

OXBOW

RESTORATION TOOLKIT



The creation of this toolkit was funded by the Resource Enhancement and Protection Conservation Education Program (REAP CEP). The toolkit and its creators do not guarantee the 'success' of restoration projects and are in no way liable for any projects created by using this toolkit. We assume users have background education in a natural resources management field, experience implementing restoration projects, will seek technical assistance when questions or uncertainty arises, and will implement oxbow restorations to address specific resource concerns or conservation objectives. Although the toolkit offers best practices for oxbow restorations, information is subject to change – make sure to check for up-to-date standards, permits, and practices. Please also reach out to the developers to provide feedback and ideas for improvement during future updates.



Research Center for Farming Innovation



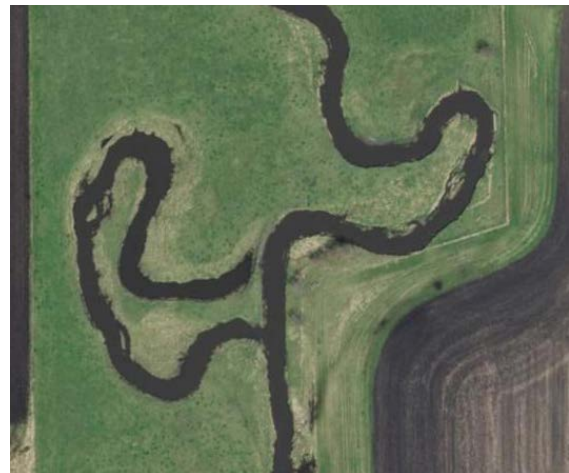
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INTRODUCTION

Rivers are dynamic landscape features that change course over time, naturally and as a result of human influences, resulting in river meanders cut-off from stream channel. These cut off river meanders, known as 'oxbows' are usually 'U' shaped and generally are in greater abundance in downstream reaches. Using the tools and procedures referenced in this toolkit, we estimate some individual prairie streams have more than 400 oxbows of varying size and condition, so it's conceivable there are tens of thousands of oxbows across Iowa's landscape. However, that doesn't mean that all oxbows need to be restored. Oxbows naturally fill in with sediment from runoff and stream erosion, evolving from oxbow 'lakes' to oxbow 'wetlands' to barely detectable 'scars'. They are, in fact, nature's natural sediment collection basins within river floodplains and the Iowa DNR estimates "Approximately 40,000 acres of river oxbows and overflow wetlands are associated with Iowa streams." However, oxbow formation and sedimentation is believed to have accelerated since European settlement due to runoff from agricultural fields, drainage improvements (e.g., channelization, dredging, tiling, etc.), and development (e.g., building and maintaining roads and infrastructure, etc.). As sediment (also known as post-settlement alluvium) is deposited in oxbows, floodwater retention decreases, water quality benefits can be lost, and fish and wildlife habitat can be degraded. Fortunately, this means there is a great opportunity to restore oxbows when the goal is to increase floodwater storage, improve fish and wildlife habitat, and/or improve water quality. Indeed, restored oxbows are now being recognized for their broad, multiple benefits as indicated by the addition of oxbow restoration as a practice in the Iowa Nutrient Reduction Strategy (on average, restored oxbows achieve >40% nitrate reduction). As an added benefit, oxbow restorations are relatively easy to plan and implement compared to other conservation practices.

Oxbow 'restoration' consists of removing post-settlement alluvium (aka sediment deposited since European settlement) from an oxbow scar to return the oxbow to its original or enhanced condition and results in improved aquatic resource functions. Oxbow 'creation' occurs when an area is



NATURALLY FORMED OXBOW



ARTIFICIALLY CREATED OXBOWS

excavated to create an oxbow-like habitat where there is no historical evidence of a meander. This toolkit is not intended to be a guide for oxbow creations. The purpose of this toolkit is to provide conservation service providers (CSP's) with all the tools, resources, and knowledge needed to complete an oxbow restoration from start to finish to increase the implementation of oxbow restorations as a multi-purpose practice in Iowa and beyond. This toolkit is meant to function as a step-by-step guide. Although the toolkit offers best practices for oxbow restorations, information is subject to change – make sure to check for up-to-date standards, permits, and practices.

OXBOW RESTORATION PROCESS



DEVELOPER CONTACT INFORMATION

The Nature Conservancy – Iowa Freshwater Specialist

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Iowa Department of Agriculture and Land Stewardship – Division of Soil Conservation & Water Quality

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Iowa Soybean Association - Research Center for Farming Innovation

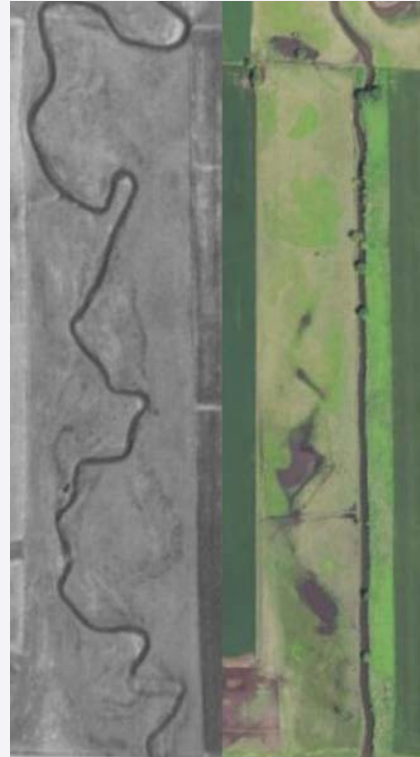
1255 SW Prairie Trail Pkwy, Ankeny, IA 50023 • 515.251.8640

STEP 1: MAPPING AND ID

Summary: Finding potential oxbow restoration sites is the first step in the restoration process. Being able to identify and map priority areas or possible locations gives you the ability to target your outreach program and more efficiently manage your time. Understanding how oxbows are created will help you refine your eye when searching for them on the landscape. Oxbows can be created by streams moving through the landscape and cutting off meanders or by human alterations of the stream (e.g. stream straightening, levees, and creation of roads). There may be opportunities to “create” oxbows where historic oxbows are not present, however this toolkit focuses on identifying, restoring, and/or enhancing existing oxbows.

