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WFI-B UMBRELLA MITIGATION BANKING INSTRUMENT
VARIOUS COUNTIES, MISSOURI

April 26, 2023

Prepared for:

WFI Holdings-B LLC
C/O Mr. Linden Graber
248 Southwoods Center
Columbia, Illinois 62236

SCI No. 2022-0867.30

SCI ENGINEERING, INC.
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CONSTRUCTION SERVICES

April 26, 2023

Linden Graber
WFI Holdings-B, LLC.
248 Southwoods Center
Columbia, Illinois 62236

RE: Final WFI-B Umbrella Mitigation Banking Instrument
Various Counties, Missouri
SCI No. 2022-0867.30

Dear Linden Graber:

SCI Engineering, Inc. (SCI) is pleased to submit the attached Revised *WFI-B Umbrella Mitigation Banking Instrument – Various Counties, Missouri*, dated April 26, 2023. The WFI-B Umbrella Mitigation Banking Instrument (UMBI) has been prepared for various watersheds/service areas within the St. Louis District of the U.S. Army Corps of Engineers (USACE) in eastern and central Missouri. SCI understands that WFI-B is proposing to develop an UMBI in accordance with 33 CFR 332, Compensatory Mitigation for Losses of Aquatic Resources ("2008 Mitigation Rule").

We appreciate the opportunity to provide you with our natural resource services. If you have any questions or comments, please do not hesitate to contact us.

Respectfully,

SCI ENGINEERING, INC.

Laura A. Vrabel, PWS
Project Scientist

Bryan M. Carlo.
Senior Archaeologist

Scott E. Billings, PWS
Senior Project Scientist

LAV/BMC/SEB/rah

Enclosure
WFI-B Umbrella Mitigation Banking Instrument

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ACRONYMS

BS – Bank Site
BSP – Bank Site Plan
CFS – Cubic Feet per Second
CPCS – Central Plains-Cuivre/Salt
DA – Department of the Army
EDU – Ecological Drainage Unit
FEMA – Federal Emergency Management Agency
HUC – Hydrologic unit code
IPaC – Information Planning and Consultation
IRT – Interagency Review Team
LIDAR – Light Detection and Ranging
MDC – Missouri Department of Conservation
MDNR – Missouri Department of Natural Resources
MSMM – Missouri Stream Mitigation Method
MWMM – Missouri Wetland Mitigation Method
MoIP – Missouri Invasive Plant Council
OAJ – Ozark-Apple/Joachim
OM – Ozark-Meramec
OML – Ozark-Moreau/Loutre
OUSFC – Ozark-Upper St. Francis/Castor
PEM – palustrine emergent
PFO – palustrine forested
PSS – palustrine scrub-shrub
RIAM – Rapid Impact Assessment Method
TMDL – Total Maximum Daily Load
UMBI – Umbrella Mitigation Banking Instrument
USACE – U.S. Army Corps of Engineers
USDA – U.S. Department of Agriculture
USGS – U.S. Geological Survey
USEPA – U.S. Environmental Protection Agency
USFWS – U.S. Fish & Wildlife Service
WFI-B – WFI Holdings-B LLC
WOTUS – waters of the United States
WQC – Water Quality Certification

WFI-B UMBRELLA MITIGATION BANKING INSTRUMENT
VARIOUS COUNTIES, MISSOURI

1.0 INTRODUCTION

On behalf of WFI Holdings-B LLC (WFI-B), SCI Engineering, Inc. (SCI) has prepared the following WFI-B Umbrella Mitigation Banking Instrument (UMBI) for various watersheds/service areas within the St. Louis District of the U.S. Army Corps of Engineers (USACE). SCI understands that WFI-B (hereafter referred to as Sponsor) is proposing to develop an Umbrella Mitigation Banking Instrument (UMBI) in accordance with 33 CFR 332, Compensatory Mitigation for Losses of Aquatic Resources ("2008 Mitigation Rule").

The UMBI Sponsor proposes to create, restore, maintain, and protect diverse wetland, stream and aquatic systems that provide habitat for wildlife, and perform many of the functions of naturally occurring aquatic systems found in this region. An inexhaustive list of the primary functions and values that mitigation banks within the WFI-B UMBI are intended to provide include improved water quality via sediment and pollution retention, flood control, aesthetics, nutrient export, species habitat, and a source of groundwater recharge and discharge. In addition, a key goal of the banks will be to serve as recreational and educational areas for the communities in which they are developed.

In addition to the many natural functions mitigation banks within the WFI-B UMBI will provide, they can also be utilized to provide a reliable source of compensatory mitigation for anticipated adverse impacts to jurisdictional waters of the United States (WOTUS) located within the WFI-B UMBI's geographic St. Louis District (Missouri) service areas. The UBMI will provide a group of service areas; this group of service areas does not act as a single service area. Available compensatory mitigation credits must be purchased from the individual service area in which impacts occur. This provides benefits to both developers and the USACE and the Missouri Department of Natural Resources (MDNR) by streamlining the mitigation portion of the Section 404/401 permitting process. Some issues that can arise during the permitting process which can potentially cause delays and increase inefficiencies include negotiating mitigation requirements and locations, review of monitoring reports, and performing compliance checks for multiple mitigation sites. The proposed WFI-B UMBI will allow monitoring and maintenance on a broad scale in the St. Louis USACE District. Mitigation compliance requirements for many projects will be satisfied by inspections occurring at one time and in one location. Mitigation success is likely to increase as the proposed WFI-B UMBI Banks would be constructed and functioning as wetlands and streams prior to project impacts. The Department of the Army (DA) permitting process would likely be expedited and the workload of the USACE would likely be lessened with the establishment of the WFI-B UMBI.

1.1 Establishment and Operation

The standard provisions for the WFI-B UMBI establishment, use, operation, and maintenance of one or more mitigation bank sites and the operating framework for the Instrument are made and entered into by the Sponsor, in consultation with the Interagency Review Team (IRT) and coordinated by the USACE. The IRT includes the U.S. Environmental Protection Agency (USEPA), the U.S. Fish and Wildlife Service (USFWS), the MDNR, and the Missouri Department of Conservation (MDC). The WFI-B UMBI is anticipated to be utilized primarily for compensatory mitigation for unavoidable impacts to WOTUS authorized under a DA Permit through Section 404 of the Clean Water Act (33 USC 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403), including wetlands and waterbodies, located at project sites within the USACE St. Louis District, specifically, those sections of the district located in Missouri. However, it should be noted, that the service areas overlap with the USACE Kansas City and Rock Island Districts as well. If a mitigation bank is set up in one of those two districts, that respective USACE office will be invited to comment or advise on the bank. The Sponsor will be responsible for implementation, performance, completion, and long-term management of the mitigation project to offset the impacts authorized by DA permits.

The Sponsor proposes to manage the development, release, and use of mitigation credits under the proposed WFI-B UMBI upon the approval of the IRT. Mitigation credits generated and approved by the IRT, on a site-specific basis, may be used for future USACE Section 404 permits that require compensatory mitigation within the WFI-B UMBI service areas. Mitigation site-specific details including service area, mitigation type, release schedule, etc. for each site under the proposed WFI-B UMBI will be provided in Site-Specific Mitigation Plans included as addenda to the Final WFI-B UMBI and will be consistent with the service areas, mitigation types, release schedule, etc. described in this UMBI. The WFI-B UMBI is anticipated to set the framework by which future individual mitigation sites will be added as addenda to the WFI-B UMBI as they are identified. The roles and responsibilities of the IRT will be outlined, including responsibilities related to review of future site-specific mitigation plans within the WFI-B UMBI. Additional details on the operation and management of the WFI-B UMBI are provided in the following sections.

1.2 Long-Term Operation and Management

1.2.1 Validity, Modification, and Termination of UMBI

This WFI-B UMBI will become valid on the date of the signature of the designated representative of the USACE, St. Louis District. Each Bank Site, when approved by the USACE, in consultation with the IRT, will be executed as a modification of this WFI-B UMBI as provided for at 33 CFR 332.8[g]&[h].

In addition, any proposed modification to this WFI-B UMBI, including, but not limited to, additions of different types of mitigation credit resources (e.g. stream or wetland credits), or alteration of performance standards, may require review and amendment of the approved WFI-B UMBI, and will require use of the most current, approved mitigation banking procedures and protocols in use in Missouri at the time of modification. Should the USACE develop new guidance regarding mitigation banking in the future (for example, functional assessments), the Bank Sites developed prior to the change shall continue to operate using the original WFI-B UMBI and Bank Site Plan (BSP) provisions.

This WFI-B UMBI may only be amended or modified with the written approval of all signatory parties. In the event the Sponsor determines that modifications must be made to the WFI-B UMBI or a site-specific BSP to ensure successful establishment of a Bank Site, the Sponsor will submit a written request for such modification to the USACE for approval. The USACE, in consultation with the IRT, agrees to not unreasonably withhold or delay such approval. Documentation of implemented modifications will be made consistent with this WFI-B UMBI.

Any of the IRT members may terminate their participation upon written notification to all signatory parties without invalidating this WFI-B UMBI. Participation of the IRT member seeking termination will end 30 days after such written notification.

This WFI-B UMBI and any associated BSP may be considered null and void by the USACE, in consultation with the IRT, if the physical improvements identified in the mitigation plan have not been completed within five years of the last date of signature or approval. The Sponsor may reinitiate the process by submitting a new UMBI consistent with the latest Banking procedures and protocols in use in Missouri at the time the project is reinitiated.

1.2.2 Specific Language of the WFI-B UMBI Will Be Controlling

To the extent that specific language in this document changes, modifies, or deletes terms and conditions contained in those documents that are incorporated into the WFI-B UMBI by reference, the specific language within the WFI-B UMBI and any associated amendments to and modifications of the WFI-B UMBI will be controlling. However, if a conflict exists between the language of the WFI-B UMBI and an Addendum to the WFI-B UMBI governing a specific Bank Site, the language of the Addendum will be controlling.

1.2.3 Notice

Any notice required or permitted hereunder will be deemed to have been given (i) when delivered by hand, or (ii) when sent electronically, or (iii) three days following the date deposited in the United States mail, postage prepaid, by registered or certified mail, return receipt requested, or (iv) the day sent by Federal Express or similar next day nationwide delivery system, addressed as follows (or addressed in such other manner as the party being notified will have requested by written notice to the other party):

IRT MEMBERS:

David Meyer – CHAIR
USACE
St. Louis District Regulatory Office
1222 Spruce Street
St. Louis, MO 63103

Contact
USFWS
Missouri Ecological Services Field Office
101 Park Deville Drive, Suite A
Columbia, MO 65203

Contact
U.S. Environmental Protection Agency
Region 7
11201 Renner Boulevard
Lenexa, KS 66219

Contact
MDNR
1101 Riverside Drive
Jefferson City, MO 65102

MDNR St. Louis Regional Office
7545 S. Lindbergh, Suite 210
St. Louis, MO 63125

Contact
MDC – Commission Headquarters
2901 W Truman Boulevard
Jefferson City, MO 65109

SPONSOR:

WFI Holdings-B LLC
Chris Elliott, Principal
248 Southwoods Center
Columbia, IL 62236

1.2.4 Entire Agreement

The WFI-B Umbrella Agreement signed by the agencies and Sponsor that are parties hereto, this Umbrella Mitigation Bank Instrument, and any addenda and/or modifications to the Agreement or this WFI-B UMBI, constitute the entire agreement between the parties concerning the subject matter hereof and supersedes all prior agreements or undertakings.

1.2.5 Invalid Provisions

In the event any one or more of the provisions contained in this WFI-B UMBI are held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability will not affect any other provisions hereof, and this WFI-B UMBI will be construed as if such invalid, illegal or unenforceable provision had not been contained herein.

1.2.6 Binding

This WFI-B UMBI will be immediately, automatically, and irrevocably binding upon the Sponsor and its heirs, successors, assigns and legal representatives upon execution by the Sponsor and the USACE, even though it may not, at that time or in the future, be executed by the other potential parties to this WFI-B UMBI. The execution of this WFI-B UMBI by members of the IRT will cause the executing agency to become a party to this WFI-B UMBI upon execution, even though all or any of the other potential parties have not signed the WFI-B UMBI. Execution does not signify the agencies' agreement with the use of credits from any Bank Site in connection with any specific permit or project.

1.2.7 Transfer of Mitigation Responsibility

In consideration of the Sponsor's agreement to be bound by the terms of this WFI-B UMBI and the Bank Sites established hereunder, the USACE and other IRT agencies acknowledge that upon approval of a proposal by a Permittee to secure mitigation bank credits through a contract with the Sponsor from an approved Bank Site under this WFI-B UMBI to satisfy all or part of the compensatory mitigation requirements for that Department of the Army and/or other agency permit.

A fully executed contract between the Sponsor and the Permittee, in concert with notification to the USACE of such agreement as detailed in Section 9.0., will act to transfer to the Sponsor all responsibility and liability for the required compensatory mitigation in accordance with the subject permit conditions, and Sponsor hereby accepts such transfer of responsibility and liability.

1.2.8 Transfer of Bank Site Ownership

The Sponsor may transfer ownership of any Bank Site, and/or this WFI-B UMBI to a third party. In the event of such sale or transfer, this transfer provision of this WFI-B UMBI must be met in its entirety. The Sponsor will first notify the USACE prior to the transfer. The Sponsor and Transferee/New Owner will, prior to the transfer, participate in an orientation meeting with the USACE to establish a new Point of Contact and means of communication with the Transferee/New Owner. Once the transfer has been executed by the Sponsor, the Transferee/New Owner remains responsible for any and all Bank Sites and all applicable provisions of this approved WFI-B UMBI and any subsequent amendments and modifications.

1.2.9 Provision of Legal Responsibility

The U.S. Army Corps of Engineers (USACE) approval of this Instrument constitutes the regulatory approval required for the Umbrella Mitigation Banking Instrument to be used to provide compensatory mitigation for Department of the Army permits pursuant to 33 C.F.R. 332.8(a)(1). This Instrument is not a contract between the Sponsor or the Property Owner and the USACE or any other agency of the federal government. Any dispute arising under the Instrument will not give rise to any claim by the Sponsor or the Property Owner for monetary damages. This provision is controlling notwithstanding any other provision or statement in the Instrument to the contrary.

1.3 Sponsor Qualifications

WFI Holdings-B LLC recently worked with the St. Louis USACE District to develop the WFI-B Umbrella Mitigation Banking Program in Illinois which was approved on August 30, 2021. Currently three stream and wetland mitigation bank sites have been approved under this Illinois umbrella (Silver Banks, Locke Bottom, and Bartelso Bottoms), with two more currently under review (Shepgarten and Sweet Water). Wetlands Forever, the primary contractor for WFI Holdings-B, has extensive experience developing, siting, designing, constructing, and monitoring mitigation banks, including the recent bank sites set up through the approved August 30, 2021 *WFI-B Umbrella Mitigation Banking Program.* SCI helped to develop the first nationwide stream mitigation bank located in Illinois in the year 2000. SCI also has extensive experience in developing, siting, designing, constructing, and monitoring mitigation banks and mitigation sites throughout the St. Louis USACE District in Missouri and in Illinois.

2.0 WATERSHED APPROACH

Watersheds were evaluated and based on characteristics such as Ecological Drainage Units (EDU), geographic location, land use, ecoregions, soil types, topographic data and the hydrologic connectivity of existing streams, rivers and wetlands within proposed services areas. The following sections detail the

historic losses and current trends, water quality, immediate and long-term needs, historic and current conditions, and short-term and long-term off-site threats for each service area. A map of the 18 Missouri watersheds located within the Missouri St. Louis – USACE district is included in Figure 1. Missouri has 18 EDUs which correspond to ecoregions and watersheds in the state. This WFI-B UMBI incorporates five EDUs; the Moreau/Loutre, Meramec, Apple/Joachim Upper St. Francis/Castor watersheds within the Ozark Subregion, and the Cuivre/Salt watersheds within the Central Plains subregion. The EDU map is included as Figure 2.

