

02

Challenges Encountered

Large-Scale Levee Setback Playbook

In March 2019, abnormal weather patterns in Nebraska, Iowa, and South Dakota caused record-setting flooding along the Missouri River, resulting in widespread catastrophic damage throughout the river valley. The Large-Scale Levee Setback Playbook (Playbook) documents how, after this historic flood, a multi-agency team worked together to complete a highly complex \$100M levee setback after floodwaters destroyed most of the left bank of Missouri River Levee Unit 536 (L-536) in northwestern Missouri. The Playbook also serves as a guide for others pursuing similar nature-based solutions that enhance flood resilience. It is organized in four distinct but complementary sections.

SECTION 1: The Story

tells the story of the historic flooding in 2019 and provides an overview of the scope and benefits of the setback, the partners involved, and project milestones.

SECTION 2: The Challenges

dives deeper into the L-536 setback project, identifying the challenges—big and small—that project partners encountered and overcame through collaborative problem solving.

SECTION 3: The Recommendations

provides recommendations from the lessons learned during the L-536 setback regarding legislation, regulation, policies, and practices that can better support levee setback projects.

SECTION 4: The How-To Guide

illustrates a process for levee sponsors considering or pursuing a similar project, as well as identifying helpful pre-disaster planning efforts.

The development of the Playbook was supported by The Nature Conservancy with experience-based contributions from project partners involved in the L-536 setback project, a nature-based solution to reduce flood risk to the community by reconnecting more than 1000 acres to the riverward floodplain and restoring more than 400 acres of wetlands.

Key Takeaways of Section 2

- The leadership and dedication of ACLD board members to the levee setback rehabilitation alternative was essential to the project success.
- L-536 project partners demonstrated the power of multi-agency collaboration, working together to overcome a variety of challenges in pursuit of a shared vision. The trust established, adaptability, and problem-solving skills of project partners proved to be keys to success from the project start through construction.
- Real estate requirements, and associated funding needs, were the most complex and time-intensive components of the project.
- USACE utilized a flexible construction contract that ensured flood protection would be restored, regardless of whether real estate could be secured for the setback footprint. The base contract was awarded for in-line repairs to the existing levee (both beyond and within the planned setback), with an option to construct the setback if real estate was secured.

Pursuing the Levee Setback Alternative

Levee District Leadership

The leadership and dedication of the ACLD Board was essential to the project's success. They understood that the levee setback protected the immediate and long-term needs of their community. ACLD's persistent pursuit of the levee setback alternative to restore pre-disaster levels of flood protection, as well as enhance flood resilience set the stage for unprecedented partnership among agencies with similar goals.

A federal levee categorized as “active” in the Rehabilitation and Inspection Program (RIP) is eligible for assistance in repairing damage caused by a flood event. Repairs are limited to restoration to pre-flood levels of protection.

Extended Highwater Conditions

Floodwaters were slow to recede throughout the Missouri River Valley, persisting until December 2019. These extended highwater conditions prevented USACE from fully accessing L-536 for damage assessment. Therefore, USACE was unable to conduct a traditional on-site damage assessment for the Project Information Report (PIR). Instead, USACE staff used videos, photos, and pre-flood GIS mapping to develop the initial damage assessment. The PIR for L-536 indicated extensive and widespread damage. It wasn't until floodwaters had fully receded at the end of 2019 that detailed damage assessments and levee repair designs could be developed.

Least Cost, Technically Feasible Alternative

The L-536 setback was able to be constructed under authority of the PL 84-99 program because the setback was the least-cost, technically feasible alternative for repairs. Had repairs in-place been determined to be the least cost, technically feasible alternative, ACLD would have been required to provide the differential in costs between the in-line repairs and the levee setback.

L-550 was also significantly damaged during the flood event, and USACE initiated in-line repairs at the major breaches as floodwaters were still receding. These breach closures precluded the opportunity to consider a levee setback for L-550 because USACE was already investing millions of dollars for the levee repairs.

Costs for all previous work on the levee, including PL 84-99 rehabilitation from prior floods and damages, are considered sunk costs, and are not used in the economic analysis and justification for determining the least cost, technically feasible alternative after new flood damage. Repetitive loss and future flood damages are generally not considered during the economic evaluation.

“The problem in this type of situation is that, for all agencies, this isn’t what we do everyday. There’s really no playbook you can pull out and say when this levee is breached, you call these agencies, and they take these steps. On a project of this scale, you have to figure it out as you go along—that’s a lot more difficult than it sounds.”

– **Jim McGuire, Missouri Department of Conservation**

Extended Timeline

Due to the extent of damage and scale of proposed repairs, USACE and ACLD decided to wait an extra year to conduct repairs: planning was to be completed in 2019, construction was to be completed in 2020, and the setback levee was to be ready by March 2021. This left the area without flood protection for a full season, but project partners, including adjacent landowners, were committed to the holistic approach of the levee setback alternative.

Inter-Agency Communication and Collaboration

Each partner agency played a different role in the levee setback project, looking at the solutions through their own respective lenses, authorities, and goals. In addition, not all partners fully understood the role other partners played and if, how, or when processes were intertwined. TNC was able to guide weekly meetings, develop a timeline template, and facilitate regular communication and collaboration among the partners, thereby keeping the highly complex multi-agency project moving forward. Upon completion of the setback, project partners documented their efforts and developed a baseline project management plan for others to use for a similar effort (see Playbook Section 4).

