Prospectus:
Missouri In-Lieu Fee Stream & Wetland Mitigation Program

Land Learning Foundation

Prepared for the Land Learning Foundation by Lakeya N. Brantley

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3615 Olive Street Ste. 211 • Saint Louis, Missouri 63108
Phone: 314-882-6623 • Fax: 1-877-398-4731

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I. Introduction

This document (the Agreement) establishes an in-lieu-fee (ILF) mitigation agreement to be run by the nonprofit organization the Land Learning Foundation, Inc. (LLF). The objective of this program is to satisfy compensatory mitigation for adverse impacts to wetlands, streams, and riparian areas (aquatic resources) throughout Missouri. LLF will cooperate with the members of the Interagency Review Team (IRT) and other appropriate organizations to manage an ILF mitigation program designed to replace aquatic resource functions and values that are adversely impacted under the Clean Water Act Section 404 and Rivers and Harbors Act Section 10 regulatory programs. As a part of the Agreement, LLF will be responsible for the implementation, performance, and long-term management of ILF compensatory mitigation projects as set forth in this Agreement.

II. Objectives of Proposed ILF Program

The objectives of the ILF program are to provide and satisfy permittee-responsible compensatory mitigation requirements issued under Section 404 and 401 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899 in the State of Missouri. These objectives will be achieved through:

1) Identifying and enhancing wetland and stream resources by evaluating the ecological deficiencies on a watershed basis.
2) Identifying and gaining approval of mitigation sites prior or concurrent to the mitigation need which will lessen the temporal loss of wetland and stream functions.
3) Ecological success on a watershed basis will be obtained through the restoration, establishment, preservation and enhancement of wetlands and streams.

III. How the ILF Program will be Established and Operated

a. Establishment of the ILF Program

Upon receipt of signatures from LLF and members of the IRT, the Land Learning Foundation In-Lieu-Fee Program shall be established. LLF will work with the Corps of Engineers (COE) to assure that their requirements of the ILF program are being met. The chairman, staff, and contractors of the LLF will carry out program operations.

b. Interagency Review Team

The IRT for the ILF program shall include the Kansas City District, St. Louis District, Rock Island District, Little Rock District, and Memphis District of the U.S. Army Corps of Engineers (Corps), the U.S. Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (FWS), the Missouri Department of Natural Resources (MDNR), and the Missouri Department of Conservation (MDC).

The IRT will provide general guidance and recommendations in development of the ILF document. IRT recommendations will ensure a careful consideration of the ecological suitability of compensatory mitigation sites, the technical feasibility for proposed mitigation techniques, and the long-term protection and maintenance of restoration sites funded under the agreement.

c. ILF Program Site Approval

For each prospective mitigation site, LLF will submit to the IRT and proper authorities a description of the proposed mitigation efforts. Each mitigation plan shall include the following items:

1. Objectives
2. Site Selection
3. Site Protection Instrument
4. Baseline Information
5. Determination of Credits
6. Credit Release Schedule
7. Mitigation Work Plan
8. Maintenance Plan
9. Performance Standards
10. Monitoring Requirements
11. Long-term Management Plan
12. Adaptive Management Plan
13. Financial Assurances
14. Other Information as Required

d. Service Areas

The geographic service area for LLF will be defined by Ecological Drainage Units (EDUs). EDUs are assemblages of like aquatic resources and are currently being used for determining the service area for existing mitigation banks. The compensatory mitigation for permitted impacts will be constructed within the EDU that the impact occurred within three years of receiving mitigation credit responsibility. The COE along with the IRT will determine if in-lieu fee sites are eligible to provide compensatory mitigation credits to permittees on a case-by-case basis. It will be up to the COE's discretion to allow credits from an ILF project site for an authorized impact that is outside its designated service area.

e. Initial Allocation of Credits

The sale of advance credits will fund the initial operations of the ILF program. These advance credits are those credits that are available for sale in each geographical service area prior to an approved mitigation plan.

Since it is difficult to anticipate future credit demand the only ILF program in the state which the Stream Stewardship Trust Fund (SSTF) operates was used to establish a historical baseline for

stream credit demand. Also, data from Missouri Department of Natural Resources (MDNR) was used to determine a historic baseline for development. As with mitigation banking a certain percentage of total credits are typically used for advance credits sales to help facilitate the development of a compensatory mitigation project.

The SSTF data shows 3 years of stream credit sales from 2007 to 2010. During these years the country has seen a dramatic downturn in development and the economy. Typically, mitigation banks are granted 20% of pre-credit sales and because of the longer time frame between credit sale and project site construction associated with ILF programs LLF requests 30% of the anticipated credit demand for a single normal year. Considering that SSTF sold 55,038 total stream credits over three poor economic years. Thirty percent of this total divided by the 8 service areas only provides 2,064 credits per EDU to purchase and construct a mitigation site. Obviously, those involved in putting projects on the ground know that this is a fraction of what is needed. If the percentage were based on a normal year such as the years prior to 2007 you would see a more realistic advance credit number. Additional research was done using numbers provided by MDNR showing the numbers of Residential Housing Development and Liquid Waste Project permits from 2000 to 2011. These two types of permits reflect residential housing developments served by individual waste water treatment systems and liquid waste projects which are public and private discharging wastewater package plants and municipal wastewater plants. Both of these permits reflect the amount of new development both in the private and public sector. It was found that there was an 81% decrease in residential housing development permits and a 66% decrease in Liquid Waste Projects from 2000 to 2010. The goal is for a 30% advance credit release in a normal year therefore LLF feels that 75% more credits should be added to the 2,064 figure. This is a better representative number for a normal economy.

Wetland impacts are more difficult to tract so LLF has consulted with wetland consultants and has tracked public notices from several corps districts within the state of Missouri. Based on what has been observed LLF feels that an average cumulative wetland impact per EDU per year is 10 acres. LLF requests 30% of this figure for advanced wetland credit release as outlined in **Table 1**.

Table 1. Allocation of Credits

EDU	Stream Credits	Wetland Credits
(Ozark Subregion) Moreau and Loutre Rivers	**3,612**	**3.33**
(Ozark Subregion) Apple / Joachim	**3,612**	**3.33**
(Ozark Subregion) Upper	**3,612**	**3.33**

Saint Frances		
(Ozark Subregion) Meramec	**3,612**	**3.33**
(Plains Subregion) Nishnabota / Platte	**3,612**	**3.33**
(Plains Subregion) Blackwater and Lamine	**3,612**	**3.33**
(Plains Subregion) Grand / Chariton	**3,612**	**3.33**
(Plains Subregion) Cuivre/Salt Rivers	**3,612**	**3.33**

As approved mitigation plans are developed within each EDU and released credits are generated, the initial advanced credits that are already sold in that service area (EDU) will be deducted from that particular project site. Prior to the Corps, in consultation with the IRT, changing advance credits into released credits a mitigation plan must be approved by the IRT. The conversion of credits will be in accordance with the mitigation plan's credit release schedule.

f. Draft Fee Schedule for Mitigation Credits

The fee schedule for advance and future credits will be determined based on market forces, which are dependent on several factors. These factors are costs associated with restoration, rehabilitation, enhancement and/or preservation. These costs will be determined using cost accounting and will include, appropriate expenses land acquisitions, project planning and design, construction, plant materials, monitoring, labor, and legal fees as well as administration, contingency costs, and long term management. Program fees will be subject to Corps review and approval.

g. Methodology for Determining Project-Specific Credits and Fees

The Corps, in consultation with the IRT, will determine the number of wetland credits granted to LLF through their compensatory mitigation activities at an ILF project site. The factors used for determining credits granted would include acreage of wetland establishment, restoration, enhancement and/or preservation: and the expected aquatic ecosystems benefit resulting from the proposed project site. Wetland credits will be determined on an acreage basis as outline in **Table 2**.

Table 2. Wetland Credit Ratios

Mitigation Activity	Credit Ratio (Credit: Acres)
Wetland Establishment/Creation	3:4
Wetland Restoration/Rehabilitation	1:1
Wetland Enhancement	1:2
Upland Buffer Creation/Enhancement	1:4
Wetland Preservation	1:10

The number of stream credits used for impacts and for mitigation projects will be determined using the Corp's Missouri Stream Mitigation Method (MSMM). Permittees will use the MSMM to determine the amount of credits needed for their unavoidable impact and upon the Corps approval will contact LLF with the amount and type of credit needed for a written estimate. The same method will be used for determining the amount of credits generated through LLF mitigation project sites. These stream impact credits will be used to offset the credits generated by the project sites. The fees associated with the credits sales will be determined by LLF and based on current market rates.

h. Monitoring Reports

LLF will provide the Corps with monitoring reports for each in-lieu-fee project site. These reports will conform to the monitoring requirements of each sites' approved mitigation plan and with Regulatory Guidance Letter 08-03 or any future relevant guidance, and will detail the status of aquatic resource improvements at each site. Information gathered during site inspections will be included in the monitoring reports and will help determine the level of success achieved at each project site as well as identify any problems needing redress through adaptive management. The Corps will distribute monitoring reports to the members of the IRT.

Site monitoring will continue until the Corps, in consultation with the members of the IRT, determines that performance standards have been met as set in each site's mitigation plan. This period shall not be less than five years. During this time, the Corps and/or members of the IRT may schedule project inspections of the project site.

i. Contingency Plans and Remedial Actions

If the Corps and members of the IRT decide that as a result of review of a monitoring or annual report, an in-lieu fee project site does not meet performance standards as described in the site's mitigation plan, or the in-lieu-fee program is not operating in a manner consistent with this agreement, then the Corps shall provide written notice to LLF of any violation and demand sufficient corrective action. When the violation involves injury to a project site resulting from use contrary to or inconsistent with the purpose of this agreement, the Corp shall provide written notice and LLF must restore the portion of the project site to its prior condition in accordance with a plan approved by the Corps.

If it is determined that the in-lieu-fee program is operating at a credit deficit within a specified geographic service area, LLF shall be notified to immediately cease from debiting credits within that geographic service area. The violation shall be cured by LLF within 60 days of receipt of notice from the Corps. In circumstances where the violation cannot be reasonably cured in 60 days, LLF will begin to cure the defect within the 60 day period and diligently pursue such cure to completion. In the event of a default or failure by LLF to implement remedial actions necessary to adequately address a failure in meeting success criteria, or for a credit deficit within 60 days, the Corps may notify LLF that debiting from the number of credits available in the specified geographic area is indefinitely suspended and then authorize the financial assurance provider to release the contingency funds to implement necessary remedial actions. The financial assurances used are in the form of an insurance policy and the Corps has the authority to how and where the funds are distributed. The advantage to this form of financial assurance is that you are not relying on a third party organization to be still in operation if a default occurs. The Corps can determine who at the present time is most qualified to take on the deficiency.

j. Financial Assurances

LLF shall provide a casualty insurance policy for each mitigation project which will be designated Financial Assurances, which will be used by an approved third party in the event that LLF fails to comply with the terms of the mitigation plan to resolve any unforeseen events. The Corps will receive notification at 120 days in advance of any termination or revocation and will be payable at the direction of the USACE to the designee. Should the Financial Assurances remain unused, they will be reduced by 50% after the second years performance standards have been met and 100% when the last year's performance standards have been met.

LLF assumes the financial and actual responsibility for performing any remedial work necessary, including any re-planting to meet the performance standards and the repair of any unforeseen gross erosional conditions within the project sites limits that may negatively impact water quality. LLF shall continue with remedial responsibilities until the project site is closed or deemed self-sustaining.

Should the Corps, in consultation with the IRT, determine that remedial action is necessary because the site has failed to achieve the success criteria specified in mitigation plan, LLF shall develop and implement such remedial action plans in coordination with the USACE and IRT. In the event LLF fails to implement necessary remedial action at a Bank site within 90 calendar days, the USACE will notify LLF that debiting from the site is suspended. If conditions at the Bank site do not improve within a reasonable time frame, the Financial Assurances and long-term management funds shall be transferred to an approved third party.

At the request of LLF, the IRT or agreed-upon IRT representative will conduct a final visit to the site to evaluate the completeness and success of all restoration, enhancement and protection efforts. Upon satisfaction of the Performance Standards and Mitigation Plan Objectives, any remaining contingency funds will be released to LLF.

k. Annual Reporting

LLF will provide annual reports to the Corps for distribution to members of the IRT for each geographic service area. These reports will include:

- Income received, dispersed, and interest earned by the program account
- Annual financial assurances and long-term management funding.
- A list of permits for which in-lieu-fee program funds were accepted, including the Corps or state permit number, the geographic service area in which the authorized impacts are located, the amount of authorized impacts, the amount of the required compensatory mitigation, the amount paid to the in-lieu-fee program, and the date the funds were received from the permittee. To assist in project tracking, the stream name, EDU and Corps district may also be included in the report.
- A description of in-lieu-fee program expenditures from the account, including costs of land acquisition, planning, construction, monitoring, maintenance, contingencies, adaptive management, and administration
- The balance of advance credits and released credits at the end of the report period for each geographic service area
- Any additional information required by the Corps or member of the IRT

All information listed above will be documented and kept by LLF for each in-lieu-fee project site.

l. IRT Review

The members of the IRT will review and respond to complete submissions of in-lieu-fee project mitigation plan proposals from LLF within timeframes established in Section 332.8 of the April 10, 2008 Final Rule describing Compensatory Mitigation for Losses of Aquatic Resources issued by the Corps and the EPA.

m. Actions Under Multiple Authorities

Proposed in-lieu-fee project activities may address requirements of multiple regulatory programs and authorities for the same activity. However, a single credit may only address the mitigation requirements of a single permitted activity.

n. Default and Closure

If the Corps determines that LLF has failed in meeting its required performance standards associated with compensatory mitigation in a timely manner the corps shall give written notice to LLF of such violation and demand corrective action sufficient to cure the violation. If the actions are still insufficient, the Corps will take appropriate action to achieve compliance with the terms of the mitigation plan and ILF instrument. Actions can include suspending credit sales, decreasing available credits, requiring adaptive management measures, utilizing financial assurances or contingency funds, and implementing the use of the financial assurances.

Either party can terminate this agreement within 60 days of written notification to the other party. If the ILF operated by LLF is terminated, LLF shall fulfill any remaining project obligations such as completion of construction activities on mitigation sites, maintenance and monitoring on existing mitigation sites, and any long-term obligations related to the mitigation project site.

All debiting of credits shall cease immediately in the event that a natural disaster destroys all or any part of an in-lieu fee project site. Such natural disasters include floods, tornados, fires, earthquakes, droughts, disease, etc., in which the Corps, in consultation with the IRT, determines beyond the control of LLF to prevent or mitigate. LLF will be responsible for any credits that are unsold at the time of the natural disaster. If it is determined by the Corps, in consultation with the IRT that the project success is unattainable even through adaptive management strategies LLF may request early closure of an in-lieu fee project site and forfeiture of the remaining anticipated credits.

IV. Proposed Service Areas

The watershed approach will be used in compensatory mitigation planning and site selection. Although WIAs are primarily watershed assessments, they help identify broad goals, objectives and provide a general direction for improving the physical, chemical, and biological functions within an individual WIA.

Aquatic Conservation Opportunity Areas (ACOAs) identified through the Aquatic Biodiversity Assessment documents constitute watershed plans. They demonstrate the physical, chemical, and biological functions at work within Missouri's watersheds, and the information located on the Missouri Department of Conservation website describes the current and historical resource conditions, describe the threats to aquatic resources in those watersheds, and collectively these

documents provide a hierarchical approach to identifying the locations with the most pressing ecological needs in those watersheds and streams. The Compensation Planning Framework document has more information on EDUs, WIAs, and COAs. This information has been gathered from the Missouri Department of Conservation website.

The proposed geographic service area for the LLF is defined as the EDU, and LLF proposes to provide compensatory mitigation in eight EDUs (Moreau/Loutre, Apple/Joachim, Upper Saint Frances, Meramec, Nishnabotna/Platte, Blackwater/Lamine, Grand/Chariton, Cuivre/Salt and basins). Additional EDUs may be added in the future, to be submitted as proposed amendments to this instrument for COE and IRT approval. LLF will provide compensatory mitigation for permitted impacts within the same geographic service area in which impacts occur unless the district engineer, in consultation with the IRT, has agreed to an exemption. The EDU was selected because the ILF has concluded that the scale is appropriate to ensure that good, high quality projects can be located and designed, the projects approved can be done in a realistic time frame, and those projects will be able to effectively compensate for adverse environmental impacts across the entire service area.

V. General Need and Technical Feasibility of the Proposed ILF Program

There is a great need for compensatory mitigation alternative throughout Missouri. The historic and current losses of aquatic resources in the state have been striking. Post European and American settlement in the state, there has been significant channelization and destruction of wetland and stream habitats. Approximately 90% of Missouri's wetlands have been lost over the past two centuries as a result of conversion to agriculture, levee construction, river management and navigation programs, urban development activities and other actions. Across the watersheds in Missouri, threats to aquatic resources include excessive nutrient loading, stream bank erosion, land clearing, increased runoff due to urbanization, invasive species, increased sediment loading, reduction of historical water levels, water pollution, and inadequate riparian corridors.

Most permittee-responsible and offsite compensatory stream and wetland mitigation projects implemented are small with limited environmental benefits. Common problems with permittee-responsible mitigation plans is that they are designed within a stream reach and not within a watershed context; they often combine poor location with poor (or inadequately implemented) design; they lack competent professional; long-term maintenance or adaptive management may be limited or nonexistent; and many projects lack performance inspections and monitoring. In order to reduce risk and uncertainty and help ensure that the required compensation is provided, the rule establishes a preference hierarchy for mitigation options and the in-lieu-fee program is second in the preference hierarchy. In-lieu-fee programs involve larger, more ecologically valuable compensatory mitigation projects as compared to permittee-responsible mitigation.

VI. Proposed Ownership Arrangements and Long-Term Management Strategy for ILF Project Sites

The In-Lieu Fee Program (ILFP) as operated and administered by LLF will be under the sole ownership of LLF and supported by a long-term In-Lieu Fee Program Management Agreement with MITICO, LLC (MITICO) of 3615 Olive, Suite 211, Saint Louis, Missouri. LLF (in and through the actions and experiences of its current and past board members) and MITICO (in and through the actions and experiences of its principals, affiliates and contractors) have amassed a significant track record in the areas of environmental land analysis and acquisition, wetland and riparian restoration under the guidelines of the Wetland Reserve Program and current and past mitigation rules as put forth by the United States Army Corps of Engineers (USACE). Please refer to the sponsor qualifications section for detailed qualifications of the board members and managers.

ILFP sites will be under the ownership of LLF, bona fide land trusts, governmental entities, qualified and willing landowners or other entities employing long term conservation methodologies. Conservation easements will be perpetual and in a form and substance meeting the most current requirements of the USACE. Conservation easements shall also include 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, as well as, transfer of title. Conservation easements will be held by LLF and third party, long-term stewardship agreements will be entered between LLF and qualified participating conservationist entities on a site by site basis.

LLF compensatory mitigation projects will be designed for long term sustainability utilizing natural hydrology and be consistently monitored for management, maintenance and specifically monitored to insure that long term performance standards are met. Long term management plans will include cost estimates and identify the funding mechanisms to be used to meet costs and needs. Through a series of endowments, contractual arrangements and insurance products, LLF will provide for a continuum of sound management and maintenance practices, in perpetuity.

The ILFP administered by LLF will be operated from the LLF's office in Keytesville, Missouri. This location is central to the state allowing for easy access throughout the services area. Records for the ILFP will be made available to auditing and examining entities during normal business hours.

VII. Qualifications of the LLF to Complete Mitigation Projects

LLF has a long and successful history of restoring, enhancing, preserving and managing more than 8,000 acres of natural resources. The outstanding efforts of LLF spans more than a decade and include wetland restoration in Saline, Chariton, Carroll, Livingston, Vernon and Linn counties.

