

Iowa Statewide Levee Districts Study

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Iowa Department of Homeland Security and Emergency Management

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Contents

Executive Summary.....	3
Acknowledgements.....	6
Section A - Levee Inventory	7
Iowa Levee Systems – National Levee Database	7
FEMA Accredited Levee System.....	8
Levee Rehabilitation & Inspection Program (Public Law 84-99).....	9
Section B – Levee District Financial Status.....	11
Assessments.....	12
Financial Challenges.....	13
Typical Expenditures	14
Cost Reduction Solutions	15
Income Generation Solutions	16
Outside Financial Assistance.....	16
Section C – Levee District Operations.....	18
District Management	18
County Officers	19
Maintenance.....	19
Trustee Succession Planning.....	19
Increasing Regulatory Requirements.....	20
Trespassing.....	20
Section D – Future Operational Challenges	21
Environmental Change.....	21
Aging Infrastructure	22
Funding	22
Governance.....	22
Regulatory.....	23

Section E – Recommendations 23
 Management Recommendations 23
 Funding Recommendations 24
 Consolidate Levee & Drainage Districts in Iowa Code 25

Appendices

- A. Levee Inventory Listing
- B. Detailed List of Inspection Ratings
- C. Levee Certification
- D. Levee Accreditation
- E. National Levee Safety Program
- F. Recommendations
- G. Mills County Economic Impact Report for M&P

Case Studies

- 1. Benton-Washington Levee District
- 2. City of Cedar Rapids
- 3. City of Council Bluffs
- 4. Coulthard Levee District
- 5. City of Hamburg
- 6. Little Sioux Inter-County Drainage District
- 7. Louisa County #11 Levee District
- 8. M&P Missouri River Levee District
- 9. Two Rivers Levee & Drainage District

Attachment

- Geophysical Imaging Report

Executive Summary

Iowa has experienced significant flood events since achieving statehood in 1846. Notable flood events began occurring as early as 1851 and have continued into the 21st century. Historical impacts have included loss of life, evacuation of entire communities, permanently displaced vulnerable populations, critical infrastructure damage, reduced crop yields, and lost economic opportunities.

Recognizing the frequency and impact of flooding, the Iowa General Assembly first adopted statutes describing and defining drainage districts in the late 1800s. However, because of the increased frequency and magnitude of flooding, the state has made a commitment to undertake a current examination of our levee systems.

On June 8, 2021, Governor Kim Reynolds approved House File 861, in which funds were appropriated to the Department of Homeland Security and Emergency Management to conduct a statewide levee districts study.

The intent of the study is to build on existing information and studies to develop a more complete picture of levees and levee management in Iowa. In particular, the study identifies areas where the governance and funding of levee districts as specified in Iowa Code could be improved at the state and local level. In addition, recommendations are provided regarding the type and scope of necessary or desired improvements and the implementation of such improvements.

Data sources for this study include:

- Case studies
- County assessors, auditors, boards of supervisors, drainage clerks
- Iowa Geological Survey
- Local economic development agencies
- Other flood-prone states
- U.S. Army Corps of Engineers
- Civil engineers
- Financial records
- Levee sponsors/trustees
- Local stakeholders
- National Levee Database
- Participating/advisory state agencies

Statewide Inventory. There are multiple data sources that help identify and document the location and condition of levees across Iowa.

The National Levee Database (NLD) was developed to represent a comprehensive inventory of all levee systems and is considered as the gold standard by most federal agencies. Therefore, the NLD was used as the primary data source for this study. As of June 2022 the database reports approximately 180 levee systems in Iowa, consisting of an estimated 750 miles.

The United States Army Corps of Engineers (USACE) operates and maintains one of Iowa's approximately 70 USACE-constructed levee systems: Des Moines, IA & SE DM - SW Pleasant Hill Red Rock Remedial Works (levee system). USACE also operates and maintains two dam-related systems: Avon Station, IA – Red Rock Remedial Works and Carlisle, IA – Red Rock Remedial Works.

Financial Status. The Flood Control Act of 1917 mandated local communities to maintain and operate levees once USACE construction was complete. The Flood Control Act of 1928 authorized USACE to design and construct flood-control projects and emphasized the requirement for local communities to perform post-construction operation and maintenance for flood-control levees. A key provision of the 1928 Act was that the federal government could not be held liable for damage from floods.

Despite the historic requirement for local communities to perform post-construction operation and maintenance for flood-control levees, many levee districts across the state are struggling financially. A financial record review of 44 levee districts indicates that only 45 percent of those districts are financially sound.

Operational Status. Levee inspection ratings are key indicators of operational conditions. Of the 115 current segment inspections, results revealed that 48 percent of the inspected segments were rated as unacceptable. In other words, these segments were overall operationally deficient.

Future Challenges. Not only is flooding one of the most common and costly disasters, as experienced in 2008, 2011, and 2019, flood risk can also change over time because of new building and development, weather patterns, and other factors.

FEMA is currently in the process of updating their Flood Insurance Rate Maps (FIRMs) for the Missouri River basin in Iowa. Preliminary indications suggest the updated FIRMs will reduce flood protection levels below the 1 percent annual chance (100-year) flood for many of the levee systems along the Missouri River. The outcome of this action will result in levees affected by the updates to lose their FEMA accreditation unless costly corrective action is taken.

Iowa's rural population is declining as farms consolidate and flood-prone properties are bought out through state and federal programs. One impact of this trend will lead to fewer landowners who are willing and able to serve as levee district trustees. Historically, local landowners have been the most knowledgeable of levee and river conditions. In addition, as key stakeholders, they typically have the most stake in protecting their properties.

Increasing federal regulations are becoming administrative and financial burdens that levee districts are increasingly unable to sustain. Regulatory compliance is required to maintain enrollment in federal

LEVEE DISTRICT FINANCIAL STANDING

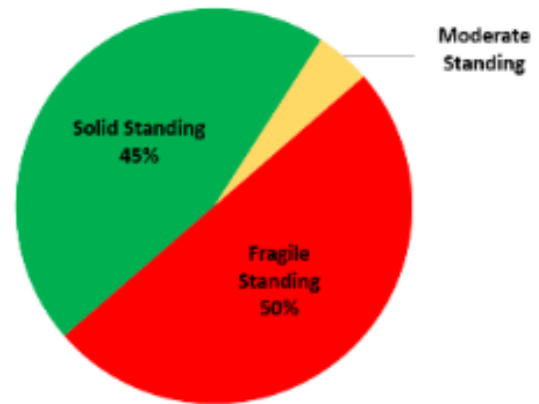


Figure 1

LEVEE SEGMENT OPERATIONAL CONDITIONS

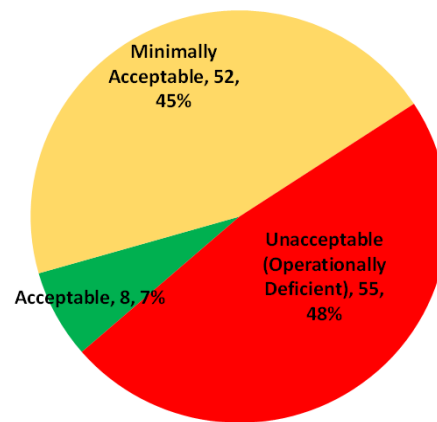


Figure 2

rehabilitation programs intended to provide sponsors with the financial assistance necessary to recover from a catastrophic event such as a levee breach or overtopping.

Recommendations. The current approach of managing and financing levee districts within the State of Iowa is unsustainable.

Management recommendations:

- Encourage existing levee districts to consolidate at the USACE system level
- Encourage a watershed approach to levee management
- Establish a state levee safety program
- Develop a comprehensive strategic plan for flood risk reduction along Iowa's waterways
- Encourage use of councils of government to complete administrative requirements

Funding recommendations:

- Raise minimum levee assessments
- Consider expanding taxing authority to a watershed scale
- Implement a statewide levee assessment
- Require levee districts to establish a cash reserve fund.
- Consider the State's funding contribution role.

Acknowledgements

The Iowa Department of Homeland Security and Emergency Management would like to recognize the vision and contributions of the Iowa General Assembly, which made this levee study possible. We thank the dozens of individuals at the levee district, county and state levels who invested their time and resources to provide information and perspective during the preparation of this report. We also thank advisory state and federal colleagues who provided insight and expertise that greatly assisted the research, although they may not agree with all of the interpretations/conclusions of this report.

City of Council Bluffs	City of Hamburg	Clinton County	Des Moines County
Fremont County	Harrison County	Louisa County	Mills County
Monona County	Muscatine County	Pottawattamie County	Woodbury County
Benton-Washington Levee District	Burlington North Bottoms Levee District	Coulthard Levee District	Honey Creek #6 Drainage District
Little Sioux Inter- County Drainage District	Louisa County #11 Levee District	M&P Missouri River Levee District	Muscatine Island Levee & Drainage District
Muscatine – Louisa County Drainage District #13	Two Rivers Levee & Drainage District		
Golden Hills Resource Conservation and Development	Iowa Drainage District Association	Mills County Economic Development Foundation	
Iowa Department of Agriculture and Land Stewardship	Iowa Department of Natural Resources	Iowa Department of Transportation	Iowa Economic Development Authority
Iowa Flood Center	Iowa Geological Survey (University of Iowa)	United States Army Corps of Engineers	

Section A - Levee Inventory

There are multiple sources of levee data available to the public. These sources help identify and document the location and condition of levees across Iowa. Data sources include the U.S. Army Corps of Engineers (USACE), the Iowa Department of Natural Resources (IDNR), and county/levee officials. Information from all of these sources were considered to develop a comprehensive inventory of levees within the state of Iowa. The various sources provided diverse and helpful information. Unfortunately, the sources also illuminated inconsistent, and, often, contradictory data. For example, through interviews with county and levee officials, several levee systems were identified in the NLD as active, but had been abandoned for several years. Levee sponsors also disputed some of the features identified in the NLD as either not being present or present in significantly different quantities. While discrepancies were identified in NLD information, it remains the gold standard for levee information within the federal government. **Appendix A** contains a listing of all Iowa levee systems listed in the NLD.

Iowa Levee Systems – National Levee Database

The National Levee Database is a congressionally authorized database that documents levees in the United States. The NLD is maintained and published by USACE. NLD information includes the location, general condition, and risks associated with the levees. The database includes multiple attributes of levees to include design, construction, operation, maintenance, repair and inspection. The NLD also contains information related to levee features, such as closure structures, embankments, floodwalls, leveed areas, pump stations, and relief wells.

As of June 2022, the NLD reports 182 levee systems in the state of Iowa containing 750 miles of levees. The NLD contains information about the condition and risk information for approximately 80 Iowa levee systems (approximately 450 miles/mostly levees affiliated with USACE programs). An additional 100 non-USACE levee systems--approximately 190 miles--have location information, but little to no information about condition and risk. It has been estimated that there may be over 890 miles of levees in the state of Iowa, leaving potentially 16 percent of all levees within the state undocumented and likely not participating in any sort of maintenance or inspection plan.

The goal of the National Levee Database and Data Collection is to be the national resource containing the most complete data record for all levees in the nation to improve flood risk management by:

- Identifying the most critical levee safety issues;
- Understanding the true cost of maintaining levees;
- Quantifying the Nation's flood risk exposure; and
- Focusing priorities for future funding.

In addition, with approximately 100 Iowa levees in the NLD, which have limited information available, there is a need to collect further levee information. The following are considerations for developing a strategy for this program component:

- Provide a comparable basic risk measure across all levees in the NLD
- Use a scalable approach for data collection that includes a less expensive "desktop" assessment method for levees with no population, buildings, or other identifiable assets behind them

- Streamline processes to reduce costs and burden on levee owner/operators and states during data collection
- Prioritize levees in states with recognized levee safety programs or where owners have volunteered to participate in inspections and assessments
- Ensure states and levee owners understand the information collected, potential uses, and how they can revise or manage the information

Recommendations

- Explore extending the in-depth research and analysis to all waterways.
- Provide county officials and any levee districts with assistance in mapping and publishing the administrative boundaries of the levee districts.

HSEMD, in conjunction with information provided by the Iowa Department of Natural Resources and the NLD, is developing a levee viewer that identifies known and suspected levee locations across the state. LiDAR information provided by the Iowa DNR proved to be too sensitive by reporting elevation changes of 3 feet or more. Most of these structures are abandoned levees or water containment features rather than levees.

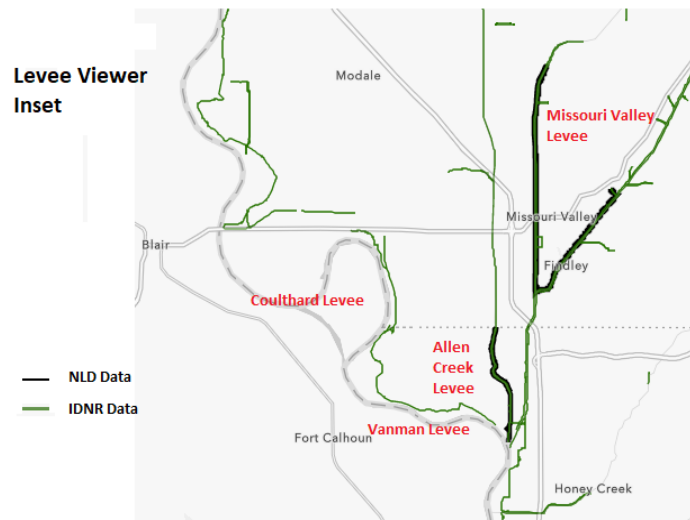


Figure 2

FEMA Accredited Levee System

An accredited levee system is a system that FEMA has determined to meet the design, data, and documentation requirements of 44 Code of Federal Regulations (CFR) 65.10; it therefore can be shown on a FIRM as reducing the base flood hazard. This determination is based on a submittal, by or on behalf of a community, which includes 44 CFR 65.10—compliant data and documentation, certified by a registered professional engineer.

The area landward of an accredited levee system is shown on the FIRM as a moderate-hazard area, labeled Zone X (shaded), except for areas of interior drainage flooding such as ponding areas, which will be shown as high-hazard areas, called Special Flood Hazard Areas (SFHAs). Flood insurance is not mandatory in Zone X (shaded) areas, but it is mandatory in SFHAs. FEMA strongly encourages flood insurance for all structures in floodplains and especially in areas landward of levees.

Provisionally Accredited Levee System

The provisionally accredited levee (PAL) designation may be used for a levee system that FEMA has previously accredited as providing base flood hazard reduction on an effective FIRM, and for which FEMA is awaiting data and/or documentation that will show the levee system is compliant with 44 CFR 65.10.

Before FEMA will apply the PAL designation to a levee system, the community or levee owner needs to sign and return an agreement indicating that the data and documentation required for compliance with 44 CFR 65.10 will be provided within a specified timeframe. Where PAL requirements are met, the impacted area landward of a PAL system on the updated FIRM is shown as a moderate-hazard area, labeled Zone X (shaded and PAL note is added). Therefore, flood insurance is not mandatory for insurable structures in the area landward of a levee system with a PAL designation; however, flood insurance and other protective FEMA accreditation measures are strongly encouraged by FEMA. A community is eligible to receive a PAL designation for a levee system only once.

As of June 2022, 60 of Iowa's levee systems in the NLD have been accredited by FEMA with an additional 15 systems having a PAL designation.

Non-Accredited or De-Accredited Levee System

If the levee system is not shown as providing base flood hazard reduction on an effective FIRM, the system is considered to be non-accredited and the levee-impacted area is mapped as Zone AE or Zone A on a FIRM following implementation of analysis and mapping procedures depending on approaches and type of study performed for the area.

If the levee system was previously shown as providing base flood protection on an effective FIRM but does not meet PAL requirements, FEMA will perform analysis procedures to effectively remove accreditation or "de-accredit" the levee system and will re-map the affected area landward of the levee. Flood insurance is required for insurable structures in SFHAs, if they have with federally backed mortgages.

Levee Rehabilitation & Inspection Program (Public Law 84-99)

Levees are either federally constructed and enhanced in cooperation with a local sponsor then turned over to the local sponsor to own and operate, or are non-federally constructed or enhanced and owned and operated by a local sponsor. Through regularly scheduled inspections, the Rehabilitation & Inspection Program assures compliance with existing agreements that the structures and facilities constructed by the federal government, or eligible projects constructed by non-federal entities, for flood protection will be continuously maintained and operated to obtain the maximum benefit. Failure of local government to maintain their project may result in removal from the program and ineligibility for federal assistance to rehabilitate, if damaged.

USACE is authorized repair storm-damaged flood control projects that have been accepted and active in the Rehabilitation and Inspection Program. For non-federal Flood Control Works (FCW), the cost share is 80 percent federal/20 percent non-federal for repairs. For Federally constructed FCW, it is 100 percent federal funds.

Assistance is limited to pre-disaster conditions and level of protection. Any FCW that remains properly maintained by a local project sponsor. Non-federally constructed FCW must pass an initial eligibility inspection.

Eligibility Requirements:

- Public sponsorship for non-federal FCW required

- Minimum level of protection
- Urban levees: 10 years plus 2 feet freeboard
- Agricultural: 5 years plus 1 foot freeboard
- Properly maintained
- No encroachments within 15 feet of levee toe
- No trees or brush within 15 feet of levee toe

Repair Qualifications:

- FCW must be in active status of Rehabilitation and Inspection Program prior to flood event
- Cumulative damages greater than \$15,000
- Benefit-cost ratio for repairs greater than 1.0
- Secondary/interior levees not eligible for repair
- Deficient/deferred maintenance is sponsor responsibility

Ratings and inspections

Flood risk and levee condition are dynamic. Levees change over time: banks erode, closures rust, animals burrow, and pumps wear out. Ongoing vigilance is needed to ensure that levee infrastructure will perform properly during a flood event. USACE regularly inspects levees within its Levee Safety Program to monitor their overall condition, identify deficiencies, verify that needed maintenance is taking place, determine eligibility for federal rehabilitation assistance (in accordance with P.L. 84-99), and provide information about the levees on which the public relies. Inspection information also contributes to risk assessments and supports levee accreditation decisions for the National Flood Insurance Program administered by FEMA.

Two Types of Inspections

USACE now conducts two types of levee inspections using a Geographic Information Systems (GIS)/Global Positioning System (GPS)-based inspection tool that incorporates a standard levee inspection checklist. Levee sponsors are encouraged to be part of the inspection team.

Routine inspection is a visual inspection to verify and rate levee system operation and maintenance. It is typically conducted each year for all levees in the USACE Levee Safety Program.

Periodic inspection is a comprehensive inspection conducted by a USACE multidisciplinary team that includes the levee sponsor and is led by a professional engineer. USACE typically conducts this inspection every five years on the federally authorized levees in the USACE Levee Safety Program. Periodic inspections include three key steps:

- Data collection: A review of existing data on operation and maintenance, previous inspections, emergency action plans and flood fighting records
- Field inspection: Similar to the visual inspection for a routine inspection, but with additional features
- Final report development: A report including the data collected, field inspection findings, an evaluation of any changes in design criteria from the time the levee was constructed, and additional recommendations as warranted, such as areas that need further evaluation.

Inspection Ratings

Both routine and periodic inspections result in a final inspection rating for operation and maintenance. The rating is based on the levee inspection checklist, which includes 125 specific items dealing with operation and maintenance of levee embankments, floodwalls, interior drainage, pump stations, and channels.

Each levee segment receives an overall segment inspection rating of acceptable, minimally acceptable, or unacceptable. If a levee system comprises one or more levee segments (if there are different levee sponsors for different parts of the levee) then the overall levee system rating is the lowest of the segment ratings.

Table 1

Levee System Inspection Ratings	
Acceptable	All inspection items are rated as Acceptable.
Minimally Acceptable	One or more inspection items are rated as Minimally Acceptable or one or more items are rated as Unacceptable and an engineering determination concludes that the Unacceptable inspection items would not prevent the segment/system from performing as intended during the next flood event.
Unacceptable	One or more inspection items are rated as Unacceptable and would prevent the segment/system from performing as intended, or a serious deficiency noted in past inspections (previous Unacceptable items in a Minimally Acceptable overall rating) has not been corrected within the established timeframe, not to exceed two years.

A levee sponsor must maintain the levee to at least the minimally acceptable standard to remain eligible for federal rehabilitation assistance through the USACE Rehabilitation and Inspection Program (PL 84-99).

USACE shares inspection results with the authority responsible for levee operation and maintenance, known as the levee sponsor. This is typically a local agency but in some cases is USACE itself. USACE also shares the results with FEMA, to help inform decisions about levee accreditation for flood insurance purposes.

As of June 2022, 59 of Iowa's more than 240 levee segments are rated as acceptable or minimally acceptable.

See **Appendix B** for a detailed list of inspection ratings.

Section B – Levee District Financial Status

One of the legislative directives for this study was to examine the current financial status of levee districts within the state. What was discovered is that most levee districts across the state are struggling financially. We examined the financial records of 44 districts located within ten counties located along the lower Mississippi and Missouri rivers impacted by flooding in 2019. We reviewed records over the five-year period of state fiscal years 2017 to 2021 (1 July 2016 to June 30, 2021). This period provided us

with a timeframe that included both normal levee operations as well as flood fighting operations. It also provided a window in which outside assistance was available to the levee sponsors and how sponsors were or were not able to tap into those resources. What our review found is of the 44 district financial records reviewed, only 20 districts have average revenues that exceed average expenses and do not have any outstanding warrants. See **Table 2**.

Table 2

Levee District Financial Summary					
County	Total Levee / Drainage Districts	# Districts Financial Information Reviewed	# Districts with Solid Financial Standing	# Districts with Outstanding Warrants	# Districts with Employees
Des Moines	2	2	2	0	2
Fremont	23	6	2	4	0
Harrison	53	4	1	4	0
Louisa	11	6	4	1	1
Mills	33	8	4	3	0
Monona	8	6	4	2	1
Pottawattamie	13	12	3	8	4
Totals	143	44	20	22	8

Assessments. The primary revenue source for drainage and levee districts are assessments levied against property owners located within the leveed area for levee districts or within the drainage area for drainage districts.

Several districts continue to use the original assessment schedule that was developed in the early 1900s when the district was initially created. This is in accordance with section 468.49 regarding the classification as basis for future assessments, which reads in part, *“A classification of land for drainage, erosion or flood control purposes, when finally adopted, shall remain the basis for all future assessments for the purpose of the district unless revised by the board in the manner provided for reclassification.”* In addition, three methods of assessing property owners were identified as currently in use. The methods included:

- The proportional amount based on derived benefit, which is described in section 468.39. This section states that the lands receiving the greatest benefits shall be marked on a scale of one hundred, and those benefited in a less degree with such percentage of one hundred as the benefits received bear in proportion thereto. They shall also make an equitable apportionment of the costs, expenses, fees, and damages computed based on the percentages fixed.
- A second method used by levee districts is the assessed value method. Section 468.184(2) (a) (4) states that each tract of land and each land improvement will be assessed its pro rata share of the assessed value of all land and improvements assessed value in the district.
- The final method of assessing is the modified assessed value process. The most equitable approach identified was established by the M&P Missouri River Levee District, which determined that the necessary reclassification of lands within the District would be based on the “Commission-Based” methodology provided by Iowa Code, Chapter 468.65. (See **M&P Case Study**)

The financial processes of levee districts is established by Iowa Code and is being followed in all instances in the counties that were included in the study. A quick summary of this process is that the board of supervisors or the board of trustees makes all the operational decisions related to the operation and maintenance of the levee. The trustees or their designated representatives execute these decisions in accordance with local, state and or federal policies. Levee assessments are issued by the county auditor's office along with all other tax assessments on property owners. These assessments are collected by the county treasurer and placed in an account established for each levee district within the county.

In the case of inter-county districts, the treasurer of the county having the largest acreage of the district shall be the depository for all funds of the district and the treasurer of the other counties in which the district is situated shall periodically, at least annually, pay over all district funds received within said period to the treasurer of the county with the largest acreage in accordance with code section 468.299.

In accordance with section 468.54, taxes collected are then placed in a separate fund known as the county drainage or levee fund. The county auditor shall continue to keep a record of each of the drainage or levee district's funds to reflect the financial condition of each district account. This section



Figure 3

does not permit expenditures on behalf of any district in excess of its share of the county drainage or levee fund. All invoices received for work performed in the district are turned over to the county auditor for payment.

In the 44 districts examined, there was only a single instance, in which the county auditor did not pay the expenditures. This instance complies with section 468.528; subsection 2, which states that trustee districts that have a pumping station may upon order of the board of trustees may direct the county treasurer to place all or any part of the moneys into a checking account established by the board in a bank or credit union. In the one instance observed, the district had a part time administrator that was responsible for managing the district's finances.

Financial Challenges. The majority of districts reviewed did not have enough revenue to cover their expenses. Assessments have not increased to offset expense increases. Levee districts have been significantly impacted by the depopulation of rural Iowa.

The depopulation of rural levee districts means there are fewer landowners to carry the burden of the increasing costs making any increases in levee assessments a significant financial burden on the remaining landowners. Federal buyouts result in the removal of any purchased lands from the assessment base causing the cost to be redistributed to the remaining landowners. While the lands purchased as part of a state buyout program continue to pay levee assessments, they do not pay property taxes, reducing the revenues available to the county to maintain roads and other services found in the acquired areas.

Another significant financial burden on levee districts is the ever-increasing amount of federal regulations required to remain within levee rehabilitation programs. Multiple levee sponsors comment that the requirements to remain in the United States Army Corps of Engineers PL84-99 Rehabilitation Program are becoming increasingly unbearable. The most vivid example provided by a levee sponsor was that under the previous inspection program you could keep the supporting documentation in one to one-and-a-half file folders. Under the current program, it requires three, 3-inch binders to contain all the required documentation.

A common problem experienced by levee sponsors is the requirement to replace corrugated metal drainpipes with concrete drainpipes in order to maintain their enrollment in the PL 84-99 program. Based on FEMA's definition of a standard useful life, which for both corrugated metal pipe and concrete structures is approximately 30 years, levees constructed prior to the 1990s have or are approaching replacement. The cost to replace a corrugated metal pipe with a concrete pipe is approximately one million dollars. Most levee districts have multiple corrugated pipes running through their levees.

Another recurring expense for levee sponsors is the inspection of relief wells. Most of the levee systems along the Mississippi and Missouri rivers utilize relief wells to deal with seepage and help prevent sand boils. USACE requires relief wells be inspected by a professional engineer every five years. Multiple sponsors explained that it costs \$5,000 - \$10,000 each to have their relief wells inspected. The City of Council Bluffs levee system contains approximately 170 relief wells. Using a cost factor of \$7,500 each, it costs the City \$1,275,000 every five years to conduct these inspections. Another levee sponsor expressed their frustration with these inspections is not only the costs, but USACE's assertions that while a pump is working and passed the inspection, they (USACE) didn't think it is pumping enough water at a certain rate and want the pump replaced in order to remain in the rehabilitation program. Another issue affecting the financial condition of levees is the availability of vendors to complete inspections or repair work to comply with USACE standards. Multiple sponsors explained that they often have to go out of state to find vendors who are willing and able to adhere to USACE's standards for the work they are being asked to complete. USACE will not provide financial assistance because the levee is not active in PL 84-99 and FEMA will not provide financial assistance because the levee was constructed by USACE.

With no federal assistance available, the only State program available is the State Contingency Fund loan program, which has an annual cap of \$1 million. Any levee that experiences a failure is looking at multiple millions of dollars to conduct emergency work and restore the levee. Following the 2019 floods, the 20 approved levee improvement projects that applied for Flood Recovery Funds had an average project cost of almost \$4 million dollars each. These awarded projects received on average only \$992,400 or less than 25 percent of their identified need.

Typical Expenditures. It costs levee sponsors thousands of dollars every year to maintain their levees. Some of the typical levee expenses found include animal and vegetation control, administrative costs, election expenses, and professional services. Most counties charge the districts an administrative fee for the work completed on behalf of the levee district by the auditor and treasurer's offices. While usually a minor expense, districts have annual elections that have associated costs that go with them. As discussed earlier, hiring qualified professionals to deal with inspection requirements is another cost to the districts. Other professional services common to levee districts include hiring engineers to complete studies or make recommendations to address structural shortcomings. Engineers are often consulted during a high-water event and immediately following to address issues as they arise during the event. Levee districts often spend thousands of dollars annually on attorney fees. Attorney services

may be required to review contract and engineering proposals, address access and right-of-way issues, or to deal with other legal disputes with landowners, local governments, the state and even the federal government. A relatively new expense is that of contracted labor. Districts have used contract labor for years on major projects, but as local populations age and decline in number, many districts have turned to contract labor to handle more routine maintenance activities that were previously completed by trustees or other landowners.

Some of the less common expenses found during this study include employee-related expenses, utilities, and debt and interest payments. Of the 44 districts for which we examined their financial records, eight districts were identified as employing full or part time employees to help manage and maintain the levees within their district.

Utilities were another infrequent expense that was associated with districts that have pumping stations. While not common, this expense can devastate a district's financial status. During high water events, it is common for monthly utility bills to be in the tens of thousands of dollars. These costs can quickly overwhelm a district's ability to pay. One southeast Iowa district had to resort to an almost \$200,000 State Contingency Fund (SCF) loan to pay their flood-related utility bills and to sustain pumping operations during the remainder of the fiscal year. This district now has a debt expense that must be addressed. A southwest Iowa district was put into a position of having to take out a \$1 million SCF loan to help fund repairs to their breached levee, incurring a \$50,000 annual payment for the next twenty years.

An expense that speaks volumes to the financial stability of a levee district is whether the district is paying interest on outstanding warrants. When a levee district is paying interest expense on outstanding warrants it means the district has insufficient funds to meet their financial obligations. Because the warrants are issued by the county, it is possible for a vendor to take the warrant to a financial institution and receive payment for their services. The financial institution will then hold the warrant pending payment by the county from the district's fund. Interest begins to accrue monthly after 60 days of the claim being made by the vendor. The rate of interest paid is 1 percent per month beyond the 60-day period, on a simple interest basis. The interest will continue to accrue until the claim is paid in full by the district. This type of interest expense can become exorbitant over time, as districts are extremely limited in their ability to respond to increased expenses.

Cost Reduction Solutions. Some districts have found ways to overcome at least some of their financial challenges by coming up with creative ways to address recurring costs and/or generate income for the district. The City of Council Bluffs faces a recurring relief well inspection cost of approximately \$1,275,000 over a five-year period. To help reduce this cost the City is currently expanding its use of seepage berms to replace relief wells where they can. The City is investing in new infrastructure that has fewer maintenance requirements in order to replace another piece of infrastructure with higher recurring costs. When the completed, the City should reduce the number of relief wells from 170 down to 54 saving the City approximately \$870,000 in inspection costs over that same five-year period.

Some districts have chosen to invest in employees and equipment in order to conduct their maintenance and project work in-house. The two largest districts examined, Little Sioux Inter-County Drainage District and the Two Rivers Levee & Drainage District both have multiple employees and equipment to conduct maintenance work within the district. Both districts have average annual revenues in excess of \$800,000 and maintain embankment lengths close to 100 miles each. Employee related expenses make up approximately 30 percent of the district's annual expenditures. Employees

are the eyes and ears of the trustees for the larger districts. They often identify challenges and in some cases create the solutions to address the challenges.

A potential cost reduction solution worthy of additional consideration is reflected in **Attachment 1**. The geophysical imaging method is efficient, effective, and scalable. One application of the method could theoretically enable levee sponsors to conduct system-wide inspections to identify areas of interest without exhausting their limited resources.

Income Generation Solutions. One district has developed a permitting system in which anyone who wishes to access the levee purchases a permit from the district for a nominal fee. This permit grants the purchaser the ability to traverse the levee as needed, it provides the district the opportunity to establish guidelines regarding acceptable activity on the levee, and it assists law enforcement in identifying trespassers when stopping individuals on the levee system. Several districts allow grass or hay to be mowed and baled from the levee slopes and rights-of-way. As regulatory requirements increase, districts are moving away from this practice due to damage concerns that may result in the district being removed from USACE's rehabilitation program.

Outside Financial Assistance. Expenses related to prolonged high-water events, overtopping or an actual levee failure result in a financial catastrophe to go along with the physical devastation caused by floodwaters. Debris cleanup and repair costs can often reach into the millions of dollars. In these situations, levee districts turn to the state and federal government to provide financial assistance to repair the levee and restore the protection it provides against future events. The federal government usually provides the bulk of funding in these situations; however, most types of federal assistance have a nonfederal local cost share component. Most often, the nonfederal share is 25 percent, which is frequently comprised of local and state funds. The \$1 million SCF loan mentioned above was needed to cover the local expenses required under the PL 84-99 rehabilitation program.

Most state funding is provided afterwards through the SCF loan program as well as funding available through the Flood Mitigation Board (FMB). The board funds projects utilizing Sales Tax Increment Financing (STIF) or the Flood Recovery Fund (FRF). The SCF loan is a 20-year, no-interest loan awarded by the Iowa Executive Council. SCF loans are capped at \$1 million dollars per state fiscal year and are awarded on a first come, first served basis. SCF loans will not provide funding for more the 75 percent of the actual or estimated cost incurred by the applicant.

In 2008, the state established an innovative flood mitigation program by establishing a base year of sales tax collections within a municipality, and as the sales tax collections grow in each successive year for up to 20 years (through inflation or economic development), a municipality can utilize up to 70 percent of the growth for flood mitigation projects. This allows available dollars to be used for levee projects that are tailored to each community's needs. With a steady stream of sales tax collections per year, each municipality is able to issue revenue bonds during the initial years to fund an immediate change in flood risk reduction and mitigation. The sales tax distributions are then used to pay the debt from the newly built infrastructure. The sales tax increment fund was established as a separate and distinct fund in the state treasury, capped at \$30 million annually and is a one-time program. There are currently 10 communities with approved STIF projects (**Figure 5**).

The Flood Recovery Fund was established under Iowa Code Chapter 418.16 as amended and signed by Governor Reynolds in May 2019. The funds are under the control of the Flood Mitigation Board and consists of moneys appropriated to the fund by the general assembly and any other moneys available to, obtained by, or accepted by the board for deposit in the fund. The funds shall be used for the purposes of flood response, flood recovery, or flood mitigation activities with the counties designated under FEMA’s Individual

Assistance Program for Disaster 4421, which include Fremont, Harrison, Louisa, Mills, Monona, Muscatine, Pottawattamie, Scott, Shelby, and Woodbury. Moneys in the fund shall not supplant any federal disaster recovery money. In September 2019, \$15 million was appropriated to the fund. The FMB awarded

STIF Recipients

City of Burlington	City of Des Moines & Metro Wastewater Reclamation Authority
City of Cedar Falls	City of Dubuque
City of Cedar Rapids	City of Iowa City
City of Coralville	City of Storm Lake
City of Council Bluffs	City of Waverly

Figure 4

six projects in southwest Iowa. In February 2020, another \$21 million was appropriated to the fund and the FMB used that money to fund 26 projects primarily in southwest Iowa.

Federal assistance is normally provided through USACE or FEMA. Ideally, the levee is active in the USACE rehabilitation program, PL 84-99, and USACE will conduct emergency repairs, restoring the levee to its pre-disaster status. While USACE covers most of the expense, levee sponsors must provide the necessary borrow material to fill any breaches as well as ensuring USACE has access to the sites they need to make repairs. Providing borrow material can be a significant expense for the district, often costing the district \$15 to \$35 per cubic yard of material. Most projects will require tens of thousands of cubic yards of borrow material costing the local sponsors hundreds of thousands of dollars in expenses.

Currently, a select few municipalities in Iowa have been able to secure federal funds for levee construction, but only after a long and convoluted process. Because of the discontinuation of earmarking and limited availability of federal funds, Iowa projects have to compete nationally against other similar projects. On a national basis, only projects with the very highest benefit-cost analysis ratios tend to receive federal funds and it can take many years for funds to be secured. Such was the case for Cedar Rapids, which was devastated when a flood in 2008 caused \$5.4 billion in damage. It was not until 10 years after the flood event that the City received \$117 million from USACE to support constructing a flood risk reduction system estimated to cost between \$550 million to \$750 million.

Levees that were not federally constructed are not eligible for USACE 84-99 funding and must fall back on FEMA’s public assistance and hazard mitigation programs in order to get financial assistance. Under this program, the federal government will typically fund 75 percent of the project IF it is determined the project provides enough economic benefit to justify the federal investment. The remaining nonfederal costs are comprised of local and, when possible, state funds. If a federally constructed levee has fallen out of the PL 84-99 program, USACE will not provide any financial assistance to the district nor will FEMA. Because the levee was constructed using federal funds, FEMA is prohibited from using their programs to provide financial assistance.

FEMA offers funding through grant opportunities, such as the Hazard Mitigation Grant Program (HMGP) and Building Resilient Infrastructure and Communities (BRIC). Hazard mitigation funds for HMGP are

distributed on the state level but can only be accessed after a qualifying storm damage event. BRIC funds are nationally competitive.

Investment in mitigation projects now can save significant funding on future repairs. A recent Congressional Research Service (CRS) report indicated that mitigation funding could avoid \$6 in future disaster recovery costs for every \$1 spent on hazard mitigation. Despite this, use of FEMA grant funds for levee improvements or new construction continues to be restricted, in part due to FEMA policies and in part due to the USACE's historical role in regulating levee construction.

