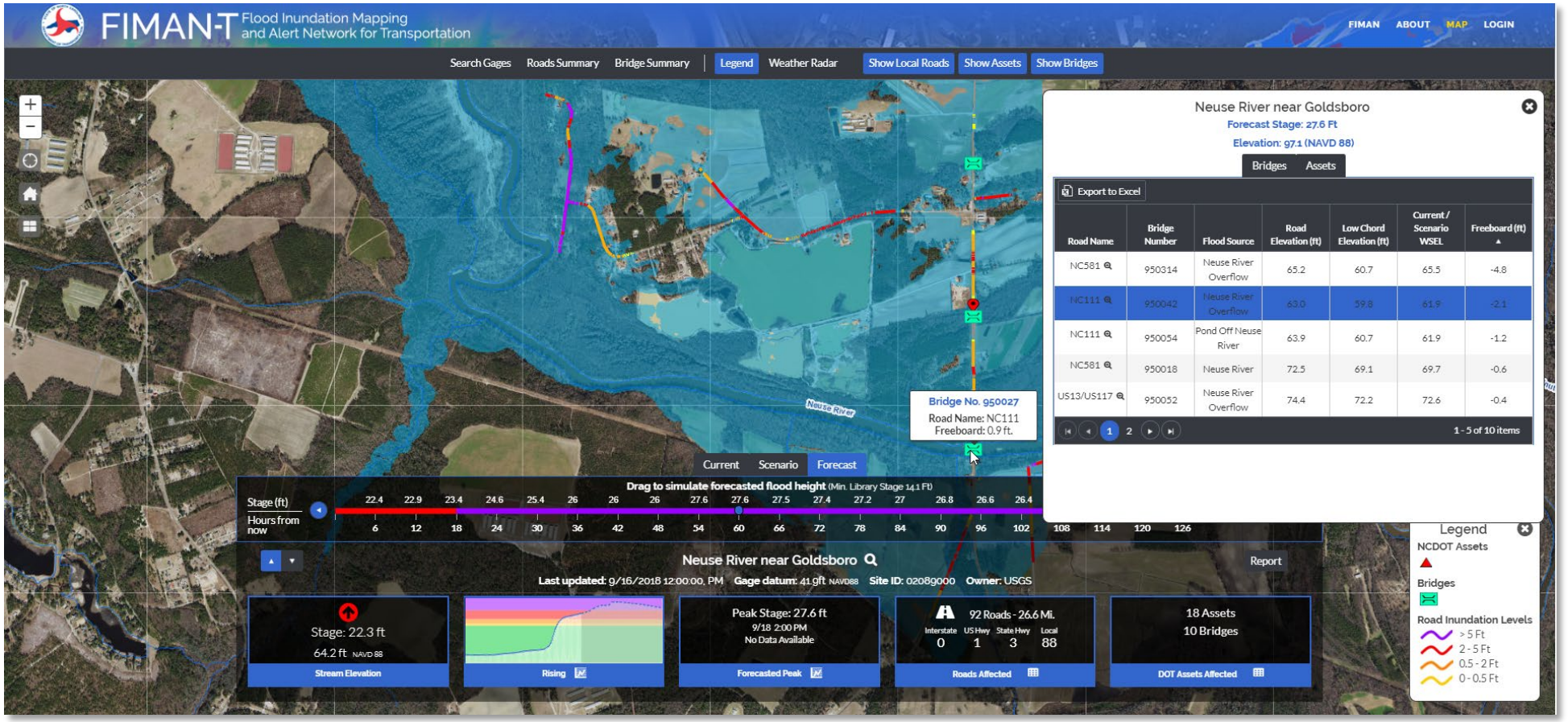


FIMAN-T

NCEM & NCDOT's Response Tool for Managing Flood Impacts

Hurricane Matthew and Florence

RESILIENCE?

Road Crossing Failures

FIMAN T Objectives

Leverage Data

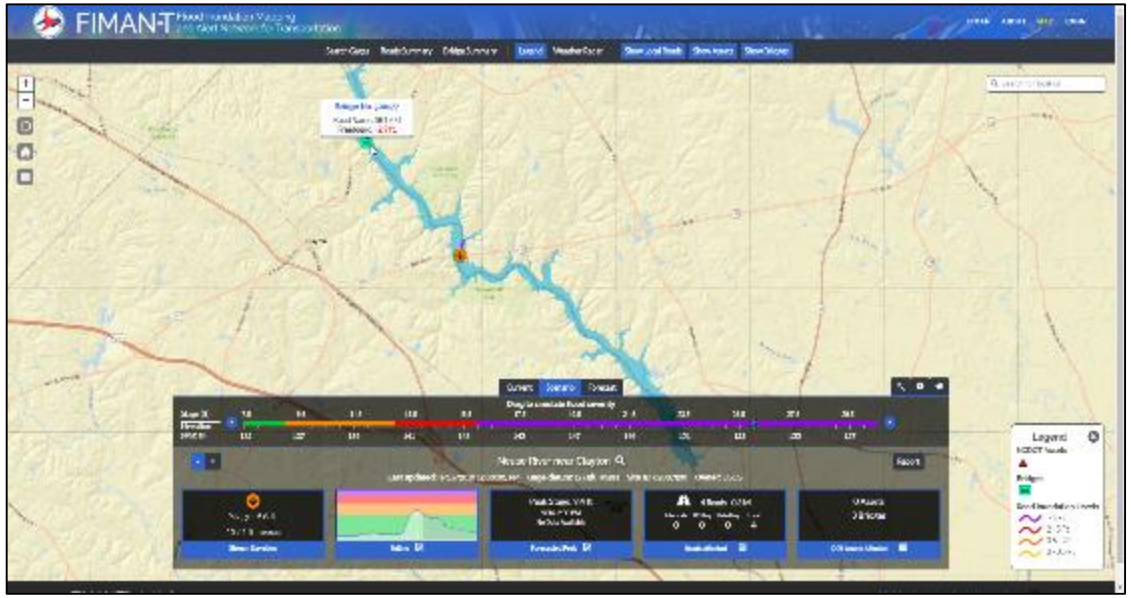
- 3D QL1/2 LIDAR Roadway Data
- FIMAN Infrastructure
- NCDOT Bridge Information Databases
- Existing Flood Inundation Modeling and Mapping
- NCDOT Asset Location

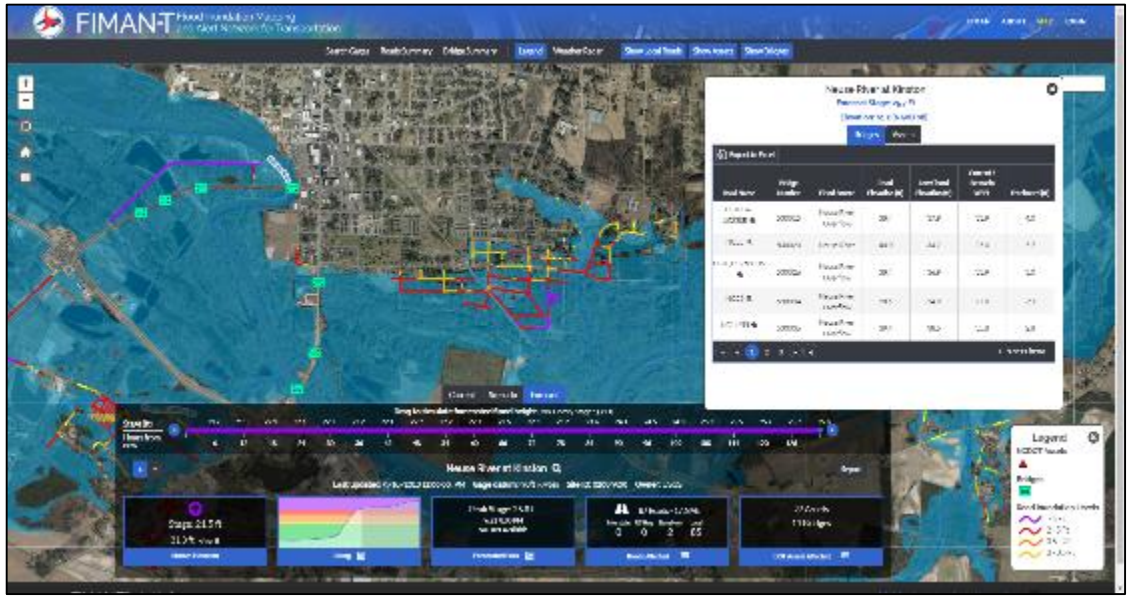
Software Goals

- FIMAN-T Enhancements
- Isolated from FIMAN Production
- Visualization Options for roads, bridges, assets
- New Reporting Tools for EOC

2019 Season Pilot Study

- Neuse River Corridor (Clayton to New Bern)
- Expanded Inundation Libraries
- FIMAN-T Functionality
- Beta = Development Server – not open to public





FIMAN-T

FIMAN

FIMAN Production Database

FIMAN-T Pilot Database

FIMAN-T DATABASE (BETA)

FEATURE CLASSES

S_DOT_ASSETS
OBJECTID
GAGE_ID
ASSET_ID
ASSET_TYPE
ASSET_NAME
DESCRIPTION
SHAPE

S_DOT_HYDCROSSINGS
OBJECTID
BRDG_NBR
FTR_INTRSC
F_CARRIED
BRDG_TYP_NM
COUNTY
ROUTE
RTE_ID
BSIP_BRDG_NBR
DIVISION
FUNC_CLASS
SUPERSTRUC
SUBSTRUCTU
B_LOWCHORDEL
DRAINAGE_AREA
GAGE_ID
DECK_EL
SHAPE

S_ROAD_INUNDATION
OBJECTID
Division
LocCntyCode
RouteClass
RouteName
StreetName
Depth_Cat
Max_Depth
GAGE_ID
Level_ID
UNIQUE_ID
LAT
LONG
AADT_2016
SCEN_ELEV
FEET
SHAPE
Shape_Length

TABLES

L_INUNDATION_HYDCROSSINGS
OBJECTID
BRIDGE_NUMBER
GAGE_ID
LEVEL_ID
B_LOWCHORDEL
LOC_WSEL
FREEBOARD

L_ROAD_INUNDATION_ROLLUP
OBJECTID
GAGE_ID
LEVEL_ID
Depth_Cat
Tot_Count
Tot_Miles
Int_Count
Int_Miles
US_Count
US_Miles
NC_Count
NC_Miles
Local_Count
Local_Miles

FIMAN PRODUCTION DATABASE

(USED TABLES)

FEATURE CLASSES

- S_GAGES_ALL
- S_FLOOD_INUNDATION

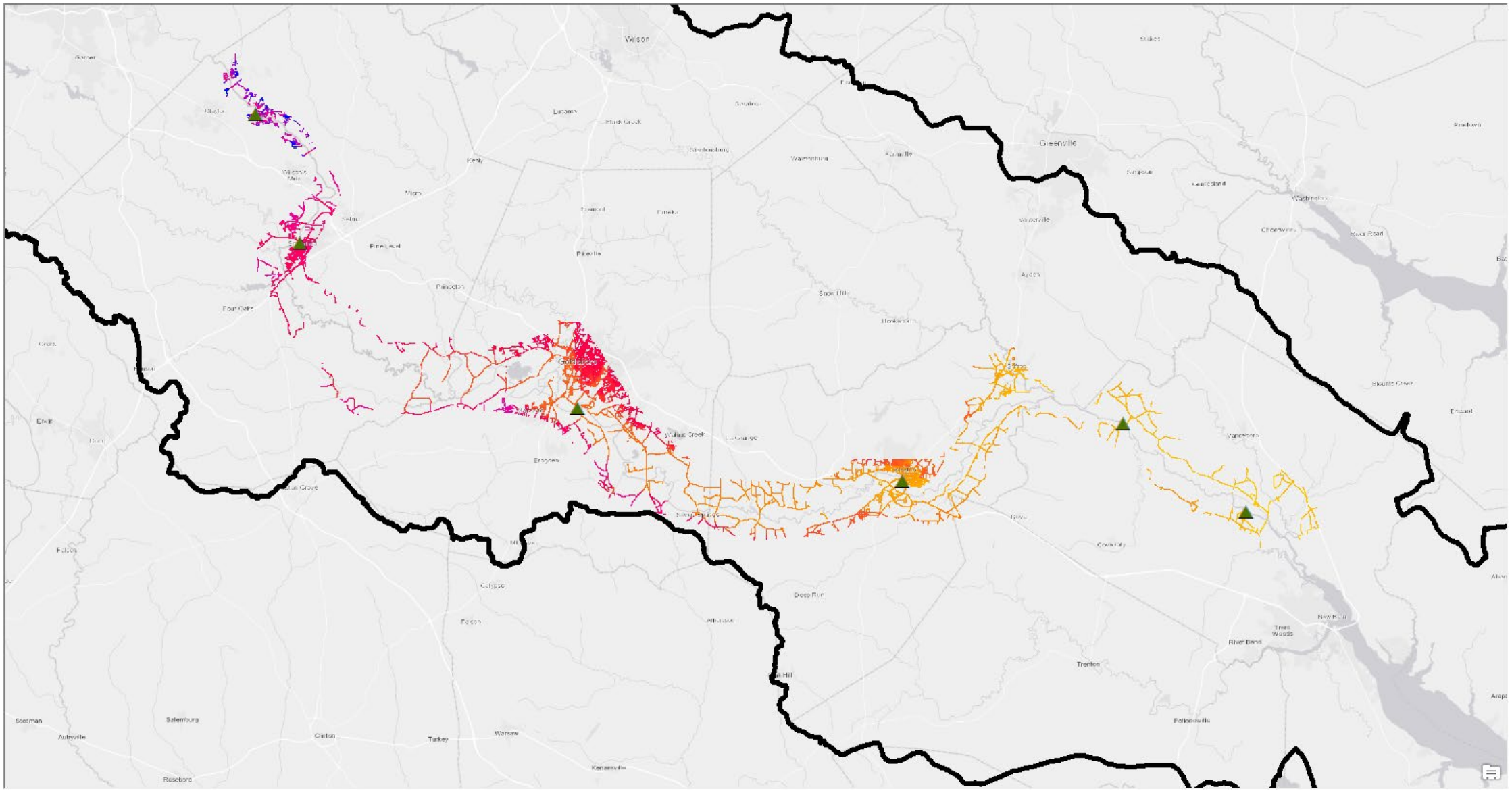
TABLES

- FIMAN_ROVER_LOG
- GAGE_TREND_CALC
- HYDRO_ALL
- HYDRO_FORECAST
- L_IMG_FILE_TYPE
- PIN_IMAGES
- SYMBOL_IMAGES
- TREND_HISTORY

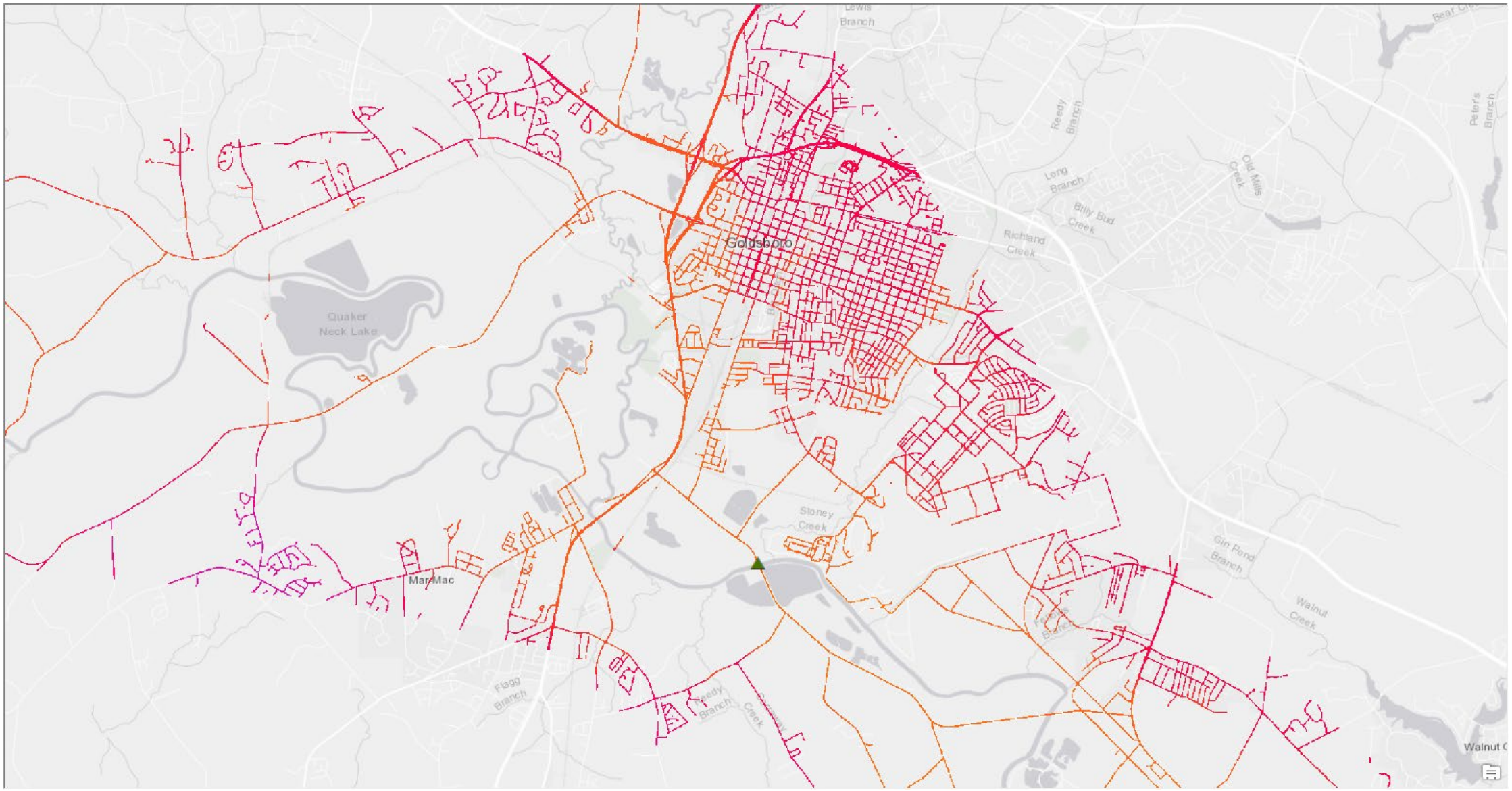
Foundational Data

FROM BUILDINGS (FIMAN) TO TRANSPORTATION INFRASTRUCTURE (FIMAN-T)

