ILLINOIS STATE WATER SURVEY
PRAIRIE RESEARCH INSTITUTE

DNR
Indiana Department of Natural Resources

The Polis Center
INDIANA UNIVERSITY-PURDUE UNIVERSITY INDIANAPOLIS

Discovery Report

Middle Wabash-Busseron Watershed, HUC 05120111

Illinois Counties-Clark, Crawford, Edgar, Lawrence, Vermilion
Indiana Counties- Clay, Greene, Knox, Parke, Sullivan, Vermillion, Vigo

Report Number 01
12/31/2011

FEMA

Project Area Community List

Illinois Communities
Clark County
City of Marshall
Crawford County
Village of Hutsonville
Village of Palestine
City of Robinson
Edgar County
City of Chrisman
Village of Metcalf
City of Paris
Lawrence County
Vermilion County
Village of Ridge Farm

Indiana Communities
Clay County
City of Brazil
Town of Staunton
Greene County
City of Jasonville
Knox County
Town of Bruceville
Town of Oaktown
City of Vincennes
Parke County
Town of Rosedale
Sullivan County
Town of Carlisle
Town of Dugger
Town of Hymera
Town of Merom
Town of Shelburn
City of Sullivan
Vermillion County
City of Clinton
Town of Dana
Town of Universal
Vigo County
Town of Riley
Town of Seeleyville
City of Terre Haute
Town of West Terre Haute

Table of Contents

I. General Information 1
II. Watershed Stakeholder Coordination 4
III. Data Analysis 6
i. Data that can be used for Flood Risk Products 7
ii. Other Data and Information 11
IV. Risk MAP Needs and Recommendations 21
i. Floodplain Studies 21
ii. Mitigation Projects 26
V. Appendices 28

List of Figures

Figure 1. Middle Wabash-Busseron Watershed Discovery Map 2
Figure 2. Discovery Meeting Photos 5
Figure 3. Illinois LiDAR Status 9
Figure 4. Indiana LiDAR Status 10
Figure 5. CNMS Rankings in Geodatabase 17
Figure 6. Middle Wabash-Busseron Watershed Land Use Map 18

List of Tables

Table 1. NFIP Participation Status 3
Table 2. Data Collection for Middle Wabash-Busseron Watershed 6
Table 3. USGS Stream Gages 11
Table 4. MHMPs: Status and Availability 12
Table 5. Essential Facilities in 1-Percent-Annual Chance Floodplain 13
Table 6. High Hazard Dams in Watershed 13
Table 7. Illinois Scoring Matrix 15
Table 8. Indiana Scoring Matrix 16
Table 9. Recent CAV/CACs 20
Table 10. Map Modernization Activity 21
Table 11: Illinois Mapping Needs 22
Table 12. Indiana Mapping Needs 24
Table 13. Mitigation Projects 26

List of Appendices

Appendix A: Summary of Communities
Appendix B: Discovery Meeting Materials
Appendix C: Community Fact Sheets
Appendix D: Discovery Map
Appendix E: Comprehensive List of Mapping Needs

I. General Information

The Wabash River flows 505 miles from west-central Ohio through Indiana and Illinois until it merges with the Ohio River in southern Illinois[1]. The lower reach of the Wabash Rivers serves as the boundary between Illinois and Indiana from its confluence with the Ohio River to approximately 200 miles upstream. The Middle Wabash-Busseron watershed encompasses approximately 1,292,892 acres with 46% located in Illinois and 54% in Indiana[2]. The watershed begins approximately 15 miles north of Terre Haute, near the Vermillion-Parke-Vigo County line. From here, the Wabash River flows to the southwest, forming the boundary between Indiana and Illinois just southwest of Terre Haute. Busseron Creek is located primarily in Sullivan County, Indiana and flows to the southwest for approximately 30 miles before discharging into the Wabash River west of Carlisle. The Middle Wabash-Busseron watershed ends just south of Vincennes, where it becomes the Lower Wabash watershed[3].

In 2011, the Illinois State Water Survey (ISWS) and Indiana Department of Natural Resources (IDNR) partnered with The Polis Center of Indiana University Purdue University-Indianapolis (IUPUI) to complete the Risk MAP Discovery process in the Middle Wabash-Busseron watershed. The process included data collection and analysis, community/stakeholder meetings and feedback, and development of recommended projects as outlined in this report.

[1] Skibsted, R. (2011). *Wabash River Strategic Plan.* National Great Rivers Research and Education Center.

[2] Middle Wabash-Busseron Watershed (2004). United States Department of Agriculture, Natural Resources Conservation Service, Illinois Conservation Security Program.

[3] Watershed Restoration Action Strategy for the Middle Wabash - Busseron Watershed, Indiana Department of Environmental Management Office of Water Quality Watershed Management Section, Prepared by Wittman Hydro Planning Associates, Inc., February 1999

Figure 1. Middle Wabash-Busseron Watershed Discovery Map

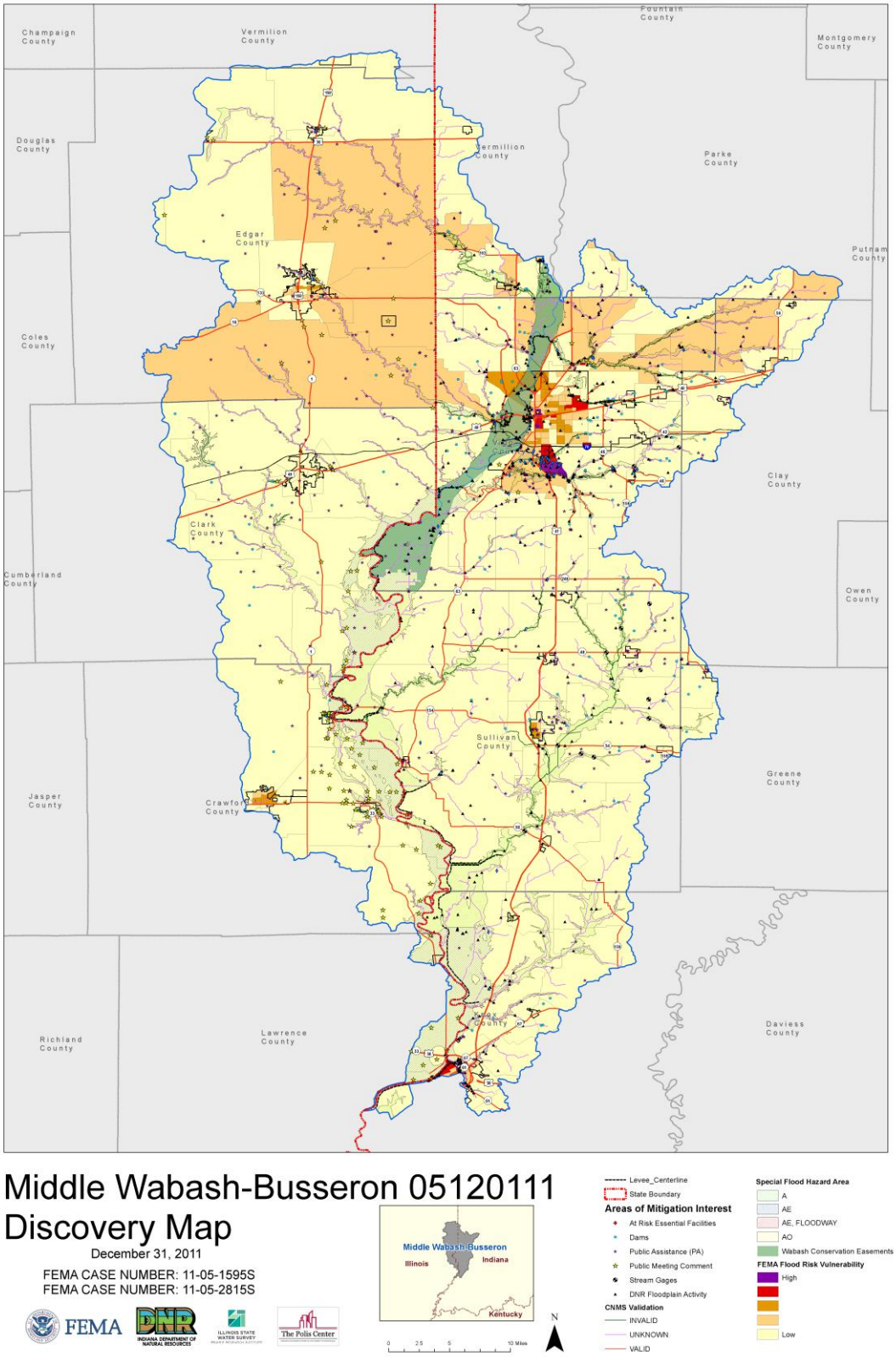


Table 1. NFIP Participation Status

Illinois		
County	**Community**	**Participating?**
Clark	Clark County	Yes
	Marshall	Yes
Crawford	Crawford County	Yes
	Hutsonville	Yes
	Palestine	Yes
	Robinson	Yes
Edgar	Edgar County	Yes
	Chrisman	Yes
	Paris	Yes
	Metcalf	Yes
Lawrence	Lawrence County	No
Vermilion	Vermilion County	Yes
	Ridge Farm	No