The most accurate way to map potential oxbow restoration sites is to compare current and historic aerial imagery maps (e.g. 1930’s – present) to locate areas where the river has changed or cut off meanders¹; however, these maps may not show oxbows that were created prior to available aerial imagery. Using GIS layers like lidar and 2’ contours gives you the opportunity to search for depressions along stream corridors and their floodplains that may not be visible from imagery; however, these maps may miss oxbows that are currently completely filled in with sediment². Therefore, it’s best to use a combination of spatial data (aerial, lidar, and contour layers) to search for and identify oxbows.

An oxbow mapping tool, created by Iowa State University, can be used if your watershed already has Agriculture Conservation Planning Framework (ACPF) modeling data^{3,4}. One thing to note is this tool is not 100% accurate and has its limitations, so using both methods to ID potential sites is recommended.



**THE SAME STREAM IN
THE 1930S VS. PRESENT**



**MAPPED POTENTIAL
OXBOWS**

Checklist:

- Identify potential restoration sites using GIS, current and historic aerial imagery, LiDAR, and/or the National Wetland Inventory “wetland mapper”⁵.
- Place a point or polygon where you find potential sites.
- Overlay county parcel information to collect landowner information⁶.
- Identify possible reference sites that you may want and be able to visit during your Site Visit.

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STEP 1: MAPPING AND ID

Include details about the site in your attributes table such as:

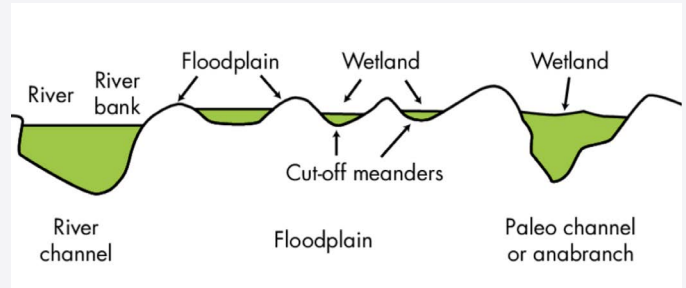
Location (latitude, longitude, legal description, etc.)

Landowner name and contact information

Size of potential restoration (acres, length, width)

Prioritization or ranking:

- Located in a priority watershed
- Proximity to threatened/endangered species or species of greatest conservation need that would benefit from oxbow restoration
- Potential stability of site based on its location relative to the current stream channel, floodway, and adjacent runoff (e.g., oxbows on inside bends have less risk of leading to channel changes)
- Past, future, and current landuse (crop, grazed, idle, etc.)
- Evidence of oxbow not holding water in average and dry years (less/no water may indicate greater need for restoration)
- Number of trees that need to be removed (tree removal greatly adds to cost of restoration)
- Evidence or suspicion of tile or culvert outlets (may indicate opportunity to achieve water quality benefits and/or additional challenges of working at a particular site)
- Amount of sediment deposited in oxbow (see survey; substantial sediment equates to greater opportunity to improve floodwater storage, increase water residence time and thereby improve water quality post-restoration).
- Current oxbow function within the landscape context (e.g., prioritize restoring oxbows that are most degraded based on current function/habitat vs. desired function/habitat vs. Reference site function/habitat)
- Landowner wildlife observations and/or survey information on the quality of vegetation, wildlife, and function (note: an "oxbow quality index" tool is being developed that could help assess oxbow quality, especially those restored to benefit Topeka shiner) ⁷.



Resources:

Historic aerial imagery and other GIS files and tools ^{1, 2, 8, 9, 10}

Oxbow Mapping Tool and User Guide ³

County parcel data ⁶

Landowner contact information ^{11, 12}

NRCS Engineering tools ¹³

STEP 2:

LANDOWNER OUTREACH

Summary: Landowner outreach is essential for cultivating landowner interest in restoring degraded oxbows. Most landowners will likely not know they have an oxbow on their property, let alone what an oxbow is or if it's restorable. There are many different tools to raise awareness of the benefits of restored oxbows depending on your intended audience. Messaging should focus on the multiple benefits that restored oxbows can provide for water quality, floodwater storage, wildlife habitat, livestock, improved aesthetics, and for increasing the conservation value of the land. The list and examples below are intended to give you an idea of the types of outreach techniques that have proven to be successful. Please feel free to use the examples below in your own outreach efforts or personalize them to your own projects.



Checklist:

Invite the landowner to join you to the potential restoration site to talk through all options and their interests.

Be prepared to answer FAQ's (see Learning) about oxbows and what Funding exists.