Voluntary Landowner Participation

ACLD board members were committed to seeing the project through. They worked tirelessly to keep landowners informed and engaged in the project. This relationship development contributed to the landowners entering voluntary conservation easements and shouldering financial risk, due to the timing issues and delayed compensation (discussed in the following Real Estate Requirement section), while the team worked to make the setback a reality. The landowner's trust of the project partners and understanding of the real estate process was critical to the project's success.

“The importance of communication and willingness of partners to collaborate cannot be overstated for this project. We had a group of partners that were committed to the goal of setting back this levee. Each person looked for ways to decrease barriers within their own organizations, and we refused to let any challenge prevent us from reaching our goal.”

- Jennifer Hoggatt, Missouri Department of Natural Resources

Real Estate Requirements

Real estate was a complex and important component of the levee setback project. USACE only needed the real estate for the setback levee footprint to begin construction. However, community support for the setback necessitated a plan for purchasing the land that would become riverward of the setback levee. Through extremely close coordination between project partners, real estate for the setback levee footprint was purchased prior to the riverward land. Purchase options signed by all landowners to sell their land was the trigger for ACLD providing real estate easements to USACE for the required certification of the new levee footprint. This allowed USACE to begin the setback construction by the August 1, 2020, deadline. Even though landowners wouldn't be compensated for their riverward lands until late 2021, all parties moved forward together.

Fair Market Value of Lands

Most agencies and all non-governmental organizations are bound by appraisal standards that value land "as is." In the case of lands adversely impacted by repetitive losses due to flooding, the "as is" value is often considered "recreational value" or "wasteland value" instead of pre-flood "agricultural value." NRCS, however, is able to assess its easement value based on pre-flood agricultural values. As a result, NRCS EWPP-FPE provided the landowners the greatest compensation for their lands.

Understanding Land Ownership Relative to Original Levee Alignment

Levee sponsors hold the levee easements placed on the property. However, documents from the 1950s were unclear if the land was purchased as part of the payment for the easement. Deeds and title searches may shed light on ownership. Regardless, having a title company confirm ownership of the old footprint will be important in finalizing the real estate of a levee setback.

Early Landowner Outreach

The L-536 levee sponsors hired a consultant with a real estate background before floodwater receded who provided ACLD with landowner outreach efforts as well as investigated various funding programs. Early and frequent landowner outreach is critical to success.

Timing Issues and Delayed Compensation

In a typical real estate deal, the seller and buyer agree on the acres to be purchased, as well as the purchase price at the beginning of the agreement, memorializing the details in a legal document. Between the time the legal document is signed until the time the real estate deal is closed, due diligence is conducted. Examples of due diligence include surveys to determine accurate legal descriptions and total acres, title searches to confirm ownership and determine clear title with no liens or encumbrances on the property, and appraisals to determine fair market value of the property. When all the due diligence is completed as spelled out in the legal document, both parties can move to close the deal, transferring ownership in exchange for payment.

Real Estate Bought and Sold

Footprint of the New Levee

Required by USACE, procurement is the responsibility of the levee sponsor.

Footprint of the Old Levee

The ribbon of land under the old levee restored to floodplain. While not required to be purchased, management and use of the land by the owner is limited due to its narrow shape. Because of its limited use and shape, it was valued as “wasteland.” As a result, in the case of L-536, all landowners chose to sell their interest to TNC.

New Riverward Land

Land between the new levee and the river. The owners can choose to keep the land or sell it. In the case of L-536, all the landowners elected to sell not only an easement to NRCS but also the residual interest to TNC. This sale was driven by the goals of the landowners, but is not a requirement for a setback.

New Landward Land

Land now protected by the new levee. Purchasing an interest in this land is not critical to establishing a levee setback. In the case of L-536, four of the five landowners elected to sell an NRCS easement on their land. The fifth chose to continue to farm their land.

NRCS Mitigation Acres via NRCS Easement Administrative Action

Construction impacts to existing NRCS WRP land required the levee district to mitigate for those impacts by providing acres through a complex process called an Easement Administrative Action (EAA). This type of real estate may or may not exist at other sites considering setback alternatives.

In the case of L-536, there were two buyers: NRCS for the conservation easement and TNC for the residual interest. The residual interest cannot be purchased until after the easement is placed because residuals are, by definition, the remaining interest on the land post-easement. As a result, TNC could not buy the residual interest before NRCS closed on its easements. In addition, some of the landowners desired to use the Internal Revenue Service's 1031-Exchange, as a means of deferring capital gains taxes, which required all real estate closings to occur near the same time.

NRCS has a detailed easement acquisition process that takes 12 to 18 months. The process begins when a landowner applies for this voluntary program. Due diligence is then done by the NRCS. Not all landowners who apply for the program receive an offer to purchase an easement from NRCS, nor is the landowner obligated to accept the NRCS offer even though they voluntarily applied. As a result, until the offer is made and accepted and the deal is closed, it's uncertain that the easement will be placed. If a landowner chooses to sell their property without an NRCS easement, it could significantly reduce the amount of time between event and sale, but it is unlikely landowners would receive pre-flooding agricultural land values.