The Missouri EDUs along the eastern Missouri boundary were the base for creating the five service areas for the Missouri UMBI. The 18 watersheds within the USACE St. Louis District - Missouri Section, were consolidated into 5 larger service areas, within the 5 EDUs discussed below. The *Proposed Service Areas* - Figure 2, illustrates the EDU Service Areas with an additional layer depicting the boundaries of the USACE Districts of St. Louis, Kansas City, and Rock Island. The goal of the combined watershed approach is to improve the quality and quantity of aquatic resources through strategic selection of compensatory mitigation sites with similar ecological characteristics. This watershed approach considers the importance of landscape position and aquatic resource type for the sustainability of aquatic resource functions within the watershed. As part of the development of the WFI-B UMBI, the Sponsor carefully analyzed and considered watershed needs and how location and types of compensatory mitigation projects address those needs. A landscape perspective helps to identify the types and locations of compensatory mitigation projects that will benefit the watershed in a changing landscape and offset losses of aquatic resource functions authorized by future USACE permits. Table 2.1 below lists the 6-digit hydrologic unit code (HUC) for primary tributaries within each EDU Service Area. For simplicity of reference, an EDU acronym is paired with each Service Area.

Table 2.1 – Service Areas

Service Area-EDU	Acronym EDU	Service Area HUC Codes	Primary Tributaries	Primary Tributary HUC Codes
Ozark-Moreau/Loutre	OML	103002	Lower Missouri	10300200
		103001	Lower Missouri-Moreau	10300102
Ozark-Apple/Joachim	OAJ	071401	Upper Mississippi-Cape Girardeau	7140105
			Cahokia-Joachim	7140101
Ozark-Upper St. Francis/Castor	OUSFC	080202	Upper St. Francis	8020202
		071401	Whitewater	7140107
Ozark-Meramec	OM	071401	Bourbeuse	7140103
			Meramec	7140102
			Big	7140104

Table 2.1 – Service Areas (continued)

Service Area-EDU	Acronym EDU	Service Area HUC Codes	Primary Tributaries	Primary Tributary HUC Codes
Central Plains-Cuivre/Salt	CPCS	071100	Bear-Wyaconda	7110001
			North Fabius	7110002
			South Fabius	7110003
			The Sny	7110004
			North Fork Salt	7110005
			South Fork Salt	7110006
			Salt	7110007
			Cuivre River	7110008
			Peruque-Piasa	7110009

The areas to be serviced by the WFI-B UMBI are located in Ecoregion 40 – Central Irregular Plains, Ecoregion 72 – Interior River Valley and Hills, and Ecoregion 39 – Ozark Highlands. A detailed description of each ecoregion is provided below. A map depicting the Ecoregions overlayed on the EDU Service Area is included as Figure 3.

The **Central Irregular Plains Ecoregion** is mainly comprised of moderate hills to flat plains, in comparison to the less irregular topography of the Western Corn Belt Plains to the north and more irregular and forested ecoregions to the south and east. Typical land use in this region includes cropland, pastureland with emphasis on livestock production, and bands of woodland.

The **Interior River Valley and Hills Ecoregion** is mainly comprised of many wide, flat-bottomed terraced valleys, forested valley walls, and dissected glacial till plains. In contrast to the rolling to slightly irregular plains in adjacent ecological regions to the north, where most of the land is cultivated for corn and soybeans, a little less than half of this area is in cropland, and the remainder is in pasture.

The **Ozark Highlands Ecoregion** is comprised of steep slopes near large streams to moderate relief hills on the broad plateaus or inter-stream areas. In contrast the other two ecoregions, a majority of the area is open forest or woodland with small, cultivated tracts in the valleys and cleared upland used for pasture and livestock.

Topographically, much of northern, western, and southeastern Missouri is flat with very little elevation change. However, as you migrate towards St. Louis through the State, the topography begins to gently slope toward the larger river valleys, ultimately ending with bluffs, steep slopes and depressional floodplain

areas as you reach the Mississippi River Valley. The land-use land-cover within the WFI-B UMBI service areas are illustrated on Figures 4A through 4E and is broken down into individual maps for each service area.

Additional information regarding anthropogenic influences on the watersheds within the service area is described in further detail in Section 3.0 and the subsections of this UMBI document. The overall, suitability of the service areas and bank sites, including the ecological suitability of each bank site to achieve the objectives of the UMBI Program, are discussed further in Section 4.0 and the accompanying subsections.

Aquatic ecosystems such as streams, rivers, lakes, and wetlands interact because of their ability to transfer material and energy, and through their ability to adjust the inputs and outputs of these materials. A key element of these interactions is connectivity, which describes the degree to which components of a river system are joined, by various transport mechanisms (USEPA, 2015). Connectivity of river systems - hydrological, chemical, and biological - is determined by characteristics of the physical landscape, climate, and the biota, as well as human impacts. To design the WFI-B UMBI in a manner in which it maximizes connectivity throughout its footprint, each watershed is analyzed and paired accordingly. The following subsections describe each EDU/Service Area, and the current trends and historic losses within each.

2.1 Ozark-Moreau/Loutre (OML) EDU – Service Area

The Ozark-Moreau/Loutre (OML) EDU includes the watersheds of the Missouri River and Mississippi River. However, for the purposes of the UMBI, this service area does not include the Missouri and Mississippi Rivers themselves. The service area is primarily within the Ozark Highlands and the Central Dissected Till Plains. These two ecoregions make the service area physiographically, hydrologically, and biologically diverse. There are approximately 8,109 miles of primary streams within this EDU. Perennial streams make up approximately 2,338 miles of the service area. The two largest watersheds in the service area are the Moreau River and the Loutre River. This service area includes the counties of Boone, Callaway, Cole, Cooper, Franklin, Gasconade, Howard, Miller, Montgomery, Moniteau, Morgan, Osage, St. Charles, St. Louis, and Warren counties. The OML service area (Figure 4A) is dominated by agricultural land use, followed by forested hills and ridge tops with the most developed areas being within St. Charles and St. Louis Counties. The primary tributaries within this EDU are illustrated on Figure 5A.

2.2 Ozark-Apple/Joachim (OAJ) EDU – Service Area

The Ozark-Apple/Joachim (OAJ) EDU is located in east-central Missouri including small direct tributaries to the Mississippi River between outlets of the Missouri and Castor Rivers diversion channel (known as the Headwater Diversion). Other primary waters in this EDU include the River Des Peres, Joachim Creek, Plattin Creek, Establishment Creek, Auxvasse Creek, Saline Creek, Cinque Hommes Creek, Apple Creek, Indian Creek, and Cape La Croix Creek. The primary streams encompass approximately 4,453 miles of channel within this service area. Perennial channels make up approximately 1,734 miles. The basins in this service area share physical, chemical and biological similarity. The similarities of land use and topography, common downstream connection with the lower Mississippi River, allow for easier mitigation planning and similar approaches in watershed, riparian, and stream channel problems and planning opportunities. This service area is located in Cape Girardeau, Jefferson, Perry, St. Francois, Ste. Genevieve, and St. Louis counties. The OAJ service area (Figure 4B) is dominated by forested hills and ridgetops, followed by agricultural land use with the most developed area being St. Louis County. The primary tributaries within this EDU are illustrated on Figure 5B.

2.3 Ozark-Upper St. Francis/Castor (OUSFC) EDU – Service Area

The Upper St. Francis River originates in Iron County in southeast Missouri and flows 225 miles to the Missouri/Arkansas border. In Missouri, the basin is equally divided (north and south) between the high-relief Ozark Highlands and the low-relief Mississippi Alluvial Plain. Wappapello Dam and Lake are located on the divide. This basin drains approximately 1,839 square miles of tributaries. This service area is located within the Mark Twain National Forest. The western portion of the EDU overlays the Ozark Highlands, and the eastern boundary of the EDU overlaps the Interior River Valleys and Hills ecoregion. This service area includes the counties of Bollinger, Cape Girardeau, Iron, Madison, St. Francois, and Wayne. The OUSFC service area (Figure 4C) is dominated by forested area. Agricultural land follows with land use, and typically is located in low valleys. The most developed cities are Cape Girardeau, Fredericktown, and Farmington. The primary tributaries within this EDU are illustrated on Figure 5C.

2.4 Ozark-Meramec (OM) EDU – Service Area

The Meramec River basin is located within the Ozark Highlands ecoregion. This EDU also overlaps much of the Mark Twain National Forest. The area surrounding the national forest is considered urban with a high population density. This service area is included in the counties of Crawford, Dent, Franklin, Iron, Jefferson, Phelps, Reynolds, St. Louis, Texas, and Washington. The Meramec River and its tributaries drain approximately 2,149 square miles from a low-population density headwater area to a high-density area downstream and toward the Missouri River. Some of the primary waters in this area include Courtois,

Crooked, Dry, Dry Fork, Huzzah, and Indian Creeks as well as the Little Meramec River. This area is dominated by karst topography and springs which provide sustained base flow to the Meramec River. The Big and Bourbeuse Rivers also provide sustained flows to the Meramec. The primary tributaries within this EDU are illustrated on Figure 5D.

The Big River enters the Meramec at river mile 35.7. The Big River basin is located in east-central Missouri and drains approximately 955 square miles of the Ozark Plateau in portions of 6 counties. The Big River has eight, order five tributaries and drains northward for approximately 138 miles until its confluence with the Meramec River. The majority of basin land use is forest and pasture with some row cropping along stream bottoms. However, urbanization is rapidly increasing in the lower basin. The Southeast Missouri Lead Mining District is a large area of historic and current lead and other heavy metal mining and include Jefferson, Washington, St. Louis, and St. Francois counties. Tributaries in this EDU can be impacted by lead, zinc, cadmium, and sediment from mining activities. The Big River Mine Tailings Superfund site is one of four sites within the mining belt. In the mining belt, tailings impoundments were created to store waste from lead ore milled from local mines. The mining contamination drains downstream into waters where sediment contamination has been observed. The Bourbeuse River drains through Phelps, Gasconade, and Franklin counties draining into the Meramec River at river mile 64. The watershed also drains portions of Maries, Osage, and Crawford counties. From its headwaters to its mouth, the Bourbeuse River is 147 miles long. This area includes medium density communities sprinkled throughout agricultural lands. The Bourbeuse River watershed drains approximately 843 square miles and is composed of several smaller watersheds including Spring Creek, Boone Creek, Brush Creek, Red Oak Creek, Dry Fork, Little Bourbeuse River, and the Lower Bourbeuse River. The physical, chemical and biological characteristics of the watershed, land use, and topography with a common downstream hydrologic endpoint of the Meramec River, Big River, and Bourbeuse River, aligns with the decision to make this one service area/EDU for umbrella mitigation planning purposes with the watershed approach. The OM service area (Figure 4D) is also dominated by forest land-use followed by developed areas. Cities located along the Interstate 44 corridor and South St. Louis County are the most developed in this service area.

2.5 Central Plains-Cuivre/Salt (CPCS) EDU – Service Area

Within this EDU, approximately 15,297 miles of primary streams drain both from Iowa and Missouri. Approximately 5,063 miles are perennial tributaries, and 11,738 miles are located within Missouri. This watershed is dominated by agricultural land use with some higher-density population towns spread

throughout. The forested areas are predominantly located along riparian corridors and farming practices do not leave much in the way of forested buffers within floodplains of tributaries. The primary tributaries within this EDU are illustrated on Figure 5E.

The Central Plains-Cuivre/Salt Rivers (CPCS) EDU drains the eastern margin of the Interior River Valleys and Hills and Central Irregular Plains ecoregions and into the Upper Mississippi River. The Cuivre River drains south from Audrain and Pike counties through Lincoln, Montgomery, Pike, St. Charles, and Warren counties. Major tributaries include the West Fork and North Fork Cuivre River. The watershed is approximately 1,235 square miles. While this area is largely dominated by agricultural practices, it is becoming heavily developed within the past 10 to 15 years. The Fox River basin, the most northeast corner of the EDU, drains over 400 square miles from Missouri and Iowa (originating in Iowa). The Fox River and its tributaries drain watershed from Scotland and Clark counties until it converges with the Mississippi River. The Wyaconda River basin (originating in Iowa) drains approximately 458 square miles of land and 336 of those square miles are located in Missouri. In Missouri, the North Wyaconda, Little Wyaconda, and Sugar Creek watersheds drain into the Wyaconda River before it converges with the Mississippi River. The Fabius River is divided into three sub-basins; the North, Middle, and South Fabius River. The North Fabius sub-basin originates in Davis County, Iowa. The Middle Fabius and South Fabius sub-basins originate in Schuyler County, Missouri. The three tributaries drain south across northeast Missouri through Adair, Clark, Knox, Lewis, Marion, Scotland, Schuyler, and Shelby counties. The rivers merge into the Fabius River which drains into the Mississippi River at the Fabius Chute. The Fabius watershed drains approximately 1,543 square miles. The North River basin drains approximately 381 square miles through Knox, Shelby, Monroe, Marion, and Ralls counties. The North River is the longest stream within the basin and includes the watersheds of the South Fork North River and Tiger Fork. The North River drains approximately 78 miles before converging with the Mississippi River. The Salt River is a 7th order river draining approximately 2,914 square miles through Adair, Audrain, Boone, Callaway, Knox, Macon, Monroe, Pike, Ralls, Randolph, Schuyler, and Shelby Counties. A portion of the Salt River was previously impounded to create Mark Twain Lake. The USACE-managed lake is approximately 18,600 acres and made up of the watersheds of the North, Middle and South Forks of the Salt River. The Salt River drains downstream for approximately 63 miles until it converges with the Mississippi River. The CPCS service area (Figure 4E) is dominated by agricultural land use, forested area follows and is largely located along riparian corridors within this EDU. The most developed area in this EDU is the northern portion of St. Charles County.

2.6 UMBI Watershed - Historic Losses and Current Trends of Wetland and Wildlife Habitats

2.6.1 Central Irregular Plains

According to maps developed by the Missouri Herpetological Atlas Project (MoHAP, 2023), the Central Irregular Plains ecoregion within the Northern portion of the EDU/Service Areas was historically dominated by prairie prior to settlement. The historic vegetation map by the Atlas Project illustrates this EDU as being dominated by prairie interspersed with open woodlands and forests along riparian corridors. Wetland and streams post-settlement era would have likely been drained in order to increase usable farmland and provide space for livestock pastures. Timber harvest also removed much of the forested area from the Central Plains watershed. This drastically removed different types of habitats from the landscape, particularly for species such as game birds that require tall and short grass prairie transitions from open fields and forests, and from larger wildlife species such as deer, coyote, and bear that require uninhabited forests to live in. The Central Plains ecoregion has been transformed into an agricultural dominated land use with narrow forested riparian corridors, dotted with smaller agricultural towns throughout. Primary row crops growing in this region include corn, soybeans, wheat, sorghum, grains for livestock and hay. Natural vegetation in this ecoregion includes grasses such as little bluestem, Indiangrass, sideoats gramma, and woody species such as white oak and bur-oak woodlands. The row crop agricultural practices in this service area have contributed to sedimentation and erosion within tributaries, as the natural functions have been degraded by the removal of floodplain area and adjacent wetlands, as farming tends to occur up to the top of streambanks.

2.6.2 Interior River Valleys and Hills

The Interior River Valleys and Hills ecoregion in Central portion of the EDU/Service Areas was historically, prior to settlement, dominated by forested and woodland areas, as well as barrens/scrub area vegetation types. There were mostly broad floodplains with river terraces and levees, and bottomland deciduous forest vegetation covering the region before much of it was converted to agricultural uses in post-settlement times. Typical row crops grown are corn, wheat, soybeans, with hay and grains meant for livestock. The Ozark portion of the UMBI Service Areas is considered agricultural to the west and developed to the east where the population density is heaviest. In the east, cities have little to no green space and tributaries carry stormwater from impermeable surfaces which can encourage petrochemical pollution into streams. Natural stream and wetland functions have been degraded by the removal of floodplain area and adjacent wetlands, as farming practices tend to occur up the top of streambanks. Additionally, many cities historically channelized and paved tributaries. Numerous tributaries are concrete

channels within the St. Louis Metropolitan area. Natural riparian vegetation dominating this landscape includes eastern cottonwoods, willow species, green ash, elm species, common hackberry, and maple-oak forests.