Outreach targeted to landowners with potential oxbows:

- Personalized letter ¹⁴
- Generic letter ¹⁵
- Phone calls
- One-on-one meetings at the site or your office

Outreach for the general public:

- Field days
- Presentations at meetings or conferences ^{16, 17}
- Brochure ¹⁸
- Newspaper articles ¹⁹
- Websites and social media ^{20, 21}
- Share resources with partner organizations who can help promote (ag retailers, ISU extension, NRCS, etc.)

STEP 3: SITE VISIT

Summary: If a potential oxbow restoration has been identified and the landowner has expressed an interest in restoration, you are ready for a site visit. Ensure you have permission to visit the site from the landowner and tenant, and invite them to meet you at the site to discuss options. The purpose of the site visit is to gather information about the site, oxbow, and landowner. Information gathered will help you evaluate if a project is feasible and will meet the objectives of the landowner, address resource concerns, fulfill funding source requirements, and determine permit requirements. Site visits will also give you information to prepare for survey, design, and permits. This might require multiple visits depending on schedules, timelines, time of year, etc.



The visit can be broken down into two main parts:

- 1) Prepare maps that will be useful for understanding the site and preparing for survey and design.
- 2) Discussion with landowner to establish their short- and long-term goals for the oxbow and property, expectations, resource concerns, and site history.

Checklist:

- 1) Prepare maps that will be useful for understanding the site:

A zoomed in Project Map to provide location and details of the oxbow and surrounding area. In addition to aerial satellite imagery, also consider incorporating other layers into you maps including floodplains, elevation information (Lidar or contours), national wetlands inventory, tile and drainage infrastructure, and soils ^{1,2,5}. Maps should be used in the field to help identify:

Exact location of the oxbow

Tile and drainage infrastructure

Stability of the site

Sensitive areas or species

Potential stream connections to the oxbow

Tree removal areas and where to dispose of them

Potential excavated spoil storage areas

Hydrology inputs and outputs

A general Site Map to provide a general overview of how the oxbow project fits in with the landscape and farming operations. Maps should be used in the field to identify:

- Property boundaries
- Potential heavy equipment access points and drives to oxbow and spoil sites
- Potential spoil storage areas

CONTINUED

STEP 3: **SITE VISIT**

2) Information to collect from landowner:

What is the current and future land use?

What are the landowner's goals for the property and does oxbow restoration fit into those long-term goals?

Does landowner have sole authority to make land management decisions? If not, who else do we need to be talking to?

Where should excavated spoils be placed?

Does oxbow hold water year-round? Does it freeze solid to the bottom annually or dry out annually? Can fish survive year-round? How frequently does it flood (ask landowner and/or use Iowa Flood Risk Map to predict)²²?

What features or benefits would the landowner like to have? Recreation, water quality improvement, habitat benefits, livestock watering source, etc.?

Where are the nearby tile drainage lines? Are there opportunities to intercept tile drainage? Are there tile maps? How deep are the lines?

How large should we consider the restoration? Restore the whole length of the oxbow or consider restoring only a portion of it for logistical, function, or funding reasons?

Any priority species that need to be considered (e.g., Topeka Shiner, Northern long-eared bat, etc.)?

Are any oxbow restoration activities on land that is currently enrolled in a conservation program or Right-of-Way? If so, contact lead agency to ensure activities are allowable.



STEP 4: FUNDING

Summary: It is important to consider funding opportunities when planning an oxbow restoration project because oxbow restoration costs can vary greatly by location, watershed, and design. Providing information on cost-share opportunities to the landowner is a key component to consider in the conservation planning process. Each funding source will have its own set of requirements, so it is important to identify which funding source will be utilized early in the process. The funding source(s) used may also influence design and permits.

Fortunately, there are many state, federal, and private programs that provide funding for oxbow restorations. Program eligibility can vary due to geographic location, area resource concerns, presence of watershed projects, etc. As conservation professionals, it is our responsibility to work with the landowner to determine their goals, evaluate resource concerns, determine program eligibility, and present the landowner with funding opportunities. In many cases, it is possible to leverage multiple funding sources for a single project/landowner, but always verify program eligibility with the lead agency.

Please note that if federal funding is associated with the design, land acquisition, or construction, the site cannot be used for any mitigation.



BEFORE



AFTER

Checklist:

Meet with landowner to evaluate site and discuss goals (see site visit).

Evaluate program eligibility (see list below) for the site.

Provide landowner with conceptual Design and potential funding opportunities.

Depending on the program, consider requesting the landowner fill out a cost-share application, and discuss associated maintenance agreements and contracts.

Encourage communication with appropriate agency/agencies to ensure all Permitting, planning, Design, and construction phases are completed in the necessary order to meet eligibility requirements.

STEP 4: FUNDING

Resources:

Natural Resources Conservation Service (NRCS)

- Environmental Quality Incentives Program (EQIP) – multiple practices including 657 Wetland Restoration ²⁵
- Mississippi River Basin Initiative (MRBI) – uses EQIP rates ²⁶
- Regional Conservation Partnership Program (RCPP) – uses EQIP rates ²⁷
- Agricultural Conservation Easement Program (ACEP) – Wetland Reserve Easement (WRE) ²⁸
- Emergency Watershed Protection Program – Floodplain Easements (EWP-FPE) ²⁹

Farm Service Agency (FSA)

- Conservation Reserve Program – CP23 Wetland Restoration ³⁰

U.S. Fish and Wildlife Service (USFWS)

- Partners for Fish and Wildlife Program – Up to 100% for oxbow restoration in priority reaches; can be combined with cost-share from most organizations, except for mitigation projects ³¹