Realizing the vital importance of wetlands to many of Missouri's wildlife and plant species, LLF founders began restoring wetland ecosystems in the 1990's. They are restoring more than 8,000 acres of wetlands along the Missouri, Chariton, and Grand Rivers in the state of Missouri and now use those lands as a part of LLF's effort to educate people about the important functions and values of wetlands and riparian (along the banks of rivers and streams) ecosystems.

LLF projects and programs involve students, educators, youth groups, and the general public in the restoration and preservation of local wetlands and riparian areas. LLF believes that their efforts to involve and educate people will ultimately lead to a more informed public that will be able to make knowledgeable decisions concerning local natural resources.

LLF, its sponsors and benefactors have been involved in substantial wetland restoration and management, as well as, significant wetland and riparian mitigation projects statewide, as:

I. Wetland/WRP/EWP

A. **The Rhodes Island Tract,** Saline County, Missouri, directly east of the town of New Frankfort, on the Missouri River. 1,400 acre EWRP wetland and riparian project, under perpetual easement and is an ongoing restoration;

B. **The Dalton Bottoms Tract,** Chariton County, Missouri and along the Missouri River. 1218 acre WRP tract under perpetual easement. This tract lies directly south of the ancient oxbow known as the Dalton Cutoff along Palmer Creek. The tract is an ongoing restoration providing thousands of acre feet of flood storage in high water times;

C. **The Shackleford and Holmes Tract,** Chariton County, Missouri. 965 acre WRP project located. This tract lies due east of the Dalton Bottoms tract, at the confluence of the Chariton and Missouri Rivers.

D. **The Dean Lake Tract,** Chariton County, Missouri. A 240 acre wetland and riparian restoration with a 100 year old, 30 acre bottom land lake, under perpetual WRP easement. Developed as a base to facilitate learning opportunities for students and educators. Tract lies adjacent to Dean Lake Lodge and Cabins, a heavily improved educational and recreational site availed by its owners to LLF for educational purposes;

E. **The Chowning Tract,** Chariton County, Missouri. Approximately 400 acres of WRP under perpetual easement. Tract fronts Grand River over one mile, open to the flow of the river.

F. **The Seneca Tract,** Chariton County, Missouri. Approximately 778 acres mostly wetland and riparian restoration lying within and without the Garden of Eden Levee. As with Tract C., above, this tract supplies thousands of acre feet of flood storage in high water times;

G. **The Jenkins Tract,** Livingston County, Missouri. A significant, 571 acre wetland and riparian restoration along the Grand River directly across from Fountain Grove Wildlife Area;

H. **The Mudhole Tract,** Ray County, Missouri. A 435 acre wetland restoration tract in the Missouri River bottom between Camden and Orrick in Ray County. Perpetual WRP easement;

II. MITIGATION PROJECTS

A. **The Swan Lake – Dickinson Tract,** Chariton County, Missouri. Land mass in excess of 2,000 acres with combination WRP, wetland and riparian mitigation restoration project currently working through approval process as wetland, riparian and species mitigation bank. Tract(s) adjoin Swan Lake Wildlife Preserve and Yellow Creek Conservation Area;

B. **The Daniels Tract,** Carroll County, Missouri. 120 acre wetland and riparian mitigation project undertaken by LLF to mitigate impacts for Missouri Department of Transportation (MoDOT) with restoration completed in 2008. Tract lies at intersection of State Highway 139 and Big Creek;

LLF, its organizers, benefactors, contractors, staff and volunteers have planted over 400,000 trees, participated in numerous federal and state cost share programs and created significant refuge areas for migrating waterfowl. LLF has developed public opportunities to educate school children and educators about the importance of preserving natural resources for wildlife and future generations. To date, these educational opportunities have had over 5,000 persons in attendance. The incredible contributions to natural resources by the founders and staff of LLF have earned them several awards including the National Wetland Award from the Environmental Law Institute and the Wildlife Conservationist of the Year Award from the Conservation Federation of Missouri. In addition LLF assisted a private landowner on the development of a 50 acre wetland mitigation site that was used by the Missouri Department of Transportation (MoDOT) for compensatory mitigation for a MoDOT project. This restoration site is located in Carroll County, Missouri and was completed 7 years ago.

George L. "Larry" Pollard is the current chairman and president of LLF. Larry has extensive experience in the preservation and enhancement of land and water resources. It is the career experiences in natural resources and the work in recent years with nonprofit associations that will continue to make LLF a success. His experiences, in a sequence from current and ongoing to past accomplishments and education are outlined below:

Since 1998 Larry has drawn together a collaborative effort to create the Chariton County Community Foundation. They were formally recognized as a 501(c) (3) public foundation in fall of 1998. Their purpose is to be a major instrument of philanthropy for community betterment in Chariton County, Missouri. Highlighted achievements the foundation is associated with include establishing county wide 9-1-1 emergency notification, planning and constructing new medical clinic facilities in Brunswick, developing and providing an economic development program for the county, encouraging and assisting a community development program for Brunswick Community and managing a number of scholarship and community betterment funds within the Foundation.

From 1998 to 2003 Larry served as an independent sales representative for Truax Drill Company of Minneapolis, MN. He provided technical assistance teaching and demonstrations on native prairie vegetation re-establishment using the Truax Seeding Equipment.

In 1996 Larry worked out of the Chariton County, University of Missouri Extension Office engaged in developing Small Businesses related to agricultural value added enterprises. He formed a collaborative effort to create the Chariton County Historical Tourism Council. Their purpose is to preserve and promote historic and natural resources of Chariton County for tourism as a county economic vehicle. They were recognized as a 501(c)(3) educational charitable organization in 1996.

From 1990 to 1994, he served as Regional Wildlife Biologist supporting USDA Soil Conservation Service (now NRCS) for the eleven state Midwest region. Larry was responsible for planning, training, development of technical materials and technical support for SCS conservation programs. He also developed and carried out several wetland restoration training programs and provided technical inputs to the Wetland Reserve Program (WRP). He retired from SCS in April 1994.

From 1976 – 1990: Larry served as State Wildlife Biologist supporting USDA Soil Conservation Service in Minnesota. He was responsible for personnel training, developing technical materials, and support for SCS conservation programs in Minnesota and primarily the USDA Waterbank Program.

1969 – 1976: Served on various field, area and state office staffs for USDA Soil Conservation Service in Missouri and Oklahoma.

1965: Earned a Bachelor of Science in Agriculture degree with majors in Wildlife Biology and Soil Science.

VIII. Compensatory Planning Framework

Moreau/Loutre Rivers Service Area

Geographic Service Area:

The Moreau/Loutre Rivers EDU consists of the immediate watershed of the Missouri River in central and eastern Missouri that includes all of the Missouri and Mississippi Rivers; however, for the purposes of the Compensation Planning Framework, this EDU does not include the Missouri River proper. The EDU is primarily within the Ozark Highlands; however, the northern and western boundaries also extend in to the Central Dissected Till Plains. This EDU is contained within Howard, Boone, Cooper, Morgan, Miller, Moniteau, Cole, Osage, Callaway, Gascondage, Montgomery, Warren, Franklin, St. Charles, and St. Louis counties. Overall, there are 8,109 miles of primary stream channel within this EDU, of which 2,338 miles are classified as perennial. Of the watersheds that make up this watershed, the two largest are those of the Moreau River and the Loutre River. Because this EDU straddles two major eco-regions, it is very physiographically, hydrologically, and biologically diverse.

Threats to the Aquatic Resources in the Moreau/Loutre Rivers EDU:

<u>Water Quality Problems</u>

Overall, water quality within the Moreau/Loutre EDU is poor. In fact, State water quality standards were not met for two streams in the basin. Water quality problems facing streams in this EDU include:

- A portion of North Moreau Creek and Straight Fork are identified as EPA CWA Section 303(d) impaired water bodies.
- Waste water discharges from sewage treatment plants throughout the basin can cause low DO, algal blooms, and ammonia from waste water discharges.
- Contamination of aquatic organisms, primarily chlordane and mercury continues to plague portions of the basin.

- Nutrient-loaded runoff from pastures, feedlots, septic drainage fields, and direct contamination to streams by free livestock contributes to increasing in-stream biological oxygen demand (BOD), suspended solids, fecal coliform counts, and algae growth.
- Although it does not constitute a major problem, point source municipal and industrial discharges are present.

Many of the water quality problems, especially those involving aquatic life contaminations are difficult, complex, and expensive to address. However, many of the problems resulting in riparian destruction, stream bank erosion, and sedimentation are an appropriate project that is addressable through the installation of mitigation projects. Preservation projects, especially in streams in rapidly urbanizing areas but still containing high quality of aquatic communities, are particularly adaptable.

Aquatic Resource Problems

Overall, the quality of aquatic resources in the Moreau/Loutre EDU is fair, with some areas of good quality and other areas of degradation. Aquatic resource problems facing streams in this EDU include:

- Livestock access to streams is causing stream bank erosion and sedimentation and overgrazing in floodplain and watershed pastures contributes to flashier runoff and sediment delivery to the stream.
- Destruction of riparian vegetation is a result of row cropping too close to the stream, construction and livestock use.
- Small-scale stream channelization due to bridge construction and replacement is causing bank erosion, riparian destruction, and sedimentation issues downstream.
- Small-scale in stream gravel mining operations and small scale attempts to remedy stream channel problems are pushing in stream gravel around causing an increase in stream bank erosion and sedimentation.
- Watershed urbanization, especially in the Columbia, Jefferson City and St. Charles areas as well as numerous small towns along the Missouri River, has adversely impacted riparian corridors and increased storm water runoff, which increases channel instability, as well as depressed aquatic species diversity.

Historic Aquatic Loss in the Moreau/Loutre Rivers EDU:

The first inhabitants of the basin were ancient "mound building" people. Evidence including burial mounds, skeletal remains and artifacts of their occupation was found near the mouth of the Missouri and Osage rivers and along the Moreau River. At the time of westward expansion, the land was occupied by Osage Indians. In the late 1700's, French hunters and trappers sought the resources of the Moreau and Osage rivers. During 1812-1816, they were followed by white settlers coming primarily from Kentucky and Tennessee. Large-scale immigration followed in

the 1820's.

Early settlers found moderate tracts of prairie in the far western portions of the EDU in Morgan, Moniteau, and Cooper counties, and smaller prairies dotting the uplands away from the Missouri River, primarily ridge tops. The majority of the EDU was upland forests consisting of various oaks, or bottomland forests consisting of sycamore, cottonwood, maple, black walnut, butternut, hackberry, poplar, and bur oaks. Several salt springs were reported along the Missouri River.

Historic channelization and dredging of the Missouri River for navigation, along with the construction of levees that opened up large floodplain areas for agricultural development, resulted in massive losses of wetland and wildlife habitats within the watershed. Outside of the immediate floodplain of the Missouri River, other causes of historic habitat loss within this EDU include agricultural conversion, urbanization, and sedimentation caused by detrimental land use practices.

Current Aquatic Resource Conditions of the Moreau/Loutre Rivers EDU:

There is an east to west and north to south gradient in environmental conditions within this EDU. The north and west landscape is more prairie in nature with deep, more fine textured soils, underlain by the Mississippian limestones, and fewer springs. These springs are warm and turbid with a high percentage of sand and silt substrates. The south and east streams are clear and cool with coarse substrates, higher gradients, and well-developed riffle-pool morphology. These conditions correspond with changes in physiography; higher relief, Ordovician dolomites, shallow cherty soils, and higher spring densities.

Over 70% of the areas in the north and west of the EDU are used for row crops and pasture, dropping to 50% in the southern and eastern portions of the EDU. Row crop agriculture and livestock production are most prevalent in the northern and western parts of the EDU. The sloping areas in the northern and western parts of the EUD and the flood plains along the Missouri River are conducive to cash-grain farming. Corn, soybeans, winter wheat, and grain sorghum are the primary cash crops. The deeply dissected areas in the southern and western parts of the EDU are primarily a mixture of pasture and timber, although limited tow cropping occurs in alluvial valleys. Beef cattle, dairy cattle, and hogs are the dominant kinds of livestock. An increasing urbanization of some areas of the EDU, such as Columbia, Jefferson City, St. Charles, and many of the smaller towns, have also brought commercial, industrial, government, and tourism enterprises.

A total of 113 fish, 26 mussels, and 6 crayfish either currently or at one time inhabited the Moreau/Loutre EDU. The fish fauna of the Moreau basin reflects a blending of Ozark-Missouri and Prairie-Lower Missouri aquatic fauna; species diversity is good and numerous intolerant species of fish are widely distributed among streams. There are 8 globally listed (rare, threatened, or endangered) species and 20 state listed species. The fish assemblage is characterized by a distinct mixture of Prairie, Ozark, and Great River species and could be

classified according to the dominant families as a Minnow/Sucker/Darter assemblage. One of the most distinctive features of this EDU is the prevalence of Great River species in the lower section of the major tributaries. Several streams contain, or have the potential to contain, unique species such as Topeka shiner, common shiner, blacknose shiner, plains topminnow, ghost shiner, Ozark sculpin, and southern redbelly dace. The most common mussel species are the giant floater, pondmussel, and fatmucket, with the black sandshell being locally rare. The virile, spothanded, papershell, and devil are the most common crayfish species.

Aquatic Resource Goals and Objectives for the Moreau/Loutre Rivers EDU:

Our major goals for the Moreau/Loutre watershed are improving water quality, improving riparian and aquatic habitat conditions, maintaining diverse and abundant populations of native aquatic organisms and sport fish and increasing public appreciation for the stream resources. Cooperative efforts with other resource agencies on water quality, habitat, and watershed management issues will be critical to our mitigation efforts. Legal enforcement of existing water quality and other stream-related regulations and necessary revisions and additions to these regulations will help reduce violations and lead to further water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system. Existing onsite habitat improvement projects on federal, state, and local government lands and those of private landowners will focus on improving stream channel and riparian area stability in priority areas in the EDU:

- Restoration of in stream habitats (pools with woody debris, boulders and/or aquatic vegetation) benefits resident sportfish, native non-game fishes (including ghost shiner, Topeka shiners, troutperch, plains minnow, etc) and unique or depressed aquatic invertebrate populations.
- Restoration, expansion, and maintenance of well vegetated riparian areas, especially in areas with high diversity of aquatic life, presence of species of conservation concern, and areas managed for specific species or communities.
- Mitigation planning may identify significant sources of pollutants (i.e. eroded soil and other non-point water quality problems) and strive to restore and stabilize them.
- Restoration of in-channel hydraulics to balance the hydrological and in-channel physical conditions of streams.

Active enforcement of existing water quality and other stream related regulations, and necessary revisions and additions, are detrimental and will help reduce violations and increase water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system.

Prioritization Strategy for Selecting and Implementing Compensatory Mitigation Strategies for the Moreau/Loutre Rivers EDU:

Mitigation projects in the Moreau/Loutre Rivers EDU will be located in areas that provide physical, chemical, and/or biological improvements to stream ecological values of the basin, and are technically feasible and appropriate to install at the project site. The highest priority will be areas of biodiversity that have been deemed Conservation Opportunity Areas using the assessment by the interagency Missouri Resource Assessment Partnership (MoRAP). The MoRAP conservation assessment process within the Moreau/Loutre EDU found 9 COAs, containing 61 target species. These COAs constitute 531 miles of stream, which represents 6.5% of the total stream miles within the Moreau/Loutre EDU, and their watersheds represent an overall area of 346 square miles, or 6.9% of the region. Specific attention to, and more intensive conservation efforts within these 9 COAs provides an efficient and effective strategy for the long term maintenance of relatively high quality examples of the various ecosystem and community types that exist within this EDU. In addition to COAs, other priority sites will be identified when a mitigation project is not possible in one of the above COAs:

- 303 (d) listed waters
- Stream reaches managed by Missouri Department of Natural Resources Aquatic
- Stream reaches containing state or federal species of conservation concern
- Conservation Opportunity Areas
- Areas of high aquatic biodiversity around Columbia, Jefferson City and St. Charles
- Greenway corridors proposed or managed by federal, state, or local entities for public recreation or habitat conservation purposes
- Upstream or downstream of all Missouri Department of Conservation state parks and other local, state or federally-owned public areas managed for natural resource or public recreation purposes

Preservation Objectives for the Moreau/Loutre Rivers EDU:

The priority of projects will continue to be on restoration and establishment. However, preservation projects are an important part of watershed management, in that critical stream reaches, unique habitats, and protection of important water quality areas of the Moreau/Loutre basin will contribute to sustaining ecological functioning over the long term. Preservation will be used in the Moreau/Loutre Rivers EDU when:

- The resources to be preserved provide important physical, chemical and/or biological functions for the watershed;
- The resources contribute significantly to the ecological sustainability of the watershed;
- Preservation is appropriate, practicable, and has the support of the IRT and the Corps;
- The aquatic resources in question are under threat of destruction or degradation; and/or

- The preserved site will be permanently protected by the appropriate real estate provision or legal instrument as part of the in-lieu fee project site mitigation plan.

Preservation efforts will be combined with associated efforts to restore, establish, or enhance other aquatic habitats as is practicable and appropriate. Stream and riparian corridor preservation will receive credit based upon the calculated amount for preservation per the State of Missouri Stream Mitigation Method. Wetland preservation will only be proposed for high quality wetlands and credits will be released at a higher ratio as approved by the Corps, in consultation with the IRT.

Public and Private Stakeholder involvement in plan development and implementation in the Moreau/Loutre Rivers EDU:

Mitigation sites within the Moreau/Loutre EDU, the Sponsor will seek out local input from federal and state agencies, municipalities, landowners, natural resource management groups and advisory groups within the watershed as appropriate. The ILF program will work with any willing public agencies to prioritize watersheds in in-lieu-fee projects. IFL project sites will not be placed on public lands.

Long-Term Protection and Management Strategies for Compensatory Mitigation in the Moreau/Loutre Rivers EDU:

Each compensatory mitigation site will be protected in perpetuity by a conservation easement held by an approved long-term steward that will be identified within the mitigation plan. These easements ensure that there will be no development or other land use change on the project sites which could diminish the level of physical, chemical, and biological ecosystem functions that each site provides to the watershed. Additionally, the conservation easement will stay with the property if that title to the property is transferred to a third party. It is the intention of LLF to maintain ownership of properties in perpetuity as highly functioning habitat in accordance with the terms of a long-term management plan and conservation easement.

In the rare event where a high priority project cannot be secured through fee title acquisition or perpetual easement, the following methods for long-term protection may be considered:

- The choice of a landowner not interested in signing a perpetual easement to choose to donate, sell, or otherwise transfer an easement for a 20-30 year period to the Missouri Department of Conservation, natural resource-oriented federal, state, or local government agency, or a natural resource-oriented land trust like the Nature Conservancy, Ozark Regional land Trust, Greenbelt Land Trust or similar non-profit entity
- The choice of a landowner not interested in signing a perpetual easement to choose to agree to a maintenance agreement, a contractual agreement between LLF and the landowner, where the landowner or other entity promises to meet specified maintenance

condition for a 20-30 year period. These projects are alienable in the event of the sale of property. If the maintenance agreement does not transfer, it remains with the original signer of the agreement.

LLF would perform annual monitoring with onsite field observations, reporting, and enforcement actions, as appropriate, on all properties.

Strategy for Periodic Evaluation and Reporting in the Moreau/Loutre Rivers EDU:

Evaluation, monitoring, and reporting is required of all compensatory mitigation projects to determine if the project is meeting its performance standards and if additional measures are necessary to ensure that the compensatory mitigation project is accomplishing its objectives. This documentation will include an accounting of the acreage and type of all mitigation activities within the service area and how the combined ecological benefit of all compensatory mitigation sites is performing to achieve the goals set forth in this EDU. Project specific mitigation plans will detail the parameters to be monitored, the length of the monitoring period, the dates that the reports must be submitted, the party responsible for conducting the monitoring, the frequency for submitting monitoring reports to the Corps, and the party responsible for submitting those monitoring reports to the Corps and the IRT. Data collection for performance objectives will occur once during the year and will be reported in an annual report until a project has been shown to meet performance standards, unless otherwise specified in the approved project-specific mitigation plan. The level of detail and substance of the report will be commensurate with the scale and scope of the compensatory mitigation project. Compliance monitoring will also be conducted annually until performance standards are met and will be reported in the annual report. After a project has met performance standards, the frequency of all monitory will decrease to a term not to be less than once every five years. Changes in reporting may be required by the Corps and the IRT as necessary to accommodate adaptive changes in the project and unforeseen natural disasters.

