Iowa River

Adaptive Management and Monitoring Plan

Sustainable Rivers Program

USACE Photo

US Army Corps of Engineers ®
Rock Island District

The Nature Conservancy

January 2024

1.0 Introduction

This Adaptive Management and Monitoring and Plan (AMMP) was prepared as part of the implementation of environmental flows (e-flows) and environmental pool management associated with operations of Coralville Dam on the Iowa River as part of the Sustainable Rivers Program (SRP). This AMMP presents a collaborative, objective-based approach for implementing an effective monitoring program to assess the status and trends of ecological resources along the Iowa River. Organizations involved include the U.S. Army Corps of Engineers (Corps), The Nature Conservancy (TNC), the Iowa Department of Natural Resources (IADNR), the U.S. Fish and Wildlife Service (USFWS), non-government organizations (NGO's) and various partners at academic institutions. Individuals from these organizations compromise the AMMP Team (Team).

While the AMMP requirements found in Section 2039 of the Water Resources Development Act (WRDA) of 2007 (as amended by Section 1161 of WRDA 2016) apply to ecosystem restoration feasibility studies, this AMMP generally follows the process outlined in WRDA for establishing a monitoring plan, developing success criteria, and defining adaptive measures. However, AMMP requirements in WRDA Section 2039 are not directly applicable to the Iowa River Adaptive Management and Monitoring Plan detailed in this document.

The adaptive management and monitoring process consists of an iterative approach to problem solving focused on objectives-based monitoring and refinement of the action to address uncertainties and assumptions associated with a given action. For the purposes of this AMMP, the Team used a general adaptive management (AM) framework (Fischenich et al., 2019) to organize completed and ongoing tasks into a logical process as outlined in Table 1.

This AMMP is intended to be a living document. As the Corps, resource agencies, and interested stakeholders continue to collaborate to improve understanding of interactions between dam operations and ecological resources in the watershed, operational objectives, monitoring metrics, and success criteria will continue to be developed and refined. This document provides the framework for operating Coralville Dam from an ecological context while also providing the flexibility to continue to improve operations into the future.

Table 1. Summary of the adaptive management and monitoring process

Adaptive Management Step	Iowa River Task
Assess and define the problem	Identify primary ecological concerns on the Iowa River that can be addressed through flow and pool management
Formulate alternatives	Formulate e-flows and environmental pool management alternatives
	Develop an adaptive management strategy, including expected outcomes, objectives, and adaptive management triggers
Implementation	Incorporate flows and pool management into operating plan
	Obtain baseline monitoring
Monitor	Implement monitoring
Evaluate results	Compare monitoring results to expectations and baseline condition, as well as management triggers
	Evaluate assumptions and uncertainties
Continue/adjust/success	If triggers met, refine pool and flow management based on defined contingency plans
	Document decisions.

2.0 Environmental Flow and Pool Management Objectives

2.1 Defining Environmental Flows

The objectives for e-flows and environmental pool management on the Iowa River were initially identified based on a Des Moines River e-flows workshop held on October 25-26, 2016. Iowa River resource managers agreed that the outcomes of this workshop were consistent with their interests for the Iowa River. The workshop, co-organized and sponsored by the Corps and TNC, was attended by over 50 scientists, as well as fisheries, water, and natural resource managers from Federal and state government agencies, universities, and NGO's. Prior to the workshop, interested stakeholders were engaged to provide feedback regarding primary ecological concerns on the Des Moines River. Based on the preliminary stakeholder feedback regarding ecological concerns, workshop attendees identified seven primary recommendations for developing e-flows on the Des Moines River that will be utilized for the Iowa River:

1. Improve water quality by reducing nitrate levels within the pool and outflow
2. Reduce mortality to mussels
3. Reduce mortality to sturgeon
4. Improve habitat conditions for migrating waterbirds and shorebirds
5. Improve habitat conditions for reptiles and amphibians
6. Reduce streambank erosion
7. Improve conditions for river recreation

With consideration to these areas of concern, three focus groups, a fish and mussel group; a water quality and other considerations group; and a floodplain habitat, riverine waterfowl, and wildlife group, were established to evaluate potential flow improvements. Each group developed recommendations for e-flows and environmental pool management; these recommendations were subsequently aligned, resulting in the unified set of flow requirements for the Des Moines River and adapted for the Iowa River (Figure 1). The subsequent set of flow requirements were based in part on the biological flow requirements (Figure 2). Figure 3 shows the integrated environmental flow recommendations. The e-flows recommendations summarized in Figures 1 and 2 served as a starting point for developing the recommended operations framework identified in Section 2.2.

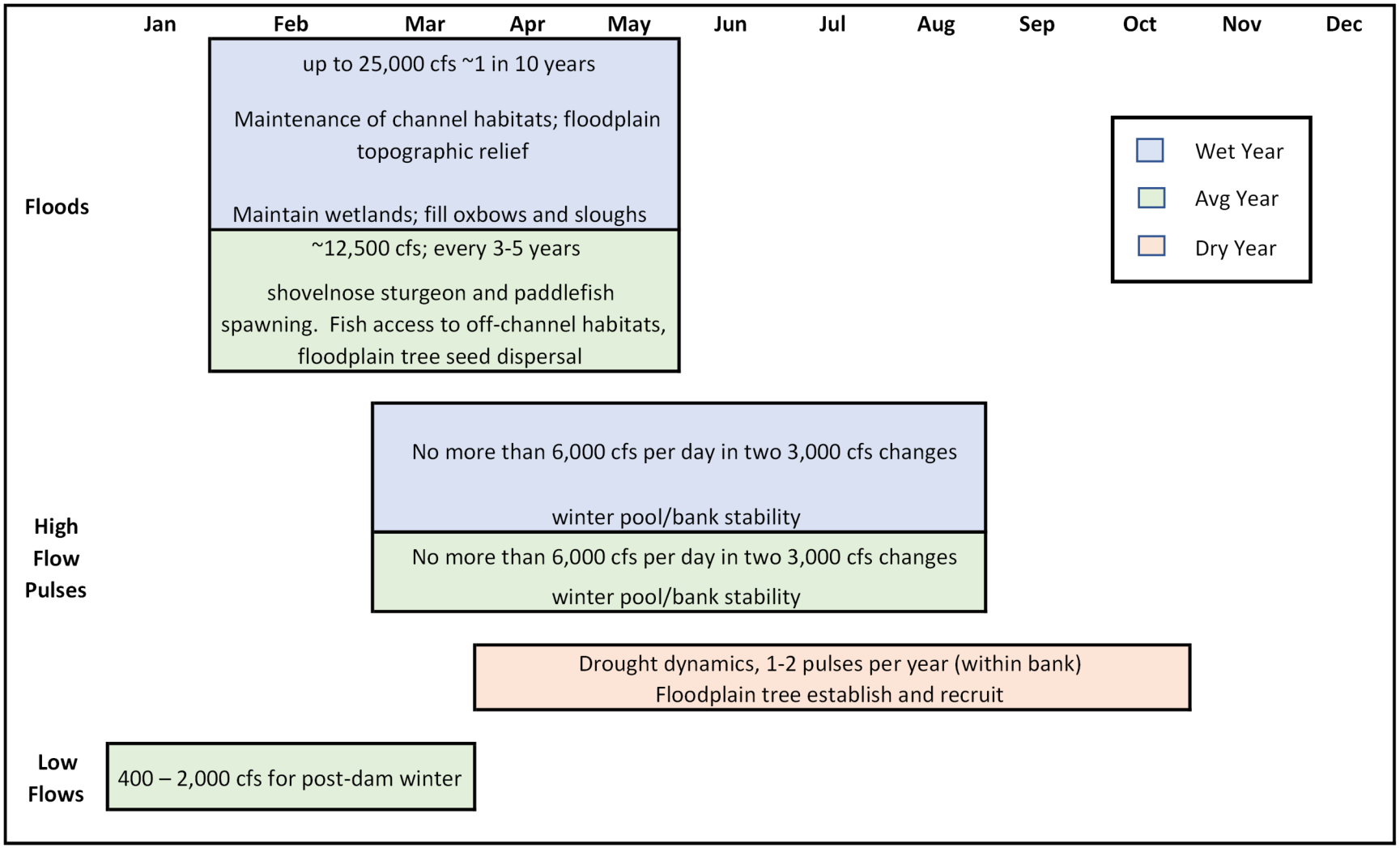

Figure 1. Unified set of flow requirements for the Iowa River below Coralville Dam