U.S. Army Corps of Engineers (USACE)

- Section 206 ³²
- Stream Mitigation ³³

Iowa Department of Agriculture and Land Stewardship (IDALS)

- Water Quality Initiative (WQI) - Multi-purpose oxbow (tile-drained) – 50% construction and materials cost ³⁴
- Urban Water Quality Initiative (WQI) projects – 50% construction and materials cost ³⁴

Iowa Department of Natural Resources (DNR)

- State Revolving Fund ³⁵
- Resource Enhancement and Protection (REAP) ³⁶
- Local Water Protection – Low interest loan
- General Non-Point Source – Low interest loan
- Sponsored Projects
- Fish Habitat Program ³⁷

*Private or local cost-share funding sources
(check with your local NRCS or SWCD office)*



STEP 5: SURVEY

Summary: The purpose of the site survey is to collect precise elevation data to create a technically- and biologically- sound design. Elevation data is also essential to calculate accurate quantities of soil to be removed and volume of oxbow pool which are important components of design, permits, and contractor and landowner agreements. A site survey form and map should be created prior to the survey to identify required data to be collected. Doing so maximizes the efficiency of the on-site survey and ensures important elevation data are captured. It is also important to establish permanent photo points during the initial site survey. Photos are useful to reference when creating the design and can also be included with Permitting documents and reporting requirements, as well as pre- and post- monitoring efforts.

The two most common methods for surveying an oxbow are a point survey or a continuous topographic survey. Survey is usually completed using a survey-transit (grade rod and laser), total station (e.g. Trimble S6), or survey-grade GPS equipment (e.g., Trimble R12); the choice may be influenced by what's available and/or site topography and canopy cover. Semi-permanent or temporary benchmarks should be established and marked prior to implementing the site survey for future reference and evaluation of site conditions post-construction. Review and follow existing survey and design standards (as applicable) whenever possible prior to conducting a site survey. It may be helpful to upload a preliminary design sketch from GIS into GPS or ArcCollector to help you identify the oxbow extents while in the field.



Below is a list of elevation data that should be collected during the survey:

Semi-permanent benchmark (e.g. rebar pin with cap)

Temporary benchmarks (e.g. wooden hub)

A cross section at each substantial change in topography, or at least every 100 ft in the area of the oxbow

An oxbow centerline profile

Adjacent stream elevations, ideally taken near the downstream connection of oxbow:

- water elevation (note what stage the stream is at – high, normal, or low flow)
- stream bed elevation (at the thalweg or flow centerline and ideally on gravel, not sand/silt)
- stream top width (top of bank) and bottom width (toe of bank)

Elevation of drain tile, culvert, roads or berms that may influence the oxbow or vice versa

Spoil placement location (consider floodplain location and vegetation type)

Bankfull elevation and Base Flood Elevation (can be requested from IDNR via PERMT)

Soil cores of bed of oxbow to verify depth of historic stream bed (i.e. depth to dig)

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STEP 5: SURVEY

Checklist:

Site map(s) depicting required survey point locations (See example Site Survey Form in Resources section), important landscape features, and proposed photo point locations

Surveyor's notebook (optional; can log elevation data in survey-grade equipment and/or on-site survey map instead)

Survey equipment (survey transit, total station, and/or survey-grade GPS equipment)

Sufficient elevation data to create the design (See list above)

Resources:

*NRCS Engineering Field Handbook
Chapter 1 – Surveying*³⁸

*Topo Survey with Trimble R8 and import
data for use in ArcGIS*³⁹

*Intro to Wetland Restoration and basic
laser level surveys*⁴⁰

*Tutorials and resources on survey and
design*^{41, 17}

*Example Survey*⁴²



STEP 6:

DESIGN

Summary: The design of an oxbow restoration should correspond to the primary goals of the project (e.g., water quality, fisheries – such as an emphasis on quality Topeka shiner habitat, waterfowl or other wildlife habitat, floodwater storage, etc.) and should result in habitat that is similar to intact oxbow/riparian habitat (i.e. ecological reference), ideally within the same watershed. Work with the landowner to determine the most important goals and state the goals as specifically as possible in the project documents (e.g., contractor and landowner agreements, designs, permits, etc.). Other important considerations to developing a technically- and biologically- sound design are historic (ideally 1930s), current, and future oxbow/riparian habitat function, condition, and land-use (view as a continuum/trajectory). Your prior landowner outreach, site visit, and survey should all inform the design.

In Iowa, oxbow restoration design should follow existing conservation practice standards, such as the NRCS Wetland Restoration (Practice Code 657) standard⁴³. Post-restoration seeding of native species should also be completed in all disturbed areas and/or spoil areas and can follow the NRCS Critical Area Planting (Practice Code 342) standard (44) whenever possible and appropriate. Pollinator plantings should be considered when possible. If a connection channel will be constructed and/or tree clearing will be required, follow the NRCS Grade Stabilization Structure (Practice Code 410) and NRCS Land Clearing (Practice Code 460) standards, respectively. In Iowa, meeting or exceeding NRCS standards will fast-track floodplain Permitting^{45, 46}. If you are planning to restore an oxbow within the range of Topeka shiner, click “Read More” below for additional design requirements and enhancements (note: also see permitting)⁴⁷.”

The complexity of an oxbow restoration design will vary on a site-by-site basis and will depend on the goals of the project.