Evaluation and reporting will concentrate on those metrics involved in performance standards and will not include species or community biotic sampling until late in the project cycle, if at all. Temporal improvement of biota and their communities often lags restoration projects by years, and sometimes decades, and biological sampling often is inconclusive as to whether a project has improved biotic communities. At the conclusion of the project, aquatic invertebrate and/or other fish diversity indices may be calculated and compared to the before-project condition and to reference indices obtained from stable streams of similar type, order, and size elsewhere within the watershed, if the biologist in charge of the project determines it is necessary.

References:

http://extra.mdc.mo.gov/fish/watershed/moreau/contents/

Apple/Joachim Rivers Service Area

Geographic Service Area:

The Apple/Joachim Creeks basin is located in St. Louis City and County, Jefferson, St. Francois, Ste. Genevieve, Perry and Cape Girardeau counties. The EDU lies in east-central Missouri and includes all of the smaller direct tributaries to the Mississippi River between the outlets of the Missouri and the Castor River diversion channel (known as the Headwater Diversion). Included are River Des Peres, Joachim Creek, Plattin Creek, Establishment Creek, Aux Vases River, Saline Creek, Cinque Hommes Creek, Apple Creek, Indian Creek, and Cape La Croix Creek. Overall there are 4,453 miles of primary stream channel within this EDU, of which 1,734 miles are classified as perennial. Because of their basic physical, chemical and biological similarity; the similarity of watershed land use and topography in each basin; the common downstream connection with the lower Mississippi River, including all of these streams in one EDU for mitigation planning will allow similar approaches to watershed, riparian, and stream channel problems and opportunities.

Threats to the Aquatic Resources in the Apple/Joachim Rivers EDU:

Water Quality Problems

Overall, the water quality of the Apple/Joachim EDU varies within the several watersheds. Water quality problems facing streams in this EDU include:

- Waste water discharges from sewage treatment plants can cause low DO, algal blooms, and ammonia buildup
- Contamination of aquatic organisms, primarily with chlordane; heavy metals from mining industrial and municipal effluents; and mercury, continue to plague the EDU
- In the middle of the EDU, with Ste. Genevieve County as the epicenter, historic lead, iron and zinc mining areas have impacted streams with mine discharges and erosion of tailing
- Intensive livestock operations increase sediment and organic discharges to the stream

Many of the water quality problems, especially those involving aquatic life and heavy metal contaminations and strenuous urban channel paving and containment, are difficult, complex, and expensive to address. However, many of the problems resulting in riparian destruction, stream

bank erosion, and sedimentation are an appropriate project that is addressable through the installation of mitigation projects. Preservation projects, especially in streams in rapidly urbanizing areas but still containing high quality of aquatic communities, are particularly adaptable.

Aquatic Resource Problems

Overall, the quality of aquatic resources in the Apple/Joachim EDU is fair, with some areas of good quality and other areas of degradation. Aquatic resource problems facing streams in this EDU include:

- Watershed urbanization, especially in the northern parts of the EDU in St. Louis and Jefferson counties adversely impacts riparian corridors, increases storm water runoff, increases stream nutrients, and depresses aquatic species diversity, especially when tied to channel alterations.
- Destruction of riparian vegetation from construction and livestock use
- Channelization ranging from full scale channel paving and/or closure in the St. Louis area (e.g., River Des Peres) to a number of more natural channels where only small-scale channelization due to bridge construction and replacement causes localized bank erosion, riparian destruction, and sedimentation downstream.
- Livestock overgrazing and unregulated access to streams causing stream bank erosion and sedimentation
- In-stream gravel operations are small scale and impacts ranging from bank erosion and riparian destruction to sedimentation are more localized
- Historic lead, iron and zinc mining in the areas of St. Genevieve county continues to impact streams

Historic Aquatic Loss in the Apple/Joachim Rivers EDU:

Prior to European settlement, the Apple/Joachim watershed was vastly forested with numerous floodplain wetlands. Upland, timber consisted typically of numerous oak species and hickory, and in the alluvial floodplains it consisted of sycamore, maple, oak, hickory, walnut, buckeye, cottonwood, birch and other similar species. Prairie and savanna areas were sparse in the uplands of the basin.

In the late 1700s, the first settlers came, establishing trading posts in St. Louis, Ste. Genevieve, and Cape Girardeau. Settlers originally survived by living off the abundant wild game, wild honey, and wild fruits, and raising corn, flax and cotton for personal use in small fields. Widespread agricultural efforts increased steadily. By the time of the Civil War, farmers were raising a variety of crops and selling them, primarily in St. Louis. An influx of German settlers and the establishment of the Iron Mountain Railroad in the late 1800s spurred an increase in agriculture in the basin. The main interest in the area was mining, and agricultural pursuits were

slow to establish. While much of the EDU remained rural, the northern part of the EDU saw an increase in urbanization as St. Louis developed over several centuries from a small trading post to a large US city. The ultimate result of the steady conversion of forest, wetland and grasslands to buildings, streets, and other urban infrastructure eliminated habitats, depressed aquatic natural features, and destroyed natural stream, riparian and upland values.

In this EDU, the topography and characteristics of native communities were similar to that of other Ozark watersheds; therefore, it is likely that the area was predominantly forested, with some interspersion of grasses and the remaining being wetland and other land uses. Much of the virgin timber began to be removed in the early 1800s, and by late in the century, timber companies had harvested much of the basin's upland timber. As settlement increased, burning and grazing forests became common practices.

Attempts at agriculture were first displayed by early settlers with the implementation of small tracts of corn, flax and cotton, cultivated for personal use. The agricultural growth was slow, except for areas in the Mississippi River floodplain, which had a history of being cultivated even by Native Americans. The growth of farming was fairly slow until the influx of German immigrants brought more farmers to the area. Livestock, barley, corn, oats, rye, wheat, potatoes, tobacco and orchard products were raised and sold locally or sent to St. Louis. Grapes were also cultured and used for winemaking.

Current Aquatic Resource Conditions of the Apple/Joachim Rivers EDU:

This EDU currently has a hydrologically diverse landscape with an equal mixture of surface water and spring flow-dominated streams. The average gradient across all stream size classes is 28 ft. /mi. The Inner and Outer Ozark Border Ecological Subsections dominate the landscape of this EDU. These two subsections differ mainly in terms of bedrock geology and relief. The Outer Ozark Border, as it runs along the Mississippi River, generally has lower relief (150 feet) and is underlain by Mississippian limestone, which corresponds with the distributional limit of many Ozark aquatic species. The Inner Ozark Border has higher relief (150-300 feet) and is underlain by Ordovician dolomites.

In general, land use and land cover are reduced from the predominantly-forested condition of the past. The northern parts of the EDU have been rapidly urbanizing; areas surrounding the larger towns elsewhere, like Ste. Genevieve, Perryville, and Cape Girardeau, have also shown conversion of other land uses to houses and developments. Forestation has been reduced, and is more concentrated in the northern portion of the EDU.

Current conditions in the southern portion of the drainage contains to cropland and pasture-dominated agriculture. Typical of the EDU as a whole, approximately 60% of Ste. Genevieve County is farmed, primarily in the uplands and floodplains; the farming breakdown is roughly half pasture and half row cropping. Forest is steadily declining and being converted to agricultural and urban land. The conversion from forest to agricultural lands increases erosion

and sedimentation in streams within the EDU, and while the incidence of CAFOs is low compared to other EDUs, they contribute to nutrient enrichment and other water quality problems in the basin. Wetlands have decreased dramatically, as drainage projects in floodplain areas have drained much of what was present prior to European settlement. The results of these land use changes have been an increase in nonpoint pollutants, erosion and sedimentation, and increasing nutrients from pasture runoff. Grazing and row cropping have increased in upland areas and valley bottoms compared to historical conditions.

While the EDU was not as heavily mined compared to other EDUs, mining occurred, and some of the larger mine processing sites are found in the Apple/Joachim basin. A long-operating lead smelter continues to separate lead from other materials in Herculaneum. Lead smelting is not without problems contributing to heavy metals contamination, and the owner of the lead smelter in Herculaneum plans to cease smelting operations in the near future and renovate the site. There are a number of limestone mining operations, primarily in the Jefferson and Ste. Genevieve county area, and small-scale gravel mining in streams occurs.

With the urbanization of the St. Louis area and the continued development of rural lands south of the city, stream degradation is occurring. Pollution-sensitive aquatic life declined in many of the streams near St. Louis; water quality and habitats also declined as watershed areas were converted to impervious surfaces like roads, parking lots and houses.

Removal of forested and vegetated riparian areas along streams also occurred, removing the buffers than protected streams from adverse impacts. Increased runoff from these areas contributed to altered hydrology, and changes to the thermal regimes of streams also occurred. A variety of water quality problems, including inadequate sewage treatment discharges, and increased municipal discharges to streams, and increased non point pollution events, combined with nutrient loading and pesticide problems from yards and gardens, also contributes to the degradation of biological communities. While these sorts of problems are currently concentrated in the northern portions of the EDU, rapid expansion of urban areas in the long term will continue to contribute problems.

A total of 121 fish, 23 mussels, and 5 crayfish either inhabit or at one time inhabited the Apple Joachim EDU. According to the Missouri Natural Heritage Program there are 8 globally listed (rare, threatened, or endangered) species and 19 state listed species. The fish assemblage is characterized by a mixture Ozark, Great River, and Lowland species and could be classified according to the dominant families as a Minnow/Darter/Sucker assemblage. Distinctive fish species include the Ozark minnow, Mississippi silvery minnow, bleeding shiner, western sand shiner, ghost shiner, crystal darter, sicklefin chub, sturgeon chub, pallid sturgeon, lake sturgeon, and Alabama shad. A distinctive feature of this EDU is the prevalence of Great River species in the lower sections of the major tributaries.

The most common mussel species are the giant floater, pondmussel, and fatmucket. The flat

floater is a distinctive mussel species. The virile, spothanded, devil, and golden are the most common and distinctive crayfish species.

Aquatic Resource Goals and Objectives for the Apple/Joachim Rivers EDU:

Our major goals for the Apple/Joachim River watershed are improving water quality, improving riparian and aquatic habitat conditions, maintaining diverse and abundant populations of native aquatic organisms and sport fish and increasing public appreciation for the stream resources. Cooperative efforts with other resource agencies on water quality, habitat, and watershed management issues will be critical to our mitigation efforts. Legal enforcement of existing water quality and other stream-related regulations and necessary revisions and additions to these regulations will help reduce violations and lead to further water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system. Existing onsite habitat improvement projects on federal, state, and local government lands and those of private landowners will focus on improving stream channel and riparian area stability in priority areas in the EDU:

- Restoration of in-stream habitats (pools with woody debris, boulders and/or aquatic vegetation) benefits resident sportfish, native non-game fishes (including ghost shiner, Topeka shiners, troutperch, plains minnow, etc) and unique or depressed aquatic invertebrate populations.
- Restoration, expansion, and maintenance of well vegetated riparian areas, especially in areas with high diversity of aquatic life, presence of species of conservation concern, and areas managed for specific species or communities.
- Mitigation planning may identify significant sources of pollutants (i.e. eroded soil and other non-point water quality problems) and strive to restore and stabilize them.
- Restoration of in-channel hydraulics to balance the hydrological and in-channel physical conditions of streams.

Active enforcement of existing water quality and other stream related regulations, and necessary revisions and additions, are detrimental and will help reduce violations and increase water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system.

Prioritization Strategy for Selecting and Implementing Compensatory Mitigation Strategies for the Apple/Joachim Rivers EDU:

Mitigation projects in the Apple/Joachim EDU will be located in areas that provide physical, chemical, and/or biological improvements to stream ecological values of the basin, and are technically feasible and appropriate to install at the project site. The highest priority will be areas

of biodiversity that have been deemed Conservation Opportunity Areas using the assessment by the interagency Missouri Resource Assessment Partnership (MoRAP). The MoRAP conservation assessment process within the Apple/Joachim EDU found 8 COAs, containing 58 target species. These COAs constitute 515 kilo meters of stream, which represents 13% of the total stream miles within the Apple/Joachim EDU. In addition to COAs, other priority sites will be identified when a mitigation project is not possible in one of the above COAs:

- 303 (d) listed waters
- Stream reaches managed by Missouri Department of Natural Resources Aquatic
- Stream reaches containing state or federal species of conservation concern
- Conservation Opportunity Areas
- Areas of high aquatic biodiversity
- Greenway corridors proposed or managed by federal, state, or local entities for public recreation or habitat conservation purposes
- Upstream or downstream of all Missouri Department of Conservation state parks and other local, state or federally-owned public areas managed for natural resource or public recreation purposes

Preservation objectives for the Apple/Joachim Rivers EDU:

The priority of projects will continue to be on restoration and establishment. However, preservation projects are an important part of watershed management, in that critical stream reaches, unique habitats, and protection of important water quality areas of the Apple/Joachim basin will contribute to sustaining ecological functioning over the long term. Preservation will be used in the Apple/Joachim EDU when:

- The resources to be preserved provide important physical, chemical and/or biological functions for the watershed;
- The resources contribute significantly to the ecological sustainability of the watershed;
- Preservation is appropriate, practicable, and has the support of the IRT and the Corps;
- The aquatic resources in question are under threat of destruction or degradation; and/or
- The preserved site will be permanently protected by the appropriate real estate provision or legal instrument as part of the in-lieu fee project site mitigation plan.

Preservation efforts will be combined with associated efforts to restore, establish, or enhance other aquatic habitats as is practicable and appropriate. Stream and riparian corridor preservation will receive credit based upon the calculated amount for preservation per the State of Missouri Stream Mitigation Method. Wetland preservation will only be proposed for high quality wetlands and credits will be released at a higher ratio as approved by the Corps, in consultation with the IRT.

Public and Private Stakeholder involvement in plan development and implementation in the Apple/Joachim Rivers EDU:

Mitigation sites within the Apple/Joachim EDU, the Sponsor will seek out local input from federal and state agencies, municipalities, landowners, natural resource management groups and advisory groups within the watershed as appropriate. The ILF program will work with any willing public agencies to prioritize watersheds in in-lieu-fee projects. IFL project sites will not be placed on public lands.

Long-term protection and management strategies for compensatory mitigation in the Apple/Joachim Rivers EDU:

Each compensatory mitigation site will be protected in perpetuity by a conservation easement held by an approved long-term steward that will be identified within the mitigation plan. These easements ensure that there will be no development or other land use change on the project sites which could diminish the level of physical, chemical, and biological ecosystem functions that each site provides to the watershed. Additionally, the conservation easement will stay with the property if that title to the property is transferred to a third party. It is the intention of LLF to maintain ownership of properties in perpetuity as highly functioning habitat in accordance with the terms of a long-term management plan and conservation easement.

In the rare event where a high priority project cannot be secured through fee title acquisition or perpetual easement, the following methods for long-term protection may be considered:

- The choice of a landowner not interested in signing a perpetual easement to choose to donate, sell, or otherwise transfer an easement for a 20-30 year period to the Missouri Department of Conservation, natural resource-oriented federal, state, or local government agency, or a natural resource-oriented land trust like the Nature Conservancy, Ozark Regional land Trust, Greenbelt Land Trust or similar non-profit entity
- The choice of a landowner not interested in signing a perpetual easement to choose to agree to a maintenance agreement, a contractual agreement between LLF and the landowner, where the landowner or other entity promises to meet specified maintenance condition for a 20-30 year period. These projects are alienable in the event of the sale of property. If the maintenance agreement does not transfer, it remains with the original signer of the agreement.

LLF would perform annual monitoring with onsite field observations, reporting, and enforcement actions, as appropriate, on all properties.

Strategy for periodic evaluation and reporting in the Apple/Joachim Rivers EDU:

Evaluation, monitoring, and reporting is required of all compensatory mitigation projects to determine if the project is meeting its performance standards and if additional measures are

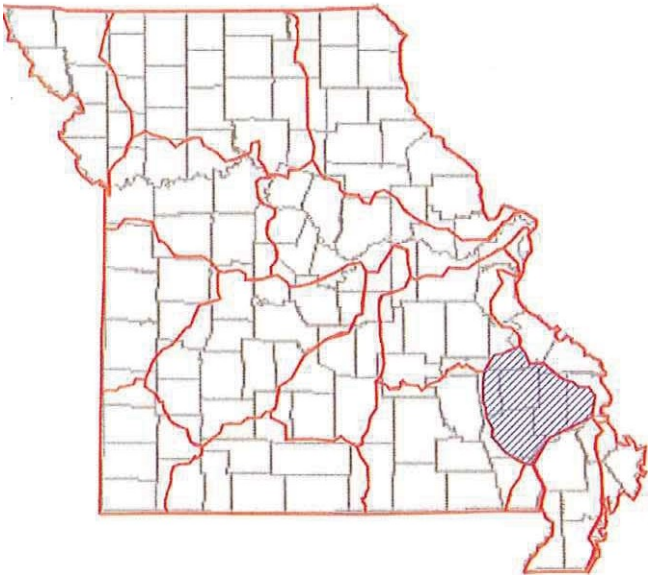
necessary to ensure that the compensatory mitigation project is accomplishing its objectives. This documentation will include an accounting of the acreage and type of all mitigation activities within the service area and how the combined ecological benefit of all compensatory mitigation sites is performing to achieve the goals set forth in this EDU. Project specific mitigation plans will detail the parameters to be monitored, the length of the monitoring period, the dates that the reports must be submitted, the party responsible for conducting the monitoring, the frequency for submitting monitoring reports to the Corps, and the party responsible for submitting those monitoring reports to the Corps and the IRT. Data collection for performance objectives will occur once during the year and will be reported in an annual report until a project has been shown to meet performance standards, unless otherwise specified in the approved project-specific mitigation plan. The level of detail and substance of the report will be commensurate with the scale and scope of the compensatory mitigation project. Compliance monitoring will also be conducted annually until performance standards are met and will be reported in the annual report. After a project has met performance standards, the frequency of all monitory will decrease to a term not to be less than once every five years. Changes in reporting may be required by the Corps and the IRT as necessary to accommodate adaptive changes in the project and unforeseen natural disasters.

Evaluation and reporting will concentrate on those metrics involved in performance standards and will not include species or community biotic sampling until late in the project cycle, if at all. Temporal improvement of biota and their communities often lags restoration projects by years, and sometimes decades, and biological sampling often is inconclusive as to whether a project has improved biotic communities. At the conclusion of the project, aquatic invertebrate and/or other fish diversity indices may be calculated and compared to the before-project condition and to reference indices obtained from stable streams of similar type, order, and size elsewhere within the watershed, if the biologist in charge of the project determines it is necessary.

References

The information in this EDU does not appear in the Watershed Inventory and Assessment (WIA) document. Information for this EDU was gathered from other resources.

Upper St. Francis River Service Area



Geographic Service Area:

The 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 Plateau and the low-relief Mississippi Alluvial Plain. Wappapello Dam and Lake are located on the divide. For inventory and planning purposes, the basin is separated into two dissimilar sub-basins: the upper sub-basin above Wappapello Dam and the lower sub-basin below Wappapello Dam.

The basin drains 1,839 square miles in Missouri. The headwater area is dominated by igneous rock in the Ozark uplift (St. Francois Mountains), followed in a downstream direction by sandstone and dolomites. The alluvial plain of the lower sub-basin is topped with a layer of unconsolidated gravel, sand, silt, and clay and is bordered on the east by Crowleys Ridge. Drainage in the lower sub-basin has been altered by a system of levees and drainage ditches. Most of the west bank of the lower St. Francis River is a levee, which prevents drainage into the river from the west.

