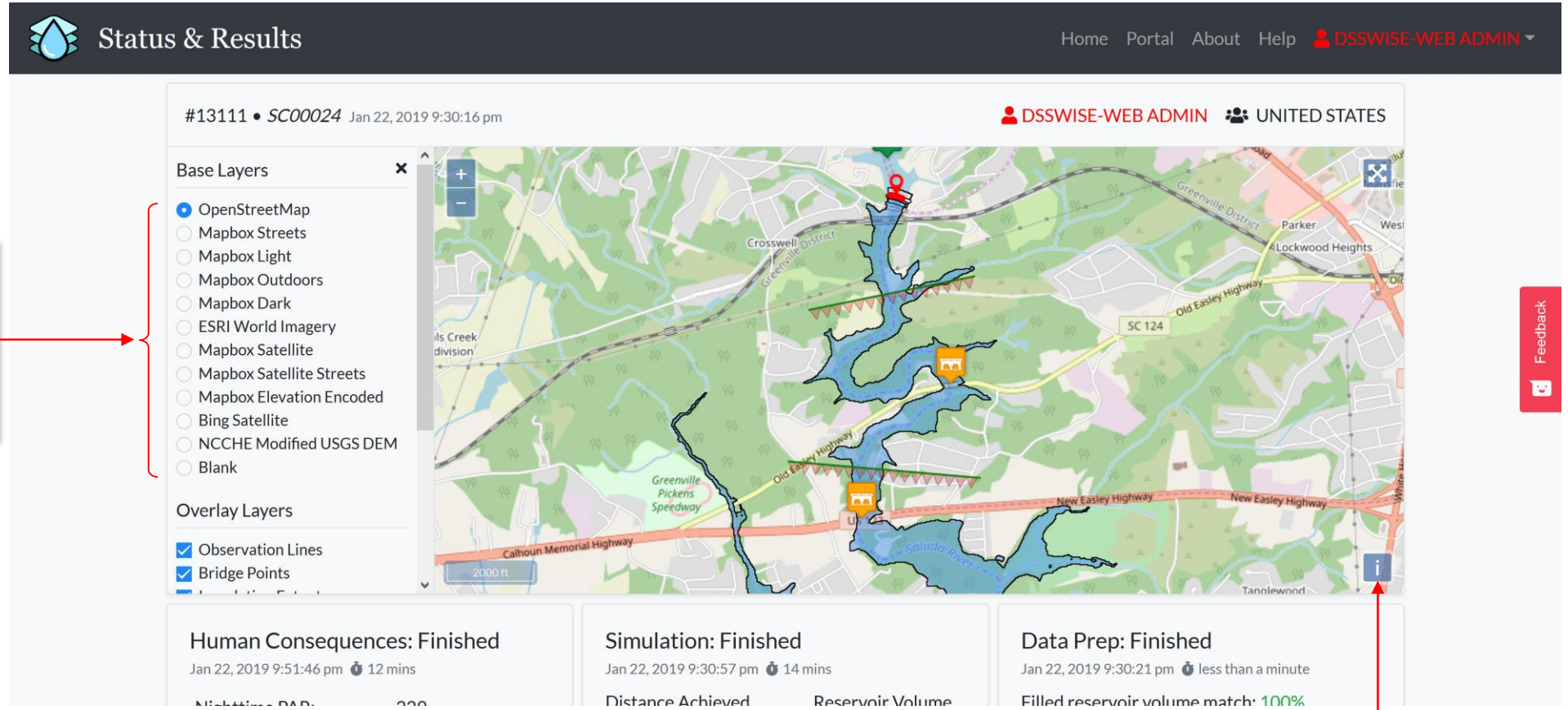
Any combination of Overlay Layers can be displayed by toggling on/off the check box next to it

These Overlay Layers are displayed by default

These Overlay Layers can also be displayed by clicking on the check box next to it

Impounding Structure (crest line captured by the user). Since the crest line is also used as an Observation Line for the breach hydrograph, triangles are attached to show the direction of positive discharge