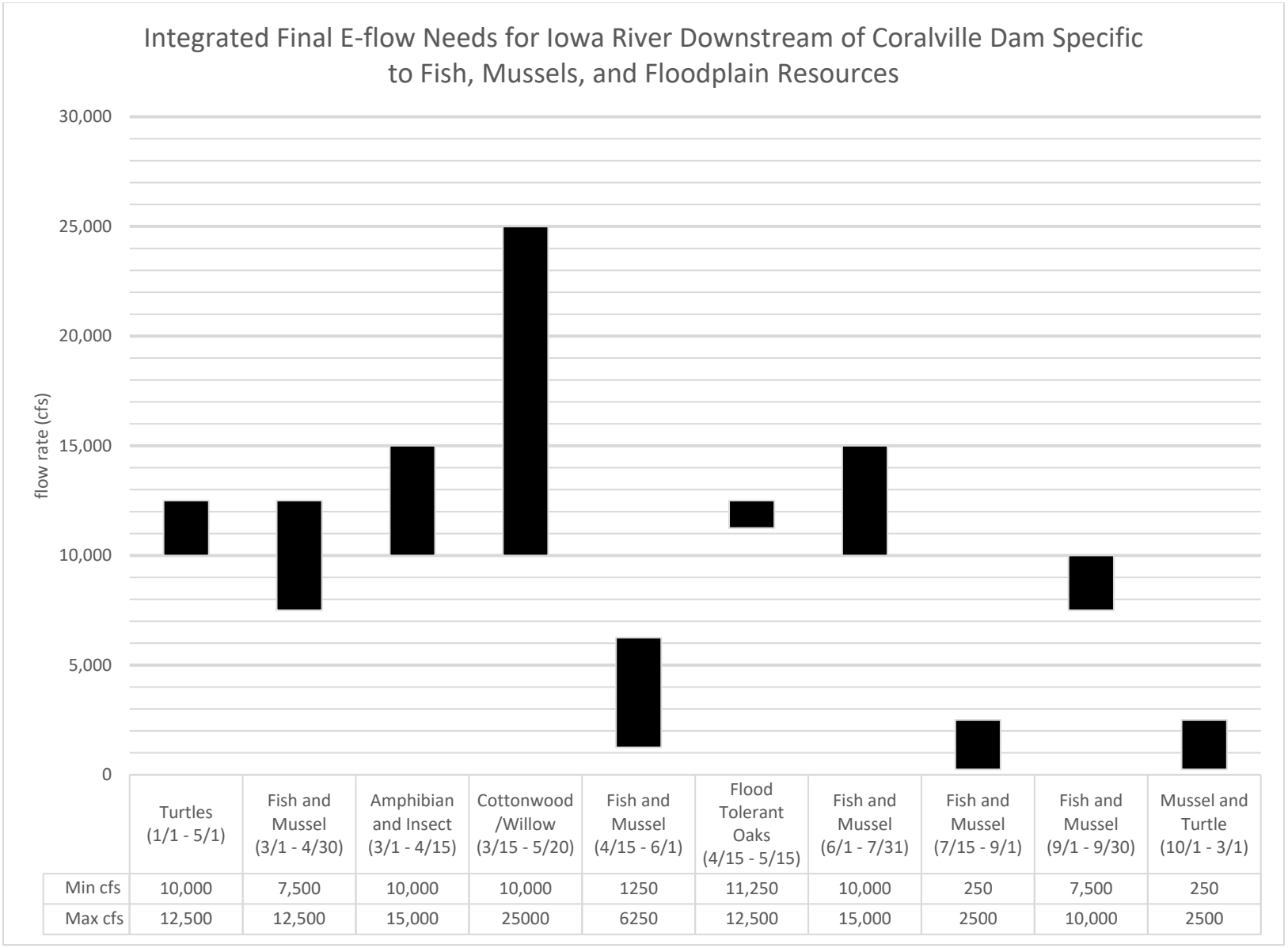

Figure 2. Biological e-flows initial recommendations

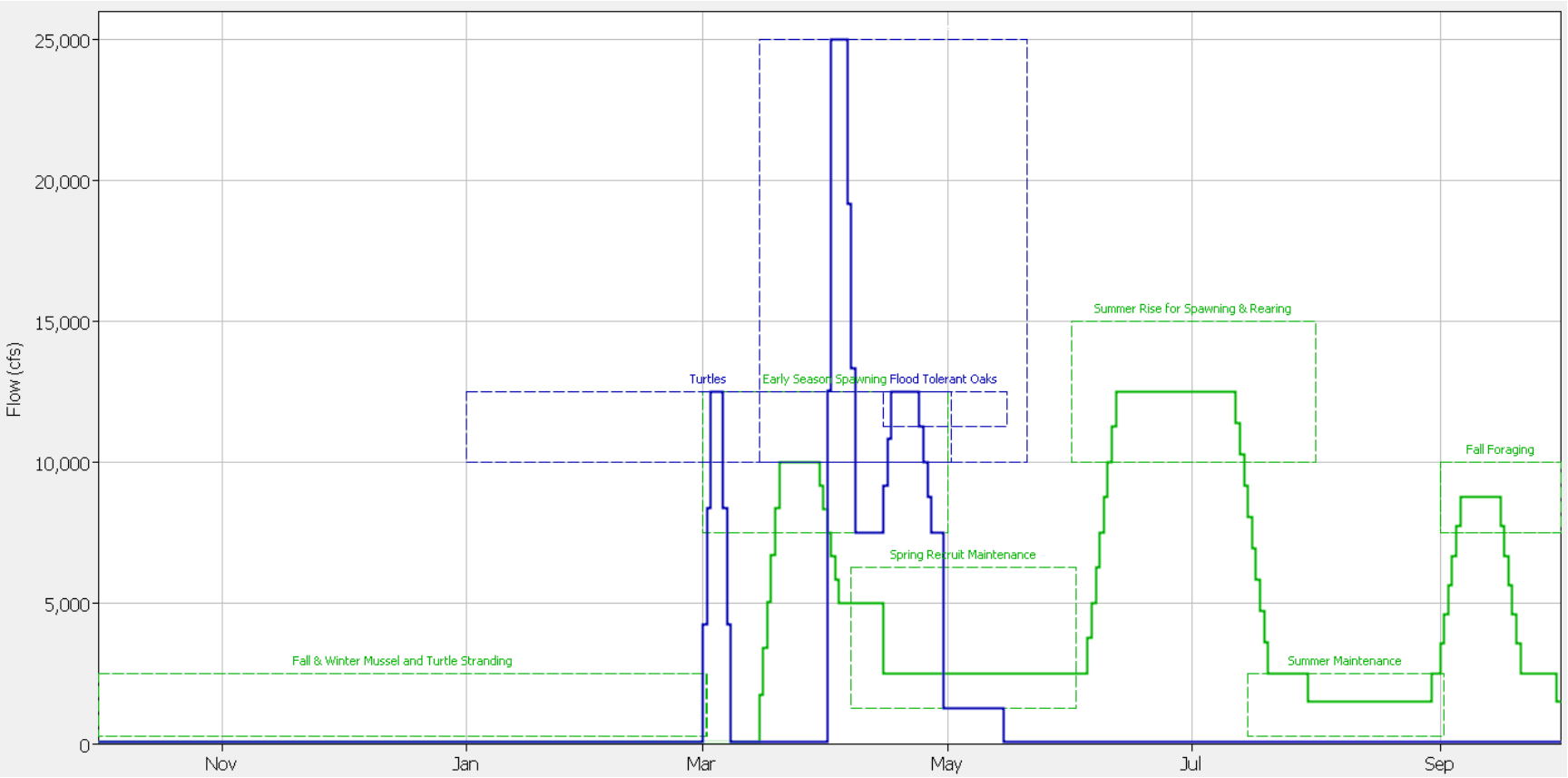

Figure 3. Final integrated environmental flow recommendations for the Iowa River below Coralville Lake

Note: Blue lines indicate a high-water year; green lines indicate a normal year.