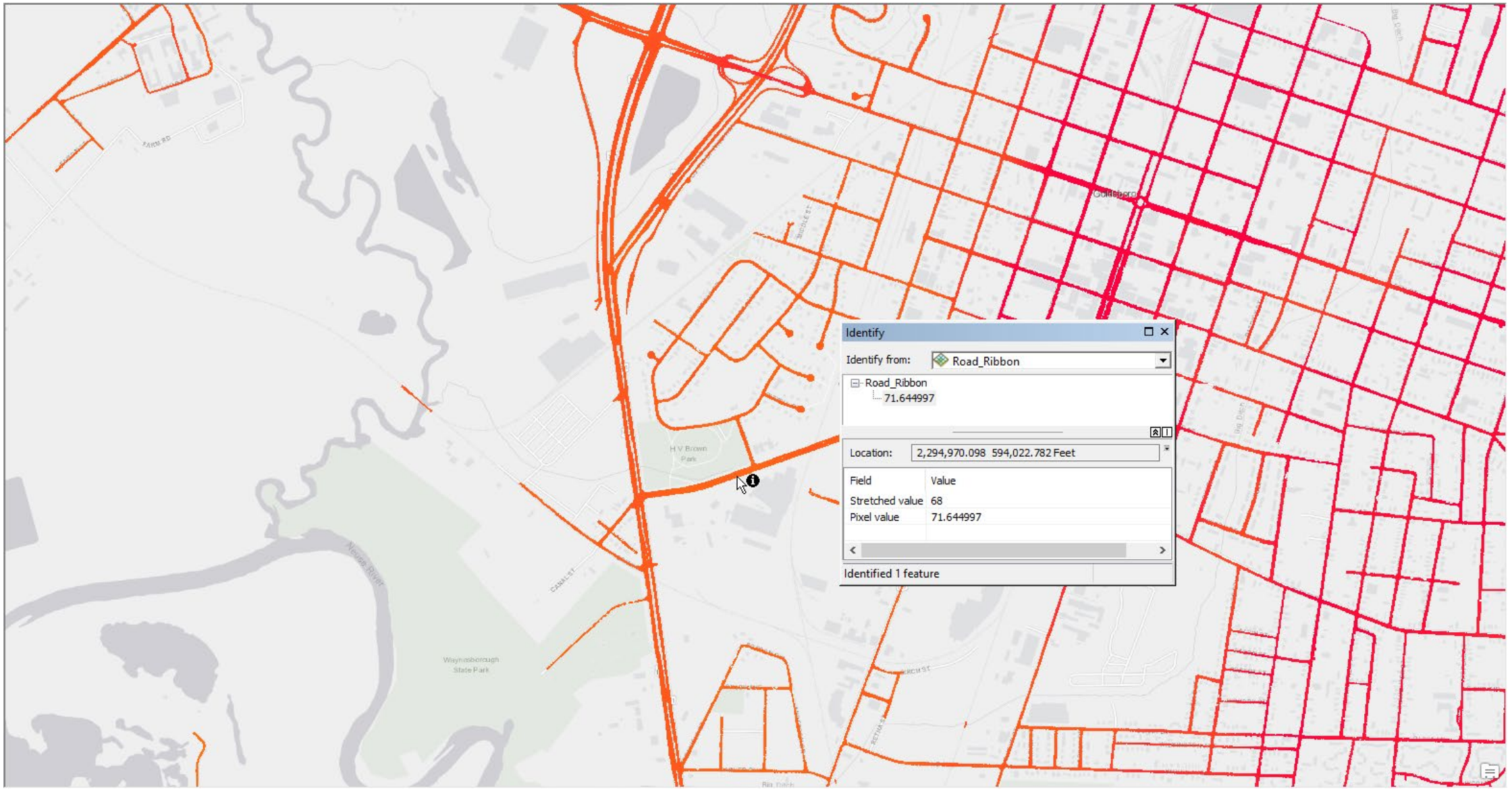
Lidar Derived 3D Road Elevation Grids



Lidar Derived 3D Road Elevation Grids



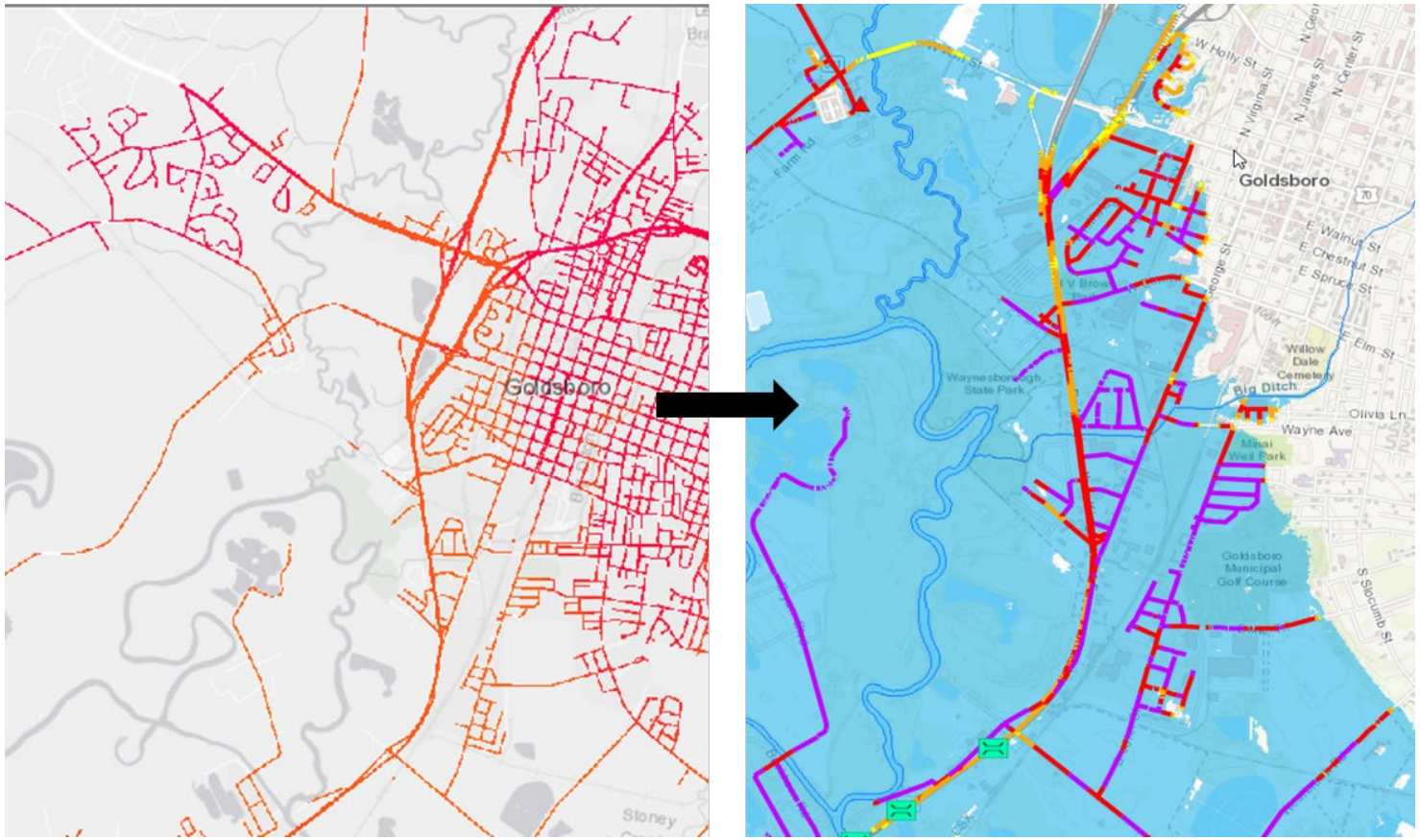
Lidar Derived 3D Road Elevation Grids



Raster to Polyline Routines

Why polylines?

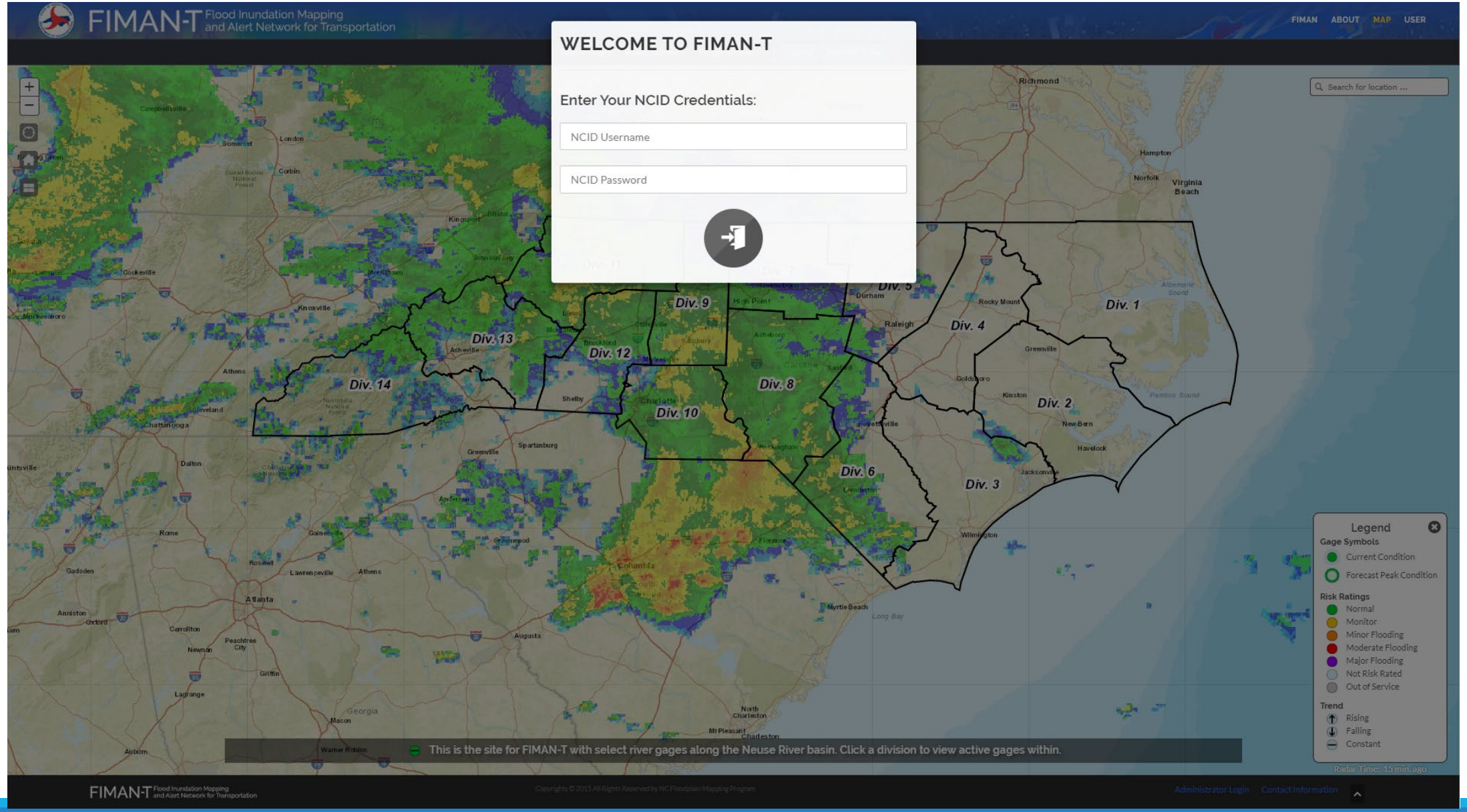
- Conflate LRS polyline data with raster to ***leverage*** attributes:
  - Road Name
  - Road Type
  - NCDOT Class
  - AADT
  - Feature Lengths
- Ability to query, search, aggregate
- Smaller file size



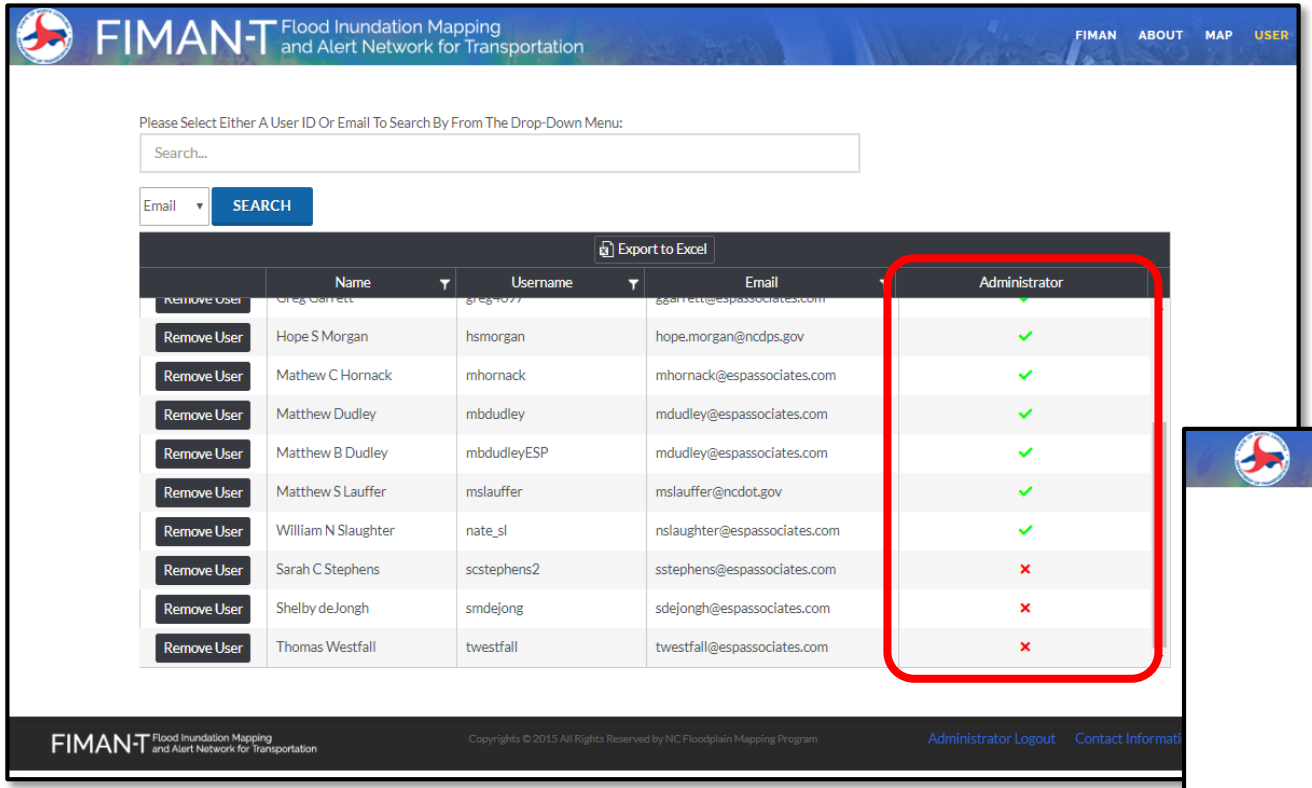
For the Geeks

- FIMAN Foundation *(shared data – separate app)*
- ASP.NET web application within .NET Framework *(v4.5)*
- Languages used: HTML, CSS/Bootstrap, Javascript, C#, SQL, Python, ArcGIS Javascript API
- Spatial Data published *(ArcGIS Web Services*
- Kendo and amCharts *(tables, slider bar, hydrographs, etc.)*
- Scheduled tasks extracting Contrail and NWS Forecast *(every 15 min)*
- Weather radar loop *(every 5 min)*

