Our Mississippi

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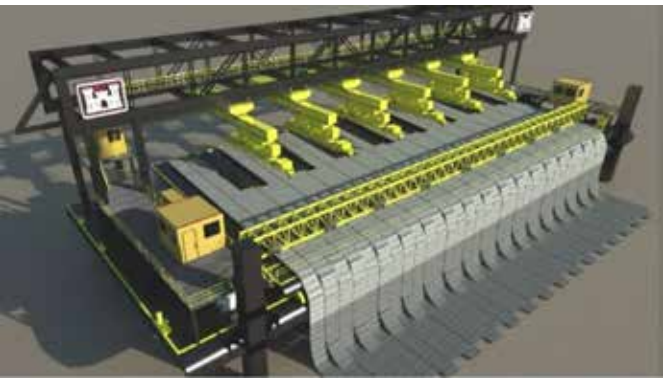
US Army Corps of Engineers

MISSISSIPPI VALLEY DIVISION · FALL 2021

Controlling a River with a Mind of its Own

ARMOR 1 will keep the meandering Mississippi in place through robotics



ABOVE: Artist rendering for the new ARMOR 1, a machine that will double the production rate of the current Mat Sinking Unit used to stabilize river banks.

THE MISSISSIPPI RIVER TENDS TO WANDER as it makes its way from Minnesota to Louisiana. But for businesses shipping goods via river transportation, a migrating navigation channel is a problem, like a Memphis-based trucking firm finding that Interstate 55 no longer runs through town.

"The river naturally wants to meander. As you look at the scars over time, it's all over the map," said Barry Sullivan, chief of the U.S. Army Corps of Engineers' Mat Sinking Unit based out of the Vicksburg District.

Sullivan's unit basically works to keep the river flowing in the same channel where it has recently flowed. They accomplish that task by placing protective mats called revetment at strategic points along the Mississippi. By creating a physical barrier against the river's relentless current, revetment reduces riverbank erosion and protects levees.

"The Mississippi River is an integral part of our nation's infrastructure and moves over 650 million tons of cargo every year. The Mat Sinking Unit is the only vessel of its kind in the world and has placed concrete revetment along the Mississippi River channel for almost 80 years," said Julie Vignes, Operations Chief, Vicksburg District.

The Corps of Engineers first started building these protective structures in the 1800s. Workers created revetment by cutting willow trees and weaving them into mats. The mats were floated in place and sunk to the river bottom with cannon ball-sized boulders, a slow and labor-intensive process. Concrete was first tried as a mat material in 1917.

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Our Mississippi is a newsletter of the U.S. Army Corps of Engineers about its work in the Mississippi River Basin toward both economic and ecological integrity of the river system. It is published by the U.S. Army Corps of Engineers, Mississippi Valley Division, in accordance with AR 360-1 for its Mississippi Valley workforce and external audiences and collaborative partners including other Corps' districts and stakeholders within the division's area of responsibility. The views and opinions expressed are not necessarily those of the U.S. Army Corps of Engineers, the U.S. Army or the U.S. Department of Defense.

The aging Mat Sinking Unit is not easily or quickly repaired. When something breaks, replacement parts are no longer available and have to be repaired on-site or custom manufactured. A better, more modern system is needed and John Cross sees the solution in robotics.

LEFT: ARMOR 1 is under construction at the Thoma-Sea shipyard in Louisiana with a full trial test planned for 2022. The USACE Vicksburg District is partnering with Hinds Community College to train workers to run the new robotic system.

Today, the Corps uses articulated concrete mats made of individual blocks stitched together with cable. Each mat, also called a square, covers 100 square feet. In its 2020-2021 season, the Mat Sinking Unit placed 266,000 squares of articulated concrete mat, an equivalent of 610 acres.

Making the mats is still a labor-intensive process. The Mat Sinking Unit uses cranes to move concrete mats one at a time from a supply barge onto the deck of a mat building plant. There, deck workers use a 60-pound pneumatic tool to tie the pieces together with cable. A worker may tie 1,000 connections in a ten-hour period.

Built in 1948, the Mat Sinking Unit is showing its age. Replacement parts are no longer available and must be custom manufactured. Maintenance costs are running $5–6 million per year.

The need for the next generation of equipment to take over the critical task of protecting the navigation channel is clear. The new system, called ARMOR 1, has been under development since 2013 and should take to the river in 2023.

"ARMOR 1 is one of a kind in the world. There's nothing like it out there," said John Cross, project manager for ARMOR 1 and a retired U.S. Army colonel. "It introduces robotics to do a lot of the hard manual labor tasks that we've been relying on for so many years. And it makes everything a lot safer, a lot quicker and much more reliable."

ARMOR 1 USES SIX ROBOTIC CRANES to move large flat concrete mats from a supply barge to a roller deck. Each mat weighs one ton and measures 25 feet long by 4 feet wide by 4 inches thick. Each crane can handle two mats at a time and communicates with the other cranes to anticipate where the next mat is needed. "Other robotics on the deck stitch all these pieces together and so you have one big piece of concrete mattress," Cross said.

ARMOR 1 can assemble up to 4,000 pieces per day, double the maximum capacity of the current Mat Sinking Unit, which currently averages 1,200 pieces per day due to mechanical breakdowns.

And the need for that capacity is on-going. Annually, Corps hydraulic engineers survey the Mississippi for areas of erosion or levee damage from Cairo, Illinois to its mouth south of New Orleans. Cross estimates the Corps has laid more than 1,000 miles of revetment over that stretch.

ARMOR 1 also incorporates technology that makes it more adaptable to today's increasingly long flood periods. The new system includes sensors that can detect whether the mat is flat on the river bottom as it is laid out, spuds that anchor the mat while it is being placed, and a winching system that can measure stress and adjust automatically, avoiding the safety hazard of broken cables.

"I'm also very happy that we're improving the safety. Our workers out there do a good job in very tough conditions. We need to give them the best operating environment we can and that's something that personally concerns me that we make sure folks are as safe as possible," Cross said.

TO DEVELOP THE NEW SYSTEM, Cross tapped expertise from across the country. The project team includes the Corps' Marine Design Center in Philadelphia, Pennsylvania, the National Robotics Engineering Center at Carnegie Mellon University in Pittsburgh, Pennsylvania, and the Bristol Harbor Group in Rhode Island. The American Bureau of Shipping in Houston, Texas is certifying the system's marine safety.

"It's been a really great team," Cross said. "I think the robotics were the most exciting for me, how we went from a concept to a design to a prototype."

The last prototype test run, completed in September 2020, demonstrated that the robotics are fully functional although refinements continue. Thoma-Sea Marine Constructors in Lockport, Louisiana, began building the hull in 2021.

An integral part of ARMOR 1's success will be its people. Beginning in early 2022, crews will start to be trained on the new system, in collaboration with Hinds Community College in Vicksburg, Mississippi. "It's a very cool thing. We're working with them to come up with a curriculum and they're going to help us do some of the introductory training and then do sustainment training over time," Cross said.

The price tag for ARMOR 1 totals $125 million, which compares very favorably to the $108 million cost (adjusted to today's dollars) of the old Mat Sinking Unit. "It is just a small drop in the bucket to make sure that we have freedom of navigation down the river and safety for our cities and towns along the river," Cross said.

