

*Lake Restoration Program  
2014 Report and 2015 Plan*

***Submitted To***

Joint Appropriations Subcommittee on Transportation,  
Infrastructure, and Capitals  
and  
Legislative Services Agency

***Submitted By***

Iowa Department of Natural Resources  
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## **Executive Summary**

The 2013 Iowa Lake Restoration Report and 2014 Plan outlines the need and demand for lake restoration in Iowa; identifies a prioritized group of lakes and the associated costs for restoration; and provides the status of past appropriated legislatively directed funding.

Iowans value water quality and desire safe healthy lakes that provide a full complement of aesthetic, ecological and recreational benefits. A recently completed water-based recreational use survey by Iowa State University found that six of 10 Iowans visit our lakes multiple times each year and spend \$1.6 billion annually in their pursuit of outdoor lake recreation. The most popular activities are fishing, picnicking, wildlife viewing, boating, hiking and biking, and swimming and beach use. The number of household trip visitations to Iowa lakes continues to increase; lake use in 2009 was 27% greater than visitation rates from 2002 through 2005. In addition, visitations at lakes that have completed watershed and lake improvements efforts continue to exceed the state average and their own pre-renovation visitation levels.

### **Quality Lakes Increase Quality of Life – the story of Lake Darling (Washington County)**

Initially impounded in 1950, Lake Darling had historically been a fair fishery plagued by severe in-lake siltation and poor water quality. Sedimentation had reduced the lake's original 305 surface acres to 267 acres. During the last five years, extensive watershed soil conservation work on state and private land has reduced sediment delivery to the lake by 60% and laid the groundwork for a complete renovation of the lake and park. All in-lake improvements were done while the lake was drained and the goal is to sustain these improvements over the next 50 years.

The park reopened in late July 2014 after being closed for renovation since 2010. In September 2014, more than 200 people gathered under a new shelter to officially rededicate Lake Darling State Park, 64 years to the day that the gates were formally set. The \$13 million investment to improve and protect the lake and completely remake the campground and park roads is now complete, returning the park to its status as a destination for outdoor getaways. Speaker after speaker thanked the Lake Darling Friends Group, the Washington County Riverboat Foundation, the local chapter of the Izaak Walton League, the Iowa Department of Natural Resources, local landowners, the Washington County Board of Supervisors, the Brighton Chamber of Commerce, the Iowa Legislature and area residents for the role they played in the renovation.



***In September 2014, more than 200 people gathered under a new shelter to officially rededicate Lake Darling State Park, 64 years to the day that the gates were formally set.***

Dr. Fay Vittetoe, representing the Friends of Lake Darling and the Brighton Chamber of Commerce, presented two framed paintbrushes used by Jay N. 'Ding' Darling, to the Federation Bank in Brighton and to the farm community for their role in the park restoration and commitment to protecting the lake. She said their work is not finished noting that ***the friends group has gone on to raise about \$500,000 in additional funds towards adding four season cabins to the park, and is working on plans to connect a bike trail from the park to the Brighton.***

### ***Lake Darling Restoration Project Activities***

- Replacing the dam
- New sediment catch basins in the watershed
- Two silt dams in the lake
- Lake level raised two feet to increase surface acres back to 305 acres
- Installed shoreline riprap, fishing jetties and piers
- New ADA fishing trail
- New roads
- New campground, with 50 amp service
- New boat ramps
- New shelter at boat rental area
- New sand on the beach
- New waterlines throughout the park
- Two new shower buildings
- New dump station
- New fishing bridge
- New trail bridge and others refurbished
- New park lodge

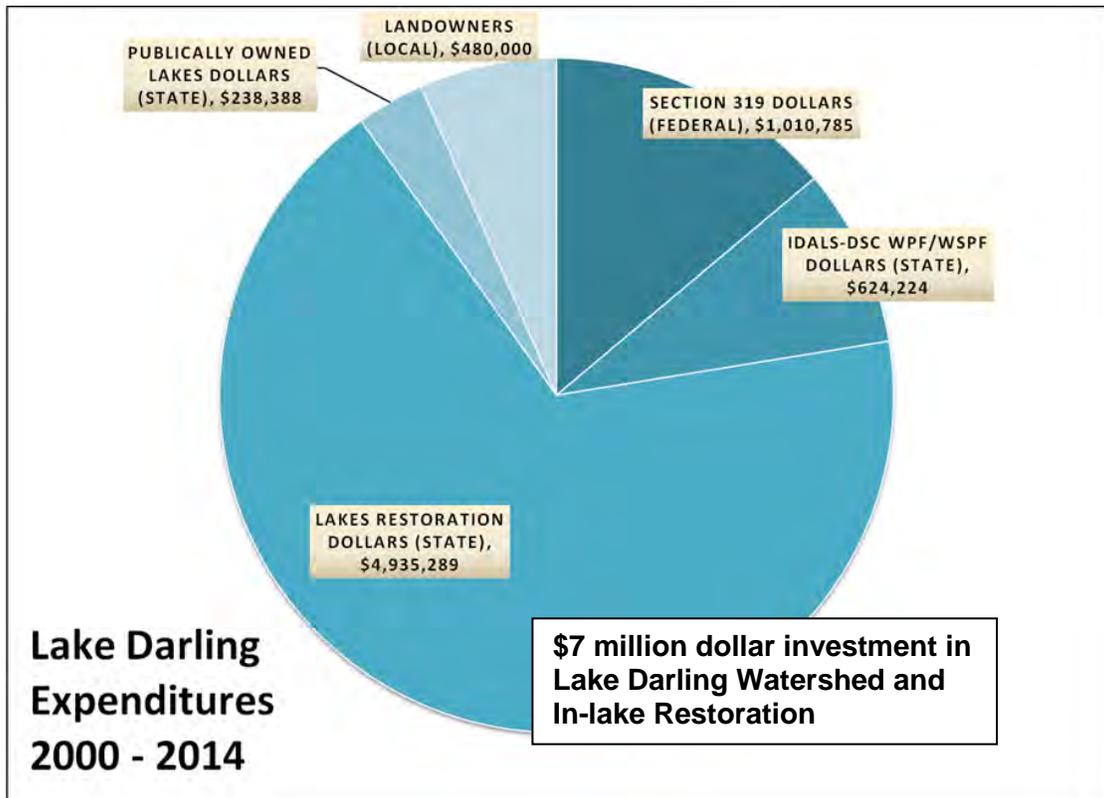


*Photo by Jo Eland*

**Funding Sources:** Lake Restoration Program, Parks & Institutional Roads, Fish and Wildlife Trust Fund, Sheldon Shoreline Access Foundation, Washington Co. River Boat Foundation, Izaak Walton League, Friends of Lake Darling, REAP Land Management, REAP Open Spaces

### Investment in Lake Darling State Park

New state park lodge (local fund raising from the Friends of Lake Darling)	\$1,000,000
Park Infrastructure	\$3,500,000
Campground electrical system upgrades	\$600,000
New shower house	\$200,000
New campground sewer system	\$700,000
	<b>\$6,000,000</b>



***The \$13 million investment to improve and protect the lake and completely remake the campground and park roads is now complete, returning the park to its status as a destination for outdoor getaways.***

Landowners need to be recognized for their role in protecting the lake. Stan Simmons, the watershed coordinator who played a significant role in working with landowners to install more than 160 ponds, terraces, water control basins, soil-holding grasses and other conservation measures, accepted a water quality initiative leadership award on behalf of the project from Iowa Secretary of Agriculture Bill Northey.

The new park will provide important health and economic benefits through visitation and outdoor recreation. An economic study by Iowa State University’s Center for Agriculture and Rural Development estimated the renovated park and lake would provide \$8.7 million annual economic benefit to the area and complements Iowa’s improved quality of life initiatives. “Businesses are looking to locate to areas that provide a healthy place to live, work and play,” added Iowa Department of Natural Resources Director, Chuck Gipp.

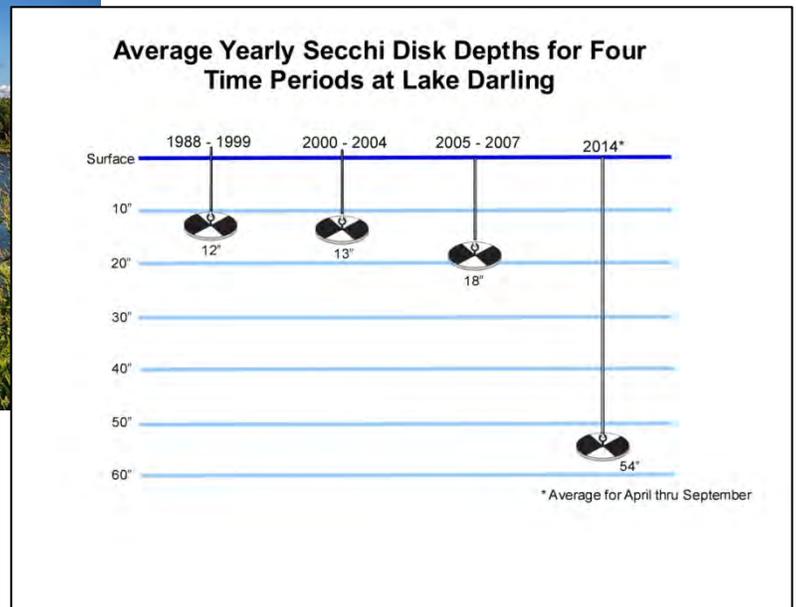
## Immediate water quality improvements



Photo by Jo Eland

**Image to the right shows** Secchi Depth, a measure of water clarity and indication of water quality over time.

(1988-1999): pre widescale implementation of watershed conservation practices; (2000-2004): the first years of extensive watershed improvement; (2005-2007): post major watershed work and before in-lake restoration and (2014): current status after completion of additional watershed improvement practices and in-lake restoration.



## Legislative Action

**Goals of Iowa's Lake Restoration Program are improved water quality; a diverse, balanced aquatic community and sustained public use benefits.**

Many of our Iowa Lakes, similar to our nation's lakes, are impaired and suffer from excessive algae growth and sedimentation due to nutrient loading and soil loss. The Iowa Department of Natural Resources (DNR) Lake Restoration Program (LRP) focus is on restoring Iowa's significant publicly-owned lakes. This report provides our plan to restore our Iowa public lakes and improve lake water quality, which will lead to increased lake use and long-term infrastructure protection.

In the 81<sup>st</sup> General Assembly, with HF 2782, the legislature responded to our need for improving Iowa's lakes by creating the Lake Restoration Plan and Report, known as the Lake Restoration Program. Included in HF2782, Section (26) of The Endowment for Iowa's Health Account is a process and criteria for completing successful lake restoration projects. It directs the DNR to report annually its plans and recommendations for lake restoration funding, as well as progress and results from projects funded by this legislation. This report has been prepared in accordance with these requirements. In addition, it describes some of the important work done by local, state and federal partners. **These partnerships, along with sound scientific information, are the foundation of current and future successful lake restoration projects.**

**Funding for the Lake Restoration Program (LRP) is currently appropriated on an annual basis. We anticipate that at the current annual level of \$9.6 million per year over ten years the DNR can complete twenty-nine projects.**

## Lake Restoration Program

The DNR modeled the Lake Restoration Program after the Federal Clean Lakes Program established in the 1970's. For the purpose of Iowa's Lake Restoration Program, the DNR defines "significant, publicly-owned lakes" as those publicly-owned lakes that meet all of the following criteria:

- are maintained principally for public use;
- are multi use systems capable of supporting a viable sport fishery and recreational opportunities;
- have a surface water area of at least 10 acres;
- have a watershed to lake surface area ratio of less than 200:1;
- are not federal flood control impoundments (exception is Rathbun Reservoir due to a watershed to lake surface area ratio that is less than 200:1); and
- are not lakes used solely as water supply reservoirs.

The goal is to invest money on projects with multiple benefits such as improved water quality and increased public use, while taking into account feasibility of restoration. Science based prioritization has been our most effective tool in targeting projects of value to the state.

***DNR is currently updating the classification to revise the prioritization and categorization of our significant publically owned lakes for restoration. This assessment will incorporate data available since the initial valuation conducted at inception of the Lake Restoration Program.***

## Lake Restoration Program - Project Goals

The department recommends funding for lake restoration projects that are designed to achieve the following goals:

- Ensure a cost effective, positive return on investment for the citizens of Iowa.
- Ensure local community commitment to lake and watershed protection.
- Ensure significant improvement in water clarity, safety, and quality of Iowa lakes.
- Provide for a sustainable, healthy, functioning lake system.
- Result in the removal of the lake from the impaired waters list.

## Lake Restoration Program - Process and Criteria

The process and criteria to recommend funding for lake restoration projects are:

- The department maintains a list of not more than thirty-five significant publicly owned lakes prioritized for funding based on the feasibility of each lake for restoration and the use or potential use of the lake, if restored. The department recommends these lake projects as a priority for funding so long as progress toward completion of the projects remained consistent with the goals of the program.
- The department meets with representatives of communities where prioritized lakes are located to provide an initial lake restoration assessment and to explain the process and criteria for receiving lake restoration funding.
- Communities with lakes not included on the initial list may petition the Director of the department for an explanation of the funding process and criteria and a preliminary assessment of the lake for inclusion in the program and prioritization for restoration
- Projects need to follow the directives to the department regarding Project Goals, Process and Criteria, and Restoration Plan Guidelines from 2006 State Legislation (HF2782).

***The Lake Restoration Program updates their 10-year plan on an annual basis to reflect the timeline and potential budget needs for lake restoration efforts at the current thirty-five significant publicly owned lake prioritized for funding (Table 1). The long-term budget is based on current conceptual plans for restoration and comparison to investment on similar past projects.***

## Lake Restoration Program - Restoration Plan Guidelines

The department works with communities to develop a joint lake restoration action plan.

- At a minimum, each joint action plan documents the causes, sources, and magnitude of lake impairment, evaluate the feasibility of the lake and watershed restoration options, establish water quality goals and a schedule for attainment, assess the economic benefits of the project, identify the sources and amounts of any leveraged funds, and describe the community's commitment to the project, including local funding.
- The community's commitment to the project may include moneys to fund a lake diagnostic study and watershed assessment, including development of a Water Quality Improvement Plan.

Each joint lake restoration plan complies with the following guidelines:

- Biologic controls will be utilized to the maximum extent, wherever possible.
- If proposed, dredging of the lake will be conducted to gain water quality benefits and to a depth that results in desired water quality benefits unless a combination of biologic and structural controls is sufficient to assure water quality targets will be achieved at a shallower average water depth.
- The costs of lake restoration will include the maintenance costs of improvements to the lake.
- Delivery of phosphorous and sediment from the watershed will be controlled and in place before lake restoration begins.
- The department will evaluate the joint action plans and prioritize the plans based on the criteria required by the program.

In-lake, along with watershed management, will meet or exceed the following water quality targets:

- Clarity. A four and one half foot secchi depth will be achieved fifty percent of the time from April 1 through September 30.
- Safety. Beaches will meet water quality standards for recreational use.
- Biota. A diverse, balanced, and sustainable aquatic community will be maintained.
- Sustainability. The water quality benefits of the restoration efforts will be sustained for at least fifty years.

[Note: Appendix A (2006 State Legislation HF2782) provides a summary of directives to the department regarding Project Goals, Process and Criteria, and Restoration Plan Guidelines for the Lake Restoration Program.]

**Table 1. Lake Restoration Program – Ten Year Plan**

Project Name	County	FY15 Budget	Proposed FY16 Budget	Proposed FY17 Budget	Proposed FY18 Budget	Proposed FY19 Budget	Proposed FY20 Budget	Proposed FY21-FY24 Budget	Ten-year Budget
<i>Hawthorn L.</i>	Mahaska	\$80,000	\$80,000						\$160,000
<b>Pleasant Creek L.</b>	Linn	\$600,000	\$750,000	\$750,000					\$2,100,000
<b>Union Grove L.</b>	Tama	\$600,000	\$520,000	\$400,000					\$1,520,000
<b>Blue Lake</b>	Monona	\$800,000	\$750,000	\$1,100,000	\$800,000	\$650,000			\$4,100,000
<b>Central Park L.</b>	Jones	\$300,000	\$250,000	\$250,000	\$50,000	\$50,000			\$900,000
<b>Easter Lake</b>	Polk	\$565,000	\$750,000	\$1,300,000	\$1,250,000	\$1,250,000			\$5,115,000
<i>Mariposa Lake</i>	Jasper	\$200,000	\$250,000	\$50,000	\$50,000	\$50,000			\$600,000
<b>Five Island L.</b>	Palo Alto	\$150,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000		\$400,000
<b>Hannen Lake</b>	Benton	\$200,000		\$100,000	\$100,000	\$50,000	\$50,000		\$500,000
<b>Hickory Grove L.</b>	Story	\$400,000	\$450,000	\$150,000	\$50,000	\$25,000	\$25,000		\$1,100,000
<b>Kent Park L.</b>	Johnson	\$150,000	\$150,000	\$50,000	\$50,000	\$25,000	\$25,000		\$450,000
<b>L. of the Hills</b>	Scott	\$150,000	\$150,000	\$50,000	\$50,000	\$25,000	\$25,000		\$450,000
<i>Lacey Keosauqua</i>	Van Buren		\$100,000	\$100,000	\$350,000	\$350,000	\$350,000		\$1,250,000
<b>Lake Geode</b>	Henry	\$100,000	\$150,000	\$300,000	\$800,000	\$725,000	\$325,000		\$2,400,000
<b>Lake Keomah</b>	Mahaska	\$100,000	\$100,000	\$150,000	\$400,000	\$400,000	\$250,000		\$1,400,000
<b>Storm Lake</b>	Buena Vista	\$850,000	\$850,000	\$750,000	\$450,000	\$400,000	\$250,000		\$3,550,000
<b>Black Hawk L.</b>	Sac	\$300,000	\$900,000	\$900,000	\$2,000,000	\$2,500,000	\$2,500,000	\$5,000,000	\$14,100,000
<b>Lake Manawa</b>	Pottawattamie	\$1,950,000	\$1,500,000	\$1,300,000	\$1,300,000	\$1,200,000	\$1,200,000	\$1,750,000	\$10,200,000
<i>Badger Creek L.</i>	Madison	\$250,000					\$1,200,000	\$5,550,000	\$7,000,000
<b>Big Creek</b>	Polk	\$175,000					\$300,000	\$3,500,000	\$3,975,000
<i>Silver Lake</i>	Dickinson	\$50,000					\$250,000	\$1,700,000	\$2,000,000
<i>Silver Lake</i>	Palo Alto	\$100,000					\$250,000	\$1,450,000	\$1,800,000
<i>Swan Lake</i>	Carroll						\$250,000	\$1,600,000	\$1,850,000
<i>Twin L. North/South</i>	Calhoun						\$450,000	\$2,100,000	\$2,550,000
<i>Silver Lake</i>	Delaware							\$2,000,000	\$2,000,000
<i>Arbor Lake</i>	Poweshiek							\$600,000	\$600,000
<b>Diamond Lake</b>	Poweshiek	\$130,000						\$500,000	\$630,000
<b>George Wyth L.</b>	Black Hawk							\$300,000	\$300,000
<i>Pine L. Upper/Lower</i>	Hardin							\$950,000	\$950,000
<b>Rock Creek L.</b>	Jasper							\$4,000,000	\$4,000,000
<b>IA Great Lakes</b>	Dickinson	\$500,000	\$750,000	\$750,000	\$750,000	\$750,000	\$750,000	\$3,000,000	\$7,250,000
<i>Rathbun Reservoir</i>	Appanoose		\$250,000	\$250,000	\$250,000	\$250,000	\$250,000	\$1,000,000	\$2,250,000
Lake Assessment		\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$400,000	\$1,000,000
Minors		\$200,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$600,000	\$1,550,000
Proj. Mgmt./Eng.		\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$2,000,000	\$5,000,000
Shallow Lakes		\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$400,000	\$1,000,000
<b>Total</b>		<b>\$9,600,000</b>	<b>\$9,600,000</b>	<b>\$9,600,000</b>	<b>\$9,600,000</b>	<b>\$9,600,000</b>	<b>\$9,600,000</b>	<b>\$38,400,000</b>	<b>\$96,000,000</b>

**Projects in Bold:** Initial list of thirty-five (35) significant publicly-owned lakes prioritized for funding based on the feasibility of each lake for restoration and the use or potential use of the lake, if restored.

**Projects Italicized:** Significant publicly-owned lakes added to the priority list after communities have successfully petitioned the director of the department or were prioritized by the department based on the feasibility of restoration and the use or potential use of the lake, if restored.

**Highlighted Cells:** Indicate estimated year that major restoration efforts will be completed.

## To Fix the Lake, Start on Land

Lake restoration starts in the watershed and relies on strong local involvement and landowner participation. Successful lake restoration projects, like at Easter Lake in Des Moines, involve many partners, have **strong local involvement** and landowner participation.



*The Easter Lake Watershed Project is working with local residents to hire the Conservation Corps to help reduce stormwater runoff from entering Easter Lake. The goal is to build rain gardens on multiple properties at a time, to increase the number of practices going in around the watershed. This installation method paired with the Easter Lake cost-share program allows homeowners to have rain gardens installed for a very small input cost.*

## Lake Restoration Program – Status

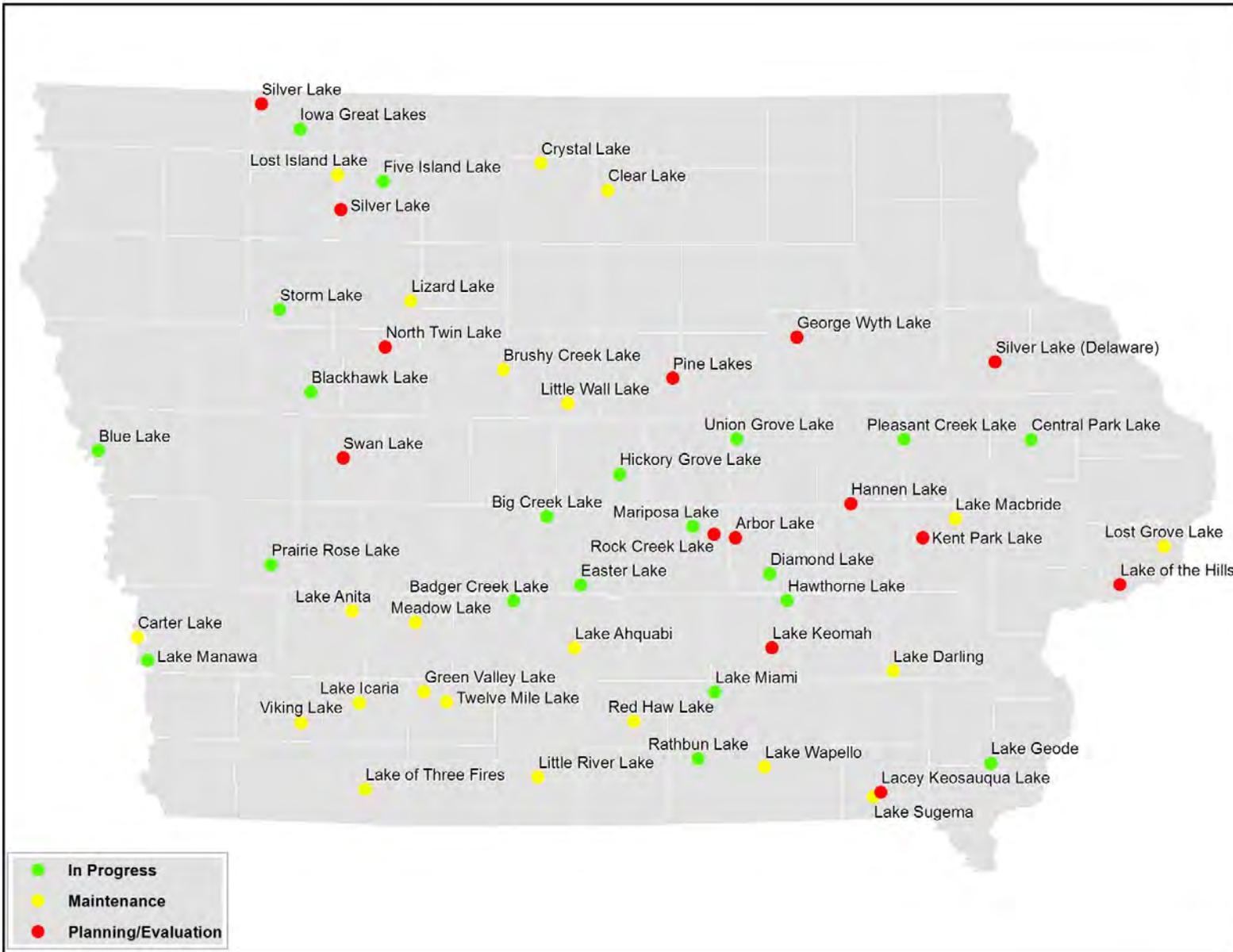
The intent of the program is to develop and administer lake restoration projects that achieve the following goals: ensure a cost-effective investment for the State of Iowa; foster a community commitment to lake and watershed protection; and provide significant improvement to the quality of Iowa lakes.

Major water quality improvement initiatives are completed or near completion at twenty-two lakes. Current program activities are in progress at an additional twenty-one lakes throughout the state and in the initial community outreach, evaluation or planning stage at fourteen lakes (Figure 1).

Timelines for many of these projects usually fall within a three-year period. However, dredging or major construction projects may take even longer. Contractors face substantial costs to mobilize and set up lake dredging operations and this critical work needs multiple year commitments to secure contractors. As such, the most practical and efficient way to complete these undertakings are as continuous projects. The Lake Restoration Program has matured to the point where a number of multi-step projects are nearing the implementation phase. Table 2 highlights major work activities planned for the remainder of FY2015 into FY2016/17.