2.2 Incorporating E-Flows into Dam Operations

Prior to identifying the broad ecological recommendations summarized in Figures 1, 2 and 3, the Coralville Dam Water Control Plan was revised to incorporate flexibility for the implementing conservation pool management, as described in the Coralville Lake Water Control Feasibility Study With Integrated Environmental Assessment (USACE, 2021). Conservation pool bands introduced flexibility to accommodate maintenance activities and achieve environmental objectives when flood control projects are not in flood operations. Given operational constraints associated with Coralville Dam, the actual operations implementable under the revised Water Control Manual are more limited than the ideal e-flows outlined in the unified flow requirements.

Within conservation bands, the Corps can manage for aquatic, wetland, and migrating species. This can benefit important mussel, fish, reptile, amphibian, and bird species during significant life stages and seasons. Table 2 shows the available water storage and equivalent flows within each band. Although sufficient water exists within the conservation bands to make large pulses, the water control plan constrains the volume of water that may be released each day per the following rules. First, outflows cannot cause a daily drop of more than 1.0 foot of pool elevation. Second, outflows cannot be reduced by more than 2,000 cfs per day.

Figure 4 shows the operating parameters for Coralville Lake and Figure 5 shows the operating limits (updated in 2022).

Table 2. Conservation pool operating limits and water available for e-flows

Season	Conservation Band (ft)	Available Water Storage (ac-ft)	Equivalent Flow (cfs-day[1])
Winter and Summer	683.0 – 684.0	4,400	3,000
Spring[2]	679.0 – 684.0	12,100	6,000
Fall	683.0 – 688.0	28,200	14,000

[1] cfs-day: the flow that can be released for a single day using all available storage within the conservation band. However, e-flows are constrained by pool drawdown limits (less than 1 ft per day) and downstream flow change requirements (less than 6,000 cfs per day in two 3,000 cfs changes), so full values would most likely not be achievable.

[2] The spring conservation band includes the optional drawdown from 683.0 ft to 679.0 ft. If the drawdown is not completed or less than 4 ft is achieved, less water would be available for e-flows purposes.

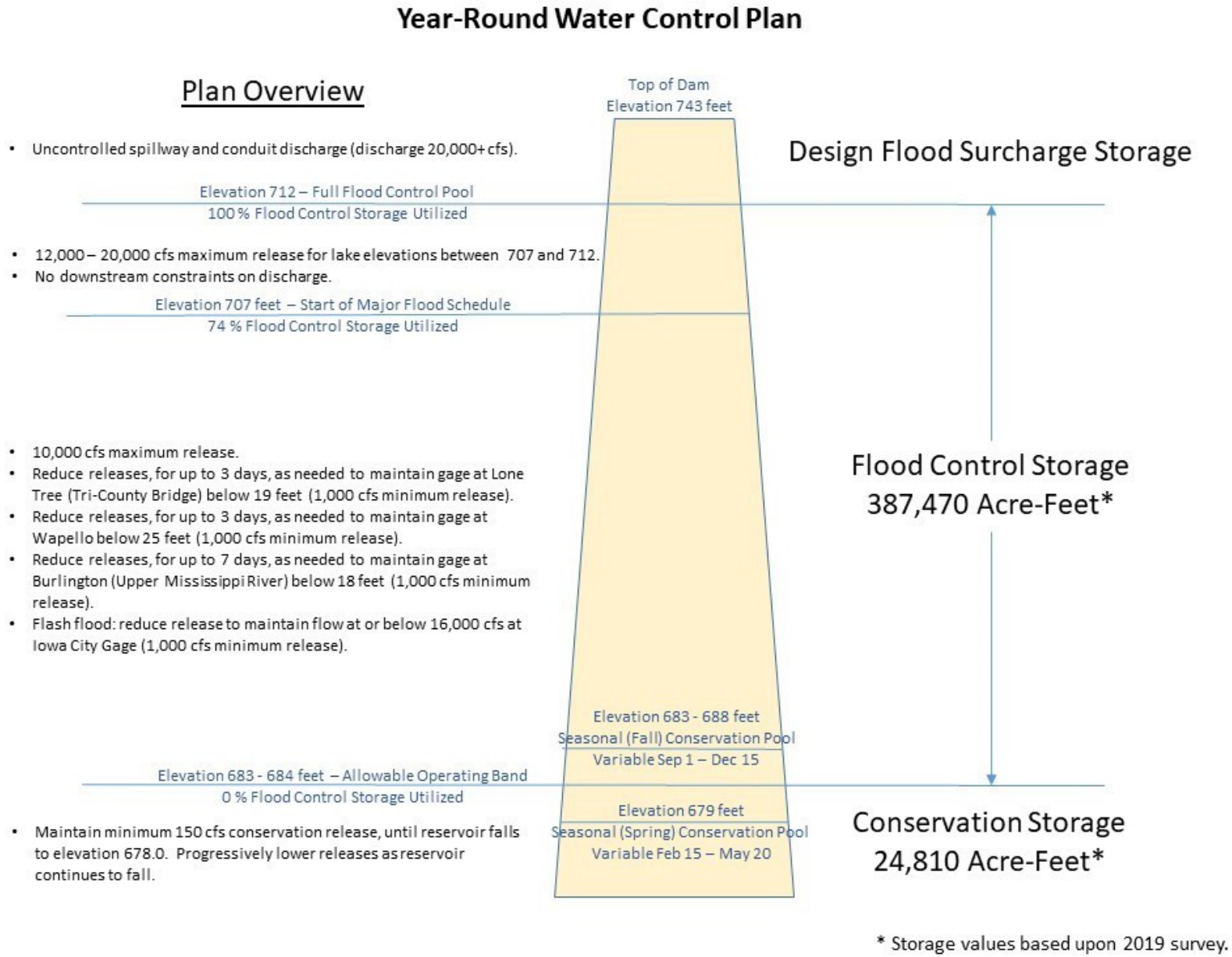

Figure 4. Coralville Lake operating parameters (updates to the Water Control Manual are described in Section 2.2).