Indiana		
County	**Community**	**Participating?**
Clay	Clay County	Yes
	Brazil	Yes
	Staunton	No
Greene	Greene County	Yes
	Jasonville	No
Knox	Knox County	Yes
	Bruceville	No
	Oaktown	No
	Vincennes	Yes
Parke	Parke County	Yes
	Rosedale	No
Sullivan	Sullivan County	Yes
	Carlisle	No
	Dugger	No
	Hymera	No
	Merom	No
	Shelburn	No
	Sullivan	No
Vermillion	Vermillion County	Yes
	Clinton	Yes
	Dana	Yes
	Universal	No
Vigo	Vigo County	Yes
	Riley	No
	Seelyville	No
	Terre Haute	Yes
	West Terre Haute	No

II. Watershed Stakeholder Coordination

The Discovery phase included an investigation of existing terrain, flood hazard data, and flood risk data; broad data mining for development of an initial Discovery map, and detailed data collection to refine the Discovery map. ISWS and IDNR led the stakeholder coordination in Illinois and Indiana respectively. The Polis Center prepared the Discovery map. Approximately four weeks prior to the meetings, ISWS and IDNR mailed letters to all invited stakeholders providing a background of the Risk MAP program and an invitation to attend a Discovery meeting. A copy of the letter and list of stakeholder recipients is included as Appendix B.

The project team coordinated six Discovery meetings. Because the project team (ISWS, IDNR, and Polis) partnered on both the Lower Wabash and Middle Wabash-Busseron Discovery projects, the meetings were combined, and three were held in each watershed respectively. The meeting locations included the following:

Lower Wabash locations:

- Mt. Carmel, Illinois (Wabash County)
- Vincennes, Indiana (Knox County)
- New Harmony, Indiana (Posey County)

Middle Wabash-Busseron locations:

- Terre Haute, Indiana (Vigo County)
- Robinson, Illinois (Crawford County)
- Paris, Illinois (Edgar County)

Each meeting was approximately two hours in length and consisted of an introductory PowerPoint presentation followed by a break-out session in which stakeholders could review the Discovery map, ask questions, and provide comments and revisions.

The PowerPoint presentation included an agenda, overview of Risk MAP and the NFIP, and discussion of the datasets presented on the Discovery map. Meeting materials are available in Appendix B.

For the break-out session, Discovery maps were available for review at approximately 6-8 stations, and each station was staffed by ISWS, IDNR, and/or Polis personnel. After reviewing the maps and clarifying any questions, stakeholders completed comment forms that included their contact information and recommended revision or general feedback. Comment forms are included in Appendix B. The following photographs from one of the Discovery meetings illustrate the break-out session format.

Figure 2. Discovery Meeting Photos

III. Data Analysis

The Polis Center met with Indiana DNR, ISWS, and Indiana Department of Homeland Security (IDHS) to determine which types of flood risk data the state agencies could share. Polis has a non-disclosure agreement with IDHS regarding sensitive data, e.g. repetitive loss and insurance claims data, stating that Polis may use the data to accurately depict risk yet retain the privacy of the policy holders and homeowners. A list of the data collected, the deliverable or product in which the data are included, the source of the data, and any pertinent comments is recorded in Table 2. Following Table 2, the data is categorized by data that can be used for flood risk products and additional data that benefited the project.

Table 2. Data Collection for Middle Wabash-Busseron Watershed

Data Layer	Description	IL Source	IN Source	Deliverable/ Product
2010 Annualized loss	National Hazus study results for flood loss by census block	FEMA Region 5, STARR Team	FEMA Region 5, STARR Team	Geodatabase
At Risk Essential Facilities	Essential facilities located in FEMA SFHAs	Southern Illinois University	The Polis Center	Discovery Map; Geodatabase
Community Boundaries	Location of community boundaries	U.S. Census Places 2010	Indiana Department of Transportation, 2007; FEMA DFIRMs	Discovery Map; Geodatabase
Composite Risk Analysis	National Flood Risk Analysis HUC Risk Data	FEMA Region V	FEMA Region V	Discovery Map; Geodatabase
County Boundaries	Location of county boundaries	USGS Topographic Maps	Indiana Geological Survey	Discovery Map; Geodatabase
Dams	Location of dams	US Army Corps of Engineers - National Inventory of Dams	Indiana Department of Natural Resources	Discovery Map; Geodatabase
Flood Hazard Areas	Location of FEMA flood hazard areas	FEMA Flood Insurance Rate Maps	FEMA FIRMs, interim digital FIRMs produced by IDNR	Discovery Map; Geodatabase
Floodplain Activity Data	Locations of DNR permit applications	N/A	Indiana Department of Natural Resources	Discovery Map; Geodatabase
Ice Jams	Location of ice jams	US Army Corps of Engineers - Ice Jam Database	N/A	Discovery Map; Geodatabase
Letters of Map Change	Locations of letters of map change	FEMA Mapping Information Platform Database	FEMA Mapping Information Platform Database	Discovery Map; Geodatabase
Levees	Location of levees considered for accreditation status by FEMA	FEMA Midterm Levee Inventory	FEMA Midterm Levee Inventory	Discovery Map; Geodatabase
Level 2 Hazus annualized loss	Detailed building point analysis from Indiana mitigation planning	N/A	IndianaMap and Indiana Department of Local Government and Finance	Geodatabase

Data Layer	Description	IL Source	IN Source	Deliverable/ Product
Major Roads	Location of interstates and major highways	Illinois Department of Transportation, 2010	Indiana Department of Transportation, 2006	Discovery Map; Geodatabase
HUC 8 Watershed	Watershed Boundary	USGS National Hydrography Dataset	USGS National Hydrography Dataset	Discovery Map; Geodatabase
State Boundaries	Location of state boundaries	2010 Census	2010 Census	Discovery Map; Geodatabase
Stream Gages	Locations of stream gauges operated by multiple agencies	USGS	USGS	Discovery Map; Geodatabase
Wabash River Conservation Easements	Conservation Easements along the Wabash River in Indiana	N/A	Indiana Department of Natural Resources	Discovery Map; Geodatabase
Wetlands	Location and type of wetlands and deep water habitats	U.S. Fish and Wildlife Service National Wetlands Inventory	U.S. Fish and Wildlife Service National Wetlands Inventory	Geodatabase
Hazus General Building Stock (GBS) Data	GBS data used in Hazus- based on modified Census block layout; data derived from this data set is in S_Cen_Blk_Ar	FEMA	FEMA	Geodatabase
2010 Census Blocks	2010 Census Data used for demographics	U.S. Census Bureau	U.S. Census Bureau	Geodatabase
EPA 303d Streams	Streams included in the EPA 303(d) list of impaired streams	US EPA Office of Water	US EPA Office of Water	Geodatabase
Wells in 1% Flood Zone	Wells and borings located within 100-yr or 1% flood zone	ISGS	N/A	Geodatabase
Public Assistance (PA)	Locations of PA disbursements	FEMA Region 5	FEMA Region 5	Discovery Map; Geodatabase

