CORALVILLE LAKE
WATER CONTROL UPDATE REPORT
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

CORALVILLE LAKE
IOWA CITY, IOWA

MARCH 2022

US Army Corps
of Engineers®
Rock Island District

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EXECUTIVE SUMMARY

The Coralville Dam was constructed by the U.S. Army Corps of Engineers (Corps), Rock Island District (District), on the Iowa River upstream of Iowa City in 1958. Since construction, the Coralville Reservoir has prevented flood damages along the Iowa and Mississippi Rivers and continues to provide a reliable source of water to maintain minimum conservation releases on the Iowa River during periods of drought. The completion of the dam has also provided fish and wildlife benefits and continues to offer valuable recreation opportunities in and around the lake.

Although the construction of the Coralville Dam created the reservoir, it is important to note that the reservoir is commonly referred to as Coralville Lake by the public. For the purpose of this Study, language throughout may utilize "reservoir" or "lake" in its context, but both are in reference to Coralville Lake. Furthermore, the dam itself was the original Corps Project and shall be referred to throughout this Study as Coralville Dam rather than Project.

Coralville Dam was a congressionally-authorized Civil Works project in 1938 (Figure ES-1). The dam is located in the Iowa-Cedar Rivers Basin, a tributary to the Mississippi River. The dam is on the Iowa River, 83.3 miles above its mouth and 5 miles upstream of Iowa City (City). The dam and lake are primarily in Johnson County with portions extending upstream into Linn and Iowa Counties. The Cedar River is the largest tributary within the basin and joins the Iowa River downstream of the dam. The Coralville Dam's authorized purposes are to provide primary benefits in flood risk management (FRM) and low flow augmentation along the Iowa and Mississippi Rivers and secondary benefits for fish and wildlife management, and recreation.

Figure ES-1. Iowa River Location Map, Extending Upstream of Coralville Lake to Burlington, IA on the Mississippi River

The current Coralville Lake Water Control Plan (WCP) and Manual was last revised in January 2001. Reservoir water control plans document operational parameters defining how and when water is stored and released. These parameters include a schedule of releases, conservation pool levels to be maintained during non-flood or drought conditions, and downstream water level constraints. Anytime WCPs are updated, the water control manual which includes historical and other pertinent information including the WCP is also updated as required by Engineering Regulation 1110-2-240*, Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors.*

The following issues were considered while formulating alternatives for the study. The primary purpose and need for the WCP update and are individually discussed in subsequent paragraphs:

1. The Iowa River has experienced a significant increase in the magnitude and frequency of flooding.

2. Sedimentation within the reservoir has negatively impacted available conservation storage capacity reducing the reliability to meet minimum conservation releases during periods of drought.

3. Changes in land use and FRM infrastructure that affect the nature and start of impacts (e.g., levees within the City of Coralville, changes to Dubuque Street, etc.) have occurred downstream of Coralville Lake.

The purpose of the Study is to update the Coralville Lake WCP to better meet mission objectives based on changes in flood frequencies, land use, and reservoir sedimentation. The District completed this feasibility report with an integrated environmental assessment to present a detailed account of the planning, regulatory and environmental considerations resulting in a Recommended Plan. The Recommended Plan will be incorporated and subsequently lead to a revised Coralville Lake Water Control Manual for FRM from Coralville Lake throughout the Iowa-Cedar Rivers Basin. The Iowa-Cedar Rivers Basin has experienced significant land use changes. These changes influence runoff rates into the main stem Iowa River and its tributaries, resulting in increased flood risk within the Iowa-Cedar Rivers Basin. Following the 2008 Iowa River flood, the District re-evaluated regulated flow frequencies on the Iowa River.

During the planning process, alternatives were developed by the planning team with input from stakeholders and the public to address increased flood risk. Alternatives were evaluated on whether they enhanced, maintained and/or reduced the ability to meet goals and objectives of the Coralville Feasibility Study (Study). Screening criteria included FRM (primary study authorization), fish and wildlife, recreation, and other stakeholder interests such as water releases from Coralville Lake.

There were eight major alternatives considered during this study along with five variations of some of the alternatives including the No Action Alternative (current WCP). The planning team did not specifically name each alternative; they are simply referred to as Alternatives 1-8. Each Alternative is outlined below:

- **Alternative 1. No Action**, a continuation of the current regulation procedures.

- **Alternative 2.** This alternative incorporates elements of recent deviations (2018, 2019, and 2020) that includes a 10,000 cfs year-round maximum release during normal flood operations, tiered and elevated downstream constraints with variable minimum releases, altered dates for seasonal downstream constraints and a modified major flood operation schedule eliminating induced surcharge operation.

- **Alternative 2A:** Alternative 2A includes all the modifications in Alternative 2 and elimination of the current spring drawdown.

- **Alternative 2B.** Alternative 2B includes all the modifications of Alternative 2 are followed except that tiered growing season constraints are held through the entire year.

- **Alternative 2C:** Alternative 2C includes all the modifications of Alternative 2 except that non-growing season constraints are held through the entire year.

- **Alternative 3.** This alternative is a Maximum Release plan that provides for increasing outflows in relation to all alternatives considered only constrained by outlet capacity.

- **Alternative 3A.** This alternative incorporates the same changes as Alternative 3 except that this is a dry reservoir scenario with no conservation pool with the exception of holding back flood water when inflow exceeds outlet capacity.

- **Alternative 4:** This is another variation of Alternative 2 but includes elevation based growing season releases to reduce downstream impacts when reservoir water levels are in the lower portion of the Flood Control Pool.

- **Alternative 4A:** Alternative 4A is the same as Alternative 4 but with a provision to maintain the maximum non-growing season release if the reservoir pool is above elevation 700 on May 1.

- **Alternative 5.** This alternative is similar to Alternative 2 except that the maximum-growing release is less aggressive and limited to 8,000 cfs along with altered dates for growing vs. non-growing season downstream constraints and releases.

- **Alternative 6:** This alternative is a stakeholder alternative provided by the Johnson County Homeland Security and Emergency Management Agency. Changes from the current WCP include a slightly reduced summer conservation pool level, an increase in the maximum growing season release, elimination of constraints at Lone Tree and Burlington, altered start date for growing season, and an altered Large Magnitude Flood Schedule beginning earlier.

- **Alternative 7:** Alternative 7 is a stakeholder alternative provided by the Two Rivers Levee and Drainage District. Changes from the current WCP include a slightly reduced summer conservation pool level, the reservoir release is only constrained by the capacity of the outlet up to 16,500 cfs, elimination of the constraint at Lone Tree, and increases in the constraints at Wapello and Burlington.

- **Alternative 8:** Alternative 8 is similar to Alternative 4 with the maximum growing season release based on whether the flood pool is above or below elevation 700 feet (85,000 cfs. vs. 10,000 cfs), a modified Large Magnitude Flood Schedule, and the same downstream constraints throughout the entire year (18.5 feet at Lone Tree and 25 feet at Wapello).

Each alternative is presented and discussed in more detail in Chapters III and IV.

Final criteria used to select the Recommended Plan were based on which alternative reduced economic flood damages the most and was compatible with meeting other Study objectives. Initial screening of the alternatives was accomplished using performance metrics representing reservoir and river conditions related to thresholds of significant operational change (e.g., activation of the emergency spillway) or significant changes in the nature and consequences of flooding. In addition, the alternatives were screened giving consideration to the acceptability, effectiveness, efficiency, and completeness of each alternative. After initial screening of the alternatives, four alternatives were chosen for detailed hydrologic and economic analysis: Alternative 1, *No Action*, Alternative 2C, Alternative 5, and Alternative 8.

Tables ES-1 and ES-2 show the results of the economic analysis for the total period of record 1919–2019 and an abbreviated wetter period from 1959–2019 which is considered to be more representative of recent hydrologic conditions. Under both the full period of record analysis and the abbreviated wetter period, Alternative 2C provided greater flood damage reduction benefits than either Alternative 1, Alternative 5,

or Alternative 8. Additionally, of the screened plans, the greater maximum allowable release provided for in Alternative 2C offers the greatest flexibility to meet potential upward trends in future precipitation and streamflow.

Based on the economic analysis and resulting damage summary, Alternative 2C is the Recommended Plan for updating the current Coralville Lake WCP. Figure ES-2 provides a summary of the Recommended Plan.

Throughout the planning process, the District engaged stakeholders across the study area and incorporated concerns and feedback provided. Although certain communities and stakeholders had initial concerns, the District addressed these through a series of public meetings and presentations. The District does not anticipate that the Recommended Plan will be controversial in nature as local emergency managers, the Iowa Department of Natural Resources, city and county governments, and Non-governmental Organizations have been active Study partners through the National Environmental Policy Act process. The Recommended Plan requires no construction, operational, or implementation costs.

Table ES-1. Flood Damages Comparison Full Period of Record for No-Action (Alternative 1) vs Alternatives 2C, 5, and Alternative 8 (1919-2019)

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
AVERAGE ANNUAL DAMAGES						
Alternative 1	$270,000	$103,000	$976,000	$434,000	$999,000	$2,782,000
Alternative 2C	$160,000	$65,000	$857,000	$498,000	$998,000	$2,578,000
Alternative 5	$185,000	$77,000	$874,000	$495,000	$1,016,000	$2,647,000
Alternative 8	$180,000	$67,000	$870,000	$495,000	$999,000	$2,611,000
AVERAGE ANNUAL DAMAGES REDUCED (FROM ALTERNATIVE 1)						
Alternative 2C	$110,000	$38,000	$119,000	($64,000)	$1,000	$204,000
Alternative 5	$85,000	$26,000	$102,000	($61,000)	($17,000)	$135,000
Alternative 8	$90,000	$36,000	$106,000	($61,000)	-	$171,000
PERCENTAGE AVERAGE ANNUAL DAMAGES REDUCED (FROM ALTERNATIVE 1)						
Alternative 2C	69%	58%	14%	-13%	0%	7.91%
Alternative 5	46%	34%	12%	-12%	-2%	5.10%
Alternative 8	50%	54%	12%	-12%	0%	6.55%

Table ES-2. Flood Damages Comparison Partial Period of Record for No-Action (Alternative 1) vs Alternatives 2C, 5, and Alternative 8 (1959-2019)

Period 1959-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
AVERAGE ANNUAL DAMAGES						
Alternative 1	$282,000	$148,000	$1,840,000	$587,000	$1,389,000	$4,246,000
Alternative 2C	$205,000	$110,000	$1,560,000	$659,000	$1,413,000	$3,947,000
Alternative 5	$255,000	$122,000	$1,589,000	$610,000	$1,434,000	$4,010,000
Alternative 8	$209,000	$120,000	$1,570,000	$643,000	$1,419,000	$3,961,000
AVERAGE ANNUAL DAMAGES REDUCED (FROM ALTERNATIVE 1)						
Alternative 2C	$77,000	$38,000	$280,000	($72,000)	($24,000)	$299,000
Alternative 5	$27,000	$26,000	$251,000	($23,000)	($45,000)	$236,000
Alternative 8	$73,000	$28,000	$270,000	($56,000)	($30,000)	$285,000
PERCENTAGE AVERAGE ANNUAL DAMAGES REDUCED (FROM ALTERNATIVE 1)						
Alternative 2C	38%	35%	18%	-11%	-2%	7.58%
Alternative 5	11%	21%	16%	-4%	-3%	5.89%
Alternative 8	35%	23%	17%	-9%	-2%	7.20%

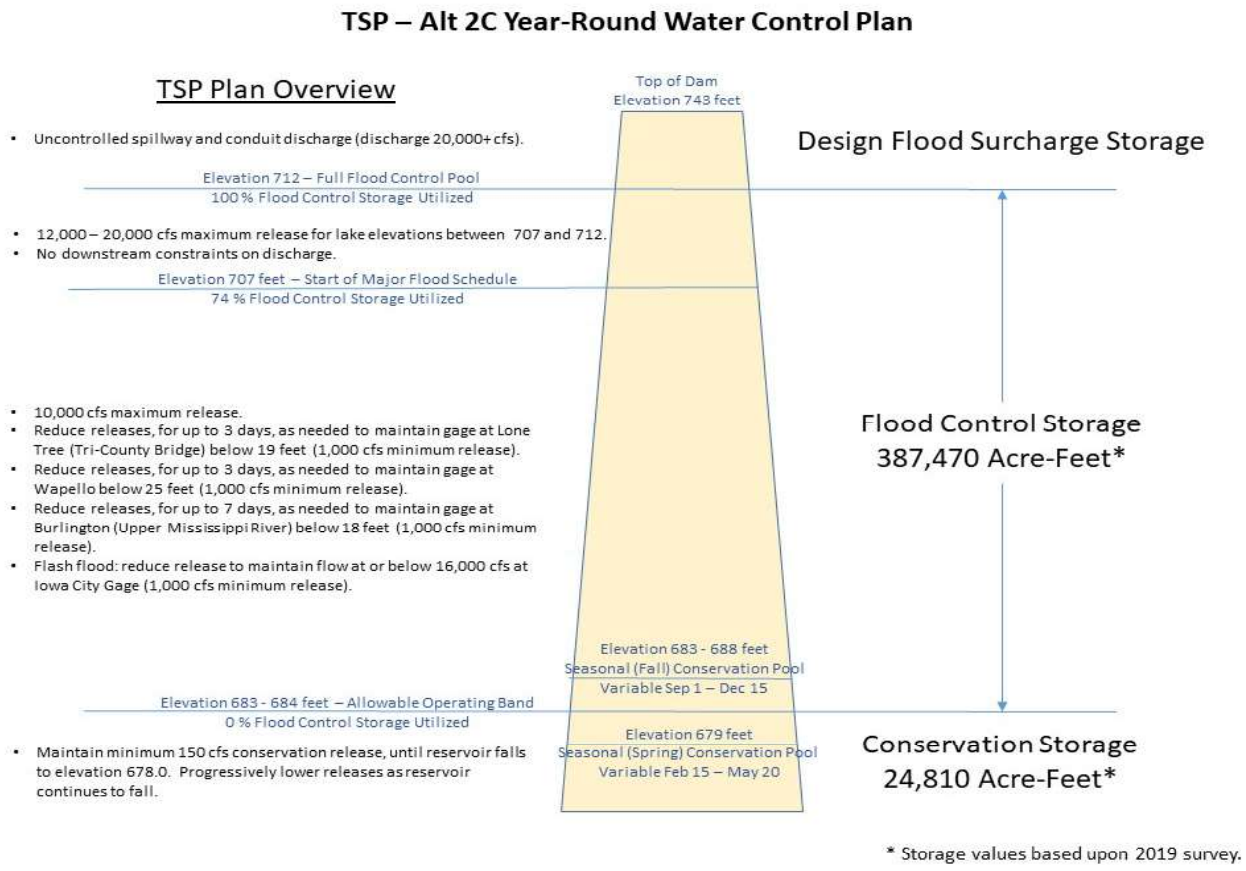

Figure ES-2. Coralville Lake Water Control Plan – Recommended Plan (Alternative 2C)

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FIGURES

TABLES

APPENDICES

ACRONYMS

Acronym	Definition
AAD	Average Annual Damages
AEP	Annual Exceedance Probability
ACS	American Community Survey
APE	Area of Potential Effect
BCSD	Bias Corrected Spatial Downscaling
CCB	County Conservation Board
CEQ	Council of Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO_2	Carbon Dioxide
CWA	Clean Water Act
CWMS	Corps Water Management System
DO	Dissolved Oxygen
EA	Environmental Assessment
ECB	Engineering and Construction Bulletin
EO	Executive Order
EPA	Environmental Protection Agency
ER	Engineering Regulation
ESA	Environmentally Sensitive Area
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FFS	Flood Frequency Study
FIRM	Flood Insurance Rate Map
FRM	Flood Risk Management
FSST	Flandreau Santee Sioux Tribe
FWCA	Fish and Wildlife Coordination Act
FWS	Fish and Wildlife Services
FY	Fiscal Year
GCM	Global Climate Model
GHG	Greenhouse Gas
HA	Hydrologic Alteration
HAZUS	Hazards United States
HEC	Hydrologic Engineering Center
HEC-FIA	Flood Impact Analysis Software
HEC-RAS	River Analysis System Software
HEC-ResSim	Reservoir Simulator Software
HEC-SSP	Statistical Software Package Software
HPMP	Historic Property Management Plan
HTRW	Hazardous Toxic and Radioactive Waste
HUC	Hydrologic Unit Code
IBA	Important Bird and Biodiversity Area
IDALS	Iowa Department of Agriculture and Land Stewardship
Iowa DNR	Iowa Department of Natural Resources
IIHR	Iowa Institute of Hydraulic Research

Acronym	Definition
IPaC	Information, Planning, and Conservation
ISU	Iowa State University
IWR	Institute for Water Resources
LiDAR	Light Detection and Ranging
LMF	Large Magnitude Flood
MBTA	Migratory Bird Treaty Act
MMC	Mapping, Modeling, and Consequences
MOA	Memorandum of Agreement
MRES	Missouri River Energy Services
MSA	Metropolitan Statistical Area
MSIM	Multiple Species Inventory Monitoring
MVD	Mississippi Valley Division
MVR	Mississippi Valley, Rock Island District
NASS	National Agricultural Statistics Service
NATA	National-Scale Air Toxics Assessment
NEPA	National Environmental Policy Act
NFHL	National Flood Hazard Layer
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NRHP	National Register of Historic Places
NRI	National Rivers Inventory
NSI	National Structure Inventory
NWI	National Wetlands Inventory
O&M	Operation and Maintenance
OMP	Operational Management Plan
PCB	Polychlorinated biohenyl
RCRA	Resource Conservation and Recovery Act
RMC	Risk Management Center
ROI	Region of Influence
SHPO	State Historic Preservation Office
SRP	Sustainable Rivers Project
THPO	Tribal Historic Preservation Officer
TNC	The Nature Conservancy
TMDL	Total Maximum Daily Load
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCP	Water Control Plan
WMA	Wildlife Management Area

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CHAPTER I: PURPOSE AND NEED FOR FEDERAL ACTION

A. INTRODUCTION

The *Coralville Lake Water Control Plan Feasibility Study* (Study) is a re-evaluation and update to the Water Control Plan (WCP) for Coralville Lake located within the Iowa-Cedar Rivers Basin. Although the construction of the Coralville Dam created the reservoir, it is important to note that the reservoir is commonly referred to as Coralville Lake by the public. For the purpose of this Study, language throughout may utilize "reservoir" or "lake" in its context, but both are in reference to Coralville Lake. Furthermore, the dam itself was the original Corps Project and shall be referred to throughout this Study as Coralville Dam rather than Project.

This Study is important, especially since the water control plan and manual were last updated in January 2001. The WCP presents operational parameters defining how and when water is stored and released. These include a schedule of releases, conservation pool levels to be maintained during non-flood or drought conditions, and downstream water level constraints. The Coralville Reservoir is authorized for FRM, low flow augmentation, fish, and wildlife management as well as recreation, although the lake is not regulated specifically for these latter purposes. This Study does not involve any modifications to the dam structures themselves, but rather is evaluating how to best manage water using the existing Coralville Dam. As such, the Study also does not propose any new construction or modification of the dam and levee structures (including the remedial works) previously constructed. Additionally, there is no anticipated cost for the Study outcome or Recommended Plan implementation.

The Study area encompasses the Iowa-Cedar Rivers Basin (Figure 1), a tributary to the Mississippi River. The Iowa-Cedar Rivers Basin is 12,640 square miles and begins in north central Iowa and southeastern Minnesota and extends south/southeast across central and southeastern Iowa. The Iowa River is approximately 323 miles long and joins the Mississippi River across from New Boston, Illinois. The U.S. Army Corps of Engineers (Corps), Rock Island District (District) impounded the Iowa River by a congressionally authorized Civil Works project, Coralville Dam (authorized in 1938). The authorized purposes included flood control and water conservation for the Iowa and Mississippi Rivers by Public Law 75-761 and recreation and fish and wildlife enhancement by Public Law 78-534 and by Public Law 94-587. The feasibility study scope will maintain the existing authorized purposes and priorities. Downstream of the dam are thousands of acres of agricultural land, wildlife habitat, and a number of cities and small towns.

This feasibility report with an integrated environmental assessment documents the Study process and results including an account of the planning, regulatory, and environmental considerations that could result in would changes to the current WCP/manual. The Commander of the Mississippi Valley Division, U.S. Army Corps of Engineers, has the authority to approve proposed changes.

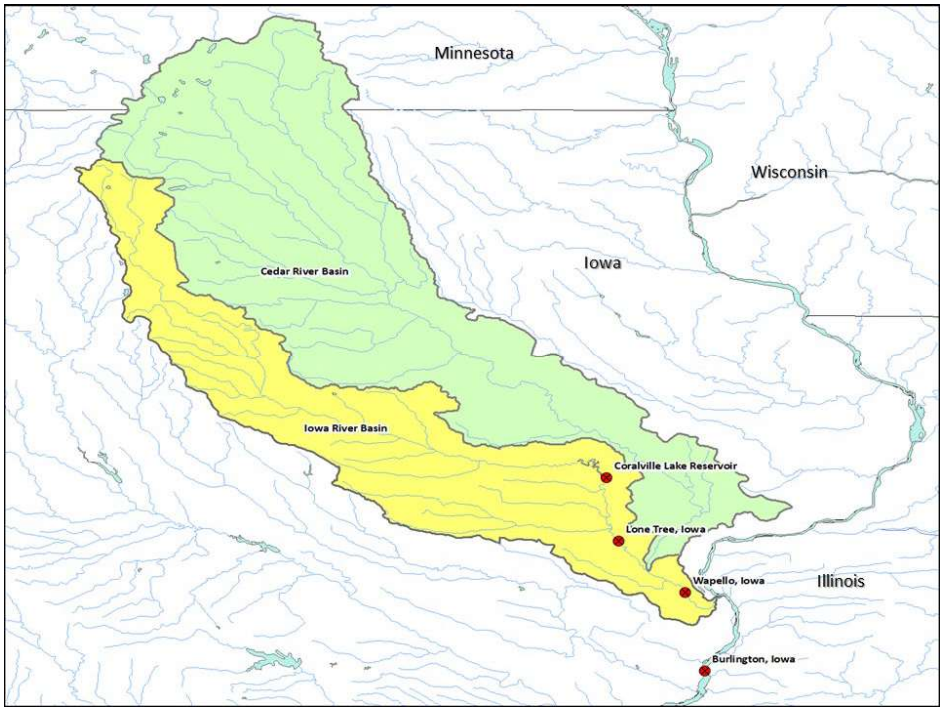

Figure 1. Overview Map of the Iowa-Cedar Rivers Basin

B. PURPOSE AND NEED

The overall plan for FRM for the Coralville Lake is to implement a regulation plan with due regard to various constraints to provide a part of the comprehensive scheme for conservation and FRM in the Iowa River and the Upper Mississippi River Basins. Other components of the overall plan for water control in the Iowa-Cedar Rivers Basin are the Lake Macbride Remedial Works and the Amana, Iowa, Remedial Works. For conservation storage, the plan of regulation is to provide a minimum low-flow in the Iowa River (150 cfs) downstream of Coralville Lake during periods of low flow and droughts.

The FRM objective of the current WCP for Coralville Lake is to manage water levels at the downstream control points at Lone Tree and Wapello, Iowa, on the Iowa River and Burlington, Iowa, on the Mississippi River in order to minimize the frequency and duration of damaging flows, as described in the following paragraphs of this section of the report.

The Iowa-Cedar Rivers Basin has experienced significant land use changes in the last century, from a prairie and forested landscape. Although there have been pockets of urbanization in Iowa City and the Coralville area, in general the basin remains largely agricultural. These changes influence runoff rates of the main stem Iowa River and its tributaries, resulting in increased flood risk within the Iowa-Cedar Rivers Basin.

Changing weather patterns have also increased the susceptibility of the environment and flood risk along the Iowa River. These factors resulted in a changed environment from which the District must try to manage water levels along the Iowa River for the stated purposes of FRM, low flow augmentation, fish and wildlife management, and recreation.

As mentioned above, the Water Control Manual was last updated in January 2001. Guidance contained in Engineering Regulation (ER) 1110-2-240*, Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors,* recommends WCPs and manuals be reviewed every 8 years for potential updates. The need for the Study arises from changes over time to hydrologic loading, land use, and reservoir sedimentation.

Alterations to the existing WCP will be considered in the context of their effect on human life and the environment within the constraints of the authorized missions of the reservoir. Any scenarios that cause additional overall system risk will not be further considered.

Following the 2008 Iowa River flood, the District received funding to re-evaluate regulated flow frequencies on the Iowa River to improve the characterization of flood risk, update the reservoir pool-frequency relationships and update the flow frequency values downstream of the District reservoirs, henceforth referred to as the Regulated Flow Frequency Study (FFS).

The Iowa River FFS, completed in October 2009, concluded the frequency of flooding on the Iowa River increased and indicated flood events like 1993 and 2008 are more likely to occur in the future than previously estimated. While there may be many underlying reasons why river flows and flooding have increased (e.g., changes in land use, increased precipitation), the Study was not designed or conducted to define the cause(s). The scope of the Study was to examine river and reservoir data and project future flood probabilities. The Study findings clearly indicate flooding is more frequent than previously estimated. Thus, floodplains adjacent to the Iowa River and some areas once thought to be outside of the floodplain or protected by flood-risk-management projects have a greater risk of flooding than was previously estimated.

Considering the results of the FFS, a study to update the WCP for Coralville Lake was proposed. The District recognized the need to comprehensively study and evaluate alternatives related to management of the reservoir.

Some of the alternatives that were considered included modifying downstream constraints, modifying the normal seasonal release schedules, and modifying the Large Magnitude Flood (LMF)schedule. It is the District's priority to develop feasible alternatives to reduce the risk of flooding along the Iowa and Mississippi Rivers.

C. DECISION

The District update has studied the WCP for Coralville Lake. The District identified alternative water control strategies that improve the Coralville Dam's ability to meet the congressionally authorized purposes, including reducing future flood risk and maintaining public safety. While it is impossible to eliminate all flood risk, the goal of this Study is to modify the WCP to better manage the reservoir to meet the Coralville Dam's authorized purposes based on current hydrologic conditions. As discussed above, the Study proposes no new construction.

The Recommended Plan developed in this Study will serve as the basis for updating the WCP for Coralville Dam. The WCP is a separate document that will be written after the recommendations of this report are approved.

D. AUTHORITY

Coralville Lake was authorized for flood control and conservation by Congress in the Flood Control Act of 28 June 1938. Recreation facility authorization started with Section 4 of the Flood Control Act of 22 December 1944 and continued under Section 111 of the Water Resources Development Act of 1976. Management for fish and wildlife was authorized as part of the 1958 Fish and Wildlife Coordination Act (Public Law No. 624, 85th Congress). The Iowa and Mississippi Rivers primary authorized purpose was originally flood control, but was semantically changed to FRM. Other purposes included low flow augmentation for water quality, fish and wildlife management, and recreation. It should be noted that while access and facilities are provided for recreation, water is not managed for these latter purposes.

ER 1110-2-240 and ER 1110-2-8156, *Preparation of Water Control Manuals,* apply to Corps actions in developing WCPs or in operating non-Corps reservoirs, locks, dams, and other water control projects in which storage is operated and managed for flood control and navigation and subject to Corps direction pursuant to Section 7 of the Flood Control Act of 1944 or other laws. These policies may also provide guidance in other cases where water resources infrastructure is similarly operated for flood control or navigation and subject to Corps direction through the establishment of water control or operational plans.

ER 1110-2-240 requires reservoirs and inter-related water resources systems to have an up-to-date Water Control Manual. The WCPs contained in the manuals must be prepared to consider all applicable Congressional Acts relating to operation of Federal facilities, i.e., Fish and Wildlife Coordination Act (FWCA), National Environmental Policy Act (NEPA), the Clean Water Act (CWA).

Policy Guidance Letter dated 2 July 2013 states updates to Water Control Manuals would generally be categorized as "other work products" and requires compliance with Engineering Circular 1165-2-217 *Civil Works Review Policy*.
ER 1110-2-8156 provides guidance on the content and format of Water Control Manuals with additional guidance in Engineering Manual 1110-2-3600, *Management of Water Control System*s. Additional

guidance on WCP development can be found in ER 1105-2-100, *Planning Guidance Notebook* and ER 1165-2-119, *Modifications to Completed Projects*.

E. SCOPING AND SIGNIFICANT ISSUES

The scope of this Study was carefully considered by the planning team and developed within the Principles & Guidelines and NEPA requirements. The scoping process consisted of facilitating all of the necessary steps to re-evaluate and update the WCP for Coralville Lake on the Iowa River, including all regulated waters within and below Coralville Lake. Early in the planning process, the following scoping items were identified and were evaluated during the planning study:

- Maximizing flood risk management (FRM) benefits of the reservoir
- Evaluating downstream control points to identify when significant flood damages begin.
- Assessing frequency of flooding impacts to flowage easement lands at Coralville Lake
- Minimizing flood damage to marinas and Corps facilities
- Providing adequate releases for water quality
- Evaluating impacts to industry & municipality vs. agricultural
- Evaluating cost/benefit of alternatives (i.e. review/update Damages Prevented analytic model)
- Seeking opportunities to improve ecological/environmental benefits within the watershed related to Iowa River water management.
- Minimizing negative ecological impacts of flow regulation.
- Maximizing positive impacts on reservoir and downstream water quality
- Maximizing all additional authorized Coralville Dam purposes within FRM constraints to include safe public recreation opportunities and environmental stewardship
- Evaluating benefit of reservoir operations for fish and wildlife benefit
- Assessing impacts of historic and future reservoir sedimentation.
- Reducing impacts to riverbank and lake shoreline erosion/sloughing
- Minimizing impacts of Large Magnitude Flood events
- Identifying potential partnering/coordination opportunities to support sound land/water management and watershed budgeting initiatives
- Identifying cost/benefit of additional water level monitoring equipment/process
- Evaluating the need for additional gauge locations for evaluating inflow and outflow stages to ensure coordination with potential modifications to the Coralville Lake WCP, the District solicited input from the public, local emergency management, state, county and Federal agencies, and tribal nations. Public meetings and multiple agency meetings were held to gather valuable input for the scope of the Study. In preparation for the public scoping meetings, the

planning team developed the following potential topics of discussion for participants; however, participants were not limited to the examples provided:

- How, and under what conditions, participants are impacted by water levels (either flood or drought) along the Iowa River.
- Concerns related to the effects of water level management actions on recreational use of the reservoir or Iowa River.
- Environmental concerns, comments or observations related to reservoir operations or Iowa River flows.
- Regarding the way water is managed at Coralville Lake, recommendations on problems and/or opportunities that should be evaluated as part of the Study.
- Alternatives or actions you believe should be evaluated as part of the Study.

The District held four separate public meetings that had significant turnout for public participation. The first public meeting was held in Wapello on February 26, 2019 and the second public meeting was held the next day in Iowa City on February 27, 2019. The third public meeting was held in Marengo on April 2, 2019 and the fourth public meeting was held in Amana on April 15, 2019. The public meetings were an important element to the scoping process and the District was able to gain valuable input and feedback from the public participation.

In addition to public meetings, there were also separate stakeholder engagement meetings to guide the planning team in the scoping process.

In addition to scoping, significant physical and regulatory issues that have priority over recreation with regard to regulation of the Coralville Dam exist for the Study. These include FRM, low-flow augmentation, and fish and wildlife management in Coralville Lake and Dam. While recreation is an authorized purpose and provides important benefits and opportunities, water is not regulated for the purpose of recreation.

The current approved plan of regulation considers several constraints regarding downstream channel capacity including flooding in Iowa City and Coralville vicinity, looking upstream of Coralville Dam and Reservoir, and minimum low-flow requirements.

F. PROBLEMS AND OPPORTUNITIES

Land-use changes have altered the landscape within the Iowa-Cedar Rivers Basin over the past few centuries, and climate variations and land management have resulted in changes to the hydrologic regime (hydrology) of the basin. As the basin environment responded to and changed over time through both natural and man-made forces, floods increased in frequency and magnitude. Consequently, water level management has become increasingly challenging. Increased flood risk, significant changes in land use and sedimentation are all factors that impact the hydrology within the Iowa-Cedar Rivers Basin.

Problem 1. Flood Risk Management. Over time, changes in precipitation and runoff in the Iowa-Cedar Rivers Basin led to changes in the magnitude and frequency of flooding. Historic flooding in 1993, 2008, 2013 resulted in widespread flood damages along the Iowa and Upper Mississippi Rivers.

Opportunity 1.1. ***Seek opportunities to improve recreational activities consistent with reservoir operating objectives of FRM, low-flow augmentation and fish and wildlife management.*** The reservoir's primary operational authorities are FRM, low flow augmentation, and fish and wildlife management which also provide recreational opportunities even though the lake is not specifically regulated for this purpose. However, flood events sometimes result in inundation of recreational areas. By more effectively managing flows and storage at the reservoir, the District could potentially reduce flooding impacts to recreational facilities.

Problem 2. Increased Runoff due to Land Use. Changes in land use have increased runoff rates into the Iowa River. Land use changes include loss of native ground cover (prairies and woodland habitat), increased urbanization, and changes in agricultural practices and tiling.

Problem 3. Sedimentation. The problem of sedimentation was anticipated and discussed in this study. However, since the purpose of this study is to update the WCP for Coralville Lake, the study is restricted to addressing the project goals and objectives which properly align with the authorized operating purposes of the reservoir: flood risk management, low-flow augmentation and fish and wildlife. While sedimentation is identified as a problem, it impacts the study goals only to the extent where sedimentation impacts the overall project benefits of water control management and there are water management strategies that can improve Coralville Lake's ability to deliver such project benefits. The authorized operating purposes most impacted by on-going sedimentation are low-flow augmentation and fish and wildlife, particularly, affects recreational activities including hunting access and operation of motorized watercraft in the upper reaches of Coralville Lake.

G. GOALS AND OBJECTIVES

The District, with input from the public, emergency management agencies, state, county and Federal agencies, and tribal nations, developed the following Study goals and objectives during the scoping process.

Goal 1. ***Reduce Future Flood Risk along the Iowa and Upper Mississippi Rivers***

Objective 1a. Modifications to the WCP to better manage the observed, higher inflow volumes due to increased run off.

Objective 1b. Reduce risks to life, health, and safety of residents due to flooding events along the Iowa and Upper Mississippi Rivers.

Objective 1c. Reduce future flood risk to critical infrastructure, commercial, residential, and agricultural areas along the Iowa and Upper Mississippi Rivers.

Objective 1d. Maintain communication mechanisms to ensure populations at risk have access to timely and relevant information on impending water levels.

Objective 1e. Coordinate with local urban entities to ensure maximum flood risk mitigation and minimal contribution to degraded hydrological conditions.

Goal 2: ***Improve low flow augmentation reliability***

Objective 2a. Maintain conservation flows to meet ecological, habitat, and municipal water supply needs downstream.

Goal 3: ***Promote Fish and Wildlife Sustainability***

Objective 3a. Implement practices that may reduce nitrate levels and /or improve water quality.

Objective 3b. Implement practices that may reduce mussel mortality.

Objective 3c. Implement practices that may reduce sturgeon mortality.

Objective 3d. Implement practices that may improve conditions for migrating waterfowl and shorebirds.

Objective 3e. Implement practices that may improve conditions for reptiles and amphibians.

Objective 3f. Preserve aquatic and terrestrial habitats and connectivity for flora and fauna during migration periods.

Goal 4: ***Promote Enhancement of Recreational Features***

Objective 4a. Sustain the availability of water-based recreational features at Coralville Lake within the parameters of other missions.