*Iowa has completed lake restoration work at **22 locations**, with **21 projects** underway and **14 projects** in the planning stages.*

**Figure 1. DNR Lake Restoration Program Status**



**Table 2. Current work schedule for select multi-year lake restoration projects**

<b>Project Name</b>	<b>County</b>	<b>Projected Timeline</b>	<b>Description</b>
Blackhawk Lake	Sac	2009 - 2021	Public led development of an implementation plan. Fish renovation completed in 2012. Cost share being provided to producers to implement conservation practices such as strip till, no till, cover crops, streambank stabilization and nutrient management. DNR is in the permitting process for dredging approximately 400,000 cubic yards of sediment from the inlet area of the lake starting in 2015.
Blue Lake	Monona	2010 - 2019	DNR hired EA Engineering to design fish barrier systems and enhancing Nebowa Bay to improve water quality inflows from McCandless-Cleghorn Ditch. Engineering design is at 90% complete and the DNR is finalizing permitting and easements for the project. Construction, estimated at \$648,000 is scheduled for 2015/2016.
Easter Lake	Polk	2011 - 2019	Public meeting scheduled February to update the public of the project. Water Quality Improvement Plan completed 2012; Implementation of watershed work started in 2014. Project partners have hired Snyder & Associates to provide design and final engineering plans for sediment retention structures along Yeader Creek and in-lake restoration (e.g. spillway modification, dredging, shoreline stabilization, fish habitat and silt retention structures). The timeline for the majority of in-lake restoration activities is from 2015 – 2018.
IA Great Lakes	Dickinson	2009 - 2021	A number of partners planned and implemented a \$450,000 restoration project for Marble and Hottes Lakes (\$350,000 from LRP). The Big Spirit Lake Association, DNR, DU, Dickinson County, and others provided funding and technical guidance to develop a comprehensive feasibility study to identify ways to return ecological health to this critical habitat.
Lake Manawa	Pottawattamie	2008 - 2021	DNR hired FYRA Engineering in 2014 to provide design/oversight services related to dredging approximately 340,000 cubic yards of material from Lake Manawa and store the material on state land adjacent to the lake. Project will start in 2015.
Prairie Rose Lake	Shelby	2010 - 2015	In-lake dredging project started in mid-July and is 45% complete. Approximately 185,000 CY of sediment will be removed from Prairie Rose Lake. DNR will also construct a sediment control pond during the 2015 construction season.
Storm Lake	Buena Vista	2001 - 2020	In addition to finishing dredging, the DNR fisheries staff, Lake Restoration and city officials are developing alternatives for improving water quality and decreasing sediment mobility in Storm Lake. Specifically, looking for ways to settle out suspended settlement; stabilize sediment at the bottom of the lake once settled out; and protect existing islands.
Union Grove Lake	Tama	2008 - 2017	DNR Lake Restoration has started working with our engineers on initial survey and planning and anticipate implementing shoreline stabilization, renovation of the fishery, modification of the spillway, habitat improvement and dredging from 2015-2017

## Lake Restoration Program - Funding

The source of FY2015 funding for the Lake Restoration Program was an appropriation from the Rebuild Iowa Infrastructure Fund under SF2349 (Figure 2). The LRP received \$9.6 million dollars in FY2015 to meet contracted obligations and budgeted program activities (Tables 3, 4, and 5).

### DNR Lake Restoration Program (LRP) Funding as of FY15 (11/30/2014)

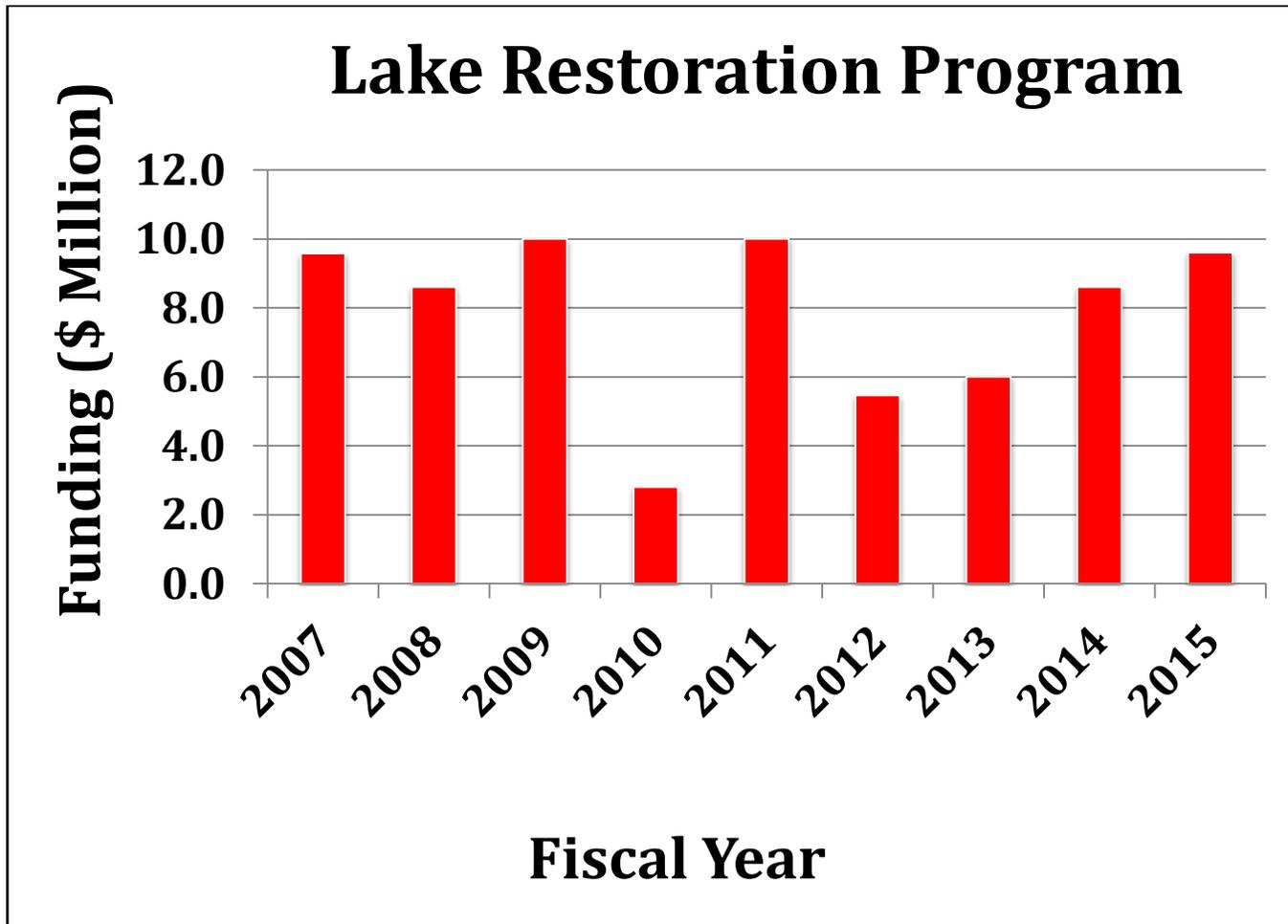
Carry Forward from FY13	\$7,923,881
FY14 Lake Restoration Program Funding	\$8,600,000
Lake Restoration Program Spent FY14 thru FY15 (11/30/2014)	(\$8,126,828)
FY15 Lake Restoration Program Funding	<u>\$9,600,000</u>
<b>Lake Restoration Program Available Balance as of FY15 (11/30/14)</b>	<b>\$17,997,053</b>
Under Contract - Actual Amount Due	(\$6,228,998)
Under Contract by 6/30/15 - Estimated Cost	<u>(\$11,558,099)</u>
<b>LRP Un-obligated Funds as of FY15 (6/30/15)</b>	<b>\$209,956</b>

Funding from FY2007 through FY2015 of \$70.6 million (approximately \$7.8 million per year) has enabled the DNR to improve many Iowa's lakes and proceed with implementing projects at a number of our other priority systems. However, the Lake Restoration Program has matured to the point where a number of multi-step projects are nearing the implementation phase; therefore, we now have more projects ready to start in a given year than we have available dollars to complete restoration at all the active projects. Maintaining flexibility in where the Lake Restoration Program can allocate funding and a consistent funding level is critical to moving these multiple year projects forward and plan for new projects.

The majority of lake restoration projects involve construction phases of watershed or in-lake implementation. A typical construction project might include the following phases: project scoping, engineering design, work bid letting, contract development, construction, and inspection. All processes must adhere to the standards and requirements of doing business as a public agency. Certain projects may require easements or land acquisition before construction can begin and/or require approvals and permits such as an archeological investigation for historic properties, an environmental review for threatened or endangered species, COE 404 permit, and DNR floodplains / sovereign lands permit.

Project planning involves working with representatives of the local community to develop a joint restoration plan. For planning purposes, it is necessary that a proper assessment of the lake and watershed is available to provide restoration alternatives to meet given water quality goals. In order to achieve lake restoration goals it is critical that the DNR form effective watershed partnerships. This includes partnerships at the local and administrative levels of government. Local, state and federal programs offer a multitude of programs for financial assistance to landowners for soil conservation and other water quality protection practices. **Building community support and development of partnerships is a long-term commitment from the Lake Restoration Program and is the foundation to the program's success.**

Figure 2. DNR Lake Restoration Program Funding History



The Lake Restoration Program cooperates in a variety of cost-share partnerships with local, state and federal entities to accomplish the water quality improvement initiatives described in this report. ***On average, there is a 35% cost-share match to Lake Restoration Program funds, which is critical to accomplishing the work detailed in this report and past summaries of LRP activities.***

Local groups include associations; such as the IGL - Iowa Great Lakes, LIPA - Lost Island Preservation Association, RRWA - Rathbun Rural Water Association, LPA - Lake Preservation Association (Storm Lake), CLPS - Carter Lake Preservation Society and the LPHC - Lake and Park Holding Corporation (Union Grove) to name a few. The DNR 319 Water Quality Improvement Section, DNR Wildlife, DNR Parks along with the Iowa Department of Agriculture and Land Stewardship – Division of Soil Conservation have worked together to implement watershed BMPs. Non-profit groups; such as DU - Ducks Unlimited, PH - Pheasants Forever and the TNC - The Nature Conservancy have also provided funding for projects. A significant number of Iowa lakes are owned and/or managed by local entities such as County Conservation Boards or Cities. Local agencies have been very active in developing restoration plans and providing resources to these efforts.

**Table 3. DNR Lake Restoration Program (LRP) Funding as of FY15 (11/30/2014)**

<b>Carry Forward from FY13</b>			<b>\$7,923,881</b>			
<b>FY14 Lake Restoration Program Funding</b>			<b>\$8,600,000</b>			
<b>Total Available Funding at Start of FY14</b>			<b>\$16,523,881</b>			
<b>Project Name</b>	<b>Project Description</b>	<b>County</b>	<b>LRP Spent</b>	<b>Fed</b>	<b>Other</b>	<b>Total Spent</b>
Administration	Project Management		\$734,839			\$734,839
Black Hawk Lake	Aquatic plant management, fish renovation	Sac	\$378,875			\$378,875
Blue Lake	Fish barriers, sediment basin	Monona	\$39,089			\$39,089
Carter Lake	Engineering/Project Implementation	Pottawattamie	\$227,867			\$227,867
Clear Lake	Shoreline/Containment Site	Cerro Gordo	\$86,115		\$3,301	\$89,416
Easter Lake	Watershed improvement, containment site	Polk	\$129,705			\$129,705
Feasibility Studies	Restoration Action Plans/Monitoring		\$280,683			\$280,683
Five Island Lake	Dredging	Palo Alto	\$340,716			\$340,716
Hawthorn Lake	Sediment ponds, watershed BMPs	Mahaska	\$48,718			\$48,718
Hickory Grove Lake	Shoreline stabilization	Story	\$18,500			\$18,500
IA Great Lakes	Okoboji View wetland restoration	Dickinson	\$251,077			\$251,077
Lake Anita	East silt basin	Cass	\$41,100			\$41,100
Lake Darling	Restoration/Dredging	Washington	\$2,422,891		\$142,109	\$2,565,000
Lake Geode	Sediment control ponds	Henry	\$88,741	\$88,466		\$177,207
Lake Icaria	Wetland Repair	Adams	\$46,922			\$46,922
Lake Manawa	Dredging design	Pottawattamie	\$91,235			\$91,235
Lake Miami	Spillway Fish Barrier	Monroe	\$48,750			\$48,750
Lost Grove Lake	Shoreline, sediment pond	Scott	\$25,073			\$25,073
Lost Island Lake	Fish Barrier/Water Control Structures	Palo Alto	\$323,573			\$323,573
Minor Projects	Minor Projects		\$77,355		\$9,800	\$87,155
Prairie Rose	Containment site, dredging, wetland	Shelby	\$1,063,485			\$1,063,485
Red Haw Lake	Sediment basins	Lucas	\$124,258			\$124,258
Shallow Lakes	N/S Twin (Calhoun) Silver (Palo Alto)		\$69,101			\$69,101
Storm Lake	Dredging, in-lake improvement	Buena Vista	\$956,327			\$956,327
Twelve Mile Lake	Wetland construction	Union	\$211,830			\$211,830
			<b>\$8,126,828</b>	<b>\$88,466</b>	<b>\$155,210</b>	<b>\$8,370,504</b>
<b>Carry Forward from FY14</b>			<b>\$8,397,053</b>			
<b>FY15 Lake Restoration Program Funding</b>			<b>\$9,600,000</b>			
<b>Current Balance as of November 30, 2014</b>			<b>\$17,997,053</b>			

**Table 4. Lake Restoration Program Funds Under Contract as of FY15 (11/30/2014)**

Project Name	Project Description	County	LRP Contracted	Fed	Other	Under Contract
Administration	Project Management		\$302,600			\$302,600
Big Creek Lake	Watershed Improvement, BMPs on Public Ground	Polk	\$226,418			\$226,418
Black Hawk Lake	Watershed improvement, Aquatic Plant Harvester	Sac	\$66,950			\$66,950
Blue Lake	Blue Lake Fish Barriers, In-lake restoration	Monona	\$17,547			\$17,547
Central Park Lake	Watershed Improvement, In-lake Restoration	Jones	\$56,122			\$56,122
Diamond Lake	Spillway Repair / Modification	Poweshiek	\$127,500			\$127,500
Easter Lake	Containment Site, Phase 1 - Watershed Practices	Polk	\$710,577	\$252,023		\$962,600
Five Island Lake	Dredging	Palo Alto	\$162,482			\$162,482
Hickory Grove Lake	Stream Corridor Restoration / Sediment Structure	Story	\$199,788			\$199,788
IA Great Lakes	Marble-Hottes Wetland Restoration, Center Lake Watershed BMPs	Dickinson	\$576,256		\$100,000	\$676,256
Lake Assessment	Iowa Lakes Monitoring, 2014 - 2016, Lake Assessments		\$286,595		\$251,777	\$538,372
Lake Darling	Dredging, Shoreline Armoring, In-lake Restoration	Washington	\$362,254		\$644,007	\$1,006,261
Lake Manawa	Dredging/Water Quality Project	Pottawattamie	\$520,353			\$520,353
Lake Miami	Shoreline Stabilization	Monroe	\$45,840		\$667,858	\$713,698
Prairie Rose Lake	In-Lake Hydraulic Dredging, Grade Stabilization Structure	Shelby	\$1,219,324			\$1,219,324
Rock Creek Lake	Sediment Basin	Jasper	\$4,452			\$4,452
Silver Lake (Palo Alto)	Survey and design of new outlet, Feasibility Study	Palo Alto	\$143,529		\$26,747	\$170,275
Storm Lake	Dredging, in-lake improvement	Buena Vista	\$1,007,212			\$1,007,212
Twin Lakes	Feasibility Study	Calhoun	\$193,199			\$193,199
			<b>\$6,228,998</b>	<b>\$252,023</b>	<b>\$1,690,389</b>	<b>\$8,171,410</b>

**Table 5. Lake Restoration Program Funds Under Contract by end of FY15**

Project Name	Project Description	County	LRP Obligated	Fed	Other	Under Contract by 6/30/14
Badger Creek Lake	Watershed structures and improvement	Madison	\$127,000	\$127,000		\$254,000
Black Hawk	Inlet Dredging Containment Site	Sac	\$220,000			\$220,000
Blue Lake	Blue Lake Fish Barrier Construction	Monona	\$648,010			\$648,010
Center Lake	Rock Fish Barrier	Dickinson	\$30,000			\$30,000
Easter Lake	Dredging, Shoreline, Spillway, In-lake Restoration	Polk	\$4,200,000		\$2,800,000	\$7,000,000
Green Valley Lake	Raise West Silt Dike	Union	\$140,000			\$140,000
Hawthorn Lake	Sediment Ponds, Watershed BMPs	Mahaska	\$170,000			\$170,000
Lake Keomah	Watershed Assessment, Dam Maintenance	Mahaska	\$66,589			\$66,589
Lake Manawa	Dredging/Water Quality Project	Pottawattamie	\$3,200,000			\$3,200,000
Lake Miami	Watershed BMPs	Monroe	\$150,000			\$150,000
Minors	L. Geode Pond, Upper Pine Wetland, Silver L.-Palo Alto		\$69,000		\$26,000	\$95,000
Prairie Rose Lake	Wetland Restoration	Shelby	\$50,000			\$50,000
Storm Lake	Dredging, in-lake improvement	Buena Vista	\$250,000			\$250,000
Union Grove Lake	Hydraulic Dredging, Shoreline Stabilization, Spillway	Tama	\$2,237,500		\$262,500	\$2,500,000
			<b>\$11,558,099</b>	<b>\$127,000</b>	<b>\$3,088,500</b>	<b>\$14,773,599</b>
	<b>Lake Restoration Program Available Balance as of FY15 (11/30/14)</b>		<b>\$17,997,053</b>			
	<b>Under Contract (Actual Amount Due)</b>		<b>\$6,228,998</b>			
	<b>Under Contract by 6/30/15 (Estimated Cost)</b>		<b>\$11,558,099</b>			
	<b>LRP Un-obligated Funds as of FY15 close (6/30/15)</b>		<b>\$209,956</b>			

## **Lake Restoration Program (LRP) – Projects In Progress**

### **Badger Creek Lake (Madison County)**

Due to the lake's structure and its proximity to the Des Moines Metropolitan Area, Badger Creek Lake has the potential to be one of Iowa's premier recreational areas. However, current impairments due to siltation, algal growth and noxious aquatic plants limit the 269 acre lake's ability to support its intended uses for primary contact recreation and aquatic life support.

The DNR Lake Restoration Program has identified Badger Creek Lake in Madison County as a priority for future lake restoration efforts and view development of a comprehensive Watershed Management Plan as a critical step toward Badger Creek's long-term recreational viability. The plan will establish water quality goals and assure long-term sustainability of improvements to water quality. Completed environmental and archeological assessment needed for permitting of future watershed improvement on surrounding state property. Current project activities include:



- Initiated design of two grade control structures to help prevent sediment and nutrients from entering the lake on two priority areas in the watershed.

#### ***View looking downstream from road culvert at Site #1***

- Created brush removal plan for surrounding state property
- Spring electrofishing indicated moderate numbers of largemouth bass with several bass captured up to 17 inches in length. There are good numbers of crappies at Badger Creek Lake with most fish in the 7.5-9 inch length range. Fall netting indicated moderate numbers of bluegills of all sizes up to 8 inches. Hybrid striped bass (aka Wipers) were stocked in 2014 as part of an on-going fisheries research project.

### **Big Creek Lake (Polk County)**

Big Creek State Park/Lake is a major recreational destination for the citizens of Iowa. Over 350,000 visitors travel to Big Creek each year and they annually generate over \$19 million in spending. Improving the lakes water quality through watershed improvements is critical to maintaining and even increasing recreational use levels.

Big Creek Lake is currently listed on the EPA 303d list for bacteria and historically has been listed for sediments and nutrients. A comprehensive review of the watershed indicates that the watershed annually delivers approximately 6,379 tons of sediment and 8,280 pounds of phosphorus to the lake. We must significantly reduce these numbers to preserve the lake's water quality and extend the lifespan of the lake. Additionally, we must also reduce waste products from humans and animals within the watershed that adversely affect water quality. During the past year, Blue-green algae blooms put Big Creek Lake in the news headlines multiple times this year. In addition, water quality samples revealed

high E. coli levels in the tributaries and at the beach. A 2007 development grant provided analyses of the Big Creek watershed. In addition, a 2008 gully analysis and 2009 land use analysis established a better understanding of critical areas in the watershed. Watershed assessment identified several gullies with severe erosion on State property.

The Iowa IDNR Watershed Improvement Section approved a Water Quality Improvement Plan in September 2010 and in March 2010 contracted with the Iowa Department of Agriculture and Land Stewardship to provide Polk SWCD and Boone SWCD with funding to complete a Watershed Management Plan. The EPA approved the Big Creek Watershed Project for \$292,834 over the five-year duration of the project.

- Extensive water quality sampling was completed in the tributaries and main lake during 2011.
- Sean McCoy and Jonathon Swanson are the watershed coordinators working on the Big Creek watershed and helped form a Big Creek Citizens Advisory Committee.
- Projects implemented in the watershed include 100 feet of streambank stabilization, 10,000 feet of grassed waterways, 5 sediment basins, and 300 acres in cover crops. These installed practices will stop 109 tons of sediment from entering Big Creek Lake each year. Numerous other projects were planned for fall 2014 but were delayed due to a short construction season, with a late harvest and early onset of ground frost in the farm fields.

Education efforts in 2014 included numerous programs, such as a female landowner meeting, a conservation management workshop, a beach rededication ceremony, public presentations, and the fourth annual Big Creek Appreciation Day. Project coordinators taught over 200 fourth graders about soil and water conservation during an outdoor classroom.

**Boone County 4<sup>th</sup> Grade Outdoor Classroom**



- Big Creek State Park celebrated all new beach shelters, restrooms, and other amenities with a beach rededication event in July 2014. Park upgrades were finished in the spring and the event drew over 100 people. Project efforts are focused on reducing bacteria levels on the beach. Staff is utilizing a dog service and a native, tall grass prairie strip near the marina to make the beach a less attractive loafing area. Goose numbers were reduced in 2014 with no established nests and no beach closings. Over the course of 2014 DNR staff also conducted a beach tillage study to determine its effects on bacteria levels. This data will result in recommendations to park staff, statewide.
- Sediment basin construction on the two most severely eroded gullies will begin this fall and alternative BMP's will be explored for the other gullies that contribute significant sediment to the lake.



**Example of an eroding gully that will be stabilized in Big Creek Lake State Park.**

## **Blackhawk Lake (Sac County)**

Blackhawk Lake is the southern most natural lake in Iowa located in Sac County, Iowa, near the town of Lake View. This 922-acre lake has a watershed of 14,097 acres. Data from the Iowa Department of Natural Resources indicate that the lake currently has an average depth of 5.2 feet. Water clarity has been predominantly in the range of 0.5 – 1.5 feet, with phosphorus levels consistently 100-200 ppb. Very poor lake transparency due to turbidity and frequent algae blooms due to high phosphorus levels are common in the past few years.

- Local leadership in cooperation with the DNR and ISU Extension formed a local steering committee (Watershed Action Group). This group includes members of the community and watershed, as well as members from various state and local agencies (e.g. ISU Extension, ISU Agronomist, Sac SWCD, Carroll NRCS, Sac Board of Supervisors, watershed residents/landowners/farmers, Iowa DNR, City of Lake View, Sac NRCS, City of Breda City Clerk, and Carroll SWCD). This committee locally raised \$42,000 to help fund the Diagnostic / Feasibility Study; the goal of the study was to provide restoration alternatives to the DNR and local community; DNR contracted with Iowa State University (ISU) for the D/F study, which they completed in fall of 2010.
- IDALS provided planning assistance to help accurately identify existing problems and issues critical to achieve desired resource management objectives and to help local leaders inventory, assess, and develop strategies to address watershed problems.
- DNR provided funding to the SWCD to take information gathered in the Watershed Assessment, Diagnostic Study and Water Quality Improvement to development of a Watershed Management Plan. This allowed the local group the ability to apply for project implementation dollars for work in the watershed. The SWCD received funding through a DNR 319 Watershed Improvement Implementation Grant. The grant is funding a watershed coordinator for the Black Hawk Lake Project and implementation of BMPs.

### ***Renovation of the fishery***

- The DNR held a public meeting August 2012 in Lake View, IA to discuss the plans to renovate the fishery in Black Hawk Lake. The major focus of the lake restoration project has been targeted at improving the watershed. However, the internal recycling of nutrients and re-suspension of sediments via rough fish activity still contribute significantly to the water quality issues in Black Hawk Lake. Taking advantage of historically low water levels the DNR implemented a fishery renovation to eradicate rough fish species, help improve water quality, and reclaim the lake in order to establish quality sport fishery.
- DNR opened up promiscuous fishing after the public meeting. Commercial harvesters came in, and over the course of about 5 weeks, removed around 130,000 pounds of fish. During this time, we conducted fish salvage. Most of the fish went to Black Hawk Pits, which was renovated early, to provide some local recreational fishing while Black Hawk Lake is turning around over the next couple of years. Some fish were also taken to Arrowhead Lake. These fish were mostly largemouth bass and channel catfish.
- DNR implemented a chemical renovation of Black Hawk Lake in November 2012. 3,720 gallons (124 barrels) of rotenone were applied in less than 4 hours on the day of the application. Upon examining the shoreline the following days, just about all of the dead the fish that washed to shore were gizzard shad, common carp, bigmouth buffalo, bullhead, and channel catfish. Aside from the channel catfish, there were very few sportfish.
- The week after the renovation, we conducted fish pick-up. It took a day and a half to complete the cleanup. DNR Fisheries estimated that they picked up between 120,000 to 140,000 pounds of fish. Workers pitchforking fish into UTVs, which dumped the fish into a tractor bucket, covered the vast majority of the shoreline and the fish were then loaded into a dump truck and dump trailer. Unusually warm weather and high winds in December caused thousands of pounds of fish to surface and wash ashore after the initial fish pick up and another effort to pick up fish, which the DNR estimated at 100,000 pounds.