Best practice recommendations are as follows:

Depth: In general, most oxbows should be dug to the historic stream gravel-bed elevation, which can be found through soil cores and through survey elevation data from the current adjacent stream. Enhancing for depth variability and uneven bottoms will diversify habitat (including the vegetation community and structure) for fish and wildlife.

Width: The width and length of the oxbow should follow the historic shape and size based on what remains of the oxbow in current topography or from historic aerial photos. It is recommended to dig the oxbow from one side, to minimize bank disturbance. Restored bank width may need to be expanded from historic bank width to account for more gentle slopes and incised streams.

Connection: Determine how active the floodplain is, how frequently the oxbow may connect with the stream, and if a connection channel, on the downstream end of the oxbow, needs to be created or modified to accomplish the oxbow restoration goals⁵¹. If a sufficient natural connection exists between the stream and the oxbow, on the downstream end of the oxbow, then likely no alterations will need to be made to the connection during restoration.

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STEP 6: DESIGN

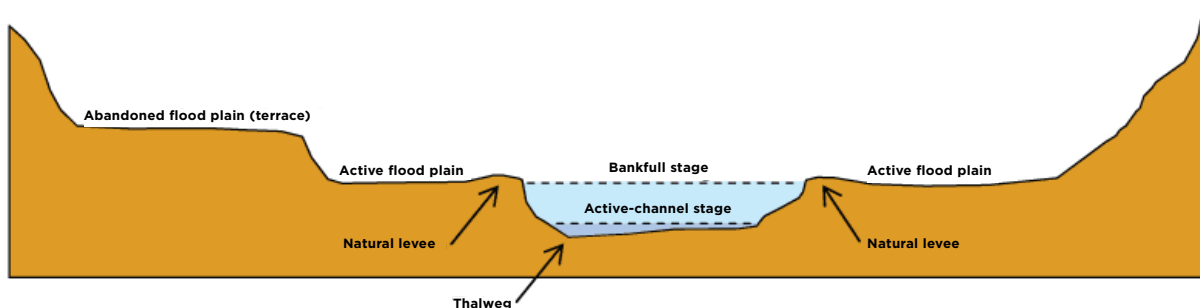
Tile: To maximize water quality and quantity benefits, it is recommended to intercept subsurface tile into restored oxbows whenever possible. However, it is not recommended to intercept the outlets from other conservation practices such as bioreactors.

Seeding: Native grasses and forbs should be seeded after restoration to benefit wildlife and stabilize the banks of the oxbow. A quick growing nurse cover crop should be seeded with the native seed to quickly stabilize the banks and prevent sediment erosion into the oxbow.

Trees: Consider restoration goals and resource concerns (e.g., was the site treeless historically, are anoxic events from decaying leaf litter going to negatively affect target aquatic species, are there high quality trees to preserve, etc.), equipment access, and costs in determining if tree removal is necessary and how many trees to remove. Also consider if felled trees could be placed in the oxbow to achieve in-water structure or other wildlife habitat goals (e.g., turtle basking habitat; note: placing woody debris in oxbows make post-restoration fish sampling more difficult and may require additional design consideration such as the need for anchoring).

Designs should, at a minimum, include all elements requested in the floodplain application⁵².

- Plan view of project area (view looking down on the project)
- At least 1 cross-section showing current and proposed elevations and slopes
- 1 profile (side) view showing current and proposed elevations (optional)
- Proposed spoil placement locations
- Quantity estimate for soil removal
- Equipment access routes and staging areas
- Elevations of other relevant features (e.g. tile, culverts, road, berms, etc.)
- Connection channel dimensions
- Location and dimensions of armored or grass spillway to prevent erosion
- Tree clearing and pile locations
- Re-seeding instructions
- Relevant construction and material specifications
- Relevant notes
- Photos of current site conditions and reference site (optional)
- Iowa One Call contact information to locate underground lines before you dig



CONTINUED

STEP 6: DESIGN

Checklist:

- Specifically identified and documented landowner and program goals
- Reviewed and incorporated site survey data (as appropriate)
- Reviewed and incorporated NRCS standards (as appropriate)
- Submitted preliminary design to an engineer for review (if required by funding source)
- Engineer reviewed and/or certified ("stamped") design (if required)
- Selected a native seed mix suitable for the site and compatible with the project goals

Resources:

*Oxbow Design Template - Fillable PDF and DWG*⁵³

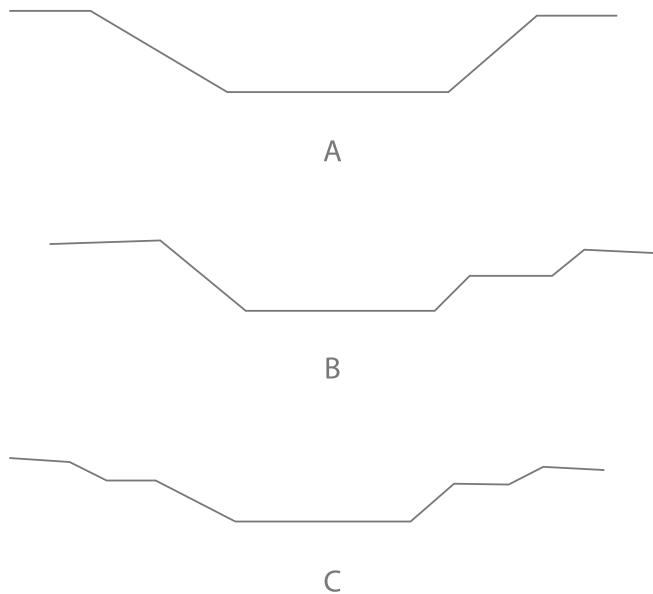
*NRCS Oxbow Standard Drawing*⁵⁴

*Iowa DNR River Restoration Toolbox – Practice Guide 4 - Oxbow*⁵⁵

*Connection Channel Design Example*⁵¹

*Iowa Riverside Plant Selection Tool*⁵⁶

Cross-Section Examples



STEP 7:

CONTRACTS AND LANDOWNER AGREEMENTS

Summary: Contracts and/or landowner agreements are necessary documents whenever funding and/or technical assistance are provided to implement an oxbow restoration, and they should clearly articulate expectations (including maintenance), cost-share allocations, and duration.