Objective 4b. When possible, reduce the potential of financial impacts to recreational interests as a result of water level fluctuations.

Goal 5: ***Accommodate Other Stakeholder Interests***

Objective 5a. When possible, reduce rate of release changes to reduce potential river and lake shore erosion.

H. PLANNING CONSTRAINTS

Sections F & G above outlined several Problems and Objectives in addition to Flood Risk Management for Coralville Lake. Like all planning efforts, there are both planning and resource constraints that create obstacles to successfully achieve every planning goal. The objective of this study is to find the best alternative that can be recommended as a Recommended Plan for updating the Coralville Lake Water Control Plan to better meet mission objectives. However, at the same time, USACE is constrained by the project authorizations for the Coralville Dam and reservoir. In other words, there can be no elimination of existing project purposes or new purposes that would require congressional authorization. Any goals or objectives identified that would require congressional authorization would be considered for future study under non-O&M funds. Currently, this study is funded provision to maintain the maximum non-growing season release if the reservoir pool is above elevation 700 on May 1 by Operation & Maintenance funding and therefore is limited by this resource constraint.

I. RELATED NEPA DOCUMENTATION AND OTHER STUDIES

Many reports and studies have been published about Coralville and the Iowa River, with the most relevant listed below

Coralville Lake

1. Pool Raise and Release Rate Studies

Regulation Plan Study - Plan 7 of Coralville Reservoir Operation, approved August 2, 1954. This was the first operating plan for the Study. Under this plan, maximum outflow was 10,000 cubic feet per second (cfs) during the non-growing season and 8,500 cfs during the growing season.

Regulation Plan Study - Plan 8 of Coralville Reservoir Operation. This plan was approved April 10, 1963 and included changes to Plan 7 to provide for non-growing season of 10,000 cfs; a transition period between April 21 and May 1, with releases between 6,000 and 10,000 cfs dependent on the reservoir elevation on April 21; and a growing season release rate of between 4,000 and 6,000 cfs dependent on the reservoir elevation on May 1.

Water Levels of the Coralville Reservoir, Iowa; Report to the Committee on Appropriation, House of Representatives. Prepared by the Corps of Engineers in Response to House of Representatives Report No. 1459, dated June 14, 1968, 90th Congress, 2nd Session, submitted April 8, 1969.

Flood Damages on the Iowa River, 1976, Thomas E. Crowley, III, Faze Krim and Rosa Chen, Iowa Institute of Hydraulic Research, Iowa City, located in the University of Iowa Library.

Stochastic Trade-Offs for Reservoir Operation, 1977, Thomas E. Crowley, III and Rosa Chen, Iowa Institute of Hydraulic Research, Iowa, located in the University of Iowa Library.

Iowa-Cedar River Basin, Coralville Lake Effects in the Lower Iowa River Valley, October 1978. Special Information Report, U.S. Army Corps of Engineers, Rock Island District.

2. Regulated Flow Frequency Study

Iowa River Regulated Flow Frequency Study, U.S. Army Corps of Engineers, Rock Island District, October 2009.

3. Original Design Documentation

Revised Definite Project Report, Appendix I Hydrology, Coralville Reservoir, Rock Island District Army Corps of Engineers, April 1, 1948

Revised Definite Project Report, Appendix XIII Plates, Coralville Reservoir, Rock Island District Army Corps of Engineers, April 1, 1948.

4. Historical Regulation and Operation & Maintenance Manuals

Coralville Reservoir, Iowa River, Iowa, Regulation Manual, dated April 30, 1951, Rock Island District, U.S. Army Corps of Engineers, and supplement thereto dated February 1, 1961.

Upper Mississippi River Basin, Iowa River, Iowa, Master Reservoir Regulation Manual, Coralville Lake 1959, revised January 31, 1991, U.S. Army Corps of Engineers, Rock Island District.

Water Control Plan with Final Supplemental Environmental Impact Statement, Coralville Reservoir, Iowa, November 1991, U.S. Army Corps of Engineers, Rock Island District.

Appendix A Master Reservoir Regulation Manual Drought Contingency Plan, October 1996, U.S. Army Corps of Engineers, Rock Island District. This document provides a base reference for water management decisions and responds to a water shortage in the Iowa River Basin due to climatological droughts.

Water Control Manual, Coralville Lake, Iowa River Basin, Coralville, Iowa, 1959, revised January 2001, U.S. Army Corps of Engineers, Rock Island District.

5. Sedimentation Surveys

Coralville Lake Report of Sedimentation, 2008. U.S. Army Corps of Engineers, Rock Island District.

Coralville Lake, Iowa River, Iowa, Report of Sedimentation, 1983 Resurvey, February 1987*,* U.S. Army Corps of Engineers, Rock Island District.

Sedimentation in the Coralville Reservoir, 1976, T. E. Crowley, Limited Distribution Report No. 63, Located in the University of Iowa, Hydraulic Library.

6. Flood and Flood Damage Reduction Studies

1993 Post Flood Report, Upper Mississippi River Basin, September 1994, U.S. Army Corps of Engineers, Rock Island District. This report includes the description and causes of the flood, resources utilized, data collected, recommended efficiencies, and findings and conclusions about the event.

Floods in the Iowa River Basin Upstream from Coralville Lake, Iowa, 1973, A. J. Heinitz, Iowa Institute of Hydraulic Research series: (100-S-1 l) and available from the University of Iowa Library.

Flood of June 17, 1990, in the Clear Creek Basin, East Central Iowa, Open File Report 94-78, U.S. Geological Survey (USGS).

Implementation of HMR52 Procedures for Probable Maximum Precipitation and Flood (PMP/PMF) Estimates, Memorandum for the Commander, U.S. Army Corps of Engineers, June 1990.

The Human Ecological Impact of Structural Flood Control on the Iowa River, Iowa, 1973, James S. Garner and Nancy Hyltquist, Iowa Institute of Hydraulic Research, Iowa City, Iowa. Located in the University of Iowa Library.
Flood Insurance Studies for Coralville, Iowa; Iowa City, Iowa; and for Johnson County, Iowa, in February 2007. Study performed by the Federal Emergency Management Agency.

Iowa Reservoirs Dam Safety Floodplain Management Study, Hydraulic Modeling and Mapping, Coralville Dam downstream to the Mississippi River, Iowa River, U.S. Army Corps of Engineers, Rock Island District, January 2013.

Hydraulic Model Report, Flood Inundation Modeling & Consequence Assessment Study, *Coralville Dam, Iowa River Basin, Johnson County, Iowa,* U.S. Army Corps of Engineers, Rock Island District, March 2014.

7. Other Studies and Reports

Coralville Lake, Iowa River, Iowa, Resource Master Plan, Design Memorandum No. l 5C, Revision No. 2, April 1976, Prepared by Midwest Research Institute in Kansas City, Missouri, and Hansen Lind Meyer in Iowa City, Iowa, for the U.S. Army Corps of Engineers, Rock Island District.

Coralville Lake Resource Master Plan, April 1977, U.S. Army Corps of Engineers, Rock Island District.
Final Environmental Impact Statement for Coralville Lake and the Downstream Area of Influence to Columbus Junction, Iowa, U.S. Army Corps of Engineers, Rock Island District April 1977.

Evaluating Two of Iowa's Reservoirs for Economic Hydroelectric Power Development Using Computer Simulation Techniques, 1989. Engineering Thesis of Justin Rundle, available at the University of Iowa Library.

Section 216 Initial Appraisal, Coralville Lake, Johnson County, Iowa, March 1995, U.S. Army Corps of Engineers, Rock Island District. This appraisal concludes a significantly changed economic and physical condition exists upstream and downstream of the reservoir.

Section 216, Review of Completed Works, Reconnaissance Report, Coralville Lake, Johnson County, Iowa, U.S. Army Corps of Engineers, Rock Island District, May 1997.

Emergency Action Plan, Coralville Dam and Amana Remedial Works, Iowa River, Iowa, 2012. U.S. Army Corps of Engineers, Rock Island District. This plan is a guide for identifying types of dam emergencies which could occur and actions to be taken.

DRAFT Coralville Dam Flood Control Pool & Amana Remedial Works, Iowa River and Price Creek, Iowa, Periodic Assessment No. 1, U.S. Army Corps of Engineers, Rock Island District, July 2014.

CHAPTER II: INVENTORY AND FORECASTED CONDITIONS

A. INTRODUCTION

The District inventoried the applicable social, economic, and environmental factors for the Study area within the Iowa River floodplain corridor. The floodplain corridor includes federally-managed lands upstream of Coralville Dam near Amana, Iowa, to the confluence with the Mississippi River (River Mile 434.1). The District used applicable social, economic, and environmental factors as the foundation of the analysis, to evaluate and compare alternatives and select the District's Recommended Plan. These factors establish a baseline to measure the Coralville Dam impacts. The floodplain corridor includes the following parameters:

- the river and adjacent lands (agriculture, urban, and wildlife habitat);
- constructed facilities adjacent to the river;
- areas subject to flood inundation as a result of Coralville Lake water releases and unregulated tributary inflows; as well as lake levels upstream of the Coralville Dam; and
- area of influence varies based on the resource and was tailored to capture the measurable impacts

The District focused on information gathered from this Study area, or area of influence. If the District used data from outside this area in their analysis, rationale is provided in the resource sections below.

Resources Not Evaluated in Detail. The District considered all possible environmental factors potentially influenced by the Study alternatives and eliminated resources from further evaluation not in the area of potential affect, or that would not be impacted by any of the alternatives. These resources include:

- Wild and Scenic Rivers
- Mineral and Energy Resources
- Noise
- Air quality (The planning area is completely not in a non-attainment zone.)

Relevant Resources Found in the Planning Area. The District focused their evaluation on those resources potentially affected by any of the alternatives. These resources are described within this chapter and include:

- Floodplain Resources
- Land Use
- Aquatic & Wildlife Resources (Fish and Mussels, Mammals, Migratory Birds)
- Threatened and Endangered Species
- Invasive Species
- Vegetation
- Water Quality, Wetlands, Rivers, and Streams
- Hydrology and Hydraulics
- State Parks, Conservation Areas, and Other Areas of Recreational, Ecological, Scenic, or Aesthetic Importance
- Historical and Cultural Resources
- Socioeconomics Resources
- Minority and Low-Income Populations
- Human Health and Safety
- Sustainability, Greening and Climate Change
- Constructed Resources (Utilities, Infrastructure, Transportation, Among Others)
- Recreation
- Sedimentation/Soils/Prime and Unique Farmland
- Hazardous Substances/Petroleum Products

Each resource section described in this chapter also includes a description of the future without project conditions, or the No Action Alternative. The No Action Alternative is the base condition to which the effects of the action alternatives are compared, as required by the NEPA. Under the No Action Alternative, environmental consequences will still occur because the existing environment is not static. Chapter I, Section H, *Planning Constraints*, lists several earlier studies proposing additional FRM actions. The District does not anticipate implementing any additional FRM measures. No other FRM actions are currently being planned or need to be implemented from the previous reports.

B. GENERAL SETTING

The Iowa-Cedar Rivers Basin (Figure 2) begins in North Central Iowa and extends southerly across central Iowa to Southeastern Iowa. The Iowa River joins the Mississippi River 20 miles South of Muscatine, Iowa, across from New Boston, Illinois.

The Iowa-Cedar Rivers Basin drains a 12,640 square mile area. Cedar Falls/Waterloo, Cedar Rapids, and Iowa City/Coralville are the largest population centers within the basin. The total Iowa-Cedar Rivers Basin population is 1,007,575 (2009). Land use and land cover in the Iowa-Cedar Basin is primarily agricultural with about 93% of the total area used for cropland or pasture. Land is largely privately owned. The remaining land area consists of about 4% forests, about 2% urban and about 1% water and wetlands.

Coralville Lake is located in Johnson County on the Iowa River in eastern Iowa, approximately 83.3 miles upstream from the confluence with the Mississippi River. The conservation pool impounded by the dam is within Johnson County. The flood pool extends into Iowa County. The City of Iowa City is 5 miles to the south of Coralville Lake. The lake is surrounded by the growing communities of Solon, North Liberty, and Coralville.

Figure 2. Iowa-Cedar Rivers Basin

C. FLOODPLAIN RESOURCES

1. Natural Floodplain. By their very nature, floodplains are the low, flat, periodically flooded lands adjacent to rivers and are subject to the land-shaping and water flow processes. As distinguished from the floodplain, a river floodway is the dry zone typically between levees, which is designed to convey flood waters. It is only during and after major flood events the connections between a river, its floodway and its floodplain become more apparent. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. In addition, the floodplain represents a natural filtering system, with water percolating back into the ground and replenishing groundwater.

2. Regulatory Floodplain. The regulatory floodplain is defined by areas inundated by the 1% annual exceedance probability discharge. A 100-year flood is defined as a flood event having a 1% chance of occurring in any given year. For land use planning purposes, the regulatory floodplain is usually viewed as all lands within reach of a 100-year flood. The Federal Emergency Management Agency (FEMA) produces floodplain maps, defining what's in and out of the 100-year (or "regulatory") floodplain in order to implement the National Flood Insurance Program. Flood Insurance Rate Map Zones (FIRM) are depicted in the floodplain terminology Table 1.

Table 1. Floodplain Terminology

Terms	Measured Flood Event	Common Name	FIRM Zones
Base Flood	1% chance flood	100-year flood	Zone AE, A
	0.2% chance flood	500-year flood	Zone X
	0.1% chance flood	1000-year flood	Zone X
Floodway			Zone AEF

A common misconception about the 100-year flood is that it represents the peak flow from historical records, or it will occur once every 100 years. In fact, a 100-year flood has a 26% chance of occurring during a 30-year period, the length of many home mortgages. The 100-year flood is a statistically derived regulatory standard used by Federal agencies, and most states, to administer floodplain management programs. A more technically accurate term for the 100-year flood is the 1% chance exceedance flood, or a flood level which has a 1% chance of happening in any given year.

For this Study, the District assumed the area of influence would be approximate to the 500-year floodplain, i.e. area inundated by the 0.2% exceedence probability annual discharge. Changes between the current (baseline) WCP and the possible revised plan alternatives do not measurably impact flood events exceeding the 500-yr event as they all result in similar, unregulated discharges from Coralville Lake.

Future Condition. The FEMA may change the regulatory floodplains based on future precipitation trends and changes in flood frequency. If a change occurs, the District would consider whether any additional changes to the Water Control Plan WCP are warranted.

D. LAND USE

The 2016 National Land Cover Database (NLCD) Data includes the most up-to-date data concerning the Study area. Table 2 and Figure 3 depict the Study area's various land uses.

Table 2. Land Cover Type

Land Cover Type	Area (ha)
Open Water	6,600
Developed, Open Space	823
Developed, Low Intensity	615
Developed, Medium Intensity	256
Developed, High Intensity	157
Barren Land	46
Deciduous Forest	1,410
Evergreen Forest	4
Mixed Forest	372
Shrub/Scrub	5
Grassland/Herbaceous	4,009
Pasture/Hay	1,001
Cultivated Crops	14,819
Woody Wetlands	8,587
Emergent Herbaceous Wetlands	7,369

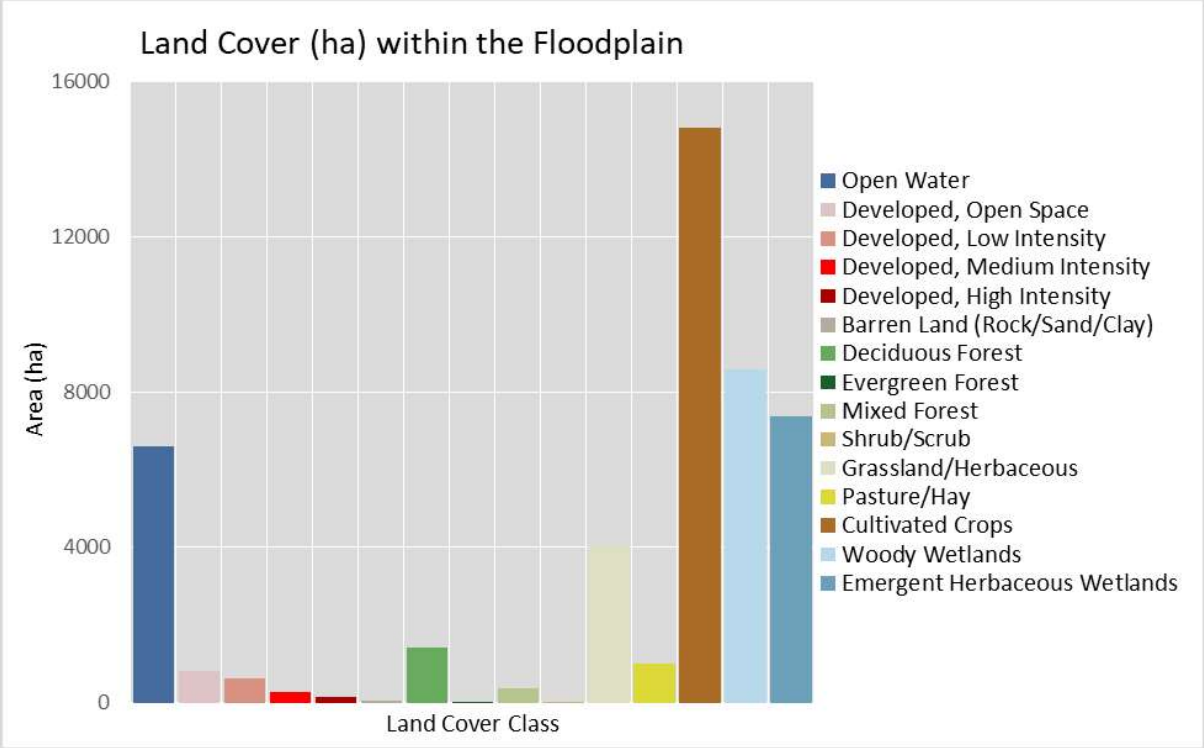

Figure 3. Land Use Land Cover Class *(Source: National Land Cover Dataset, 2016)*

According to the NLCD database, the largest land cover type within the floodplain of the Study area is Cultivated Crops, followed by wetlands and open water. Comparatively, data shows that land use and land cover throughout the entire Iowa-Cedar Rivers Basin is primarily agricultural with about 93% of the total area used for cropland or pasture. Land is largely privately owned. The principal crops are corn, soybeans, hay, and oats. The remaining land area consists of about 4% forests, about 2% urban, and about 1% water and wetlands. Industrial outputs are food processing, machinery, electric equipment,

chemical products, publishing, and primary metals. Iowa produces the nation's largest amount of ethanol and many farms in the Cedar-Iowa basin grow corn for the growing biofuel industry.

Following the Floods of 1993 and 2008, communities and landowners downstream of Coralville Lake have taken measures to reduce their exposure to future flooding. In the City of Coralville, a levee and floodwall system has been constructed along the Iowa River to provide flood protection against flooding 2 feet higher than the 2008 record flood event. In Iowa City, a combination of buyouts, relocations, structural flood proofing, and temporary flood fighting measures have been implemented to reduce future risk to the City as well as the University of Iowa. In downstream historically agricultural areas, extensive lands (particularly in the Wapello Reach) have been enrolled in permanent NRCS conservation easements, reducing future agricultural flooding impacts in these areas.

Land Use Plans. Corps reservoir master plans are management plans for environmental stewardship of the land and recreational opportunities. Master plans do not address the specifics of regional water quality or water level management for FRM.

Master plans present an inventory of land resources; land classifications; and three main focus areas—Sustainable Environment, A Natural Place to Play, and Connections. The focus areas provide management concepts for environmental stewardship of environmentally sensitive areas and other lands; existing and expanded recreational facilities; and connections between people and nature. All actions by the District, partnering agencies, and individual granted leases use District-managed lands (out-grantees) must be consistent with the master plans.

Master Plans are based on responses to regional and local needs, resource capabilities and suitability and expressed public interests consistent with authorized Coralville Dam purposes and pertinent legislation and regulations. They provide a District-level policy consistent with national objectives and other State and regional goals and programs. The plans are distinct from the Project-level implementation emphasis of the Operational Management Plan (OMP). Policies in the master plan are guidelines implemented through provisions of the OMP, specific design memorandums, and the annual management plans. Coralville Lake staff are in the process of updating and approving their master plan. The current master plan was approved in 1977.

While the Iowa Department of Natural Resources (Iowa DNR) manages a large share of federally-managed lands at Coralville Lake for wildlife management purposes, it does not have an established planning document, other than the original lease agreements. The District reviews and approves the Iowa DNR's annual work plan at each site.

Additionally, much of the agricultural land in the Wapello reach has been converted from production to conservation land through the Federal Conservation Reserve Program (CRP). The U.S. Department of Agriculture (USDA) Farm Service Agency (FSA) administers the CRP through exchange or yearly rental payments for removal of environmentally sensitive landform agricultural production. The enrollment of lands in the CRP successfully increases available wildlife habitat, improves water quality, and reduced soil erosion. Landowners in the project area continue to apply for enrollment of their land along the Iowa River in the CRP, which may result in increased lands within the project area under conservation management.

Future Condition: The Iowa-Cedar Rivers Basin should continue to be predominately agricultural land use; however, urbanization and non-permeable surfaces are expected to expand at their current rate. This may increase flash flooding and increased run-off. Local FRM measures may result from the urban growth near the river. Land under current county, state, and Federal management should continue as

public lands. These lands' missions should remain as FRM, water supply, fish and wildlife management, and recreation.

The enrollment of low lying, flood-prone, agricultural areas into permanent NRCS conservation easements is expected to continue as funding for the NRCS programs allow. In 2019, the NRCS received funding for the program and requested applications for easements on historically flooded areas from farmers. The response in Iowa, which included lands along the Iowa River below Coralville, far exceeded the current funding capabilities of the program. Due to the uncertain nature of funding for such programs, the current land use condition was assumed in assessing potential flood damages in this Study.

E. WILDLIFE RESOURCES

Fisheries, Mussels, and Their Habitats. Fisheries and other aquatic resources in Coralville Lake and the Iowa River are managed by the Iowa DNR Fisheries Bureau. Work is aimed at monitoring fish, mussels, and aquatic life, as well as maintaining a sport fishery for anglers. Primary management species in the Iowa River include Walleye, hybrid Striped Bass (Striped Bass x White Bass), and Northern Pike, which require stocking due to limited or no reproduction. Largemouth Bass, Channel and Flathead Catfish, White Bass, crappie, and other pan fishes reproduce naturally and only require supplemental stocking when necessary. A contract commercial fish harvester is allowed to remove rough fish species from September 15th to May 15th. Each year they remove approximately 250,000 pounds of rough fish from Coralville Lake. Riverine fishes below the dams include species such as catfish, suckers, minnows, Walleye, and gar. Rarer species like American Eel and Shovelnose Sturgeon also inhabit the Iowa River at certain times of the year.

Shoreline development, bridges, and dams limit the river's natural setting in many places. Still, the Study area supports a good fishery near dams, snags, and other places where flow and structure are diverse. The Coralville Dam limits upstream movement of fish in the lake, while also losing many due to flushing through the outlet, such as striped bass, muskellunge, and other game fish.

The Iowa River was historically inhabited by at least 36 species of mussels. Unfortunately, a loss in species diversity has occurred below Coralville Lake. However, this is not surprising, as a loss in species diversity and range size has been a statewide trend in Iowa (Poole and Downing, 2004). Recent mussel surveys in the Iowa River found 22 species, including the federally-endangered Higgins-eye pearlymussel. The stretch of the Iowa River from below Coralville Lake to Hills, Iowa is anecdotally known as one of the best mussel beds in the State of Iowa in terms of species richness and diversity.

Wildlife and Its Habitat. The Study area is a mosaic of habitat types closely associated with the riverine environment. Agriculture, urbanization, recreation, dams, and other infrastructure such as utility and transportation corridors contribute to habitat fragmentation and other stressors to wildlife.

Iowa ranks among the lowest in public land ownership and is considered to have one of the most altered landscapes nationally (National Wilderness Institute, 1995). Large, intact tracts of wildlife habitat are uncommon in most of the state and as a result, the full value of the resources found at Coralville Lake and Iowa River, and their impact on wildlife and vegetation native to eastern Iowa are difficult to measure, but are assuredly high. Identified as a "Large Habitat Complex in the Southern Iowa Drift Plain" by the Iowa Wildlife Action Plan (2006, update 2015), it is the largest contiguous area of undeveloped land between the Mississippi and Des Moines Rivers. This is critical for species whose populations are negatively impacted by habitat fragmentation.

The 24,689 acres of Coralville Lake include (at conservation pool level): 5,430 acres of water, 9,897 acres

of deciduous and coniferous forest, 3,506 acres of wetland, and 1,318 acres of prairie and savannah. There are 4,066 acres of land are in agricultural production, which provide funding for outgrantees, act as food plots in designated areas, and allows former landowners to continue farming the land until funding is available to convert the land to forest or prairie. Since the completion of Coralville Dam, 309 acres of deciduous forest and 67 acres of coniferous forest, along with 338 acres of prairie have been planted.

Pressures on the resource are significant and multifaceted. Invasive species, climate change, and urbanization pose the greatest threats to maintaining sustainable ecosystems. Annual visitation of over one million people also has an impact on Coralville Lake's natural resources. Recreational activities from boating, hiking, snowmobiling, ATV use, horseback riding and hunting all pose some degree of disturbance to wildlife and natural resources. Human disturbance can be a limiting factor and dense visitation impacts may be difficult to quantify.

Neighboring urban development will have a significant impact on local wildlife populations. A majority of the lands being converted to residential and commercial purposes were once either primarily forested, row crop agriculture, or pasture. Forested and agricultural lands provide a higher wildlife habitat value than do urban landscapes. This reduction in habitat will place more demand on remaining ecosystems found on Corps lands. An increase in the urban/parkland interface will also create more opportunities for human conflict with wildlife that inhabits parklands adjacent to housing developments (i.e. raccoons, White-tailed deer, and opossums).

There are several large tracts of timber, however the majority of adjacent property is residential or industrial areas. Despite the human disturbances such as traffic, recreation, noise, and lights, the river corridor has suitable habitat for those species accustomed to an urban setting. Common residents are white-tailed deer, bats, squirrels, cottontail rabbits, raccoons, and year-round resident birds such as owls, and songbirds. Mammals such as muskrat, mink, raccoons, and beaver may use the river side habitat.

Existing rip rap mainly near the dam, outlet, and along urban levees, may make traversing these areas more difficult for wildlife species, however species such as mink will regularly hunt these areas for small mammals and fish.

Migratory Birds. All of Coralville Lake fee title lands, as well as several tributaries, have been recognized as an Important Bird Area (IBA) for the State of Iowa by the Audubon Society in 2004. An IBA is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations. An IBA supports:

- Species of conservation concern (e.g. threatened and endangered species);
- Range-restricted species (species vulnerable because they are not widely distributed);
- Species that are vulnerable because their populations are concentrated in one general habitat type or biome; and,
- Species, or groups of similar species (such as waterfowl or shorebirds), that are vulnerable because they occur at high densities due to their congregatory behavior (National Audubon Society, 2016).

Migrating birds such as warblers, waterfowl, and songbirds migrate and nest through the river corridors in the planning area. Bird nesting occurs along the mud flats in the upper reaches of each lake as well as the woodlands and prairies near the lake and the downstream Study areas. Coralville Lake is also considered an important part of the Mississippi Flyway, a migratory bird corridor.

The US Fish and Wildlife Service's (USFWS) website, *Information for Planning and Consultation* (IPAC), (USFWS, 2020, Appendix D) listed 23 migratory bird species of conservation concern and has the highest priority for conservation that may use the Study area sometime during their nesting or migration seasons (Table 3).

Table 3. Migratory Birds of Conservation Concern

Species	Scientific Name	Season	Habitat[1]
American Bittern	*Botaurus lentiginosus*	Breeding	EW
American Golden-plover	*Pluvialis dominica*	Migration	EW
Bald Eagle	*Haliaeetus leucocephalus*	Year-round	BLH/OW
Black Rail	*Laterallus jamaicensis*	Breeding	EW
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Breeding	UH
Bobolink	*Dolichonyx oryzivorus*	Breeding	P
Buff-breasted Sandpiper	*Calidris subruficollis*	Migration	EW/OW
Cerulean Warbler	*Dendroica cerulea*	Breeding	UH
Dunlin	*Calidris alpina arcticola*	Migration	EW/MF
Eastern Whip-poor-will	*Antrostomus vociferus*	Breeding	UH
Golden Eagle	*Aquila chrysaetos*	Wintering	OW/BLH
Henslow's Sparrow	*Ammodramus henslowii*	Breeding	P
Hudsonian Godwit	*Limosa haemastica*	Migration	MF
Kentucky Warbler	*Oporornis formosus*	Breeding	BLH/UH
Least Bittern	*Ixobrychus exilis*	Breeding	EW
Lesser Yellowlegs	*Tringa flavipes*	Migration	EW/MF
Prothonotary Warbler	*Protonotaria citrea*	Breeding	BLH
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Year-round	UH
Ruddy Turnstone	*Arenaria interpres morinella*	Migration	MF
Rusty Blackbird	*Euphagus carolinus*	Wintering	EW
Semipalmated Sandpiper	*Calidris pusilla*	Migration	MF/OW
Short-billed Dowitcher	*Limnodromus griseus*	Migration	MF
Wood Thrush	*Hylocichla mustelina*	Breeding	UH

[1]BLH=bottomland hardwoods, UH=upland hardwoods, SS=shrub/scrub, P=prairie, EW=emergent wetlands, UE-upland edge, OW=open water, MF=mudflats (USFWS, 2020)

Fish and Wildlife Management. Wildlife and fisheries management are important components of the resource management program. Coralville Lake lands outgranted to the Iowa DNR for wildlife management total 13,427 acres. Close coordination and partnering occurs between District staff and the Iowa DNR to reach management objectives. Hunting, fishing, and wildlife viewing are popular at Coralville Lake and efforts will continue to preserve and promote these activities. Additional land along the Iowa River Corridor is collectively managed by the Iowa DNR and multiple county conservation boards (CCB).

Wildlife management activities are targeted primarily at white-tailed deer, eastern wild turkey, waterfowl, and mourning doves. Additionally, small game hunting and upland birds are managed species, but are limited by lack of suitable habitat. Non-game wildlife species benefit from habitat provided project wide.

Through cooperative efforts each project's natural resource team and their partners have restored and maintained this public land for multiple user groups to enjoy now and in the future (Figure 4).

Figure 4. Habitat Management at Coralville Lake

F. ENDANGERED, THREATENED, & CANDIDATE SPECIES

The District conducted a preliminary review of federally-listed threatened and endangered species in the Study area using the IPAC website (USFWS, 2020a) (Appendix D, *Correspondence and Coordination*). The website lists nine species that may occur in the Study area due to suitable habitat (Table 4). Two other species not listed in the IPaC but are species of concern are the Monarch butterfly and the Black rail.

Table 4. Threatened and Endangered Species for the Study Area

Common Name	Classification	Habitat
Indiana bat *Myotis sodalis*	Endangered	Caves, mines (hibernacula); small stream corridors with well-developed riparian woods; upland forests (foraging)
Northern long-eared bat *Myotis septentrionalis*	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during late spring and summer.
Eastern Prairie Fringed Orchid *Platanthera leucophaea*	Threatened	Mesic to wet unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches. The eastern prairie fringed orchid also occurs in bogs, fens, and sedge
Prairie Bush-clover *Lespedeza leptostachya*	Threatened	Tallgrass prairies
Western Prairie Fringed Orchid *Platanthera praeclara*	Threatened	Mesic to wet unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches.
Rusty patch Bumblebee *Bombus affinis*	Endangered	Grasslands and tallgrass prairies of the Upper Midwest and Northeast
Higgins Eye (pearlymussel) *Lampsilis higginsii*	Endangered	Larger rivers where it is usually found in deep water with moderate currents. Sand and gravel substrate.
Sheepnose Mussel *Plethobasus cyphyus*	Endangered	Larger rivers where it is usually found in deep water with moderate currents. Sand and gravel substrate.
Spectaclecase (mussel) *Cumberlandia monodonta*	Endangered	Larger rivers where it is usually found in deep water with moderate currents. Rocky substrate.
Monarch (butterfly) *Danaus plexippus*	Candidate species	Milkweed host plant (primarily Asclepias spp.)
Eastern black rail *Laterallus jamaicensis jamaicensis*	Threatened	Wet sedge meadows with dense cover

Ref: US Fish and Wildlife Service webpages:
http://www.fws.gov/midwest/Endangered/lists/iowa_cty.html
http://www.fws.gov/midwest/Endangered/lists/iowa_cty.htmlhttp://www.fws.gov/midwest/Endangered/lists/iowa_cty.html
http://www.fws.gov/midwest/Endangered/lists/iowa_cty.html
(updated February 13, 2020)

The Indiana bat and Northern long-eared bat may inhabit the wooded areas within the Study area. Both bat species utilize mature or dead trees with flaky bark as their summer maternity sites and may forage in areas near the river.

Prairie bush clover is a federally-threatened prairie plant found only in the tallgrass prairie region of four Midwestern states. Prairie bush clover's rarity is probably best explained by the loss of its tallgrass prairie habitat. At the beginning of the 19th century, native prairie covered almost all of Illinois and Iowa, a third of Minnesota and 6% of Wisconsin. Prairie with moderately damp-to-dry soils favored by prairie bush clover was also prime cropland; today only scattered remnants of prairie can be found in the four states. Many of today's prairie bush clover populations occur in sites that were too steep or rocky for the plow.

The western prairie fringed orchid is restricted to west of the Mississippi River and currently occurs in Iowa, Kansas, Minnesota, Nebraska, North Dakota, and in Manitoba, Canada. This orchid occurs most often in mesic-to-wet unplowed tallgrass prairies and meadows but has been found in old fields and roadside ditches.

The Higgins eye pearlymussel relies on deep, free-flowing rivers with clean water. Much of their historic habitat has been changed from free-flowing river systems to impounded river systems. Impoundments changed water flow patterns, substrate characteristics, and host fish habitat which, in turn, affect how Higgins eye feed, live, and reproduce. Municipal, industrial, and farm run-off degrade water quality. As filter-feeders, mussels concentrate chemicals and toxic metals in body tissues and can be poisoned by chemicals in their water. Dredging and waterway traffic produce siltation which can cover river substrate and mussel beds. Higgins eye pearlymussel have been documented immediately downstream of the Coralville Dam as recently as August 2019.

The Sheepnose is a freshwater mussel found across the Midwest and Southeast. However, it has been eliminated from two-thirds of the total number of streams from which it was historically known. The Sheepnose is a medium-sized mussel that grows to about 5 inches in length. It lives in larger rivers and streams where it is usually found in shallow areas with moderate to swift currents flowing over coarse sand and gravel. Most populations of Sheepnose are small and geographically isolated. These small populations, which live in short sections of rivers, are susceptible to extirpation from single catastrophic events, such as toxic spills. In addition, isolation makes natural repopulation impossible without human assistance. The Sheepnose mussel is considered extirpated from the Iowa River.

Historically, the Spectaclecase mussel was found in at least 44 streams of the Mississippi, Ohio, and Missouri River basins in 14 states. It has been extirpated from 3 states and today is found in only 20 streams. The Spectaclecase's current range includes Alabama, Arkansas, Illinois, Iowa, Kentucky, Minnesota, Missouri, Tennessee, Virginia, West Virginia, and Wisconsin. With few exceptions, Spectaclecase populations are fragmented and restricted to short stream reaches. No recent surveys have found Spectaclecase in the Iowa River.