**Total Pounds of Fish Tissue Removed from Black Hawk Lake: 354,000; Pounds of Phosphorus Removed via Fish Removal: 8,071; Pounds of Nitrogen Removed via Fish Removal: 37,170)**

### **Status of the Fishery**

Following the fishery renovation in 2012 DNR fisheries staff have been aggressively stocking the lake with sport fish (bluegill, walleye, yellow perch, largemouth bass, muskellunge and channel catfish). Although no official creel surveys have been conducted, conversations with anglers have indicated that the bluegill, yellow perch, and channel catfish have been providing great fishing. Some harvestable size walleye have been caught as well. The future looks very bright for the fishery in Black Hawk Lake and anglers should start to see good walleye fishing in 2015.

**No common carp, buffalo, bullhead, green sunfish, or gizzard shad have been found while sampling.**

**Right: Nineteen inch muskie sampled on Black Hawk Lake.**



### **Outlet Fish Barrier**

A fish barrier was needed on the outlet of Black Hawk Lake to block undesirable fish species from reentering the system following the fish renovation of 2012. The Black Hawk LPA hired a local fabricator to design, manufacture, and install the barrier and funded the project with their money and a Sac County Endowment Fund Grant. The cost of project was approximately \$21,000. The fish barrier provides a complete enclosure of the spillway for protection under high water events and features 10 rotating gates that can easily be cleaned of debris to allow for unobstructed flow of water.

### **Denison Beach Shoreline Armoring (Lake Restoration and MFT)**

DNR awarded a contract for the hard armoring of Denison Beach. The plan calls for placement of hard armor along 350 feet of shoreline at the Denison Beach portion of Black Hawk State Park. There will be 50 feet of shoreline left unarmored to maintain a beach area at Denison Beach. Although the project was scheduled for fall of 2014, the timeline was changed and is now scheduled for winter when the ground is frozen in an effort to save money on reseeding costs.

### **Ice House Point Shoreline Armoring (Wildlife Management Grant and Section 319 Grant)**

Local DNR fisheries staff applied for a wildlife management grant to armor a section of the shoreline at the Ice House Point portion of Black Hawk State Park. Instead of using hard armor (i.e., rock), the proposed project will use biological armoring. Native grasses, forbs, and aquatic emergent vegetation will be used to stabilize a portion of the failing shoreline. Local DNR staff hopes to use this area as a demonstration project to show riparian owners other alternatives to biological armoring. There are dollars available in the Section 319 grant to help cover the costs in the event the wildlife management grant is not awarded to this project.

### **Vegetation Management (Lake Restoration, Local Dollars)**

Following the fishery renovation in 2012 and numerous improvements to the watershed, the water clarity in Black Hawk Lake has been significantly improving. Because of the improved water clarity, vegetation has started to grow in the lake basin on scale that has not been seen in decades. While aquatic vegetation is essential to maintaining good water quality and sport fish populations, it can interfere with

certain types of aquatic recreation if there is too much vegetation. DNR fisheries wrote a comprehensive aquatic vegetation management plan to address these issues. This plan was reviewed by the Black Hawk Lake Protection Association and the City of Lake View. It was also presented at a Lake View City Council meeting and made available to the public.



***The aquatic vegetation harvester on Black Hawk Lake***

The Lake Restoration Program purchased an aquatic vegetation harvester to remove vegetation in select areas in an effort improve recreation. The operation of the harvester is a joint effort between the DNR, the City of Lake View, Sac County, The Lake View Community Club, and the Black Hawk Lake Protection Association. The four entities that have collaborated with the DNR are bearing the cost of the operation and maintenance of the machine, including wages for employees operating it.

DNR fisheries staff also applied aquatic herbicide in select areas of Black Hawk Lake to improve recreation. Herbicide was applied on a scale larger than usual in anticipation of a late delivery of the harvester. Many of these areas will not be treated with chemical next year now that the harvester has been delivered. Local DNR staff will continue to treat the two main public beaches with chemical for the near future.

### **State Marina Dredging (MFT)**

Marine Fuel Tax dollars have been allocated to mechanically dredge the state marina on Black Hawk Lake. The marina has silted in over the years and has rendered it unusable during periods of low water. The proposed project will remove an average of three feet of soft sediment throughout the marina, which will improve access to the public boat ramp, boat hoists, and bathrooms in this area. The Black Hawk Lake Protection Association is looking into the possibility of installing a fueling station in this area to provide additional amenities.

### **Inlet Dredging**

The DNR has received approval from the Army Corps of Engineers to use the old spoil site on the Merehoff property. The plans are to excavate the material that was deposited into the spoil site in the early 1990s and move it to another area on the same parcel. DNR Engineering is completing final design plans for the spoil site and an archeological review is underway. Local DNR staff has met with geomorphologists that are contracted to conduct archeological and lithostratigraphy investigations in the inlet slough. The geomorphologists plan to conduct their investigations this winter through the ice and develop a report of the findings. The current plan for dredging is to remove approximately 400,000 cubic yards of sediment from the inlet area. Removing this amount will achieve an average depth of three feet in the inlet area, which is what Iowa State University determined would be needed to achieve a 60% reduction in phosphorus loading to Black Hawk Lake proper.

(Right) Proposed core transects for Phase I archeological survey needed in the inlet region of the lake before dredging can occur.

### ***Inlet Fish Barrier/Water Control Structure/ Vegetation Management***

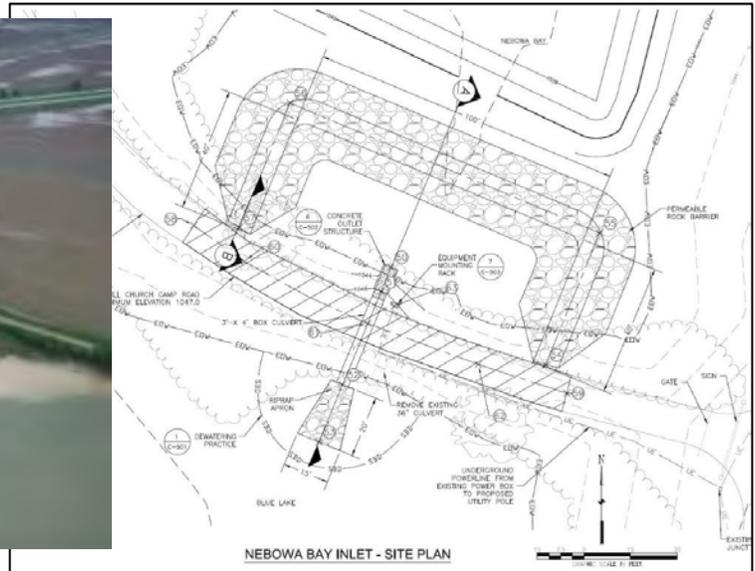
DNR fisheries and wildlife staff met with Ducks Unlimited to discuss the concept of a new fish barrier and water control structure at the inlet bridge of Black Hawk Lake. Ducks Unlimited completed initial survey work in March 2013. This project would hinder rough fish movement (if they were ever reintroduced) into their prime spawning habitat during high flow events. The current barrier is undersized and fish can find their way around it during high water events. The water control structure would allow managers to dewater the inlet portion of the lake to reestablish aquatic vegetation, and if need be, remove carp. Water quality testing has shown that nutrients leaving the inlet than what is being received indicating the need for better management capabilities in this part of the lake. Funding still needs to be secured for actual construction of the project, but Ducks Unlimited has completed the engineering and design work. It is estimated that this project would cost around \$380,000.



### **Blue Lake (Monona County)**

Blue Lake is a Missouri River oxbow lake located in western Monona County three miles west of Onawa and three miles east of the Missouri River. The lake was an active channel of the Missouri River in 1804 when the Lewis and Clark expedition went through the area. The lake shoreline is now part of Lewis and Clark State Park. Excessive growth of algae, a lack of clarity caused by this algal growth, and non-algal turbidity are the impairments at Blue Lake. These problems combine to reduce the recreational use of the lake.

- DNR completed a Water Quality Improvement Plan for Blue Lake in 2008 and held a public meeting to discuss the findings of the study. DNR held a public meeting in 2009 to present the lake assessment and restoration process and develop a local technical advisory team of conservation agencies and local stakeholders to help guide the project. The group met periodically during the year. Objectives of the project are to reduce nutrient and sediment inputs from the watershed, reduce re-suspension/recycling of in-lake nutrient and sediments, eliminate rough fish introductions and evaluate lake and water table interactions.
- A public meeting was held in March of 2011 to discuss potential restoration efforts with the community. Lake Restoration contracted with MSA Professional Services to conduct a diagnostic-feasibility study on the lake. Extensive data collection was conducted by local DNR staff throughout 2010. The final report from MSA on the diagnostic-feasibility study was completed in November of 2011. The report proposes that construction of a storm water settling basin, reconstruct water control structures to minimize common carp introductions, dredging and removal of common carp will achieve water quality goals for the lake.
- A Technical Advisory Team meeting was held in 2013 to discuss the report and develop a restoration and implementation plan. The lake aeration system was upgraded in 2013 with a new motor and blower to prevent fish winterkills.



**DNR hired EA Engineering to determine the feasibility of and methods for a fish barrier system and water level management capabilities between Blue Lake and Camp Nebowa Bay (shown above) Blue Lake and West Blue and Blue Lake and South Blue and the potential of enhancing Nebowa Bay to improve water quality inflows from McCandless-Cleghorn Ditch to Blue Lake.** Engineering design is at 90% complete and the DNR is finalizing permitting and easements for the project. Construction, estimated at \$648,000 is scheduled for 2015/2016.

### **Carter Lake (Pottawattamie County)**

Carter Lake is a natural lake that is uniquely located in both Iowa and Nebraska. Carter Lake is an old oxbow of the Missouri River that was isolated from the river main channel in 1877. The lake is approximately 300 surface acres at conservation pool elevation 970.0 feet, with a watershed area of 2,675 acres (watershed area to lake area ratio of 8/1). The lake is approximately 75% in Nebraska and 25% in Iowa. Park areas in Nebraska and the City of Carter Lake in Iowa dominate land use adjacent to the lake. Problems at the lake have centered on poor water quality, chronic low water levels and nuisance algae bloom. Past impairments included nutrients/algae, indicator bacteria, and fish contaminants (PCBs).

- Carter Lake is a highly productive lake with a history of poor water clarity, high nutrient concentrations, frequent algal blooms, and periodically high bacteria. Given the nature of the problems at Carter Lake, corrective measures focused on the reduction of phosphorus, which is the driving force behind algal production. The goals pertain to protecting aquatic life and public uses of the lake such as recreation, fish consumption, and aesthetics.
- Restoration of Carter Lake involves the cooperation of Iowa, Nebraska and the cities of Omaha and Carter Lake. A local Iowa group, the Carter Lake Preservation Society (CLPS), has been very active in moving this project forward. In 2006, the cities of Carter Lake, Iowa and Omaha, Nebraska, requested assistance from environmental agencies in addressing water quality problems at Carter Lake. The Carter Lake Environmental Assessment and Rehabilitation (CLEAR) Council, with assistance from numerous local and state agencies, developed a conceptual plan to address water quality concerns. The community led steering committee finalized the Carter Lake Water Quality Management Plan in the spring of 2008.
- Fall 2008, the Metro Area Planning Agency (MAPA), with support of project partners, selected Tetra Tech, Inc. for the purpose of preliminary design and engineering of critical components of the Water Quality Management Plan for Carter Lake. Their work focused on the restoration alternatives of water-budget/seepage management, dredging, and storm water/in-lake alum treatment. By winter of 2009 project partners had enough information on probable cost, effectiveness and permitting issues to determine how to best move forward with implementation.

### Project funding partners

Iowa Department of Natural Resources – Lake Restoration Program	\$2,494,624
Iowa Department of Natural Resources – Section 319	\$381,744
Iowa Water Quality Review Board	\$175,000
Nebraska Department of Environmental Quality - Section 319	\$1,120,000
Nebraska Game and Parks Commission	\$2,105,837
Nebraska Environmental Trust	\$400,000
City of Omaha	\$500,000
City of Carter Lake (in-kind)	\$250,000

- Metropolitan Area Planning Agency (MAPA) hired a project coordinator to work with both the local Watershed Council and agencies. One of their primary responsibilities was to finalize plans on a first group of watershed improvement projects and have these projects ready to bid for final design/construction by fall of 2010.
- Project partners made significant progress at Carter Lake in 2010 with a spring alum treatment followed up by a complete fish renovation in the fall. Nebraska and Iowa, following the community accepted restoration plan guidelines established a no-wake zone on 100 acres of the lake in 2010 to lessen the impacts of recreational boating.



**Wetland plants behind breakwater**

- The Carter Lake fish renovation was a joint project involving Nebraska Game and Parks, the City of Carter Lake, and Omaha.
  - Applied 2665 gallons of rotenone on September 26, 2010
  - Physically removed 89.6 tons of fish (Approximately 600 lbs./ac)
  - Each worker handled ~ 10,000 lbs. of fish twice (pitched in & out the boat) in 3 days
- Clear water conditions persisted again during the summer of 2014 allowing aquatic plants to fill a significant portion of the water column. Lifelong residents of Carter Lake commented that they had never seen the bottom the Carter Lake before. Due to the clarity and resulting response in plant growth a BMP for aquatic plants was drafted in consultation with the local communities to establish guidelines for future plant management efforts.

**Almost immediately, visitors to Carter Lake saw drastically improved water clarity. Water quality data collected since the summer of 2010 showed that toxic algae blooms have declined, phosphorous and nitrogen concentrations are lower, and water clarity has increased.**



- As part of the vegetation management plan the Technical Advisory Team authorized the chemical (herbicide) treatment of vegetation around public access points, canals, private docks, and ski club area. State agencies treated the public access areas in 2014. Local homeowners contracted a private aquatic pesticide applicator to treat vegetation around privately owned docks, canals, and ski club area. The TAT discussed various options, but ultimately decided to chemically treat a limited number of acres of open water areas to open up boating lanes. A permit to apply aquatic herbicide and a contractor were secured by the City of Carter Lake to chemically treat 100 acres of open water area with the herbicide “Reward” in 2014.
- The lakes re-charge system was completed and activated in 2012. This system provided well water to Carter Lake during the dry summer assisting in vegetation management, dredging operations and recreational use of the lake.
- To address aquatic plant management needs at Carter Lake, Iowa and Nebraska purchased an aquatic vegetation harvester; operation and maintenance will be provided by the cities of Carter Lake and Omaha.



**City of Carter Lake receives delivery of a much larger vegetation harvester for use in 2014.**

### **Central Park Lake (Jones County)**

Central Park Lake is a 24 acre lake with a 365 acre watershed. In 2012, the DNR worked with Jones CCB to acquire a 77-acre parcel (Pearson Tract) directly above the lake that was in CRP. The purpose of acquisition of the tract was to provide an area for protection and enhancement of Central Park Lake. The CCB will manage the area to improve water quality in Central Park Lake. The Conservation Board’s management plan for the area includes the construction of wetlands and ponds to serve as catch basins for runoff, open space for storage of dredge material from the lake, mixed prairie planting throughout the entire area, tree and shrub plantings and walking trails for access to the area and environmental education programs.

The NW wetland on the Pearson Tract is engineered and will be constructed next spring. Funding for these projects is from WIRB, Jones County Supervisors, DNR Lake Restoration and the Jones County Conservation Board. The large western pond (~6 acres) on the Pearson Tract will be engineered this winter and constructed next fall. The south pond on the Pearson Property is engineered and will be built the same time. Funding for these projects was from the Fish Habitat Program, Twin River Pheasants Forever, DNR Lake Restoration, WIRB and the Jones County Conservation Board.

New Septic systems (tanks and fields) were installed at the dump station, shower building, campground and rangers residence in 2013. These areas have erosion control devices installed and were covered with straw. Next spring they will be leveled and planted turf grass or native grasses. The lagoon area has been reclaimed (sewage pumped, sludge and 6-12 inches of soil removed). The earthen berms surrounding it were pushed into the lagoon to create a shallow wetland.

## **Clear Lake (Cerro Gordo County)**

Clear Lake is a 3,625-acre natural lake in Northwest Iowa. It has a watershed to lake area ratio of 2.3/1. In 2001, ISU completed a lake/watershed diagnostic/feasibility study. They presented a number of lake restoration options; specifically dredging of Little Clear Lake and restoration of Ventura Marsh.

- The DNR and local sponsors purchased a 208-acre dredge spoil site with approximately \$660,000 of LRP funds and an additional \$660,000 local match. Contractors completed the \$886,000 containment site in spring of 2008. The estimated cost of dredging was \$8 million dollars (2.3 million cubic yards at \$3.50/cu. yd.). DNR had a January 2008 bid letting for the hydraulic dredging of the Little Lake portion of Clear Lake and awarded the low bidder, L.W. Mattensen of Burlington, Iowa, the \$6,453,000 contract (75% LRP and 25% local-match funding).
- Dredging commenced in late spring of 2008 and completed by late summer of 2009. Contractors removed a total of 2.4 million cubic yards.



***(Left) In 2013/2014, the DNR lowered the dikes on the dredge containment site. Trees were also removed and pushed into piles. The Wildlife staff burned the trees during the past winter. Long-term plan for the containment site is seeding down to native prairie and management as a wildlife area.***

***1,500 feet of publically owned shoreline was protected with native stone rip rap in 2011. This work took place on the ice along the shorelines of McIntosh Woods State Park. One hundred twenty five feet of this project was***

***along the State Dock area on North Shore Drive. An additional 750 feet of native riprap was completed for the State Dock area in 2013.***

- The recently dredged west end of Clear Lake has continued to show improved water quality when compared to pre-dredged conditions. The recent monitoring data indicates that water clarity is returning to what was seen in the mid 1970's. The west-end sampling site has shown better water quality than the other two sites on Clear Lake now that dredging has been completed. Prior to dredging, the west end site showed poorer water quality than the other two sites. Overall, the water quality of Clear Lake has shown substantial improvement over the past ten years that watershed and lake improvements have been implemented. Water quality remains excellent following previous restoration activities.

## Section 206 U.S. Army Corps of Engineers Aquatic Ecosystem Restoration Project for Ventura Marsh

- Construction is completed on a Section 206 U.S. Army Corps of Engineers Aquatic Ecosystem Restoration Project for Ventura Marsh, which flows into the west end of Clear Lake. In its present degraded state, the marsh serves as a major source of nutrients contributing to water quality problems in the lake and is a major reproduction area for common carp. The Army Corp of Engineers (COE) budgeted \$3.2 million for the Ventura Marsh restoration project. Ventura Marsh state land and in-kind credits of \$1,331,200 and approximately \$884,062 in LRP dollars will fund the DNR's portion of the marsh restoration project. The goal was to work with the COE to restore Ventura Marsh and gain water level management capabilities. This will allow for fish removal and revegetation of the marsh.
- The old stop log structure was removed and replaced with a new structure in 2011. The stop log structure will be used to control water levels from the marsh crest elevation down to Clear Lake's water level. For water level manipulations below Clear Lake's level, the pumping station will need to be used. A flow path was dredged in 2011 to allow the deeper portions of the marsh basin to drain towards the pumping station. This will allow nearly a complete drawdown.
- In 2013 /2014, DNR constructed of a catch basin and a water flow path in the southwest corner of the marsh. This feature will treat water entering the marsh from two large tile sources and allow for longer retention of water entering the marsh before it gets to Clear Lake. The implemented project established two sediment basins to treat major tile inlets in the southwest corner of Ventura Marsh.
- Rotenone was applied to the dredged trench to kill the carp reproduction that occurred in the marsh. The treatment was effective in the area of the Ventura Grade, but live carp were likely present in other portions of the basin and watershed for the marsh. Stoplogs were removed and Clear Lake and water was allowed to flow west into Ventura Marsh. The water level stabilized with the current lake level, which gave adequate levels in the marsh to allow for waterfowl hunting opportunities.

### Anticipated Benefits

The total cost of all above activities is approximately \$17.0 million. Of this amount, local and federal match represent 40% of the funds necessary to complete these restoration efforts. Restoration efforts and improvements in water quality have the potential to double the annual economic return that Clear Lake generates to the local economy. The Center for Agriculture and Rural Development at ISU has projected a significant benefit to cost ratio from lake and watershed restoration at Clear Lake. Restoration of Ventura Marsh will improve the water quality of Clear Lake and help keep the Carp population under control. Local groups and DNR Section 319 continue to pursue watershed projects that have the potential to decrease sediment delivery to Clear Lake.



***Carp are back in Ventura Marsh, but water quality remains excellent. Dense beds of cattail exist on 80% of the basin.***

*Photo by Zenner, October 2014*

## Diamond Lake (Poweshiek County)

Diamond Lake Park is a 660 acre county park with a 98 acre lake that is managed by the Poweshiek County Conservation Board. The fishery is managed by the DNR. Diamond Lake Park is located near the city of Montezuma and features fishing, camping and day use activities. The Poweshiek CCB and the DNR have a history of working together to maintain water quality and provide a fishery at Diamond Lake.

The DNR entered into an agreement is to reimburse the Poweshiek CCB for repair and modification of the existing spillway. The current spillway is in need of repair. By working with the Poweshiek CCB, we will be able to modify the spillway with a ten-foot drop, which will eliminate migration or rough fish from Moon Creek into the lake. This will benefit both the DNR and the CCB in terms of future fish management and negative effect of rough fish on water quality. Preliminary engineering has been done to repair and modify spillway. Possible construction date would be summer of 2015.



## Easter Lake (Polk County)

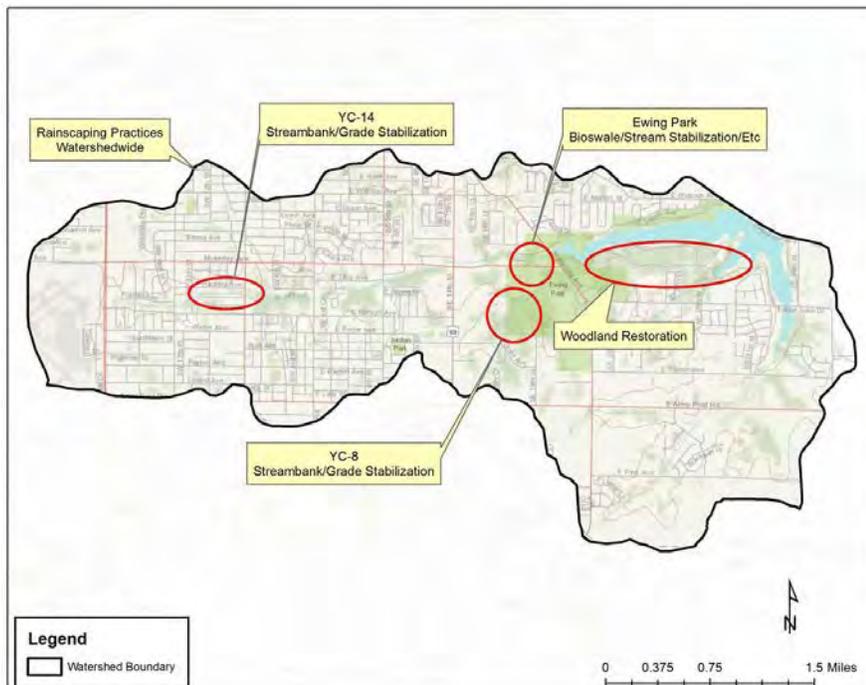
Easter Lake is a 178-acre constructed lake with a watershed to lake ratio of 36/1. Constructed in 1967, Easter Lake began as a lake in an agriculture/suburban watershed that over the years has shifted to a highly developed urban area. Construction activities and storm water issues have contributed greatly to more than a 20% reduction in lake volume. The Polk CCB owns and manages this area and they continue to work in partnership to accomplish lake and watershed improvements.

- A Technical Advisory Team met multiple times from 2007 through 2013 to discuss plans for Easter Lake and the watershed. Representatives from the Polk County Conservation Board, City of Des Moines – Parks and Recreation / Public Works, IDNR – Environmental Services Division / Fisheries / Watershed Improvement Section, Iowa Department of Agriculture and Land Stewardship, Iowa State University, and the Natural Resources Conservation Service have attended these meetings.
- EA Engineering completed a water quality improvement plan for Easter Lake in the fall of 2012. This plan incorporated findings from previous watershed and in-lake research projects. A public meeting was held to inform the public of the proposed improvement and gather feedback and a local steering committee was formed from watershed landowners who attended past public meetings. This committee is assisting throughout the restoration process
- The watershed project coordinators have made significant strides involving the community and stakeholders in the project. They have made 100+ site visits with landowners, hosted 31 educational events and taught a high school education program. In addition, the coordinators have taken a lead role with various BMP projects such as rain barrels, soil quality restoration, permeable pavement and woodland restoration throughout the watershed.
- The Easter Lake Watershed Project is working with local residents to hire the Conservation Corps to help reduce stormwater runoff from entering Easter Lake. The goal is to build rain gardens on multiple properties at a time, to increase the number of practices going in around the watershed. This installation method paired with the Easter Lake cost-share program allows homeowners to have rain gardens installed for a very small input cost.

The Easter Lake Watershed project recently participated in the “discover your watershed” program with Polk County Conservation Board that engaged nearly 500 local high school students to learn about their local watersheds. The program was funded in part by a REAP-CEP Grant. The program used a combination of conventional teaching methods, outdoor activities, and a little hard work to convey the importance of caring for watersheds. Easter Lake Watershed Coordinators worked with 100 Lincoln High School students, including in-class activities as well as a field trip to Easter Lake Park. On the field trip, students participated in canoeing, water quality and biological sampling, as well as a 1/2 acre of soil quality restoration. Over the course of three hours, students spread 32 cubic yards of compost over aerated soil to help improve soil health and its ability to absorb rainwater.