"We want the Mississippi River to stay where it's at. We don't want to lose our ports. And we don't want to lose our cities and towns and infrastructure. ARMOR 1 will help us prevent the river meandering and try to keep it within its banks for the future." —D.D.

Mapping the meandering to set a course for the future

In 1944, U.S. Army Corps of Engineers cartographer Harold Fisk studied and mapped the historic geology of the Mississippi River Valley. He created maps famous today both for the beauty of the colorful meanders and the research so comprehensive that it explained the establishment of the river's historic courses and also explained factors that would shape future behavior and help agencies like USACE better tame the Mighty Mississippi for human use.

Fisk's team used detailed topographic maps, extensive use of aerial photography and historical accounts of the river valley, including narratives from Spanish explorers of the 16th century, to help identify abandoned courses of the Mississippi River and its tributaries. Data from approximately 16,000 soil borings were incorporated as well. The report's results would drive Mississippi River engineering for decades.

The most impressive aspect of Fisk's report were several volumes of colored, detailed topographical and geological maps (like the one on page 1) that trace significant river course changes over the last 2,000 years. For instance, the river has taken at least three different routes through Louisiana to the Gulf of Mexico; its present course through New Orleans dates only to around 650 years ago.

Renovating a Riverfront

Memphis River Parks Partnership and U.S. Army Corps of Engineers join forces to transform a key river park.

It's a major Memphis project that has been 30 years in the making, now morphing into one of the most ambitious public parks along the Mississippi River's long, meandering riverfront there. It's Tom Lee Park, the place dedicated to the hero Tom Lee, who in 1925 pulled more than 30 people out of the river when the M.E. Norman steamer overturned.

The park at the end of Beale Street was dedicated to him in 1954. Then in 1992, the United States Army Corps of Engineers (USACE) constructed a much-needed dike, which expanded the park to the 30 riverfront acres, space that the city of Memphis expected to turn into a world-class park back then.

"Basically, they didn't have the money to do it," explains George Abbott, the director of external affairs for the Memphis River Parks Partnership, the nonprofit organization that is spearheading the long-awaited expansion. "The city put the project on hold due to budget constraints at the time. So now, almost 30 years later, is when we're finally building that park."

The partnership is working in conjunction with USACE the work rooted in a partnership with the Corps of Engineers and designed so it doesn't impact the stability of the dike, says Cory Williams, chief of the Geotechnical Engineering Branch of the Corps Memphis District.

"Since the 1930s, the Corps of Engineers has put millions of dollars worth of work out into the river to stabilize the bank. We constructed that mile-long dike that parallels Riverside Drive in the 1990s, so we have this big investment. We want what they're doing to expand it to be consistent with our original design," he explains.

The park project is centered on a four-zone master plan design focused on limiting erosion and increasing flood protection as well as boosting opportunities for recreation, Abbott notes. The park's four quadrants include the "Civic Gateway," the "Active Core," the "Community Batture" and the "Habitat Terrace," each created with different key features.

The Civic Gateway will have the Gateway Plaza, a lovely entrance with a view of Beale Street Landing, as well as a reimagined Cutbank Bluff, complete with views and handicapped accessibility. At the Active Core, visitors will find everything from a kids' play deck and for-everyone fitness areas to a large "Civic Canopy" that provides shade for sports and events. This area will host Memphis in May once again, a longtime Tom Lee Park festival that will return to its home once the renovation is complete.

The Community Batture is a place where families can barbecue, wander in the restored riparian forest, hang out in the hammock grove and visit the Tom Lee Memorial that features picturesque views of the Mississippi River. Finally, the Habitat Terrace is a place for nature lovers, especially children who can learn about the ecology of the river firsthand in outdoor classrooms. And this is the spot where the Canopy Walk is designed to become an iconic Memphis destination, a massive platform with high-up treetop views of the river and Harahan Bridge.

"Let me say, apart from my role as part of the Army Corps of Engineers, I'm excited about the park," Williams says. "I know that it's going to be extremely popular. I think the most exciting thing, the thing that I'm going to look forward to is walking out and looking at the river, from that [Canopy Walk] structure on the south end, the elevated structure. I think it's going to give a unique and beautiful view of the downtown area and the river. And you have the bridges, it's between both the bridges, I think it's gonna be a really fantastic thing." —J.P.

My **MISSISSIPPI**

Mark Manning, Cartographer, U.S. Army Corps of Engineers Memphis District

"If you don't like your work, you're going to have a long day. I get paid to get in a boat, punch on a computer and ride on the Mississippi River all day long."

"The first flood control mission I was on was in '91, and I've done every one since. On the first I was low man on the totem pole. I wasn't doing much but toting sandbags, looking for sand boils. Now most of the floods I'm doing discharge measurements getting crucial flows. They send me on reconnaissance missions they can't get to by land. I'll boat in and do data collection.

"Another reason for mapping is for navigation purposes. When I first started, we'd go out and survey the actual channel of the river, and turn it over to my supervisor. They'd say, 'Do we need to go in and dig that channel out? Is it too shallow for barges to get through?'

"The old-style maps we used to generate would shoot out a piece of paper with numbers that were the depths of the river. You had to hand contour that. We'd contour every five feet, and I'd lay that over our master plan so I could draw on the dikes and other structures. You got to actually look at the depths, think about it and interpret which way you thought the river was going. I might draw a straight line across; another guy might curl that around and come back. Then they put me on computer, which was pretty darn nice after hand contouring for five or six years.

"I have surveyed from Rosedale, Mississippi, below the end of our district, to Cairo, Illinois and have seen every bank of the river for the last 20 years. One time I was doing an environmental survey. I saw a big old log floating, then later, I noticed it was back upstream. It was an old snapping turtle, a loggerhead, that must have been 300 or 400 pounds. She looked like a dinosaur with spikes almost three inches long. That's when I got on the bandwagon. Instead of just worrying about navigation and commodities, there's another branch of our work that deals with nature. I'd like my daughter one day to see a turtle like that."

Special Corps teams aid in Ida response

FROM TOP: USACE teams, led by the USACE Mississippi Valley Division, survey flooding and other damage by air. Major General Diana Holland shares news about task force efforts. This pump was moved to the Plaquemines Parish as one piece of the Unwatering Mission. And Operation Blue Roof, illustrated in bottom photo, is a priority mission managed by the Corps for the Federal Emergency Management Agency (FEMA). The free service protects homes quickly with temporary roofing covers.

WHEN HURRICANE IDA MADE LANDFALL on Aug. 29, the 16th anniversary of Hurricane Katrina, it hit with maximum sustained winds of 150 mph. Its strength made it the second most intense hurricane to strike Louisiana, second only to Katrina.

It also provided the first major test of the massive Corps of Engineers-created Hurricane & Storm Damage Risk Reduction System (HSDRRS) designed to protect the city and avoid a Katrina-type catastrophe in the future.

Over the past ten years, the Corps has strengthened the levees, floodwalls, gated structures and pump stations that form the 133-mile Greater New Orleans perimeter system, as well as improved approximately 70 miles of interior risk reduction structures. Among its technically-advanced engineering solutions, the HSDRRS now includes the world's largest surge barrier of its kind, the IHNC-Lake Borgne Surge Barrier, and the largest drainage pump station in the world, the GIWW-West Closure Complex. The HSDRRS is capable of defending against a 100–year level of storm surge, also known as a storm that has a one percent chance of occurring in any given year.