Delayed Appraisals and Land Values

Land value appraisals have a shelf-life between three months to one year prior to the scheduled real estate closing, meaning the estimated fair market value is relevant for only that time. As a result, the real estate closing process needs to factor in when an appraisal should be ordered and when it should be completed. For L-536, obtaining appraisals to determine land values was impossible due to high water and the long time frame until closing. TNC instead contracted an appraiser to conduct a comparative market analysis to give a baseline range of values. Landowners had to agree to a level of uncertainty and estimated value as placeholders while signing the agreement to sell. This uncertainty was lessened by including language in the documents that allowed insertion of the appraised value of the property in the final contract as well as pre-defined out clauses for the landowners should either party not agree on the final sale price.

There are a variety of logistical considerations related to riverward real estate acquisition, including but not limited to:

- the amount of time a landowner has to wait from the loss caused by the flood event to the time they are able to sell the interest in their land
- landowners having to agree to sell prior to knowing the final number of acres to be sold, the final configuration of acres to be sold, or the final sales prices
- the upfront cost of due diligence and uncertain or delayed reimbursement

From the acquiring entities' perspective, due diligence has to be closely coordinated and planned in advance.

The Corning Conservation Area

The Corning Conservation Area is an 1,880-acre mitigation project, designed to enhance fish and wildlife habitat along the Missouri River. The area is (1) owned in fee title by USACE- Kansas City District under the MRRP, (2) has an NRCS WRP easement on part of the property, and (3) has day-to-day management activities conducted by MDC under a land management partnership agreement. This area is managed for a variety of game and non-game species of fish and wildlife. All three agencies need to ensure close coordination when a construction or management action is being proposed.



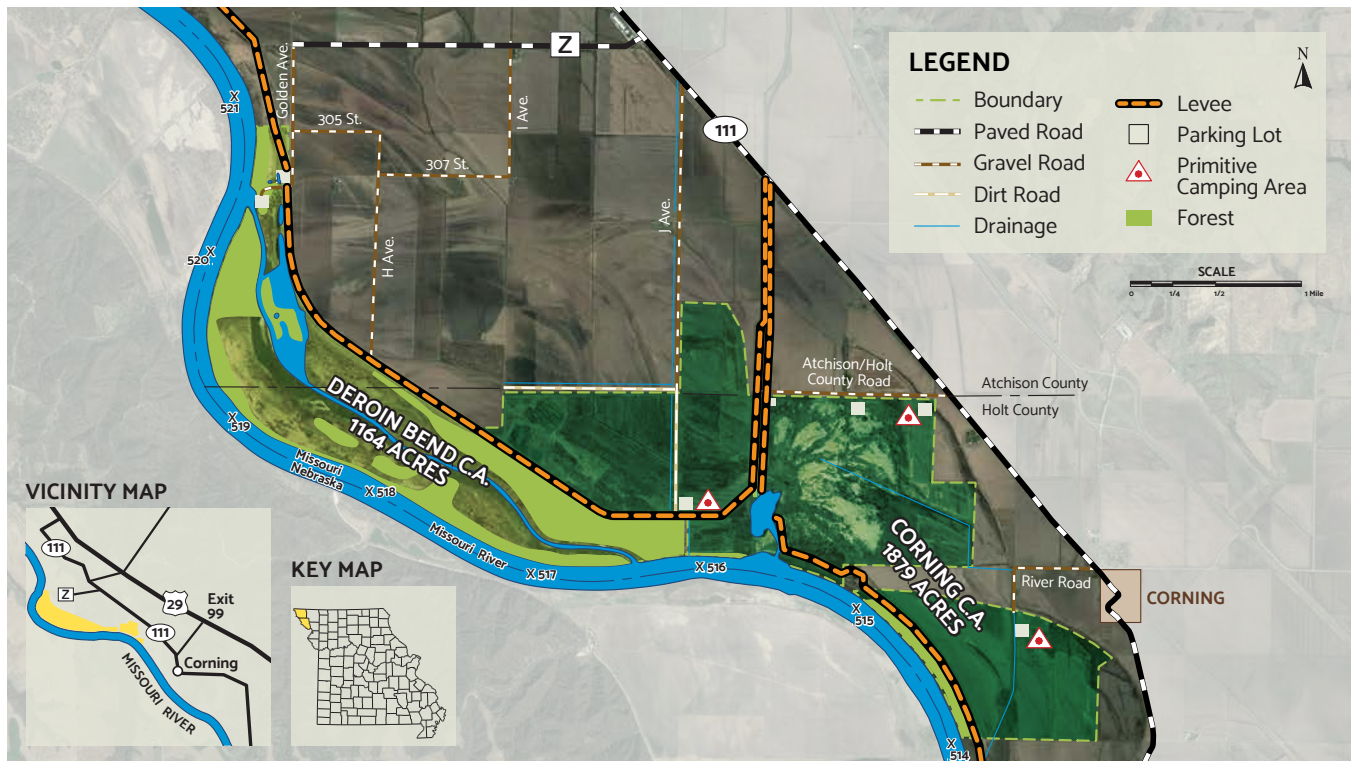


Figure 6: Deroin Bend and Corning Conservation Areas map before levee setback.

