The National Weather Service

Inundation Mapping

Release 2.0

© 2012 Office of Hydrologic Development/Office of Climate Water and Weather Services

Table of Contents

Background 3

Web Browser Requirements 4

The Interface 5

Blue Left-hand Data Selection Area 6

The Mapping Area 7
- Satellite View 10
- Map View 11

Current Map Information and Legend Area 13

Gauge Information Area 15

The Flood Category Legend allows users to distinguish what level of flood the gauge location may be experiencing based upon the gauge location plot color. 17

Available Data Types 18
- Inundation Levels 18
- Flood Categories 19
- Current / Forecast 20

APPENDIX A: Data Definitions 21

Background

Inundation mapping corresponding to National Weather Service (NWS) flood categories conveys flood severity and risk, based on the potential impact to property and public safety rather than on the probability of occurrence. Such maps are provided at select NWS Advanced Hydrologic Prediction Service (AHPS) forecast locations, with the aim to assist local partners – such as emergency mangers and public officials – in assessing their overall flood risk.

The NWS Inundation Mapping Interface is a web-based tool that provides flood inundation maps that show the extent of flooding expected spatially over a given area. The inundation indicates when roadways, streets, buildings, airports, etc. are likely to be impacted by floodwaters. The accuracy of the mapping depends on the degree of accuracy of DEM data available for use in GIS application(s), plus other factors. This tool was developed for an initial target audience of the state and local agencies that must make emergency operational decisions during flooding events. However, since the graphics are easy to view, anyone with an interest during these events can make use of the maps, including the Federal Emergency Management Agency (FEMA), the U.S. Geological Survey (USGS), Corps of Engineers (COE), state and local emergency managers, the media, and the general public.

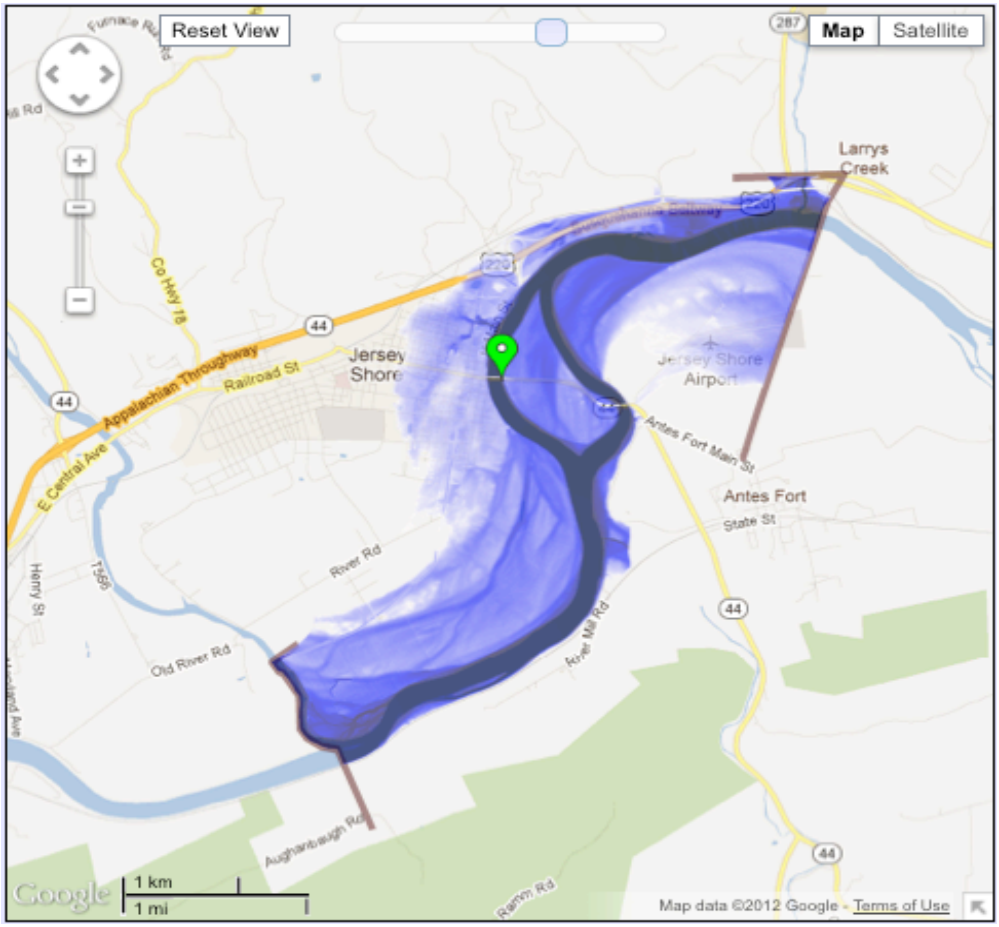
When viewing this data, please note that The National Weather Service prepares its forecasts and other services in collaboration with agencies like the US Geological Survey, US Bureau of Reclamation, US Army Corps of Engineers, Natural Resource Conservation Service, National Park Service, ALERT Users Group, Bureau of Indian Affairs, and many state and local emergency managers across the country. Should these data providers be used for a location, links to their agencies can be found on this site.

Web Browser Requirements

The NWS Inundation Mapping Interface Version 2.0 has been enhanced with the integration of Google Maps. While Google Maps may work for other browsers, we recommend using one of the following for the best experience:

- Microsoft Internet Explorer (IE) 8.0 and later (for Windows) Download
- Firefox 3.6 and later (for Windows, Mac, and Linux) Download
- Safari 3.1 and later (for Mac and Windows) Download
- Google Chrome (for Windows and Mac) Download

If users experience problems, please check that to ensure that the most up-to-date version of browser is being utilized. If this isn't the case, users can access the Google Maps troubleshooting guidelines to assist in getting the interface working properly on the local system. To utilize all of the point-n-click and dynamic slider features of the Inundation Mapping Interface, users **must have JavaScript enabled in their Web browser**. If JavaScript is not enabled users will not be able to utilize the interface and its active features.



The Interface

The new Inundation Mapping Interface consists of 4 main areas:

- **The Blue Left-hand Data Selection Area**
- **The Mapping Area**
- **Current Map Information & Legend Area**
- **Gauge Information Area**