> The system performed as designed, and there was no overtopping of the system, despite early National Weather Service projections. Two key state levee systems within the hurricane's path also held.

The system performed as designed, and there was no overtopping of the system, despite early National Weather Service projections. Two key state levee systems within the hurricane's path also held.

That doesn't mean help wasn't needed in the disaster's wake. Corps teams that provide emergency power, that 'unwater' flooded spaces, that do emergency roofing work to protect homes—and more—were called to work in partnership with local, state and other federal agencies.

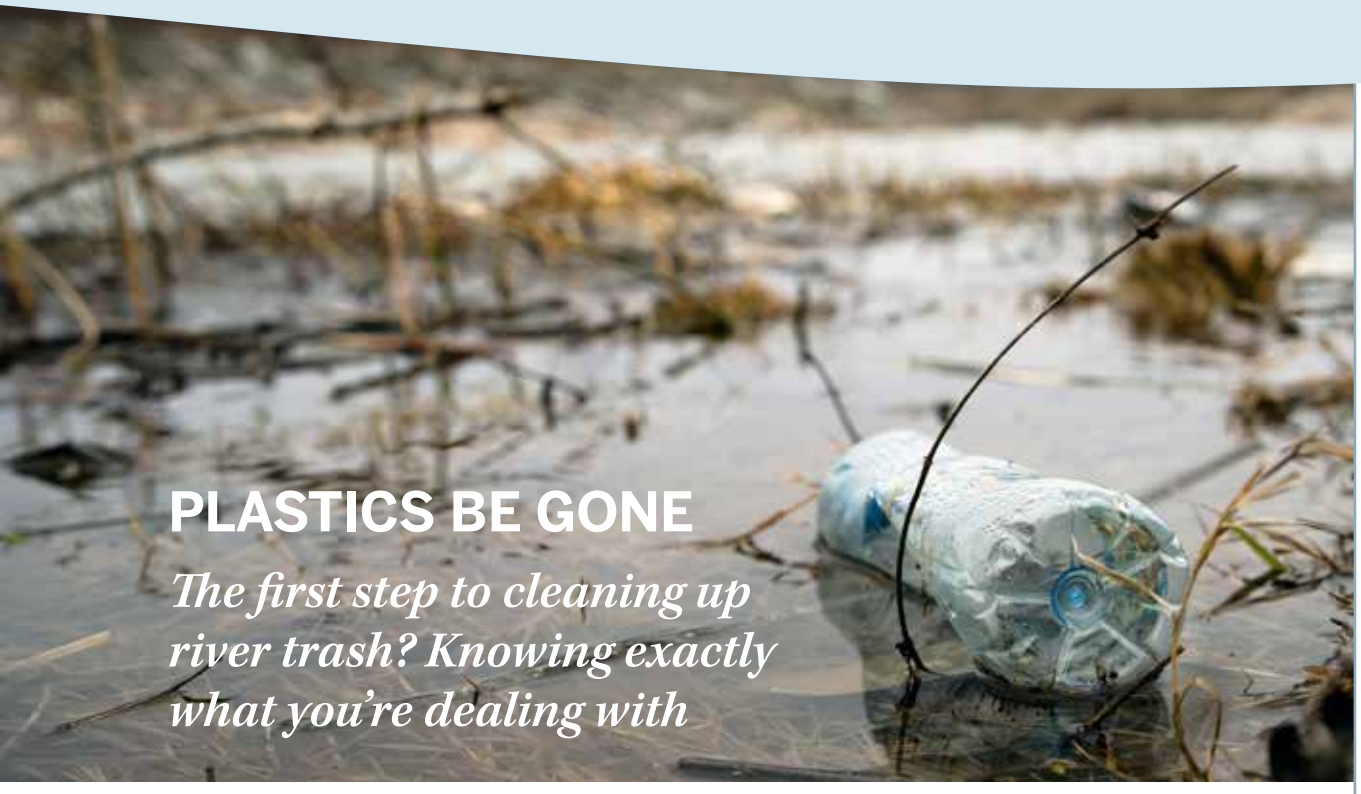
The Corps, led by its Mississippi Valley Division, deployed its Temporary Power Planning and Response Team, its Temporary Roofing planning group and temporary subject matter experts in debris removal, hydraulics, infrastructure assessment and more.

The Power Restoration Task Force, which partners with the state of Louisiana, FEMA and Department of Energy, was immediately deployed. It installed its first generator Aug. 31 at the Southeast Louisiana Veterans Home. Installation priorities included hospitals, medical facilities and nursing homes.

The Corps also received a FEMA mission assignment for temporary roof installations, a priority mission called Operation Blue Roof. The Corps's Unwatering team also was deployed to remove excess water in South Louisiana. Pumps were deployed to Kraemer in LaFourche Parish and Lafitte in Jefferson Parish. In lower Plaquemines Paris, the Corps will undertake controlled engineering cuts in levees to promote drainage.

While the storm reduction system held, there were still significant impacts to federal navigation channels in Southeast Louisiana. All four major ports on the Mississippi River were temporarily shut down due to the loss of electrical power and the fouling of the river caused by scores of sunken, submerged, and grounded barges and vessels up and down the river as well as nine grounded deep draft vessels. Downed high-tension power lines that hung across the river at water level from a tower in New Orleans knocked down by the winds closed the busiest river in the U.S. to North-South traffic at that point for six days until the lines were cut by explosives and removed. The inoperability of numerous bridges across federal waterways due to storm damage posed a challenge to teams moving dredging and other equipment.

PHOTOS: U.S. ARMY CORPS OF ENGINEERS.



PLASTICS BE GONE

The first step to cleaning up river trash? Knowing exactly what you're dealing with

Three years ago, a coalition of Mississippi River cities mayors decided that someone needed to do something about the plastics and other waste flowing down the river and into the Gulf of Mexico. And they decided that someone would be them. Through their Mississippi River Cities and Towns Initiative (MRTCI)—a close partner of the U.S. Army Corps of Engineers—they became the first river system to join the Clean Seas Initiative of the United Nations Environmental Program and the National Geographic Society.

The first step toward a solution, they decided, would be to see what—down to each individual piece of trash—they were dealing with. They partnered with the University of Georgia, which developed a Debris Tracker app, and sent volunteers out to systematically comb the banks of three river towns (St. Paul, Minnesota, St. Louis, Missouri, and Baton Rouge, La.) throughout 2020.

What volunteers found was a whopping 81,000 pieces of trash, including 11,000 cigarette butts, 10,000 styrofoam fragments, 7,000 food wrappers, 6,500 beverage bottles and 3,600 metal cans.

The findings weren't a total shock to river mayors, says Jennifer Wendt, the plastic waste reduction campaign manager for MRCTI. After all, the debris is inundating their city riverbanks as it makes its way to the Gulf and then to the ocean. The next step, she says, will be sharing the data with mayors so they can develop specific initiatives that target efforts to reduce trash.

> "There are around 8 million tons of plastic entering the ocean each year. Most of it ... originates from land-based sources including rivers like the Mississippi as well as coast lines,"
>
> —BARBARA HENDRIE, NORTH AMERICAN DIRECTOR, THE UNITED NATIONS ENVIRONMENT PROGRAMME

The Mississippi River watershed drains 40 percent of the continental U.S., so a soda bottle from Great Falls, Montana, could float into the sea with a cigarette butt from Olean, New York, 1,641 miles east. And this is just one system.