2.6.3 Ozark Highlands

The Ozark Highlands ecoregion in the southern portion of the EDU/Service Areas was historically forested. Timber harvest, agriculture, and development have removed more than half of the forested area. Livestock pasture, haying, and row cropping dominate agriculture in this region. Timber harvest removed much of the forested area which impacted large mammal habitat in the landscape, for species such as deer, coyote, bobcat, and bear that require uninhabited forests to live in. Fragmentation of forests have impact bat species who utilize roost trees to bear their young in the summer such as the federally endangered and threatened species Indiana bat and the Northern long-eared bat. Additionally, mining and recreational cave use in this ecoregion has also impacted the federally endangered species gray bat. This area historically was known for lead mining, and metals such as copper, silver, cobalt, zinc, iron, as well as barite, and manganese. Due to mining activities, many of the streams within the Ozark Highlands have degraded water quality as seen in sampling of aquatic organisms. This ecoregion is characterized by extreme biological diversity and high uniqueness of species. Vegetation communities are dominated by open oak-hickory and shortleaf pine woodlands and forests. Included in this area are community types of fens, forests, wetlands, fluvial features, and carbonate and siliceous glades. Natural vegetation in this area includes little bluestem-Indiangrass prairie, sideoats gramma, shortleaf pine-oak forest, black-scarlet oak woodland, white oak forest, post-blackjack oak and white-black oak woodlands, and alkaline glade communities.

2.7 UMBI Watershed - Water Quality and Aquatic Resources

Water quality within the UMBI service area is typical of agricultural land-use dominated landscapes. This includes nutrient-loaded runoff from farm fields, livestock pastures and feedlots, household septic fields, and impacts from livestock who access open stream channels. Local point source pollution from small municipal and industrial operations are present but to a lesser degree in the northern Service Areas of the Central Plains, but to a higher degree with larger population densities and cities within the southern Service Areas of the Ozark region. Wastewater treatment facilities also provide additional nutrient loads to this watershed. Heavy metals such as Mercury and chemicals such as Chlordane are also still present in samples of biological organisms in the EDU. Information presented here was reviewed from the MDC Watershed Inventory (MDC, 2023). In developing this UMBI banking instrument several MDNR stream assessments were reviewed in each of the EDU's. These MDNR stream assessments could be utilized when planning project specific bank sites. A representative assessment from each EDU is summarized below.

The assessments included biological assessments and metals characterizations as well. One EDU did not have any MDNR biological assessment information available. The USEPA "How's my waterway?" website was utilized for information on streams within the EDU.

Within the Ozark/Apple/Joachim EDU, historic lead and zinc mining practices created a hazard of pollution from mine discharges and mine tailings. Additionally, urbanization within the watershed, destruction of riparian vegetation, channelization ranging from full channel paving to small-scale channelization, livestock overgrazing, and in-stream gravel operations have caused degradation in aquatic resources within the EDU. Review of the USEPA "How's My Waterway?" report for the River aux Vases within the EDU indicates a waterbody in "good" condition in 2020 (USEPA, 2023). The waterbody report indicates that for the category of "Aquatic life, the status of fish, macroinvertebrates, plants, and animals that live in the water", water quality parameters are meeting state or tribal specific water quality standards. There was insufficient information for the other water quality categories.

- Overall, the quality of aquatic resources in the Ozark/Moreau/Loutre EDU is fair, some watersheds are in good standing and others are degraded. Sections of North Moreau Creek and Straight Fork are identified as EPA CWA Section 303(d) impaired waters. Water quality issues include degradation due to livestock, removal of riparian vegetation advancing erosion and sedimentation, channelization, and urban development. MDNR performed a biological assessment of Stinson Creek in 2018 through 2020. The study area is located within the City of Fulton, Callaway County, Missouri. The study area is comprised of the developed city of Fulton, as well as grassland, forestland, and agricultural upstream and downstream limits.

    - The objectives of the study were to determine if Stinson Creek fits the beneficial use designation of supporting aquatic habitat since the completed upgrades to the City of Fulton's Wastewater Treatment Facility (WWTF). Sampling stations were located upstream and downstream of the WWTF. The macroinvertebrate community and the instream habitat were compared longitudinally among the five Stinson Creek stations as well as compared with MDNR reference stream data from the Ozark/Moreau/Loutre EDU. Water quality and nutrient parameters were compared between Stinson Creek study sites as well as compared to the MDNR 2018 water quality standards and the USEPA's ambient water quality criteria recommendations for nutrients from 2000 (MDNR 2018-2020).
    - Six null hypotheses were also tested during the study.
        - *Land cover characteristics in the Stinson Creek watershed will be similar to land cover characteristics of the Ozark/Moreau/Loutre EDU.* This hypothesis was rejected as the land use between Stinson Creek and the EDU contained different land cover characteristics. The study stream contained less cropland and forestland and contained more grassland and urban/impervious land than the EDU (MDNR 2018-2020).
        - *Stream habitat assessment scores of Stinson Creek will be similar to the average stream habitat scores of the MDNR reference streams located within the Ozark/Moreau/Loutre EDU.* This hypothesis is accepted. When comparing the habitat assessment scores of the Stinson Creek stations to the average of the reference streams, the study stream scores were greater than 75 percent of the average reference stream score (MDNR 2018-2020).

- *The macroinvertebrate community in Stinson Creek will be similar among longitudinally separate reaches of Stinson Creek.* This hypothesis is rejected. Measurable differences in the macro community among the stations were evident throughout the study (MDNR 2018-2020).
- *The macroinvertebrate community in Stinson Creek will be like the macroinvertebrate community of the MDNR reference streams in the Ozark/Moreau/Loutre EDU.* This hypothesis was rejected as the macro scores for the study stations varied over the seasons ranging from non-supporting to fully supporting (MDNR 2018-2020).
- *The macroinvertebrate community in Stinson Creek will be similar to the macroinvertebrate community of the MDNR reference streams in the Ozark/ Moreau/Loutre EDU.* This hypothesis was rejected as the macro scores varied over the sampling seasons (MDNR 2018-2020).
- *Physicochemical water quality of the study stream will meet the WQS and USEPA's recommended values.* This hypothesis was partially accepted, with Dissolved Oxygen, chloride, and nutrients being exceptions (MDNR 2018-2020).

- Overall, the water quality in the Ozark/Upper St. Francis/Castor EDU is good and evaluations from MDNR show that most of the basin, including the entire St. Francis River and Wappapello Lake are classified as full use attainment waterbodies. The main sources of non-point pollution are nutrient and pesticides from agricultural runoff, as well as contamination from mining activities. Channelized sections in lower basin streams are in poor conditions due to head-cutting and sloughing banks leading to abundant unconsolidated sediments, decreased depths, and accelerated bank erosion. MDNR performed a Biological Assessment which included metals characterization for the Little St. Francis River, Village Creek, and Saline Creek. The objectives of the study were to assess stream habitat quality, the "protection of warm water habitat" designated beneficial use statuses via benthic macroinvertebrate community sampling, assess the physicochemical water quality, determine the dissolved metals concentrations in surface water, and determine the heavy metals character of the fine sediment in the study streams (MDNR, 2018-2019).

- The *Little St. Francis River, Village Creek, and Saline Creek 2018-2019 Biological Assessment and Metals Characterization Report* (MDNR, 2018-2019) focuses on streams in and around Fredericktown, Missouri. The Fredericktown area streams included in this study are within the general vicinity of an area known as the Madison County Mines Superfund Site and abandoned mine area and cover approximately 645 acres around the city of Fredericktown. While the study purpose and objectives were met, 5 of the 6 null hypotheses being tested were rejected.
  - Little St. Francis River (LSFR) was placed on the MDNR 303(d) List of Impaired Waters in 2014 for inorganic lead associated with sediment, and the protection of aquatic life was listed as the impaired beneficial use. The 303(d) reach extends approximately 32 miles from the Logtown Branch confluence to Little St. Francis River's confluence with the St. Francis River. Catherine Mine and Mine LaMotte were listed as potential sources of contamination (MDNR, 2018-2019). The TMDL priority is High and is expected to be developed by 2023.
  - A TMDL for inorganic sediment (non-volatile suspended solids) and lead, with a source of Mine LaMotte abandoned mine land with a TMDL Priority Ranking of high was written for Village Creek (VC), Madison County in 2010. The length of the impaired segment upstream is approximately 1.5 miles, and the downstream reach is approximately 3.0 miles. The impaired beneficial use is listed as protection of warm water aquatic life (MDNR, 2018-2019).
  - Saline Creek (SC) was placed on the 303(d) list for nickel, and a TMDL was written and approved by EPA in 1998-1999 for dissolved nickel and cobalt. The impaired segment is 0.5 miles downstream from its confluence with Goose Creek. The source is emerging ground waters from Madison Mine with a TMDL Priority Ranking of High (MDNR, 2018-2019).

- Six null hypotheses were tested during this study. While the study purpose and objectives were met, several null hypotheses were rejected which were compared against reference stream data and state standards for physiochemical water quality parameters. These determinations are described below (MDNR, 2018-2019).
  - *Stream habitat quality will be comparable to the stream habitat control at all stations.* This null hypothesis was rejected for LSFR 13.7, downstream from Spiva Branch, and SC 1.2, downstream from Tollar Branch.
  - *MSCI scores will indicate that LSFR, VC, and SC will be fully supporting of the beneficial use – for the protection of WWH, and individual biological metric scores will be within the optimum scoring range of wadeable/perennial reference stream biological criteria during the fall and spring seasons.* The null hypothesis suggesting all individual metrics values will be within the optimal range was rejected for all stations in LSFR (fall), VC and SC in both seasons. The null hypothesis for the fully supporting criterion was rejected for:
    - All LSFR stations were partially supporting except three farthest downstream (LSFR 10.4, LSFR 3.0, and LSFR 0.4), which had fully supporting MSCI scores;
    - VC 0.2 was partially supporting in both seasons;
    - VC 1.7 was fully supporting in fall and partially supporting in spring; and
    - SC stations downstream of Unnamed Tributary (SC 1.3 and SC 1.2) were partially supporting in both seasons.
  - *DMT (Secondary metrics) will indicate that macroinvertebrate communities in LSFR, VC, and SC are similar to BIOREF stream communities.* The null hypothesis was rejected for all LSFR, VC, and SC stations.
  - *Physicochemical water quality parameters will be within acceptable limits as specified in Missouri's Water Quality Standards, and will not be notable using suggested guidelines.* The null hypothesis for notable parameters based on EPA (2000) suggested guidelines was rejected because:
    - Turbidity, total nitrogen, nitrate+nitrite as N, and total phosphorus exceeded EPA (2000) suggested guidelines at all LSFR stations.
    - Total nitrogen, nitrate+nitrite as N, and total phosphorus consistently exceeded EPA (2000) suggested guidelines at both VC stations. Turbidity exceeded guidelines downstream of Shays Creek (VC 1.7) during both seasons andupstream of Shays Creek (VC 0.2) only in spring.
    - Turbidity, total nitrogen, nitrate+nitrite as N, and total phosphorus consistently exceeded EPA (2000) suggested guidelines at all SC stations.
    - The null hypothesis for Water Quality Standards was not rejected for all stations. Physicochemical parameters met water quality standards.
  - *Dissolved metals in the surface water at stations will be within acceptable hardness-dependent limits outlined in Missouri's Water Quality Standards LSFR, VC, and SC. The null hypothesis was rejected because:*
    - Dissolved lead exceeded WQS chronic toxicity threshold in an LSFR station, downstream of Fredericktown City Lake.
    - Dissolved nickel exceeded WQS chronic toxicity threshold at an SC station and another SC station in the spring.
    - The null hypothesis was not rejected for both VC stations in fall and spring, and SC stations in fall.
  - *Benthic fine sediment metals (i.e. arsenic, cadmium, copper, lead, nickel, silver, or zinc) concentrations will be below potentially toxic threshold levels in LSFR, VC, and SC sampling stations.*
    - This hypothesis was rejected at all but the two downstream LSFR sample stations due to lead exceedance of the probable effects concentration (PEC) at eight upstream sample stations. Nickel exceeded the PEC downstream of Sweetwater Branch (LSFR station),

Spiva Branch (LSFR station), at the Mill Creek confluence (LSFR station), downstream of Mill Creek (LSFR station), and downstream of Plum Creek (LSFR station), and Arsenic exceeded its PEC at the Mill Creek confluence (LSFR station).
    - This hypothesis was rejected for both VC stations because: Arsenic exceeded the PEC at two VC stations, and Lead exceeded the PEC at one VC station.
    - This hypothesis was rejected for the three downstream SC stations, because Nickel exceeded the PEC at three SC stations, Lead exceeded its PEC at two SC stations, and Copper exceeded its PEC at one SC station.
- Overall, water quality in the Ozark/Meramec River EDU basin is also good. The MDNR Clean Water Commission has designated segments of Courtois Creek, Huzzah Creek, Blue Springs Creek, and the Meramec River as Outstanding State Resource Water (OSRW). However, water quality issues are still present. The Southeast Missouri Lead Mining District contains The Big River Mine Tailings Superfund site which includes a major tailings impoundment to store waste from lead ore milled from mines at Desloge, Missouri. Livestock pasture, erosion of mine tailings, urban watersheds and increased impervious surfaces has increased the pollution and sediment load of some of the watershed's streams For this EDU the MDNR Fox Creek Biological Assessment and Stressor Study Report was reviewed. Fox Creek flows through a forested and somewhat suburban upper watershed and more rural and cropland lower watershed in St. Louis County in Wildwood and Eureka, Missouri (MDNR, 2014). The purpose of the assessment was to determine if the macroinvertebrate community and/or stream habitat were impaired and possible causes, and to define the water quality characteristics of the creek.
    - The study concluded that the Fox Creek macroinvertebrate community is impaired due to long-term Dissolved Oxygen readings that fell below Water Quality Standards and that no fully supporting MSCI scores were attained. The macroinvertebrate community Fox Creek was compared with the MDNR wadeable perennial reference streams (MDNR, 2014). However, as the Fox Creek macroinvertebrate community was compared with MDNR wadeable perennial reference streams and that the flow dynamics observed during this study, the determination of the comparison was deemed questionable (MDNR, 2014).
    - There were 5 null hypotheses tested during and the findings concluded that macroinvertebrate assemblages are similar between Fox Creek and MDNR reference streams in the same EDU is rejected, the null hypothesis that macroinvertebrate assemblages are similar between Fox Creek sample stations is accepted, the null hypothesis that macroinvertebrate assemblages will not differ between the two sample seasons in 2014 is accepted, the null hypothesis that habitat quality is similar among Fox Creek sample stations is accepted, and the null hypothesis that habitat quality is similar between Fox Creek and MDNR biocriteria reference streams is accepted (MDNR, 2014).
- Overall, the quality of aquatic resources in the Central Plains/Cuivre/Salt Rivers EDU varies. Some watersheds are somewhat depressed while others have chronic ongoing water quality issues. These issues include erosion due to development along riparian corridors, row cropping and livestock pasture, and channelization of major watersheds including levee construction to control drainage and flooding. Some of the watersheds are in this EDU are experiencing heavy commercial and residential development. One of the most developed and developing watersheds in this EDU includes Dardenne Creek.

    - According to the MDNR Biological Assessment Stream Report (MDNR, 2002) of the Dardenne Creek Study in St. Charles County, Missouri, there is concern that increased residential and commercial development in the Dardenne Creek watershed was causing poor water quality and habitat conditions in the creek which could have an impact on the aquatic community. Volunteers collected Water Quality data on Dardenne Creek from 1998-2001. The data suggested that the in-stream concentrations of dissolved oxygen, solids, turbidity, and pH were being affected by changes in the watershed.

- In 2002, ten null hypotheses were investigated; five of the hypotheses were to test the macroinvertebrate assemblages, water chemistry, fecal coliform concentrations, benthic sediment percentages, and habitat quality, longitudinally, between Dardenne Creek sample stations. These hypotheses would compare stations with best management practices in place versus stations without these practices. The other five hypotheses were to test the same parameters between Dardenne Creek, the regional control stream (North Fork Cuivre River), and the biocriteria reference stream (South River).
- The objectives were to determine: 1) whether there is greater aquatic life impairment in the most urbanized portions of Dardenne Creek relative to sections upstream least developed; 2) whether aquatic life in Dardenne Creek is impaired relative to that of regional reference streams; and 3) whether Dardenne Creek is impaired due to nutrification and sedimentation by urban runoff.
- The findings of this study revealed there were some clear differences in samples collected among the Dardenne Creek sites and between samples collected at Dardenne Creek and the control/reference streams. As a result, all but one of ten the null hypotheses were rejected. Habitat assessments conducted at Dardenne Creek and North Fork Cuivre River were compared, and the differences were insignificant. Therefore, the hypothesis concerning comparable habitat quality was accepted.