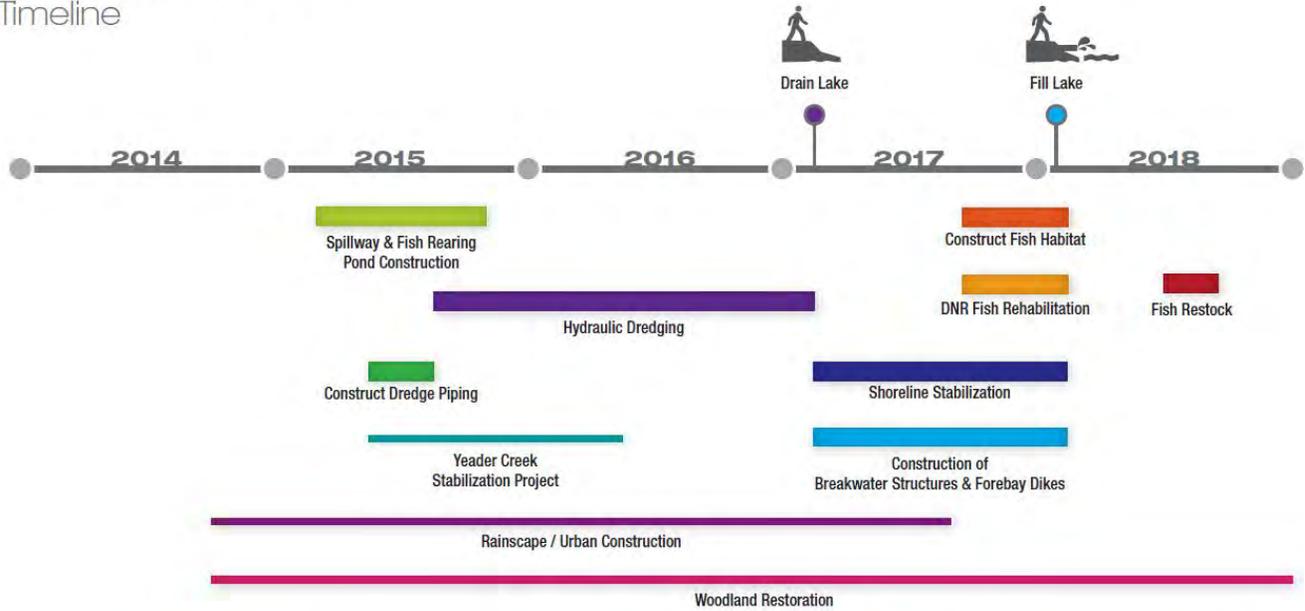
- The Polk County SWCD working with the Technical Advisory Team recently applied for and received \$699,727 in DNR 319 funding. These dollars will allow for implementation of Phase I in the plan. The total Phase 1 budget is \$1,912,950. This includes cost-share of \$500,000 from the City of Des Moines and in addition resources from the NRCS, Polk CCB and the DNR Lake Restoration Program.



**Project partners have hired Snyder & Associates to provide technical design and final engineering plans/costs estimates for sediment retention structures along Yeader Creek and in-lake restoration (e.g. spillway modification, dredging, shoreline stabilization, fish habitat and silt retention structures). The timeline for the majority of in-lake restoration activities is from 2015 – 2018.**



# RESTORATION Timeline



**Milestone schedule for Easter Lake Restoration Project**

## Five Island Lake (Palo Alto County)

Five Island Lake is a 973-acre natural lake located on the north side of the town of Emmetsburg, Iowa in Palo Alto County. In 1989, following years of diminished recreational opportunities and poor water quality conditions due to low lake levels, a group of concerned citizens formed the Five Island Lake Board. They established two major goals for the project: Increase the lake water depth; and, improve the lake water quality.

Goals of the 1994 diagnostic feasibility study included goals for dredging and shoreline stabilization. During the 90's, the Lake Board has stabilized almost 10.5 miles of lake shoreline, dredged over 4.4 million cubic yards of silt, and has worked in the watershed to reduce nutrients and sediment from entering the lake. Funding for this project since 2000 has required a combination of 1:1 state and local matching grants.

Year	Cubic Yards
1991-1993	1,390,000
1994-1999	3,028,000
2002-2011	1,926,296
2013	205,221
2014	250,968
<b>Total</b>	<b>6,800,485</b>

Five Island Lake, based on the 1994 DF Study map, had a mean depth of 4.6 feet. Over the 1994 - 2014 dredge seasons, an additional 3,354 acre-feet was dredged, which increased the mean depth to 8.0 feet. The current plan is to dredge approximately 250,000 cu. yds. over the next year in order to complete deepening in the areas approved for dredging and achieve a mean depth greater than 8 feet. The planned work during 2015 will be accomplished using FY14/FY15 funds.

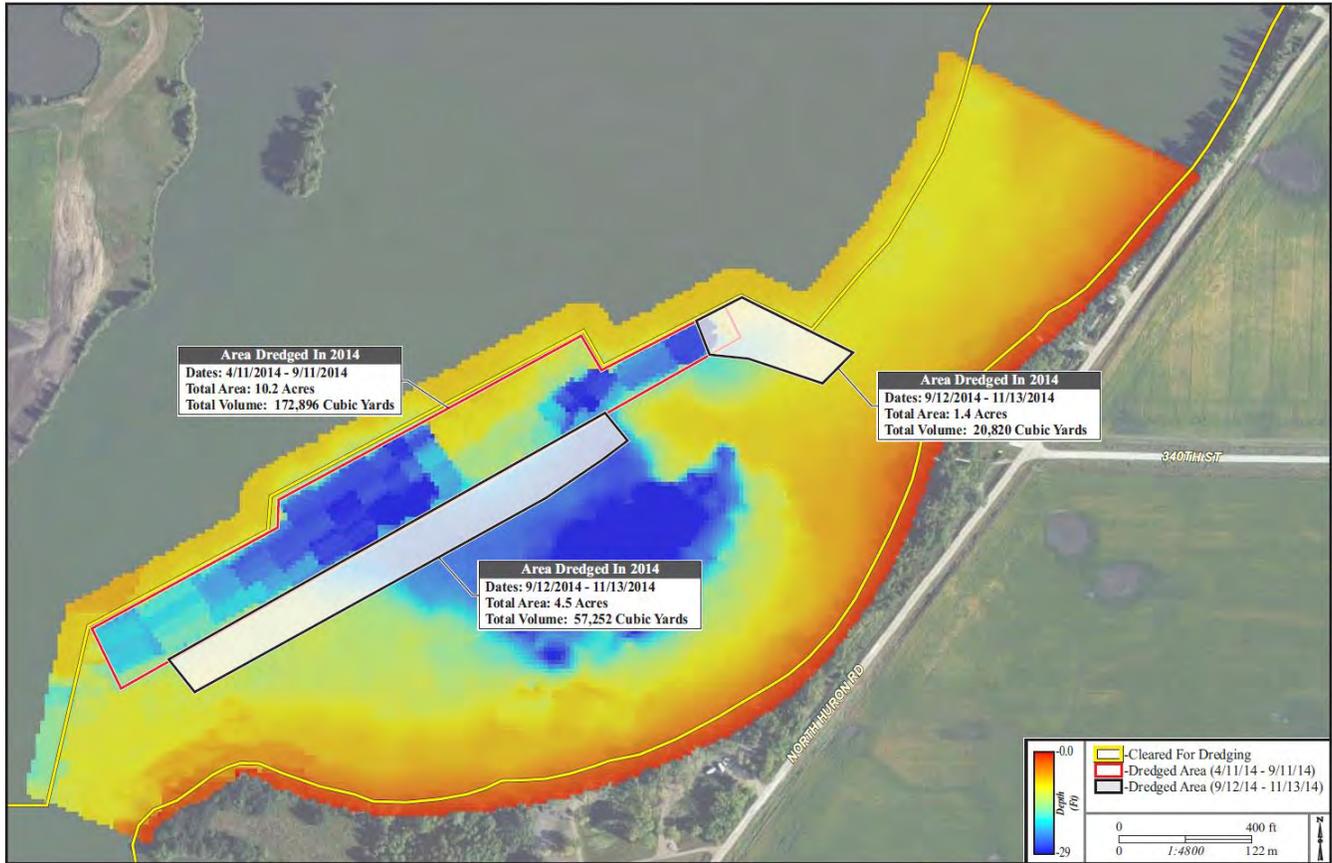


Figure 1. Areas dredged in 2014.

**Region dredged during the 2014 open water season. Bear Creek Archeology survey estimated that as of November 2014 the City had dredged 250,968 cubic yards from a 16.1 acre area.**

2006 TMDL: Impaired water for algae and turbidity

- Large source of turbidity is from internal re-suspension of sediment. A TP load reduction of 17% is needed to achieve water quality goals and protect the designated uses.
- TMDL supports that dredging is a critical component to improving and maintaining water quality improvements. However, partners recognize that water quality still does not meet expectations and a plan needs to be developed to address the watershed and any other in-lake issues.

Recent Activities

- The Palo Alto SWCD received an IDALS-DSC development grant for assessment of Five Island Lake and its watershed. This was completed in 2007.
- Summer 2008 tour with local stakeholders and the DNR Lake Restoration Program reviewed progress and the need for continued watershed work to compliment local dredging efforts.
- On November 2011, the DNR met w/ the City of Emmetsburg, Palo Alto SWCD, Palo Alto CCB, IDALS and members of the Lake Board to discuss status of project and potential future work.

- In addition to wrapping up the dredging portion of their project, the community is evaluating the need for additional work in the watershed and in-lake management strategies to achieve the desired water quality goals. The Lake Program will be working with the community to obtain any additional information needed to develop water quality improvement plans and in order to implement practices.

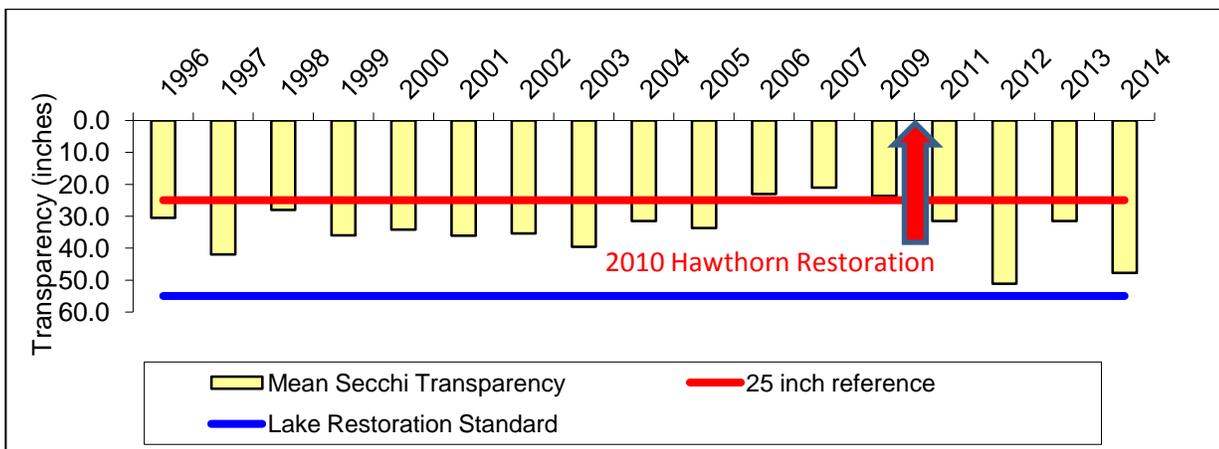
### Hawthorn Lake (Mahaska County)

The Mahaska County SWCD applied for, received a watershed assessment grant from IDALS, and completed the assessment during the winter of 2007. They then held a kick-off meeting in May of 2010, with 34 landowners, stakeholders, staff, commissioners, news media, etc. in attendance. Partners discussed shoreline work, structures on public property, signage, private land progress, and reviewed goals. The Mahaska SWCD applied for and received a WIRB grant of \$360,900 toward Lake Restoration activities. In addition, a total of \$208,618 in Publicly Owned Lakes (POL) funds has been available to the project. Lake Restoration Program utilized funds of \$450,000 for in-lake shoreline stabilization, deepening, and watershed improvement on state lands.

- To-date landowners have completed a grade stabilization structure with sediment loading reduction of 157 (tons/year). 3,238' of terraces on private property have been installed reducing sediment loading by 104 (t/y), and 2,109' of waterways reducing sediment loading by 32 (t/y) on private property.
- DNR awarded a \$384,854 contract to Cornerstone Excavating, Inc. of Washington Iowa for in-lake restoration work at Hawthorn Lake (\$147,824 Fish and Wildlife Habitat Funds, \$132,033 Lake Restoration Program, \$100,000 Mahaska County SWCD WIRB grant). The project, completed April 2011, consists of the placement of in-lake habitat, shoreline armoring and deepening, and jetty construction/repair.

The DNR has designed eight sediment control ponds for watershed improvement on public ground. Phase I: Five of the eight structures on public property were let for bid on January 19, 2012 and are now completed. We are currently under permit review by the U.S. Army Corps of Engineers for the remaining three pond sites that are planned for 2015 construction. In addition, treatments on one parcel of private ground are under design and will be funded through cost share to further improve water quality in the watershed. A Lake Restoration / Wildlife Bureau joint purchase of an additional 40 acres in the northwest portion of the watershed will be treated to improve water quality.

Water quality benefits from restoration efforts have already been observed. The figure below demonstrates water quality before and after the 2010 lake restoration project. Trends in secchi disk transparency suggest that water quality has improved in the years following the completed restoration efforts. The additional treatments planned for 2015 should further increase water clarity.



The Hawthorn Lake fishery has redeveloped quickly following completion of the 2010 restoration project. Largemouth bass abundance is high and largemouth bass up to 18 inches are common. Angling pressure continues to build as the quality of these fish improves. Bluegill angling is improving with 8-inch bluegill presently available. Channel catfish abundance is excellent and size quality is well developed. Channel catfish in excess of 22 inches are present. Muskellunge were restocked in 2012 and in May 2014. Five new sediment control structures completed on state property were also stocked with largemouth bass and bluegill in 2013.

The DNR Lake Restoration Program, DNR Wildlife Bureau and Mahaska County Conservation Board worked cooperatively to eradicate early secondary succession woody vegetation from targeted areas on the Hawthorn Wildlife area. Lake Restoration provided up to \$15,000 for removal of these trees, which will allow for the stabilization and restoration of native grasses, providing overall better watershed protection while improving wildlife habitat.

Lake Restoration and Wildlife have been successful in obtaining a purchase agreement with the owner of a 40 acre tract of land in the Hawthorn watershed. The purchase of this property will negate the need for a flood easement for construction of one of the final four sediment basins on DNR property. We are also working with the Mahaska County SWCD and another landowner to construct multiple dry basins on his property to eliminate the need for one of the previously unpermitted large ponds. The Corps of Engineers has apparently softened somewhat on their requirements for foot for foot mitigation when constructing these basins and a revised mitigation plan will be submitted to the Corps in hopes construction of the final three basins (formerly 4) can be completed to wrap up the Hawthorn restoration project.

### **Hickory Grove Lake (Story County)**

The Hickory Grove Watershed is located in Story County, Iowa. It has a drainage area of 4,026 acres and landuse distribution of 84.7% row crop, 9.8% grass, 1.6% forest, 2.2% water, 0.9% barren and 0.7% artificial. Iowans consider Hickory Grove Lake an important recreational resource; however, the lake is experiencing event driven water quality problems that negatively affect this resource. In general, the Hickory Grove watershed has few elevation changes and much of the agricultural land is under tile drainage management. Storm related surface runoff has led to gully erosion, debris and nitrogen spikes immediately after these events.

The eastern end of the lake is now sediment filled, limiting boat access. The fishery is healthy; however, carp have destroyed most vegetation and IDNR is considering a lake fishery renovation. The lake has a designated use of primary contact recreation and is listed on the 2008 303(d) Impaired Waters Listing for elevated bacteria concentrations.

- Watershed Technical Advisory Team met from the summer of 2008 - 2012 to discuss water quality improvement efforts at the lake. The NRCS received Development grant was in 2008 to determine critical areas in the watershed with significant quantities of sediment and nutrient delivery to the lake and completed a land use assessment in 2009.
- The Story SWCD has listed the Hickory Grove Lake Watershed as an Environmental Quality Incentives Program (EQIP) priority watershed. The EQIP is a voluntary program that provides financial and technical assistance to agricultural producers to help plan and implement conservation practices.
- Spring 2011, ISU received an IDNR Planning Grant for development of a Watershed Management Plan for Hickory Grove Lake. In October 2011, Dr. Michelle Soupir, from Iowa State University, named Aaron Andrews, from the Iowa Learning Farms (ILF) as the Watershed Project Coordinator.

- Aaron Andrews made one-on-one contact with the majority of the watershed landowners. Continued communication with these landowners was recommended.
- ISU has finished the Watershed Management Plan, which outlined recommended improvement strategies for as bacteria levels and goose control at the beach, lake drawdown, sediment removal and fishery renovation over the next three years.
- The County received a WIRB grant in 2014 to relocate livestock from a tributary stream and reduce erosion on a watershed landowner's property.



**Story County staff stabilized approximately 450 feet of shoreline with riprap along the southwest shoreline and the emergency spillway from the ice in 2013/2014 at a cost of \$18,500 to Lake Restoration. A more recent evaluation of the lake shoreline was also completed in the fall of 2014.**

**Story County staff continues to work on timber stand improvement and oak savanna restoration and clearing of invasive species from around lake using mechanical removal and prescribed burns.**



### **Iowa Great Lakes (Dickinson County)**

The DNR recognize the Iowa Great Lakes (IGL) as a significant public resource and continues to support efforts to maintain and improve lake water quality in the region. The IGL are major recreational lakes for Iowa residents and visitors from adjacent states.

Summary of DNR Lake Restoration Program funded projects at the Iowa Great Lakes (2010 – 2015)

<b>Project Description</b>	<b>Project Cost</b>	<b>Lake Restoration Program Cost-share</b>
Center Lake Urban BMPs	\$469,999	\$47,944
Watershed Conservation Practices	\$330,685	\$181,896
Great Lakes Electric Fish Barrier	\$1,038,000	
Okoboji View - Beddell Tract	\$578,000	\$250,000
Okoboji View – Chapman-Sebby/Peace Tract	\$680,000	\$25,000
Okoboji View Restoration	\$554,793	\$185,287
Marble/Hottes Restoration	\$494,360	\$394,320
Spring Run Wetlands (Lower Gar)	\$299,000	\$117,000
<b>Total Cost</b>	<b>\$4,444,837</b>	<b>\$1,201,447 (27%)</b>

### *Work in the Iowa Great Lakes Watershed*

The DNR is working with the Department of Agriculture and Land Stewardship to implement conservation strategies, in cooperation with the local County Soil and Water Conservation District that support the common efforts of installing \$330,685 in watershed management practices, the DNR is providing \$181,896 in funding support for the following projects:

#### Urban Practices

- Improve storm water intakes for filtering storm water before it reaches the lake and improve lake shoreline to prevent further erosion.
- Construct a bio-cell as a water control structure to filter or settle sediment from running water before the water enters East Okoboji Lake.
- Construct two subdivision bio-cells that will capture and filter storm water runoff.
- Low Impact Development within the Center Lake watershed.

#### Wetland Restoration

- Implement a wetland and prairie restoration on the North Shore of West Okoboji that will reduce the amount of sediment reaching the lake.

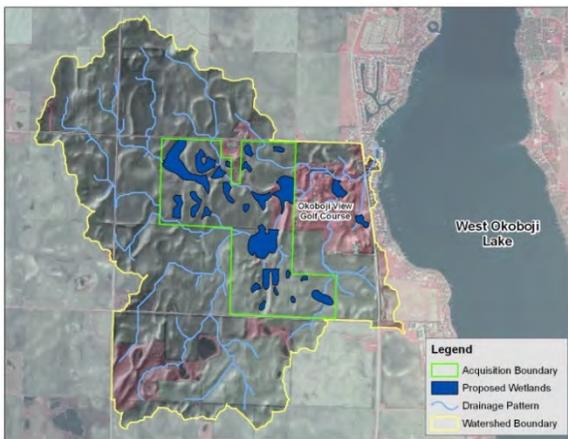
### **Okoboji View Watershed Project / Sandpiper Cove – West Okoboji Lake**

For years, this 1,700-acre portion of the West Okoboji Lake watershed has been considered an area of primary concern for maintaining water quality in West Okoboji Lake. It drains into Sandpiper Cove on West Okoboji Lake, an area known for chronic blue-green algae problems and flooding. In 2008, a watershed assessment was completed for the Iowa Great Lakes watershed under an EPA 319 grant and this subwatershed was identified as a high priority for restoration.

***Water and sediment delivery to West Okoboji Lake during a rainfall event in 2011 from the Okoboji View Watershed.***



Acquisition of property within the West Okoboji watershed has allowed for this opportunity for wetland restoration. For example, in 2010 the Natural Resource Commission approved the acquisition of a 90-acre tract of land offered by the Iowa Natural Heritage Foundation for \$478,000 (\$250K LRP, \$150K NAWCA and \$78K REAP Open Spaces). The tract was appraised at \$578,000 (INHF received a \$100,000 grant from the Dickinson County Water Quality Commission). This is part of a larger 230-acre tract acquired by the INHF in March 2010. After restoration, the land now contains 54 acres of native prairie plantings and 35 acres of restored wetlands. Also in 2010, the INHF acquired a 120-acre parcel and facilitated transfer to public ownership. The Chapman-Sebby/Peace tract was another critical acquisition toward a successful improvement to the Okoboji View drainage. The 120-acre tract was purchased for \$680,000 by INHF using the following funding sources (USFWS Waterfowl Production Area Program - \$448,000; North American Wetlands Conservation Act grant program - \$82,000; Dickinson County Water Quality Commission - \$75,000; INHF - \$50,000 and the Lake Restoration Program - \$25,000.



***Map showing the Okoboji View Watershed, public land boundary, and proposed wetland locations.***

Pre-project modeling estimated sediment deliver from portions of this watershed at 480 tons for a two-inch rainfall. Project partners implemented a \$554,793 initiative to address sediment delivery/nutrient loads from this sub-watershed of the Iowa Great Lakes. Approximately 75 acres of wetlands have been constructed or restored on 350 acres of public land and a private golf course. The DNR constructed and restored wetlands on the project site to be capable of storing up to 100 acres of water during storm events. The project was tested immediately following completion as an extreme rain event hit the area in June 2014. The wetlands and water level control structures functioned well preventing downstream flooding on the West Okoboji Lake shoreline and stopping countless tons of sediment from entering the lake.

***(Right) A series of wetland basins were constructed and restored near the bottom of the 1,700 acre watershed.***

***The Okoboji View Golf Course was an important partner in this project. The golf course lies just downstream from the project wetland construction and enhancement on this private property was critical in reaching the overall project goals.***



**East and West Hottes Lake/Marble Lake/Grovers Lake Complex (Dickinson County)**

Located within the Kettleon Hogsback wildlife complex in northern Dickinson County, these 4 basins are of extreme importance to fish and wildlife as well as water quality in the Iowa Great Lakes. Mable Lake (160 acres) and West Hottes (225 acres) drain to Big Spirit Lake. In fact, nearly 20% of the water entering Big Spirit Lake comes through these lakes. Historically, these basins contained a diversity of high quality aquatic plants that supported a wide array of sport fish, waterfowl, water birds, furbearers, reptiles, amphibians, and other wildlife. Excessive numbers of carp and chronic high water levels have resulted in the loss of many of these plants and the animals that depend on them.



**West Hottes and Mable Lake Watershed boundary**



**Nearly completed pumping station on Marble Lake**

A number of partners planned and implemented this \$450,000 restoration project for Marble and Hottes Lakes (\$350,000 from LRP). The Big Spirit Lake Association, DNR, DU, Dickinson County, and others provided funding and technical guidance to develop a comprehensive feasibility study to identify ways to return ecological health to this critical habitat. Final design incorporated water control structures and pumps that allow for the temporary draining of the basins and fish barriers that allow for the passage of game fish but preclude the passage of carp.

In May 2014, the Spirit Lake Protective Association hosted a well-attended/positive public meeting prior to the beginning of construction. The first phase of construction is now complete and pumping at Marble Lake began in November 2014. DNR will commence with additional drawdown activities soon to facilitate the second phase of construction.

**Asian Carp in the Iowa Great Lakes**

The Iowa Great Lakes electric fish barrier went into formal operation in May 2014. At the site of the electric barrier, final safety fencing, signage and site grooming was also completed this past summer. A technician from Smith-Root Inc. visited the electric barrier site to make final adjustments and electrical field measurements. Fisheries staff was heavily involved during construction and make regular visits to the barrier during weekend and weekday hours throughout any operation of the barrier to provide safety reminders, communicate, and educate the public about the barrier. Another positive in addition to long-term protection of the Iowa Great Lakes from future introduction of invasive fish species is that only one additional bighead carp was captured this spring during commercial seining and fisheries sampling.

**Barrier Cost**

Item	Bid	Cost
Engineering and Construction Oversight	\$118,000	\$118,000
Materials and Construction	\$843,000	\$920,000
<b>Total</b>	<b>\$961,000</b>	<b>\$1,038,000</b>

**Fundraising**

Source	Funds
Local partners and private donations	\$400,000
Iowa DNR	\$377,000
Minnesota DNR	\$261,000
<b>Total</b>	<b>\$1,038,000</b>

***Breakdown of final costs and fundraising of the Iowa Great Lakes electric fish barrier***



***Fish barrier final preparations and activation***

**Center Lake (Dickinson County)**

The Iowa DNR Lake Restoration Program is supporting the Dickinson SWCD watershed Improvement Review Board (WIRB) Center Lake Low Impact Development \$469,999 grant for the installation of urban conservation practices that will be installed in the Center Lake Watershed. These urban conservation practices, involving bio-retention cells, pervious paving systems, and other Low Impact Development Practices will result in beneficial impact to the water quality of Center Lake. The Lake Restoration Program will contribute an estimated \$47,944 dollars over the life of the project. Remaining funding is EPA 319 Grant - \$374,111 and City of Spirit Lake - \$47,944.



Projects recently completed

A series of strategically placed urban low impact development practices were constructed in 2014 in the Center Lake watershed. These practices will slow rainwater, sediment and nutrients from entering the extensive stormwater system that drains to Center Lake.