"There are around 8 million tons of plastic entering the ocean each year. Most of it — around 80 percent — originates from land-based sources including rivers like the Mississippi as well as coastlines," said Barbara Hendrie, North American director of the United Nations Environment Programme (UNEP).

MRCTI is an organization of 101 mayors of communities along the river. It launched the plastic pollution initiative to help fill gaps in data about the plastic pollution flowing into the Mississippi River specifically, Hendrie said.

"We are working to fill this important data gap by answering three important questions: What is it? How did it get here? What can we do about it?"

The river mayors quickly found company in their concerns, Wendt said, getting partners from each city and finding 100 organizations eager to join. Thousands of volunteers have searched designated quadrants of river bank and logged debris counts on

"We gave people a specific method to follow for them to walk in a path about a meter wide and count all of the items they saw in that path for 30 minutes," said Jenna Jambeck, a professor of engineering at the University of Georgia and co-creator of the Debris Tracker deployed by UNEP. "This method gives us data that is comparable across cities and around the world."

In about one year, volunteers counted items on 111 square kilometers (27,429 acres) of riverbank. Nearly three-quarters of the trash was some type of plastic — cigarette butts, foam fragments, food wrappers, beverage bottles and broken pieces of hard plastic.

"One of the things that struck me was the number of plastic bottles and aluminum cans," Jambeck said. "Plastic bottles are very recyclable and aluminum cans even have value, yet they still end up in the environment."

Resulting actions will include usual efforts at picking up trash and recycling, she said, and extend to reducing the plastics that are manufactured introduced into the environment. Many restaurants, she noted, have switched from styrofoam to paper containers for carry-out food. The American Beverage Association is striving to recycle 100 percent of its plastic bottles through an "Every Bottle Back" program. Many communities and businesses are providing bottle refill stations to reduce purchases of water in disposable bottles. The plastics initiative has engaged thousands of people, a sign that progress awaits, Jambeck said. —R.S.

More on the plastic initiative: debristracker.org

My MISSISSIPPI

Mitchell Serjogins, Working Supervisor Lock and Dam 4; St. Paul District Dive team member; Alma, Wisconsin

"I've always been a river rat. I've been in the water, on the water my whole life, I blame my parents. My first time I was on the river I was two months old, always on Pool 5. I have a 1 ½ year old son, and I'm raising him the same way.

"As soon as I got on the Corps, I was asking about the dive team. In 2017, they sent me down; they had to see if I was able to handle it. Our district's dive team is quite a bit different than those of other districts. We have a team set to dive three to four months a year. It's all we do June to September, and we get to be a pretty tight-knit group.

"Anything underwater that needs to be done is what we do. Diving is usually a last-case scenario. If there's any way to do it top side, we always do it that way. But we do inspecting of gates, some of the concrete structures. Last week we dove below every gate on the dam—that was 28 gates, Next week I'll be going with the team dredging the lower gates of Lower St. Anthony Falls. We'll do the inspection of the new gates and Lock and Dam 2, and the week after we'll assist the Portland District in Oregon.

"I always like it. It's the only time involving my job where you are by yourself, in full control of what you're doing. In some cases in cleaner water you can actually see stuff, but most times, you can put your hand right to your face and can't see it. You're doing everything by feel.

"I've touched fish before, and when you have decent visibility they sometimes spook you. We did a periodic inspection in the Headwaters, and I was checking a wing wall along the dam. I turned around and there were hundreds of sunfish following me.

I think the most fun I've had on a dive is setting bulkheads that were 80,000 pounds. We'd sit underneath the barge, and once we got it set would unhook the shackles. Everything went well; nobody got hurt. I want to give the dive team as a whole a shout-out. Safety is always the key factor. They call it the most dangerous job in the Corps of Engineers. I don't see it being dangerous when I'm with the crew I work with."

Restoration Program marks 35 years of environmental wins

It's not hard to find ways to celebrate the 35th anniversary of the Upper Mississippi River Restoration Program.

You could go birdwatching in a spot where there's more waterfowl than ever, dip a line in a pool now teaming with fish, maybe paddle a backwater that's quite a bit clearer than it was 35 years ago—and by no accident.

In 1986, Congress declared the Upper Mississippi River System as both a nationally significant ecosystem and nationally significant commercial navigation system and provided for the system to be regulated as such. Through one immediate action, it authorized the Upper Mississippi River Restoration program (UMRR) and made it the first federal program to combine ecosystem restoration, monitoring, and science on a large river system.

Results and Plans

UMRR has focused primarily on two of the six initially authorized elements: habitat rehabilitation and enhancement projects and long term resource monitoring, research, and analysis. These two elements have comprised the essence of UMRR from the beginning.

Habitat projects have restored and connected more than 100,000 acres along the Upper Mississippi River, with an additional 75,000 acres of habitat projects planned for the next decade. These provide vital habitat for diverse fish and wildlife species including rare and endangered ones, says Marshall Plumley, UMRR regional program manager. The program has another 24 projects in planning, design or construction, he says, projects expected to have an even greater impact due to lessons learned and methodologies improved.

"For the last 35 years our understanding of the UMRS and how it functions and responds to change has grown exponentially," he said. "I envision that will continue and accelerate which will drive more robust and effective restoration on the Upper Mississippi River System."

The program has created islands for more sheltered habitat, restored forests, dredged pools where fish can now overwinter. Its long-term resource monitoring arm has been key in informing and measuring the other effort's results and in developing an impressive database of information on the system.

Each year, UMRR LTRM field station staff members use consistent, standardized methods to collect water quality, aquatic plant and fisheries data in six study reaches that span over 900 miles of the Upper Mississippi and Illinois Rivers (Pool 4, Pool 8, Pool 13, Pool 26 and Open River reach of the Upper Mississippi and La Grange Pool of the Illinois River.) The resulting database is considered one of the most extensive and comprehensive databases on any large river system in the world, and its methodology has been adopted by several others, says Jeff Houser, science director.

The monitoring reveals patterns and trends, establishes current state benchmarks for comparison to future conditions, serves as an early warning of change and more, he says. Both parts of the program also depend on key partnerships. Though administration is done through the U.S. Army Corps of Engineers, the U.S. Geological Survey heads the monitoring and many agencies contribute to the field and restoration work.

Says Plumley: "Successful management of the Upper Mississippi River requires thoughtful and meaningful coordination among numerous agencies, organizations, and individuals with varying but related mandates and missions."

MONITORING REVEALS KEY TRENDS

Water Quality

In the Upper Impounded Reach (Navigation Pools 2 through 13), some aspects of water quality have improved. The biggest change has been the increase in water clarity from 1993, partly due to project-related reductions in input of suspended sediment and changes in vegetation (see below).

Submerged Aquatic Vegetation

The submersed aquatic vegetation in the Upper Mississippi experienced a 'crash' in the late 1980s for reasons that remain poorly understood. Low vegetation abundance and much murkier water remained until the early 2000s when, in the Upper Impounded Reach, vegetation abundance and water clarity began to increase.

Fish

The most dramatic change in fish populations has been the remarkable increase in the amount of invasive bighead carp with evidence that sport fish have declined where the carp have become established. There is evidence that sport fish have declined in the LTRM study reaches where bighead carp have established and become common. A similar decline has not been detected in the study reaches where bighead carp are not abundant (Navigation Pools 4, 8 and 13). In fact, recreationally valued native fish have increased in parts of the Upper Impounded Reach.