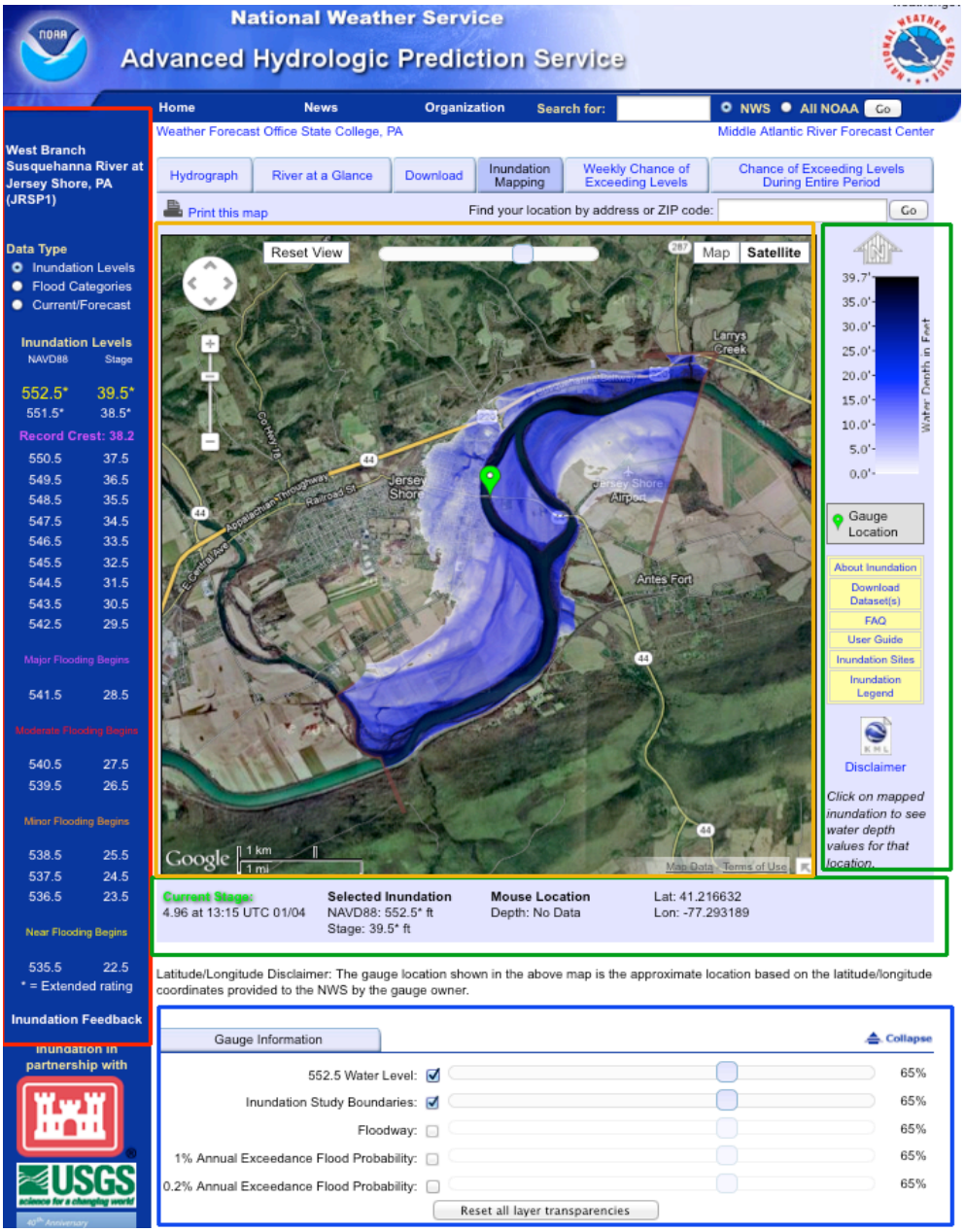


***Figure 1*: The Interface**

Blue Left-hand Data Selection Area

The Blue Left-hand Data Selection Area is where users can select to view what data are displayed within the Mapping Area. There are different types of data available for selection and each of these will be covered later in the document. These are:

- **Inundation Levels (default selection)**
- **Flood Categories**
- **Current/Forecast**

Here users can also use an intuitive point and click interface to select data increments or layers to be viewed within the Mapping Area. Additionally, users can also select to visit website(s) of Inundation Project Partners as well choose to participate in a website survey that is designed to help improve the website for the general public.

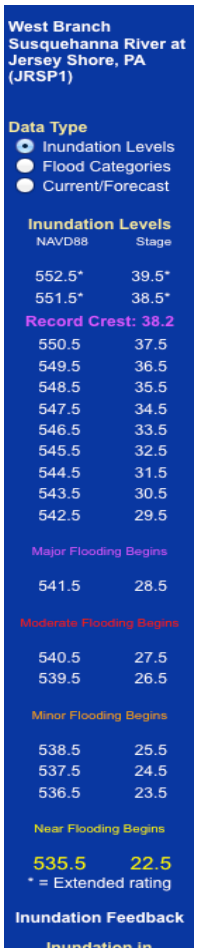


***Figure 2*: Blue Left-hand Data Selection & Navigation Area**

The Mapping Area

With the release of Inundation Mapping Version 2.0, Google Maps has been integrated into the interface to provide for a better overall user experience. Google Maps is a widely utilized web mapping service application provided by Google. Google Maps provides high-resolution aerial or satellite images for most urban areas in the United States (including Hawaii, Alaska, Puerto Rico, and the U.S. Virgin Islands), Canada, and the United Kingdom, as well as parts of Australia and many other countries. Please note that Google Maps satellite images are not updated in real time; they are several months or years old. The Google Maps projections that are available for the NWS Inundation Mapping Interface are **Satellite** – **default view** and **Map** (road/infrastructure). We will preview each map type later in the document. Along with the new types of map projections, there are new map controls that are available within the mapping area to allow users to customize the map to make the information more meaningful to them. Each feature will be color coded and denoted by the same color box in ***Figure 3*** below.

Navigation and Zoom Controls

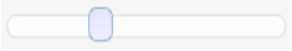
The navigation and zoom controls are two separate functions that are located in close proximity to each other. The navigation control is the circular shaped object that has arrows for up, down, left and right. Users can move the map in the appropriate direction by clicking the corresponding arrow. Users can also move the map by simply clicking and holding the mouse left mouse button and dragging the map. The zoom control slider is located just below the map navigation control circle. User can click the to “zoom in” and likewise click to “zoom out”. Users can also use their mouse to slide the slider up and down to control the zoom level.

Reset View

By clicking

, users can reset the map to the default position and zoom level configured for that location. This comes in handy if users accidently move the map or needs to move from a more zoomed in area to the full inundation study area quickly.

Total Layer Transparency Slider

This item  is used to control the transparency of all displayed layers within the mapping area at once. Users can also control the transparency of data layer independently within Gauge Information Area, however this item will raise or lower the transparency in relation to where it is set in that area.

Map Type Selection Buttons

These items

are where users can select different map projections. The default view is Satellite-Labels option turned on. Once users have selected an appropriate map type, they can click the active button again to display the options for that particular map type. For Satellite view this is “Labels” which displays the roads and major thoroughfares. For Map view the option is for “Terrain” which will display physical contours within the mapping area.

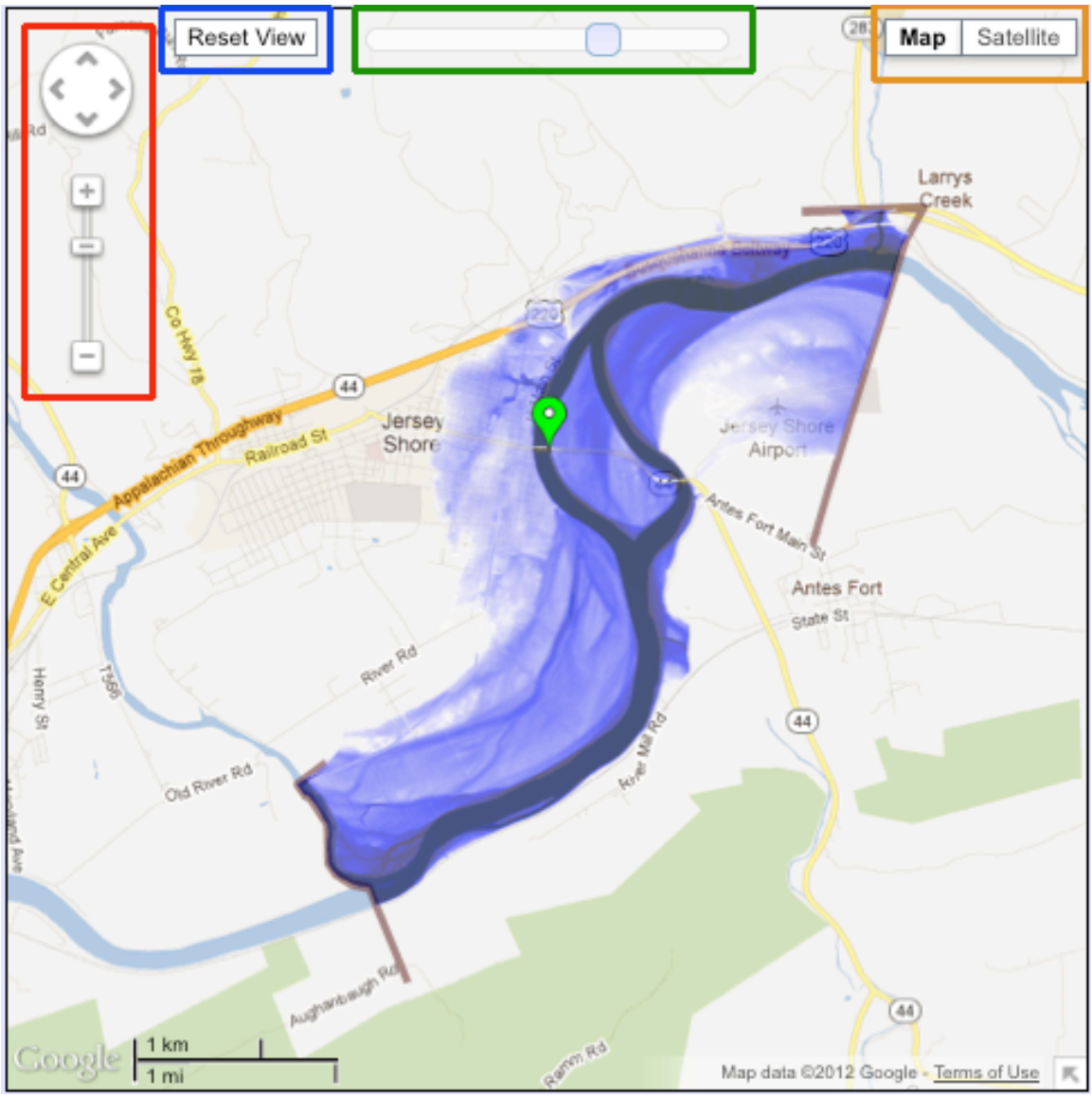


***Figure 3*: Mapping Area Customization Controls**

Another new feature available with the integration of Google Maps is the ability to allow users to point and double-click on a particular site and place a marker on the map. Once a maker has been set, it will display the latitude and longitude of the marker site, water depth at that site at the level of inundation selected within the Blue Left-hand Data Selection Area and the action will also perform a lookup and display the nearest geolocated address to the marker. This can be seen in ***Figure 4*** below. This can be particularly useful to flood planning purposes of the general public and emergency officials.