FIMAN-T Login Page

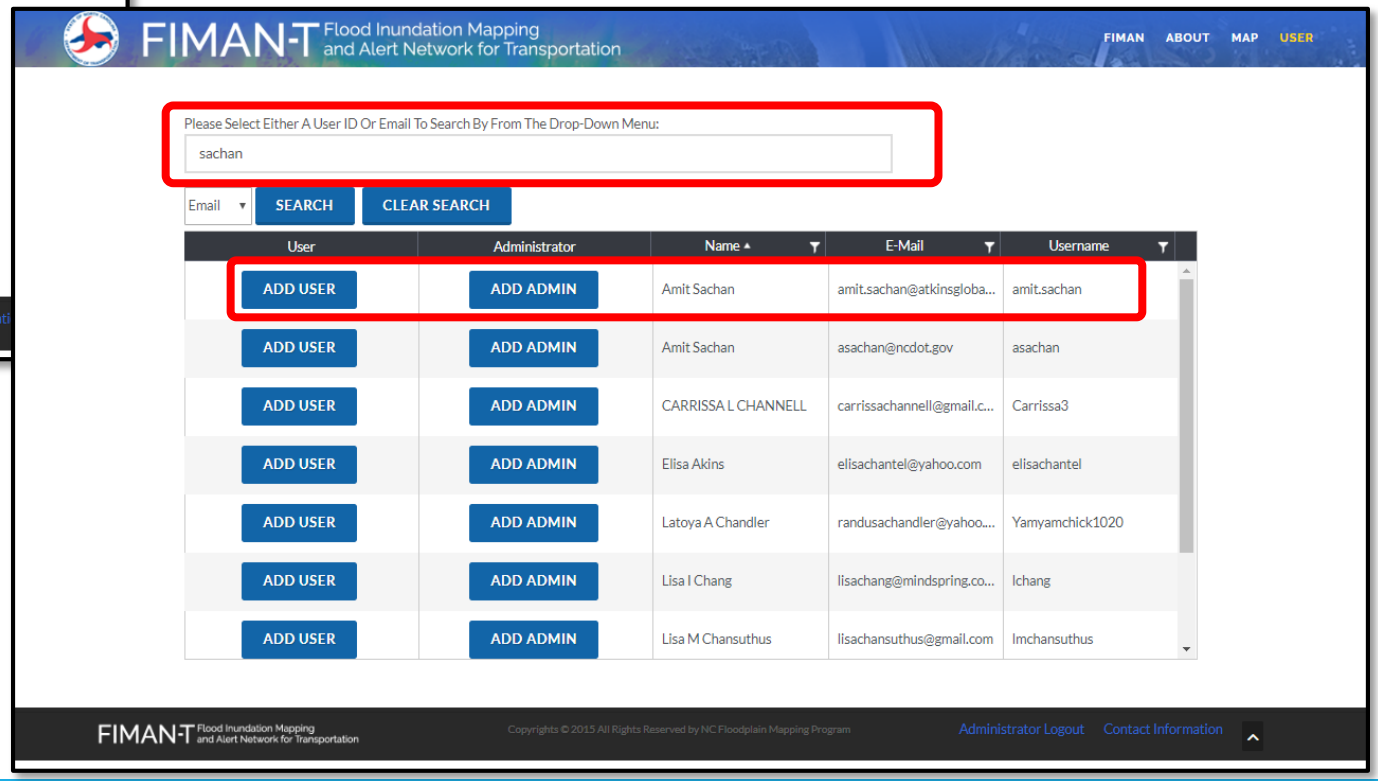


User Administration Module

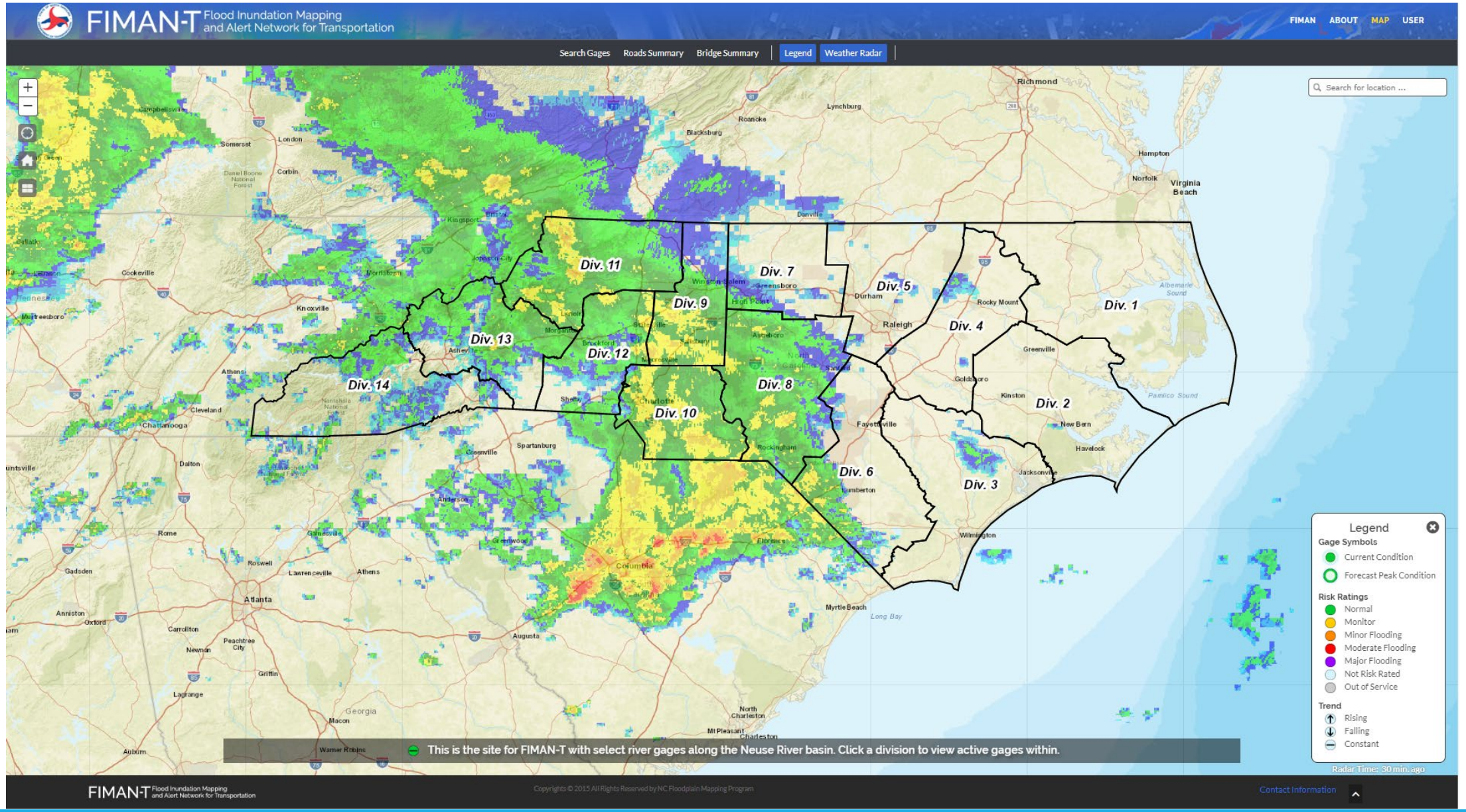


Current Users and Administrator View

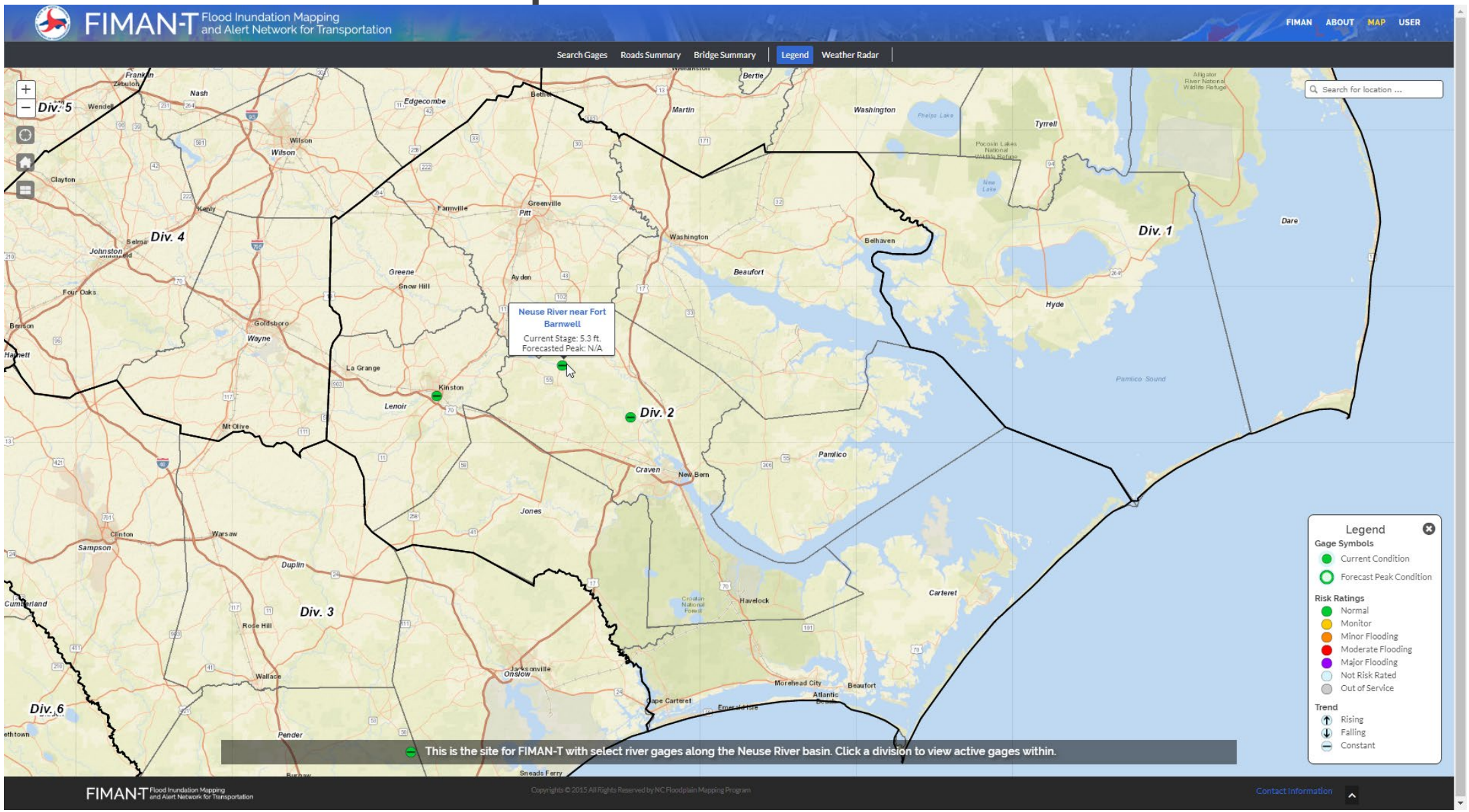
Add User Tools



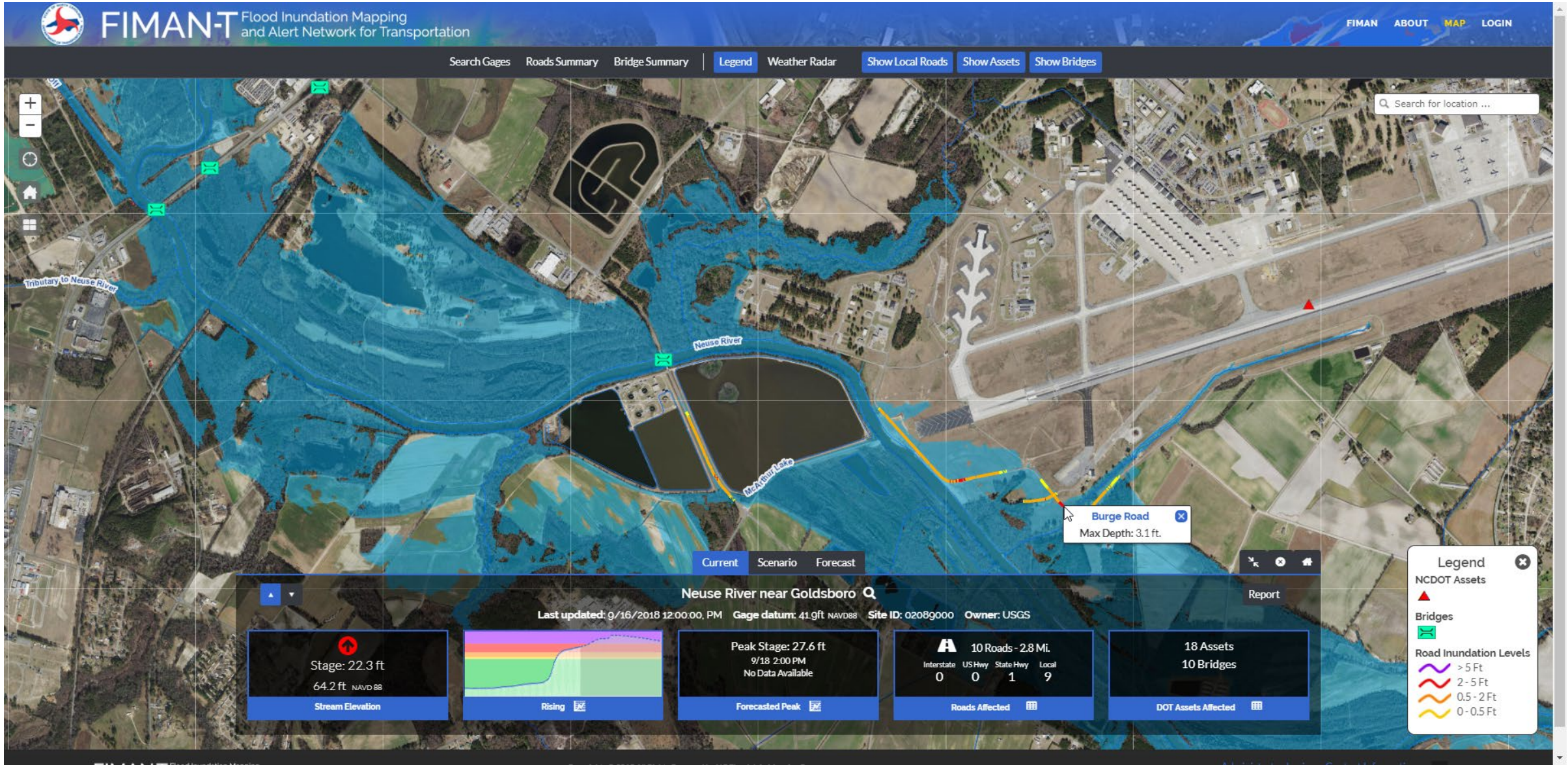
FIMAN-T: Pilot Area Home Screen



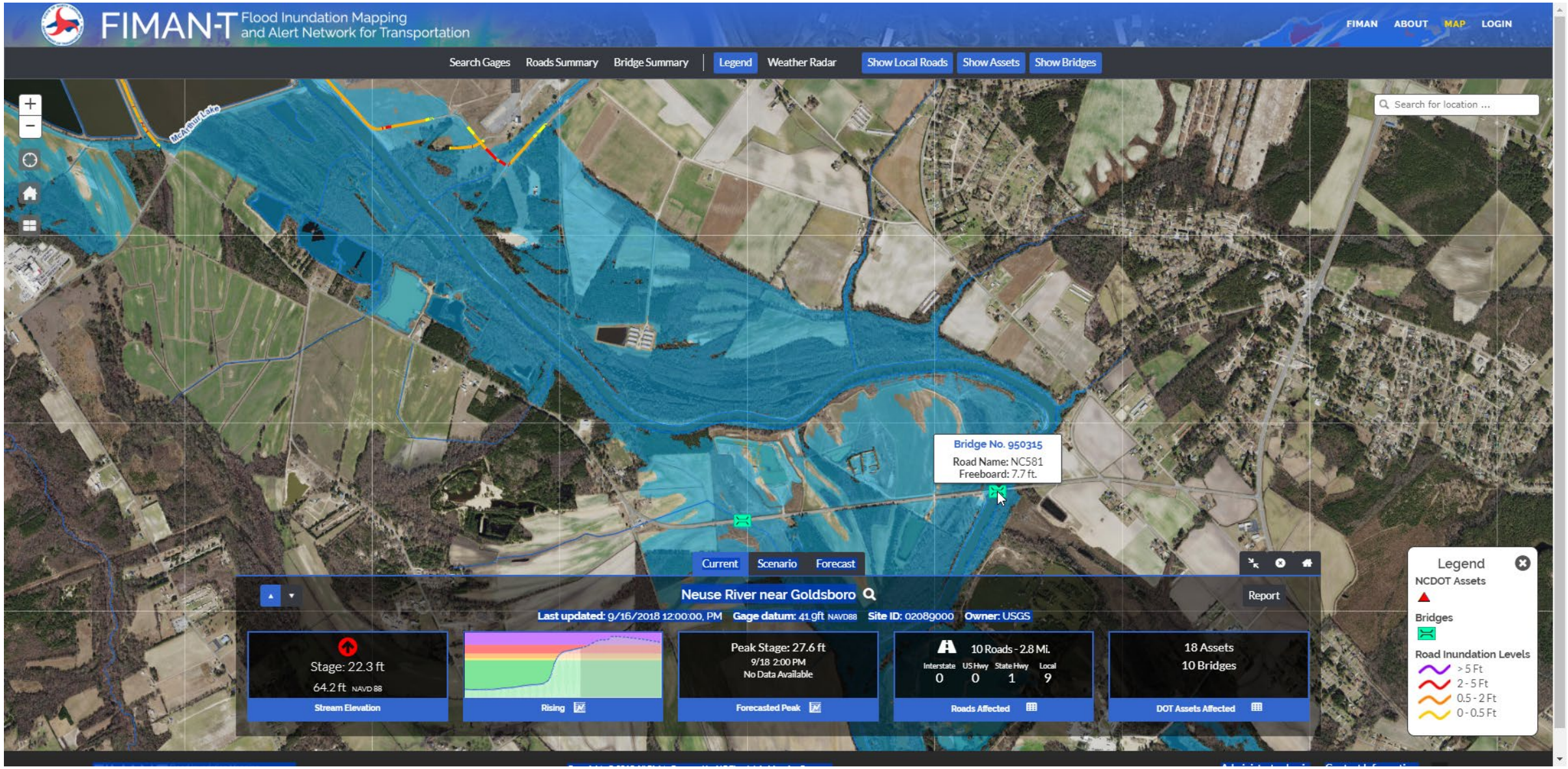
FIMAN-T: Division Map



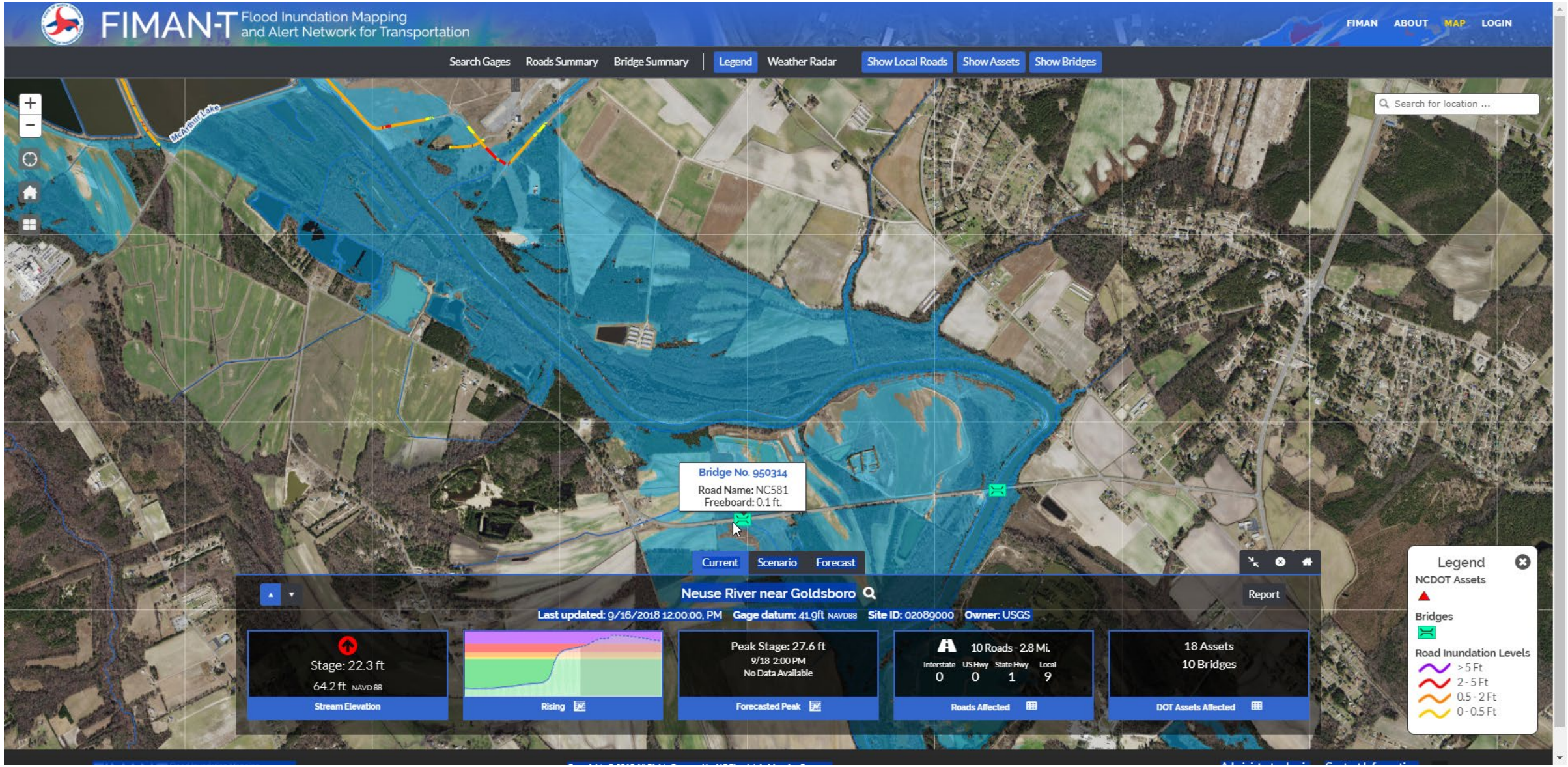
Current Conditions (Inundation and Road Flooding)