The Rusty Patched Bumble Bee was listed as federally-endangered in March 2017. The population has declined by 87% in the last 20 years. The species is likely to be present in only 0.1% of its historical range (USFWS, 2019). There are many potential reasons for the rusty patched bumble bee decline including habitat loss, intensive farming, disease, pesticide use and climate change. Currently, three rusty patched bumble bee "High Potential Zones" overlap parts of the Study area and nearly all of the Study area is within the "Low Potential Zones." It is likely more rusty patched bumblebees will be identified at Coralville Lake, since it is a large contiguous area with relatively undisturbed habitat.

During the breeding season, monarchs lay their eggs on their obligate milkweed host plant (primarily Asclepias spp.). Sufficient quality and quantity of nectar from flowers are needed for adult feeding throughout the breeding and migration seasons. Individual monarchs in temperate climates, such as eastern and western North America, undergo long-distance migration, where the migratory generation of adults is in reproductive diapause and lives for an extended period of time.

In the interior United States, eastern black rails use wet sedge meadows with dense cover. Black rail also use shallow wetlands often dominated by cattails. Many black rails nest in marshes along the Atlantic seaboard and in the Midwest., but in winter, they concentrate in the coastal marshes of East Texas, Louisiana, and Florida, areas that face many threats. The black rail is exceedingly rare in Iowa, showing up only accidentally.

Although the bald eagle is no longer listed as threatened or endangered under the Endangered Species Act, they are protected by the Bald and Golden Eagle Protection Act to prohibit killing, selling, or otherwise harming eagles, their nests, or eggs. Despite the Coralville Lake's urban setting and presence of human activity, many eagles forage, roost, and nest in the Iowa River corridor. Large numbers of bald eagles use the lake for feeding and roosting during the winter, which attracts many visitors to Coralville Lake. Several nests have also been observed around Coralville Lake and the Iowa River.

The Iowa River Valley is home to 150+ state listed species. These include mussels, amphibians, reptiles, birds, mammals, and plants. For county specific information, see, the Iowa DNR's Natural Areas Inventory webpage for up to date information on state listed species (https://programs.iowadnr.gov/naturalareasinventory/pages/Query.aspxhttps://programs.iowadnr.gov/naturalareasinventory/pages/Query.aspx.

Future Condition: Fish and wildlife species (common to rare), will continue to inhabit the riverine and urban areas along the river and lakes. As urbanization increases, introduction of invasive species, or other habitat threats, animal species may shift from specific niche species to generalists who can adapt to future habitat changes or declines.

G. INVASIVE SPECIES

The potential for exotic and invasive plants in urban settings is prevalent. Invasive species continue to pose significant threats to resources along the Iowa River. Sixty-four terrestrial invasive plant species and 11 terrestrial animal species have been identified on Coralville Lake lands alone. Many species pose relatively minor risk to altering native systems, while others have the potential to greatly impact them. "Escaped" plants and seeds from home gardens are a constant threat to native vegetation. More persistent species such as Tree-of-Heaven prefer wet fields, roadsides, fencerows, woodland edges, and forest openings. Several plants like exotic bush honeysuckle, oriental bittersweet, and garlic mustard prefers shaded or semi-shaded areas (upland and floodplain forests, shrublands, and shaded yards). Phragmites is a very persistent wetland invasive plant found in the Study area. A few species including *Serecea Lespedeza*, Autumn olive, and Crown vetch cause serious threats and expensive control measures on an annual basis. All of these species have the ability to significantly alter native ecosystems.

Aquatic invasive species include zebra mussels, quagga mussels, rusty crayfish, big head carp, grass carp, and silver carp in the river. Barriers such as the Coralville Dam have helped to curb these species' upstream migration.

Aquatic plants have difficulty establishing in the reservoir and pose a smaller threat; however, if zebra mussels, Big Head Carp, Silver Carp, or Black Carp were introduced, they would negatively affect the overall fishery of Coralville Lake.

Invasive species pose a significant threat to the Coralville Lake landscape. The vegetative management program spends over $60,000 annually on invasive species management. Now and in the future, the Emerald ash borer will have tremendous consequences, both in actual costs to manage and the overall dynamic change that will occur within forests. Trees are also very susceptible to invasive species, as evidenced by the Emerald ash borer, Gypsy moth (oak) and Thousand cankers disease (walnut and chestnuts).

Future Condition: The success of an invasive species is in large part due to favorable conditions resulting from the complex interactions among natural and anthropogenic factors such as native and nonnative pests, fires, droughts, hurricanes, wind storms, ice storms, climate warming, management practices, human travel, and trade (Dix, et al., 2009). Globalization involves the movement of people and products around the globe. The transport and introduction of invasive species and non-native wildlife are one consequence of globalization. These trends will likely continue in the future. However, many strategies are in development to stop the damage caused by invasive species and to prevent future releases and invasions. Educating the public about the dangers and adverse effects of transporting and introducing non-native species to new areas is an important component of invasive species management. Many laws and regulations have also been passed to combat the future spread of invasive species.

H. VEGETATION

The existing upland and wetland forests located on and adjacent to the river are structurally diverse and include elements such as dead snags, an overstory and understory, and downed logs. These are all indicative of habitat for a variety of species.

Surveys conducted by the Government Land Office prior to European settlement (circa mid-1800s) documented the majority of the land along the Iowa River corridor extending to Corps-managed boundaries was predominantly “Scattered Oaks” (oak savanna as it is identified now), and to a lesser extent “tall grass prairie” and “timber.” Oak savanna is the transition zone between timber and tall grass prairie ecosystems and is comprised of large open-grown oak trees with a diverse ground cover of shade tolerant grasses and forbs. What remnant oak savanna remained after European settlers converted the land to agricultural production was most often found in steep valleys that were inaccessible or impractical for farming. Lack of landscape scale fire has allowed natural succession to occur in these remnants, and the majority of oak savanna originally found on Corps-managed lands have succeeded to timber (called Deciduous Forest in other sections of this plan). Through combinations of prescribed fire and mechanical thinning (removal of shade tolerant trees and invasive species), oak savanna is being restored on Corps-managed lands where practical, or timber stands are enhanced to encourage mast production for wildlife enhancement. Timber stands which were planted on agricultural lands during the 1980s and 1990s are actively managed by mechanical thinning (removal of shade tolerant trees and invasive species) and the introduction of prescribed fire.

Prairie habitat comprises about 1,300 acres or 18% of total acreage of Coralville Lake. The majority of prairie stands have resulted from re-establishment of warm season grasses on previous agricultural land or upon conversion of brome sod fields. A few small patches of native prairie are known to occur in the Study area and may be true remnants of the original tall grass prairie. These areas have been found in railroad rights-of-way and on slopes considered inaccessible for farming. Prairies located on government

lands are actively managed through prescribed fires, mechanical removal of brush, and over-seeding with hand collected seed or local ecotype purchased seed.

Future Condition: The current vegetation types and quantity may experience slight declines based on urbanization and the spread of invasive plant species, despite efforts to restore native habitat and manage invasive species.

I. RIVERS AND STREAMS, WATER QUALITY, WETLANDS

Rivers and Streams. Within the Study area, the Iowa River has several tributaries, the Cedar River being the largest. The District monitors 23 streams within the Iowa-Cedar Rivers Basin. These rivers and streams are like other Iowa streams as far as their benefits to drinking water, fish, wildlife, and humans. There are other small intermittent streams and drainages throughout the planning area. Levees and small head dams have heavily constrained some of the streams in certain segments through the planning area. Table 5 and Figure 5 identify the major rivers and streams in the Iowa River Watershed.

Table 5. Major Rivers and Gaged Streams in the Iowa River Watershed

ID	Name	Length (km)	Length (miles)
1	Iowa River	520	323
2	South Fork Iowa River	103.85	64.53
3	Timber Creek	38.64	24.01
4	Deer Creek	NA	NA
5	Richland Creek	NA	NA
6	Walnut Creek	107.23	66.63

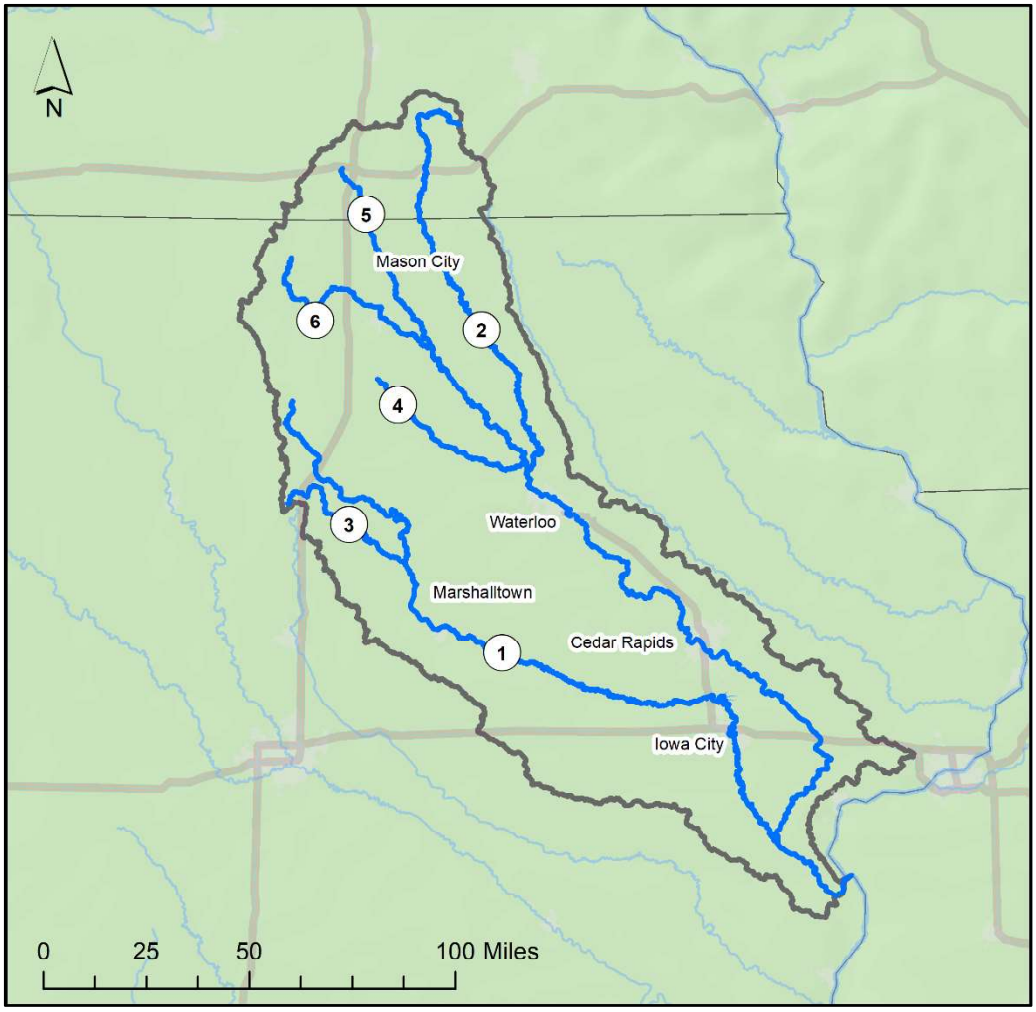

Figure 5. Major Rivers and Streams in the Iowa River Watershed

Water Quality. The Iowa DNR manages water quality through the implementation of the state's Water Quality Standards. Lakes and stretches of streams and rivers in Iowa each have specific designations, based on what they are used for—recreation such as swimming or fishing; drinking water; or maintaining a healthy population of fish and other aquatic life.

There are five categories or designations for Iowa's water quality:

Category 1: All designated uses (e.g., for water contact recreation, aquatic life, and/or drinking water) are met.

Category 2: Some of the designated uses are met but insufficient information exists to determine whether the remaining uses are met.

Category 3: Insufficient information exists to determine whether any uses are met.

Category 4: The waterbody is impaired but a total maximum daily load (TMDL) is not required.

Category 5: The waterbody is impaired and a TMDL is required, designated as a CWA, Section 303(d) Impaired Water Body.

If the water quality in the stream or lake does not meet its designated use, it does not meet Iowa's water quality standards and is considered "impaired" .http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Quality-Standards .http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Quality-Standards . Water quality improvement plans investigate streams and lakes on Iowa's impaired waters list. The ultimate goal is to improve water quality and remove streams and lakes from the impaired list. The plans, developed by the Iowa DNR, use research results and the public's input to help reduce the amount of pollutants reaching our water.

In Iowa, there were 831 impairments of 622 stream/river segments and 285 impairments of 146 lakes, reservoirs, and wetlands (Iowa DNR, 2018). There are several rivers and streams in the planning area with water quality concerns including a designation 303(d) status (Figure 6).

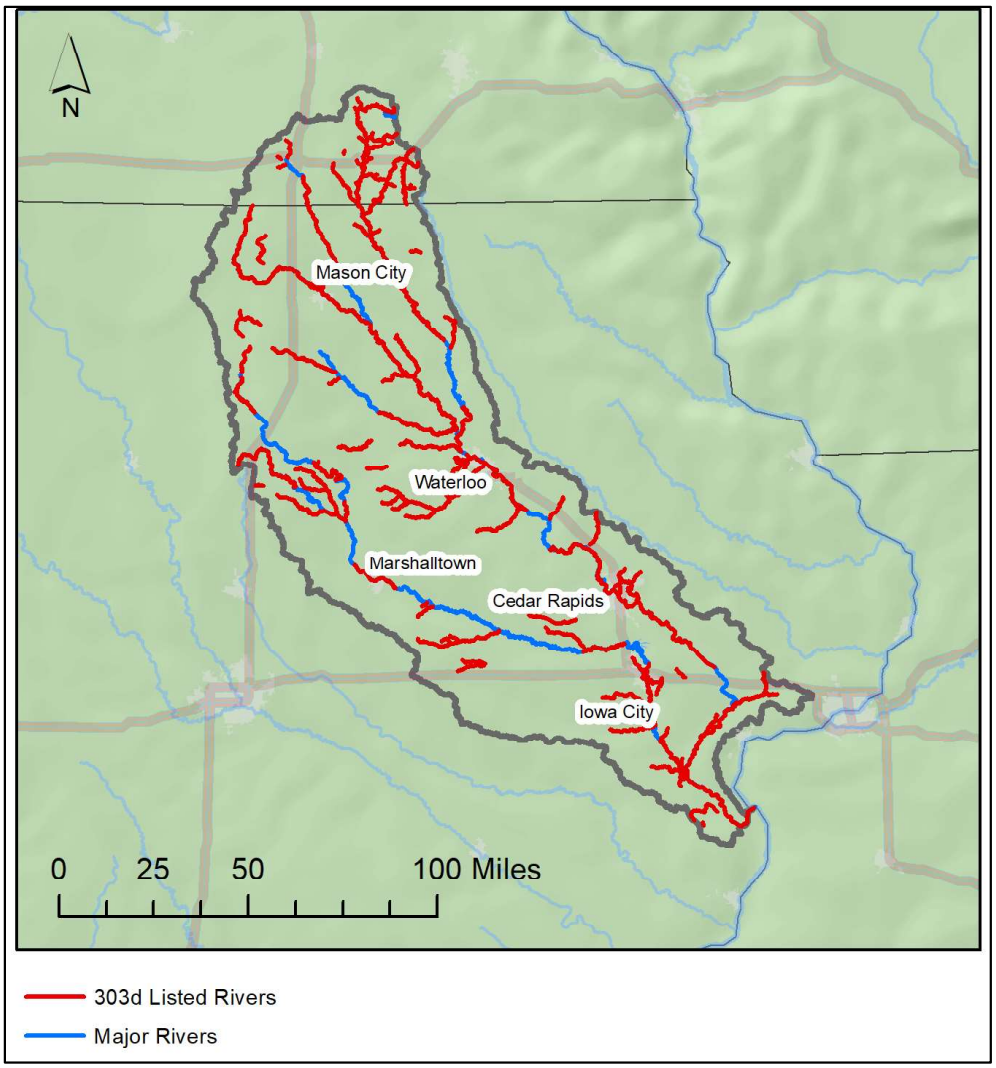

Figure 6. Iowa-Cedar Rivers Basin Impaired Water Bodies

Coralville Lake and the Iowa River within the Study area are on 2018 Iowa Impaired Waters List. The majority of the Study area falls under Category 5A, except for the 9-mile reach immediately downstream of the Coralville Dam, categorized as 4A. Coralville Lake's primary impairment is turbidity. The Iowa

River suffers varying impairments throughout its course within the Study area, including turbidity, bacteria (*E. coli*), low fish and invertebrate biotic index, loss of native mussels, and pesticide pollution.

Wetlands. The District reviewed the USFWS National Wetlands Inventory (NWI) data to identify areas of potential wetland within the Study area. Table 6 and Figure 7 provides a summary of NWI-indicated wetland currently mapped within the floodplain of the Study area.

Table 6. Summary of NWI-Indicated Wetlands (ha) within the 500-year Floodplain

Wetland Type	Area (ha)
Freshwater Emergent Wetland	4,126.5
Freshwater Forested/Shrub Wetland	8,352.03
Freshwater Pond	585.47
Lake	3,523.37
Riverine	2,690.38

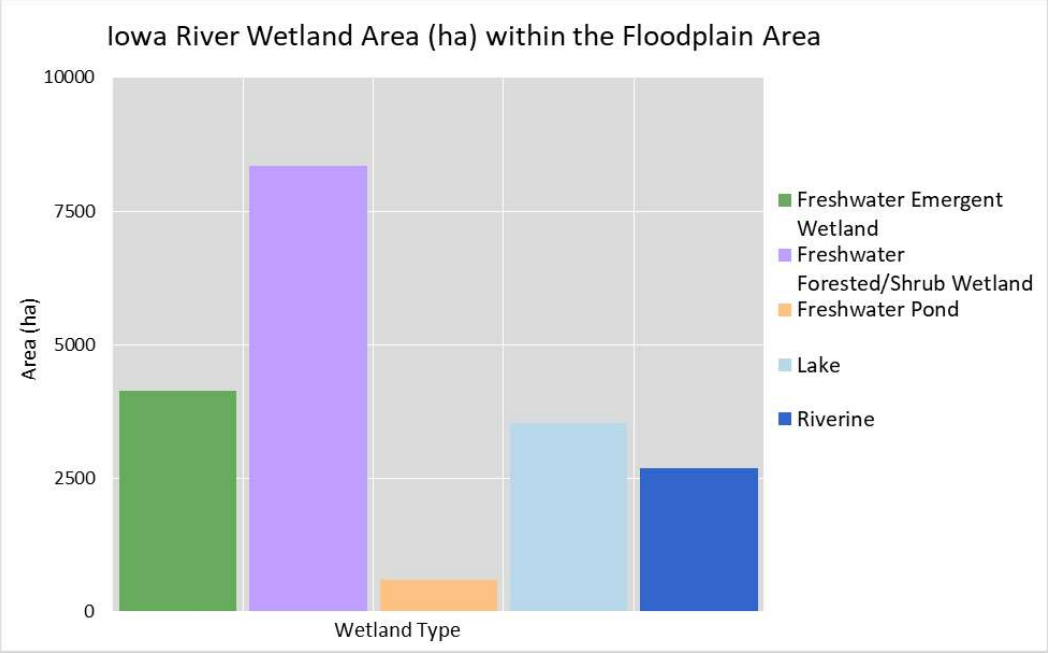

Figure 7. Iowa River Wetland Area (ha)

Future Conditions. The Study area's rivers and streams will likely not change in the near future. Climate change (increased precipitation) and urbanization (increased impermeable surfaces) may promote flash flooding more often.

Urbanization increases flood volume, frequency, and peak flood value because it brings with it more impervious surfaces, such as roads and large paved areas. This causes increased runoff that would occur more rapidly and with greater peak flows than under rural conditions. Urbanization tends to increase flash flooding, turbidity, pollutant loads, and bank erosion. Increases in dissolved solutes (conductivity), suspended solids (turbidity), fecal bacteria, nitrogen and phosphates, dissolved oxygen, and/or toxics (e.g. metals, pesticides, pharmaceuticals, other organic pollutants) would tend to increase. Additionally, chloride, sulfates, ammonia, and bacteria by infiltration from surface water polluted by municipal and industrial wastes and/or from leaking sewer lines could contaminate the groundwater.

To address the potential for an increase in contaminants entering water sources, the Iowa DNR, and the Iowa Environmental Protection Agency (IA EPA) would continue to update and enforce regulations addressing and minimizing the pollutant effects on water quality.

Wetland conditions will likely remain at risk of invasive plants and development.

J. HYDROLOGY AND HYDRAULICS

The Iowa-Cedar Rivers Basin is generally long, narrow, and sinuous with variable topography. The average slope of the river is 1.9 feet per mile. The watershed is also long and narrow. Its length is approximately 180 miles and its greatest width is about 38 miles with an average width of 18.5 miles. The maximum difference in elevation between uplands and streams is approximately 150 feet. The Cedar River, having a watershed area of about 7,870 square miles, but considered a tributary of the Iowa River, joins the latter 29.6 miles above its mouth. The total drainage area for the Iowa River and its tributaries is approximately 12,640 square miles.

The current WCP for Coralville Lake was developed based on the hydrologic record available at the time (1904 to 1996) the current plan was developed. Since the Coralville Dam was constructed, significant changes in rainfall and resulting inflow to the reservoir have been observed. Annual precipitation records show significant upward trends in precipitation over the 20th and early 21st centuries (Figure 8). This observed trend of increased annual precipitation has resulted in an increased inflow volume into Coralville Lake.

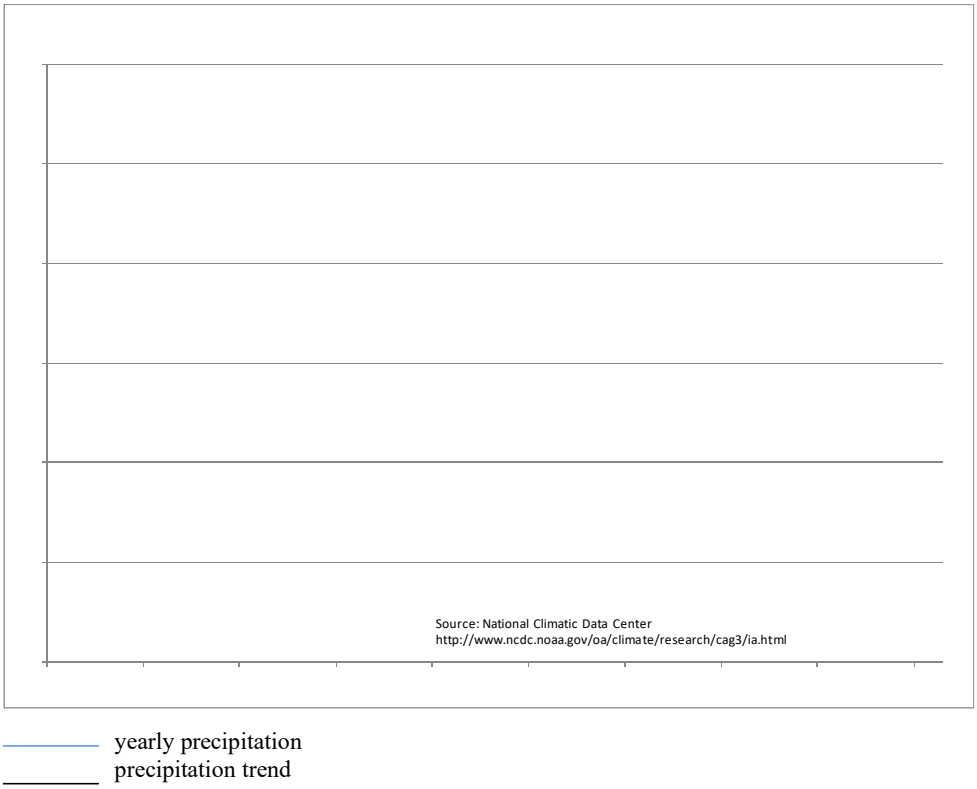

Figure 8. Iowa Annual Precipitation

Due to the use of reservoir storage to manage flood flows, peak annual reservoir elevations and downstream flood flows are driven by overall flood volumes rather than peak daily inflows.

Coralville Lake. The Coralville Lake is located in the south-central part of the Iowa-Cedar Rivers Basin in east-central Iowa. The Iowa River drainage area is approximately 12,640 square miles, of which 3,115 square miles is upstream of Coralville Lake. The Coralville Dam is situated on the Iowa River, approximately 83.3 miles above its mouth and 6 miles upstream of Iowa City, Iowa. The Coralville Lake and Dam Study area is located primarily in Johnson and Louisa Counties, Iowa, with portions extending upstream into Iowa and Linn Counties and downstream into Washington County.

The Coralville Lake was originally authorized for the primary purpose of flood control, with recreation and fish and wildlife facilities subsequently authorized. Operation of the dam provides FRM benefits for communities downstream of the lake, as well as along the Mississippi River below the confluence with the Iowa River. Low-flow release agreements have been reached between the Iowa City Water Works and the State of Iowa to provide a minimum flow of 150 cfs at Iowa City, Iowa. Also, the October 1996 drought contingency plan constructively rations water during extreme drought periods.

The current WCP for Coralville Lake considers several constraints in determining outflow. Among these are the downstream channel capacity, flood stages at Lone Tree and Wapello on the Iowa River and at Burlington, Iowa, on the Mississippi River. Consideration is also given to the pool level, the maximum rate that the reservoir outflow may be changed, and minimum low-flow requirements. Flood risk management and low-flow augmentation have priority over recreation needs. While recreation is an authorized purpose providing many recreational opportunities including boating, swimming and camping, the lake is not regulated to support these activities.

The District developed the current WCP with the objective of reducing the discharge at the downstream control points during runoff events when there is less utilization of flood control storage. As more storage capacity is utilized, the degree of downstream protection is reduced. For reduction of flooding at the downstream control points, about 70% of the reservoir flood storage capacity is utilized prior to the reservoir reaching the major flood level of 707 feet NGVD.

The overall plan for FRM for the Coralville Lake is to implement a regulation plan with due regard to various constraints to provide a part of the comprehensive scheme for conservation and FRM in the Iowa River and the Upper Mississippi River Basins. Other components of the overall plan for water control in the Iowa-Cedar Rivers Basin are the Lake Macbride Remedial Works and the Amana, Iowa, Remedial Works. For conservation storage, the plan of regulation is to provide a minimum low-flow in the Iowa River (150 cfs) downstream of Coralville Lake during periods of low flow and droughts.

Integrated Project Components. Integrated components of the Coralville Lake are as follows:

- Coralville Lake for flood control
- Amana, Iowa, Remedial Works for flood control
- Lake Macbride Remedial Works for flood control and recreation
- Coralville conservation pool for low-flow augmentation

The FRM objective of the current WCP for Coralville Lake is to manage water levels at the downstream control points at Lone Tree and Wapello, Iowa, on the Iowa River and Burlington, Iowa, on the Mississippi River in order to minimize the frequency and duration of damaging flows, as described in the following paragraphs of this section of the report.

At Lone Tree, the control stage is 14.0 feet for the growing season and 16.0 feet for the non-growing season which corresponds to discharges of 12,000 cfs and 18,000 cfs respectively. At Wapello the control stage is 21.0 feet for the growing season and 22.0 feet for the non-growing season, which

corresponds to discharges of 40,000 cfs and 48,000 cfs respectively. The control stage on the Mississippi is 18.0 feet at Burlington, Iowa. If the lake level is between the conservation pool level (683.0 feet, NGVD) and 707.0 feet, NGVD, and a downstream constraint is exceeded, a reduction of the release rate to as low as 1000 cfs is made. This reduction is made for the peak three days of the expected crest at Lone Tree and Wapello and the peak 7 days at Burlington. The reduction is made to keep the control point below or as close to its constraint as possible, while not letting the release drop below 1,000 cfs.

In the reach of the Iowa River from Coralville Lake to the mouth, the channel capacity increases from 12,000 cfs to 40,000 cfs as registered at the Lone Tree and Wapello gages, respectively. During the non-growing season (December 15 through May 1) larger discharges can be tolerated through the two reaches without causing significant damage. If the lake level is between the conservation pool (683 feet, NGVD) and 707 feet, NGVD, inflows will be released up to a maximum outflow of 6,000 cfs in the growing season (May 1 through December 15), and a maximum of 10,000 cfs in the non-growing season (December 16 through April 30).

When reservoir levels are at or forecasted to exceed the major flood pool level of 707.0 feet, NGVD, the Major Flood Schedule prescribing releases is followed, and all other constraints are disregarded. On this schedule, during the growing season releases are incrementally increased based on lake level from 7,000 cfs at elevation 707 feet NGVD to a fully open conduit with a release of 20,000 cfs at 712 feet NGVD. Similarly, during the non-growing season, releases are incrementally increased from 10,000 cfs at elevation 707 feet to 20,000 cfs at elevation 712 feet. If the lake level continues to rise exceeding elevation 712, water flows over the spillway and the total combined release (spillway plus conduit discharge) increases in excess of 20,000 cfs. Once the inflow to the reservoir has peaked, the release is based on either the minimum outflow required to utilize the remaining storage below elevation 712 feet, or the present outflow, whichever is higher. As the reservoir pool recedes and reaches elevation 707 feet, the release is gradually reduced, following the normal flood control schedule.

During drought when inflow is not sufficient to maintain conservation pool, 150 cfs is released until the pool falls below 678 feet at which time releases are further reduced to conserve remaining reservoir storage.

Details of the current WCP for Coralville Lake are shown in Figures 9 and 10 and Table 7.

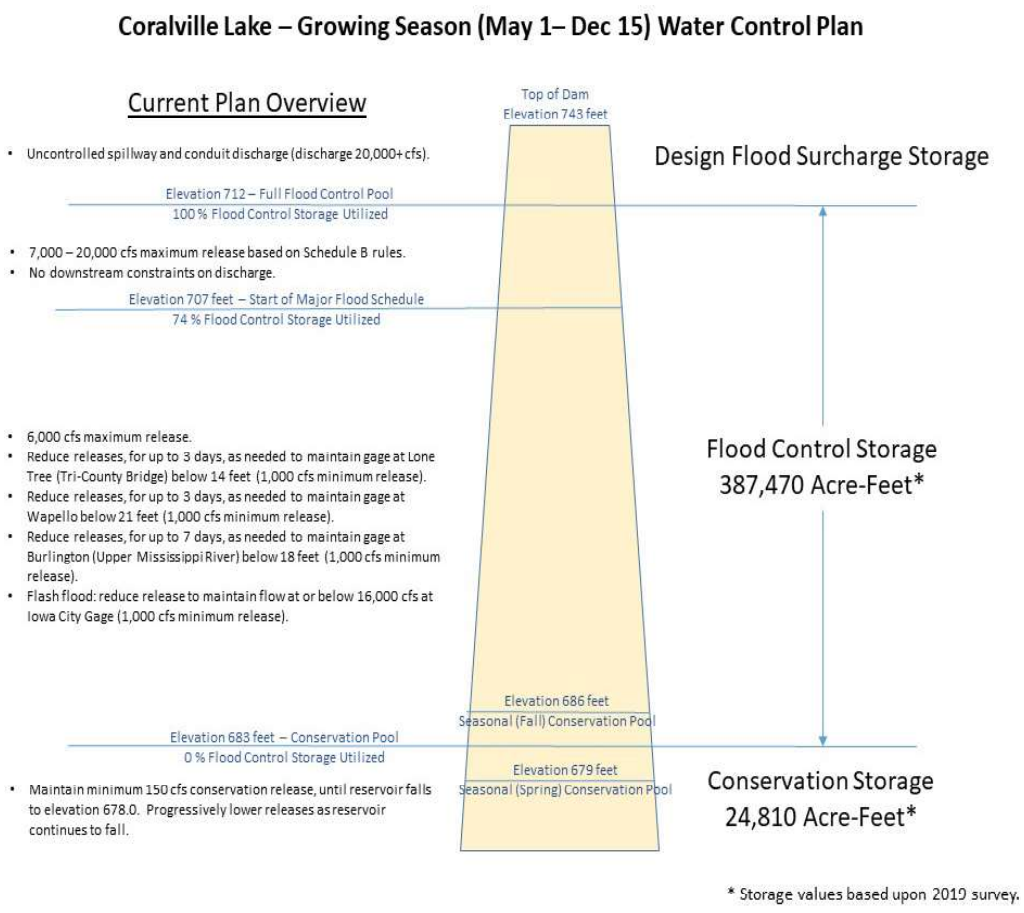

Figure 9. Coralville Lake Growing Season Water Control Plan

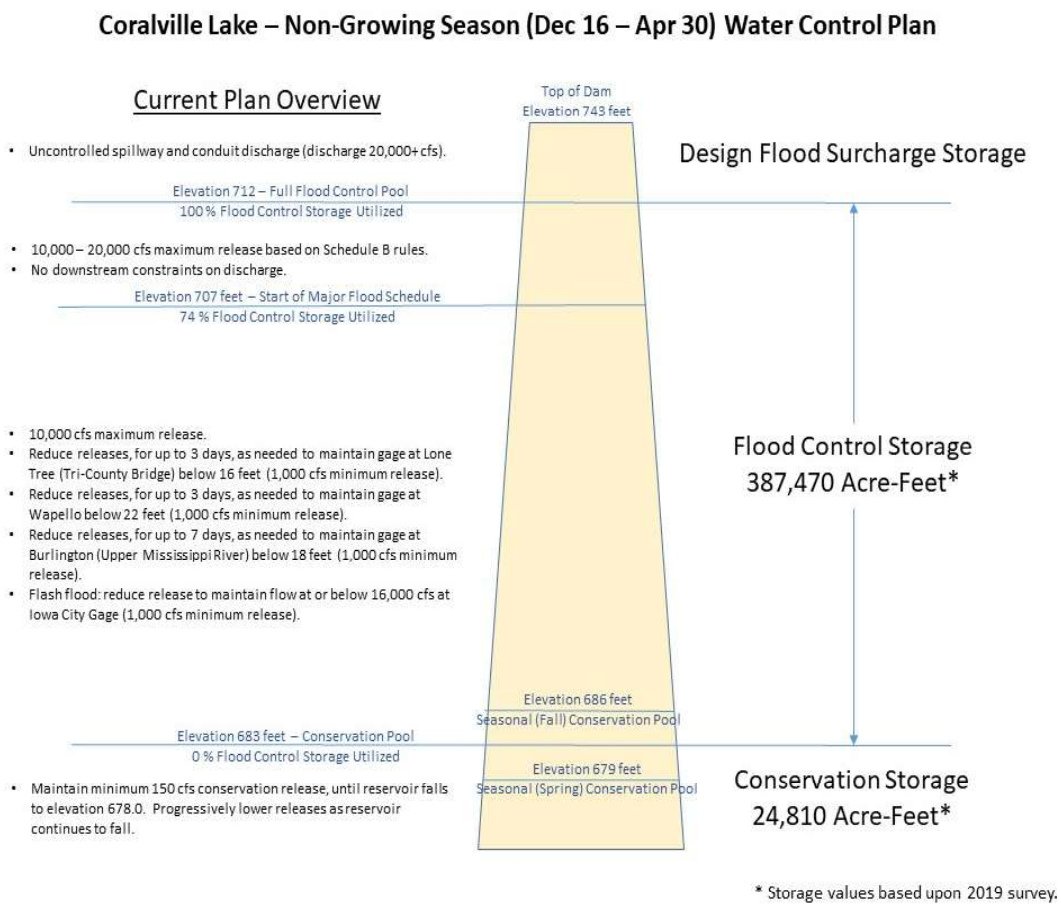

Figure 10. Coralville Lake Non-Growing Season Water Control Plan

Table 7. Pertinent Elevation-Area-Discharge Data

Description	Elev NGVD Ft	Surface Area Acres (Ac)[1]	Incremental Storage Ac-Ft [1]	Storage (Ac-Ft)	Maximum Outlet Capacity (cfs)	Discharge Capacity Spillway (cfs)
Surcharge Pool	737.9	43,500	930,300	1,342,600	22,100	244,000
Top of Flood Control Pool	712	24,960	387,470	412,280	21,000	0
Top of Fall Conservation Pool	686	6,070	15,100	39,910	13,000	0
Top of Conservation Pool	683	4,090	12,070	24,810	11,800	0
Top of Spring Conservation Pool	679	2,130	12,740	12,740	10,500	0

[1] Based on 2019 area and volume computations. At request of Iowa DNR, the conservation pool may vary between elevations 679 to 683 feet from 15 Feb to 20 May and from 683 to 686 from 01 Oct to 15 Dec

The following provides information pertinent to the Coralville Dam and Reservoir:

CORALVILLE LAKE

PERTINENT DATA

Location	Iowa River, River Mile 83.3, Johnson County, Iowa
Drainage Area	3,115 square miles
Volume of 1-inch of runoff	166,000 acre-feet
Uncontrolled Drainage Area	
Above Iowa City	156 square miles
Above Lone Tree	1,178 square miles
Above Wapello	9,384 square miles

DAM EMBANKMENT

Type	Rolled Earth-fill with Riprap Slope Protection
Height	743 feet NGVD (100 feet above streambed)
Length	1,400 feet
Top Width	22 feet

OUTLET FACILITIES

Type of outlet	One Circular Concrete Conduit with one Intake Tower
Conduit Diameter	23 feet
Type of Service Gates	3 electrically operated gates, each 8 feet wide by 20 feet high, 4-inches thick

SPILLWAY

Type	Chute Spillway with uncontrolled concrete weir
Crest elevation	712 NGVD
Real Estate Guide Taking Lines (fee title)	702 feet NGVD
Flowage Easement	702 -717 feet NGVD

K. STATE PARKS, CONSERVATION AREAS, AND OTHER AREAS OF RECREATIONAL, ECOLOGICAL, SCENIC, OR AESTHETIC IMPORTANCE

Parks, conservation areas, and wildlife management areas (WMA) in or near the planning area are listed in Table 8. In addition to the lands and waters managed by the District's Coralville Lake Project, the Project area contains approximately 18,040 hectares of public lands for recreation and conservation use. An example of a popular recreational area is the bridge with the bike trail pictured in Figure 11. These areas are free of housing developments or other buildings and provide simple pleasures such as relaxing, exercising, hunting, fishing, and nature watching. Some of these areas provide protection to sensitive plants and wildlife.