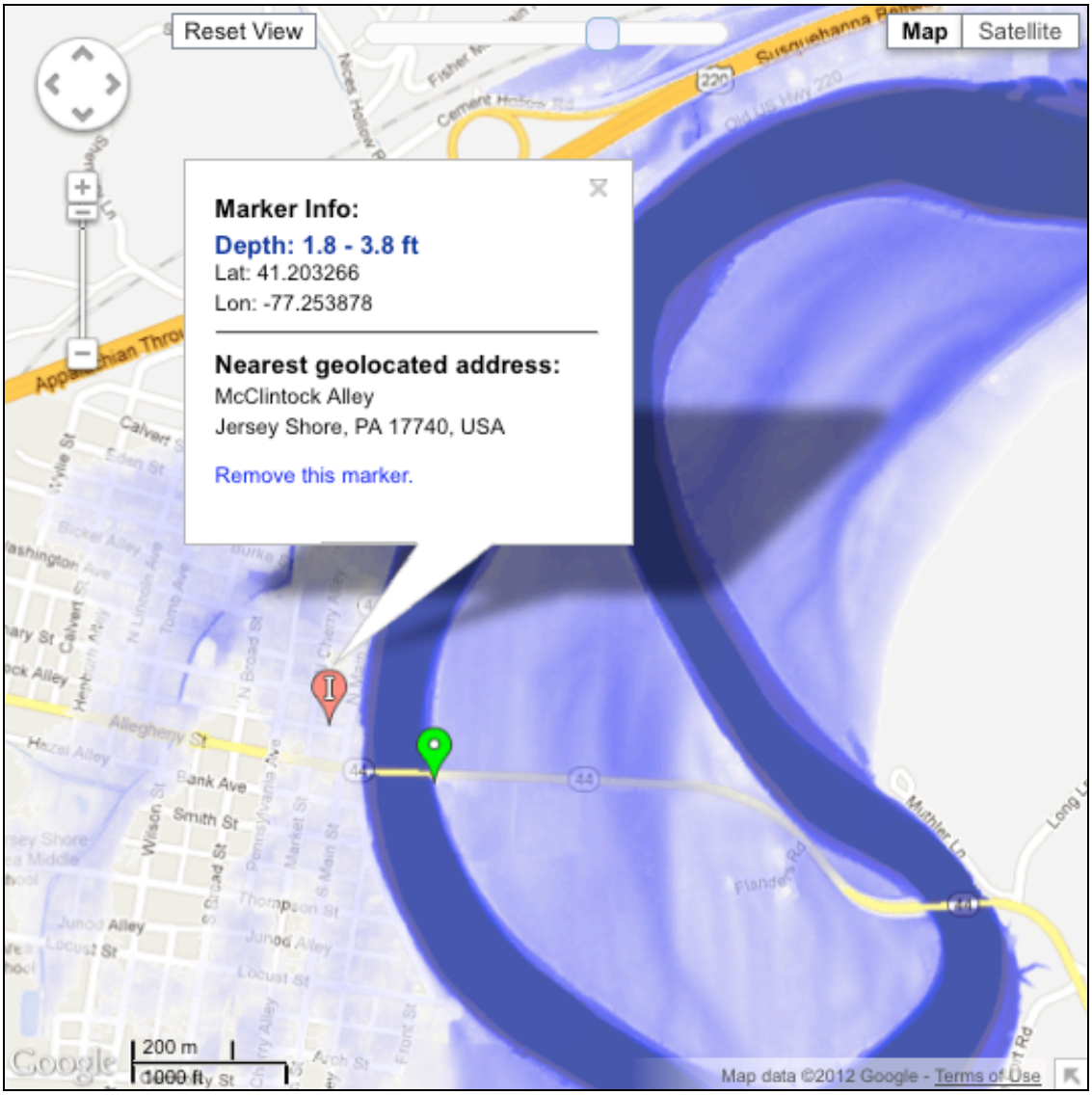


***Figure 4*: Map Marker Placement Example**

Satellite View

The Satellite view/Inundation Levels is the first view users will be provided when they arrive at the selected gauge site. ***Figure 5*** below represents the Satellite view. Users will notice that certain towns, roads, highways, airports, etc. are labeled. These are turned "on" by default and can be disabled via the Satellite view/Labels option selection box. The tear-shaped marker denotes the gauge site. This marker will be colored in relation to the current stage level to flood category level the site is currently experiencing.

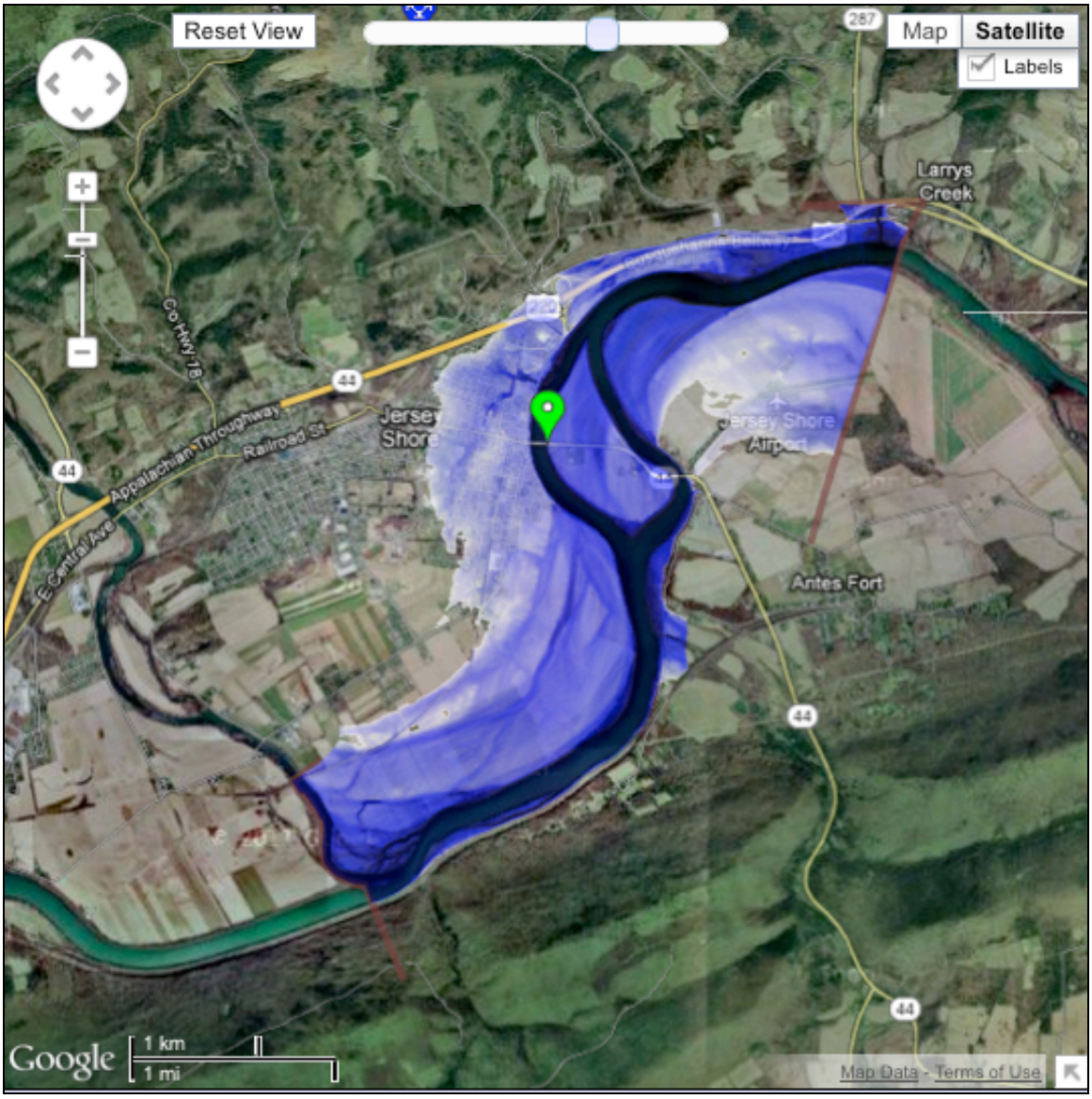


***Figure 5*: The Satellite View**

Map View

The Map view will need to be selected via the Map Type selection buttons within the Mapping Area. Once this type of map has been selected a street/road map will be displayed within the interface ***Figure 6***. As with the Satellite view, the tear-shaped marker denotes the gauge site. This marker will be colored in relation to the current stage level to flood category level the site is currently experiencing. Users also have the option to add elevation contours to the map by clicking the “Map” view button again and checking the “Terrain” box. A “Terrain” option map can be seen below in ***Figure 7***.