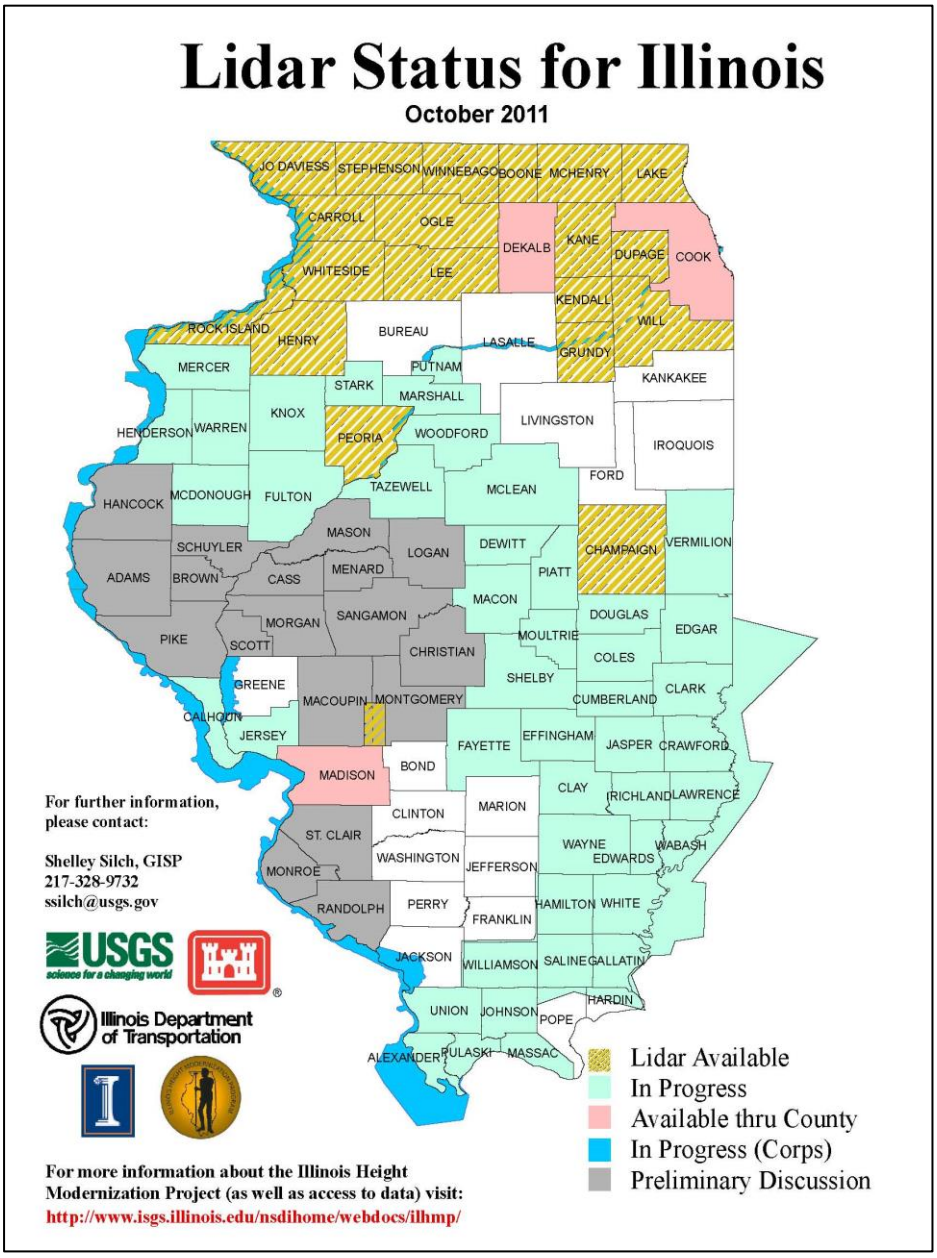
i. Data that can be used for Flood Risk Products

Topographic and Imagery Data

As part of the Illinois Height Modernization effort, the Illinois Department of Transportation (IDOT) is leading LiDAR data acquisition for Illinois counties scheduled by IDOT district. The counties in the Middle Wabash-Busseron watershed are within Districts 5 and 7. IDOT District 7 includes Clark, Crawford, and Lawrence counties within the study area. LiDAR has been collected for District 7 and processing of the data is underway. There is no known priority list, but data for counties in District 7 will be available as completed. LiDAR projects in IDOT District 5, which includes Edgar County, are slated to begin in late 2012 or early 2013.

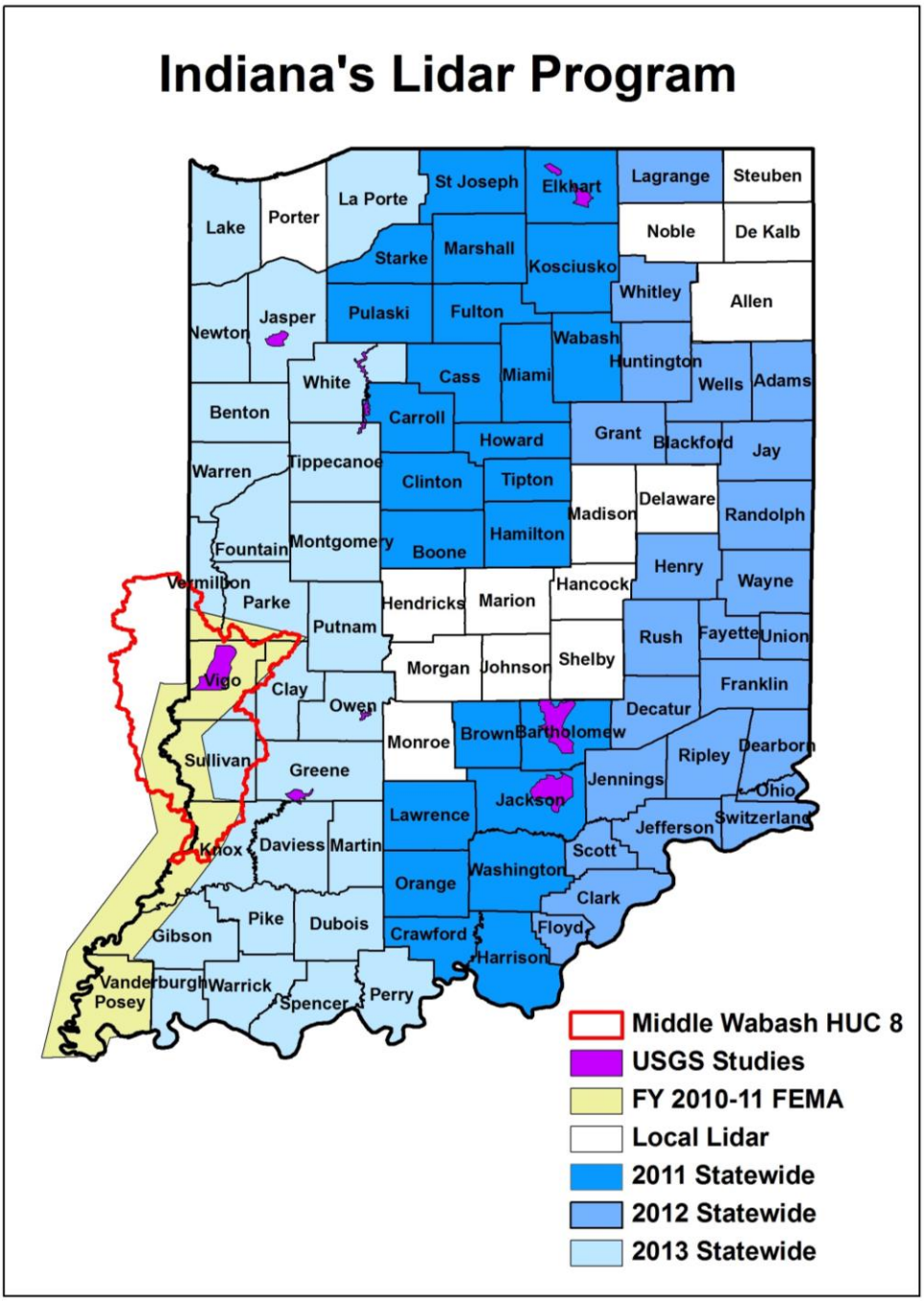
FEMA has funded LiDAR acquisition for the Wabash River corridor in conjunction with this Discovery project. The raw data point cloud was obtained in 2011, and the data is currently being reviewed and processed; it is anticipated to be available for use in 2012.