Population growth in the UMBI Service Area has increased the dependence on water reservoirs constructed on major rivers in the region and on groundwater for household and public water supply. Because of population growth and increases in industrial and agricultural activities, not only is adequate water quantity an issue, but maintaining good water quality is also a challenge. Point and nonpoint sources of excessive nutrients are an issue. Within the urbanized areas of the UMBI program area such as St. Louis and St. Charles counties, development continues to remove green spaces and stream and wetland habitat. Development also exacerbates flooding and erosion in the region. Also, typical of many municipalities is the use of combined storm and wastewater sewer overflow systems which can carry human waste into streams. This water quality problem is being addressed from a local and statewide standpoint with the reconstruction of stormwater and wastewater infrastructure. With this, is the addition of row crop agricultural practices in this service area which has created sedimentation and erosion within tributaries.

2.8 UMBI Historic & Existing Hydrology/Major Waterbodies

Historically, watersheds within the WFI-B UMBI service area were supported by larger river systems and their active floodplains. This includes major river systems such as the Mississippi River, Missouri River, and Meramec River. Over time, human expansion has brought along an increased number of habitat modifications and the inclusion of impervious surfaces, which has led to increased runoff volumes and rates. Channelization, dredging, levee construction has increased stormwater volumes and flow rates which have caused smaller headwater drainages to scour. Overtime this scour activity has in part, given us the named rivers and creeks that we see today. A figure showing the primary waterbodies within each proposed service area is included as Figures 5A through 5E.

2.9 Soils and Geology of the UMBI Service Area

2.9.1 Central Irregular Plains

Soil orders dominating the ecoregion include *Mollisols (Argiudolls, Hapludolls*) and *Alfisols (Hapludalfs, Epiaqualfs, Paleudalfs*). Mollisols have a thick, dark, humus-rich surface horizon, which makes them desirable in agricultural settings. These soils are typically a loamy till or clay loam till soil type. Alfisols are also suitable for cultivation. These are also loamy and clay loam till soils with the addition of clay pan limiting zone. A mesic and udic temperature and moisture regime combined with these soil types means that there is well distributed rainfall, common of humid climates. Geology within this region includes Pennsylvanian sandstone, limestone and shale.

2.9.2 Interior River Valleys and Hills

Soils orders dominating the ecoregion include *Mollisols (Hapludolls*) and *Inceptisols (Eutrudepts*). Mollisols have a thick, dark, humus-rich surface horizon, which makes them desirable in agricultural settings. These soils are typically a loamy till or clay loam till soil type. Inceptisols are found on fairly steep slopes and are not typically suitable for cultivation. These are also sandy, clayey, and silty soils. A mesic and udic temperature and moisture regime combined with these soil types means that there is well distributed rainfall, common of humid climates. Geology within this region includes Mississippian and Pennsylvanian limestones, sandstones, and shales with considerable bedrock exposure. Karst features can be present.

2.9.3 Ozark Highlands

Soils orders dominating the ecoregion include *Ultisols (Paleudults, Fragiudults, Hapludults), Alfisols (Fragiudalfs, Hapludalfs, Paleudalfs)* and *Mollisols (Hapludolls*). Ultisols are strongly leached and acidic forest soils with relatively low fertility. Mollisols have a thick, dark, humus-rich surface horizon, which makes them desirable in agricultural settings. These soils are typically a loamy till or clay loam till soil type. Alfisols are also suitable for cultivation. These are also loamy and clay loam till soils with the addition of clay pan limiting zone. A mesic and udic temperature and moisture regime combined with these soil types means that there is well distributed rainfall, common of humid climates. Geology within this region includes Ordovician dolomite, Ordovician sandstone, Mississippian limestone, glades of Ordovician limestone or dolomite, scattered exposures of Precambrian igneous rocks, Pennsylvanian shales and clays, Precambrian granite, rhyolite, and intermediate rocks, and Cambrian dolomites and sandstones in basins. Karst features can be found throughout the limestone rich region.

2.10 Jurisdictions and Demographics

The areas to be serviced by the proposed WFI-B UMBI are comprised of 48 counties spread throughout eastern Missouri. In general, many of these areas are comprised of smaller, rural farming communities, with larger urban areas existing as you approach the St. Louis Metro area. Based on United States Census Bureau - *Annual Estimates of the Resident Population: April 2020 – July 2021*, Counties within the UMBI support anywhere from approximately 3,744 (Knox County) to 1,004,125 residents (St. Louis County).

It is important to note that only 6 of these counties contain greater than 100,000 residents. The remaining 42 counties, many of which are comprised of rural farming communities, contain less than 81,000 residents. Noteworthy municipalities within the WFI-B UMBI service areas include St. Louis, St. Charles, St. Peters, Chesterfield, Washington, Rolla, Salem, Fredericktown, Cape Girardeau, Jefferson City, Fulton, Troy, Columbia, Boonville, Mexico, Bowling Green, Moberly, Hannibal, Kirksville, and Memphis.

2.11 Climate

All five service areas proposed within the WFI-B UMBI are contained within the State of Missouri, which lies midway between the Continental Divide and the Atlantic Ocean, while the State's southeastern tip is approximately 400 miles north of the Gulf of Mexico. Missouri's climate is typically continental with cold winters, warm summers, and frequent short fluctuations in temperature, humidity, cloudiness, and wind direction. Overall, the climate within each watershed is not drastically different. Per the State Climatologist Office, the climate of Missouri is known to have five unique features:

- Four distinct seasons, each with different conditions;
- Minor north-south temperature contrasts;
- An extremely wide variety of types and amounts of precipitation with moderate variations between monthly and seasonal average values;
- Extreme variability of weather conditions in different parts of the state and, certainly, between years; and
- A large number of storms during all seasons.

2.12 Overall Water Quality of the Missouri UMBI Program Area

The overall water quality of the Eastern Missouri watershed is in degraded condition with some fair quality waters as well. Many waters have been impacted by lead, cadmium, zinc, and coal mining activities in general. The Missouri Department of Natural Resources (MDNR) 2020 Missouri Integrated Water Quality

Report - 305(b) listed waters requiring an individual Section 401 Water Quality Certification (WQC) located within the Eastern Missouri UMBI service area are included in Table 2.2 below (MDNR, 2020 305 (b) list and map). This is not a static report or list of streams as waterbodies can be listed and delisted as water quality improves or degrades, therefore the report is subject to change with updates every two years. These watersheds could specifically and potentially be key concentration areas for water quality improvement through mitigation bank projects in the UMBI region.

Table 2.2 - MDNR 305 (b) Waters Requiring Individual 401 WQC - Missouri UMBI

County	Water Name	Miles	Cause	Source
St. Charles	Peruque Creek	0.3	Unknown	Lake St. Louis Dam
St. Louis	Meramec River	22.8	Lead	Old lead belt tailings
Jefferson	Mississippi River	0.2	Lead	Herculaneum smelter
			Zinc	
Jefferson/St. Francois	Big River	52+	Lead	Old lead belt tailings and mill tailings
			Cadmium	
			Zinc	
			Sedimentation	
St. Francois	Eaton Branch	1.2	Lead	Leadwood tailing pond
			Cadmium	
			Zinc	
	Flat River Creek	4.7	Lead	Old lead belt tailings
			Sedimentation	
	Koen Creek	1.0	Lead	Mine tailings
	Shaw Branch	1.2	Lead	Federal tailings pond
	Turkey Creek	6.1	Lead	Bonne Terre chat pile
			Cadmium	
			Zinc	
Washington	Courtois Creek	2.6	Lead	Doe Run lead mine
	Indian Creek	1.9	Lead	Doe Run lead mine
			Zinc	
	Pond Creek	1.0	Zinc	Mill tailings
			Sedimentation	Barite tailings pond
	Salt Pine Creek	1.2	Lead	Barite tailings pond
			Zinc	
	Shibboleth Branch	1.0	Lead	Mill tailings
			Zinc	

Table 2.2 - MDNR 305 (b) Waters Requiring Individual 401 WQC - Missouri UMBI (continued)

County	Water Name	Miles	Cause	Source
Washington	Tributary to Old Mines Creek	1.5	Sedimentation	Barite tailings pond
			Lead	
			Zinc	
Madison	L. St. Francis River	24.2	Lead	Catherine Lead Mine, pos. Mine La Motte
	Village Creek	1.9	Sedimentation	Mine La Motte tailings area
Iron	Big Creek	1.8	Cadmium	Glover smelter
Crawford	Crooked Creek	3.5	Lead	Buick Lead smelter
			Cadmium	
Phelps	L. Beaver Creek	3.5	Sedimentation	Smith Sand and Gravel
Reynolds	Logan Creek	6.1	Lead	Sweetwater Lead Mine/Mill
	W. Fork Black River	2.1	Lead	West Fork Lead Mine/Mill
			Nickle	
Boone	Hinkson Creek	7.6	Unknown	Urban runoff/Storm sewers
		6.8		
Shelby/Marion	S. Fabius River	4.2	Fish Bioassess.	Channelization
Knox/Lewis/Marion	Troublesome Creek	41.3	Sedimentation	Habitat Modification
Schuyler/Marion Lewis/Scotland	N. Fabius River	92	Habitat Assessment	Channelization

There are streams within the UMBI program area with great water quality. Streams listed by the MDNR as Outstanding State Resource Waters include Big Sugar Creek, a tributary to Cuivre River (Cuivre/Salt EDU), Whetstone Creek a tributary to the Loutre River, Gans Creek and Devils Ice Box Cave Branch tributaries to Little Bonne Femme Creek (Moreau/Loutre EDU), Courtois Creek, Huzzah Creek, Blue Springs Creek, and the Meramec River (Meramec EDU), Coonville Creek a tributary to the Big river, Pickle Creek a tributary to River aux Vases (Apple/Joachim EDU), and Big Creek a tributary to the St. Francis River (Upper St. Francis/Castor EDU).

2.13 UMBI Watershed – Short-Term and Long-Term Off-site Threats

Westward expansion continues to migrate away from major metropolitan areas such as St. Louis, and cities such as Columbia, Jefferson City, Cape Girardeau and their surrounding counties. With this continued development, additional wastewater, stormwater, urban contaminants, coal and metal mining by-products, will continue to pollute not only the developed areas of the UMBI watershed, but new pollutants will be introduced into watersheds that previously have not seen these impacts to green habitat and wildlife areas before. Typically, rural communities do not typically have the planning departments already set up with

environmental staff to help properly plan riparian corridor and wetland/natural area setbacks. Additionally, with climate change happening at an exponential rate, the continued removal of steams corridors and wetland buffers will likely increase the destruction incurred by 500-year flood events such as we have seen within the Midwest region in the summer of 2022. These types of rain and flood events are predicted to become normal in the coming decade. Well thought out suburban and urban planning and designs across communities within the UBMI Program Service Area will be needed in the short and long term.

2.14 UMBI Watershed - Immediate and Long-term Needs of Wildlife Habitat and Water Quality

Water quality issues overall can be complex and can require solutions from a state and federal approach such as recommending and enforcing Total Maximum Daily Load (TMDL) limits on waterbodies for pollution. Pollutant impacts to aquatic organisms can take more time and money to solve due to the studies and testing that can be required. Some of the physical issues caused by riparian corridor removal, stream bank erosion, and sedimentation of downstream waters can be solved through the construction and utilization of stream and wetland mitigation bank projects. These types of projects can impact quite quickly wildlife habitat, erosion, and sedimentation issues within a watershed. Additionally, in the long-term, mitigation projects can help to offset the impacts described previously due to climate change within the UMBI Watershed.

There is a unique opportunity now for mitigation banks to consider not only constructing bank sites within rural agricultural landscapes, in order to address nutrient pollution, erosion and sedimentation, but to begin pushing for urban watershed stream and wetland mitigation projects to help off-set the flooding damage that is predicted to increase in coming years. Urban riparian restoration in the form of concrete channel removal, reintroducing stream channels to their floodplains, and acquiring stream buffers in urban areas to create floodplain wetlands, could be a piece of the solution to climate change threats. These reintroduced ecosystems will provide wildlife habitat, and also help pre-treat polluted urban stormwater, as it heads downstream from headwaters within the UMBI Service Area, and eventually into the Mississippi River.

3.0 CULTURAL RESOURCES AND THE WATERSHED

The following sections detail the cultural resource history, from the Prehistoric age through the 20th century, of the UMBI Service Areas.

3.1 Prehistoric Overview

Archaeologists have developed a broad chronological and cultural classificatory scheme with which to organize and describe the prehistory of the Midwestern United States, which includes the project service area. The regionally applicable cultural sequence developed thus far for Missouri is subdivided into the following 11 periods beginning with the oldest: Early Man (?-12,000 B.C.), Paleo-Indian (12,000-8,000 B.C.), Dalton (8,000-7,000 B.C.), Early Archaic (7,000-5,000 B.C.), Middle Archaic (5,000-3,000 B.C.), Late Archaic (3,000-1,000 B.C.), Early Woodland (1,000-500 B.C.), Middle Woodland (500 B.C.-A.D. 400), Late Woodland (A.D. 400-900), Early Mississippian (A.D. 900-1450), and Late Mississippian (A.D. 1450-1650) (Chapman 1975, 1980; O'Brien and Wood 1998). These periods represent culturally unique segments of over 14,000 years of human adaptation to an ever-changing environment. This sequence has developed out of decades of archaeological research in Missouri and the Midwest, and it forms a framework that is useful for organizing and interpreting new archaeological data. In general, the prehistoric cultural sequence reflects a trend toward increasing socio-cultural and technological elaboration over time. The earliest stages are characterized by egalitarian hunting and gathering band-level societies, but by the end of prehistory complex hierarchically organized societies with an agricultural economic base had developed in some parts of Missouri. The prehistoric periods are used as historic contexts in the *Master Plan for Archaeological Resource Protection in Missouri* (Weston and Weichman 1987).

As Chapman (1975, 1980) and O'Brien and Wood (1998) have emphasized, prehistoric cultural developments in some regions of Missouri appear to differ somewhat from those characteristics of the Midwest as a whole. Also, because of the lack of adequate data some prehistoric periods are not well known. This is particularly so for the period immediately preceding the arrival of the first Europeans. This was apparently a time of transition and reorganization as shifting populations were re-adapting in the wake of the Mississippian cultural decline. Thus, over much of the Midwest it is difficult to align prehistorically identified cultures with the tribal groups described by the first Europeans to arrive in the region.

3.2 Early Man Period

The Early Man period or Pre-Clovis (?-12,000 B.C.) comprises the span of time during which the New World was first populated. The length of this period and the nature of the remains associated with it are still controversial although some sites, such as Meadowcroft Rockshelter (Adovasio 1990) have been put forward as representative of this period. The criteria for recognizing sites dating to this stage remain

uncertain - associations between extinct fauna and crude stone industries have been suggested (Krieger 1964). Because of the skepticism with which the archaeological profession views claims for early finds, it is likely that the only acceptable evidence would be found in deeply buried contexts in stratified sites.

3.3 Paleoindian Period

Paleoindian period sites (circa. 12,000-8,000 B.C) are recognized by the presence of fluted projectile points of the Clovis or Folsom types. The Paleoindian period is well documented in portions of the United States, especially in the Great Plains region, but evidence for Paleoindian occupation in Eastern Missouri is still meager. Largely by analogy with the Great Plains data, Midwestern Paleoindians are thought to have organized themselves into small, highly mobile bands and to have subsisted by hunting big game animals, including extinct Pleistocene megafauna, but very few sites that are sufficiently intact to permit the testing of these ideas have been found in eastern North America (Chapman 1975). The tool kit of this period is most often characterized by fluted projectile points (such as Clovis and Folsom), end scrapers, side scrapers, burins, drills, and beveled flake tools associated with bone and hide working. Clovis sites are ordinarily found on well-drained landforms like high terraces and bluff tops. Such prominent locations on the landscape would allow these early groups to watch not only the movements of herds but also other groups of people (Koldehoff and Walthall 2000).