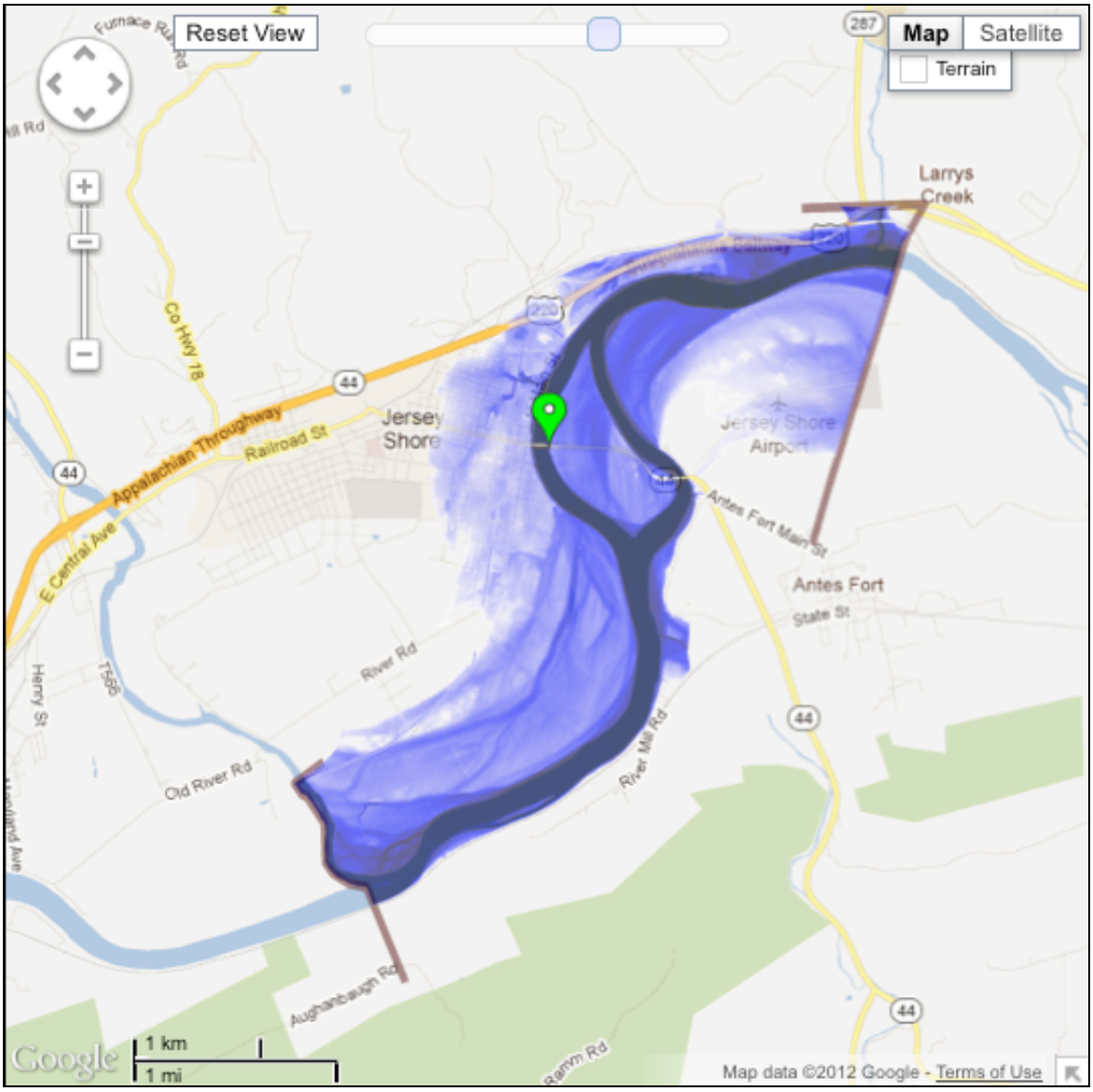


***Figure 6*: The Map View**

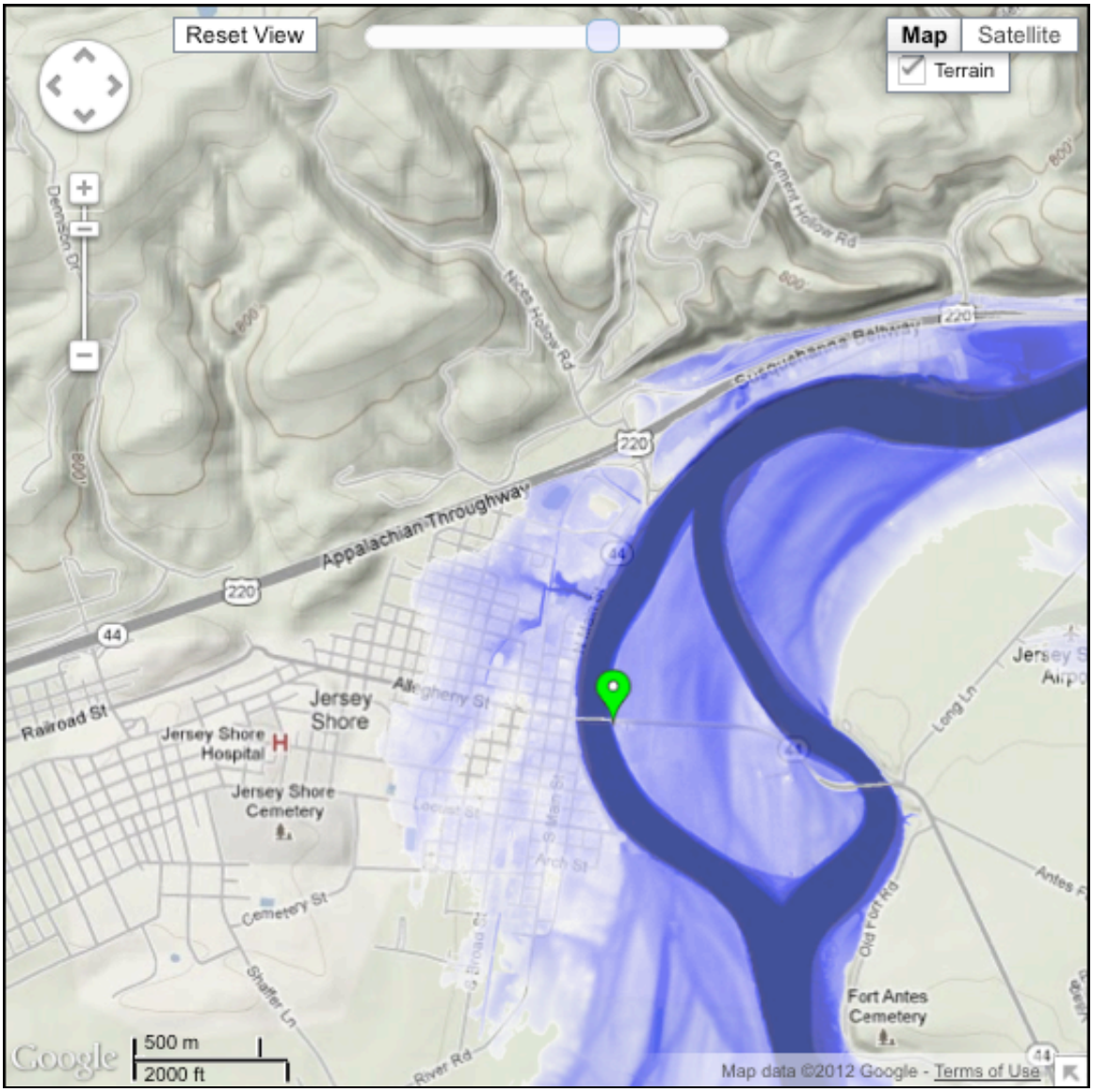


***Figure 7*: The Map View "Terrain" Option**

Current Map Information and Legend Area

The Map Data and Legend Area contains many informational items about the Inundation Mapping Area/Interface. Here users can view:

- **Current Stage Value Report at Gauge** (value/timestamp)
- **Selected Level(s) of Inundation** (NAVD88/Stage)
- **Water Depth, Latitude, and Longitude of Mouse Pointer on Map**
- **Informational Links Pertaining to Inundation Mapping**
- **Water Depth Legend**