During high water events on the river or in the reservoir, many recreation facilities go out of service. The District designed many of the recreation facilities along the reservoir's shorelines to accommodate low water and high-water conditions. Their design maximizes recreation opportunities as well as keep maintenance costs low.

Future Conditions: Public lands will likely not change in the future. They will continue to play an important role for people's enjoyment and education, as well as important wildlife areas. Because these areas are in public ownership, their popularity should increase as other non-public lands become more urbanized. Conservation easements should continue but may depend on State and Federal funding. These areas are generally low in agriculture value, so there should be a financial incentive to the landowners to continue setting aside flood prone lands for wildlife.

Table 8. Parks, Conservation Area, and Wildlife Management Areas in the Study Area

Park Name	Owner	Manager	Type
Auburn Hills Park	City of Coralville	City of Coralville	City Park
Big Grove Preserve	Johnson County Heritage Trust	Johnson County Heritage Trust	Non-governmental Organizations Preserve
Brown Deer Golf Course	City of Coralville	City of Coralville	Public Golf Course
Cappy Russell Access	Louisa CCB	Louisa CCB	County Park
Central Park	City of Coralville	City of Coralville	City Park
Chauncey Swan Park	City of Iowa City	City of Iowa City	City Park
Chinkapin Bluffs Recreation Area	Louisa CCB	Louisa CCB	County Park
City Park	City of Iowa City	City of Iowa City	City Park
Clear Creek Greenbelt	City of Coralville	City of Coralville	City Park
Cone Marsh WMA	IA DNR	IA DNR-Wildlife	State WMA
Coralville Bike Trail	City of Coralville	City of Coralville	Recreation Area
Coralville Lake	Corps of Engineers	Corps of Engineers	Federal Lands and Waters
Coralville Lake - Scales Point Leased Area	Corps of Engineers	Private	Federal Recreation Area
Court Hill Park	City of Iowa City	City of Iowa City	City Park
Crandic Park	City of Iowa City	City of Iowa City	City Park
Creekside Commons Park	City of North Liberty	City of North Liberty	City Park
Creekside Park	City of Iowa City	City of Iowa City	City Park
Dovetail Recreation Area	City of Coralville	City of Coralville	City Park
Edgewater Park	City of Coralville	City of Coralville	City Park
Edgewater park Addition	City of Coralville	City of Coralville	City Park
English River Access	IA DNR	IA DNR-Wildlife	Access
Ferry Landing	Corps of Engineers	Corps of Engineers	Recreation Area
Finkbine Golf Course	Univ of Iowa	Univ of Iowa	Public Golf Course
Finkbine Prairie (East)	Univ of Iowa	Univ of Iowa	Research Area
Finkbine Prairie (West)	Univ of Iowa	Univ of Iowa	Research Area
Glendale Park	City of Iowa City	City of Iowa City	City Park
Hawkeye WMA	Corps of Engineers	IA DNR-Wildlife	State of Iowa WMA
Hanging Rock Ridge WMA	IA DNR	IA DNR-Wildlife	State of Iowa WMA
Hawkeye Softball Complex/Cretzmeyer Track	Univ of Iowa	Univ of Iowa	Recreation Area
Hawkeye WMA	Corps of Engineers	IA DNR-Wildlife	State WMA
Heritage Museum	City of Coralville	City of Coralville	Historical Site
Hickory Hill Park	City of Iowa City	City of Iowa City	City Park
Hills Access	Johnson CCB	Johnson CCB	County Park
Hoover Nature Trail	Linn County Trails Association	Linn County Trails Association	Recreation Area
Hubbard Park	Univ of Iowa	Univ of Iowa	Green space

Park Name	Owner	Manager	Type
Hunter's Run Park	City of Iowa City	City of Iowa City	City Park
Hwy 61 Access	Louisa CCB	Louisa CCB	County Park
Indian Fish Trap State Preserve	Amana Society	Amana Society	State Preserve
Indian Slough Wildlife Area	Louisa CCB	Louisa CCB	WMA
Iowa City Greenspace	City of Iowa City	City of Iowa City	Green space
Iowa River	State of Iowa	IA DNR	Sovereign Waters
Iowa River Bottoms	Johnson County	IA DNR-Wildlife	County Park
Jerry Quinlan WMA	IA DNR	IA DNR-Wildlife	State WMA
Kiwanis Park	City of Iowa City	City of Iowa City	City Park
Lake MacBride State Park	IA DNR, ACE	IA DNR - Parks	State Park
Lake Odessa WMA	Corps of Engineers	IA DNR-Wildlife	State WMA
Lake View OHV Park	Corps of Engineers	IA DNR - Law	State Off Highway Vehicles Area
Larry Quinlan WMA	IA DNR	IA DNR-Wildlife	State WMA
Longfellow Nature Trail	City of Iowa City	City of Iowa City	City Park
MacBride Recreation Area	Corps of Engineers	Univ of Iowa	Recreation Area
Mesquakie Park	City of Iowa City	City of Iowa City	City Park
Millrace Flats WMA	IA DNR	IA DNR-Wildlife	State WMA
Mississippi River	Multiple	IA DNR	Sovereign Waters
Mississippi River Islands WMA	Corps of Engineers	IA DNR-Wildlife	State WMA
Mormon Handcart Park	Univ of Iowa	Univ of Iowa	Historical Site
Napoleon Park	City of Iowa City	City of Iowa City	City Park
North Ridge Park	City of Coralville	City of Coralville	City Park
Oakdale Open Space	Univ of Iowa	Univ of Iowa	Green space
Old State Quarry State Preserve	Corps of Engineers	Univ of Iowa	State Preserve
O'mara - Newport Woods	Johnson County Heritage Trust	Johnson County Heritage Trust	Non-governmental Organizations Preserve
Outdoor Research Area	Univ of Iowa	Univ of Iowa	Research Area
Parkview Court (Recreation Trail)	City of North Liberty	City of North Liberty	City Park
Parkview Court Entry (Recreation Trail)	City of North Liberty	City of North Liberty	City Park
Peninsula Park	City of Iowa City	City of Iowa City	City Park
Port Louisa National Wildlife Refuge	Iowa FWS	Iowa FWS	National Wildlife Refuge
Ralston Creek	City of Iowa City	City of Iowa City	Green space
Recreation Trail	City of North Liberty	City of North Liberty	City Park
River Forks Access	Louisa CCB	Louisa CCB	County Park
River Junction Access	Johnson CCB	Johnson CCB	Access
Rogers Green -	City of Iowa City	City of Iowa City	City Park
Rotary Camp Cardinal Park	City of Coralville	City of Coralville	City Park
S.T. Morrison Park	City of Coralville	City of Coralville	City Park
Sand Lake City Park	City of Iowa City	City of Iowa City	City Park
Soccer Park/Water Treatment Plant	City of Iowa City	City of Iowa City	City Park
Stainbrook State Preserve	Corps of Engineers	Univ of Iowa	State Preserve
Swan Lake (Johnson) WMA	IA DNR	IA DNR - Wildlife	Sovereign Waters
Sycamore Wetlands	City of Iowa City	City of Iowa City	City Park
Terrel Mill Park	City of Iowa City	City of Iowa City	City Park

Park Name	Owner	Manager	Type
Turkey Creek Preserve	Johnson County Heritage Trust	Johnson County Heritage Trust	Non-governmental Organizations Preserve
Univ of Iowa Arboretum	Univ of Iowa	Univ of Iowa	Green space
Wapello Bottoms WMA	IA DNR	IA DNR-Wildlife	State WMA
Wastewater Treatment Plant	City of Iowa City	City of Iowa City	City Park
Water Plant Park	City of Iowa City	City of Iowa City	City Park
West River Bluffs	Univ of Iowa	Univ of Iowa	Green space
Wetlands Reserve Program	Iowa FWS	Iowa FWS	WMA
Williams Prairie State Preserve	TNC	TNC	State Preserve
Willow Creek Park	City of Iowa City	City of Iowa City	City Park

Figure 11. Woodpecker Trail Bridge Coralville Lake in Johnson County

L. HISTORICAL AND CULTURAL RESOURCES

The following information was largely taken from the cultural resources existing condition description in the Draft Coralville Master Plan as prepared by the assigned District Archeologist and was current as of 2018. Long before construction of Coralville Dam, Coralville Lake formed due to the Iowa River's natural impoundment approximately two miles upriver of Iowa City. Located almost entirely within the Southern Iowa Drift Plain landform, human habitation around the lake has occurred for the past 13,000

years, from the Paleoindian period through the Archaic and Woodland periods into the Meskwaki occupation of the area and subsequent Euro-American settlement.

Archaeological survey and data recovery excavations have been conducted at Coralville Lake for several decades. Notable surveys and excavations include the Smithsonian's work in advance of and concurrent with reservoir construction (Caldwell 1961; Wheeler 1949), large-scale surveys in the 1980s (Anderson and Overstreet 1986; Emerson et al. 1984; Overstreet and Stark 1985; Overstreet et al. 1985, 1987; Richardson et al. 1989; Schermer 1983), and a survey in anticipation of Lake Macbride restoration (Sellars and Ambrosino 2000). Work completed in the 1980s formed the basis for most conclusions and recommendations within the most recent Historic Properties Management Plan (HPMP; Overstreet 1986).

Many small-scale investigations have also been conducted, mainly related to construction projects (e.g., Doershuk and Peterson 2005; Fishel 1993; Kendall 2016; Peterson 1999; Rogers 2015). Examples include those at the Late Woodland Walter's Site (13JH42; Anderson 1971), multicomponent Woodpecker Cave (Enloe 2014, 2016), indeterminate-aged prehistoric sites (Titus 1996), and historic farmstead remnants (Gade 1998; Peterson and Jones 1996; Snow and Link 1997). Approximately 9,230 acres of the Project's total 24,591 acres (roughly 38%) of land and water have been explored through formal archaeological investigation, although some surveys pre-date the utilization of modern archaeological field methods. In addition, avocational archeologists have recorded many sites in the Iowa Site File.

The 411 archaeological sites identified on U.S. Government fee-titled lands at Coralville Lake are located in impounded areas, along the lake's periphery, or on adjacent uplands. One midden has only been documented to contain shell, and therefore may be non-cultural (13JH207), however the remaining 410 properties represent a wide variety of site types. These include historic farmstead remnants, an 1838–1839 Meskwaki village, a Euro-American cemetery, pre-contact era mounds, lithic scatters, habitations, and rock shelters. A total of 226 sites located around Coralville Lake lack diagnostic materials, resulting in general temporal association with Native American habitation prior to European colonization.

Thirteen sites around the lake have been found to contain or are likely to contain human remains. These include 10 mounds or mound groups (13JH1, 13JH3, 13JH6, 13JH331, 13JH343, 13JH519, 13JH1303-1304, 13JH1443-1444), a corner of one historic cemetery (the Alt/Wein Cemetery; 13JH1365), isolated human remains from the Sandy Beach site (13JH43; habitation/scatter; Middle Archaic and Woodland era site components), and Woodpecker Cave (13JH202; Middle and Late Archaic, Early to Late Woodland eras and Great Oasis site components). There are no identified Traditional Cultural Properties (TCPs) at Coralville Lake.

Only one site is known to meet the requirements for listing on the National Register of Historic Places (NRHP), a Woodland Era habitation site called Sugar Bottom NW (13JH272). Thirty-eight sites have been recommended for testing to assess NRHP eligibility, 300 have been recommended or determined ineligible, and the remaining 72 archaeological sites have no associated NRHP eligibility recommendation. Sites lacking eligibility recommendations are primarily avocational archeologist-recorded finds or historic sites recorded on the basis of archival information alone.

Three Paleoindian Period (11,500-8,500 Before Common Era or B.C.E.) sites have been identified around the reservoir (13JH53, 13JH126, 13JH161). Early Paleoindian populations in Iowa are associated with Clovis and Folsom cultural complexes, and are generally described as highly mobile hunter-gatherers who lived in small groups and maintained large territories. Their subsistence economy emphasized large game, but evidence exists that they also utilized deer, fish, berries, and small mammals as they seasonally followed big game herds. In Iowa, Late Paleoindian and Early Archaic cultures existed contemporarily,

with Early Archaic sites more prevalent in the eastern portion of the state in proximity to the Eastern Woodlands.

The area's Archaic Period (8,500-800 B.C.E.) utilization is represented by at least 34 sites. During this time the average number of persons living in settlements increased, and some groups grew large enough to form small villages. Artifact assemblages dating to this period demonstrate greater diversity of lithic and biological resources, and the presence of specialized equipment suggests increased exploitation of aquatic resources and nuts. Archaic sites here include scatters, habitations, and a rock shelter. The nearby Late Archaic Edgewater Park site (13JH1132) was identified as a small encampment and resource processing site in the City of Coralville along the Iowa River. Soil samples collected from the site contained seeds that suggest occupants were practicing the earliest stages of domestication.

Although some crop domestication occurred during the Late Archaic, not until the Woodland Period (800 B.C.E – Common Era or C.E. 1250) did farming intensify. This increasing reliance on crops meant that people could live in one location for longer durations, because there was a more dependable food supply. Village size increased, food storage pits became common, and ceramics were developed to aid in food processing. A greater variety of exotic raw materials and finished goods can be found at sites dating to this period, suggesting that trading networks became increasingly complex. The Coralville Lake area includes 93 identified Woodland sites, including mounds, two possible villages, other habitations, scatters, and rock shelters. Two sherds resembling Great Oasis (C.E. 900-1100) ceramics have been identified from assemblages at Woodpecker Cave (13JH202), and represent that culture's easternmost manifestation. Additionally, two sherds similar to Central Plains tradition ceramics have been identified from the site.

Five Late Prehistoric sites are recorded around the lake. An association with the Oneota tradition (C.E. 1000-1650) has been suggested for some components of these sites, mostly on the basis of avocational reports of isolated shell-tempered sherds at multicomponent sites 13JH2, 13JH26, and 13JH205. A number of modern tribes descend from Oneota peoples, including the Baxoje (Ioway), Ho-Chunk/Winnebago, Otoe-Missouria, Omaha, and Ponca. Sites 13JH1379 and 13JH1380 each resulted in the recovery of a small projectile point, very tentatively associated with the Late Woodland or Late Prehistoric periods.

The arrival of Marquette and Joliet to the Upper Mississippi River in 1673 represents the beginning of the historic period in Iowa, with the first documented contact between European and Native peoples in the region. Historic-era Native American sites identified around Coralville Lake include Poweshiek's 1838-1839 Meskwaki village (associated with two site numbers: 13JH1177, 13JH1337), its associated trading post (13JH1251), and a nearby artifact scatter (13JHJ1252). In addition, the location of the "paper" town (platted but probably never occupied) of Monroe (13JH1338) likely was chosen due to its proximity to the trading post, river, and Meskwaki farm fields. Other Meskwaki-related sites such as winter camps may be present but remain unidentified.

After the Black Hawk War in 1832, the United States officially combined the Meskwaki, or "Fox," and Sauk tribes into a single federally-recognized group known as the Sac & Fox Confederacy. The Meskwaki were removed from their ancestral homelands along with the Sauk people to a reservation in eastern Kansas in 1839. After all Meskwaki lands had been conceded through treaty in 1845, Euro-American settlers arrived, quickly purchasing all available lands and converting much of the prairie and timber into farmland. There are 95 known historic era archeological sites in and around the reservoir. In addition to the Meskwaki-related sites, historic era archeological sites include a sawmill, flour mill, school, church/school, farmsteads, rural residences, road/trail remnants, and artifact scatters.

Reservoir erosion has destroyed many recorded archaeological sites surrounding the lake. However, sedimentation has buried some sites with historic alluvium, effectively sealing those deposits. Some archeological sites remain in relatively undisturbed contexts, such as those found on ridgetops and high terrace landforms. Well-preserved examples include the Woodland era habitation Sugar Bottom NW (13JH272; on an upland noseslope) and McAlister Creek VI (13JH151; Archaic habitation on a high terrace).

In addition to archeological resources, inventoried architectural buildings and structures at Coralville Lake include NRHP-listed resources at Lake Macbride State Park, contributing to the Multiple Property listing "Civilian Conservation Corps (CCC) Properties in Iowa State Parks: 1933-1942" (McKay 1989). These CCC-constructed resources include the superintendent's stone residence, a frame maintenance building, a set of portals, a culvert, and a limestone footbridge. Non-contributing resources include a refectory, a pit vault latrine, a shelter, the bathhouse, and archeological remnants of limestone stairs (13JH1083).

The Old State Quarry (Iowa Architectural Site 52-00166) is NRHP-listed due to its association with the construction of important buildings, including the Iowa Territorial Capitol at Iowa City and the present Iowa State Capitol. Several other inventoried architectural resources are NRHP-ineligible (Hoosier Creek bridges 52-00250 and 52-00170; Krieger Farmhouse 52-05039).

The Coralville Dam complex construction began in 1949 and the dam became operational in 1958. Original (1948) plans group the proposed dam-related structures or objects into the categories of earth embankment (dam), outlet works (gates, approach channel, outlet control house, service bridge to control house, conduit, stilling basin, and outlet channel), spillway, and hydraulic gages. The Coralville Lake dam complex minimally includes those structures and objects, and may additionally include other associated resources, such as roads, recreational facilities, and administrative buildings. The District plans to conduct an NRHP eligibility assessment of the complex in the coming years.

M. SOCIOECONOMIC RESOURCES

The Region of Influence (ROI) for the socioeconomic resources includes four counties in Iowa: Johnson, Linn, Louisa, and Washington. Socioeconomic data is presented for the four-county ROI.

Population. Population of the ROI in 2020 was estimated to be 407,857, an increase of 13% from year 2010. A majority of the Study area's population resides in Linn and Johnson Counties (92%), encompassing the Cities of Cedar Rapids, Coralville, and Iowa City. A substantial amount of the population growth within the ROI took place in Johnson County. Table 9 and Figure 12 reflect population growth for Johnson, Linn, Louisa and Washington Counties as well as the overall ROI and the State of Iowa. Johnson County population increased 105% or an additional 76,064 people over 50 years between 1970 and 2020.

Table 9. Region of Influence Population Growth 1970 - 2040

	Dec 1970	Dec 1980	Dec 1990	Dec 2000	Dec 2010	Dec 2020	Dec 2030	Dec 2040
Johnson County	72,207	82,203	96,595	111,455	131,293	148,271	155,914	162,628
Linn County	163,394	169,764	169,295	192,365	211,679	227,186	241,359	253,999
Louisa County	10,694	12,084	11,620	12,174	11,364	10,902	10,766	10,748
Washington County	18,988	20,169	19,617	20,718	21,697	21,499	20,423	19,553
ROI	265,283	284,220	297,127	336,712	376,033	407,857	428,463	446,928
State of Iowa	2,828,500	2,916,000	2,781,018	2,929,067	3,050,738	3,169,479	3,260,354	3,344,330

Source: U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

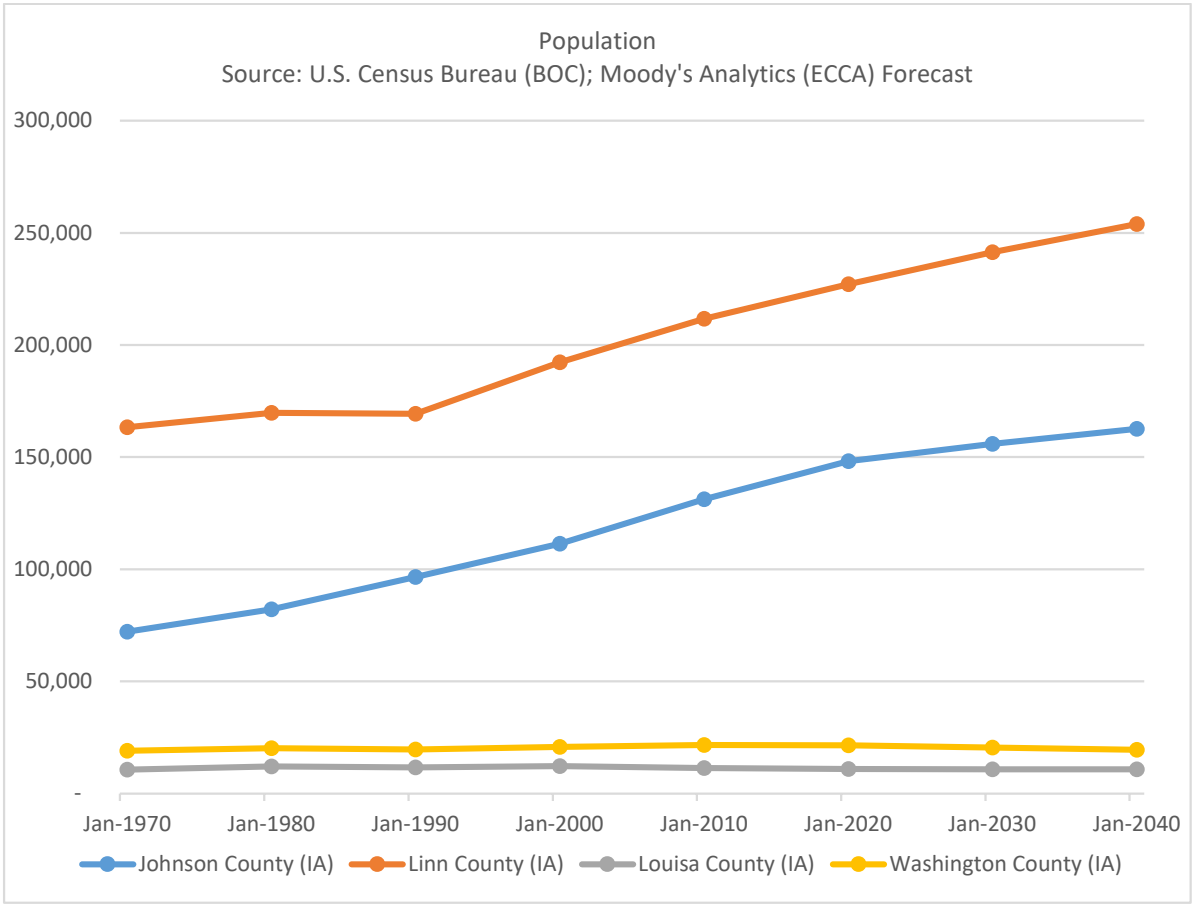

Figure 12. Region of Influence Population, 1970-2040

Households. In 2020, 169,474 households were present in the ROI. The increase in households tracks with the increase in population within the area, as shown in Table 10 and Figure 13.

Table 10. Region of Influence Increase in Population to Households

	Dec 1970	Dec 1980	Dec 1990	Dec 2000	Dec 2010	Dec 2020	Dec 2030	Dec 2040
Johnson County	22,500	30,400	36,246	44,352	52,936	60,885	67,010	72,309
Linn County	50,876	61,766	65,706	77,182	86,409	95,456	106,004	115,297
Louisa County	3,457	4,228	4,306	4,525	4,342	4,305	4,457	4,609
Washington County	6,138	7,223	7,456	8,092	8,747	8,828	8,777	8,693
ROI	82,972	103,618	113,714	134,151	152,434	169,474	186,248	200,908
Iowa	896,993	1,053,825	1,065,959	1,152,776	1,224,584	1,309,677	1,408,382	1,493,360

Source: U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

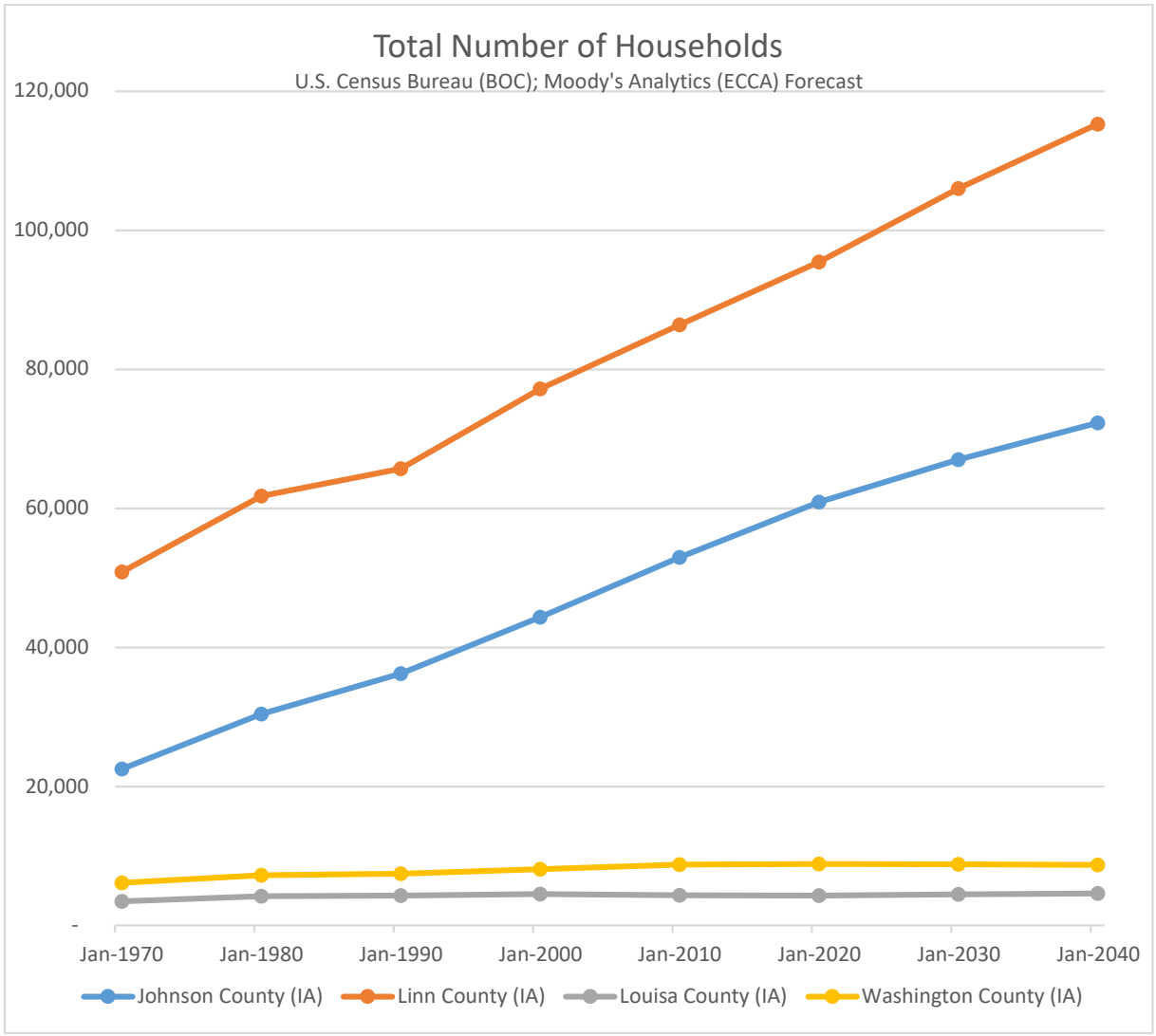

Figure 13. Region of Influence Households, 1970-2040

Race/Ethnic Diversity. Ethnic diversity in the Study area is lower than state and national levels. The largest three races represented by proportion are White (86.6%), Black or African American (5.5%), and Asian, (3.7%). All counties in the Study area have a majority white population (Tables 11 and 12). Hispanic or Latino (of any race) percent for Johnson, Linn, Louisa, and Washington Counties (2019 American Community Survey 5-year average) estimates were 5.6%, 3.2%, 15.8% and 6.2% respectively.

Table 11. Racial Composition in Study Area, Estimated 2018 (Total Population)

	Total Population	White Alone	Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander	Some Other Race Alone	Two or More Races
Johnson County	147,001	120,694	9,945	290	9,240	98	3,277	3,457
Linn County	222,121	196,391	11,858	370	5,205	288	1,896	6,113
Louisa County	11,223	10,234	125	57	422	-	286	99
Washington County	22,143	21,307	201	60	104	-	183	288
ROI	402,488	348,626	22,129	777	14,971	386	5,642	9,957

Table 12. Racial Composition in Study Area, Estimated 2018

	White Alone	Black or African American Alone	American Indian and Alaska Native Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race Alone	Two or More Races
Johnson County	82.1%	6.8%	0.2%	6.3%	0.1%	2.2%	2.4%
Linn County	88.4%	5.3%	0.2%	2.3%	0.1%	0.9%	2.8%
Louisa County	91.2%	1.1%	0.5%	3.8%	0.0%	2.5%	0.9%
Washington County	96.2%	0.9%	0.3%	0.5%	0.0%	0.8%	1.3%
ROI	86.6%	5.5%	0.2%	3.7%	0.1%	1.4%	2.5%

Income. Per Capita income within the ROI is presented in Table 13 ranges from $44,521 in Louisa County to $65,619 in Washington County (estimated 2020).

Table 13. Income: Per Capita ($)

	Dec 1980	Dec 1990	Dec 2000	Dec 2010	Dec 2020	Dec 2030	Dec 2040
Johnson County	9,955	18,494	30,342	39,569	57,312	82,991	121,267
Linn County	10,829	20,040	31,932	41,374	56,941	78,768	111,915
Louisa County	9,051	16,046	24,194	31,365	44,521	60,545	83,428
Washington County	9,609	17,255	28,475	38,920	65,619	113,433	196,098
Iowa	8,869	16,480	25,572	36,607	56,862	86,353	132,922

Source: U.S. Bureau of Economic Analysis (BEA); U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

Employment. Table 14 and Figure 14 present Employment: Total Nonfarm Payroll for the ROI. Total nonfarm payroll employment is the number of paid US workers in all businesses, excluding those who work for farms, serve in the military, volunteer for nonprofit organizations, and perform unpaid work in their own household. Self-employed, unincorporated individuals are excluded as well. Government; Trade, Transportation, and Utilities; and Education & Health Services are the leading employment categories within the ROI (estimated 2020).

Table 14. Employment: Total Nonfarm Payroll

Description:	Dec 1970	Dec 1980	Dec 1990	Dec 2000	Dec 2010	Dec 2020
Natural Resources and Mining	216	250	188	144	158	160
Construction	3,551	6,210	6,401	9,638	9,363	12,258
Manufacturing	26,796	31,759	27,381	28,161	26,508	25,557
Trade; Transportation; and Utilities	18,813	22,462	29,701	39,965	43,275	48,298
Information	2,917	3,769	5,252	9,559	7,392	6,298
Financial Activities	4,229	6,039	6,972	10,789	13,002	14,650
Professional and Business Services	5,102	7,773	10,538	19,474	18,787	22,502
Education & Health Services	6,520	10,281	15,062	20,410	27,516	31,422
Leisure and Hospitality	5,816	10,468	13,201	16,544	19,222	22,599
Other Services (except Public Administration)	3,375	4,191	6,062	6,603	6,634	7,558
Government	25,710	33,518	38,898	42,615	47,618	52,181
Total Nonfarm Payroll	103,045	136,718	159,657	203,901	219,477	243,483

Source: U.S. Bureau of Labor Statistics: Census of Employment & Wages (QCEW - ES202);
Moody's Analytics (ECCA) Forecast

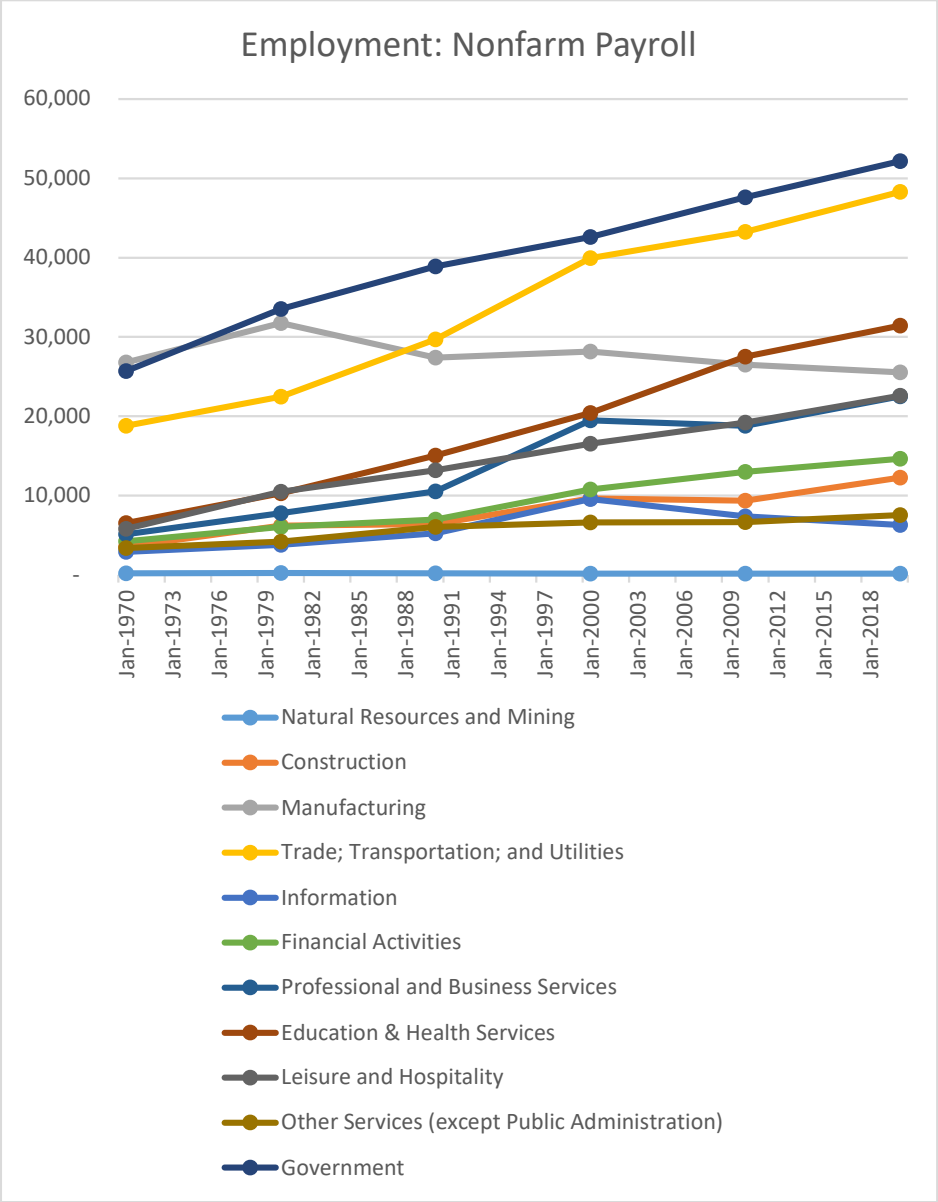

Figure 14. Employment: Total Nonfarm Payroll

Education Level. The ROI has a high percentage of persons age 25 and older with a High School Degree or greater. The ROI average education level tracks higher than the United States average (Table 15).