Status and Results Page: Base Layers that can be Displayed on the Map

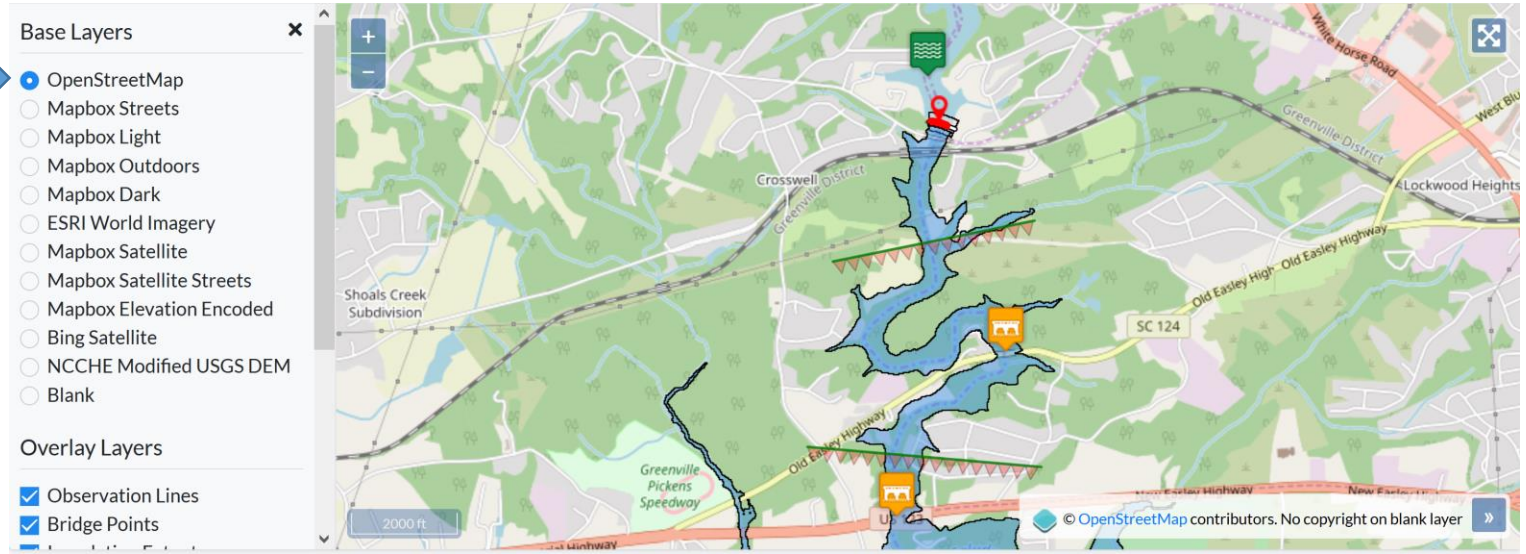


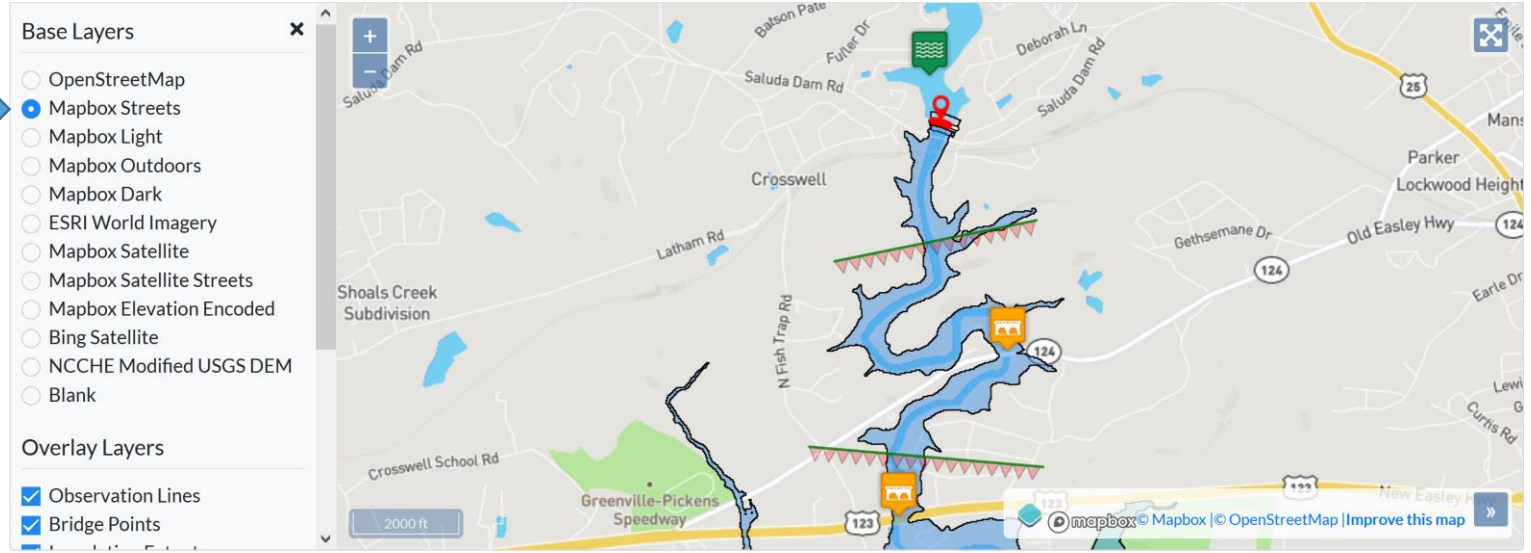
Only one Overlay Layer can be displayed at a time by clicking on the corresponding radio button.

Click on the information button to display the source and copyright information for the current Base Layer.