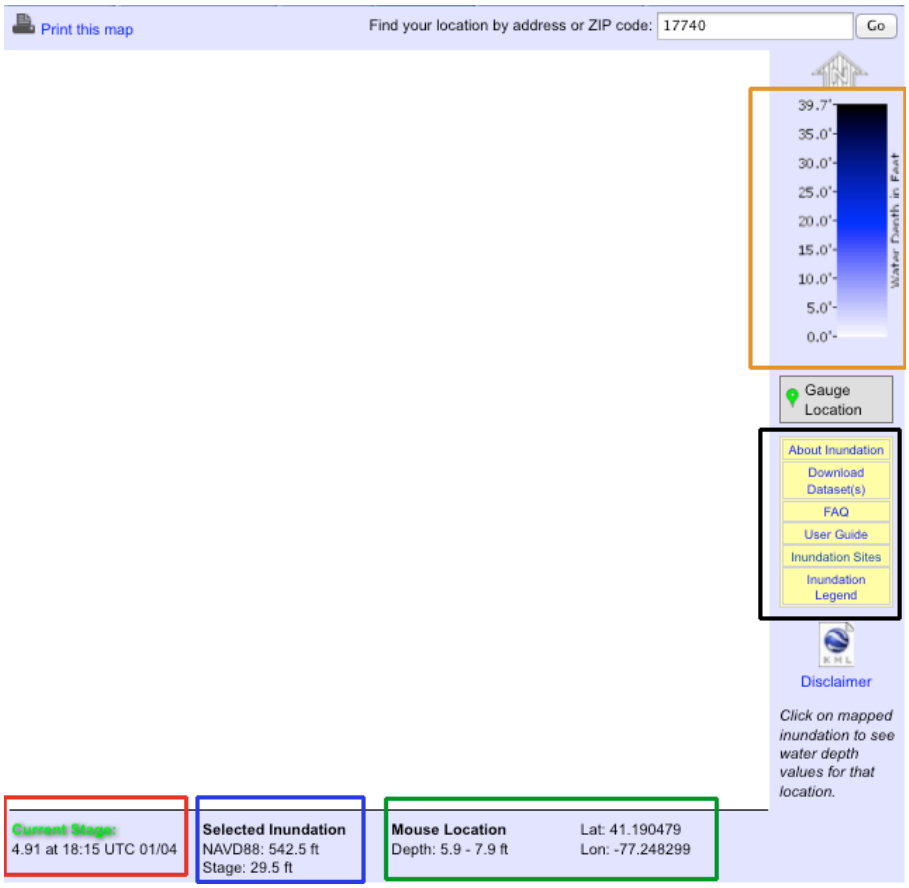
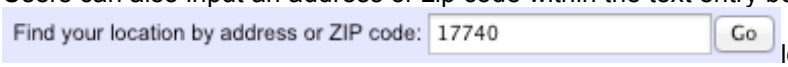


***Figure 8*: Map Data & Legend Area**

Users can also input an address or zip code within the text entry box



located above the mapping area on the right side of the Current Map Information and Legend Area**.** Once users have input the desired location information, they can click “Go” and the Google Maps interface will display that site.

Finally users can choose to print the current map displayed within the interface by clicking

located within the Current Map Information and Legend Area above the left side of the mapping area. Once this link is clicked, a legal disclaimer will display on the screen ***Figure 9***. Once the user has chosen to "Accept" to the terms of the disclaimer they will be presented with a page that displays the current stage information, the selected inundation value for mapping area, the inundation legend, site name and Data Partner logos.

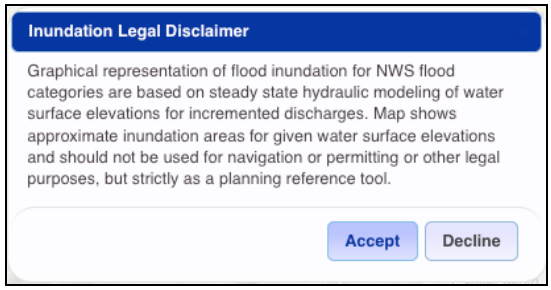


Figure 9: **Print Map Legal Disclaimer**

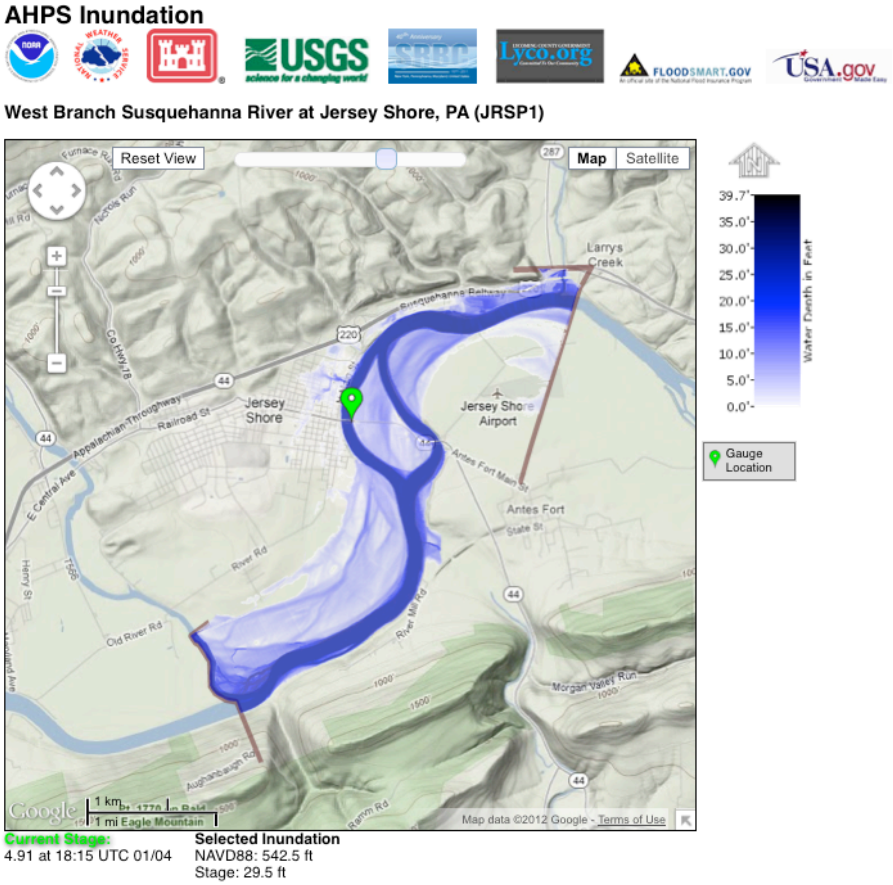


Figure 10: **Print Map Page**

Gauge Information Area

The Gauge Information Area is where users can display and control the level of transparency for the site-specific data layers within the Mapping Area. There are items that are standard across all Data Types and these are:

- **Inundation Study Boundaries**
- **Floodway** (may not be available at some gauge sites)
- **1% Annual Exceedance Flood Probability** (may not be available at some gauge sites)
- **0.2% Annual Exceedance Flood Probability** (may not be available at some gauge sites)

An example of each layer (at default 65% transparency) will be shown below in the examples below and the following pages. Users can raise or lower these transparencies using the slide locate next to each data layer. Users can select via the radio check box to display or not display a particular layer.