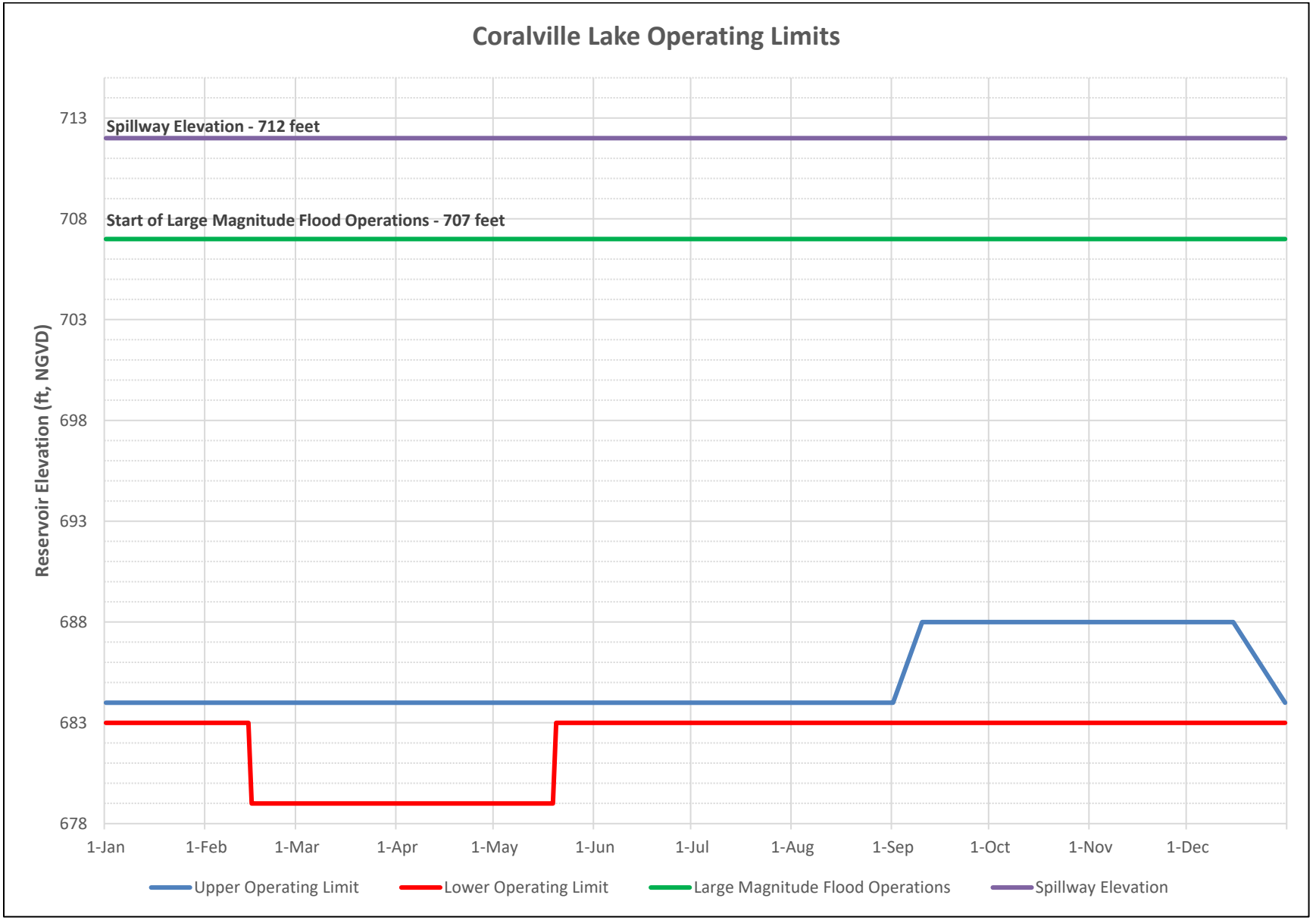

Figure 5. Operating limits for Coralville Lake (effective February 2022).

2.3 Linking E-Flow and Pool Management to Objectives

For the purposes of developing an AM framework (Figure 6), the actual range of implementable operations served as the starting point for the preliminary linking of flows to ecological objectives. The objectives identified in Figure 6 originated from the e-flows workshop described in Section 2.1.

Following the preliminary linking of implementable flows to objectives, flow prescriptions were more clearly defined with consideration of the recommendations provided in the e-flows workshop. In addition, environmental pool management opportunities at Coralville were evaluated, with consideration for previous and ongoing pool management efforts, as well as the interaction between environmental pool management and e-flows releases.

In support of these efforts, a collaborative workshop facilitated via webinar took place on May 14, 2020. This workshop included representatives from the Corps, TNC, USGS, IADNR, and local universities, including many of the same participants as the e-flows workshop. As a result, a refined list of targeted e-flows and environmental pool management options and associated objectives were developed. The refined list was shared with workshop participants from the workshop for review and additional refinement.

Using information from the May 2020 workshop, as well as subsequent input received, a refined set of e-flows and environmental pool management actions and objectives were developed (Tables 3 and 4).

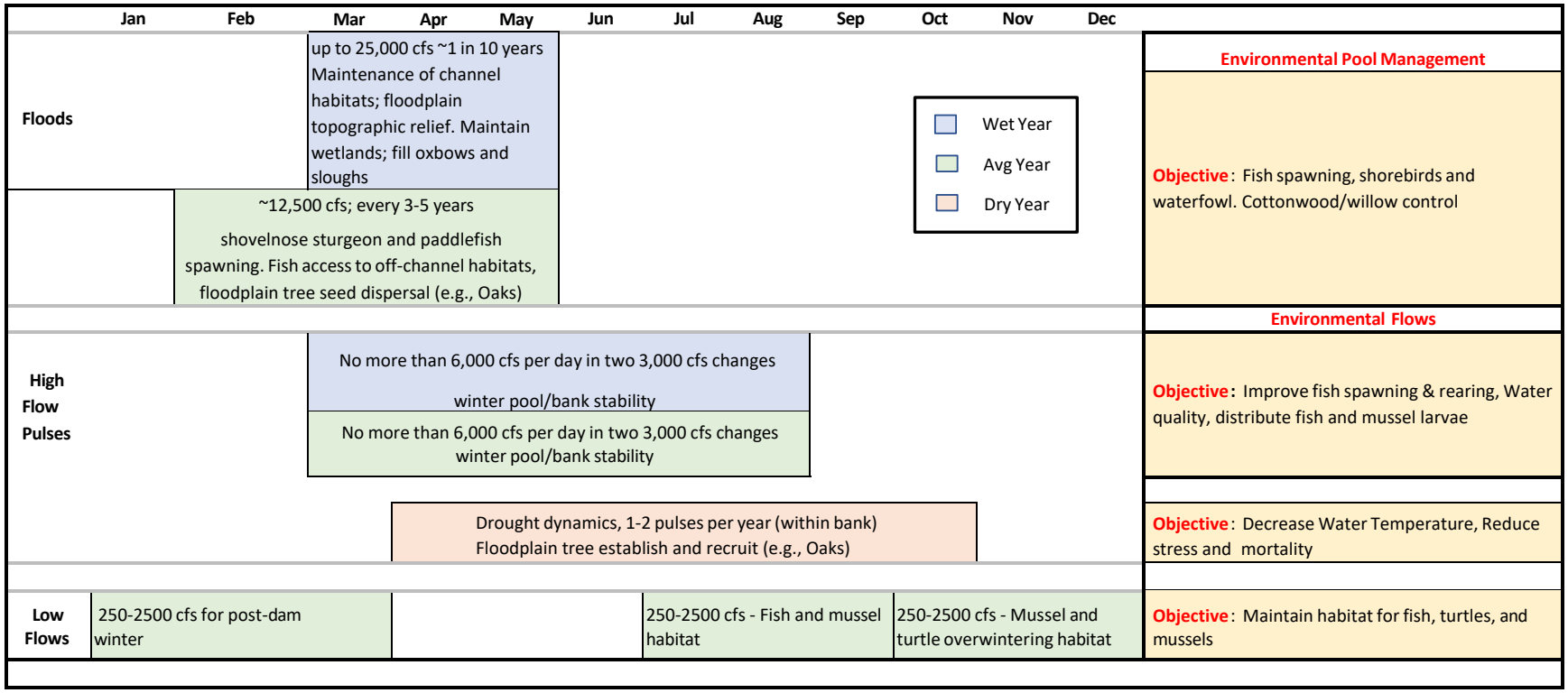

Figure 6. Implementable e-flows linked to preliminary objectives, including Environmental Pool Management, for the Iowa River (Table 3) and Coralville Lake (Table 4).

Table 3. Summary of recommended e-flows for the Iowa River

Flow	Objectives	Coralville Details
Early Season Spawning Pulse	**Primary:** Improve spawning conditions for native fish **Secondary:** Avoid triggering walleye emigration from reservoir	• Magnitude of up to 12,500 cfs max flow • Duration: 7 days ascending, a several day peak, 7 days descending • Timing from March 1 to April 30, targeting water temperatures between 16-20°C. • Frequency: 1 out of every 5 years
Summer High Flow Pulse	**Primary:** Improve spawning conditions for native fish	• Magnitude of 10,000-12,000 (conservation band) releases if pool is over elevation 683 Mean Sea Level (MSL). • Duration: 7 days ascending, a several day peak, 7 days descending • Timing from April 1 to July 30 (flows beyond 15 June may benefit invasive carp) • Frequency: 1out of every 5 years
Opportunistic Heatwave Pulse	**Primary:** Improve water temperatures for fish rearing and mussels	• Magnitude of 250 to 2,500 cfs • Duration: volume dependent • Timing: July 15 or later • Frequency: opportunistic.
Base Flow	**Primary:** Protect mussel and sturgeon populations	• Maintain a baseflow at or greater than 150 cfs to the extent possible • If outflows must be entirely turned off, limit duration to 12 hours during daylight. • If outflows must be shut off or reduced for a prolonged period, utilize a 3- to 4-week incremental reduction to encourage mussel migration.

Table 4. Summary of Environmental Pool Management at Coralville Lake and range of integrated pool levels.