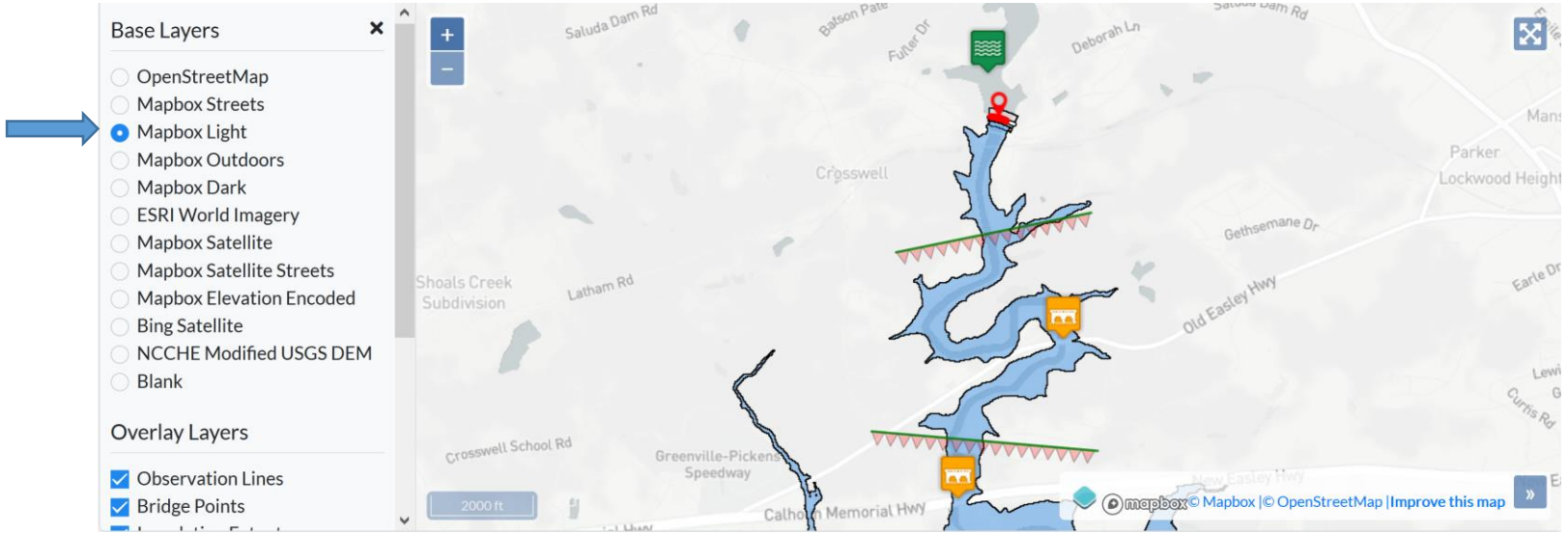
Click on the double arrow to hide the layer information.

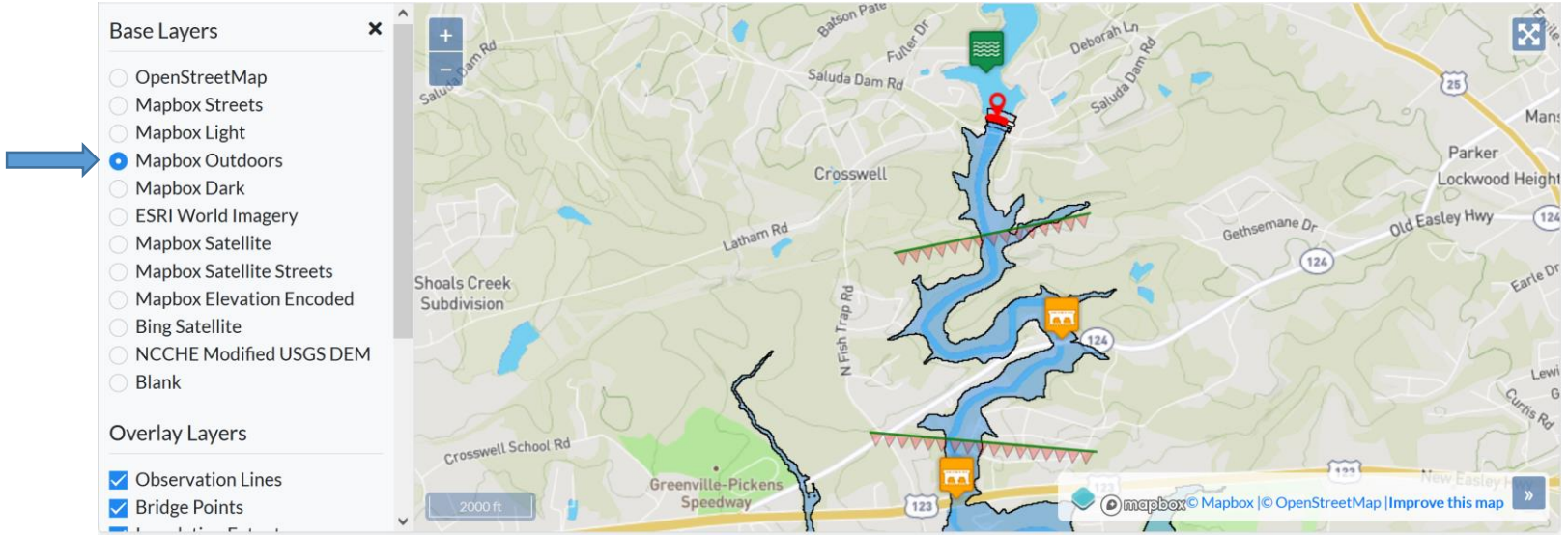
Status and Results Page: Base Layers that can be Displayed on the Map (continued)