Figure 3. Illinois LiDAR Status



Imagery at 1' pixel resolution (4-band imagery) and USGS-compliant LiDAR data for the state of Indiana will be completed by 2013. Currently LiDAR elevation data and digital orthophotography is available for counties located in the central tier of the state.

Figure 4. Indiana LiDAR Status



USGS Gages

The project team identified USGS stream gages in the watershed. The locations of the gages are shown on the Discovery map and listed in Table 3.

Table 3. USGS Stream Gages

Gage Number	Station Name and Location	Years of Record (Peaks)
03341420	Brouillettes Creek NR Universal, IN	5
03341500	Wabash River at Terre Haute, IN	120
03341700	Big Creek Tributary Near Dudley, IL	15
03341900	Raccoon Creek Tributary Near Annapolis, IL	25
03342000	Wabash River at Riverton, IN	75
03342100	Busseron Creek Near Hymera, IN	37
03342150	West Fork Busseron Creek Near Hymera, IN	20
03342180	Kettle Creek Tributary NR Shelburn, IN	10
03342244	Mud CR NR Cass IN	10
03342250	Mud CR NR Dugger IN	15
03342300	Busseron CR NR Sullivan, IN	20
03342350	Buttermilk Creek Near Paxton, IN	7
03342500	Busseron Creek Near Carlisle, IN	64
03343000	Wabash River at Vincennes, IN	82
03343010	Wabash River at Memorial Bridge at Vincennes, IN	1

Average Annualized Loss (AAL) Data

In 2010, FEMA completed a Hazus flood analysis to determine average annualized losses for the entire United States. The analysis was based on USGS 30-meter DEM and Hazus default inventory data. The purpose of the study was to identify relevant riverine and coastal flood risk across the U.S. To determine annualized risk, the study analyzed the 10-year (10%), 50-year (2%), 100-year (1%), 200-year (.5%), and 500-year (.2%) Hazus flood losses. This data is included in the flood risk database for Indiana and Illinois.

Additionally, The Polis Center, as part of the local Multi-Hazard Mitigation Plan risk assessment process, used approximate building locations derived from GIS parcel maps and E911 address points with Indiana Department of Local Government and Finance (IDLGF) building information, including building replacement costs, to refine the analysis for Indiana. The individual structure losses were calculated using Hazus flood depth damage curves and the results aggregated by census block. Both data sets are included in the flood risk database. The detailed building point, Level 2 analysis for Indiana will be used for subsequent analyses.

ii. Other Data and Information

Recent Flooding in the Watershed

Recent flooding in the watershed has significantly impacted the communities within. The 2008 floods in particular resulted in millions of dollars in damage to urban infrastructure and

agricultural areas. More recent flooding, in 2011, also caused significant damage, but final cost estimates have not yet been determined[4].

Mitigation Plans/Status, Mitigation Projects

Multi-Hazard Mitigation Plans (MHMPs) are prepared for unincorporated and incorporated communities within Indiana and Illinois counties. The plans include comprehensive mitigation strategies intended to promote flood-resilient communities. The project team reviewed the mitigation strategies in available MHMPs to determine which, if any, were relevant for the Discovery process. Table 4 lists the MHMPs, their status, and their availability for review.

Table 4. MHMPs: Status and Availability

County	MHMP	Hazus	Issue Date	Expiration Date	Available for Review
Illinois					
Clark	Y	Y	2011	2016	Y
Crawford	Y	Y	2011	2016	Y
Edgar	N	N/A	N/A	N/A	N
Lawrence	N	N/A	N/A	N/A	N
Vermilion	N	N/A	N/A	N/A	N
Indiana					
Clay	Y	Y	2009	2014	Y
Greene	Y	Y	2009	2014	Y
Knox	Y	Y	2009	2014	Y
Parke	Y	Y	2010	2015	Y
Sullivan	Y	Y	2011	2016	Y
Vermillion	Y	Y	2010	2015	Y
Vigo	Y	Y	2008	2013	Y

Essential facilities are the facilities that can impact the delivery of vital services, cause greater damages to other sectors of a community, or put special populations at risk. They include schools, fire departments, police departments, emergency operations centers (EOC), and care facilities. The assessment of the flood risk posed to essential facilities within the watershed is an important aspect of the MHMPs. Essential facilities that are located within the 1-percent-annual-chance floodplain were quantified and identified as at-risk structures. The exact number of essential facilities that are considered at-risk is not always quantifiable due to the limited detail presented in the MHMPs. The number of essential facilities estimated to be within the 1-percent-annual chance floodplain was determined by overlaying the essential facilities points included in the MHMPs with the latest flood hazard data. However, the risk of flood damage is limited by the detail and accuracy of the most recent flood map. In Indiana, seven essential facilities within the watershed are considered at-risk and should be identified as an Area of Mitigation Interest. These facilities are included in the following table.

[4] Skibsted, R. (2011). *Wabash River Strategic Plan.* National Great Rivers Research and Education Center.

Table 5. Essential Facilities in 1-Percent-Annual Chance Floodplain

Name	Facility Type	Location
Terre Haute Montessori School	School	Terre Haute, IN (Vigo County)
Otter Creek Township Fire Department	Fire Department	Terre Haute, IN (Vigo County)
Honey Creek Township Fire Department	Fire Department	Terre Haute, IN (Vigo County)
Midwest Surgery Centers, Inc	Care Facility	Terre Haute, IN (Vigo County)
Harborside Health Care	Care Facility	Terre Haute, IN (Vigo County)
Wyndmoor Senior Living	Care Facility	Terre Haute, IN (Vigo County)
Bethesda Gardens	Care Facility	Terre Haute, IN (Vigo County)

None of the identified critical facilities located within the study region in Illinois fell within the 1-percent-annual chance floodplain.

Numerous locations of roads overtopping during flood events were identified during the data collection and Discovery Meeting process.

Numerous dams exist within the watershed, but only some are mentioned in the MHMPs as flood control structures. One dam located within the study region in Illinois is identified as a high hazard dam, where high hazard potential classification are those dams where failure or mis-operation has the highest risk to cause loss of human life and significant damage to buildings and infrastructure. In Indiana, nine high hazard dams are located within the watershed.

Table 6. High Hazard Dams in Watershed

Dam Name	County	Community
Lincoln Trail State Park Lake Dam	Clark	Clark County, IN
Hoosier Energy Reservoir Dam	Sullivan	Merom, IN
Busseron Dam No. L-1	Sullivan	Sullivan, IN
Wisbey Dam	Vigo	Seelyville, IN
Hulman Lake Dam	Vigo	Seelyville, IN
Llewellyn Lake Dam	Vigo	Seelyville, IN
Hulman Lodge Dam	Vigo	Seelyville, IN
Hawthorn Park Dam	Vigo	Seelyville, IN
St. Mary of the Woods (Lower)	Vigo	New Goshen, IN
Daisy Lake Dam	Vigo	New Goshen, IN

CNMS and NFIP Mapping Study Needs

ISWS and IDNR applied geospatial technologies to coordinate the management of mapping needs. CNMS contains data for stream reaches to support existing and proposed flood mapping activities. Update and analyses of the CNMS data for the Middle Wabash-Busseron watershed is complete. Analyzed studies have been identified in Illinois as "VALID," "UNKNOWN," and "UNVERIFIED." In Indiana, DNR uses different CNMS status terminology which includes "IN PROGRESS," "VALIDATED," "UNKNOWN," "UNMET NEED," and "REQUIRES ASSESSMENT."