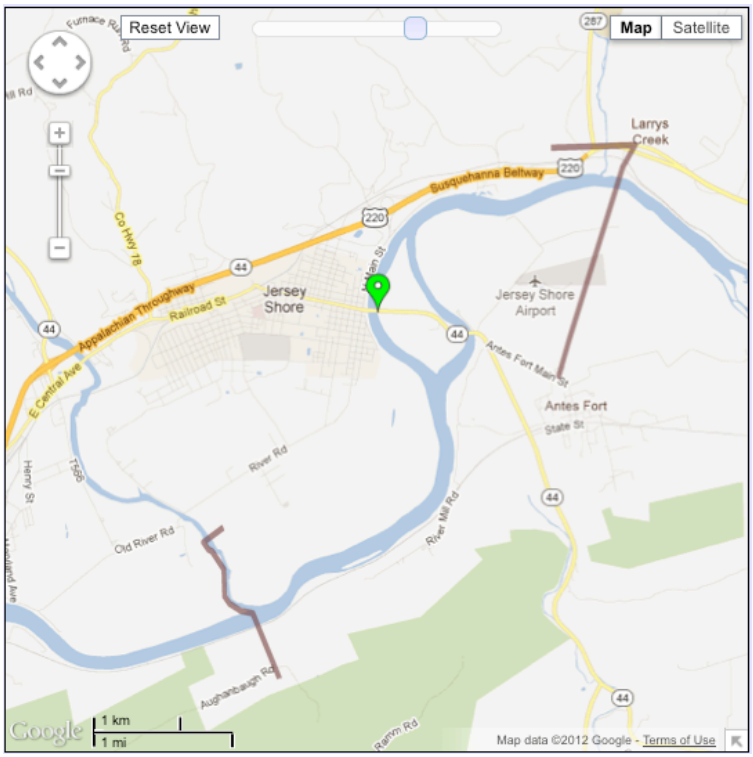


***Figure 11*: Inundation Study Boundaries**

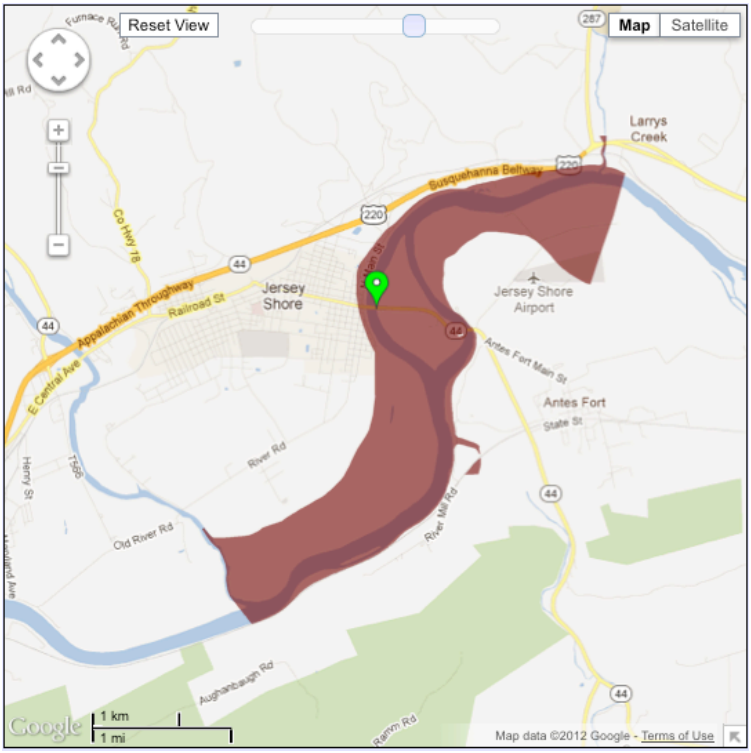


***Figure 12*: Floodway**

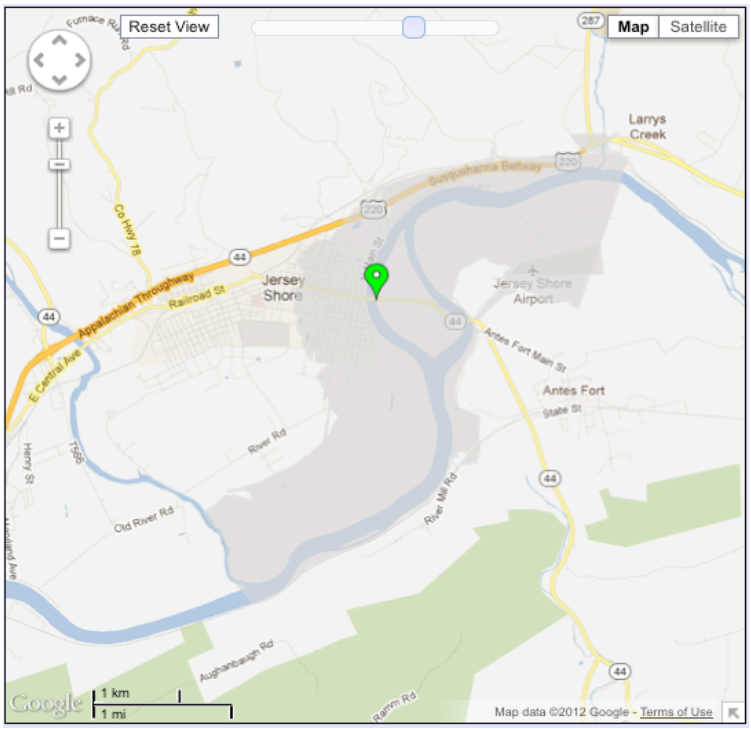


***Figure 13*: 1% Annual Exceedance Flood Probability**

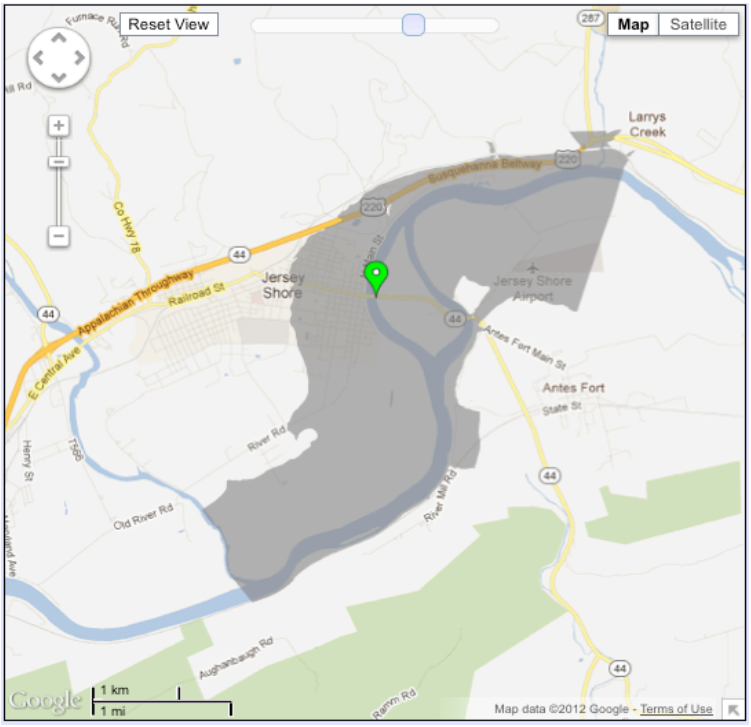


***Figure 14*: 0.2% Annual Exceedance Flood Probability**

Information pertaining to definitions of Annual Exceedance, Floodway, Flood Categories and Unique Local Data Layer information can be viewed in the Appendix of this document.

Also located in the Gauge Information Area is the Flood Category Legend for the site and Historical Crest information ***Figure 15.***

Flood Categories (in feet)

Major Flood Stage	29
Moderate Flood Stage	28
Minor Flood Stage	26
Near Flood Stage	23
Below Flood Stage	

Historical Crests

(1) 38.2 ft on 06/23/1972
(2) 37.9 ft on 03/19/1936
(3) 37.3 ft on 06/01/1889
(4) 32.8 ft on 11/25/1950
(5) 30.74 ft on 09/18/2004
(6) 30.6 ft on 03/11/1964
(7) 29.5 ft on 01/20/1996
(8) 27.6 ft on 09/26/1975
(9) 27 ft on 02/15/1984
(10) 25.5 ft on 03/06/1979

Show More Historical Crests

***Figure 15:* Flood Category and Historical Crest Information**

The Flood Category Legend allows users to distinguish what level of flood the gauge location may be experiencing based upon the gauge location plot color.

Available Data Types

Inundation Levels

Inundation Levels is the default Data Type select for users. Users will see different levels of inundation (NAVD88 and Stage) via the point-and-click interface located in the Blue Left-hand Data Selection Area. In this view, inundation levels are represented via a graduated blue color to represent different water depths. By default, the lowest level of inundation available will be displayed. Inundation is represented from the shallowest of water depths (lightest colors) to the deeper water depths (darker colors). Users can control the transparency of the water depth inundation levels via the slider within the "Gauge Information Area".