Whether it be federal, state, non-profit or other local sources of cost-share funding, the respective agency, company or partnership will likely want the oxbow restoration project to function as long as possible. In a majority of available programs the landowner maintains ownership of the property and therefore may have some maintenance responsibilities.

Terms of contracts and agreements will vary in scope from agency to agency and are an important topic of discussion early in the conservation planning process. It is imperative that the landowner understands their roles and responsibilities in making sure the oxbow will continue to serve as a successful conservation project for years to come.

As conservation professionals, it is our responsibility to ensure the landowner understands the details of the agreements but also to reassure them that conservation professionals are available to answer any questions or concerns they may have with the project during and following restoration.



BEFORE



AFTER

Checklist:

- Provide information on associated contracts, maintenance requirements, and landowner agreements.
- Provide landowner with a draft or example contract/agreement language for review by himself/herself, family, attorneys, accountants, etc.
- Landowner(s) signs necessary paperwork
- Documents are uploaded, recorded, copied, etc. to the official award/project file

STEP 8:

PERMITS

Summary: A variety of Federal, State, and local permits may be required to restore an oxbow to ensure project activities and effects are documented, negative effects to land, infrastructure, and wildlife are minimized, and regulatory requirements are met. In Iowa, “construction, excavation or filling in streams, lakes, wetlands, or on the flood plains may require permits from both the USACE and Iowa DNR”⁵⁷. Following established practice standards as applicable (e.g., NRCS, USFWS, IDALS, etc.; see design), established agency-specific procedures for permitting, and developing a formal Landowner Agreement will streamline the permitting process. However, permitting for projects in a floodplain can be complex and applications often require multiple levels of governmental review. There are also many different types of permits that correspond to different impacts (floodplain construction, threatened and endangered species, storm water, etc.). Although it’s up to the landowner (and their authorized representative) to ensure all required Federal, state, and local permits are obtained, regulatory agencies are willing to provide guidance to help landowners and CSP’s understand and meet applicable rules.

In Iowa, it is most effective and efficient to use the online PERMT system to determine if floodplain permits may be needed and, if so, to apply for permits by submitting a Joint Application (also known as ‘Protecting Iowa Waters’ form)⁵⁸. By submitting a Joint Application using PERMT, the applicant is able to submit project information simultaneously to:

A) the USACE for review under Section 404 of the Clean Water Act (including compliance with other federal laws such as the Endangered Species Act for projects in the vicinity of federally-listed T&E species and the National Historic Preservation Act for projects that could affect Historic Properties, etc.) and,

B) the Iowa DNR Sovereign Lands Program for both Environmental Review (including state-listed T&E species impacts) and review of Sovereign Lands permitting criteria⁵⁹, and

C) the Iowa DNR Flood Plain and Dam Safety Section for review under state flood plain management and dam safety rules regarding construction and permitting criteria⁶⁰.

Additionally, projects that propose to disturb more than 1 acre of ground may require a separate application for a storm water permit from the Iowa DNR’s Storm Water Program⁶¹.

Best Practices:

1. Submit a Joint Application through PERMT after reading the Joint Application FAQs at the bottom of the PERMT website⁵⁸. It can take up to 120 days to receive permits after all required documentation is received by an authorizing agency.

2. Document permit conversations and decisions (written and oral) in the project file and know who to contact if project circumstances change before or during project implementation. Permits are required if a project may affect a listed species or its habitat, even if a project is funded privately. Always request an Environmental Review from Iowa DNR and contact USFWS if the Information for Planning and Consultation (IPAC) results indicate federal trust resources may be affected.

3. Contact the regulatory agencies if you have questions about any permitting requirements.

CONTINUED

STEP 8: PERMITS

Checklist (Note: it is up to the landowner and CSP to determine if AND which permits are required; the following list may or may not be inclusive and is subject to change):

Determined if federal, state, or local floodplain permit(s) may be needed using the online PERMT system⁵⁸.

Exemptions⁵².

Submitted Joint Application (using PERMT), or contacted the appropriate agencies, IF a Federal, State, or local permit may be required⁵⁸.

Note: Procedures for review of applications⁶³

Note: USACE's Nationwide or Regional Permits⁶⁴

Note: Federally Funded and/or Authorized (e.g., USACE and/or USFWS permits are required) Projects

Completed all Section 7 steps⁶⁸; following agency specific procedures, if available

Note: Privately-Funded Projects.

Determined if a local (county or city) permit is needed.

Received and reviewed all required permits, including terms, conditions, and reporting requirements before restoration activities begin.

CONTINUED

STEP 8: PERMITS

Know who to contact if unexpected situations are encountered (e.g., cultural resource unearthed, oxbow connects to stream during excavation allowing fish to enter the excavation area that need to be removed by a fisheries biologist, significant alteration needs to be made to the design during excavation, etc.)