Section C – Levee District Operations

Managing a levee district requires individuals with a diverse skill set as well as a determination to do what is best for everyone in the district in the face of personal challenge and public attacks. Levee managers must have a solid understanding of engineering, financial management, hydrology, regulatory requirements, soil types and weather patterns as well as local politics. Chapter 468 of the Iowa Code outlines the basic management principles for Iowa levee districts.

District Management. In accordance with 468.1, the board of supervisors of any county has the jurisdiction, power, and authority at any regular, special, or adjourned session, to establish a drainage district or districts, and to locate and establish levees. The county board of supervisors is the default management entity for drainage and levee districts located within the county. The code allows for other management types under specific conditions; section 468.315-468.327 applies if a levee district is embracing part, or the whole, of a city.

When 25 percent or more of a district is located within the corporate limits of any city, the board of supervisors may relinquish control of the district to the city. The city must accept control of the district and management is assumed by the city council. Iowa Code Section 468.500 allows for any drainage or levee district in which the original construction has been completed and paid for by bond issue or otherwise, may be placed under the control and management of a board of trustees to be elected by the persons owning land in the district that has been assessed for benefits. Districts managed by city councils have the same option to transfer management to a board of trustees. The decision to transfer management to a board of trustees must be supported by the majority of the persons, including corporations owning land within the district, by signing a petition to be filed with the office of the auditor. Trustees are elected by the landowners within the districts for a three-year term. Trustees of the board serve staggered terms requiring elections to be held every year for one trustee position.

Iowa Code section 468.506 lays out specific eligibility requirements to be a district trustee. The primary requirement is that the individual owns land and resides within the district. Trustees shall have control, supervision, and management of the district for which they are elected and shall have all the same powers conferred on the board of supervisors for the management of drainage and levee districts. Section 468.530 requires the trustees to provide the auditor of each county in which any part of the district is situated, with a correct report of their acts and proceedings, which report shall be signed by the chairperson and the clerk of the board and shall be recorded by the auditor in the drainage record, and shall be published in one official paper in the county having a general circulation in the district.

County Officers. The primary function of a levee district board of trustees is to manage the operations and maintenance of the levee system within their district. The three-member board relies on several others to assist in this task, which requires a significant amount of communication and coordination. As discussed earlier, the county auditor issues the annual assessments and pays the district's expenses and the treasurer collects the district's assessments. Other county officials who regularly interact with the board are the county sheriff and the county emergency manager. The sheriff assists in keeping trespassers off the levee as well as notifying and evacuating residents in the event of a potential breach or overtopping event. The districts also work with the county emergency manager, particularly during high water events, to communicate levee conditions and the likelihood of levee failure or overtopping. It is important that levee districts are included in the development of the county's emergency management plan to ensure all potential threats can be properly assessed and prepared for. This coordination can assist levee managers when dealing with federal and state agencies because most of their programs require a levee emergency action plan. Often, these agencies will accept the county's plan as long as the levee is addressed within the plan. The board relies heavily on the residents within the district to assist in maintaining the levee by providing equipment and labor especially during flood fights.

County Population Percentage Change Since Construction

Table 3

YEAR	Lee	Des Moines	Louisa	Muscatine	Fremont	Mills	Pottawattamie	Harrison	Monona	Woodbury
1900	39,719	35,989	13,516	28,242						
1920	39,676	35,520	12,179	29,042						
1940	41,074	36,804	11,384	31,296						
1960	44,207	44,605	10,290	33,840	10,282	13,050	83,102	17,600	13,916	107,849
1980	43,106	46,203	12,055	40,436	9,401	13,406	86,561	16,348	11,692	100,884
1990	38,687	42,614	11,592	39,907	8,226	13,202	82,628	14,730	10,034	98,276
2010	35,849	40,241	11,382	42,803	7,434	15,076	93,363	14,909	9,248	102,388
2020	33,405	38,785	10,917	42,454	6,560	15,150	93,148	13,993	8,571	103,699
% change since construction	-16%	8%	-19%	50%	-36%	16%	12%	-20%	-38%	-4%

Source: worldpopulationreview.com

Maintenance. As Iowa's rural populations age and decline, trustees are increasingly turning to contracted vendors to conduct routine maintenance on the levee. Contracted labor is an increased cost that districts are incurring in order to maintain their enrollment in PL84-99. Flood fighting is a significant event for a levee district. It is time and labor intensive as well as extremely expensive.

County Population Clusters

Table 4

County	Rural, Metro or Urban	Urban or Urban Clusters	People per Square Mile	% Age 18-64	Largest Age Group
Monona	Rural	Yes	12.5	54	60-69
Fremont	Rural	No	13.5	56	60-69
Harrison	Metro	Yes	20.2	58	50-59
Louisa	Rural	No	27.7	59	50-59
Mills	Metro	Yes	34.3	58	50-59
Lee	Rural	Yes	65.6	58	60-69
Des Moines	Rural	Yes	94.3	57	60-69
Muscatine	Rural	Yes	97.6	59	30-39
Pottawattam	Urban	Yes	98.3	59	50-59
Woodbury	Urban	Yes	117.6	59	10-19

Source: US Census Bureau and Census Reporter

Trustee Succession Planning. Being a levee district trustee is a huge responsibility that is largely a voluntary effort as most trustees are compensated less than \$500 a year for their time and effort. As such, there is very little trustee turnover. Trustees often serve in that role for decades and some joke that it is a lifetime appointment. Following a disaster,

trustees are required to make decisions that will affect the financial future of the district for decades as they attempt to recover and restore the protection provided by the levee.

Because trustees are required to reside in the district, the depopulation of districts significantly affects the available pool of people who are available to serve in this capacity. **Table 3** shows the population trends of the counties included in this study.

The U.S. Census Bureau defines “rural” as any population, housing, or territory NOT in an urban area. The Census Bureau currently defines an urban area as “urbanized areas” that have a population of 50,000 or more and “urban clusters” that have a population of at least 2,500 and less than 50,000. The definition of an urban area has changed over time as the country’s population has increased. The Census Bureau reports that in 1900 60 percent of the nation’s total population were considered rural compared to just 19.3 percent in 2020. Metropolitan statistical areas or “metro” areas are defined at the county level, and most counties have a mix of urban and rural areas. According to the latest American Community Survey, 54.4 percent of people living in rural areas are within a metro area. **Table 4** identifies the Iowa counties in this study as either rural, metro or urban. It also shows the population density and demographics on age.

Increasing Regulatory Requirements. Levee district trustees universally expressed their concern and frustration with increasing regulatory requirements coming from USACE. One of the new requirements we frequently heard about was the requirement to conduct a video inspection of pipes and other drainage structures. USACE requires that the video include the entire structure from one end to the other. This is a challenge as most of these structures have water passing through them constantly. In order to comply with the requirement, sponsors must pay to dam off the structure in order to drain the structure to be able to video the bottom of the structure. Another common frustration reported was the electronic testing of pumps. We often heard frustrations from sponsors that pumps that are working fine and performing as intended but fail this test and USACE wants them replaced. These new requirements are extremely technical and require trustees to hire companies to complete these requirements.

USACE has recognized the fact that an increasing number of districts are struggling to maintain their enrollment in the PL 84-99 rehabilitation program and has developed the System Wide Improvement Framework (SWIF) Program. The intent of the program is to provide levee sponsors a method to demonstrate they are actively working to address items identified during inspections that jeopardize the levee’s continued participation in the rehabilitation program. The program contains 18 components, focused on structural features that must meet program requirements. The SWIF program is very structured and detailed in order to deal with complex issues found in other parts of the country. USACE explained that there are two types of levees - federal and non-federal. Federal levees are specifically authorized by appropriation for the USACE to construct and then turn over through contractual obligation for local sponsors to operate and maintain, while non-federal levees are locally constructed and then with formal agreement with USACE are brought into the USACE 84-99 program. In either example, the basic Operations and Maintenance (O&M) requirements are essentially the same and so are the responsibility of the local sponsor.

Trespassing. Sponsors work hard and spend tens of thousands of dollars annually to maintain their levees in order to protect people living and working within the district and their way of life. Most people not familiar with maintaining a levee fail to understand the potential impacts unauthorized activities by trespassers pose to a levee. Because of this, sponsors actively work to restrict access to levees through gates and no-trespassing policies. County sheriffs are encouraged to stop anyone they

observe on the levee and if they are not authorized to be there, the individual is removed from the levee and charged with trespassing

Some levee districts have sought to find a balance between strict trespassing policies and granting the public access to areas on the riverside of the levee by issuing access permits. By issuing permits, it provides access to natural areas but limits the number of people who are traversing the levee thus limiting the potential for damage. Many people believe that levees are public structures and should be made available to the public for their use. With the proper engineering and structures, levees can be made available to the public for limited recreational use such as bicycling and hiking. Access decisions are up to the individual levee districts based on the condition their levee.

Section D – Future Operational Challenges

Most of today's challenges will continue into the future and most will likely worsen unless a concerted effort is made to address these challenges. The rivers are constantly changing and levee districts must recognize these changes. They must develop plans and resources to adapt to these new and changing conditions. This is going to require new approaches to solve current and future challenges.

Environmental Change. Precipitation in Iowa has gradually increased over the last 100 years, as the central United States is experiencing more intense rain events resulting in more episodes of higher runoff and potential flooding. Levels of streamflow have risen in part because of changes in precipitation. Iowa's soils can absorb approximately 1.25 inches of precipitation in a one-day rain event, anything more than this amount initiates runoff and increased streamflow.

As more water runs off into the rivers, the river levels rise more quickly and potentially reach higher levels than previously seen. This is what happened in the spring of 2019 when a bomb cyclone weather system brought warming temperatures, high winds, and 2 to 3 inches of rain to southeast Nebraska and southwest Iowa. In addition to the rainfall, the warming temperatures resulted in rapidly melting snow that was unable to be absorbed into the still frozen ground. Flooding was exacerbated by levee failures, which accelerated flooding resulting in emergency evacuations of entire communities in southwest Iowa.

The potential for rising river levels has significant ramifications for the current levee systems within the state.

FEMA is currently in the process of updating Flood Insurance Rate Maps for the Missouri River basin in Iowa. Preliminary indications suggest the updated FIRMs will increase the area of the 1 percent annual chance (100-year) flood for many communities along the Missouri River unless costly corrective action is taken.

The loss of accreditation has the potential to affect the entire region as residents, farmers, and business owners must decide if it is economically viable to remain in their current location. The M&P Missouri River Levee District trustees have invested hundreds of thousands of dollars to have a professional engineering assessment completed to determine the work required to bring the levee and associated

tieback levees up to current design standards necessary to meet FEMA accreditation requirements. The report estimates it will require approximately \$65 million to make the necessary modifications.

As communities across the state respond to threats of flood damage by improving local levee systems, it is important that national agencies such as USACE and FEMA continue to track and record the ongoing changes to physical floodplain properties and ensure modeling data is kept up-to-date.

Aging Infrastructure. The National Levee Database reports the average age of Iowa levees is 52 years. Levees, like other pieces of infrastructure such as buildings, bridges, and roads require more frequent and intensive maintenance to keep them in an operational condition as they age. A review of recent USACE inspection reports found that of the 89 systems inspected, only five systems obtained an acceptable rating with another 49 systems were identified as minimally acceptable, and 35 were found to be unacceptable.

Funding. The future of levee funding varies greatly depending on the levee's location. Urban levees and rural levees near expanding urban areas generally have a large enough assessment base to enable them to maintain their infrastructure. Some districts are taking advantage of the code to transition to an assessed value assessment method, which allows them to take advantage of the higher value of commercial, and industrial properties located within the district. Agricultural and rural levees face significant funding challenges under the current assessment method due to decreasing assessment bases and reducing likelihood that districts will qualify for any type of federal financial assistance. There needs to be a concerted effort to identify alternative assessment methods of funding agricultural and rural levees to provide sufficient funding to maintain these levees. If sufficient funding cannot be obtained to maintain the levees, they will become inactive in the PL 84-99 rehabilitation and WHEN they fail, there will be no financial assistance available to repair them.

Governance. Currently, the overwhelming majority of levee districts examined are managed by a board of trustees. As the number of resident landowners continues to decline, this type of management may not be feasible in the future. A relatively simple solution is for district management to revert to the county board of supervisors. However, there are challenges with supervisor management as well, one of those being the ability to manage and be on site at multiple levees at the same time. Supervisors may or may not have any experience in levee management and operations. One option that will be explored in more detail later in this study is to consolidate multiple levee districts into a single levee district for each levee system. For example, USACE levee system L594-601 has five segments each managed by a different levee district. Under consolidation, this entire system would be managed by a single board of trustees. This type of consolidation may become necessary as USACE regulations change. Under interim guidance published by USACE, PL 84-99, eligibility will be awarded at the system level instead of the segment level. Under this approach, if four segments of the L594-601 have acceptable or minimally acceptable ratings and one does not, all five segments will be considered inactive in the rehabilitation program and ineligible for federal assistance in repairing the levee system. A system board of trustees can develop a maintenance approach that will address the issues preventing the system from obtaining an acceptable rating on their USACE inspections. The two largest and most effective districts examined as part of this study are the result of consolidating several smaller districts into a single district. One of the things that was identified was a lack of required communication between the levee district trustees and the county board of supervisors. The trustees are required to submit an annual report to the county auditor. If that information was shared with the board of supervisors, we did not see any indication of that.

Regulatory. Levee sponsors are significantly impacted by and deal with the decisions and regulatory requirements of the USACE and FEMA. In general, USACE certifies levees and FEMA accredits levees. Levee certification is the process that deals specifically with the design and physical condition of the levee, and is the responsibility of the levee owner or community in charge of the levee's operations and maintenance. Note that levee certification does not warrant or guarantee performance. The levee owner is responsible to ensure the levee is being maintained and operated properly. Certification must be completed for the levee to be eligible for accreditation by FEMA.

Levee accreditation is FEMA's acknowledgment that a levee provides adequate risk reduction on the FIRM if the certification and adopted operation and maintenance plan provided by the levee owner are confirmed to be adequate. It is important to note that FEMA's accreditation is not a health and safety standard, it only affects insurance and building requirements. If a levee is not accredited, the area will be mapped as a high-risk area, known as a Special Flood Hazard Area, or SFHA.

The National Levee Safety Act of 2007, as amended and codified in 33 USC Chapter 46, includes activities in support of establishing a National Levee Safety Program to be led by USACE in cooperation with FEMA.

More details on the National Levee Safety Program are found in **Appendix E** of this study.

Section E – Recommendations

Based on the information collected, we have concluded that the current approach of managing and financing levee districts within the state of Iowa is unsustainable. The following section provides a summary of the recommendations for your consideration in addressing the information provided in this report.

Management Recommendations. Levee management recommendations include:

- Encourage existing levee districts to consolidate at the USACE system level
- Encourage a watershed approach to levee management
- Establish a state levee safety program
- Develop a comprehensive strategic plan for flood risk reduction along Iowa's waterways
- Encourage use of Councils of Government to complete administrative requirements

District consolidation at the system level provides the new district with more financial resources with minimal impact to the landowners living within the district. The consolidated district is able to fund projects that the smaller districts could not. This would allow for economy of scale advantages. These advantages could include purchasing power, the ability to hire administrative and maintenance employees, and increased trustee pool. Enrollment in USACE's rehabilitation program is determined at the system level so it makes sense for the system to be managed by a single board of trustees as opposed to multiple segment level boards because if one segment fails, the entire system fails. Flood risk reduction at the watershed level provides an opportunity for all entities along a watershed to work together to achieve the desired effects that could not be achieved individually. The advantages to this type of holistic approach to flood risk mitigation along the entire length of a watershed is the

cumulative effects of multiple sequenced projects. Multiple smaller projects along the length of the river can have a cumulative effect reducing the risks for everyone within the watershed. Smaller projects are generally cheaper to install and maintain while taking pressure of the larger more maintenance intensive features further downstream. This type of approach allows for the sequencing of projects to achieve the maximum benefits with the minimum costs.

The establishment of a state levee safety program coincides with language included in the National Levee Safety Program. As part of the legislation for the National Levee Safety Program, Congress envisions that state levee safety programs would adopt and implement consistent national levee safety program practices; be able to help receive federal assistance in support of levee safety; carry out public education activities to improve awareness of flood risk; and collect and share levee information using the National Levee Database. In addition, there is opportunity for state levee safety programs to: help build capacity in levee owner/operators to inspect, assess, repair and rehabilitate levees; collaborate across programmatic and political jurisdictions to ensure all levees have adequate oversight; and apply services in a fair and equitable way across the landscape with special attention to disadvantaged communities, tribes, and individuals particularly vulnerable to flooding.

Given the extensive planning and expense to establish and maintain a levee there needs to be a comprehensive approach to making these decisions. Currently local needs are identified and plans are developed to meet those immediate needs often without regard for the second and third order effects of that decision. The development of a state-level strategic plan will address not only long-term flood risk reduction but also assist system trustees in making decisions regarding immediate needs.

Levee sponsors are frequently required to make important and lasting financial and operational decisions with incomplete information. Having a pre-approved plan that addresses these types of situations helps guide trustees through the decision-making process. A strategic financial plan assists trustees in prioritizing their maintenance efforts to meet regulatory compliance and identify emergency funding sources before they are required. These plans at the State level help to focus recovery efforts and ensure limited resources are applied to projects that provide the most return on investment.

Funding Recommendations. The majority of the levee and drainage districts are not financially sound and lack the resources required to maintain their infrastructure. A different approach to funding this critical infrastructure is needed if Iowa is to continue to benefit from the risk reduction currently provided by the levees across the state. The following recommendations identify potential solutions to address funding shortfalls:

- Raise minimum levee assessments
- Consider expanding taxing authority to a watershed scale
- Implement a statewide levee assessment
- Require levee districts to establish a cash reserve fund
- Consider the State's funding contribution role

Iowa Code Chapter 468.127 states that any assessment made under this section on any tract, parcel or lot within the district, which is computed at less than five dollars, shall be fixed at the sum of five dollars. Raising the minimum assessment could generate a significant revenue increase to the district while having a minimal impact on the taxpayer. This particular change would be most beneficial to urban

levee districts that have large quantities of minimally assessed properties. The change would have minimal impact on generating funds for rural districts.

When developing a watershed approach, it is necessary to provide that entity with the financial resources necessary to conduct large-scale operations and maintenance activities. By assessing all parcels within the watershed, you greatly expand the population and diversity of the tax base. Taxing at the watershed scale includes all parcels that contribute water to the flooding problem instead of just taxing those who benefit from the levee's protection.

The major flooding events over the last 30 years have demonstrated that everyone benefits from levees and the protection that they provide. Levee system failures jeopardize our access to clean drinkable water, communications and energy infrastructure, as well as our transportation networks, all of which are vital to the health of our citizens and our economy. The implementation of a statewide levee assessment in which all taxpayers contribute would help to provide the necessary financial resources required to provide adequate flood risk reduction to our State's critical physical and economic infrastructure.

Require levee districts establish a cash reserve or emergency fund to pay for future maintenance, operations, and improvements. Regardless of any changes made to the methods of collecting revenue to support the state's levee infrastructure, recommend a change to Iowa Code 468 establishing a mandatory cash reserve fund to pay maintenance and repair expenses at the district level. Given the aging levee infrastructure in the state and the corresponding increase in maintenance expenses that comes with it, it is fiscally responsible to require the establishment of a cash reserve fund to prepare for major expenses and disaster response scenarios. The establishment of a state-level cash reserve fund to provide the districts with financial assistance following a State or federally declared disaster is something to be considered as well.

Under the current funding model, the State of Iowa only provides financial assistance to levee districts following a catastrophic event. We suggest the State explore the idea of providing ongoing, consistent financial assistance to levee sponsors to assist in the ongoing operations and maintenance levees. The establishment of a consistent and reliable source of financial assistance, in conjunction with a state-level strategic plan to assist levee sponsors in attaining and maintaining enrollment in the PL 84-99 rehabilitation program, could save the State millions of dollars in funds used to repair damage by ensuring levee sponsors qualify for federal assistance. Any new funding mechanism should include a method of equitable distribution of resources while achieving the State's strategic flood mitigation goals. The Resource Enhancement and Protection (REAP) Program is a potential example of equitable distribution of funding.

Strategic investments in flood risk reduction help to ensure limited financial resources are applied to those projects that provide the most return on investment. Money strategically invested in mitigation projects in the upper watershed projects have the potential to save millions of dollars in repairs and future projects in the lower watershed.

[Consolidate Levee & Drainage Districts in Iowa Code](#). Merging drainage or levee districts is a voluntary action taken by the current managing board of the district and cannot currently be directed. There are several advantages to merging districts given the challenges faced by drainage and levee districts, which include economy of scale purchases, larger assessment base, larger trustee base, and alignment with regulatory changes. The consolidated districts examined as part of this study are among

the most financially viable districts included in this study. Consolidated districts have the financial resources available to enable them to take advantage of economy of scale purchases for both materials and services. Additional details on all of the above recommendations can be found in **Appendix F** of this report.

Appendices

SYSTEM NAME	STATE	COUNTY	COMMUNITY NAMES
Main Ditch No. 6 (Atchison County) 1	Iowa, Missouri	Atchison, Fremont	Atchison County
Hamburg - Main Ditch 6 LB	Iowa, Missouri	Atchison, Fremont	Fremont County
Main Ditch No. 6 (Atchison County) 2	Iowa, Missouri, Nebraska	Atchison, Fremont, Nemaha	Atchison County
L-575 (BW-McKissock-Buchanan-Atchison-Hamburg)	Iowa, Missouri, Nebraska	Atchison, Fremont, Nemaha	Atchison County, Fremont County, Hamburg City, Nemaha County
Waterloo Flood Control Project Levee 1	Iowa	Black Hawk	Waterloo City
Waterloo Flood Control Project Levee 2	Iowa	Black Hawk	Waterloo City
Cedar River/Dry Run Creek At Cedar Falls 1	Iowa	Black Hawk	Cedar Falls City
Cedar River	Iowa	Black Hawk	Waterloo City
Cedar Falls, IA	Iowa	Black Hawk	Cedar Falls City
Waterloo, IA - RDB Cedar River / LDB Black Hawk Ck. (North West)	Iowa	Black Hawk	Waterloo City
Waterloo, IA - RDB Cedar River / RDB Black Hawk Ck. (South West)	Iowa	Black Hawk	Waterloo City
Waterloo & Evansdale, IA - LDB Cedar River	Iowa	Black Hawk	Evansdale City, Waterloo City
Waterloo, IA - Waste Water Treatment Plant (South)	Iowa	Black Hawk	Waterloo City
Badger Creek Levee	Iowa, Nebraska	Boone, Ida	Ida Grove City
East Fork Wapsipinicon River Levee	Iowa	Bremer	Bremer County
Wapsipinicon River Levee	Iowa	Bremer	Bremer County
Undefined	Iowa, Missouri	Butler, Monona	Monona County
Undefined	Iowa	Cape Girardeau, Monona	Monona County
Mississippi River Levee - Marquette	Iowa	Clayton	Marquette City
Elkport, IA	Iowa	Clayton	Elkport City
Elkader, IA	Iowa	Clayton	Elkader City
Volga, IA	Iowa	Clayton	Volga City
Volga, IA - Nagle Creek	Iowa	Clayton	Volga City
Mississippi River - Guttenberg	Iowa	Clayton	Clayton County, Guttenberg City
Clinton, IA	Iowa	Clinton	Clinton City
Clinton, IA LDB Turtle Creek	Iowa	Clinton	Clinton City
Sewage Disposal Pond Levee 1	Iowa	Crawford	Crawford County, Denison City
Sewage Disposal Pond Levee 2	Iowa	Crawford	Crawford County
Denison - East Boyer River LB (NF)	Iowa	Crawford	Denison City
Denison - East Boyer River RB	Iowa	Crawford	Denison City
Van Meter Levee	Iowa	Dallas	Dallas County, Van Meter City
Des Moines County Drainage District Seven 3	Iowa	Des Moines	Des Moines County
Burlington Northern Bottoms Levee	Iowa	Des Moines	Burlington City
Skunk River Levee	Iowa	Des Moines	Des Moines County
Hawkeye-Dolby 1	Iowa	Des Moines	Des Moines County
Des Moines County Drainage District Seven 5	Iowa	Des Moines	Des Moines County
Hawkeye-Dolby 2	Iowa	Des Moines	Des Moines County
Des Moines County Drainage District Seven 7	Iowa	Des Moines	Des Moines County
Hawkeye-Dolby 3	Iowa	Des Moines	Des Moines County

SYSTEM NAME	STATE	COUNTY	COMMUNITY NAMES
Mississippi River	Iowa	Des Moines	Des Moines County
Des Moines County Drainage District Seven 4	Iowa	Des Moines	Des Moines County
Des Moines County Drainage District Seven 2	Iowa	Des Moines	Des Moines County
Des Moines County Drainage District Seven 1	Iowa	Des Moines	Des Moines County
Burlington, IA (North Bottoms Levee And Drainage District)	Iowa	Des Moines	Burlington City, Des Moines County
Two Rivers L&DD - Middle Unit	Iowa	Des Moines	Des Moines County
Two Rivers L&DD - Lower Unit	Iowa	Des Moines	Des Moines County
Two Rivers L&DD - Yellow Springs Cr (SW)	Iowa	Des Moines	Des Moines County
Union Township, IA - LDB Skunk River / LDB Brush Creek (East)	Iowa	Des Moines	Des Moines County
Union Township, IA - LDB Skunk River / RDB Brush Creek (West)	Iowa	Des Moines	Des Moines County
Two Rivers L&DD - Upper Unit	Iowa	Des Moines, Louisa	Des Moines County, Louisa County
Omaha - Missouri River RB	Iowa, Nebraska	Douglas, Pottawattamie	Carter Lake City, Omaha City
Dubuque Levee	Iowa	Dubuque	Dubuque City
Cascade	Iowa	Dubuque	Cascade City
Dubuque, IA	Iowa	Dubuque	Dubuque City
Cascade, IA	Iowa	Dubuque, Jones	Cascade City
Whitehead	Iowa	Fremont	Fremont County
Winslow Segment 1	Iowa	Fremont	Fremont County
Winslow Segment 2	Iowa	Fremont	Fremont County
Winslow Segment 3	Iowa	Fremont	Fremont County
L-594-575 (BW-PV-Waubonsie)	Iowa	Fremont	Fremont County
Riverton - Winslow - East Nishnabotna LB (NF)	Iowa	Fremont	Fremont County
IAfrem0141 - East Nishnabotna RB & West Nishnabotna LB	Iowa	Fremont	Fremont County
L-594-601	Iowa	Fremont, Mills	Fremont County, Mills County
Sewage Disposal Pond Levee - Churdan	Iowa	Greene	Churdan City, Greene County
Missouri Valley Levee 1	Iowa	Harrison	Harrison County, Missouri Valley City
Missouri Valley Levee 2	Iowa	Harrison	Harrison County, Missouri Valley City
Missouri Valley Levee 4	Iowa	Harrison	Harrison County
Missouri Valley Levee 5	Iowa	Harrison	Harrison County
Missouri Valley Levee 6	Iowa	Harrison	Harrison County
Missouri Valley Levee 7	Iowa	Harrison	Harrison County
Missouri Valley Levee 8	Iowa	Harrison	Harrison County
Missouri Valley Levee 9	Iowa	Harrison	Harrison County
Missouri Valley Levee 10	Iowa	Harrison	Harrison County, Logan City
Missouri Valley Levee 11	Iowa	Harrison	Harrison County
Little Sioux LB & Hogue Ditch LB – Inter-county	Iowa	Harrison, Monona	Harrison County, Monona County
Little Sioux RB & Monona-Harrison LB – Inter-county	Iowa	Harrison, Monona	Harrison County, Monona County
Little Sioux West Fork Ditch RB & Monona-Harrison Ditch RB – Inter-county	Iowa	Harrison, Monona, Woodbury	Harrison County, Monona County

SYSTEM NAME	STATE	COUNTY	COMMUNITY NAMES
Allen Creek Levee	Iowa	Harrison, Pottawattamie	Pottawattamie County
Allen Creek Levee 2	Iowa	Harrison, Pottawattamie	Pottawattamie County
Missouri Valley Levee 3	Iowa	Harrison, Pottawattamie	Harrison County, Pottawattamie County
Badger Creek Levee 2	Iowa	Ida	Ida Grove City
Ida Grove - Odebolt Creek RB & Maple LB	Iowa	Ida	Ida County, Ida Grove City
Ida Grove - Maple River RB	Iowa	Ida	Ida Grove City
Ida Grove - Maple River LB	Iowa	Ida	Ida Grove City
Ida Grove - Odebolt Creek LB	Iowa	Ida	Ida County, Ida Grove City
Amana	Iowa	Iowa	Iowa County
Marengo, IA	Iowa	Iowa	Iowa County, Marengo City
Green Island 1	Iowa	Jackson	Jackson County
Green Island 2	Iowa	Jackson	Jackson County
Green Island 3	Iowa	Jackson	Jackson County
Sabula, IA	Iowa	Jackson	Jackson County, Sabula City
Green Island Levee & Drainage District No. 1	Iowa	Jackson	Jackson County
Clear Creek Park Street Levee	Iowa	Johnson	Tiffin City
Green Bay Levee & Drainage District No. 2	Iowa	Lee	Lee County
Keokuk, IA	Iowa	Lee	Keokuk City
Cedar River Levee No. 1	Iowa	Linn	Cedar Rapids City
Cedar River Levee No. 3	Iowa	Linn	Cedar Rapids City
Cedar Rapids, IA - East	Iowa	Linn	Cedar Rapids City
Louisa County Levee District No. 11	Iowa	Louisa	Louisa County
Louisa County Levee District No. 8	Iowa	Louisa	Louisa County
Louisa County Levee District No. 14	Iowa	Louisa	Louisa County
Muscatine Island L&DD, Muscatine - Louisa Co DD No 13 & Muscatine, IA	Iowa	Louisa, Muscatine	Louisa County, Muscatine County, Muscatine City
Eddyville, IA	Iowa	Mahaska, Monroe, Wapello	Eddyville City, Mahaska County, Wapello County
Iowa River Private - Marshalltown	Iowa	Marshall	Marshalltown City
Marshalltown, IA - RDB Iowa River/LDB Linn Creek (North)	Iowa	Marshall	Marshalltown City
Marshalltown, IA - RDB Linn Creek/RDB Anson Creek (South East)	Iowa	Marshall	Marshalltown City
Marshalltown, IA - RDB Linn Creek/LDB Anson Creek (South West)	Iowa	Marshall	Marshalltown City
Emerson FPP	Iowa	Mills	Mills County
Private Levees	Iowa	Mills	Mills County
Mills County Ag Levees	Iowa	Mills	Mills County
MRLS L-601 Watkins-LD A	Iowa	Mills	Mills County
MRLS L-601 Watkins-LD B	Iowa	Mills	Mills County
Emerson - Indian Creek RB	Iowa	Mills	Emerson City, Mills County
L-601 - Watkins Ditch RB - Watkins DD	Iowa	Mills	Mills County
L-611-614-Moriv LB & Upr Pony Creek LB & L1B LB	Iowa	Mills, Pottawattami e	Council Bluffs City, Mills County, Pottawattamie County
Little Sioux – Inter-country DD	Iowa	Monona	Monona County
Little Sioux LB - Nagel DD South	Iowa	Monona	Monona County
Little Sioux LB & Maple River RB – Inter-country	Iowa	Monona	Monona County
Little Sioux LB - Nagel And Inter-country DD	Iowa	Monona	Monona County
Little Sioux LB & Cottonwood Cr LB –	Iowa	Monona	Monona County

SYSTEM NAME	STATE	COUNTY	COMMUNITY NAMES
Inter-county			
Little Sioux LB & Beaver Creek LB - Inter-county	Iowa	Monona	Monona County
Little Sioux LB & Beaver Creek RB – Inter-county	Iowa	Monona	Monona County
Little Sioux Maple River RB North – Inter-county	Iowa	Monona	Castana City, Monona County
Little Sioux LB - Castana – Inter-county	Iowa	Monona	Castana City, Monona County
Little Sioux Maple River RB South – Inter-county	Iowa	Monona	Castana City, Monona County
Little Sioux LB - Nagel DD North	Iowa	Monona, Woodbury	Monona County, Woodbury County
Little Sioux Wolf Cr RB & W Fork LB – Inter-county	Iowa	Monona, Woodbury	Monona County
Little Sioux West Fork Ditch RB – Inter-county	Iowa	Monona, Woodbury	Monona County
Little Sioux & Wolf Creek	Iowa	Monona, Woodbury	Monona County, Smithland City, Woodbury County
Coe Creek Levee	Iowa	Montgomery	Elliott City
Red Oak - East Nishnabotna LB	Iowa	Montgomery	Montgomery County, Red Oak City
Hockey's Slough Levee	Iowa	Muscatine	Muscatine County, Nichols City
Hockey's Slough Levee B	Iowa	Muscatine	Muscatine County, Nichols City
Hockey's Slough Levee A	Iowa	Muscatine	Muscatine County, Nichols City
Muscatine, IA - Mad Creek (South)	Iowa	Muscatine	Muscatine City
Muscatine, IA - Geneva Creek (North)	Illinois, Iowa	Muscatine, Rock Island	Muscatine City
WDM-I	Iowa	Polk	Des Moines City
Des Moines Water Works Levee	Iowa	Polk	Des Moines City
Polk County Drainage District Number 9	Iowa	Polk	Carlisle City, Polk County
Des Moines, IA & SE DM - SW Pleasant Hill Red Rock Remedial Works	Iowa	Polk	Des Moines City, Pleasant Hill City
Des Moines, IA - DM Ii - RDB Des Moines River / LDB Raccoon River	Iowa	Polk	Des Moines City
Des Moines, IA - DM Iii - RDB Des Moines River / Raccoon River	Iowa	Polk	Des Moines City
Des Moines, IA - Rr I - RDB Raccoon River	Iowa	Polk	Des Moines City
West Des Moines & Des Moines, IA	Iowa	Polk	Des Moines City, West Des Moines City
Des Moines, IA - LDB Des Moines River (Birdland)	Iowa	Polk	Des Moines City
Des Moines, IA - RDB Des Moines River (Central Place)	Iowa	Polk	Des Moines City
Indian Creek Levee - Story Co, IA	Iowa	Polk, Story	Story County
Indian Creek Levee - Story Co, IA 2	Iowa	Polk, Story	Story County
Mosquito Creek Tieback	Iowa	Pottawattamie	Council Bluffs City
Council Bluffs Levees	Iowa	Pottawattamie	Council Bluffs City
L-624-627-611-614 - Mosquito Cr & Upper Pony Cr	Iowa	Pottawattamie	Council Bluffs City, Pottawattamie County
L-611-614 - Upper Pony Creek LB & Lat 1B RB	Iowa	Pottawattamie	Pottawattamie County

SYSTEM NAME	STATE	COUNTY	COMMUNITY NAMES
L-624 Mo Riv LB & Indian LB & Mosquito Creek RB	Iowa	Pottawattamie	Council Bluffs City
L-627 Mo River LB & Indian Creek RB	Iowa	Pottawattamie	Council Bluffs City
Alcoa Levee	Iowa	Scott	Riverdale City
Bettendorf Local FPP	Iowa	Scott	Bettendorf City, Davenport City
Bettendorf, IA	Iowa	Scott	Bettendorf City
Davenport, IA - Water Treatment Plant	Iowa	Scott	Davenport City
Hawarden - Dry Creek RB	Iowa	Sioux	Hawarden City
Hawarden - Dry Creek LB	Iowa	Sioux	Hawarden City
Ballard Creek Levee	Iowa	Story	Cambridge City, Story County
Indian Creek Levee - Story Co, IA 3	Iowa	Story	Story County
Tama, IA	Iowa	Tama	Tama County, Tama City
Ottumwa, IA - LDB Des Moines R RDB Har. B Ck LDB Dr D (Westside-Middle C.)	Iowa	Wapello	Ottumwa City
Ottumwa, IA - LDB Des Moines R LDB Harrows B Ck (Westside - Lower Cell)	Iowa	Wapello	Ottumwa City
Ottumwa, IA - RDB Des Moines R (South)	Iowa	Wapello	Ottumwa City, Wapello County
Ottumwa, IA - LDB Des Moines R RDB Drainage D (Westside - Upper Cell)	Iowa	Wapello	Ottumwa City
Ottumwa, IA - LDB Des Moines R (North)	Iowa	Wapello	Ottumwa City, Wapello County
Old Joe Griffin Levee	Iowa	Wapello	Ottumwa City, Wapello County
Levee #1 Highway 9	Iowa	Winneshiek	Winneshiek County
College Levee	Iowa	Winneshiek	Decorah City
Valley View Drive Levee	Iowa	Winneshiek	Decorah City
Decorah Levee	Iowa	Winneshiek	Decorah City
Dry Run - Decorah - Left Bank	Iowa	Winneshiek	Decorah City
Dry Run - Decorah - Right Bank	Iowa	Winneshiek	Decorah City
Little Sioux LB - Bennet-Smithland	Iowa	Woodbury	Woodbury County
Sioux City - Floyd River LB	Iowa	Woodbury	Sioux City City
Sioux City - Floyd River RB	Iowa	Woodbury	Sioux City City
Sioux City - Big Sioux River LB	Iowa	Woodbury	Sioux City City
Sioux City - Perry Creek Left Bank	Iowa	Woodbury	Sioux City City
Sioux City - Perry Creek Right Bank	Iowa	Woodbury	Sioux City City