Pool Management (date range)	Objectives	Dry Year Elevation	Avg. Year Elevation	Wet Year Elevation	Description
Fall Pool Raise and Hold (Sept 1– Dec 14)	**Primary:** Provide stop-over and foraging habitat for migrating birds. **Secondary:** Drop pool as slowly as conditions allow to ensure aestivating reptiles and amphibians are not detrimentally impacted.	683–686	684–687	685–688	By Sept 1, begin fall pool raise for waterfowl per DNR request. In late flood years, DNR would likely request this elevation increase ranging from 1-5 feet above normal pool. Elevations will be variable based on water and vegetative conditions.
Fall and Winter Pool Low Water Maintenance (Dec 15– Feb 14)	**Primary:** Provide conditions within the reservoir beneficial for fish spawning. **Secondary:** Drop pool as slowly as conditions allow to ensure aestivating reptiles and amphibians are not detrimentally impacted.	683	683	683	Decrease the pool beginning December 15 at a maximum of a 2-inch drop per day, back to elevation 683 or until freeze-up and ice forms to protect overwintering herptiles
Spring Pool Maintenance (Feb 15– May 31)	**Primary:** When conditions allow, maintain conservation pool and outflows for late fish and herp spawners	683	683	683	Maintain consistent water levels and outflows for predictable conditions.
Summer Shorebird Management[1] (Jun 1– Aug 31)	**Primary:** Provide stop-over and foraging habitat for migrating shorebirds (summer)	683	683	683	Raise the pool to elevation 684 by July 1. For the summer pool raise and drop, increasing quickly is fine, but the levels should drop more slowly/incrementally. In wet years, hold the drop in flood pool levels to a maximum of 3” per day. From July 15 to end of August, drop 2” per week to 683. Vary elevations based on vegetative conditions.
Opportunistic Post-flood Pool Management	**Primary:** Provide conditions within the reservoir beneficial for fish spawning.	683-684	683-684	683-684	Following a high flow flood risk management (FRM) release in spring, drop the pool as slowly as conditions allow.

[1]This management action can occur as modification to either the fall pool raise or fall and winter lower water maintenance

2.4 Updated Flow and Pool Management Recommendations

The e-flows (Table 3) and environmental pool management (Table 4) actions and objectives include several refinements from the initially recommended e-flows (Figure 1). In addition, the e-flows summary reiterates and refines recommendations for low-flow management. Primary changes from previous recommendations are summarized as follows:

Environmental Pool Management Refinements. Under current environmental pool management practices, the reservoir level is raised in the fall as proposed in Table 4. However, the pool is drawn back down beginning December 15th. This timeframe for pool drawdown has the potential to have significant detrimental effects to aestivating reptiles and amphibians. Based on water temperature, many reptiles and amphibians may begin aestivating in early fall (e.g., October). Organisms that rely on shallow water or mud- bottom habitat for aestivating (e.g., softshell and snapping turtles) could be detrimentally impacted if their aestivation site is exposed after they have become dormant for the season. However, due to flood control constraints, the fall pool raise cannot be maintained through the winter and into the spring.

Environmental Flow Refinements. The preliminary environmental flow prescription recommended a fall spike release (Figure 2). Based on the best professional judgment and expertise of the Corps and participating stakeholders, this release was expected to have minimal potential benefits. In addition, a fall spike release could have undesirable impacts, such as helping to distribute invasive carp having a more protracted spawning period than most native fish species.

3.0 Objectives-Based Monitoring

Since no continuous funding stream is currently available for implementing AM on the Iowa River, the AMMP Team initially looked for opportunities to leverage any existing programs. The annual SRP request for proposals is one potential source of support for AM. Prior to developing potential success metrics for monitoring and AM, a preliminary review of ongoing and anticipated future monitoring efforts was performed, as discussed in Sections 3.1, 3.2 and 3.3.

3.1 Ongoing Monitoring Efforts

The Corps conducts year-round water quality monitoring on the Iowa River to ascertain the effects of Coralville Dam operation on downstream river quality and to characterize upstream water quality. Over 40 parameters are monitored throughout the year. For public health purposes, seasonal monitoring is conducted to analyze levels of bacteria and microcystin at beaches and the main body of the lake during peak recreational periods.

The IADNR has a number of monitoring efforts that could potentially be leveraged for AM work on the Iowa River. The IADNR administers a long-term monitoring program called Multiple Species Inventory and Monitoring. The monitoring protocols and permanent sampling areas serve as a baseline for long-term monitoring of Iowa's wildlife populations. Multiple Species Inventory and Monitoring activity has been limited in the Iowa River corridor.

The U.S. Geological Survey (USGS) has a stream gage in Iowa City. The gage primarily measures river levels, but the USGS also has water quality data dating back to 1903. These parameters typically are collected by the USGS for the purposes of supporting short-term operational needs of the data network (e.g., precipitation at some locations) or parameters measured to facilitate the computation of another parameter of interest (for example, stage is

used in the computations of streamflow). In either case, these parameters are not necessarily corrected for errors or omissions either because the short-term need for the operational data has passed or because other methods were used to estimate the primary parameter of interest. Some of the sampling parameters are suspended sediment, discharge, temperature, and specific conductance. Additional USGS stream data for the Iowa City location is located here: https://waterdata.usgs.gov/monitoring-location/05454500/#parameterCode=00065&period=P7D.

3.2 Future Monitoring Efforts

The Corps plans to collaborate with other agencies to gather baseline information and evaluate monitoring opportunities and metrics between 2023 and 2025. The Corps will review historic monitoring data, develop a suite of potential monitoring metrics, and gather preliminary baseline data associated with these metrics. In addition, if conditions allow, the metrics will be measured following implementation of actual dam-related e-flows and/or pool management actions (Table 3). The Corps will then evaluate the metrics for response and sensitivity to dam operations, which will inform the choice of final metrics to serve as AM triggers.

In the coming years, additional collaborative efforts with the IADNR and other agencies may result in initiating monitoring programs. The Corps may have research proposals for monitoring efforts associated with Coralville Dam through both the SRP and the Ecosystem Management and Restoration Research Program. Proposals would cover monitoring of migratory bird use; herpetological resources and habitat use; and denitrification. If any of these efforts are approved and funded, results may provide additional insight into the development of monitoring metrics and success criteria.

The AMMP team anticipates the IADNR will contribute their Iowa River fish and wildlife monitoring results to this effort. This may include, but not be limited to, water quality sampling, fish/mussel surveys, and migratory bird observations. The IADNR's historical and ongoing surveys will play an important part in the AM decisions at Coralville.

3.3 Linking Monitoring Metrics to Objectives

When selecting metrics to use as indicators or criteria for AM, the initial focus will be on selecting metrics that are clearly linked to operational objectives consistent with the following criteria:

- Respond quickly and significantly to the operation being evaluated at a spatial and temporal scale useful for guiding operational change.
- Be clearly linked to the desired or expected ecological outcome (i.e., the objective).
- Be strongly affected primarily by the operation being evaluated, rather than by other external factors.
- Be easily measured and interpreted in the context of the operation being evaluated.

Monitoring efforts (Section 3.1) will be evaluated for potential metrics to inform AM. Additional monitoring metrics will be evaluated for potential inclusion (Section 3.2).

4.0 Implementation Considerations

Species, guilds and habitats often have different and potentially conflicting resource needs, which creates unique challenges when attempting to implement operations for ecological benefit. In the context of this AMMP, several specific conflicting resource needs have been identified:

- The Coralville Fall pool raise and hold benefits waterfowl but degrades inundated vegetation and may degrade crappie and other sportfish habitat the following season.
- During low water or hot years, water releases intended to reduce downstream water temperatures may reduce the likelihood of being able to implement a fall pool raise.
- Early season flow pulses benefit downstream habitat, but may impact fishery habitat in reservoir, depending on timing and water availability.
- Evacuating reservoirs before winter may benefit existing vegetation and associated fishery habitat, but negatively impact aestivating reptiles and amphibians.
- Evacuating reservoirs in late winter or early spring (i.e., before April) may provide benefit to some aquatic and fisheries resources but may trigger walleye emigration.

When implementing operations at Coralville Dam, the Corps and other stakeholders in the Iowa River watershed will address potential trade-offs through annual coordination (see Section 5.0).

By utilizing available resource information (i.e., survey and monitoring data), as well as best-professional judgment, multi-disciplinary teams can incorporate resource needs and status into annual decision making. If survey data shows declining trends in a specific ecological or biological resource, these can be weighed when making decisions regarding operational trade-offs. Conversely, if monitoring data shows a given biological or ecological resource is performing particularly well (e.g., increasing abundance or diversity), this information can also be considered.