Table 15. Education Level in Region of Influence

	Johnson County	Linn County	Louisa County	Washington County	United States
High School Graduate or Higher, % of Persons Age 25+, 2014-2019	95.3%	94.7%	81.9%	91.1%	87.7%
Bachelor's Degree or Higher, % of Persons Age 25+, 2014-2019	53.0%	33.0%	14.2%	21.5%	1.5%

Source: U.S. Census and ACS 2014-2019.

Future Conditions: The future conditions, or No Action Alternative, includes the current operating scenarios and therefore, conditions occurring today are likely to exist in the future.

Minority and Low-income Populations (Environmental Justice). Environmental justice is defined as the fair treatment and meaningful involvement of all people, the final decision should be whether the Study area is likely to, or is already, impacted by greater adverse effects than a demographically similar reference community.

The five-year average (2014-2018) American Community Survey (ACS) data was queried to obtain relevant information associated with environmental justice. This ACS data is tabulated by the U.S. Census Bureau and was procured from the national, state, and county perspective in order to provide a multi-level geographical analysis.

In order to identify whether the potential alternatives may disproportionately affect minorities or impoverished citizens, an analysis was conducted utilizing county obtained from ACS. The following information was collected from specific census block groups in the Study area.

- **Racial and Ethnic Characteristics.** Race and ethnic populations in each census block of the Project area were characterized using the following racial categories: Hispanic, White, Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Persons of Hispanic Origin, and Other. These categories are consistent with the affected populations requiring study under Executive Order (EO) 12898. Table 11 lists race and ethnic characteristics per County in the ROI.

- **Percentage of Minority Population.** As defined by the U.S. Census Bureau, the minority population includes all non-Whites and White-Hispanic persons. According to Council of Environmental Quality (CEQ) guidelines, "Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50% or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis." The map following this section displays the block group locations in relation to the ROI.

- **Low-Income Population.** The percentage of persons living below the poverty level, as defined in the 2014-2018 ACS, was one of the indicators used to determine the low-income population in a given census block or tract. Low-income population is defined as a group with 20% or more of its residents below the poverty threshold.

Minority and population below poverty level percentages are shown in Table 16 and Table 17. Percent minority as a fraction of population, where minority is defined as all but Non-Hispanic White Alone. Calculated from the Census Bureau's American Community Survey 5-year summary estimates. Percent of individuals whose ratio of household income to poverty level in the past 12 months was less than 2 (as a fraction of individuals for whom ratio was determined). Calculated from the Census Bureau's American Community Survey 5-year summary estimates.

Table 16. Percentage of Minority Population in Study Area

	Johnson County	Linn County	Louisa County	Washington County	ROI
White Alone	82.1%	88.4%	91.2%	96.2%	86.6%
Black or African American Alone	6.8%	5.3%	1.1%	0.9%	5.5%
American Indian and Alaska Native Alone	0.2%	0.2%	0.5%	0.3%	0.2%
Asian Alone	6.3%	2.3%	3.8%	0.5%	3.7%
Native Hawaiian and Other Pacific Islander Alone	0.1%	0.1%	0.0%	0.0%	0.1%
Some Other Race Alone	2.2%	0.9%	2.5%	0.8%	1.4%
Two or More Races	2.4%	2.8%	0.9%	1.3%	2.5%

Source: 2018 American Community Survey (ACS) 5 Year Estimate

Table 17. Low Income Population in Study Area

	Population for Whom Poverty Status Is Determined	
Johnson County	**Total**	138,866
	Below Poverty Level	24,728
	Percent Below Poverty Level	17.8
Linn County	**Total**	216,510
	Below Poverty Level	20,566
	Percent Below Poverty Level	9.5
Louisa County	**Total**	11,074
	Below Poverty Level	1,231
	Percent Below Poverty Level	11.1
Washington County	**Total**	21,749
	Below Poverty Level	2,021
	Percent Below Poverty Level	9.3

Source: 2018 American Community Survey (ACS) 5 Year Estimate

Future Conditions: The future conditions are likely to include the current operating scenarios. Conditions occurring today are likely to exist in the future. Therefore, impacts to Environmental Justice resources taking place today, including minority and low-income population, are expected to continue into the future.

N. HUMAN HEALTH & SAFETY

The Coralville Lake Project offer FRM for people living downstream. The purpose of the District's FRM mission is to reduce the threat to life and reduce property damages from riverine flooding. The District's FRM projects include structural and non-structural measures. The District is an integral part of the nation's efforts to manage floodplains and maintain and operate aging water resources infrastructure. Execution of the FRM program serves to integrate and synchronize programs and activities within the Corps and with counterpart activities of the Department of Homeland Security, FEMA, other Federal agencies, state organizations, and regional and local agencies.

Coralville Lake's FRM structures include the Coralville Dam (embankment, outlet works, overflow spillway), Lake MacBride Remedial Works and Amana Iowa Remedial Works.

In addition to the FRM health and human safety component, low flow augmentation for water quality, fish and wildlife enhancement and recreational safety is a high priority at the reservoir. Reservoir staff fosters public and employee safety through education, research, and proactive visitor assistance activities, such as personal visitor contact, water safety patrols, and timely maintenance of signs and public use facilities.

Future Conditions. The area populations are likely to continue to increase and, concurrently, development is also likely to increase. As a result, water use and current water borne issues are likely to continue in the future.

O. SUSTAINABILITY, GREENING AND CLIMATE CHANGE

Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* (January 24, 2007), directs Federal agencies to conduct their environmental, transportation and energy-related activities in an environmentally, economically, and fiscally sound and sustainable manner. The District strives to protect, sustain, and improve the natural and man-made environment of the Nation, and is committed to compliance with applicable environmental and energy statutes, regulations, and EOs. Sustainability is an overarching concept encompassing energy, climate change, and the environment to ensure Federal activities do not negatively impact resources for future generations. Proposed alternative plans must provide for sustainable solutions addressing both short- and long-term environmental as well as social and economic considerations.

Many scientists believe greenhouse gases (GHGs) are components of the atmosphere trapping heat relatively near the surface of the earth and contribute to the greenhouse effect (or heat-trapping) and climate change. Most GHGs occur naturally in the atmosphere from natural processes and events, but increases in their concentration result from human activities such as burning fossil fuels. Several studies conclude global temperatures are expected to continue to rise as human activities continue to add carbon dioxide (CO_2), methane, nitrous oxides, and other GHGs to the atmosphere.

In 2010, the CEQ released draft guidance on when and how Federal agencies should consider GHG emissions and climate change in NEPA analyses. This draft guidance includes a presumptive effects threshold of 27,563 tons of CO_2 equivalent emissions from a Federal action annually (CEQ, 2010). In 2017, CEQ withdrew Final Guidance for Federal Departments & Agencies on GHG Emissions and Effects of Climate Change in NEPA Reviews.

Climate change impacts within the Study area would likely involve increased temperatures (Figure 15) and increased precipitation leading to further altered (flashier) hydrologic conditions (Figure 16). Any changes in hydrologic conditions occurring within the basin would likely result from less frequent but more intense warm-weather precipitation events, moderately to severely reduced summer flow conditions and degraded water quality, less winter ice cover and more cold-weather erosion events. The character of riparian habitats may also change, and invasive species may move into the area with changing climate (Pryor et al., 2014). Extreme rainfall events and flooding have increased during the last century and these trends are expected to continue, causing erosion, declining water quality, and negative impacts on transportation, agriculture, human health, and infrastructure. The range and distribution of fish and other aquatic species will likely change, and an increase in invasive species would also likely occur (Pryor et al., 2014).

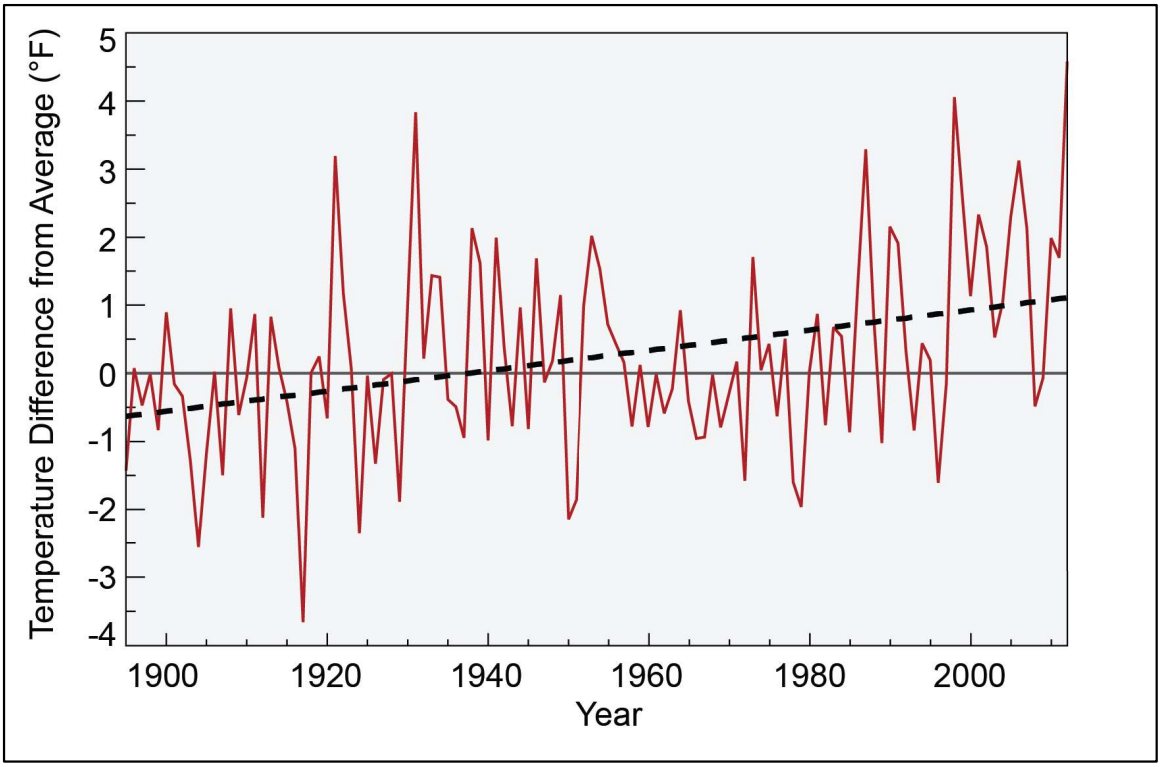

Figure 15. Temperatures Rising in the Midwest
Annual average temperatures (red line) across the Midwest show a trend towards increasing temperature. The trend (heavy black line) calculated over the period 1895-2012 is equal to an increase of 1.5°F. (Source: updated from Kunkel et al. 2013).

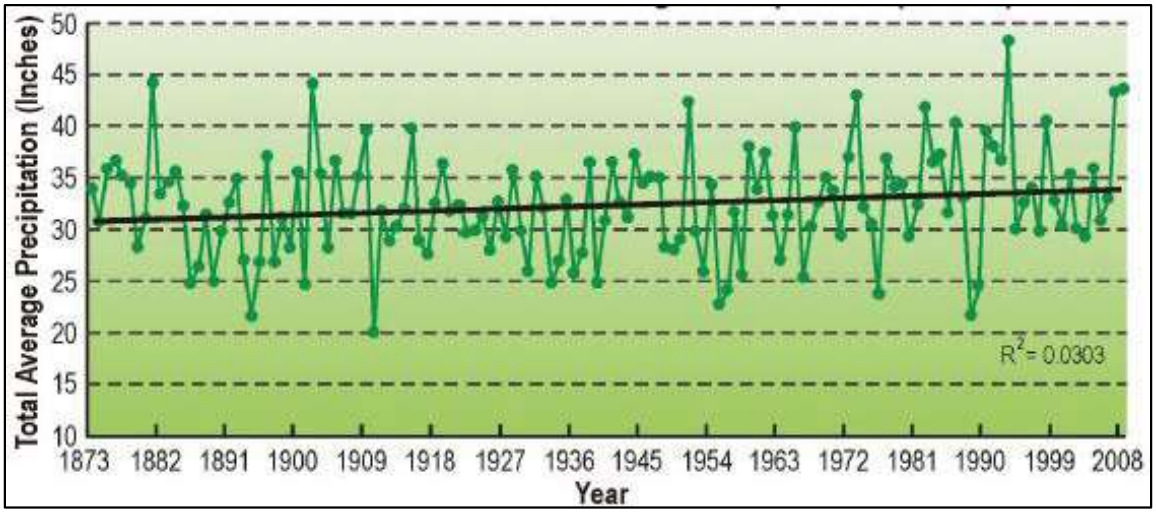

Figure 16. Iowa Annual State-wide Precipitation in Inches from 1873-2008
Note the State has had an 8% increase in annual precipitation over this 136-year period (Iowa Climatology Bureau, 2010. (http://www.iowadnr.gov/Conservation/Climate-Change)

In the next few decades, it is expected longer growing seasons and rising CO_2 levels would increase yields of some crops, though such benefits will be progressively offset by extreme weather events.

Though adaptation options can reduce some of the detrimental effects, in the long-term, the combined stresses associated with climate change are expected to decrease agricultural productivity (Pryor et al., 2014).

The climate change assessment tools, utilized in the Study are consistent with USACE Engineering and Construction Bulletin (ECB) 2016-25, *Guidance for Incorporating Climate Chance Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects* to provide an indication of the potential for non-stationarity and impact to flood risk. Additional discussion on this topic is found in Appendix C, *Climate Change Impact Assessment*.

Future Conditions: District projects, programs, missions, and operations have generally proven to be robust enough to accommodate the range of natural climate variability over their operating life spans. However, recent scientific evidence shows in some places and for some impacts relevant to District operations, climate change is shifting the climatological baseline about which natural climate variability occurs, and may be changing the range of variability as well. This is relevant to the District because the assumptions of stationary climatic baselines and fixed range of natural variability, as captured in the historic hydrologic record may no longer be appropriate for long-term projections of flood risk.

The District considered climate change impacts on the hydrology of the Iowa-Cedar Rivers Basin in accordance with ECB 2016-25, *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs and Projects*, as well as USACE Engineering Technical Letter 1100-2-3, *Guidance for Detection of Nonstationarities in Annual Maximum Discharges*.

Overall, there is no consensus among the gages in the Iowa-Cedar Rivers Basin to suggest that trends in observed data or detected nonstationarity change points should be applied to the entire watershed such that only the more recent portion of the observed record should be used to estimate flow statistics for alternative evaluation. 1-day, 7-day, and 15-day annual max unregulated inflows to Coralville Reservoir (computed from HEC Res-Sim) were evaluated for changepoints. Robustness was identified in a changepoint (~1957) found in each of the volume duration time series, however the (~1957) changepoint did not show consensus (multiple tests identifying a changepoint in the same statistical property), therefore there was not enough evidence to identify a strong changepoint nor to support two distinct periods that should be analyzed separately. Each of the volume duration time series (1-, 7-, and 15-day) showed an upward trend in annual maximums. However, the prevalence of an upward trend in streamflow and precipitation records, points to the hydrologic uncertainty of simply utilizing the full period of record and assuming stationarity. Relaxing sensitivity parameters in order to try to pick up detections from additional tests did not change the results.

Available literature and Corps Climate Assessment tools do not reach a consensus on observed and projected streamflow throughout the Iowa-Cedar Rivers Basin due to long-term persistent climate trends or anthropogenic climate change. However, there is some agreement that streamflow variability will increase, and extreme events will likely occur more frequently.

P. CONSTRUCTED RESOURCES - PUBLIC STRUCTURES, UTILITIES, TRANSPORTATION, OTHER

There are many critical structures such as hospitals, schools, fire stations, police stations, pump stations, electrical sub stations, wastewater treatment and drinking water facilities in the Study area. Within the Study area there is an FRM dam (Coralville Lake Dam), once recreation dam associated with the Coralville Project (Lake MacBride), and two low head dams (Coralville Mill Dam and Burlington Street Dam).

There are over 30 river crossings of the Iowa River and Coralville Lake in the Project area, including interstate, state, county, and local highways as well as railroad and bicycle trails. There are also utility crossings such as overhead transmission lines or underground pipes.

Future Conditions: Infrastructure in and near the river will remain an integral part of the Iowa River. These structures will require maintenance, upgrades, and replacement. Additional constructed structures would reduce the river's meander into a stable channel.

Q. RECREATION

Recreation at Coralville falls within two categories and can be identified as either land or water-based recreation. Management objectives for each type vary depending on the location, safety hazards, and the intensity of use. At Coralville Lake, the operations project managers use their Master Plan to guide their work necessary to meet the public's needs for land and/or water-based recreation, while maintaining stewardship to the resource. Land-based recreation activities include camping, picnicking, biking, hiking, disc golf, shore fishing, hunting, bird, and wildlife watching, cross country skiing, sledding, snowmobiling, horseback riding, geo-caching, sightseeing, etc. on or adjacent to Corps-managed land.

Facility types typically found within recreation areas within the Iowa River Valley include campsites, picnic shelters, picnic sites, playgrounds, disc golf courses, equestrian trails, sand volleyball courts, horseshoe pits, ball fields, hunting areas, and hard and soft trails. These recreation areas are managed by several entities, which include the District, the Iowa DNR, CCBs, and city governments. Land-based recreation includes modernizing and rehabilitating existing recreation areas and providing a justified level of service.

Water-based recreation activities occurring within the planning area's water managed areas include pleasure boating, fishing, waterfowl hunting, sailing, swimming, paddle boarding, kayaking, water skiing and tubing, wind surfing, parasailing, and canoeing (Figure 17). The District manages the majority of water-based recreation with assistance from the Iowa DNR and Coast Guard Auxiliary. The management objective is to ensure public safety, while providing recreation opportunities on the water. This involves promoting water safety, studying recreation carrying capacity vs. current use patterns, zoning requirements for no-wake or restricted areas, and areas to remain open for public recreation.

Future Conditions: The parks, wildlife, historical, and recreation areas would remain an important part of the community. As development and human population increase around Coralville Lake and the Project Area, the need for sufficient recreations areas and the value provided to the community will continue to increase.

Figure 17. Marina at Coralville Lake

R. SEDIMENTATION/GEOLOGY/SOILS/PRIME AND UNIQUE FARMLAND

Reservoir Sedimentation: Reservoir sedimentation is an important issue with regard to meeting authorized purposes and reservoir life. The rate of sedimentation varies based on watershed characteristics. As sediment deposition occurs, reservoir storage capacity for both water conservation and FRM is reduced.

Since being placed into operation in 1958, 62% of the available conservation storage below elevation 683 feet has been lost due to sedimentation. The most recent survey of the lake was in the spring of 2019. Based on this resurvey, the amount of deposition below elevation 712 ft (flood control pool elevation) amounted to 79,700 ac-ft since operation of the reservoir began in September 1958 equating to about 1,320-acre feet of storage loss per year. The current rate of sedimentation is consistent with the overall rates calculated previously in 1999 and 2008 that utilized GIS and modern elevation survey methods. For the 2019 resurvey, the amount of sediment deposition below elevation 683 NGVD29 (conservation pool) amounted to 49% of the total deposition in the reservoir since September 1958.

Approximately 40,600 acre-feet of sediment deposition occurred between elevations 683 feet and 712 feet (current flood control pool) from 1958 to 2019 which equates to a loss of 9.5% of the original volume available between those elevations. The future long-term rate of sediment entrapment within the reservoir (712 ft and below) is expected to be similar to the previous surveys, at approximately 1,300 ac-ft per year.

Geology, Soils, & Prime and Unique Farmland. The Iowa-Cedar Rivers Basin lies in the Dissected Till Plains of the Central Lowland Province of the United States. Characteristic of this province is that the surface bedrock is almost entirely sedimentary and of Paleozoic age. The general regional structure is that of broad basins separated by intervening low domes. The bedrock is made up of limestone, shale, and sandstone. Limestone greatly predominates. The strata have a slight dip to the southwest. This dip

approximates 10 feet per mile. The strike is northwest southeast; this gives the shape of a band to the areas outcrop of each formation.

Soil mapping is available showing the various soil types, parent material, slope, drainage, and fertility characteristics. This information is used to determine resource protection needs, historic biotic occurrence, stability, fertility, and drainage characteristics for various uses. The Gridded Soil Survey Geographic Database was developed by the National Cooperative Soil Survey, Natural Resources Conservation Service, U.S. Department of Agriculture (Soil Science Division Staff, 2017). Table 18 and Figure 18 summarize the planning area's soil information.

Table 18. Soil Farm Class Within the Study Area Floodplain Area

Soil Farm Class	Area (ha)
Farmland of Statewide Importance	4,905.61
All Areas Are Prime Farmland	8,706.57
Prime Farmland if Drained	9,984.73
Prime farmland if Irrigated	609.50
Prime Farmland if Protected from Flooding or Not Frequently Flooded During the Growing Season	800.86
Prime Farmland if Drained and Either Protected from Flooding or Not Frequently Flooded During the Growing Season	3,197.32
Not Prime Farmland	17,867.37

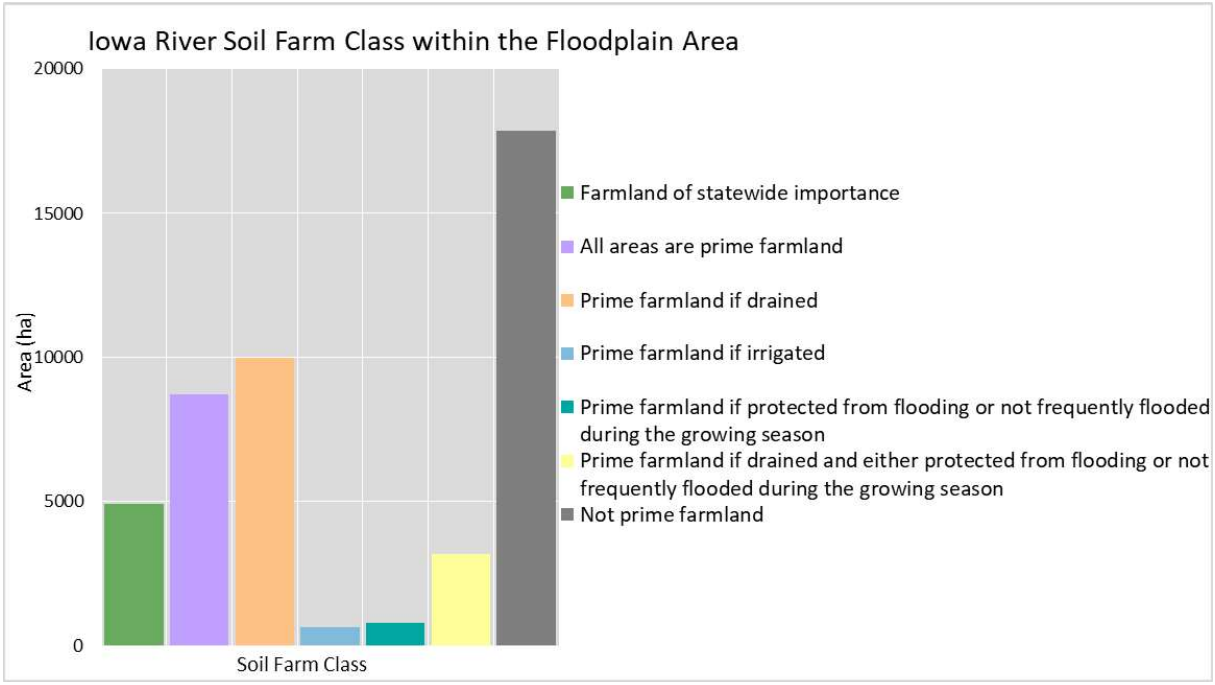

Figure 18. Soil Farm Class Within Study Area Floodplain Area

Future Conditions: The geologic character of the Study area should remain relatively unchanged. However, soils should continue moving throughout the system and silting-in the reservoir. The topography of the Study area would change with accretion and erosion activities throughout the riverine system in the Study area.

S. HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW)

Per ER 1165-2-132, *Hazardous Toxic and Radioactive Waste HTRW Guidance for Civil Works Projects*, HTRW includes any material listed as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601 et seq (CERCLA). [See 42 U.S.C. 9601(14].) Hazardous substances regulated under CERCLA include "hazardous wastes" under Sec. 3001 of the Resource Conservation and Recovery Act, 42 U.S.C. 6921 et seq; "hazardous substances" identified under Section 311 of the Clean Air Act, 33 U.S.C. 1321; "toxic pollutants" designated under Section 307 of the CWA, 33 U.S.C. 1317; "hazardous air pollutants" designated under Section 112 of the Clean Air Act, 42 U.S.C. 7412; and "imminently hazardous chemical substances or mixtures" on which EPA has taken action under Section 7 of the Toxic Substance Control Act, 15 U.S.C. 2606; these do not include petroleum or natural gas unless already included in the above categories.

The USEPA's EnviroMapper Database and the Iowa DNR's Facility Explorer Database list 23 regulated facilities or incidents within close proximity to the planning area. Given the level of ongoing development in the region surrounding the Coralville Reservoir, it is difficult to accurately identify all of the potential hazardous materials that may exist within or adjacent to the Project boundary. Federal law requires site-specific due diligence on a case-by-case basis before development can take place.

Previous studies with integrated environmental assessments have been conducted for the Coralville Reservoir. Since this Study will not involve the acquisition of real estate outside of that already under the control of USACE nor the construction of new engineering measures, it is deemed unnecessary to conduct an HTRW assessment at this time. Should conditions change, the District would conduct a HTRW assessment, as needed.

Future Conditions: There is no anticipated change to HTRW risks.

T. SUMMARY OF FUTURE CONDITIONS

The Iowa-Cedar River Basin should continue to be predominately agricultural land use; however, urbanization and non-permeable surfaces should continue to expand at their current rate. This may increase flash flooding and increased run-off. As urbanization increases, introduction of invasive species, or other habitat threats, animal species may shift from specific niche species to generalists who can adapt to future habitat changes or declines. Climate change (increased precipitation) may also promote flash flooding more often.

The District anticipates the population with the Study area will continue to grow from 407,857 to 446,928 by 2040, an increase of approximately 10%. While this growth and development pattern is not as drastic as those found in other parts of Iowa, it may contribute to continued resource decline in the river's vicinity.

Available literature and Corps Climate Assessment tools do not reach a consensus on observed and projected streamflow throughout the Iowa-Cedar Rivers Basin due to long-term persistent climate trends or anthropogenic climate change. However, there is some agreement that streamflow variability will increase, and extreme events will occur more frequently.

CHAPTER III: FORMULATION OF ALTERNATIVES

A. ALTERNATIVE FORMULATION STRATEGIES FINAL ARRAY OF ALTERNATIVES

Based on the Study goals, objectives and planning constraints, an initial array of alternatives was developed. The existing water control plan, Alternative 1, *No Action*, plus seven major alternatives were formulated for consideration with an additional five alternatives that are minor variations of Alternatives 2, 3 and 4. This initial set of alternatives focused on FRM and to a lesser degree low flow augmentation as these are the primary authorizations for the Coralville Dam. Details of each alternative are presented in Section B, *Alternatives Considered but Not Carried Forward for Detailed Analysis*.

There are a few regulation rules for the reservoir that are common to all of the alternatives, including the No Action Alternative, but which are omitted or ambiguous in the current WCP.

These include:

- Once the reservoir has peaked and storage is being evacuated, the maximum daily reduction in outflow should be maintained so as not to exceed a recession rate in the pool in excess of more than 1.3 feet per day in order to limit erosion around the rim of the reservoir.

- As the reservoir recedes following a Large Magnitude Flood (LMF), the maximum release rate is to be maintained until either elevation 705 (LMF- Alternative 6, explained below) or 707 is reached and then gradually reduced to follow the normal flood control operation schedule.

- All alternatives that include a conservation pool with the exception of the No Action Alternative will allow the pool to be maintained within a 1-foot operating band between elevations 683.0 and 684.0 with an allowable fall pool level up to elevation 688.0 and a spring drawdown to elevation 679.0.

B. ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD FOR DETAILED ANALYSIS

The alternatives that were considered but not carried forward were eliminated from further consideration as they either did not improve or worsened the frequency of occurrence and or duration of flooding during the initial hydraulic evaluation as compared to the alternatives carried forward. Details related to the hydraulic evaluation and elimination of alternatives from further consideration are presented in Chapter IV.

Alternative 2. This alternative incorporates elements of recent approved deviations from the current WCP that includes a 10,000 cfs year-round release during normal flood operations, tiered downstream constraints with variable minimum releases, altered dates for seasonal downstream constraints and a modified major flood operation schedule eliminating induced surcharge operation. Additional details of this alternative include the following:

- Elimination of growing season release reduction, holding a maximum of 10,000 cfs all year.

- Tiered, seasonal downstream constraints at Lone Tree and Wapello with variable minimum releases. When forecast indicate any of these constraints will be exceeded, reduce the release to control discharges as near as possible to the constraint stages during the peak 3-days of the crest with due allowance for travel time.

  - Growing Season:
    - Release not less than 6,000 cfs when the stages at Lone Tree and Wapello reach 16 feet and 22 feet, respectively
    - Release not less than 1,000 cfs when the stages at Lone Tree and Wapello reach 19 feet and 25 feet, respectively
  - Non-Growing Season: Release not less than 1,000 cfs when the stages at Lone Tree and Wapello reach 19 feet and 25 feet, respectively

- No changes to the Iowa City (16,000 cfs) and Burlington (18 feet) downstream constraints
- Altered dates for seasonal downstream constraint changes (Apr 15–Dec 15)
- Modified LMF Operations release schedule and elimination of "Induced Surcharge Operation" (Table 19).

Table 19. Alternative 2 Large Magnitude Flood Schedule

Forecasted Peak Pool Elevation (feet)	Release (cfs)
707	12,000
710	14,000
710.5	16,000
711	18,000
711.5	20,000
712	Fully Open

Alternative 2A: This alternative is a variation of Alternative 2. All of the modifications in Alternative 2 are followed along with elimination of the spring drawdown to elevation 679 feet.

Alternative 2B: This is another variation of Alternative 2, which includes all of the changes made in Alternative 2, except that the tiered growing season downstream constraints are held all year.

Alternative 3: "Maximum Release Plan" plan provides envelope for increasing outflows and constraints in relation to all alternatives considered. This alternative consists of the following measures:

- No change to conservation levels including spring drawdown
- Release constrained by outlet capacity only
- No downstream constraints

Alternative 3A: This alternative incorporates the same changes as Alternative 3. However, this is the "Dry Reservoir Scenario". No conservation pool is held at any time, with the exception of holding back floodwaters when inflow exceeds outlet capacity.

Alternative 4: This alternative is another variation of Alternative 2. However, Alternative 4 includes elevation-based growing season releases to reduce downstream impact for water levels in the lower portion of the Flood Control Pool:

- Maximum growing season release determined by reservoir pool elevation:
  - Below Elevation 700 feet – 8,500 cfs
  - Above Elevation 700 feet – 10,000 cfs
  - Non-Growing Season Release – 10,000 cfs

Alternative 4A: Alternative 4 with provision to maintain non-growing season maximum discharge (10,000 cfs) if above elevation 700 on May 1.

- Maximum discharge is maintained until pool is lowered to conservation levels.

Alternative 6: Alternative 6 is a stakeholder alternative provided by the Johnson County Homeland Security (HS) & Emergency Management Agency (EMA). The changes from the existing Coralville Dam regulation plan are as follows:

- Decrease the summer Conservation Pool elevation from 683 feet to 682 feet
- Maximum growing season release changed to 9,000 cfs. No change to maximum non-growing season release.
- Growing season to start on May 20 and end on Dec 01 (changed from May 01 and Dec 15, respectively)
- Raise the Iowa City flow constraint from 16,000 cfs to 16,500 cfs
- Change the Wapello constraint
  - Increase the growing season maximum stage from 21 feet to 23 feet
  - Increase the non-growing season maximum stage from 22 feet to 25 feet
  - Increase the minimum releases from Coralville Dam from 1,000 cfs to 3,000 cfs
- Eliminate the downstream stage constraints at Lone Tree and Burlington
- Altered LMF Release Schedule, starting at Elevation 705 feet and increasing flows more rapidly (Table 20).