Threats to the Aquatic Resources in the Upper Saint Frances River EDU:

<u>Water Quality Problems</u>

Overall, the water quality in the Upper Saint Frances River EDU is good. Evaluations from the Missouri Department of Natural Resources show that most of the basin, including the entire St. Francis River and Wappapello Lake are classified as full use attainment. Water quality problems facing streams in this EDU include:

- The basin has some of the lowest erosion potential in the state, which results in particularly low sediment yields, bed loads, and turbidities.
- The primary sources of non-point pollution in the lower sub-basin of the EDU are nutrient and pesticide loading from agricultural runoff (90% of the sub-basin is cropland and pasture).
- Pesticide residues are present in surface and shallow groundwater supplies throughout the sub-basin.
- Head-cutting and rill and gully erosion are substantial problems upstream from the channelized sections

- Mining activity has periodically affected water quality by contaminating localized surface water, groundwater, channel substrates, and vegetation with heavy metals and other harmful mine, mill, or smelter byproducts

Many of the water quality problems, especially those involving heavy metals and aquatic life contamination are difficult, complex, and expensive to address. However, many of the problems resulting in riparian destruction, stream bank erosion, and sedimentation are an appropriate project that is addressable through the installation of mitigation projects. Preservation projects, especially in streams in rapidly urbanizing areas but still containing high quality aquatic communities are particularly adaptable.

Aquatic Resource Problems

In lower sub-basin streams, channelized sections are in very poor condition due to head-cutting and sloughing stream banks. The remaining areas of the lower sub-basin are in good condition, with only minor problems. Aquatic resource problems facing streams in this EDU include:

- Moderate to severe habitat destruction has occurred and will continue to occur throughout the sub-basin upstream of the channelization
- Head-cutting in the main stream, tributaries, and lateral ditches has caused lower stream bed elevations, wider and shallower stream channels, and steeper banks, which are experiencing severe sloughing and erosion in many locations. Increased deposition downstream is causing abundant unconsolidated sediments, decreased depths, and accelerated bank erosion

Historic Aquatic Loss in the Upper Saint Francis River EDU:

The headwaters of the St. Francis River basin have undergone the same type of land disturbances that are typical of the Ozark Plateau. Suppression of wildfire was followed by mining, highly selective upland logging, annual burning to support open range for grazing, transient attempts at upland row cropping, a second intensive timber cutting concentrated on the slopes, and most recently, increased grazing intensity.

Prior to the 1800s, the sub-basin was in the historic pine range -- a wildfire-maintained upland savannah dominated by shortleaf pine with a prairie grass understory. The steep valley walls grew lush forests of oak, hickory, and pine, while the valley bottoms produced dense stands of bottomland hardwoods.

Early prospectors mined mineral deposits (lead, zinc, silver, iron) on the slopes of the St. Francois Mountains. During the early settlement period (1800-1880) settlers raised crops in the valleys and grazed livestock on the forested hillsides and the natural grass of the uplands. Small logging operations selectively cut old growth timber in the uplands and a network of roads was developed. Land disturbances caused by early settlement had minimal effect on runoff and

erosion.

During the timber boom (1880-1920), large-scale timber operations began. Many settlers moved to the region for jobs. Log drives down streams could be large and logs were not tied into rafts. In 1909, Missouri began regulating log drives because they were dangerous and damaged stream banks. By 1920, most of the marketable shortleaf pine and hardwoods had been cut and the larger mills ceased operation.

Many of the unemployed loggers and lumber mill workers settled on the cut-over land vacated by the departing timber companies. Indiscriminate logging took more, the remnant forest was burned each year to increase grass production, livestock over-grazed the newly converted range land, and bottomland agriculture (row crops and livestock) expanded.

Agriculture peaked from 1940 to 1950, then decreased. Passage of an open range law, fewer range fires, acquisition of public lands, improved soil conservation practices, and reforestation of marginal pasture and row crop acreage all contributed to improved watersheds.

The entire Bootheel region of Missouri (which includes the lower sub-basin of the St. Francis River) has undergone a total landscape transformation from an immense swampland forest, with intermingled streams, lakes, swamps, bayous, and sloughs, to a vast agricultural area.

Current Aquatic Resource Conditions of the Upper Saint Francis River EDU:

This sub-basin is 77 percent woodland, 10 percent grassland, 7 percent cropland, and 6 percent other land uses, which includes industrial, urban, and water developments (MDNR 1984)(Figure Lu01). Small cropland tracts are most often restricted to the wider mainstream floodplains in St. Francois County, while grasslands (hay fields and pasture) tend to be associated with bottoms and cleared ridge-tops in Iron, Madison, and Wayne counties. Land use patterns have apparently stabilized.

The woodlands are usually large upland tracts of oak-hickory forest dominated by a black-scarlet oak association (45%) and a secondary white oak association (31%). Succession is toward conversion to a more desirable white oak forest type. The tracts are considered moderately (56%) to poorly (26%) stocked with proportional stand size-classes of 49 percent sawtimber, 33 percent poletimber and 18 percent seedlings and saplings (Leatherberry 1990). Most of the woodlands (71%) are privately owned; 19 percent are under state or federal stewardship. Livestock grazing in woodlands can present some ecological and hydrologic concerns relating to canopy closure, understory development, leaf litter accumulation, and soil compaction.

A local mining industry (iron, lead, zinc, quarried red granite) and various small urban centers provide important components of the basin's economy. Small farms are common throughout the basin, but most farm operators supplement their incomes with off-farm employment.

The sub-basin is mostly rural and sparsely populated (MDNR 1986). The communities of

Farmington, Fredericktown, and Ironton and the area surrounding Wappapello Lake are experiencing the greatest population growth. Uncontrolled sediment and storm water runoff at construction sites can pose localized problems. There are no industrial developments, associated with the small urban centers that pose serious threats to local streams.

Aquatic Resource Goals and Objectives for the Upper Saint Frances River EDU:

Our major goals for the Upper Saint Frances River watershed are improving water quality, improving riparian and aquatic habitat conditions, maintaining diverse and abundant populations of native aquatic organisms and sport fish and increasing public appreciation for the stream resources. Cooperative efforts with other resource agencies on water quality, habitat, and watershed management issues will be critical to our mitigation efforts. Legal enforcement of existing water quality and other stream-related regulations and necessary revisions and additions to these regulations will help reduce violations and lead to further water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system. Existing onsite habitat improvement projects on federal, state, and local government lands and those of private landowners will focus on improving stream channel and riparian area stability in priority areas in the EDU:

- Restoration of in-stream habitats (pools with woody debris, boulders and/or aquatic vegetation) benefits resident sportfish, native non-game fishes (including ghost shiner, Topeka shiners, troutperch, plains minnow, etc) and unique or depressed aquatic invertebrate populations.
- Restoration, expansion, and maintenance of well vegetated riparian areas, especially in areas with high diversity of aquatic life, presence of species of conservation concern, and areas managed for specific species or communities.
- Mitigation planning may identify significant sources of pollutants (i.e. eroded soil and other non-point water quality problems) and strive to restore and stabilize them.
- Restoration of in-channel hydraulics to balance the hydrological and in-channel physical conditions of streams.

Active enforcement of existing water quality and other stream related regulations, and necessary revisions and additions, are detrimental and will help reduce violations and increase water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system.

Prioritization Strategy for Selecting and Implementing Compensatory Mitigation Strategies for the Upper Saint Frances River EDU:

Mitigation projects in the Upper Saint Frances EDU will be located in areas that provide physical, chemical, and/or biological improvements to stream ecological values of the basin, and are technically feasible and appropriate to install at the project site. The highest priority will be areas of biodiversity that have been deemed Conservation Opportunity Areas using the assessment by the interagency Missouri Resource Assessment Partnership (MoRAP). The MoRAP conservation assessment process within the Upper Saint Frances EDU contains over 200 COAs, containing at least 100 target species. In addition to COAs, other priority sites will be identified when a mitigation project is not possible in one of the above COAs:

- 303 (d) listed waters
- Stream reaches managed by Missouri Department of Natural Resources Aquatic
- Stream reaches containing state or federal species of conservation concern
- Conservation Opportunity Areas
- Areas of high aquatic biodiversity
- Greenway corridors proposed or managed by federal, state, or local entities for public recreation or habitat conservation purposes
- Upstream or downstream of all Missouri Department of Conservation state parks and other local, state or federally-owned public areas managed for natural resource or public recreation purposes

Preservation objectives for the Upper Saint Frances River EDU:

The priority of projects will continue to be on restoration and establishment. However, preservation projects are an important part of watershed management, in that critical stream reaches, unique habitats, and protection of important water quality areas of the Upper Saint Frances basin will contribute to sustaining ecological functioning over the long term. Preservation will be used in the Upper Saint Frances EDU when:

- The resources to be preserved provide important physical, chemical and/or biological functions for the watershed;
- The resources contribute significantly to the ecological sustainability of the watershed;
- Preservation is appropriate, practicable, and has the support of the IRT and the Corps;
- The aquatic resources in question are under threat of destruction or degradation; and/or
- The preserved site will be permanently protected by the appropriate real estate provision or legal instrument as part of the in-lieu fee project site mitigation plan.

Preservation efforts will be combined with associated efforts to restore, establish, or enhance other aquatic habitats as is practicable and appropriate. Stream and riparian corridor preservation will receive credit based upon the calculated amount for preservation per the State of Missouri

Stream Mitigation Method. Wetland preservation will only be proposed for high quality wetlands and credits will be released at a higher ratio as approved by the Corps, in consultation with the IRT.

Public and Private Stakeholder involvement in plan development and implementation in the Upper Saint Frances River EDU:

Mitigation sites within the Upper Saint Frances EDU, the Sponsor will seek out local input from federal and state agencies, municipalities, landowners, natural resource management groups and advisory groups within the watershed as appropriate. The ILF program will work with any willing public agencies to prioritize watersheds in in-lieu-fee projects. IFL project sites will not be placed on public lands.

Long-term protection and management strategies for compensatory mitigation in the Upper Saint Frances River EDU:

Each compensatory mitigation site will be protected in perpetuity by a conservation easement held by an approved long-term steward that will be identified within the mitigation plan. These easements ensure that there will be no development or other land use change on the project sites which could diminish the level of physical, chemical, and biological ecosystem functions that each site provides to the watershed. Additionally, the conservation easement will stay with the property if that title to the property is transferred to a third party. It is the intention of LLF to maintain ownership of properties in perpetuity as highly functioning habitat in accordance with the terms of a long-term management plan and conservation easement.

In the rare event where a high priority project cannot be secured through fee title acquisition or perpetual easement, the following methods for long-term protection may be considered:

- The choice of a landowner not interested in signing a perpetual easement to choose to donate, sell, or otherwise transfer an easement for a 20-30 year period to the Missouri Department of Conservation, natural resource-oriented federal, state, or local government agency, or a natural resource-oriented land trust like the Nature Conservancy, Ozark Regional land Trust, Greenbelt Land Trust or similar non-profit entity
- The choice of a landowner not interested in signing a perpetual easement to choose to agree to a maintenance agreement, a contractual agreement between LLF and the landowner, where the landowner or other entity promises to meet specified maintenance condition for a 20-30 year period. These projects are alienable in the event of the sale of property. If the maintenance agreement does not transfer, it remains with the original signer of the agreement.

LLF would perform annual monitoring with onsite field observations, reporting, and enforcement actions, as appropriate, on all properties.

Strategy for periodic evaluation and reporting in the Upper Saint Frances River EDU:

Evaluation, monitoring, and reporting is required of all compensatory mitigation projects to determine if the project is meeting its performance standards and if additional measures are necessary to ensure that the compensatory mitigation project is accomplishing its objectives. This documentation will include an accounting of the acreage and type of all mitigation activities within the service area and how the combined ecological benefit of all compensatory mitigation sites is performing to achieve the goals set forth in this EDU. Project specific mitigation plans will detail the parameters to be monitored, the length of the monitoring period, the dates that the reports must be submitted, the party responsible for conducting the monitoring, the frequency for submitting monitoring reports to the Corps, and the party responsible for submitting those monitoring reports to the Corps and the IRT. Data collection for performance objectives will occur once during the year and will be reported in an annual report until a project has been shown to meet performance standards, unless otherwise specified in the approved project-specific mitigation plan. The level of detail and substance of the report will be commensurate with the scale and scope of the compensatory mitigation project. Compliance monitoring will also be conducted annually until performance standards are met and will be reported in the annual report. After a project has met performance standards, the frequency of all monitory will decrease to a term not to be less than once every five years. Changes in reporting may be required by the Corps and the IRT as necessary to accommodate adaptive changes in the project and unforeseen natural disasters.

Evaluation and reporting will concentrate on those metrics involved in performance standards and will not include species or community biotic sampling until late in the project cycle, if at all. Temporal improvement of biota and their communities often lags restoration projects by years, and sometimes decades, and biological sampling often is inconclusive as to whether a project has improved biotic communities. At the conclusion of the project, aquatic invertebrate and/or other fish diversity indices may be calculated and compared to the before-project condition and to reference indices obtained from stable streams of similar type, order, and size elsewhere within the watershed, if the biologist in charge of the project determines it is necessary.

References

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/st-francis-river

Meramec River Service Area

Geographic Service Area:

The Meramec River basin is located in east central Missouri in Crawford, Dent, Franklin, Iron, Jefferson, Phelps, Reynolds, St. Louis, Texas, and Washington counties. Found in the northeast corner of the Ozark Highlands, the Meramec River and its tributaries drain 2,149 square miles. The main stem of the Meramec's 218 linear miles carries water from the lightly populated, forested, and agricultural upper watershed north easterly to the heavily populated and urbanized lower watershed to enter the Mississippi River below St. Louis. Meramec tributaries of fifth order or greater include Courtois, Crooked, Dry, Dry Fork, Huzzah, and Indian creeks and the Little Meramec River. Meramec base flows are well sustained by spring's characteristic of the region's karst topography and by drainage from the Big and Bourbeuse rivers, two major tributaries large enough to merit their own basin inventory and management plans.

The Big River enters the Meramec at river mile 35.7. The Big River basin is located in east-central Missouri and drains 955 square miles of the Ozark Plateau in portions of six counties. Big River has eight, order five tributaries and flows northward for 138 miles until it reaches 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 Bourbeuse enters the Meramec at river mile 64.0. The Bourbeuse River watershed is located within the northeastern quarter of the Ozark Highlands. The main stem of the Bourbeuse River winds northeasterly through Phelps, Gasconade, and Franklin counties to join the Meramec River, and its watershed additionally encompasses portions of Maries, Osage, and Crawford counties. The Bourbeuse River is 147 miles from mouth to headwaters, and the lower 132 miles have permanent flow. The Bourbeuse River watershed drains 843 square miles and is composed of a number of smaller watersheds including Spring Creek, Boone Creek, Brush Creek, Red Oak Creek, Dry Fork, Little Bourbeuse River, and the Lower Bourbeuse River. The Bourbeuse River has fewer springs with smaller discharges than the Meramec River.

The basic physical, chemical and biological similarity; the similarity of watershed land use and topography in all three basins; and the common downstream hydrologic endpoint, including the Meramec, Big and Bourbeuse Rivers, supports utilizing one EDU for mitigation planning to allow similar approaches to watershed, riparian, and stream channel problems and opportunities.

Threats to the aquatic resources in the Meramec River EDU:

Water Quality Problems

Overall, water quality within the Meramec River basin is quite good. In fact, the Missouri Department of Natural Resources Clean Water Commission designated segments of Courtois Creek, Huzzah Creek, Blue Springs Creek, and the Meramec River as Outstanding State Resource Waters. Despite the basin's overall good water quality, problems do exist. Water quality problems facing streams in this EDU include:

- In the upper and middle basin, cattle's grazing on creek bottom pastures is very common. When cattle have open access to streams, damage to riparian areas and excessive nutrient loading of the streams often results.
- In the upper basin, impoundments containing tailings from mining operations pose a potential threat to stream water quality.
- The lower watershed from Eureka to Fenton is an urbanized zone that poses other threats to water quality.
- Sediment and pollution-laden runoff enter the lower Meramec system rapidly because of impervious surfaces from development and the channelization of tributaries.

Many of the water quality problems, especially those involving heavy metals and aquatic life contamination are difficult, complex, and expensive to address. However, many of the problems resulting in riparian destruction, stream bank erosion, and sedimentation are an appropriate project that is addressable through the installation of mitigation projects. Preservation projects, especially in streams in rapidly urbanizing areas but still containing high quality aquatic communities are particularly adaptable.

Aquatic Resource Problems

Stream habitat quality is fair to good throughout most of the basin. Some areas, including portions of the Brazil subwatershed, Courtois, Huzzah, and Indian Creek watersheds, suffer from a more severe lack of riparian vegetation. Aquatic resource problems facing streams in this EDU include:

- In these and other streams the lack of adequate riparian corridors, excessive nutrient loading, streambank erosion, excessive runoff and erosion, and the effects of extensive in-stream gravel mining
- Grazing practices along many streams contribute to streambank instability, nutrient loading, and poor riparian corridor conditions
- Increased land clearing and higher runoff associated with urbanization also impact stream habitat quality

Analysis Historic Aquatic Loss

Changes in stream morphology have taken place within the entire Ozarks and the Meramec River basin. Written historic observations of early settlers and explorers do not suggest extensive gravel bars on Ozark streams as seen today. Nevertheless, geologists working in the late 1800s, before significant land use, describe large quantities of gravel in stream banks and beds (Jacobson and Primm 1994). Until 1920, shortleaf pine logging practices created minimal erosional processes; however, Jacobson and Primm believe the combined effects of land clearing, road construction and floods from 1895-1915 to be the beginning of upland disruption that peaked from 1920-60. Stream disturbance may have resulted from several practices in the post-timber boom period (1920-60) such as upland burning, grazing of cut-over-valley-side slopes and open land, and lastly, using marginal land for cultivated crops. Oral-history reports compiled by Jacobson and Primm (1994) reveal "flashier" streams in the period from 1960-93 than the period from 1920-60 due to changes in upland and riparian zone vegetation, resulting in decreased water storage and flow resistance. Jacobson and Primm identify destruction of riparian vegetation from livestock grazing on bottom lands as the most disrupting force on Ozarks stream channels.

Farming

Floodplains are well known as fertile areas, making them desirable for settlement. By the early 1800s, the land was being cleared for crops and the wood used as timber for home construction, fences, and firewood. In pre-settlement times, main-stem riparian zones were up to two miles wide on either side of the river. In upland areas different settings existed due to fires set by Native Americans, which resulted in expansive savannahs and glades that dotted the Meramec River basin.

Grazing

As the Timber-boom period (1880-1920; see subsection B.1.6) came to a halt and large commercial interests sought more fertile grounds outside the Ozarks, the inhabitants' livestock grazed the open ranges left in cutover areas. To prevent trees and shrubs from reclaiming the range, the basin residents burned seasonally. Oral-history accounts from residents describe seasonal burning as necessary to maintain pasture. Some oral-history respondents recall extensive erosion in areas of the Ozarks due to the upland farming and grazing, and gully and sheet erosion were common sites (Jacobson and Primm 1994).

Recreation

In 1940, the Missouri State Planning Board estimated 834,350 persons recreated in the Meramec River basin from May 15 - September 30 (Brown 1945). Fishing, swimming, picnicking, and boating made up 85% of the recreational use. The Missouri State Planning Board calculated that flooding during this peak attendance caused losses of $1.36 per person per day. Finding a means

of controlling these floods has been a concern of the Army Corps of Engineers since the 1930s. Consequently, Meramec Park Lake was advocated as a flood control reservoir as well as a recreational reservoir. The reservoir was never constructed, however, because of public opposition.

Mining

The original attraction to the Meramec River region was the lure of precious metals such as gold, copper, and silver. These metals were not found, but the first white settlers did find lead and iron ore (Jackson 1985). Also, highly prized for clean sand and gravel, streams in the Meramec River basin have been mined to provide construction materials.