Water Levels

From 1940 to 2019 there has been a general increase in the magnitude and duration of high river discharge. This is one of the few long-term trends that is true for the entire system. One consequence of this change is that floodplain forests are struggling to regenerate in areas where there are currently mature trees. Extensive sections of dead trees are evident on the floodplain.

—JEFF HOUSER, SCIENCE DIRECTOR

ICE FISHING: HERT NIKS. EAGLE: PHILIPP PILZ. CANOE: MICHAEL NIESSL. ALL VIA UNSPLASH.

Pool 12: Making room for fish to winter

Anyone who has bundled up inside a shanty on a frozen Midwestern lake and looked down under the ice below knows that fish, too, are hearty souls that can thrive even in the middle of winter. But to do so, they need at least six feet of water under that ice—something increasingly hard to find as sediment fills the backwater habitats of the Upper Mississippi River.

However, if the increasing number of fishing boats is any indication, a restoration project in Mississippi River Pool 12 is making a difference. The UMRR project launched with its first contract award in 2013 will hold a virtual ribbon cutting in November to signify the end of the construction of better habitat for fish to overwinter and in four different lakes within the pool located in the U.S. Army Corps of Engineers Rock Island District, just downstream of Dubuque, Iowa.

What sets this project apart is the way that follow-up efforts will track construction of better winter fish habitat in four different lakes within the pool, says Julie Millhollin, the project manager. Future efforts will track the response of fish including whether or not they swim from pool to pool or how far they travel to their winter getaways.

The dredged material wasn't just disposed of. Instead, it was moved to land adjacent to the pool to help boost forest restoration efforts as well. Teams planted vegetation and specific tree species designed to broaden the variety in areas heavily dominated by silver maple. Future projects, Millhollin says, will focus on forest plantings across the pool. —K.S.

Celebrate through exploration



Most of this year's 35th anniversary events will be virtual, but there are many ways to honor the success of UMRR projects through outdoor recreation and exploring the Upper Mississippi River. To celebrate, try one of these suggestions by Sabrina Chandler, Refuge Manager, U.S. Fish and Wildlife Service's Upper Mississippi River National Wildlife and Fish Refuge:

- **Drop a line in Polander Lake, Pool 5, in Winona County, Minnesota.** Here, project-related dredging increased deep water habitat for fish. The pretty recreational lake is popular for trout fishing, especially since UMRR projects increased habitat diversity and improved water quality in the backwater area favored by paddlefish.
- **Ice fish, Lake Onalaska, Pool 7, in La Crosse County, Wisconsin.** Here, dredging increased deep water habitat for fish. Today, anglers find largemouth bass, smallmouth bass, channel catfish, black crappie, walleye, bluegill, pumpkinseed sunfish, yellow perch and northern pike.
- **Go bird watching, Brownsville Overlook along the Pool 8 Islands, Genoa, Wisconsin.** Projects constructed islands to protect aquatic vegetation and reduce sedimentation, increasing food supplies and adding loafing structures for migratory waterfowl. Today, it's a birdwatcher's paradise of eagles, pelicans, coots, ducks, tundra swans and more.
- **Hunt waterfowl, Pool 9 Islands, Crawford County, Wisconsin.** Here, horseshoe-shaped islands were constructed to protect aquatic plant beds and shallow waters, providing food and shelter in this mallard and canvasback mecca. Some 300,000 ducks at a time have been spotted during migration and outfitters offer guide services that cater to hunters.
- **Paddle Ambrough Slough, Pool 10, upstream of Prairie du Chien, Wisconsin.** Restoration of 2,500 acres of backwater wetlands improved water quality by increasing water depth, reducing siltation and improving aquatic vegetation to enhance habitat for fish, mussels, waterfowl—and those who want to paddle amid them.

My MISSISSIPPI

Christine Brewer, 65,
Grammy Award winning Opera Singer

"I grew up in Grand Tower, the southern Illinois town named for the grand tower or Tower Rock that juts about 60 feet above the Mississippi River. When I lived there, a ferry connected Grand Tower to Wittenburg, Missouri.

"My family often picnicked in Devil's Backbone Park, but my mother would never let us swim in the river because of the swift current and whirlpools at Grand Tower. I didn't learn to swim until I was an adult, and now I do it every day in part as a good exercise for my lungs.

"I can't remember a time I wasn't performing. My mother was in a musical group called the Shawnee Trio. My brothers and I often sang specials at my grandparents' church in McClure, another river town about 25 miles south. Once we did a gospel sing at Devils Backbone Park with the river as our backdrop.

"Becoming an opera singer was something I never considered until I was in college. Over the years, I have had the opportunity to perform on some of the world's grandest stages, Paris, London, New York at the Metropolitan Opera and symphony halls in Japan, Australia, New Zealand and Italy. Performing before the Queen of England was a highlight, as was a private performance for Prince Charles.

"When I am asked to lead workshops, I tell students that it doesn't matter what you are singing, you must connect emotionally to the music.

"I get a little weepy when I sing "Mira" from the musical Carnival by Bob Merrill. I can bring that number more to life because of my childhood on the river. It kind of sums up my life.

I came from the town of Mira,
beyond the bridges of St. Clair.
I guess you've never heard of Mira,
It's very small, but still it's there.
They have the very greenest trees,
and skies as bright as flame,
But what I liked the best in Mira,
Was everybody knew my name.
Can you imagine that?
Can you imagine that?
Everybody knew my name.

"I'm relying heavily on my memories of Grand Tower as I prepare for my next performance – a cabaret in December at the Blue Strawberry in St. Louis called 'From Grand Tower to Grand Opera.'" —D.L.M.

National Loon Center opens

Loon preservation and learning to be a new feature of popular Corps' Cross Lake recreation area

A STOREFRONT CALLED THE NEST may sound unassuming. But its opening in Crosslake, Minnesota marks the first physical presence of a community effort to preserve lakes and loons—with their haunting calls and iconic connection to the North—in the Mississippi headwaters and beyond.

Opened in June 2021, The Nest serves as a welcome center for the National Loon Center Foundation, a nonprofit organization with the mission to be "an interactive educational destination that transforms visitors into champions for loons and freshwater everywhere."

The National Loon Center's permanent home, still in the planning stages, will be located at the U.S. Army Corps of Engineers' Cross Lake Recreation Area, just across the highway from The Nest welcome center.

"Establishing ourselves here on the square is the first tangible proof to the public that the Loon Center is not just a future vision, but that it's operating now, has exciting programs and things to do, and current research efforts underway," said Jon Mobeck, the National Loon Center's new executive director.

The National Loon Center launched its first educational programs, called Loon Lab, this summer. A partnership with the Gull Lake Sailing School of Brainerd, Minnesota offered children and adults on-the-water experience learning about loons, their behavior and habitat, and the importance of protecting freshwater lakes and rivers. The volunteer instructors used a curriculum designed jointly by the National Loon Center and researchers from the University of Minnesota.

2021 also marked the start of a loon research project, led by Dr. Walter Piper, a professor with Chapman University and chief science advisor to the National Loon Center. He has studied loon populations in Wisconsin for more than 20 years and is establishing a parallel study of Minnesota's loon population. This summer's activity included banding loons on the Whitefish Chain of Lakes.