A DNR presentation to the Center Lake Association in October 2014 that included a discussion on future potential work was well received. A grant to assist with restoration efforts

on this lake was funded through the Dickinson County Water Quality Commission and a number of projects are now awaiting engineering.

- *Center Lake shoreline restoration* – 800 ft. of severe shoreline erosion on public land has been identified and engineering solutions for this problem are being explored.
- *Center Lake common carp management* – Engineering and construction of two rock barriers to block common carp migration into two key spawning locations. These barriers will help manage in-lake common carp populations and allow these shallow water marshes to recover and have improved water quality further protecting the lake.
- *Common carp barrier between the Center Lake and Jemerson Slough Complex* - This barrier would prevent common carp from migrating upstream from West Okoboji Lake into the lakes and wetlands in this complex.

**Lake Anita (Cass County)**

Maintenance activities at the 159-acre Lake Anita over this past year included expansion of the sediment retention basin above the east arm of the lake. The box culvert at the road was raised four feet and 8,000 cubic yards of material was removed all in an effort to increase the trapping efficiency reducing the sediment and nutrient delivery to the lake. This project will benefit the lake for the next 30 years.

What started out to be a project to take advantage of drought conditions and clean out a nonfunctioning sediment retention pond at Lake Anita ended up with a total rebuild. NRCS engineers provided us with a design to raise the water level four feet by modifying the box culvert. In addition to raising the water level, 8,000 CY of dirt was removed from the upper end to act as a sediment trap. Combined this will extend the life of this sediment pond by an estimated 30 years and allow for water level control (management capabilities) of the east pond. Cost of the project was \$41,000 and funded through Lake Restoration.



The water quality and fishery at Lake Anita continues to meet Lake Restoration goals on an annual basis. In 2013, Lake Anita had an estimated 64 surface acres vegetated or 39% of the entire lake surface area of the lake. This amount of vegetation is at the top end of the recommended 10 to 40% range optimal for growth and survival of fish. In 2014, a significantly larger area of the lake was treated. A total of 15 acres in three locations were treated with aquatic herbicide Reward. This reduced the vegetated area of Lake Anita down to 28% of the total surface acres, improving access to the lake and enhancing the fishery.

**Lake Anita aquatic vegetation treatment**

Lake Anita water clarity is again excellent this year in the lake (10' Secchi). Vegetation treatments were completed May 27 and 28. In 2013 Lake Anita had an estimated 64 surface acres vegetated which is 39% of the entire lake surface area and is at the top end of the recommended 10 to 40%.

### Lake Geode (Henry County)

Lake Geode, located in Henry and Des Moines Counties, is a 174-acre lake encompassed by a 1,640-acre state park. The entire Lake Geode Watershed consists of approximately 10,327 acres. The watershed encompasses drainage from Cedar Creek and the lake outlets to the Skunk River. This scenic lake was constructed in 1950 and has excellent fishing. DNR estimates that Lake Geode State Park attracts approximately 180,000 annual visitors who camp, hike, fish, and boat within the park.

The goals of the Lake Geode Watershed Project are to reduce bacteria, sediment and phosphorus from loading into Lake Geode. Project partners plan to achieve these goals through a combination of best management practices that will target identified source contributors from state and private land. The following agencies are working in partnership to achieve this goal, Iowa Department of Natural Resources (DNR), Iowa Department of Agriculture and Land Stewardship – Division of Soil Conservation (IDALS-DSC), Natural Resources Conservation Service (NRCS) , Henry Soil and Water Conservation District and Des Moines Soil and Water Conservation District.

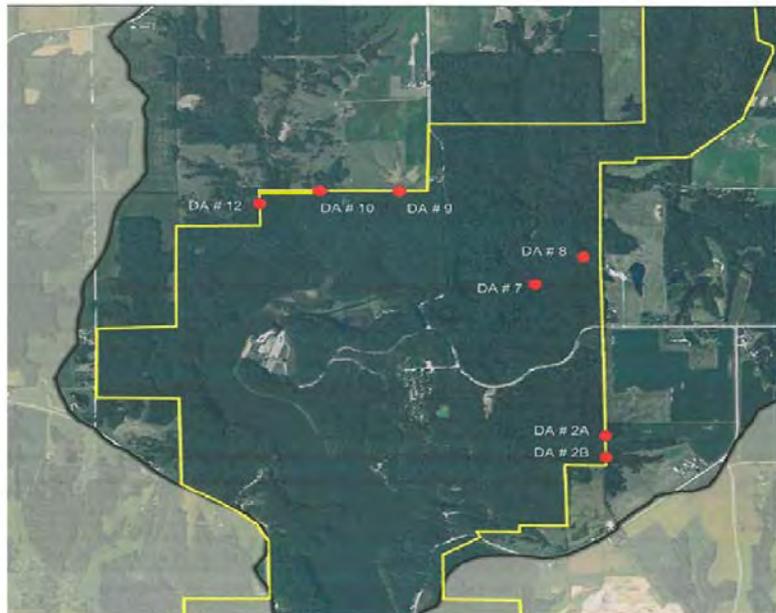
Goal 1: Address bacteria impairment of Lake Geode in an effort to remove it from the 303(d) list

Goal 2: Reduce total phosphorus and sediment delivery from agricultural and non-agricultural sources by 6,351 lbs. /year and 2,499 tons/year, respectively.

The Natural Resources Conservation Service, Iowa Department of Agriculture and Land Stewardship and the Iowa Department of Natural Resources have been working together to install Best Management Practices (BMP's) on state property. The Lake Geode Watershed Coordinator continues to make progress in the watershed. For example, terrace projects have been completed and septic systems are being investigated in terms of leakage/upgrading.

In 2012, the DNR completed five grade stabilization structures and four sediment ponds within the park boundaries.

***During 2014, the DNR was able to move forward with seven additional ponds, many of which involved cooperation with neighboring landowners. Hammes Bulldozing Inc. from Sigourney, Iowa finished all the ponds by fall 2014.***

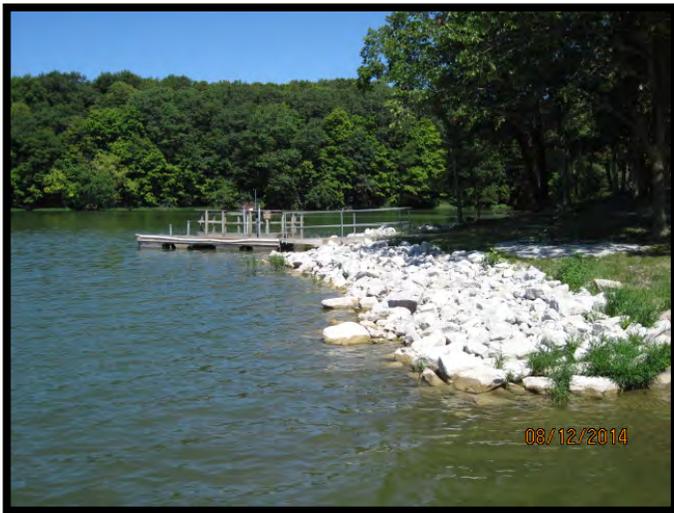




**Site #9 along the north boundary of the park.**

A shoreline riprap project was recently undertaken and completed near the Lake Geode main boat ramp. Both Natural Resources Conservation Service (NRCS) and Iowa Department of Natural Resources (IDNR) staff noticed that, in recent years, the shoreline surrounding this key infrastructure was showing considerable signs of erosion due to wind and wave action as well as sustained foot traffic by recreational users. Portions of the affected shoreline were lightly armored in the past, but constant battering from waves had

resulted in sloughing which rendered much of the previous riprap ineffective. Wind and wave erosion can lead to lakeshore instability. Unstable banks eventually slough resulting in loss of depth and decreased water clarity given the soil can be suspended in the water column. Nutrients once adhered to soil are now available for uptake by aquatic plants leading to algal blooms.



Buford Dozing and Excavating, Bonaparte, IA was awarded the contract for nearly \$100,000 to armor almost 1,000 feet of shoreline with 24-inch diameter rock (commonly used for riprap protection).

Placement of the riprap was unique in that the rock was loaded on a barge and transported to areas of concern. This method led to minimal damage to the landscape and trees as opposed to if the project would have completed from shore. The cost of the riprap project was paid for using State Marine Fuel Tax and Lake Restoration funds.

**2014 - Lake Geode Shoreline Restoration Project – Funded by: State Marine Fuel Tax and Lake Restoration Funds.**

## **Lake Icaria (Adams County)**

Lake Icaria's clarity used to be measured in inches; it is now measured in feet. Before, you could only see down six inches in the murky waters of this southwestern 647 acre Iowa lake. Now, following work in the watershed and in the lake, you can watch your toes wiggle when standing in waist-deep water. Landowners set out in 1996 to improve the lake as part of the Adams County Three Lakes Project. In the past decade, landowners have changed how they farm to improve water quality.

Following work in the watershed, the DNR moved ahead with restoration efforts in the lake in 2004. At Lake Icaria, in-lake work has helped protect 10,000 feet of shoreline from erosion. Anglers will notice four new fishing jetties, repaired jetties and a repaired main boat ramp, as well as a renovated fishery and restocked lake. The DNR also placed 12 underwater rock mounds to attract fish for anglers. Since Lake

Icaria completely refilled in the spring of 2007, the water is remarkably clearer – generally, a person can see three feet down in the water, sometimes up to six feet. With an improved lake, anglers, campers and other park visitors are taking notice. Starting in 2008, fishing and park visitations have improved. In-lake work has helped protect 10,000 feet of shoreline from erosion. Anglers will notice four new fishing jetties, repaired jetties and a repaired main boat ramp, as well as a renovated fishery and restocked lake.

- The DNR Lake Restoration Program cooperated with the Adams SWCD by providing funding resources to repair and improve the main tributary wetland that was originally constructed in 2004. In 2013, the DNR contracted with Murphy Heavy Contracting Corp. to repair the wetland at a cost of \$386,028 (WIRB grant to the SWCD paid \$170,525 and the Lake Restoration Program paid \$215,503). Construction was completed September 2013.

***The DNR and Adams County SWCD worked together to repair and improve the main tributary wetland during the 2013 construction season.***



- In addition, Adams CCB applied for a fish habitat grant for four sediment control ponds above Lake Icaria. The DNR and Adams CCB coordinated planning for these structures during the winter of 2012/2013 and the ACCB constructed these ponds during the summer of 2013 at a cost of \$67,221 (Fish Habitat Grant \$34,871, SWCD \$22,500 and Lake Restoration \$9,850).



***In 2014, the DNR repaired the existing riprap shoreline along the point that surrounds the Primitive Campground at Lake Icaria with more riprap.***

- The future of walleye angling at Lake Icaria looks promising. Age-0 walleye captured during night electrofishing in the fall of 2014 averaged 90 fish/ hour, which may lead to a strong year class of walleyes and may produce good walleye angling in future years.

## **Lake Manawa (Pottawattamie County)**

Lake Manawa is a 715-acre oxbow lake with a watershed to lake ratio of 4:1. Mosquito Creek supplies additional water to the lake. Past lake dredging work in the 1960s deepened significant portions of the lake. However, maximum lake depth does not exceed 13 feet with large expanses of 6 to 7 feet deep water. The Iowa Department of Transportation approached the DNR to explore the possibility of dredging

the lake for sand to use for highway construction. However, there is concern about whether they can remove sand materials from Lake Manawa while still maintaining the hydraulic seal between the lake and the fluctuating Missouri River.

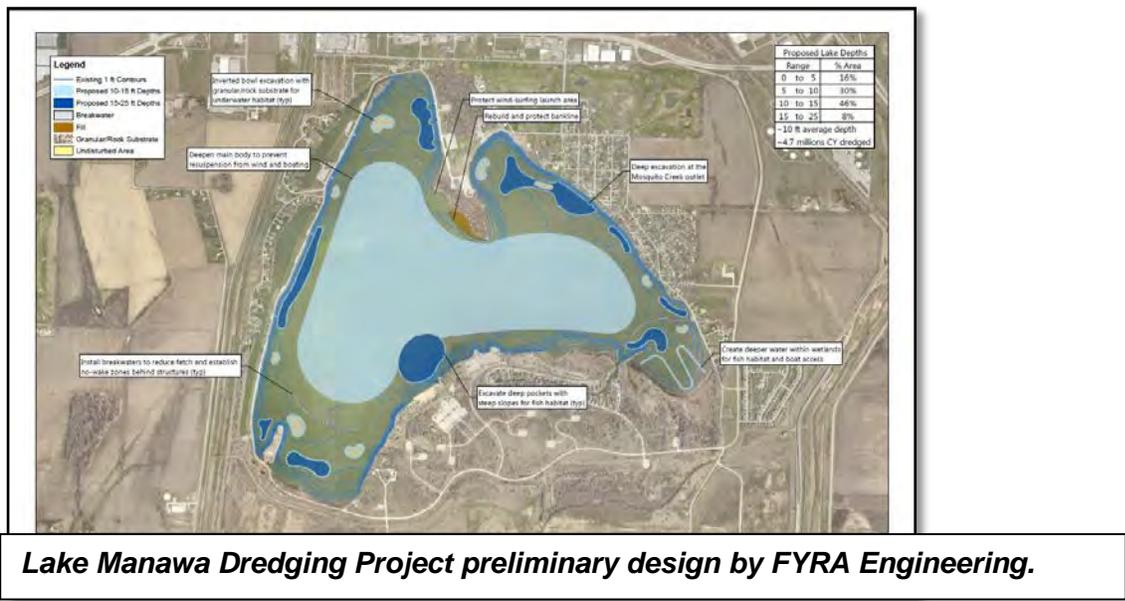
- The Iowa DOT and DNR have met periodically between of 2007 and present to discuss opportunities to obtain highway building materials from Lake Manawa sediments.
- The DNR hired Tetra Tech to conduct a diagnostic and feasibility study and review the option of dredging as a potential lake restoration activity. Tetra Tech also completed a Jurisdictional Wetland Delineation for Lake Manawa Pilot Dredge Spoil Site and finalized a dredging plan that will reduce the risk involved both in providing the materials to the specifications required and in the ability to control additional seepage from areas along the lake bottom. The project remains a viable opportunity for both DNR and the Iowa Department of Transportation (IDOT).
- In advance of dredging, Tetra Tech has prepared a Phase I Archaeological Investigation as part of the Diagnostic and Feasibility Study of Lake Manawa.
- One of the primary goals of Lake Manawa's restoration would include an increase in mean depth from the current 6.1 feet to approximately 10.0 feet and an increase in water clarity to 4.5 feet, at least 50% of the time as measured from April through September. Achieving a mean depth of 10.0 feet will require removal of 4.7 million cubic yards of material. A secondary goal would be to obtain deeper sand that may then be used for Iowa Department of Transportation (IDOT) road projects and/or other local construction activities.
- DNR hired FYRA Engineering in 2014 to provide design/oversight services related to dredging approximately 340,000 cubic yards of material from Lake Manawa and store the material on state land adjacent to the lake.



***Lake Manawa dredging meeting draws a crowd in Council Bluffs. FYRA Engineering and Lake Restoration visits with Nonpareil reporter.***

The Project will consist of the following objectives:

- 1) Provide final design and construction plans for dredging 500,000 CY from Lake Manawa.
- 2) Be onsite for all critical construction activities as defined by both the designated DNR engineer and consultant's engineer.
- 3) Implement a quality control program to monitor the material properties of the sand produced, any impacts of dredging on seepage and feasibility of continued dredging. And,
- 4) Other services may include comparison analysis of alternatives and design related to Indian Creek seepage reduction; and, Mosquito Creek treatment options.



- The DNR continues to meet with groups such as the “Friends of Lake Manawa” to solicit support and to assist in moving the lake/watershed restoration project along. A series (3) of public meetings were held in 2014.

### Lake Miami (Monroe County)

Lake Miami is a 122-acre impoundment located on the 776 Miami Wildlife Area, approximately 6 miles northwest of Albia, in Monroe County. The lake, constructed in 1967, is owned by the Iowa Department of Natural Resources. The area is cooperatively managed by the Iowa DNR and through a 28-E agreement by the Monroe County Conservation Board, which operates campground, cabin rental, and a nature center facility on 89 additional acres of adjacent County Park. The lake and park provide facilities for boating, fishing, camping, picnicking, and hiking. Park use, as determined in the recent Center for Agricultural and Rural Development (CARD) study is estimated at approximately 43,000 visits per year. Approximately 160 hours of angling effort per acre are expended annually at Lake Miami. However, the most recent creel surveys suggest angling activity has declined in recent years.

The Iowa Department of Natural Resources (DNR) has identified Lake Miami as impaired and has placed it on the Clean Water Act Section 303(d) list of impaired waters in the state. The identified pollutant is siltation from agricultural non-point sources (NPS) impairing aquatic life in the lake. In addition, Lake Miami is one of the significant publically owned lakes in Iowa as identified by the Iowa Department of Natural Resources Lake Restoration Program.

From 1971 to 1991 mean Secchi disk readings exceeded 25 inches eight out of 10 times (80%); since that time mean Secchi readings have exceeded 25 inches only four out of 10 times (40%). These data indicate a substantial decline in Secchi transparencies in this time. Possible reasons for the decline in water quality include turbidity from sediment, nutrient delivery from sheet/rill and gully erosion in the watershed, shoreline erosion due to wind and wave action and the re-suspension of these bottom sediments and their associated nutrients from wave action, and re-suspension of sediments by rooting action of Common Carp.

The Monroe County Soil Conservation District applied for and was awarded \$17,000 (\$15,000 from Division of Soil Conservation with \$2,000 from Iowa Lake Restoration funding) for an updated watershed assessment of the Lake Miami Watershed. This assessment was completed fall 2012.

The District applied for \$250,000 in WIRB funding for the construction of up to 14 structures on State property to reduce gully erosion. Funding for \$150,000 was awarded for this project under WIRB. As a result, the project was reevaluated and the total number of structures to be constructed was reduced to six. In addition, Lake Restoration will augment the allowed funding and will fund design and contracting of these structures to ensure project completion. ***These structures will be constructed in 2015.***

An assessment of the fishery indicated that common carp were present in excess of 400 lbs./acre while gamefish biomass was minimal. Angling quality has decline dramatically in recent years, mirroring



changes in water quality. Lake Miami was listed on DNR Fisheries Bureau 5-year capital plan for dredging in 2004; however, the project was removed from the plan due to funding limitations with the intention of returning it to the capital budget at the earliest time possible. The fish population at Miami was renovated in late October 2013. Common carp and all other fishes were removed from the lake. The lake was restocked in the spring of 2015. Largemouth bass up to 18 inches and bluegills up to 6 inches are already available for anglers.

***Lake restoration funded the design and construction of a carp barrier in the Lake Miami spillway.***

This structure will ensure that carp will not reinvade the renovated fishery and thus, negatively affect water quality. The total cost of this structure was \$46,000 and was completed in May 2014.

A shoreline survey was conducted at Lake Miami in February of 2013. A total of 10,000 feet of priority shoreline was identified from this survey. Marine Fuel Tax funds are available for a shoreline restoration project in winter 2014/2015.

The Lake Miami shoreline restoration project was awarded at \$687,848.70. Funding for the shoreline portion of the project is being funded through MFT. \$40,000 in Lake Restoration funds toward the 10,000 feet of shoreline restoration freed up \$40,000 for construction of two fishing jetties which will be completed as an add to the existing contract. The contractor started date in December 2014. No fish habitat component of this project can be completed due to a shortage of funding. However, Rathbun Fisheries, along with the Monroe County Conservation Board anticipate the placement of several hundred cedar trees in the basin this winter. The carp barrier was constructed this past spring and is pictured above. The cost of this barrier was just \$46,000, compared to a \$350,000 barrier that was constructed at Lake Wapello approximately 10 years ago, that will accomplish the same goal. This structure will be monitored for effectiveness in the future. The fish renovation at Miami was completed in fall 2013 and restocking efforts are on schedule. The Monroe County Conservation board completed an application for WIRB funding of 12 basins in the Miami watershed, at a projected cost of \$250,000. Due to funding shortfalls, this project was only funded at \$150,000 through WIRB. To make up the shortage, IDNR absorbed the design and contracting of all structures and only six basins will be completed. Lake Restoration will round out funding for this portion of the project.

**Lost Grove Lake (Scott County)**

The Iowa Department of Natural Resources has nearly completed work to construct Lost Grove Lake, Scott County. The project is an investment in Iowa's infrastructure; promoting long-term economic growth; is a watershed/water quality project; and will provide flood protection and soil conservation

benefits. The Lost Grove Lake recreation site was selected in 1987. Land acquisition from willing sellers began in 1988 and completed in 2003. The state purchased a total of 1,701 acres of land as the site for this 400 surface acre lake. This recreation project has strong local support from groups such as; the Quad City Conservation Alliance, Pheasants Forever, the Izaak Walton League, Scott County Soil and Watershed Conservation District and the Quad City Bass Club. In addition, the Scott County Soil and Watershed District completed a watershed assessment and implemented water quality projects that have included filter strips, grass waterways, sediment basins and EQIP nutrient and pest management enrollments.



***This silt pond west of Lost Grove Lake will help keep the lake clean, and is an area where hunters can train their dogs.*** Photo by Scott Campbell

Thanks to the generosity of several area sportsmen’s groups, and money from the Iowa Clean Water Fund, hunting enthusiasts have a new tool at their disposal when it comes to training their dogs. The Iowa Department of Natural Resources spearheaded the Lost Grove Lake project, and it involved constructing a sediment nutrient basin to keep sediments and nutrients out of the newly constructed lake. A pond was constructed on Iowa DNR ground just west of Utica Ridge Road and upstream from the lake, and hunters and their dogs can use the pond and surrounding area.

“More than \$9,000 was raised toward the project,” said Ed Kocal, Iowa Conservation Officer, “and it was true partnership with a variety of sportsman’s groups.

“The lake and pond are beginning to fill, and this basin will help keep the lake clean,” said Kocal. “The secondary purpose of the area is that it can be used for dog training, and there is a lot of interest in that.”



Photo by Scott Campbell

Lost Grove Lake braved the elements on a recent morning and gathered for a photo. From left: Terry Commer and Don Stewart, Davenport Izaak Walton League; Ed Kocal, Iowa Conservation Officer; Pat Purcell, National Wild Turkey Federation; Kurt Rouse, Nestle Purina; Tom Macke, Scott County Pheasants Forever; Mike Botts, Mississippi Valley Hunting Retriever Club; Bob West, Nestle Purina; Kevin Kahl; and Heath Pacha, Mississippi Valley Sportsmen Inc. Also contributing to the project were the Quad City In Fisherman Club and Quad City Conservation Alliance.

**The lake site is located 10 miles north of Davenport, Iowa and will provide needed public fishing opportunities for the areas 400,000 residents. The lake and surrounding public land will also support outdoor activities such as hunting, wildlife viewing, boating and hiking.** While a campground is not proposed at this time, local or county support could incorporate development of a campground site in the future.



- The Lost Grove Lake and Recreation Area project provided 60 to 75 jobs during the construction phase. Iowa State University Center for Agriculture and Rural Development (CARD) research indicates that a lake of this size that exhibits good water quality will annually provide over 350,000 visits, create approximately \$20 million in local spending and will result in supporting 175 jobs.
- Project activities include dam construction, shoreline stabilization, boating and shore access, fish habitat enhancement and site access roads. Prior land acquisition, watershed improvements, utility relocation, dam design and road modification funding expenditures have totaled \$4.495 million (Federal Sport Fish Restoration \$2.610M, DNR Fish and Wildlife Trust Fund \$1.00M, State Marine Fuel Tax Fund \$885,000).
- This project will provide a high quality recreational lake while at the same time providing immediate economic stimulus to the region and when completed will provide long-term economic benefits to the State of Iowa.
- Langman Construction, Inc. was awarded the Fish Habitat, Riprap, and Shoreline Access phase of the project. The bid was for \$1.17 million. Construction commenced the week of July 25 and was completed on October 7, 2011.
- J.B. Holland Construction was the lowest bidder (\$4,341,437) on the Lost Grove Lake dam construction project. The NRC approved the bid on June 10, 2010. Dam construction began in July 2010 and was completed summer 2012. Given Lost Grove Lake's small watershed to lake area ratio, the lake is expected to take 2-3 years to reach full pool.
- Scott County Secondary Roads designed two road culvert risers on Utica Ridge Road (see green dots on map). These risers will temporarily impound water to allow settling of sediment and nutrients, and thus, preserve the water quality of Lost Grove Lake. Arensdorf Excavating & Trucking, Inc., Anamosa, IA received the bid for \$90,089.84. The project was completed in December 2012.
- The boat ramp, parking lot, and pit-vault toilet construction phase of the project was bid in February 2013 and work on the \$920,000 project began in late July 2013. These items and below described work was completed by fall 2014.

- Main Boat Ramp (triple lane).
  - Ramp and parking lot have been graded.
  - The concrete for the ramp and parking lot has been completed.
  - The access road has been built and a portion has been graveled.
  - Armoring around the ramp as well as finish work remains.
  - Slippage of the main dam required rip rap and grouting of a 3' x 4' trench at base of ramp
- Middle Boat Ramp (double lane).
  - Ramp and parking lot have been graded.
  - Concrete forms are currently being installed.
  - The access trails to the boat slip and parallel fishing structure have been built.
- West Boat Ramp (single lane).
  - Crews are currently constructing the access road and grading the ramp.
  - Road culverts are being installed where drainage problems are likely.

The lake is re-filling and fish stocking is underway.