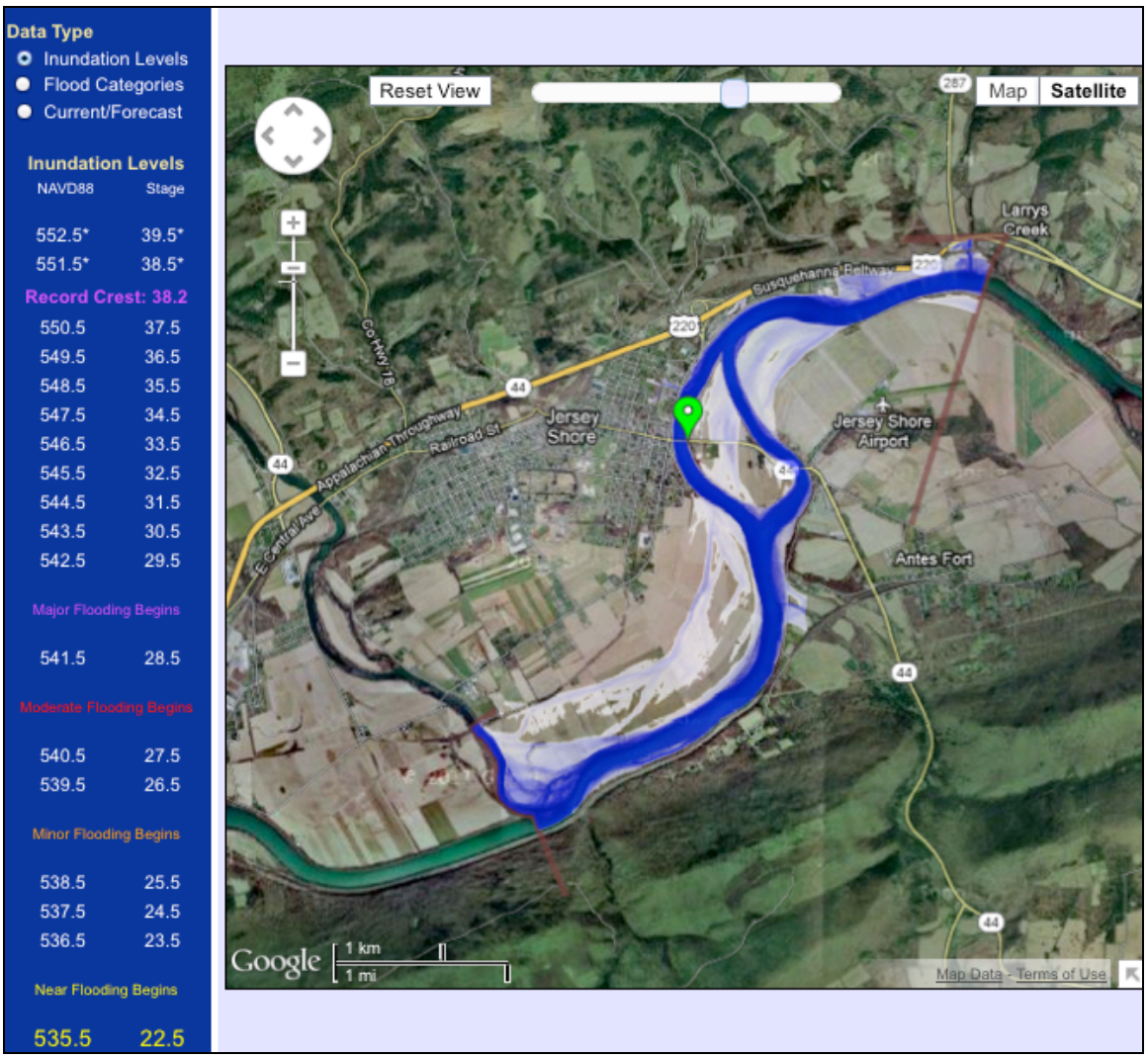


***Figure 16*: Inundation Levels**

Flood Categories

By selecting the data type labeled “Flood Categories”, users will see different colored categories of flooding, ranging from below flooding to major flooding. The extent of inundation depicted within the mapping interface will represent the maximum level of inundation for their respective categories. Flood categories can be displayed one at a time or overlapped for a composite image. Users can select which category to display by simply clicking the radio button located next to the respective flood category. By default the “Below Flood” Category is displayed. Just as with inundation levels, users can adjust each flood category transparency level independently with in the “Gauge Information Area”.

Definitions for each Flood Category can be found in the Appendix.

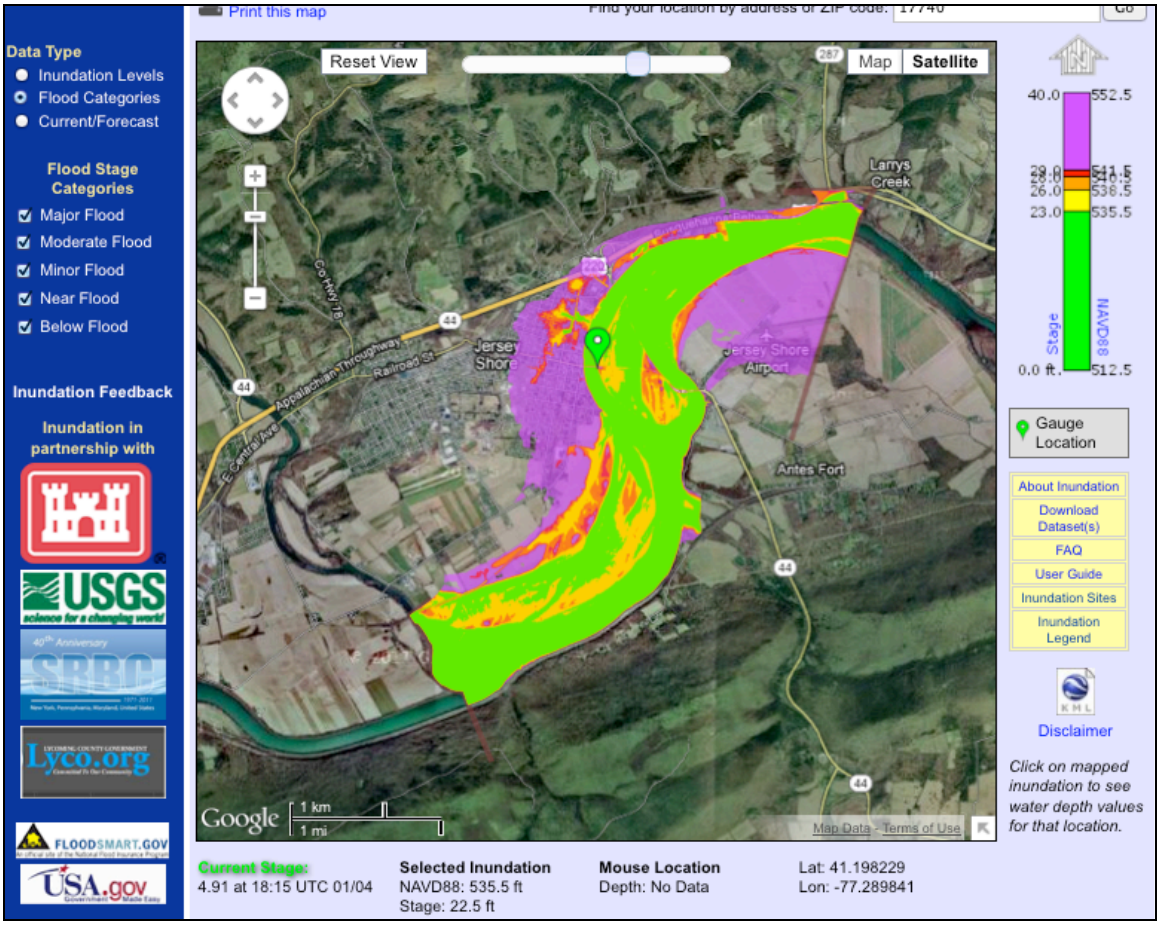


***Figure 17*: Flood Categories w/ All Category(s) Layers Displayed**

Current / Forecast

By selecting the data type, labeled “Current/Forecast”, users will see the current forecast, listed numerically in the left panel and also underneath the folder tabs. If the current forecast is close to flooding, inundation maps will be provided. Users can view the range of inundation forecasts for the given time via point-and-click interface located in the Blue Left-hand Data Selection Area. ***Figure 18*** below represents what the interface will look like when the Current/Forecast data are not within inundation data range. If data were available the layer information could be controlled once again inside the “Gauge Information Area”.