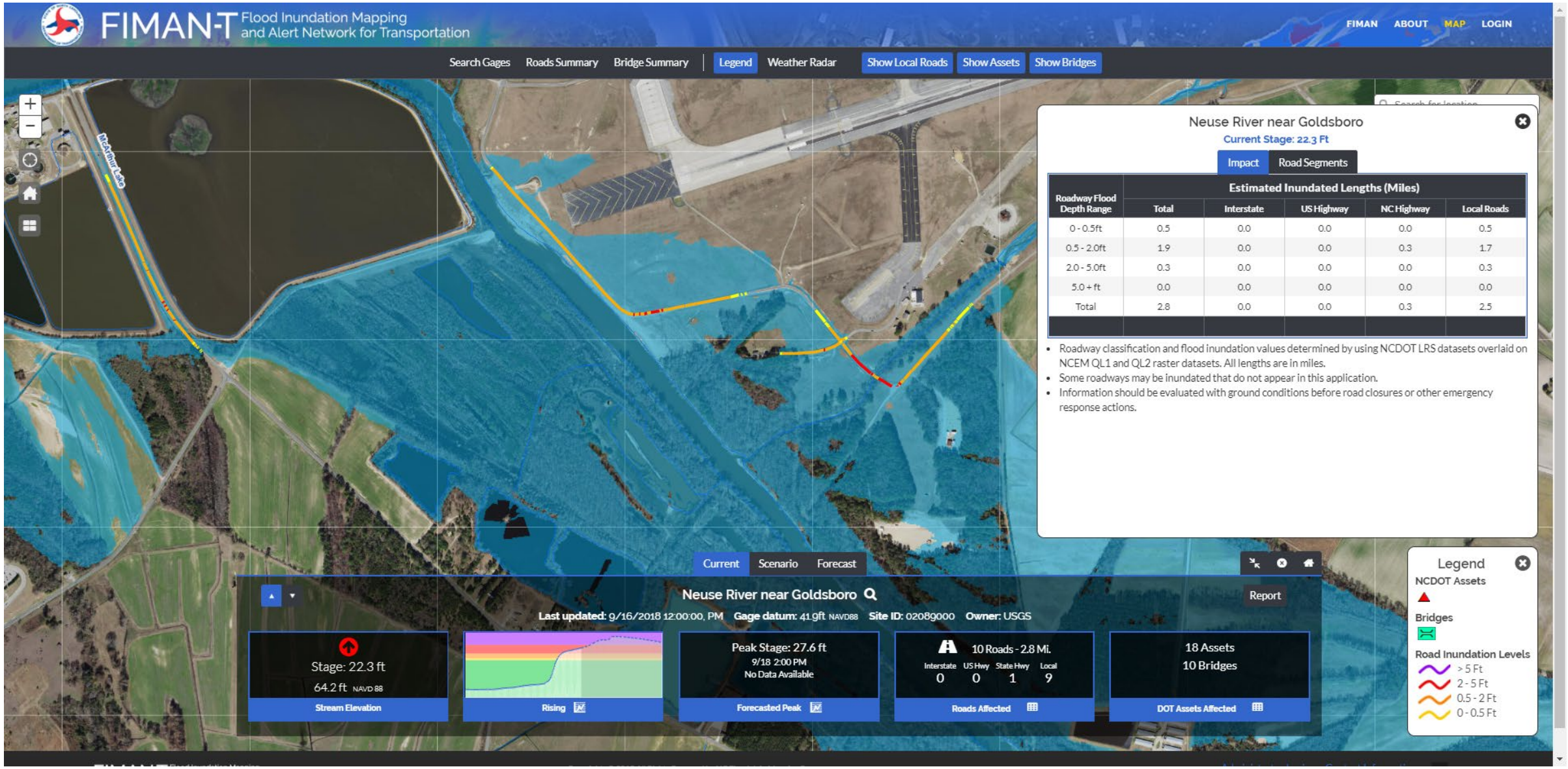
Current Conditions (Bridge Performance)



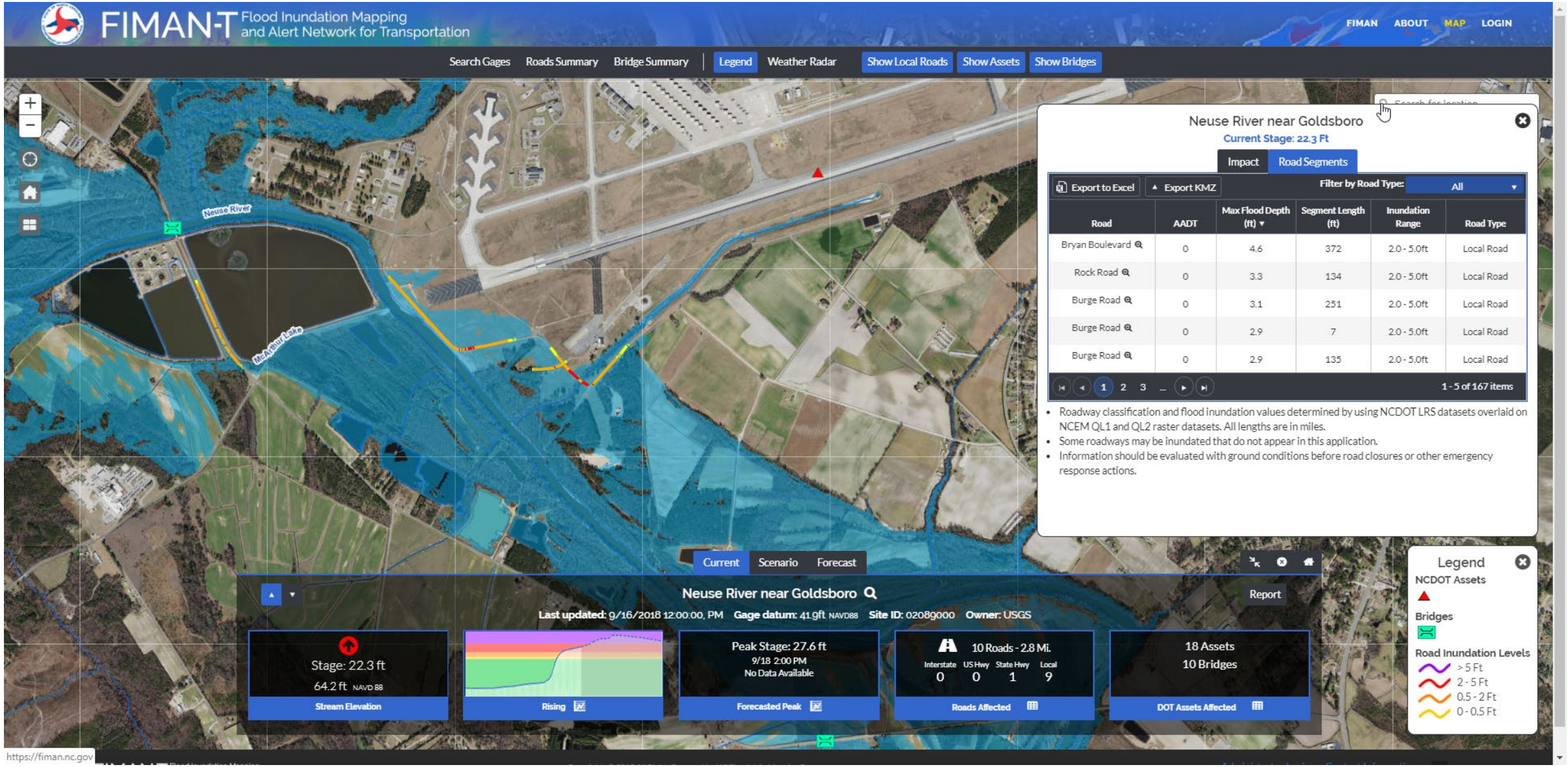
Current Conditions (Bridge Performance)



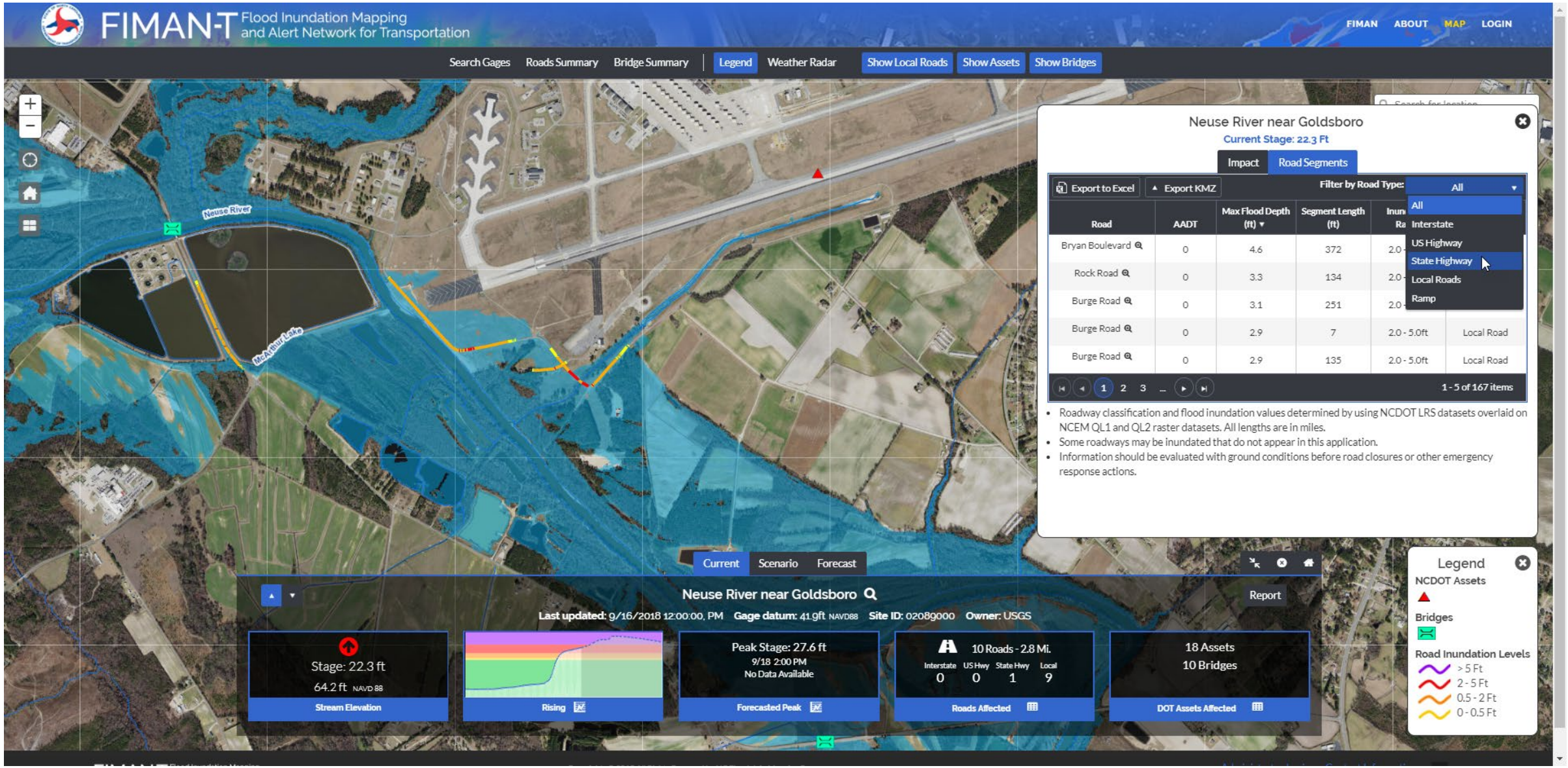
Current Conditions: Road Impact - Summary



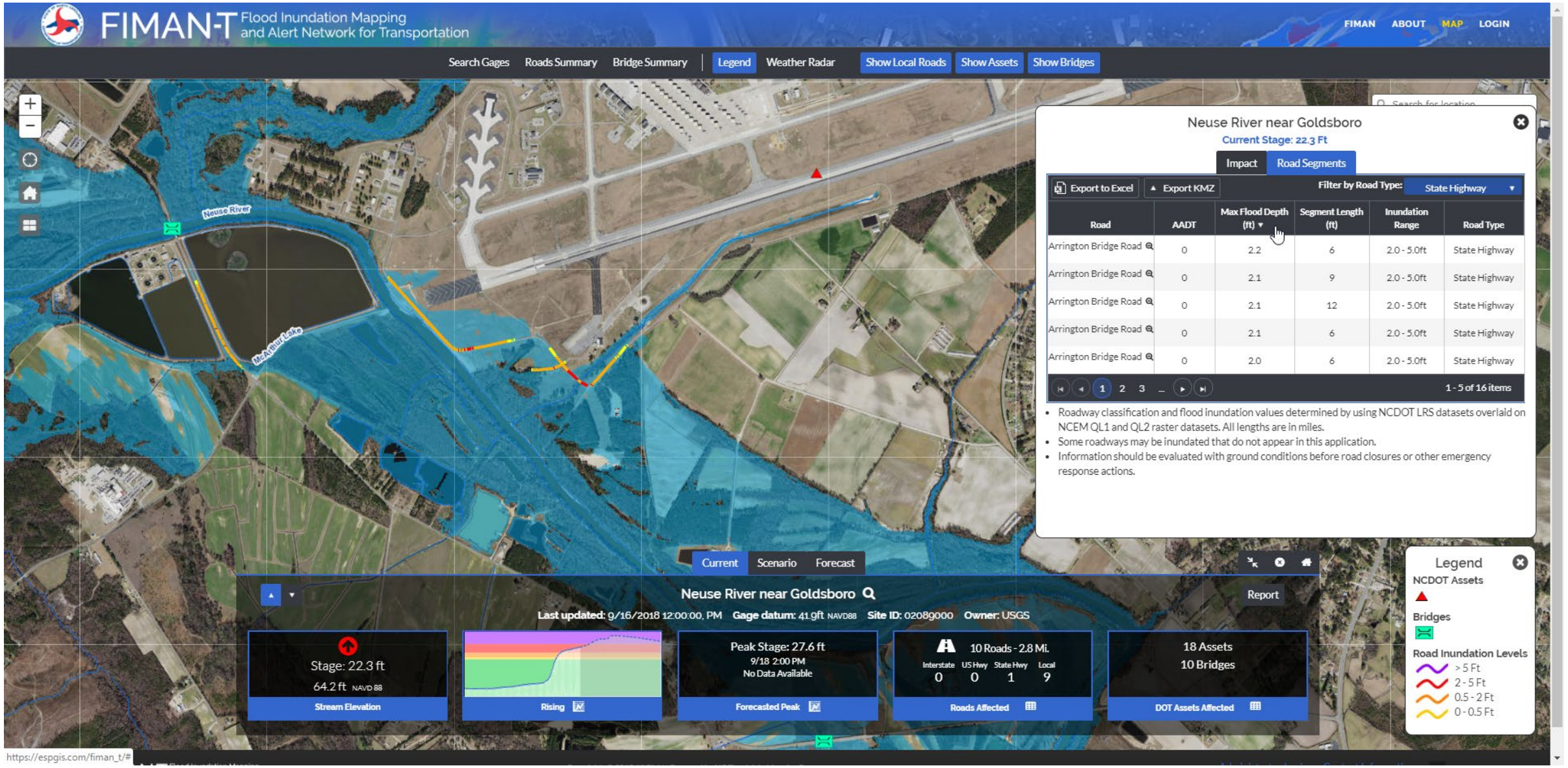
Current Conditions: Road Impacts – Details



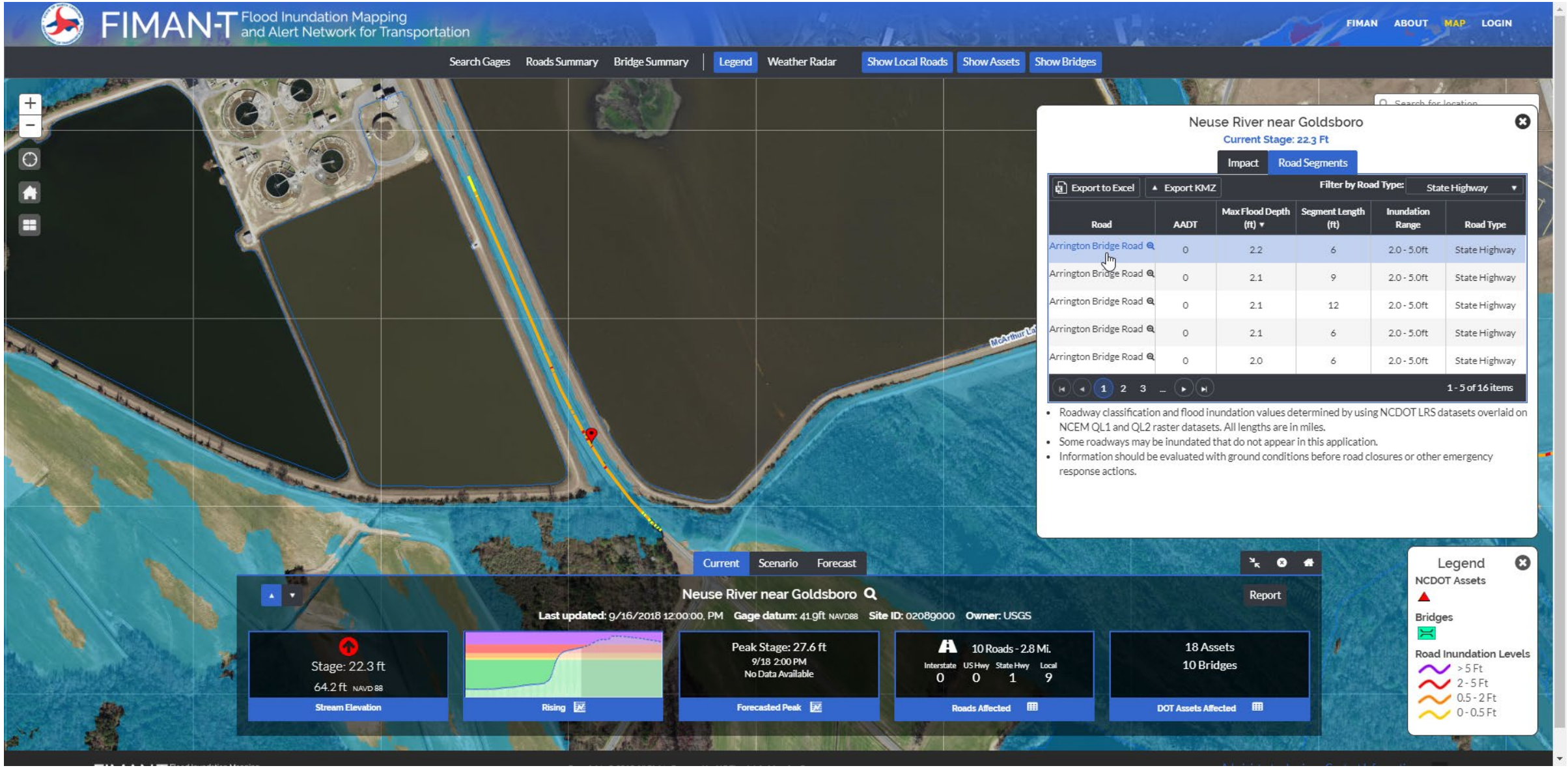
Current Conditions: Road Impacts – Details



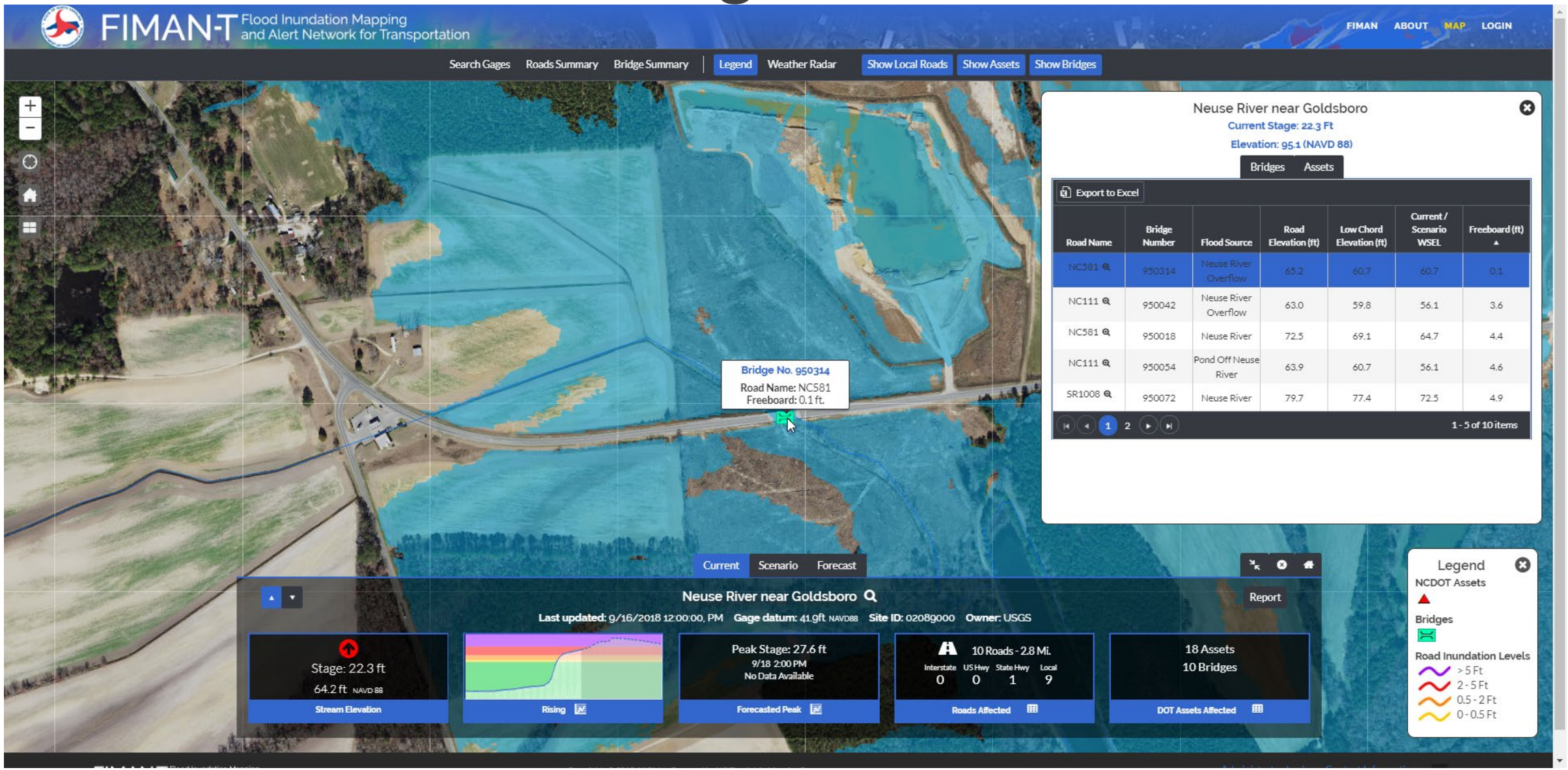
Current Conditions: Road Impacts – Details