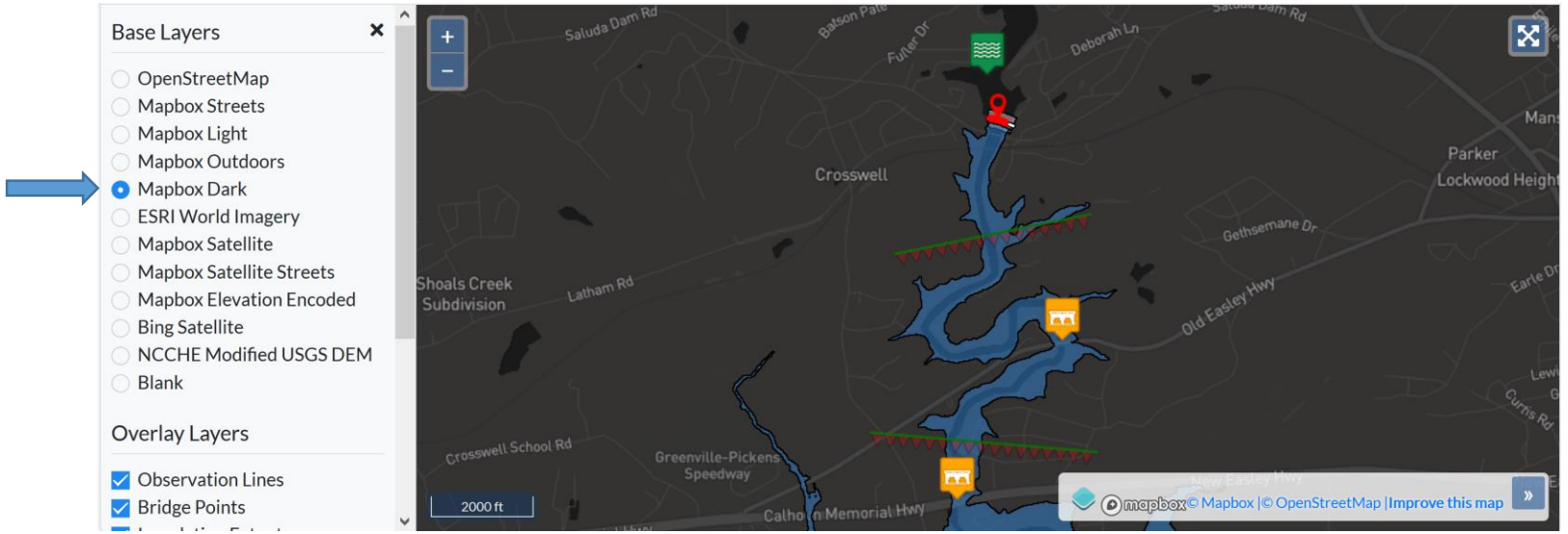


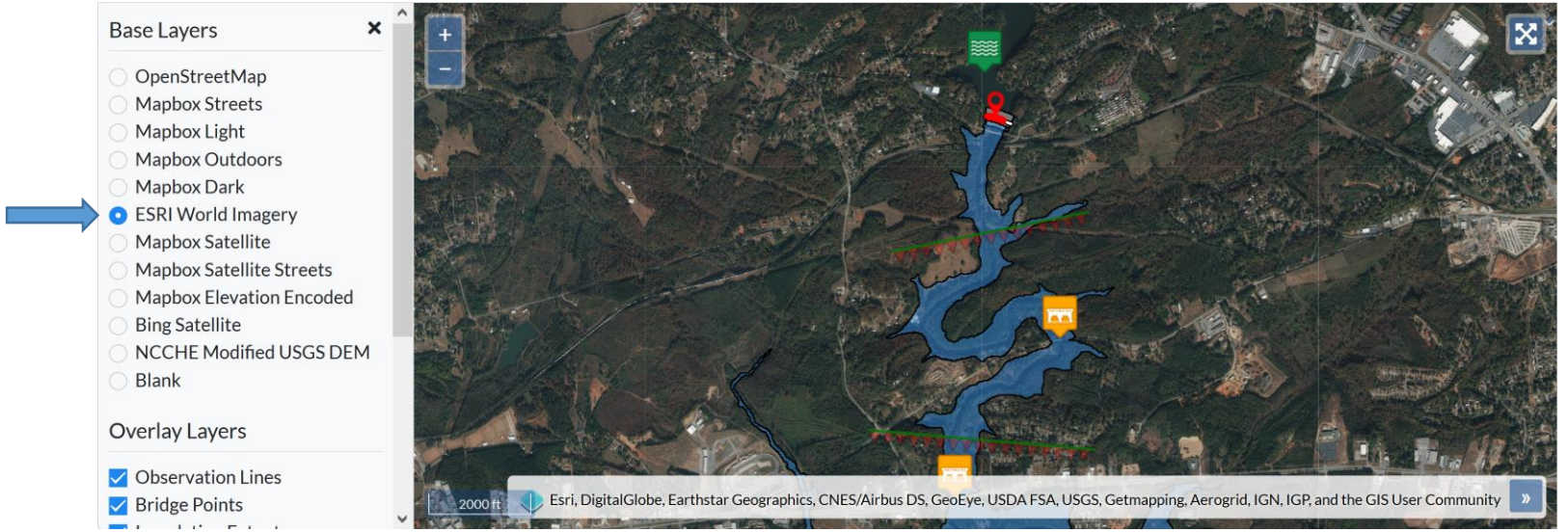
Status and Results Page: Base Layers that can be Displayed on the Map (continued)