Illinois Prioritization Methodology

To provide a basis for prioritizing mapping needs in the watershed, a methodology was determined to rank streams based on several criteria. There are a number of flooding issues in the Middle Wabash-Busseron watershed. The method used in Illinois to identify streams of concern was to perform a spatial analysis of the data to determine where there are combinations of potentially invalid or unverified engineering data, high risk, and community concerns. Three sources of information were used for this initial screening task. The Coordinated Needs Management Strategy (CNMS) Phase III data is a geospatial database of stream reaches attributed with an assessment of the engineering analyses as valid, unverified or unknown. The FEMA National Flood Risk Analysis HUC Risk Data spatial data were used to provide relative risk ranking. It is a Census Block Group GIS layer that contains aggregated flood claims data along with ten weighted parameters used to compute relative national risk (1 to 10 with 1 being highest risk) by Census Block Group. Study requests contained in CNMS as well as local mapping concerns collected at the Discovery meeting were used to identify areas of known flooding issues.

A subset of stream segments was created by combining those stream segments identified as having engineering analyses that may no longer be valid (CNMS unverified) and any stream segment where comments collected indicate that the SFHA mapping is inaccurate or inadequate. This subset of stream segments was then intersected with the HUC Risk Data and separated into two categories: high concern for those segments which flow through Census Block Groups with Risk Rankings between 1 and 5; medium concern for those segments which flow through Census Block Groups with Risk Rankings between 6 and 10. Stream segments outside the combined set were categorized as low concern. The entire list of study needs including stream names, floodplain zone, stream length, and category of concern are provided in Appendix E. Final ranking of CNMS scores are stored in the geodatabase as well as a GIS feature class derived from the CNMS named Streams of Concern.

Table 7. Illinois Scoring Matrix

Level of Concern	CNMS Status	Local Mapping Request	FEMA Risk Decile
High	Unverified	Yes/No	1-5
	Unknown	Yes	1-5
Medium	Unverified	Yes/No	6-10
	Unknown	Yes	6-10
	Valid	Yes	1-10
Low	Valid	No	n/a
	Unknown	No	n/a

Indiana Prioritization Methodology

To prioritize the mapping study needs listed in Section i and Appendix E of this report, the project team used a flood risk ranking methodology that assembles flood risk metrics along a floodway to deterministically rank all stream reaches within the watershed. The methodology tabulated values (by min, max, sum, or count) for three required risk categories and three optional risk categories; then calculated a total score for each CNMS reach. The required risk categories include 1) CNMS status, 2) local mapping request, and 3) FEMA risk decile score.

Because Indiana had compiled additional flood risk data sets, these were included in the ranking methodology as optional categories. The optional categories for this watershed include the following:

1) Hazus level 2 annualized losses: individual building AAL scores summed for each CNMS reach
2) Essential facilities (EFs) at risk: schools, fire stations, police stations, EOCs, and care facilities located within the special flood hazard area
3) Permit requests related to floodplain activity including:
    a. Flood insurance determination
    b. Miscellaneous study
    c. Flood insurance study
    d. 100-year discharge
    e. Permit amendment
    f. New levee
    g. Levee
    h. Outfall structure – stormwater
    i. LOMA/LOMR letter for FEMA
    j. Bank protection – riprap
    k. Permit revision
    l. Erosion control
    m. Dam

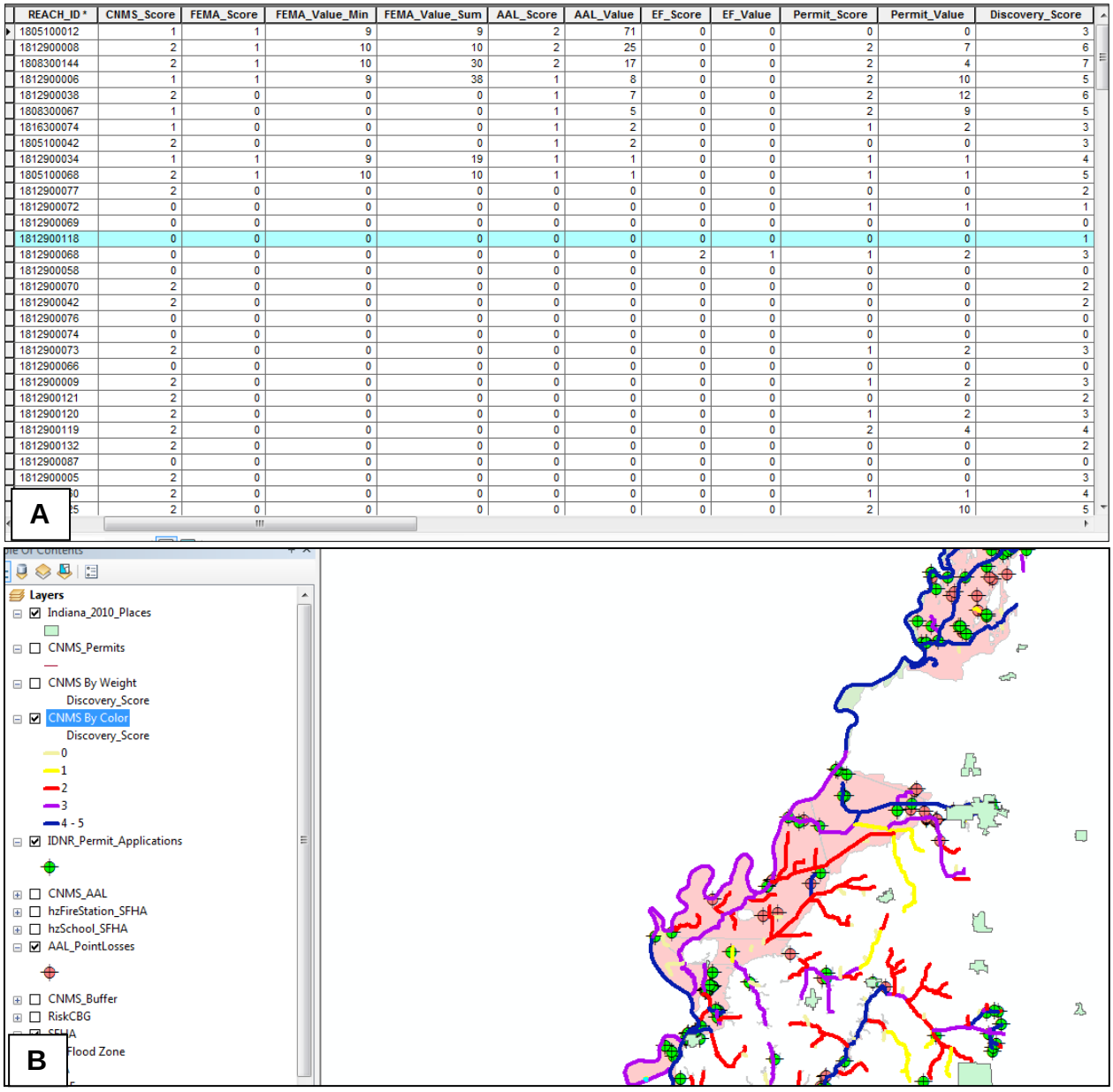
The following table describes the scoring matrix.

Table 8. Indiana Scoring Matrix

REQUIRED CATEGORY 1: CNMS STATUS	
Validation	**Score**
IN PROGRESS, VALIDATED, UNKNOWN	0
All Other Values	1
UNMET NEED	2
REQUIRES ASSESSMENT	3
REQUIRED CATEGORY 2: LOCAL MAPPING REQUEST	
Study Requested	**Score**
No	0
Yes	2
REQUIRED CATEGORY 3: FEMA RISK DECILE	
Minimum Risk Decile	**Score**
0	0
6-10	1
1-5	2
OPTIONAL CATEGORY 4: HAZUS LEVEL 2 AAL	
Sum AAL	**Score**
0	0
< $10,000	1
> $10,000	2
OPTIONAL CATEGORY 5: EFs IN SFHA	
Count EFs	**Score**
0	0
> 0	2
OPTIONAL CATEGORY 6: PERMIT ACTIVITY IN FLOODPLAIN	
Count Select Permits	**Score**
0	0
1-5	1
> 5	2

Final ranking of CNMS scores are stored in the geodatabase as a GIS feature class derived from the CNMS.