Table 20. Alternative 6 Large Magnitude Flood Schedule

Forecasted Peak Pool Elevation (feet)	Release (cfs)
705	11,000
706	12,000
707	13,000
708	15,000
709	16,000
710	18,000
711	20,000
712	Fully Open

Alternative 7. Alternative 7 is a stakeholder alternative provided by the Two Rivers Levee & Drainage District, which is located in Louisa and Des Moines Counties, Iowa, downstream of Wapello, Iowa. The changes from the existing Coralville Dam regulation plan are as follows:

- Decrease the summer Conservation Pool elevation from 683 feet to 682 feet
- Reservoir releases only constrained by the capacity of the outlet, up to a maximum release of 16,500 cfs. Above that flow, follow the existing LMF Release Schedule from Alternative 1
- Change the Wapello constraint
  - Increase the growing season maximum stage from 21 feet to 23 feet
  - Increase the non-growing season maximum stage from 22 feet to 25 feet

- Increase the stage constraint at Burlington on the Mississippi River from 18 feet to 20 feet
- Eliminate the stage constraint at Lone Tree
- No change to the flow constraint and Iowa City

C. ALTERNATIVES CARRIED FORWARD FOR DETAILED ANALYSIS

Alternative 1- No Action- Maintains the current WCP and facilitates no changes to the current Iowa-Cedar Rivers Basin Master Reservoir Regulation Manual for Coralville Lake. Under this baseline alternative the reservoir would continue to be operated under the current WCP. This would mean:

- Maintain the normal Conservation Pool level of 683 feet.
- Reservoir releases during normal flood control operations (reservoir elevations between 683 and 707 feet):
  - Growing season maximum release: 6,000 cfs
  - Non-growing season maximum release: 10,000 cfs
- Downstream constraint at Iowa City (flash flood operations): Any date that the flow at the Iowa City gage is at, above, or forecast to exceed 16,000 cfs, reduce the release to not less than 1,000 cfs to maintain the flow at or below 16,000 cfs.
- Seasonal downstream constraints at Lone Tree and Wapello. When forecasts indicate any of these constraints will be exceeded, reduce the release to control discharges as near as possible to the constraint stages during the peak 3-days of the crest with due allowance for travel time.
  - Growing Season: Release not less than 1,000 cfs when stages at Lone Tree and/or Wapello are forecast to exceed 14 and 21 feet, respectively
  - Non-growing Season: Release not less than 1,000 cfs when stages at Lone Tree and/or Wapello are forecast to exceed 16 and 22 feet, respectively
- Downstream constraint at Burlington: Any date the Mississippi River is forecast to exceed a stage of 18 feet at Burlington, Iowa, reduce the release to not less than 1,000 cfs during the peak 7-days of the Mississippi River crest with due allowance for travel time.
- LMF operations begin at elevation 707 feet with 71.5% of flood storage capacity being utilized. Prescribed releases are followed between elevations 707 and 712 feet and all constraints are relaxed (Table 21).

Table 21. Alternative 1 Large Magnitude Flood Schedule

Forecasted Peak Pool Elevation (ft)	Growing Season Release (cfs)	Non-growing Season Release (cfs)
707	7,000	10,000
708	8,000	10,000
709	9,000	10,000
710	10,000	
711	11,000	
711.1	12,000	
711.2	13,000	
711.3	14,000	
711.4	15,000	
711.5	16,000	
711.6	17,000	
711.7	18,000	
711.8	19,000	
711.9	20,000	
712	Gates Fully Open	

Alternative 2C: Maintain the measures implemented in Alternative 2 (alternative considered but not carried forward), with the only difference being that the higher non-growing constraints are maintained throughout the entire year.

This would mean:

- Elimination of growing season release reduction, holding a maximum of 10,000 cfs all year during normal flood operation.
- When forecasts indicate constraint stages will exceed 19 feet at Lone Tree and/or 25 feet at Wapello, reduce the release to not less than 1,000 cfs during the peak 3-days of the crest with due allowance for travel time.
- No changes to the Iowa City (16,000 cfs) and Burlington (18 feet) downstream constraints
- Modified Large Magnitude Flood Operations (LMF) release schedule, as shown in Table 22, which eliminates “induced surcharge operation”.

Table 22. Alternative 2 Large Magnitude Flood Schedule

Forecasted Peak Pool Elev (feet)	Release (cfs)
707	12,000
710	14,000
710.5	16,000
711	18,000
711.5	20,000
712	Fully Open

Alternative 5: Alternative 5 is almost the same as Alternative 2 (alternative considered but not carried forward) with the only difference being that the growing season maximum release is 8,000 cfs. Downstream stage constraints are April 15–Dec 15 (growing season) and Dec 16 –April 14 (non – growing season). Details of this alternative include:

- Growing season maximum release is 8,000 cfs (May 1 - Dec 15).
- Non-growing season maximum release is 10,000 cfs (Dec 16 - Apr 30)
- Tiered, seasonal downstream constraints at Lone Tree and Wapello with variable minimum releases. When forecast indicate any of these constraints will be exceeded, reduce the release to control discharges as near as possible to the constraint stages during the peak 3-days of the crest with due allowance for travel time.
    - Growing Season:
        - Release not less than 6,000 cfs when the stages at Lone Tree and/or Wapello are forecast to exceed 16 feet and 22 feet, respectively
        - Release not less than 1,000 cfs when the stages at Lone Tree and/or Wapello are forecast to exceed 19 feet and 25 feet, respectively
    - Non-Growing Season: Release not less than 1,000 cfs when the stages at Lone Tree and/or Wapello are forecast to exceed 19 feet and 25 feet, respectively
- No changes to the Iowa City (16,000 cfs) and Burlington (18 feet) downstream constraints
- Altered dates for seasonal downstream constraint changes (Apr 15–Dec 15)
- Modified Large Magnitude Flood Operations (LMF) release schedule, and elimination of "Induced Surcharge Operation" (Table 23).

Table 23. Alternative 2 LMF Schedule

Forecasted Peak Pool Elev (feet)	Release (cfs)
707	12,000
710	14,000
710.5	16,000
711	18,000
711.5	20,000
712	Fully Open

Alternative 8: Alternative 8 is similar to Alternative 4 (alternative considered but not carried forward) but with the same downstream constraints throughout the entire year and a modified LMF schedule. Details of this alternative include:

- Maximum growing season release determined by reservoir pool elevation:
    - Below Elevation 700 – 8,500 cfs
    - Above Elevation 700 – 10,000 cfs
- Maximum non-growing season release is 10,000 cfs
- Release not less than 1,000 cfs when forecasts indicate the stage at Lone Tree constraint is 18.5 feet and Wapello constraint is 25 feet.
- The LMF schedule is shown in Table 24.

Table 24. Alternative 8 LMF Schedule

Forecasted Peak Pool Elev (feet NGVD)	Release (cfs)
707	12,000
710	16,000
711	18,000
711.5	20,000
712	Fully Open

CHAPTER IV: EVALUATION OF ALTERNATIVE PLANS

A. INTRODUCTION

Potential alternatives were initially evaluated on the basis of whether the alternatives enhanced, maintained or reduced the ability to meet Study goals and objectives. Screening criteria included FRM (primary Coralville Lake authorization), low flow augmentation, fish and wildlife, recreation, and other stakeholder interests such as inundation of flowage easement lands within Coralville Lake. Following the completion of the qualitative screening process, the alternatives were analyzed quantitatively using the reservoir simulation model HEC-ResSim to further evaluate each alternatives effectiveness, primarily focusing on FRM and to a lesser extent water conservation.

The initial quantitative screening process was conducted by modifying an existing HEC-ResSim model of the Iowa River/Iowa-Cedar Rivers Basin using study and tributary flow data spanning the years from 1917 through 2019 as primary inputs to the model. Model results were provided as daily flows and reservoir elevations throughout the system. Each alternative plan was modeled, and results were evaluated and compared based on estimating frequency and duration of a series of metrics related to key flows and reservoir levels related to changes in Dam operations or the nature/severity of flood impacts.

B. STEP 1. HYDRAULIC EVALUATION

Results from the HEC-ResSim model are presented in Table 25, which provide a comparison of reservoir simulation results for each alternative plan, organized by river reach and associated concerns and metrics. Results related to each metric are presented in terms of exceedance probability, duration or other pertinent measures as shown in the tables. The highlighted results shown in green in the table under each alternative indicate that the frequency, duration, or other pertinent measure improved for that alternative when compared to Alternative 1, *No Action Alternative*. Similarly, highlighted results shown in red in the table under each alternative indicate that the frequency, duration, or other pertinent measure were worse for that alternative when compared to Alternative 1, *No Action Alternative*. Non- highlighted results in the tables indicated that in implementing that alternative, conditions remained the same as in the No Action Alternative.

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Table 25. Summary of Reservoir Simulation Results for Alternative Plans

Summary of Reservoir Simulation Results for Alternative Plans

Based Upon Period of Record Simulations (1917-2019)

Flood Risk Management																
River Reach	**Concern**	**Metric**	**Unregulated**	**Alternative 1**	**Alternative 2**	**Alternative 2A**	**Alternative 2B**	**Alternative 2C**	**Alternative 3**	**Alternative 3A**	**Alternative 4**	**Alternative 4A**	**Alternative 5**	**Alternative 6**	**Alternative 7**	**Alternative 8**
Above Coralville Lake	Frequency of Flooding of Land Within Flowage Easements	Number of Years Reservoir Exceeded Elevation 702 feet NGVD	NA	29	23	23	24	22	4	**3**	23	23	23	18	17	22
	Duration of Flooding of Land Within Flowage Easements	Percent of Time Reservoir Exceeds Elevation 702 feet NGVD	NA	2.4%	1.6%	1.6%	1.6%	1.5%	**0.2%**	**0.2%**	1.6%	1.6%	1.7%	1.1%	0.8%	1.6%
	Overtopping of Spillway, Potential Erosion of Spillway Channel	Number of Years Reservoir Exceeded Elevation 712 feet NGVD	NA	3	2	2	2	2	**1**	**1**	2	2	2	2	2	2
	Overtopping of Spillway, Potential Erosion of Spillway Channel	Total Duration of Spillway Events (Number of Days Above Elevation 712 feet NGVD)	NA	29	26	25	25	21	**7**	**7**	26	26	25	24	24	23
	Flooding in Upstream Communities in the Amana Area and Loading of Remedial Works (Top of original Remedial Levee 717.0 ft NGVD)	Number of Years Reservoir Exceeded Elevation 715 feet NGVD	NA	1	1	1	1	1	**0**	**0**	1	1	1	1	1	1
Coralville Tailwater	Flooding of Access to River Front Estate NE	Number of Years of 13,000 cfs, or greater, Release From Coralville Dam	50	7	5	5	5	**4**	30	24	5	5	5	9	37	**4**
	Installation of Removable Flood Wall on 1st Avenue in Coralville, Closing Road to Traffic.	Number of Years of 17,000 cfs, or greater, Release From Coralville Dam	32	5	3	3	3	**2**	5	5	3	3	3	**2**	3	3
Iowa City Reach (Between Clear Creek and English River Confluences)	Flash Flooding in Iowa City	Number of Years Exceeding 16,500 cfs at Iowa City Gage	37	6	6	6	6	**4**	14	12	6	6	6	6	20	**4**
	Significant Increase in Floodwaters Impacting Access to, and Use of, University of Iowa Buildings	Number of Years Exceeding 20,000 cfs at Iowa City Gage	24	4	**2**	**2**	**2**	**2**	5	5	**2**	**2**	**2**	**2**	**2**	**2**
Lone Tree Reach (Between English and Cedar River Confluences)	Significant Increase in Flooding of Agricultural Areas and Secondary Roads	Number of Years Exceeding 16 ft (17,000 cfs) at Lone Tree Gage	50	**24**	35	35	26	42	47	44	34	34	34	44	47	40
	Start of Flooding for a few Residences and Significant Increase in Agricultural Damage	Number of Years Exceeding 19 ft (27,750 cfs) at Lone Tree Gage	22	**8**	**8**	**8**	**8**	**8**	18	16	**8**	**8**	**8**	11	**8**	**8**
Wapello Reach (Between Cedar and Mississippi River Confluences)	Flooding of Agricultural Areas and Secondary Roads	Number of Years Exceeding 22 ft (44,300 cfs) at Wapello Gage	45	**38**	39	39	39	39	41	41	**38**	**38**	39	40	40	39
	Widespread Flooding of Agricultural Lands and Roads, Increasing Non-Crop Damage	Number of Years Exceeding 25 ft (63,150 cfs) at Wapello Gage	28	**20**	**20**	**20**	**20**	**20**	24	24	**20**	**20**	**20**	21	21	**20**
Burlington Reach (Mississippi River)	Mississippi River Flooding	Average Reduction in Peak Mississippi River Flow for Events Exceeding Burlington Gage Constraint	0	10,546	10,873	10,983	11,069	10,907	3,803	4,241	10,918	10,918	11,105	7,798	**12,158**	11,023

Notes:

Metrics that improve over the baseline (Alternative 1) are shown in Green, those that worsen are shown in Red.

The best performing Alternative for each metric is shown in **Bold**.

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In order to eliminate alternatives less effective at meeting Study objectives, metrics were categorized based on the importance of the metric with regard to reducing flood risk concerns and operational feasibility and effectiveness. Downstream of the reservoir, when releases exceed 13,000 cfs evacuation of residents in Riverview Estates a few miles downstream of the reservoir is initiated due to loss of access by residents and emergency responders. When reservoir releases approach 17,000 cfs, 1st Avenue, a major artery in the City of Coralville is closed to allow installation of a removable flood wall in order to protect businesses along that thoroughfare. In addition, anytime discharges exceed 16,500 cfs at the Iowa City gage, there is a potential for flash flooding along Clear Creek, a tributary to the Iowa River. Further downstream flows commensurate with stages of 19 feet (27,750 cfs) at Lone Tree or 25 feet at Wapello (63,150 cfs) cause widespread flooding of agricultural land as well as closure of roads and non-crop damage. Of utmost importance is the frequency and duration of spillway overtopping. Overtopping of the spillway creates significant impacts downstream as flows exceed or equal 20,000 cfs when reservoir water levels approach elevation 712 feet. Flows exceeding 20,000 cfs at the Iowa City gage, cause significant impacts with regard to access to and use of buildings on the University of Iowa campus and in Iowa City. In addition, there is increased potential for erosion in the downstream spillway channel.

While Alternatives 2, 2A and 2B reduced the frequency or duration of impacts related to the concerns discussed above as compared to Alternative 1, *No Action Alternative* – current regulation plan), results between these alternatives for the most part were equal. Flows for Alternative 2 and its variants, are higher than those seen for Alternative 1 at Lone Tree, Iowa, and Wapello, Iowa, for frequencies below the 10% to 4% Annual Exceedance Probability (AEP) (10 to 25-year) events due to the higher allowable maximum flood control releases from Coralville Lake. However, with the exception of the higher flow frequencies at Lone Tree and Wapello for low impact events, Alternative 2C performed somewhat better for all of the other metrics and will be carried forward for detailed analysis. Alternative 2C reduced the frequency and duration of spillway overtopping, reduced flooding of Riverview Estates, reduced the frequency of flash flooding in Iowa City, and reduced the frequency of closing 1st Avenue in Coralville.

While maximum release alternatives 3 and 3A reduced the frequency and duration of adverse impacts upstream of Coralville Reservoir and resulted in reducing spillway overtopping events from 2 to 1, these alternatives were eliminated from further consideration due to the significant increase in the frequency and duration of adverse impacts for the entire reach of the Iowa River downstream of the reservoir as well as the Mississippi River.

Alternatives 4 and 4A are variations of Alternative 2 but include elevation-based growing season releases to reduce downstream impact when lake levels are relatively low, and storage is available. Alternative 4A is a variation of Alternative 4 but considers the lake elevation on May 1 as a decision point with the maximum discharge being maintained until the pool falls to the conservation level. However, the results of the HEC-ResSim for both of these alternatives were relatively the same as Alternative 2 but increased the magnitude of flows at Iowa City, Iowa, and Lone Tree, Iowa, below the 5% ACE (20-year) event, Wapello, Iowa, below the 20% ACE (5-year) event (see Appendix B, *Hydrology and Hydraulics*). These two alternatives were also eliminated from further consideration.

Alternative 5 is also a variation of Alternative 2. However, this alternative limits the maximum growing season release to 8,000 cfs when the lake is below elevation 707. Since this alternative is somewhat less aggressive than Alternative 2, adverse impacts to downstream agricultural land are reduced as compared with Alternative 2. Alternative 5 also reduces peak reservoir elevations within Coralville Lake, preserving flood storage over a wide range of exceedance probabilities. The reduction in frequency of exceeding elevation 707 feet results in less frequent initiation of LMF operations and uncontrolled spillway releases, respectively. Alternative 5 also reduces the duration of flood storage within Coralville Lake for events below the spillway elevation of 712 feet, but less so than other alternatives due to its

lower maximum growing season release. The reduction in frequency of exceeding elevation 707 feet results in less frequent initiation of LMF operations and uncontrolled spillway releases, respectively. The result is a reduction in peak downstream flows below Coralville Dam and at Iowa City, Iowa (see Appendix D, *Hydrology and Hydraulics,* for details). Based on these results, Alternative 5 was selected to be carried forward for further detailed analysis.

Alternative 6, a stakeholder alternative provided by Johnson County HS and EMA is an aggressive alternative which was conceived to limit impacts in the damage centers of Iowa City, Coralville, and surrounding Johnson County by increasing the maximum growing season release, raising downstream, constraints, increasing the minimum allowable release and transitioning to the large magnitude flood earlier when the reservoir is at elevation 705 feet instead of 707 feet. Due to the aggressive nature of this alternative, impacts downstream at Lone Tree as well as in Riverview Estates occur with greater frequency than all of the alternatives analyzed with the exception of Alternatives 3 and 3A which were only limited by the conduit capacity. Therefore, the impacts of this alternative were considered unacceptable, and it was eliminated from further consideration.

Alternative 7 is another stakeholder alternative formulated by the Two Rivers Levee and Drainage District. Similar to Alternative 6, this alternative increases the growing season constraint for Wapello, but in addition increases the Mississippi River constraint. The maximum allowable release is only constrained by the capacity of the outlet and the Iowa City flow constraint. This alternative increases the frequency of flooding impacting access to Riverview Estates but reduces the frequency of flooding along 1st Avenue in Coralville and flooding in Iowa City. However, the frequency of flooding downstream of Iowa City (Lone Tree/Wapello reaches) was increased although there was a slightly greater reduction in Mississippi River flows at Burlington than the other alternatives. Nonetheless, Alternative 6 was eliminated from further consideration as a viable alternative due to the predominance of negative impacts for most of the metrics.

Finally, Alternative 8 is very similar to Alternative 4 but with the same downstream constraints throughout the entire year and a modified, more aggressive LMF schedule. Analysis of this alternative revealed that the frequency of occurrence of reaching water level or flow triggers related to impacts both upstream and downstream of the reservoir were improved for almost all of the metrics considered as compared to Alternative 1. Therefore, this alternative is also carried forward for detailed flow frequency and economic analysis.

The screening of alternatives compared performance across metrics based on acceptability, efficiency, effectiveness, and completeness. Completeness is the extent to which a given alternative provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. Effectiveness is the extent to which an alternative alleviates the problems and achieves the opportunities. Efficiency is the extent to which an alternative is the most cost-effective means of alleviating the problems and realizing opportunities, consistent with protecting the Nation's environment. Acceptability is the workability and viability of the alternative with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies. Table 26 provides a summary of alternative performance in acceptability, efficiency, effectiveness, and completeness criteria.

Table 26. Summary of Alternative Performance in Acceptability, Efficiency, Effectiveness and Completeness Criteria

	Acceptability	Efficiency	Effectiveness	Completeness
Alternative 1 (No Action)	Alternative is considered to be acceptable to public, state, and local entities as it is the currently approved operations plan.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	While Alternative is acceptable at meeting FRM criteria and addressing some of the identified problems and opportunities, it is not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 2	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*, but was not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 2A	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*, but was not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 2B	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*, but was not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 2C	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. This alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk.* This alternative was somewhat more aggressive and reduced impacts over alternatives 2, 2A and 2B and will be further analyzed considering economic benefits.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 3	Alternative is not acceptable to public, state, and local entities as it does not meet FRM criteria and is not meeting the primary authorized purpose of FRM.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative does not address some identified problems and opportunities. Alternative did not meet all FRM criteria and therefore did not meet Goal 1: *Reduce Future Flood Risk*, the primary authorization for the Coralville Dam. Alternative is not considered effective.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 3A	Alternative is not acceptable to public, state, and local entities as it does not meet FRM criteria and is not meeting the primary authorized purpose of FRM.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative does not address some identified problems and opportunities Alternative did not meet all FRM criteria and therefore did not meet Goal 1: *Reduce Future Flood Risk*, the primary authorization for the Coralville Dam. Alternative is not considered effective.	Alternative is complete, no other plans or investments are needed for implementation.

Alternative 4	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*, but was not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation
Alternative 4A	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*, but was not considered optimally effective as compared to other alternatives considered.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 5	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. This alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*. This alternative was somewhat less aggressive than Alternative 2C and had slightly reduced agricultural impacts during non-flood years. It will be further analyzed considering economic benefits.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 6	Alternative is a stakeholder alternative that is not acceptable to all public, state, and local entities and does not meet FRM criteria and other authorized purposes.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative does not address some identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk* for certain metrics while negatively impacting others.	Alternative is complete in that no other plans or investments are needed for implementation.
Alternative 7	Alternative is a stakeholder alternative that is not acceptable to all public, state, and local entities does not meet FRM criteria and other authorized purposes.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative does not address some identified problems and opportunities. Alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk* for certain metrics while negatively impacting others.	Alternative is complete, no other plans or investments are needed for implementation.
Alternative 8	Alternative is considered to be acceptable to public, state, and local entities as many aspects were similar to those coordinated and approved as recent deviations.	Alternative has no implementation or construction cost. Alternative is considered to be efficient.	Alternative addresses identified problems and opportunities. This alternative met FRM criteria and Goal 1: *Reduce Future Flood Risk*. This alternative is less complex to interpret and execute than many of the other alternatives. It will be further analyzed considering economic benefits.	Alternative is complete, no other plans or investments are needed for implementation

With the intent of selecting a Recommended Plan, Alternative 2C (similar to Alternative 2 but with tiered non-growing season constraints maintained throughout the year), Alternative 5 (similar to Alternative 2 but with maximum growing season release of 8,000 cfs) and Alternative 8 (similar to Alternative 4 but with the same downstream constraints throughout the entire year and a modified LMF schedule) were selected for detailed hydrologic and economic analyses as all three plans provide enhanced flood risk reduction when compared to the other alternatives. Additionally, detailed economic analysis of Alternative 1, *No Action Alternative,* is required for comparison purposes in all Corps studies as the baseline alternative.

C. STEP 2: ECONOMIC EVALUATION

Economic assessments were completed on alternatives carried forward for detailed analysis, Alternative 1, *No Action Alternative*, Alternative 2C, Alternative 5, and Alternative 8, using HEC-FIA. The HEC-FIA used a structure inventory from the nationwide National Structure Inventory (NSI). To estimate agriculture damages, the HEC-FIA model used corn and soybean acreages from a 2019 land cover grid from National Agricultural Statistics Service (NASS), and prices and yield from the 2019 Purdue Crop Cost & Return Guide, which is published annually by the University of Purdue Agriculture Extension Service. The crop budget uses variable & fixed costs, crop yields, replanting rates, and duration damage curves by month that allow the model to determine damages by frequency. Hydraulic stage data were used to determine the flood depths at each location or structure, and structure depth-damage curves were used to estimate structural damages.

The economic model was split into the following six reaches:

1. Above Coralville Lake (Pool)
2. Coralville Tailwater (to Confluence with Clear Creek)
3. Iowa City Reach (between Clear Creek and English River Confluences)
4. Lone Tree Reach (between English River and Cedar River Confluences)
5. Wapello Reach (between Cedar River and Mississippi River Confluences)
6. Burlington Reach (Mississippi River)

Each reach was analyzed using depth, duration, and arrival grids. The change in benefits, or damages avoided, for each alternative was determined through the hydraulic frequency of each of the flows or stages occurring. Results of this analysis are summarized in Chapter VI, Section B, *Process for Selection of a Recommended Plan,* and the detailed assessment is provided in Appendix E.

The final array of Alternatives, 2C, 5 and 8, met all Study goals and objectives. Final economic criteria used to select the Recommended Plan was based on which alternative reduced flood damages the most while maintaining compatibility with other Study objectives and goals. Tables 22 and 23 in Chapter VI-B present the final comparison of Alternatives 2C, 5 and 8.

CHAPTER V: THE ACTION ALTERNATIVES' ENVIRONMENTAL CONSEQUENCES

A. INTRODUCTION

With-Project Conditions Environment Summary. Along with FRM improvements, the District considered environmental impacts and environmental compliance to verify the preferred alternative. An environmental impact, or effect, may be described in terms of significance, duration, frequency, location, magnitude, or other characteristics, such as reversibility, the ability to retrieve, and the relationships to long-term productivity.

B. COMPARING FINAL ARRAY

Chapter 2 describes Alternative 1, *No Action,* in detail. Table 27 summarizes environmental impacts in a qualitative assessment if the District were to select Alternative 2C, 5 or 8. Impacts to environmental resources were considered to be similar in nature across the range of with-study alternatives. However, the magnitude of adverse and beneficial impacts to resources for the with-study alternatives were considered to be proportional to the impact of each action alternative.

Table 27. Summary of Environmental Impacts

Public Interest Category/Measure	Alternatives			
	No Action	**2C**	**5**	**8**
Floodplain Resources	-	+	+	+
Land Use	o	o	o	o
Aquatic & Wildlife Resources	o	+	+	+
Threatened & Endangered Species	o	+	+	+
Invasive Species	o	o	o	o
Vegetation	o	+	+	+
Water Quality,	o	+	+	+
Wetlands	o	+	+	+
Rivers	o	+	+	+
Streams	o	+	+	+
Hydrology and Hydraulics	-	+	+	+
State Parks, and Other Aesthetic Resources	o	o	o	o
Cultural and Historic Resources	o	o	o	o
Socioeconomics	o	+	+	+
Minority and Low-Income Populations	o	o	o	o
Human Health & Safety	o	+	+	+
Sustainability, Greening & Climate Change	o	o	o	o
Constructed Resources	o	+	+	+
Recreation	o	o	o	o
Sedimentation/Soils/Prime and Unique Farmland	o	o	o	o
Hazardous Substances, Toxic, Radioactive Waste (HTRW)	o	o	o	o

++ Expected major long-term environmental or social benefit as a result of alternative implementation.
+ Expected moderate long-term environmental or social benefit as a result of alternative implementation.
o No or minor expected long-term environmental or social benefit or impact as a result of alternative implementation.
- Expected moderate long-term environmental or social impact as a result of alternative
-- Expected major long-term environmental or social impact as a result of alternative implementation.

Significance. Resource significance is determined by the importance and non-monetary value of the resource based on institutional, public, and technical recognition in the Study area. The potential significant impacts of the Study were considered in compliance with the Council of Environmental Quality (CEQ) NEPA regulations (40 Code of Federal Regulations (CFR) 1500.1(b), 1501.7(a)(2) and (3), and 1502.2(b)). "Significant" is defined as, "likely to have a material bearing on the decision-making process" (Apogee Research, Inc., 1995).

Engineering Regulation 1105-2-100, Corps' Planning Guidance Notebook, defines these significance criteria as:

- **Institutional Recognition:** Significance based on institutional recognition means that the importance of an environmental resource is acknowledged in the laws, adopted plans, and other

policy statements of public agencies, tribes, or private groups. Sources of institutional recognition include public laws, executive orders, rules and regulations, treaties, and other policy statements of the Federal Government; plans, laws, resolutions, and other policy statements of states with jurisdiction in the planning area; laws, plans, codes, ordinances, and other policy statements of regional and local public entities with jurisdiction in the planning area; and charters, bylaws, and other policy statements of private groups.

- **Public Recognition.** Public recognition means that some segment of the general public recognizes the importance of an environmental resource, as evidenced by people engaged in activities that reflect an interest or concern for that particular resource. Such activities may involve membership in an organization, financial contributions to resource-related efforts, and providing volunteer labor and correspondence regarding the importance of a resource.

- **Technical Recognition:** Technical recognition means that the resource qualifies as significant based on its "technical" merits, which are based on scientific knowledge or judgment of critical resource characteristics. Whether a resource is determined to be significant may of course vary based on differences across geographical areas and spatial scale. While technical significance of a resource may depend on whether a local, regional, or national perspective is undertaken, typically a watershed or larger (e.g. ecosystem, landscape, or ecoregion) context should be considered. Corps planners should describe technical significance in terms of one or more of the following criteria or concepts: scarcity, representativeness, status and trends, connectivity, critical habitat, and biodiversity.

This section outlines the possible environmental impacts associated with the alternatives carried forward for detailed analysis (Alternatives 2C, 5, and 8). The District compared the Alternative 1, *No Action,* to these alternatives for operational differences in Chapter III, *Formulation of Alternatives*. The following section compares the action alternatives' environmental consequences with the No Action alternative (profiled in Chapter II, Affected Environment).

The District determined the environmental consequences would be very similar among the action alternatives. Therefore, in the sections below, consequences are described individually where the consequences differ between Alternatives 2C, 5, and 8 or described as the "action alternatives" in sections where consequences are expected to be similar across Alternatives 2C, 5, and 8.

C. FLOODPLAIN RESOURCES

Since Alternatives 2C, 5, and 8 operate similarly to the No Action Alternative during low flow and high flows no additional impacts to floodplain natural and constructed resources are expected. The alternatives would not result in a decrease in floodplain capacity or an increase in flood risk. The proposed action would be in compliance with Executive Order 11988, *Floodplain Management*. Based on the District's hydraulic modelling, the action alternatives should reduce overall flood risk in the floodplains below each reservoir.

D. LAND USE

The action alternatives are consistent with current land uses and would enhance the existing public use areas and general quality of life for local residents. The alternatives would not alter existing land uses or transportation facilities within the Study area. None of the action alternatives would negatively impact the community state parks, conservation areas, and other areas of recreational, ecological, scenic, or aesthetic importance (per 40 CFR 1508.27(b)(3)).

Operating the dam during non-flood periods for natural resource management would contribute to the Master Plan goals.

E. AQUATIC WILDLIFE RESOURCES

Under the action alternatives and under normal operating conditions (outside flood conditions), the District could manage water levels and outflows for aquatic, wetland, and migrating species within the operating conservation band. This would benefit important mussel, fish, herptiles, and birds during important life stages and seasons.

For any of the three alternatives selected, the District would coordinate with the resource agencies as time allows for operation or maintenance induced low flow periods during year-round conditions, especially during cold temperatures (40 degrees F or below for water and or air temperature). If the District or other entity requests the flows out of the dam be reduced for dam inspections, maintenance, or any other activity, the District would minimize reductions in outflow in coordination with the resource agencies to minimize impacts to aquatic wildlife resources downstream of the dam.

F. ENDANGERED, THREATENED, & CANDIDATE SPECIES

The District determined the action alternatives would have **No Effect** to any listed species or species being considered by the FWS for listing. The District concludes the action alternatives would not change hydraulic scenarios to cause negative impacts to listed species. Updates to the Coralville Reservoir WCP, and guidelines mentioned in the previous section would ensure protection of listed mussel species occupying the areas near the dam outlets under Alternative 2C, 5, or 8. Updates would not include a change to the minimum low-flow requirements, which are critical to the protection of the Iowa River's diverse mussel population.

G. INVASIVE SPECIES

Implementation of the No Action or the action alternatives would not have an effect on invasive species introduction, spread, or management. The District would continue to implement best management practices with regards to invasive species management at Coralville Lake. Following District policy and using adaptive and best management practices in prevention, education, early detection, rapid response, and containment in trying to control invasive species will aid in cost effective and environmentally sound invasive species management regardless of the selected plan.

H. VEGETATION

Alternatives 2C, 5, or 8 could operate lake and river levels during normal operations for more flexible natural resources management than the No Action Alternative. This may result in improved vegetation communities. The District would be able to focus on habitat management problems and opportunities to promote aquatic and wetland plant growth.

For instance, maintaining the lakes a foot or two higher than normal and then dropping them to flat pool during the growing season would promote plant growth on the exposed mudflats in the upper reaches of each lake.

Under Alternative 1, *No Action*, the District is required to operate the lake at flat pool with no ability to fluctuate the levels for habitat management except in the fall for migrating bird benefits. A fall pool raise would still be a wildlife management option under Alternative 2C, 5 or 8.

I. RIVERS AND STREAMS, WATER QUALITY, WETLANDS

Alternatives 2C, 5, or 8 would not impact Iowa River or Coralville water quality. The District would continue low flow augmentation practices to ensure adequate water volume at downstream water intakes and outfalls.

Water residence time in Coralville Lake was compared for Alternatives 1, 2C, 5, and 8 for the growing season (1 May-15 Dec) when the pool is at conservation elevation. For the period of record analysis (1959-2019), when the pool is at conservation elevation, the change in residence time during the growing season was -4.24 days (15.33 to 11.09 days, 27.7%). Therefore, the proposed action alternatives would not significantly change the water retention time at the reservoir to substantially alter water quality positively or negatively. Since the District proposes no construction or would have no discharge into the Waters of the United States, a CWA, Section 401 Water Quality Certification is not required.

During the update to the Des Moines River Basin Master Reservoir Regulation Manual, Iowa DNR sent an email stating that it is well documented that water residence time is an extremely important factor when it comes to managing and maintaining reservoir fisheries (USACE, 2019). The Iowa DNR has observed that flow rates and Walleye loss are positively correlated at Rathbun Lake. This same relationship has been shown to be true for crappie species. In addition, turbidity will likely increase in the reservoir as increased velocities carry sediment further into the basin. A reduction in water residence time is not beneficial for reservoir fisheries management or angling. In response to this concern, the District and partner agencies would adaptively manage spring reservoir levels within the conservation band to promote fish spawning and rearing conditions. There may not be optimal fish spawning and rearing conditions every year, but if conditions would allow it, the District would hold spring water levels to promote the fisheries. The District's efforts to promote the reservoir's spring fisheries is in place now and would continue with any of the Study alternatives.

Without watershed improvements, under the No Action alternative or the action alternatives, the threat of water quality impairment would continue its current trend.

Annual wetland management may or may not be an achievable goal due to other habitat management objectives in the Master Plan for any given year. Flood risk management takes priority over wetland management. Still, wetlands at the reservoir would improve under the action alternatives given the added flexibility of water level management during normal (non-flood) years.

The action alternatives would not have additional (positive or negative) impact to the rivers and streams in the Study area. The proposed action alternatives would not impact any water bodies designated as a wild or scenic waterway, in accordance with the Wild and Scenic Rivers Act.

The District would continue their robust water quality monitoring program under any of the alternatives. Based on the results of water quality monitoring, the Iowa DNR or the District may impose beach closures, or other precautionary steps. If possible, the District would attempt to offset water quality problems while operating the reservoir within in its conservation band.

J. HYDROLOGY AND HYDRAULICS

The action alternatives carried forward have positive impacts on the system's hydrology/hydraulics by conserving reservoir storage through earlier releases of water during small scale flood events, thereby reducing flood risk during long duration, large magnitude flood events resulting from multiple storms. While higher non-damaging flood events within bank flows would be observed more frequently. It should

be noted that in order to conserve flood storage, the frequency and duration of flows exceeding the channel capacity downstream of the reservoir will be reduced in most cases.

Opportunities for increased flexibility in reservoir operations would be built into the regulation schedules. This would allow water managers to easily adapt project regulation for each event based on information available at the time of the event. Overall, this flexibility would help to account for the uncertainty in projected climate change impacts in the Iowa River watershed and would help to reduce future flood risk. Figures 19, 20, 21, 22, 23 and 24 illustrate the proposed operational rule changes between current operations and Alternatives 2C, 5 and 8. Operational rules in red on the right of the illustration are proposed rule changes.