Two noteworthy Paleoindian sites have been reported in east central Missouri. A rare but important Paleoindian kill site, Mastodon State Park (Kimmswick site) in Jefferson County, Missouri, has provided a great deal of information on these early hunters in the region. At Kimmswick, in situ deposits containing late Pleistocene megafauna have been found in direct association with cultural material dating to the Paleoindian Period (Adams 1953; Graham 1982). Not only has Kimmswick provided us with important information on the inhabitants of the Midwest at the end of the Pleistocene, but also much needed data on the vegetation and faunal species present at the time, allowing for refinements of the environmental reconstruction for the late Pleistocene (Koldehoff and Walthall 2000). Another important Paleoindian site is Martens site in Chesterfield, Missouri. A study of 2 acres of this large camp site produced approximately 5,000 stone artifacts from surface as well as subsurface archaeological investigations. Use-wear analysis of some of the artifacts indicates that blades and flakes were used to scrape, cut, incise/engrave, plane, perforate and wedge. Likely activities include not only cutting and butchering meat and working fresh hides but also working medium to hard materials such as wood, ivory, antler, and bone (Morrow 2000; Morrow and Morrow 1999).

3.4 Dalton Period

The Dalton Period (circa. 8,000-7,000 B.C.) spans the beginning of the Holocene, a time of climatic amelioration, and it is transitional between the Paleo-Indian and Archaic periods with respect to subsistence patterns and technology. A serrated, lanceolate projectile point/knife form with a deep, unfluted concave base called the "Dalton point" is diagnostic of this period (Chapman 1975:95-97). Several sites in Missouri, including Graham Cave, Arnold Research Cave and Rodgers Shelter, contain substantial evidence of Dalton period occupations. These occupations have been interpreted as the remains of short-term campsites made by small bands (Chapman 1975:96). Analysis of faunal and floral remains recovered from the Dalton level at Rodgers Shelter indicated an economic emphasis on hunting modern fauna, primarily white-tailed deer, raccoons, and small mammals, and the gathering of wild plant foods, primarily hickory nuts and black walnuts (McMillan 1976). Kay (1982:569) suggested that the Dalton component at Rogers Shelter consisted of the remains of a series of briefly occupied autumn camps.

3.5 Early Archaic Period

With the Early Archaic period (circa. 7,000-5,000 B.C.), trends toward the exploitation of a greater variety of plant and animal species occur, and sites tend to become larger, suggesting an increase in the size of social units (Chapman 1975:127). At Rodgers Shelter, a trend toward increased exploitation of prairie fauna is observed in collections from Early Archaic deposits. It has been argued that prairies were expanding at the expense of woodlands at this time, compelling substantial changes in prehistoric subsistence and settlement patterns (McMillan 1971, 1976; O'Brien and Wood 1998:101-108). Early Archaic people continued to live in small, mobile bands. Early Archaic camp sites tend to be small and shallow. Consequently, they are vulnerable to disturbance except when they are buried in floodplain or rockshelter deposits. Archaic people are thought to have exploited food plants to a greater extent than the Paleoindians or Dalton people and several plant processing tools were added to the Archaic tool kits. This idea is implied by Chapman's (1975:127-130) characterization of the Archaic as the "Forager Tradition."

In addition to unfluted lanceolate projectile points, such as Rice Lanceolate or Searcy points, several stemmed and notched projectile point forms appear in Missouri during the Early Archaic period. These new forms include Hidden Valley Stemmed, Graham Cave Notched, Cache River Side-Notched, and Rice Lobed projectile points (Chapman 1975:127-157; O'Brien and Wood 1998). Early Archaic points frequently have beveled or serrated edges as a result of resharpening (Ray et al. 2009:173). Other artifacts included flake scrapers, preforms, choppers, trianguloid adzes, pebble choppers, and pitted anvilstones (Chapman 1975:129).

3.6 Middle Archaic Period

The trend toward a diverse subsistence base that was evident in the Early Archaic period continued into the Middle Archaic period (circa. 5,000-3,000 B.C.). Environmental data from Rodgers Shelter and other stratified mid-Holocene sites indicate that this was a dry period during which the prairies reached their maximum extent. At Rodgers Shelter, the drier conditions are reflected in the increased exploitation of rabbits and other small game. However, mussels also begin to be used. In contrast to the Early Archaic horizons, the Middle Archaic occupations at Rodgers Shelter seem to be of brief duration. Characteristic Middle Archaic projectile points include several side-notched forms, such as Big Sandy Notched, Raddatz or White River points, basally notched Calf Creek points, and Jakie Stemmed, a form that persisted from the late Early Archaic period. Middle Archaic points were resharpened bifacially and rarely display beveled or serrated edges. However, heat treatment to improve knappability becomes common at this time (Ray et al. 2009:173). Full-grooved ground-stone axes also appear in the archaeological record during this period (Chapman 1975:155-159; O'Brien and Wood 1998).

3.7 Late Archaic Period

In many areas of the Midwest, the Late Archaic period (circa. 3,000-1,000 B.C.) is marked by a noticeable increase in population size and innovations in subsistence and technology which anticipated later developments. At Rodgers Shelter, the Late Archaic levels show greater exploitation of Woodland fauna, especially deer, and aquatic fauna such as mussels and turtles. These finds suggest that the climate was becoming wetter (McMillan 1971, 1976). The Late Archaic horizon at Rodgers Shelter contained three human burials, but few other features (Kay 1982). In several parts of eastern North America, the remains of tropical cultigens have been found in Late Archaic deposits, providing important evidence concerning the origins of agriculture in the region. One site in southwestern Missouri, the Phillips Spring site in the Truman Reservoir, has yielded this type of evidence. Here squash and gourd remains were recovered from Late Archaic deposits dating to the third millennium B.C. (Chomko 1978; Kay et a1. 1980). Possibly in connection with the increased importance of plant foods in the economy, stone grinding, pulping, and digging tools become more common in Late Archaic assemblages. Also, a few burial mounds have been associated with the Late Archaic occupants of the region (O'Brien and Wood 1998:162-163; Wood 1961:48-51).

The Late Archaic period is marked by a further expansion of the lithic tool kit and several new stemmed, corner-notched, and shallow side-notched point styles are introduced. Common Late Archaic projectile point forms in southwestern Missouri include Smith Basal Notched, Afton Corner Notched, Table Rock Stemmed, Stone Square Stemmed, Etley Stemmed, and Sedalia Lanceolate. A series of distinctive

ground-stone tools, including three-quarter-grooved axes, bannerstones, and plummets, also appear during Late Archaic times (Chapman 1975:184-201). Two distinctive chipped stone tools, the triangular, unifacial Clear Fork gouge and the rectangular, bifacial Sedalia Digger, also may reflect the increased importance of plant processing. Chapman (1975:184) interpreted the latter artifacts as digging tools and suggested that the Clear Fork Gouges were used for scraping, pulping, or woodworking.

3.8 The Woodland Period

The Woodland period (circa 1,000 B.C. - A.D. 900) is marked by several important technological and social changes, including the beginnings of pottery manufacture and the construction of burial mounds. In some parts of the Midwest, populous sedentary, hierarchically organized societies developed during the Woodland period. The Woodland period is conventionally divided into three sub-periods, the Early Woodland period (1,000-500 B.C.), the Middle Woodland period (500 B.C.-A.D. 400), and the Late Woodland period (A.D. 400-900) (Chapman 1980:1-6; O'Brien and Wood 1998:168-169).

3.9 Early Woodland

Early Woodland sites are generally recognized by crude, thick, grit-tempered pottery sherds which are often fabric-marked or cordmarked and sometimes have incised or punctuated decorations on them. Projectile points are large straight- or contracting-stemmed forms, including Gary Stemmed, Langtry Stemmed, and Kramer points. However, these point styles may have been used before and after the Early Woodland period (Chapman 1980:9-20).

3.10 Middle Woodland

The same stemmed projectile point styles that occur on Early Woodland period sites persist into the Middle Woodland period (500 B.C. - A.D. 400). Other common Middle Woodland projectile point forms are Snyders Corner Notched and Steuben Expanded Stemmed (Chapman 1980:32). The most substantial Middle Woodland sites in western Missouri, called Kansas City Hopewell, occur along the Missouri River in the vicinity of Kansas City (Chapman 1980:27-38; O'Brien and Wood 1998:192-193). A second concentration in Middle Woodland sites, called the Big Bend Center, is present along the Missouri River near the mouth of the Chariton River in central Missouri (Chapman 1980:38-47 O'Brien and Wood 1998:193-196). Middle Woodland sites in Lower Missouri River drainage are believed to be related to the Havana Tradition of the Missouri River valley (Chapman 1980:47-61). Middle Woodland pottery in Missouri is thinner and harder than Early Woodland pottery and is frequently decorated by means of dentate stamping, incising, punctations, or bossing (Chapman 1980; O'Brien and Wood 1998:187-192).

3.11 Late Woodland

The Late Woodland period (A.D. 400-900) is often characterized as a period of cultural regression, but developments occurred during this period that reflect precursors of features of the more flamboyant Mississippian cultures which followed. Late Woodland pottery lacks the elaborate decorative features of Middle Woodland pottery, but it tends to be thinner and better fired. Small projectile points such as Scallorn Corner Notched and Mississippi Triangular appear during the Late Woodland period and are common at sites dating later than A.D. 650. They are thought to be associated with the introduction of the bow and arrow. In parts of the Midwest, maize agriculture becomes important during the Late Woodland period (Ahler et al. 2010: 224-225; Chapman 1980: 78; O'Brien and Wood 1998:123-124). Also, in many parts of Missouri Late Woodland sites are larger and more numerous than sites associated with the Early and Middle Woodland periods, suggesting an increasing population (O'Brien and Wood 1998:224).

3.12 Mississippian Period

The Mississippian period (A.D. 900-1650), in some parts of the Midwest, is characterized by large villages of sedentary agriculturalists. Often, these villages were fortified and might contain pyramidal mounds that were used for ceremonial purposes or were occupied by members of the elite. In the Mississippi River Valley, Mississippian period houses were usually of wattle and daub construction and were set on wall trench foundations. Mississippian ceramics are usually tempered with crushed shell and are much more elaborate than Woodland pottery. A variety of vessel forms and decorative styles were used. Triangular or notched arrow points, such as Cahokia Notched, Huffaker Notched, and Madison Triangular, are commonly found at Mississippian sites. In Missouri, ceramic variation is used to divide the Mississippian period into an early subperiod (A.D. 900-1450) and a late subperiod (A.D. 1450-1650) (Chapman 1980:138-261). A major concentration of Mississippian mound centers and smaller habitation sites occurred in the Mississippi River valley in the vicinity of St. Louis. Some satellite Mississippian settlements also have been reported in the lower Missouri River valley to the north and west of St. Louis (Chapman 1980).

3.13 Historic Overview

When the French made their first penetrations into what is now the state of Missouri in the late 17th century 2 Native American tribes, the Missouri and the Osage, were residents of the state. The southwestern part of the state was controlled and occupied by the Osage tribe. The early French accounts indicate that the main permanent Osage villages were located along the Osage River and near the confluence of the Little Osage and the Marmiton rivers in Vernon County, Missouri. Apparently, the western Ozarks were used as hunting territory. The first recorded visit to the Osage villages was by Du Tisne in 1719, but it is likely that

there were earlier, unrecorded visits. About this time, the Osage split, and the Little Osage band moved to a site on the Missouri River near the major village of the Missouri tribe in Saline County. During the 18th century, the Osage developed an alliance with the French and became involved with the fur trade (Mathews 1961). Several 18th and early 19th century Osage villages have been excavated and all produced large quantities of European trade goods (Bray 1978; Chapman and Chapman 1964:94-99; O'Brien and Wood 1998:356).

The French claimed Missouri as part of the Colony of Louisiana and their earliest settlements were along the Mississippi River at Kaskaskia, St. Genevieve, and St. Louis. French settlement in western Missouri was limited to a few small forts and trading posts along the Missouri River. The most notable of these was Fort Orleans, a post that the trader Bourgmont established in 1723 near the villages of the Missouri and Little Osage. However, this post was abandoned in 1728 (Bray 1978:12-16). After its defeat in the French and Indian War and the loss of Canada in 1763, France ceded Louisiana to Spain. The Spanish maintained the settlement at St. Louis, but they made little effort to establish settlements elsewhere in Missouri (Mathews 1961).

During the 18th century and early 19th century, eastern Indian tribes, including the Cherokee, Kickapoo, Fox, Sac, Delaware, Shawnee and Potawatomi, moved into the traditional hunting grounds of the Osage as they were pushed westward by intertribal conflicts and the expanding American frontier. The Delaware and Shawnee were brought into the state by the Spanish governors to make war on the Osage. The Kickapoo were granted a reservation that included the Osage and Pomme de Terre drainages and they had a large village near the modern city of Springfield. The Delaware Reservation included the southwestern corner of the state, and they had a village on the James Fork of the White River. The Shawnee Reservation was east of the Delaware. These tribes were moved from their Missouri reservations between 1829 and 1832 (Chapman and Chapman 1964:112-117; Mathews 1961).

In 1803, the United States acquired Missouri and the surrounding region as part of the Louisiana Purchase. Subsequently, the pace of settlement accelerated, but initially American settlers tended to concentrate in the larger river valleys. Missouri joined the union as a slave state in 1821. Western Missouri was ceded by the Osages to the United States under the terms of two treaties signed in 1808 and 1825 (Mathews 1961). After the Kickapoo, Delaware and Shawnee reservations were moved westward, all of Missouri was opened for Euro-American settlement.

Many of the early 19th century settlers in Missouri were immigrants from the southern Appalachian highlands in the states of Kentucky, Tennessee, Virginia and North Carolina. Many of these people were of Scotch-Irish decent; a Scottish cultural group that immigrated to the eastern United States from Northern Ireland during the 18th century. From the southern Appalachians, upland southerners migrated westward along the Ohio, Cumberland and Tennessee rivers. They brought with them economic and cultural patterns from the southern highlands that were readily adapted to the Ozark environment. The Upland South cultural tradition has been characterized as including a reliance on diversified farming with corn and hogs being the major products; a wood-oriented technology; dispersed, kin-based settlement patterns with the family as the main cooperative economic unit; an oligarchic political system centered on the county court; and a stratified social system with slaves as the lowest class (Mason 1984; Smith and Edging 2005).

The first arrivals, the vanguard of the American frontier, have been characterized as "hunter-squatters." They were mobile and often didn't bother with the formality of acquiring land titles. They lived in primitive log cabins or lean-tos and obtained much of their food by hunting and collecting wild foods. Their agriculture was limited to small plots of corn and a few pigs, which were allowed to forage in the forests. Occasionally, they would travel to commercial centers and trade deer skins, wild honey and beeswax for manufactured goods. Following the squatters were the subsistence farmers. Frequently, early settlers selected land near springs. They cleared land and planted a greater variety of crops but continued to live in log cabins. Corn and hogs were the major products and sometimes hogs were brought to market. Livestock were now kept in pens or fenced areas. Many upland Ozark farmers continued to operate at the subsistence level into the early 20th century. Larger farms, sometimes employing slave labor, were established along the major rivers within the state prior to the Civil War. These farms produced cash crops and were integrated into the national economy (Rafferty 1980; Smith and Edging 2005).

3.14 Service Areas and Cultural Resources

The overall service areas represent major drainage basins that empty into the Mississippi River. These basins and their confluences represent some of the richest archaeological areas in the United States. Many of the sites mentioned in the above discussion are to be found in one of the subject drainage basins. This, coupled with the fact that only a small portion of each of these basins have been subjected to archaeological investigations, would indicate that there is a high potential for prehistoric and historic archaeological resources within each of these drainages that are yet to be discovered. This potential exists from the mouth of these waterways to their headwaters and covers the entire drainage basin. Therefore, based on what has been found in the past and given the high potential for the presence of numerous

significant archaeological sites, it should be anticipated that any proposed actions within these drainage basins would need to be preceded by cultural resource investigations as per the National Historic Preservation Act of 1966, as amended, via compliance with the Section 106 process.

4.0 UMBREALLA MITIGATION BANK PLAN

Aquatic ecosystems such as streams, rivers, lakes, and wetlands interact because of their ability to transfer material and energy, and through their ability to adjust the inputs and outputs of these materials. A key element of these interactions is connectivity, which describes the degree to which components of a river system are joined, by various transport mechanisms (USEPA, 2015). Connectivity of river systems - hydrological, chemical, and biological - is determined by characteristics of the physical landscape, climate, and the biota, as well as human impacts. To design the WFI-B UMBI in a manner in which it maximizes connectivity throughout its footprint, existing watersheds were further analyzed and grouped accordingly.