"We've noticed that the population in Wisconsin is declining. We want to see if that pattern is consistent here. And if it is, then that means that we need to do a lot of conservation work to help the loons," Mobeck said.

Piper also leads the National Loon Center's Scientific Learning Council, comprised of nationally recognized biologists, ecologists, and wildlife scientists.

The Council's immediate task is guiding development of exhibits for the National Loon Center's world-class educational facility, slated to open in the spring of 2024, Mobeck said. It will include a boardwalk, dock, and shoreline restoration with recreational access.

"Outdoor exhibits are being installed this year," Mobeck said. The first one describes the meanings of various loon calls. Others will be about aquatic invasive species and the effect of lead fishing tackle on loons.

"Signage explaining the National Loon Center and what they do is being installed in the interpretive garden at our entrance. We plan to finish before the end of summer," said Corrine Hodapp, Supervisory Park Ranger of the Cross Lake Recreation Area, the most visited of the Corps' St. Paul District recreation facilities. The Paul Bunyan Scenic Byway Association is a key partner in establishing and maintaining this garden and the new signage.

The shoreline restoration project also exemplifies another strong partnership. When the recreation area closes for the season, work will begin on installation of a boardwalk, dock, including a boat slip for a floating classroom, and shoreline plantings. These projects should improve water quality and demonstrate how to preserve lakefront habitat.

"The Corps' focus (in this project) is where the land meets the water. We don't want to impact our current users. We want people to be able to use the walkways, sit on benches, and enjoy looking out over the water," Hodapp said.

Mobeck concurred. "We really want to make sure that the exact areas that we are restoring are of the highest benefit to the Army Corps. That's very much a joint effort to make sure that we're effecting the right change here," he said. —D.D.

Lower Mississippi gets restoration boost

TWO FEASIBILITY STUDIES—among just 10 authorized across the nation—will look for the most viable ways to restore the river's ecosystem in and around Memphis, Tennessee, and in ways that won't interfere with other U.S. Army Corps missions like flood control and navigation.

Both are exciting opportunities for the Corps' Mississippi Valley Division and the river's southern stretches, says Col. Zachary Miller, commander of the Memphis District. Feasibility studies are a first step toward recommended improvement options and funding approval for plan construction.

"We've done an incredible job over many, many decades of taming this river and making it useful for our economy for all the citizens and the farmers and the industries that work and live along the river," he said. "But that has resulted in some disconnection between the river and some of the natural habitat. About 80 percent of natural floodplain of the Mississippi River is disconnected from the river now, and while we cannot reconnect all that, we can certainly go a long way toward creating an environment that's conducive to the many plants and animals and fish that call this region home."

Funded in conjunction with major partners, both studies seek to improve critical habitat that's already home to rare or endangered aquatic life, wildlife and natural systems. The Hatchie/Loosahatchie, feasibility study is being in conducted in a cost share agreement with the Lower Mississippi River Conservation Committee (LMRCC); for the Running Reelfoot Bayou study, the Corps is partnering with the West Tennessee River Basin Authority.

Running Reelfoot

The Corps is no stranger to the 20-mile channel between Reelfoot Lake and the Lake Isom National Wildlife Refuge to the Obion River that makes up the boundaries of Running Reelfoot. The Corps 50 years ago re-engineered to control flooding in the bordering agricultural lands of the study area known as Running Reelfoot.

The original flood control project did help farmers, but as an unintended result, there was a loss of wetlands and bottomland forest, in part due to the way farms over time encroached on the channel, says Jase Ray, the study's project manager. Enlarging and deepening the channel for flood control also resulted in a loss of the stream's natural meanders, he said.

If nothing is done, the bayou will continue to degrade, habitat will not improve and downstream flooding may increase. That all threatens one of the state's most popular spots for both wildlife and vacationers. Reelfoot Lake State Park on 15,000 acre Reelfoot Lake, noted for its fishing, boating and viewing of resident bald eagles and migrating waterfowl as well as the majestic Cypress trees that rise above the water. The lake itself is considered a threatened national natural landmark; it is a natural lake formed during the 1812 New Madrid earthquakes when for a short time the Mississippi River flowed backward.

The end goal, Ray says, is to keep flooding at bay but to restore the natural ecosystem that existed prior to the flood control project.

Hatchie/Loosahatchie

This $3 million, three-year study on a 39-mile reach of the Mississippi River, beginning at the mouth of the Hatchie River and extending south to the Wolf River Harbor, is the first to be studied of the eight stretches recommended for improvement through the Lower Mississippi River Resource Assessment.

Resource managers decided to concentrate on one stretch at a time in the larger effort to improve habitat and allow people to interact recreationally on the lower river, says Marsha Raus, the original project manager. Recreation doesn't drive the improvements but can be seen as a bonus of restoration efforts, she says. On the key ecological side, study teams will likely look at restoring river species like river cane, (also known as canebrake) a type of now nearly eradicated bamboo that was once expansive in this stretch of the river and important for use as wildlife cover and erosion control. The project also will look at restoring the original structure and functions of the river—things such as side channels and other aquatic habitat, floodplain forests and now scarce communities of vegetation. The study will look at optimizing habitat, too, for the many endangered and threatened species found within its reaches.

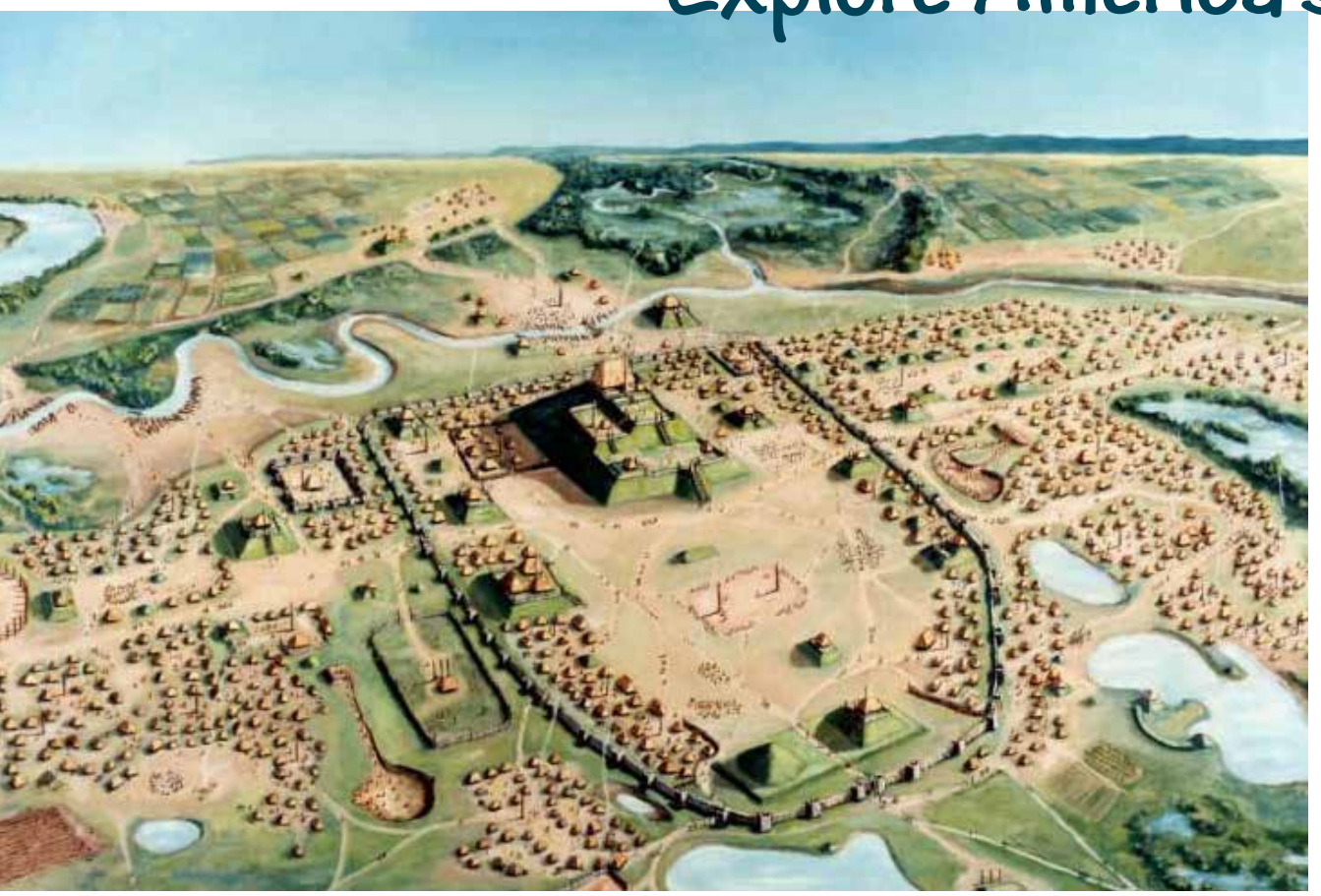
Perhaps most importantly, the study offers an opportunity to think comprehensively about lower river restoration opportunities, says Angie Rodgers, LMRCC coordinator.