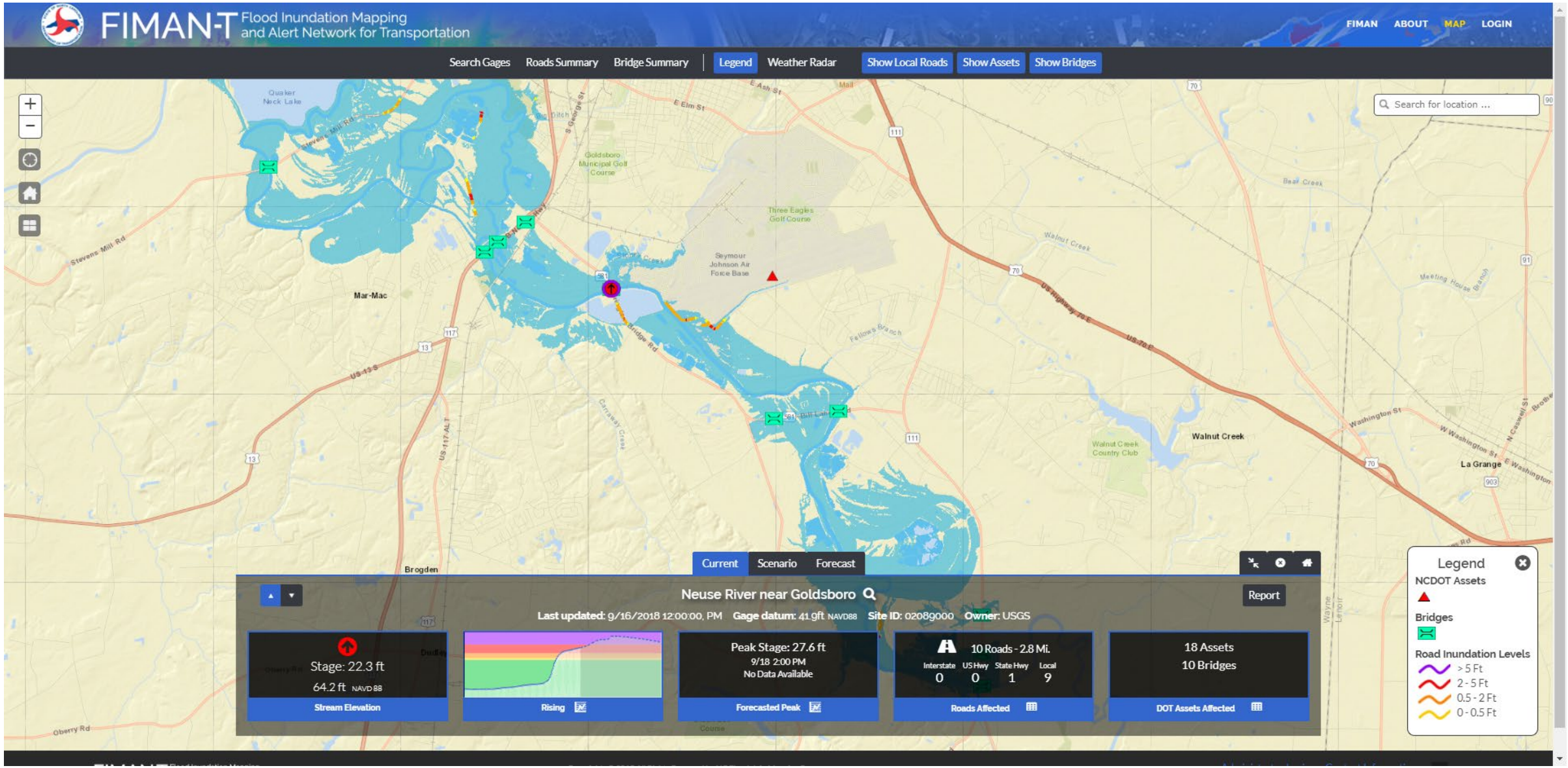
Current Conditions: Road Segment Inspector