Lead and Iron

The first lead mine was established in 1797 by Moses Austin. The site is now the town of Potosi. Several other lead mines were described by Schoolcraft (1821) in Jefferson and Washington counties (Jacobson and Primm 1994). In 1818, one mine was worked in what is now Jefferson County, Gray's Mine on the Big River. In fact, in Washington County, most lead mines mentioned in Schoolcraft (1821) were on the Big River system.

Historic Land and Gravel Operations

Since the early 1800s, the Meramec River has been recognized and utilized for its sand and gravel resources. Operations included the removal of sand and gravel from quarry and in-stream locations. Sand and gravel were, and still are, important construction materials. The quality of the sand and gravel varies among river systems, as well as between small and large streams within a system. Geologists found Meramec gravel samples to be clean and abundant. The Ozarks Region produced 20% of the state's sand and gravel during 1913, and during that same year, the Meramec River produced 17% by weight of Missouri's total sand and gravel output (Dake 1918). In 1918, sand and gravel operations on the Meramec River were located at Valley Park, Drake, Sherman, Pacific, and Moselle (Dake 1918). Some of these sites are still active today.

Logging

The expansive Ozark Plateau had two land-use periods known as the Timber Boom (1880-1920) and the Post-timber Boom (1920-1960) that affected uplands, valley slopes, and valley bottoms. The Post-timber Boom was a time of economic depression and migration out of the Ozarks. Cutover valley slopes during the Timber Boom were converted to pasture and seasonally burned. The Great Depression placed increased pressure on the valley bottoms and uplands for subsistence farming (Jacobson and Primm 1994). From 1880-1920, timber was cut for a variety of uses. Several portable sawmills existed for home use. Because of the limited supply of shortleaf pine, builders used hardwoods for railroad ties, flooring, barrel staves, and fuel.

Franklin, Jefferson, Crawford, and Washington counties had predominately hardwood species such as scrub oak, white oak, post oak, and red oak in the uplands and black walnut, hickory, maple, ash, birch, sycamore in bottom lands (Goodspeed 1888). Sources agree that until the railroad reached the Meramec vicinity in 1870, cutting was limited to small operations near river systems (Goodspeed 1888; Jacobson and Primm 1994). Large-scale producers of dairy products and cord wood shipped their goods to St. Louis via the Iron Mountain Railroad. Transport, however, was mainly for producers within the vicinity of the railroad, and it was noted in that, "Wood supply along the immediate line of the Iron Mountain Railroad was being exhausted" (Goodspeed 1888). This notation compares well with the decline in Missouri timber production in 1900 described by Jacobson and Primm (1994).

Current Aquatic Resource Conditions of the Meramec River EDU:

Some of the same forces affecting the past land-use periods still exist today. Recent land-use practices (1960-present) include greatly reduced intentional burning. Grazing and row cropping has increased in upland areas, and valley bottom lands are still being cleared for pasture and row cropping. Logging operations on valley slopes and uplands are better managed than during the Timber Boom and Post-timber Boom periods, but upland areas and valley slopes still have a slight increase in annual runoff, storm runoff, and upland sediment yield as compared to pre-settlement conditions (Jacobson and Primm 1994).

In general, land-use and land-cover estimates from the NRCS (1995) classify watershed areas as 4.5% cropland, 48% forest, 24% pasture, 1.3% rural transportation, 6.5% urban development, 15.7% water, minor and other land-use categories. Within the upper Meramec River watershed, nearly one third of forest land is owned by farmers, corporations, and forest industries, and another one third by the federally owned Mark Twain National Forest, and the remaining one third by other private landowners. Only a small percentage of forest land is owned by the forest industry. In recent years, urban development in the lower Meramec has reduced the size of contiguous forest tracts.

Present Meramec River basin land cover consists of roughly one-half forest, one-quarter pasture, and one-quarter cropland, rural transportation, urban development, water, and other minor land uses combined. Within the upper Meramec River portion, nearly one third of the forest land is privately owned. The Mark Twain National Forest covers a large area in the remaining two thirds. Major resource uses within the Meramec River basin include grazing, logging, and mining lead, iron, sand and gravel. Earlier land-use practices have been identified as possible causes for stream morphology changes in the Meramec as well as other stream systems within the Ozarks. There is a current trend toward increasing numbers of cattle and increasing grazing density. Where cattle have free access to streams, this trend causes more stream-channel disturbance. Also, gravel mining contributes to the accelerated transport of sediments in the Meramec River basin.

Aquatic Resource Goals and Objectives for the Meramec River EDU:

Our major goals for the Meramec River watershed are improving water quality, improving riparian and aquatic habitat conditions, maintaining diverse and abundant populations of native aquatic organisms and sport fish and increasing public appreciation for the stream resources. Cooperative efforts with other resource agencies on water quality, habitat, and watershed management issues will be critical to our mitigation efforts. Legal enforcement of existing water quality and other stream-related regulations and necessary revisions and additions to these regulations will help reduce violations and lead to further water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system. Existing onsite habitat improvement projects on federal, state, and local government lands and those of private landowners will focus on improving stream channel and riparian area stability in priority areas in the EDU:

- Restoration of in-stream habitats (pools with woody debris, boulders and/or aquatic vegetation) benefits resident sportfish, native non-game fishes (including ghost shiner, Topeka shiners, troutperch, plains minnow, etc) and unique or depressed aquatic invertebrate populations.
- Restoration, expansion, and maintenance of well vegetated riparian areas, especially in areas with high diversity of aquatic life, presence of species of conservation concern, and areas managed for specific species or communities.
- Mitigation planning may identify significant sources of pollutants (i.e. eroded soil and other non-point water quality problems) and strive to restore and stabilize them.
- Restoration of in-channel hydraulics to balance the hydrological and in-channel physical conditions of streams.

Active enforcement of existing water quality and other stream related regulations, and necessary revisions and additions, are detrimental and will help reduce violations and increase water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system.

Prioritization Strategy for Selecting and Implementing Compensatory Mitigation Strategies for the Meramec River EDU:

Mitigation projects in the Meramec EDU will be located in areas that provide physical, chemical, and/or biological improvements to stream ecological values of the basin, and are technically feasible and appropriate to install at the project site. The highest priority will be areas of biodiversity that have been deemed Conservation Opportunity Areas using the assessment by the interagency Missouri Resource Assessment Partnership (MoRAP). The MoRAP conservation assessment process within the Meramec EDU found 11 COAs, containing 103 target species.

These COAs constitute 1,508 miles of stream, which represents 8.8% of the total stream miles within the Meramec EDU, and their watersheds represent an overall area of 219,629 acres, or 8.7% of the EDU. In addition to COAs, other priority sites will be identified when a mitigation project is not possible in one of the above COAs:

- 303 (d) listed waters
- Stream reaches managed by Missouri Department of Natural Resources Aquatic
- Stream reaches containing state or federal species of conservation concern
- Conservation Opportunity Areas
- Areas of high aquatic biodiversity
- Greenway corridors proposed or managed by federal, state, or local entities for public recreation or habitat conservation purposes
- Upstream or downstream of all Missouri Department of Conservation state parks and other local, state or federally-owned public areas managed for natural resource or public recreation purposes

Preservation objectives for the Meramec River EDU:

The priority of projects will continue to be on restoration and establishment. However, preservation projects are an important part of watershed management, in that critical stream reaches, unique habitats, and protection of important water quality areas of the Meramec basin will contribute to sustaining ecological functioning over the long term. Preservation will be used in the Meramec EDU when:

- The resources to be preserved provide important physical, chemical and/or biological functions for the watershed;
- The resources contribute significantly to the ecological sustainability of the watershed;
- Preservation is appropriate, practicable, and has the support of the IRT and the Corps;
- The aquatic resources in question are under threat of destruction or degradation; and/or
- The preserved site will be permanently protected by the appropriate real estate provision or legal instrument as part of the in-lieu fee project site mitigation plan.

Preservation efforts will be combined with associated efforts to restore, establish, or enhance other aquatic habitats as is practicable and appropriate. Stream and riparian corridor preservation will receive credit based upon the calculated amount for preservation per the State of Missouri Stream Mitigation Method. Wetland preservation will only be proposed for high quality wetlands and credits will be released at a higher ratio as approved by the Corps, in consultation with the IRT.

Public and Private Stakeholder involvement in plan development and implementation in the Meramec River EDU:

Mitigation sites within the Meramec EDU, the Sponsor will seek out local input from federal and state agencies, municipalities, landowners, natural resource management groups and advisory groups within the watershed as appropriate. The ILF program will work with any willing public agencies to prioritize watersheds in in-lieu-fee projects. IFL project sites will not be placed on public lands.

Long-term protection and management strategies for compensatory mitigation in the Meramec River EDU:

Each compensatory mitigation site will be protected in perpetuity by a conservation easement held by an approved long-term steward that will be identified within the mitigation plan. These easements ensure that there will be no development or other land use change on the project sites which could diminish the level of physical, chemical, and biological ecosystem functions that each site provides to the watershed. Additionally, the conservation easement will stay with the property if that title to the property is transferred to a third party. It is the intention of LLF to maintain ownership of properties in perpetuity as highly functioning habitat in accordance with the terms of a long-term management plan and conservation easement.

In the rare event where a high priority project cannot be secured through fee title acquisition or perpetual easement, the following methods for long-term protection may be considered:

- The choice of a landowner not interested in signing a perpetual easement to choose to donate, sell, or otherwise transfer an easement for a 20-30 year period to the Missouri Department of Conservation, natural resource-oriented federal, state, or local government agency, or a natural resource-oriented land trust like the Nature Conservancy, Ozark Regional land Trust, Greenbelt Land Trust or similar non-profit entity
- The choice of a landowner not interested in signing a perpetual easement to choose to agree to a maintenance agreement, a contractual agreement between LLF and the landowner, where the landowner or other entity promises to meet specified maintenance condition for a 20-30 year period. These projects are alienable in the event of the sale of property. If the maintenance agreement does not transfer, it remains with the original signer of the agreement.

LLF would perform annual monitoring with onsite field observations, reporting, and enforcement actions, as appropriate, on all properties.

Strategy for periodic evaluation and reporting in the Meramec River EDU:

Evaluation, monitoring, and reporting is required of all compensatory mitigation projects to determine if the project is meeting its performance standards and if additional measures are

necessary to ensure that the compensatory mitigation project is accomplishing its objectives. This documentation will include an accounting of the acreage and type of all mitigation activities within the service area and how the combined ecological benefit of all compensatory mitigation sites is performing to achieve the goals set forth in this EDU. Project specific mitigation plans will detail the parameters to be monitored, the length of the monitoring period, the dates that the reports must be submitted, the party responsible for conducting the monitoring, the frequency for submitting monitoring reports to the Corps, and the party responsible for submitting those monitoring reports to the Corps and the IRT. Data collection for performance objectives will occur once during the year and will be reported in an annual report until a project has been shown to meet performance standards, unless otherwise specified in the approved project-specific mitigation plan. The level of detail and substance of the report will be commensurate with the scale and scope of the compensatory mitigation project. Compliance monitoring will also be conducted annually until performance standards are met and will be reported in the annual report. After a project has met performance standards, the frequency of all monitory will decrease to a term not to be less than once every five years. Changes in reporting may be required by the Corps and the IRT as necessary to accommodate adaptive changes in the project and unforeseen natural disasters.

Evaluation and reporting will concentrate on those metrics involved in performance standards and will not include species or community biotic sampling until late in the project cycle, if at all. Temporal improvement of biota and their communities often lags restoration projects by years, and sometimes decades, and biological sampling often is inconclusive as to whether a project has improved biotic communities. At the conclusion of the project, aquatic invertebrate and/or other fish diversity indices may be calculated and compared to the before-project condition and to reference indices obtained from stable streams of similar type, order, and size elsewhere within the watershed, if the biologist in charge of the project determines it is necessary.

References:

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/meramec-river

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/big-river

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/bourbeuse-river

Nishnabotna/Platte Rivers Service Area

Geographic Service Area:

The Nishnabotna/Platte Rivers EDU lies mainly in northwest Missouri and southwest Iowa. A small portion of the EDU covers the eastern Kansas and Nebraska. The Missouri portion of the EDU is contained within Worth, Nodaway, Platte, Clay, Clinton, Buchanan, Andrew, Gentry, Holt, Worth, and Atchison counties and contain the major watersheds of the Nodaway River, the One Hundred and Two River, the Platte River, the Tarkio River and a number of smaller streams which drain directly into the Missouri River. The EDU is bound on the east by the Grand River basin, on the south and west by the Missouri River, and the north by the Iowa state line. The basin is entirely contained within the Central Dissected Till Plains Ecological Section. Streams flow primarily in a southerly direction and empty into the Missouri River. Overall, there are 14,884 miles of primary stream channel within this EDU, of which 5,088 miles are classified as perennial. Of that total, 5,026 miles (34%) falls within Missouri. The basic physical, chemical and biological similarity; the similarity of watershed land use and topography in each basin; and the common downstream connection with the Missouri River, supports including all of these streams in one EDU for mitigation planning; which allows similar approaches to watershed, riparian, and stream channel problems and opportunities.

Threats to the Aquatic Resources in the Nishnabotna/Platte Rivers EDU:

<u>Water Quality Problems</u>

Water quality problems facing streams in this EDU include:

- Contamination of aquatic biodiversity, primarily with chlordane and mercury
- Point source concerns in the basin are those associated with municipal waste near three major urban areas and pollution from Kansas City International Airport. Another threat to fish populations through the basin has been the improper management of municipal sewage and the subsequent runoff into receiving streams. Problems associated with Maryville and St. Joseph have been addressed; however, municipal effluent from the Kansas City Todd Creek STP has been a chronic problem in the Todd Creek since 1976
- Intensive livestock operations and large amount of row crop agriculture increases sediment discharges and fertilizer/livestock wastes in runoff adversely affects stream water quality with increased nitrate levels, which are heightened by weak base stream

flows. Basin streams often have manganese and fecal coliform levels that are commonly above Missouri water quality criteria.

- Non-point source pollution has the greatest negative influence upon water quality within the basin. The most common problems associated with non-point sources are low dissolved oxygen, high levels of turbidity, fecal coliform bacteria, phosphorus, nitrates, ammonia nitrogen and other organic nutrients, all of which are influenced by excessive runoff and extended low flows, primarily due to channelization, intensive row cropping, and livestock operations

Many of the water quality problems, especially those involving channelization and contamination are difficult, complex, and expensive to address. However, many of the problems resulting in riparian destruction, stream bank erosion, and sedimentation are an appropriate project that is addressable through the installation of mitigation projects. Preservation projects, especially in areas that have escaped channelization and in rapidly urbanizing areas that still contain high quality aquatic communities, are particularly adaptable.

Aquatic Resource Problems

Overall, the quality of aquatic resources in the Nishnabotna/Platte EDU is widespread and depressed. In rural areas, aquatic resources are endangered by threats such as agricultural conversion, nutrient and sediment runoff, and livestock damage. Aquatic resource problems facing streams in this EDU include:

- Thermal regimes have been adversely impacted due to the shallow nature and weak base flows in basin streams, impacting fish and fish spawning success
- The erosive nature of area soils and the increased water velocities due to channelization raises channel stability concern, especially in areas with bridges, roads, and pipelines
- Destruction of riparian vegetation from construction, live stock use, and row cropping
- Watershed urbanization has adversely impacted riparian corridors, increased storm water runoff, and depressed aquatic species diversity
- Large scale channelization has significantly degraded in-stream habitats. For example, in the Platte River basin, about 20% of stream miles in the basin have been lost to channelization; 7 of 11 fifth order streams and 41 of 74 fourth order streams have been channelized. This results in down-cutting of channels, sedimentation and channel filling, elimination of stream length and fish habitats, depression of invertebrate populations, and a significant loss of fish standing crop
- CAFOs and runoff from feedlots, as well as direct access of livestock to stream channels, causes nutrient enrichment and the lack of adequate vegetation or buffer strips between feedlots or holding facilities and the stream allows runoff to carry waste and soil directly to streams, causing increases in sedimentation

Historic Aquatic Loss in the Nishnabotna/Platte Rivers EDU:

The word "Nadowa" and similar sounding terms are found in many Indian languages and the Menominee, Chippewa, and Ottawa all have terms similar to "Nadowa" that refer to snakes, usually rattlesnakes. A variation of the term (“Nadowe”) was often associated with snakes generally thought to be massasauga rattlesnakes (Hodge 1912). The application of the name to the Nodaway River is believed to have described it as being twisted or sinuous like a snake.

Settlement first took place in forested areas, and the adjoining prairies were used as free range for cattle. These lands had an important role in the development of the early Missouri cattle industry. Preferred sites were those on the edge of the timber with close association to both water and native prairie. The settlement of prairies soon followed the settlement of forested lands. Settlement of wet prairies was avoided due to their reputation for producing fevers and respiratory ailments, but they were used as wintering areas for cattle. Native grasses were also cut for hay (Schroeder 1982).

The first railroads, built in the 1870’s, increased the momentum of the agricultural movement by providing easy access to plows, reapers, and fencing. This enabled settlers to aggressively convert native prairie into cropland. The last areas cultivated were the wet bottom lands and building ditches and draining these areas helped convert them in agricultural production. This opened large new areas for settlement. The arrival of more people and cattle, along with the arrival of commercialized farming, marked the beginning of the end for native prairies in the basin. Destruction of the native prairie can be attributed to three main factors: plowing, overgrazing, and fire control (Schroeder 1982).

Groups of farmer began stream channelization in the early 1900’s and a large part of the basin was channelized by the 1930’s, although relatively few channel alterations were made in the narrower downstream valley reaches. This increased the amount of tillable acreage, intensified erosion, and permanently altered the natural quality of the basin’s aquatic resources.

Current Aquatic Resource Conditions of the Nishnabotna/Platte Rivers EDU:

According to the Missouri Department of Natural Resources, the major water quality areas of concern in this EDU are: 1) atrazine and other herbicides in many drinking water reservoirs at all times of year and in streams used for drinking water during spring and summer; 2) alluvial aquifers in the Kansas City area have experienced localized groundwater contamination due to industrial spills and improper waste disposal; and, 3) channelization has reduced aquatic habitat quality in the Tarkio River, Nodaway River, Platte River, and 102 River (MDNR, 1996).

This EDU contains thick to very thick loess deposits that occur in the western and central sections. Coal deposits, thin-bedded limestones, Pennsylvanian shales, and some sandstone lie underneath the thick loess and glacial deposits and generally have little influence on surface features. The soils are primarily silty and clayey loams with moderate infiltration rates.

Most of the basin is rural with portions of the watershed lying within the cities of St. Joseph, Kansas City, and Maryville. Favorable climate and fertile soils makes the area suitable for grain production. Much of the basin lands are used for cultivation. Current land use is comprised of approximately 70% row crop production, 20% pasture, and 10% forest. This has contributed to an increase in both upland and stream bank erosion and delivers high sediment loads and agricultural chemicals directly to basin streams. The Conservation Reserve Program (CRP) has removed some of the highly erodible land from production; however, the impacts remain severe.

In a recent survey, the Missouri portion of the Platte River basin that was not channelized was found to be more stable and over 50% of the stream bank vegetation consisted of trees and shrubs. However, these conditions were opposite in channelized areas. Most streams within the basin have little or no woody stream corridor and fencing to exclude cattle from the stream corridor is rare. In areas where cattle were present they usually had free access to the streams, which increases habitat degradation. Over half the sights surveyed consisted entirely of row crop production, and crops were often planted to the edge of the stream bank.

The survey results showed that channel conditions throughout the basin were generally poor. In the Platte River basin, channelization within the basin has resulted in about 250 miles of lsot stream length and a 19.4% reduction in total stream miles from fourth order and larger streams. In the Nodaway River, 94 of the original 105 miles of the Nodaway mainstream within Missouri have been channelized. Only the lower 11 miles of river remain unchannelized. Stream banks along channelized reaches were highly susceptible to erosion resulting in poorly vegetated, high vertical stream banks. Channelization and siltation have eliminated much of the riffle-pool complex in most of the streams within the basin. Loss of quality pool habitats, in-stream habitat, large woody debris, and riffles, are serious habitat related problems in the basin.