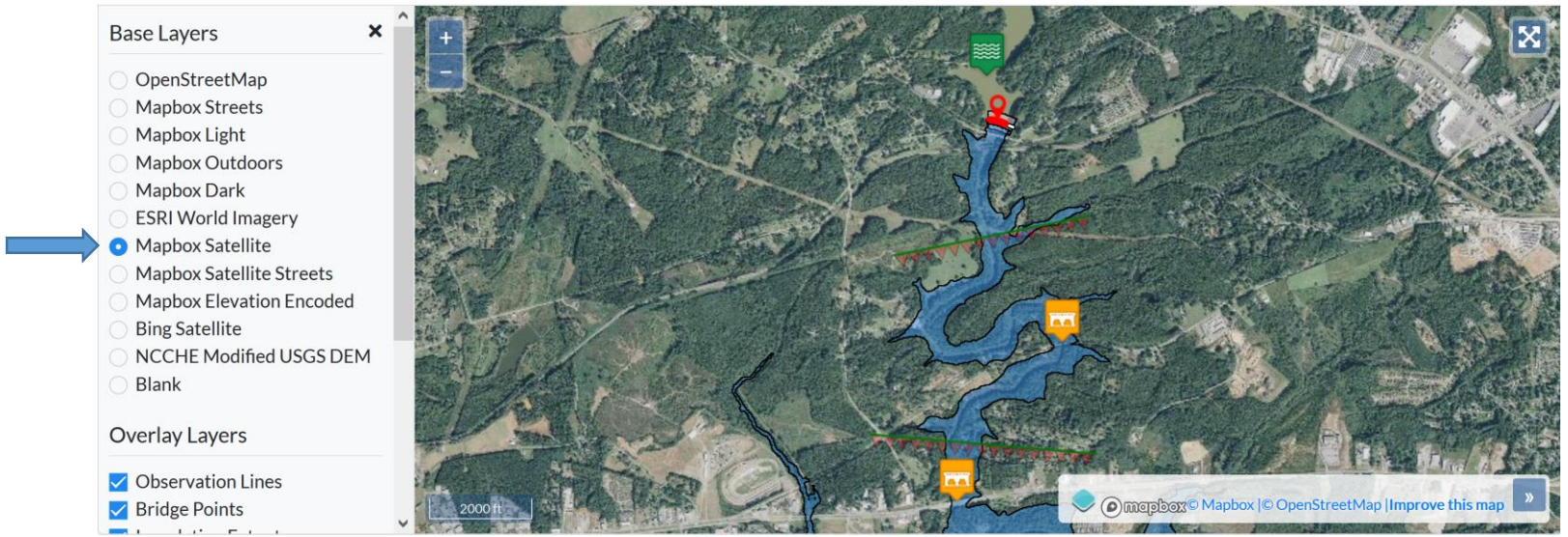


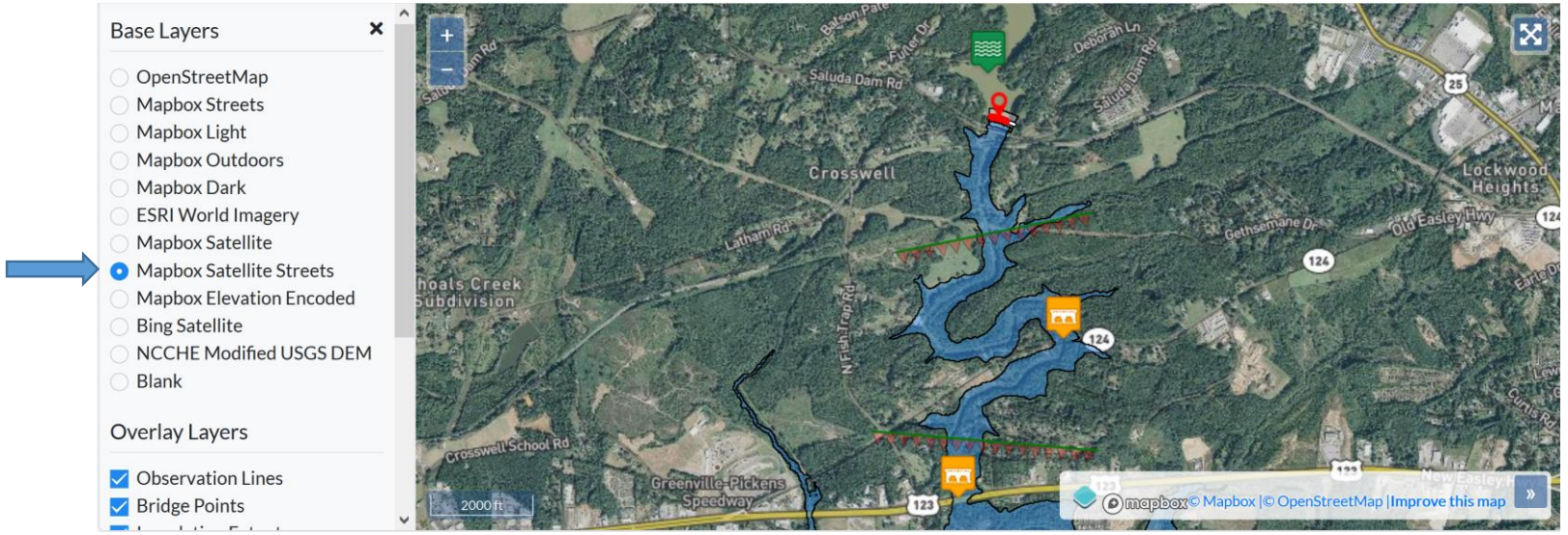
Status and Results Page: Base Layers that can be Displayed on the Map (continued)