In addition to considering the status of each resource when making operational decisions, recently implemented operations should be considered when making decisions regarding upcoming operations. For example, in the context of the Iowa River, if a fall pool raise has been implemented for several consecutive years in order to benefit waterfowl, strong consideration should be given to implementing an operation intended to benefit a different resource. In this case, the fall pool could be held steady (i.e., no raise) in order to benefit fisheries resources. Similar resource balancing was considered when developing the recommendations in Tables 3 and 4 and should continue to be considered during annual coordination efforts.

5.0 Coordination and Communication

The Corps and stakeholders share a proud partnership on the Iowa River, developed over years of collaboration at Coralville Lake. The key to this partnership is communication. For many years, the Corps, IADNR, and USFWS have collaborated to implement operations for ecological benefit on the Iowa River in coordination with other partners including the TNC, USGS, and the Natural Resource Conservation Service. Carrying out this AMMP involves all the agencies to collaborate on behalf of the public and our natural resources.

In order to continue collaborating while implementing AM on the Iowa River, each March, the Corps and the SRP partners will meet to discuss the previous year's monitoring and management efforts (Figure 7). The annual meeting will provide a forum to review recent operations on the Iowa River, as well as available monitoring data, and determine if operations are having the anticipated beneficial effects.

The Corps will detail the hydrologic events and FRM activities that took place over the previous year. This information can be used to consider if FRM activities are having an impact on natural resource management. In addition, the Corps will review the recent history of any environmental pool management or environmental releases that occurred on the Iowa River. Agencies and stakeholders can provide information from recent monitoring efforts and outline their ongoing or anticipated monitoring efforts, as well as resource management goals for the upcoming year.

The established fall pool raise meeting will continue to occur annually in August (Figure 7). During these meetings, the Corps will outline the major hydrologic events that took place at each Corps' reservoir (Coralville, Red Rock and Saylorville) throughout the year. The IADNR will outline its proposed water level management strategies to meet their fall pool management goals.

Meeting annually to review previous operations and monitoring data and collaborating on the implementation of AM actions will allow the Corps to leverage available data and knowledge shared across agencies to improve the management of shared ecological resources within the watershed.

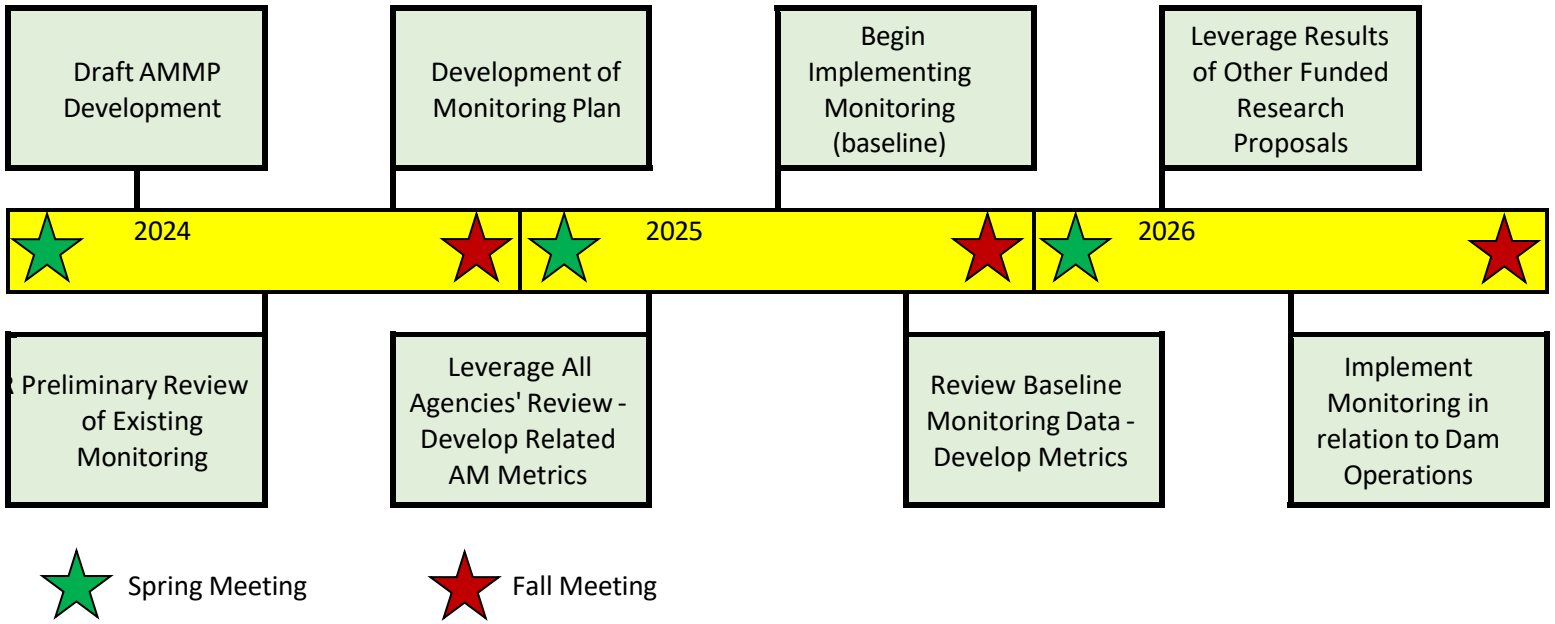

Figure 7. Anticipated timeline of upcoming efforts associated with continued development of the Iowa River AMMP.

6.0 Adaptive Management Criteria

The AMMP Team met on August 24, 2023, in Kent Park, Iowa, to discuss existing monitoring program goals, potential implementation triggers, and AM criteria. The team validated the AM goals and dam operation criteria listed in Table 3. Establishing a reference or baseline condition and success criteria efforts are expected to continue in 2024, 2025 and 2026. In particular, ongoing efforts in collaboration with the IADNR are expected to contribute significantly to the initial development of monitoring and AM metrics. The goal of the Spring 2024 meeting is to gather stakeholders to review flood forecast information in order to make recommendations for which e-flows guidelines to implement.

6.1 Record Keeping and Reporting

Appendix C contains blank monitoring and reporting sample sheets used to document annual monitoring. The Corps will provide the annual documentation to the AMMP Team prior to the spring team meeting. The AMMP Team should use the completed forms to provide information when submitting a request for funding.

The Corps will document AMMP meetings minutes (decisions) following the spring & fall meetings and disseminate the meetings notes to the stakeholders.

7.0 Future Funding Considerations

There is currently no dedicated funding stream for the continuous implementation of monitoring and AM. As a result, various funding mechanisms and opportunities will continue to be pursued for the development, refinement, and implementation of monitoring and AM actions. Given the challenges associated with ensuring long-term funding, monitoring efforts have focused on first identifying existing monitoring programs that can be leveraged to inform AM without the need for additional costs or monitoring efforts. If funding is required, the annual request for proposals from SRP may be an opportunity.

In addition, collaboration with regional stakeholders is critical in ensuring the long-term success of AM on the Iowa River. Through close coordination and collaboration with the IADNR, USFWS, USGS, TNC, and various partners at academic institutions and other agencies, the Corps hopes to leverage each organization’s ongoing efforts and expertise to contribute to the AM of resources within the Iowa River corridor.

8.0 Citations

Fischenich, J.C., S.J. Miller and A.J. LoSchiavo. 2019. A systems approach to ecosystem adaptive management. Engineering Research and Design Center, Environmental Laboratory, EL SR-19-9.

Higgins, J.V., C.P. Konrad, A. Warner and J.T. Hickey. 2011. A framework for monitoring, reporting, and managing dam operations for e-flows at Sustainable Rivers Project sites. Version 1.0. SRP Measures Working Group.

U.S. Army Corps of Engineers. 2021. Coralville Lake Water Control Feasibility Study with Integrated Environmental Assessment. Coralville Lake, Iowa City, Iowa.