Riverward Lands Ownership and Management

Riverward lands are lands between a levee and the river. They are considered unprotected and should likely be used as recreational land. Determining who will own and manage the riverward lands is a factor to consider.

Landowners involved in the L-536 setback did not wish to keep their riverward lands. TNC purchased these lands and will own them for several years, with the intention to eventually transfer ownership to MDC. During TNC's ownership, MDC will manage the land as an extension of their Deroin Bend Conservation Area and will continue to do so upon transfer.

Riverward Land Access

The setback levee cuts off access to the riverward lands but access must be provided to all landowners and included in the levee design and all legal descriptions. Ideally, the access points should utilize existing public rights-of-way. For L-536, access points were negotiated between the levee sponsor (tasked with maintaining the levee), the county road commissioners (tasked with maintaining the roads and rights-of-way), TNC and MDC (as the riverward landowners requiring access), NRCS (as the holder of the mitigation acres), and USACE (as the builder of the access ramps).

NRCS Mitigation Acres via Easement Administrative Action (EAA)

Construction impacts to the existing NRCS WRP easement required mitigation and a headquarters-level Easement Administrative Action (EAA) to allow design and construction of the proposed levee setback alignment on the Corning Conservation Area. This is a requirement of NRCS and is the levee sponsor's responsibility. Typically, the mitigation acres must be at least a 1:1 ratio of acres impacted in both ecological quality as well as financial fair market value. In the case of L-536, 53 acres were impacted and 53 "equivalent" acres had to be acquired and placed into an NRCS easement to compensate. The 53 acres to be mitigated are a combination of the old levee footprint together with acreage on the landward side that one of the landowners was willing to sell. This requirement had to be met even though 640 acres of better functioning wetlands and floodplains were gained when 53 acres were lost. Providing mitigation acres required four additional appraisals and four review appraisals, adding to the time delays and complexity of the real estate process. The Missouri NRCS, ACLD, TNC, and USACE worked with the national NRCS headquarters to process the EAA. An emergency clause of the regional NRCS-USACE MOU was enacted to allow work to proceed with the setback alignment on WRP easement before the EAA was completed.

Real Estate Process Inefficiencies

Each agency has its own processes for surveying, appraisal, title work, environmental inspections, permitting, and other due diligence. Some of these processes, like title work and surveying, can be streamlined through coordination and information sharing. Land surveys were conducted by three agencies: USACE, NRCS, and TNC. USACE conducted a metes and bounds survey for the footprint of the setback levee and an elevation survey during construction, checking the dimensions of the levee. NRCS and TNC conducted metes and bounds surveys, checking the legal boundaries of each parcel. Land surveying efforts could be coordinated, with completed surveys shared for use by all project partners. A refined survey of the legal boundaries would still need to be conducted to calculate actual final acres to be purchased, but the original legal boundaries would have been identified, lessening the work for later.

Funding

Under PL 84-99, it is the levee sponsor's responsibility to provide all real estate required for construction, which includes the levee footprint and borrow source, (the material to construct the new levee).

Though not required by PL 84-99, ACLD and project partners were committed to compensating the landowners who no longer wished to own riverward land that would not be protected by the new levee. This left ACLD responsible for securing 138 acres for the new levee footprint and more than 400 acres for the riverward lands, at a cost of \$3.5M. This posed one of the biggest project challenges because not only was the real estate cost well beyond the financial means of ACLD, the levee setback alternative could not be constructed without the necessary real estate.

Real estate funding was ultimately provided through a combination of NRCS EWPP-FPE, state funds from SEMA, MDC, and TNC:

- Landowners agreed to participate in the voluntary NRCS conservation easement program and have a permanent conservation easement placed on their properties.
- TNC offered to purchase residual (recreational) interest on their riverward lands.
- NRCS, USACE, and MDC restored the riverward lands as a floodplain and conservation area.
- MDC will manage the riverward lands through an agreement with TNC with the intention that ownership will be transferred to MDC.

Lack of Funding Resources

Missouri River Recovery Program

The MRRP is a program that has previously helped with land acquisition in support of a large-scale levee setback, L-575 along the Missouri River. But the MRRP has not had funding approved for land acquisition due to limited appropriations since 2011.

U.S. Economic Development Administration Federal Disaster Recovery

After the March 2019 flood event, the U.S. Economic Development Administration (EDA) provided federal disaster recovery funding to make flood control infrastructure improvements to protect businesses and make areas more resilient to future natural disasters. NWMORCOG quickly reached out to EDA because they had money to help with disaster relief and there was critical infrastructure in the L-536 project area, such as Interstate 29, highway bridges, and railroads.

Project partners initially thought this funding could be used to purchase riverward real estate. Unfortunately, due to the complexity and timing of the setback process, the application preparation took longer than anticipated and EDA's special disaster funding was not available by the time the application was submitted. The smaller pot of EDA's regular funding was not awarded for the project. The grant application was not competitive due to the job creation award criteria. To take advantage of the less restrictive disaster funding, that did not include job creation and retention requirements, project partners would have needed to secure their real estate strategy earlier.

Community Development Block Grant

The U.S. Department of Housing and Urban Development (HUD) allocates Community Development Block Grant (CDBG) funding to states, which establish their own priorities and evaluation criteria. Project partners initially considered pursuing CDBG funding, but recognized the limited chance of award because the state adjusted its CDBG priorities, deprioritizing flood recovery projects due to the amount of disaster recovery funding being made available by other agencies.

CDBG funding was reconsidered during the team's initial EDA funding pursuit, as CDBG funds are a great source for match dollars. However, this funding source would have been limited to the intended use of the EDA dollars, which had been identified initially for the levee footprint real estate, not the riverward land. CDBG funding was ultimately not used because the new levee footprint had yet to be determined and project partners could not apply for funding with an unknown footprint.

Funding Gaps

Not many funding programs are set up to support levee setbacks, leaving levee sponsors to find their own solution to fill the funding gap. Figure 7 shows the funding breakdown for the L-536 setback project.

Funding Sources

Total Levee Construction Cost: ~\$103.5M

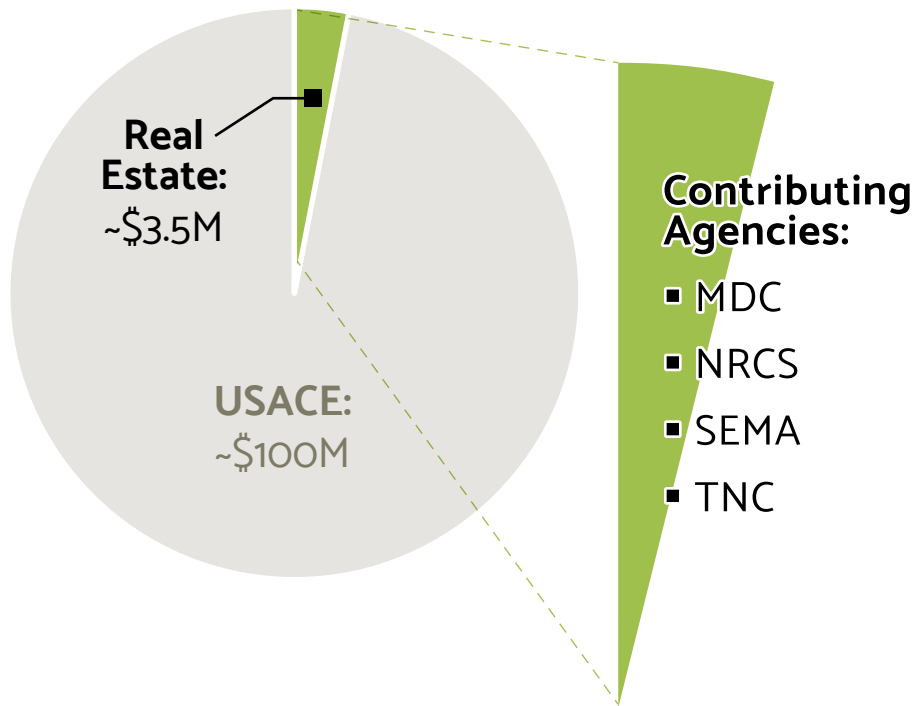


Figure 7.

Filling the Funding Gap on L-536

NRCS FPE

NRCS administers Emergency Watershed Protection Program - Floodplain Easements (EWPP-FPE), a congressionally-funded program that provides funding to purchase conservation easements after federally declared disasters to restore, protect, maintain, and enhance the functions of floodplains while conserving their natural values. The state NRCS office develops a ranking system and landowners can apply to enroll in the program. If selected, the landowners continue through an enrollment process and are compensated for the easement on their land. The process typically takes 12 to 18 months.

After the 2019 flood, Missouri NRCS developed ranking metrics that prioritized applications that could result in flood risk reduction or flood resilience benefits (like levee setbacks). Missouri NRCS made two EWPP-FPE funding requests in order to select as many applications as possible, which helped ensure funding for all L-536 applications.

MDC

MDC's innovative Land Conservation Partnership Grant program provided funding to acquire land riverward of the new levee alignment. MDC is funded through a state sales tax, which allows for significant flexibility in its funds. This flexibility allowed funding to fill a critical gap for the project.

SEMA

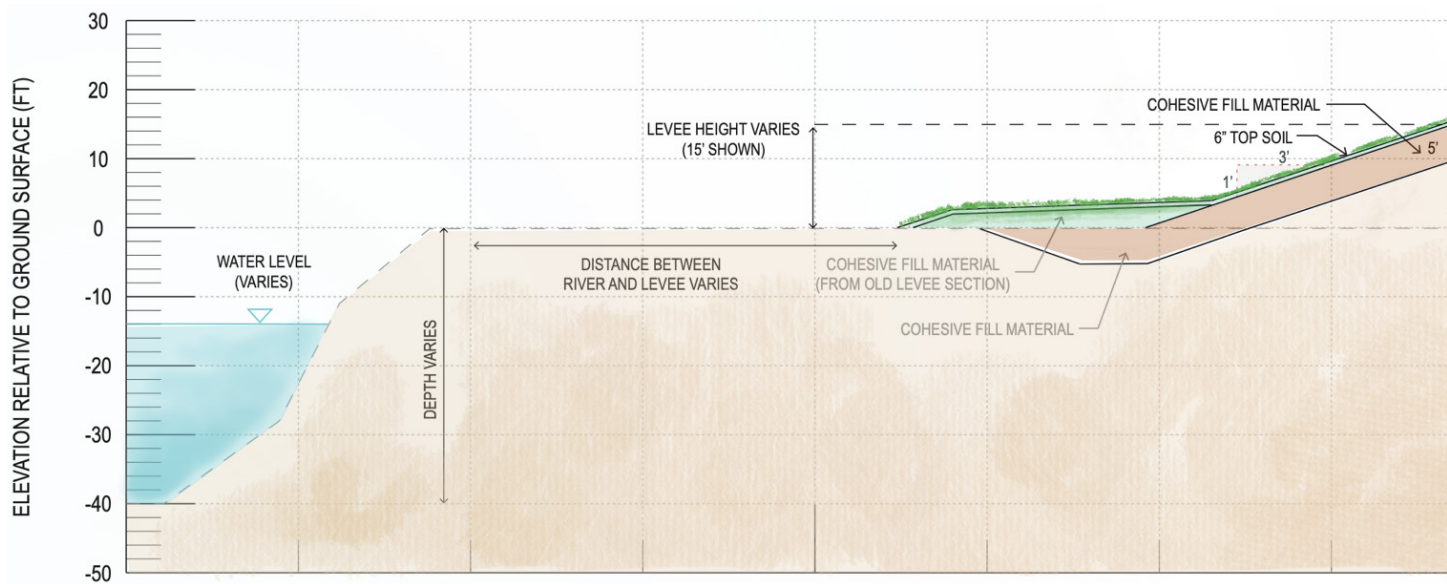
In response to the 2019 flooding, the Missouri Governor and Legislature recognized the need for additional funding to help with recovery statewide. This funding was allocated to SEMA for administration and oversight. As a state appropriation of general revenue, this funding had significant flexibility and could be used in a variety of ways to fulfill the intent of helping local levee districts recover from flooding. Funding was provided to support purchasing the new levee footprint and riverward lands.

TNC

As a non-profit conservation organization, TNC contributed staff time and funding to conduct real estate work, including working with landowners to establish real estate purchase options, contracting for appraisals, title work, surveys and pursuing grants to fill the gap for land acquisition funding.

Design

A unique aspect of the L-536 large-scale levee setback was that the 2019 spring flooding left the area with no flood protection. The scale of the damage to the entire levee and complete lack of flood protection complicated the design process. In addition to the levee being devastated, seven full/partial breach locations also caused significant scouring of the levee foundation and destroyed seepage berms, relief wells, and interior drainage structures. The damage was so extensive that repairs in-place were estimated as being more expensive than rebuilding the levee on a new foundation. Contingency actions for flood fighting during construction were considered, but fortunately were never needed.



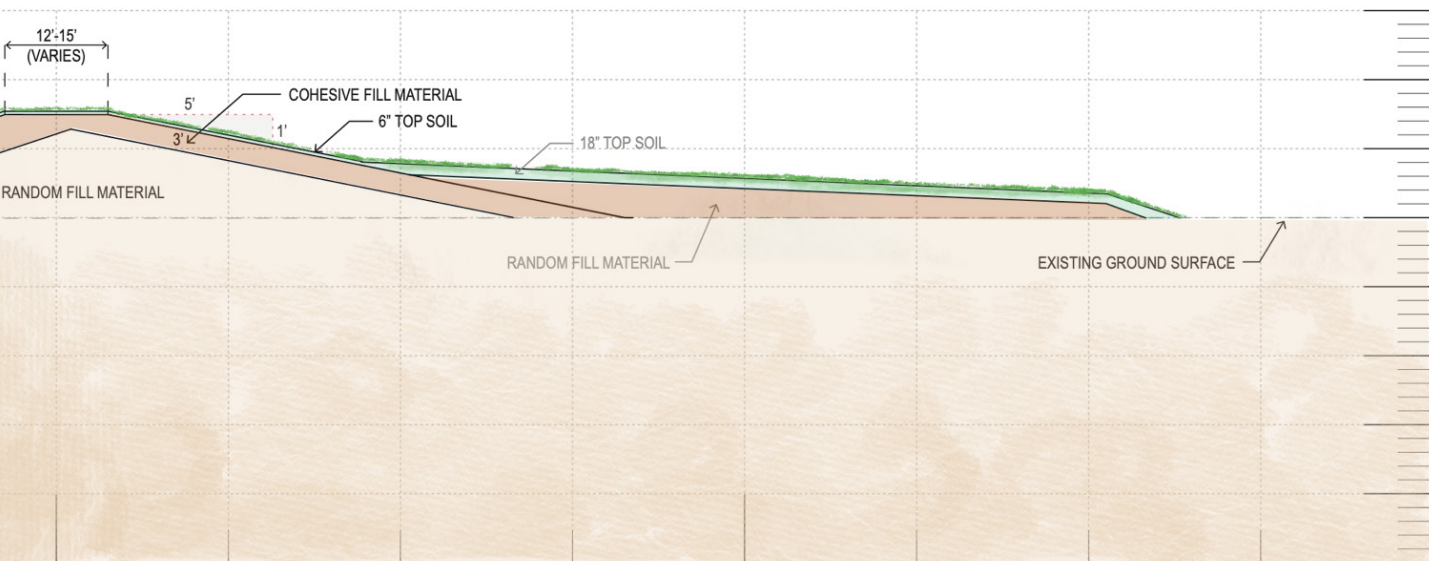
LEVEE SETBACK
TYPICAL

Image based on

Figure 8: USACE levee design template.

Levee Design Templates

While USACE-Omaha District waited for floodwaters to recede, they utilized digital elevation models to create engineering design templates for the placement of the levee with its height, side slopes, and seepage berms so that quantities could be determined, expediting the final design of repair alternatives (Figure 8).



CROSS SECTION REPAIR

USACE levee design plans

Permitting

Like any other large-scale construction effort, permitting and environmental law compliance were critical aspects of the project. USACE complied with all applicable laws and regulations. Due to the state of emergency associated with this levee setback, much of the permitting coordination occurred simultaneously with the design, easements, and other construction tasks. The USACE final report for permitting and compliance was completed post-construction. The section below describes the permitting process followed by the L-536 setback team. Section 4 of the Playbook describes a general permitting process necessary for any levee setback.

NEPA Compliance

The team used the Programmatic EA to begin with, and concurrently developed tiered EA (under ER 200-2-2, USACE emergency NEPA implementation procedures) with NRCS as the cooperating agency. This enabled all other agency coordination and environmental law compliance actions to be completed in real time.

Complying with Process of Multiple Agencies

When conducting permitting and environmental reviews, the importance of project partner coordination cannot be understated. In some cases, the same process and coordination may be conducted by different agencies, presenting an opportunity for a condensed, streamlined process. For example, during this project, both USACE and NWMORCOG conducted redundant National Historic Preservation Act Section 106 coordination. Letters were sent separately requesting reviews of project changes. While not a major problem, USACE and NWMORCOG could have sent one letter to simultaneously satisfy both agencies. Eventually, USACE led the remainder of the Section 106 coordination and shared information with other relevant agencies.

Non-Linear Project Development

The project's emergency nature necessitated permitting to occur simultaneously with planning, design, and construction. The impacts to wetlands and water resources were self-mitigating, no cultural or historic resources were located on site, and no threatened/endangered species were impacted by construction, generally minimizing the concern at L-536 as progress continued.

Environmental Law Compliance on L-536 Setback

National Environmental Policy Act (NEPA)

- Completed Programmatic Environmental Assessment (EA) for all 2019 flood-related construction
- Finalized an L-536 specific tiered EA as per ER 200-2-2, paragraph 8
- NRCS signed on as Cooperating Agency

Clean Water Act

- 404(b)(1) report, 401 water quality certification from MoDNR prior to wetland filling
- USACE complied with all 404 permit requirements
- L-536 project was self-mitigating

Endangered Species Act (ESA)

- Completed bat survey prior to tree removal
- Incorporated pallid sturgeon conservation measures by avoiding dredging at certain locations and establishing specific times for dredging

Migratory Bird Treaty Act

- Coordination with USFWS before any tree removal
- Conducted nesting surveys prior to tree removal
- Established tree removal avoidance time frames and nesting tree distance buffers prior to /during construction

Fish and Wildlife Coordination Act (FWCA)

- Conducted constant coordination with USFWS, MoDNR, and MDC

National Historic Preservation Act Section 106 (NHPA):

- Repeated coordination with Missouri SHPO and Tribes on new borrow sites/levee impacted lands

NRCS Easement Coordination

- Coordinated EWP easements process for the new alignment along with the levee repair schedule
- Assisted with WRP impacts and EAA process
- Significant NRCS headquarters coordination and approvals

Missouri River Recovery Program (MRRP)

- Received MDC and MRRP land manager input during new borrow site identification
- Frequently worked with landowners

Construction Permits

- National Pollutant Discharge Elimination System (NPDES) Permit
- Dredging permit from MoDNR

Construction

Most projects of this scale require several years of planning and design before construction begins. As planning and construction occurred concurrently with the L-536 setback, project partners had to be quicker in defining variables that could affect the schedule, such as securing the necessary real estate for construction to begin.

After a year of planning, design, and coordination, a contract for construction was in place as of May 19, 2020, with construction substantially completed in summer 2021.

Contracting

USACE utilized a unique contract tool only available during large-scale disasters: a Rapid Disaster Infrastructure contract. In order to be prepared for unavailable real estate, the L-536 contract was set up with the upstream in-line repairs as the base contract award, with an option to complete the remaining repairs as a setback. Structuring the contract this way provided USACE the means to ensure flood protection would be restored, regardless of whether levee sponsors were able to secure real estate for the setback footprint. ACLD successfully secured the footprint real estate in the days leading up to the deadline to initiate a setback, allowing the levee setback contract option to be exercised.



Crews conduct excavation work on the L-536 setback project, October 2020.

Borrow/Construction Material

All construction borrow material necessary for levee rehabilitation must be provided by the levee sponsor as part of the Lands, Easements, Right-of-Ways, Relocations, and Disposal (LERRD) requirements of PL 84-99. The borrow material could include sand deposited onto the floodplain by floodwaters or below surface material located within the floodplain. Many of the pre-construction assumptions regarding borrow location and availability ended up being incorrect, severely limiting the amount of material the sponsor thought they would be able to provide. For example, it was assumed that the old levee contained suitable clay material, but it actually contained very little. However, if it is advantageous to the conservation program's goals and mission, material can come from conservation land. MRRP and NRCS approved excavation from the Corning Conservation Area and Brownville Wildlife Management Area.

As the team continued looking for suitable clay material for levee construction, coordination among project partners (USACE, Missouri NRCS, NRCS headquarters, ACLD, and property owners) enabled the use of borrow from the riverward side to begin before landowners were enrolled in the EWPP-FPE easement program. The majority of the material for L-536 was excavated from MRRP and NRCS conservation grounds, saving considerable time and effort in locating and transporting suitable borrow material.

When sand also became difficult to find, the USACE construction management team worked to implement a dredge operation, dredging sand from the Missouri River to construct a significant portion of the seepage berms.

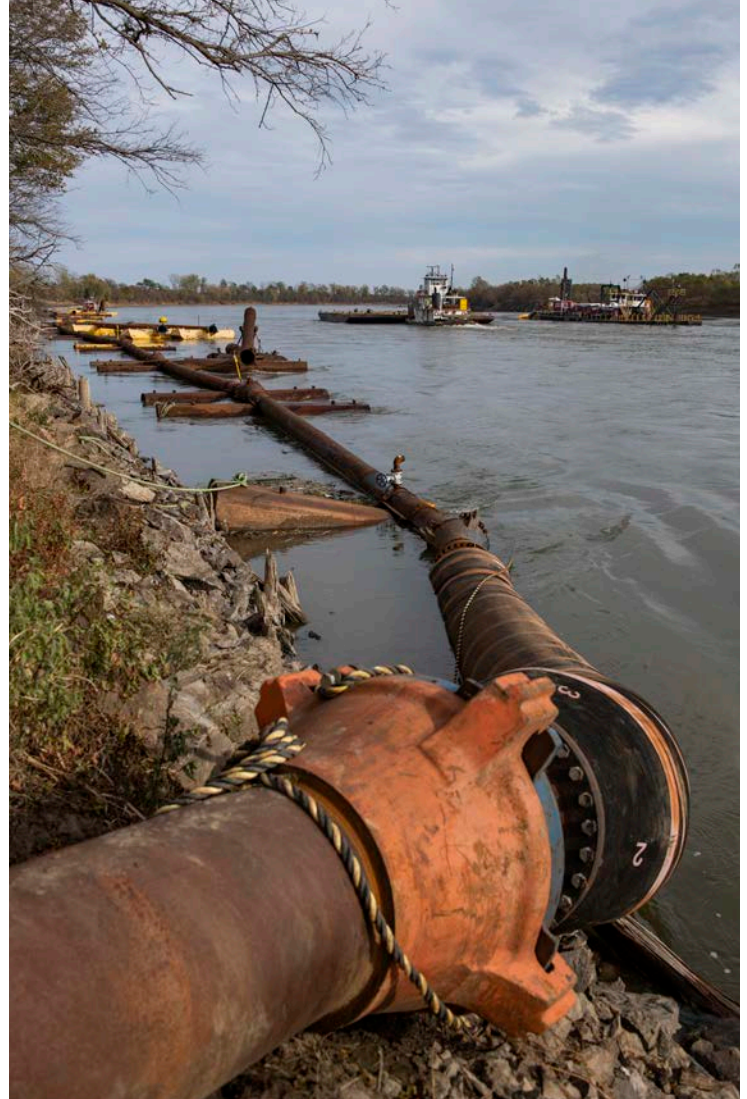
In hindsight, additional geotechnical investigation prior to construction would have supported a more proactive borrow site identification, as well as allowed for additional site identification and cost optimization.



Dredging work along the Missouri River, October 2020.



Levee composition work at L-536, September 2020.



Dredging work along the Missouri River, October 2020.

Weather Considerations

A polar vortex in winter 2020/2021 brought extreme cold temperatures that dipped below -25 degrees Fahrenheit and threatened to halt construction efforts. The project team used huge heated winter tents to keep clay material thawed and to allow construction to keep progressing.

Construction Permits

After miscommunication, the contractor failed to apply for a return flow permit for the placement of dredge material. However, because of the close communication among project partners, MoDNR was able to expedite the permit, preventing costly construction delays.

Levee District Unexpected Expenses

Levee sponsors are responsible for the land encompassing the levee setback footprint, including roadway and utility easements. Early coordination with the county commissioner eliminated county road concerns, but midway through the project, ACLD received a large bill for the relocation of a utility's transmission lines. ACLD mentioned this unexpected cost to project partners, who worked to help offset it. MoDNR was able to secure a portion of SEMA's legislature-allocated flood recovery funding to cover this cost.



Warming tents were used to thaw the project's clay material during the last quarter of construction, Winter 2021.