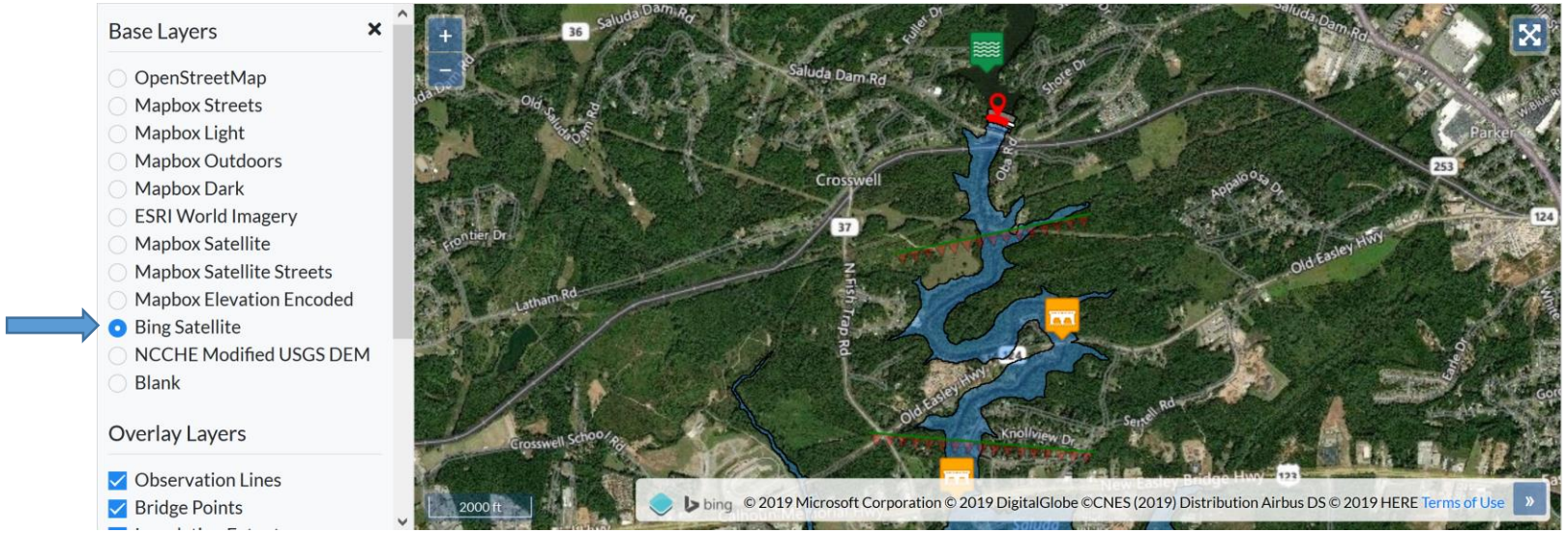


Status and Results Page: Base Layers that can be Displayed on the Map (continued)