SEGMENT NAME	IS USACE	COUNTY	INSPECTION RATING
L-624 Mo Riv LB & Indian LB & Mosquito Creek RB	Yes	Pottawattamie	Acceptable
Bettendorf, IA	Yes	Scott	Acceptable
Tama, IA	Yes	Tama	Acceptable
Des Moines, IA - LDB Des Moines River (Birdland)	Yes	Polk	Acceptable
Cascade, IA	No	Dubuque, Jones	Acceptable
Ottumwa, IA - LDB Des Moines R RDB Drainage D (Westside - Upper Cell)	No	Wapello	Acceptable
Muscatine-Louisa County DD No. 13	No	Louisa, Muscatine	Acceptable
Des Moines, IA - LDB Des Moines River (DM-I)	Yes	Polk	Minimally Acceptable
Avon Station, IA Red Rocks Remedial Works	Yes	Polk	Minimally Acceptable
Carlisle, IA - Red Rocks Remedial Works	Yes	Warren	Minimally Acceptable
Bedford Iowa Channel	Yes	Taylor	Minimally Acceptable
Little Sioux Monona-Harrison Ditch RB – Inter-county Segment	Yes	Harrison, Monona, Woodbury	Minimally Acceptable
Red Oak - East Nishnabotna LB	Yes	Montgomery	Minimally Acceptable
Sioux City - Big Sioux River LB	Yes	Woodbury	Minimally Acceptable
L-575 - Nishnabotna RB - Hamburg D&LD Segment	Yes	Atchison, Fremont, Nemaha	Minimally Acceptable
Hamburg - Main Ditch 6 LB	Yes	Atchison, Fremont	Minimally Acceptable
L-575 - Mo River LB & Nishnabotna River RB - NW Atchison LD Segment	Yes	Atchison, Fremont, Nemaha	Minimally Acceptable
L-575 - Mo River LB - Buchanan DD#1 Segment	Yes	Atchison, Fremont, Nemaha	Minimally Acceptable
L-611-614 - Mo Riv LB & Upper Pony Creek LB & Lateral 1B LB	Yes	Mills, Pottawattamie	Minimally Acceptable
L-611-614 - Upper Pony Creek Right Bank - M&P MR LD Segment	Yes	Pottawattamie	Minimally Acceptable
Denison - East Boyer River RB	Yes	Crawford	Minimally Acceptable
Omaha - Missouri River RB	Yes	Douglas, Pottawattamie	Minimally Acceptable
Ida Grove - Odebolt Creek LB	Yes	Ida	Minimally Acceptable
Sioux City - Perry Creek LB	Yes	Woodbury	Minimally Acceptable
Sioux City - Perry Creek RB	Yes	Woodbury	Minimally Acceptable
Burlington, IA (North Bottoms Levee And Drainage District)	Yes	Des Moines	Minimally Acceptable
Clinton, IA	Yes	Clinton	Minimally Acceptable
Dubuque, IA	Yes	Dubuque	Minimally Acceptable
Muscatine, IA (Muscatine Island LD)	Yes	Louisa, Muscatine	Minimally Acceptable
Muscatine, IA - Mad Creek (South)	Yes	Muscatine	Minimally Acceptable
Sabula, IA	Yes	Jackson	Minimally Acceptable
Cedar Falls, IA	Yes	Black Hawk	Minimally Acceptable
SE Des Moines & SW Pleasant Hill, IA - Red Rock Remedial Works	Yes	Polk	Minimally Acceptable
Des Moines, IA - RDB Des Moines River / LDB Raccoon River (DM-II)	Yes	Polk	Minimally Acceptable

SEGMENT NAME	IS USACE	COUNTY	INSPECTION RATING
Des Moines, IA - RDB Des Moines And Raccoon River (DM-III)	Yes	Polk	Minimally Acceptable
Des Moines, IA - RDB Raccoon River (RR-1)	Yes	Polk	Minimally Acceptable
West Des Moines, IA (WDM-DM)	Yes	Polk	Minimally Acceptable
Des Moines, IA - RDB Walnut/LDB Raccoon R (WDM-DM)	Yes	Polk	Minimally Acceptable
Marengo, IA	Yes	Iowa	Minimally Acceptable
Marshalltown, IA - RDB Iowa River/LDB Linn Creek (North)	Yes	Marshall	Minimally Acceptable
Marshalltown, IA - RDB Linn Creek/RDB Anson Creek (South East)	Yes	Marshall	Minimally Acceptable
Marshalltown, IA - RDB Linn Creek/LDB Anson Creek (South West)	Yes	Marshall	Minimally Acceptable
Evansdale, IA	Yes	Black Hawk	Minimally Acceptable
Waterloo, IA - Virden Creek Dry Reservoir	Yes	Black Hawk	Minimally Acceptable
Van Meter, IA	Yes	Dallas	Minimally Acceptable
Des Moines, IA - RDB Des Moines River (Central Place)	Yes	Polk	Minimally Acceptable
Davenport, IA - Water Treatment Plant	Yes	Scott	Minimally Acceptable
Mississippi River - Guttenberg	Yes	Clayton	Minimally Acceptable
Dry Run - Decorah - Left Bank	Yes	Winneschek	Minimally Acceptable
Ida Grove - Maple River RB	No	Ida	Minimally Acceptable
Denison - East Boyer River LB (NF)	No	Crawford	Minimally Acceptable
Volga, IA	No	Clayton	Minimally Acceptable
Elkader, IA	No	Clayton	Minimally Acceptable
Louisa County LD No 11	No	Louisa	Minimally Acceptable
Keokuk, IA	No	Lee	Minimally Acceptable
Ottumwa, IA - RDB Des Moines R (South)	No	Wapello	Minimally Acceptable
Ottumwa, IA - LDB Des Moines R RDB Harrows B Ck LDB Drainage D (Westside - Middle Cell)	No	Wapello	Minimally Acceptable
Ottumwa, IA - LDB Des Moines R LDB Harrows B Ck (Westside - Lower Cell)	No	Wapello	Minimally Acceptable
Eddyville, IA	No	Mahaska, Monroe, Wapello	Minimally Acceptable
Little Sioux LB - Bennet-Smithland	Yes	Woodbury	Unacceptable
Little Sioux LB - Nagel DD South	Yes	Monona	Unacceptable
Little Sioux LB - Nagel DD North	Yes	Monona, Woodbury	Unacceptable
Little Sioux LB & Maple River RB – Inter-county	Yes	Monona	Unacceptable
Little Sioux Wolf Creek RB & W Fork LB – Inter-county	Yes	Monona, Woodbury	Unacceptable
Little Sioux West Fork Ditch RB – Inter-county	Yes	Monona, Woodbury	Unacceptable
Little Sioux LB - Nagel DD Segment	Yes	Monona	Unacceptable
Little Sioux LB – Inter-county DD Segment	Yes	Monona	Unacceptable
Wolf Creek LB – Inter-county DD Segment	Yes	Monona, Woodbury	Unacceptable
Little Sioux RB - Nagel DD Segment	Yes	Monona, Woodbury	Unacceptable
Little Sioux RB - Bennett-Smithland Segment	Yes	Monona, Woodbury	Unacceptable
Little Sioux LB & Hogue Ditch LB – Inter-county	Yes	Harrison, Monona	Unacceptable

SEGMENT NAME	IS USACE	COUNTY	INSPECTION RATING
Little Sioux LB & Cottonwood Creek LB – Inter-county	Yes	Monona	Unacceptable
Little Sioux LB & Beaver Creek LB – Inter-county	Yes	Monona	Unacceptable
Little Sioux LB & Beaver Creek RB – Inter-county	Yes	Monona	Unacceptable
Little Sioux Maple River RB North – Inter-county	Yes	Monona	Unacceptable
Little Sioux LB - Castana – Inter-county	Yes	Monona	Unacceptable
Little Sioux Maple River RB South – Inter-county	Yes	Monona	Unacceptable
Little Sioux RB & Monona-Harrison Ditch LB – Inter-county Segment	Yes	Harrison, Monona	Unacceptable
Ida Grove - Odebolt Cr RB & Maple LB	Yes	Ida	Unacceptable
Hawarden - Dry Creek RB	Yes	Sioux	Unacceptable
Hawarden - Dry Creek LB	Yes	Sioux	Unacceptable
Emerson - Indian Creek RB	Yes	Mills	Unacceptable
Sioux City - Floyd River LB	Yes	Woodbury	Unacceptable
Sioux City - Floyd River RB	Yes	Woodbury	Unacceptable
L-594 - Waubonsie Creek Ditch LB - Waubonsie DD Segment	Yes	Fremont	Unacceptable
L-594 - Missouri River LB - Pleasant Valley Segment	Yes	Fremont	Unacceptable
L-575 - Plum Creek RB - Benton-Washington Segment	Yes	Fremont	Unacceptable
L-575 - Nishnabotna RB - McKissock Island D&LD Segment	Yes	Atchison, Fremont, Nemaha	Unacceptable
L-575 - Mo River LB & Plum Creek LB - Benton-Washington Segment	Yes	Atchison, Fremont, Nemaha	Unacceptable
L-601 - Watkins Ditch LB - Watkins DD Segment	Yes	Fremont, Mills	Unacceptable
L-601 - Missouri River LB - Miller-Sturgeon Segment	Yes	Fremont, Mills	Unacceptable
L-601 - Missouri River LB - Bartlett Segment	Yes	Fremont, Mills	Unacceptable
L-594 - Waubonsie Creek RB - Waubonsie DD Segment	Yes	Fremont, Mills	Unacceptable
L-601 - Watkins Ditch RB - Watkins DD	Yes	Mills	Unacceptable
L-624-627 - Mosquito Creek LB - City Of CB Segment	Yes	Pottawattamie	Unacceptable
L-611-614 - Upper Pony Creek LB & Lat 1B RB	Yes	Pottawattamie	Unacceptable
L-627 Mo Riv LB & Indian Creek RB	Yes	Pottawattamie	Unacceptable
Ida Grove - Maple River LB	Yes	Ida	Unacceptable
Little Sioux - Farmer-Garretson Ditch RB & West Fork Ditch RB Segment	Yes	Harrison, Monona, Woodbury	Unacceptable
Two Rivers L&DD - Upper Unit	Yes	Des Moines, Louisa	Unacceptable
Two Rivers L&DD - Middle Unit	Yes	Des Moines	Unacceptable
Two Rivers L&DD - Lower Unit	Yes	Des Moines	Unacceptable
Green Bay Levee And Drainage District No. 1	Yes	Lee	Unacceptable
Muscatine Island Levee District	Yes	Louisa, Muscatine	Unacceptable
Muscatine, IA - Geneva Creek (North)	Yes	Muscatine, Rock Island	Unacceptable

SEGMENT NAME	IS USACE	COUNTY	INSPECTION RATING
Waterloo, IA - RDB Cedar R. / LDB Black Hawk Ck. (North West)	Yes	Black Hawk	Unacceptable
Waterloo, IA - RDB Cedar R. / RDB Black Hawk Ck. (South West)	Yes	Black Hawk	Unacceptable
Waterloo, IA - LDB Cedar River (East)	Yes	Black Hawk	Unacceptable
Waterloo, IA - W/W Treatment Plant (South)	Yes	Black Hawk	Unacceptable
Amana, IA - Coralville Remedial Works	Yes	Iowa	Unacceptable
Dry Run - Decorah - Right Bank	Yes	Winneshiek	Unacceptable
Riverton - Winslow - East Nishnabotna LB (NF)	No	Fremont	Unacceptable
Union Township LDB Skunk River/LDB Brush Creek (East)	No	Des Moines	Unacceptable
Union Township LDB Skunk River/RDB Brush Creek (West)	No	Des Moines	Unacceptable
Green Island Levee And Drainage District No. 1	No	Jackson	Unacceptable

Levees provide flood hazard reduction at various levels to private, public, and critical service infrastructure. Yet it is difficult for communities to determine how much protection a levee provides just by visual inspection. Qualified engineers must review levees and the results are passed on to the community. Levee certification is the process that deals specifically with the design and physical condition of the levee, and is the responsibility of the levee owner or community in charge of the levee's operations and maintenance. Certification consists of documentation, signed and sealed by a registered professional engineer, as defined in 44 CFR, Section 65.2. This documentation must state the following:

1. The levee meets the requirements of 44 CFR, Section 65.10
2. The data is accurate to the best of the certifier's knowledge
3. The analyses are performed correctly and in accordance with sound engineering practices

This documentation is provided to FEMA to demonstrate that a registered professional engineer certified the levee, and it meets the specific criteria and standards to provide risk reduction from a least the 1 percent annual chance flood.

To certify a levee, the community or levee owner must work with a licensed engineer or a federal agency responsible for levee design to develop and certify documentation that the levee meets design construction standards for at least the 1 percent annual chance flood. Levee certification does not warrant or guarantee performance, and is the responsibility of the levee owner to ensure the levee is maintained and operated properly.

For federally constructed levees, communities work closely with the USACE to monitor the condition of their levees. This monitoring is conducted through routine and periodic inspections. Routine inspections are a visual inspection to verify and rate the levee system operation and maintenance. It is typically conducted each year for all levees in the USACE Levee Safety Program. Several levee sponsors indicated that these annual inspections are transitioning to an every-other-year inspection. A periodic inspection is a comprehensive inspection conducted by an USACE multidisciplinary team that includes the levee sponsor and is led by a professional engineer. USACE typically conducts this inspection every five years on the federally authorized levees. The periodic inspections include three key steps:

1. Data Collection: A review of existing data on operation and maintenance, previous inspections, emergency action plans and flood-fighting records.
2. Field Inspection: Similar to the visual inspection for a routine inspection, but with additional features.
3. Final Report Development: A report including the data collected, field inspection findings, an evaluation of any changes in design criteria from the time the levee was constructed, and additional recommendations as warranted, such as areas that need further evaluation.

Both routine and periodic inspections result in a final inspection rating for operation and maintenance. The rating is based on the levee inspection checklist, which includes 125 specific items dealing with operation and maintenance of levee embankments, floodwalls, interior drainage, pump stations, and channels.

Each levee segment receives an overall segment inspection rating of acceptable, minimally acceptable or unacceptable. If a levee system comprises one or more levee segments (if there are different levee sponsors for different parts of the levee) then the overall levee system rating is the lowest of the

segment ratings. (<https://www.usace.army.mil/Missions/Civil-Works/Levee-Safety-Program/Levee-Inspections/>)

1. Acceptable: All inspection items are rated as acceptable
2. Minimally Acceptable: One or more inspection items are rated as minimally acceptable or one or more items are rated as unacceptable and an engineering determination concludes that the unacceptable inspection items would not prevent the segment/system from performing as intended during the next flood event.
3. Unacceptable: One or more inspection items are rated as unacceptable and would prevent the segment/system from performing as intended, or a serious deficiency noted in past inspections (previous unacceptable items in a minimally acceptable overall rating) has not been corrected within the established timeframe, not to exceed two years.

USACE shares inspection results with the authority responsible for the levee operation and maintenance, known as the levee sponsor. USACE also shares the results with FEMA, to help inform decisions about levee accreditation for flood insurance purposes.

Levee accreditation is a process by which FEMA formally recognizes a levee as providing protection from a 100-year flood or the base flood. In order for a levee to be accredited, it must first be evaluated by a professional engineer or a federal agency responsible for levee design such as the USACE and determined to meet their requirements as laid out in 44 CFR, Section 65.10. Additionally FEMA also maps the levee or levee system on the National Flood Insurance Program (NFIP).

FEMA plays a critical role in the process of approving levee accreditation. As administrator of the NFIP, FEMA is responsible for assessing flood hazards and related risks and providing appropriate flood hazard and risk information to communities in the flood insurance maps. FEMA does not design, build, inspect, operate, maintain or certify levees. As the administrator of the NFIP, FEMA is responsible for accurately identifying flood hazards and communicating those hazards and risks to affected stakeholders.

Because conditions in a community or watershed are constantly changing it is necessary to update flood hazard information reflected on Flood Insurance Rate Maps that are periodically assessed to ensure they reflect the current flood risk to both people and property. FEMA updates FIRMs nationwide through the Risk Map program. Levee systems are shown as being accredited, provisionally accredited, non-accredited or in the process of being restored or constructed. FEMA designates the areas landward of the levees as Zone A, Zone AE, Zone AR, Zone A99, Zone D, Zone X (shaded), or Zone X depending on the status of the levee systems and the type of study performed. Community officials use the new or updated FIRMs to make more informed decisions when advising where and how to build more safely. New or updated FIRMs also communicate to the public about the flood risk in each zone, allowing everyone to make more informed decisions about reducing the risk to families, homes and businesses.

According to the Guidance for Flood Risk Analysis and Mapping, “an accredited levee system is a system that FEMA has determined meets requirements of the NFIP regulations as cited in the Code of Federal Regulations at Title 44, Chapter 1, Section 65.10 (44 CFR 65.10) and that FEMA has recognized on a FIRM as reducing the flood hazards posed by a base (1-percent-annual-chance) flood.” FEMA makes this determination based on a submittal, by or on behalf of a community, which includes 44 CFR 65.10-compliant design data and documentation, certification by a registered professional engineer, as well as operations and maintenance documentation from the appropriate jurisdiction.

A FEMA accreditation of a levee system is not a guarantee that a levee will provide flood hazard reduction to properties of flooding. FEMA includes a note on related FIRM panels that overtopping or failure of an accredited levee system is possible. As a result, FEMA strongly encourages flood insurance for all insurable structures located in a floodplain. Property owners and residents are encouraged to consider flood insurance and flood proofing or other protective measures as a way to mitigate flood risk.

A provisionally accredited levee system is one, which has not met the documented requirements of an accredited system. FEMA established the provisionally accredited levee designation as an option for mapping the area while providing levee owners or communities more time to gather the required data and documentation. The levee owner or community leader must sign and submit an agreement to FEMA indicating the required data and documentation for compliance with 44 CFR 65.10 will be provided within 24 months of the 91st day following the date of the initial FEMA notification letter. Impacted FIRM panel(s) landward of the levee system will indicate that FEMA has provisionally accredited the levee system. Provisional accreditation is depicted on the FIRM as Zone X (shaded) areas of flood reduction.

According to the Guidance for Flood Risk Analysis and Mapping, “non-accredited levee systems are levee systems that do not meet the NFIP regulatory requirements of 44 CFR 65.10 and that are not shown on a FIRM as reducing the base flood hazard.” FEMA recognizes that a non-accredited levee does impact flood risk; therefore they have developed analysis and mapping procedures for non-accredited levees. They use a suite of approaches for analyzing flood hazards landward of levee systems.

Even accredited levee systems are subject to damage and overtopping which reduces the flooding risk mitigation to the protected areas until repairs can be completed. NFIP regulations contain two provisions that help alleviate the flood insurance impacts on property owners during the restoration of damaged levees or the construction of a new levee system. These provisions are intended to reduce flood insurance premium rates for insurable structures landward of levee system projects designed and intended for eventual accreditation. Under these provisions, FEMA will recognize a levee system undergoing construction or restoration, but not currently meeting 44CFR65.10 requirements as providing some (less than base level) level of hazard reduction.

In areas where a project is sufficiently underway to restore a levee system to meet 44 CFR 65.10 requirements, FEMA will issue a flood protection restoration determination in accordance with 44 CFR 65.14. Areas landward of the levee system being restored will be mapped as Zone AR on the FIRM and may present base flood elevations (BFEs) representing the current hazard as if the levee system was not in place. The Zone AR determination may provide property owners with reduced flood insurance premiums rates lower than rates in other mapped special flood hazard areas.

Of the 181 Iowa levee systems identified in the National Levee Database, only 58 are fully accredited by FEMA with an additional 16 receiving provisional accreditation. This leaves 107 or 59 percent of Iowa’s levee systems without this important designation. FEMA is currently updating their FIRM maps based on more recent data along the Missouri River. It is widely expected that this will result in most of the accredited Missouri River system losing its accredited status.

Levee systems play a vital role in managing flood risk for the nation. Approximately 25,000 miles of levees reduce risk for over 17 million people that live and work behind them. They also reduce risk to \$2.3 trillion in property value and much of our nation's critical infrastructure. Periodic flood events continue to shine light on the importance of levees and the continued need for a consistent national approach to better predict their performance and manage them in the broader community context.

To address this need, Congress enacted Title IX, entitled the National Levee Safety Program, of the Water Resources Development Act (WRDA) of 2007, as amended and codified in 33 U.S.C. Chapter 46. Title IX provides authorities for various activities, which are led by the U.S. Army Corps of Engineers and the Federal Emergency Management Agency, intended to work in a complimentary manner with each other.

The need for a National Levee Safety Program is driven by the current diverse approach to levee management. Responsibility for levee safety is currently distributed across all levels of government (federal/state/tribal/local), and while levee owners/operators work diligently to maintain levees with limited resources: much of the levee infrastructure is decades old and was built without the benefits of modern engineering practices; levees are designed, constructed, and managed by various entities, using different processes and standards; development continues to intensify behind levees, putting more reliance on levees' ability to perform and the need to consider evacuation and land-use planning for managing flood risk; and much of the public continues to remain unaware of their flood risks or actions they can take to reduce those risks.

The reliance on levees continues to grow as the climate changes, levees age, and increasing populations live and work behind levees. It is important that as we look at the next generation of investments in flood risk management, that stakeholders come together and coordinate efforts to combine levees with other ways of increasing community resilience, reducing disaster relief costs, recapturing some of the natural floodplain functions, and addressing inequities in technical capabilities, funding and oversight.

The National Levee Safety Program components are intended to work together to facilitate an integrated framework for managing reliable levee systems to protect people and reduce property damage. The objectives include:

1. Levee owners and all levels of government understand their roles and responsibilities in managing flood risk and creating resilient communities.
2. Levee owners have knowledge and tools to manage levee performance.
3. Communities have access to clear and actionable information regarding the benefits and risks of living with levees.
4. Levee owners and all levels of governmental agencies manage levees in a manner to reduce environmental impacts.
5. Federal agencies will align their programs to support levee-related flood risk management and community resiliency activities, starting with USACE and FEMA.

As the National Levee Safety Program is developed, USACE and FEMA will:

1. Engage in dialogue with all levels of government (federal/state/regional/local/tribal)
2. Conduct robust stakeholder engagement
3. Develop a robust set of voluntary national guidelines

4. Improve inspection and assessment capacity and tools
5. Use risk information to help inform decisions about levees
6. Align federal flood risk management programs where applicable.

The National Levee Safety Program contains four key components.

1. National Levee Safety Guidelines
2. Integrated Levee Management
3. National Levee Database
4. Implementation Support

National Levee Safety Guidelines. The goal of the National Levee Safety Guidelines is to serve as a national resource of voluntary best practices to help achieve nationwide consistency in improving the reliability of levees and resiliency of communities behind levees throughout the United States. The intent of the guidelines is for: levee owners/operators to have a common resource of practices; local officials and communities to have a common resource for best practices in floodplain, mitigation planning and emergency management; the private sector to have an available reference document; and federal, state, regional, and tribal organizations to use in association with their levee safety programs.

The approach to be taken for the National Levee Safety Guidelines is that they will contain a common set of practices. These practices are defined as: “Methods or techniques that have been generally accepted as superior to any alternatives and used to maintain quality. A practice may also include an established series of actions that are the accepted way of doing something.” Throughout development, we will strive to ensure the guidelines: reflect the needs of the intended user/practitioners through a collective consensus; are developed and reviewed by a diverse and relevant set of subject matter experts from government, industry, and associations; utilize credible sources of information; and are presented in an organized manner such that relevant information is easily found, key concepts may be easily understood, and the depth of content supports levee safety tasks and responsibilities.

Integrated Levee Management. Agencies at all levels of government contribute to floodplain management and levee management, but roles and responsibilities vary and sometimes are not well defined or coordinated. An integrated, coordinated set of levee safety programs across the country is envisioned as the mechanism to ensure that all levees in the nation have adequate, consistent oversight regardless of levee ownership. The goals for integrated levee management include: clarifying roles and responsibilities to improve coordination and implementation in order to be more complementary, streamlined, and effective in managing all levees in the nation; and promoting and encouraging formal levee safety programs at the state level to serve as key integrators with other entities that have levee responsibilities.

Understandably, there are various federal agencies with differing authorities – some own/operate levees, some oversee management of levees by others, and some have programs that assist stakeholders for floodplain management and/or levee-related activities.

An integrated approach to levee safety requires each entity (federal, state, tribe, levee owner/operator), and communities to understand and fulfill their responsibilities and to do so in coordination with each other. It is envisioned that the lynchpin to success is having states serve in a key integrator role. States have existing legal authorities to implement floodplain management regulations and have long-standing

relationships with local governments in areas such as emergency planning and response. Even though federal agencies and tribes can have their own levee safety programs for management of levees within their authorities, their levees still influence watersheds that exist within states.

As part of the legislation for the National Levee Safety Program, Congress envisioned that state levee safety programs would adopt and implement consistent national levee safety practices; be able to receive federal assistance in support of levee safety; carry out public education activities to improve awareness of flood risk; and collect and share levee information using the National Levee Database. In addition, there is opportunity for state levee safety programs to:

1. Help build capacity in levee owner/operators to inspect, assess, repair, and rehabilitate levees
2. Collaborate across programmatic and political jurisdictions to ensure that all levees have adequate oversight
3. Apply services in a fair and equitable way across the landscape with special attention to disadvantaged communities, tribes, and individuals particularly vulnerable to flooding

National Levee Database. The National Levee Database, found at <https://levees.sec.usace.army.mil>, is intended to serve as a dynamic, searchable inventory of information about all known levee systems in the nation and be a key resource for supporting decisions and actions affecting levees.

The goal of the National Levee Database and Data Collection is to be the national resource containing the most complete data record for all levees in the nation to improve flood risk management by:

1. Identifying the most critical levee safety issues
2. Understanding the true cost of maintaining levees
3. Quantifying the nation's flood risk exposure
4. Focusing priorities on future flooding

Efforts over the next few years will be focused on combining data from the National Levee Database with other national datasets such as the National Inventory of Dams, seeking ways to make the database compatible with other tools, and developing dashboards and training materials that will help users apply the information in a manner that best assists in levee management and investment decisions. In addition, with more than 5,000 levees in the National Levee Database which have limited information available, there is a need to collect further levee information. The following are considered for developing strategy for this program component:

1. Provide a comparable basic risk measure across all levees in the National Levee Database
2. Use a scalable approach for data collection that includes a less expensive "desktop" assessment method for levees with no population, buildings, or other identifiable assets behind them
3. Streamline processes to reduce costs and burden on levee owner/operators and states during data collection
4. Prioritize levees in states with recognized levee safety programs or where owners have volunteered to participate in inspections and assessments
5. Ensure states and levee owners understand the information collected, potential uses, and how they can revise or manage the information.

Implementation Support. The goal of this component is to identify and implement types of assistance, such as financial, technical, or streamlined processes, to motivate and support participation in the

National Levee Safety Program. As the program continues to evolve, there is an intent to put in place processes to continuously review the effectiveness of the program and assess the needs of users. This information will then be used to either improve existing program components or develop new materials or tools to help make further progress in achieving the program objectives.

There are many existing federal programs that can promote positive behaviors in floodplain management and behind levees by creating incentives that involve prioritization of federal funding and technical assistance and reductions or streamlining of federal requirements. The biggest and immediate opportunities rest with USACE and FEMA-led programs.

Having USACE and FEMA as co-leads of the National Levee Safety Program helps ensure the right blending of expertise (technical, floodplain management, flood risk identification, and communication) needed for the program. There is also an opportunity to recognize the importance of alignment of the National Levee Safety Program with two other national-level programs. First, the National Flood Insurance Program, administered by FEMA with approximately 21,000 participating communities, is a program that makes federally backed flood insurance available in those states and communities that agree to adopt and enforce floodplain management ordinances to reduce future flood losses. Second, the National Dam Safety Program, led by FEMA and supported by the USACE with 90,000 dams nationwide. Together, dams and levees play an important role in managing flood risks. These three national-level programs, working together, can truly help drive positive changes in behaviors.

Several other existing USACE and FEMA programs that provide assistance to support either floodplain management or levee-related activities present opportunities for improved alignment of requirements and objectives.

Based on the information collected during this study, we have concluded that the current approach of managing and financing levee districts within the state of Iowa is unsustainable in the future. Rural depopulation and changing regulatory requirements are beyond the Iowa General Assembly's ability to impact, and as such, they must adapt the Iowa Code to deal with these new realities. This appendix outlines the recommendations to be considered by the Iowa General Assembly regarding the management and funding of drainage and levee districts across the state.

A – Management Recommendations

We propose five recommendations to the General Assembly for consideration regarding the management of levee districts across the state. They include encouraging existing drainage and levee districts to consolidate at the USACE system level, encouraging a watershed approach to levee management, establishing a state levee agency, and developing a comprehensive strategic plan for flood control along Iowa's major waterways.

Encourage Existing Levee Districts to Consolidate at the USACE System Level. Current Iowa Code Chapter 468 allows for the merger of two or more drainage and levee districts under specified conditions identified in Subchapter I, Part 7. *In accordance with 468.263, "a merger must involve two or more voluntarily participating drainage or levee districts. In order to merge, all participating boards must identify which district will be the dominant district whose board will survive to govern the new district and all other boards will be dissolved. Once this has been determined, each participating board must propose and approve the merger as proposed. The boundary of participating drainage or levee districts must adjoin all or part of the boundary of another participating drainage or levee district. If two districts wishing to merge are separated by land not already included in a drainage or levee district, the proposed merger is contingent upon the annexation of such land. A merger may occur notwithstanding that a drainage or levee district participating in a merger is not otherwise eligible for dissolution under Part 6 of Subchapter I. In order to participate in a proposed merger, the board of a drainage or levee district must determine that the merger will substantially benefit the owners of land situated in the district. Public hearings must be held to provide landowners the opportunity to learn more about the proposed merger and voice their concerns. Each board of a participating drainage or levee district shall meet to vote on a resolution, which includes the question whether or not to approve the proposed merger. A board must vote on the resolution within forty-five days of the last public hearing conducted. The board shall only consider written objections to the proposed merger as filed in the office of the county auditor as provided in the notice for public hearings or comments made at a public hearing."*

Merging drainage or levee districts is a voluntary action taken by the current managing board of the district and cannot currently be directed. There are several advantages to merging districts given the challenges faced by drainage and levee districts, which include economy of scale purchases, larger assessment base, larger trustee base, and alignment with regulatory changes. The consolidated districts examined as part of this study are among the most financially viable districts included in this study. Consolidated districts have the financial resources available to enable them to take advantage of economy of scale purchases for both materials and services. Two Rivers Levee & Drainage District commented that they have generated cost savings through economy of scale purchases with minimal impact on levee and drainage assessments on the individual landowners. Consolidation of funding has allowed the district to fund projects that the individual districts would not have been able to address on their own. Consolidated districts also had the resources available to hire full- and part-time employees

to handle the day-to-day operations of the levee, conducting maintenance, monitoring pumps, and managing contracted projects. Consolidated districts have the additional resources available because of the expanded assessment base that comes with a larger district. Larger districts mean a larger population living within the district. This deepens the available pool of individuals who qualify to serve as a district trustee and creates a more competitive environment in which all voices have a chance to be heard. Larger districts are more likely to have a diverse population that includes commercial businesses, industry, and residential neighborhoods in addition to the agricultural lands typically found in a district. Assessment methods adapted to this type of diverse district can be very beneficial for everyone living and working in the district as demonstrated by the M&P Missouri River Levee District. See the M&P Levee District case study in Appendix Z-8 for more details on their assessment model. As discussed earlier in the report, USACE regulatory changes are shifting toward systems and away from segments. In most cases, each segment within a system is managed and operated by a different drainage or levee district. As inspections and program eligibility transition to the condition of the system, it makes sense for the system to be managed by a single entity. Consolidating the individual segment sponsors along a system into a single district creates a unity of effort that enables management to focus on the most pressing issues that are preventing the system from being eligible for federal assistance. By providing the necessary financial resources gained from a larger assessment base, this helps address issues in a timely manner to keep the system eligible for the PL 84-99 rehabilitation program and other federal assistance.

Encourage a Watershed Approach to Levee Management. Levee and drainage districts should be encouraged to participate in available watershed management authorities and if not currently available, they should work with neighboring districts and communities to form one. In 2010, Iowa lawmakers passed legislation authorizing the creation of watershed management authorities. A WMA is a mechanism for cities, counties, soil and water conservation districts (SWCDs) and stakeholders to cooperatively engage in watershed planning and management. A WMA is formed by an intergovernmental (Chapter 28E) agreement by two or more eligible political subdivisions within a specific eight-digit hydrologic unit code watershed. A board of directors governs the WMA, which may undertake the following activities: assess and reduce flood risk, assess and improve water quality, monitor federal flood risk planning and activities, educate residents of the watershed regarding flood risks and water quality and allocate moneys made available to the WMA for purposes of water quality and flood mitigation. Requirements of a WMA per Iowa Code Chapter 466B Subchapter II are: *“must be located within an 8-digit HUC watershed; all eligible political subdivisions (cities, counties, SWCDs) must be notified and provided the opportunity to participate within 30 days prior to WMA organization; a Chapter 28E agreement that includes a map of the watershed must be filed with the Secretary of State; the WMA must be governed by a Board of Directors and adopt by-laws and WMAs may not acquire land through eminent domain and do not have taxing authority.”* There are multiple benefits to cooperating with other jurisdictions within a watershed that include: conducting planning on a watershed scale, which has greater benefits for water quality improvement and flood damage reduction; fostering multi-jurisdictional partnership and cooperation; leveraging resources such as funding and technical expertise as well as facilitating stakeholder involvement in watershed management.

Since 2010, there have been 27 WMAs created across the state. There are three WMAs located within the counties included in this study; the East Nishnabotna Watershed Coalition (Fremont, Mills, and Pottawattamie), the West Nishnabotna Watershed Coalition (Fremont) and the Lower Cedar WMA (Louisa and Muscatine). While legislation establishing WMAs specifically states flood risk reduction, flood risk education, and flood mitigation are objectives of the authorities, most WMAs are focused almost exclusively on water quality issues. The current legislation on WMAs does not specifically state that levee districts are eligible for membership; however, they are generally considered a political subdivision of the State when applying for federal and State assistance. The advantage to this type of approach is the holistic approach to flood risk mitigation. Multiple smaller projects along the length of the river can have a cumulative effect, reducing the risks for everyone within the watershed. Smaller projects are generally cheaper to install and maintain, while taking pressure off the larger more maintenance intensive features further downstream. This type of approach allows for the sequencing of projects to achieve the maximum benefits with the minimum costs. If an upstream project can reduce river levels, downstream levees may not need to be raised to experience less saturation that leads to maintenance issues. The disadvantage of this type of management approach is it requires the voluntary participation by the cities and counties within the watershed. If a city or county opts not to participate in the WMA, the entire watershed is unable to maximize the benefits potential that could be achieved. Watersheds do not neatly fit into existing political subdivisions, which can create challenges in taxing citizens at the city or county level. A single county may have multiple watershed management authorities that they are working with and trying to financially support. Given the extended nature of a watershed, there are often different concerns at different points along the length of the watershed. These competing interests must be weighed and negotiated by WMA leadership to arrive at solutions that are in the best interest of the WMA as a whole.

Establish a State Levee Safety Program. The recommendation of the establishment of a state levee safety program is a result of language included in the National Levee Safety Program. Enacted by Congress in 2007, the National Levee Safety Program provides authorities for various activities, which led by USACE and FEMA, are intended to work complimentary with each other. The need for a National Levee Safety Program is driven by the current diverse approach to levee management. Appendix D details the reasoning and components of this program. An integrated approach to levee safety requires each entity (federal, state, tribe, levee owner/operator), and communities to understand and fulfill their responsibilities and to do so in coordination with each other. It is envisioned that the lynchpin to success is having states serve in a key integrator role. States have existing legal authorities to implement floodplain management regulations and have long-standing relationships with local governments in areas such as emergency planning and response. Even though federal agencies and tribes can have their own levee safety programs for management of levees within their authorities, their levees still influence watersheds that exist within states. As part of the legislation for the National Levee Safety Program, Congress envisions that state levee safety programs would adopt and implement consistent national levee safety program practices, be able to facilitate federal assistance in support of levee safety, carry out public education activities to improve awareness of flood risk, and collect and share levee information using the National Levee Database. In addition, there is opportunity for state levee safety programs to: help build capacity in levee owner/operators to inspect, assess, repair and rehabilitate levees; collaborate across programmatic and political jurisdictions to ensure all levees have adequate oversight; and apply services in a fair and equitable way across the landscape with special attention to disadvantaged communities, tribes, and individuals particularly vulnerable to flooding.