"We truly believe that navigation and flood risk management can be managed in balance with ecosystem restoration on this 39 mile stretch," she said. "Since 2006, we've been conducting habitat restoration on the river in partnership with the Corps, but we've not had the capacity to manage such a large stretch." —K.S.

Two key feasibility studies are looking at options for keeping two stretches of the Mississippi River pristine. The areas already are home to mammals, turtles, bald eagles, migratory waterfowl, songbirds, endangered bats, fish and more but are at risk for further degradation.

BREWER: CHRISTIAN STEINER.

Explore America's first big city



400 years before Christopher Columbus arrived in the New World, Native Americans of the Mississippi Valley constructed one of the world's largest cities.

In the year 1000, 10 miles east of modern-day St. Louis, the city of Cahokia was home to some of North America's best farmers, thanks to the fertile soil of the Mississippi floodplain. The Cahokians were also excellent traders, bartering their corn and other products all along the Mississippi River. But they were especially famous for their earthen mounds, constructed as building platforms and burial sites.

You can still see those mounds today, including Monk's Mound, the granddaddy of them all. Monk's Mound is the largest earthworks in the Americas, covering an area equal to 10½ football fields and standing as tall as three school buses stacked end to end! To build this massive mound, ordinary Mississippians gathered straw baskets of dirt, one after another, adding to the pile day after day. If you built Monk's Mound today, a classroom of 30 students would have to fill, carry and dump eight 55-pound baskets of dirt every day. And it would take 167 years to finish!

What happened to Cahokia? Archaeologists aren't sure, but many believe that climate change destroyed the local farming culture. Whatever the cause, Cahokia was abandoned by the year 1400. But the Cahokia Mounds remain, a reminder of a great civilization that thrived on the banks of the Mississippi 1,000 years ago. CAHOKIAMOUNDS.ORG

Play your own version of America's first pastime

Tchung-kee, a Mandan Game Played with a Ring and Pole, painting by George Catlin, 1833, oil on canvas, Smithsonian American Art Museum.

Long before baseball was invented, the Native Americans of Cahokia played a game called Tchung-kee (also known as Chunkey). Grown men and athletes competed with one another for fame and prizes, and thousands of fans gathered to cheer on their favorites. Children also played Tchung-kee, practicing for the day when they might have the chance to prove their strength and skill. Although Cahokians used clay disks and spears, you can try a simpler version with a Frisbee and sticks.

HOW TO PLAY TCHUNG-KEE

1. Gather all players at one end of a field or playground. Balancing the Frisbee on its edge, one player rolls the disk away from the group. (If you don't have a Frisbee, use a ball.)
2. All players run alongside the Frisbee and toss their sticks ahead of them, aiming for the point where they believe the Frisbee will come to a rest. Cahokians often added bird feathers or streamers to their sticks to help them travel a quick and straight path.
3. The stick that lands closest to the point where the Frisbee stops earns a point.
4. Allow each player a turn to roll the Frisbee. The player to earn 20 points first wins.

My MISSISSIPPI

Morgan Gates, licensed park guide, author and owner of Haunted Vicksburg, Vicksburg, Mississippi

"I'm a retired educator from the Vicksburg-Warren School District, I have a master's degree in history and education. I love history; it's my passion. Today I'm a licensed guide at the Vicksburg National Military Park, and I lead a ghost tour called Haunted Vicksburg. A little history, a little mystery. Why not? I was born on Halloween by the way.

"Vicksburg is a great place for both. It is over 200 years old, it was the site of the most complex campaign in the Civil War, and it's located on the banks of the Mighty Mississippi. The history runs as deep and wide here as the Mississippi River itself. History gets a bad rap as a dry and boring subject full of dull facts and meaningless dates, but it's not—not if it's done right, anyway.

"So let me share a story. It is the story of a young Irish immigrant that fought with the 95th Illinois regiment. He was the smallest fellow in the regiment, but he was as tough as anyone. His small size made him an ideal scout, and he would sneak up to the Confederate line and gather information. He was captured, but his guards underestimated him and he overpowered them and escaped back to the Union lines. Many years later back in Illinois he was working for a Senator when he was accidentally hit by a car. When the doctor treated his broken leg, he discovered that Albert was really a woman whose real name was Jenny Hodgers. Perhaps we should call history His-Story, or in this case Her-Story.

"Of course, everyone loves a ghost story, and Vicksburg has all the right ingredients to make it a very haunted town: the horrible history and the raw power of the Mississippi River. People have been touched, hair has been pulled. We have a playful little girl ghost named Maggie who likes to play peek-a-boo with our guests. You don't have to believe in ghosts to enjoy my tour, but you may leave a little more convinced than when you arrived."

Say *oui* to Missouri's historic French rivertown

The Centre for Colonial Life showcases early life in this town founded by French Canadian settlers, from the unusual architecture to the frequent use of the town's logo with a French flair.

The U.S. Congress ratified the Show-Me State's statehood on August 10, 1821, making this the state's bicentennial year. But decades before Missouri became the 24th U.S. state, the little settlement of Ste. Genevieve became its first town.

French Canadian settlers founded Ste. Genevieve sometime in the 1740s in what was then French territory, and the French influence is still obvious throughout.

The Mississippi River's Le Grand Champ (the Big Field) in modern-day southeastern Missouri drew the immigrants, who raised wheat, corn, and other produce in the river's rich bottomland—facts you'll learn on a tour of Ste. Genevieve National Historic Park.

"This region was the bread basket for New Orleans, given its proximity to the Mississippi," says Claire Casey, a National Park Service ranger.