A total of 71 fish, 23 mussels, and 4 crayfish either occur or historically have occurred within this EDU. However, a number of these 98 species have likely been locally extirpated. The fish community is characterized by wide-ranging, tolerant species. Red shiner was the most abundant species overall, and was also the most common species collected, accounting for over two thirds of the fish population. Other common species include bigmouth shiner, central stoneroller, creek chub, fathead minnow, green sunfish, channel catfish, bluegill, yellow bullhead, common carp, largemouth bass, and river carpsucker. There are 5 globally listed (rare, threatened, or endangered) species and 16 state listed species of conservation interest. The Topeka shiner and flathead chub are two of the few species of conservation interest that may still be present in the EDU.

The mussel resources in the Platte River basin have depleted. However, recently, a few streams in northern Missouri were found to contain mussels, including the flat floater and rock pocketbook that were once thought to be eliminated. Sixteen species of freshwater mussels historically occurred in the basin. The northern crayfish is the most abundant present, followed by the papershell crayfish, and the prairie crayfish, respectively.

Within this service area, likely sources of nonpoint source pollution include: runoff from row crop agriculture, livestock grazing and dairy operations, sedimentation from erosion in disturbed watersheds, sludge application from waste water treatment facilities, seepage from septic tanks, and urban runoff. Additionally riparian degradation caused directly or indirectly by agricultural practices and land development within the service area has contributed to streambank instability and bank erosion.

Aquatic Resource Goals and Objectives for the Nishnabotna/Platte Rivers EDU:

Given that so much of the basin has been subject to degradation, priority areas require more attention rather than the entire basin. Our major goals for the Nishnabotna/Platte River basin are improving water quality, improving riparian and aquatic habitat conditions, maintaining diverse and abundant populations of native aquatic organisms and sport fish and increasing public appreciation for the stream resources. Cooperative efforts with other resource agencies on water quality, habitat, and watershed management issues will be critical to our mitigation efforts. Legal enforcement of existing water quality and other stream-related regulations and necessary revisions and additions to these regulations will help reduce violations and lead to further water quality improvements. Onsite habitat improvement projects, primarily on private landowners' property (99% of the basin is private ownership) will focus on improving stream channel and riparian area stability in priority areas in the EDU:

- Restoration of in-stream habitats (pools with woody debris, boulders and/or aquatic vegetation) benefits resident sportfish, native non-game fishes (including Topeka shiners and flathead chubs) and unique or depressed aquatic invertebrate populations (especially the rock pocketbook and flat floater mussels).
- Restoration, expansion, and maintenance of well vegetated riparian areas, especially in areas with high diversity of aquatic life, presence of species of conservation concern, and areas managed for specific species or communities. Urbanizing areas north of Kansas City, and around St. Joseph and Maryville, as well as priority areas that are excessively row cropped and/or with excessive livestock use will be targeted.
- Mitigation planning may identify significant sources of pollutants (i.e. watershed uplands in critical areas should have minimal sources of eroded soil and other non-point water quality problems) and strive to restore and stabilize them. Using revegetation and leveraging the resources of other appropriate agencies such as the soil conserving responsibilities of the Natural Resources Conservation Service and similar agencies
- Restoration of in-channel hydraulics to balance the hydrological and in-channel physical conditions of streams. Careful project assessments will be undertaken to make sure that only projects that will be successful are chosen and those with a higher probability of continued degradation in spite of the project are avoided.

Active enforcement of existing water quality and other stream related regulations, and necessary revisions and additions, are detrimental and will help reduce violations and increase water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system.

Prioritization Strategy for Selecting and Implementing Compensatory Mitigation Strategies for the Nishnabotna/Platte Rivers EDU:

Mitigation projects in the Nishnabotna/Platte EDU will be located in areas that provide physical, chemical, and/or biological improvements to stream ecological values of the basin, and are technically feasible and appropriate to install at the project site. The highest priority will be areas of biodiversity that have been deemed Conservation Opportunity Areas using the assessment by the interagency Missouri Resource Assessment Partnership (MoRAP). The MoRAP conservation assessment process within the Nishnabotna/Platte EDU, when taken collectively, contains 9 COAs, containing 24 target species. These COAs constitute 327 miles of stream, which represents 6.5% of the total stream miles within the Nishnabotna/Platte EDU, and their watersheds represent an overall area of 248 square miles, or 6.7% of the EDU. In addition to COAs, other priority sites will be identified when a mitigation project is not possible in one of the above COAs:

- 303 (d) listed waters
- Stream reaches managed by Missouri Department of Natural Resources Aquatic
- Stream reaches containing state or federal species of conservation concern
- Conservation Opportunity Areas
- Areas of high aquatic biodiversity and unchannelized habitats, especially in urbanizing areas.
- Greenway corridors proposed or managed by federal, state, or local entities for public recreation or habitat conservation purposes
- Upstream or downstream of all Missouri Department of Conservation state parks and other local, state or federally-owned public areas managed for natural resource or public recreation purposes

Preservation objectives for the Nishnabotna/Platte Rivers EDU:

The priority of projects will continue to be on restoration and establishment. However, preservation projects are an important part of watershed management, in that critical stream reaches, unique habitats, and protection of important water quality areas of the Nishnabotna/Platte basin will contribute to sustaining ecological functioning over the long term. Preservation will be used in the Nishnabotna/Platte EDU when:

- The resources to be preserved provide important physical, chemical and/or biological functions for the watershed;
- The resources contribute significantly to the ecological sustainability of the watershed;
- Preservation is appropriate, practicable, and has the support of the IRT and the Corps;
- The aquatic resources in question are under threat of destruction or degradation; and/or
- The preserved site will be permanently protected by the appropriate real estate provision or legal instrument as part of the in-lieu fee project site mitigation plan.

Preservation efforts will be combined with associated efforts to restore, establish, or enhance other aquatic habitats as is practicable and appropriate. Stream and riparian corridor preservation will receive credit based upon the calculated amount for preservation per the State of Missouri Stream Mitigation Method. Wetland preservation will only be proposed for high quality wetlands and credits will be released at a higher ratio as approved by the Corps, in consultation with the IRT.

Public and Private Stakeholder involvement in plan development and implementation in the Nishnabotna/Platte Rivers EDU:

Mitigation sites within the Nishnabotna/Platte EDU, the Sponsor will seek out local input from federal and state agencies, municipalities, landowners, natural resource management groups and advisory groups within the watershed as appropriate. The ILF program will work with any willing public agencies to prioritize watersheds in in-lieu-fee projects. IFL project sites will not be placed on public lands.

Long-term protection and management strategies for compensatory mitigation in the Nishnabotna/Platte Rivers EDU:

Each compensatory mitigation site will be protected in perpetuity by a conservation easement held by an approved long-term steward that will be identified within the mitigation plan. These easements ensure that there will be no development or other land use change on the project sites which could diminish the level of physical, chemical, and biological ecosystem functions that each site provides to the watershed. Additionally, the conservation easement will stay with the property if that title to the property is transferred to a third party. It is the intention of LLF to maintain ownership of properties in perpetuity as highly functioning habitat in accordance with the terms of a long-term management plan and conservation easement.

In the rare event where a high priority project cannot be secured through fee title acquisition or perpetual easement, the following methods for long-term protection may be considered:

- The choice of a landowner not interested in signing a perpetual easement to choose to donate, sell, or otherwise transfer an easement for a 20-30 year period to the Missouri Department of Conservation, natural resource-oriented federal, state, or local government

agency, or a natural resource-oriented land trust like the Nature Conservancy, Ozark Regional land Trust, Greenbelt Land Trust or similar non-profit entity

- The choice of a landowner not interested in signing a perpetual easement to choose to agree to a maintenance agreement, a contractual agreement between LLF and the landowner, where the landowner or other entity promises to meet specified maintenance condition for a 20-30 year period. These projects are alienable in the event of the sale of property. If the maintenance agreement does not transfer, it remains with the original signer of the agreement.

LLF would perform annual monitoring with onsite field observations, reporting, and enforcement actions, as appropriate, on all properties.

Strategy for periodic evaluation and reporting in the Nishnabotna/Platte Rivers EDU:

Evaluation, monitoring, and reporting is required of all compensatory mitigation projects to determine if the project is meeting its performance standards and if additional measures are necessary to ensure that the compensatory mitigation project is accomplishing its objectives. This documentation will include an accounting of the acreage and type of all mitigation activities within the service area and how the combined ecological benefit of all compensatory mitigation sites is performing to achieve the goals set forth in this EDU. Project specific mitigation plans will detail the parameters to be monitored, the length of the monitoring period, the dates that the reports must be submitted, the party responsible for conducting the monitoring, the frequency for submitting monitoring reports to the Corps, and the party responsible for submitting those monitoring reports to the Corps and the IRT. Data collection for performance objectives will occur once during the year and will be reported in an annual report until a project has been shown to meet performance standards, unless otherwise specified in the approved project-specific mitigation plan. The level of detail and substance of the report will be commensurate with the scale and scope of the compensatory mitigation project. Compliance monitoring will also be conducted annually until performance standards are met and will be reported in the annual report. After a project has met performance standards, the frequency of all monitory will decrease to a term not to be less than once every five years. Changes in reporting may be required by the Corps and the IRT as necessary to accommodate adaptive changes in the project and unforeseen natural disasters.

Evaluation and reporting will concentrate on those metrics involved in performance standards and will not include species or community biotic sampling until late in the project cycle, if at all. Temporal improvement of biota and their communities often lags restoration projects by years, and sometimes decades, and biological sampling often is inconclusive as to whether a project has improved biotic communities. At the conclusion of the project, aquatic invertebrate and/or other fish diversity indices may be calculated and compared to the before-project condition and to reference indices obtained from stable streams of similar type, order, and size elsewhere within the watershed, if the biologist in charge of the project determines it is necessary.

References

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/platte-river

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/nodaway-river

Blackwater/Lamine Rivers Service Area

Geographic Service Area:

The Blackwater/Lamine Rivers EDU lies in west-central Missouri. The Lamine River Basin is located in Benton, Johnson, Morgan, Moniteau, Saline and Cooper counties. It originates at the meeting of Richland and Flat Creeks in northern Morgan County, and flows 50 miles northward through Cooper County to its convergence with the Blackwater River. Above its confluence with Blackwater River, the Lamine River is a sixth order stream with an area of 1080 square miles. The Blackwater River flows eastward and is located in Saline, Cooper, Lafayette, Johnson, and Pettis counties. The Blackwater River is a sixth order stream and drains over 1400 square miles. The remainder of the EDU is made up of a section of the Missouri River and the streams it receives between the Kansas and the Chariton Rivers. These rivers occupy almost 2600 square miles of watershed located in Missouri.

Overall, there are approximately 8600 miles of primary stream channel within this EDU, of which over 2300 miles are classified as perennial. This EDU contains a diverse landscape because it straddles the boundary between the Central Dissected Till Plains and the Ozarks and also borders the Missouri River. The majority of the EDU falls along the southeastern margin of the Central Dissected Till Plains Ecological Section as described by Bailey (1995), but also includes unglaciated sections of the Blackwater and Lamine drainages that are often labeled as Ozark Border.

Threats to the Aquatic Resources in the Blackwater/Lamine Rivers EDU:

Water Quality Problems

Overall, the water quality in the Blackwater/Lamine Rivers EDU is fair. Water quality problems facing streams in this EDU include:

- Soil, stream bank and streambed erosion contributes to excessive sediment to the stream especially in areas of inadequately sized vegetated riparian corridors
- Contamination of aquatic organisms, primarily chlordane and mercury, continues to affect the basin, especially urban areas
- Excessive nutrients due to sewage treatment plant effluents and intensive cattle and poultry operation contribute to a low DO; algal blooms; nitrate, nitrite, ammonia, and phosphate discharges; and excessive sediment
- Several small abandoned coal mined areas may cause localized problems with low pH, high sulfate and high iron levels in the receiving streams

Many of the problems resulting in riparian destruction, stream bank erosion, and sedimentation are an appropriate project that is addressable through the installation of mitigation projects.

Aquatic Resource Problems

Overall, the quality of aquatic resources in the Blackwater/Lamine Rivers EDU is fairly depressed due to areas of high runoff of solids, high BOD concentrations, and toxic materials. Aquatic resource problems facing streams in this EDU include:

- A limited number of small, active and inactive gravel mining sites present, especially in the Ozark border portions of the watershed
- Watershed urbanization which has adversely impacted riparian corridors and increased storm water runoff (which increases channel instability), as well as depressed aquatic species diversity
- Stream bank erosion due to inadequately sized vegetated riparian corridors, channel alterations, row cropping in the Osage Plains sections of the watershed, and grazing
- Destruction of vegetation from construction, cattle use and row crop agricultural activities
- Only small scale channel alterations due to stream straightening, levee construction, and attempts to control stream bank erosion are found in the basin (except projects in the Blue River in Kansas City and the Blackwater River project)

Historic Aquatic Loss in the Blackwater/Lamine Rivers EDU:

Archeological records indicate that the Blackwater/Lamine basin has been frequented by inhabitants for thousands of years. Native Americans who inhabited the area include the Sac, Iowa, and Osage. In the early 1500s, French and Spanish explorers could be found in the area. The Lewis and Clark expedition enabled the basin to be settled by white immigrants early in the 1800s. The area was officially recognized as a part of Missouri in 1821.

Flora and Fauna were reportedly diverse and abundant in the basin in the 1800s. Early descriptions of the basin report that forests occurred along the stream valleys and steeper slopes leading to patchy prairies on the uplands. During the 1800s, forests consisted of diverse flora including cottonwood, maples, elms, pecan, gum walnut, oak, hickory, and other trees. An increase in settlement increased the clearing of forests for cropland and wetland drainage increased as well. Prairie areas were interspersed between wooded and areas and estimates indicate that less than half of the basin was historically prairie. Wildlife in the basin included bear, fox, wolf, bobcat, turkey, rabbit, squirrels, geese, snipe, chicken, ducks, quail, elk, deer, bison, plover, and rail. Fish reported in the area were pike, suckers, buffalo fish, black bass, catfish, and perch. The water was considered clear and the fish population was abundant.

Tree cutting had increased by the 1900s for fuel and building material and the land was drained with the expansion of agricultural production. Agricultural activities which were confined to the fertile valleys and the 5-mile wide Missouri River flood plain were considered to have good natural drainage which was favorable to cultivation. With the rise of the city of Kansas, urbanization began to increase on the western area of the basin. As the land was changed to agricultural use, elsewhere, soil erosion and sedimentation increased. Historic aerial photos of the Lamine River in the region of the Lamine River Wildlife Area show dismal land practices within that portion of the basin in the late 1930s. Extensive overgrazing and gully formation on agricultural land were evident. Aerial photos of the 1950s and 1960s reveal abandoned pasture and cropland which was severely eroded. Much of the same land was cleared again in the 1970s for agricultural use and similar changes are assumed elsewhere within the basin.

Current Aquatic Resource Conditions of the Blackwater/Lamine Rivers EDU:

Within the Central Dissected Till Plains, the EDU straddles the Missouri River. The landscape is covered with thick to very thick loess deposits. Pennsylvanian shales, thin-bedded limestones, and some sandstone and coal deposits are present underneath the thick loess and glacial deposits and generally have little influence on surface features. Silty soils and clayey loams with moderate infiltration rates are present. Local relief ranges from 0 within the floodplains of the Missouri River to 50-250 feet in the uplands. Streams that are south of the Missouri River and east of the Lamine River (e.g., Gabriel and Richland Creeks) are cutting through older Mississippian limestones and dolomites throughout most their length. The average gradient across all stream size classes is 39 ft/mi. Streams in the western portions of this EDU are

generally surface water dominated, turbid with sand and silt substrates. Streams in the south and east are clear, gravelly, and approach Ozark streams in character. There is a transition from Prairie to Ozark Streams and the smaller watersheds within the basin reflect this transition. In the 1980's, the upland forests were of the oak-hickory type with white oak, black oak, northern red oak, hickory, white ash, winged elm, hackberry and post oak being most common. Flood plain forests were narrow corridors restricted to creek and river margins, consisting primarily of cottonwood, green ash, silver maple, box elder, elms and hackberry. In the early 1980's, forest covered only ten percent of some of the more agricultural parts of the basin. Current land use within the watershed is comprised is 9% urban, 34% cropped, 26% pasture, 24% forest, and 7% other land uses; however, some watersheds in the Kansas City area exceed 90% urban development (e.g., the Blue River watershed). Approximately 90% of the forested lands in the basin are used by livestock for grazing.

Land use is mostly cropland in areas of the basin in the Prairie region, while Ozark watersheds are predominantly forested. About 14 % of the forest grows on bottom lands. Most of the forest land in the basin is in poor hydrologic condition due to excessive grazing. A few major channelization projects (e.g., Blackwater and Blue Rivers) have been completed in the basin, but as in most agricultural watersheds in Missouri, numerous small stream sections have been straightened by landowners in an attempt to slow erosion on their property. Drainage ditches and diversions are limited in the basin as are levees, especially on the larger rivers. Most drainage modifications were implemented to divert water from upland fields around bottom land fields which have drainage problems.

The fish community in the Blackwater /Lamine Rivers EDU is one of transition from Ozark to prairie fauna. In some of the eastern streams (Flat and Richland creeks), fish more typical of Ozark streams such as longear sunfish, stonerollers, redbelly dace, and black and golden redhorse are found; elsewhere, fishes of more general distribution (largemouth bass, green sunfish, bluegill, and black bullhead) or preferring prairie habitats (common and red shiners) can be found. Twenty seven species of mussels and four species of crayfish can also be found. Of species of special conservation concern, the blacknose shiner and Topeka shiner have been collected in the basin, although not recently, and active pallid and lake sturgeon reintroduction programs are ongoing in the Missouri River. No threatened or endangered mussel or crayfish are found in the EDU.

Greater detail on current aquatic resource conditions in the Blackwater/Lamine Rivers EDU is available in the three WIA documents cited under the reference section following this EDU information.

Aquatic Resource Goals and Objectives for the Blackwater/Lamine Rivers EDU:

Our major goals for the Blackwater/Lamine River watershed are improving water quality, improving riparian and aquatic habitat conditions, maintaining diverse and abundant populations

of native aquatic organisms and sport fish and increasing public appreciation for the stream resources. Cooperative efforts with other resource agencies on water quality, habitat, and watershed management issues will be critical to our mitigation efforts. Legal enforcement of existing water quality and other stream-related regulations and necessary revisions and additions to these regulations will help reduce violations and lead to further water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system. Existing onsite habitat improvement projects on federal, state, and local government lands and those of private landowners will focus on improving stream channel and riparian area stability in priority areas in the EDU:

- Restoration of in-stream habitats (pools with woody debris, boulders and/or aquatic vegetation) benefits resident sportfish (including the walleye, flathead catfish, blue catfish, etc) and native non-game fishes (including the blacknose and Topeka shiners) Preservation efforts through spawning and nurseries may are important to the life and history of this fauna.
- Restoration, expansion, and maintenance of well vegetated riparian areas, especially in areas with high diversity of aquatic life, presence of species of conservation concern, and areas managed for specific species or communities. Urbanizing areas, headwaters, and those with excessive livestock use will be targeted.
- Mitigation planning may identify significant sources of pollutants (i.e. eroded soil and other non-point water quality problems) and strive to restore and stabilize them.
- Restoration of in-channel hydraulics to balance the hydrological and in channel physical conditions of streams.

Active enforcement of existing water quality and other stream related regulations, and necessary revisions and additions, are detrimental and will help reduce violations and increase water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system.