Figure 5. CNMS Rankings in Geodatabase

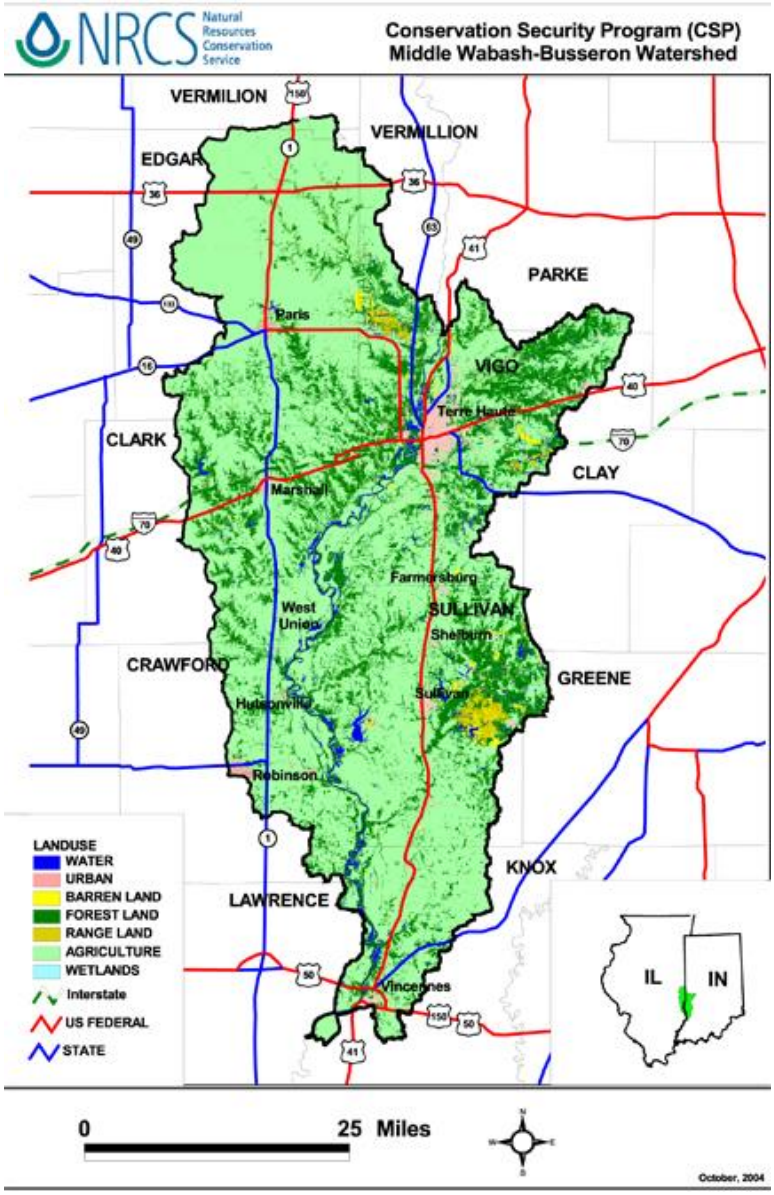


REACH_ID *	CNMS_Score	FEMA_Score	FEMA_Value_Min	FEMA_Value_Sum	AAL_Score	AAL_Value	EF_Score	EF_Value	Permit_Score	Permit_Value	Discovery_Score
1805100012	1	1	9	9	2	71	0	0	0	0	3
1812900008	2	1	10	10	2	25	0	0	2	7	6
1808300144	2	1	10	30	2	17	0	0	2	4	7
1812900006	1	1	9	38	1	8	0	0	2	10	5
1812900038	2	0	0	0	1	7	0	0	2	12	6
1808300067	1	0	0	0	1	5	0	0	2	9	5
1816300074	1	0	0	0	1	2	0	0	1	2	3
1805100042	2	0	0	0	1	2	0	0	0	0	3
1812900034	1	1	9	19	1	1	0	0	1	1	4
1805100068	2	1	10	10	1	1	0	0	1	1	5
1812900077	2	0	0	0	0	0	0	0	0	0	2
1812900072	0	0	0	0	0	0	0	0	1	1	1
1812900069	0	0	0	0	0	0	0	0	0	0	0
1812900118	0	0	0	0	0	0	0	0	0	0	1
1812900068	0	0	0	0	0	0	2	1	1	2	3
1812900058	0	0	0	0	0	0	0	0	0	0	0
1812900070	2	0	0	0	0	0	0	0	0	0	2
1812900042	2	0	0	0	0	0	0	0	0	0	2
1812900076	0	0	0	0	0	0	0	0	0	0	0
1812900074	0	0	0	0	0	0	0	0	0	0	0
1812900073	2	0	0	0	0	0	0	0	1	2	3
1812900066	0	0	0	0	0	0	0	0	0	0	0
1812900009	2	0	0	0	0	0	0	0	1	2	3
1812900121	2	0	0	0	0	0	0	0	0	0	2
1812900120	2	0	0	0	0	0	0	0	1	2	3
1812900119	2	0	0	0	0	0	0	0	2	4	4
1812900132	2	0	0	0	0	0	0	0	0	0	2
1812900087	0	0	0	0	0	0	0	0	0	0	0
1812900005	2	0	0	0	0	0	0	0	0	0	3
[illegible]0	2	0	0	0	0	0	0	0	1	1	4
[illegible]5	2	0	0	0	0	0	0	0	2	10	5

Socioeconomic Status

Land use in the Middle Wabash-Busseron watershed is primarily agricultural. There is also a preponderance of coal mining in this region, which greatly influences the hydrology of the watershed.

Figure 6. Middle Wabash-Busseron Watershed Land Use Map



The project team intersected the HUC 8 watershed boundary with 2010 Census block data and aggregated the data by the individual counties and communities within the watershed to determine socioeconomic statistics. Community fact sheets are available in Appendix C. The approximate population of the Middle Wabash-Busseron watershed is 182,794 with a median age of 37. Approximately 14.7% of the population is 65 years or older. The estimated population distribution is 90.4% Caucasian, 5.4% African American, 1.6% Hispanic, and 0.3% American

Indian. The average unemployment rate is 6.2%, and the mean household income is $39,904. The top three industries employing residents are 1) manufacturing, 2) educational, health, and social services, and 3) retail trade[5].

Community Rating System (CRS)

Vigo County, Indiana is the only community in the Middle Wabash-Busseron watershed that participates in the CRS. Its CRS class is 10 and status is rescinded.

Levees

FEMA provided the Midterm Levee Inventory to use in the Discovery process. The Midterm Levee inventory includes levees from various sources including FIRMs and the U.S. Army Corps National Levee Database. This data represents a small percentage of actual total miles or more of levees in the U.S.

The Vincennes/Brevoort Levee in Indiana is over 40 miles long and protects communities from flood waters from the Wabash and White Rivers. Much of the land protected by this levee is agricultural; however, it also protects portions of the City of Vincennes. PAL (Provisionally Accredited Levee) designation has not yet been issued for this levee, but the communities in the area are in the process of collecting certification materials, and an engineering study is now in progress.

There are several other levees in the Middle Wabash-Busseron watershed. In West Terre Haute, the PAL has expired and the levee is in the process of decertification, although the community is still in the process of collecting certification materials.

Construction of Honey Creek levee on the south side of Terre Haute was completed in 2011. It is currently in the process of certification by NRCS and will be submitted for a Letter of Map Revision (LOMR) in 2012.

Floodplain Management/Community Assistance Visits (CAVs)

As the state coordinating agencies for the National Flood Insurance Program, the Indiana Department of Natural Resources, Division of Water, and the Illinois Department of Natural Resources, Office of Water Resources, conduct Community Assistance Visits (CAVs) as part of their floodplain management programs. A CAV typically consists of a tour of the floodplain to assess any recent construction activities, a review of local permitting process and evaluation of the local floodplain ordinance. A meeting with the local floodplain official is held to discuss the NFIP, the local permitting process, any recent flood events, training opportunities, and any program deficiencies. The following table lists the communities in the watershed and the date of their latest CAV or Community Assistance Call (CAC).

[5] U.S. Census Bureau. Census 2000-2009. http://factfinder.census.gov. Retrieved 2011-10-20.