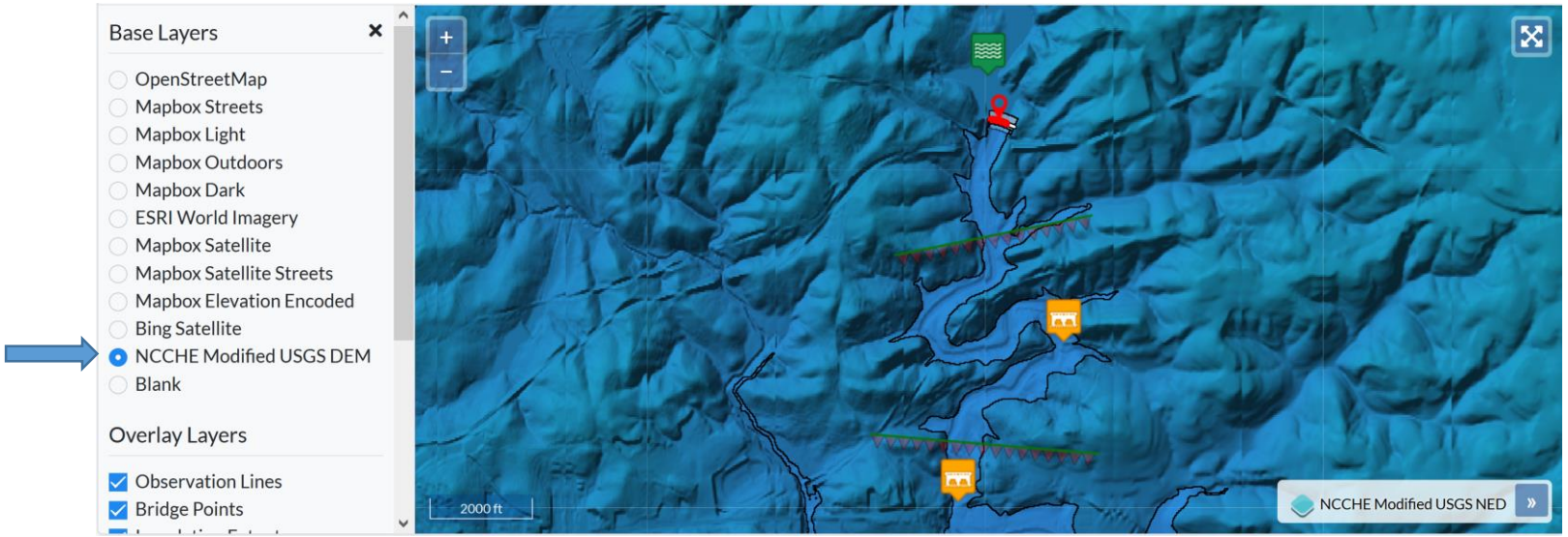




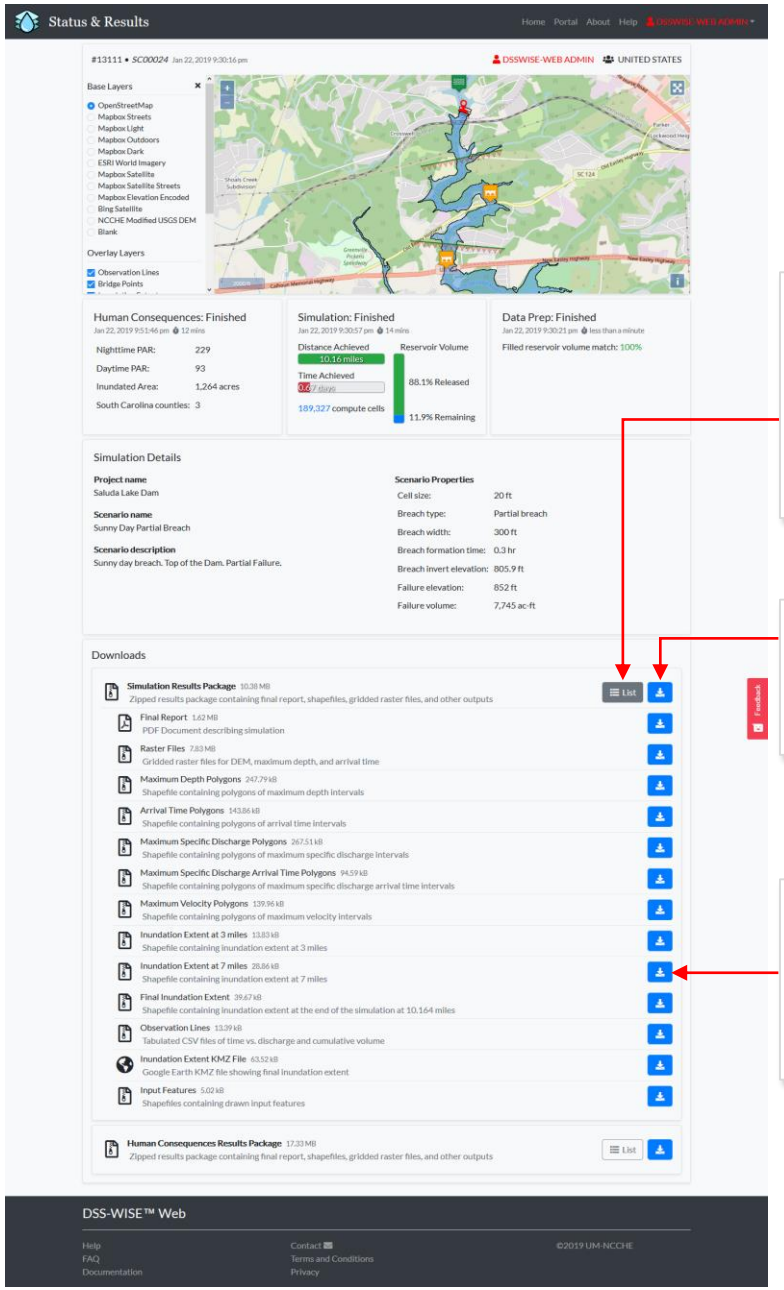
Status and Results Page: Base Layers that can be Displayed on the Map (continued)



Status and Results Page: Base Layers that can be Displayed on the Map (continued)