Prioritization Strategy for Selecting and Implementing Compensatory Mitigation Strategies for the Blackwater/Lamine Rivers EDU:

Mitigation projects in the Blackwater/Lamine Rivers EDU will be located in areas that provide physical, chemical, and/or biological improvements to stream ecological values of the basin, and are technically feasible and appropriate to install at the project site. The highest priority will be areas of biodiversity that have been deemed Conservation Opportunity Areas using the assessment by the interagency Missouri Resource Assessment Partnership (MoRAP). The MoRAP conservation assessment process within the Blackwater/Lamine Rivers EDU found 13 COAs that represent a broad diversity of watershed and stream types that occur throughout the

basin. These COAs constitute 469 miles of stream, which represents 5.5% of the total stream miles within the Blackwater/Lamine Rivers EDU. In addition to COAs, other priority sites will be identified when a mitigation project is not possible in one of the above COAs:

- 303 (d) listed waters
- Stream reaches managed by Missouri Department of Natural Resources Aquatic
- Stream reaches containing state or federal species of conservation concern
- Conservation Opportunity Areas
- Areas of high aquatic biodiversity
- Greenway corridors proposed or managed by federal, state, or local entities for public recreation or habitat conservation purposes
- Upstream or downstream of all Missouri Department of Conservation state parks and other local, state or federally-owned public areas managed for natural resource or public recreation purposes

Preservation objectives for the Blackwater/Lamine Rivers EDU:

The priority of projects will continue to be on restoration and establishment. However, preservation projects are an important part of watershed management, in that critical stream reaches, unique habitats, and protection of important water quality areas of the Blackwater/Lamine basin will contribute to sustaining ecological functioning over the long term. Preservation will be used in the Blackwater/Lamine EDU when:

- The resources to be preserved provide important physical, chemical and/or biological functions for the watershed;
- The resources contribute significantly to the ecological sustainability of the watershed;
- Preservation is appropriate, practicable, and has the support of the IRT and the Corps;
- The aquatic resources in question are under threat of destruction or degradation; and/or
- The preserved site will be permanently protected by the appropriate real estate provision or legal instrument as part of the in-lieu fee project site mitigation plan.

Preservation efforts will be combined with associated efforts to restore, establish, or enhance other aquatic habitats as is practicable and appropriate. Stream and riparian corridor preservation will receive credit based upon the calculated amount for preservation per the State of Missouri Stream Mitigation Method. Wetland preservation will only be proposed for high quality wetlands and credits will be released at a higher ratio as approved by the Corps, in consultation with the IRT.

Public and Private Stakeholder involvement in plan development and implementation in the Blackwater/Lamine Rivers EDU:

Mitigation sites within the Blackwater/Lamine EDU, the Sponsor will seek out local input from federal and state agencies, municipalities, landowners, natural resource management groups and advisory groups within the watershed as appropriate. The ILF program will work with any willing public agencies to prioritize watersheds in in-lieu-fee projects. IFL project sites will not be placed on public lands.

Long-term protection and management strategies for compensatory mitigation in the Blackwater/Lamine Rivers EDU:

Each compensatory mitigation site will be protected in perpetuity by a conservation easement held by an approved long-term steward that will be identified within the mitigation plan. These easements ensure that there will be no development or other land use change on the project sites which could diminish the level of physical, chemical, and biological ecosystem functions that each site provides to the watershed. Additionally, the conservation easement will stay with the property if that title to the property is transferred to a third party. It is the intention of LLF to maintain ownership of properties in perpetuity as highly functioning habitat in accordance with the terms of a long-term management plan and conservation easement.

In the rare event where a high priority project cannot be secured through fee title acquisition or perpetual easement, the following methods for long-term protection may be considered:

- The choice of a landowner not interested in signing a perpetual easement to choose to donate, sell, or otherwise transfer an easement for a 20-30 year period to the Missouri Department of Conservation, natural resource-oriented federal, state, or local government agency, or a natural resource-oriented land trust like the Nature Conservancy, Ozark Regional land Trust, Greenbelt Land Trust or similar non-profit entity
- The choice of a landowner not interested in signing a perpetual easement to choose to agree to a maintenance agreement, a contractual agreement between LLF and the landowner, where the landowner or other entity promises to meet specified maintenance condition for a 20-30 year period. These projects are alienable in the event of the sale of property. If the maintenance agreement does not transfer, it remains with the original signer of the agreement.

LLF would perform annual monitoring with onsite field observations, reporting, and enforcement actions, as appropriate, on all properties.

Strategy for periodic evaluation and reporting in the Blackwater/Lamine Rivers EDU:

Evaluation, monitoring, and reporting is required of all compensatory mitigation projects to determine if the project is meeting its performance standards and if additional measures are

necessary to ensure that the compensatory mitigation project is accomplishing its objectives. This documentation will include an accounting of the acreage and type of all mitigation activities within the service area and how the combined ecological benefit of all compensatory mitigation sites is performing to achieve the goals set forth in this EDU. Project specific mitigation plans will detail the parameters to be monitored, the length of the monitoring period, the dates that the reports must be submitted, the party responsible for conducting the monitoring, the frequency for submitting monitoring reports to the Corps, and the party responsible for submitting those monitoring reports to the Corps and the IRT. Data collection for performance objectives will occur once during the year and will be reported in an annual report until a project has been shown to meet performance standards, unless otherwise specified in the approved project-specific mitigation plan. The level of detail and substance of the report will be commensurate with the scale and scope of the compensatory mitigation project. Compliance monitoring will also be conducted annually until performance standards are met and will be reported in the annual report. After a project has met performance standards, the frequency of all monitory will decrease to a term not to be less than once every five years. Changes in reporting may be required by the Corps and the IRT as necessary to accommodate adaptive changes in the project and unforeseen natural disasters.

Evaluation and reporting will concentrate on those metrics involved in performance standards and will not include species or community biotic sampling until late in the project cycle, if at all. Temporal improvement of biota and their communities often lags restoration projects by years, and sometimes decades, and biological sampling often is inconclusive as to whether a project has improved biotic communities. At the conclusion of the project, aquatic invertebrate and/or other fish diversity indices may be calculated and compared to the before-project condition and to reference indices obtained from stable streams of similar type, order, and size elsewhere within the watershed, if the biologist in charge of the project determines it is necessary.

References:

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/blue-river

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/lamine-river

Grand/Chariton Rivers Service Area

Geographic Service Area:

The Grand River Basin is located in northwest Missouri and southwest Iowa. The watershed consists of 7,900 square miles with over three-fourths of this area in Missouri. The basin is best characterized as rural with a declining population and no major urban areas. Land use is predominantly agricultural with cropland the largest component. The basin contains more than 1,000 third-order and larger streams. Approximately 2% of the basin is in public ownership.

The Chariton River originates in Iowa in southeastern Clarke County. It flows eastward and southward until it is dammed to form 11,000-acre Rathbun Reservoir in Appanoose County, Iowa. After flowing southward for approximately 30 miles the Chariton River enters Missouri, forming the boundary between Putnam and Schuyler counties. It continues to flow to the south through Adair and Macon counties. Upon entering the northeastern corner of Chariton County, the river takes a southwesterly route to its confluence with the Missouri River. The basin's eastern boundary is known as the "Grand Divide". All streams to the east flow to the Mississippi River, all streams to the west are tributaries of the Missouri River.

Threats to the Aquatic Resources in the Grand/Chariton Rivers EDU:

<u>Water Quality Problems</u>

The water quality in the Grand/Chariton EDU is variable, ranging from degraded in the northern watershed, to higher quality in the southern portions of the EDU. Because of the variability, there are a number of problems facing streams in the EDU:

- Channelization of streams and sedimentation from poor land practices continue to be the major management problems in this EDU
- Excessive sedimentation and pollution-laden runoff from non-point sources
- Contamination of aquatic biodiversity, primarily with iron and manganese
- Point source concerns in the basin are those associated with Oil and petroleum product pipelines belonging to Amoco, Arco and Mapco companies cross the basin from east to west for its entire length. An Amoco pipeline break in 1990 spilled 86,000 gallons of crude oil and impacted over 35 miles of Little Turkey Creek and the Chariton River
- Another threat to fish populations through the basin has been the improper management of municipal sewage and the subsequent runoff into receiving streams

- Water quality standards for iron, magnesium and fecal coliform bacteria are frequently exceeded
- Damage to riparian areas and excessive nutrient loading of the streams often results

Many of the water quality problems, especially those involving petroleum and aquatic life contamination are difficult, complex, and expensive to address. However, many of the problems resulting in riparian destruction, stream bank erosion, and sedimentation are an appropriate project that is addressable through the installation of mitigation projects. Preservation projects, especially in streams in rapidly urbanizing areas but still containing high quality aquatic communities are particularly adaptable.

Aquatic Resource Problems

In rural areas, aquatic resources are endangered by threats such as agricultural conversion, nutrient and sediment runoff, and livestock damage. Aquatic resource problems facing streams in this EDU include:

- Large scale channelization has significantly degraded in-stream habitats
- Livestock access to streams is causing stream bank erosion and sedimentation and overgrazing in floodplain and watershed pastures contributes to flashier runoff and sediment delivery to the stream
- Increased land clearing and higher runoff associated with urbanization also impact stream habitat quality
- Historic mining in the areas along the watersheds continues to impact streams

Historic Aquatic Loss in the Grand/Chariton Rivers EDU:

Pre-settlement in the northern portion of the EDU was characterized by long narrow prairies generally oriented north-south and divided by timbered ridge tops and stream valleys (Schroeder 1982). Only in the southwest part of the basin did prairies open up to wide expanses averaging one or two miles across.

Large areas of the broad flood plains of streams in the Grand-Chariton region supported a `luxuriant growth of coarse wild grass' (Watkins et al. 1921). Sometimes these wet prairies occupied the entire bottomland, except for a timber strip fringing the banks of streams. Clay or gumbo soils prevented good drainage, and marshes and ponds abounded.

The first European settlers came to the northern region of the EDU in 1817. However, extensive settlement did not begin until after 1830 (Boehner 1937). Much of the agricultural activity was related to clearing trees for firewood and row crop production. Prairie areas, especially those near streams were not farmed because primitive implements could not plow the tough soil. Early settlers also believed that land that did not grow trees could not grow crops (Boehner 1937).

Grazing and timber clearing probably had the most impact on streams during this time.

In the southern region of the EDU, the basin's first inhabitants, Native Americans of the Fox, Sac, Illinois, Missouri and Iowa tribes, and white explorers, exerted little pressure on the land and its natural resources. Intensive land use came to the basin after it was settled by European immigrants in the early to mid 1800s. The first immigrants in any area of the basin settled on the hillsides where timber was easily accessible. The grasslands were used for open range (SCS 1995, 1994, 1989).

Prior to settlement, it was reported that as much as 70% of the basin was forested (St. Louis Historical Co. 1884). Railroads were built shortly after the organized settlement of the basin in the mid 1800s. This stimulated the commercial sale of many of the basin's natural resources. Coal mining began at this time, but did not peak as an industry until 1900 through 1925 in Randolph, Macon, Adair and Putnam counties (SCS 1995, 1989; Kirksville-Adair Co. Bicentennial Committee 1976; History of Adair, Sullivan, Putnam and Schuyler counties 1888). Railroads and coal mines produced a great demand for timber in the form of ties, pillars and props. By the end of World War I there were no extensive stands of virgin timber left in Adair County (Kirksville-Adair Co. Bicentennial Committee 1976).

Current Aquatic Resource Conditions of the Grand/Chariton Rivers EDU:

Land use in the Missouri side of the northern portion of the EDU is estimated to be 92% agricultural and 5% forest. Missouri has approximately 1.3 million acres (26%) of the basin within Watershed Protection and Flood Prevention Act (Public Law 83-566) watershed projects (USDA-SCS 1993). The Panther Creek Watershed project in Harrison County, is the first completed PL-566 project. Ten other projects within the basin are in various stages of planning and construction.

Fish habitat throughout much of the northern region of the EDU has been degraded. Much of the unique habitat consists of streams that have not been channelized or contain coarse substrate and bedrock.

Sixty species of fish have been collected by various investigators in the northern portion of the EDU since 1963. An additional 16 species have distributions that overlap portions of the basin (Pflieger 1971, 1975), but have not been collected. Common species within the basin are channel catfish, black bullhead, yellow bullhead, common carp, river carpsucker, creek chub, red shiner, sand shiner and green sunfish. Historically fish population has been diversed. Catfish are the most important sportfish within the basin. An estimated 72,920 catfish and bullheads were caught in the EDU in 1975 (Fleener 1977). Missouri River tributaries such as the northern portion of the EDU are important spawning and nursery areas for big river. A flathead catfish tagged in the Missouri River near Columbia, Missouri was captured in the EDU near Gallatin.

Five species of crayfish have been collected within the EDU. The species which have been

collected in order of abundance are the northern crayfish, papershell crayfish, devil crayfish, grassland crayfish and the White River crayfish.

Currently, in the southern region of the EDU, over 80% of the land is used for commodity production. At the turn of the Millennium, 43% of the basin was in hay or pasture, including lands enrolled in the Conservation Reserve Program (only 21% hay/pasture in 1982; USDA), 38% was in cropland (53% in 1982), 15% was forested, including grazed woodlands (17% in 1982), and 4% was used for other purposes. Changes over the past two decades likely reflect some conversion of highly erodible cropland to CRP or idle ground, and would support the recent reduced soil erosion findings.

In general, the level ridge tops and floodplains are used to grow crops. Hayland and pasture occur on the hillsides as well as the ridge tops. Forested land can be found along small and larger streams, on hillsides and ridges, but is not a predictable part of any landform. The Mussel Fork Creek sub-basin is more heavily forested than the remainder of the Chariton River Basin.

The predominant type of farming changes from hay and livestock production in the northern Missouri portion of the basin to grain crop production in the basins southern reaches, and is reflected in the annual production record for each county. Putnam, Adair and Macon counties are among the top hay-producing counties in the state (Reddick 1992). Beef cattle numbers are also highest in the northern reaches of the basin; Putnam County supports over 25,000 head. Row crop production predominates in the southern reaches of the basin; Macon and Chariton counties are among the top soybean producers in the state, and Chariton County is among the top ten producing counties for soybeans as well as corn and wheat (Reddick 1992).

Corporate hog farms now dwarf the production of private hog farmers. Prior to the development of corporate farms, there were roughly 56,000 hogs produced annually basin-wide. Though there are fewer small family hog farms today, corporate farmers alone have boosted this annual production figure by approximately 270,000 head, to a herd size of 326,000 in the late 1990s ' roughly equivalent to a human population of 1.2 million.

The most recent fish community data were collected by seine between late July and late September in 1990, 1992, 1993 and 1994. 51 species of fish (and several hybrids) were identified in the most recent basin surveys. Minnow species such as bigmouth shiners, sand shiners, and red shiners that are tolerant of shallow, sediment-filled channels occurred at over 80% of all sample sites. Other cyprinids occurring at over half of the sites seined were central stoneroller, bluntnose minnow, fathead minnow, and creek chub. Sunfishes were surprisingly prevalent; green sunfish, bluegill, and largemouth bass occurred at 68%, 50%, and 46% of all sample sites, respectively.

Suitable mussel habitat is generally lacking throughout the basin. As of 2001, the only qualitative survey to assess the mussel fauna was conducted on Mussel Fork Creek in Chariton County in 1994. The most common species collected were mapleleaf, white heelsplitter and fragile

papershell. Less common species included threeridge, yellow sandshell, Anodonta, giant floater, pink papershell, deer-toe, only one specimen, paper pondshell, shell only and pond mussel, shell only.

Aquatic Resource Goals and Objectives for the Grand/Chariton Rivers EDU:

Our major goals for the Grand/Chariton River watershed are improving water quality, improving riparian and aquatic habitat conditions, maintaining diverse and abundant populations of native aquatic organisms and sport fish and increasing public appreciation for the stream resources. Cooperative efforts with other resource agencies on water quality, habitat, and watershed management issues will be critical to our mitigation efforts. Legal enforcement of existing water quality and other stream-related regulations and necessary revisions and additions to these regulations will help reduce violations and lead to further water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system. Existing onsite habitat improvement projects on federal, state, and local government lands and those of private landowners will focus on improving stream channel and riparian area stability in priority areas in the EDU:

- Restoration of in-stream habitats (pools with woody debris, boulders and/or aquatic vegetation) benefits resident sportfish, native non-game fishes (including ghost shiner, Topeka shiners, troutperch, plains minnow, etc) and unique or depressed aquatic invertebrate populations.
- Restoration, expansion, and maintenance of well vegetated riparian areas, especially in areas with high diversity of aquatic life, presence of species of conservation concern, and areas managed for specific species or communities.
- Mitigation planning may identify significant sources of pollutants (i.e. eroded soil and other non-point water quality problems) and strive to restore and stabilize them.
- Restoration of in-channel hydraulics to balance the hydrological and in-channel physical conditions of streams.

Active enforcement of existing water quality and other stream related regulations, and necessary revisions and additions, are detrimental and will help reduce violations and increase water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system.

Prioritization Strategy for Selecting and Implementing Compensatory Mitigation Strategies for the Grand/Chariton Rivers EDU:

Mitigation projects in the Grand/Chariton EDU will be located in areas that provide physical, chemical, and/or biological improvements to stream ecological values of the basin, and are

technically feasible and appropriate to install at the project site. The highest priority will be areas of biodiversity that have been deemed Conservation Opportunity Areas using the assessment by the interagency Missouri Resource Assessment Partnership (MoRAP). The MoRAP conservation assessment process within the Grand/Chariton EDU contains 64 COAs. In addition to COAs, other priority sites will be identified when a mitigation project is not possible in one of the above COAs:

- 303 (d) listed waters
- Stream reaches managed by Missouri Department of Natural Resources Aquatic
- Stream reaches containing state or federal species of conservation concern
- Conservation Opportunity Areas
- Areas of high aquatic biodiversity
- Greenway corridors proposed or managed by federal, state, or local entities for public recreation or habitat conservation purposes
- Upstream or downstream of all Missouri Department of Conservation state parks and other local, state or federally-owned public areas managed for natural resource or public recreation purposes

Preservation objectives for the Grand/Chariton Rivers EDU:

The priority of projects will continue to be on restoration and establishment. However, preservation projects are an important part of watershed management, in that critical stream reaches, unique habitats, and protection of important water quality areas of the Grand/Chariton basin will contribute to sustaining ecological functioning over the long term. Preservation will be used in the Grand/Chariton EDU when:

- The resources to be preserved provide important physical, chemical and/or biological functions for the watershed;
- The resources contribute significantly to the ecological sustainability of the watershed;
- Preservation is appropriate, practicable, and has the support of the IRT and the Corps;
- The aquatic resources in question are under threat of destruction or degradation; and/or
- The preserved site will be permanently protected by the appropriate real estate provision or legal instrument as part of the in-lieu fee project site mitigation plan.

Preservation efforts will be combined with associated efforts to restore, establish, or enhance other aquatic habitats as is practicable and appropriate. Stream and riparian corridor preservation will receive credit based upon the calculated amount for preservation per the State of Missouri Stream Mitigation Method. Wetland preservation will only be proposed for high quality wetlands and credits will be released at a higher ratio as approved by the Corps, in consultation with the IRT.

Public and Private Stakeholder involvement in plan development and implementation in the Grand/Chariton Rivers EDU:

Mitigation sites within the Grand/Chariton EDU, the Sponsor will seek out local input from federal and state agencies, municipalities, landowners, natural resource management groups and advisory groups within the watershed as appropriate. The ILF program will work with any willing public agencies to prioritize watersheds in in-lieu-fee projects. IFL project sites will not be placed on public lands.

Long-term protection and management strategies for compensatory mitigation in the Grand/Chariton Rivers EDU:

Each compensatory mitigation site will be protected in perpetuity by a conservation easement held by an approved long-term steward that will be identified within the mitigation plan. These easements ensure that there will be no development or other land use change on the project sites which could diminish the level of physical, chemical, and biological ecosystem functions that each site provides to the watershed. Additionally, the conservation easement will stay with the property if that title to the property is transferred to a third party. It is the intention of LLF to maintain ownership of properties in perpetuity as highly functioning habitat in accordance with the terms of a long-term management plan and conservation easement.