APPENDIX A

IOWA RIVER SUSTAINABLE RIVERS PROGRAM
ADAPTIVE MANAGEMENT AND MONITORING PLAN MEETING

AGENDA AND STAKEHOLDER COMMENTS

Hosts: U.S. Army Corps of Engineers and The Nature Conservancy
Date: Thursday, August 24, 2023 1:00 – 4:00

Location:
Conservation Education Center
FW Kent Park
2048 Hwy 6 NW
Oxford IA, 52322

AGENDA

1:07: Introductions Mary Sue Bowers, USACE

1:13: Meeting Overview and Agenda, Joe Jordan, USACE
Purpose and goals
Overview of the SRP monitoring and adaptive management guidance
Anticipated path for the Iowa River Adaptive Management

1:20: Mission and goal of SRP review, Perry Thostenson, USACE

1:25: Iowa River SRP History & Review, Mary Sue Bowers, USACE

1:30: Reservoir Regulation Plan Update Review, Mindy Grupe, USACE

1:50: Review and refine draft Adaptive Management and Monitoring Plan for the Iowa River, Joe Jordan, USACE

2:45: Break

2:55: Discuss potential monitoring & implementation triggers, Karen Wilke, TNC

3:02: SRP Request for proposals, Josh Spies, TNC

3:12: Examples of Reservoir Water Level Management, Perry Thostenson, USACE

3:40: Meeting concluded

Participant Comments and Responses

Ryan Hupfeld – Were all the comments received for the flow prescription addressed? And is it too late to modify that document?
All stakeholder comments were incorporated into the final flow prescription. However, if future concerns arise, please bring them to SRP Team (USACE or TNC staff) to be addressed.

Amy Foster – Asked for clarification around the 16,000 cfs downstream constraints at Iowa City during Mindy's presentation.
That constraint is only during times of flash flooding on Rapid Creek and Clear Creek, to take the top off the flash.

Brad Freidhof – So, what is in there allows us to maintain river flow downstream?
Yes, we built the pool up to have extra so that we don't have to drawdown.

Steve Woodruff – For the Hawkeye Wildlife Area, we put in a request verbally to get it bumped up to 684.6 MSL for the Teal season before it gradually freezes. Can we bump that up, or are we in a tough situation this year?
[Mindy Grupe] We're in a tough situation because the inflows are so low right now. We've requested a new survey on the tailwater gauge from USGS to see what we're actually releasing verses what the gauge is saying.

Padraic O'Shea - I just talked to our guy and he got that measured [recalibrated] for you now [actual release vs gauge has been resolved].

Amy Foster – How do you prioritize what you are protecting? For example, you have the Hawkeye Wildlife Area upstream and the Iowa River downstream and the lake itself, he needs more water, but so do we. How do you negotiate that?
The regulation manual and hydraulic conditions are the overarching guidance. Historically on the Des Moines River, there has been tension between priorities. We used to have an annual Fall meeting to bring all stakeholders together to discuss what the requests will be. Now the DNR meets in house to come up with a joint request to send to our hydrology folks. We don't pick winners or losers; the hydrologic conditions dictate what's going to happen. There's some give and take. We would recommend Spring and Fall meetings to assess forecasted levels and make decisions as a team of stakeholders. Try to stagger the benefits so that if upstream species received benefits last time, maybe this time we focus on downstream benefits.

Brad Freidhof – Are we really gaining anything (water quantity) or are we just offsetting sedimentation rates within the pool? If we're raising the water levels but the sedimentation rates are high, then we're losing the bottom storage and not actually holding more water. Do we have less water to float our boats on for recreation?
We did a survey last year, and we did not have a huge change in sedimentation. As of now we are status quo.

Brad Freidhof – There was some discussion that reducing flow rates might be reducing the spawn success of invasive fish. Have you seen anything like that or done anything like that on the Des Moines?
Ryan Hupfeld – Michael Weber had some larval sampling, but I'm not sure if they've completed the analysis. It doesn't overlap with the sturgeon, most species spawn before Asian Carp do. So, if we can limit pulses after June 1st or 15th, that would be good. But that wouldn't be any good for herps.

[Mindy Grupe] I know that 25,000 [cfs] number for Cottonwood/willow is kind of daunting, but we can't even do that. We would have to spill [overtop the spillway] to do that. That's just a wish list of levels to benefit certain species.

Ryan Hupfeld – It's helpful to try to steer decisions from year to year to figure out what we're going to do. We hold internal meetings regularly prior to the season, guided by the flood outlook to inform possibilities.
It's always going to be a tradeoff. There's going to be winners and losers. There are going to be tradeoffs. Over the long haul we'll make sure we get a lift for each species. We can't do it all each year, so we try to take opportunities and recognize threats, and let upstream vs downstream benefits level out over the years.

Brad Freidhof – These e-flows perimeters (see Figure 1: Unified Set of Flow Requirements for the Iowa River Below Coralville Dam) are all based on current conditions, that's without doing anything in the off-channel habitat (for instance oxbow restoration)? If partners provide that input it could improve the recommendations.
Yes. Anything that anyone else does for habitat restoration is going to benefit natural resources, synergistically, and those non-federal actions can be used or influence COE actions through the AMMP process, because it is ongoing.

Ryan Hupfeld – Dr. Moore at ISU is leading larval sampling for sturgeon on the Des Moines. That opens the IADNR to be able to focus more time on research on the Iowa River this year. We're also tagging Shovelnose Sturgeon on the Cedar River.

Steve Woodruff – Starting last week in August, we do weekly waterfowl surveys to see the trend of migration through the fall and winter. A lot of it depends on water availability, they will concentrate around water. And depends on if we have a good stand of vegetation. That's how we monitor migration. That info is available on our website.
Through SRP and DNR monitoring, we can glean insights from trends to inform our flow prescription.

Amy Foster – We have a decent amount of data on mussels downstream that we'd like to continue. We found 5 Higgins eye, but they're all about 8 years old. We would like to see reproducing populations. But I wonder if it's not going to be achievable with the dams no matter what we do. Current mussel surveys on the Wapsi River are finding naturally occurring populations that may be caused by recent dam removals. There are areas on the Iowa where you can't even walk because there are so many live mussel shells. They are tracked in I-Naturalist.

Paul Sleeper – When water levels are low it's easier to sample the mussels, when levels are high, we depend on divers and may miss some mussels. We're looking at stocking some small Higgins Eye, about 1,000 in the Iowa. Stocking Smallmouth bass as a host to the mussels too. There is a fair population in the Iowa. Floods were devastating in 2008 though. It's starting to come back. When levels are low, we should track those populations. We'd like to see a bump 1st of June to help with spawning. And then bring it back down after vegetation is established.

Brad Freidhof – The assumptions we're making are based on historic weather patterns, which are changing drastically, which is why spring and fall meetings will be so critical to reevaluate current weather patterns and flows.
We get 3 precipitation forecasts from NOAA a year throughout February and March. It would be best to hold meetings after those predictions come out.

Amy Foster – Who would be the person making the final call when we go into implementation?
We listen to the team of stakeholders, it's a very collaborative effort, it's not just the Corps making the final decision unless it's a flood.

Amy Foster - Do you [Mindy Grupe] let them know daily at the reservoir what to do for flows?
Yes, every morning (7 days a week) at 8am. We'll send out orders to what flows/levels we're trying to maintain based on the water surface levels and what is predicted in the next 24 hours.

Ryan Hupfeld – Monitoring water quality and how we influence it is important, given it's one of our goals and there's a lot of different species that are sensitive to water quality. But SRP doesn't like to fund equipment purchases, so if that's something that we could fund through SRP then it would be a light lift on our end to do the monitoring and analysis. Iowa Nutrient Research Center collects water quality data, but it will likely only be funded for 1 more year.

Brad Freidhof – How much information is being collected at the flood center?

Nathan Young – The Iowa Flood Center operates a stream stage network that compliments the USGS stream gage network in Iowa, along with the Iowa Flood Center hydrologic monitoring station network. The water quality sensor network described by Ryan Hupfeld is also operated by IIHR [Flood Center].

Kate Giannini – Amphibious vehicle Research by Casey Harwood, and HAB early detection with drones by Corey Markfort may be of interest. As well as nutrient monitoring by IGS [Iowa Geological Survey] and our water quality team. We have several research projects statewide and nationally and expanding efforts with a SRF [State Revolving Fund] project will support our goals and hopefully meet the goals of stakeholders and users, as well as aid with educating the next generation.