Status and Results Page: List of Files Generated by DSS-WISE Lite

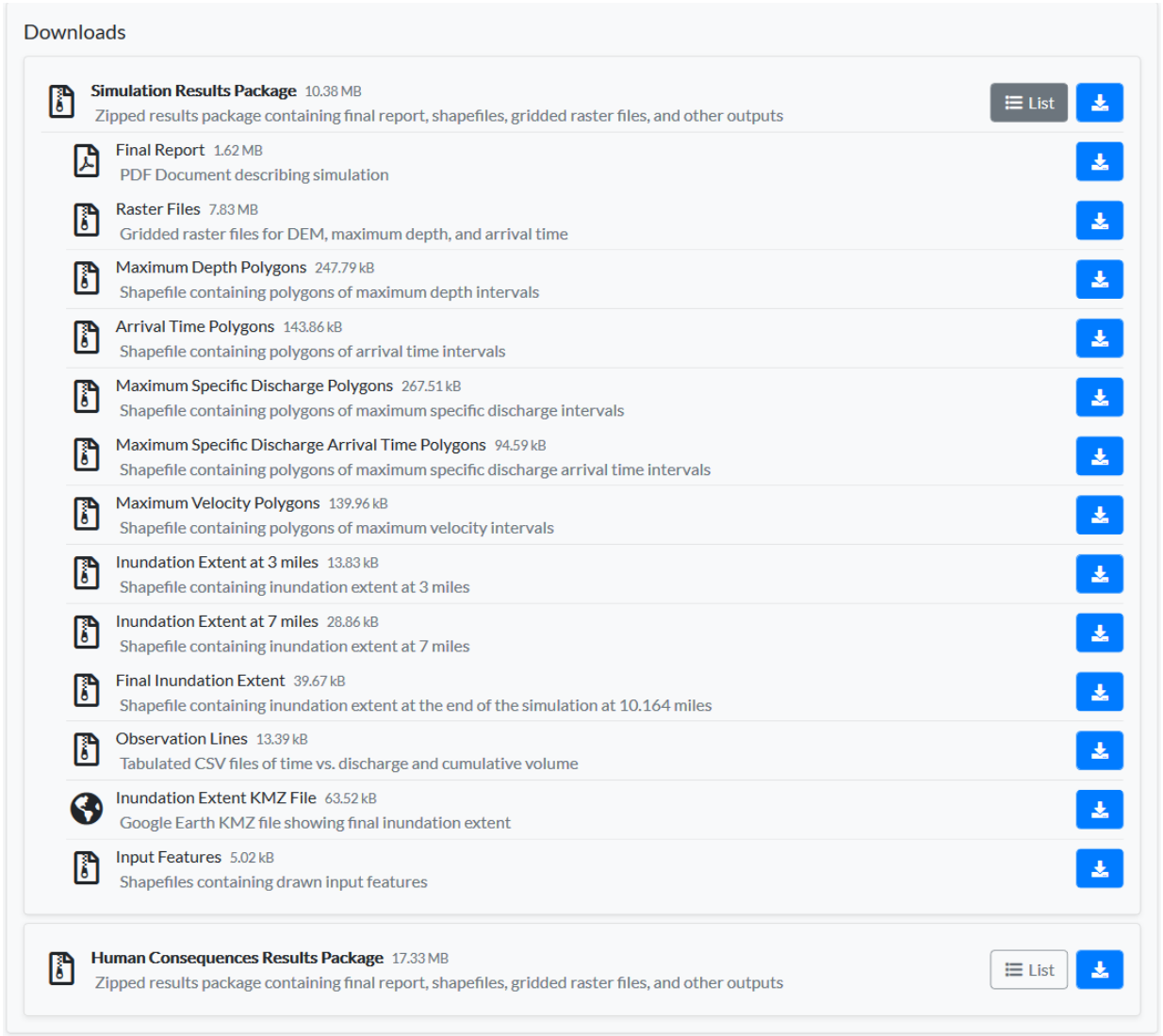


Click this icon to list all files available in the final results package. Click again to hide the list.

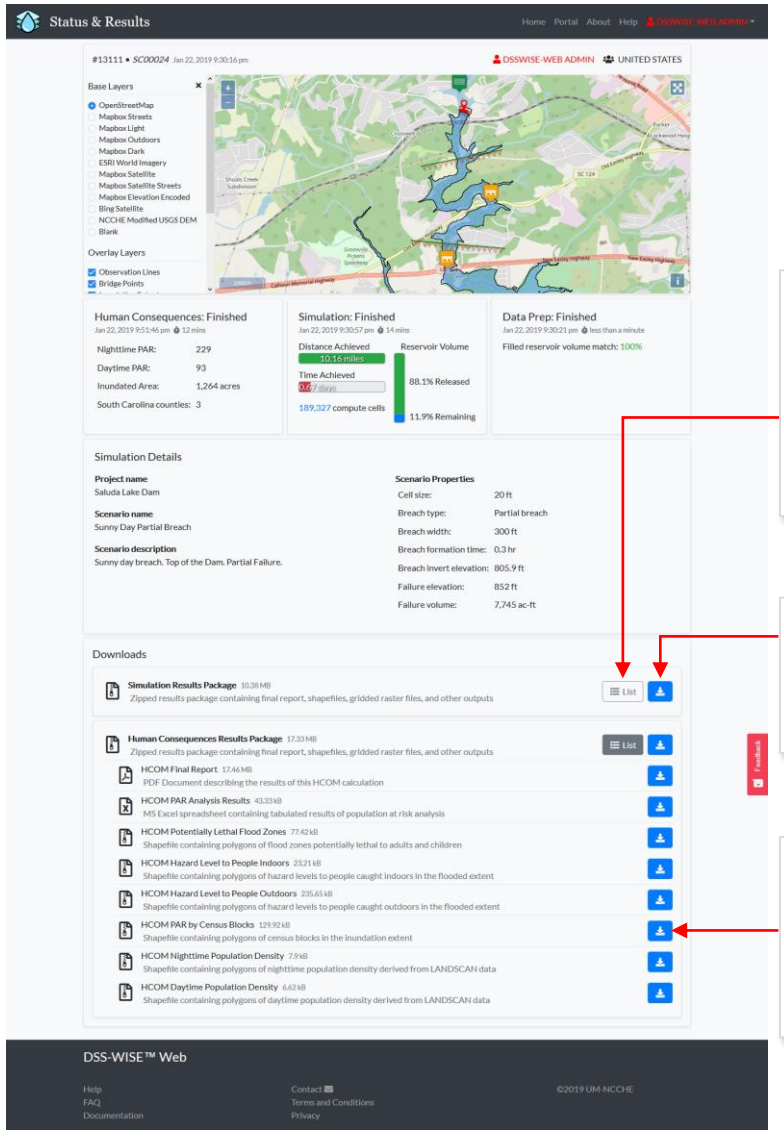
Click this icon to display all files as a single zipped file.

Click blue icon for any listed file to download it individually.

Files Generated by DSS-WISE Lite Simulation



Status and Results Page: List of Files Generated by DSS-WISE HCOM



Click this icon to list all files available in the final results package. Click again to hide the list.

Click this icon to display all files as a single zipped file.

Click blue icon for any listed file to download it individually.

Files Generated by DSS-WISE HCOM Analysis

Downloads

Simulation Results Package 10.38 MB
Zipped results package containing final report, shapefiles, gridded raster files, and other outputs
List

Human Consequences Results Package 17.33 MB
Zipped results package containing final report, shapefiles, gridded raster files, and other outputs
List

- HCOM Final Report 17.46 MB
  PDF Document describing the results of this HCOM calculation
- HCOM PAR Analysis Results 43.33 kB
  MS Excel spreadsheet containing tabulated results of population at risk analysis
- HCOM Potentially Lethal Flood Zones 77.42 kB
  Shapefile containing polygons of flood zones potentially lethal to adults and children
- HCOM Hazard Level to People Indoors 23.21 kB
  Shapefile containing polygons of hazard levels to people caught indoors in the flooded extent
- HCOM Hazard Level to People Outdoors 235.65 kB
  Shapefile containing polygons of hazard levels to people caught outdoors in the flooded extent
- HCOM PAR by Census Blocks 129.92 kB
  Shapefile containing polygons of census blocks in the inundation extent
- HCOM Nighttime Population Density 7.9 kB
  Shapefile containing polygons of nighttime population density derived from LANDSCAN data
- HCOM Daytime Population Density 6.62 kB
  Shapefile containing polygons of daytime population density derived from LANDSCAN data

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