The following sections outline the Goals and Objections, Site Selection, Site Protection Instrument, Baseline Information, Determination of Credits, Mitigation Work Plan, Operation and Maintenance Plan, Ecological Performance Standards, Monitoring Requirements, Long-term Management Plan, Adaptive Management Plan, and Financial Assurances.

4.1 Goals and Objectives

The objective of the Umbrella Mitigation Bank program is to satisfy the compensatory mitigation required for projects receiving DA permits issued by the USACE pursuant to Section 404 of the Clean Water Act (33 USC 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403). The development, implementation, and operation of the WFI-B UMBI and its associated Bank Sites are intended to accomplish the following goals and objectives:

1. Support the national goal of “no net loss” of wetlands and improving stream quality through restoration activities, by providing wetland and stream mitigation Bank Sites and credit options in Eastern Missouri;

2. Consolidate resources in order to increase the potential for the establishment, permanent protection and long-term management of successful mitigation that maximizes opportunities for contributing to biodiversity and/or watershed function;

3. Contribute to watershed function through appropriate determination of the Bank Site geographic service area (generally hydrologically based on watershed basin);

4. Reduce permit processing times and provide more cost-effective compensatory mitigation opportunities for those projects which qualify;

5. Increase review and compliance monitoring efficiency and, thus, improve the reliability of efforts to restore, create, or enhance wetland areas for mitigation purposes;

6. Identify sites with an aquatic resource base, some significant portion of which is degraded and restorable to a properly functioning condition;

7. Select and prioritize sites based on review of hydrologic function, water rights, position within the landscape and watershed, and ownership structure;

8. Establish permanent protection for the created, restored and enhanced aquatic resources of the Bank Sites;

9. Establish an appropriate coverage area for the WFI-B UMBI, as well as appropriate geographic boundaries within which each Bank Site may operate in terms of crediting and debiting; and

10. Establish sites within each EDU-Service Area, where reasonably possible, as market conditions warrant.

4.2 Bank Site Selection

This section will provide a description of the factors that will be considered during the site selection process. WFI-B compensatory mitigation projects will utilize a Missouri EDU approach to be appropriately site and design banks in an effort to provide a site with natural hydrology and landscape position that will support long-term sustainability and function as a self-sustaining system. The Bank Sites will be designed to be ecologically suitable by providing the desired aquatic resource functions and by describing their specific attributes, which may include the following:

1. The size and the location of the Bank Sites relative to hydrologic sources and other ecological features. WFI-B understands that climate change has the potential to impact the reliability of sources of hydrology, so this will be considered for the long-term success of each bank site.

2. The watershed-scale features such as aquatic habitat diversity, habitat connectivity, the existence of threatened or endangered species related to prior habitat loss, and other landscape scale functions.

3. The hydrological conditions, soil properties, native seed source, and other physical and chemical characteristics.

4. The compatibility with adjacent land uses and any existing watershed management plans.

5. The reasonably foreseeable effects the compensatory mitigation project will have on ecologically important aquatic or terrestrial resources, cultural resources, or habitat for federally or state listed threatened and endangered species.

6. Other information as available including potential chemical contamination, impacts from land use changes including residential and/or commercial development within the watershed, and the proximity to the location of other mitigation banks, in-lieu fee mitigation project sites, protected conservation areas within the watershed, or utilizing publicly available LIDAR imagery for detailed, high resolution topography maps as a tool to assist in stream and wetland mapping and understanding proposed design plans.

7. A table outlining Existing Conditions and Proposed Conditions

8. Bank site selection will include analyzing critical watershed conditions or characteristics that could influence the success of proposed project goals and objectives. Items that could be considered include.
   - Are there any non-point source pollution or nutrient inputs?
   - Is the area experiencing excessive flooding or drought?
   - Is the area experiencing a boom in development which could add exponential impervious surface, and thereby potentially increasing the chances for flooding?
   - Are there large areas of mining for minerals or aggregate which may impact a successful project?
   - Are soils incapable of supporting hydrology and hydrophytic vegetation for developing wetlands?
   - Sites that have degradation issues that cannot be improved successfully will be abandoned.

4.3 Site Protection Instrument

The following sections summarize the ownership and legal arrangements that will be used to provide long-term protection of the proposed Bank Sites.

1. For long-term protection of non-government property other than transfer of title, the use of conservation easements and/or deed restrictions are deemed sufficient site protection measures. WFI-B will strive to utilize the standard District conservation easement and establish an appropriate third party (government or non-profit resource management agency) the right to enforce site protections and provide the third party the resources necessary to monitor and enforce the site protections.

2. The long-term protection mechanism must contain a provision requiring 60-day advance notification to the district engineer before any action is taken to void or modify the instrument, management plan, or long-term protection mechanism, including transfer of title to, or establishment of any other legal claims over, the compensatory mitigation bank site.

3. For government property, long-term protection may be provided through federal facility management plans or integrated natural resources management plans as long as those plans are compatible with restrictive covenants specified on nongovernment property.

4. Each site will generate a Title Report and overview of all ownership rights and easements.
   - This will include restricted and prohibited activities as well as property rights to be reserved by the landowner, such as hunting, fishing, trapping, and passive recreation.

4.4 Baseline Information

This section of the WFI-B UMBI describes the current conditions of the proposed Bank Site and the characteristics that the design team deems as highly qualified for wetland and stream restoration.

1. **Bank Site:** This section discusses the existing conditions of the Bank Site (hydrology, soil characteristics, and hydrophytic vegetation). This section will also include a delineation of the proposed BS, using the 1987 USACE Wetland Delineation Manual and Midwest and Eastern Mountains and Piedmont Supplements. The BS report will describe the existing conditions and the bank sponsor will provide the following analysis, information and maps/figures as required:
    - Hydrologic conditions of the site;
    - Soil Classifications and soil maps of the site;
    - Analysis of vegetation within the mitigation site from observations during the wetland and waterbody delineation, which will catalog existing vegetation of uplands and wetlands and will be included in the text of the wetland and waterbody delineation report;
    - Boundary of proposed mitigation bank;
    - Review of readily-available historic aerial photos, historic U.S. Geological Survey (USGS) topographic maps, and USGS or state/local level land use maps;
    - BS location to include county, township and range and latitude and longitude points;
    - Wetland Determination of the site to identify soils, hydrology and vegetation and any wetlands existing within its boundaries;
    - A hydrograph will be generated for each site based on local gage data or gage data extrapolated from a similar watershed (USGS) if practical to generate;
    - *Stream Stabilization I&E Forms – Missouri NRCS – Version 3.4 modified 3/2010 (R. Book)* will be developed for each site and include drainage area, width-depth ratio, entrenchment ratio, USGS Flood Peak Discharges, and Bank Full Velocity Check;
    - Ratio comparing Top Bank Capacity (CFS) to Bank Full Flow (CFS) will be provided;
    - A bank-height ratio will be provided;
    - *Habitat Assessment Field Data Sheets – Low/High Gradient Streams* will be generated for each site (sinuosity, buffer width, etc.);
    - A USFWS IPaC review will be completed for each proposed bank site location to determine if any potential federally protected species or critical habitats are collocated with the bank site. This not only could show a habitat uplift on the bank site, but could also streamline agency consultation needs which may arise; and
    - Watershed scale maps showing the locations of nearby named aquatic features (streams/wetlands/lakes), private and public conservation lands, and Federal Emergency Management Agency (FEMA) regulatory floodways.

The cumulative baseline information, as provided above, will be utilized in development of the design plan for each proposed mitigation bank site. The Sponsor recognizes that hydrology is a significant component of a mitigation bank site and the existence of hydric soils, and a hydrograph will provide a frequency of over bank events that will drive hydrologic indicators for each site. Additionally, some of the baseline information will be utilized when determining if bank performance standards are being met following construction and approval. Specific stream performance standards beyond what are proposed in this document may be developed on a site-by-site basis as bank sites are proposed.

2. **Reference Site:** This section is needed to identify an area near the proposed mitigation site that is similar in wetland and/or stream characteristics to predict the future conditions of the site. This reference site needs to have similar hydrology, soil characteristics, and hydric vegetation. A reference site can be used to aid in the design of restored stream reaches. For stream restoration, WFI-B would utilize a reference reach that allows for a design that would mimic the native composition, density, and structure of a fully functional stream located within the same watershed. The reference reach (if available and applicable) should be the same Rosgen stream type as the intended design, stable for two meander wavelengths (20 bankfull widths), and should have similar valley slope, and sediment regime as the design reach.

3. **Rapid Impact Assessment Method (RIAM):** This assessment method will be utilized on all BS locations and as a standard tool in the evaluation of the BS. The RIAM is used to determine how well the bank site is functioning before and after the mitigation bank is built and provide an ecological lift rating.

4. **Archaeological Phase 1 Survey:** The BS will receive an overview by the Bank Sponsor in coordination with the IRT as to requirements for an Archaeological Phase 1 Survey, however, at this time unless unusual circumstances arise, all BS will receive a Phase 1 Survey. The survey will provide an overview of cultural resources within the BS project area and serve as a coordination point for the project permit with the State Historic Preservation Office.

5. **Environmental Site Assessment:** Every BS will receive an Environmental Site Assessment (ESA) report. This report will identify at a macro level any expected environmental issues that might be identified with the BS.

4.5 Determination of Credits

This section provides an overview of the types of credits that are to be provided at each Bank Site with a brief description for the determination of the wetland type. Wetland credit types need to be identified to the *Cowardin class* and, in the absence of a functional assessment method, determined based on a combination of land area and method of compensation. In determining wetland credits, the *Missouri Wetland Mitigation Method (MWMM)* will be utilized (USACE, 2017). Streams credits will be determined using the *Missouri Stream Mitigation Method (MSMM)* (USACE, 2013). In addition, the sponsor will utilize the most current USACE St. Louis District Guidance for determining credit ratios. As a result, the USACE and the IRT will ultimately determine the amount of credit for each specific wetland type.

4.5.1 Wetlands

Wetland credits will be determined by using the current version of the MWMM. According to the MWMM guidance, Compensatory mitigation means compensating for adverse effects by replacing or providing substitute resources or environments. Compensatory mitigation for aquatic areas addressed by this evaluation method includes the following:

- *Establishment* (Creation) means the conversion of non-aquatic habitat to aquatic habitat. Wetland establishment usually includes grading, providing a suitable substrate, hydrology, and establishment of appropriate vegetation.

- *Restoration* means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: re-establishment and rehabilitation.
  (a) *Re-establishment* means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions.
  (b) *Rehabilitation* means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain
- *Enhancement* differs from restoration because the objective of enhancement is usually to improve one or two functions within a wetland, which may result in a decrease in the performance of other functions. Increasing those particular functions does not change the amount of area occupied by the aquatic resource. In contrast, re-establishment and rehabilitation (which are forms of restoration) are intended to return most, if not all, natural and/or historic functions to a former or degraded aquatic resource.

- *Preservation* means the removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in gain of aquatic resource area or functions. (credits are determined on a case-by-case basis)

***Compensation Ratio** – *when the Corps determines that a third-party mitigation source is acceptable to fulfill compensatory mitigation requirements, the total credits determined on this worksheet shall be applied to mitigation banks at a 1:1 ratio when the impact area is within an approved service area. However, an increased compensation ratio may be used at the Corps discretion when an impact occurs beyond the geographic service area of an approved mitigation bank.*

4.5.2 Streams

Stream credits will be determined by using the current version of the MSMM. Stream mitigation credit for each Bank Site is determined by stream type, location, condition, in- stream improvements, and linear feet of stream. These factors are determined using the MSMM which derives a value expressed in credit. Riparian areas located with a Bank Site will have mitigation credits awarded to riparian areas in accordance with the MSMM as well.

4.6 Mitigation Work Plan

A BSP will be developed for each Bank Site identified by the Bank Sponsor (WFI-B). The BS will evaluate and provide stream and wetland design techniques to clearly identify areas, acres, construction features and locations for streams and wetlands within the Bank Site. additional or other measures upon IRT and USACE review and approval" to help account for future mitigation method improvements. The following items will be provided for each BSP:

- Project Description
  - The bank will exist within a specified acreage site; and
  - additional or other measures upon IRT and USACE review and approval
- Existing land use classification
  - i.e. Prior converted cropland, farmed wet, emergent, river channel, and existing wooded wetlands; and
  - additional or other measures upon IRT and USACE review and approval
- Future acreage and restrictions
  - The BSP will outline cumulative acreage and restrictions used to protect the site/property in perpetuity; and
  - additional or other measures upon IRT and USACE review and approval
- Construction timing, sequence, and soil management and erosion control measures
- Maintenance and Condition
  - Outline of maintenance and condition for a minimum of five years in accordance with the Bank Closure Procedures; and
  - additional or other measures upon IRT and USACE review and approval
- Goals for future land classification
  - Forested Wetland;
  - Emergent Wetland;
  - Streambank Riparian Corridor; and
  - additional or other measures upon IRT and USACE review and approval

4.6.1 Forested Wetlands

The BSPs will identify actions to be taken to improve and increase functions of the BS for the establishment of Palustrine Forested (PFO) Wetlands. The actions will include the following items to evaluate, design, and construct PFO wetlands at the BS (list not exhaustive):

- Analysis for unpredictable flooding and a mix of vegetation that can tolerate a wide range of water/hydrologic levels;
- Analysis and steps to be taken for improving hydrology across the site is to re-establish historic hydrology in support of forested restoration;

- Analysis and design of excavation and tillage/fill features that will replicate a natural high bank and associated oxbows of historic wetland environments;

- Analysis and descriptions of tillage techniques to improve hydrology whether increasing or decreasing BS hydroperiod to meet the goals of forested wetlands;

- Location of mounds to allow for flood flowage in and around the forested planting;

- Enhancement techniques to open up existing aquatic/forested habitat such as clearing operation, Timber Stand Improvement (TSI) techniques of thinning, girdling and falling trees and Spraying applications to clean up understory habitats;

- Other features in managing hydrology will consist of removal or modification of agricultural drainage ditches to manage hydrology for wetland forest restoration;

- Analysis of weirs to manage water depth around the site and reduction of velocity will determine material use for these structures (dirt or rock); and

- Support of hydrophytic vegetation throughout the BS.

These actions focus on providing a streamlined approach to reach a Climax Forest status in a shorter timeframe than the typical 180 years (+) normal successional model. The Bank Site Plan will include various construction maps and design features for the project.

4.6.2 Emergent Wetlands

BSP's will identify actions to be taken to improve and increase functions of the Bank Site for establishment of the Palustrine Emergent (PEM) Wetlands. The actions will include the following items to evaluate, design, and construct PEM wetlands at the Bank Site (list not exhaustive):

- Creating historical low area through the management of a drainage channel (rock checks or cleaning of ditches) and the utilization of berm construction;

- Constructing rice levee berm around boundaries that will extend hydrology duration of low areas;

- Restoration of historic meander scars through excavation and placement of material to generate an emergent wetland feature; and

- Utilizing low profile stop log structures for management of emergent areas.

4.6.3 Riparian Corridor

The BSP will identify actions to be taken to improve and increase functions of each Bank Site for establishment of Riparian Corridors and Forested Wetlands. The actions will include the following items to evaluate, design, and construct riparian corridors and forested wetlands at the Bank Site (list not exhaustive):

- Utilizing the MSMM guidance stream bank riparian corridor component will employ bottomland hardwood forest plantings similar to the forested wetland plantings outlined above;
- The use of rice levee plow berms will allow for less flood tolerant species to survive and re-generate at higher elevations;
- The general width of riparian corridors will range from 100 to 175 feet in most locations; and
- In the preservation area the width of the riparian corridor will range from 50 feet to 300 feet.

4.6.4 In-Stream Enhancements

The BSP will identify actions to be taken to improve and increase aquatic functions of the Bank Site. The actions will include the following items to evaluate, design, and construct in-stream features at the Bank Site (list not exhaustive):

- Rock-riffle structures to improve stream quality and physical habitat through the development of pools, riffles, and runs, increased water quality levels and dissolved oxygen, and aid in providing increased stability of eroding streambanks;
- Modification of flow characteristics through the installation of rock riprap instream structures such as bendway weirs, stream barbs, chevrons, and/or J-Hooks to promote scouring of various depth pools and increase the stability of eroding banks;
- Installation of boulder arrangements (3 to 5 bedrock material boulders in a small grouping) to help create, diversify, and improve quality cover habitat for fish species;
- Stabilization of vulnerable and eroding stream banks through the installation of stone-toe protection;
- Tree root wad installation to address aquatic habitat via woody structure at multiple locations; and
- To the extent possible all construction to be implemented from the bank of the river reducing impacts to the existing riparian border.