The development of a state levee safety program provides an opportunity for the state to collect information and monitor the status of levees across the state, which is not currently being done. A state levee safety program can serve as an intermediary between the local levee districts, state agencies and the federal government. In this role, a state levee safety program can advocate on behalf of the levee district and assist them on compiling information requirements to obtain federal funding similar to how the Iowa Department of Homeland Security and Emergency Management (HSEMD) does with FEMA. A state program can also attempt to address the differences in federal guidance between USACE districts. Other states have used this type of program to help monitor compliance with USACE and FEMA regulatory requirements by establishing annual reporting requirements.

A state department or agency responsible for the state levee safety program would be positioned to take a holistic approach to flood mitigation efforts across the state and develop a strategic plan for building, maintaining and rehabilitating levees across the state. The responsible agency would be positioned to coordinate or synchronize statewide flood mitigation efforts. In our discussion with levee sponsors, we discovered multiple state agencies interact with the districts to include the Iowa Department of Homeland Security and Emergency Management, Iowa Department of Natural Resources, the Iowa Department of Transportation and the State Historical Society. Potential State entities to take on this role include the Iowa Department of Agriculture and Land Stewardship, Iowa Economic Development Authority, Iowa Department of Natural Resources, Iowa Department of Transportation, Iowa Homeland Security and Emergency Management, and the Iowa Flood Center, as the impacts of a levee failure will have ramifications for all.

Develop a Comprehensive Strategic Plan for Flood Risk Reduction along Iowa's Waterways. Given the extensive planning and expense to establish and maintain a levee there needs to be a comprehensive approach to making these decisions. Often under the current management method, a local need is identified and a plan is developed to meet that immediate need without regard for the second and third order effects of that decision. Because these projects are often cost prohibitive without state or federal assistance, local governments are competing for limited state and federal resources to build and maintain their structures. Because these resources are limited, there needs to be a reasoned, thought-out approach to issuing financial support other than funding the squeaky wheel.

The following example is based on hindsight and all information available to us may or may not have been available to the Flood Mitigation Board at the time applications were approved. In early 2020, the Flood Mitigation Board took applications for projects related to Disaster 4421 with total funding of \$21 million dollars available. Applications were received from 49 potential applicants with 26 applicants being awarded funding for projects. The FMB awarded \$4,427,650 to the Coulthard Levee District to repair an existing breached levee that protects sparsely populated farmlands and I-29 by tying in the high ground along the south side of US Highway 30 to the Vanman Levee. The FMB chose not to award a \$5,013,895 project to re-establish an abandoned levee that would protect the same areas as the Coulthard Levee PLUS the DeSoto Refuge and additional farmland west to the US Highway 30 Bridge at Blair Nebraska. Completion of the Rand Peterson project would provide continuous levee protection along the Missouri River from Blair, Neb., to the Boyer River. By not funding the Rand Peterson Project, the Coulthard and Vanman levee projects that were funded by the FMB will be put at risk of failure from floodwaters flowing through the Rand Peterson's project area. A strategic plan prepared in advance that took a holistic view of the area would have likely identified the benefits of funding the Rand Peterson project over the Coulthard project.

A strategic plan should be developed at the district, watershed management authority (WMA) and the State level. These plans need to be communicated to residents at the appropriate level and they need to be coordinated among the various levels of government as well as with neighboring districts. Because the levee-related financial needs far exceed the available resources, it is important to identify the projects that can provide the greatest benefits that maximize the available funding. Communicating strategic plans at the county, WMA and State levels helps leaders at all levels to identify the scope of the problems and work together to generate the financial resources required to address issues. There will likely never be enough available funding to address all the needs. Strategic planning at the WMA and State levels provides an opportunity for the sequential funding of projects to achieve the desired long-term results that may not otherwise be achieved through random awarding of flood mitigation projects.

Encourage use of Councils of Government to Complete Administrative Requirements. Levee sponsors statewide are struggling to keep up with new and burdensome regulations to maintain their enrollment in federal rehabilitation programs. The time and effort required to complete and stay current on requirements exceeds the time available to the average trustee who is trying to operate and maintain their farm or business. To relieve some of this administrative burden, levee and drainage districts could tap into an already existing resource, which is the local council of government or COG. Formed more than 45 years ago, COGs provide regional planning and technical assistance to local governments and the communities in their region by *“providing individualized assistance to cities, counties, businesses, community organizations and community members (such as a local comprehensive plan, loans to local businesses, grant-writing assistance, and housing and workforce programs); providing planning services across multiple jurisdictions (such as regional comprehensive solid waste management plan or long-range transportation plan); and providing a forum that combines the elements of transportation planning, housing development, solid waste planning, and use planning, workforce development, and economic development into a comprehensive approach to regional growth and development.”* While COGs do not currently have the experience with these type of programs, they are experienced in working with local, state and federal agencies to obtain financial resources and meet regulatory requirements. This experience would greatly benefit most districts especially as they transition to less experienced trustees.

B – New Funding Approaches

The majority of the levee and drainage districts examined are not financially sound and lack the resources required to maintain their infrastructure. A new approach to funding this critical infrastructure is needed if Iowa is to continue to benefit from the risk reduction currently provided by the levees across the state. There are no easy answers to developing this new approach as it will need to place a financial burden on people who are not currently paying levee assessments and place new financial requirements on levee sponsors to plan ahead for expensive repairs and even more costly disaster responses. We offer three potential funding solutions for consideration by the General Assembly and an Iowa Code change to require financial savings by levee districts.

Raise Minimum Levee Assessments. Iowa Code Chapter 468.127 states that any assessment made under this section on any tract, parcel or lot within the district, which is computed at less than \$5, shall be fixed at the sum of \$5. Raising the minimum assessment to \$25 would generate a significant increase to the district while having a minimal impact on the taxpayer. This particular change would be most beneficial to urban levee districts that have large quantities of minimally assessed properties. The

change would have little or no impact on generating funds for rural districts. While this is a significant increase in the tax rate as percentage, the small amount currently being assessed allows for this because the result is only a \$20 per parcel increase in the property owners' annual assessment.

Consider Expanding Taxing Authority to a Watershed Scale. When developing a watershed approach to levee management, it is important to provide those managers the financial resources needed to operate and maintain such an area. By expanding the taxing authority to a watershed scale, you greatly increase the population and diversity of the tax base. This change helps ensure that everyone who contributes water to the river basin is included in providing resources to address flooding problems. Currently, only those taxpayers who receive flood protection from a levee are contributing to the district's financial resources. Property owners who live on the high ground above a leveed area do not contribute to the financial resources of a leveed area but they do contribute to the amount of water entering the leveed area. By expanding the tax base to include all property owners within the watershed, everyone financially contributes to the cost of operating and maintaining the flood risk reduction features within the watershed.

Statewide Levee Assessment. For decades, the costs of maintaining Iowa's levees have been born by the people and businesses who live and work in the leveed areas these structures provide. The major flooding events over the last 30 years have demonstrated that everyone benefits from these structures and the protection that they provide. Levees protect our transportation networks to include interstates, highways, county roadways, and railroads, which are used by taxpayers from across the state and nation to conduct business and travel for individual purposes. They also protect our utility infrastructure such as the electrical distribution systems, traditional phone services, cell phone towers, water distribution systems, sewer services, wastewater treatment facilities, and gas pipelines found in a single district that serve everyone in greater multi-county/state area. Other districts protect additional services such as water production facilities, electrical generation facilities, and internet service providers that provide services to people living outside of the leveed area protected by the levee system. Interruptions to these transportation networks and essential public services caused by widespread flooding put the state's economic, physical, and social well-being at risk. As such, the General Assembly should consider imposing a statewide levee assessment to be paid by all taxpayers, not just property owners. This assessment could be imposed as part of an individual's annual income taxes. This type of assessment could be a relatively small amount of \$25 paid by all taxpayers regardless of income or a more progressive income-based assessment could be imposed. This assessment should be made against the taxpayer not just property owners to include all Iowans in supporting the protection of our infrastructure. Rough estimates using the \$25 per taxpayer model indicate that \$37.5 million could be raised annually to support Iowa's levees. This is roughly equivalent to the recovery funding provided by the Flood Mitigation Board following the 2019 floods. This type of annual revenue, coupled with a state strategic plan, could significantly reduce flood risk across the state. It is this type of consistent funding necessary to rehabilitate and maintain Iowa's levees into the future.

Require Levee Districts to Establish a Cash Reserve Fund. Regardless of any changes made to the methods of collecting revenue to support the state's levee infrastructure, we recommend a change to Iowa Code 468 establishing a mandatory sinking fund to pay maintenance and repair expenses at the district level. Currently levee districts have the option under 468.61 that when one-half or more of all assessments for a drainage or levee district have been paid and it is ascertained that there will be a surplus in the district fund after all assessments have been paid, the board may refund to the owner of

each tract of land, not more than 50 percent of the owner's proportionate share of such surplus. Chapter 468.127 allows that if funds on hand are not sufficient to pay such expenses, the board within two years shall levy an assessment sufficient to pay the outstanding indebtedness and leave the balance which the board determines is desirable as a sinking fund to pay maintenance and repair expenses.

The average age of Iowa's levees is 52 years. Like other infrastructure (buildings, bridges, roads, etc.), as items age they require more and more funding to maintain them in a serviceable condition. Given the aging levee infrastructure in the state and the corresponding increase in maintenance expenses that comes with it, it is fiscally responsible to require the establishment of a sinking fund to prepare for major expenses and disaster response scenarios. The establishment of a State-level sinking fund to provide the districts with financial assistance following a State or federally declared disaster is something to be considered as well.

Consider the State's Funding Contribution Role. One of the factors identified was the lack of consistent and reliable funding for flood mitigation risk reduction projects. State programs such as the Flood Mitigation Fund have been established by the General Assembly but never funded, and the Flood Recovery Fund, established following the 2019 floods, is narrowly focused on specific counties impacted by that event. Both the federal and State governments surge financial resources to fund recovery efforts to restore levees to their pre-disaster condition after they have failed.

Critical to the success of developing and executing a strategic plan is being able to fund the projects needed to achieve the plan's desired effects. In order to achieve these effects, strategic planners need a reliable funding source to enable them to sequence projects to achieve the maximum effects. We recommend that the General Assembly utilize one or all of the methods outlined below to fund the Flood Mitigation Fund and the Flood Recovery Fund. Specific funding percentages can be adjusted as required based on the needs within the state.

Any new funding mechanism must include a method of equitable distribution of resources to the levee districts that need them. A concern voiced during discussions with levee sponsors was that the densely populated districts would be given the political and financial support for their programs because that is where the most voters reside. A couple of recommendations to consider include a per-mile or per-feature distribution of funding. This type of distribution is based on the physical attributes and features of the levee and not the number of voters protected by the levee. Another possible distribution approach would be based on the State's strategic plan for flood mitigation. Under this approach, projects would be funded based not only on immediate need but also on their results in achieving the goals established in the State's strategic plan.

C – Continuing Effort Recommendations

Statewide Levee Inventory. Part of the intent of this study was to establish a statewide levee inventory. This study represents an initial attempt to develop a levee inventory to be used for decision-making purposes. In order to accomplish this intent, we recommend that the General Assembly authorize additional funding to continue development of the inventory. Part of this ongoing effort needs to be a validation of the information found in the National Levee Database. There are significant discrepancies between the information found in the database and the information being provided by levee sponsors. These discrepancies include the omission of levee features to the inclusion of levee systems that are no longer active. This effort would require on-site observations by qualified staff.

Levee Monitoring Program. The General Assembly should consider the establishment of a statewide levee-monitoring program as part of a state levee safety program. The intent of the monitoring program is to identify levee systems in danger of structural failure and provide the financial assistance needed to prevent that failure. This would be achieved by monitoring USACE inspection reports, maintaining communication with levee sponsors and USACE, as well as requiring the submission of annual reports.

Standardize National Inspections. Standardize national inspection and design performance requirements for levees. There are differences in how the different USACE districts conduct inspections and implement guidance from the national level. The key to effectively spending limited financial resources so that municipalities can best reduce flood risk is to start with a clear understanding of the risks associated with a particular levee system. Risk assessment is best accomplished through a single set of national design standards and continuous levee assessment programs, which would require periodic inspection of all levee systems in Iowa. Only after standardizing design performance and inspection data collection attributes can one type of levee system be evaluated against a different type of levee system. Through this process, the NLD becomes a critical asset management tool that needs to be financially supported and sustained on a national level. By leveraging the risk assessment information in the NLD, federal, State and local authorities will then be able to effectively prioritize the use of limited funding resources.

Floodplain Hydraulics Studies. There is a need to fund continued study of floodplain hydraulics in order to maintain accurate data sets that incorporate impacts from climate change and infrastructure changes, which can cause variations in runoff rates and storm water volumes. Iowa municipalities and local levee sponsors have no capacity to analyze changes in regional weather patterns, nor measure impacts to floodplain profiles due to infrastructure improvements that change the hydrologic characteristics along flood corridors. USACE and other federal agencies have the most extensive resources available to be able to integrate regional data collection assets such as those maintained by the Iowa Flood Center and Iowa State University's climate science programs. Successful integration of all available data sources on a regional and national level provides the best opportunity for civil engineers to access data sets that will produce the most accurate floodplain models.

D – Iowa Code Modifications

Chapter 466B.2. Add Levee and Drainage Districts as specified political subdivisions. Add “3f. Levee and Drainage Districts”

Chapter 468.127.1, 468.136 and 468.137 Increase Minimum Levee Assessments from \$5 to \$25.

Change the language of the last sentence to include the word “twenty” as indicated in following sentence: “Any assessment made under this section on any tract, parcel, or lot within the district which is computed at less than twenty-five dollars shall be fixed at the sum of twenty-five dollars.”

Align Assessment Guidance for Levee and Drainage Districts

468.184. a. (5) – Levee district only – When the board shall, as authorized by section 468.65, determine that the assessments of benefits of said levee district against the lands in said levee district are generally inequitable the board may by resolution, or if a petition is filed by more than one-third of the owners, including corporations, of land within said levee district and who is the aggregate own more than one-

third of the value of the land and land improvements in said levee district as the value thereof is then shown by the general tax records of the county or counties in which such land and land improvements are located, requesting the board to do so, the board shall order the lands in said levee district and the improvements on the land in said levee district classified or reclassified in accordance with the assessed taxable value of said land and land improvements as the same are then shown and as the same may be thereafter shown by the assessment roll of the county or counties in which said land and land improvements are located.

468.327 Trustee Control. A district formed pursuant to this part, under the control of a city council, may be placed under the control and management of a board of trustees as provided in subchapter III of this chapter. Each trustee shall be a citizen of the United States not less than eighteen years of age and reside in a primary residence located within the benefited land in the district for which the trustee is elected. If the nominee is a family farm corporation as defined by section 9H.1, subsection 9, a business corporation organized and existing under chapter 490 or 491, or a partnership, a stockholder or officer authorized by the corporation or a general partner may be elected as a trustee of the district.

E – Iowa Code Additions

Establish Statewide Levee Assessment. See “Statewide Levee Assessment” paragraph above for details.

Mills County Economic Impact Analysis



August 4, 2022

1. Project Overview

The goal of this report is to provide the economic impact of potential new construction and projects in Mills County.

2. Model & Assumptions

- Model
 - IMPLAN Trade/Flow
- Regions
 - Mills County
- Multiplier
 - Type I and SAM multiplier types
- Capital Investment
 - Commercial Construction: \$72.6 million
 - Manufacturing Construction: \$450.0 million
- Potential Projects Included in Analysis
 - Industry Category: Warehousing and Storage
 - New Jobs: 50
 - Industry Category: Warehousing and Storage
 - New Jobs: 150
 - Industry Category: Hotels and Motels
 - New Jobs: 14
 - Industry Category: Beef Cattle Ranching and Farming
 - New Jobs: 650
 - Industry Category: Warehousing and Storage
 - New Jobs: 12

3. Summary

- During the years of construction, the \$522.6 million in construction activity would help support over 5,000 jobs in the construction industry and an additional 765 jobs in the community based on the increased economic activity.
- When fully operational, the economic activity generated by these projects in the area **would add about \$118.4 million to the local economy** each year.
 - Includes activity directly related to the company's operations and associated "spillover" activity.
- The 876 jobs at the five projects would help support an **additional 155 workers** in the community.
 - Additional workers include truck transportation, real estate, retail, restaurants, accountants, etc.
- The Mills County economy sees a **boost to earnings of about \$16.9 million** for jobs directly related to the operations of the projects, additional business-to-business spending, and additional household spending.

July 27, 2022

Flood Recovery Economic Development Impact and Opportunity

The Mills County Economic Development Foundation is grateful for the opportunity to play a supportive role in the funding of levees within Southwest Iowa. The following economic development activity and related information was assembled by the Mills County Economic Development Foundation for the review of state agencies and elected officials (Iowa), while they collectively consider the economic impacts of levee repairs and possible new mechanisms for funding in the M&P Missouri River Levee District located in Mills County, Iowa.

I. Introduction

The cost of not improving levees to accredited FEMA status is long term and severe. Critical infrastructure repairs within the M&P Missouri River Levee District are needed to spur and support new and existing economic growth at the present and log into the future. In 2021, the firm FYRA Engineering completed a \$1.3 million levee study on behalf of the M&P District to understand the specific projects and costs associated with improving the levee systems. Funding the needed levee repairs makes an immediate impact for the state, regional, and local communities charged with aiding the development of a more resilient and prosperous future for all Iowans.

The 2021 study named funding priorities and specific projects, which include: 1) Missouri River Levee Seepage Mitigation - Hwy 34 to I-29; 2) Missouri River Levee Seepage Mitigation - Hwy 34 to Hwy 370; 3) Missouri River Levee/Lateral 1B Seepage Mitigation (Upper Pony Creek); 4) Lower Pony Creek Levee Setbacks and NRCS Detention Cell Modification. The total cost of these improvements is \$65.3 million. A detailed project budget including construction, permitting, land rights can be found in the 2021 M&P Levee District Investigative Study Report completed by FYRA Engineering.¹

The expected return on investment of levee improvements in the M&P Missouri River Levee District will result in a more sustainable levee system as commercial development will supply new sources of revenue for Southwest, Iowa. The M&P District protects thousands of acres in cropland and existing commercial and industrial development sites (see attached Map 1.0). The district is home to the last remaining large and contiguous greenfield sites for large commercial and industrial development within Southwest, Iowa and the Interstate-29 corridor between Sioux City, Iowa, and Kansas City, Missouri. This commercially available land in Mills County supplies a competitive advantage for economic development growth in Iowa, helping the existing and future workforce of the region and the communities deriving an increased amount of future property tax revenue.

The Mills County Economic Foundation, with support from the Greater Omaha Economic Partnership work as a strategic partner aiming for the creation of new job opportunities and increased capital investment with the Greater Omaha-Council Bluffs Metropolitan Statistical Area (MSA). Future development will result in expanded property tax revenue, increased local wages and increased sales tax revenue. A lack of a funded plan will place Iowa in a more perilous economic development position.

¹ "171-20-01- M&P Levee Investigative Study Report". FYRA Engineering, www.fyraengineering.com (2021).

II. Opportunity in Mills County

A sizable percentage of land with high development potential exists within Mills County. This land is protected the critical infrastructure of the Missouri River Levee and Upper and Lower Pony Creek levees within Mills County, Iowa, and managed locally by the M&P Levee District in Mills. Sites² controlled by the Mills County Economic Development Foundation as well as development sites under control of private sector developers have gone through extensive due diligence.

Currently, there are over two thousand acres of land with completed due diligence, which is being considered for various commercial land use projects. Estimates of future property tax revenue is often difficult to predict prior to completed construction, but the estimated capital investment numbers associated with the projects surpass a billion dollars in total capital investment.

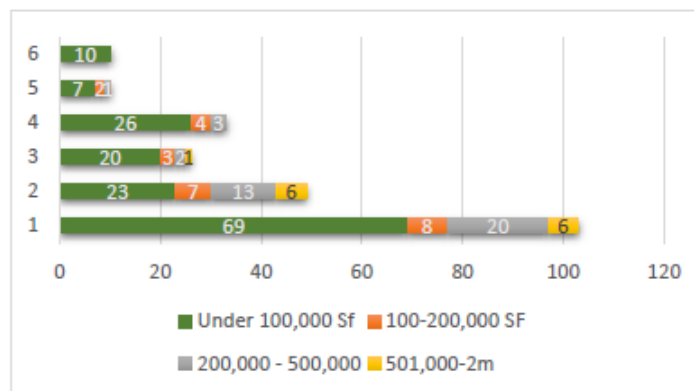
Mills County Development Sites:

1. Pacific Junction South Transload Park: **152 Acres**
2. Loess Hills Logistics Park: **440 Acres**
3. Bunge Ave and Interstate-29 Industrial: **196 Acres**
4. Bunge Ave and Interstate-29 Industrial (East): **160 Acres**
5. Mills Crossing IEDA Certified Industrial Site: **1600+ Acres**

III. Regional Economic Conditions and Current Demand for Real Estate:

The Mills County and the Omaha-Council Bluffs growing population, competitive laborshed, and diverse industry mix attract new opportunities for capital investment to the region. Inventory and availability of sites for future development is critical to the continued economic growth of the region. Mills County plays a significant role in meeting the site requirements for logistical, warehouse, and manufacturing projects looking to be strategically found to Interstate-29, close to a large labor force, and in need of large development sites to construct facilities.

Chart 1: Building Square Footage Demand 2021³.



² See attached see attached maps of “Active Economic Development Locations.” Produced by the Mills County Economic Development Foundation (2021).

³ Charts #1-2“2021 Building Demand, Building Type, Total Square Footage. Data compiled by *The Greater Omaha Chamber*, (2022)

Chart 2: Building Square Footage Demand 2021 (Lease vs Build).

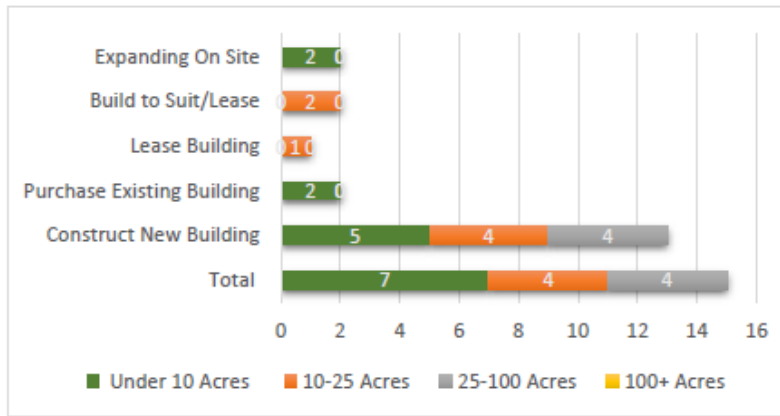


Chart 4: Building Construction, Purchase, or Lease⁴:

2021 Building Maximum Demand	Total	Construct New Building	Purchase Existing Building	Lease Building	Build to Suit/Lease
Under 100,000 Sf	69	23	20	26	7
100-200,000 SF	8	7	3	4	2
200,000 - 500,000	20	13	2	3	1
501,000-2m	6	6	1	0	0

Table 5: Job and Occupational Growth Rate 2010-2019 (See attachment 3)

IV. Regional Commercial Development Impact

Competitive local growth, specifically large power (electrical), logistical, and manufacturing expansions are currently invested in land within in Mills County. Between 2020-2022, Mills County has received request for site information (RFIs) for projects over \$30 billion in joint value. Currently, there are over \$700 million of projects in an active stage of development within Mills County real estate.

The recently certified Mills Crossing – Mega Site⁵, illustrates the collaborative regional, state, renewable energy sector (Mid American Energy) efforts to develop and invest in competitive economic advantage Southwest, Iowa. The Mega Site is minutes away from the Interstate 29 and Highway-34 interchange,

⁴ Table #1 “2021 Building Construction, Purchase, or Lease. Data compiled by *The Greater Omaha Chamber*, (2022)

⁵ See Certified Site, Mill County; <https://www.iowaeda.com/certified-site/mills-crossing/>

which will act a critical staging and logistical home for the potential industrial user(s) of the 1,641-acre site in Mills County.

The Economic Impact of the Mills Crossing Mega Site and existing active development projects has Mills County well positioned for industrial growth and expansion. It is premature to estimate the potential economic impact of the the Mills Crossing Mega Site, however an economic impact analysis of the current Mills County project activity can be estimated to provide a spill over effect of over \$110 million annually for the local community, creating over 5,000 construction jobs, and over 700 new jobs in the community.⁶

The direct and indirect economic impacts of active projects in addition to the substantial investment in mega-site development positions Mills County as a high growth area in Iowa and the greater Midwest. The Iowa Department of Homeland Security's desire to catalyze a more financially stable levee system in Iowa can be supported by a variety of existing and exploratory financial mechanisms, which should consider public-private partnerships. Local development impact fees, TIF Financing (TIF), property tax revenues and a concerted effort to exploring innovative financing mechanisms for the improvement of critical infrastructure and the future of economic vitality of Iowa communities is greatly needed.

Table 6. Population growth of Omaha-Council Bluffs MSA and Mills County 2010-2019⁷

Area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Mills County, Iowa Population	15,157	15,112	15,028	14,983	14,946	14,862	14,841	14,933	14,957	15,034
YOY Growth		-0.3%	-0.6%	-0.3%	-0.2%	-0.6%	-0.1%	0.6%	0.2%	0.5%
Omaha-Council Bluffs, NE-IA MSA Population	845,820	856,222	866,454	876,355	886,157	895,919	904,834	914,190	922,891	931,779
YOY Growth		1.2%	1.2%	1.1%	1.1%	1.1%	1.0%	1.0%	1.0%	1.0%

⁶ IMPLAN Trade/Flow Analysis. Data provided by Mills County Economic Development Foundation, with IMPLAN Trade/Flow Analysis produced by the Greater Omaha Chamber (2022).

⁷ Source: JobsEQ; one. American Community Survey, 5-year estimates ending with the year shown in the column header. Exported on: Friday, May 13, 2022, 3:55 PM.

Table 7: Industry Snapshot: Omaha Council Bluffs/Mills County –

NAICS	Industry	Mills County, Iowa		Omaha-Council Bluffs, NE-IA MSA	
		Employed	Percent	Employed	Percent
72	Accommodation and Food Services	173	4.1%	40,342	8.0%
56	Administrative and Support and Waste Management and Remediation Services	197	4.7%	29,744	5.9%
11	Agriculture, Forestry, Fishing and Hunting	197	4.7%	3,438	0.7%
71	Arts, Entertainment, and Recreation	80	1.9%	9,126	1.8%
23	Construction	325	7.7%	34,091	6.8%
61	Educational Services	515	12.2%	40,328	8.0%
52	Finance and Insurance	150	3.6%	32,875	6.6%
62	Health Care and Social Assistance	916	21.7%	73,377	14.6%
51	Information	25	0.6%	11,167	2.2%
55	Management of Companies and Enterprises	5	0.1%	14,995	3.0%
31	Manufacturing	221	5.2%	34,289	6.8%
21	Mining, Quarrying, and Oil and Gas Extraction	20	0.5%	465	0.1%
81	Other Services (except Public Administration)	167	4.0%	20,425	4.1%
54	Professional, Scientific, and Technical Services	127	3.0%	30,560	6.1%
92	Public Administration	229	5.4%	16,755	3.3%
53	Real Estate and Rental and Leasing	51	1.2%	8,261	1.6%
44	Retail Trade	369	8.7%	53,819	10.7%
48	Transportation and Warehousing	207	4.9%	27,615	5.5%
22	Utilities	43	1.0%	3,252	0.6%
42	Wholesale Trade	200	4.7%	16,499	3.3%
	Total - All Industries	4,218		501,425	

Source: JobsEQ; 1. American Community Survey, 5-year estimates ending with the year shown in the column header. Exported on: Friday, May 13, 2022, 3:18 PM

I. Request for Funding

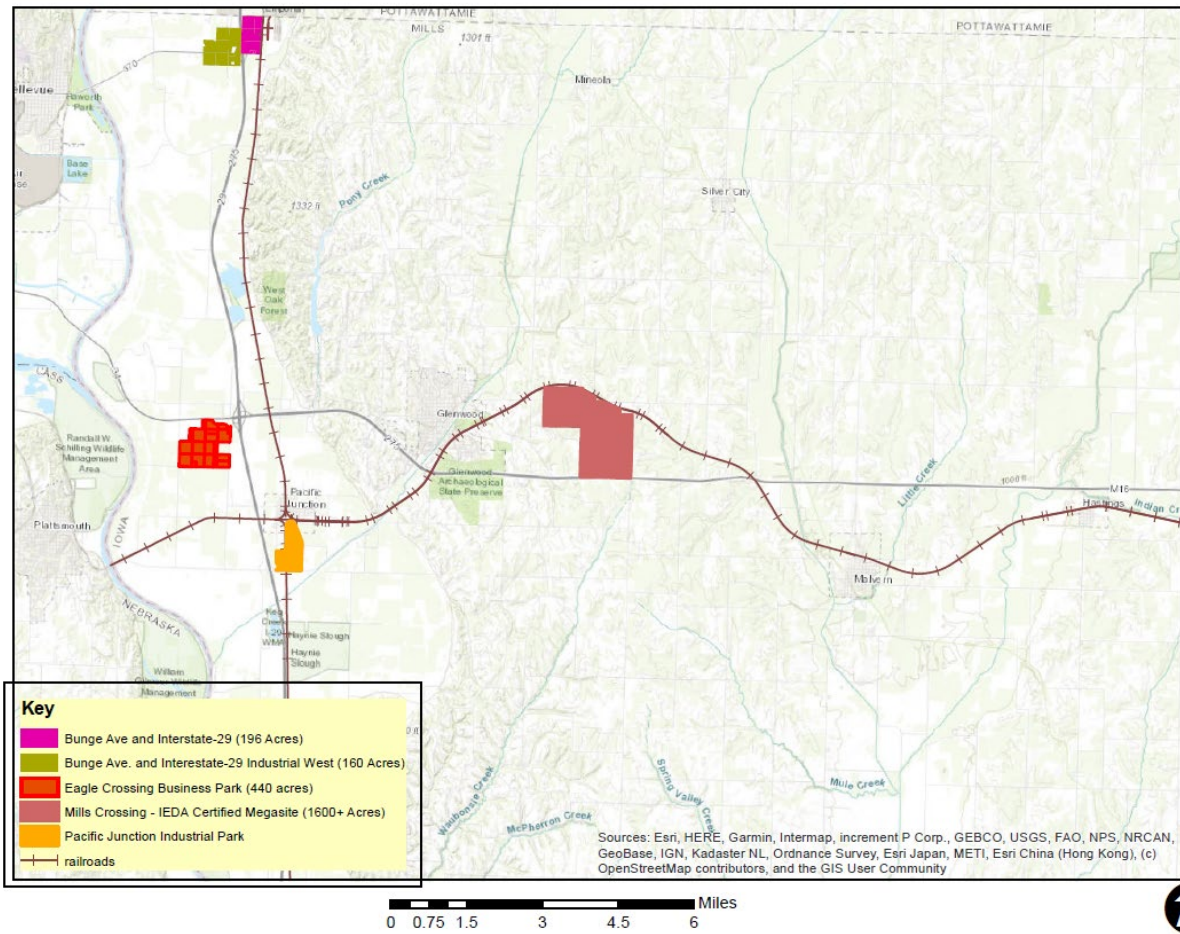
The historical floods in 2019 inundated portions of Mills County with recordings of up to eight feet of water in specific places. The toppling of the Missouri River levee and later flooding of cropland and commercially zoned properties changed the status of development projects underway. FEMA Flood Maps and related flood insurance ratings impact future development. Aiding the M&P Missouri River Levee District keeps, commercial and economic development

Levee improvements are needed to promote and confirm the commercial development demand in Mills County and the Omaha-Council Bluffs MSA. Levee improvement resulting in maintained accreditation of the Missouri River Levee section in Mills County and the future accreditations of the Pony Creek levee system will support the current and future demand for commercial development.

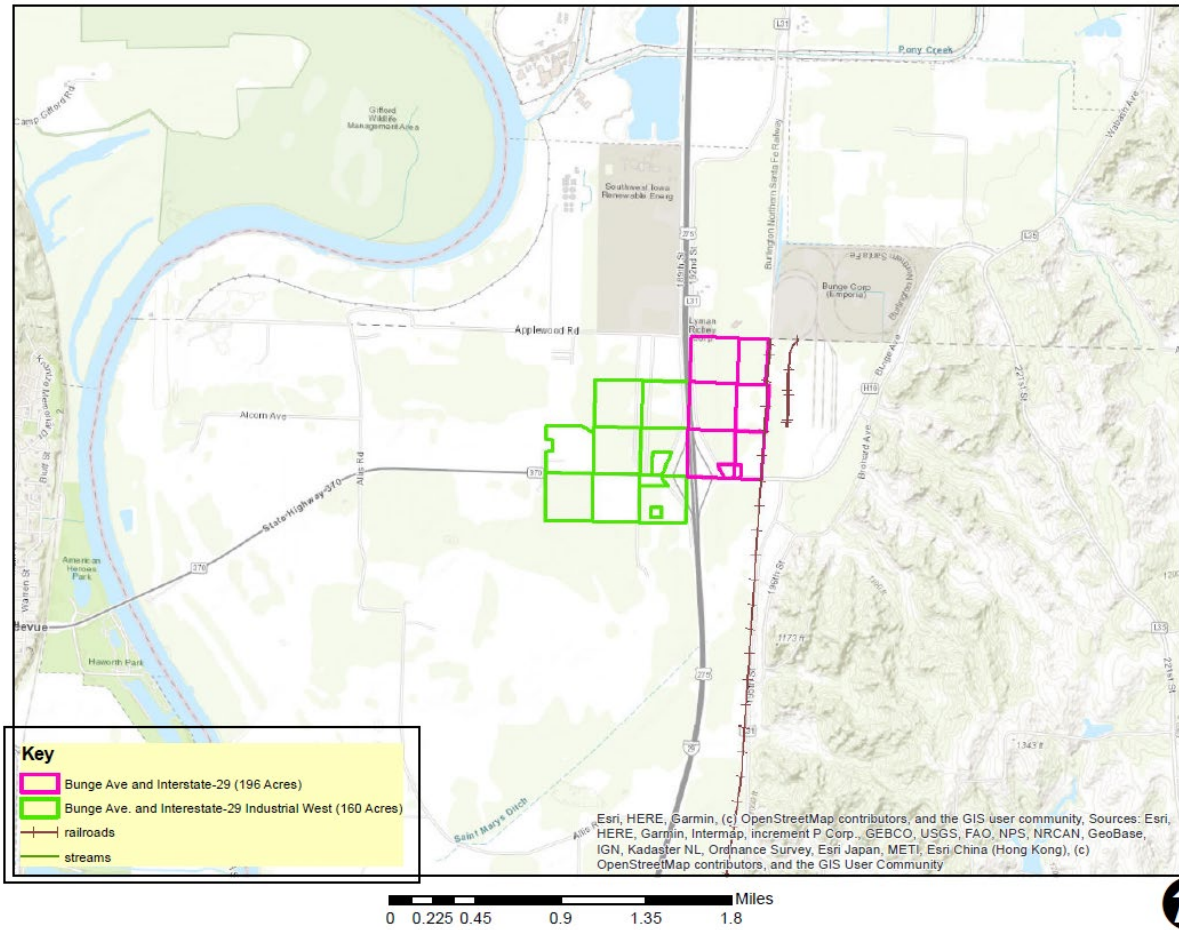
Priority Project Summary:

Missouri River Levee Seepage Mitigation - Hwy 34 to I-29	\$21.2M
Missouri River Levee Seepage Mitigation - Hwy 34 to Hwy 370	\$15.4M
Missouri River Levee/Lateral 1B Seepage Mitigation (Upper Pony Creek)	\$13.0M
Lower Pony Creek Levee Setbacks and NRCS Detention Cell Modification	\$15.7M
<p>* The above costs were shown in four project segments and include all construction, land rights, engineering and permitting costs. A more detailed breakdown is available in the attached Draft Investigative Study.</p>	

Active Site Development Locations (General)- Mills County



Bunge Ave and Interstate-29 Development Sites



Case Studies

The Benton-Washington Levee District is located in western Fremont County along the Missouri River. The northern portion of the levee runs west from Thurman, Iowa, along Plum Creek and turns south running along the Missouri River all the way to the Iowa-Missouri border. The levee was initially constructed in 1948-1950 as part of a USACE project to prevent flooding along the Missouri River. The Benton-Washington Levee District is a segment sponsor for the largest portion of USACE levee L-575 with Benton-Washington District being responsible for approximately 75 percent of the total L-575 leveed area. The Benton-Washington section of the levee suffered significant failures when the levee was breached in multiple locations in both 2011 and 2019.