Table 9. Recent CAV/CACs

Community	CAV	CAC
Illinois		
Clark County	3/22/2005	N/A
Crawford County	3/23/2005	N/A
Village of Hutsonville	N/A	10/14/1998
Village of Palestine	N/A	9/05/1997
City of Robinson	3/23/2005	N/A
City of Paris	10/15/1992	9/18/2000
Vermilion County	7/19/2006	2/16/1996
Indiana		
Clay County	4/14/2004	N/A
City of Brazil	N/A	7/14/2009
Greene County	N/A	7/24/2006
Knox County	N/A	5/21/2008
City of Vincennes	N/A	5/21/2008
Parke County	3/25/2010	N/A
Sullivan County	N/A	7/14/2009
Vermillion County	N/A	7/16/2009
City of Clinton	N/A	7/16/2009
Vigo County	1/12/2009	N/A
City of Terre Haute	4/11/2011	N/A

Regulatory Mapping

As part of FEMA's Map Modernization program, ISWS and IDNR recently updated a number of countywide maps throughout the state of Indiana. The following table lists the Map Modernization activity in the Middle Wabash-Busseron watershed. Many of these maps are effective or in the final stages of map adoption. While these maps are in digital format, they do not necessarily reflect newer hydrologic or hydraulic study information and therefore may not be the most accurate representation of flood risk within the watershed.

Table 10. Map Modernization Activity

County	Status	Effective Date
Clark County, IL	Effective	8/2/2007
Crawford County, IL	Effective	6/2/2011
Edgar County, IL	Effective	1/19/2011
Lawrence County, IL	Effective	7/8/2011
Vermilion County, IL	Effective	5/16/2012
Clay County, IN	Effective	9/02/2011
Greene County, IN	Preliminary	N/A
Knox County, IN	Projected Preliminary 2012	N/A
Parke County, IN	Preliminary	N/A
Sullivan County, IN	Projected Preliminary 2012	N/A
Vermillion County, IN	Preliminary	N/A
Vigo County, IN	Effective	2/18/2011

Additional Data

The Indiana Department of Natural Resources maintains a statewide GIS file of permits and activity in the floodplain. These activities were used as an indicator of potential areas that may be experiencing or developing flood issues.

IV. Risk MAP Needs and Recommendations

The project team presented the Discovery map and discussed the results of the data collection and analysis with the watershed stakeholders in detail during the Discovery meetings. This section addresses the areas of concern and interest within the Middle Wabash-Busseron watershed that could be addressed with Risk MAP projects.

i. Floodplain Studies

ISWS and IDNR have completed a number of DFIRM projects as part of the Map Modernization program. With input from community stakeholders, IDNR and ISWS have identified several areas in which new or updated studies are recommended.

The goal of the floodplain mapping program is to have a high quality, model-based floodplain mapped for all streams that drain greater than one square mile. While the mapping needs listed below are the highest priority stream reaches for modeling, there are other mapping needs that also need to be included in any project proposed for this basin. These needs are fully documented in CNMS. Appendix E lists the additional mapping needs required to meet this goal.

Table 11: Illinois Mapping Needs

Stream Name	Study Type	Study Length (Miles)	Category of Concern
Brouilletts Creek	Approximate	36.03	Medium
Clear Creek	Approximate	2.57	Medium
East Fork Big Creek	Approximate	2.69	Medium
East Mill Creek Reservoir	Detailed	0.77	Medium
Hutson Creek	None	1.40	Medium
Lamotte Creek	Approximate	2.79	Medium
Lamotte Creek	None	1.37	Medium
Lincoln Trail State Park	Detailed	1.34	Medium
Mill Creek	Detailed	1.29	Medium
Mill Creek	None	1.68	Medium
Mill Creek Lake	Detailed	3.51	Medium
Mill Creek Tributary	Detailed	0.44	Medium
Salt Fork	Approximate	6.15	Medium
Salt Fork	None	4.67	Medium
South Fork Brouilletts Creek	Approximate	9.66	Medium
South Fork Brouilletts Creek	None	5.73	Medium
South Fork Raccoon Creek	Approximate	0.50	Medium
South Fork Raccoon Creek	None	3.32	Medium
Sugar Creek	Approximate	18.33	Medium
Sugar Creek	None	0.96	Medium
Tributary A	Detailed	1.33	Medium
Unnamed	Approximate	0.62	Medium
Unnamed	Approximate	3.54	Medium
Unnamed	None	1.36	Medium
Unnamed	None	1.75	Medium
Unnamed	None	1.37	Medium
Wabash River	Detailed	22.83	Medium
Wabash River	Detailed	33.69	Medium
Wabash River	Detailed	0.58	Medium
Wabash River	Detailed	21.14	Medium
West Fork Big Creek	Approximate	20.03	Medium
West Fork Big Creek	Approximate	1.53	Medium

*The methodology behind the category of concern determination is described in the Data Analysis section of this report.

The following map illustrates the Streams of Concern in Illinois.