Amy Foster – We've been having issues at the state level in keeping funding for water quality monitoring. Is that something that SRP could help with?
Unless the program emphasis changes, probably no. A lot of the equipment is expensive, and it is unclear who will maintain it afterwards. But it would be good to make sure we're all sharing the data we already have to help inform our decisions.

Ryan Hupfeld – The equipment is expensive but compared to the hours and quality of data from grabbing in by hand it's worth it. If we saw temperatures going up we could implement a plan real time.

Kate Giannini – IIHR would be interested in owning and maintaining equipment. It costs $25-35,000 per site to buy the equipment.

Steve Woodruff – Ducks Unlimited held a brief tour through Otter Creek Marsh with Mike Naig, Iowa Secretary of Agriculture. The discussion basically covered watershed siltation deposits at Otter Creek Marsh. We would like to encourage landowners to incorporate conservation practices that would benefit them (from addition soil loss) and Otter Creek Marsh by reducing silt deposits.

Kate Giannini – We have water quality research scientist who will be replacing Chris Jones, and WMA's [Watershed Management Authorities] are effective tools to get conservation on the ground too. Martin St. Clair, recently retired from Coe College, will be working full-time at IIHR, with part-time responsibilities of running the water quality sensor network previously ran by Chris Jones.

The second half of the meeting was not successfully recorded. Comments that were written as notes during the meeting are captured below, but the stakeholder was not captured for each comment:

Comment: Ongoing monitoring efforts include: Iowa City USGS water quality sampling is done at the Burlington Street Bridge, bio-criteria modelling is done by DNR (https://programs.iowadnr.gov/bionet/), Iowa River at Marengo has water quality data from 1968 – 2012, IIHR Bio criteria monitoring can be incorporated into flow recommendations from the Iowa DNR.

Kate Giannini – We have water research projects done by the students who are utilizing drones to detect harmful algal blooms. DNR usually tests on a Tuesday, results take a few days, how can we speed that up? University of Iowa willing to own and maintain equipment, maybe SRP would be willing to fund purchasing the equipment?

SRP is not able to fund equipment at this time since it is unclear who would house and maintain the equipment. Some small / consumable equipment may be funded.

Question: Are water quality sensors being used? Possibly budget with partners for funding. (USGS).

Padraic O'Shea – The USGS has several options for working with cooperating agencies when it comes to the ownership, maintenance, and operation of field sensor equipment. It is not rare for the USGS to house and maintain equipment that are technically owned by other agencies. However, USGS funded data collection must meet USGS standards, per USGS Fundamental Science Practices. This means that the data collection and processing must follow published USGS methods, if any apply, even if part of that process is handled by non-USGS staff or with non-USGS equipment or facilities. Inquiries for additional information regarding USGS QW practices can be sent to Jessica Garrett (jgarrett@usgs.gov) or Shannon Meppelink (smeppelink@usgs.gov).

Comment: Water quality reports and analysis do help us. Some research ideas are algae data and sediment core samples. Real time data could help get ahead of potential risks to species, potentially have a case to request funding through SRP to help us with flow prescriptions.

Padraic O'Shea – We have many reports and journal articles that are difficult to find. We will put together a bibliography of that info. We also have algae data that has never been published, sediment data that has never been published, that data can be provided to help drive research ideas and flow prescriptions.

Data was provided after the meeting and can be found here: USGS 05453100 Iowa River at Marengo, IA Water Quality Data *and* USGS 05453100 Iowa River at Marengo, IA

Comment: SRP website has examples of how other areas of the country have used their monitoring funding. See:
https://www.hec.usace.army.mil/sustainablerivers/publications/
See also "Articles" on the menu for more information.

Comment: Including Iowa and the Des Moines River for analysis may be helpful to make our application more competitive for funding.

APPENDIX B

IOWA RIVER SUSTAINABLE RIVERS PROGRAM
ADAPTIVE MANAGEMENT AND MONITORING PLAN MEETING

LIST OF PARTICIPANTS

Ryan Hupfeld – Fisheries Biologist
Iowa Department Natural Resources

Brad Freidhof, Conservation Program Manager
Johnson County Conservation

Padraic O'Shea, Statistician
U.S. Geological Survey

Amy Foster, Stormwater Coordinator
City of Coralville

Kelly Hayworth, City Administrator
City of Coralville

Greg Gelwicks, Interior River Research Biologist
Iowa Department Natural Resources - Fisheries

Steve Woodruff, Wildlife Biologist
Iowa Department Natural Resources

Paul Sleeper, Fisheries Management Biologist
Iowa Department Natural Resources

Kate Giannini, Program Manager
IIHR-Hydroscience and Engineering, Iowa Flood Center, University of Iowa

Chad Arp, Stormwater Specialist
City of Iowa City

Nathan Young, Associate Director
Iowa Flood Center, University of Iowa

Anthony Seeman, Water Lab Service Manager
Iowa Soybean Association

Perry Thostenson, Supervisory Natural Resource Specialist
U.S. Army Corps Engineers, Lake Red Rock

Mary Sue Bowers, Natural Resource Specialist
U.S. Army Corps Engineers, Coralville Lake

Mindy Grupe, Hydraulic Engineer & Water Manager
U.S. Army Corps Engineers – Rock Island Clocktower

Joe Jordan, Biologist
U.S. Army Corps Engineers, Planning Division

Karen Wilke, Associate Director of Freshwater
The Nature Conservancy

Dan Meden, Biologist
US Army Corps Engineers

Josh Spies
The Nature Conservatory

Cheri Massie, Administrative Officer
U.S. Army Corps Engineers – Coralville Lake

Howard (Dee) Goldman, Lake Manager
US Army Corps of Engineers

Justin Kerwin, Supervisor
US Army Corps of Engineers

Michelle Mattson, Ecologist (IWR)
US Army Corps of Engineers

APPENDIX C

TEMPLATES FOR MONITORING & REPORTING LONG-TERM ECOSYSTEM TRENDS

BLANK FORM

INDICATOR:

Conceptual Link to Flow Management (Refer to Conceptual Model):

Major Factors Influencing Indicator:

Response Time and Other Factors Influencing Indicator:

Metric To Be Used To Evaluate Response Including Spatial Extent:

Sampling Frequency:

EXAMPLES

INDICATOR 1: % Change in area of native floodplain forest vegetation

Conceptual Link to Flow Management: High flow pulses will allow germination of floodplain trees while low summer base flows will allow seedlings to become established (see ecological model in flow prescription report).

Major Factors Influencing Indicator: Structural constraints (Levees) to floodplain connectivity with river, implementation of flow prescription, deer browsing.

Response Time and Other Factors Influencing Indicator: 5 years to achieve sufficient vegetation density for accurate satellite imagery assessment.

Metric To Be Used To Evaluate Response Including Spatial Extent: Change in area of dominant native vegetation in floodplains located laterally from 5 miles below dam to 38 miles below dam.

Sampling Frequency: Every 5 years for on-the ground sampling (ground-truth imagery and evaluate species composition) and satellite imagery processing.

INDICATOR 2: % Change in density of riffle-spawning river mainstem fish species

Conceptual Link To Flow Management: Clean riffles provide necessary breeding habitats for riffle breeding fishes resulting in increased fish species densities (bottleneck has existed because of high embeddedness of riffle habitats due to lack of high flow pulses). (See ecological model in flow prescription report).

Major Factors Influencing Indicator: Sufficient force and duration of high flow pulses, sources of sediment.

Response Time And Other Factors Influencing Indicator: 1 year for recruitment, 3 years to use standard adult fish sampling techniques.

Metric To Be Used To Evaluate Response Including Spatial Extent: Change in densities of adult age classes of 2 riffle-breeding fish species over time.

Sampling Frequency: Every 3 years

INDICATOR 3: % Change in Osprey reproduction

Conceptual Link to Flow Management: More successful breeding because of increase in prey (fish) populations as a result of repeated high flow pulses that provide access to floodplain habitat and improvements of riffle habitat for fish reproduction/rearing. (See ecological model in flow prescription report).

Major Factors Influencing Indicator: Fish productivity, changes in nesting habitat

Expected Response and Response Time: Increased osprey reproduction within 3 years

Metric To Be Used To Evaluate Response Including Spatial Extent: Change in number/density of breeding pairs over time from river mile 5 to 38.

Sampling Frequency: Every 3 years