The National Levee Database provides the following information for the L-575 levee. The levee protects a population of 984 people and 916 buildings. The total protected property value is listed as \$165 million. The communities of Hamburg and Percival are found within the leveed area as is Interstate 29 and Iowa Highway 2. The Burlington Northern Santa Fe Railway (BNSF) runs north-south along I-29 through the Benton-Washington Levee District. The loss of I-29 and the BNSF railway have significant economic impacts on the entire region far outside the leveed area. The L-575 levee contains 20 embankments, 48 gravity drains, 19 pump stations and 195 relief wells. Within the Benton-Washington segment, there are three pumping stations, 14 gravity drains, and 82 relief wells.

Like most levee districts, the Benton-Washington Levee District is managed by a three-person board of trustees. The district has no full-time staff and relies heavily on assistance from Sandi Graybill, NW Atchison Segment trustee, to complete their USACE compliance documentation. The district takes in approximately \$125,000 a year in levee and drainage assessments; however, the district's expenses routinely exceed their revenues. Following the 2019 flood, the district received almost \$30,000 in federal funding and just over \$1 million dollars in State funding. The majority of State funding was in the form of a State Contingent Fund (SCF) loan for \$1,000,000. The SCF loan is a no-interest loan with a 20-year repayment period. As the district deals with the aftermath of the 2019 flood, they have seen a dramatic increase in their legal and miscellaneous costs, with each totaling over \$100,000 in fiscal year 2020-2021.

The biggest challenges identified by county and levee officials is an insufficient tax base, Missouri River management, and trespassing on the levee. Like other areas in the state, Fremont County has a declining population, which results in a declining tax base. Federal buyout programs have contributed to this problem by removing approximately 6,600 acres from the tax base within the Benton-

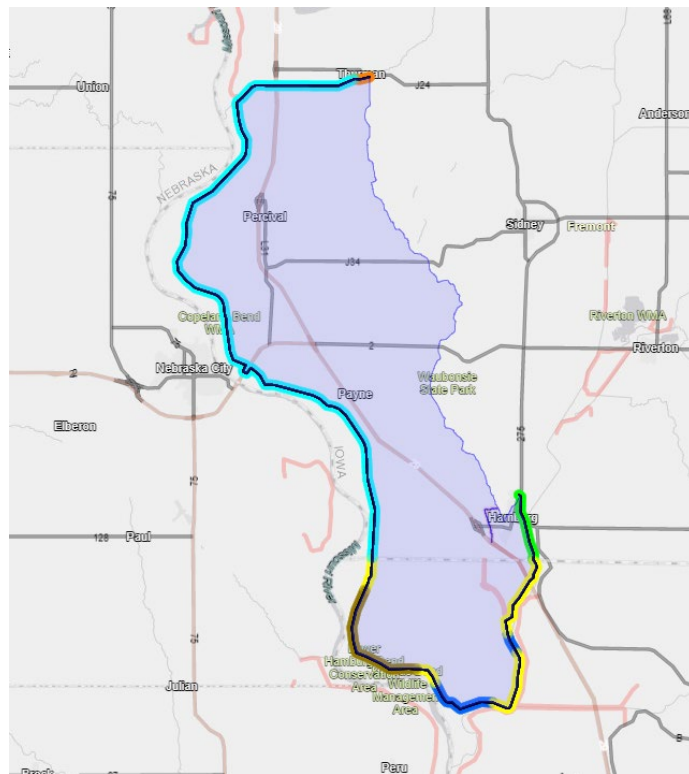


Figure 5

Washington Levee District. District officials repeatedly cited what they feel as the United States Army Corps of Engineers' mismanagement of the Missouri River as a contributing factor in recent flood events. Officials feel that USACE is more concerned with placating environmentalist interests instead of controlling river levels to prevent flooding. They support these claims by citing USACE projects installed to create wildlife habitat that has the effect of slowing river flow by 50 percent and raising river levels. Landowners who farm on the riverside of the levee were able to harvest a crop 70 percent of the time prior to 2011 are now only harvesting a crop 20 percent of the time.

Trespassing on the levee is a significant problem for sponsors attempting to maintain the levee and prevent unintended damage. Large areas of conservation set-aside acres on the riverside of the levee has led to increased hunting and fishing along the river. This problem is further exacerbated by the lowa DNR publishing maps showing public access areas that do not have access except via the river. The maps incorrectly identify private property as public land. District officials have pointed out the problem to DNR officials but no updates have been published. The district works closely with the Fremont County Sheriff's Office to combat the trespassing problem.

District officials are frustrated with USACE and their management of the Missouri River. They point to a change in management approach following a 2008 lawsuit in which the United States Fish and Wildlife Service won the right to enforce elements of the Endangered Species Act. Following that ruling, several "unrequested" levee projects have been implemented to install wing dikes to create habitat as well as preventing sponsors from restoring levee heights to their original, legal levels. They also state that USACE does not maintain the river side of the levee to the same standards that levee sponsors are required to meet on the landward side of the levee. For example, vegetation is allowed to encroach on the levee and debris is not removed following high water events. As a result, it slows the river, dropping sediments, which shallows the river making the levees less effective because there is less free board available. Officials observed that historically it took two or three 5-6 inch rains in the Norfolk, Neb., area to raise the river to 20-foot level. Now it only takes one 5-6 inch rain in the same area to raise the river to the 21-foot level.

District officials were also frustrated by USACE's "one-size-fits-all" approach. They believe that in order to comply with all of USACE's requirements it takes a fulltime staff that most rural districts cannot afford. They also feel that USACE is imposing more and more regulatory requirements on the districts, all of which cost money to implement or maintain. Officials cited a neighboring levee system that has fallen out of the PL 84-99 rehabilitation program because they do not have the \$15,000-\$20,000 required to complete and file the compliance documentation.

The city of Cedar Rapids straddles the Cedar River in Linn County. The city has battled floodwater for decades but the city was devastated by floodwaters in June 2008 with historic flooding. The Cedar River crested at over 31 feet, 19 feet above flood stage. The flood surpassed the previous record, set nearly 80 years earlier, by 11 feet. Floodwater covered more than 10 square miles of the city or 14 percent of the city's landmass. More than 300 public buildings and 900 businesses sustained damage. In addition to the businesses, 5,930 homes inhabited by more than 18,000 citizens were affected and an additional 10,000 residents were displaced by the flooding. The flood caused over \$5.4 billion in damage to the community. In addition to the damage sustained to business and residential properties, all local government facilities were crippled. The central fire station, police station, city hall, county courthouse, county administrative offices and county jail all required immediate relocation, which was accomplished quickly and efficiently with no interruption of public services.

In the midst of a natural disaster of this magnitude, steps toward recovery began even before the flood waters receded. On June 17, four days after the river crested, the Cedar Rapids City Council met to establish long-term, strategic flood recovery goals. Based on consultation with other communities that had recently experienced similar disasters, Cedar Rapids declared its intent to take charge of its own recovery in order to succeed long-term. The City committed to engaging all sectors of the community in every step of recovery planning. Specific focus was placed on flood-stricken neighborhoods. It meant not only addressing residents' immediate needs and determining how to redevelop flood-ravaged neighborhoods, but also planning for the community's protection against future flooding.

After a series of public meetings, the city council approved a flood management strategy in November 2008, just five months following the flood. The community's strategy creates approximately 220 acres of new greenway within the 100-year floodplain. The plan balances protection with recreation and includes:

- An amphitheater that also serves as a flood levee
- Eight-block downtown promenade
- Over 4 miles of restored river's edge
- Eight acres of wetlands
- 15 acres of playfields
- 12 miles of trail along the Cedar River

In 2012, Cedar Rapids proposed a novel funding source to the Iowa legislature. On December 3, 2013, two years of strategic legislative collaboration culminated in the creation of the State of Iowa Flood Mitigation Board, which made its first award to Cedar Rapids in the form of a 20-year, \$263.7 million commitment to flood protection, later amended to \$269.4 million. The Flood Mitigation Board makes disaster mitigation funding available to Iowa communities by reinvesting a portion of future sales tax growth in those cities across the state dealing with watershed management and flood protection problems.

In 2018, Congress appropriated approximately \$117.4 million in funding (\$76.3 million firm with \$41.1 million low-interest loan) for Cedar Rapids, for only the East side of the Cedar River, as part of the Water Resources Development Act Supplemental Funding.

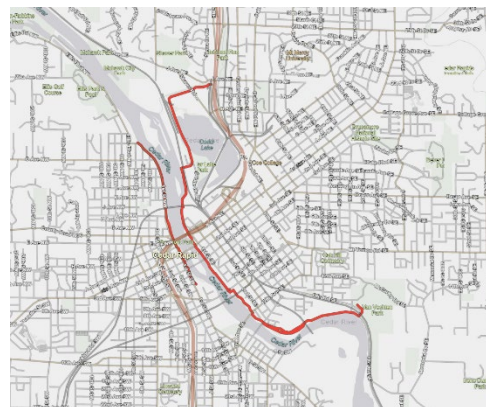


Figure 6

The City of Cedar Rapids made a commitment to provide protection to both sides of the Cedar River. The Flood Control System (FCS) builds upon prior efforts focused on the east side flood control system as well as develops a plan for flood control improvements that will benefit the west side of the river. The plan provides a basis for:

- Defining an alignment for future flood control improvements on both sides of the Cedar River
- Creating a transportation continuity across the Cedar River during flooding (including preserving emergency services and ability to erect and maintain FCS during a flood event)
- Creating overall design criteria
- Initial prioritization for implementing flood improvements as well as a methodology for future decisions concerning the sequencing of flood improvement design and construction activities
- The cost opinion for design and construction of the flood control system, along with funding strategy
- Delineating a property acquisition policy
- Communications and public outreach
- Aesthetics and amenities

As of June 2022, the City of Cedar Rapids continues to execute the FSC project. **Figure 8** contains a listing of completed and ongoing projects.

The National Levee Database lists three systems in Linn County, all of which are related to the Cedar Rapids Flood Control System. The three systems are listed as Cedar Rapids, IA – East, Cedar River Levee No. 1, and Cedar River Levee No. 3.

Cedar Rapids Flood Control System			
Completed Projects	Year Completed	Ongoing or Upcoming Projects	Projected Completion
McGrath Amphitheatre Levee	2013	Northern Segment	
CRST Floodwall	2016	E & F Avenue NW Reconfiguration	2022 PH I
CRST Riverwalk	2017	6th Street NW Extension to Ellis Blvd NW	2023
Sinclair Pump Station (initial pump)	2017	Shaver Road NE Bridge Elevation	2023
Sinclair Detention Basin	2017	Cedar Valley Nature Trail Improvements	2023
Northwest Gateway & Memorial Plaza	2018	Northwest Neighborhood Detention Basins	2025
Lot 44 Pump Station	2018	O Avenue NW Gateway	TBD
Sinclair Levee	2018	Central Segment	
Completion of Sinclair and NewBo pump stations	2019	Demolition of Hydroelectric Facility at the 5-in-1 Dam	2022
Czech Village Levee substantially completed	2019	1st Avenue SE Floodgate	2022
16th Ave SE Floodgate	2020	Kingston Village Storm Sewer Consolidation	2022
1st Street Storm Sewer Improvements	2021	E & F Avenue NE Floodgates under 5-in-4 Dam	2023
Quaker Oats Flood Wall	2021	Tree of Five Seasons Park	2023
Masaryk Park Memorial	2021	City Hall Flood Control	2024
Czech Village Underground Gate	2021	4th Avenue Riverfront	2024
3rd Avenue SE Floodgate	2021	8th Avenue Bridge & Riverfront Improvements	TBD
NewBo Lot 44 Levee	2021	South Segment	
Amphitheatre Floodwall	2021	Otis Road Storm Sewer	2021
		16th Avenue SW Floodgate	2022
		Czech Village Pump Station	2022
		12th Avenue SE Floodgate	2023
		National Czech & Slovak Museum & Library Floodwall	2023

Figure 7

The NDL information for these levees is listed in **Table 5**

Table 5

Cedar Rapids Flood Control System					
System	Pop.	Bldg.	Property Value	Embankment Length	Embankments
Cedar Rapids, IA – East	10,120	835	\$2.13B	1.06	1
Cedar River Levee No. 1	339	64	\$79.6M	0.44	1
Cedar River Levee No. 3	3,189	519	\$677M	1.45	1
System	Floodwalls	Pump Stations	Accredited	PL 84-99	
Cedar Rapids, IA – East	5	0	No	No	
Cedar River Levee No. 1	0	0	No	No	
Cedar River Levee No. 3	0	0	No	No	

The city of Council Bluffs, Iowa, is located along the Missouri River in Pottawattamie County. The 2020 census reports the city's population at 62,000 people covering approximately 43 square miles. The City of Council Bluffs manages the levees protecting the city from flooding. In addition to the main stem levee, there are tie-back levees that prevent flooding along Indian Creek and Mosquito Creek.

The City manages all or segments of five levee systems in the National Levee Data Base. See **Table 6**.

The overall Council Bluffs levee system is one of two urban levees included in this study and is the only levee system actively managed by a city. Because the levees are managed by the City instead of trustees, there are more resources available to maintain the levee.

Table 6

City of Council Bluffs Managed Systems				
System	USACE Constructed	Total Miles	FEMA Accredited	PL 84-99
L-627 Mo River LB & Indian Creek RB	Yes	15.35	Yes	Active
L-624 Mo River LB & Indian Creek LB & Mosquito Creek RB	Yes	8.86	Yes	Active
Mosquito Creek Tieback	No Data	0.51	Yes	Not Enrolled
Council Bluffs Levee	No Data	0.68	Yes	Not Enrolled
L-624-627-611-614 - Mosquito Cr & Upper Pony Cr	Yes	8.00	Yes	Active

The City dedicates one full-time employee and one part-time employee to work on the levees. They are focused primarily on vegetation control and debris removal from the levees.

The City's levee budget draws from multiple sources. The primary sources are the City's general fund and drainage assessments. The majority of the funding comes from the general fund. The City does collect drainage assessments from three drainage districts that were annexed by the City in the early 1970s when it expanded south of Interstate 80. Those districts are the West Lewis Drainage District, the Sieke 32 Drainage District, and the Mosquito Creek Drainage District. Assessments are collected by Pottawattamie County and paid to the City. The city council serves as the management authority for these districts and the City's public works department completes any drainage-related work for the districts. Large levee-related projects are funded using sales tax increment financing and local option sales tax. We will discuss projects later in this case study.

Like other levee sponsors, the City of Council Bluffs takes the lead in flood fighting. The City surges its public works department workforce to monitor the levee during high-water events as well as sandbagging as required. The City communicates with Iowa DOT, keeping them apprised of levee conditions that could affect Interstates 29 and 80. Council Bluffs is also a significant railroad hub with four railroad companies with rail lines passing through Council Bluffs and three major railyards located within the city. The Union Pacific Railroad provides labor to help monitor points in which the railroad crosses the levee.

The City of Council Bluffs has a close working relationship with the United States Army Corps of Engineers, which considers the Council Bluffs area as one of the most at-risk areas within the Omaha District. The public works director explained that the City has a somewhat frustrating relationship with USACE. USACE is responsive to repairing damage to the levees but is slow in reviewing and approving City-requested improvements to the levee or responding to requests for information or clarification. Delays to the City's levee improvement projects have been largely due to USACE's slow approval process.

In late 2013, the City of Council Bluffs proposed the levee and Indian Creek Flood Mitigation Project, which was approved in May 2014. The \$114 million project included several sub projects that utilized federal, State and local funding sources. Fifty percent of the funding to be provided by the State Flood Mitigation Program, 30 percent local funding provided through local option sales tax and non-public investment with 20 percent federal funding provided by the U.S. Department of Housing & Urban Development (HUD) Community Development Block Grant (CDBG) and USACE PL 84-99 Emergency Operations and Levee Rehabilitation as well as USACE Operations and Maintenance funding. HUD provided \$2.4 million in federal funding from the CDBG Multi-Family Unit Production Rental Disaster Recovery Fund. The City received \$20.4 million from the USACE PL 84-99 Emergency Operations and Levee Rehab, USACE Operations and Maintenance. City of Council Bluffs local option sales tax and non-public investment provided \$6.5 million toward the Industrial Park Levee Accreditation. Local option sales tax funding, along with State Flood Mitigation Program funding, also went to toward levee accreditation engineering analysis totaling \$2,147,603. State Flood Mitigation Program funding, along with \$50 million in local option sales tax, was also dedicated toward levee system improvements and accreditation. While several of the smaller projects have been completed, the overall project was only 40 percent complete as of April 30, 2022.

A portion of the levee improvement project is replacing approximately 170 relief wells with seepage berms. This conversion will generate long-term maintenance savings because it costs the City approximately \$7,500 each to conduct the five-year periodic relief well inspection as required by USACE. These inspections cost the city approximately \$1,275,000 every five years. Once installed, there are no inspection requirements and minimal maintenance requirements for the seepage berms, saving the City millions of dollars in recurring costs.

City officials identified maintaining their enrollment in USACE's PL 84-99 rehabilitation program as one of their biggest challenges. The City is currently maintaining a "minimally acceptable" rating on their most recent inspections. The City has enrolled in the USACE System-wide Improvement Framework (SWIF) in order to help maintain enrollment by communicating how they plan to address issues in a timely manner. While the City's SWIF plan was approved, they have not received any feedback on any of their progress reports submitted.

City officials identified the ongoing FEMA accreditation process as one of their biggest concerns. There is a lot riding on this process as the results could significantly affect the flood insurance rates of businesses and residents of the community. Insurance companies are already routinely contacting the City seeking to know if FEMA has released their rating yet. Officials are concerned that inspectors are seeking information about portions of the city that are not within the leveed areas of the city. FEMA is also asking about low areas within the city where water ponds or collects following rainfalls. City officials also expressed concerns with the anticipated release of new flood-level projections based on

new climate projections. Officials are concerned that they are spending millions of dollars on levee improvements that will be determined to be insufficient once the new levels are announced.

The Coulthard Levee District is located in Harrison and Pottawattamie counties in southwest Iowa. The Coulthard Levee District No. 2 was first established in June 1928 after two previous attempts to establish the district failed to garner the necessary support. The initial district included 1,867.60 acres. The district was reclassified in June 1930, which expanded the district to 2,007.60 acres. The reclassified assessment amount was \$1,464.32. The Coulthard Levee, in conjunction with the Vanman Levee, were designed and constructed to provide protection to parts of southwest Harrison and northwestern Pottawattamie counties from Missouri River flooding. They were built eastward of a large bend in the river known as DeSoto Bend. The upstream terminus of these levees tied into naturally high ground that is located along the southern edge of US Highway 30. All floodwater that would escape the Missouri River channel downstream from US Highway 30 on the Iowa side of the river would be prevented from flowing eastward of these levees as these levees returned all water flowing on the flood plain to the Missouri River via the downstream end of the DeSoto Bend channel.

Coulthard Levee District was an active district until around September 1963, which was when the last meeting minutes were recorded in the county's drainage record. The next recorded meeting did not occur until May 2018 when a petition for repair was presented to have DeSoto National Wildlife Refuge repair a hole in the levee as a result of the 2011 flood. The Coulthard Levee is not found in the National Levee Database, which indicates that it was not an active district for several years when Harrison and Pottawattamie county levees were added to the database. The leveed area of the district has very few homes and structures remaining after federal buyouts following major flooding in 2011 and 2019.

In 1958, lands adjacent to the levees were sold to the United States of America as part of the ultimate establishment of a wildlife refuge. Subsequent to the purchase, the lands owned by the U.S. government came to be operated by the United States Fish & Wildlife Service (USFWS). At approximately the same time, the federal government cut off the DeSoto Bend in the Missouri River for the purposes of constructing the congressionally authorized Missouri River Bank Stabilization and Navigation Project. In order to prevent the river from reclaiming the now cutoff river bend channel, the federal government built a large earthen embankment to separate the newly channelized Missouri River from the cutoff river channel. This large embankment ran for approximately 5 miles from the Vanman Levee on the downstream end to a private levee at the upstream end. This private levee tied into high ground in the US Highway 30 embankment near the bridge over the Missouri River at Blair, Neb. and ran downstream for approximately 2.5 miles. The levee owner removed the levee in the 1970s, leaving a gap in the line of protection. Prior to construction of the embankment by the federal government, the flood protection provided by this private levee and whether or not it existed was not a concern to private property and public infrastructure east of the Vanman and Coulthard levees since these latter levees would return all Missouri River flood flows to the river via the downstream end of the DeSoto Bend channel. However, since the federally constructed embankment blocked all of the DeSoto Bend, including the downstream channel, this embankment not only served to block the Missouri River from accessing the now abandoned DeSoto Bend river channel, but it also served to block any future flood flows that would flank or get behind the upstream end of the federally built embankment from returning to the Missouri River. Unfortunately, for the Vanman and Coulthard levees, the federal government built this embankment a few feet higher than the Vanman and Coulthard levees. This meant that any floodwater that escaped the Missouri River channel downstream of the bridge at Blair and flanked the embankment would be forced to overtop the Vanman and Coulthard levees since the

channels to return the floodwater to the Missouri River were blocked by the higher federally built embankment.

This is exactly what happened in June 2011 when floodwater was able to flank the federally built embankment. Floodwaters flowing from the west were contained for approximately a day within the confinement provided by the Vanman and Coulthard levees on the east, the high ground on the north, and the federally constructed embankment on the south. Once this confined area filled, the full conveyance of floodwater overtopped the Vanman and Coulthard levees, flowing in an easterly and southerly direction for the remainder of the flood, which was approximately two months. This floodwater impacted farmland, county roads, and farmsteads and contributed to flood damage to, and closure of, I-29 and the Canadian National Railroad. Due to the long duration of the flooding, both the Vanman and Coulthard levees were severely damaged.

In February 2013, the Harrison and Pottawattamie county boards of supervisors submitted a letter to U.S. senators Tom Harkin and Charles Grassley and to U.S. representatives Steve King and Tom Latham asking for their assistance in obtaining federal funding to repair the Coulthard and Vanman levees. The proposed plan presented in the February 2013 letter included obtaining federal funding to repair the Vanman and Coulthard levees and either raising the Vanman and Coulthard levees within the refuge so they are at least three feet higher than the federally built embankment or lowering the federally built embankment across the downstream end of the DeSoto Bend channel so it is at least 3 feet lower than the Vanman and Coulthard levees. This proposal has been opposed by the USFWS which has taken legal action in the form of a "cease and desist" letter to block the district from repairing the levee to its original height. Because the levee centerline is now within the boundaries of the DeSoto National Wildlife Refuge, the district needed permission of USFWS to gain access to the levee to make repairs. This access was denied by USFWS which expressed concerns that restoring the levee to its original height would flood its new visitor center and museum. All attempts to resolve this issue were rebuffed by the USFWS, which indicated that it would do everything within its power to prevent the repair of the levee.

In February 2020, the Coulthard Levee District was awarded \$4.427 million dollars from the Iowa Flood Mitigation Board to complete repairs on the levee. Approximately \$1 million dollars of those funds have been expended in legal battles with USFWS. In the spring of 2022, the board of trustees made the decision to relocate the levee further to the east outside the control of the USFWS. The district estimates it will require approximately \$2 million in additional funding in order to complete construction of the new structure.

The community of Hamburg is located in southwest Fremont County, only one-quarter mile north of the Iowa-Missouri state line. Founded before Iowa became a state in 1846, Hamburg is located along the west bank of the Nishnabotna River just below the confluence of the East and West Nishnabotna rivers. Due to its proximity to the Nishnabotna and Missouri rivers, Hamburg is frequently subjected to flooding. As a result, the community is surrounded by levees on three sides with the 42-mile-long L-575 levee protecting the east side of town and Main Ditch 6 levee protecting the west and south. The northern side of town is protected by the Loess Hills. Hamburg's population grew to a peak of over 2,000 in the 1940s, and then slowly declined as some jobs were centralized or outsourced, to around 1,200 prior to the 2019 flood.

Hamburg has been severely impacted by flooding throughout its history, including the 2019 event, which flooded about half the city, forcing residents to evacuate. The city is somewhat protected by a levee system (although it is not sufficient in larger flood events), which the City is now working to reconstruct/improve. The homes and businesses damaged in the flood were located toward the southern end of town (lower elevation); some properties in the area had been bought out in previous flood events and are owned by the City. Additional properties were bought out by FEMA and are now deed-restricted. Most of the residents and businesses have returned and repaired/rebuilt; the 2020 census indicates a population of under 900.

Since March 2007, the City of Hamburg has received over \$23.5 million in federal and State disaster aid with an additional \$11.2 million in funding identified for potential projects. The bulk of these projects are debris removal and emergency protective measures. Following the 2011 floods, the City received \$1,269,029 in Public Assistance Program funding, and following the 2019 floods they received \$1,974,137 in Public Assistance Program funding, \$1,510,520 in Hazard Mitigation Grant Program assistance, and \$4,955,204 in State flood mitigation funding. The City is able to obtain this type of federal and State support because the City's leadership is active in pursuing the needed resources.

The L-575 Levee protects Hamburg from Missouri River and Nishnabotna River flooding. It also protects Highway 2 area from flooding. The flood protection level of the various segments is quite variable, ranging from "not reported" to 500-year. The protection level for the system, overall, is only reported to be 20-year in the NLD and therefore could not be certified or accredited as-is. This levee system is active in the Corps Rehab program. This levee is reported in the NLD as being an accredited levee system. However, FEMA is in the process of remapping this area and, to date, the levee has not been certified as meeting the 44 CFR 65.10 standards and therefore cannot be accredited. If the system meets standards prior to the remapping study, the area could be mapped outside the 100-year floodplain. Modeling by the Iowa Flood Center (IFC) indicates that most reaches have inadequate freeboard and some reaches are below 100-year flood stage.

The Ditch 6 levee system also protects Hamburg. The Ditch 6 segment is a federal levee, but the Interstate 29 segment is a local levee connecting the Ditch 6 levee to the Nishnabotna levee along Interstate 29. The system is located west of the city of Hamburg at Skyline Drive, is constructed moving west approximately 2,375 feet at which time it breaks south/southeast and continues for approximately 6,200 feet crossing Highway 333 and the BNSF railroad, and ending at Interstate 29. At that point, a HESCO barrier floodwall would follow Interstate 29 for approximately 9,800 feet tracking southeast, and cease at the Nishnabotna River levee. The system is currently non-accredited in the NLD. An Annual Exceedance Probability is not provided in the NLD but it is known that the existing profile is too low to

provide 100-year protection. To reduce flood risk in Hamburg, the Corps and the City of Hamburg are reconstructing and raising the Ditch 6 segment. Hamburg officials have coordinated construction of the Ditch 6 levee with the IDOT, elevating Highway 333 and BSNF Railway for closure structures where Ditch 6 cross these transportation routes.

It has been recommended that accreditation studies be conducted on the Missouri River L595-601 (that includes the Nishnabotna River levee) and Hamburg Main Ditch 6 levee systems to determine the necessary improvements to provide a minimum Zone D flood designation. An alternative to making the necessary levee improvements would be a combination of raising individual buildings and ring levees. Another alternative for Hamburg may be to focus levee improvements and accreditation on the reaches of the Nishnabotna levee segment and the Ditch 6 system required to protect Hamburg rather than on the entire L595-601 system. Since the Ditch 6 system is between Hamburg and the Missouri River, the Ditch 6 system could potentially provide necessary flood protection without the need for improvements to the Missouri River segments.

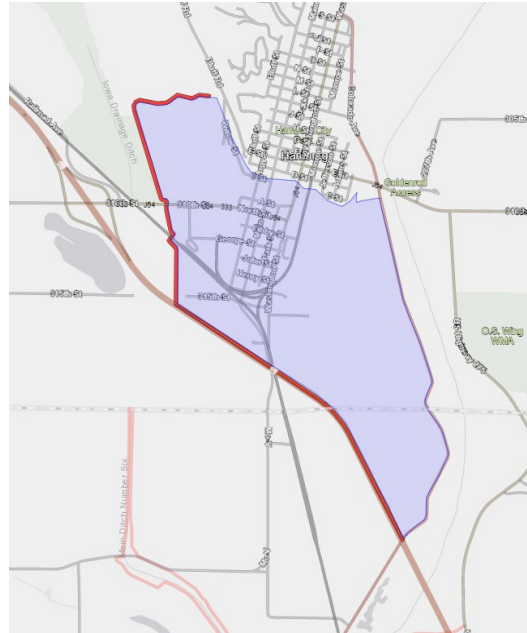


Figure 9

The Little Sioux Inter-County Drainage District is located in southern Woodbury County, throughout Monona County and northern Harrison County. The levees in the district were constructed as part of a United States Army Corps of Engineers project to control flooding of the Little Sioux River. The National Levee Database divides the district into 15 different systems which are summarized below. The district features are listed in **Table 7**.

Table 7

Little Sioux Inter-County Drainage District				
System	USACE Constructed	Total Miles	FEMA Accredited	PL 84-99
Little Sioux	No	5.05	No	No
Little Sioux LB – Beaver Creek LB	Yes	4.33	No	Inactive
Little Sioux LB – Beaver Creek RB	Yes	8.07	No	Inactive
Little Sioux LB – Cottonwood Cr LB	Yes	8.53	No	Inactive
Little Sioux LB – Hogue Ditch LB	No	7.37	No	Inactive
Little Sioux LB – Maple River LB	Yes	10.35	No	Inactive
Little Sioux LB – Castana	Yes	2.20	No	Inactive
Little Sioux LB – Nagel & Intercounty	Yes	4.07	No	Inactive
Little Sioux Maple River RB North	Yes	1.26	No	Inactive
Little Sioux Maple River RB South	Yes	2.21	No	Inactive
Little Sioux RB – Monona Harrison LB	Yes	44.87	No	Inactive
Little Sioux West Fork Ditch RB – Monona Harrison Ditch RB	Yes	51.75	No	Inactive
Little Sioux West Fork Ditch RB	Yes	22.29	No	Inactive
Little Sioux Wolf Creek RB – West Fork Ditch LB	Yes	27.05	No	Inactive

Figure 10 represents the leveed area of the Little Sioux West Fork Ditch RB & Monona-Harrison Ditch RB, which is the longest system within the drainage district extending over 50 miles.

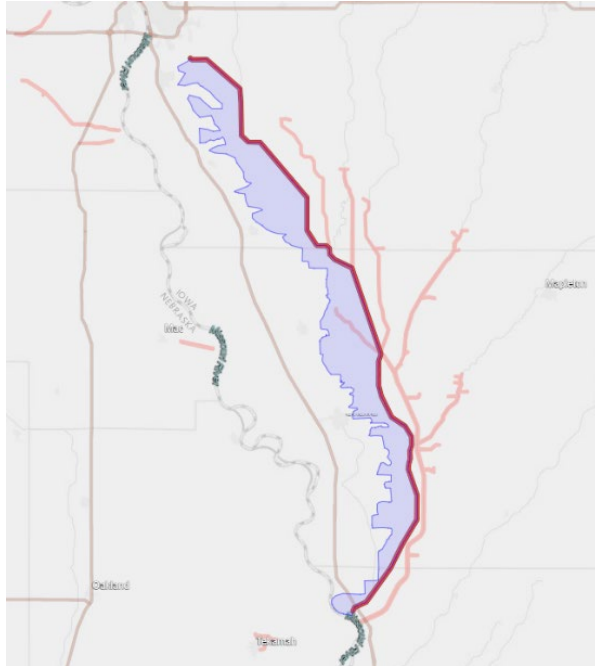


Figure 10

The 15 systems operated by the Little Sioux Inter-County Drainage District protects a total population of 1,505 people. The total protected property value is estimated to be \$205,480,000. The levees protect farmland and the families that work the land. The levees also protect portions of I-29 and state highways 141 and 175, as well as the communities of Hornick, Onawa, Little Sioux, and River Sioux.

As indicated earlier, the Little Sioux Inter-County Levee District was created by taking portions of several already existing drainage districts to create the new larger district as part of the USACE Little Sioux River Flood Control Project. A review of the district's drainage records indicate that the county board of supervisors went through the proper procedures outlined in Iowa Code Chapter 468, Part

2-Federal Flood Control Cooperation, to create the new district.

The Little Sioux Inter-County Drainage District is staffed with a full-time superintendent and maintenance person. The district also employs four part-time maintenance employees as well. The employees conduct most of the maintenance and repairs themselves. The district has some heavy equipment which allows them to take on larger projects, such as setting back levees without having to contract for services. The superintendent's primary focus is getting the district enrolled in the USACE PL 84-99 rehabilitation program. One point made by the superintendent was that "minimally acceptable" is enough to get into and maintain enrollment in the rehabilitation program. The district is finding that obtaining minimally acceptable standards is much cheaper and provides more options than trying to achieve and maintain an "acceptable" rating.

The Little Sioux Inter-County Drainage District has annual revenues of approximately \$800,000 dollars. Roughly \$680,000 of this revenue comes from assessments with the remaining balance coming from interest or miscellaneous income. Examples of miscellaneous income include land leases, sale of hay, sale of unused materials, and doing work for other levee and drainage districts. The district uses its equipment and employees to complete maintenance work for other districts.

Levees in this district are somewhat different from other levees in that they are designed to contain the water from a drainage ditch. The levees are located on both sides of the ditch. One of the challenges with the levees in this district is sloughing or the slope sliding down into the drainage channel. To combat or repair this, levees are set back away from the main channel to create more flow which reduces the speed or rate of flow. By doing this, pinch points are created at bridges since it is up to the county or state to put a new, longer bridge to avoid the pinch point.



Figure 11



Figure 12



Louisa County Levee District #11 is located along the left bank of the Iowa River in Louisa County. The district starts just north and east of the city of Wapello and runs south along the Iowa River for approximately 8 miles, see **Figure 14**.

The levee was locally constructed in the early 1900s and continues to be locally maintained. Emergency assistance for the system has been received in 1929, 1933, 1938, 1960 and 1991. The system was activated in the PL 84-99 rehabilitation in the early 1990s. The system has received rehabilitation assistance through PL 84-99 in 1993 and 2008.

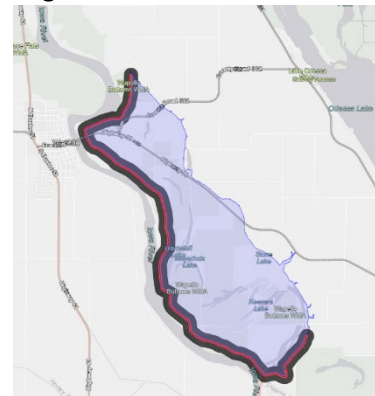


Figure 14

The levee was designed to protect 3,200 acres of agricultural lands and associated farmsteads. Due to flooding events described below, the levee currently protects 820 acres of agricultural land, eight residences, 13 other structures, and County Highway 99. The remaining 2,380 acres have been converted to conservation wetlands as part of the National Resource Conservation Service (NRCS) Wetland Reserve Program.

Over the last 100 years, the levee district sought emergency assistance five times between 1929 and 1991 and rehabilitation assistance twice in 1993 and again in 2008. During the 2008 flood event, the levee was breached in seven locations. Two of these breaches were located on the upstream portion of the levee above County Highway 99. These breaches were repaired using hydraulic sand fill from the Iowa River. The system also sustained minor overtopping and wave wash damage. Due to the unrepaired flank levee breaches, the downstream portion of the leveed area was purchased by the NRCS and is allowed to flood while the upstream portion, including County Highway 99, remain protected due to the land and highway being a vital part of the local economy.

Table 8

Louisa County Levee District No. 11				
System	USACE Constructed	Total Miles	FEMA Accredited	PL 84-99
Louisa County Levee District No. 11	No	7.88	No	Active

Louisa County Levee District #11 is faced with a unique situation as it abuts an abandoned levee. Louisa County Levee #8 was breached in 1993. The damage was so significant that repairs were never undertaken and the levee district was disbanded. The disbandment of the levee district left the flank levee unprotected until the property was purchased by NRCS. As part of the purchase, the NRCS performed flank levee work to bring the levee up to PL 84-99 program standards, with the flank levee turned over to Louisa County #11. During high water events, floodwaters continue to flow through the Levee 8 breaches and continue to cause damage to the Levee District 11 flank levee, widening the existing breaches.

Modifications made to the levee system by the sponsors include the installation of a 36-inch Corrugated Metal Pipe culvert with flap gate, the placement of clay borrow along portions of the levee embankment to improve slopes to 3H:1V, the placement of rock and broken concrete at one foreshore location and a couple levee embankment slope locations to repair minor erosion damage and to prevent future erosion

damage, and the placement of a clay face along the riverside slope at the 2008 repaired breach locations.

Following the 2008 breaches and the purchase of 2,380 acres by the NRCS, roughly 75 percent of the leveed area is no longer subject to taxation by the levee district. However, the district is still attempting to maintain the entire 8-mile length of the levee. As a result, the district only brings in approximately \$14,500 a year. The district spends approximately \$3,500 a year to mow the levee twice a year, which is a minimum requirement to maintain the levee in the PL 84-99 rehabilitation program. This only leaves around \$11,000 per year to address all other maintenance concerns. The district does not have the funding necessary to install new culverts that extend 40 feet on either side of the levee in order to stay in compliance with new USACE requirements.

Louisa County Levee District #11 is an example of the worst-case scenario for depopulation. With all the NRCS purchases, there are less than two dozen people, including children, living within the district. This means there are very few property owners within the district who qualify to serve as trustees and very few people to pay the levee assessments required to keep the district operational. It is not feasible to raise assessments to the point required to sustain the levee because it would bankrupt the remaining property owners. With the small population and limited infrastructure within the leveed area, it is highly unlikely that the levee district will be able to pass a cost-benefit analysis to receive federal assistance in the future.