## **Lost Island Lake (Palo Alto County)**

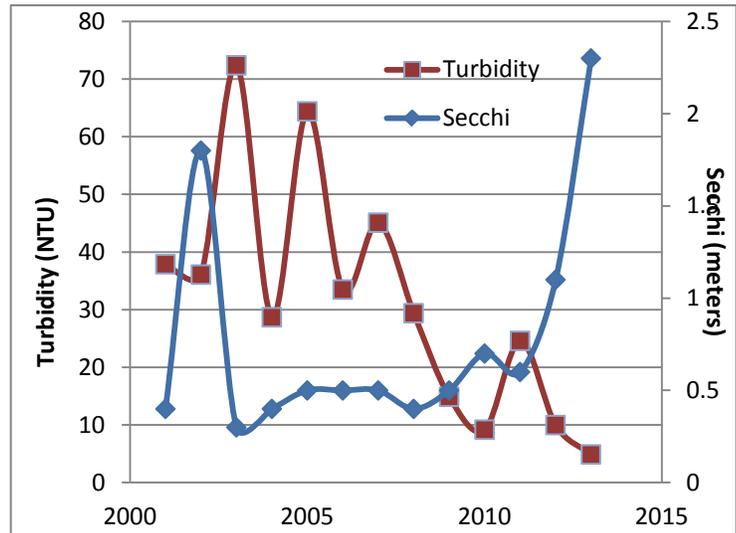
### **Lost Island Lake /Barringer Slough / Blue-wing Marsh Complex**

This is an aggressive and comprehensive plan to improve water quality in the > 2,200-acre complex, which includes the 1,162-acre lake. The plan includes reducing existing carp numbers, preventing remaining rough fish from entering most spawning areas, conducting beneficial drawdowns on associated wetland areas (780-acre Barringer Slough, 150-acre Blue-wing Marsh) and eliminating rough fish. Resulting germination of aquatic plants and consolidation of bottom sediments will restore proper wetland function and improve the water quality at Lost Island Lake.

- The project includes an innovative plan to allow for the removal of up to 75% of the exiting carp biomass, an aggressive stocking of predatory fish and new construction or rehabilitation of four water control structures and five fish barriers throughout the complex.
- During summer 2008, DNR-Fisheries used mark – recapture techniques to estimate in-lake carp numbers and biomass and initiated an intensive commercial fishing contract, which resulted in the harvesting of approximately 427,000 lbs. of carp and 353,000 lbs. of buffalo in 2010. The result has been a 90% reduction in population and 80% reduction in the biomass of rough fish.
- At present, a commercial hauler is aggressively removing rough fish from Lost Island Lake and the DNR is stocking large numbers of predatory fish into the system. Harvesting efforts will target of additional 34,000 lbs. of carp and 60,000 lbs. buffalo by spring 2012.
- DNR awarded Ducks Unlimited, Inc. a contract to design effective water control and fish barrier structures. The survey and design work began during summer/fall 2009. Local excitement regarding the project is high. Nearly 70 local stakeholders attended a December 2009 public meeting and voiced strong approval for the design work.
- The NRC approved Lake Restoration Funding toward the \$834,263 bid from Landwehr Construction, St. Cloud, MN for the project. The Watershed Improvement Review Board awarded the Palo Alto County Conservation Board \$180,000 to cover part of the cost (two water level control/fish barrier systems); construction began in the fall of 2010 and was completed summer of 2012. The \$1.3 million project is a partnership between the Iowa Department of Natural Resources, Palo Alto County, Ducks Unlimited, and the Lost Island Protective Association.
- Various basins within the complex have been dewatered to eliminate rough fish, create favorable conditions for re-vegetation. Weather permitting; all basins should be at full pool during fall 2013 thereby providing excellent habitat for wildlife species and much-improved recreational opportunities for Iowans. Some additional minor work will be completed at several of the structures to ensure the entire system works efficiently and there are still plans to install an electric fish barrier at the Barrier Marsh site.

- Over 1.27 million pounds of common carp and buffalo have been removed from Lost Island Lake since 2008 reducing the common carp density from nearly 400 lbs./acre to 66 lbs./acre. The lake has shown substantial increases in water quality and habitat.

***Water quality trends in Lost Island Lake. Water transparency (secchi) has increased and turbidity has decreased.***



The final infrastructure component of the Lost Island Lake restoration project (at Barrier Marsh) was completed fall 2013. An electric fish barrier was added to the water control structure that will prevent breeding common carp from reaching Blue-wing Marsh wetlands in the Lost Island Lake’s watershed while allowing debris to pass during high water events.



***Left: Constructed electric fish barrier in the Lost Island Lake watershed.***

The Barringer Slough and Blue Wing Marsh complexes did not fill completely this summer because of dry weather conditions. Smith Root Inc. has designed and engineered a fish barrier and construction is complete. This electric barrier, at a cost of \$234,720, is the final major component to be completed for the Lost Island Lake Restoration Project. Common carp population estimates continued in 2013. The common carp population continues to remain below the biomass target of 100 lbs./acre (66 lbs./acre). Water quality, habitat, and the sport fishery continue to respond.

## Mariposa Lake (Jasper County)

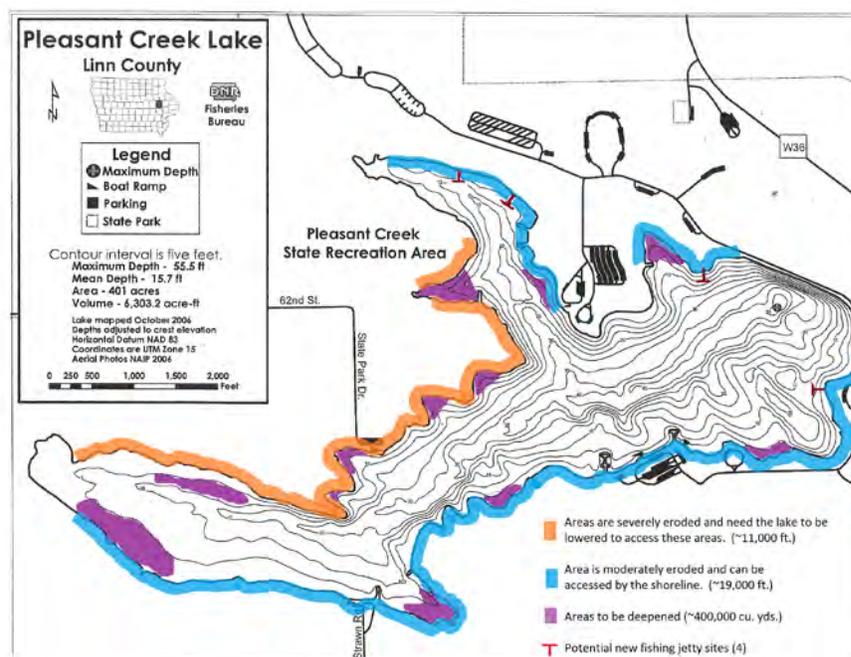
The Mariposa watershed project ran through June 2011. The NRCS completed a waterway project in spring 2009. The Jasper County Conservation Board has completed bank stabilization practices along approximately 900 ft. of shoreline using rock riprap and coconut fiber logs and has completed a 3-acre timberstand improvement project. An overgrown area over a gully was cleared to approximately 25% canopy cover to allow grasses to grow and seeded to native grasses and wildflowers. In addition, Jasper County Conservation installed a 3.9 acre wetland in 2012. The wetland will collect run off from 368 acres of watershed and it will benefit the in-lake water quality by filtering sediment & nutrients.

DNR and Jasper CCB held a couple of Technical Advisory Team meetings this spring to discuss the potential of renovating this small lake in Jasper County. Publicly owned Lakes funds from the Iowa Department of Agriculture and Land Stewardship were secured and we hope to see additional BMP's implemented in the watershed. The Jasper CCB Director developed a RFQ from qualified engineering firms to begin design work and cost estimates for park and in-lake improvements. Four firms provided proposals to the County, which are currently under review. Park and in-lake work is slated to begin in 2015.

## Pleasant Creek Lake (Linn County)

Pleasant Creek is a 401-acre lake owned by the State of Iowa with a watershed to lake ratio is 5:1. The State owns 90% of the 2,035-acre watershed. The other 10% is mainly in timber.

A meeting was held in October 2013 with DNR Parks, Lake Restoration and IDALS regarding developing a management approach and time line for the project. The plan is for DNR Fisheries and Parks to work cooperatively with IDALS in developing a watershed plan to address potential issues. From initial survey, there may be some opportunity to do some gully control structures on park property and review/update land management approaches on state ground. In-lake restoration will include shoreline riprap, shoreline deepening and fishing jetty development. Lake Restoration has funding in FY15-FY17 of their ten-year plan for lake and watershed improvements.



**Map highlighting critical regions of shoreline erosion and need for shoreline deepening**

The local power plant utility contributed financially to the acquisition of land for building Pleasant Creek dam and for dam construction. As part of the original financial contribution, they were granted the option to pump water from the lake to serve their power plant operation needs. Recently, the utility has approached the DNR indicating that they no longer have this water need and want to relinquish that right.

Pleasant Creek Dam has a crack around the valve housing and leaking water and the initially proposed fix to seal the pipe prior to turning complete rights of the dam to the DNR may not be acceptable to the DNR because it might limit our future ability to lower the lake for management/repair purposes. DNR Engineering will be investigating the problem further and DNR is in discussions with the utility company on how to resolve repair and transfer of control to the DNR.

DNR plans to accelerate Pleasant Creek Lake restoration plans due to the availability of marine fuel tax funds. Tentative plans are to start lowering the lake summer of 2015 to complete the archeological study, with construction starting late fall/winter of 2015.

### **Prairie Rose Lake (Shelby County)**

Prairie Rose Lake is a 173-acre constructed lake with a watershed to lake ratio of 24:1. Problems at the lake center on low fish populations, historic lake siltation and poor water quality. Lake improvements in past years included; jetties and fish structure (1998), sediment basin and shoreline riprap (2001) and sediment basins (2004). Shelby County SWCD conducted a watershed assessment followed by a joint Iowa Department of Agriculture and Land Stewardship / DNR Watershed Improvement Section grant to accomplish targeted soil conservation work in the watershed. The Shelby County Soil and Water Conservation District was awarded a \$510,611 Water Quality /Watershed Protection Project Grant in 2008. Through the Prairie Rose Water Quality Project, there was over 225,000 feet (40 mi.) of terraces, grassed waterways and nutrient management plans added to the watershed reducing sediment and nutrient delivery to the lake by 60%.



***2008 Water Quality/Watershed Protection Project led the way by reducing sediment and nutrient delivery to Prairie Rose.***

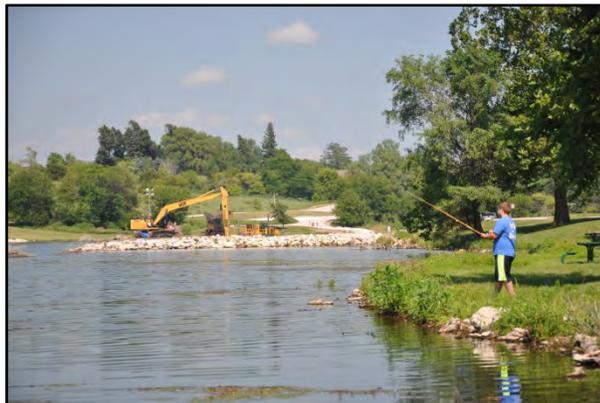
- DNR, in partnership with Pheasants Forever, acquired a 77-acre dredge spoil containment site in 2010, an important component to the in-lake restoration work.
- Rock chute wetlands and road risers were constructed on public land on the four main drainages of the lake during fall 2011/spring 2012.
- Prairie Rose Lake was dewatered in July 2011 to allow construction work to begin in the basin. Stabilizing the eroding shoreline and removal of 60,000 cubic yards of sediment was completed during the winter of 2011-12.
- The spillway modification to prevent rough fish re-entering the lake from below is now in place.
- Additional fish habitat and shoreline access has been added to the lake basin utilizing \$150,000 of DNR Trust Fund dollars.

- In September 2012, the gate was shut and Prairie Rose Lake began to re-fill following the treatment of the watershed to remove undesirable fish species (e.g. common carp). By June of 2013, the lake had refilled.
- Restocking Prairie Rose Lake began in April 2013 with largemouth bass, bluegill, and channel catfish were stocked. It will be another year before significant fishing gets started. The development of the fish population in the lake is on track. In addition to the largemouth bass, bluegill, and channel catfish populations already establish in the lake, 800 adult black crappie were stocked during the fall of 2014. Fishing activity at the lake is expected to ramp up starting next spring.
- Construction of the dredge spoil containment site was completed in 2014. This containment site is designed to hold 200,000 cubic yards of dredge spoil.



***Dredge spoil containment site constructed in 2014***

<b>Prairie Rose Restoration Plan</b>	<b>Cost</b>
Water Quality/Watershed Protection Grant	\$510,611
Containment site purchase	\$340,000
<b>Phase 1: drain lake July 11, 2011</b>	<b>2012 and 2013</b>
Two road risers and two wetland rock chutes	\$393,866
Spillway modification/M47 Structure/Gate Valve	\$185,242
Containment site construction	\$629,154
Mechanical dredging/Shoreline/Fish habitat	\$524,197
Fish renovation/archeological assessment	\$30,000
<b>Phase 2: 2014 / 2015</b>	<b>2014</b>
Hydraulic dredging (under contract)	\$1,480,000
Sediment pond construction (under contract)	\$110,000
<b>Prairie Rose Restoration 4 year total:</b>	<b>\$4,203,070</b>



***Prairie Rose Lake dredging started in 2014 and is now 45% complete. The remaining work will be completed in 2015.***

- The NRC accepted a donation of a permanent easement for storage of water for retention of silt adjacent to Prairie Rose State Park above the campground arm of the lake. The DNR accepted the low bid of \$109,966 to build a grade stabilization pond at this location. Construction is scheduled to start in spring 2015.
- The In-Lake Dredging project started moving sediment in mid-July. Contractor switched from a hydraulic dredge with a cutter head to a barge mounted excavator dumping into a slurry box because of the amount of terrestrial and aquatic vegetation. Approximately 185,000 CY of sediment is to be removed from Prairie Rose Lake. 45% of the project is complete.

### Rathbun Reservoir (Appanoose County)

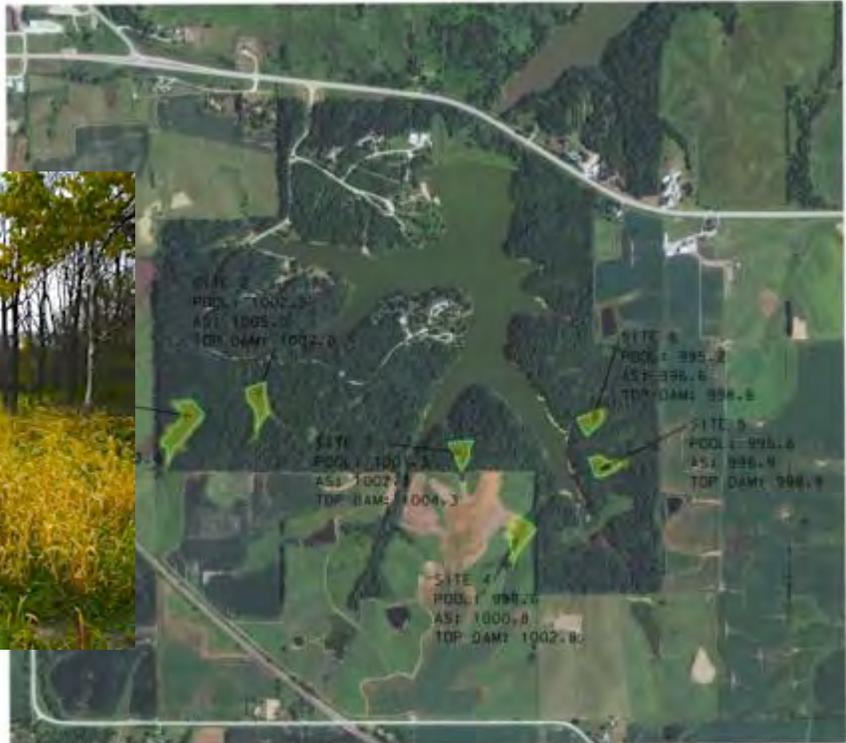
- Rathbun Land and Water has been successful in assisting 400 farmers with BMP application for priority land in 24 targeted sub-watersheds; they helped apply BMP on 16,500 acres (goal: 60,000 acres); these practices will reduce sediment delivery to Rathbun Lake by 25,600 tons per year (goal: 84,000 tons). In addition, these BMPs will reduce phosphorus delivery to Rathbun Lake by 110,400 pounds per year (goal: 360,000 pounds).
- The State and Army COE have been working on in-lake work to protect vital habitats and improve water quality in several bays on the lake by protecting shoreline. Stabilized shoreline loss will reduce erosion and improve water quality. The COE is constructing the Rathbun Lake Habitat Restoration Project under Section 1135 of the Water Resources Development Act (WRDA) of 1986. Cost-share (75% COE / 25% DNR).
- Phase 1 of the Rathbun Lake Section 1135 project addressed seven sites with rock quantities exceeding 45,000 tons. In addition to water quality improvements, fish habitat was improved for a number of important game fish species. Work was completed spring 2011.
- Phase 2 of the Rathbun Lake Section 1135 project addressed the Honey Creek Resort Point. Honey Creek is a 300 plus acre arm of Rathbun Lake and provides some of the highest quality crappie spawning habitat available in the lake. Protection of the Honey Creek Resort Point will provide water quality benefits that will translate into improved crappie habitat and production, and secondarily will preserve resort infrastructure from flood damage. Total rock quantities placed exceed 40,000 tons. Work was completed spring 2012. The final phase of the joint COE/DNR Section 1135 project restored an additional 500' of shoreline and was completed fall 2012.

<b>Rathbun Section 1135 Final Cost Share</b>			
<b>Total Project Cost</b>		\$6,512,000	
Federal Share (Cash)		\$4,884,000	
DNR Share		\$1,628,000	
DNR Share Breakdown:			
Cash			\$1,548,000
In-Kind South Fork Construction			\$26,000
In-Kind S-13 Wetland Design			\$25,000
In-Kind Lands for S-13			\$29,000

- A new Section 1135 start has been given by the U.S. Army Corps of Engineers. This new start will allow for the capture of additional funding on a 75% - 25% Federal / State basis for the construction of additional water quality improvements to Rathbun Lake. Of primary importance will be the continuation of shoreline ecosystem restoration, which will reduce shoreline erosion and improve water quality throughout the lake.

## Red Haw Lake (Lucas County)

- In 2001, a wetland and three sediment retention ponds were constructed within this watershed to improve and protect water quality.
- Recently IDALS performed a watershed assessment and identified priority gully areas. **The DNR initiated design for construction of six structures within the State park and repair of one private pond to control sediment and provide additional water quality benefits.** Construction of these sties was completed in the summer of 2014 at a cost of \$124,258.
- Fall 2014 rains filled all ponds to capacity and fish stockings, including largemouth bass and bluegill, were completed in the fall of followed in each of the six ponds.



## Storm Lake (Buena Vista County)

Storm Lake is a shallow natural lake (3rd largest natural lake in Iowa) with a surface acreage of 3,104 acres and a watershed to lake ratio of 5:1. The Diagnostic / Feasibility Study and the Impaired Water's Assessment both indicate that internal loading from re-suspension of bottom sediment is the primary source of nutrient availability and water turbidity, which supports dredging as a critical restoration approach to achieve desired improvement in water quality.

- DNR constructed a dredge spoil site at Storm Lake in 2001 and began dredging activities in 2001/2002. Lake dredging removed 1.32 million cu./yds. of sediment at a total project cost of approximately \$4.0 million during this first year of operation. Funding limitations restricted this initial dredging activity to 180-acres of the lake.
- The Lake Preservation Association (LPA) expressed a strong interest to continue dredging to achieve better water quality and from 2003 to 2013 has, along state partnership, dredged an additional 4,861,659 cubic yards of sediment. The City of Storm Lake leased the original DNR containment site and has since has constructed two containment sites east of Storm Lake.

### Funds contributed to the project (2001 – 2012)

State allocation	\$8,942,920
Federal Allocation	\$1,765,000

City of Storm Lake	\$1,378,995 (Annually contributes a portion of Hotel/Motel Tax)
City of Lakeside	\$110,477 (Annually contributes a portion of Local Option Sales Tax)
Buena Vista County	\$680,000
Private Pledges	\$1,385,964

**Funds contributed to the project (FY2013 – FY15 11/30/14)**

State allocation	\$1,626,558
Local cost-share	\$1,042,788

**Total (2001- FY15 11/30/14)                    \$16,932,702 (63% State, 27% Local, 10% Federal)**

**Economic Development – Storm Lake**

Lake restoration efforts encouraged a \$35 million economic development named “Project AWAYSIS” that created an estimated 690 new jobs and more than \$28 million in spending in Storm Lake and Buena Vista County. “Lake restoration work for Storm Lake and its watershed has been the inspiration for the community to come together and chart its destiny into the future. This community has traditionally had most of its economic base centered on agriculture. Because of lake restoration work, our people determined that we could diversify our economic base by increasing recreational opportunities at Storm Lake,” said Jon Kruse, mayor of Storm Lake.



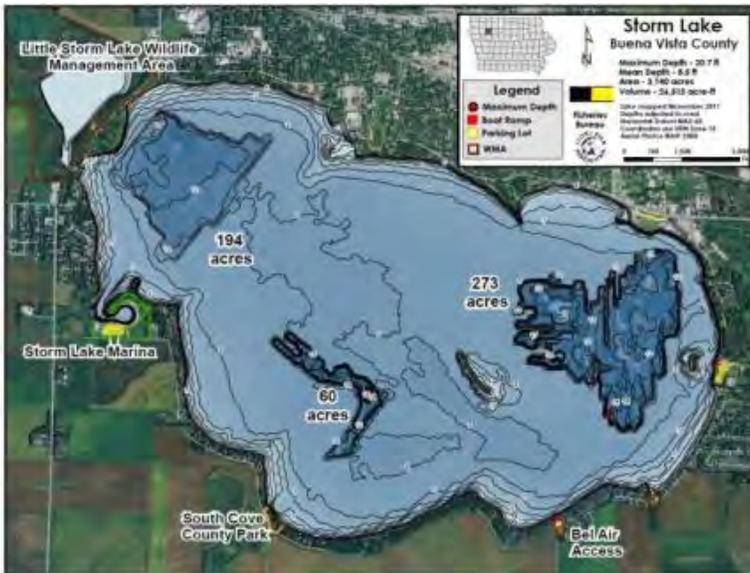
***A \$1 million project transformed Little Storm Lake into a working marsh that once again removes sediment and absorbs nutrients from Powell Creek before the water enters the lake.***

*Buntrock-Salie Photography, taken June 2012*

Joint (DNR/Local) Five-year Dredging Plan (FY13-FY17)

Storm Lake was mapped after the 2009 dredge season. At that point, the mean depth was 8.3 feet. Over the 2010-2011 dredge seasons, an additional 701 acre-feet was dredged, which increased the mean depth to 8.5 feet. From 2012-2014, an additional 490 acre-feet was dredged, which results in a current estimated mean depth of 8.7 feet. The current dredge containment capacity is approximately 2.5M CY (1,550 acre-feet). Given a 3,140-acre lake, we will have the capacity between both containment sites to add 0.5 feet to the mean depth, which will result in Storm Lake having 9.2 feet in mean depth.

<b>Year</b>	<b>Cubic Yards</b>
2002	1,320,000
2003	50,000
2004	699,112
2005	548,389
2006	573,225
2007	527,837
2008	244,450
2009	559,966
2010	579,673
2011	550,604
2012	281,448
2013	246,955
2014	261,895
<b>Totals</b>	<b>6,181,659</b>



**Storm Lake mapped November 2011**

### **ISU Storm Lake Dredging Analysis Study**

Iowa State University, under the direction of Dr. John Downing, completed a study aimed to determine which areas of Storm Lake and to what depths Storm Lake could be dredged in the immediate future to yield the most reduction in sediment resuspension. In addition, this project explored alternative management scenarios that may further improve water clarity in Storm Lake.

DNR fisheries and lake restoration staff met with the City of Storm Lake and Iowa State University in March 2013 to discuss preliminary findings from the ISU study. A meeting was also held in November 2013 to discuss the final findings of that study and a presentation was given by ISU. DNR, City of Storm Lake, and ISU staff were present at the meeting. The information gathered from this study will help to guide future dredging in order to get the most benefit for water quality. The goal is for the DNR and the City of Storm Lake to continue dredging at locations and to depths that will maximize our potential to reach our water quality goals within constraints of how much dredge spoil we can contain in existing containment sites.

#### **Key take-home points from ISU Storm Lake Dredging Analysis Study**

- 1) Current dredge only strategy will not be able to obtain water clarity goals unless stakeholders are willing to commit to dredging an additional 13.1 million cubic yards of sediment. At present, there is only storage capacity for 2.5 million cubic yards of sediment removal.
- 2) Dredging a larger surface area by removing less sediment in each location produce greater water clarity gains than dredging to deeper depths in a limited footprint.
- 4) Allowing degradation of the “big island” will have negative impacts to water quality.
- 5) If able to be successful in protecting existing islands, establishing islands independent of dredging may be a useful strategy to improve water clarity in Storm Lake.

DNR and the City of Storm Lake, based on information provided by the ISU study, are dredging at a (quantity, location, depth) that will maximize our potential to reach our water quality goals within constraints of how much dredge spoil we can contain. In addition, the DNR is moving forward with recommendation #4 and re-establishing existing islands back to at least their 1974 as-built condition. DNR fisheries has worked with DNR engineers to conduct preliminary surveys of the big island in Storm Lake and the plan is for 2015 construction.

DNR fisheries staff also met with Lake Restoration and city officials to discuss other alternatives for improving water quality and decreasing sediment mobility in Storm Lake. Specifically, to look for ways to

settle out suspended sediment; look for ways to stabilize sediment at the bottom of the lake once settled out; and look for ways to build islands w/ in-situ materials, possibly as a function of dredging.

## **Twelve Mile Lake (Union County)**

Twelve Mile Lake is a 595 acre lake with a 17 ft. mean depth and 42 ft. max depth. This multi-use resource (Wildlife Management Area) has a 14,080 acre watershed and 24:1 acre watershed to lake ratio. During its peak in the late 90's Twelve Mile held nearly 30 fishing tournaments per year. By 2004, that number dropped to two. There were problems with common carp, decrease in water quality and drinking water required additional treatment.