Figure 7: Illinois Streams of Concern

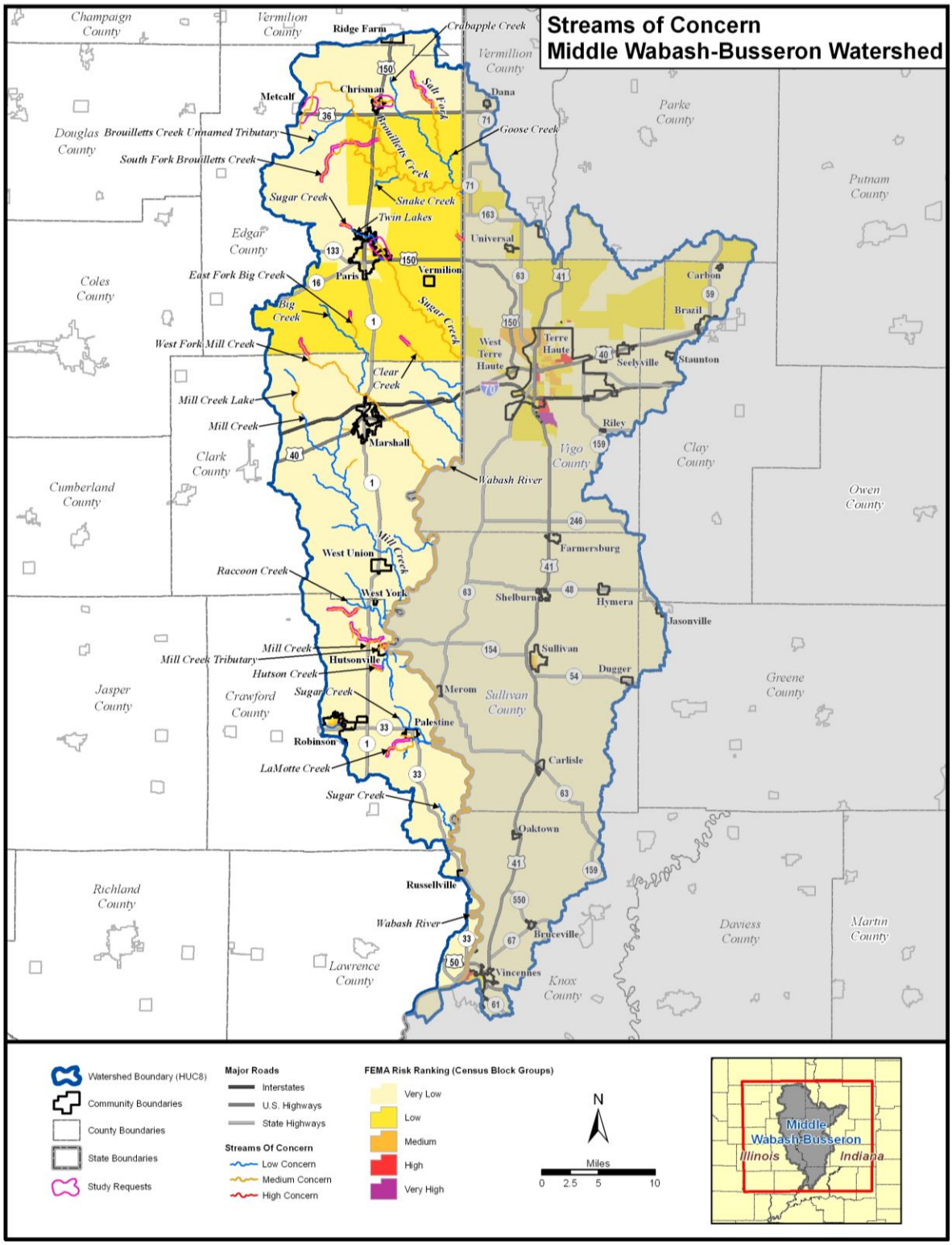


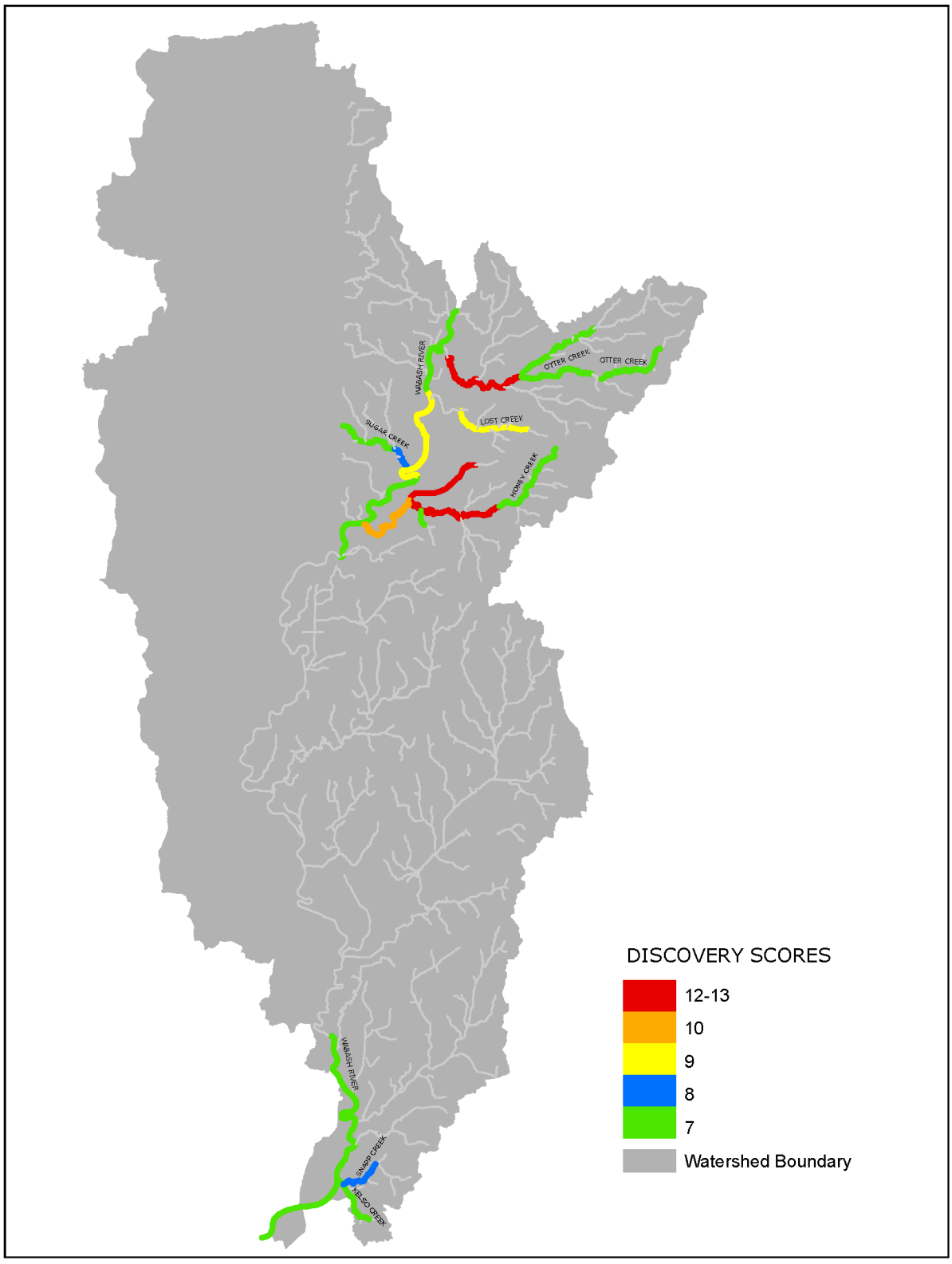
Table 12. Indiana Mapping Needs

Priority	ID	Discovery Score*	Flooding Source	Study Length (Miles)
1	181670002	13	Honey Creek	10
2	181670006	13	Thompson Ditch	9
3	1816700040	13	Otter Creek	6
4	1816700023	10	Honey Creek	7
5	1816700030	9	Lost Creek	9
6	1816700144	9	Wabash River	6
7	1808300063	8	Snapp Creek	4
8	1816700061	8	Sugar Creek	2
9	1816700022	7	Honey Creek	21
10	1816700060	7	Sugar Creek	10
11	1816700042	7	Otter Creek	8
12	1816700037	7	North Branch Otter Creek	7
13	1802100053	7	Otter Creek	7
14	1816700143	7	Wabash River	6
15	1816700142	7	Wabash River	6
16	1816700091	7	UNT Honey Creek (Vigo #1)	6
17	1808300022	7	Kelso Creek	5
18	1808300146	7	Wabash River	1

*The methodology behind the Discovery score determination is described in the Data Analysis section of this report.

The following map illustrates Indiana's mapping needs as listed in the previous table.

Figure 8: Indiana Mapping Needs



ii. Mitigation Projects

In the Discovery meetings, community stakeholders identified several locations in which mitigation projects could reduce the impacts of flooding. Topics of mitigation interest included levees, roads that frequently flood, significant riverine erosion, at-risk essential facilities, streamflow constriction, and recent and/or future development. The following mitigation projects were identified. A more comprehensive list of community strategies and feedback is available in Appendix B.

Table 13. Mitigation Projects

Community	Subject(s)	Project	Status
Crawford County, IL	Overtopped road	Repair or replace culverts in Riverton and Merom	Incomplete
Chrisman, IL	Other	Request for flood evaluation	Incomplete
Chrisman, IL	Streamflow constriction	Clean out creek bed from Illinois Route 1 east to city limit line	Incomplete
Chrisman, IL	Other	Construct berm to enclose water treatment plant	Incomplete
Chrisman, IL	Overtopped road	Engineer and raise Washington Ave from Rte 1 east to Michigan St.	Incomplete
Edgar County, IL	Overtopped roads	Mitigate water over bridges and roads	Incomplete
Edgar County, IL	New development	New bridges	Complete
Edgar County, IL	At-risk Essential Facilities	New facilities linked to Midwestern pumping station via underground pipeline	In progress
Edgar County, IL	Areas of mitigation success	Community outreach through Red Cross	Ongoing
Lawrenceville, IL	Levee	Assess structure of Lower Embarras levee	Incomplete
Kansas, Brocton, Metcalf, and Vermilion, IL	Areas of mitigation success	Performed mapping and conditional assessment and have LiDAR	Complete
Knox County, IN	Levee, riverine erosion, at-risk Essential Facilities	Bank stabilization on Wabash River	Ongoing
Knox County, IN	Other	New stream gage	Incomplete
Knox County, IN	Levee	Stabilize levee	Incomplete
Knox County, IN	At-risk Essential Facilities	Need more published BFE on unnumbered Zone A	Incomplete
Marshall, IL	Riverine erosion	Stream bank protection along Big Creek	Incomplete
Oaktown, IN	Other	Improve drainage	In progress
Paris, IL	Areas of mitigation success	Cleaned debris and stabilized bank	Complete

Community	Subject(s)	Project	Status
Paris, IL	Overtopped roads	Repair and construct new storm sewers	Proposed
Vincennes, IN	At-risk Essential Facilities	Replace water line to water treatment plant	Incomplete

V. Appendices

Appendix A: Summary of Communities
Appendix B: Discovery Meeting Materials
Appendix C: Community Fact Sheets
Appendix D: Discovery Map
Appendix E: Comprehensive List of Mapping Needs