Completed all applicable post-construction reporting requirements

Resources:

*Example Reporting and Pre-Construction Notification Letter (can be submitted with Joint Application or directly to USACE and/or IA DNR)*⁶⁹

*Certificate of Completion Example (Note: Using the "Notification of Completion" function in Iowa DNR's online PERMT tool does not notify USACE of project completion; a separate form included in your permit needs to be submitted to iowaregulatory@usace.army.mil, if applicable)*⁷⁰.

*Iowa DOT BMPs*⁷¹

*State Historic Preservation Office*⁷²

*What is the Difference Between Floodplain and Floodway*⁷³

Regulatory Contact Information:

Iowa DNR Floodplain and Dam Safety: floodplain-help@dnr.iowa.gov

Iowa DNR Storm Water Program: 515.725.3403

USACE: iowaregulatory@usace.army.mil

USFWS Illinois-Iowa Field Office: rockisland@fws.gov

STEP 9: CONTRACTORS

Summary: In most cases, the conservation service provider (CSP) or the landowner will need to hire a contractor to dig the oxbow, remove trees, and re-seed any disturbed areas. Typically, a contractor will need to have access to and be able to operate a long-reach excavator, dump truck, bulldozer, and/or other heavy equipment necessary for restoration. Contractors should be licensed and have experience with land improvement or wetland restoration projects, and the CSP and/or landowner should be onsite during construction to answer questions that arise and ensure design plans are followed. Depending on your funding source, you may need to complete a competitive bid process (3 or more bids is best as bids vary greatly based on contractor experience, and how busy and challenging they anticipate the work to be). When possible, advertise the project as broadly as you can, making sure to include minority, women, and small local businesses. Know the average cost (per cubic yard) for excavation projects in your area for similar types of projects (e.g. wetland restoration) so you know if the bids are acceptable and reasonable. Site conditions, geography, and logistics (especially spoil placement distance and tree removal) vary site-by-site and can greatly impact the actual cost of restoration.



Checklist:

Compile contractor packet complete with restoration designs, oxbow location, estimates of cubic yards to be removed, and number/size of trees to be removed. Make sure to inform contractors that working conditions may be wet and muddy. Be very clear on your expectations of the contractor, when you expect work to be completed, and if there are times the work can NOT be completed (e.g., to avoid impacts to state- and/or federally-listed species). Contractors will likely need to wait for excavated spoil to dry before final grading.

Compile a list of local contractors who are interested in being considered for oxbow restorations. Local NRCS offices usually have a contractor list that can be shared. Make sure to include minority and women contractors and small local businesses^{74,75}.

Advertise the project to local contractor lists, in newspapers, etc. to get competitive bids.

Select a qualified and reasonably priced contractor, and let other contractors know they were not selected.

Sign a Contract with selected contractor to set the cost and terms of the project.

STEP 10: PROJECT MANAGEMENT

Summary: Active project management is important to make sure your project is completed as designed in a timely manner. Oxbow restorations are relatively new practices to many contractors so their familiarity could be limited. Creating clear and precise guidelines for the contractor ensures an effective restoration. Communication is key when it comes to project management; frequent site visits and phone calls are needed. Keeping all parties informed and up to date on the status of the project will create a smoother restoration process. Restoration meetings should be held before, during, and at completion of the projects. These meetings should include project managers, contractors, landowners, tenants, and all other parties involved.



Checklist:

Outline restoration and spoil area with markers or flags.

Setup photo point/game camera locations for pre- and post- monitoring and reporting (if applicable; optional).

Conduct initial pre-restoration meeting. Review designs with all parties and confirm design components.

Breaking ground – Be onsite when contractor begins restoration to ensure they understand design components and target depths.

Conduct progress site visits to ensure restoration is on track and following design specifications. Document visit dates, conversations, and status of project. Be ready to solve problems that arise (see Learning).

Conduct second restoration meeting to make sure all parties are still in agreement (optional).

Continue progress site visits to ensure restoration is on track and following designs.

Hold final post-restoration meeting at completion of project, review restoration to make sure it matches designs and guidelines, and ensure all parties are satisfied with the project.

Complete a certification of completion document with all parties and complete permit reporting (see Permitting section), if required.

Create and execute a management plan with the landowner or operator.

Ensure the landowner and tenant are involved throughout the restoration process and that their concerns are addressed along the way.

Resources:

*Project Plan Example*⁷⁶

STEP 11: MONITORING

Summary: Every oxbow restoration is different, so don't be surprised to learn something new with every restoration. Additionally, monitoring (e.g., project process, fish, wildlife, revegetation, water quality, etc.) should occur to verify the restoration goals have been achieved, fulfill reporting requirements (if required), and/or create outreach tools. Included below is a list of some lessons learned by conservation professionals across Iowa.



Checklist:

Return to the site in the following year(s) to monitor and evaluate the condition of the restored oxbow and determine if the goals have been achieved.

Keep notes of lessons learned and share them with others implementing oxbow projects.