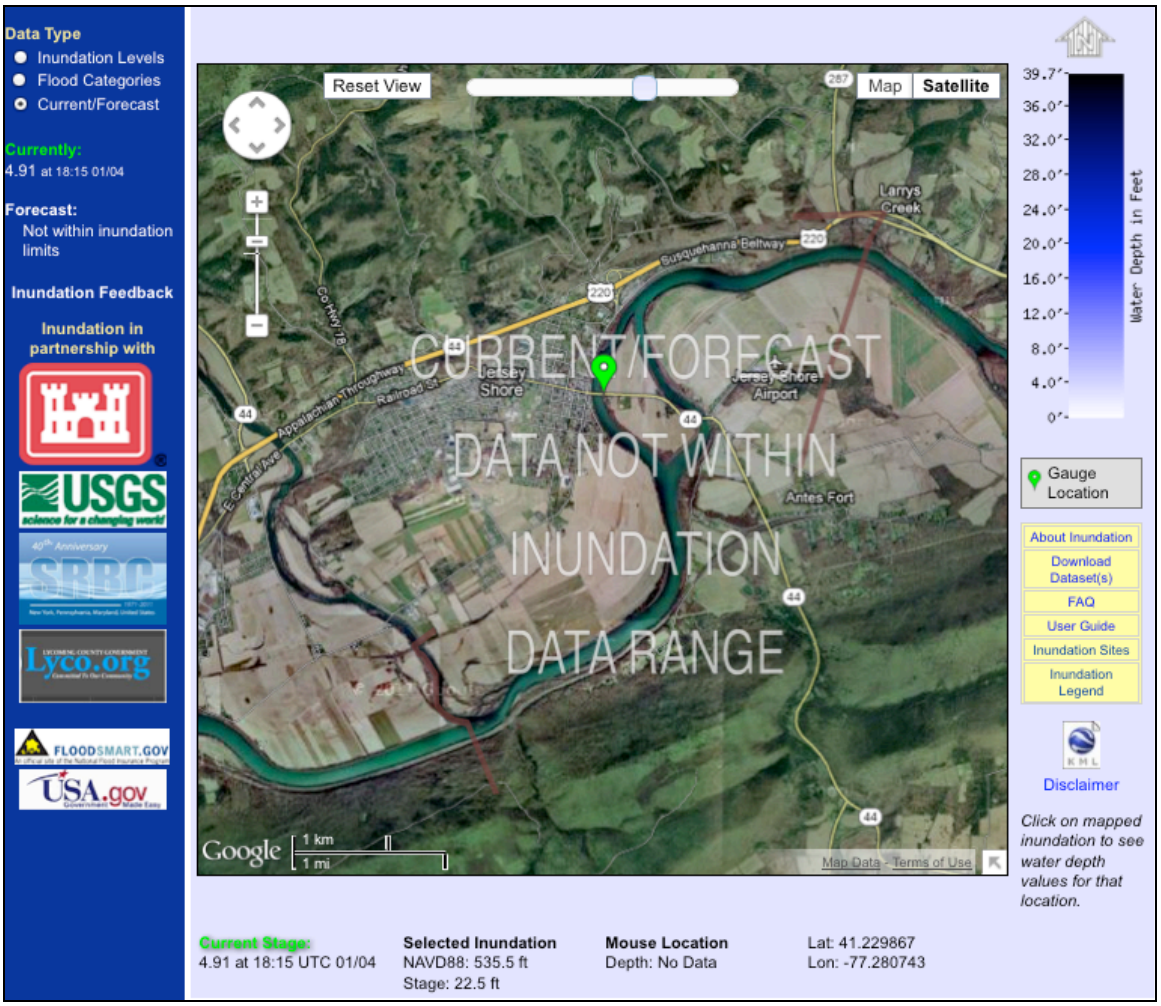


***Figure 18*: Current / Forecast Inundation Levels**

This concludes the Inundation Mapping Users Guide

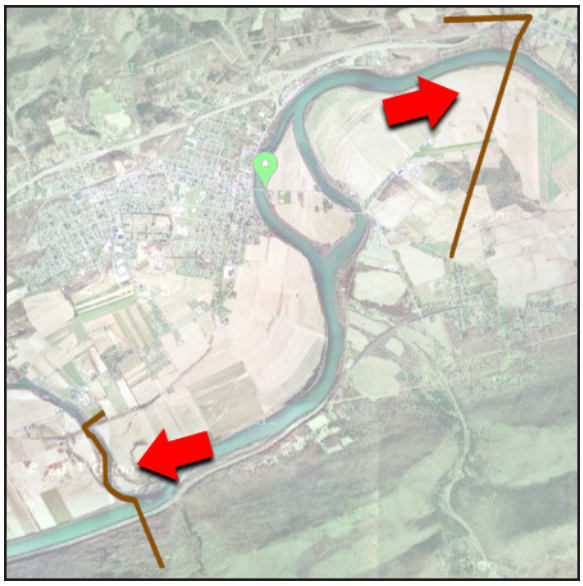
APPENDIX A: Data Definitions

ADVANCED HYDROLOGIC PREDICTION SERVICE FLOOD INUNDATION MAP LEGEND

GLOBAL MAP ITEMS

Water Level

White-to-blue image on map represents a color ramp of the least amount of water depth to the greatest. Mapped inundation level are at approximately 1-foot intervals or less.



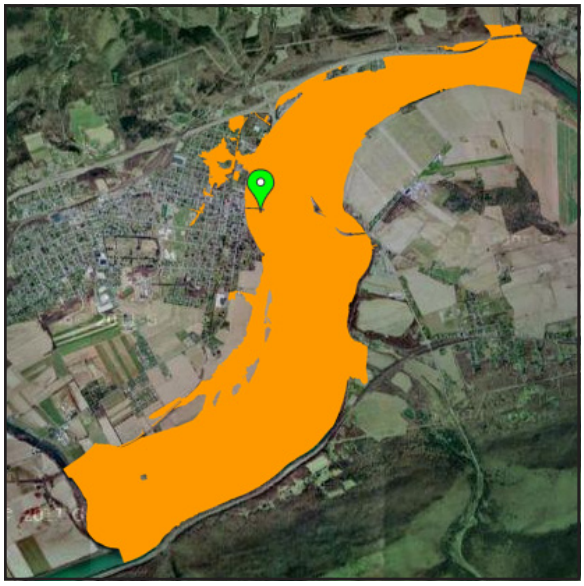
Inundation Study Boundaries

Brown lines, indicate extent of Inundation study area. Note: Map layer adjusted and red arrows added to highlight inundation lines.

GLOBAL MAP ITEMS

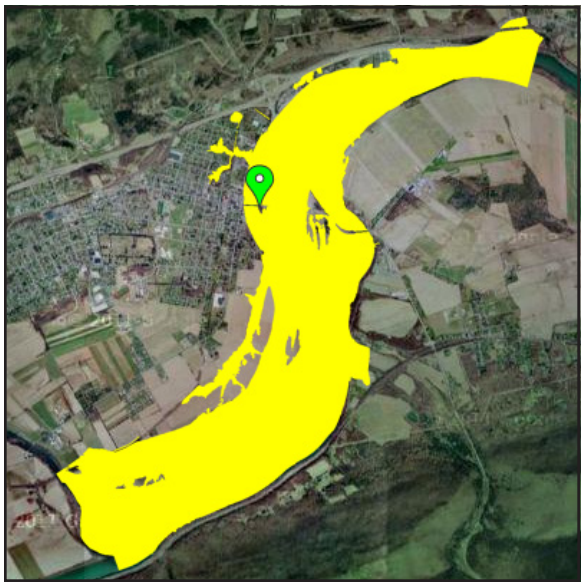
Major Flood
Purple layer in Flood Categories. Boundaries represent maximum extent based on available data for major flood level alert. Graphical representation of flood inundation for NWS flood categories are based on steady state hydraulic modeling of water surface elevations for incremental discharges. Major Flooding is defined as an event in which there are extensive inundation and property damage. Usually characterized by the evacuation of people and livestock and the closure of primary and secondary roads.
May not be available for all gauges.

Moderate Flood
Red layer in Flood Categories. Boundaries represent maximum extent based on available data for moderate flood level alert. Graphical representation of flood inundation for NWS flood categories are based on steady state hydraulic modeling of water surface elevations for incremental discharges. Moderate Flooding is defined as an event in which there are closure of secondary roads. Transfer to higher elevation may be necessary to save property. Some evacuations may be required.
May not be available for all gauges.



Minor Flood
Orange layer in Flood Categories. Boundaries represent maximum extent based on available data for minor flood level alert. Graphical representation of flood inundation for NWS flood categories are based on steady state hydraulic modeling of water surface elevations for incremental discharges. Minor Flooding is defined as an event in which there are some public inconvenience, but minimal or no property damage are likely.
May not be available for all gauges.

GLOBAL MAP ITEMS



Near Flood
Yellow layer in Flood Categories. Boundaries represent maximum extent based on available data for near-flood level alert.
May not be available for all gauges.

Below Flood
Green layer in Flood Categories. Boundaries represent maximum extent based on available data for below-flood level alert.
May not be available for all gauges.

1% Annual Exceedance Flood Probability
Represents a flood that has a 1-percent chance of being equaled or exceeded in any given year. A base flood may also be referred to as a 100-year storm and the area inundated during the base flood is sometimes called the 100-year floodplain.
May not be available for all gauges.

GLOBAL MAP ITEMS

.2% Annual Exceedance Flood Probability

Represents a flood that has a 0.2-percent chance of being equaled or exceeded in any given year. A base flood may also be referred to as a 500-year storm and the area inundated during the base flood is sometimes called the 500-year floodplain.

May not be available for all gauges.

Floodway

The floodway is one of two main sections that make up the floodplain. Floodways are defined for regulatory purposes. Unlike floodplains, floodways do not reflect a recognizable geologic feature. Floodways are defined as the channel of a river or stream, and the overbank areas adjacent to the channel. The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest.

May not be available for all gauges.