The Mills & Pottawattamie County (M&P) Levee District is located in Mills and Pottawattamie counties as indicated by the name. The district was formed in 1968 with the purpose of building and maintaining a series of levees and other improvements along the Missouri River to protect lands in the Missouri River Valley from flooding. The U.S. Army Corps of Engineers constructed the Missouri River Levee and designated it as Levee System Unit L-611-614. The M&P Missouri River Levee District assumed the duties of project sponsor after construction was completed on December 30, 1978. The District is managed under the direction of three (3) local trustees and headquartered in Glenwood, Mills County, Iowa. The levee begins at Wasbash Avenue southwest of Council Bluffs, IA and runs down the left bank of Lateral Ditch 1B and the left bank of Pony Creek downstream to the Missouri River. It continues down the left bank of the Missouri River, ending at the confluence with Keg Creek. The main stem levee generally sets back 1,500 feet east of the centerline of the Missouri River. The flood control improvements consist of 17.7 miles of mainstream levees and 9.5 miles of tie-back levees, for a total of 27.2 miles of levees, which must be operated and maintained by the District. Approximately 25,000 acres of land is protected by the system, which includes agricultural crop ground, residential homes, commercial businesses, industries, county roads, highways, railroad transportation systems, utility systems, and wetland conservation areas. Due to growth and development of the area, the levee system’s designation has changed from an agricultural levee to an urban levee. **Figure 15** is a NLD image of the system.

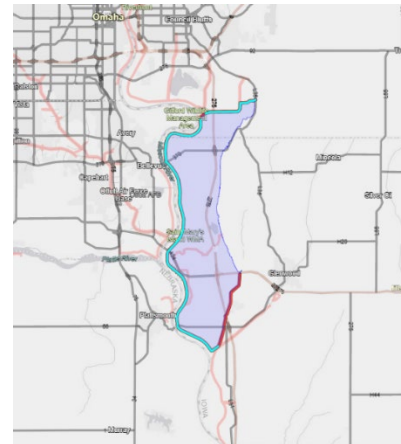


Figure 15

The levee was initially managed by a joint Board of Supervisors from Mills and Pottawattamie Counties. The district’s landowners were not satisfied with Supervisor management and the conversion to Trustee management took place in 1994. The district continues to be managed by three trustees representing the north, central and southern portions of the district.

The National Levee Database (NLD) identifies the district’s levee as L-611-614-MoRiv LB & Upr Pony Creek LB & L1B LB levee system. The system’s NLD attributes are shown in **Table 9**.

Table 9

M&P Missouri River Levee District				
System	USACE Constructed	Total Miles	FEMA Accredited	PL 84-99
L-611-614—MoRiv LB & Upr Pony Creek LB & L1B LB	No	26.25	Yes	Active

This levee protects predominantly agricultural land however; key infrastructure like Interstate 29 and US Highway 34 run through the leveed area of the district. Failure of this system interrupts interstate travel and negatively impacts populations from Missouri to South Dakota as well as Iowa and Nebraska. Recently added infrastructure to the leveed area includes a Google facility.

The M&P Missouri River Levee district has developed a unique assessment method to help generate the income required to maintain the levee. The details of this method were developed by Olmstead & Perry Consulting Engineers Inc. and found in their report entitled *Flood Protection Benefits Assessment M&P Missouri River Levee District* in 2017. The district collects approximately \$950,000 a year in assessments from landowners in Mills and Pottawattamie Counties. Most district assessments are levied based on a proportional amount based on derived benefits provided by the levee to the landowner. Under this method, those living closest to the levee end up being assessed at a higher rate than those living further away from the levee. Another common method used to determine assessments is using assessed value of the property. Under this method, the landowner's levee is determined by the assessed value of their property in relation to the total value of property within the leveed area. M&P uses a modified assessed value, which uses a combination of the other two methods. Trustees report that the District invested \$350,000 to have the method professionally developed and they have recouped that investment many times over. Trustees also report that under this method, almost 50 percent of those assessments come from a single commercial landowner. This landowner willingly pays the higher assessment because they understand the importance of the protection provided by the levee and they have the financial resources available.

The M&P Missouri River Levee District Trustees have also made significant investments to have a professional engineering assessment completed to determine that work required to bring the levees and associated tie-back levees up to current design standards necessary to meet FEMA accreditation requirements. The district is taking steps to maintain the levee system's certification by an engineer in order to stay accredited by FEMA. FYRA Engineering is the firm hired to complete the study and released their investigative phase report entitled *Investigative Phase Summary for Missouri River Federal Levee System L-611-614*, which was released in May 2022. The 1,200-page report provides a project background, looks at the physical engineering aspects of the levee system, required levee modifications and estimated project costs. The report estimates it will require approximately \$65 million to make the necessary modifications.

An economic impact analysis of the area indicates that commercial development growth is dependent upon levee accreditation. **See Appendix G.** From a strategic perspective, the levee district demonstrates the close relationship between flood-risk management and sustainable economic growth that benefits not only those stakeholders within the leveed area, but also drives regional and statewide growth.

District leadership has a positive relationship with USACE. USACE is responsive to their requests for assistance and works with them to address issues identified during USACE's inspections. They also believe that USACE is doing a good job of managing the river. However, they believe USACE inspection requirements have become onerous.

The challenges faced by this district are similar to those identified by other districts across the state. These include identifying the next generation of trustees to take over. The trustee we interviewed has been serving as a trustee since 1994 and has a wealth of knowledge and experience. However, they are also elderly and are looking to pass their responsibilities to someone else. The trustees struggle to find people willing to do the physical work required to maintain the levee and to flood fight when necessary. The district also faces the mounting cost of maintaining an aging structure and replacing features with ones that meet the new USACE standards. To address some of these challenges, the trustees are

outsourcing an increasing amount of maintenance and operation activities to FYRA. This is an option available to this district because of their unique assessment model and the revenues generated.

The Two Rivers Levee and Drainage District is located in southern Louisa and eastern Des Moines counties. The levees in this district were originally constructed in the early 1900s to protect against flooding from the Iowa and Mississippi Rivers. In the mid-1960s, the United States Army Corps of Engineers (USACE) planned and funded improvements to the existing levees. The National Levee Database (NLD) divides the district into upper, middle and lower segments. The NLD uses the tie back levees along Hawkeye-Dolby Diversion Ditch and Yellow Spring Creek Diversion Ditch as the dividing lines between the segments. The district features include 15 embankments, 16 gravity drains, 12 relief wells, 4 pump stations and 1 closure structure. The NLD lists a total of 86 miles of embankment within the three segments.

There are multiple systems operated by the Two Rivers Levee and Drainage District protecting predominately-agricultural cropland of approximately 45,000 acres. The Two Rivers L&DD – Upper Segment also protects critical infrastructure, which includes County Highway 99 and the town of Oakville, which contains one of the largest employers in Louisa County. **Table 10** provides a summary of the NLD levee information for the district.

Table 50

Two Rivers Levee & Drainage District				
System	USACE Constructed	Total Miles	FEMA Accredited	PL 84-99
DSM County DD Seven 1	No	1.66	No	Not Enrolled
DSM County DD Seven 2	No	1.85	No	Not Enrolled
DSM County DD Seven 4	No	2.45	No	Not Enrolled
Hawkeye Dolby 1	No	1.01	Yes	Not Enrolled
Hawkeye Dolby 2	No	2.72	Yes	Not Enrolled
Hawkeye Dolby 3	No	0.48	No	Not Enrolled
Two Rivers L&DD – Lower Unit	Yes	10.72	Yes	Active
Two Rivers L&DD – Middle Unit	Yes	29.22	Yes	Active
Two Rivers L&DD – Upper Unit	Yes	46.93	Yes	Active
Two Rivers L&DD – Yellow Springs Cr	Yes	0.89	No	Active

The Two Rivers Levee & Drainage District is unique in that it is the product of voluntary consolidation of existing levee and drainage districts. This history of consolidation goes back to 1911 when the Louisa County and Des Moines County Boards of Supervisors decided to consolidate Louisa County Levee Districts No. 5 and No. 6 with Des Moines County Levee District No. 1 into a single district governed by a joint board named Flint Creek Iowa River Levee District No. 16.

Following the events of the 2008 flood the Boards of Trustees of the Louisa-Des Moines County Drainage District No.4, Des Moines County Drainage District No. 7 and Des Moines County Drainage District No. 8 were assimilated into the overlying district Iowa River-Flint Creek Levee District No. 16 of Louisa and Des Moines Counties effective December 31, 2013. That district was renamed when the Two Rivers Levee & Drainage District was established on January 1, 2014. District consolidation was pursued.

Prior to consolidation, all four districts had the same administrative person working to obtain resources and file grant documentation. Because the districts were all significantly impacted by the 2008 flood, they all applied for similar federal funding and had similar reporting requirements. By consolidating the

districts, it reduced the documentation and reporting requirements for administrative personnel. The district's administrator reports that consolidation has resulted in little or no impacts on levee and drainage assessments but has generated cost savings through economy of scale purchases. The consolidation of funding has allowed the district to fund projects that the individual districts would not have been able to address on their own.

Another unique feature of the Two Rivers Levee & Drainage District is that the district has chosen to pay their bills directly without going through the county like other levee and drainage districts across the state. In accordance with Iowa Code Section 468.528, drainage and levee districts with pumping stations, by order of the board of trustees may direct the treasurer to place all or any part of the districts moneys into a checking account established by the board in a bank or credit union as defined in section 12C.1. The county treasurer transfers drainage and levee assessment payments into the districts checking account on a monthly basis. Under this arrangement, the district must follow similar procedures as if the County was making the payment. *"The Board shall not expend moneys in the account for a purpose if the board could not order the county treasurer to expend moneys from the county's separate fund for that same purpose."* In accordance with Iowa Code, the district must file an annual financial report that is accompanied by an unqualified opinion based upon an audit of the account performed by an Iowa certified public accountant with the County Auditor.

Like most levee districts within the State of Iowa, the Two Rivers Levee & Drainage District is managed by a five member Board of Trustees that are elected by the landowners within the leveed portion of the district. The district's daily operations are executed by five full time maintenance employees and a part time administrator. Maintenance employees monitor and maintain the pump stations, embankments and other levee features. The district utilizes its own vehicles and equipment to conduct minor maintenance and repairs. Major or specialized repairs are contracted out. The administrator serves as the secretary/treasurer for the Board of Trustees. The administrator is the district's primary point of contact and works closely with outside entities to obtain assistance and share information as required.

The Two River Levee & Drainage District works closely with local authorities to include the County Sheriff's Department, County Emergency Management agencies and the United States Army Corps of Engineers, especially during flood fights. The district is required to have an Emergency Action Plan to alert businesses and residents living within the leveed area of potential and eminent dangers related to levee operations. The district coordinates with local emergency managers to ensure they are informed about the status of the embankments, pump station and other features especially during high water events. The district relies on local law enforcement to implement voluntary and mandatory evacuations in the event of a potential levee breach or overtopping. During flood fights, the Board of Trustees and employees meet daily to ensure leadership and partner agencies understand the status of the levees. The Trustees are responsible to obtain the necessary volunteers to conduct flood-fighting efforts such as sandbagging. Landowners and residents residing within the leveed area provide the bulk of the volunteer workforce. Daily updates are provided to local emergency managers and law enforcement to keep them apprised of the situation. As the water continues to rise, or there is an increased risk of levee failure, updates are provided at least twice a day or up to hourly if required.

The Two Rivers Levee & Drainage District has a substantial annual budget. It takes in approximately \$1 million a year in drainage and levee assessments plus additional revenues annually in interest and miscellaneous income. This district expends approximately \$1.1 million annually. These numbers do

not include any federal and state disaster recovery funding or disaster related expenditures that may be received as a result of a breach or other levee failure. Even with budgets of this size, the district struggles to maintain PL 84-99 compliance with USACE and has several unfunded projects that need to be addressed. Flood fighting can create a significant drain on the district's resources. During the 2019 flood fight, a single pump station had a monthly utility bill of \$58,000. Diesel powered pumps can consume \$16,000-\$17,000 a week in fuel. The district spent approximately \$800,000 in utility expenses that year which was over 80 percent of the \$968,000 annual budget.

Like most other levee districts, the Two Rivers Levee & Drainage District is struggling with a declining population/tax base and increasing maintenance requirements to remain in USACE's rehabilitation program. Following the 2008 overtopping of the upper segment, the district lost approximately 17,000 taxable acres and almost 1/3 of the ag-land owners in that segment. As the agriculture community trends towards corporate and large farms, there are fewer available candidates to serve as levee district trustees. As USACE increases their inspections requirements, it is becoming increasingly difficult to find vendors who are qualified and willing to do the work. Two Rivers must often go as far away as St. Louis, MO to find qualified vendors. Even if a vendor can be located, they often have a significant waiting list, up to 18 months, before they are available to provide the service making it difficult to maintain USACE compliance. Because of the age of their pumps, Two Rivers must often fabricate their own repair parts because they are no longer available for purchase. Most of the district's pumps were installed in the 1940s and 1950s making them close to 80 years old in some cases.

In talking with the District leadership, one of their biggest concerns is USACE's ever-increasing requirements to remain in the rehabilitation program (PL 84-99). Culverts must now be inspected by a certified engineer with special certifications. Relief well inspections also require a special certification, which makes it difficult to find a qualified inspector. Once one was identified in St. Louis, they had an 18-month waiting list. The District has nine relief wells that are operational and working but do not meet USACE's "pumping standards" and must be replaced to maintain 84-99 compliance. Each relief well costs approximately \$100,000 to replace. The district estimates it will take an estimated \$300,000-\$400,000 to get the levee FEMA certified to qualify for reduced flood insurance rates.

Attachment

Geophysical Imaging Pilot Investigation Southeast Iowa

Prepared for HSEMD



December 2022

Prepared by Jason Vogelgesang and Keith Schilling

**Iowa Geological Survey
IIHR - Hydroscience and Engineering
The University of Iowa**

IOWA

Iowa Geological Survey

Introduction

This report summarizes geophysical evaluation services provided by the Iowa Geological Survey (IGS) for the Iowa Department of Homeland Security and Emergency Management (HSEMD). A pilot investigation was proposed for the IGS to utilize geophysical technology to image the subsurface of existing levees to identify potential anomalies. Two representative levee systems were chosen by HSEMD for this pilot investigation with a plan to collect up to 12 combined miles of linear data at the sites. The locations and names of the participating levee systems are being kept confidential.

This pilot effort consisted of two components: 1) initial electromagnetic (EM) levee imaging, and 2) detailed electrical resistivity (ER) surveying in areas flagged by the EM surveys. Results from the geophysical surveys were processed, interpreted, and summarized below.



Figure 1. EM data collection at one of the levee sites.

Geophysical Surveys

EM Methods

A Geonics Limited (Geonics) EM-31 MK2 EM ground conductivity meter was utilized to conduct linear surveys of the levees. The EM is 12 feet in length with one end serving as a transmitter coil and the other as a receiver coil. The transmitter coil produces an alternating current, which induces circular eddy loops into the subsurface. The receiver coil then intercepts a portion of the magnetic field from the eddy loops and records this as an output voltage that is converted to apparent conductivity. The EM produces average conductivity (quadrature component, mS/m, inverse of resistivity) and in-phase (metal content, ppt) to approximately 20 feet below ground surface.

For the levee surveys, the EM was mounted on a Gator all-terrain vehicle (ATV) for ease of travel along the levee features. At each site, the EM was first affixed to the ATV and driven to a representative top-of-levee location. The unit was then calibrated using methods outlined by Geonics. The purpose of the calibration was to mask metal from the ATV, set a reference baseline for all other data collected, and prepare the unit for collection. The EM unit was affixed to the ATV in vertical dipole mode via a custom PVC/non-metal mount, which suspended the unit approximately hip level over the driver's side of the ATV. The purpose of the mount was to suspend the EM over ground where data were to be collected, away from the effects of the metal ATV, to create a means of efficiently collecting geophysical data at levee sites. When traveling between 0-10 miles per hour, conductivity and in-phase data were recorded on a field tablet at a rate of 5 readings per second. Each measurement was stamped with a geographic location from a Juniper Systems Geode sub-meter precisions GPS.

EM field measurements were collected on October 11 and 20, 2022, and were obtained by driving from a starting location at the north end of the levee and traveling south along the top of the levee (Figure 2). A return trip was then made along the land-side toe-slope of each levee system, traveling from south to north (Figure 2). A few areas, mainly along toe-slopes, were inaccessible with the equipment due to vegetation or unsafe slopes. On a few occasions, the river-side toe slope was driven if it was less vegetated and/or steep. Due to better-than-expected data collection efficiency, more levee length was collected than was originally planned. At Site A, approximately 5 miles of one-way levee length were assessed. At Site B, approximately 7 miles of one-way levee length were analyzed (the entire levee system). Overall, a total of 88,050 EM measurements were collected. For the purposes of this investigation, only conductivity was analyzed, as it is the most applicable to levee imaging.

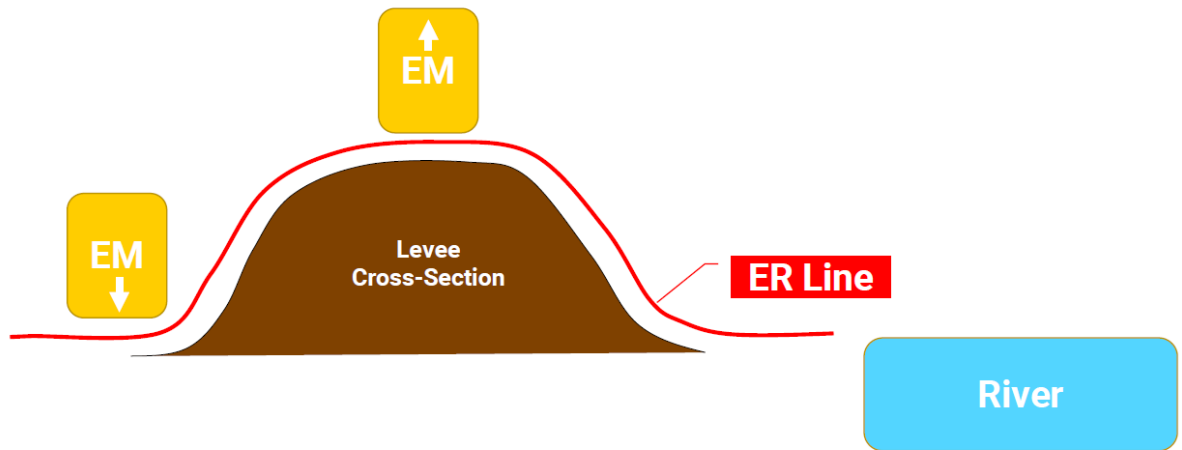


Figure 2. Generalized levee cross-section showing planned locations for geophysical data collection.

Field data were processed using the Geonics DAT31W application and ESRI mapping software. Color raster images were created, showing how ground conductivity, averaged from the land surface to approximately 20 feet below the land surface, varied along the imaged area.

EM Results

EM results show how the average subsurface ground conductivity varied from the land surface to approximately 20 feet below ground. Many variables influence conductivity distribution in the figures, with the most prominent being subsurface moisture and material. Conductivity results have been shown to be well correlated to geologic material, with coarse, dry sand and gravel showing high resistance/low conductance to electrical charge (reds) and wet clay or fine-grained sediments showing low resistance/high conductance (blues). EM survey results are presented in several figures. Figures 3 and 9 show complete, zoomed-out results whereas Figures 4-8 and 10-16 show zoomed-in tiles showcasing detailed results along each levee.

Each detailed tile figure shows an “R” where anomalously resistive areas were observed in the data. Areas with higher resistivity were flagged since high resistivity can correlate to 1) coarse sediments, like sand and gravel, 2) open voids, possibly caused by vegetation or animals, or 3) zones of higher hydraulic conductivity that may transmit water. It is important to note that the “R” notation does not necessarily imply a problematic area within the levee, but instead serves as an indication that differences were observed within the data at these locations. The flagged areas may be prioritized for further investigation, if desired. The drilling of boreholes to confirm geophysical results was not included in this investigation but is highly recommended to determine the sediment characteristics present at some or all flagged locations. An “I” shown in figures corresponds to interference from infrastructure, mainly from nearby buildings or roadways. Anomalies in the EM data may be seen near these locations; however, a field inventory of possible interference locations suggests these anomalies are related to infrastructure and not the levee composition itself.

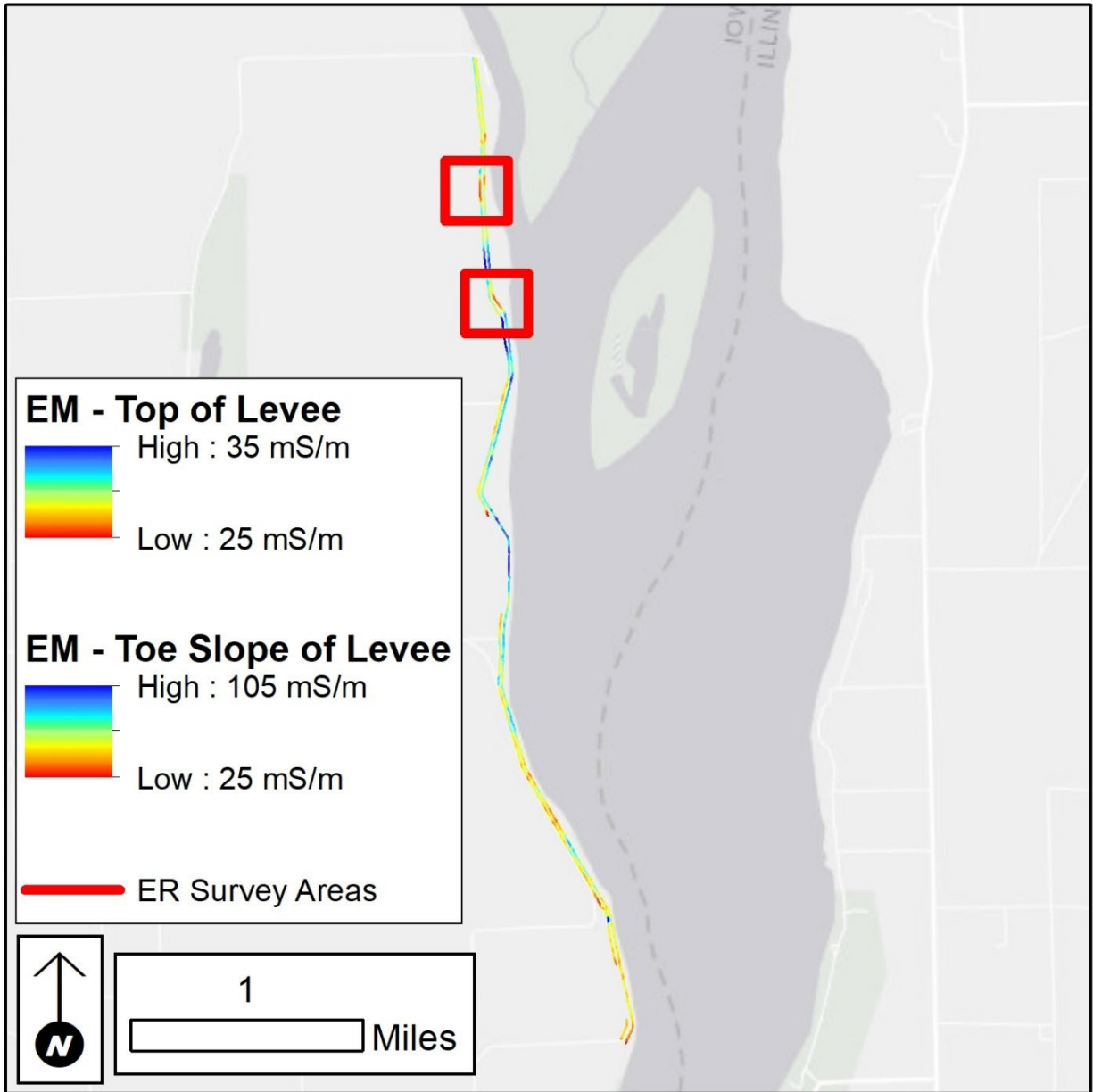


Figure 3. EM results for Site A.

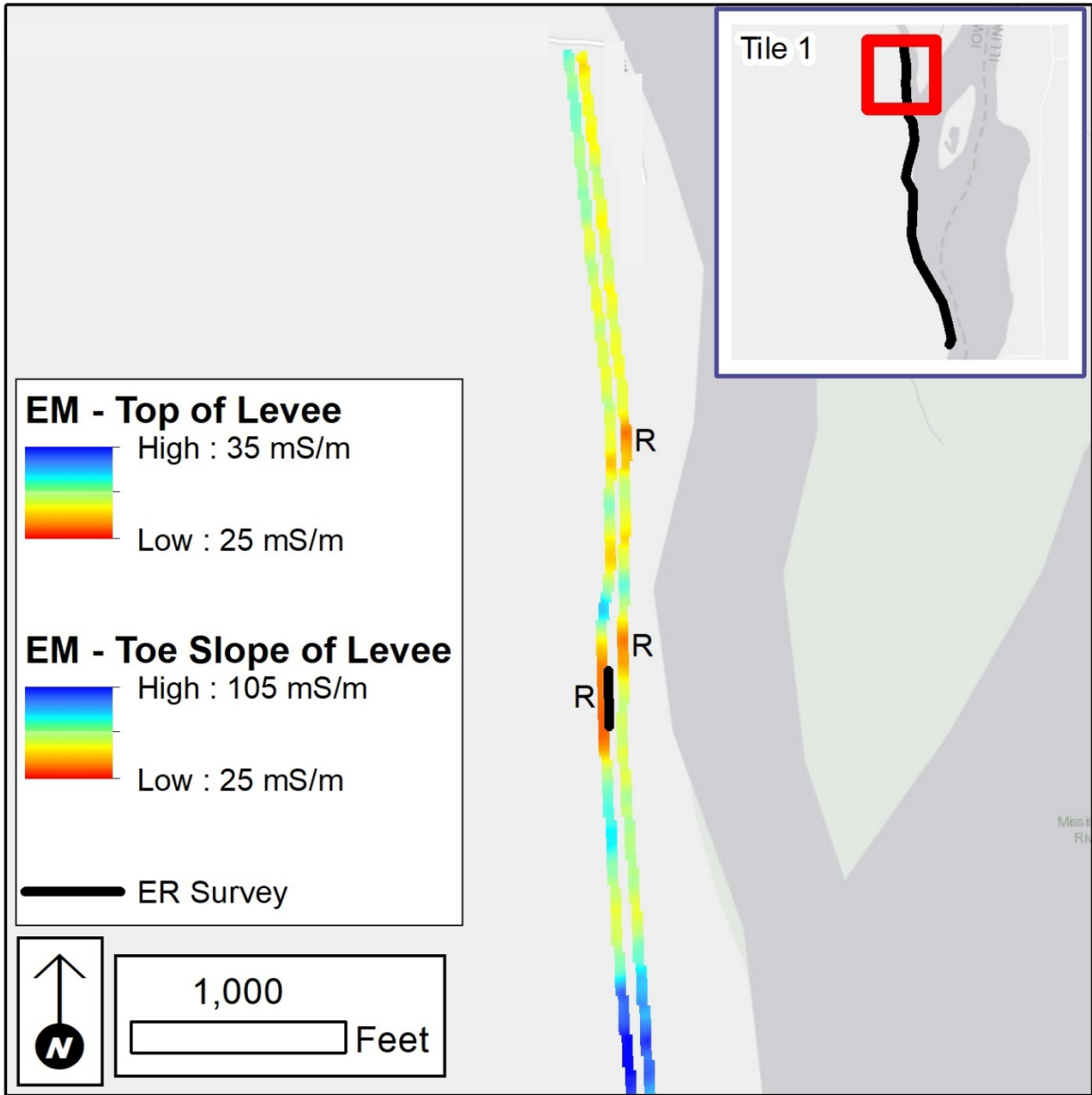


Figure 4. Site A, tile 1 EM results. "R" denotes resistive anomalies.

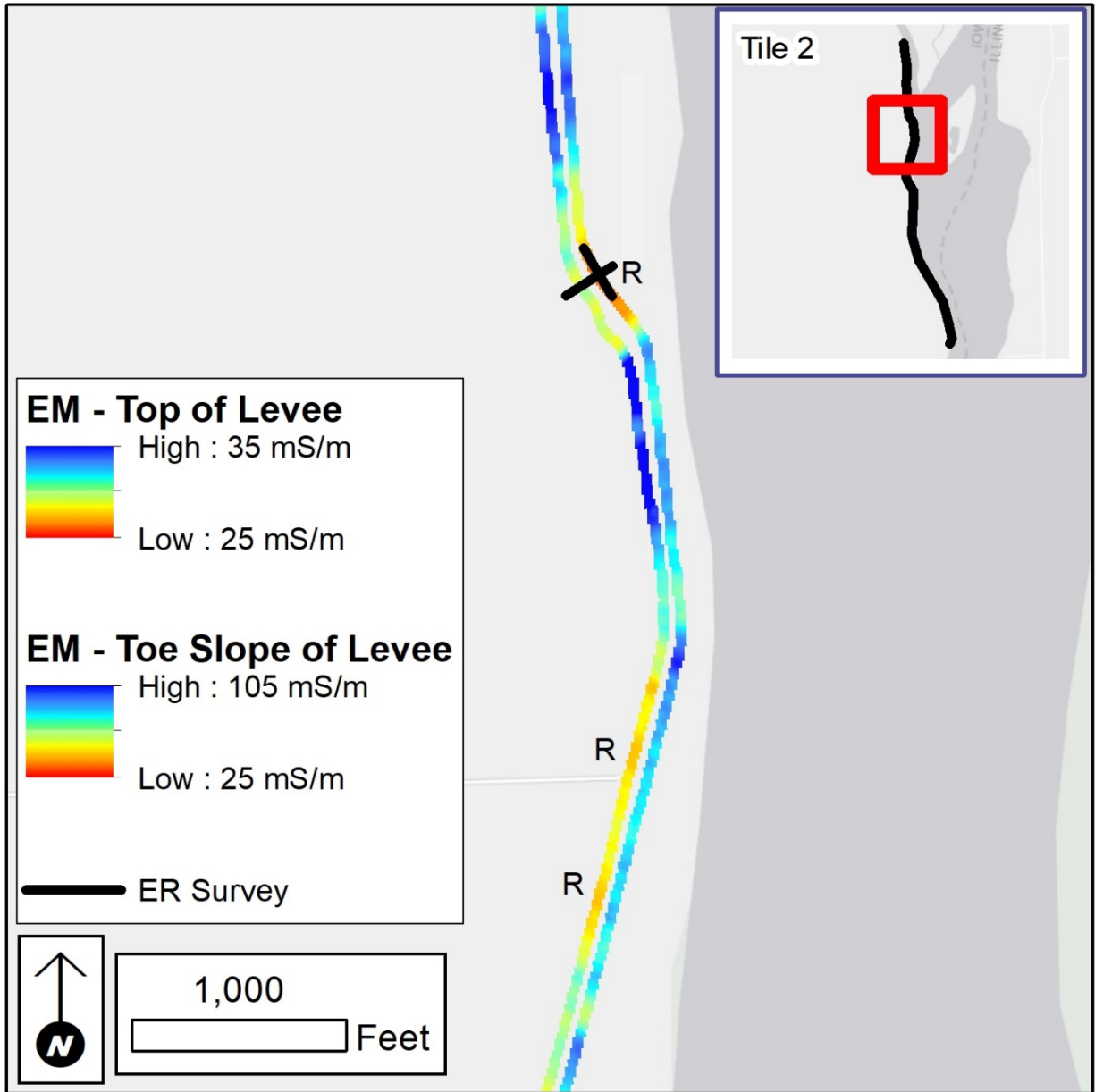


Figure 5. Site A, tile 2 EM results. "R" denotes resistive anomalies.

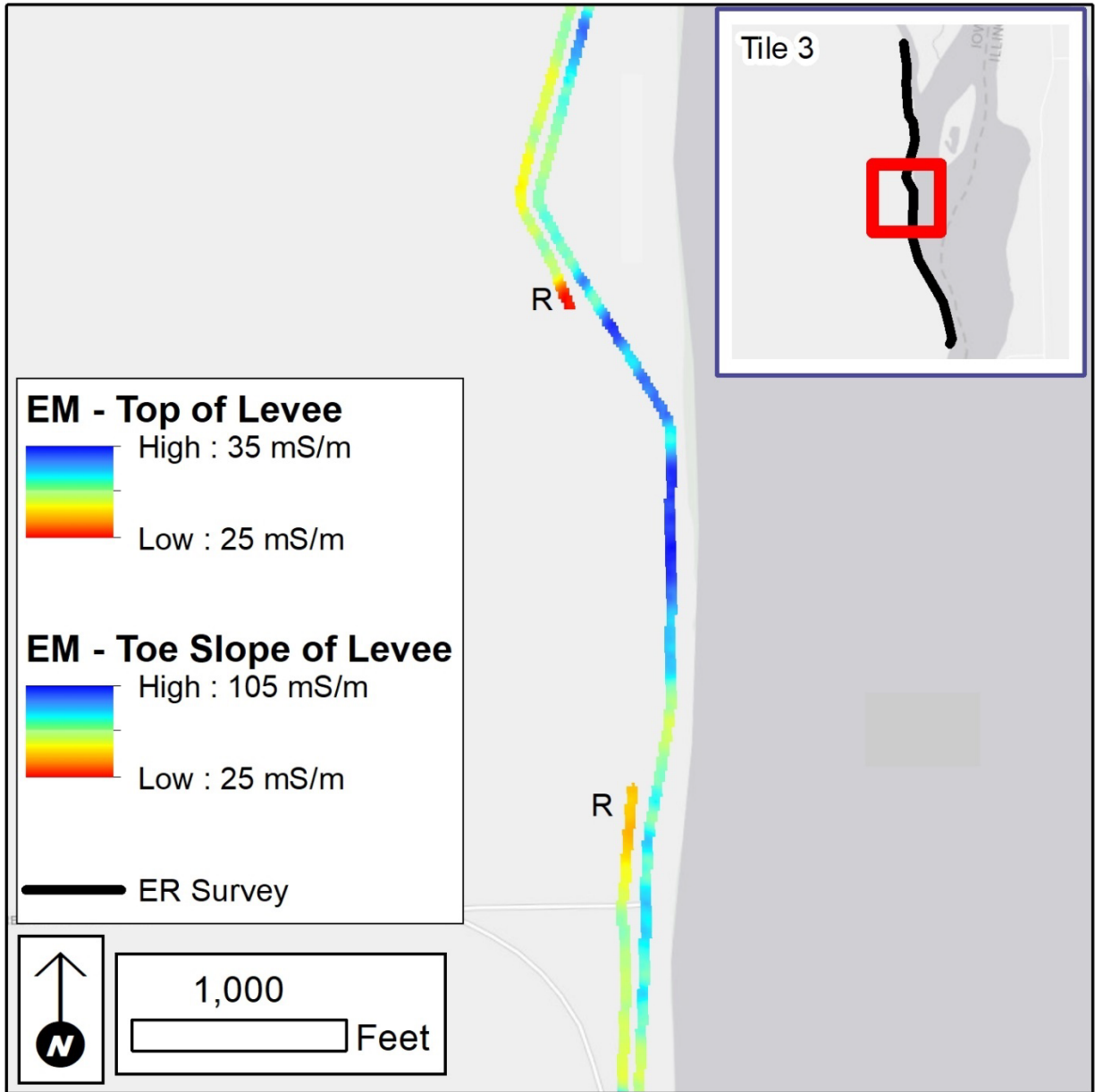


Figure 6. Site A, tile 3 EM results. "R" denotes resistive anomalies.