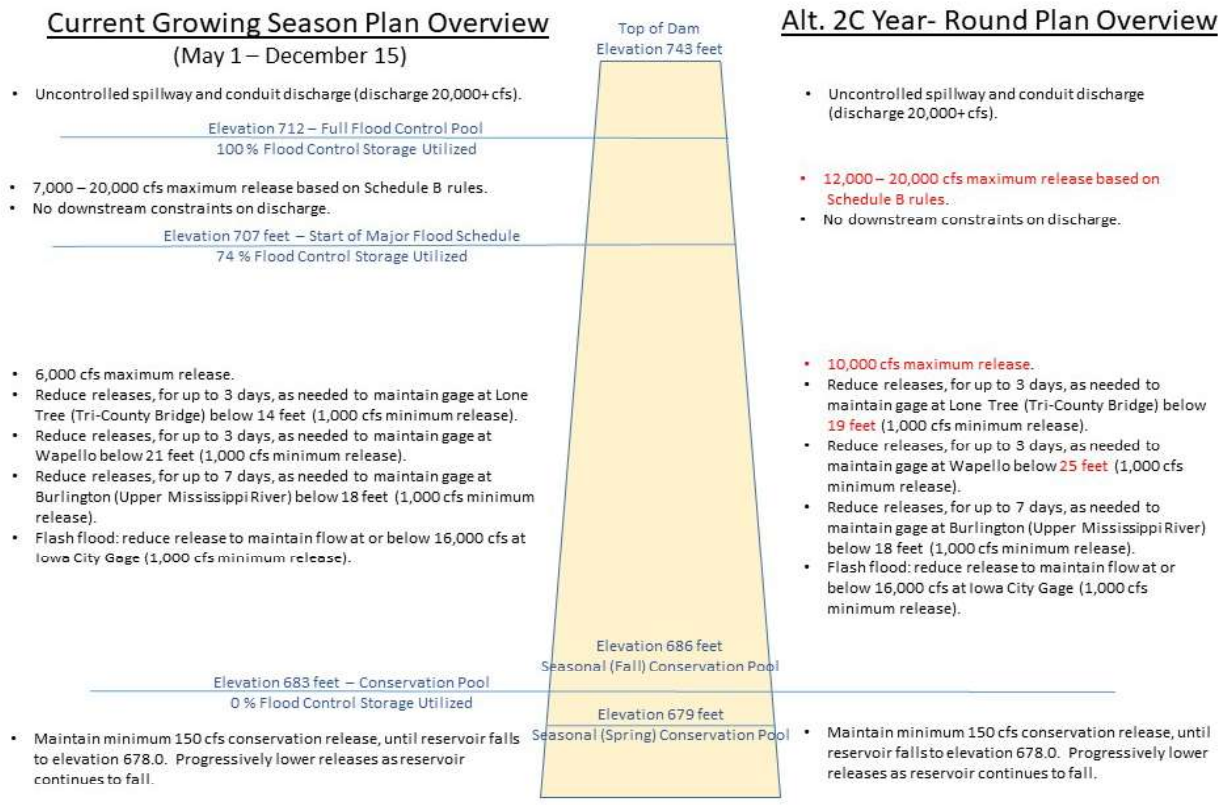

Figure 19. Coralville Lake Water Control Plan – Current Growing Season Plan (May 1–December 15) vs Alternative 2C Year-Round Plan

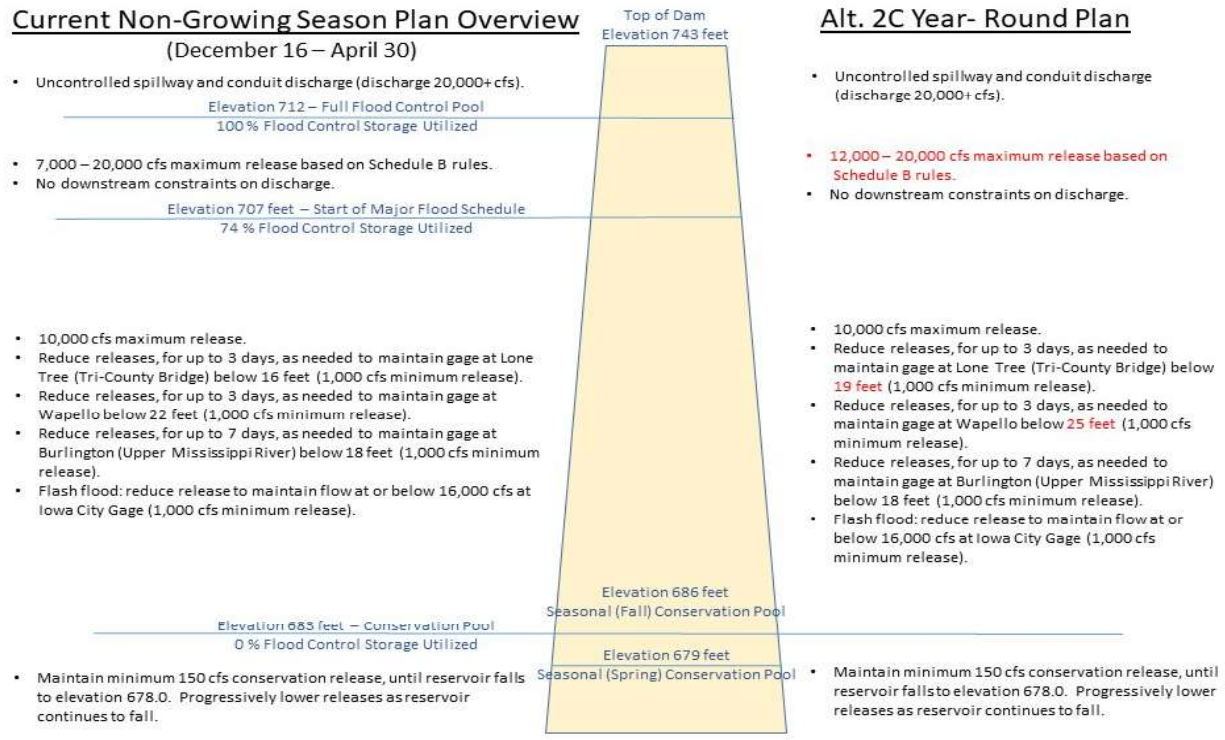

Figure 20. Coralville Lake Water Control Plan – Current Non-Growing Season Plan (December 16–April 30) vs Alternative 2C Year-Round Plan

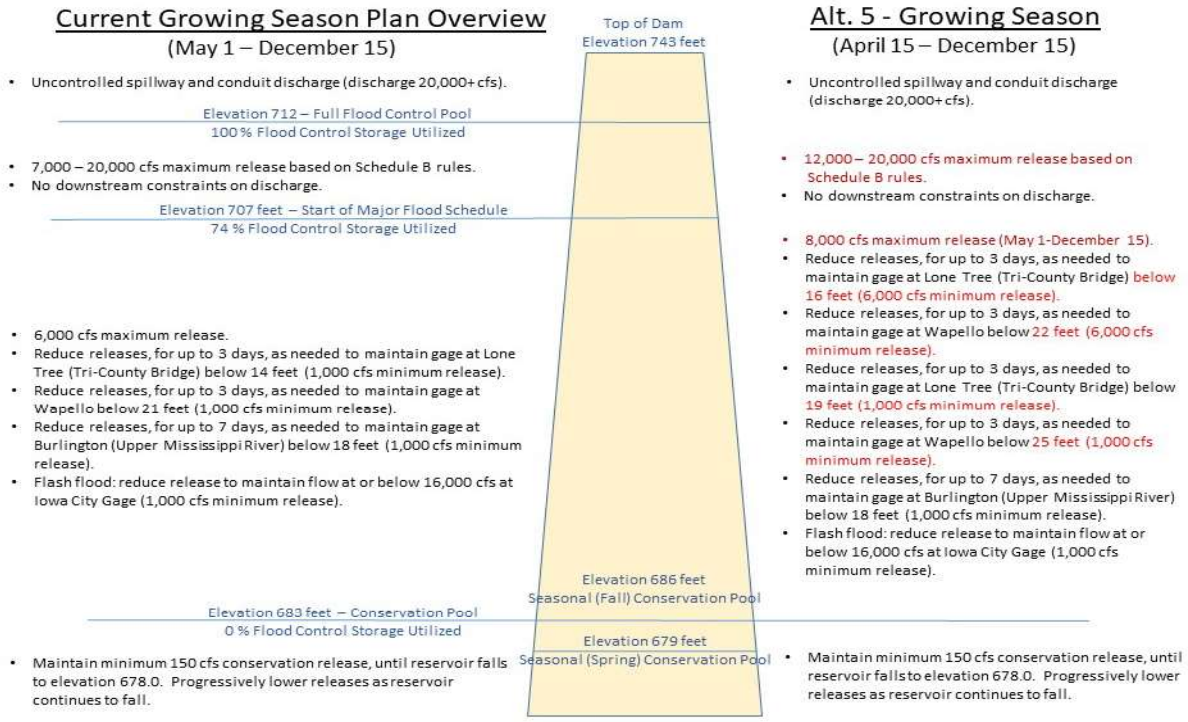

Figure 21. Coralville Lake Water Control Plan – Current Growing Season Plan (May 1–December 15) vs Alternative 5 – Growing Season (April 15–December 15)

Figure 22. Coralville Lake Water Control Plan – Current Non-Growing Season Plan (December 16–April 30) vs Alternative 5 – Non-Growing (December 16–April 14) Season

Figure 23. Coralville Lake Water Control Plan – Current Growing Season Plan (May 1–December 15) vs Alternative 8 - Growing Season (April 15–December 15)

Figure 24. Coralville Lake Water Control Plan – Current Non-Growing Season Plan (December 16–April 30) vs Alternative 8 – Non-Growing (December 16–April 14)

K. STATE PARKS, CONSERVATION AREAS, AND OTHER AREAS OF RECREATIONAL, ECOLOGICAL, SCENIC, OR AESTHETIC IMPORTANCE

The action alternatives do not require construction so there would be no impacts from construction lighting, noise, dust, or other disturbances to the planning area. Long-term beneficial impacts would include natural resource restoration opportunities.

The activities within the action alternatives are consistent with current land uses and potentially would improve habitat and wildlife viewing, thereby enhancing the general quality of life for local residents.

Several public areas are adjacent to or in the planning area ranging from city parks to preserves. Alternative 2C may increase the frequency of nuisance flooding in Iowa City parks, but will help avoid negative impacts due to high magnitude flood events. Any impacts to the community, state parks, conservation areas, and other areas of recreational, ecological, scenic, or aesthetic importance would be minimal in nature for any of the action alternatives [per 40 CFR 1508.27(b)(3)].

L. HISTORICAL AND CULTURAL RESOURCES

Confirmed National Register of Historic Places (NRHP)-listed or eligible archeological sites are limited to the Woodland Era habitation site called Sugar Bottom NW (13JH272). Thirty-eight sites are recommended for testing to assess NRHP eligibility, 300 are recommended or determined ineligible, and the remaining 72 archaeological sites have no associated NRHP eligibility recommendation. Sites in the latter category primarily relate to avocational-archeologist recorded finds or historic sites recorded on the basis of archival information alone. Because maximum water outflow rates and pool elevations associated with the preferred plan are the same as those presently utilized—with only timing and release triggers being modified—preferred plan is anticipated to cause no adverse effects to historic properties.

The action alternatives maintain the same flood pool elevations as were coordinated in the past, and all proposed maximum flow rates are within rates already utilized. Implementation of the preferred alternative is expected to have no measurable impacts on historic properties as compared to the existing WCP. Implementation of the preferred alternative is not expected to affect sites 13PK404 or 13PK415, which have not been assessed for their NRHP eligibility.

The District initiated consultation with the SHPO, Tribes, and interested parties and proposed a finding of No Adverse Effects in a letter dated July 9, 2020. SHPO concurred with this determination by stamped approval dated August 5, 2020 (R&C# 200700037). The Crow Creek Sioux THPO concurred with the determination by e-mail dated July 14, 2020. The Ho-Chunk Nation THPO concurred with the determination by e-mail dated July 29, 2020. They further requested to remain as a consulting party for the undertaking and in the event of unanticipated discovery. The District received no other NHPA-related responses.

M. SOCIOECONOMIC RESOURCES

Alternatives 2C, 5, and 8 are expected to reduce the number of extreme floods. With improved flexibility under the normal non-flood operations that manipulate lake and river levels, socioeconomic resources are expected to be improved. Socioeconomic resources would be positively impacted as flooding frequency could be reduced in developed areas.

Three economic reaches, including Coralville Lake, Coralville Tailwater, and Iowa City are expected to see a reduction in damages from flood events. The Wapello reach would see little reduction with

Alternative 2C, an increase with Alternative 5 and no reduction with Alternative 8. The Lone Tee Reach would see an increase with any of the alternatives. Population, housing, businesses, and agriculture would realize positive benefits from both Alternatives 2C, 5 and 8 in terms of FRM. Alternative 2C provides a higher level of risk reduction than Alternatives 5 and 8, compared to Alternative 1, *No Action*. Alternative 2C, would provide the largest percent reduction in Average Annual Damages (AAD) in the Coralville Pool reach Area closely followed by Coralville Tailwater reach Area. The Alternative 2C annual damage reductions would have a positive impact on all socioeconomic resources in the Study area. A vast majority of the FRM benefits are from reduced flooding of structures. See the Appendix E, *Economics*.

Environmental Justice. Impacts associated with the action alternatives are expected to have positive benefits for people in the Study area, including minority and low-income residents throughout the WCP Study area. Environmental Justice Communities are spread throughout the WCP Study area, with most of the Environmental Justice communities (as identified using block group data) located in Johnson County. There would be no direct or indirect high adverse impacts on minority and/or low-income communities within the Study area as per 2016 U.S. Census information and requirements of EO 12898.

N. HUMAN HEALTH & SAFETY

The proposed action would not impact human health and safety.

O. SUSTAINABILITY, GREENING & CLIMATE CHANGE

Corps of Engineers projects, programs, missions, and operations have generally proven to be robust enough to accommodate the range of natural climate variability over their operating life spans. However, recent scientific evidence shows in some places and for some impacts relevant to Corps operations, climate change is shifting the climatological baseline about which that natural climate variability occurs, and may be changing the range of that variability as well. This is relevant to the Corps because the assumptions of stationary climatic baselines and fixed range of natural variability, as captured in the historic hydrologic record may no longer be appropriate for long-term projections of flood risk.

The District considered climate change impacts on the hydrology of the Iowa-Cedar Rivers Basin in accordance with ECB 2016-25, *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs and Projects* as well as Engineering Technical Letter 1100-2-3, *Guidance for Detection of Nonstationarities in Annual Maximum Discharges.*

The majority of stream flow gages evaluated in the Iowa River exhibit upward trends in annual peak flow. The exception being the Iowa City gage, located immediately below Coralville Lake, which exhibited a downward trend in peak annual stream flow due to the regulating effects of the reservoir. The statistical significance of the computed upward trends was mixed. Evaluation of historical precipitation trends identified a statistically significant upward trend, reinforcing the upward trend in annual peak stream flow.

For the Iowa-Cedar Rivers Basin, according to the Climate Hydrology Assessment Tool, there is projected to be an increase in variability and an upward trend of annual maximum monthly flow through the 21st century. According to the Vulnerability Assessment tool, the Iowa-Cedar Rivers Basin is moderately vulnerable to climate change impacts on FRM. While the literature review indicated precipitation is projected to increase, there is less consensus on the projection of future stream flows. Multiple authors suggest there may be seasonal changes in stream flow with higher flows in the winter/spring and lower flows in the summer/fall. Although available literature and Corps Climate

Assessment tools do not reach a consensus on observed and projected stream flow throughout the Iowa-Cedar Rivers Basin due to long-term persistent climate trends or anthropogenic climate change, there is some agreement that stream flow variability would increase, and extreme events will occur more frequently.

P. CONSTRUCTED RESOURCES - PUBLIC STRUCTURES, UTILITIES, TRANSPORTATION, OTHER

The action alternatives would not have negative impacts to constructed resources. The alternatives would not alter existing land uses or transportation facilities within the Study. Further, the action alternatives would not impact surrounding facilities such as police stations, fire stations, schools, hospitals, and post offices.

Q. RECREATION

The action alternatives would not have any impacts to lake or river recreation. With improved natural resource management, there may be additional eco-recreation opportunities. Based on the proposed higher, earlier releases to preserve flood storage, and thereby reduce the likelihood of higher reservoir releases during moderate to major flood years, Alternatives 2c, 5, or 8 would improve the availability of water based recreational features at Coralville Lake (Goal 4.a). This means boat ramps and entrance roads may stay open longer or remain open as a result of fewer high-water events.

R. SEDIMENTATION/SOILS/PRIME AND UNIQUE FARMLAND

The action alternatives would not have any additional impacts to prime or unique farmland.

S. HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW)

None of the alternatives would be expected to affect HTRW sites within the planning area. The lands affected by any of the action alternatives would not be expanded beyond what already exists, so known HTRW sites would not change.

CHAPTER VI: SELECTED PLAN

A. CONSERVATION POOL MANAGEMENT

The current operating plan for Coralville Lake utilizes a single elevation to define the conservation pool level to be maintained during normal (non-flood or drought) operations. In reality the reservoir level fluctuates daily sometimes by as much as 1-foot above the authorized conservation pool elevation of 683 feet due to natural causes (rain, wind) and operational reasons (discrete gate settings based upon forecasted flow conditions).

In updating the WCP, it is desired to formally accommodate these fluctuations into an identified operating band (as opposed to continuing to identify a single elevation). Operating within a defined band, as opposed to a single target value, is currently incorporated into the WCPs at the other reservoir and lock and dam projects within the District. Use of an operating band accounts for operational uncertainties inherently related to forecasting reservoir inflows as well as providing operational flexibility to support:

- completion of routine, minor maintenance activities;
- accommodating minor (short-term) stakeholder requests;

- management for fish and wildlife resources during non-flood or drought periods; and
- flexibility in the operating band can potentially offset some of the negative aspects of sedimentation such as meeting conservation release targets during dry periods.

Examples of routine, minor maintenance activities include short term reductions in releases to accomplish inspection activities and facilitate removal of debris that can accumulate upstream of the outlet works of the dam. Minor stakeholder requests typically focus on temporarily reducing releases to assist search and rescue operations in the river downstream of the reservoir or water intake/outlet maintenance. These types of operations result in short term usage of a small amount of reservoir storage that can immediately be released following the event (often within the same day), while maintaining the reservoir elevation within a defined operating band.

With regard to management of fish and wildlife resources, operation of Coralville Lake for fish and wildlife resources was authorized as part of the 1958 Fish and Wildlife Coordination Act. Under the current WCP, the primary operational consideration included for fish and wildlife management is the allowance for up to a 3-foot fall pool raise to be conducted between September 15 and December 15. As part of this Study effort, the Study team met with the state and Federal resource agency partners to identify several potentials to increase the flexibility of reservoir operations to support fish and wildlife objectives which include:

- increasing the allowable fall pool raise to provide greater benefits to migratory waterfowl;
- allowing the fall pool raise to be held through the winter months (ending May 1) to reduce the impacts to herptiles associated with drawing the pool down in mid-December; and
- allowing for not drawing the conservation pool down to 679 in the spring to improve water quality and conditions for fish.

The identified measures are designed to provide operational flexibilities to support fish and wildlife resources during non-flood or drought periods. Historically, Coralville Lake has been in normal (non-flood or drought) operations in excess of 90% of the time. By identifying and incorporating operational flexibilities in the form of an operating band (rather than identifying highly specific seasonal operations), the Study is better able to support a range of potential management actions and allows for adaptive management.

Based on the proposed measures, the District considered the following operating bands:

- December 16–February 14 (“winter” season - variable) Elevations 683 - 688
- February 15–May 20 (“spring’ season - variable) Elevations 679 – 683
- May 21–August 30 (“summer” season) Elevation 683 – 684
- September 1–December 15 (“fall” season - variable) Elevations 687 – 688

To test the impacts of the proposed operating flexibilities on the Study’s FRM mission against the alternatives considered, sensitivity analyses were run in HEC-ResSim by conducting period of record analyses (1917-2019) using 3 different conservation pool levels:

- Existing conservation pool schedule
- Top of the proposed operating band
- Bottom of the proposed operating band

The results of the analysis indicated that maintaining the pool at the bottom of the proposed operating band showed no change in flood releases compared to the current pool management schedule. However,

maintaining the pool at the top of the proposed operating band when holding the fall pool level of 688 throughout the winter, showed an increase in maximum flood releases for several flood events. In practice, it would be difficult to be proactive in bringing the pool back down early (prior to March 1) if significant snowpack or forecasted precipitation were to occur due to the presence of ice cover.

Therefore, based on the results of the analysis and practical considerations, it is recommended that the operating band for much of the year be between elevation 683 and 684 feet; reflecting the range over which reservoir levels have historically been managed. During the late winter and spring (February 15–May 20), the operating limits would expand to incorporate, but not require, the current spring drawdown to elevation 679 feet. The flexibility in later winter and spring operations would allow for situational management of water levels based upon observed conditions. During wet conditions, characterized by heavier than normal snowpack or significant forecasted rainfall events, the reservoir could be lowered within the band in advance of the runoff to increase available storage. During dry to normal conditions, the normal conservation level (elevation 683 feet) can be maintained to preserve full conservation storage, benefit fish and wildlife, and to improve public safety. In the fall (15 September through 15 December) the current allowable fall pool raise would be increased by two feet (from elevation 686 feet to elevation 688 feet). A more detailed discussion of the analysis and these results is available in Appendix D, *Hydrology and Hydraulics*.

B. ENVIRONMENTAL OPERATING PRINCIPLES AND CAMPAIGN PLAN GOALS

The significance of the Iowa River's contribution to the health of aquatic, terrestrial, and migrating birds' ecosystems are of national importance. Preserving the opportunity to restore additional habitat in the future is supported by the Corps Environmental Operating Principles and Campaign Plan goals. These principles and goals were considered in the development of the Recommended Plan in order to provide additional flexibility to the Recommended Plan. While these provide additional flexibility within the Recommended Plan, integrating these principles and goals would not result in allocating storage at Coralville Reservoir for environmental and ecological purposes. The principles are:

1. Foster sustainability as a way of life throughout the organization.

2. Proactively consider environmental consequences of all Corps activities and act accordingly.

3. Create mutually supporting economic and environmentally sustainable solutions.

4. Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.

5. Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.

6. Leverage scientific, economic, and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.

7. Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.

These principles were considered in developing the Recommended Plan, which would address these principles in the following ways:

1. The Recommended Plan would incorporate environmental sustainability by operating the Coralville Lake outflows in a conservation band when flooding or drought is not a concern. This would create a more naturally functioning wetland, lake, and river ecosystem.

2. Coordination with resource agencies and stakeholders through development of the Study identified and resolved or reduced the risk of environmental consequences of implementation of the Recommended Plan.

3. The Recommended Plan would create aquatic and riparian habitat conditions required by numerous fish and wildlife species living in or migrating through the system. The economic benefits were not quantified but would tend to invigorate the existing ecotourism economy associated with the resource. Implementation would not impact flood risk or floodplain development and would not cause negative environmental impacts.

4. The Recommended Plan has been reviewed and found to be consistent with all applicable laws and policies, including those related to potential impacts to human and natural environments. The District would meet their corporate responsibility and accountability for the Recommended Plan in accordance with those laws and policies.

5. The Recommended Plan would balance providing ecosystem and habitat benefits without increasing the existing flood risk. Cost and schedule risk assessment was considered for study implementation to assure costs and construction schedules were achievable. Risk management was also applied in the development of the adaptive management and monitoring plan to assure restoration plans realized forecast environmental outputs.

6. The District has operated the Coralville Lake since 1958. The knowledge of resource agency subject matter experts and long-standing partnership with the resource agencies was leveraged in the collection of field data and to develop the possible conservation band management for environmental management.

7. The Study process involved coordination with and the participation of numerous agencies and interested resource partners. Both the local sponsor and the District met with the public to seek input at the beginning and during the Study.

The Corps' Campaign Plan is a strategic change decision document. It drives and aligns strategic change; anticipates and shapes future operating and fiscal environments; unites all of the Corps with a common vision, purpose, and direction; and responsively adapts to mission and "battle space" changes. The plan is composed of four goals: Support National Security, Deliver Integrated Water Resource Solutions, Reduce Disaster Risk, and Prepare for Tomorrow. The Recommended Plan relates to the second goal. The second goal reflects an effort to operationalize the civil works strategic plan by focusing on holistic integrated water resource management. The goal has four objectives: deliver quality water resources solutions and services, deliver the civil works program using innovative solutions, develop the civil works program to meet the future water resources needs of the Nation, and manage the life-cycle of water resources infrastructure systems to consistently deliver reliable and sustainable performance. Each objective has three action items. Of the twelve items, those to which the Recommended Plan relates are listed below: The applicable Campaign Plan goal is Goal 2 – Deliver Integrated Water Resource Solutions. The goal has four objectives:

1. Deliver Quality Water Resource Solutions and Services

2. Deliver the Civil Works Program and innovative solutions

3. Develop the Civil Works Program to meet the future needs of the Nation

4. Manage the life cycle of water resources infrastructure systems to consistently deliver reliable and sustainable performance.

The preserved study opportunity would apply to Objectives 1 and 3 by maintaining the ability to initiate an FRM in the timeliest manner in the future. The significance of the FRM and natural resources value to the surrounding ecosystem are of national importance.

The District used USACE approved hydraulic models and coordination with resource agencies to assess impacts to the environment.

C. PROCESS FOR SELECTION OF A RECOMMENDED PLAN

Selection of a Recommended Plan was accomplished by developing analytic frequency curves for each of the four alternatives carried forward by following the procedures used in developing the regulated flow frequency relationships used in the 2009 Iowa River Regulated FFS. The procedures generally consisted of:

- developing an unregulated period of flow record based upon the HEC-ResSim simulation using historical inflows;
- developing volume-duration-frequency curves for reservoir inflow volumes using the simulated unregulated flow record;
- estimating the critical duration for flood inflows;
- developing a relationship between the regulated peak reservoir outflow and the unregulated inflow volume for the identified critical duration; and
- combining the volume-duration-frequency curve for the critical duration with the regulated versus unregulated relationship to obtain the regulated frequency curve.

Results of the Hydrologic Engineering Center's model, HEC-RAS, for computing water surface elevations and developing inundation mapping were provided as input to the flood impact analysis package, HEC-FIA, to develop stage/flow versus damage relationships for each reach. Results from the HEC-ResSim simulations were then used to develop regulated flow (or stage in the reservoir) frequency estimates for each alternative considered. The two results (HEC-FIA and regulated flow frequencies) are numerically integrated to develop average annual damage (AAD) estimates for each alternative which can be compared to identify the relative FRM benefits. Tables 28 and 29 provide a summary of computed average annual damages, and associated reductions in damage, for each alternative (2C, 5, and 8) compared to Alternative 1. Results are presented in terms of dollars and percent reduction in damages. This analysis was conducted for the entire period of record between 1917 and 2019, and a shorter, wetter period extending from 1959 to 2019 which was evaluated to test the robustness of the Study conclusion (i.e., do the two time periods identify the same best performing plan).

Table 28. Average Annual Damages Full Period of Record

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Average Annual Damages ($)					
Alternative 1	270,000	103,000	976,000	434,000	999,000	2,782,000
Alternative 2C	160,000	65,000	857,000	498,000	998,000	2,578,000
Alternative 5	185,000	77,000	874,000	495,000	1,016,000	2,647,000
Alternative 8	180,000	67,000	870,000	495,000	999,000	2,611,000

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Average Annual Damages Reduced (From Alternative 1)					
Alternative 2C	110,000	38,000	119,000	(64,000)	1,000	204,000
Alternative 5	85,000	26,000	102,000	(61,000)	(17,000)	135,000
Alternative 8	90,000	36,000	106,000	(61,000)	-	171,000

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Percentage Average Annual Damages Reduced (From Alternative 1)					
Alternative 2C	69%	58%	14%	-13%	0%	7.91%
Alternative 5	46%	34%	12%	-12%	-2%	5.10%
Alternative 8	50%	54%	12%	-12%	0%	6.55%

Table 29. Average Annual Damages Partial Period of Record

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Average Annual Damages ($)					
Alternative 1	282,000	148,000	1,840,000	587,000	1,389,000	4,246,000
Alternative 2C	205,000	110,000	1,560,000	659,000	1,413,000	3,947,000
Alternative 5	255,000	122,000	1,589,000	610,000	1,434,000	4,010,000
Alternative 8	209,000	120,000	1,570,000	643,000	1,419,000	3,961,000

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Average Annual Damages Reduced (From Alternative 1)					
Alternative 2C	77,000	38,000	280,000	(72,000)	(24,000)	299,000
Alternative 5	27,000	26,000	251,000	(23,000)	(45,000)	236,000
Alternative 8	73,000	28,000	270,000	(56,000)	(30,000)	285,000

Period 1919-2019	Coralville Pool	Coralville Tailwater	Iowa City	Lone Tree	Wapello	Cumulative Total
	Percentage Average Annual Damages Reduced (From Alternative 1)					
Alternative 2C	38%	35%	18%	-11%	-2%	7.58%
Alternative 5	11%	21%	16%	-4%	-3%	5.89%
Alternative 8	35%	23%	17%	-9%	-2%	7.20%

D. DISCUSSION OF RECOMMENDED PLAN

Based on the hydrologic and economic analysis of the screened alternatives, Alternative 2C was identified as the preferred alternative or Recommended Plan for replacing the current Coralville Lake WCP. Details of the Recommended Plan are shown in Figure 25 and addresses normal flood management operations, large magnitude flood operations, drought, and conservation pool management.

The criteria used to select the Recommended Plan was which alternative resulted in the lowest, system-wide, average annual flood damages and was compatible with meeting the other Study goals and objectives. Alternative 2C results in the lowest, system-wide, average annual damages (AAD) for both the full period of record (1919-2019) and the abbreviated wetter period (1959-2019) analyzed. Within individual study reaches, Alternative 2C provides the greatest reduction in flood damages in three of the five damage reaches studied (including the areas upstream of the reservoir and in downstream reaches extending from Coralville Dam through Iowa City). Within two reaches, Lone Tree and Wapello, the average annual damages were greater under Alternative 2C than under the current water control plan (Alternative 1).

Upstream of Coralville Dam, the frequency and duration of flooding of lands is reduced. This includes agricultural areas for which the Federal government acquired (as part of the Coralville Lake Project) easements for occasional overflow as well as flooding along the remedial works near the historical Amana Colonies.

Downstream of Coralville Dam, including the heavily populated City of Coralville and Iowa City areas, Alternative 2C reduces the likelihood of large magnitude and spillway releases that cause significant impacts and damages in those communities.

While average AAD were 12 percent higher in the Lone Tree reach under Alternative 2C as compared to Alternative 1, the increase in AAD in the Lone Tree reach is primarily to low-lying agricultural land that is impacted by flash flooding from English Creek. Under Alternative 2C, releases from Coralville Lake would not be as aggressively reduced during such downstream flash-flood events in favor of preserving storage within the reservoir to reduce the risk of large magnitude flooding or spillway releases which result in more wide-spread damage to urban and agricultural areas. The tradeoff between overall damage reduction during major flood events and localized impacts during short-duration flash flooding appeared to be acceptable to landowners in the Lone Tree Reach as was indicated during earlier scoping meetings. This approach to managing reservoir releases was also preferred by Johnson County.

In the Wapello reach, while AAD for Alternative 2C were slightly higher than Alternative 1, they were lower than with Alternatives 5 and 8. However, similar to the Lone Tree Reach, flood damages in the Wapello reach are influenced to a much greater degree by the Cedar River which is unregulated, than by the operation of Coralville Reservoir. Additionally, much of the low-lying agricultural land in the Wapello reach has been taken out of production and permanently enrolled in conservation easement programs offered through the Natural Resources Conservation Service (NRCS).

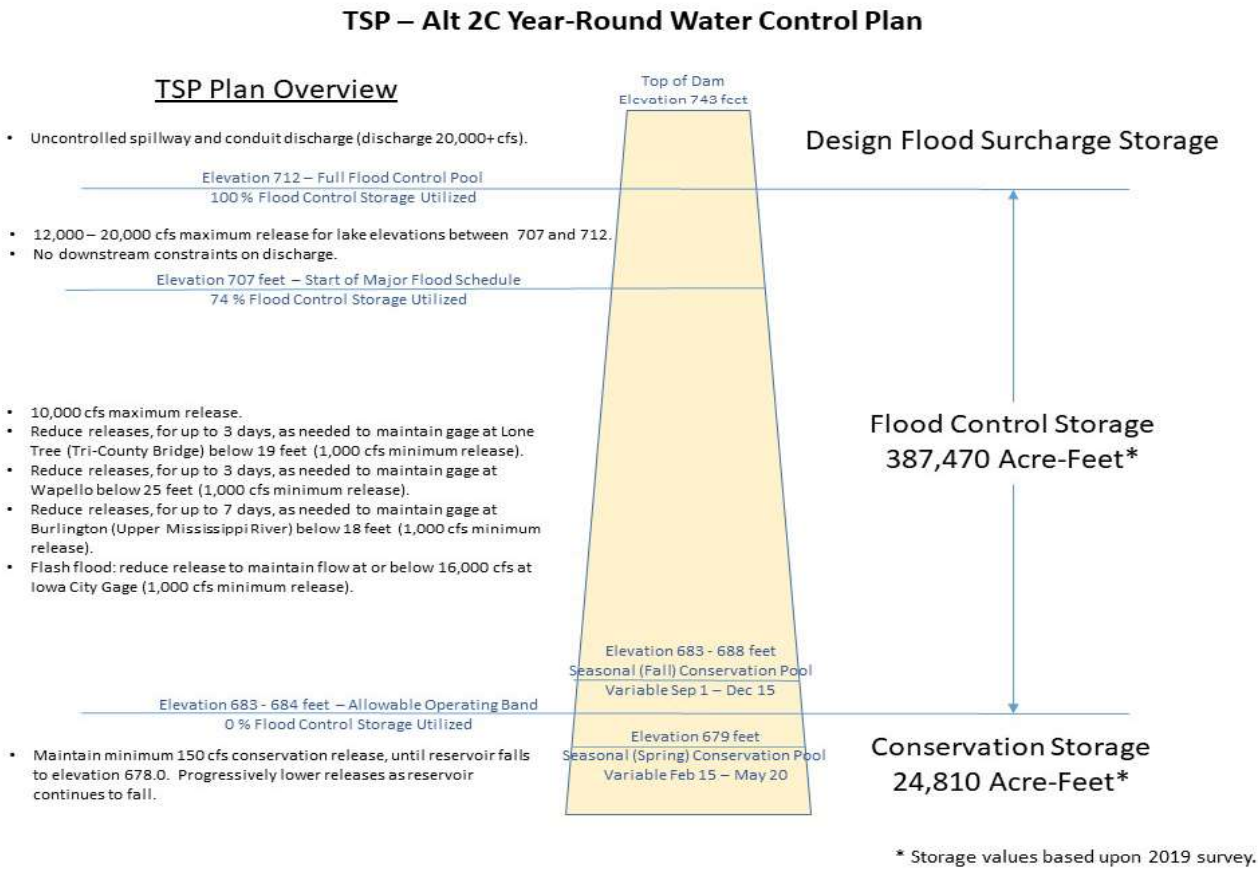

Figure 25. Tentatively Selected Plan – Alternative 2C

E. PARTNER COORDINATION

Public Involvement. The District held four open house-style public meetings between February and April 2019, and two virtual public meetings between February and March 2021 (Table 30). The District conducted the meetings to obtain public input at the beginning phase, as well as at the Tentatively Selected Plan (TSP) milestone, of the feasibility study to ensure agency perspectives aligned to the extent allowable under law and policy with public needs. District representatives including reservoir staff, were available to answer questions from the public or other agency representatives. The meetings consisted of an approximately 30-minute meeting followed by an open question and answer session.

Table 30. Public Meeting Locations

Date	Location	Time
February 27, 2019	Iowa City	6:00 pm –8:00 pm
February 26, 2019	Wapello, Iowa	6:00 pm –8:00 pm
April 2, 2019	Marengo, Iowa	6:00 pm –8:00 pm
April 15, 2019	Amana, Iowa	6:00 pm –8:00 pm
February 25, 2021	Virtual	5:00 pm –7:00 pm
March 4, 2021	Virtual	5:00 pm –7:00 pm

The following is a brief synopsis of the public's input.