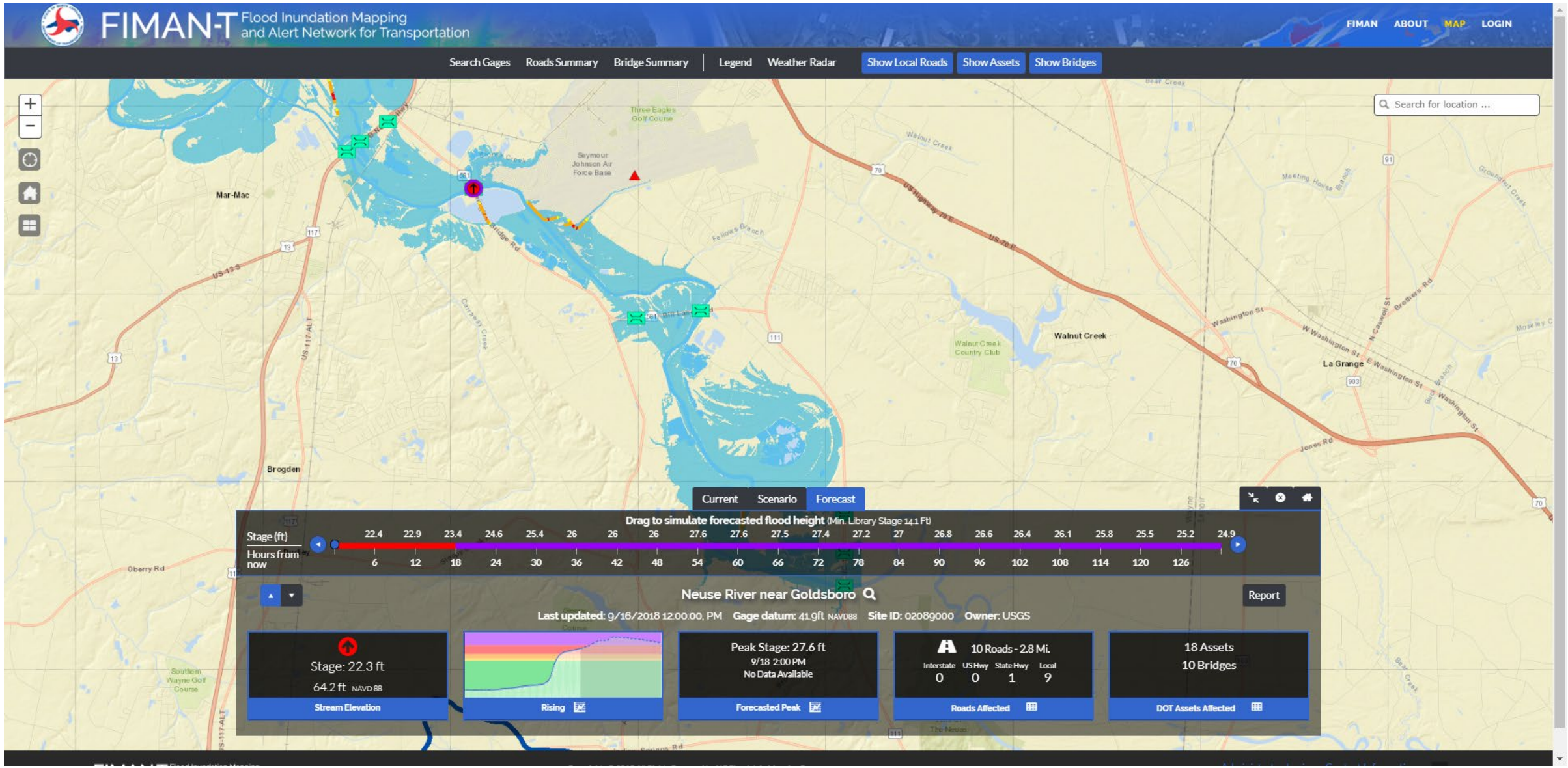
Current Conditions: Bridge Performance



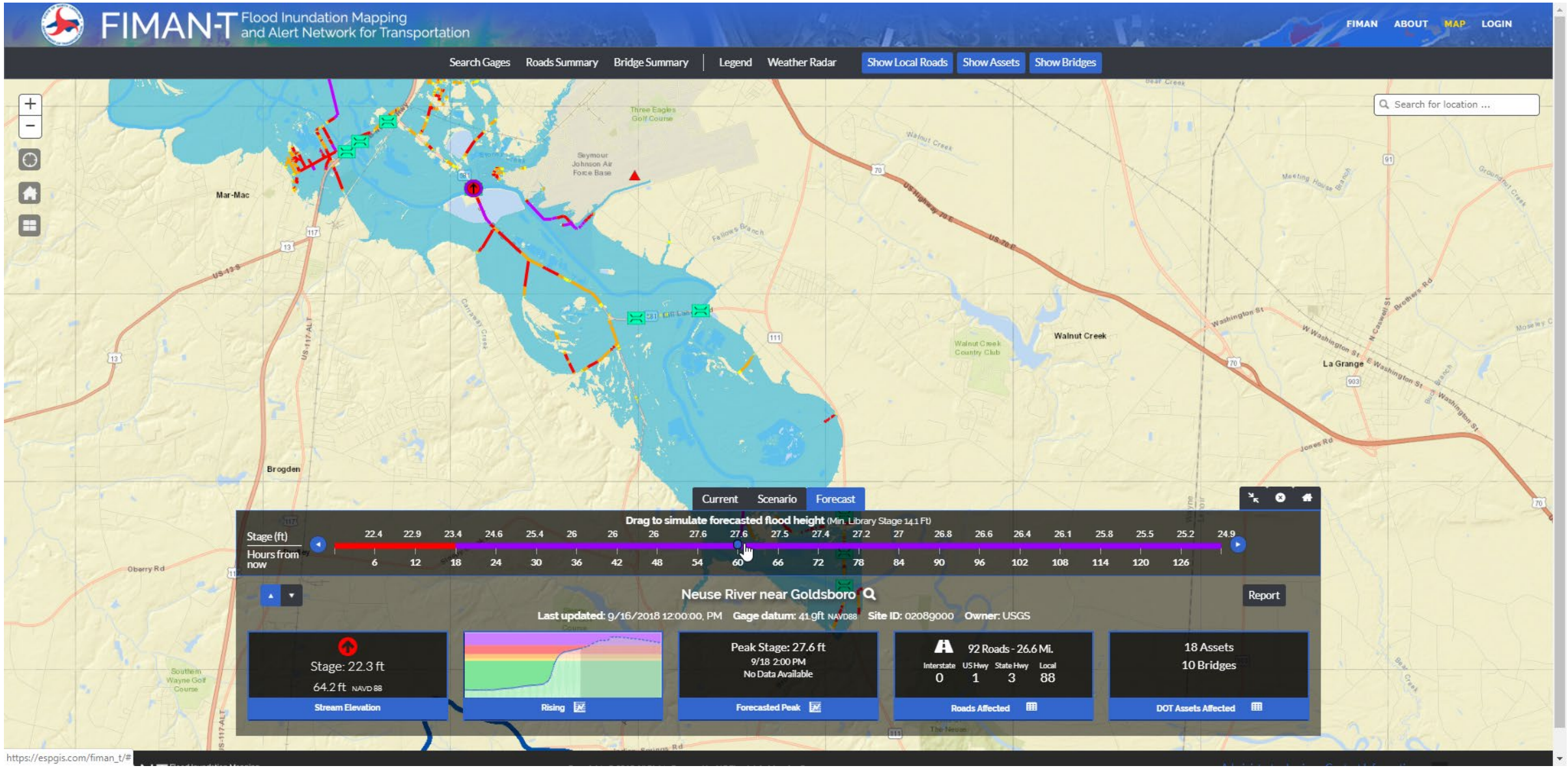
Current Conditions: Goldsboro



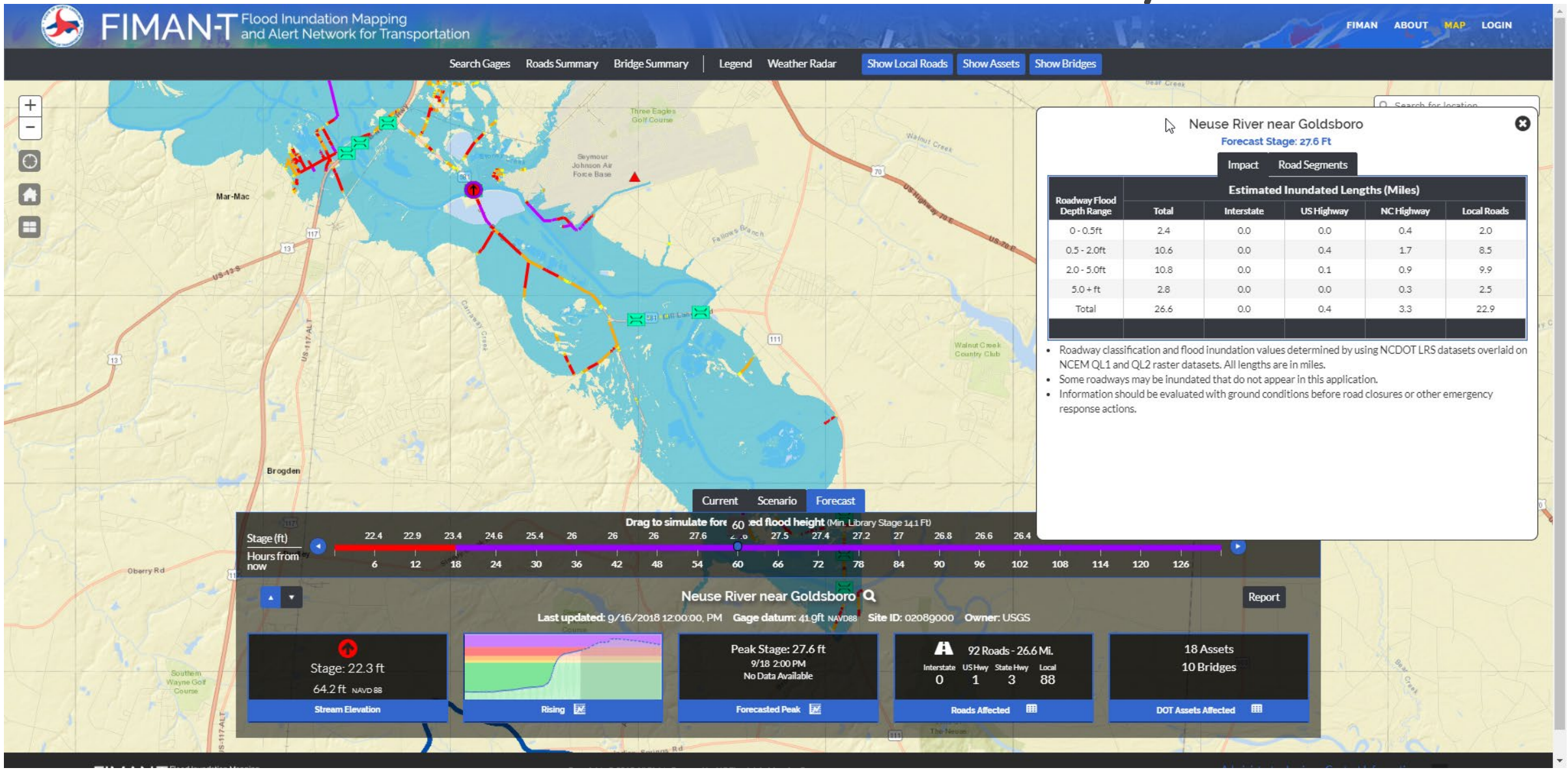
FIMAN-T Forecast Tab: Goldsboro



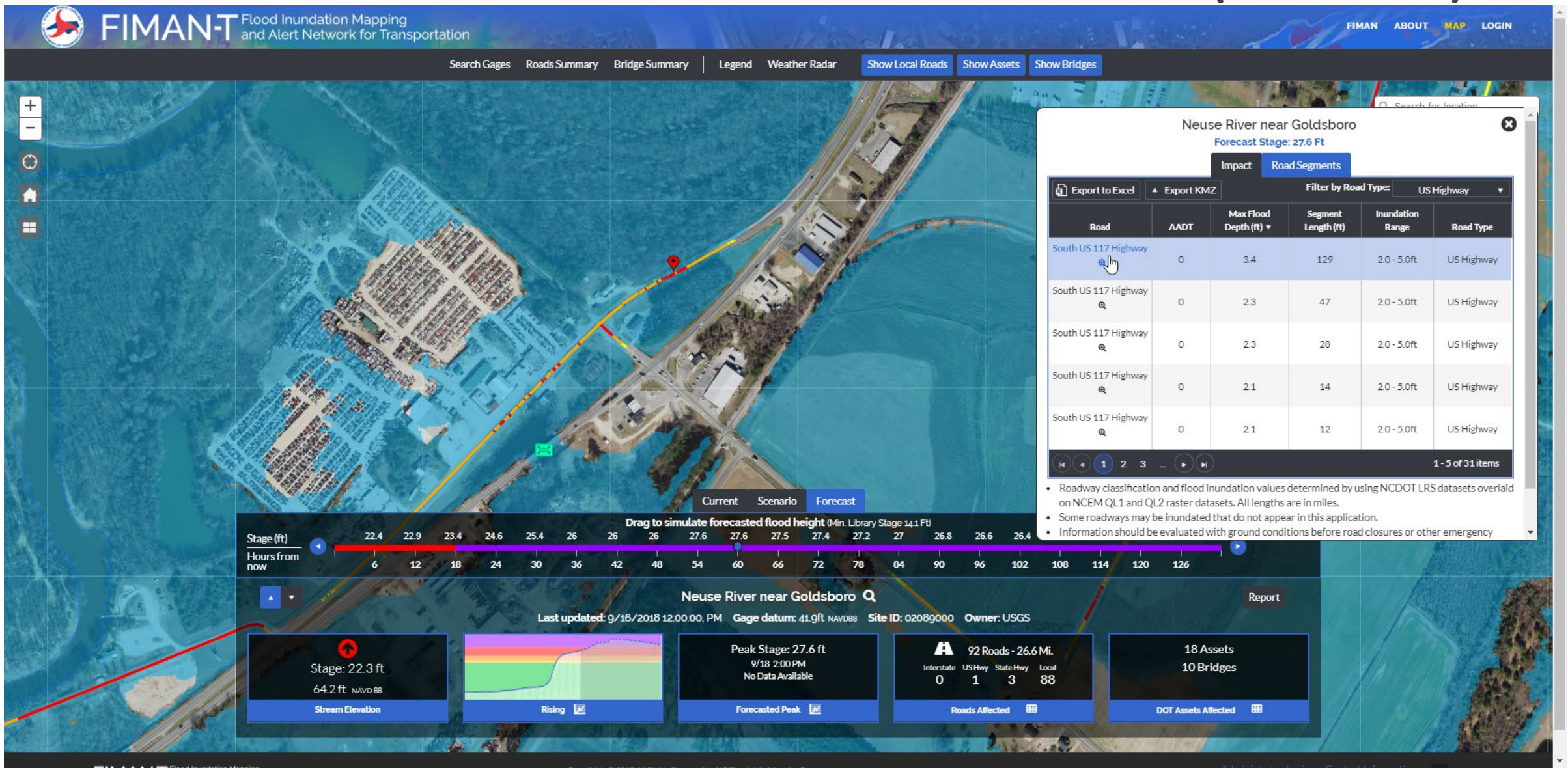
Forecasted Peak: Goldsboro



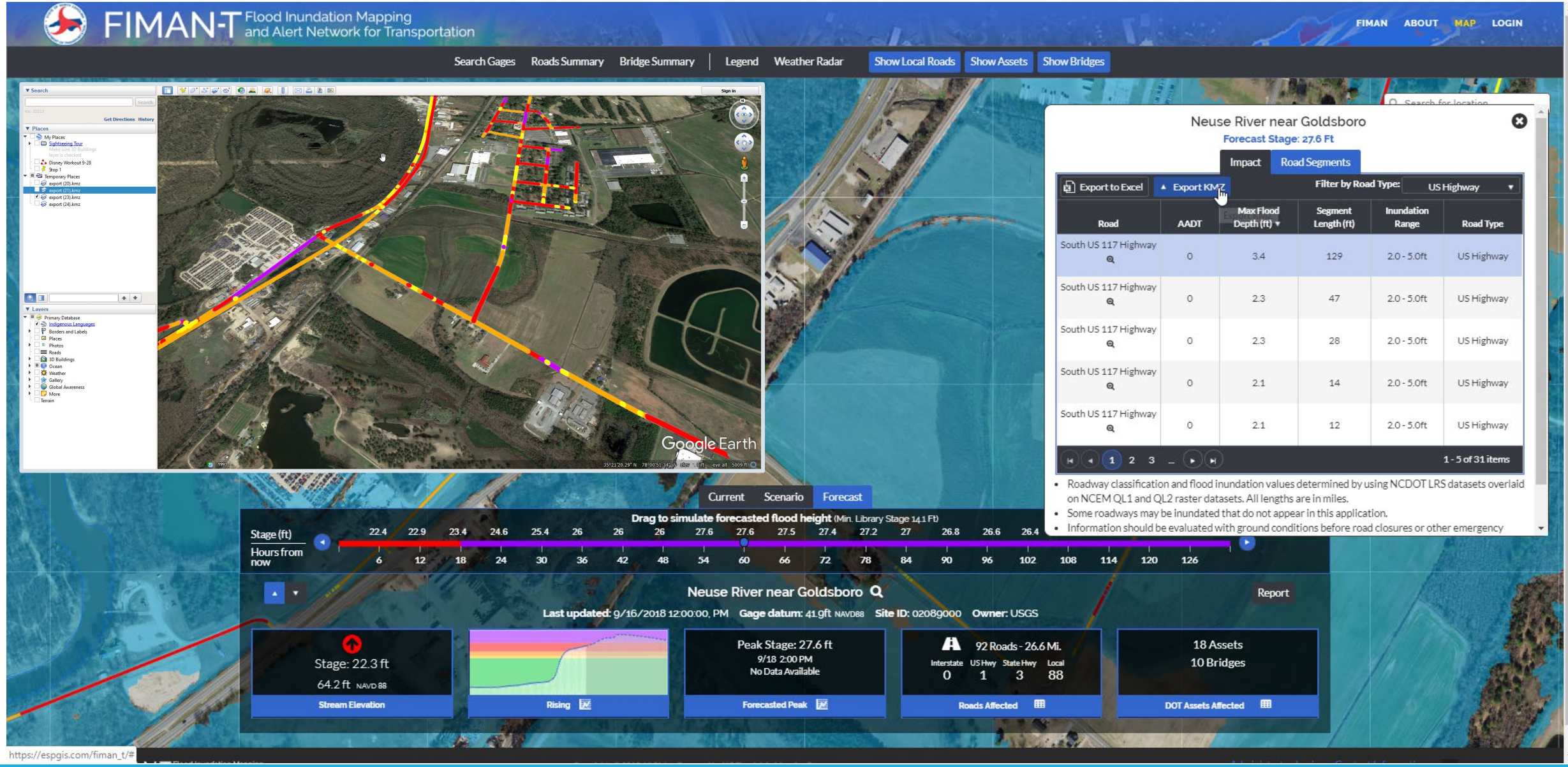
Forecasted Peak: Road Inundation Summary



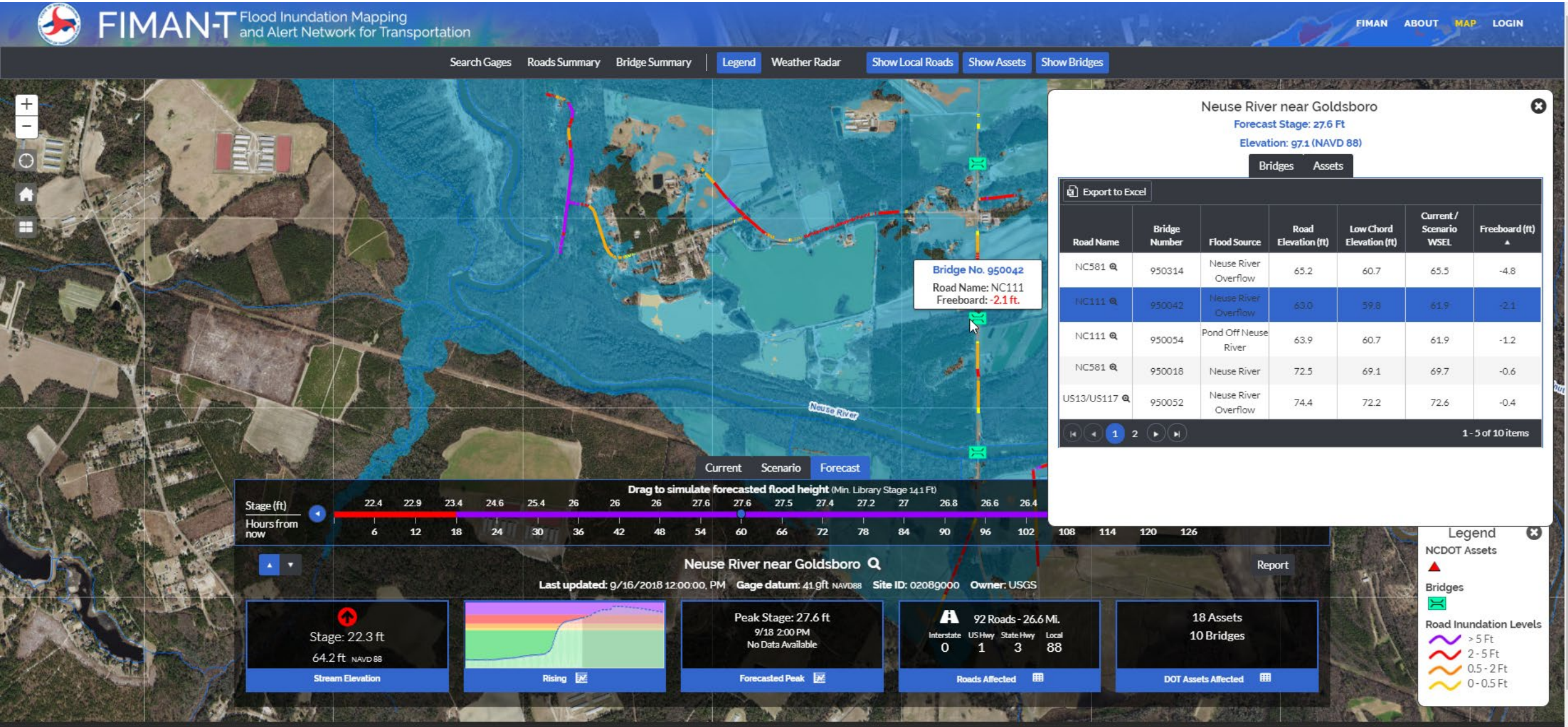
Forecasted Peak: Interactive Road Inundation (Zoom to)



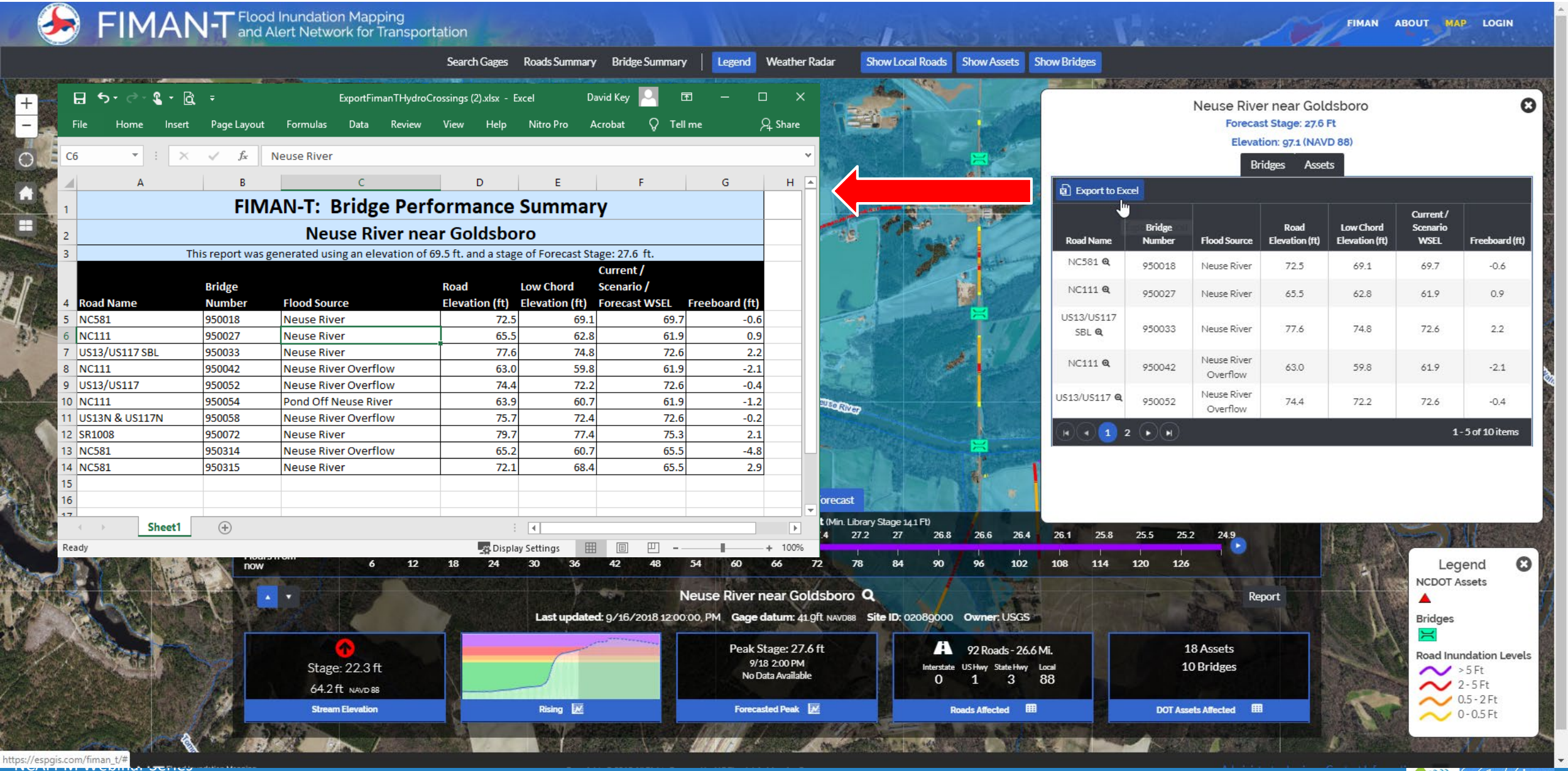
Forecasted Peak: Google Earth Export



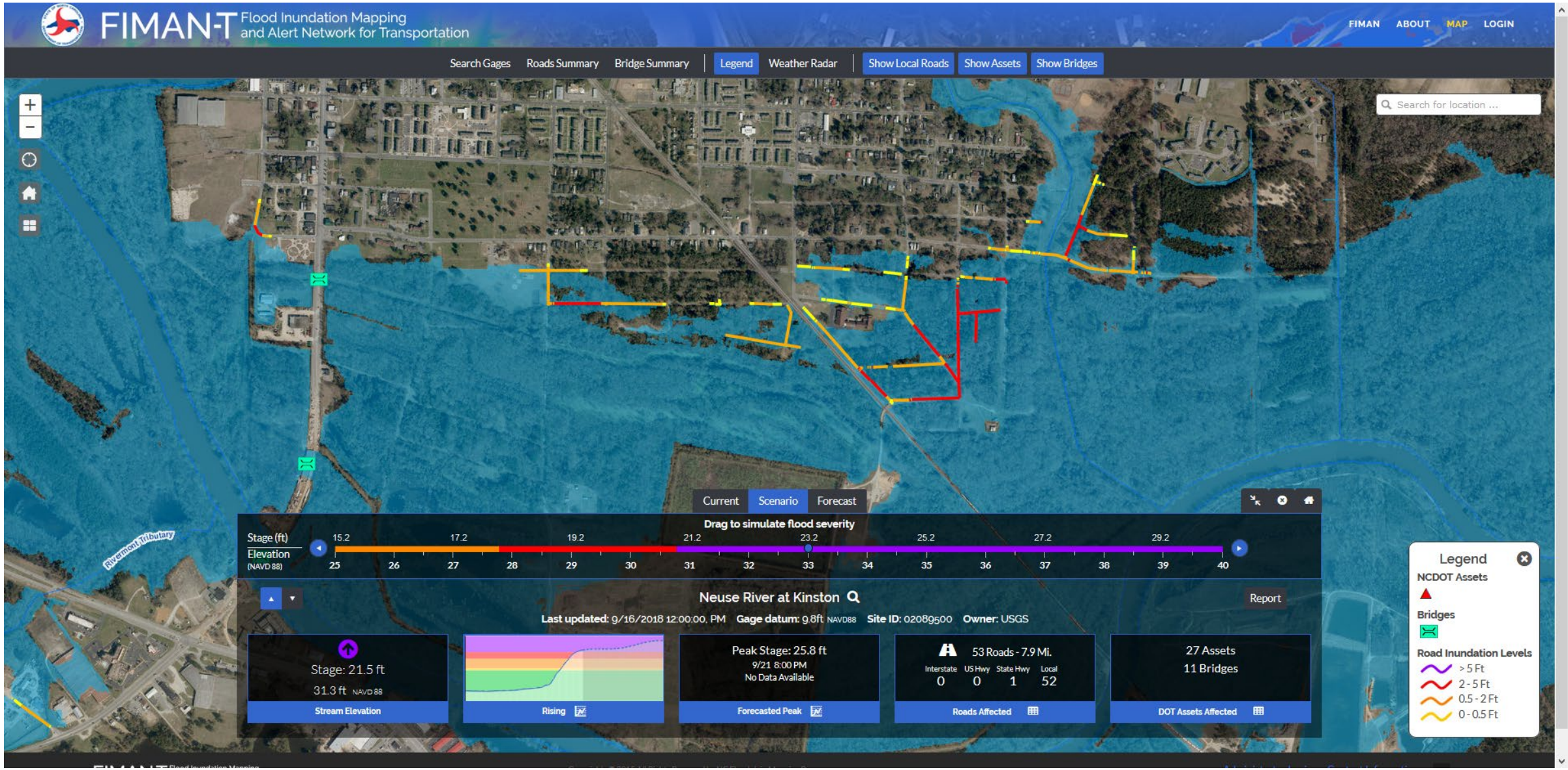
Forecasted Peak: Bridge Performance Table



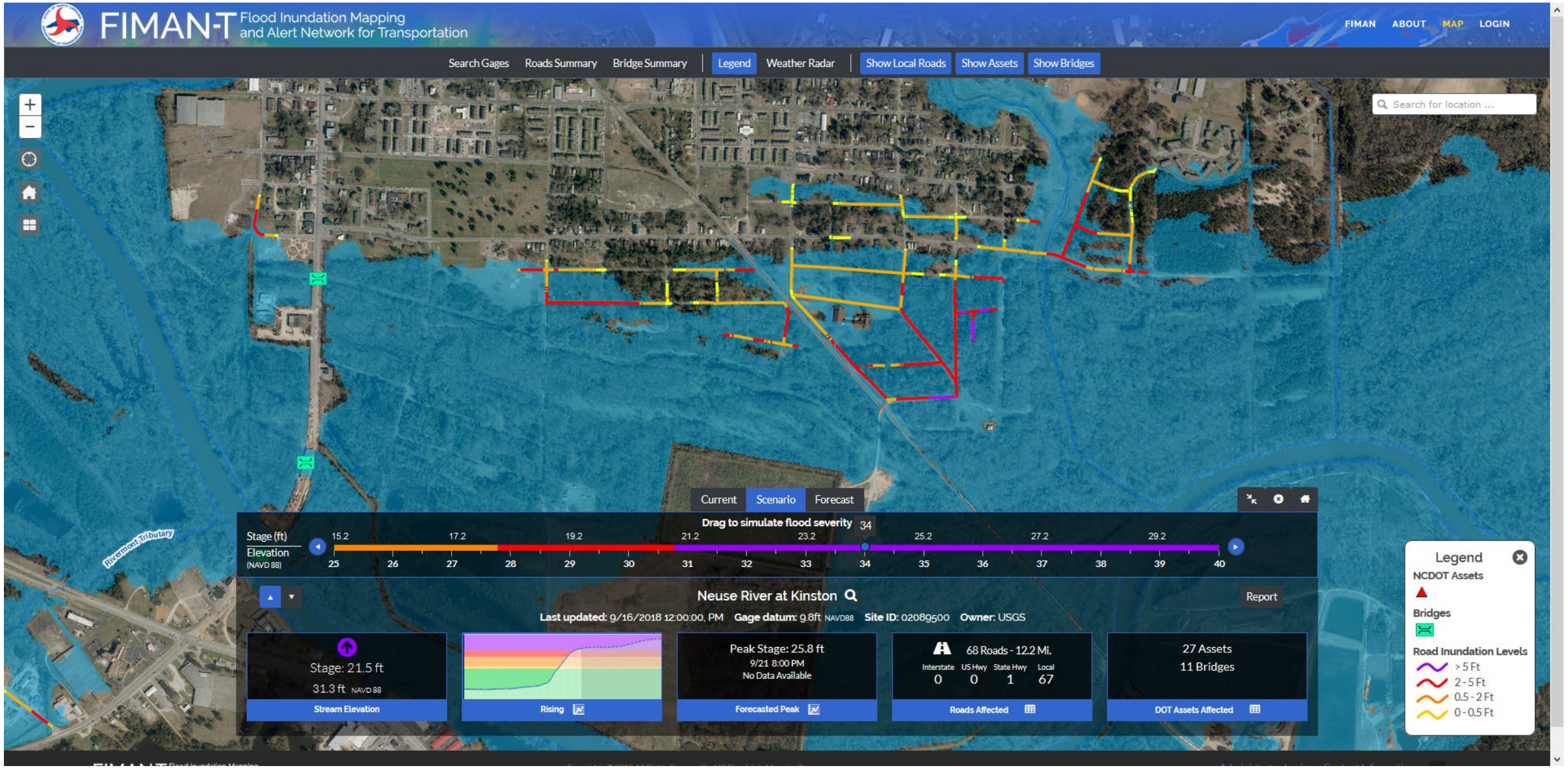
Forecasted Peak: Bridge Performance Excel Export