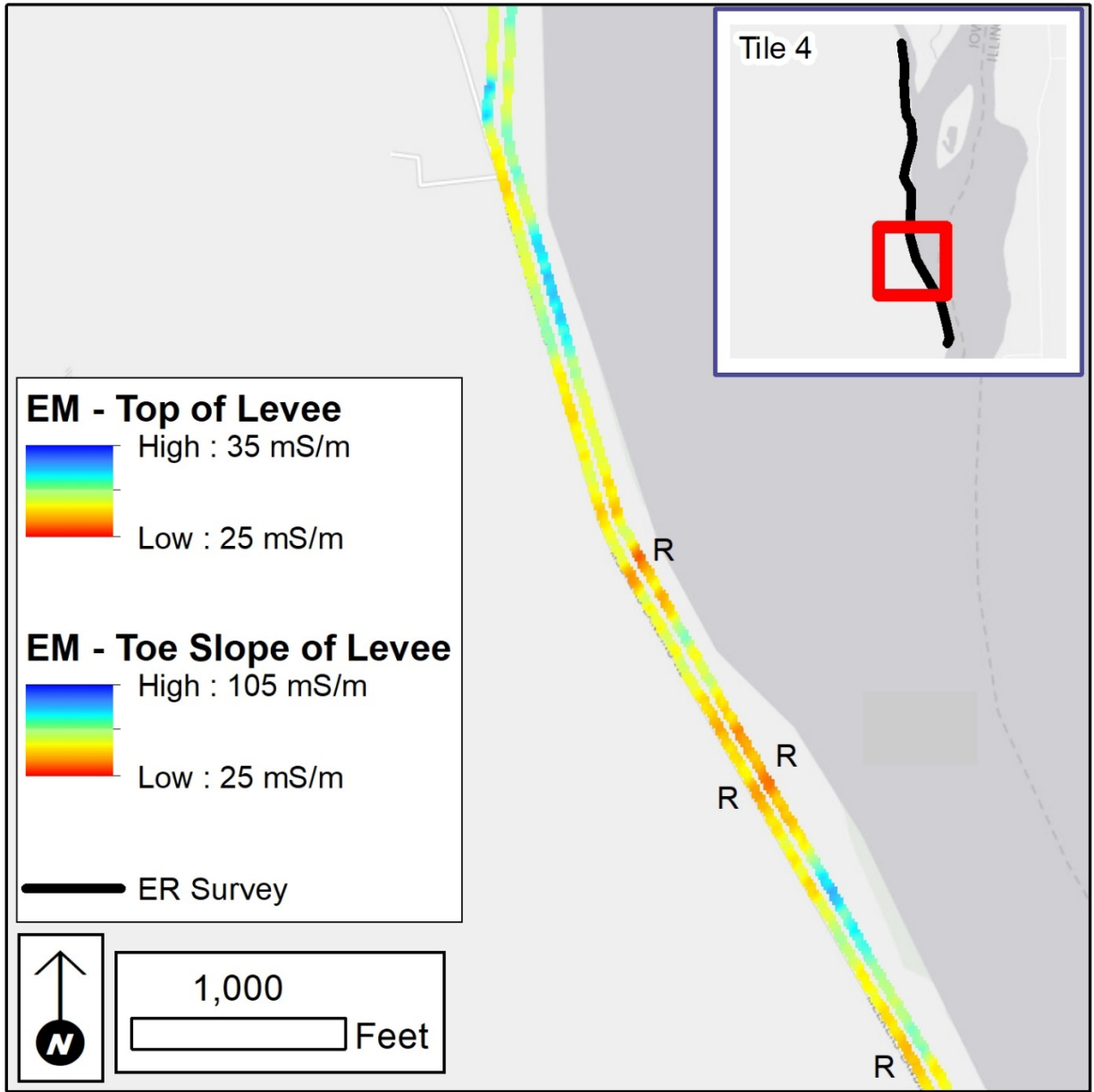


Figure 7. Site A, tile 4 EM results. "R" denotes resistive anomalies.

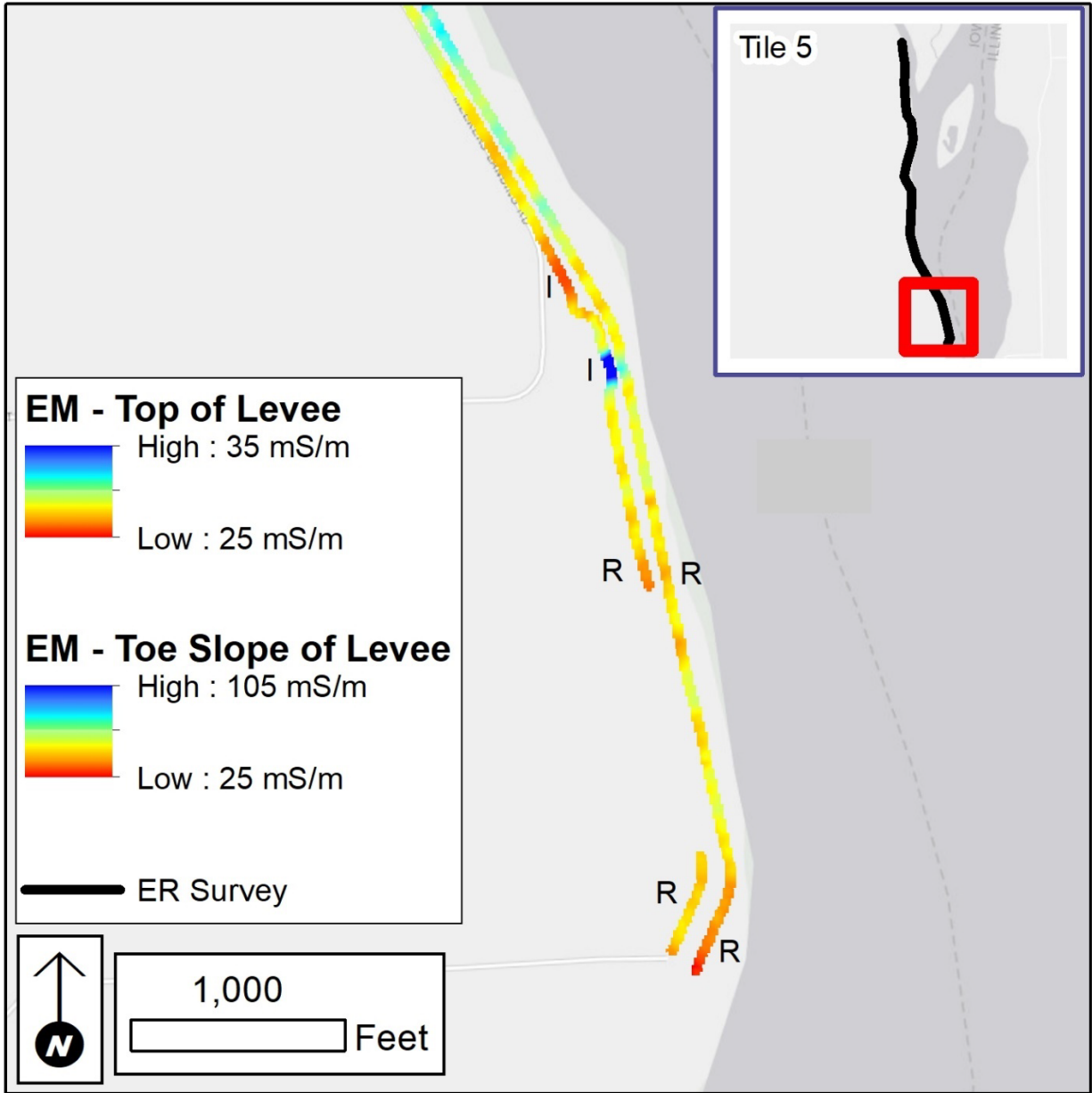


Figure 8. Site A, tile 5 EM results. "R" denotes resistive anomalies. "I" denotes interference from infrastructure.

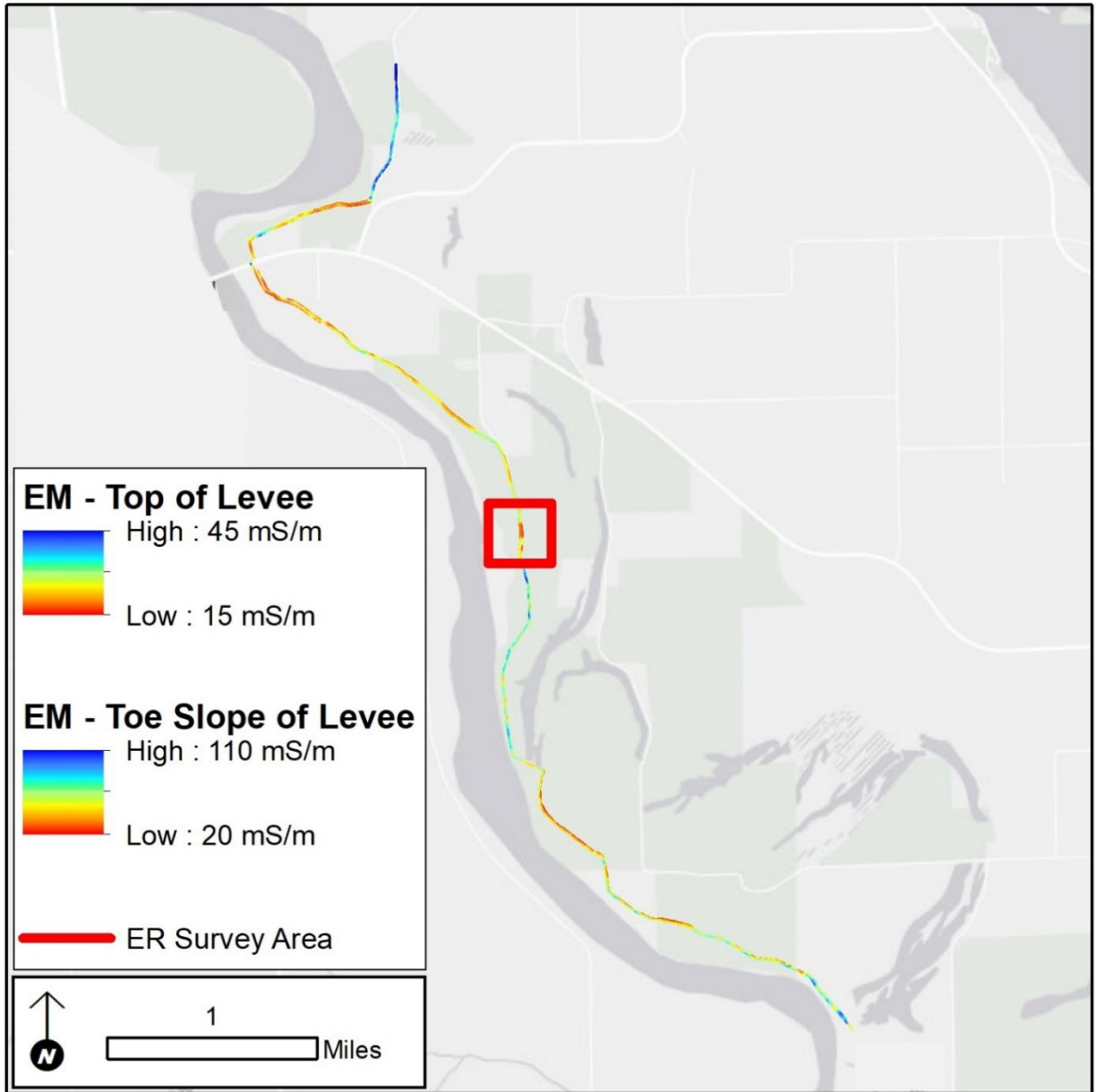


Figure 9. EM results for Site B.

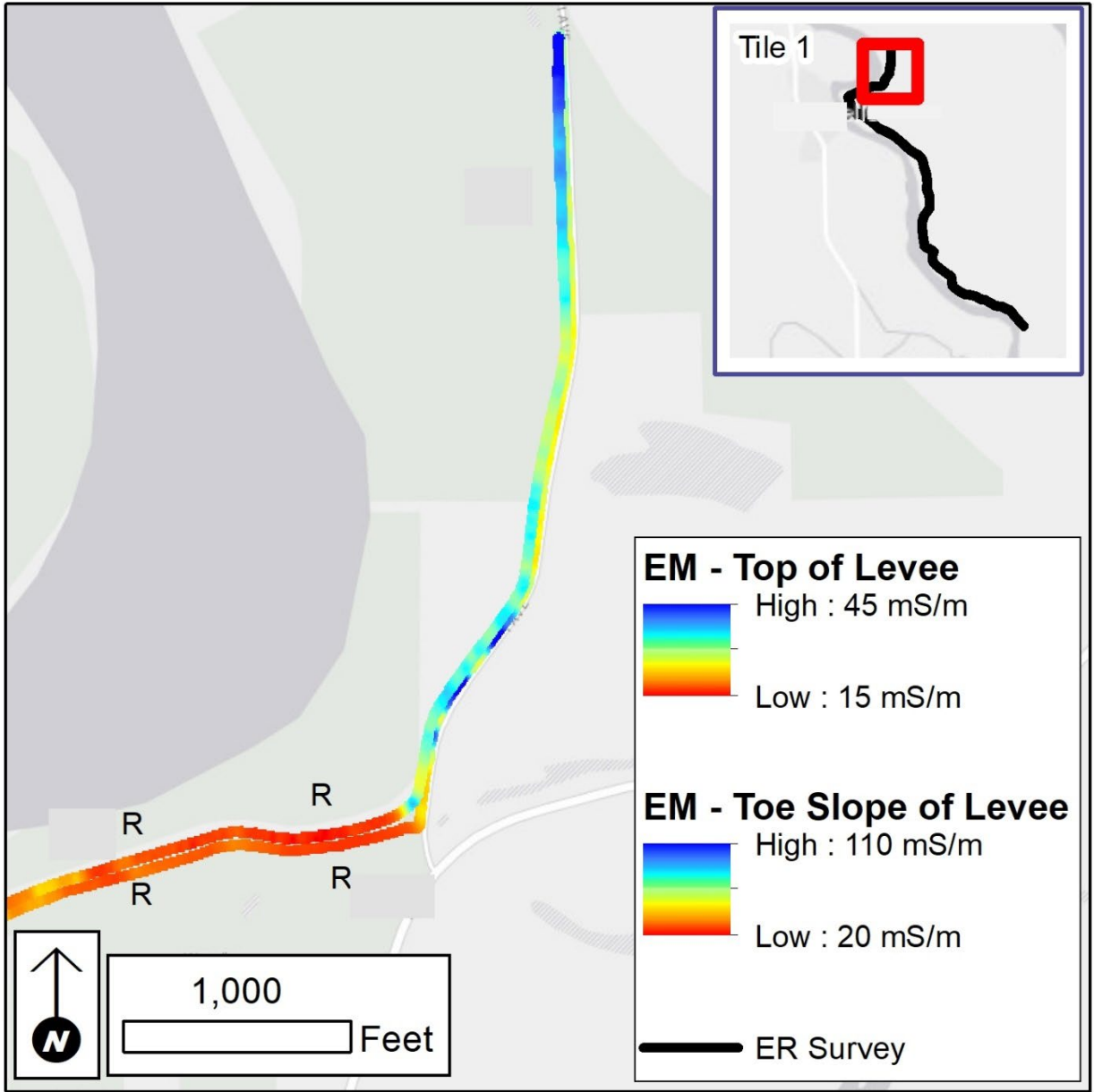


Figure 10. Site B, tile 1 EM results. "R" denotes resistive anomalies.

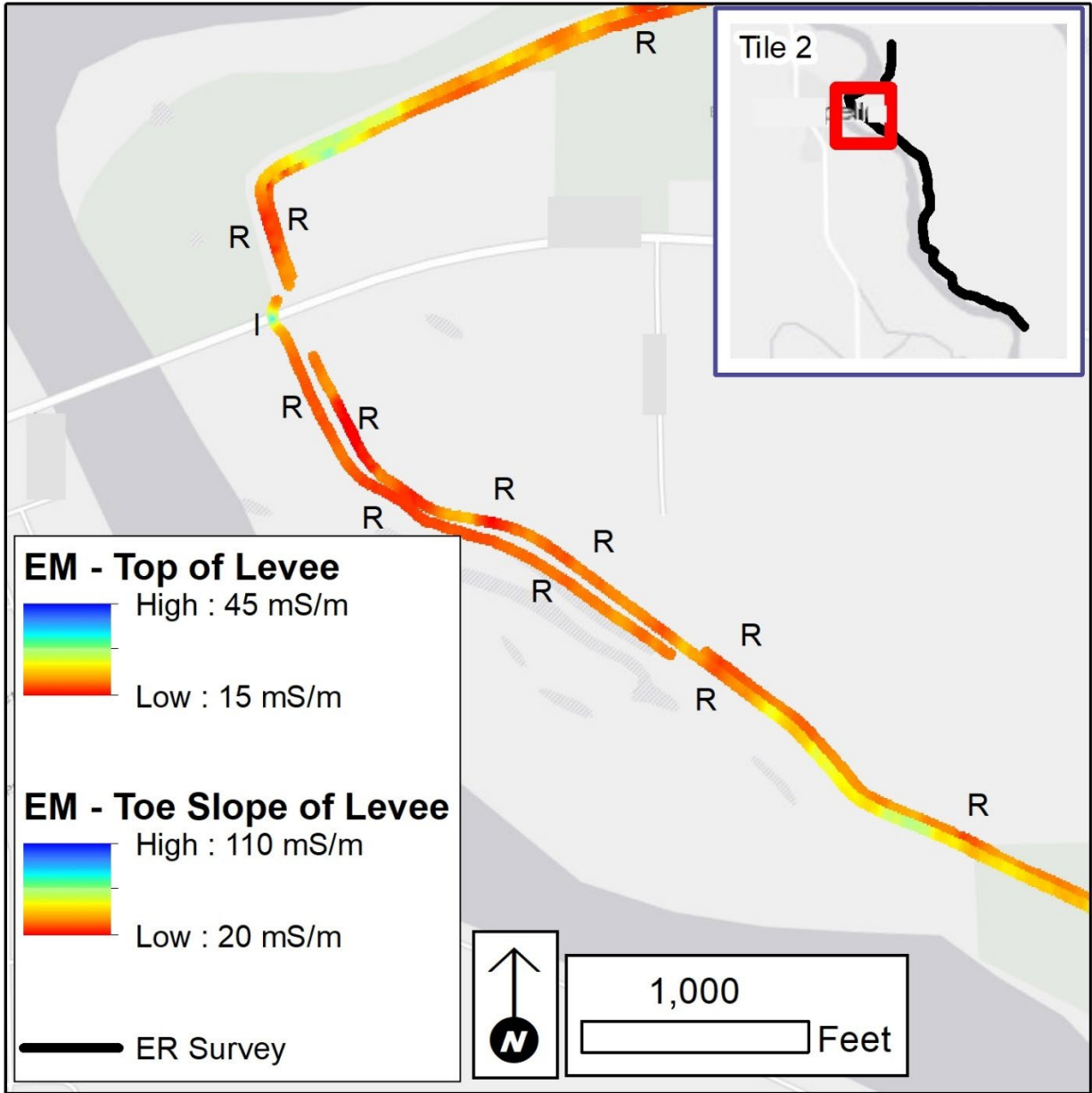


Figure 11. Site B, tile 2 EM results. "R" denotes resistive anomalies. "I" denotes interference from infrastructure.

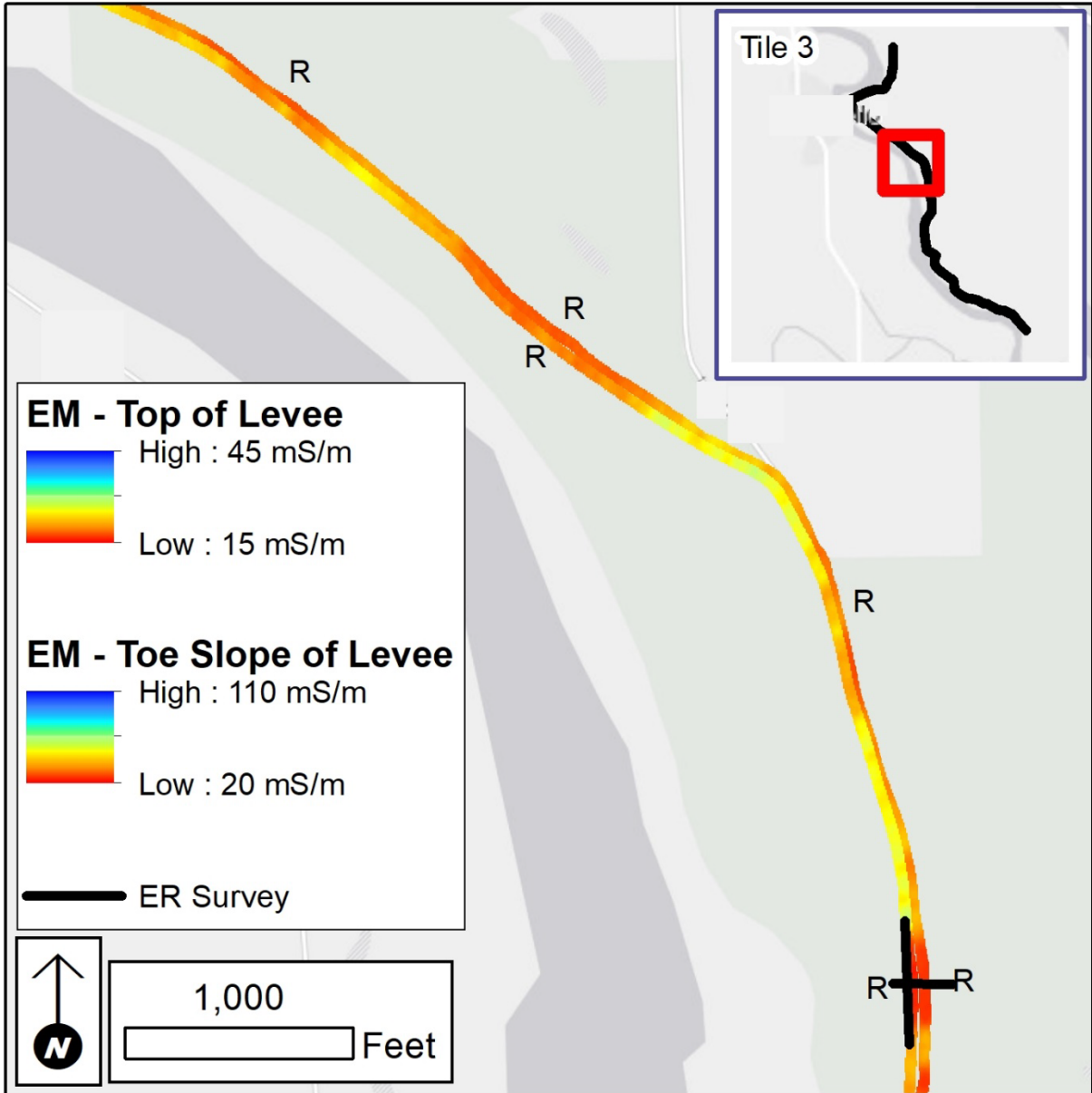


Figure 12. Site B, tile 3 EM results. "R" denotes resistive anomalies.

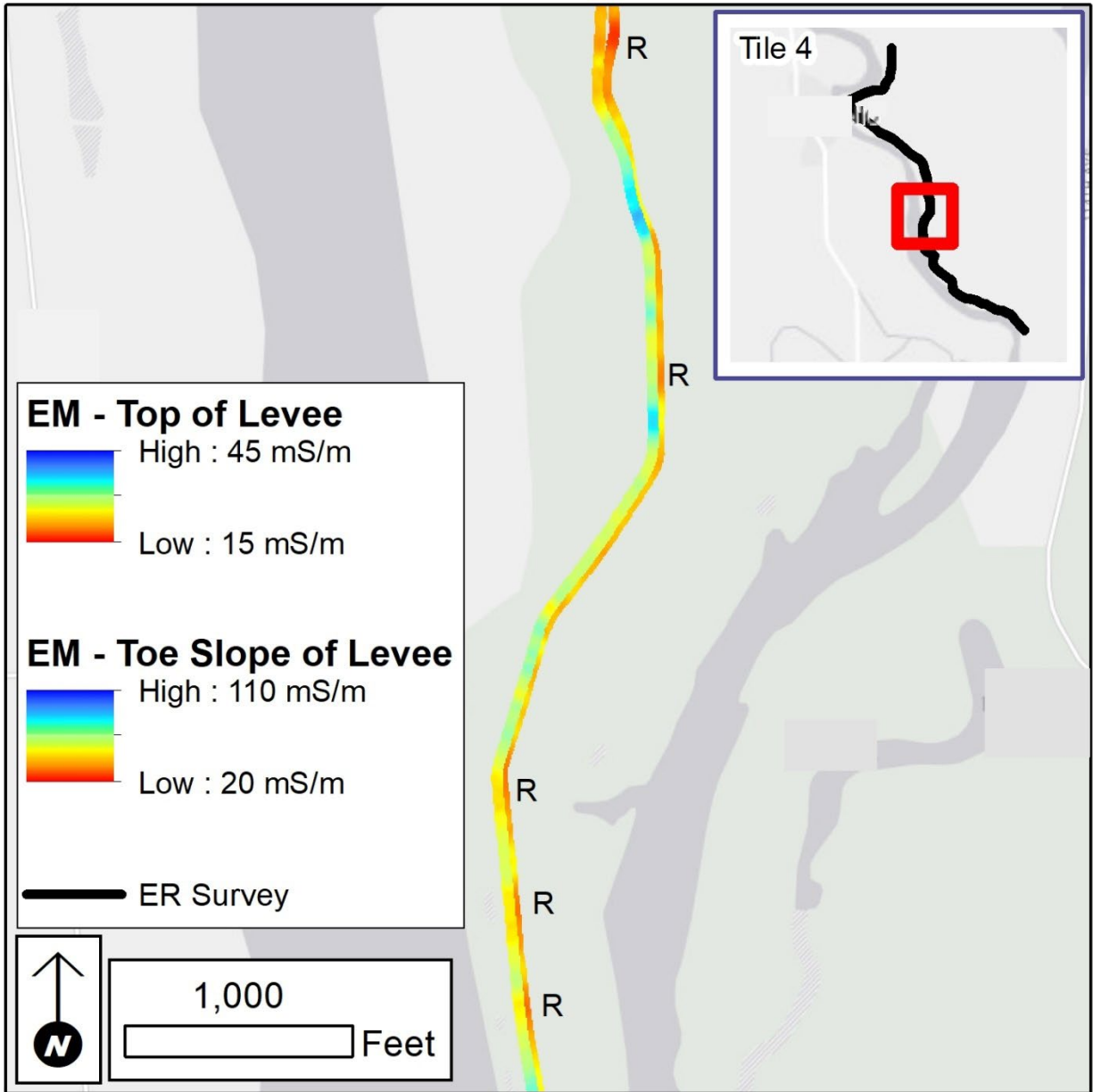


Figure 13. Site B, tile 4 EM results. "R" denotes resistive anomalies.

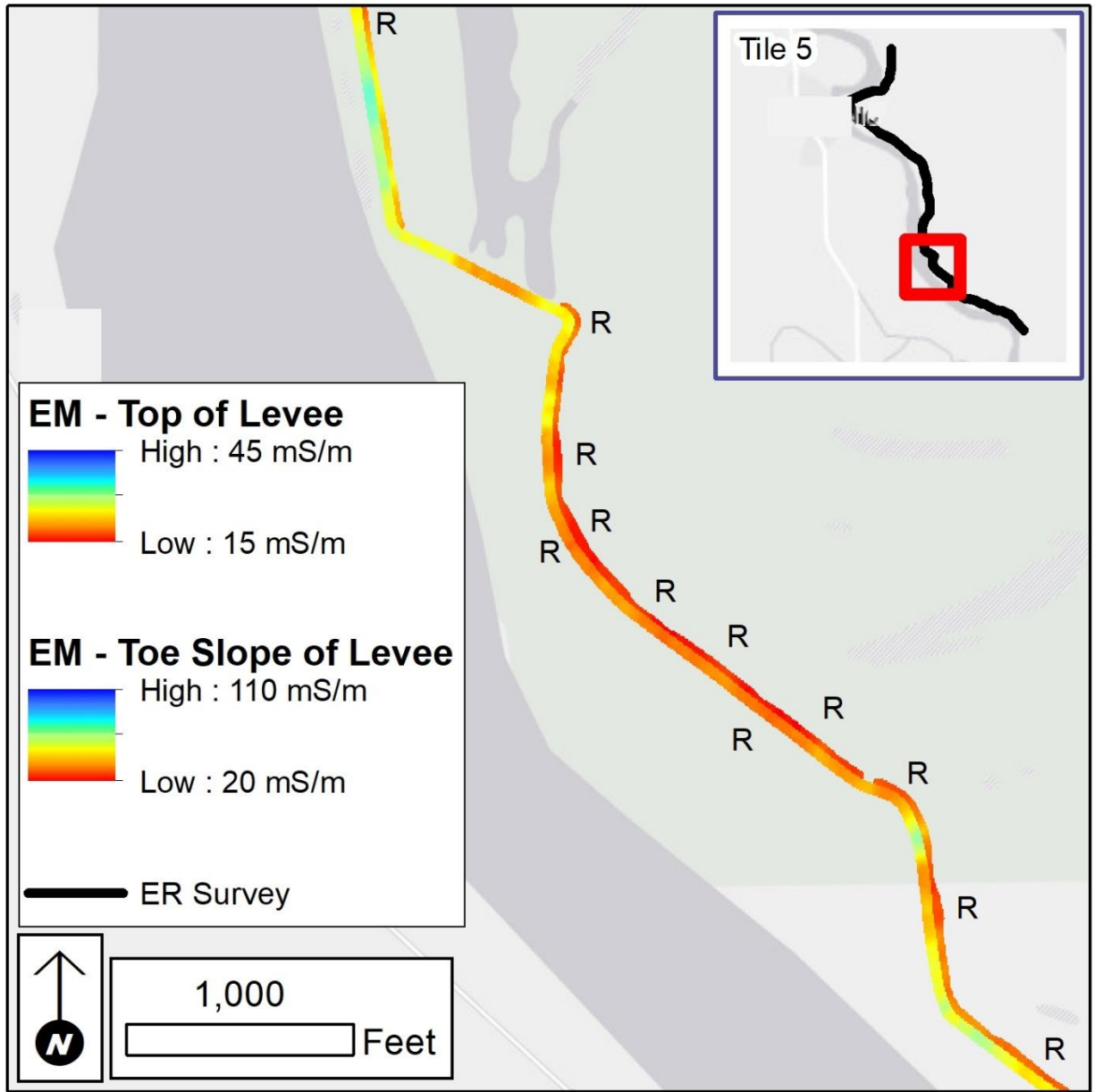


Figure 14. Site B, tile 5 EM results. "R" denotes resistive anomalies.

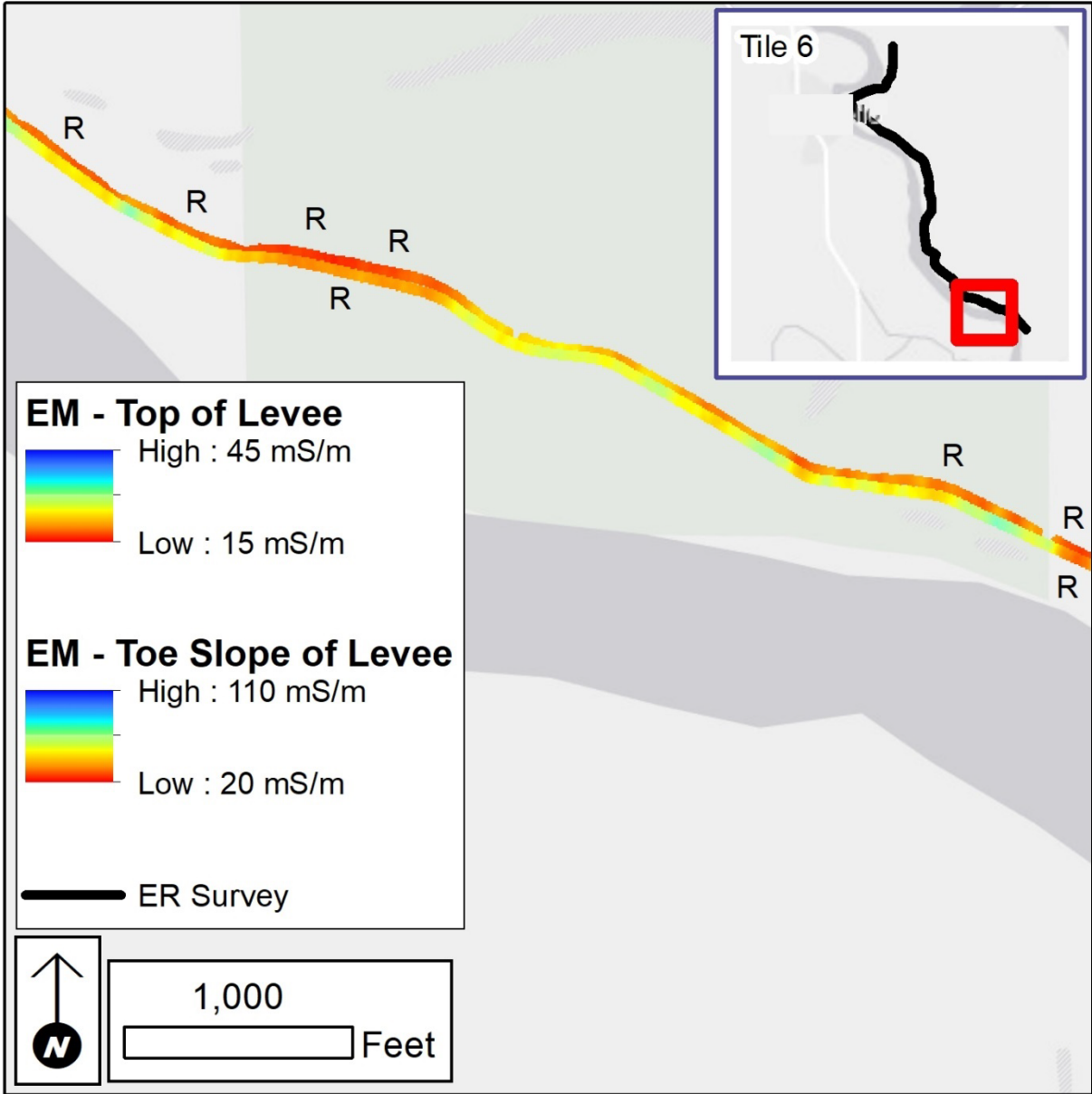


Figure 15. Site B, tile 6 EM results. "R" denotes resistive anomalies.

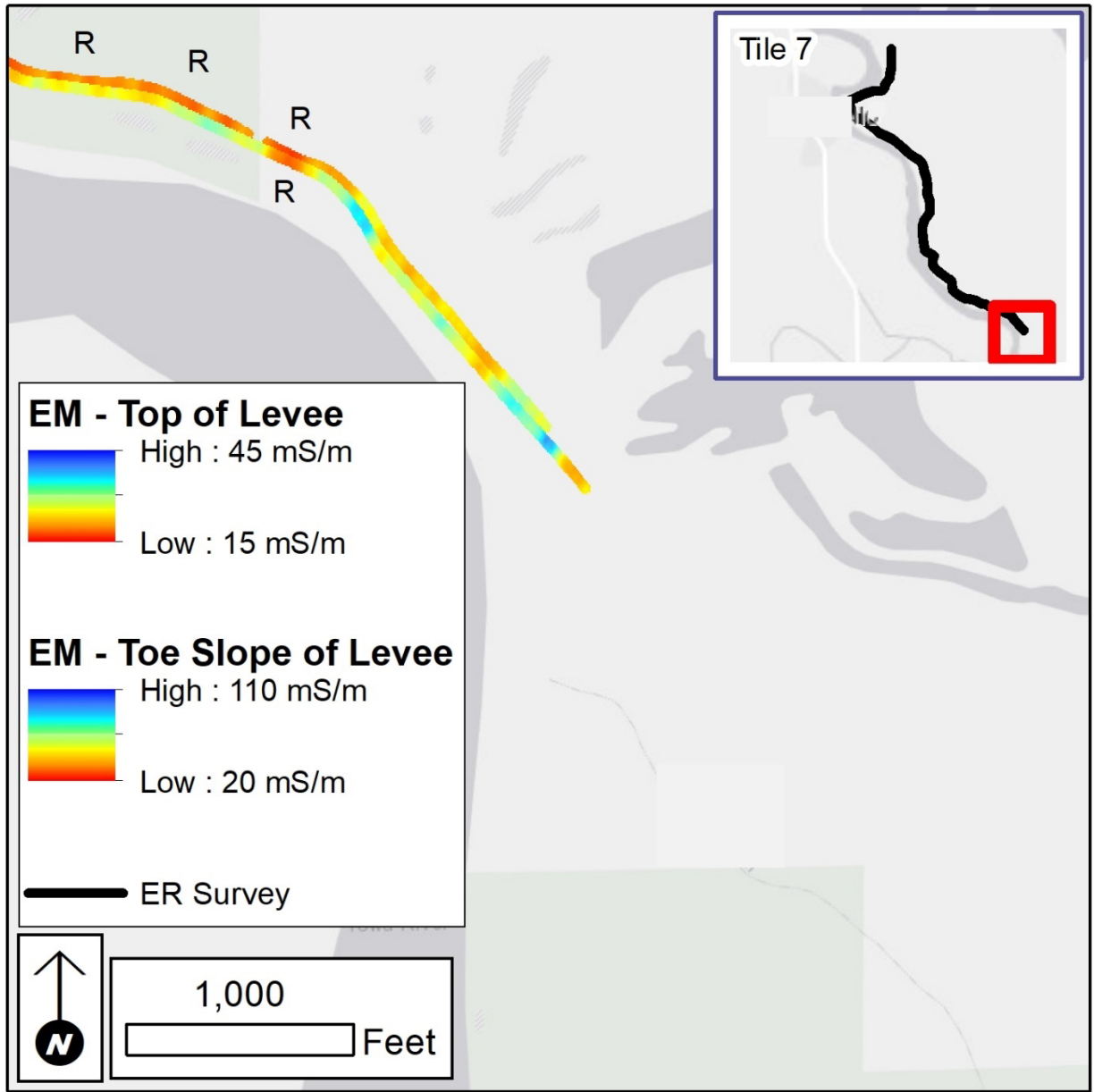


Figure 16. Site B, tile 7 EM results. "R" denotes resistive anomalies.