Public Meetings

Participants at each public meeting were given the same questionnaire to complete. The questionnaire was developed by the planning team and proved to be helpful in the planning process. The planning team received several questionnaire responses from participants which were then sorted by the following goals:

- Goal 1 - Comments to reduce future flood risk
- Goal 2 - Comments to improve low flow augmentation reliability
- Goal 3 - Comments to improve fish and wildlife sustainability
- Goal 4 - Comments to promote enhancement of recreational features
- Goal 5 – Comments to accommodate other interests

The majority of comments were from individuals providing input to the flood stages where they experienced significant flooding and the impacts it had to their property. Many participants also provided their recommendation on reservoir pool levels and releases.

Further information and details of the public meetings in Wapello, Marengo, Iowa City and Amana can be found in Appendix D.

Agency Coordination. The USFWS, the Iowa DNR, The Nature Conservancy (TNC), and other natural resources managers were invited to participate and were involved throughout the Study's duration. The plan fulfills a number of missions and objectives common to these organizations. The organizations provided input throughout the Study and were involved in plan formulation, and data collection (Appendix D). The District integrated their comments into this planning document. The Iowa SHPO, federally-recognized tribes, and other interested parties have been invited to comment on the District's No Adverse Effects finding for this Study.

Additionally, a project under the Sustainable Rivers Program has been approved for the Iowa-Cedar Rivers Basin. The District anticipates the relationships built and feedback given by the natural resources

management partners during the course of this Study will assist to guide the goals and implementation of the Iowa River SRP. The District tried to anticipate many of the environmental benefits and worked to incorporate the SRP goals into the modeling and plan formulation of this Water Control Feasibility Report with Integrated Environmental Assessment. However, the partners involved with the SRP could identify other environmental features that were not considered or may need to be revisited during the process of developing the SRP.

The District held a follow up meeting with U.S. Fish and Wildlife Service, Port Louisa National Wildlife Refuge and Iowa DNR, Odessa Wildlife Unit staff on February 26, 2021 after the respective agencies raised concern regarding their involvement in stakeholder engagement. Both agencies expressed concern their comments submitted during 2019 scoping were not included in the report. However, these comments could be found in Table D-1 of Appendix D during the public review. Following this meeting, additional correspondence occurred between agencies, resulting in formal comment submitted during the public review period. Formal comments, a summary of the correspondence, and the District's responses can be found in Appendix D.

Stakeholder Input. The District engaged with public agency partners and stakeholders from county and local emergency management, public works, and engineering offices throughout the Iowa River watershed. Input received from these stakeholders helped in identification of critical thresholds and impacts. Several meetings were held, and communication continued throughout the Study period, including during the three temporary deviation periods within 2018-2020. The stakeholders provided feedback regarding impacts of potential changes to the WCPs for Coralville Lake. Below is a summary of the stakeholder input that was received.

Input for Coralville Lake Reservoir Operations:

1. Increase the downstream constraints at Lone Tree and Wapello to conserve reservoir storage and lessen the risk of substantially higher releases.

2. Increase the growing season maximum release from 6,000 cfs to as much as 10,000 cfs to conserve reservoir storage and lessen the risk of substantially higher releases and spillway flows.

3. Investigate beginning LMF operations at a lower lake elevation with more aggressive increases in releases to lessen the risk of substantially higher releases and spillway flows.

Public Review. The District circulated this feasibility report to a wide distribution list (Appendix E) to solicit public input as part of the decision-making process. The District also posted the report on the District's website's Public Notice link (http://www.mvr.usace.army.mil/About/Offices/Programs-and-Project-Management/Civil-Works-Public-Notices/). During the public review, the District held virtual public meetings to solicit input on this report and the TSP. The District integrated all comments received into its decision-making process. Appendix D table d-2 contains all comments received and a table with the District's responses.

F. ENVIRONMENTAL COMPLIANCE

The District prepared this integrated report to satisfy the requirements of all applicable environmental laws and regulations. The District's efforts comply with the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Part 1500–1508) and the District's implementing NEPA regulation ER 200-2-2, *Environmental Quality: Policy and Procedures for Implementing NEPA*, 33 CFR 230. In implementing the Recommended Plan, the District would follow provisions of all applicable laws, regulations, and policies related to the proposed actions. The following sections present brief summaries of Federal environmental laws, regulations, and coordination requirements applicable to this Study.

Clean Water Act. The CWA was enacted to restore and maintain the integrity of the nation's waters. There are two fundamental goals: to eliminate the discharge of pollutants into the nation's waters, and to achieve water quality levels that are fishable and swimmable. Two sections of the Act are discussed below.

Section 404(b)1. The Corps, under the direction of Congress, regulates the discharge of dredged and fill materials into all waters of the United States, including wetlands. Although the Corps does not issue itself permits for construction activities affecting waters of the U.S., it must meet the legal requirement of the Act. Since the action alternatives do not require any fill activities, the District did not complete a CWA, Section a 404(b)(1) analysis.

Section 402. Since there are no construction activities associated with the Recommended Plan, a National Pollutant Discharge Elimination System requirement of the CWA Section 402(p) is not required.

Clean Air Act of 1970. Federal agencies are required by this Act to review all air emissions resulting from federally-funded projects or permits to ensure conformity with the State Implemented Plans in non-attainment areas. The project's affected area (the lake and Iowa River to the confluence with the Mississippi River) is not in air nonattainment zone meaning there are no air restrictions for the operation of the Coralville Dam. The Recommended Plan would be in accordance with the Clean Air Act.

Endangered Species Act (ESA). The Recommended Plan would have "no effect" on any federally-listed endangered or threatened species. "No effect" means the proposed project would not affect, directly or indirectly any ESA-listed species or critical habitat. Generally, this means no ESA-listed species or critical habitat would be exposed to any potentially harmful/beneficial elements of the action. Additional documentation is not required under this Act for consultation with the USFWS. The "no effect" determination fulfilled the District's ESA, Section 7(a)2 consultation requirements.

Executive Order 13112, Invasive Species. The EO 13112 recognizes the significant contribution native species make to the well-being of the nation's natural environment and directs Federal agencies to take preventative and responsive action to the threat of the invasion of non-native plants and wildlife species in the United States. This EO establishes processes to deal with invasive species and, among other items, establishes that Federal agencies "will not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

The Recommended Plan would be in compliance with EO 13112 since the action alternatives are within the existing Coralville Lake operation.

Executive Order 11988, Floodplain Management. EO 11988 was enacted May 24, 1977, in furtherance of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), the National Flood Insurance Act of 1968, as amended (42 U.S.C. 4001 et seq.), and the Flood Disaster Protection Act of 1973 (Public Law 93-234, 87 Star.975). The purpose of the EO was to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.
The order states each agency shall provide and shall take action to reduce the risk of the flood loss to minimize the impacts of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing federally-undertaken, financed, or

assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

The FEMA digital flood insurance rate maps of the Study area were analyzed to establish the locations of the 100-year and 500-year flood zones. All alternatives were designed to ensure that the proposed alternatives would not result in a decrease in the floodplain capacity and an increase in flood risk to the Study area.

The Recommended Plan would be implemented within the 500-year floodplain, but there would be no direct or indirect impact to the floodplain or related to floodplain development. It was not necessary to apply the eight-step process required by the Water Resources Council, Floodplain Management Guidelines for Implementing EO 11988, and February 10, 1978.

Migratory Bird Treaty Act, Migratory Bird Conservation Act, and Executive Order 13186, Migratory Birds. The importance of migratory non-game birds to the nation is embodied in numerous laws, executive orders, and partnerships. The Fish and Wildlife Conservation Act of the Army for Civil Works demonstrates the Federal commitment to conservation of non-game species. Amendments to the Act adopted in 1988 and 1989 direct the Secretary to undertake activities to research and conserve migratory non-game birds. EO 13186 directs Federal agencies to promote the conservation of migratory bird populations, including restoring and enhancing habitat. Migratory Non-Game Birds of Management Concern is a list maintained by the USFWS. The list helps fulfill the primary goal of the USFWS to conserve avian diversity in North America. The USFWS Migratory Bird Plan is a draft strategic plan to strengthen and guide the agency's Migratory Bird Program. The proposed natural resource management capabilities within the Recommended Plan would contribute directly to the USFWS Migratory Bird Program goals to protect, conserve, and restore migratory bird habitats to ensure long-term sustainability of all migratory bird populations. The Recommended Plan's increased natural resource management capabilities would promote bird nesting and migratory habitat.

Bald and Golden Eagle Protection Act. The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. If the District implements the Recommended Plan, there would be no negative impacts to eagles. There is no construction required and the Recommended Plan would not promote additional development that might impact eagles. In fact, the Recommended Plan increased natural resource management capabilities would maintain eagle nesting and feeding opportunities at Coralville.

Executive Order 12898, Environmental Justice. EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* dated February 11, 1994, requires all Federal agencies to identify and address disproportionately high and adverse effects of its programs, policies, and activities on minority and low-income populations. Data was compiled to assess the potential impacts to minority and low-income populations within the Study area.

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Even though minority communities exist in portions of the project area, implementation of any of the action alternatives would not have a disproportionately high or adverse effect on these populations. The Recommended Plan would be consistent with EO 12898.

Executive Order 13045, Protection of Children. EO 13045 *Protection of Children from Environmental Health Risk*s, dated April 21, 1997, requires Federal agencies to identify and address the potential to

generate disproportionately high environmental health and safety risks to children. This EO was prompted by the recognition that children, still undergoing physiological growth and development, are more sensitive to adverse environmental health and safety risks than adults.

The Project, or in this case the Recommended Plan would cause no short-term impacts on the protection of children. Since no construction or project altering activities would take place, there is no risk to children or their neighborhoods. Further, green space and public parks where children thrive, would not be diminished or lost if the proposed project is implemented.

Farmland Protection Policy Act of 1981. The Recommended Plan would not affect downstream farmland since the action alternatives do not significantly alter downstream flows.

Rivers and Harbors Act

Section 10 (30 Stat. 1151; 33 U.S.C 403, 1899). The Recommended Plan would not place any permanent obstruction across navigable water nor would it place obstructions to navigation outside established Federal lines.

Section 122 (PL 91-6110, 1970) 17 Points. This Act ensures the District will consider all possible adverse economic, social and environmental effects relating to any proposed project have been fully considered in developing such project. The final decisions on the Project are made in the best overall public interest taking into consideration the need for FRM, navigation, and associated purposes, and the cost of eliminating or minimizing such adverse effects. The Act referred to the specific resources all projects need to consider during the planning process. Table 31 outlines each of these resources and the Project's possible impacts. These resources are commonly called the 17 Points.

Table 31. Rivers and Harbors Act – 17 Points[1]

Resource	**Possible Project or** Recommended Plan **Effects**[1]
Air	No Impacts
Noise	No Impacts
Water Pollution	No Impacts
Man-made Resources	No Impacts
Natural Resources	Positive Impacts
Aesthetic Values	No Impacts
Community Cohesion	No Impacts
Availability of Public Facilities and Services	No Impacts
Availability of Public Services	No Impacts
Employment	No Impacts
Tax Income Value Losses	No Impacts
Property Value Losses	No Impacts
Displacement of People	No Impacts
Business and Industrial Growth	No Impacts
Farms	No Impacts
Community Growth	No Impacts
Regional Growth	No Impacts

[1] All 17 points – Reason for Possible Project Effects: No construction activity or change in long-term O&M.

Engineer Regulation 1105-2-100. In addition to the resources listed in Table 32, ER 1105-2-100, *Planning Guidance Notebook* 1983, identifies other resources to consider for the project planning in Table 25.

Table 32. Engineering Regulation 1105-2-100 Resources

Resource	**Possible Project or** Recommended Plan **Effects**	Reasons
Life	Positive Effect	Added FRM
Health	Positive Effect	Added FRM
Safety	Positive Effect	Added FRM
Long Term Productivity	Positive Effect	Added Natural Resource Benefit
Energy Requirements	No Effect	
Energy Conservation	No Effect	

Executive Order 11990 Protection of Wetlands. This EO states each Federal agency shall avoid undertaking new construction located in wetlands unless there is no practicable alternative to such construction, and the proposed action includes all practicable measures to minimize harm to wetlands. This WCP update would not initiate or alter water management to change any existing wetland impacts. The Recommended Plan is in full compliance with the EO.

Wild and Scenic Rivers Act of 1968, as amended. The Iowa River is not listed in the National Rivers Inventory (NRI). The Cedar River, a tributary of the Iowa River, from Highway 6 to the confluence with the Iowa River is listed in the NRI as outstandingly remarkable for its cultural, fish, and wildlife resources. The NRI is used to identify rivers that may be designated by Congress to be Component Rivers in the National Wild and Scenic Rivers System. However, neither the Iowa River, nor its tributaries, are designated as Wild and Scenic Rivers.

Federal Water Project Recreational Act of 1966. The Act states, "it is the policy of Congress and the intent of this Act that in investigating and planning any Federal navigation, flood control, reclamation, hydroelectric, or multipurpose water resource project that consideration shall be given to the opportunities, if any, which the Project affords for outdoor and for fish and wildlife enhancement ..."

The District considered recreation impacts in project planning but concluded the Recommended Plan would not significantly alter recreation opportunities.

National Historic Preservation Act of 1966. Federal agencies are required under Section 106 of the NHPA of 1966, as amended, to *"take into account the effects of their undertakings on historic properties"* and consider alternatives *"to avoid, minimize or mitigate the undertaking's adverse effects on historic properties" [*(36 CFR 800.1(a-c)] in consultation with the SHPO officer and appropriate federally-recognized Indian Tribes (Tribal Historic Preservation Officers - THPO) [(36 CFR 800.2(c)].

Other applicable cultural resources laws, rules, and regulations will inform how investigations and evaluations will proceed throughout the Study and implementation phases (e.g., Archeological and Historic Preservation Act of 1974, National Environmental Policy Act of 1969, Native American Graves Protection and Repatriation Act, Engineer Regulation 1105-2-100).

The District initiated consultation with the SHPO, Tribes, and interested parties and proposed a finding of *No Adverse Effects* in a letter dated July 9, 2020. SHPO concurred with this determination by stamped approval dated August 5, 2020 (R&C# 200700037). The Crow Creek Sioux THPO concurred with the determination by e-mail dated July 14, 2020. The Ho-Chunk Nation THPO concurred with the

determination by e-mail dated July 29, 2020. They further requested to remain as a consulting party for the undertaking and in the event of unanticipated discovery. The District received no other NHPA-related responses.

Archaeological and Historic Preservation Act. The Archaeological and Historic Preservation Act of 1974 amends the 1960 Reservoir Salvage Act by providing for the preservation of significant scientific, prehistoric, historic and archaeological materials and data that might be lost or destroyed as a result of flooding, the construction of access roads, relocation of railroads and highways, or any other federally-funded activity associated with the construction of a dam or reservoir. The Recommended Plan would not create any new dams, raise water levels beyond the existing conditions, or increase flooding. No impact to any project significant scientific, prehistoric, historic, and archaeological materials and data is anticipated.

Fish and Wildlife Coordination Act. The FWCA requires Federal agencies that are impounding, diverting, channelizing, controlling, or modifying the waters of any stream or other water body to consult with the USFWS and appropriate state fish and game agency to ensure wildlife conservation receives equal consideration in the development of such projects. The USFWS and the Iowa DNR have been involved in the planning process of this Study since the initial stages participating in the planning process, data collection efforts, providing input and comment throughout the process. For past water regulation manual updates, the District and USFWS agreed a FWCA Coordination Act Report is not required for this type of project. Therefore, the Recommended Plan is in full compliance with the FWCA.

Advisory Circular 150/5200-33B – Hazardous Wildlife Attractants on Near Airports. The advisory circular provides guidance on locating certain land uses having the potential to attract hazardous wildlife to or in the vicinity of public-use airports. The circular provides guidance on wetlands in and around airports and establishes notification procedures if reasonably foreseeable projects either attract or may attract wildlife.

In response to the advisory circular, the U.S. Army as well as other Federal agencies, signed a Memorandum of Agreement (MOA) with the Federal Aviation Administration (FAA) to address aircraft-wildlife strikes. The MOA establishes procedures necessary to coordinate their missions to more effectively address existing and future environmental conditions contributing to aircraft-wildlife strikes throughout the U.S.

Because the Recommended Plan would not be actively managing wetland habitat in the airports' runway zones, the District determined there would be no adverse impacts or increased likelihood of bird/airplane accidents.

G. RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

There would be no short-term use issues with the Recommended Plan. The District anticipates long-term FRM benefits as well as long-term productivity for natural resource management. Long-term productivity would be enhanced through improved natural resource inspired lake and river levels during non-flood periods.

H. RELATIONSHIP TO LAND USE PLANS

The current land use plans at each reservoir would not change because the Coralville Lake is compatible with all existing land use plans within the Study area. The land use remains the same because the Recommended Plan would not add or remove any mission elements.

The Coralville Lake Master Plan is currently under revision. This Study is compatible with the existing Coralville Lake Master Plan (1977), as well as the proposed revision.

A Real Estate review of easements and other lands within the Study area determined that existing easements are sufficient to meet the needs of the Recommended Plan and that no additional real estate interests are needed.

I. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The Recommended Plan would not entail significant irretrievable or irreversible commitments of resources. Long-term sustainability actions were included for the benefit of environmental resources.

J. INDIRECT EFFECTS

Indirect effects, as defined by the CEQ regulations, are "caused by the proposed action and occur later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystem" (40 CFR 1508.8). Indirect effects differ from direct impacts associated with the construction and operation of the proposed project and are caused by an action or actions having an established relationship or connection to the proposed project. Indirect effects can be linked to direct effects in a causal chain, which can be extended as indirect effects producing further consequences.

As previously discussed, implementation of the proposed action would directly result in a net beneficial impact to FRM and natural resources along the Iowa River. In addition, the Recommended Plans ecosystem measures may result in benefits extending farther outside the Study area for several notable environmental resources such as migrating birds.

K. REASONABLY FORESEEABLE EFFECTS

The July 16, 2020, revised CEQ regulations define a reasonably foreseeable effect as environmental trends and planned actions in the affected area. To the extent environmental trends or planned actions in the area(s) are reasonably foreseeable, they should be included in the discussion of the affected environment. Reasonably foreseeable effects should have a reasonably close causal relationship to the proposed action.

Reasonably foreseeable effects associated with this Project may include the operation of project facilities, upgrades, and maintenance of recreation sites, as well as residential, commercial, and industrial development throughout the region. Continued project operations would result in the sustained maintenance and development of recreational facilities. These facilities would enhance the recreational offerings made by the District and other management partners. Such improvements would result in varying levels of impacts to the surrounding resources. Similarly, surrounding residential, commercial, and industrial development could result in varying levels of adverse impacts to many resources. Within the Project boundary, adverse impacts would be offset through resource stewardship efforts.

The Preferred Alternative would provide updated FRM and improved natural resource management capabilities to the region. An SRP has been approved for the Iowa River and would be undertaken in the coming years. This SRP will build upon this project and further assist in implementing natural resources management goals for the future. Other actions in the region would be climate change, improved

infrastructure, regional growth, and urbanization; these actions are speculative. The District's FRM mission will be challenging, but flexible to accommodate system wide changes in the future.

The programmatic approach to project management, would allow for future development plans and mitigation responses to be adapted to address any adverse actions. This would allow the District and other management partners at Coralville Lake to continue to reduce the contribution of its activities to regional cumulative impacts through proactive actions and adaptive resource management strategies.

L. ADAPTIVE MANAGEMENT AND MONITORING PLAN

A fully vetted monitoring and adaptive management is not required for this WCP update. If the FRM efforts need modification, there is a formalized procedure to request a deviation from the Corps' Mississippi Valley Division for the approved plan.

For the natural resource management aspect of operating within the conservation band, the District would continue its existing practice of meeting with its resource partners on an annual basis. During this meeting the District and agencies discuss the current year's desired outcomes based on the ability to manage with a drier or wetter than normal conditions. They also discuss the next year's management goals. If conditions are right, the District would operate the dams to the best of their ability to meet these goals. This report offers management scenarios fitting with the proposed conservation operating band. The District would also implement other operating scenarios within the conservation band not in the plan if there were a potential for natural resource benefit.

M. RISK AND UNCERTAINTY

Uncertainty gives rise to risk. Risk is a measure of the probability and consequence of uncertain future events. It is the chance of an undesirable outcome. Uncertainty often results from a lack of knowledge about critical elements or processes contributing to risk or natural variability in the same elements or processes. Planning, risk and uncertainty were identified throughout the Study. Risk informed decisions were made regarding the reliability of estimated benefits and the costs of alternative plans.

Measures were developed to manage risk, expanding on and referencing successful similar work completed by previous water regulation manual updates nationwide. Experience from previous projects helped in the identification of possible risks and decrease uncertainty in plan formulation. No measure or alternative in the Recommended Plan is burdened by significant risk or uncertainty regarding its eventual success. Significant risks were avoided by using proper design, appropriate selection, and correct seasonal timing of applications. Risks were also managed through extensive coordination with other agencies and District experts.

During 2018, 2019, and 2020 deviations from the existing Coralville Reservoir WCP created an opportunity to test the acceptability and effectiveness of various aspects of some of the alternative plans considered in this Study. These deviations helped the District formulate alternatives as well as strengthen the hydraulic modelling in the evaluation of alternatives. Future climate and precipitation amounts are the principal sources of uncertainty.

N. DAM SAFETY CONSIDERATIONS

The Rock Island District reviewed the Potential Failure Modes Analyses (PFMA) Coralville Lake to determine any potential change, associated with Alternative 2C, to conditions impacting the significant failure modes and risk drivers identified in the 2014 Risk Assessment Report.

For Coralville Dam, there was one risk driver identified: a spillway event leading to loss of spillway slabs and training wall causing erosion of the embankment. For the Amana Remedial Works, there were three risk drivers identified: overtopping erosion, backward erosion piping (BEP) into the CMP at the pump station, and BEP under the flood wall. The Recommended Plan would result in lower reservoir levels than would otherwise occur under the existing plan and would therefore reduce the risk of reaching loading conditions that correspond to the identified potential failure modes.

O. CONCLUSIONS

The Recommended Plan selected for the Coralville Lake Water Control Plan Feasibility Study is Alternative 2C.
Alternative 2C provides the greatest maximum allowable release offering the greatest flexibility to meet potential upward trends in future precipitation and streamflow. Alternative 2 C is also the Recommended Plan based on the economic analysis and resulting damage summary highlighted in Tables 28 & 29 above.

Throughout the planning process, the District engaged stakeholders across the study area and incorporated concerns and feedback provided. Although certain communities and stakeholders had initial concerns, the District addressed these through a series of public meetings and presentations. The District does not anticipate that the Recommended Plan will be controversial in nature as local emergency managers, the Iowa Department of Natural Resources, city and county governments, and Non-governmental Organizations have been active Study partners through the National Environmental Policy Act process. The Recommended Plan also requires no construction, operational, or implementation costs.

Finally, the selected Recommended Plan, Alternative 2 C is designed to meet the goals to strengthen the FRM measures on Coralville Lake by reducing risks to life, health, and safety of residents due to flood events along the Iowa River. Additionally, a reduction in future flood risk to critical infrastructure, commercial, residential, and agricultural areas along the Iowa River is anticipated.

The Recommended Plan has positive impacts on the hydrology/hydraulics of the system by conserving reservoir storage through earlier releases of water during small-scale flood events, thereby reducing flood risk during long duration, large magnitude flood events resulting from multiple storms.

The Recommended Plan would incorporate environmental sustainability by regulating the Coralville Reservoir pool in conservation bands when flooding is not a concern, creating a more naturally functioning wetland, lake, and river ecosystem. Furthermore, the Recommended Plan would create aquatic and riparian habitat conditions required by numerous fish and wildlife species living in or migrating through the system. Implementation would not impact flood risk or floodplain development and would not cause negative environmental impacts.

The Recommended Plan has positive impacts on recreational areas as they are projected to be inundated less frequently, potentially reducing operational costs. Further, the Recommended Plan is consistent with and fully supports the authorized purposes of Coralville Lake and will be used to update the Coralville Lake Water Control Plan

CHAPTER VII. LITERATURE CITED

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FINDING OF NO SIGNIFICANT IMPACT

CORALVILLE LAKE WATER CONTROL UPDATE
WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

IOWA RIVER, CORALVILLE LAKE

The U.S. Army Corps of Engineers, Rock Island District (Corps) conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The final Integrated Feasibility Report and Environmental Assessment (IFR/EA) dated 19 March 2021, for the Coralville Lake Water Control Feasibility Study addresses proposed modification to the Water Control Plan to better manage Coralville Lake, and maximize its authorized purposes, based on the current hydrologic conditions in the Iowa-Cedar Rivers Basin, Johnson, Washington, Louisa, and Des Moines Counties, Iowa.

The Final IFR/EA, incorporated herein by reference, evaluated various alternatives that would reduce flood risk) in the Study area. The Recommended Plan is the National Economic Development (NED) Plan and includes:

Alternative 1. No Action. Under this alternative, the District would continue to operate Coralville Lake under the current WCP. This alternative maintains the current WCP and facilitates no changes towards the current Iowa-Cedar Rivers Basin Master Reservoir Regulation Manual for Coralville Lake.

Alternative 2C. The District's Preferred Alternative: Under this alternative, this District would eliminate the growing season release reduction, holding a maximum of 10,000 cfs all year during Normal Flood Operations. This alternative eliminates seasonal downstream constraints in lieu of year-round constraints at Lone Tree and Wapello and uniform minimum releases. When forecasts indicate constraint stages will exceed 19 feet at Lone Tree and/or 25 feet at Wapello, releases would be reduced to not less than 1,000 cfs during the peak 3-days of the crest with due allowance for travel time. This alternative would also modify the Large Magnitude Flood Operations (LMF) release schedule compared to the existing plan and eliminate "Induced Surcharge Operation". However, this alternative would not change downstream constraints from the existing plan for Iowa City or Burlington. Figure 1 outlines the details of this alternative addressing normal flood management operations, large magnitude flood operations, drought, and conservation pool management.

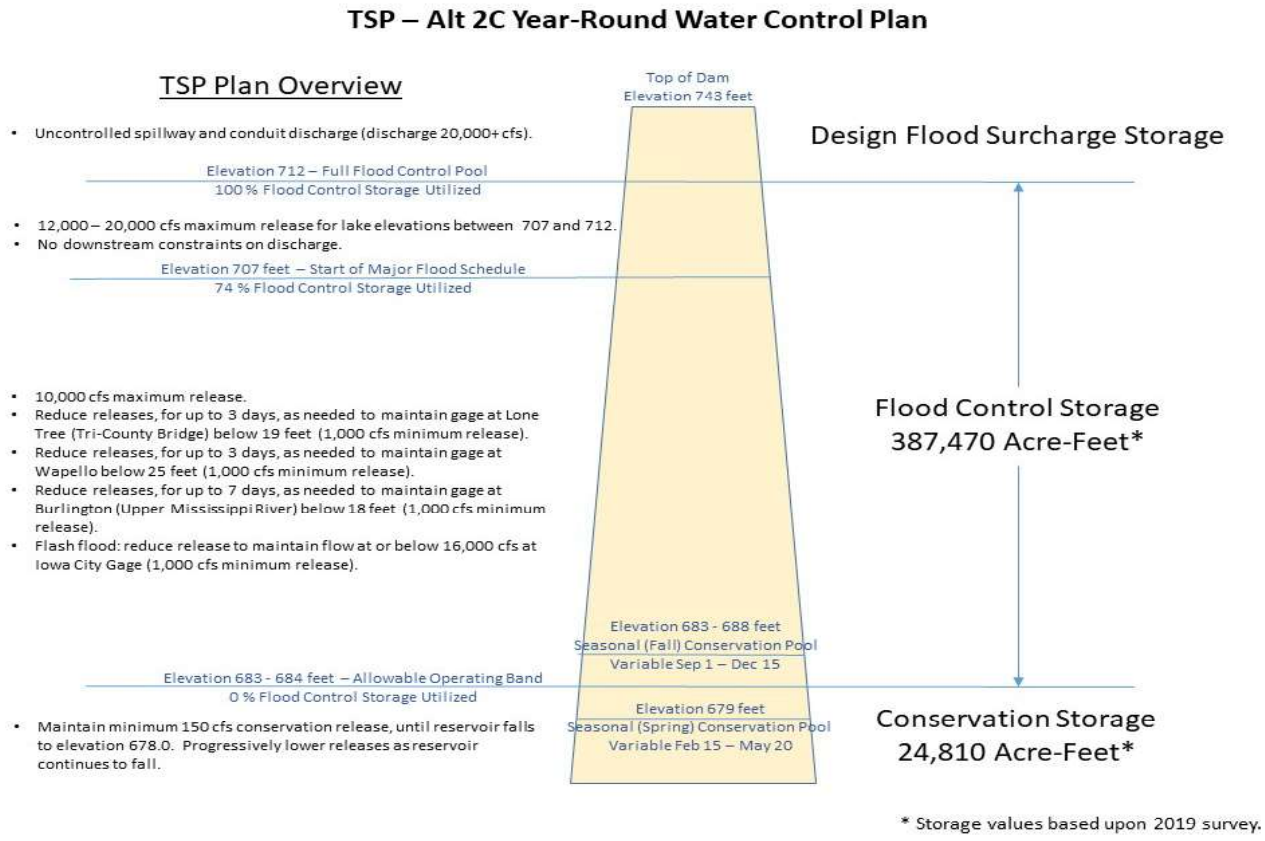

Figure 1. Tentatively Selected Plan – Preferred Alternative 2C

Alternative 5: Under this alternative, the District would tier seasonal downstream constraints at Lone Tree and Wapello with variable minimum releases. When forecast indicate any of these constraints will be exceeded, releases would be reduced to control discharges as near as possible to the constraint stages during the peak 3-days of the crest with due allowance for travel time. As such, during the growing season, a minimum allowable release of 6,000 cfs would occur when the stages at Lone Tree and/or Wapello are forecast to exceed 16 feet and 22 feet, respectively. Likewise, a minimum allowable release of 1,000 cfs would occur when forecasts indicate stages at Lone Tree and/or Wapello exceed 19 feet and 25 feet, respectively. During the non-growing season, a minimum allowable release of 1,000 cfs would occur when the stages at Lone Tree and Wapello are forecast to exceed 19 feet and 25 feet, respectively. Growing season maximum release would be 8,000 cfs (May 1 - Dec 15), while non-growing season maximum release would be 10,000 cfs (Dec 16 - Apr 30). This alternative would not change the current plan's downstream constraints at Iowa City or Burlington. This alternative would alter the dates for seasonal downstream constraint changes to April 15–December 15. This alternative would also modify the Large Magnitude Flood Operations (LMF) release schedule compared to the existing plan and eliminate "Induced Surcharge Operation".

Alternative 8: Under Alternative 8, the District would determine maximum growing season releases by reservoir pool elevation. When Coralville Lake is below elevation 700, the maximum growing season release would be 8,500 cfs. When Coralville Lake is above elevation 700, the maximum growing season release would be 10,000 cfs. This alternative would include a maximum non-growing season release of 10,000 cfs. A minimum allowable release of 1,000 cfs would occur when the stages at Lone Tree and/or Wapello are forecast to exceed 18.5 feet or 25 feet respectively during the peak 3-days of the crest with due allowance for travel time.

SUMMARY OF POTENTIAL EFFECTS:

For all alternatives, the potential effects were evaluated, as appropriate. Table 1 summarizes the potential effects of the Preferred Alternative.

The Preferred Alternative does not require compensatory mitigation.

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the Recommended Plan.

Public review of the draft IFR/EA and FONSI was completed on 19 March 2021. All comments submitted during the public review period were responded to in the Final IFR/EA and FONSI

Table 1: Summary of Potential Effects of the Tentatively Selected Plan

	Insignificant Effects	Insignificant Effects as a Result of Mitigation*	Resource Unaffected by Action
Aesthetics	☐	☐	☒
Air Quality	☐	☐	☒
Aquatic Resources/Wetlands	☒	☐	☐
Invasive Species	☐	☐	☒
Fish and Wildlife Habitat	☒	☐	☐
Threatened/Endangered Species/Critical Habitat	☐	☐	☒
Historic Properties	☐	☐	☒
Other Cultural Resources	☐	☐	☒
Floodplains	☐	☐	☒
Hazardous, Toxic & Radioactive Waste	☐	☐	☒
Hydrology	☒	☐	☐
Land Use	☒	☐	☐
Navigation	☐	☐	☒
Noise Levels	☐	☐	☒
Public Infrastructure	☒	☐	☐
Socio-Economics	☒	☐	☐
Environmental Justice	☒	☐	☐
Soils	☒	☐	☐
Tribal Trust Resources	☐	☐	☒
Water Quality	☒	☐	☐
Climate Change	☐	☐	☒

OTHER ENVIRONMENTAL AND CULTURAL COMPLIANCE REQUIREMENTS:

A. ENDANGERED SPECIES ACT. Pursuant to section 7 of the Endangered Species Act of 1973, as amended, the U.S. Army Corps of Engineers determined the Recommended Plan would have no effect on federally-listed species or their designated critical habitat. The U.S. Army Corps of Engineers coordinated this determination with the U.S. Fish and Wildlife Service during the public and agency review.

B. NATIONAL HISTORIC PRESERVATION ACT.

HISTORIC PROPERTIES NOT ADVERSELY AFFECTED:

Pursuant to section 106 of the National Historic Preservation Act of 1966, as amended, the U.S. Army Corps of Engineers determined that historic properties would not be adversely affected by the Recommended Plan. The District initiated consultation with the SHPO, Tribes, and interested parties and proposed a finding of *No Adverse Effects* in a letter dated July 9, 2020. SHPO concurred with this determination by stamped approval dated August 5, 2020 (R&C# 200700037). The Crow Creek Sioux THPO concurred with the determination by e-mail dated July 14, 2020. The Ho-Chunk Nation THPO concurred with the determination by e-mail dated July 29, 2020. They further requested to remain as a consulting party for the undertaking and in the event of unanticipated discovery. The District received no other NHPA-related responses.

C. CLEAN WATER ACT SECTION 404(B)(1) COMPLIANCE. Pursuant to the Clean Water Act of 1972, as amended, this project does not require section 404(b)(1) analysis.

D. CLEAN WATER ACT SECTION 401 COMPLIANCE. Since the District proposes no construction or discharge into the Waters of the United States, a Clean Water Act, Section 401 Water Quality Certification is not required.

OTHER SIGNIFICANT ENVIRONMENTAL COMPLIANCE

FINDING

Technical, environmental, and economic criteria used in the formulation of alternative plans were those specified in the Water Resources Council's 1983 *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies.* All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives.

The District determined the Preferred Alternative meets the objectives of providing sound flood risk management and natural resources management at Coralville Lake, Johnson County, Iowa. The other alternatives do not meet the District's objectives or do not reduce flood damages to extent of the Preferred Alternative.

I have reviewed the information provided in the accompanying IFR/EA, along with data obtained from cooperating Federal, state, and local agencies, and from the interested public. Based on this review, I find the proposed Project would not significantly affect the quality of the human environment. Therefore, it is my determination an Environmental Impact Statement is not required. The District would re-evaluate this determination if warranted by later developments.

9 March 2022
Date

Jesse T. Curry
Colonel, US Army
Commander & District Engineer