In the rare event where a high priority project cannot be secured through fee title acquisition or perpetual easement, the following methods for long-term protection may be considered:

- The choice of a landowner not interested in signing a perpetual easement to choose to donate, sell, or otherwise transfer an easement for a 20-30 year period to the Missouri Department of Conservation, natural resource-oriented federal, state, or local government agency, or a natural resource-oriented land trust like the Nature Conservancy, Ozark Regional land Trust, Greenbelt Land Trust or similar non-profit entity
- The choice of a landowner not interested in signing a perpetual easement to choose to agree to a maintenance agreement, a contractual agreement between LLF and the landowner, where the landowner or other entity promises to meet specified maintenance condition for a 20-30 year period. These projects are alienable in the event of the sale of property. If the maintenance agreement does not transfer, it remains with the original signer of the agreement.

LLF would perform annual monitoring with onsite field observations, reporting, and enforcement actions, as appropriate, on all properties.

Strategy for periodic evaluation and reporting in the Grand/Chariton Rivers EDU:

Evaluation, monitoring, and reporting is required of all compensatory mitigation projects to determine if the project is meeting its performance standards and if additional measures are necessary to ensure that the compensatory mitigation project is accomplishing its objectives. This documentation will include an accounting of the acreage and type of all mitigation activities within the service area and how the combined ecological benefit of all compensatory mitigation sites is performing to achieve the goals set forth in this EDU. Project specific mitigation plans will detail the parameters to be monitored, the length of the monitoring period, the dates that the reports must be submitted, the party responsible for conducting the monitoring, the frequency for submitting monitoring reports to the Corps, and the party responsible for submitting those monitoring reports to the Corps and the IRT. Data collection for performance objectives will occur once during the year and will be reported in an annual report until a project has been shown to meet performance standards, unless otherwise specified in the approved project-specific mitigation plan. The level of detail and substance of the report will be commensurate with the scale and scope of the compensatory mitigation project. Compliance monitoring will also be conducted annually until performance standards are met and will be reported in the annual report. After a project has met performance standards, the frequency of all monitory will decrease to a term not to be less than once every five years. Changes in reporting may be required by the Corps and the IRT as necessary to accommodate adaptive changes in the project and unforeseen natural disasters.

Evaluation and reporting will concentrate on those metrics involved in performance standards and will not include species or community biotic sampling until late in the project cycle, if at all. Temporal improvement of biota and their communities often lags restoration projects by years, and sometimes decades, and biological sampling often is inconclusive as to whether a project has improved biotic communities. At the conclusion of the project, aquatic invertebrate and/or other fish diversity indices may be calculated and compared to the before-project condition and to reference indices obtained from stable streams of similar type, order, and size elsewhere within the watershed, if the biologist in charge of the project determines it is necessary.

References

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/grand-river

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/chariton-river

Cuivre/Salt Rivers Service Area

Geographic Service Area:

The Cuivre/Salt Rivers EDU lies mainly in northeastern Missouri, but also covers portions of western Illinois and southeastern Iowa, draining the eastern margin of the Central Dissected Till Plains Ecological Section. Streams flow easterly or southeasterly and empty into the pooled portion of the Upper Mississippi River.

The Cuivre River is seventh order, low gradient river located in northeast Missouri. It originates in Audrain and Pike counties and flows south-eastward through Pike, Montgomery, Lincoln, Warren and St. Charles counties to its confluence with the Mississippi River near Winfield, Missouri. Its major tributaries are the West Fork Cuivre River and the North Fork Cuivre River. The entire watershed is 1,235 square miles.

The Fabius River is divided into three main sub-basins. The North Fabius sub-basin originates in Davis County, Iowa. The Middle Fabius and South Fabius sub-basins originate in Schuyler County, Missouri. Approximately 6% of the watershed is in Iowa. These three streams flow parallel southeasterly across northeastern Missouri, draining portions of eight counties. The Middle Fabius River joins the North Fabius in southeastern Lewis County. The North Fabius flows 8.9 miles to merge with the South Fabius in northeastern Marion County and forms the Fabius River. The Fabius River then flows 3.5 miles before reaching its union with the Mississippi River in the Fabius Chute. The Fabius watershed drains 1,543 square miles, which is approximately 988,900 acres of land. The North Fabius River is a sixth order stream that is longer than fifth-order Middle Fabius River and South Fabius River.

The Fox River basin is a relatively small system of streams, which drains over 400 square miles in northeastern Missouri and southeastern Iowa. The largest stream in the basin is fifth order Fox River. In Missouri, the Fox River and tributaries drain watersheds in Scotland and Clark counties before its convergence with the Mississippi River downstream of Wayland.

The North River basin drains 381 square miles, or 243,857 acres, of northeastern Missouri covering parts of Knox, Shelby, Monroe, Marion, and Ralls counties. The order 6 North River is the longest stream within the basin. It flows 78 miles southeastward before entering the Upper Mississippi River.

The Salt River is a seventh order river draining 2,914 square miles of the northeastern Missouri counties of Adair, Audrain, Boone, Callaway, Knox, Macon, Monroe, Pike, Ralls, Randolph,

Schuyler, and Shelby. The longest tributary is the North Fork of the Salt River, which flows 119 miles prior to its confluence with the South Fork in Mark Twain Lake. Mark Twain Lake, an 18,600-acre Corps of Engineers impoundment, is situated on the Salt River where the North, Middle and South forks meet, approximately 63 miles upstream from the river's junction with the Mississippi River.

The Wyaconda River basin is located in the Glaciated Plains Natural Division of southeast Iowa and northeast Missouri. It drains 458 square miles of land and 336 of those square miles lie within the state of Missouri. The Wyaconda River, a fifth order stream, is the largest within the basin. It flows 70 miles in Missouri before joining the Mississippi River above LaGrange, Missouri.

Overall there are 15,297 miles of primary stream channel within this EDU. 5,063 of those miles are classified as perennial. Of the total, 11,738 miles, or 77%, falls within Missouri.

Threats to the Aquatic Resources in the EDU:

Water Quality Problems

Overall, the water quality of the Cuivre/Salt Rivers EDU is fair and it, too, varies within the several watersheds. Water quality problems facing streams in this EDU include:

- Soil erosion from excessive livestock and intensive row cropping and stream bank and streambed erosion in stream channels contribute to turbidity and excessive sediment to the stream especially in areas of inadequately sized vegetated riparian corridors
- Contamination of aquatic biodiversity and organisms
- Few sewage treatment plants lead to excessive nutrients which spread throughout the EDU and intensive livestock operations contribute to low DO; algal blooms; nitrate, nitrite, ammonia and phosphate discharges and excessive sediment

Many of the water quality problems, especially those involving aquatic life contaminations are difficult, complex, and expensive to address. However, many of the problems resulting in riparian destruction, stream bank erosion, and sedimentation are an appropriate project that is addressable through the installation of mitigation projects. Preservation projects, especially in streams in rapidly urbanizing areas but still containing high quality of aquatic communities, are particularly adaptable.

Aquatic Resource Problems

Overall, the quality of aquatic resources in the Cuivre/Salt Rivers EDU varies: some watersheds are somewhat depressed while others have major, chronic problems. Aquatic resource problems facing streams in this EDU include:

- Destruction of riparian vegetation from construction, row crop agricultural activities and livestock
- Stream bank erosion to inadequately sized vegetated riparian corridors, channel alterations, row cropping in the Till Plains sections of the watershed and cattle grazing
- Large reach channelization projects, especially in North Fabius, Fox, North, and Wyaconda watersheds and widespread small scale channel alterations due to stream straightening, levee construction, and attempts to control stream bank erosion

Historic Aquatic Loss in the Cuivre/Salt EDU:

The French settled in the area as early as 1682, however, Native Americans of the Missouri, Osage, Fox, and Sac tribes were in undisputed possession of northern Missouri until the United States took ownership in 1803 as part of the Louisiana Purchase. In 1804, Native Americans made a series of treaties consequently relinquishing their claims to land in Missouri. White immigrants from other states were arriving at the time and subsequently established farming as the region's economic base. Farming corn and winter wheat on the highly fertile land provided the economic base for the region. The human population expanded in the basin’s counties until the early 1900's.

Much of the basin’s landscape prior to settlement was prairie grasses. Grasses consisted primarily of big and little bluestem, Indian grass, switchgrass and side-oats grama, broken by bands of timber that ran along the major streams. Prairies of the basin were usually long and narrow since they were located on the narrow uplands or ridges along streams. Nearly all floodplains contained wet, bottomland prairies. Wooded areas, generally of the oak-hickory type, were found across the steeper rolling hills and adjacent to streams. Prairie land in the region ranged from 30% to 75%, depending on the watershed. The most notable prairie, prior to settlement, in the basin was the Grand Prairie which covered nearly all of Audrain County and portions of Monroe, Ralls, and Pike counties. This prairie, once covered with massive expanses of native blue stem grass and roaming grounds for bison, elk and other wildlife, rapidly diminished when row cropping agricultural production and livestock grazing increased in the early 1800's. By 1865, just 10% of the land in Audrain County was cultivated. Both prairie and forest diminished rapidly with the commencement of land clearing for both row crops and livestock grazing.

Agriculture has been the main economic base of the basin, however, mineral resources also contributed significantly to the economic development of the basin. Mining activities included coal, sand and gravel, limestone, shale, and fire clay. Prior to 1927, the lower reaches of the Cuivre River were substantially altered by channelization. Eight miles of stream were lost when a straight channel was cut across several loops near the mouth of the river.

Current Aquatic Resource Conditions of the Cuivre/Salt EDU:

The level, undissected, uplands in the western portion of the drainage are underlain mainly by horizontally bedded Mississippian and Pennsylvanian shales, while the more hilly and dissected topography to the east is underlain principally by Ordovician limestones and sandstones. A distinctive feature of this EDU is the "claypan region", which covers most of the west/southwest portion of the EDU. This region is a very flat plain underlain by claypan soils that have resisted postglacial stream erosion. Local relief in this region is generally less than 100 feet. Soils are deep and poorly drained and harbor a perched water table in the winter and spring as a result of the claypan subsoils. Soil surface textures are mainly silty loams. The average gradient across all stream size classes is 34 ft/mi. Average gradients (ft/mi) by size class are: headwater 54, creek, 14, small river 4.2, and large river 1.6. Streams in the west and north of this EDU are generally surface water dominated, turbid with sand and silt substrates. Streams in the south and east are clear, gravelly, and approach Ozark streams in character with springs locally abundant.

Today, almost all the areas covered by prairie grasses in the EDU have been cultivated with much of the timber removed near streams. Current watershed land use is approximately 30% forested and 70% is cultivated, pastured or otherwise developed. Soybeans are the most important row crop cultivated, followed by corn, wheat, and sorghum. Livestock production includes cattle and hogs. The forested areas are made up of maples, elms, oaks, black walnut and eastern red cedar. While a number of large channelization projects remain, small channelization projects continue to occur on private property or with road and bridge construction. Inundation by Mark Twain Reservoir and its reregulation pool adversely affect the flowing water characteristics of the Salt River, and runoff from abandoned coal mines also continue to impact streams in the southwestern part of the EDU.

From a basin wide perspective, the fish community includes species representative of the Prairie, Lowland, Ozark, and Big River faunal regions. The Cuivre/Salt EDU is home to 117 species of fish. The fish community in the southern portion of the EDU is a combination of Ozark border fauna (stonerollers, steelcolor, striped and bigeye shiners, redbelly dace, hogsuckers, redhorses, smallmouth bass, banded sculpin, orangethroat darters and logperch) and prairie fauna (red shiner, bigmouth shiner, suckermouth minnow, quillback, stonecat, orangespotted sunfish and blackside darter). As one goes farther north and west, prairie species become more dominant and Ozark species less so. The connection of streams with the Mississippi River also blends big river species such as gar, common carp, silver chub, emerald shiner, river carpsucker, buffalo, flathead catfish, channel catfish, white bass, white crappie, sauger, walleye and freshwater drum. The ghost shiner is a species of special conservation concern and could be found in patchy locations throughout the EDU. Fifty one species of freshwater mussels and 5 species of crayfish are also found in the EDU.

Much greater detail on current aquatic resource conditions in the Cuivre/Salt EDU is available in the five WIA documents cited under the Support Data section above, and readers are encouraged

to download and read them.

Aquatic Resource Goals and Objectives for the Cuivre/Salt EDU:

Our major goals for the Cuivre/Salt River watershed are improving water quality, improving riparian and aquatic habitat conditions, maintaining diverse and abundant populations of native aquatic organisms and sport fish and increasing public appreciation for the stream resources. Cooperative efforts with other resource agencies on water quality, habitat, and watershed management issues will be critical to our mitigation efforts. Legal enforcement of existing water quality and other stream-related regulations and necessary revisions and additions to these regulations will help reduce violations and lead to further water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system. Existing onsite habitat improvement projects on federal, state, and local government lands and those of private landowners will focus on improving stream channel and riparian area stability in priority areas in the EDU:

- Restoration of in-stream habitats (pools with woody debris, boulders and/or aquatic vegetation) benefits resident sportfish, native non-game fishes (including ghost shiner, Topeka shiners, troutperch, plains minnow, etc) and unique or depressed aquatic invertebrate populations.
- Restoration, expansion, and maintenance of well vegetated riparian areas, especially in areas with high diversity of aquatic life, presence of species of conservation concern, and areas managed for specific species or communities.
- Mitigation planning may identify significant sources of pollutants (i.e. eroded soil and other non-point water quality problems) and strive to restore and stabilize them.
- Restoration of in-channel hydraulics to balance the hydrological and in-channel physical conditions of streams.

Active enforcement of existing water quality and other stream related regulations, and necessary revisions and additions, are detrimental and will help reduce violations and increase water quality improvements. Collaborations with related agencies to promote public awareness and incentive programs and cooperating with citizen groups and landowners will result in improved watershed conditions, better water quality, and a healthier stream system.

Prioritization Strategy for Selecting and Implementing Compensatory Mitigation Strategies for the Cuivre/Salt EDU:

Mitigation projects in the Cuivre/Salt EDU will be located in areas that provide physical, chemical, and/or biological improvements to stream ecological values of the basin, and are technically feasible and appropriate to install at the project site. The highest priority will be areas of biodiversity that have been deemed Conservation Opportunity Areas using the assessment by

the interagency Missouri Resource Assessment Partnership (MoRAP). The MoRAP conservation assessment process within the Cuivre/Salt EDU found 10 COAs that represent a broad diversity of watershed and stream types that occur throughout the basin. These COAs constitute 317 miles of stream, which represents 2.7% of the total stream miles within the Cuivre/Salt EDU. Specific attention to, and more intensive conservation efforts within these 10 COAs provides an efficient and effective strategy for the long term maintenance of relatively high quality examples of the various ecosystem and community types that exist within this EDU. In addition to COAs, other priority sites will be identified when a mitigation project is not possible in one of the above COAs:

- 303 (d) listed waters
- Stream reaches managed by Missouri Department of Natural Resources Aquatic
- Stream reaches containing state or federal species of conservation concern
- Conservation Opportunity Areas
- Areas of high aquatic biodiversity
- Greenway corridors proposed or managed by federal, state, or local entities for public recreation or habitat conservation purposes
- Upstream or downstream of all Missouri Department of Conservation state parks and other local, state or federally-owned public areas managed for natural resource or public recreation purposes

Preservation objectives for the Cuivre/Salt EDU:

The priority of projects will continue to be on restoration and establishment. However, preservation projects are an important part of watershed management, in that critical stream reaches, unique habitats, and protection of important water quality areas of the Cuivre/Salt basin will contribute to sustaining ecological functioning over the long term. Preservation will be used in the Cuivre/Salt EDU when:

- The resources to be preserved provide important physical, chemical and/or biological functions for the watershed;
- The resources contribute significantly to the ecological sustainability of the watershed;
- Preservation is appropriate, practicable, and has the support of the IRT and the Corps;
- The aquatic resources in question are under threat of destruction or degradation; and/or
- The preserved site will be permanently protected by the appropriate real estate provision or legal instrument as part of the in-lieu fee project site mitigation plan.

Preservation efforts will be combined with associated efforts to restore, establish, or enhance other aquatic habitats as is practicable and appropriate. Stream and riparian corridor preservation will receive credit based upon the calculated amount for preservation per the State of Missouri Stream Mitigation Method. Wetland preservation will only be proposed for high quality wetlands

and credits will be released at a higher ratio as approved by the Corps, in consultation with the IRT.

Public and Private Stakeholder involvement in plan development and implementation in the Cuivre/Salt EDU:

Mitigation sites within the Cuivre/Salt EDU, the Sponsor will seek out local input from federal and state agencies, municipalities, landowners, natural resource management groups and advisory groups within the watershed as appropriate. The ILF program will work with any willing public agencies to prioritize watersheds in in-lieu-fee projects. IFL project sites will not be placed on public lands.

Long-term protection and management strategies for compensatory mitigation in the Cuivre/Salt EDU:

Each compensatory mitigation site will be protected in perpetuity by a conservation easement held by an approved long-term steward that will be identified within the mitigation plan. These easements ensure that there will be no development or other land use change on the project sites which could diminish the level of physical, chemical, and biological ecosystem functions that each site provides to the watershed. Additionally, the conservation easement will stay with the property if that title to the property is transferred to a third party. It is the intention of LLF to maintain ownership of properties in perpetuity as highly functioning habitat in accordance with the terms of a long-term management plan and conservation easement.

In the rare event where a high priority project cannot be secured through fee title acquisition or perpetual easement, the following methods for long-term protection may be considered:

- The choice of a landowner not interested in signing a perpetual easement to choose to donate, sell, or otherwise transfer an easement for a 20-30 year period to the Missouri Department of Conservation, natural resource-oriented federal, state, or local government agency, or a natural resource-oriented land trust like the Nature Conservancy, Ozark Regional land Trust, Greenbelt Land Trust or similar non-profit entity
- The choice of a landowner not interested in signing a perpetual easement to choose to agree to a maintenance agreement, a contractual agreement between LLF and the landowner, where the landowner or other entity promises to meet specified maintenance condition for a 20-30 year period. These projects are alienable in the event of the sale of property. If the maintenance agreement does not transfer, it remains with the original signer of the agreement.

LLF would perform annual monitoring with onsite field observations, reporting, and enforcement actions, as appropriate, on all properties.

Strategy for periodic evaluation and reporting in the Cuivre/Salt EDU:

Evaluation, monitoring, and reporting is required of all compensatory mitigation projects to determine if the project is meeting its performance standards and if additional measures are necessary to ensure that the compensatory mitigation project is accomplishing its objectives. This documentation will include an accounting of the acreage and type of all mitigation activities within the service area and how the combined ecological benefit of all compensatory mitigation sites is performing to achieve the goals set forth in this EDU. Project specific mitigation plans will detail the parameters to be monitored, the length of the monitoring period, the dates that the reports must be submitted, the party responsible for conducting the monitoring, the frequency for submitting monitoring reports to the Corps, and the party responsible for submitting those monitoring reports to the Corps and the IRT. Data collection for performance objectives will occur once during the year and will be reported in an annual report until a project has been shown to meet performance standards, unless otherwise specified in the approved project-specific mitigation plan. The level of detail and substance of the report will be commensurate with the scale and scope of the compensatory mitigation project. Compliance monitoring will also be conducted annually until performance standards are met and will be reported in the annual report. After a project has met performance standards, the frequency of all monitory will decrease to a term not to be less than once every five years. Changes in reporting may be required by the Corps and the IRT as necessary to accommodate adaptive changes in the project and unforeseen natural disasters.

Evaluation and reporting will concentrate on those metrics involved in performance standards and will not include species or community biotic sampling until late in the project cycle, if at all. Temporal improvement of biota and their communities often lags restoration projects by years, and sometimes decades, and biological sampling often is inconclusive as to whether a project has improved biotic communities. At the conclusion of the project, aquatic invertebrate and/or other fish diversity indices may be calculated and compared to the before-project condition and to reference indices obtained from stable streams of similar type, order, and size elsewhere within the watershed, if the biologist in charge of the project determines it is necessary.

References

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/cuivre-river

http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/salt-river