Resources:

Fish and Water Quality Monitoring^{77, 78}

*Water Quality Research*⁷⁹

*Before-After Photo Monitoring Template*⁸⁰

*Bird Monitoring*⁸¹

*Prairie Reconstruction Initiative Monitoring Protocol*⁸²

LESSONS LEARNED

- Be prepared for last minute changes. Try your best to be specific in your contract with landowners and contractors and get any amendments in writing. For example, the tenant may verbally agree to spread the stockpiled soil in the adjacent farm field after restoration but may change their mind when they realize it's more work than planned for, leaving you to have to hire another contractor to spread the soil last minute or to find another spoil placement location. Make sure any revisions to soil placement locations are consistent with all permit terms and conditions.
- There is often a very short window for restoring oxbows. Excavated soil will likely be placed in an adjacent farm field, meaning many oxbows can only be excavated between cash crop harvest and planting. Contractors are often busy with more profitable projects during the fall and many don't like to work in the winter because frozen ground is hard on equipment. The project timeframe is also limited by waiting for the right weather conditions; too much snow will make it hard to see the topography and spring floods may leave the site too wet to work in. It may feel as though you are just waiting and waiting for the right conditions. To the extent possible, plan (funding, permits, etc.) for a broad timeline (2-3 years) to complete the project.
- Obtain all required permits (Federal, State, and Local), know the 'terms and conditions' of each permit (e.g., if the oxbow must be completely dry or frozen to the bottom before excavation can begin to minimize adverse effects to federal- and state-listed species such as Topeka shiner), and know who to contact if something unexpected happens during restoration (e.g., if the creek floods into the oxbow during restoration or if a potential cultural resources is unearthed during excavation, coordinate with all the agencies that have permitted the restoration to determine if and when the work can resume)
- Make sure to check on the progress of the restoration frequently to ensure that the restoration is meeting design specs and standards. Oxbows are a fairly new practice, and for many contractors it may be their first time on a restoration project. There have been cases of contractors digging in the wrong spot, not digging deep enough, and digging too deep.
- It is best to have a back-up plan for the excavated soil (spoil) or have the landowner (or whoever wants the spoil) sign an agreement to take the spoil. There have been cases where a local contractor agreed to haul the dirt off site in order to use the black dirt at a later time, but the contractor backed out after restoration began or planned to spread it in a wetland ("pond"). Make sure the contractor is specific with spoil placement locations and that any revisions to spoil placement locations are consistent with all permit terms and conditions.
- Have a backup plan for where to place excavated soil if the soil contains more sand or rocks than anticipated. Most of the time nutrient-rich black soil is excavated from the oxbow, which is suitable for spreading in adjacent farm fields. However, landowners and tenants would likely not want soil that is too sandy, rocky, or has substantial woody debris to be spread in their farm field.
- If quicksand is unearthed during excavation, it may be best to stop restoration in that specific area and try to dig the remainder of the oxbow.

CONTINUED

LESSONS LEARNED

- It is best to get one or more soil cores when putting together a restoration plan, to ensure your calculations for depth-to-dig are accurate. There have been cases where the historic riverbed (gravel, bedrock, or blue clay) has been encountered shallower than the target depth elevation (e.g. dug 1.5 feet instead of the 3.5 feet deep planned), which is most likely in floodplains where natural streams have been altered (e.g., dredged, ditched, filled, etc.).
- Make sure you are working with the sole decision maker for the property, or that you have permission from all landowners if necessary. One example is of a restoration that could not be complete because 37 landowners had an interest in the same property, many lived in different places across the county, and all would have needed to sign the contract.
- Beavers are often attracted to these features. Having resident beavers at your restored oxbows could help hold excess water and be beneficial for increased water quality improvements and fish habitat. However, a beaver dam may backup excess water into an adjacent farm field, which could result in the tenant or landowner blaming the restored oxbow for water in their field. Beavers also may impede restoration activities if they dam water into the oxbow immediately before excavation. If you have to remove a beaver, The Iowa Beaver Project may be able to assist with relocation or provide contact information for landowners that want to reestablish beaver (87).
- Make sure to check the restoration site for potential bat habitat and eagle nests; adhere to work-window requirements (e.g., tree removal may need to occur from October 1st – March 31st to minimize impact to bats) and BMPs outlined in federal and state permits.
- Although native seeding is encouraged around restorations, native seed may be difficult to establish if the surrounding area is overrun with invasive or weedy plants (such as reed canary grass). Plan for how to establish (e.g., seeding and mowing requirements) and manage (e.g., tree control, prescribed fire, etc.) native seed in the floodplain and include native species that are easy to establish, are appropriate for the location, are good long-term competitors (prairie cordgrass, troublesome sedge, fox sedge, Virginia wildrye, switchgrass, etc.) and/or provide substantial food resources for migratory birds (Pennsylvania smartweed, rice cutgrass, wild rice, American sloughgrass, arrowhead, wild celery, bulrush species, etc.) and pollinators (swamp milkweed, sneezeweed, joe pye weed, ironweed, cup plant, blue vervain, etc.).
- Keep an eye on your restorations and maintain open communication with the landowner to ensure that the restoration is still performing as planned. For example, a restoration near a county road was accidentally drained when the county was repairing the roadside ditch and culvert. Luckily the mistake was noticed immediately, and the county made repairs to the oxbow quickly.
- Be prepared to provide reassuring responses to concerns. Some common concerns include: “it’s going to attract mosquitos”, “it’ll never hold water”, “I don’t want to be regulated by having a federally endangered fish on my land”, ...

ACKNOWLEDGEMENTS

We would like to give special thanks to the following organizations for reviewing the content of this toolkit and for sharing their expertise and knowledge.

Natural Resources Conservation Service

Iowa Department of Natural Resources

U.S. Army Corps of Engineers

U.S. Fish and Wildlife Service

Iowa Department of Agriculture and Land Stewardship

Iowa Soybean Association

The Nature Conservancy

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