Work began in 2005 to address improve water quality. Work included shoreline protection, terraces, buffers and sediment structures placed in the watershed. DNR renovated the fishery and re-stocked the lake. Twelve Mile still has above average water quality compared to other IA lakes. Rooted vegetation has re-established in some areas with a recent trend is stable water quality. Twelve Mile continues to be in the top 1/3 in visitation. Over 50% of the anglers recently fishing 12-Mile are from > 50 miles away (twice what we normally see). Tournaments once again are scheduled throughout the open water season.

- A 40-acre wetland was constructed on the north end of 12-Mile Creek Lake in 2014 to retain nutrients and sediment. The project was delayed several times in 2014 due to record summer rainfall in southern Iowa.
- Lake Restoration Program and DNR Wildlife funds were used to help survey the 12-mile Creek Lake watershed and implement three grade control structures in the watershed. The wetland was constructed at a cost of \$447,291 (\$297,291 Lake Restoration / \$75,000 NAWCA / \$75,000 State Duck Stamp).
- 12-Mile Creek Lake has developed into a popular fishery since renovation. There are good numbers of 14-16 inch largemouth bass, and a few bass exceed 16 inches. Bluegills up to 10 inches are available to anglers at 12-Mile Creek Lake as well as moderate numbers of yellow perch and crappies in the 9-11 inch length range.



***New 40-acre wetland structure above 12-Mile Creek Lake.***

The wetland will further protect this valuable resource and add additional recreational opportunities for our constituents. Located at the upper end of permanent pool, the wetland is expected to remove and store sediment/nutrients in runoff and compliments continued work in the watershed, which is important to the goal to improve/maintain water quality for the main lake.

## **Union Grove Lake (Tama County)**

Union Grove is a 105-acre shallow constructed lake owned by the State of Iowa, with a watershed to lake area ratio of 63/1. It has 6,640 acres in the watershed with the vast majority is in private ownership. In the late 1980s, the state dredged the lake and installed an in-lake silt and nutrient dike on the north end of the lake. The DNR purchased an additional 60-acre parcel on the southwest side of the park and constructed a 10-acre pond. Union Grove Lake was last dredged from 1988 - 1990. Dredging from Union Grove Lake involved removal of 275,000 cubic yards of sediment accumulated since the lake was built in 1936.

Spillway water seepage had been an on-going problem at Union Grove Lake and past attempts to repair the problem had limited success. DNR hired a geo-tech firm in 2005 to evaluate the problem and contracted a firm in 2006 to repair the structure. The DNR completed the project in July of 2007 and successfully addressed the water seepage issue. Total project cost for the spillway repair was \$178,572, with the Lake Restoration Program as the funding source. The construction firm also made several recommendations for additional future spillway modifications that will preserve the integrity of the system at an estimated cost of \$40,000.

Union Grove Lake is on the Iowa's impaired waters list because of four limitations: pH, bacteria, algae, and turbidity. The Union Grove Lake Watershed Project has been underway since April of 2008. The project aims to reduce the soil and phosphorus reaching the lake, as well as reduce the effects of livestock on streams in the watershed.

As progress continued in the watershed, a 116-acre parcel at the top of the lake went to auction. This strategically important piece of land that filters 40 percent of the watershed was purchased by the Iowa Natural Heritage Foundation and held until the DNR's watershed improvement section, using EPA section 319 funds, and local supporters could purchase the \$695,000 parcel. This acquisition will be seeded with perennial prairie grasses and an existing wetland will be expanded providing permanent water quality protection for the lake.

Local partners, with the DNR have updated the plan to improve the lake and water quality conditions. The Tama SWCD Watershed Project Coordinator worked to revise and approve the Management Plan. In addition, the Tama County Sanitarian completed a report on a septic plan for the lake community.

DNR Lake Restoration has started working with our engineers on initial survey and planning and anticipate implementing shoreline stabilization, renovation of the fishery, modification of the spillway, habitat improvement and dredging from 2015-2017. The lake will be drawn down, fish eliminated to get rid of carp and yellow bass, and the lake outlet will be modified to prevent rough fish from reentering the lake. An improved Union Grove Lake when paired with the renovated state park will likely see increased visits and use of the area.

The renovated campground features a new shower house and bathroom, nine campsites with electricity, water and sewer connections and two campsites with electricity among the 25 campsites available. The \$400,000 campground renovation project was completed in 2012. Part of the renovation included adding a new four season modern family cabin with air conditioning. DNR completed final designs for the dredging locations and for the containment structures. Construction of the containment site will be next spring and dredging operation to start fall on 2015. The proposed lake restoration options were presented at the annual homeowner's association meeting in September 2014.

## **Lake Restoration Program (LRP) – Projects in Maintenance and Evaluation/Planning Stage**

### **Green Valley Lake (Union County)**

Green Valley Lake is a 390 acre lake constructed in 1950. It has a watershed to lake ratio of 11:1. The DNR implemented a limited lake restoration project through the State and U.S. EPA's Clean Lakes Program in the mid 1980s, however additional watershed and in-lake work was needed. Project partners initiated current restoration efforts at Green Valley Lake in 2006.

The local district soil group and NRCS completed a watershed assessment and developed a four-year plan to make needed watershed improvements. Cost share funding allowed local landowners to accomplish soil and water quality improvement projects on their property. Iowa State University completed a Diagnostic Feasibility study in 2008 and presented a variety of restoration alternatives (i.e. spillway modification, fish restoration and dredging of coves) for consideration. A technical workgroup that included DNR staff, NRCS and SWCD staff, the City of Creston, Southern Iowa Rural Water, Green Valley Chemical and CIPCO coordinated project activities.

DNR Parks has worked in parallel with lake improvements efforts to complete a facelift to the park. Including, adding full hook-up sites, removing a number of campsites to increase the size of each site, redesigning all the camping pads, a new electrical system upgrading from 30 amps to 50 amps, each site will have a new picnic tables and fire grills and a new shower building was installed. DNR Parks added new pit latrines at the campground, the cabins and the north picnic area and built a third camping cabin. Green Valley also has a new playground that was donated in part by the family of Greg Haley, who was the park manager when he passed away in January 2009, and built by volunteers. In addition, the park was connected to the City of Creston by a paved bike trail in 2009 that allows park visitors easy access to the amenities in town.

- The local NRCS District Conservationist has implemented a four-year, \$409,000, watershed improvement plan and completed approved soil and water quality improvement projects.
- Recent fish population estimates had supported the presence of high numbers of yellow bass and common carp, species both considered detrimental to sport fish populations, with common carp having the additional negative impact of contributing to poor water quality conditions. The DNR renovated the fishery in September 2008 and has since restocked the lake with bluegill, largemouth bass, channel catfish, crappie and walleye.
- The concrete spillway had starting to develop some structural problems and its design allowed common carp to enter the lake during high outflow periods. Iowa Bridge & Culvert LC completed a redesigned spillway in May 2009 at a cost of \$510,435. DNR awarded a \$348,767 contract to CL Carroll Company Inc. for in-lake fish habitat and protecting of the existing shoreline. Fish Habitat Stamp funds in cooperation with Federal Dingell-Johnson, Marine Fuel Tax and Lake Restoration Program funds paid for this aspect of the project.
- The Natural Resource Commission approved the acquisition of a parcel of land with LRP funding. The land is located 2.5 miles north of Creston, and adjacent to the northeast corner of Green Valley State Park. The Betty E. Gater Estate offered this 67.58-acre parcel for \$338,000. This site is serving as a storage area for sediments removed from the Green Valley Lake during the lake restoration process and will be re-shaped and seeded down spring 2012.
- Taylor Construction & Excavation signed a contract in the fall of 2009 for removal of approximately 250,000 yards of sediment targeted from both existing sediment retention basins and in-lake areas. In addition, a new sediment dike was installed at a location below an area identified in the diagnostic study as a subwatershed area contributing significant sediment and nutrient loading and critical areas of shoreline were stabilized.

- The campground at Green Valley State Park opened in 2013 after being closed for nearly two years for renovations. The campground features full hook-up sites, each site has been enlarged and camping pads redesigned, a new electrical system now provides up to 50 amp service, and a new picnic table and fire grill at each site. The campground has a new shower building and pit latrines were added at the campground, the cabins and the north picnic area.
- Green Valley fishery and water quality looks very good. The fishery has an unusual number of “keeper” sized fish of all species including >9” Bluegill, >10” Crappie, Bass up to 18”, good Channel Catfish and Walleye up to 20”.
- DNR Engineering is in process of raising the west silt dike to maximize sediment trapping efficiency. Estimated cost is \$140,000.

Green Valley fishery and water quality looks very good. There is a lot of rooted vegetation of many species all around the lake. Most is confined to poor shoreline access areas and should not be a major problem in the future. The fishery has an unusual number of “keeper” sized fish of all species. The public should enjoy it for several years.

### **Kent Park Lake (Johnson County)**

A planning meeting is scheduled for early next year to develop a project plan and get a watershed assessment schedules.

### **Lacey Keosauqua State Park Lake (Van Buren County)**

Lake Restoration, Fisheries, and IDALS staff met in the summer of 2014 to discuss watershed improvement in the Lacey Keosauqua watershed. Previous efforts have identified watershed issues, primarily gullies and their associated head cuts, as the primary threats to Lacey Keosauqua water quality. Lake Restoration and IDALS are working jointly to develop a watershed assessment to quantify watershed issues so that a plan may be developed to best treat these issues. Lacey Keosauqua has a small watershed of just 724 acres, most of which is under state ownership, which may simplify future efforts to improve water quality and recreational opportunities.

### **Lake of the Hills (Scott County)**

Lake of the Hills (LOH) is located in Davenport, Iowa. The main basin of the lake is 54 acres with an approximately 2,000-acre watershed. LOH is the largest lake in a complex of four (Bluegrass Lake, Railroad Lake, and Lambach Lake) that make up the West Lakes. The other three lakes serve as sediment retention ponds but offer recreational fishing.

Lake of the Hills is often listed on the 319 list for algal turbidity or bacteria and has both gizzard shad and grass carp. There is also a private lake, Lake Canyada that adjoins the complex and suffers from poor water quality. There has been strong interest from the partnering agencies to develop a plan for lake restoration and a great deal of progress has been made on initiating this effort. For example, the Scott CCB entered into an agreement with Pathfinders Resource Conservation and Development to assist in the development of a watershed management plan and grant writing. NRCS has even begun to contact landowners about the possibility of implementing projects to reduce sediment delivery. There is potential for work (e.g., rain gardens, fertilizer application) in housing developments adjacent to the lake complex as well.

Lake of the Hills is an additional project where Lake Restoration has had a role in the Lake Darling Mgmt. District. Most of the work done at Lake of the Hills has been planning and developing partnerships (e.g., with IDALS, NRCS, CCB, SWCD). A shoreline assessment was also completed on both Lake of the Hills and Railroad Lake; this assessment was aimed at determining the need for riprap protection in shoreline

areas subject to erosion. Meeting discussions have centered on the possible watershed practices that could be implemented to help improve lake water quality. Lake of the Hills has been listed as impaired for either algae or bacteria in the recent past. Lake of the Hills is the largest lake in the West Lake Complex of lakes (which consists of Bluegrass Lake, Railroad Lake, Lambach Lake, and Lake of the Hills). Bluegrass, Railroad, and Lambach Lakes all serve as sediment retention basins for Lake of the Hills. Bluegrass Lake has nearly filled with sediment; in fact, it is more indicative of marsh habitat as opposed to lake habitat now. Railroad Lake has also begun to fill in (especially at the upper end). It often has poor water clarity because flocculent sediments are constantly being resuspended via wind and wave action. Lambach Lake has also been subject to some sedimentation, but less so than its sister lakes. DNR would envision that sediment removal will be needed to regain holding capacity and deepen shoreline areas complex-wide. Numerous sediment retention ponds and/or silt traps will be need to be constructed in erodible gullies. The West Lake System is also infested with gizzard shad and common carp; thus, the long-term plan would include renovating the fishery. The Scott CCB has collaborated with Pathfinders RCD in order to develop a Watershed Assessment Report. Writing of this document is currently ongoing.

### **Lake Keomah (Mahaska County)**

- DNR held a public meeting in fall of 2009 to gauge local support for restoration activities at Lake Keomah. The Mahaska County Soil and Water Conservation District applied for, but did not receive, a watershed assessment grant to evaluate the status of sheet and rill and gully erosion within the watershed in 2008. They completed a sheet and rill assessment in 1991; however, it did not include any assessment in the State Park or in Keomah Village.
- Current activities center on the creation of a “Friends” group for the State Park, laying the groundwork for local support and participation in future restoration activities.
- DNR Watershed Improvement Section completed a Water Quality Improvement Plan in 2012 to address non-support of designated recreational use due to impairment issues of algae and pH.
- DNR Lake Restoration Program has identified Lake Keomah as one of our 35 priority lakes for restoration. Currently, Lake Restoration and other Fisheries Bureau staff are communicating with the Mahaska Soil and Water Conservation District to in an effort to perform a watershed assessment of sheet, rill, and gully erosion on private and state-owned property comprising the Lake Keomah watershed.

Lake Keomah is one of the high priority lakes for restoration, identified by the Iowa Lakes Study. Lake Restoration, IDALS, and Rathbun Fish Management met on-site in 2014 to discuss steps for lake restoration at this 79 acre impoundment. An initial list of objectives was completed. IDALS will approach the Mahaska Soil and Water Conservation District, to determine interest in completing an updated watershed assessment. Lake Restoration will fund the study. The last assessment was completed in 1991. Miami TMDL’s for sedimentation and nutrient impairments have been completed, but underlying causes have not been addressed since construction of one large basin on the western arm in 1996.

Potential restoration activities discussed included: dredge removal of 100,000 cubic yards of sediment, improvement of upper boat ramp, improvement of trail on Keomah Village side on the DNR setback, with improved marking of DNR access to the Keomah Village road, in conjunction with parking improvements for jetty access on the eastern side of the lake, construction of fishing jetties on the western side of the east arm, improved access from trains for the western arm of the lake, fish habitat improvements, timber clearing on and near the dam, construction of basins and other BMP’s as indicated by the watershed assessment. Potential funding sources include POL and Lake Restoration. Funding through 319 is problematic due to limited availability and funding cycles, removal of grass carp with low-dosage rotenone treatment and increased pool elevation of the large eastern basin on State property. The overall project is anticipated to cost between \$1 and \$1.5 million.

## Little River Lake (Decatur County)

Little River Lake was created in 1985 as a multipurpose PL-566 structure to reduce flood damage, provide drinking water for the City of Leon and Decatur City, provide an established fishery, and to provide recreational opportunities for Decatur County and neighboring areas. Little River Lake is a 788-acre lake with a 17:1 watershed to lake ratio. For the first 15 years, the lake produced tremendous quantities of quality fish. However, common carp, an inadequately protected watershed, and unprotected shoreline problems have reduced water clarity, suppressed sport-fish abundance and growth, recreation opportunities, and increased water treatment costs. The lake had no shoreline protection in place at its initial impoundment construction. Shoreline erosion, silt loading, and a common carp population have all adversely affected water clarity. Fish quality and angling activity have steadily declined since 2000 to a point where the lake offered few sport-fish or angling opportunities today.

The Decatur County Soil District and the NRCS have completed a watershed assessment and have developed a four-year plan to make needed watershed improvements. Cost share funding was made available for local landowners to accomplish soil and water quality improvement projects on their property.

- Decatur County, Southern Iowa Rural Water Association, Decatur County Conservation Board, Decatur County Soil and Water Conservation District, the City of Leon, and the Iowa Department of Natural Resources began planning water quality improvement efforts in 2008. Since that time, the group has met to plan and implement water quality improvement practices for the watershed.
- The Decatur County Soil & Water Conservation District and NRCS personnel assessed the watershed's problems, quantified soil erosion, and identified best management practices, (BMPs). The Watershed Improvement Review Board (WIRB) awarded the Decatur SWCD a \$423,900 grant to cost-share improvement costs with landowners. The group also received a letter of support from the DNR Lake Restoration Program to consider Little River Lake for future funding for in-lake improvement projects. Pending adequate implementation of watershed soil conservation practices, Lake Restoration funding will address in-lake improvements such as shoreline stabilization, rough fish management and silt basin improvements.
- The restoration process during 2011 involved implementation of remaining targeted watershed practices with available WIRB funding. Re-assessment of the watershed will guide planners to any remaining areas of the watershed to address before potential work in-lake.
- The local NRCS District Conservationist has implemented \$384,419 of WIRB funding, \$214,359 of EQIP funds, \$192,471 of Public Owned Lakes funding, \$100,865 of State cost share funding, \$14,793 REAP funding, and \$316,439 of landowner commitments totaling \$1.2 million to improve the watershed and complete approved soil and water quality improvement projects. To-date less than \$20,000 of WIRB funding remains available. Landowners in the watershed receive bonus points when competing for countywide funding from the Soil District and NRCS.
- Recent fish population estimates had indicated a dense common carp population. Their feeding for bottom organisms suspends fine clay sediments causing poor water clarity. The DNR renovated the fishery in October 2011 and in 2012 restocked the lake with walleye, largemouth bass, bluegills, crappies, and channel catfish. Fish population surveys conducted during 2012 has found excellent growth and survival of all stocked species.
- The elevation of the dike and outflow chute of the wetland above Little River Lake was raised two feet to allow additional storage capacity. The additional area is expected to restore wetland's sediment and nutrient trapping efficiency. Expansion of the wetland area above Little River Lake (completed spring 2012 at a cost of \$207,340 paid for by Lake Restoration) doubled the area, improved sediment trapping capabilities above the lake and allowed for water level management of the wetland.
- In 2011, the DNR awarded a \$1.1 million contract to TK Concrete of Pella for shoreline deepening, shoreline stabilization, and in-lake fish habitat. The Lake Restoration Program funds paid for \$880,000 million for shoreline improvements and Fish Habitat Stamp funds in cooperation with Federal Dingell-Johnson, Marine Fuel Tax funds paid for \$220,000 in fish habitat improvements.

Construction was complete spring 2013, the DNR renovated the fishery and re-stocked gamefish, and the lake has now re-filled.



***Shoreline stabilization of regions with significant erosion***

This level of clarity has not been seen since the lake's initial impoundment in the late 1980's. ***Post restoration water clarity measurements at Little River Lake routinely exceed 36 inches and have been over 80 inches.*** The largemouth bass population has a very strong 2012 year class. Night electro-fishing catches can easily exceed 1000 per hour. Growth for bass increased from that found in 2012 and all sizes have good body condition. Bluegills of all sizes are present ranging from 1 inch to 8.5 inches with a lot above 7.0 inches. It produced a moderated size fish for the 2012/2013 ice fishing season and following spring. The 2012 walleye stocking survived well. Night fall electro-fishing catches were 125 per hour. None of the 2013 stocked fry or 2-inch fingerlings were found.

Little River has water clarity of over 10 feet at times. This level of clarity has not been seen since the lake's initial impoundment in the late 1980's. The largemouth bass population has a very strong 2012 year class. Night electro-fishing catches can easily exceed 1000 per hour. Growth increased from that found in 2012. All sizes have good body condition. Bluegills of all sizes are present ranging from 1 inch to 8.5 inches with a lot above 7.0 inches. It should produce a moderate size fish for the ice fishing season and be a little better by late spring. The 2012 walleye stocking survived well. Night-fall electro-fishing catches were 125 per hour. None of the 2013 stocked fry or 2-inch fingerlings were found. The CCF sampled range from 18 to 25 inches. No problems have been found.

Little River Lake is becoming a popular destination for walleye anglers. Good numbers of 13-15.5 inch walleye were captured during electrofishing surveys in 2014. The future of walleye angling at Little River Lake looks bright as 133 age-0 walleye/ hour were captured during fall night electrofishing in 2014. Spring electrofishing also indicated good numbers of largemouth bass in the 9.5-11.5 inch length range and a few bass over 15 inches.

### **Little Wall Lake (Hamilton County)**

A DNR working group met multiple times in 2014 with a local group on concerns with lake levels and future lake management. The group is looking into future management of the past used lake dredging project containment site, low dose rotenone treatment to remove grass carp and yellow bass, alternate water sources for lake level enhancement on dry years, and improved public access facilities and opportunities.

## Lizard Lake (Pocahontas County)

Lizard Lake was a highly degraded 285-acre shallow natural lake. Rough fish (buffalo, bullhead and carp) dominated the lake population. The lake contained limited aquatic vegetation and exhibited poor water quality. A local lake group has promoted lake restoration and they continue to meet with DNR staff to discuss their concerns. In June 2006, IDALS and the local Soil and Water Conservation District awarded a Development Grant to evaluate the watershed of Lizard Lake. The Iowa State University Limnology Laboratory conducted a Diagnostic Feasibility study for Lizard Lake. This 2008 study, completed by Dr. John Downing, states that Lizard Lake is one of the most eutrophic lakes studied in Iowa. As part of potential restoration alternatives, ISU presented "shallow lakes management" as an option for improving the lake's water quality, fish population structure and wildlife potential. During 2008 and 2009, DNR staff has met several times with local partners and stakeholders to discuss shallow lake management options for Lizard Lake. Many stakeholders recognized the benefits of shallow lake management and expressed a preference for that type of management. Other stakeholders, while preferring dredging, realize that high dredging costs make that option unattainable and therefore support shallow lake management. Other stakeholders preferred to continue supporting dredging as the only alternative.

With strong support from most local constituents, the DNR hired Ducks Unlimited to conduct survey work during winter 2009 and plans to construct a water control structure and fish barrier. Construction of a new water control structure, fish barrier, and improved draw down channels was completed in 2011. DNR drained the lake to eliminate high populations of common carp and other problems fish, allow for the consolidation of loose bottom sediments, and promote the growth of aquatic plants. These plants will help keep water in the lake clean by holding down bottom sediments, reducing wave energy, using up nutrients otherwise available for growing algae, and provide habitat for the small invertebrates that eat algae. Aquatic plants will also provide excellent habitat for sport fish and a multitude of game and nongame wildlife species that depend on clean-water lakes for survival.

- Lizard Lake was drawn down during the winter/spring of 2011 as planned. The draw-down went very well and the wildlife biologist was able to achieve a complete draw down. Cooperating weather conditions allowed vegetation to flourish in the exposed lakebed.
- Construction activities on and around Lizard Lake were completed as planned. A new outlet and water control structure was installed to replace the antiquated one. A private firm was contracted to survey the outlet structure to assure local citizens that the new outlet structure was installed at the same elevation as the old one.
- A velocity tube fish barrier was installed just downstream of the outlet structure at Lizard Lake. This fish barrier is the first of its kind as it allows debris to flow through the structure, but does not allow fish to pass through it because it is installed at a steep enough grade.

In 2012, Lizard Lake went through its second year of a draw-down since the project's inception. Good stands of perennial emergent vegetation were established. We attempted to hold three feet of water in the basin throughout the summer and then bring the lake up to crest by fall. The drought kept us from achieving that goal. DNR did attempt to stock yellow perch into the lake when there was several feet of water; however, the lake basin dried up after they were stocked.

Although we were not able to hold water in the lake, it was there long enough to inhibit emergent plant growth in the deeper portions of the lake, which created open pockets of water. DNR fisheries staff met with the Pocahontas CCB in March 2013 to discuss plans for Lizard Lake for the 2013 season. 50,000 yellow perch were stocked into Lizard Lake in July. Many locals were present for the stocking and a good article on the stocking was published in the local paper. All of the stop logs are currently in place to hold as much water as possible going into the 2014 season. Also in 2013, the DNR acquired 120 acres of land in the watershed of Lizard Lake. This land will be protected in perpetuity and help to improve water quality in Lizard Lake. The land also provides more shoreline access for the public and connects two existing pieces of public property.

***Fifty thousand little yellow perch, all about 1.5 inches in length, were stocked in Lizard Lake on July 2<sup>nd</sup> 2013. They should grow rapidly and be a perfect prize for anglers next winter. Northern pike will be stocked in 2014.***

DNR fisheries staff has been monitoring water levels at Lizard Lake and have assisted with stocking adult perch and fertilized perch eggs. Northern pike were also stocked in June of 2014. DNR fisheries staff has worked with the local press to publish articles related to fish stocking and progress at Lizard Lake throughout the year.

**Land Acquisition (MFT, REAP, Fish Habitat Stamp, Wildlife Habitat Stamp)**

Approximately 110 acres of land on the north side of Lizard Lake was purchased by the Iowa DNR. Funds from MFT, Reap, fish habitat stamp, and wildlife habitat stamp were used to buy the property. The majority of the property lies within the watershed of Lizard Lake and connects the public property on the west and east sides of the lake. The land will be planted to native grasses and forbs and any restorable wetlands will be re-established, which will improve the water quality in Lizard Lake and protect that part of the watershed in perpetuity.

**Meadow Lake (Adair County)**

Meadow Lake is a 34-acre public owned lake located six miles north of Greenfield in Adair County. Constructed in 1963, the lake sits within a larger 320-acre fish and wildlife area owned and managed by the Iowa Department of Natural Resources to provide fishing, hunting, and other outdoor recreation activities for the public. Overall, Meadow Lake has provided good fishing for largemouth bass, bluegill, crappie, and channel catfish for over 40 years. The DNR listed Meadow Lake as impaired water in 2004 for algae and added impairment for turbidity in 2008. The presence of aesthetically objectionable blooms of algae and poor water transparency impair the primary contact recreational uses at the lake.

- DNR Lake Restoration and the Watershed Improvement Section, with design from NRCS, constructed an in-lake structure in the spring of 2010 at Meadow Lake to achieve sediment and phosphorous reduction from 236 acres of the watershed. In addition, two wetlands were constructed above Meadow Lake in 2010. The larger of the two wetlands is 14 surface acres. Removing Meadow Lake from the impaired waters list is the ultimate goal of the project.
- The effect of grass carp on aquatic vegetation by installing exclusion fencing was monitored in 2014. Grass carp removal is ongoing.