4.6.5 Mitigation Plan

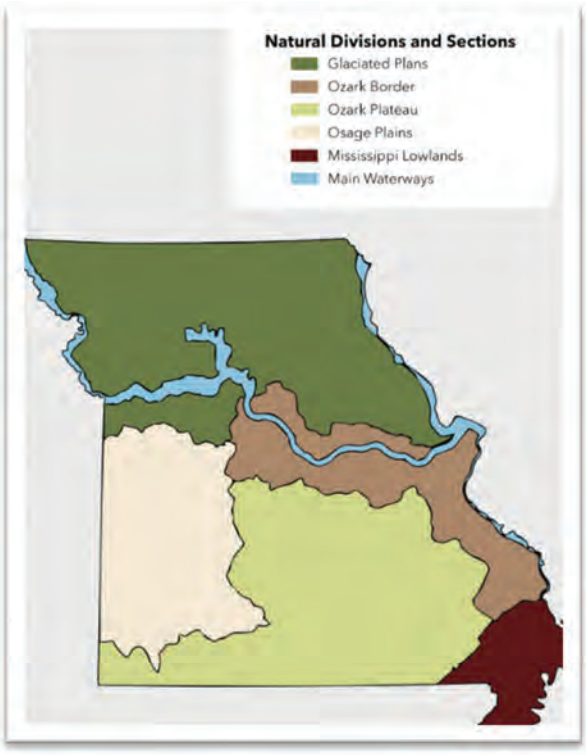
Each Bank Site mitigation plan will detail the site location information, size, community components, methods and means of construction, tree species information, in-stream construction techniques, tree and seed planting techniques, and maintenance and monitoring requirements.

4.7 Operation and Maintenance Plan

WFI-B will be responsible for the construction, performance, success, and long-term management of each mitigation bank project to offset the impacts authorized by the DA permit. Each DA permittee will no longer be responsible for mitigation once compensatory mitigation credits are purchased from the UMBI. The WFI-B program will work with the USACE to meet all requirements for the Bank Sites to remain satisfactory. The sponsor's contractors will aid in developing Bank Sites; however, the Sponsor maintains responsibility for construction, development, and management of mitigation projects. All Bank Sites will be designed to be self-sustaining to the largest extent possible for the long-term management and maintenance of the Bank Site. This section outlines responsibility for the Sponsor on active management Bank Sites that have been constructed and are operating during credit sales and performance standards activities.

Maintenance for each Bank Site will be determined based on observations gathered during post-construction monitoring and will include these overarching main themes:

- Specific schedule of maintenance;
- Evaluation of invasive species (included in Missouri law Noxious Weed Law 263.190, 12 species are listed, as well as the Missouri Invasive Plant (MoIP) Council 2021 Top Invasive Plants by Region lists and the lists are included in Appendix A);
  - MoIP Top 15 in the Big Rivers Region
  - MoIP Top 15 in the Glaciated Plains Region
  - MoIP Top 15 in the Ozark Border Region
  - MoIP Top 15 in the Ozark Plateau Region



MoIP Invasive Plant List Regions

- Evaluation and maintenance of water control structures, both structural and earthen;
- Evaluation of vegetative success and management;
- Evaluation of instream features, if applicable; and
- Potential consultation with agencies for any site operation or maintenance activity affecting federally protected species.

In addition, every Bank Site will be evaluated for the following items:

- Animal damage and if the damage will cause or lead to poor site performance measured by the ecological performance standards, ensuring stability of the designed conditions of berms/weirs/overflow structures;
- The need for supplemental tree plantings;
- Any invasive, undesirable or noxious species will be addressed through an herbicide or insecticide application program.
  - The timing, application method, and type and frequency of the application will be approved prior to commencing with the activity;

- Mowing may be implemented to reduce competition and evaluated periodically after that.
  - Any necessary mowing would occur in the summer and be mowed to a height of approximately 6 inches and used as a tool to stimulate or retard specific species that the site manager has identified as being problematic or beneficial to the habitat being restored;

- Boundary signs marking the perimeter of the mitigation area will be addressed during this initial maintenance period;

- During the monitoring period, slight adjustments may be made to the berms/wiers to prolong or shorten inundation to ensure optimum hydrologic conditions;

- Optimum hydrologic conditions will promote the growth of native plant species and diversity that will aid in achieving ecological performance standards of wetland communities; and

- Instream structures will be visually evaluated for overall functionality of the structure, focused mainly on stability within the banks with no major erosion or deposition.

4.7.1 Operation and Maintenance Plan

- **Post Construction and Year 1**
  - Conduct an ecological functional assessment using the Rapid Impact Assessment Method **RIAM** (Stein and Ambrose 1998) to compare the site prior to project implementation to conditions present after implementation of the project (assumption used is by best professional judgment) using the following six evaluation criteria: endangered species habitat, structural diversity of habitat, spatial diversity of habitat, open space habitat, linear contiguity of habitat and adjacent habitats. A transect meander search will be utilized.
  - Restore and plant Bank Site acreage in accordance with the Mitigation Plan.
  - Monitor tree planting and maintain.
  - Monitor in-stream structures and maintain.

- **Years 2 through 5**
  - Monitor and replace where needed forested plantings.
  - Monitor all herbaceous and hydrophytic vegetation.
  - Transect time meander search in accordance with Monitoring Plan.
  - Mow as needed based on Mitigation Plan.
  - Monitor in-stream structures and maintain.

4.8 Ecological Performance Standards

This section describes the ecological standards that the Bank Site will use to determine if the Bank Site is achieving its ecological objectives. The performance standards listed below will be used to measure or assess whether the mitigation project is developing into the desired resource type and providing the expected functions. These performance standards will be applied to determine the success of this compensatory mitigation activity.

- The Bank Site will meet jurisdictional wetland criteria as outlined in the Midwest Regional Supplement to the 1987 USACE Wetland Delineation Manual (USACE 2008, Environmental Laboratory 1987).
  a. Predominance of hydrophytic vegetation. More than 50 percent of the dominant plant species must be hydrophytic at each sampling location.
  b. Presence of hydric soils. Hydric soil characteristics should be present, or conditions favorable for hydric soil formation should persist. Favorable conditions include inundation or saturation to within 12 inches of the surface.
  c. Presence of wetland hydrology. According to the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region-Version 2.0 (*USACE, 2012), the standard requires 14 or more consecutive days of flooding or ponding, or a water table 12 inches (30 cm) or less below the soil surface, during the growing season at a minimum frequency of 5 years in 10 (50 percent or higher probability) (National Research Council 1995) unless an alternative standard has been established for a particular region or wetland type.

- Stream Performance standards shall examine design criteria based on measured relationship to the current position of the bank toe or top of bank, which will show any erosion or deposition. Evaluation of toe undercutting, lateral bank movement, and overall rock structure stability. The stabilization will be determined successful if the rock structures remain functionally in place following high flow events, and the bank line does not move beyond what would reasonably be expected for normal stream dynamics and morphology. To assess the performance of the grade control structures, a channel cross section will be taken at each photo station, when stream conditions allow.

- The Bank Site area should meet the standards for vegetative cover and floristic composition, and hydrology outlined in Table 4.1 below.

Table 4.1 - Performance Standards for Wetlands, Streams, and Buffer Areas

Target	Annual Performance Standards
Vegetative Success for Wetland Areas: Palustrine Emergent (PEM)	Years 1-3: At least 75 percent of the vegetative cover consists of native (*per the USACE National Wetland Plant List- biological attributes checklist*) hydrophytic vegetation suitable for the proposed areas water regime and site potential. No single occurrence of invasive species shall exceed 0.25 contiguous acre in area even if the overall abundance of invasive species is less than 25 percent. *This includes the invasive and noxious weeds per Missouri Noxious Weed Law 263.190, and those listed by applicable regions by the MoIP Council – See Appendix A.* Years 4-5: At least 75 percent of the vegetative cover consists of native hydrophytic vegetation suitable for the proposed areas water regime and site potential. Minimum of 15 hydrophytic plant species per acre. The 15 species must also be native perennial species. In addition, no single occurrence of invasive species shall exceed 0.10 contiguous acre in area even if the overall abundance of invasive species is less than 10 percent. The 25 percent threshold for invasives drops to 10 percent in Years 4 and 5. **Hydrology:** No more than 5 percent of the wetland shall consist of a contiguous "unvegetated open water" area measured no later than September 15th of each monitoring year.
Vegetative Success for Wetland Areas: Palustrine Scrub-Shrub (PSS)	Performance standards for this habitat type will be proposed on a site-by-site basis and will generally mirror either the Emergent or Forested, depending upon site-specific parameters. No single occurrence of invasive species shall exceed 0.10 contiguous acre in area even if the overall abundance of invasive species is less than 10 percent.

Table 4.1 - Performance Standards for Wetlands, Streams, and Buffer Areas (continued)

Target	Annual Performance Standards
Vegetative Success for Wetland Areas: Palustrine Forested (PFO)	Sponsor will comply with the St. Louis District Mitigation Tree Planting Guidance, (https://www.mvs.usace.army.mil/Portals/54/docs/regulatory/mitigation/MVS%20District%20Tree%20Planting%20Guidance.pdf). Note that only 20 percent of the surviving trees after monitoring may be from natural recruitment. In addition, trees re-planted within the previous two years will not count towards the survivability metric. No single occurrence of invasive species shall exceed 0.10 contiguous acre in area even if the overall abundance of invasive species is less than 10 percent. **Hydrology:** No more than 5 percent of the wetland shall consist of a contiguous "unvegetated open water" area measured no later than September 15th of each monitoring year
Stream: In-Stream	Monitoring will include the establishment of fixed photo stations (pins) along the bank. These pins will be measured in relationship to the current position of the bank toe or top of bank, which will show any erosion or deposition. Monitoring reports will note the presence of toe undercutting, lateral bank movement, and overall rock structure stability. Due to the method of stabilization and the existing bank conditions, some changes in bank conditions may continue to occur as the bank establishes a stable slope. The stabilization will be determined successful if the rock structures remain functionally in place following high flow events, and the bank line does not move beyond what would reasonably be expected for normal stream dynamics and morphology. To assess the performance of the grade control structures, a channel cross section will be taken at each photo station, when stream conditions allow, to monitor any changes in the shape of the stream channel. *A checklist similar to the NRCS Streambank & Shoreline Protection – Operation and Maintenance Plan (Appendix B) could be used during monitoring events. However, ultimately the monitoring measures will be bank site-specific, and could include a percentage or measurable range of variation from the "as-built" plans (i.e. 5 or 10* percent *loss of stone or change in "slope, longitudinal profile, or latitudinal profile".* Performance for the stream structures will be evaluated by the stability of the structures. Sites deemed not to create any instability for the stream channel shall the considered to meet performance standards for stream stability. A Rapid Bioassessment Protocol (RBP) determination will be utilized to determine overall ecologic lift for the in stream reaches. The RBP will be performed every year and be compared to the baseline RBP for the project. The RBP will be the main criteria for ecological performance. Specific stream performance standards beyond what are proposed in this document may be developed on a site-by-site basis as bank sites are proposed.
Stream: Riparian Area	Sponsor will comply with the St. Louis District Mitigation Tree Planting Guidance https://www.mvs.usace.army.mil/Portals/54/docs/regulatory/mitigation/MVS%20District%20Tree%20Planting%20Guidance.pdf). Note that only 20 percent of the surviving trees after monitoring may be from natural recruitment. In addition, trees re-planted within the previous two years will not count towards the survivability metric. No single occurrence of invasive species shall exceed 0.10 contiguous acre in area even if the overall abundance of invasive species is less than 10 percent.
Buffer Areas	No single occurrence of invasive species shall exceed 0.10 contiguous acre in area even if the overall abundance of invasive species is less than 10 percent. Additional buffer performance standards may be added on a site-by-site basis depending upon site-specific parameters.
RIAM	Between years four to five, verify if pre-project assessment in Section D meets post project ranking as determined by best professional judgment.

4.8.1 Planting Performance Standards

The following Planting Performance Standards are being applied from the *St. Louis-USACE Mitigation Tree Planting Guidance* (Appendix C), which calls for "a preferred survival rate minimum of 70 percent after the monitoring period" (compared to the 75 percent survival rate for woody planted species proposed

herein). The following performance standards in Table 4.2 assume near normal behavior of those conditions generally affecting plant establishment and growth. For example, below normal precipitation may delay performance by vegetation.

Table 4.2 - Planting Performance Standards

Year*	Percent Cover of Hydrophytic Vegetation	Percent Cover of Woody Species	Percent of Species Planted Forbs Should Be Found	Percent Survival of RPM[1] Woody Species Planted
1	35	5	20	80
2	50	5	20	75
3	50	7	35	75
4	60	10	50	75
5	75, and Minimum of 10 species/acre (species must be native perennial)	Minimum of 110 woody stems/acre consisting of 5 or more species	60	75

*Determined in November, RPM[1] - Root Pruned Method

The use of hydric soils and their associated seed banks will be expected to produce a variety of volunteer native species, both obligate and facultative, which may or may not have been planted but which will be considered as acceptable cover and species in determining compliance with all of the aforesaid performance criterion. On-site RIAM will be conducted to determine if as assessed at pre-project by best professional judgment. Where inspected landscape work does not comply with the requirements, replace rejected work and continue specified maintenance until reinspected by the Wetlands Forever, Inc. Environmental Scientist and found to be acceptable.

4.8.2 Wildlife Monitoring

Observations during spring, summer and fall to determine wildlife migration and breeding seasons, nesting, brood-rearing and migratory and/or resident wildlife recruitment over winter.

4.9 Monitoring Requirements

This section describes the parameters to be monitored, monitoring methods, and procedures to determine if a Bank Site is on track to meet performance standards, or if adaptive management is needed. A five-year monitoring program will be initiated after installation of the planting material for all Bank Sites and for each phase of construction. The Sponsor or their assigned Environmental Scientist shall conduct all monitoring.

Monitoring and data collection will be conducted annually through year five. Monitoring reports will be written by the Wetlands Forever, Inc. Representative, Environmental Scientist and provided to USACE to document all monitoring events in accordance with Regulatory Guidance Letter 06-3. The reports shall provide a description of site assessment, results, and recommendations. Monitoring Report summaries will be prepared and submitted to the USACE by December 31 of each scheduled year following the issuance of the mitigation banking instrument. The monitoring will continue for a minimum of five calendar years after construction is completed. The following information shall be collected during each monitoring event:

- General ecological condition of the wetland;
- Percent of surviving planted RPM woody species;
- Height and diameter at breast height (dbh) of the trees (10 percent of the total planted);
- Photographs at four pre-determined locations (locations and view direction are to be marked in the field for consistency at repeat visits);
- Wildlife observed; and
- USACE Wetland Automated Data Sheets (ADS) will be utilized
  - Estimated percent cover of emergent and woody species;
  - Hydrologic indicators depth of inundation, primary and secondary indicators;
  - Hydric soil indicators
- Random and transect based meander search for each class at every site:
  - The transect meander search will follow defined transects that intersect specific wetland classes on the site.
  - The random meander search will seek to quantify wetland classes on the site.
  - The transect meander will be performed as a baseline, verification of hydrology and final meander search.
  - The random meander search will be performed during regular monitoring events as identified in this Section.
  - The random search shall be conducted in October - November of each year. The samples will be randomly taken at approximately 200 feet intervals for classes that were seeded and/or planted.
  - The USACE Wetland Delineation Manual of 1987 will be used as the standard for this transect sampling.
- The method by which wetland hydrology will be monitored will be determined on a site-by-site basis. The approved USACE wetland delineation data forms will be utilized as the primary indicator of whether or not the site is meeting hydrologic requirements. The use of additional hydrology monitoring methods including monitoring wells or a “Water Level Monitoring” device will be utilized to supplement the data form, as deemed necessary.
  - The number of devices utilized will be outlined in each Bank Site plan, typically one in an unchanged area of the mitigation site and another within the modified hydrology zone to document duration and depth modifications.