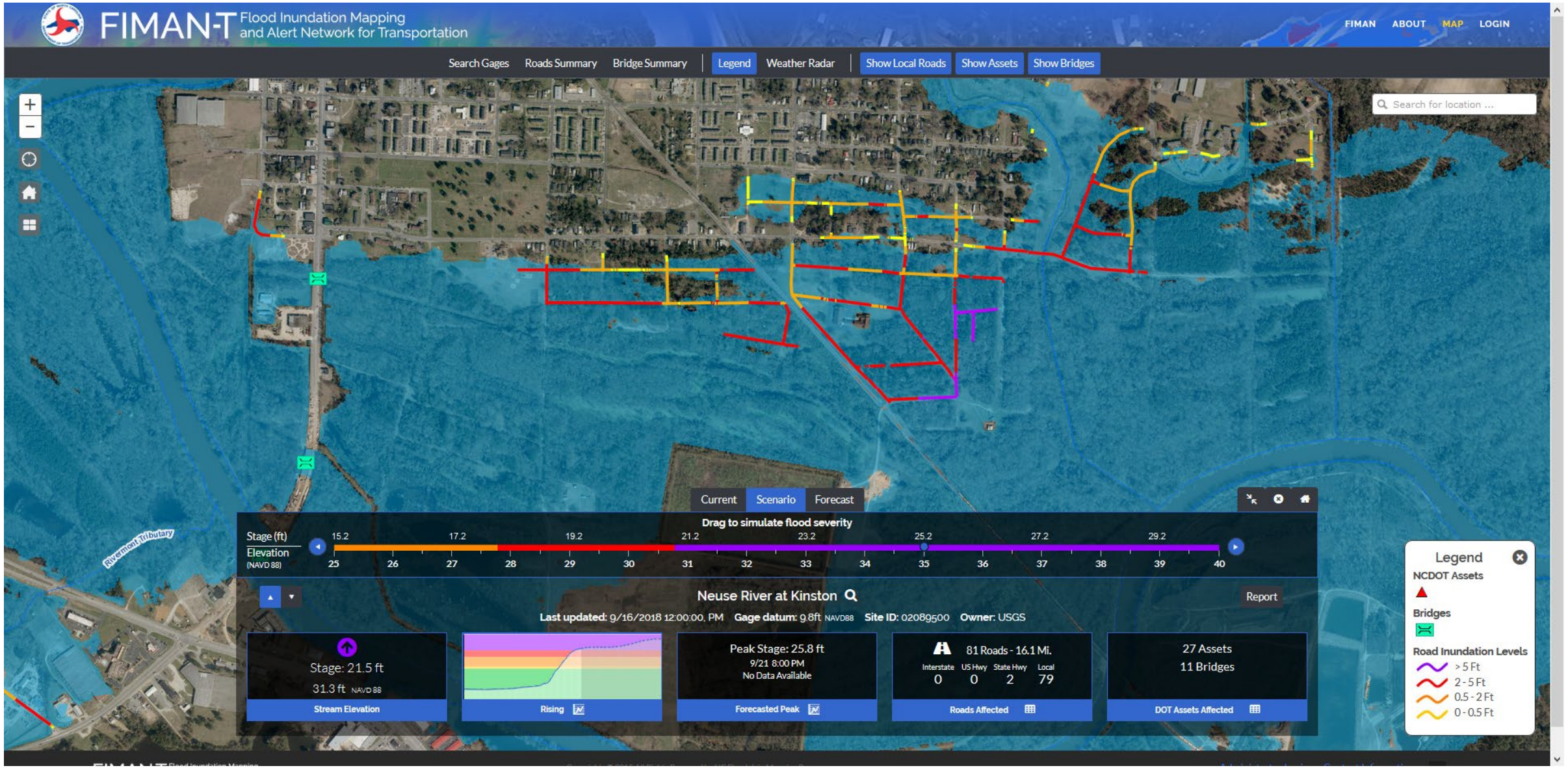
Scenario Modes for Planning: Kinston (33-ft)



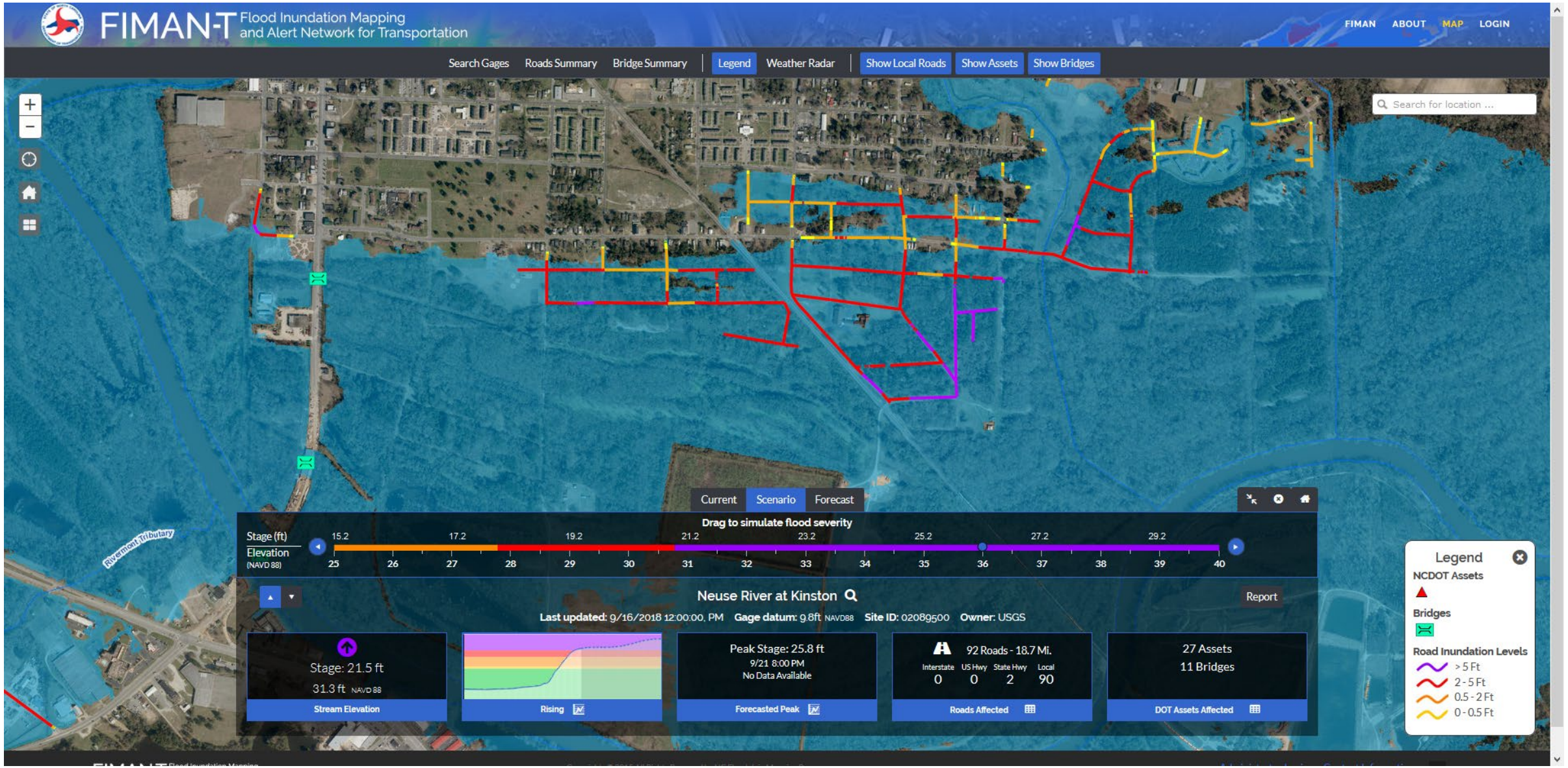
Scenario Modes for Planning: Kinston (34-ft)



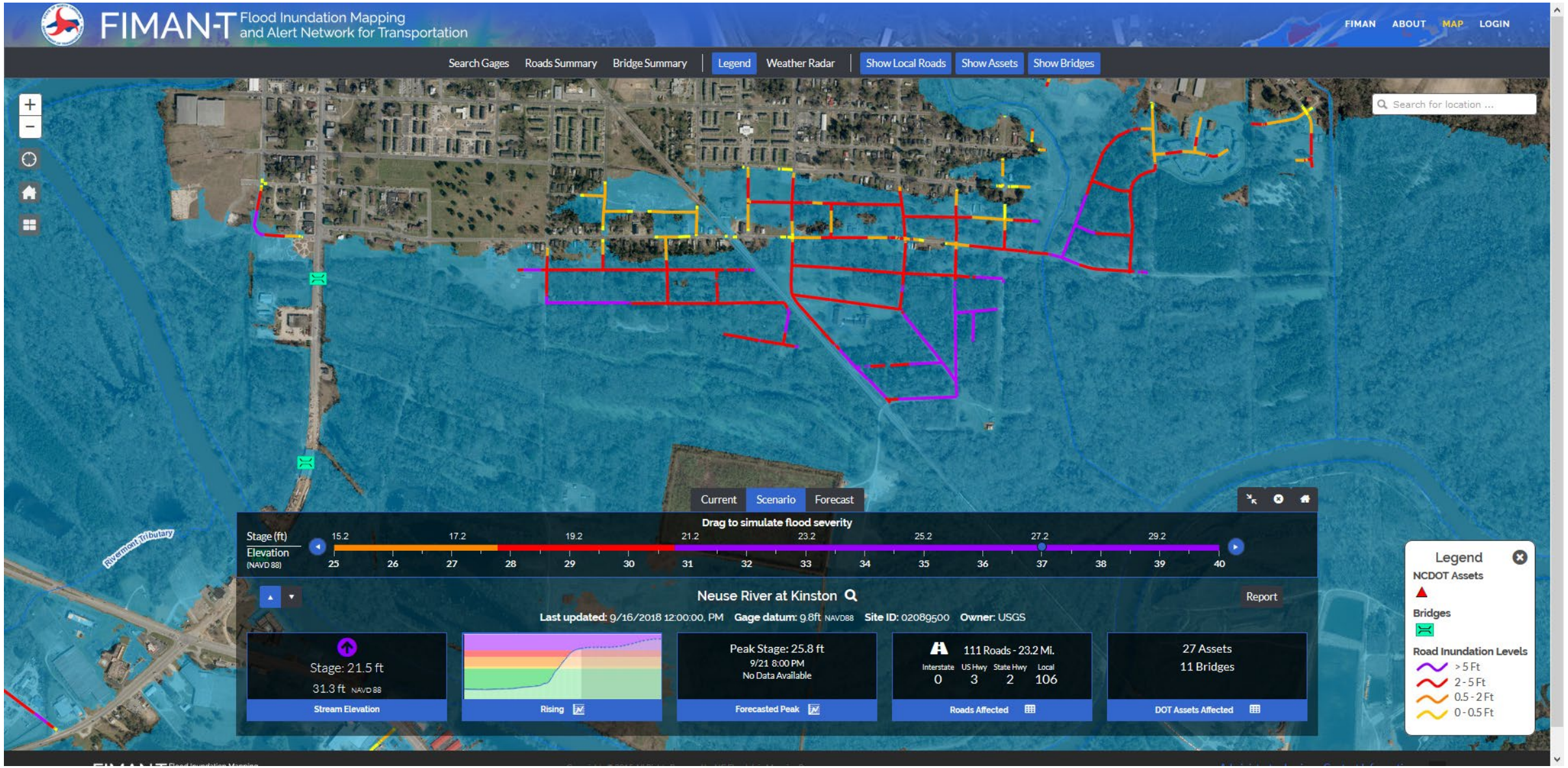
Scenario Modes for Planning: Kinston (35-ft)



Scenario Modes for Planning: Kinston (36-ft)



Scenario Modes for Planning: Kinston (37-ft)



Version 2 Enhancement
Hydraulic Performance Dashboards

FIMAN-T *Hydraulic Performance Dashboards* RETURN TO FIMAN-T

Current | Scenario | Forecast

1

Drag to simulate forecasted flood height (Min. Library Stage 12.7 Ft)

Stage (ft)	19.7	20.3	20.3	19.7	18.9	17.9	16.7	15.1	13.4	11.7	10.2	9.5	9.9	10.9	11.8	12.5	13.2	13.7	14.1
Hours from now	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	

US70B Over Neuse River

Return Home **Last Updated:** Feb 7, 2020 at 5:15 PM **Gage Datum:** 98.3ft NAVD88 **Associated Gage:** 02087570 - Neuse River at Smithfield **Bridge ID:** 500040

Hydaulic Performance Variables

(Forecast Conditions)

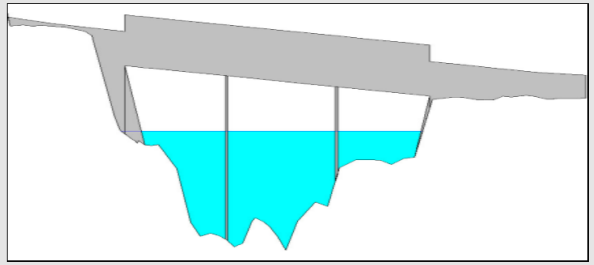
2

Variable	Value	Variable	Value
Stage (ft)	20.3	Deck Elev (ft)	131.8
Elevation (NAVD88)	119.0	Superstructure Elevation (ft)	125.4
Avg Velocity - Inside Bridge Opening (ft/s)	2.4	Overtopping Freeboard (ft)	12.8
Avg Velocity - Main Channel (ft/s)	3.5	Superstructure Freeboard (ft)	6.4

Bridge Cross Section

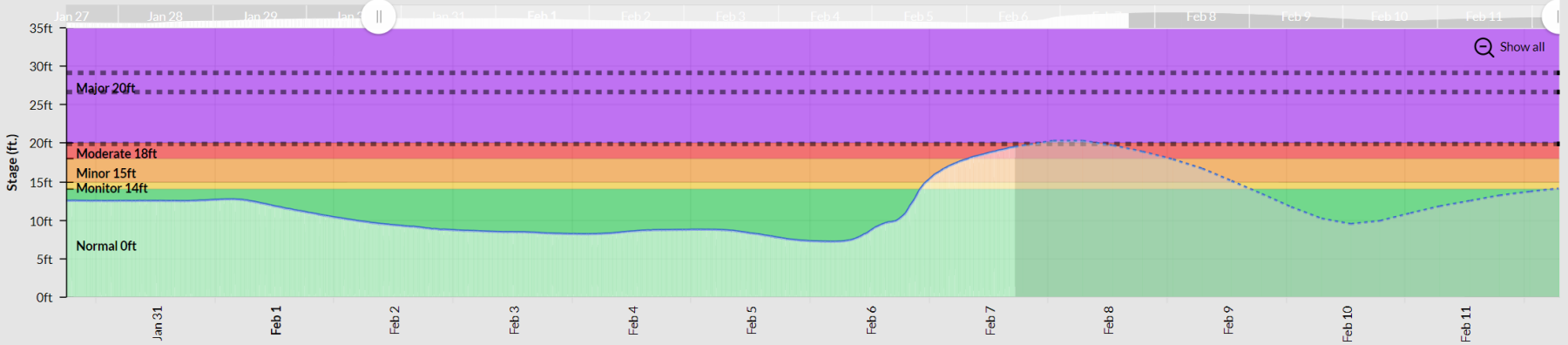
(Forecast Conditions)

3



Hydrograph

4

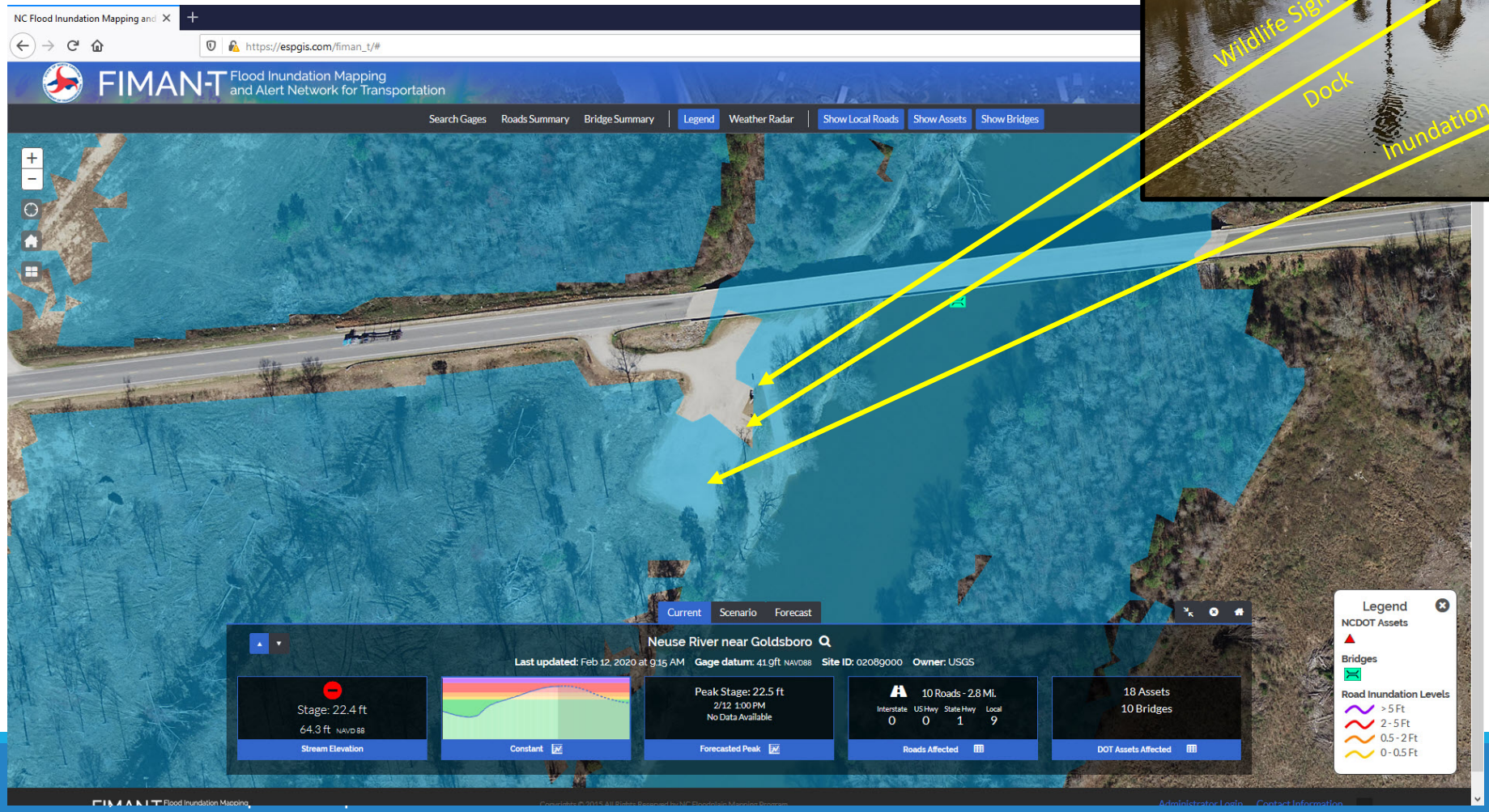


Ground Truthing Opportunity

NC 581 over Neuse River Prices Landing Boat Ramp

4.25 miles from FIMAN Gage

Date: 2/12/20
Time: 9:30am
Neuse Stage: 22.4



NC 581 over Neuse River
FIMAN-T Bridge Freeboard Ground Truth

4.25 miles from FIMAN Gage

Bridge No. 950314
Road Name: NC581
Freeboard: 0.1 ft.

Bridge No. 950315
Road Name: NC581
Freeboard: 7.8 ft.

NC 581 Relief Opening:
FIMAN-T 'Modeled'
Freeboard = 0.1 ft

FIMAN ABOUT MAP ACCOUNT LOG OUT

Legend | Weather Radar | Show Local Roads | Show Assets | Show Bridges

Search for location ...

Current | Scenario | Forecast

Neuse River near Goldsboro

Last updated: Feb 12, 2020 at 1:15 PM Gage datum: 41.9ft NAVD88 Site ID: 02089000 Owner: USGS

Stage: 22.3 ft
64.3 ft NAVD 88
Stream Elevation

Constant

Peak Stage: 22.5 ft
2/12 7:00 PM
No Data Available
Forecasted Peak

10 Roads - 2.8 Mi.
Interstate 0 | US Hwy 0 | State Hwy 1 | Local 9
Roads Affected

18 Assets
10 Bridges
DOT Assets Affected

Legend
NCDOT Assets
Bridges
Road Inundation Levels
> 5 Ft
2 - 5 Ft
0.5 - 2 Ft
0 - 0.5 Ft

FIMAN-T Flood Inundation Mapping and Alert Network for Transportation

Administrator Login | Contact Information

NC 581 over Neuse River
FIMAN-T Bridge Freeboard Ground Truth

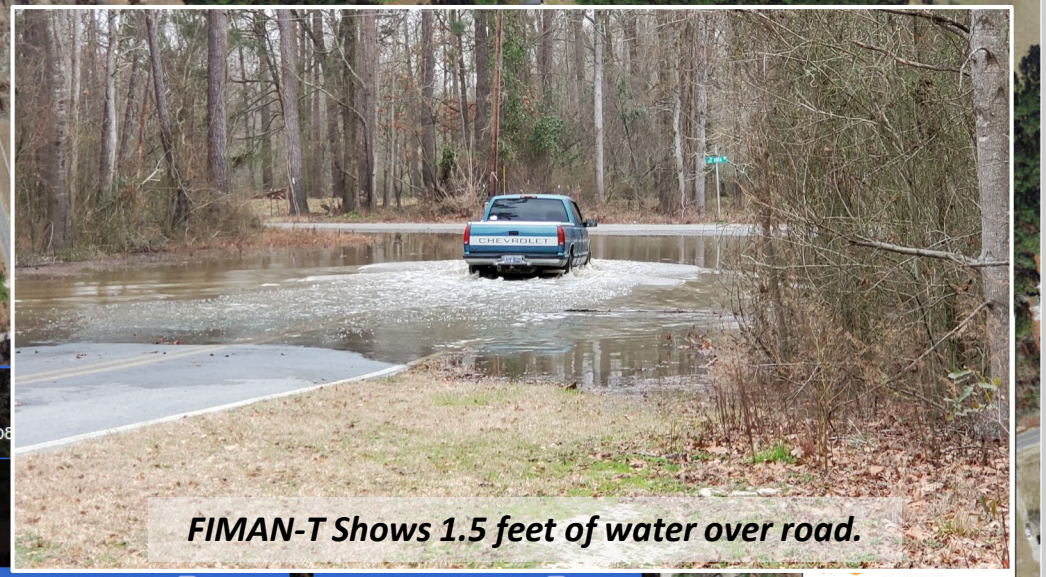
4.25 miles from FIMAN Gage

Slick Rock Road downstream of Goldsboro

FIMAN-T Inundation and Road Flooding Depth Ground Truth

Note: 8.3 miles downstream from FIMAN Gage

Photo taken here



Current Scenario Forecast

Neuse River near Goldsboro

Last updated: Feb 12, 2020 at 9:15 AM Gage datum: 41.9ft NAVD88 Site ID: 0208

Stage: 22.4 ft
64.3 ft NAVD 88
Stream Elevation

Constant

Peak Stage: 22.5 ft
2/12 1:00 PM
No Data Available
Forecasted Peak

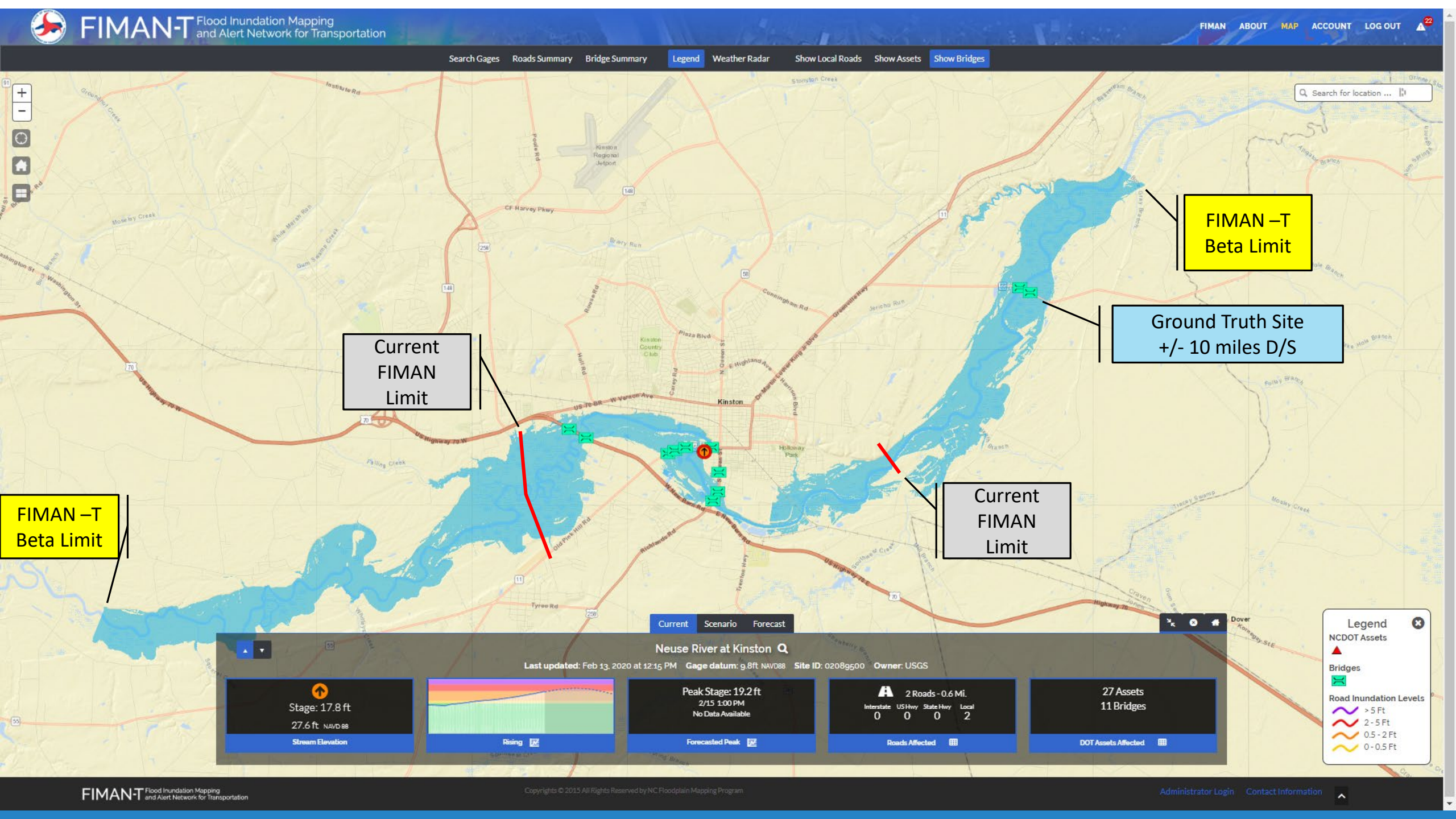
Roads Affected

DOT Assets Affected

0 - 0.5 Ft

FIMAN Flood Inundation Mapping

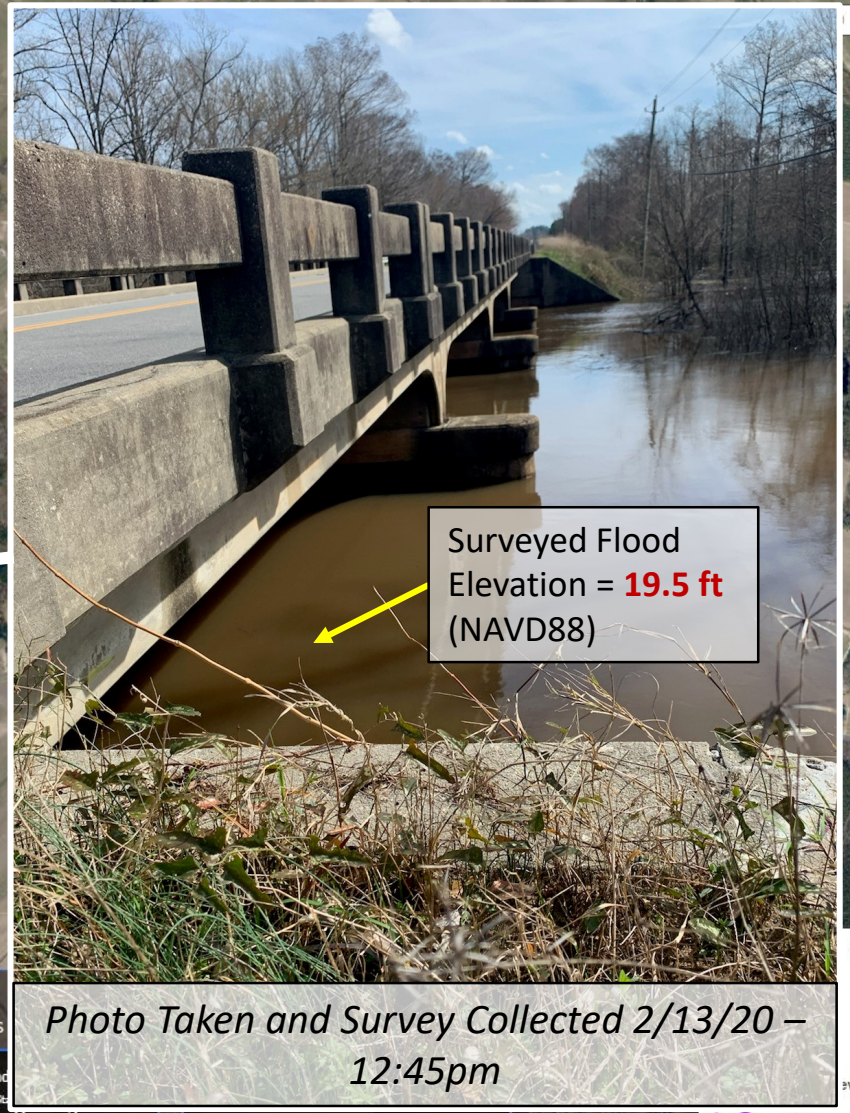
Administrator Login Contact Information


FIMAN-T Flood Inundation Mapping and Alert Network for Transportation
FIMAN ABOUT MAP ACCOUNT LOG OUT
Search Gages Roads Summary Bridge Summary Legend Weather Radar Show Local Roads Show Assets Show Bridges
Search for location ...
FIMAN –T Beta Limit
Ground Truth Site +/- 10 miles D/S
Current FIMAN Limit
Current FIMAN Limit
FIMAN –T Beta Limit
Kinston
Current Scenario Forecast
Neuse River at Kinston
Last updated: Feb 13, 2020 at 12:15 PM Gage datum: 9.8ft NAVD88 Site ID: 02089500 Owner: USGS
Stage: 17.8 ft
27.6 ft NAVD 88
Stream Elevation
Rising
Peak Stage: 19.2 ft
2/15 1:00 PM
No Data Available
Forecasted Peak
2 Roads - 0.6 Mi.
Interstate US Hwy State Hwy Local
0 0 0 2
Roads Affected
27 Assets
11 Bridges
DOT Assets Affected
Legend
NCDOT Assets
Bridges
Road Inundation Levels
> 5 Ft
2 - 5 Ft
0.5 - 2 Ft
0 - 0.5 Ft
FIMAN-T Flood Inundation Mapping and Alert Network for Transportation
Copyrights © 2015 All Rights Reserved by NC Floodplain Mapping Program
Administrator Login Contact Information

NC 55 over Neuse River
Lenoir County

9.7 miles from FIMAN Kinston Gage

Date: 2/13/20
Time: 12:45pm
Kinston Stage: 17.8



Surveyed Flood Elevation = **19.5 ft** (NAVD88)

Photo Taken and Survey Collected 2/13/20 – 12:45pm

FIMAN Library Elevation = **20.0 ft**

Bridge No. 530034
Road Name: NC55
Freeboard: 4.5 ft.

FIMAN-T Flood Inundation Mapping and Alert Network for Transportation

FIMAN ABOUT MAP ACCOUNT LOG OUT

Search Gages | Roads Summary | Bridge Summary | Legend | Weather Radar | Show Local Roads | Show Assets | Show Bridges

Current | Scenario | Forecast

Neuse River at Kinston

Last updated: Feb 13, 2020 at 12:15 PM Gage datum: 9.8ft NAVD88 Site ID: 02089500 Owner: USGS

Stage: 17.8 ft
27.6 ft NAVD 88
Stream Elevation

Rising

Peak Stage: 19.2 ft
2/15 1:00 PM
No Data Available
Forecasted Peak

Interstate 0 | US Hwy 0

Roads Affected

DOT Assets Affected

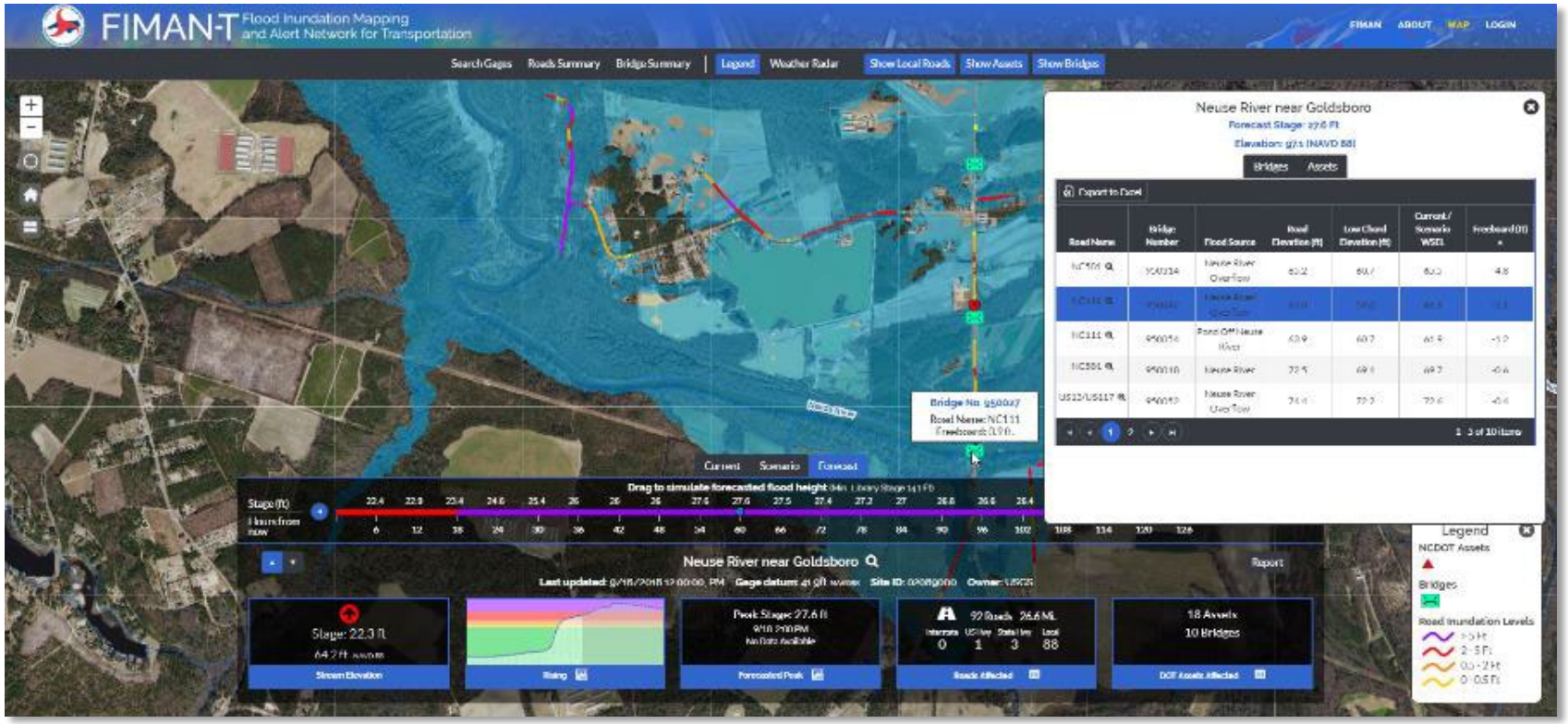
2 - 5 Ft
0.5 - 2 Ft
0 - 0.5 Ft

Administrator Login | Contact Information

FIMAN-T: Planned Next Steps

- Integration with Production FIMAN
- Bridge Hydraulics Dashboards
- FIMAN-T Coastal Surge Module
- Multi-Modal Integration
- System Coverage Expansion (Phase 2)
  - Gage Installations
  - North East Cape Fear River / Wallace / I-40
  - Lumberton / I-95
  - Tar-Pamlico Basin
  - Roanoke / Chowan Basin
  - Statewide Implementation
- Divisional Training/Engagement/Feedback

Flood Resilient



WEBINAR ATTENDEES QUESTIONS?

(PLEASE USE CHAT WINDOW IN SKYPE IF POSSIBLE)

Webinar Attendees Questions?

(please use chat window in Skype if possible)

Attendance Roster and Continuing Education Credits

- Please visit the link provided in the Webinar Chat window
- https://docs.google.com/forms/d/e/1FAIpQLSdeAOgYgdZmAlMXhOp42WGMIzMri2j08VRpophA_E0DqW2U7g/viewform?usp=sf_link
- Complete the roster and fill in applicable CFM, PE and PLS information