***Meadow Lake exclusion fence demonstrates the effects of grass carp.***

**Rock Creek Lake (Jasper County)**

Rock Creek Lake is a 491-acre lake constructed in 1952. The lake has a watershed to lake ratio of 54/1. Iowa State University, in a 2000 Diagnostic/Feasibility Study, indicated that over the last 50 years the lake has lost almost 40% of its lake water volume and 102 lake surface acres. Local efforts have

accomplished some work in the watershed; however, local and state partners need a renewed effort to move this project forward. Continued watershed improvement projects have been a difficult “sell” to area landowners.

A fall 2008 technical work group meeting resulted in an outlined approach to meet the necessary reductions in sediment and nutrient delivery to Rock Creek Lake. It focused on dividing the total watershed into larger sub-watershed segments, and then designing larger watershed structures that will require a higher government percentage contribution to put these water quality improvement practices in place. Several landowners had expressed interest in this concept; however, due to the inability to implement projects on private ground, the involved agencies did not grant the requested Watershed Project extension and the project contract expired December 31, 2009.

- During fiscal year 2009, landowners completed some small practices such as waterways and small basins in the Rock Creek Watershed as part of the funded Watershed Project. Implementation of these practices resulted in a sediment reduction of 1,439 tons/year and 750 acres protected from June 2008 to September 30, 2009.
- Work on the Rock Creek Watershed Project at this time is limited to five grade stabilization structures in the state park. The project coordinator had selected sites for the placement of three ponds and two large dry basins to address critical areas of gully erosion. The construction of these structures is completed. The IDNR is in the process of stocking three of the ponds.
- This challenging watershed will require other innovative concepts to significantly reduce sediments and nutrients from reaching Rock Creek Lake and to eventually allow us to move forward with the D/F studies lake restoration measures.

### **Silver Lake (Palo Alto)**

The Silver Lake Protective Association was successful in 2012 at acquiring local grant money to pursue survey, design, and engineering of a fish barrier on the existing outlet structure and determining the feasibility of using the existing drawdown structure. That project is complete and a set of drawings and hydraulic analysis were completed this spring.

In August 2013, the lake association met with Fisheries, Wildlife, and Lake Restoration staff. The meeting provided the association with a framework for moving towards a restoration project. An ongoing diagnostic and feasibility study of Silver Lake and its watershed was initiated in 2014 and is being conducted by Iowa State University. The Silver Lake Improvement and Protection Association is providing \$22,000 during each of the two years of the study. Iowa State University hosted a public meeting in Ayrshire in July 2014 to discuss the preliminary and anticipated results of the study.

### **Swan Lake (Carroll County)**

DNR fisheries staff has been working closely with the Carroll CCB in efforts to re-establish emergent vegetation around the perimeter of Swan Lake. Siphoning and pumping efforts have taken the lake 4 feet below the crest of the spillway, which was the goal of the draw down project. There was a vegetative response to the draw down. As expected, it was mostly annuals. The draw-down occurred throughout the 2013 season in order to establish a good stand of perennial vegetation, such as bulrush and cattails.

DNR monitored Swan Lake throughout the summer of 2013 and observed a very good vegetative response of annual species, such as smartweed and yellow nut sedge. DNR also found bulrush and some cattail in several areas. In addition, we attempted an experimental removal of grass carp with a commercial angler using trammel nets. Through our efforts were removed 40 grass carp from Swan Lake. Three hundred grass carp were originally stocked in Swan Lake since the renovation in 2004 and

none have been stocked since. Due to the success of removing grass carp, we are planning to attempt another removal effort through the ice when the grass carp cannot jump the nets. The Carroll CCB is paying for the services of the commercial angler. Although we have winter aeration there, we are still going to bring some water back into the lake via well/pipeline. The Carroll CCB is also paying for the cost of pumping in water and running aeration.

#### *Wetland Restoration*

The Carroll County Conservation Board was awarded a WIRB grant to construct a 4-acre wetland in the watershed of Swan Lake. Part of the matching funds, which are required for a WIRB grant, were promised by the NRCS, but they backed out at the last minute. DNR fisheries staff worked with the Carroll CCB and Lake Restoration to keep the project on track despite the setback. Lake restoration staff provided \$7,000, which is what was needed to cover what was promised by the NRCS. The Carroll County Conservation Board completed the four-acre wetland in the watershed of Swan Lake in 2014. The wetland is an instrumental part of our Swan Lake Watershed Management Plan and its construction will be critical to improving water quality by reducing the amount of sediment/phosphorus that enters the lake from the watershed.

#### *Water Level Management*

Swan Lake was partially drawn down in 2012 and 2013 in an effort to establish vegetation around the perimeter of the lake and improve water quality. The draw down was achieved using a pump purchased by the Lake Restoration program and Carroll CCB dollars paying for the fuel and oil. The lake was allowed to refill in 2014 and emergent aquatic vegetation has started to grow in the shallow areas around the perimeter of the lake. Some submergent vegetation was also observed.



***(Photo above) Emergent vegetation growing in the basin of Swan Lake during the partial draw down.***

### **Twin Lakes - North and South (Calhoun County)**

Local DNR fisheries and wildlife biologists met with the Twin Lakes Restoration Association (TLRA) to discuss water quality issues in the lake system. Local DNR staff fielded a number of calls throughout 2011 in regards to water quality issues and potential projects at both lakes. The TLRA invited local biologists to attend a meeting and provide information regarding water quality projects.

- Biologists explained that the best way to start a water quality project is to conduct a comprehensive Diagnostic Feasibility Study on both lake systems. The TLRA has sent a letter to the Director of the

DNR requesting that the Twin Lakes System be included in the Lakes Restoration Program budget to fund a DF Study.

- The potential for a successful restoration project on the Twin Lakes System is high. North Twin Lake has an average depth of 8.7 feet, which is relatively deep compared to other natural lakes in the region. Additionally, both North and South Twin Lakes have a relatively small watershed to lake ratios and although the land surrounding the two lakes is primarily in row crop production, the slope of the land is low.

DNR fisheries staff attended a meeting with the North Twin Lake Restoration Association and Senator Beall in March 2013. The purpose of the meeting was for DNR staff to provide information on what is involved with a Diagnostic Feasibility Study, how the study is conducted, and what to expect if such a study were to be carried out. Senator Beall provided information on legislative and budgetary issues.

- The DNR signed a \$209,854 contract with Iowa State University to carry out a DF Study, which started in October. The DNR intends to utilize the information gathered and analyzed in this Contract to plan and implement lake and watershed improvement efforts on North and South Twin Lakes.
- The Twin Lakes Restoration Association has pledged \$43,000 to help DNR Lakes Restoration fund the DF Study. In September 2013, DNR fisheries staff and members of the TLRA met with the Calhoun County Board of Supervisors to discuss a partnership. The Board of Supervisors pledged to contribute \$20,000 to lessen the burden of the TLRA's responsibility for providing match money. DNR fisheries staff and members of the TLRA also met with the Calhoun SWCD to discuss the same issues. The SWCD pledged to contribute \$1,000 to the DF Study. The largest contribution from the SWCD will most likely come in the form of grant applications and employing a watershed coordinator as the project progresses.
- In November 2013, Iowa State University and the DNR held a public meeting at North Twin Lake to present and discuss the DF Study that will be carried out on North and South Twin Lakes. Approximately 40 people attended.

ISU is actively collecting samples for the DF Study for the Twin Lakes. DNR fisheries staff presented at the annual Twin Lakes Restoration Association meeting and provided an update on the DF Study in June 2014. DNR fisheries, lake restoration, and ISU met with the local steering committee to provide an update of the DF Study and answer questions in August 2014. DNR fisheries attended and presented at a tour of the Twin Lakes watershed in November 2014. The purpose of the tour was to highlight some of the best management practices already installed in the watershed and discuss the future of the lake restoration project.



**(Photos above) Iowa State University staff collecting water quality data on North and South Twin Lakes.**

## **Special Projects**

### **Lake Delhi (Delaware County)**

Lake Delhi, a 450-acre on-stream impoundment located on the Maquoketa River in Delaware County, was not included as one of the top thirty-five priorities or on the initial list of significant public lakes for several reasons. Lake Delhi technically is an on-stream impoundment and has a huge watershed draining into it (220,000 acres). With such a large watershed, lake improvements cannot be sustained for the required 50 years, and the water quality goals cannot be met. The DNR Lake Restoration Program, following the legislative plan, is involved in a number of lake restoration projects around the state and none of the current or past projects has such large watershed-to-surface acreage lake ratios. Lake Delhi's watershed-to-lake ratio is 488/1, and as stated above and based on experience and past restoration work, ratios greater than 100/1 are almost impossible to control. A watershed as large as Lake Delhi's could not be adequately treated to meet the water quality guidelines that permit the program to initiate in-lake restoration.

#### **2010 Flood Event**

The Lake Delhi Dam is located southwest of the city of Delhi, Iowa and forms an impoundment on the Maquoketa River. During the flood event of July 23-24, 2010 a portion of the southern earthen embankment of the privately owned dam was breached and eroded by the flood and the concrete spillway's gates were damaged. Floodwaters also infiltrated and seeped through a section of the northern embankment.

When the Delhi Dam breached during high water in July, it created a waterfall from the higher situated bed of Lake Delhi that had been receiving silt for 80 years, to the river below. The force of the falling water ate away at the silt, moving the waterfall gradually upriver and causing tremendous loads of silt to be released downstream. Any areas this head cut passed were highly susceptible to rapid channel widening during high water, which released sediments even more rapidly. It was estimated that hundreds of thousands of tons of silt had been released into the river downstream creating maintenance problems, recreational problems and threats to aquatic life.

Iowa Governor Chet Culver issued a disaster declaration in October 2010 charging the Iowa Department of Natural Resources to stabilize the Maquoketa River's eroding lakebed. Under direction of the disaster declaration, the DNR Policy and Coordination Bureau submitted a project request to develop and implement an engineering project to stabilize the head cut. The DNR also collaborated with the Lake Delhi Recreation Association with assistance from the Natural Resources Conservation Service to complete the project. The resulting project was construction of two riffle areas. One initiative sought to head off the lakebed erosion at the County Road X29 bridge. To stop the erosion, the project called for removing much of the accumulated silt and adding rock riffles to the bed. Much of the work took place under water. The other work, which took place at the Delhi Dam and cleaned up breach site, used loose rock to shore up the remaining portion of the dam and created a stilling pool upstream of the breach area. The two projects in the Maquoketa River designed to stabilize the former bed of Lake Delhi are now complete.

The DNR, operating under the understanding that they would be re-imbursed for stabilization of the Maquoketa River, paid for the \$666,049 project out of DNR Lake Restoration Program funds with the intent of having the Program re-imbursed. Federal Emergency Management Agency (FEMA) was identified as a potential funding source. However, at this point the DNR has not been able to secure FEMA reimbursement. The DNR has submitted necessary documentation to FEMA and is currently examining the opportunity to appeal if funding is denied.

#### **Feasibility Study for Dam Restoration**

The DNR has also entered into a Cooperative Agreement with the Lake Delhi Combined Recreational Facility and Water Quality District to fund a preconstruction dam restoration study as directed under House File 648. The District has entered into this Cooperative Agreement to retain consulting services for analysis of conditions for reconstruction of Lake Delhi Dam; preparation of regulatory documentation for the reconstruction of Lake Delhi Dam; preparation of construction documents for the reconstruction of Lake Delhi Dam; bidding services and engineering services during construction.

Funding for this project was appropriated during the 2011 legislative session per HF 648. "Of the amount appropriated in this lettered paragraph, \$350,000 shall be allocated to a county with a population between seventeen thousand seven hundred and seventeen thousand eight hundred as determined by the 2010 federal census, for a lake with public access that has the support of a benefited lake district. The allocated moneys shall be used for purposes of completing a preconstruction dam restoration study that would include a geotechnical evaluation, hydrological studies, restoration alternatives and construction specifications. The preconstruction dam study shall be filed with the general assembly upon completion". This project is not typical of our current lake restoration process; however, it was supported through legislative direction. To-date, all available funds have been billed for this project.

#### Restoration of Lake Delhi Dan

The Iowa legislature appropriated a total of \$5.0 million (\$2.5 M from FY13 and \$2.5M from FY14) from the Rebuild Iowa Infrastructure Fund for the restoration and reconstruction of Lake Delhi dam under SF 2316 of the 84<sup>th</sup> General Assembly, with administration of funding was given to the DNR. Funding for restoration and reconstruction of the lake and dam is being handled through a grant from the DNR to the Lake Delhi Combined Recreational and Water Quality District (the District) and covers architectural and engineering design costs, including all related survey; acquisition of real estate and property rights; construction management costs; and construction labor and material costs.

***As of November 30, 2014, the District has requested \$ 2,766,903 of the appropriated \$5.0 million in funding for re-payment of eligible expenses.***

Below information taken from the Lake Delhi Voice – November 2014.

Phase 1 Construction Update: Phase 1 work by Lunda began work in April 2014 and through October 31, 2014, other than the setback in June with the flooding, the project has benefited from ideal weather the rest of the construction season. Recent work completed by Lunda includes all concrete patches on the main structure are done; the new south pier has been poured and the steel forms removed that will be reused on the new south pier; rock bolt anchoring has been completed and backfilled; and electrical demolition has begun inside the powerhouse structure. Work continues on removing concrete at the south Abutment and placing rebar and forms at North and South Abutments for new Gate and Stop Log Guides. The south downstream Wing Wall rehab patches have been identified and deteriorated concrete removed and new rebar and forms placed and is ready for concrete. Lunda has removed some of the Sheet Pile Shoring at the NW corner of the Powerhouse section of the dam. Lunda's Phase 1 work is under budget and is projected to remain so. They are well positioned to complete their work in a manner that will easily coordinate with the new Phase 2 contractor once they are in place for the second part of the work to restore Lake Delhi in 2015.

Phase 2 Update: Recently the Trustee board sent out the Phase 2 bid package. Contractors were asked to respond based on two timing options First: The Final phase two completion date of July 2015 Second: Final phase two completion date of September 2015. Results: We had a significant amount of interest from a number of contractors with three actual bids coming in. None of the bidders responded with an option to have completion in July of 2015. Two of the three responders bid for a completion of September of 2015 and the other for completion of 2016. The bids received ranged from \$1.3 Million to \$4.1 Million higher than our original Engineer's Estimate of \$6.6 Million. Trustee Board Decision: After review of the bids and input from Stanley Consultants (Our Engineering Firm), the board made the decision to reject all bids and to move forward with preparations for a re-bid for Phase 2.

## **Shallow Lakes Management Initiative**

Shallow lake management has always been a challenge in Iowa and around the world. Shallow lakes are scattered throughout Northwest Iowa and, in most of these lakes water quality is less than desired. In fact, most of these lakes are turbid, algae-dominated systems with little to no vegetation, and poor sport fisheries comprised mostly of common carp (*Cyprinus carpio*), and black bullheads (*Ameiurus melas*). Successful restorations of deeper lakes have historically focused on reducing nutrient inputs by repairing the watershed and/or removing phosphorus-laden sediments from the lake. Successful shallow lake management strategies require intensive in-lake management strategies that can immediately flip the basin from the turbid-water state to the clean-water state, and long-term watershed protection efforts that help maintain clean water over time.

Shallow lakes differ substantially from deeper lakes in many respects. Shallow lakes usually exist in either of two alternative stable trophic states with or without any change in the nutrient budget of the lake. These lakes can exist as very turbid, algae-dominated systems with little to no vegetation, or as clear water, macrophyte dominated systems. In shallow lakes, the benthivorous and planktivorous fishes along with wind and wave action and in some cases heavy boating traffic can perpetuate the algae dominated system.

***Severe blue green algae blooms are capable of producing during warm weather in unhealthy shallow lakes.***

By controlling or removing the factors perpetuating the algae dominated turbid system, it is possible to "flip" the system into a clear water macrophyte dominated system. The positive impacts of emergent and submergent vegetation on water quality are due to several factors. Rooted vegetation prevents resuspension of sediments into the water column by solidifying bottom sediments and suppressing wind and wave action. Rooted plants provide habitat for periphyton and zooplankton and fish species commonly found in clear water lakes. Rooted vegetation also ties up nutrients making them unavailable for algae. Some plants also release allelopathic substances into the water suppressing algae growth. Many of these mechanisms are difficult to assess and vary among water bodies; however, their combined effect stabilizes the clear water trophic state. Both the clear water macrophyte state and the algae dominated state are stable, and it takes a major perturbation to move from one state to another. Three methods that show great promise to cause the shift from the turbid to the clear water state are benthivorous fish control, heavy piscivore stockings (to control both benthivorous and planktivorous fishes), and water level draw downs. The goal of this project is to develop tools that managers can use to shift and maintain shallow lakes in a clear water state.

Many natural Lakes in Northwest Iowa are characterized as these shallow, windswept systems that exhibit poor water quality. Significant watershed changes and the introduction of common carp in the late 1800's have forever made management of these water bodies a challenge. Through work accomplished on the projects listed below, great strides have been made in our understanding of these systems. These ground breaking projects in Iowa will undoubtedly lead to others as the health to these unique water bodies is restored. Success is also being measured in public education and outreach, communities and user groups are coming together to make these projects truly successful demonstration models for improving not only water quality, but fostering partnerships for the long-term active management required to maintain the health of these lakes.

***Good water quality and healthy aquatic plant communities can become evident through shallow lake improvement projects***

Iowa DNR's Wildlife and Fisheries Bureaus in cooperation with Ducks Unlimited have established a list of shallow lakes prioritized renovated. The current focus of the Lake Restoration Program is on shallow lakes that support both fishing and wildlife benefits. In addition, there is an emphasis on shallow systems above important natural lakes.

## **Shallow Lake Projects**

### **Pickerel Lake (Buena Vista County)**

Pickerel Lake, located in extreme NE Buena Vista County, is a 170-acre basin that suffered from the same problems as most other shallow lake basins in the upper Midwest; poor water quality due to an intensively cultivated watershed, an overabundance of rough fish, and a lack of beneficial aquatic plants. Even with poor water quality, walleyes have surprisingly been able to reproduce in Pickerel Lake. Project partners initiated intensive in-lake management to enhance water quality, fish and wildlife habitat in Pickerel Lake. In addition, they will continue to work long-term throughout the watershed to ensure that soil, fertilizers, and pesticides stay on the uplands. In-lake actions included installing a new water control structure and fish barrier on the lake's outlet and enhancing existing draw down channels in the lake and downstream of the new water control structure. Once this infrastructure was in place, the DNR temporarily drained the lake to allow for the elimination of problem fish, the consolidation of bottom sediments, and the establishment of beneficial aquatic plants.

Pickerel Lake was drained in the late winter/early spring of 2011 and now has gone through its second year of a draw down since the project's inception. No boards were put in the stop log structure to hold water in 2012 and good stands of perennial emergent vegetation were established. Some attempts were made to hold water in Pickerel Lake in 2013, but water levels are quite low. Even with low water levels, 42,000 yellow perch were stocked into Pickerel Lake in July 2013 in the hope to get a start on the fishery going into 2014. DNR fisheries staff has been monitoring water levels at Pickerel Lake in 2014 and have assisted with stocking adult perch and fertilized perch eggs.

### **Rice Lake (Winnebago County)**

Local interest has developed for shallow lakes management on Rice Lake. The fishery has declined and the water quality is currently poor. DNR held public meetings to discuss shallow lakes management with the community. The public meetings held in 2013 had overwhelming support for shallow lakes management.

The lake was drawn down 4 feet in late 2013 to facilitate renovation of the fishery and promote aquatic vegetation growth. The DNR applied rotenone through the ice during the winter of 2013/2014. Vegetation growth responded well and water levels will be brought up slowly in the spring of 2014. In addition, fish stockings were initiated in June 2014. Fish stocking included yellow perch ribbons and adults, walleye fry and fingerlings, largemouth bass fingerlings, bluegill fingerlings. The lake remained about 20 inches low going into winter 2014.



***Engineers from Ducks Unlimited are working on the design for a new water control structure. The new structure will allow for better water level management and reduce spring bounces that the current structure creates.***

## Silver Lake (Worth)

DNR conducted shallow lakes restoration work at Silver Lake starting in 2011 in response to poor water quality. The plan was to replace the current water control structure, dig a channel in the lakebed to aid in draining the basin, and renovate the fishery. The benefits will be improved water quality, establishment of an aquatic plant community, and a restored fishery.

Silver Lake water control structure was replaced in 2011/2012 and a drawdown was conducted in 2012 for vegetation establishment. Three feet of stop logs were placed in new structure in August 2012 to begin re-filling the lake. ***The plant community response has been good. There is a good stand of bulrush establishing with several other species of aquatic plants coming as well.***

Fish stockings of yellow perch and bluegill occurred in 2013. However, this fall we started getting reports from the public stating they were observing carp in the lake. A DNR electrofishing survey confirmed that carp were present in the system. The Conservation Officer also collected some carp with a mud motor after the electrofishing survey. The only gamefish collected was one perch.



A public meeting will be held and explain the situation. The opinion of the DNR is that a 7-inch rain event in late May either topped the barrier or allowed a few fish to jump the barrier. DNR plans to modify the barrier to address vulnerable spots in the barrier.

The management strategy was to lower the lake after freeze up and try to winterkill the carp. Rotenone was added under the ice to get a complete kill. The lake was then be boarded up to near crest to capture as much as the spring 2014 as possible. Spring 2014 fish stocking included yellow perch ribbons and adults, largemouth bass fingerlings, bluegill fingerlings. The lake at crest going into winter 2015.



***Aerial view of Silver Lake Worth Co.  
taken on October 2014.***  
*Photo by Zenner*

**Trumbull Lake (Clay County)** - One of Iowa's larger shallow lakes was the focus of a water quality improvement project that was initiated from 2012 drought conditions. The 1,200-acre Trumbull Lake and its 1,000 acres of connected marshes, in Clay County, are nearly dry which is unusual for the shallow lakes system that receives water from a nearly 50,000-acre watershed.

The Iowa Department of Natural Resources presented its plan to improve the lake during a meeting October 2012 in Okoboji.

"Trumbull has an enormous watershed so we need to take advantage of this opportunity that Mother Nature is granting us to recharge the marshes and improve the lake by getting plants to return and eliminate the carp," said Mike Hawkins, fisheries biologist with the Iowa Department of Natural Resources. Hawkins said restoration plans shifted gears when it became apparent that the summer was going to be a drought for the record books. What began as a partial drawdown of 22 inches last spring, ended with, essentially, a dry lake.

"This is a blessing, in a good way," said Bryan Hellyer, wildlife biologist for the DNR. "While things didn't go as planned with the drawdown, we now have an opportunity to reset the lake-marsh system and go from a shallow lake with murky water and no vegetation to one that benefits waterfowl, shorebirds and all kinds of wetland wildlife with emergent and submergent vegetation. That's exciting."

Hawkins said they will dig an existing channel to keep the lake water free as much as possible next spring to allow plants to germinate and grow on the lakebed. "We have a small window of opportunity in May and June to get these plants to germinate so we plan to begin digging the channel soon after this meeting," Hawkins said. Trumbull Lake was drawn down during the summer and fall of 2012. Following a public meeting in October of 2012, Trumbull Lake was drawn down throughout 2013 and the watershed renovated through low water and rotenone application. The restoration plan included stocking yellow perch and northern pike in the spring of 2014.

"Trumbull Lake has been in a dismal state for years. It has a history of some boom and bust cycle of fishing, but mostly poor fishing and poor water quality. What this project should do is improve the water quality and make the fishery more consistent," Hawkins said. "If this is your spot to hunt or fish, we understand how this can be disappointing, but if all goes as planned, Trumbull Lake will dramatically change for the better for wildlife and fishing for quite a few years," Hellyer said. In addition, it will be carp-free for the first time since carp were introduced 100 years ago.



Trumbull Lake was refilled in June 2014 by heavy rains. Aquatic habitat and water quality have improved. Yellow perch were stocked in Trumbull Lake in 2014 with predator stocking will follow in 2015.

***Photo of the Trumbull Lake outlet structure. Aquatic plants can be seen in the lake.***



***Aerial photo of Trumbull Lake taken in October showing the increase in emergent aquatic plants following the drawdown.***

**Virgin Lake (Palo Alto County)** - Virgin Lake is a unique 220-acre basin in western Palo Alto County that features a highly diverse shoreline, back bays, peninsulas, and islands. Like other shallow lakes in Iowa and the upper Midwest, it has become unhealthy due to intensive agriculture in its watershed and an overabundance of rough fish. Together, these and other factors have resulted in turbid water in the lake and the subsequent loss of the beneficial aquatic plants needed to sustain clean water and provide habitat for sport fish and aquatic wildlife. Project partners, including DNR and DU plan to improve the lake by ridding the lake of problem fish species, restoring aquatic plants, and stocking quality game fish.

The lake was drained fall 2011 and was drawn down completely during early 2012. Aquatic plants have germinated over the entire basin. Yellow perch eggs were stocked in April 2014. Water levels recovered very slowly because of drought conditions in 2013 and a small watershed, but the lake is now within a

foot of crest. Approximately 20,000 yellow perch fingerlings from Genoa National Fish Hatchery were stocked in August 2014. Drought conditions in 2012 and 2013 were unexpected and provided an opportunity for both aquatic and terrestrial vegetation to become very thick in the lakebed. This situation should improve with water back in the lake.



***Aerial photo of Virgin Lake taken October of 2014. Photo by Zenner***

## **Lake Restoration Program (LRP) – Other Program Activities**

### **Meetings with Local Leaders and Stakeholders**

In accordance with Section 26 of House File 2782, the department has met with representatives of communities with lakes on the initial priority list are located to provide an initial lake restoration assessment and to explain the process and criteria for receiving lake restoration funding. The DNR has established local stakeholder groups or held initial technical field staffs planning for a number of planned lake/watershed improvement projects; including Kent Park Lake, (Johnson Co.), Lacey Keosauqua Lake (Van Buren Co.), Lake Keomah (Mahaska Co.), