

SOUTH BEND PLANNING ASSISTANCE TO STATES (PAS) FLOOD STUDY

2022 INAFSM Annual Conference
Greg Mausolf, Hydraulic Engineer
Detroit District
15 September 2022

“The views, opinions and findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other official documentation.”



US Army Corps
of Engineers®



USACE PROGRAMS & AUTHORITIES FOR STORMWATER & FLOODING ISSUES

Agenda

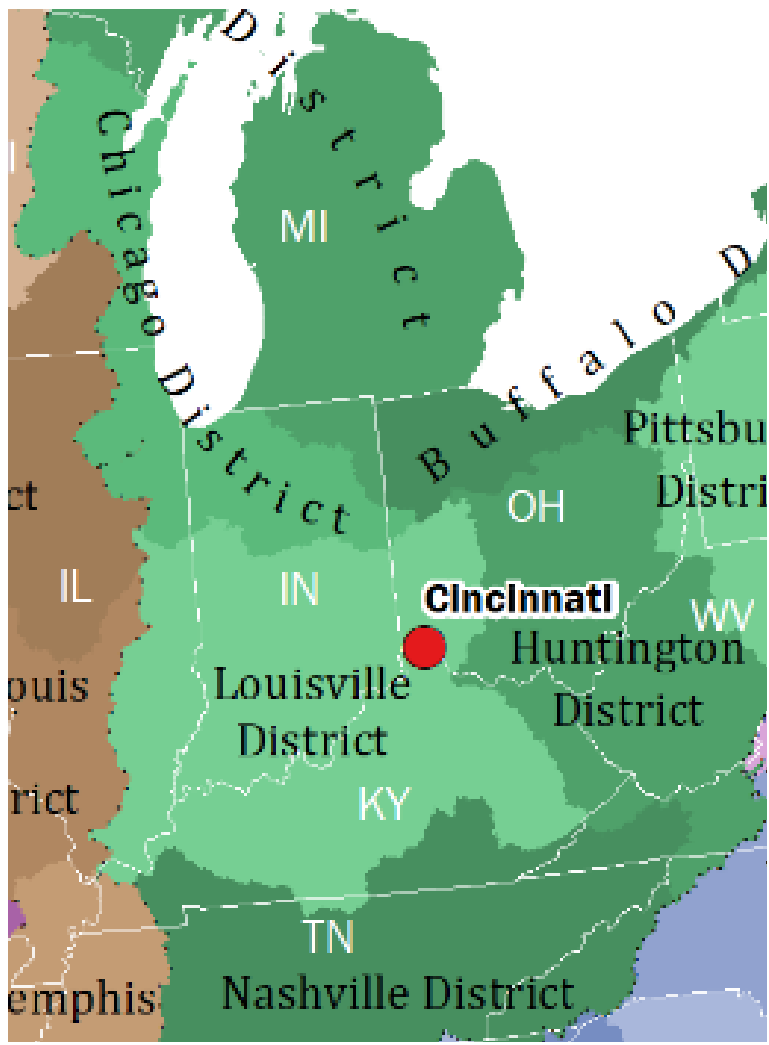
- USACE District Boundaries
- St. Joseph River
- South Bend PAS Flood Study
- Planning Assistance to States (PAS)
- Floodplain Management Services (FPMS)
- Section 205 Flood Damage Reduction
- High Water Mark Assistance



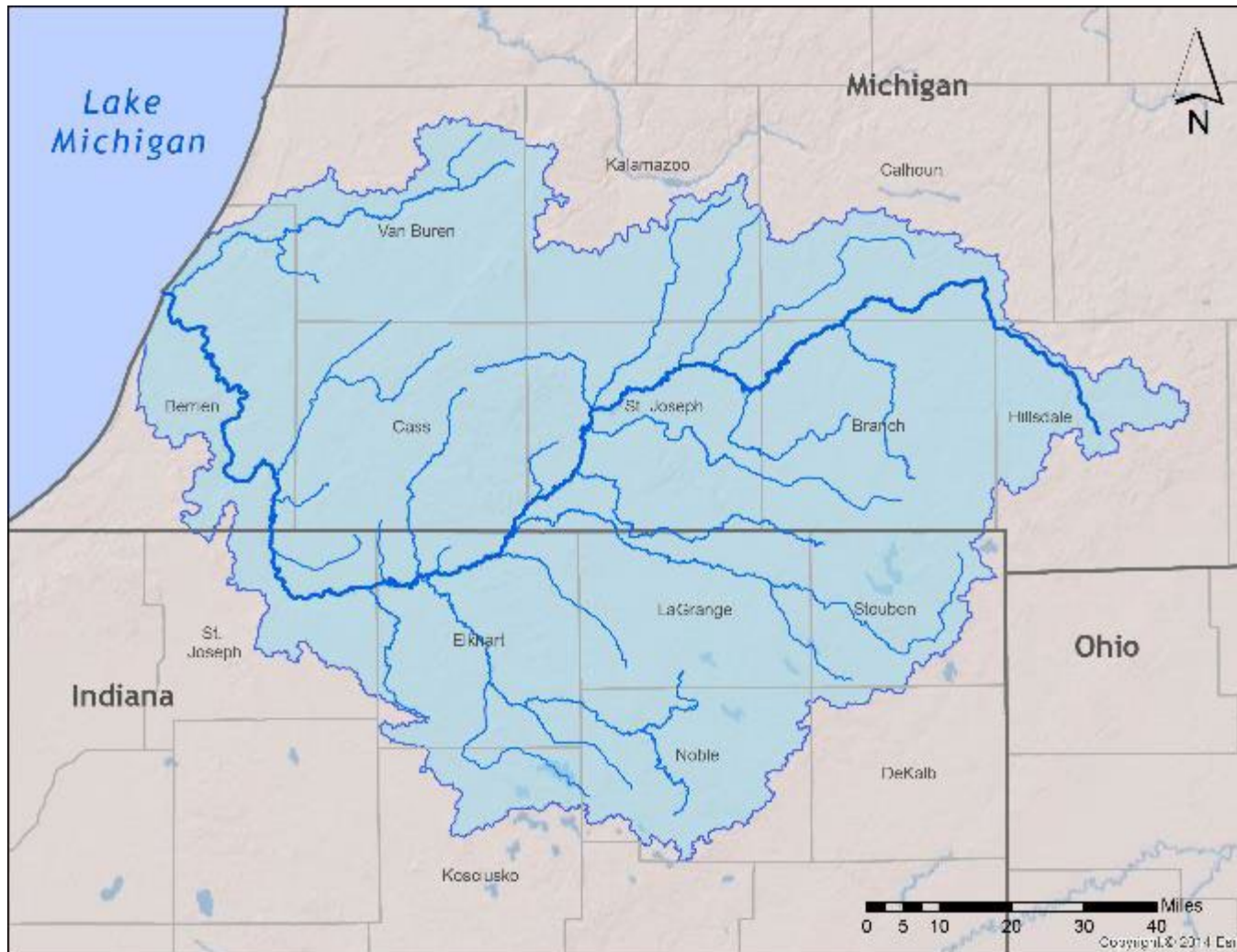
US Army Corps
of Engineers[®]



USACE DISTRICT CIVIL WORKS BOUNDARIES



ST. JOSEPH RIVER WATERSHED



- 206 Miles Long
- 3,742 River Miles
- Drains 4,685 Square Miles
- 3,619 Square Miles at South Bend
- 15 Counties

Source: St Joseph River Basin Commission



US Army Corps
of Engineers®



SOUTH BEND PAS FLOOD STUDY OVERVIEW



- The Saint St. Joseph River, located in Northern Indiana, has experienced stresses related to development, increased precipitation and concentration of runoff.
- Top 25 historic crests of the St. Joseph River in the City of South Bend, IN, all occurring since 1980.
- Most recently, a period of extended above normal precipitation resulted in a flood of record on the St. Joseph River in South Bend in February of 2018.
- In the wake of the recent flooding, the City requested that the Detroit District prepare H&H analyses and models to analyze approximately eight miles of the St. Joseph River for the purpose of creating a Flood Inundation Mapping Library.
- The H&H analyses and models were completed in early 2022. These analyses and models are currently being incorporated by the USGS in their Flood Inundation Mapper (FIM) system and website.
- The study will allow the City of South Bend to predict flooding extents within the modeled area, based on forecasted stages provided by the National Weather Service during various flood stages in real-time.

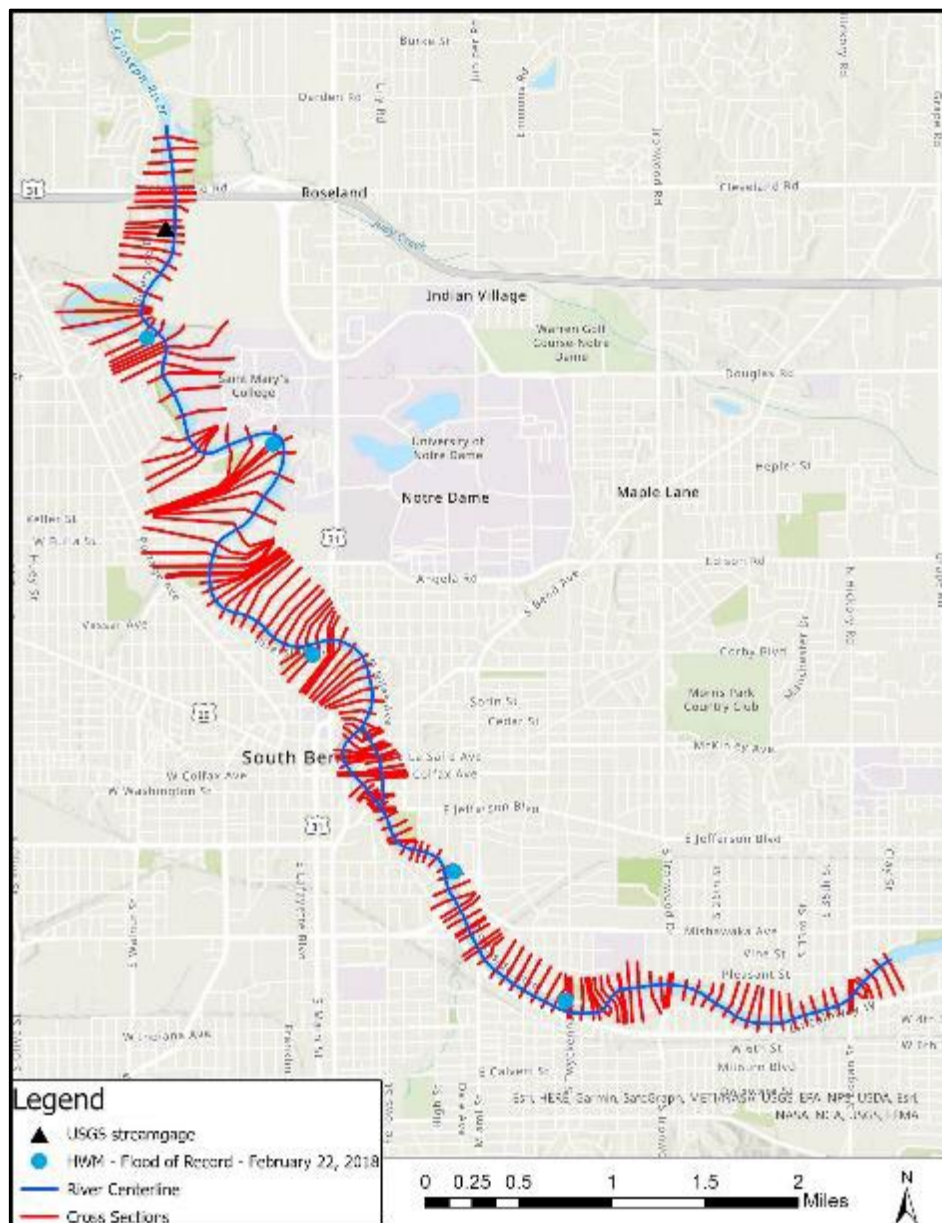


US Army Corps
of Engineers[®]



U.S. ARMY[®]

SOUTH BEND PAS FLOOD STUDY EXTENTS



- 8.7-mile reach of the Saint Joseph River
- 0.3 of a mile upstream of N. Logan St Bridge (approximately 8.1 river miles upstream of USGS St. Joseph River at South Bend streamgage (04101225))
- 0.3 of a mile downstream of the Cleveland Rd Bridge near I-90 (approximately 0.6 of a river mile downstream of the gage).
- 180 cross sections – approx. 670' spacing

SOUTH BEND PAS FLOOD STUDY SURVEYING

- Observed high-water mark (HWM) data from the February 2018 flood of record was used for model calibration, along with the stage-discharge data from the St. Joseph River at South Bend gage.
- Previous model IDNR using the HEC-RAS (FEMA, 2015). Current flood inundation and for the bridge low steel for: Angela, Michigan, Twyckenham, Ironwood, and N. Logan Bridges.
- USACE collected survey for a pedestrian railroad crossing, a pedestrian bridge, Sample St. Bridge and the IUSB Bridge. As-built data was available for the remaining bridges and weirs.
- 2017 Light Detection and Ranging (LiDAR) data collected and resampled into a two-and-a-half-foot grid by the USGS was used for all overbank data and for mapping.
- Hydrosurvey was collected in 2019 by the USGS. The hydrosurvey for the channel was merged into the LiDAR overbank to create a single terrain.



US Army Corps
of Engineers[®]



SOUTH BEND PAS FLOOD STUDY STREAM GAGES

- Continuous records of streamflow were collected at streamgage 04101225, St. Joseph River at South Bend, IN, from 2019 to present (2022). A staff gage was previously located there, and manual readings were recorded prior to the install of the existing continuous gage.
- The highest known stage at the gage location was 12.7 ft on February 22, 2018, which was on the old staff gage. The discharge from this event was not recorded as the current gage was not operational yet.
- The current rating curve only extends to a stage of 10 ft, so the discharge associated for the flood of record was estimated from a basin area ratio method to adjust the peak flow recorded at the USGS gage on the St. Joseph River at Niles, MI.



US Army Corps
of Engineers[®]



SOUTH BEND PAS FLOOD STUDY HECRAS MODELING

- 1-D Steady Flow Hydraulic Model using the USACE Hydrologic Engineering Center's River Analysis System (HEC-RAS) modeling software (version 5.0.7)
- HEC-RAS RASMapper interface to create static maps at each of the flood stage intervals.
- This is a complex reach with sixteen bridges, two weirs, and one split flow reach that was simulated using a standard step backwater model.

| Stage (feet above gage datum) | Elevation (feet, NAVD 88) | Discharge (ft ³ /s) | National Weather Service Flood Categories |
|----------------------------------|------------------------------|-----------------------------------|--|
| 4.5 | 660.90 | 7,995 | Action Stage |
| 5.5 | 661.90 | 9,861 | Minor Flood Stage |
| 6 | 662.40 | 10,930 | |
| 7 | 663.40 | 13,244 | |
| 8 | 664.40 | 15,721 | Moderate Flood Stage |
| 9 | 665.40 | 18,342 | Major Flood Stage |
| 10 | 666.40 | 21,114 | |



US Army Corps
of Engineers[®]



SOUTH BEND PAS FLOOD STUDY HECRAS MODELING

| River Station (feet) | Location Description | Structure type | Presence of road overflow | Solution type |
|----------------------|------------------------------------|----------------|---------------------------|---|
| 44,349 | N. Logan St | Bridge | No | Momentum |
| 39,170 | S. Ironwood Dr. | Bridge | No | Momentum |
| 37,784 | Pedestrian Bridge (IUSB Bike Path) | Bridge | No | Momentum (4.5' - 8' stage) Energy (9'-10' stage) |
| 36,040 | S.Twyckenham Dr. | Bridge | No | Momentum |
| 32,799 | Railroad Tracks | Bridge | No | Momentum |
| 32,180 | E. Sample St | Bridge | No | Momentum |
| 31,581 | S. Eddy St | Bridge | No | Momentum |
| 28,743 | Pedestrian Bridge | Bridge | No | Momentum |
| 27,710 | E Jefferson Blvd | Bridge | No | Energy |
| 26,862 | East Race Headworks | Inline Weir | No | Gate Flow |
| 27,175.5 | South Bend Dam | Inline Weir | Yes | Weir |
| 26,421 | W. Colfax Ave | Bridge | No | Energy |
| 25,853 | W. LaSalle Ave | Bridge | No | Momentum |
| 21,618 | N. Michigan Ave | Bridge | No | Momentum (4.5' - 8' stage) Energy (9'-10' stage) |
| 17,128 | W Angela Blvd | Bridge | No | Momentum |
| 16,910 | Railroad Tracks | Bridge | No | Momentum |
| 2,033 | Indiana Toll Road (I-90) | Bridge | No | Momentum (4.5' - 8' stage) Energy (9'-10' stage) |
| 1,827 | Cleveland Road | Bridge | No | Momentum |



US Army Corps
of Engineers[®]



SOUTH BEND PAS FLOOD STUDY PROFILE VERIFICATION (OR CALIBRATION)

| Stage (feet) | Rating Curve Elevation (feet, NAVD 88) | Computed Elevation (feet, NAVD 88) | Difference (feet) |
|-------------------------|---|---|------------------------------|
| 4.5 | 660.90 | 661.20 | 0.30 |
| 5.5 | 661.90 | 662.10 | 0.20 |
| 6 | 662.40 | 662.58 | 0.18 |
| 7 | 663.40 | 663.55 | 0.15 |
| 8 | 664.40 | 664.49 | 0.09 |
| 9 | 665.40 | 665.40 | 0.00 |
| 10 | 666.40 | 666.30 | -0.10 |



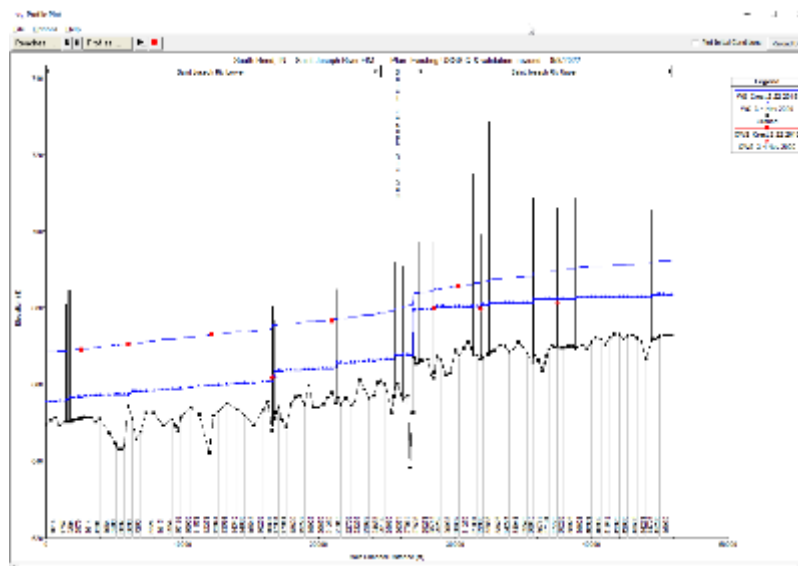
US Army Corps
of Engineers[®]



SOUTH BEND PAS FLOOD STUDY HIGH WATER MARKS (HWMs)

- HWMs were collected by USACE for the February 22, 2018 flood of record. The computed water-surface profiles for the flood of record profile are within 0.3 ft of the HWMs

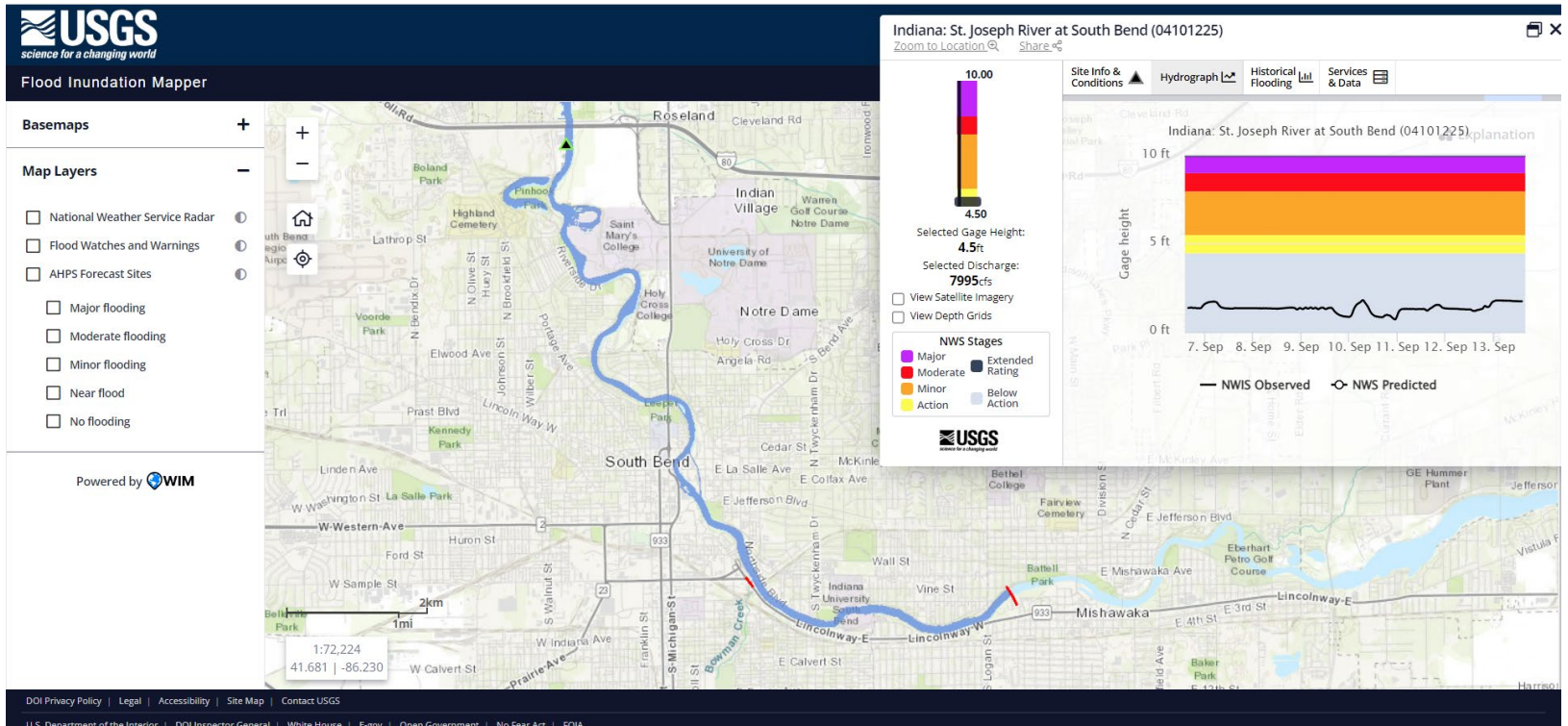
| Model River Station | Observed HWM water-surface elevation (feet, NAVD 88) | Computed water-surface elevation (feet, NAVD 88) | Difference (feet) |
|---------------------|--|--|-------------------|
| 30602 | 685.60 | 685.47 | -0.13 |
| 21259 | 676.50 | 676.94 | 0.44 |
| 12603 | 672.90 | 673.00 | 0.10 |
| 6340 | 670.40 | 670.63 | 0.23 |
| 2879 | 669.10 | 669.04 | -0.06 |



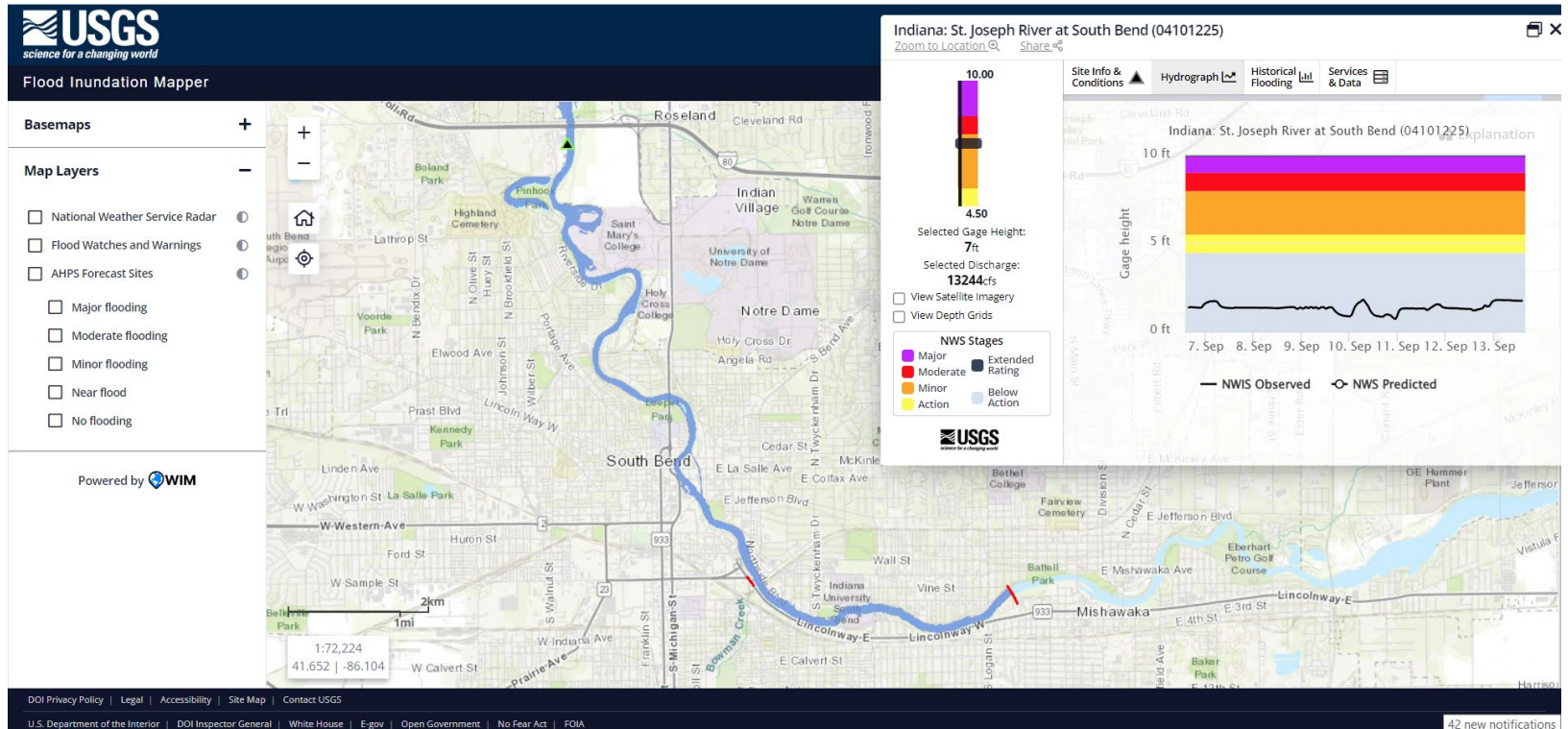
US Army Corps of Engineers®



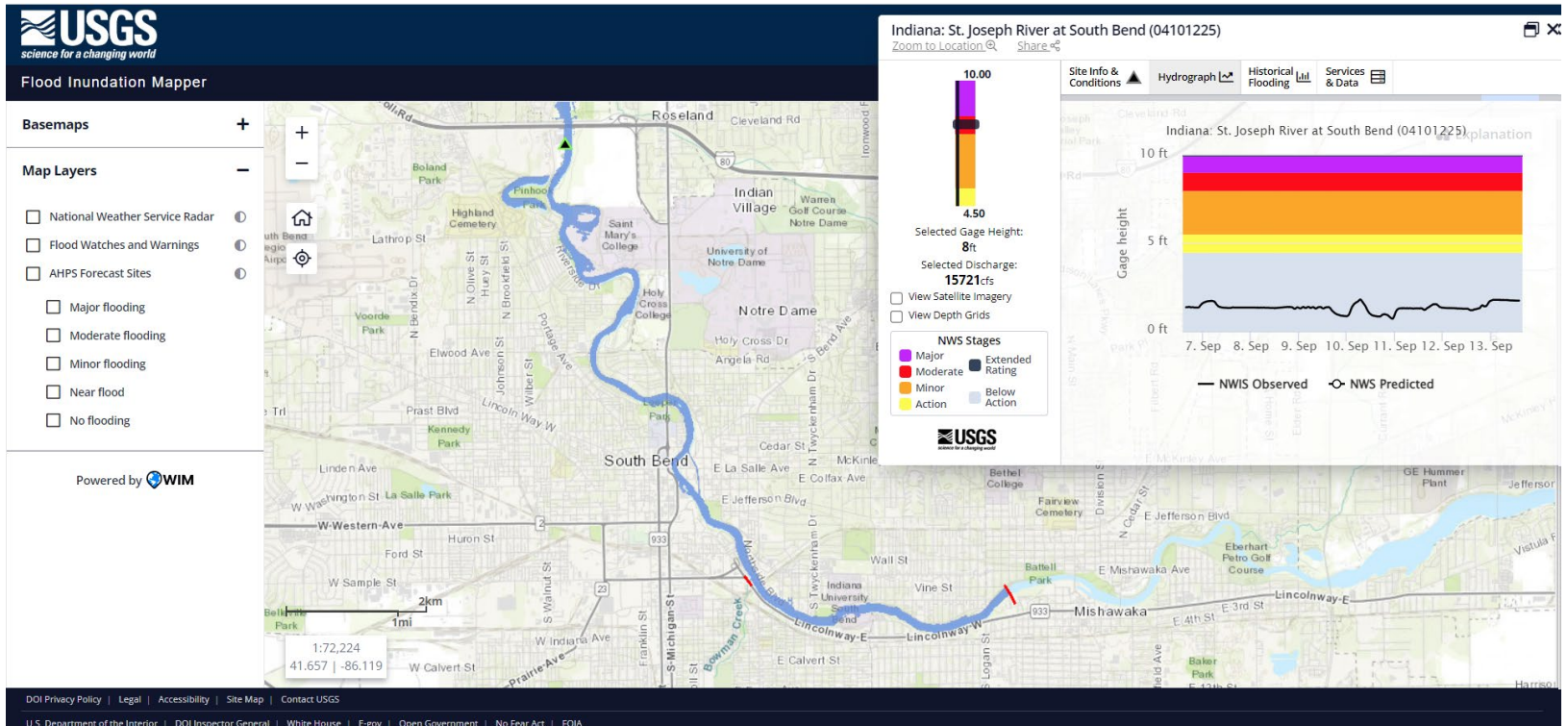
SOUTH BEND PAS FLOOD STUDY FLOOD INUNDATION MAPPER 4.5' STAGE (ACTION)



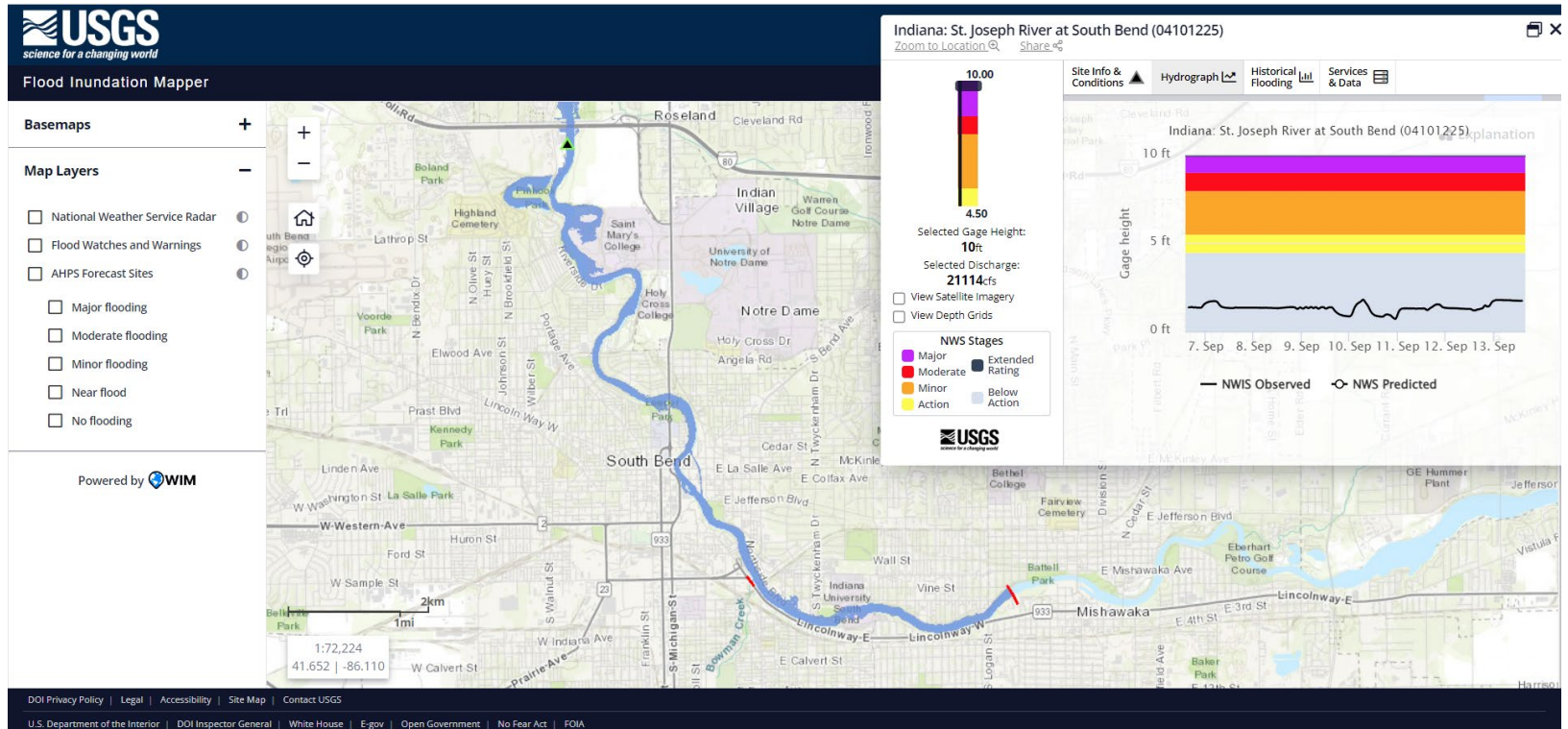
SOUTH BEND PAS FLOOD STUDY FLOOD INUNDATION MAPPER 7' STAGE (MINOR)



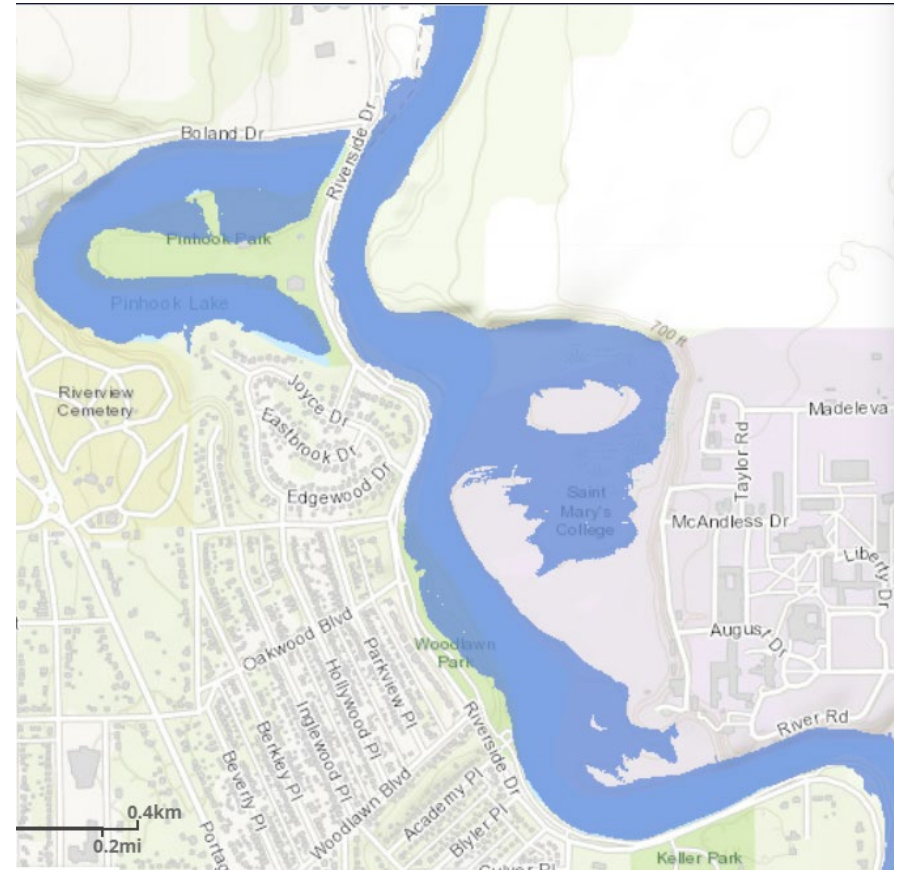
SOUTH BEND PAS FLOOD STUDY FLOOD INUNDATION MAPPER 8' STAGE (MODERATE)



SOUTH BEND PAS FLOOD STUDY FLOOD INUNDATION MAPPER 10' STAGE (MAJOR)



SOUTH BEND PAS FLOOD STUDY FLOOD INUNDATION MAPPER 4.5' STAGE VERSUS 10' STAGE



PLANNING ASSISTANCE TO STATES (PAS)

Purpose:

Support States, Tribes, Communities, Non-Profits in Planning to develop, utilize and conserve water and related land resources.

Cost:

50% Federal

50% Non-federal (Cash, Work in Kind)

Tribal Waiver for up to \$530,000 (100% Federal)

Can involve analysis for stormwater, floodplain, data collection, environmental, GIS, and community planning



US Army Corps
of Engineers[®]



PLANNING ASSISTANCE TO STATES (PAS)

Examples:

- Floodplain Delineation
- GIS and Photogrammetric Mapping Products
- Coastal Zone Management/Protection Studies
- Harbor/Port Studies
- Surveys (Topographic/Bathymetric)
- Flood Risk Reduction Studies
- Water Quality Studies
- Watershed Studies
- Dam Break Analysis
- Other Data Collection and Analysis



US Army Corps
of Engineers[®]



FLOODPLAIN MANAGEMENT SERVICES (FPMS) PROGRAM

Purpose:

To provide a full range of technical services and planning guidance needed to support effective flood plain management and flood risk reduction measures.

Partners:

State, regional, local governments, Indian tribes & other non-federal public agencies

100% Federally Funded

- Competitive
- Limited Funding



US Army Corps
of Engineers[®]



FLOODPLAIN MANAGEMENT SERVICES (FPMS) PROGRAM

Examples:

- Floodplain Modeling & Mapping
 - HEC-HMS, HEC-RAS & GIS
- Flood Risk Reduction
- Technical Courses Taught by USACE Staff
- Flood Warning/Preparedness
 - Collaboration with USGS (Surveys, Stream Gages, Modeling)
 - Lansing Flood Inundation Mapper (FIM)
 - Lansing Flood Barrier Analysis
 - Muskegon River Ice Jam Study
 - Huron River flood warning system, FIM, non-structural study
 - North Branch Elkhart River flood warning tool



US Army Corps
of Engineers[®]



PAST FPMS CLASSES & WORKSHOPS

- HEC-RAS Sediment Transport
- Basic HEC-RAS
- Advanced HEC-RAS
- Unsteady HEC-RAS
- Non-Structural Flood Proofing Workshop

- All classes are funded by FPMS after a request from the State

- Is there any need you see within the State for Technical Courses currently for stormwater and floodplain related issues



US Army Corps
of Engineers[®]



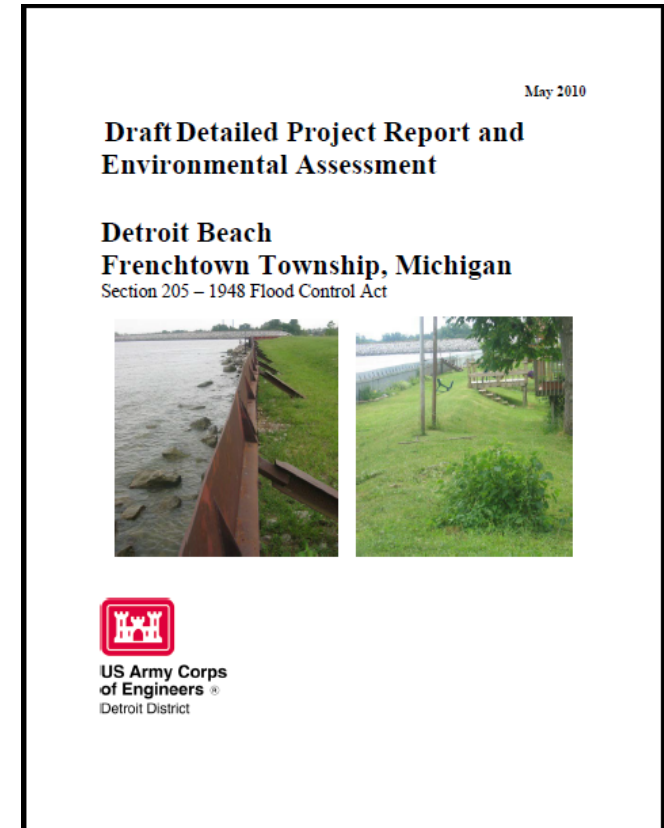
SECTION 205 – SMALL FLOOD DAMAGE REDUCTION PROJECTS

- The U.S. Army Corps of Engineers (Corps) can partner with a non-federal sponsor (sponsor) to plan and construct small flood damage reduction projects that have not previously been specifically authorized by Congress and are not part of a larger project
- Projects may be structural (i.e., levees, flood walls, diversion channels, pumping plants and bridge modifications) or non-structural (i.e., floodproofing, relocation of structures and flood warning systems)
- Authority is provided by Section 205 of the Flood Control Act of 1948 (P.L. 80-858), as amended, also referred to as Section 205 under the Continuing Authorities Program.



SECTION 205 – SMALL FLOOD DAMAGE REDUCTION PROJECTS

- Initial \$100,000 for feasibility study is 100% federal, then 50/50 cost share
- Construction costs are shared 65% federal and 35% sponsor
- Sponsor must provide all lands, easements, rights-of-way, relocations, and disposal areas (LERRDs)
- Sponsor's cost share includes credit for LERRDs and pre-approved work-in-kind
- At least 5 percent of the cost share requirement must be provided in cash.
- Sponsor is responsible for all O&M after construction
- Maximum federal contribution is \$10,000,000



FLOOD CONTROL AND COASTAL EMERGENCY ACT

- The Army Corps of Engineers is authorized by PL 84-99 to provide flood emergency assistance under 3 categories:
 - Emergency Operations: Pre and post flood fight assistance
 - Rehabilitation of eligible damaged flood damage reduction projects
 - USACE assistance is intended to be supplemental and not a replacement for local interests' self-help
 - Requires a request from the state
 - Maximum use of local resources must be made before assistance from USACE can be provided
 - Assistance cannot be provided to individuals or businesses
- Assistance is made available through requests submitted to the State of Michigan Emergency Management
- USACE EOC Contact: [\(313\) 226-1323](tel:3132261323) or by email at: CELRE-EOC@usace.army.mil



HIGH WATER MARK ASSISTANCE FROM USACE

- Must be a record setting flood event
- County/Community requests USACE to conduct HWM through the State
- USACE will assemble all collected data and distribute to the state, county, others
- USACE HWM's are provided at no cost

Emergency Operations Center

(313) 226-1323

CELRE-EOC@usace.army.mil



US Army Corps
of Engineers[®]



U.S. ARMY[®]

POINTS OF CONTACT



PAS Program Manager
Greg Mausolf

Gregory.M.Mausolf@usace.army.mil
(313) 226-3389

FPMS Program Manager
Garrett Ray

Garrett.D.Ray@usace.army.mil
(313) 226-3393

Outreach Coordinator
Jim Luke

James.D.Luke@usace.army.mil
(313) 226-3387



US Army Corps
of Engineers®