ER Methods

Electrical Resistivity tomography (ER) was conducted at several anomalous areas identified by the EM surveys. An Advanced Geosciences, Inc. (AGI) SuperSting R8, eight channel electrical resistivity meter was utilized for this investigation. An electrode spacing of approximately 10 feet (3.0 meters) was utilized. This spacing represents half of the maximum spacing and was chosen to ensure high-resolution data were collected and adequate depths were imaged. Decreased electrode spacing, as used in this investigation, allows for more detailed resolution and strong electrical contact, at the expense of additional labor. The number of electrodes used varied by line length, ranging from 28 to 56. A total of 5 ER lines were collected on October 27, 2022. As planned, some of the lines were collected perpendicular to the levees (Figure 2). Additionally, some of the lines were collected parallel to the levees, both on top and along the toe-slope. ER results are heavily influenced by subsurface moisture, including the presence of the water table. The lines parallel to the levees were gathered to determine if a constant water table depth (achieved by stable line elevation: parallel to levee) was more beneficial to a variable water table depth (achieved by variable line elevation: perpendicular to levee).

A full line with 56 electrodes cycles through up to 200 electrode pairs. A maximum of 691 potential readings (data points) were gathered from each line with shorter lines having fewer potential readings. A Juniper Systems Geode sub-meter, precision GPS was used to identify starting and ending locations along each ER line. Field data were collected using a dipole-dipole collection array. Field equipment was set to automatically utilize two reading cycles, where each measurement collected was duplicated. The two measurements were averaged for a final reading. If the percent error between the two measurements was greater than 2%, a third measurement was taken and included in the average. Transects of sufficient length were run to obtain electrical resistivity data to depths of approximately 60 feet below the ground surface or deeper at each site. Data were processed using AGI EarthImager 2D software using default surface settings. Elevation was obtained from the statewide LiDAR elevation dataset and is shown in figures as feet below ground. Table 1 shows starting and ending line elevations.

ID	Elevation FASL (LiDAR)
Site A Top Start	543.6
Site A Top End	544.0
Site A Perpendicular Start	526.5
Site A Perpendicular End	530.0
Site A Toe Start	532.1
Site A Toe End	532.4
Site B Perpendicular Start	554.8
Site B Perpendicular End	555.5
Site B Top Start	566.2
Site B Top End	566.7

Table 1. ER line elevations.

ER Results

Prior to collecting ER data, it is important to determine whether there is adequate contact between the electrodes and the soil materials. To do this, contact resistance tests were performed along each line. Current was introduced at one electrode and directly measured at an adjacent electrode to ensure both were connected to the subsurface and to quantify connections. The process was repeated on every electrode pair along each line. Generally, contact resistance values below 300 ohms are often found in Iowa and represent good electrical connection with the ground. At the levee sites, good soil contact was found along the low-lying farmland but the degree of soil contact decreased considerably on top of the levee (e.g., soil resistance to an electrical current increased). Contact resistance values above 2,000 ohms can mean the sediment is not ideal for ER data collection. Figure 17 shows results from a contact resistance test performed along ER line Site A (perpendicular to levee). Note the low values on the left (along the low farm field), the high values in the middle (levee), and low values on the right (along the low floodplain). The high values in the middle of the levee indicate that the electrodes are not making good electrical contact with the soils.

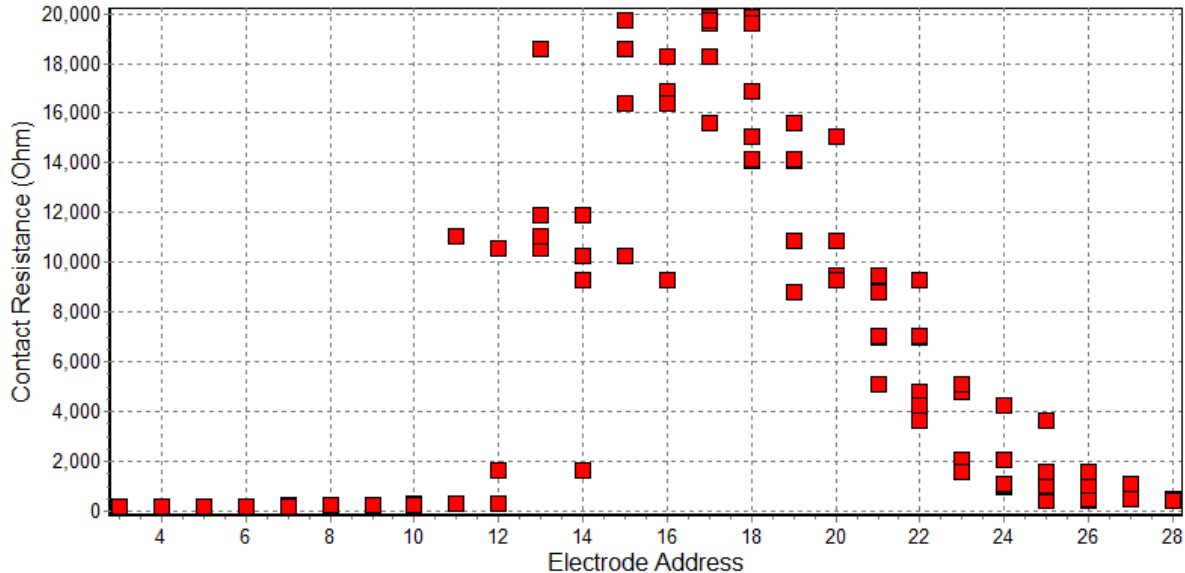


Figure 17. Contact resistance results from the ER line Site A Perpendicular. Note the low values on the left (along the low farm field), the high values in the middle (levee), and low values on the right (along the low floodplain).

Coarse, poorly sorted surficial sand was observed at nearly all of these problematic areas (Figure 18). Loose, dry sand at these locations made electrical connection with the electrodes very difficult, with some electrode stakes only loosely coupled to the ground surface. Since the ER surveys were specifically conducted at levee areas flagged as being anomalously resistive by the EM survey, it is possible that the ER survey results were confirming the EM results suggesting that these particular levee sections are anomalous.



Figure 18. Left: An electrode stake installed in the coarse sand found along Site B Top. Right: A close-up photo with a finger for scale showing the coarse sand and gravel along Site B Top.

ER results (Figures 19-23) show how the subsurface beneath each line responds to electrical charge. The appendix also shows unmarked, high resolution ER images. It is important to note that many variables influence resistivity distribution in the figures, with the most prominent being subsurface material and moisture. Resistivity results have been shown to be well correlated to geologic material, with coarse, dry sand and gravel showing high resistance to electrical charge (reds) and wet clay or fine-grained sediments showing low resistance (blues). Subsurface saturation, including the water table, can be significantly less resistive. Therefore, we would expect to see conductive (blue) responses beneath the baseline land surface and resistive (red) responses within the dry levee. Of course, this dynamic can change depending on flood stage and the presence of surface water inundation. At the time of the investigation, rivers water levels were low and soils were dry, even for the fall season.

While showing expected geologic or hydrogeologic changes in the vertical component is helpful, the real benefit to ER is highlighting relative differences in areas where they would not be expected. For example, if resistivity values in a levee are consistently stable but one area shows anomalously high or low values in a small area, it would be wise to investigate what those anomalous values represent. Anomalies found in the ER data are presented and described in detail below. It is important to note that geophysical results are only interpretations until confirmed by borehole investigation. Borehole drilling was not included in this effort, due to concerns regarding permitting and levee integrity.

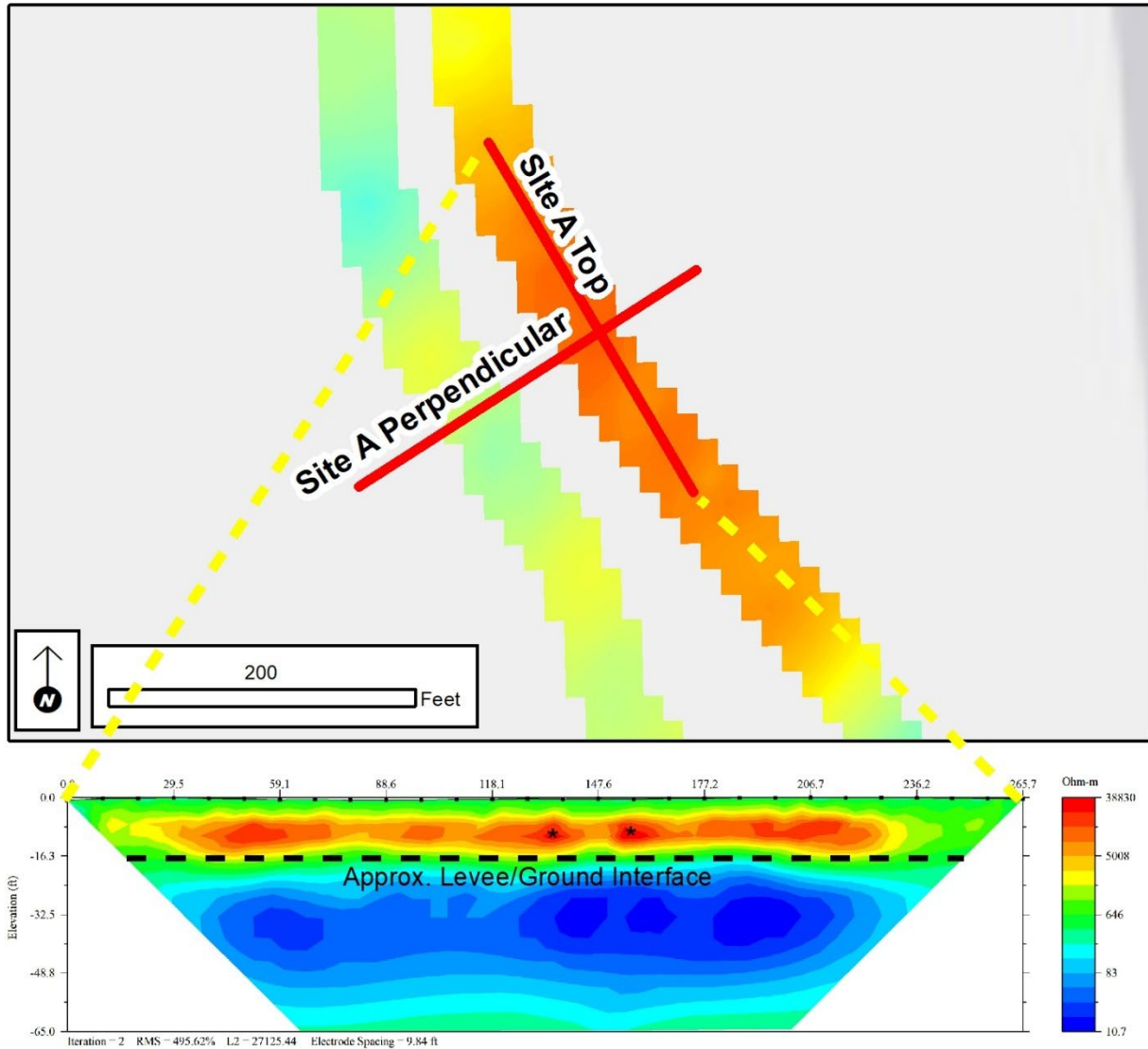


Figure 19. Site A Top ER results.

Site A Top ER results show very high resistivity values (max resistivity of $\sim 40,000$ ohm-m), indicative of high contact resistance and dry sediments (Figure 19). This location was chosen due to the presence of a small, resistive feature observed in the EM data along the top of the levee. Overall, the ER results matched what was shown in the EM data. Unlike other ER locations, this site was mainly vegetated along the levee surface with no deep sand present. Two minor, high-resistivity zones were observed in the ER results (asterisks in Figure 19) that may correlate to the EM results, however, these zones do not appear to be significant in the ER results. A clear levee/ground interface can be interpreted between the yellow and green colors, with the blues below possibly correlating to the presence of the shallow water table. Although best-fit indicators like RMS and L2 values were high, results look consistent in this line. Consistent resistivity values exist within the upper levee sediments and the lower alluvial sediments.

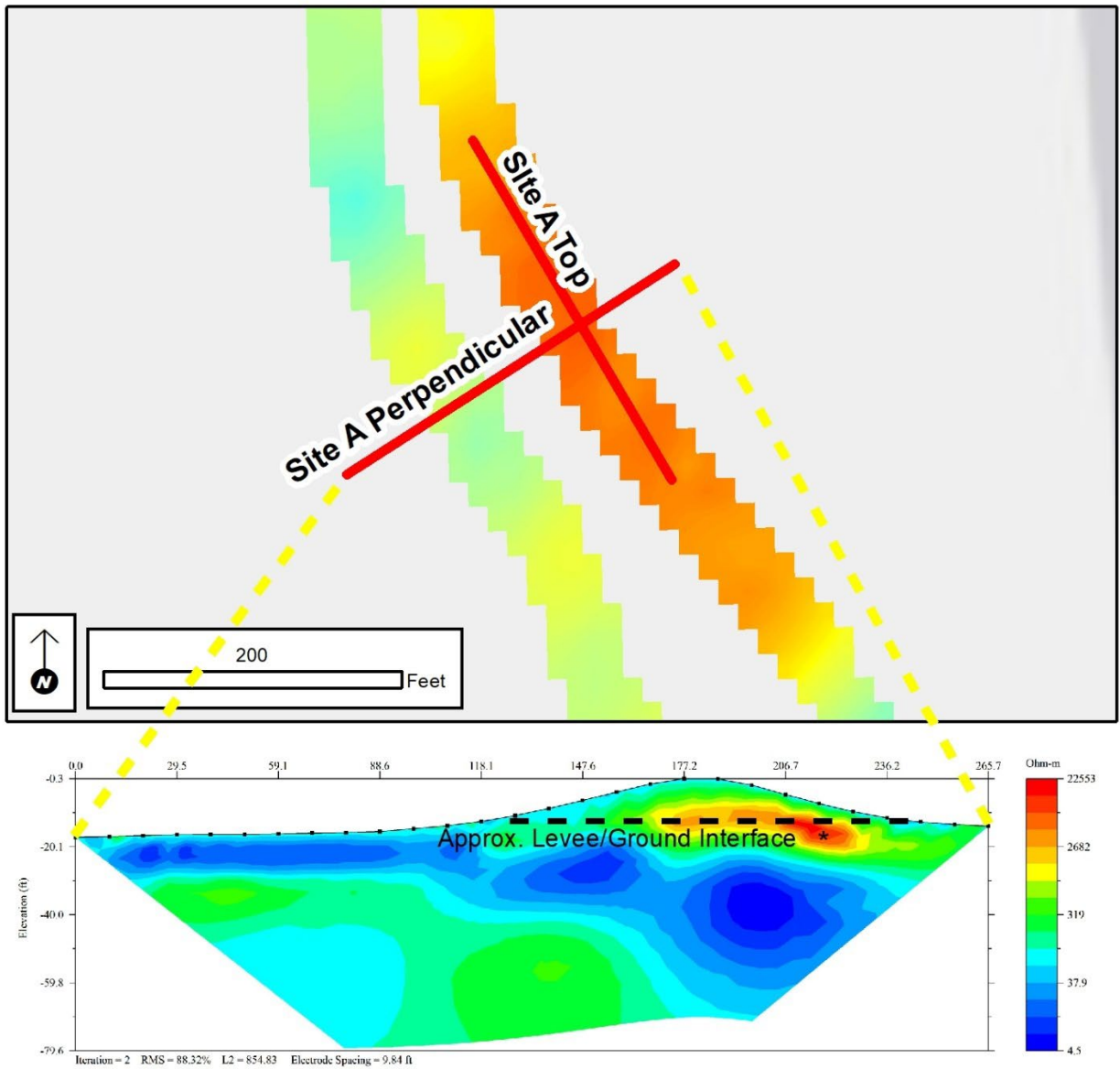


Figure 20. Site A Perpendicular ER results.

Site A Perpendicular ER results show very high resistivity values (max resistivity of ~20,000 ohm-m), indicative of high contact resistance and dry sediments (Figure 20). This location was chosen due to the presence of a small, resistive feature observed in the EM data along the top of the levee. Overall, the ER results matched what was shown in the EM data. Unlike other ER locations, this site was mainly vegetated along the levee surface with no deep sand present. One minor, high-resistivity zone was observed in the ER results (asterisk above), however, this zone does not appear to penetrate the width of the levee. A moderately clear levee/ground interface can be interpreted between the yellow and green colors, with the blues below possibly correlating to the presence of the shallow water table. Although best-fit indicators like RMS and L2 values were high, results look moderately consistent in this line. Consistent resistivity values exist within the upper levee sediments and the lower alluvial sediments.

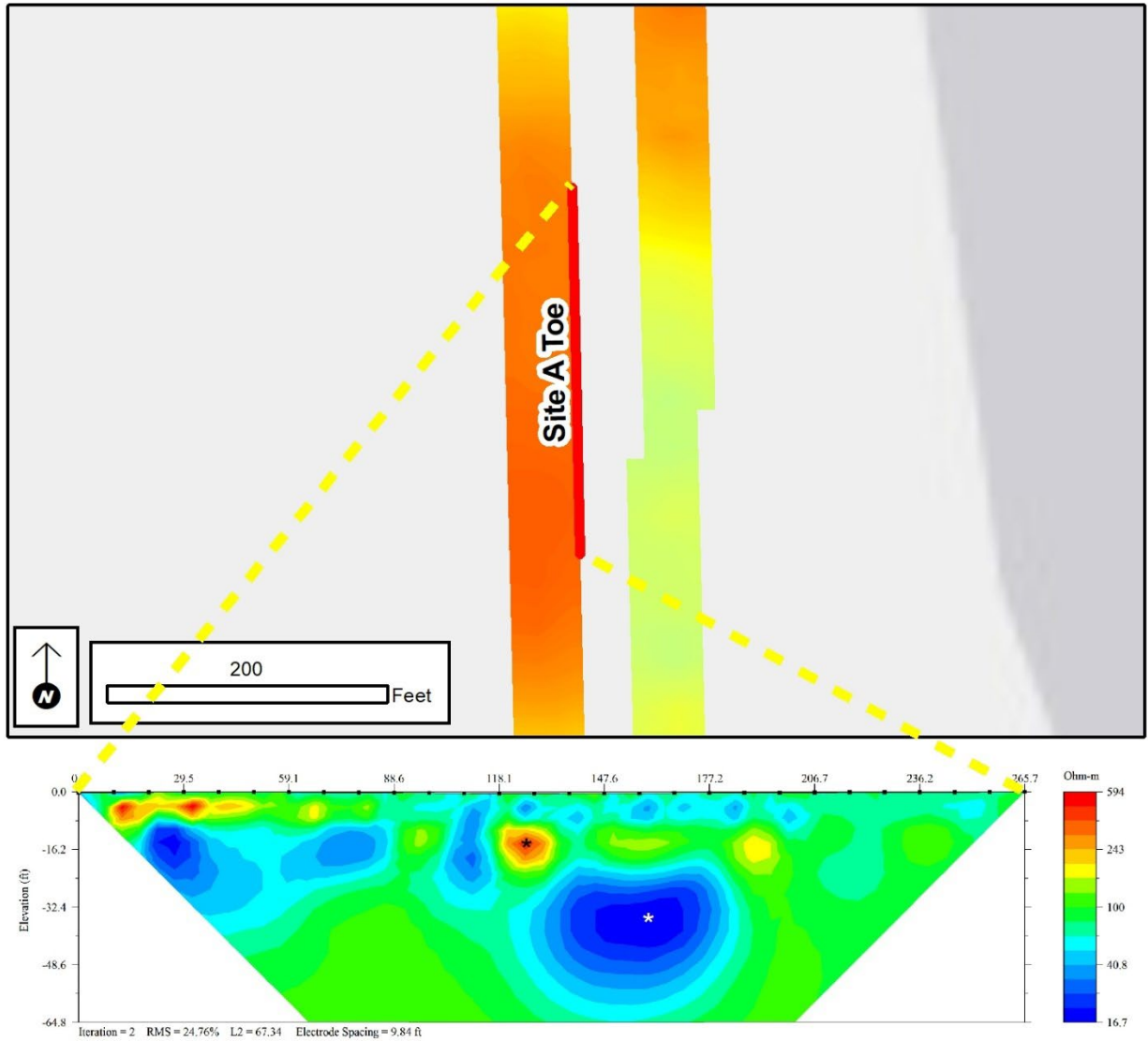


Figure 21. Site A Toe ER results.

Site A Toe ER results show somewhat low resistivity values (max resistivity of ~600 ohm-m), however, the contact resistance experienced at this location was the highest experienced at Site A (Figure 21). This location was chosen due to the presence of a long resistive feature observed in the EM data along the toe slope of the levee. Unfortunately, due to the high contact resistance, results show a significant amount of noise, as indicated by strong conductive and resistive signatures in close proximity (asterisks above).

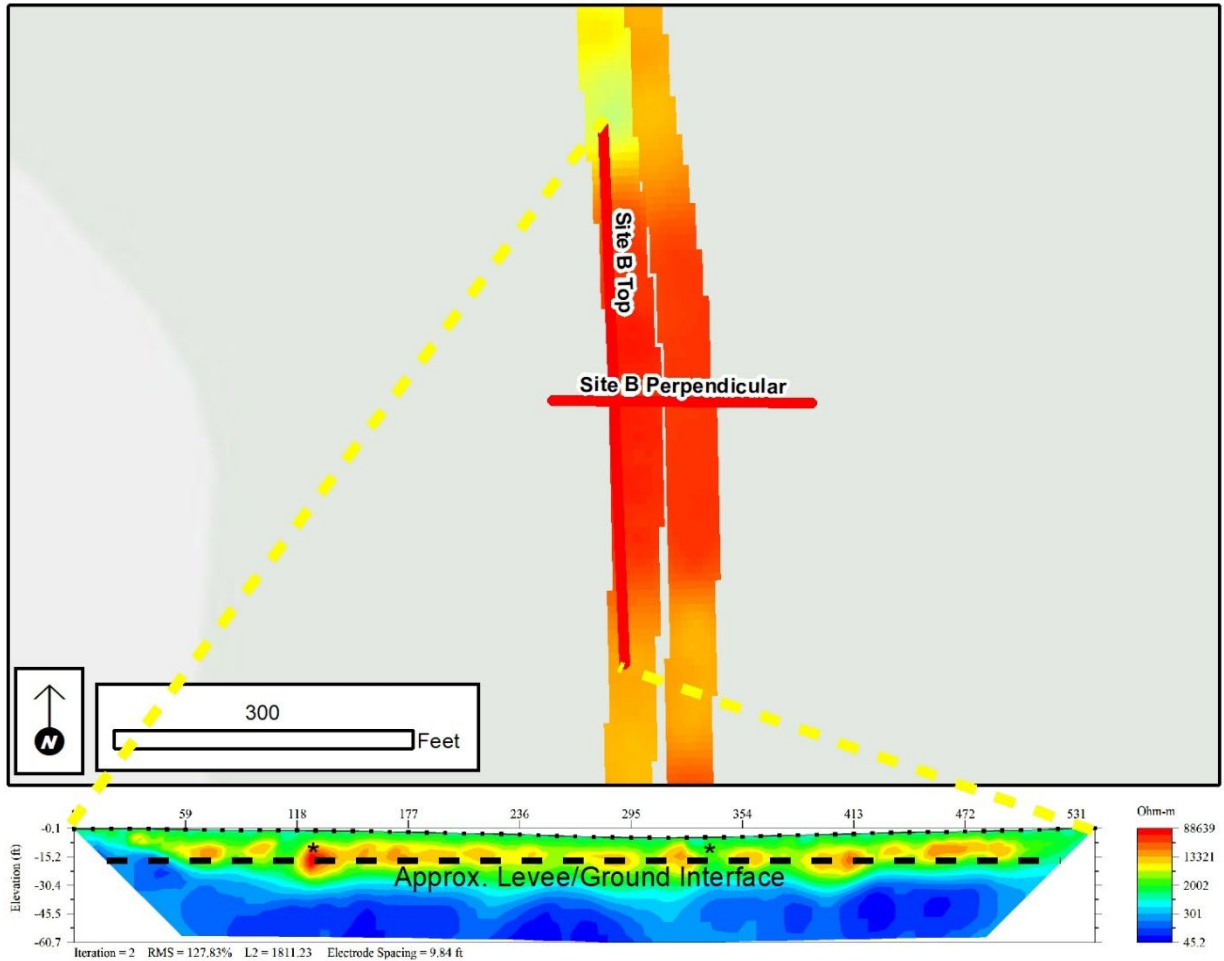


Figure 22. Site B Top ER results.

Site B Top ER results show extremely high resistivity values (max resistivity of ~90,000 ohm-m), indicative of high contact resistance and dry, coarse sediments (Figure 22). This line was twice the length of the others, with the intent of capturing a longer dataset. This location was chosen due to the presence of a long, resistive feature observed in the EM data along the top of the levee. Overall, the ER results matched what was shown in the EM data. This location had the most coarse, loose sand and gravel at the surface. One minor, high-resistivity zone and one minor, low-resistivity zone were observed in the ER results (asterisks above), however, these zones do not appear to be significant in the ER results. A levee/ground interface was expected to be observed higher in elevation, possibly indicating the presence of coarse alluvium beneath this stretch. Although best-fit indicators like RMS and L2 values were high, results look consistent in this line. Consistent resistivity values exist within the upper levee sediments and the lower alluvial sediments.

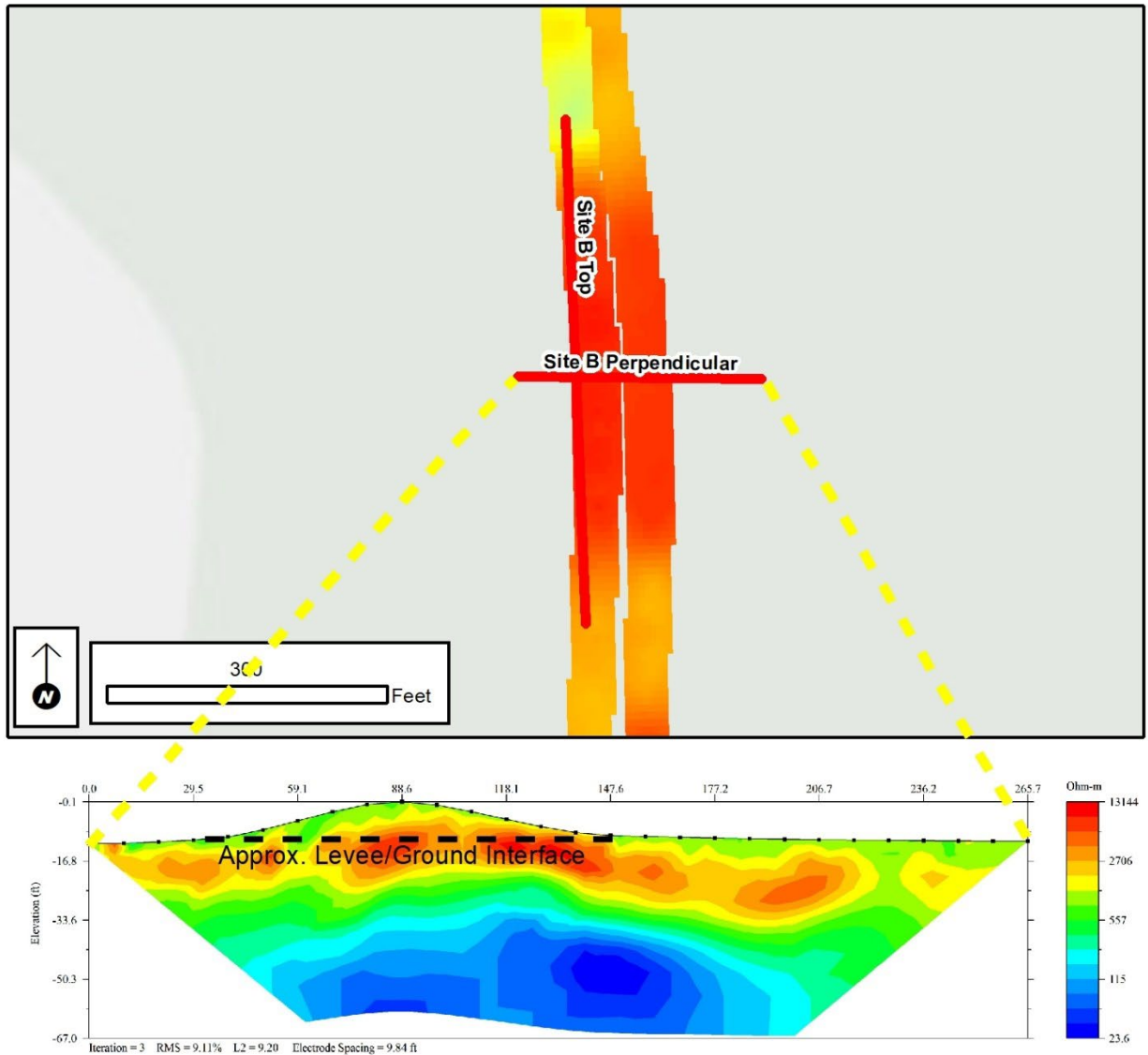


Figure 23. Site B Perpendicular ER results.

Site B Perpendicular ER results show high resistivity values (max resistivity of ~15,000 ohm-m), indicative of high contact resistance and dry, coarse sediments (Figure 23). This location was chosen due to the presence of a long, resistive feature observed in the EM data along the top of the levee. Overall, the ER results matched what was shown in the EM data. This location had the most coarse, loose sand at the levee's top surface. A levee/ground interface was expected to be observed higher in elevation, possibly indicating the presence of coarse alluvium beneath this stretch. High resistivity values were observed on either side of the levee, again, pointing to the possibility of coarse alluvial material adjacent to this stretch. Best-fit indicators like RMS and L2 values were reasonably low and results look consistent in this line.

Discussion and Conclusion

This report summarizes geophysical evaluation services provided by the IGS for HSEMD. A pilot investigation was completed, utilizing geophysical technology to image the subsurface of existing levees to identify potential anomalies. Two representative levee systems were chosen by HSEMD for the pilot investigation and approximately 12 miles of linear levee miles were analyzed. Results from EM and ER geophysical surveys showed promising potential to identify relative changes in levee composition with an efficient method of collecting data. The EM ATV survey proved to be especially helpful in highlighting subsurface changes within the upper 20 feet of the ground surface. Collecting EM data was quicker than anticipated and provided helpful information to guide 1) levee composition mapping via top of levee collection and 2) alluvial sediment characterization beneath the levee via levee toe-slope collection. Both methods allow an efficient, cost-effective means of imaging levee systems to identify potentially anomalous areas on top of the levee and along the levee toe-slopes.

For future efforts, collecting levee toe-slope data on both sides of the levee, instead of just one, may help image the interconnectedness of alluvial sediments across the levee. Overall, ER surveys were more labor-intensive than the EM surveys but provided helpful cross-section views further characterizing small areas. The relatively deep, dry sand observed at a few of the sites contributed to less-than-ideal ER data quality. In the future, ER investigations should be considered on a site-specific basis and only completed in areas where better electrical connection with the ground can be achieved (more conductive sediments). For improved interpretability of the EM surveys, it would be beneficial to have access to levee construction and repair information. It was evident that some anomalous areas identified by the geophysics were correlated with the presence of coarse surficial sand of unknown origin.

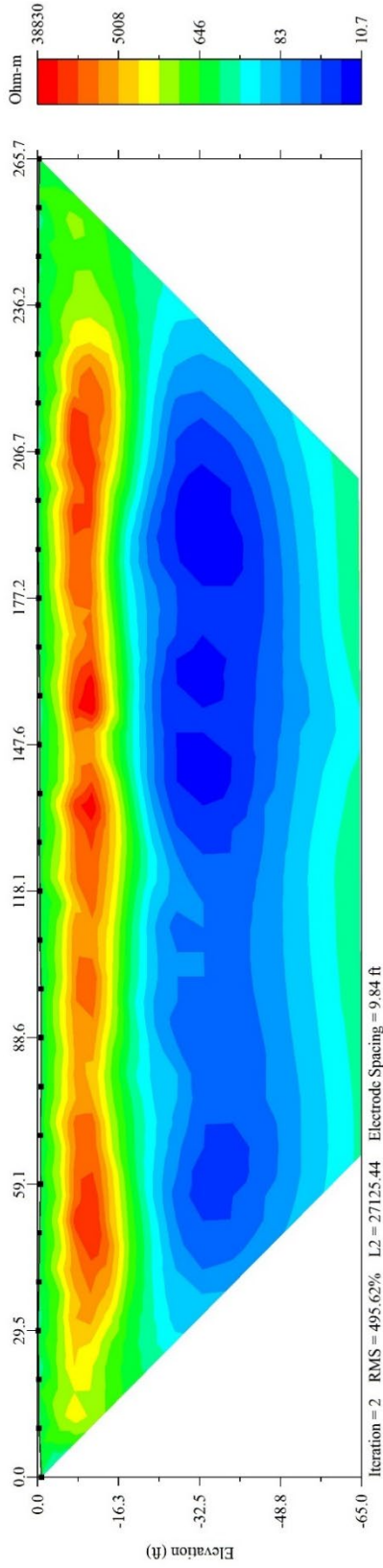
Based on time needed to a) mobilize and conduct the field work and b) process and analyze the geophysical data for this pilot investigation, we estimate that other levee surveys could be conducted at a rate of approximately \$1,000 to \$2,000 per linear levee mile. The higher rate would be associated with factors such as higher mobilization costs, limited accessibility or requests for additional ER work. Overall, an easy rule-of-thumb estimate for regional planning would be approximately \$1,000 per linear levee mile. The estimate includes EM and ER data collection, processing, interpretation, and reporting as done for this pilot study. It is important to recognize that unit costs would decrease significantly with additional levee miles as mobilization and field work costs decrease with a larger scale.

For future surveys, it is recommended that ground-truthing the geophysical results be considered through borehole drilling, if possible. This would be an additional expense and perhaps could be completed by levee systems after the geophysical surveying is done. Without drilling or other subsurface sampling, there is no ability to accurately determine the cause of the geophysical anomaly. From the geophysical surveys alone, potentially problematic levee areas can be flagged as being anomalous. It will then be incumbent of levee systems to monitor these areas for signs of potential weakness or trouble.

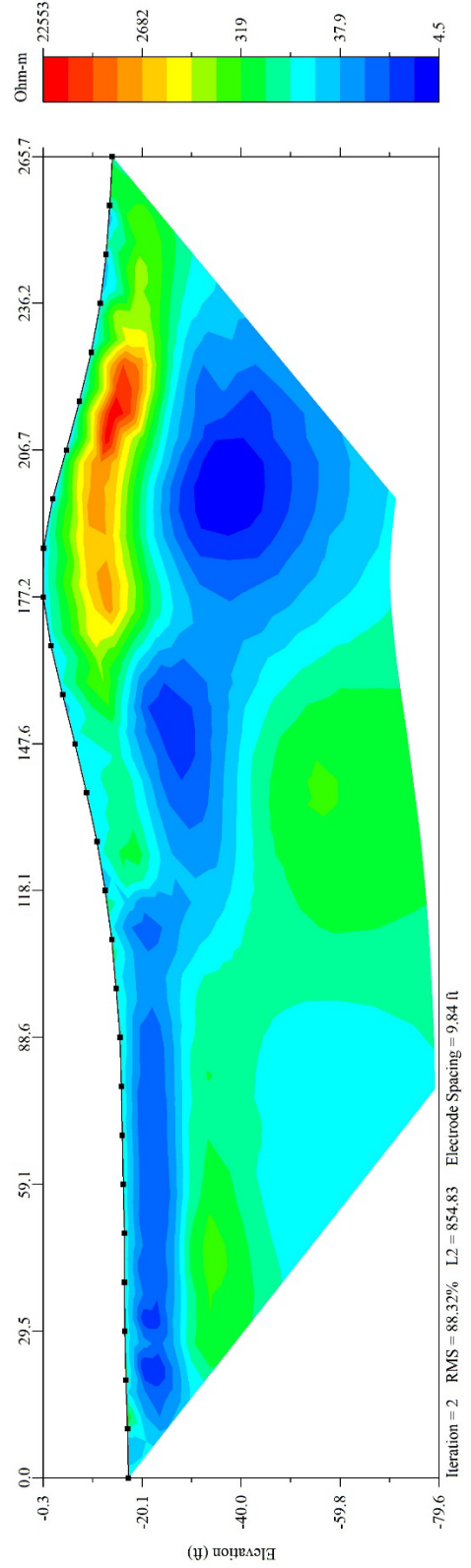
With methods established as part of this pilot investigation, the IGS is currently equipped to image up to approximately 200 levee miles per year. This effort could be increased with the addition of field staff and/or the rental of additional equipment.

APPENDIX – ER Results

Site A Top



Site A Perpendicular



Site A Toe