Beyond the Mississippi's value as an agricultural resource, the river naturally also served as an important means of transportation. Settlers took advantage of the fertile land along the Mississippi for agriculture. They then used the river to transport their goods to New Orleans and throughout the region.

Persistent flooding eventually caused the residents of Ste. Genevieve to relocate their town three miles inland—the devastating flood of 1785 marked a final turning point—but the streets of historic Ste. Genevieve still bear the look of a remarkably old town by Midwestern standards, lined as they are with late 18th- and early 19th-century buildings.

The Green Tree Tavern ranks as the town's oldest, dating from 1790. The former inn, tobacco store and Masonic lodge displays an excellent example of Ste. Genevieve's unique French Colonial architecture. Unlike traditional American log homes, these colonial buildings were constructed following the *poteaux-sur-sol* (post-on-sill) or *poteaux-en-terre* (post-in-earth) methods, in which logs were oriented vertically rather than horizontally and either supported on a stone sill or set directly in the earth.

The tavern also sits at a raised elevation and includes a gallery, a broad colonnaded porch that completely encircles the building. Both building features were characteristic of French Colonial architecture of the time and designed to maximize cool breezes during Missouri's hot, humid summers.

Not far from the Green Tavern sits the Amoureux House. Built in 1792, the building is named for Pélagie Amoureux, a freed African American woman who lived here with her family before and after the Civil War.

The Centre for French Colonial Life uses special exhibits and demonstrations to flesh out Ste. Genevieve's culture, one described by curators as a creole of French as well as African, Native American, Spanish, Caribbean, Canadian and German traditions. The colony's possession in the late 18th century by the Spanish and, not many years later, by the Americans surely plays a role in creating this cultural mélange. But credit is also given to the Mississippi River itself, which transported diverse cultures alongside its travelers, and left a lasting imprint on the region's cuisine, music, religious life and festivals.

Tucked between Ste. Genevieve's numerous historic buildings lie an assortment of attractive boutiques and gift shops, winery tasting rooms and coffee shops. And while you'll see restaurant menus that reflect Ste. Genevieve's cultural diversity—Cajun rice, German schnitzels, and Southern fried chicken—you won't find much traditional French food.

For that, you'll have to attend Ste. Genevieve's annual festivals, all of which feature French foods from centuries ago: La Veillée, a summer festival, featuring colonial French folk dancing, folk tales and historic home tours; Le Réveillon, with the traditional music, decorations and customs of a colonial French Christmas; and La Guiannée, a centuries-old New Year's Eve tradition reminiscent of a caroling party, and traditionally celebrated by descendants of French settlers.

Or you might just walk down the quaint old streets of Ste. Genevieve, where 275 years of history lie visible at every turn. —A.E.

For more: visitstegen.com

The Great River Road has a color tour for you

The Mississippi River celebrates "Drive the Great River Road Month" each September, encouraging road trippers to explore the waterway in autumn, when the river's lush green trees turn a dozen shades of red and yellow. But the show lingers along the Mississippi, with peak color beginning in mid-September in the North and extending into early November in the South. Pack up the car and get ready for a rainbow-colored road trip. With a fall foliage tour this long, there's a stretch at peak color whenever you can get away.

Minnesota

Twin Cities to La Crescent, 140 miles
Peak Color: Late Sept. to Mid-Oct.
The cityscape of the Twin Cities contrasts sharply with the natural beauty of the Mississippi. Visit Minneapolis' Minnehaha Falls, particularly beautiful when surrounded by brilliant hardwood trees, and St. Paul's Raspberry Island, in the middle of the river, before heading south. The Great River Road twists and turns through a spectacular show of autumn color, through small towns and forests, with plenty of scenic overlooks along the way. Must-sees include Barn Bluff in Red Wing, Frontenac State Park in Frontenac, and Great River Bluffs State Park near Winona.

Iowa

Davenport to McGregor, 160 miles
Peak Color: Mid-Oct.
The Quad Cities offer a chance to see the Mississippi's fall beauty from the water, on board themed river cruises, before driving the Great River Road north to Dubuque. There, Iowa's longest-running farmers market sells fall goodies like apples, pears and cider, and Dubuque's Riverwalk leads through a vibrant riverside canopy of trees. The road trip ends at Pike's Peak State Park near McGregor. One of Iowa's most photographed destinations, the park overlooks the Mississippi from a 500-foot bluff, especially striking in autumn.

Tennessee

Memphis to Tiptonville, 130 miles
Peak Color: Mid- to Late-Oct.
Board a riverboat, hop on a public bike, paddle a kayak or just walk along the water at Memphis' urban river parks, including Tom Lee, Mud Island and Chickasaw Heritage Parks. The Great River Road leads upriver from Memphis to Fort Pillow State Historic Park, where piles of colorful leaves litter the trails and the Mississippi sparkles between the trees. Along the walk, look for fortifications from Fort Pillow's Civil War times. The Tennessee color tour ends in Tiptonville and Reelfoot Lake State Park, popular for its fishing and boating. Reelfoot Lake is a remnant of the Mississippi itself, when a series of earthquakes temporarily diverted the river in 1811–12.

More ideas: experiencemississippiriver.com

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Draft Report Recommends Disposal of Upper Saint Anthony Falls Lock and Dam

In its draft disposition study for the Upper Saint Anthony lock and dam, the U.S. Army Corps of Engineers (Corps) recommends a tentatively selected alternative that the Corps step away from any ownership of the facilities and that it offers a cash incentive to the new owner to offset maintenance costs.

Release of the draft report and subsequent 60-day public comment period are the latest steps in a process that began when navigation at Upper Saint Anthony Falls stopped in 2015 with the Congressionally mandated closure of the locks to prevent the spread of invasive carp. The cessation of navigation ended the Corps' original, primary mission at the site.

Nan Bischoff, project manager, and her planning team have been working through the more than 110 letters received during the public comment period. Responses came from a variety of river advocacy groups, neighborhood associations, tribal communities and more. Few public comments supported the Corps' likely recommendation of disposition. That means that while the Corps' likely recommendation of disposition is in the best interest of the federal government, she says, it will not be a popular decision.

The ultimate resolution of what happens at Saint Anthony Falls lies with Congress which decides whether or not to act on the report's recommendation. The required disposition study for Lower Saint Anthony Falls and Lock and Dam 1 will not start until after the Upper Saint Anthony Falls study is done. —D.D.

Fishing line litter can be deadly to wildlife

The Riverlands Migratory Bird Sanctuary, managed by the U.S. Army Corps of Engineers in West Alton, Missouri, has seen more than 100,000 additional visitors in the past year, bringing both opportunity and challenges.

Many of the new visitors have come looking for fishing experiences, including many new to the sport. That has contributed to a considerable increase in fishing line discarded along the sanctuary shores.

This particular type of litter isn't just unsightly; it's deadly. Wildlife that gets tangled in the line is more at the mercy of predators and often unable to find food. Additionally, lead weights used to sink fishing line has also become ingested and can cause poisoning.

The U.S. Army Corps of Engineers, in part through a grant awarded to the Mississippi River Water Trail Association from the National Environmental Education Foundation, has established fishing line receptacles around Riverlands. Use them—or make your own.

HOW TO BUILD
tinyurl.com/555fv8kz

HOW TO RECYCLE
tinyurl.com/5b3nazmt

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Our Mississippi

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