- In stream channel monitoring will include the Monitoring in fixed photo stations (pins) based on reaches along the bank. These pins will be measured in relationship to the current position of the bank toe or top of bank, which will show any erosion or deposition.
  - Monitoring reports will note the presence of toe undercutting, lateral bank movement, and overall rock structure stability. Due to the method of stabilization and the existing bank conditions, some changes in bank conditions may continue to occur as the bank establishes a stable slope.
  - The stabilization will be determined successful if the rock structures remain functionally in place following high flow events, and the bank line does not move beyond what would reasonably be expected for normal stream dynamics and morphology.
  - Annual in-stream channel monitoring will take place. Additionally, monitoring will take place after at least one bankfull event has occurred, to ensure that stabilization is successful.
  - Visual Monitoring Worksheet will be utilized for all in stream structures to determine stability (example worksheet included below).
  - The Visual Monitoring Worksheet will examine structures and determine if the stream bank has experienced any stream dynamics from an erosional and depositional perspective. It will examine stability of the structure regarding cross sectional area and undercutting of the toes of the structures. Subsequently, any instability will be outlined and addressed in the actions section of the worksheet. A similar monitoring method to the Bank Erosion Hazard Index (BEHI) can be considered on a bank site by bank site basis as well.

- Compliance inspection by the IRT may be conducted every year upon their request.

- Inspections shall be conducted to assess compliance with long-term performance standards as outlined in the Performance Section above.

- A summary table will be added to each annual monitoring report comparing the results from each of the previous year's monitoring results. This would assist the IRT in reviewing bank sites and seeing any trends that occur in the 5-year monitoring cycle and provide an overview that would allow the IRT to better utilize the data to update performance standards on a statewide level as necessary in the future.

Visual Monitoring Worksheet – Example

Little Muddy Wetland and Stream Mitigation Bank - Addendum 1							
In Stream Restoration - Visual Monitoring Worksheet							
Reach 1 - 11 structures	**Photo**	**Bank Erosion**	**Bank Deposition**	**In Stream Erosion**	**In Stream Deposition**	**Stable Structure**	**Actions**
Description of Structure							
Chevron 1-1							
Chevron 1-2							
Boulder Weir 1-1							
Chevron 1-3							
Stream Barb 1-1 ***							
Chevron 1-4							
Boulder Weir 1-2							
Chevron 1-5							
Stream Barb 1-2							
Chevron 1-6							
Riffle 1 ***							
Reach 2 - 9 structures	**Photo**	**Bank Erosion**	**Bank Deposition**	**In Stream Erosion**	**In Stream Deposition**	**Stable Structure**	**Actions**
Description of Structure							
Stream Barb 2-1							
Chevron 2-1							
Chevron 2-2 ***							
Boulder Weir 2-1							
Chevron 2-3							
Chevron 2-4							
Chevron 2-5							
Chevron 2-6 ***							
Chevron 2-7							
Reach 3 - 3 structures	**Photo**	**Bank Erosion**	**Bank Deposition**	**In Stream Erosion**	**In Stream Deposition**	**Stable Structure**	**Actions**
Description of Structure							
Stream Barb 3-1							
Stone Toe Protection							
Riffle 2 ***							
Reach 4 - 21 structures	**Photo**	**Bank Erosion**	**Bank Deposition**	**In Stream Erosion**	**In Stream Deposition**	**Stable Structure**	**Actions**
Description of Structure							
Boulder Weir 4-1							
Boulder Weir 4-2							
Boulder Weir 4-3							
Root Wad 4-1							
Root Wad 4-2							
Boulder Weir 4-4							
Boulder Weir 4-5							
J-Hook 4-1 ***							
Stream Barb 4-1							
J-Hook 4-2							
Bendway Weir 4-1							
Bendway Weir 4-2							
Bendway Weir 4-3							
Bendway Weir 4-4							
Bendway Weir 4-5							
Bendway Weir 4-6 ***							
Bendway Weir 4-7							
Root Wad 4-3							
Root Wad 4-4							
Root Wad 4-5							
Riffle 3 ***							
8 Established Monitoring Site	***						
will have additional monitoring							

4.10 Long-term Management Plan

This section describes how the Bank Site will be managed after performance standards have been met and achieved, to ensure the long-term sustainability of the Bank Site. The mitigation site will have a long-term management plan that focuses on the survival and success of the streams and wetlands being restored. Long-term management will be implemented after the performance standards are met. A reputable third-party (such as a non-profit organization) will be identified as the primary long-term manager/steward in each BSP.

4.10.1 Structure of Long-term Financing

The goal of Long-term Management is to secure the site in perpetuity for both physical and financial stability. Long-term financing will be outlined in each chosen WFI-B UMBI Bank Site. The method for securing the financial stability will be handled through the creation of endowment.

4.10.2 Provisions for Long-term Management and Maintenance

The Bank Sites have been designed to be self-sustaining to the largest extent possible, therefore, long-term care is deemed to be minimal once the project has met the specified performance standards. However, a management and maintenance plan will be in the Bank Site Plan to address the management requirements of the project.

4.11 Adaptive Management Plan

During the mitigation bank progress to completion there may be a time when the bank cannot be constructed in accordance with mitigation plan. When this is discovered, the Sponsor will notify the USACE immediately and provide an alternative to the activity for approval. Remedial measures will be based on information contained in the monitoring reports (i.e. the attainment of prescribed Performance Standards) and site inspection by the USACE and/or IRT.

Performance standards are established to show that each bank site is providing ecological benefits as it was planned and intended. However, due to unforeseen circumstances either caused by construction or environmental factors, these performance standards may not be met. The Sponsor will act immediately once this deficiency is identified and notify the USACE. The Sponsor will work with the USACE to rectify the deficiency and determine if the ecological benefits will still be met.

Some of the measures that will be considered to rectify the deficiencies may include site modifications, design changes, altering construction techniques and revising maintenance requirements. These changes will be reviewed by the USACE to ensure they meet the original goals for aquatic resource functions as outlined in the mitigation plan. Where measures have been taken to overcome deficiencies and management strategies have changed, it may be necessary to revise the performance standards. The performance standards may be revised only if it is agreed that the changes are comparable or exceed the original goals for the aquatic resource functions as outlined in the mitigation plan.

5.0 CREDIT RELEASE SCHEDULE

The stream and wetland credit release schedules for each Bank Site shall be as follows:

1. Upon Bank Establishment (USACE signing of the Banking Instrument, recording of an IRT-approved Conservation Easement, and establishment of acceptable financial assurances as described in the BI), 20 percent of anticipated wetland and stream credits will be made available for sale.

2. Upon Bank Establishment, USACE approval of as-built drawings (for all construction, structures, and complete seeding of approved species) an additional 30 percent (cumulative total of 50 percent) of anticipated wetland and stream credits will be made available for sale.

3. For each following year when performance standards are met and approved in writing by the USACE, up to 10 percent of anticipated credits will be approved for sale if unsold, successfully restored credits are present.

4. Credits may be released at an earlier time at the discretion of the USACE and the IRT, should it be determined that objectives have been met, prior to the end of the 5-year monitoring period.

5. After one year has passed from the date of the first credit sale, if wetland hydrology is not present in the majority of years, the native plant communities are not developing, or if any performance standards for the wetlands or streams are not met, additional coordination will be necessary.

A summary of the Credit Release Schedule is provided in Table 5.1, below.

Table 5.1 – Stream and Wetland Credit Release Schedule

Description	Total Credits
Bank Approval	20%
Construction Complete	30%
Year 1 Performance Standards	10%
Year 2 Performance Standards	10%
Year 3 Performance Standards	10%
Year 4 Performance Standards	10%
Year 5 Performance Standards	10%
Total	**100%**

6.0 ACCOUNTING PROCEDURES

6.1 Use of Credits

At the discretion of the Corps, all activities authorized by DA permits are eligible, to use the mitigation bank to fulfill compensatory mitigation requirements for DA permits, including compensatory mitigation associated with unauthorized activities or non-compliance actions. The USACE, in consultation with the IRT, will determine the number of credits granted to the WFI-B through the compensatory mitigation activities at a project site. The factors used for determining credits granted would include acreage/LF of wetland/stream establishment, restoration, enhancement and/or preservation and the expected aquatic ecosystems benefit resulting from the proposed project site.

6.2 Ledger – Credit Tracking

The Sponsor shall submit a statement to the USACE St. Louis District each time credits are debited, in addition to an annual ledger showing all transactions at each Bank Site for the previous year. If requested, the USACE will distribute the statement to other members of the IRT.

7.0 REPORTING REQUIREMENTS

7.1 Monitoring Reports

Monitoring Reports will be written by the Wetlands Forever, Inc. Representative, Environmental Scientist and provided to USACE to document all monitoring events in accordance with Regulatory Guidance Letter 06-3. The reports shall provide a description of site assessment, results, and recommendations. Monitoring Report summaries will be prepared and submitted to the USACE by December 31 of each scheduled year following the issuance of the mitigation banking instrument. The monitoring will continue for a minimum of five calendar years after construction is completed. Monitoring reports are discussed in Section 4.9.

7.2 Ledger Accounting Reports

The Sponsor shall submit an annual ledger to the USACE for distribution to all members of the IRT, showing all transactions at the bank for the previous year. This will become part of the administrative record and archived with WFI-B, for each Bank Site and the UMBI program. The annual reports will be comprised of; transaction details including the DA permit number, the geographic service area, the amount of credits released, the amount of credits debited, and the balance of remaining credits.

7.3 Financial Assurances

7.3.1 Structure of Assurances

Each Bank Site will have a plan of financial assurances and long-term management that focuses on the survival and success of the Bank Site. Financial Assurances will support the project during construction and monitoring while long term management will be implemented after the performance standards are met.

7.3.2 Construction Financial Assurances

The Sponsor agrees to provide the following financial assurances for the work described in the Banking Instrument.

- The Sponsor will coordinate a sum of dollars based on the BSP to be used by a third party to be approved by the USACE in the event that the Sponsor fails to comply with the terms of the Banking Agreement to rectify any unforeseen events as determined by the IRT.
- Said sum of dollars shall consist of a performance bond or an insurance policy.
- The financial assurances shall be in force for a minimum of five years (The five-year term coincides with a Section of the BSP).
- The financial assurances may be phased-out or reduced, once it has been demonstrated that the bank is increasing in functionality and/or self-sustaining (in accordance with performance standards).

7.3.3 Structure of Long-term Financing Endowment

Financing for long-term management services are referenced below and will be provided as part of each Bank Site:

- An Endowment will be established along with Financial Assurances component of the project;
- The Total Endowment funding for each Bank Site will be outlined in the BSP for a specified amount and rate of return which generates an estimated return over 10 years;

- WFI-B recommends a stepped funding strategy consisting of two major activities;
  - A Fixed Annual Payment
  - A Final Endowment Funding at Project Close-Out

- Fixed Annual Payments in the amount of $X,XXX per year;
  - Timing of Annual Payment: within 90 days of beginning of calendar year for prior calendar year (example: annual payment for 2024 to be made by end of March 2025)

- Final Endowment Funding action to fund the remainder of Endowment;
  - Timing of Final Endowment: Project Close-Out
    - Amount: equal to an amount to bring the endowment to a total of the coordinated amount in the BSP
    - Total Endowment Funding from the BSP, less sum of Fixed Annual Payments, less sum of interest earned
    - Shall not exceed a maximum of Total Endowment Funding of the BSP less sum of Fixed Annual Payments

- Total Endowment funding identified in the BSP at time of Project Close-Out: $XX,XXX;

- WFI-B will typically fund a TSI/Pruning Management action at Close-out; and

- An endowment in the amount of said dollars based on the BSP will be completely funded to an interest accruing account at Project Close-out. Based upon financing and anticipated forested management action, the non-diminishing endowment is intended to have financial stability in perpetuity.

7.3.4 Provisions for Long-term Management and Maintenance

Each Bank Site will be designed to be self-sustaining, therefore, long-term care is deemed to be minimal once each Bank Site has met the specified performance standards. However, a management and maintenance plan will be established to address the minimal management requirements.

8.0 DEFAULT AND CLOSURE PROVISIONS

8.1 Default Provisions

If the USACE determines that a Bank Site is not meeting performance standards or complying with the terms of the instrument, appropriate action will be taken. Such actions may include, but are not limited to, suspending credit sales, adaptive management, decreasing available credits, utilizing financial assurances, and/or terminating the Bank Site specific instrument.

8.2 Closure Provisions

A Bank Closure Report (Close-out Report) will be provided upon completion or termination of operation of the Bank Site. "Completion" shall be defined as meeting final performance standards and achieving all credit releases. The report will include aquatic resource delineation and Cowardin Classification including

palustrine emergent, palustrine scrub-shrub, and palustrine forested (PEM/PSS/PFO) of each identified resource, pre-construction and current aerial photography, expected land use and management of the site, a current credit ledger, long-term management steward identification and ownership records. It is anticipated that the Bank Site will be a self-sustaining system to the largest extent possible with little operation or maintenance required. The long-term management plan will be outlined and included within the Bank Site Close-out Report.

8.3 Force Majeure

In the event of a complete or partial mitigation area failure attributed to natural catastrophes, such as flood, fire, wind, drought, disease, regional pest infestation, etc., the Sponsor, or an approved third party will contact the USACE to evaluate the physical and functional changes to the Bank Site. If such events occur before performance standards are met, the Sponsor, with consultation from the USACE and the IRT, will determine the extent of site changes and follow the adaptive management plan outlined to either take corrective action or modify performance standards. Neither the Sponsor, Long-Term Steward, nor an approved third party shall be held responsible for natural catastrophes that may occur after a Bank Site has successfully met performance standards.

9.0 WFI-B MISSOURI UMBRELLA AGREEMENT SIGNATURE PAGE

WFI-B MISSOURI UMBRELLA AGREEMENT FOR THE ESTABLISHMENT AND OPERATION OF BANK SITES IN THE STATE OF MISSOURI

This WFI-B Umbrella Agreement, entered into by WFI Holdings-B LLC and the U.S. Army Corps of Engineers (USACE), is for the purpose of establishing and operating mitigation Bank Sites (“Bank Sites”) in the State of Missouri. Bank Sites will be used to mitigate for unavoidable wetland and stream impacts approved through the USACE, which is responsible for administering Section 404 of the Clean Water Act. The creation, operation, and use of this Umbrella Bank and the Bank Sites hereunder will be in accordance with the WFI-B Umbrella Mitigation Banking Instrument, dated_____, and enclosed.

The Interagency Review Team (IRT) that provided technical support to the USACE includes the following agencies: USEPA; USFWS; and MDNR; These agencies sign in support of the creation of this WFI-B Umbrella Mitigation Bank.

The goal of this WFI-B Umbrella Agreement, UMBI, and the component Bank Sites, is to compensate for impacts to WOTUS generated by construction projects, and more specifically special aquatic sites such as wetlands and streams. The objectives for each Bank Site are to produce, through restoration, enhancement and/or preservation, highly functional wetlands and streams, along with creditable upland buffers and inclusions, as well as riverine habitat, which will be allocated compensatory mitigation credits in accordance with the provisions articulated in within this document.

The coverage area for this Umbrella Agreement will be the eastern portion of the State of Missouri, and Bank Sites will be established to provide compensatory mitigation credits within Geographic Service Areas as illustrated in Figure 2-Service Areas, which basins are based on the United States Geological Survey Hydrologic Unit Code watershed boundaries. At the discretion of the USACE, credits may be approved for use outside the geographic service areas on a case-by-case basis.

USACE approval of this Instrument constitutes the regulatory approval required for the Missouri Umbrella Agreement to be used to provide compensatory mitigation for Department of the Army permits pursuant to 33 CFR 332.8(a)(1). This Instrument is not a contract between the Sponsor and USACE or any other agency of the state or federal government which may be signatory hereto. Any dispute arising under this Instrument will not give rise to any claim by the Sponsor for monetary damages. This provision is controlling notwithstanding any other provision or statement in the Instrument to the contrary.

IRT Team	**Signature**	**Date**
Chris Elliott, Principal WFI Holdings-B LLC		
Colonel Kevin R. Golinghorst, District Engineer USACE, St. Louis District		
David Meyer, IRT Chair USACE, St. Louis District		
Contact USFWS		
Contact USEPA – Region 7		
Contact MDNR – Jefferson City		
Contact MDNR St. Louis Regional Office		
Contact MDC – Jefferson City Commission Headquarters		

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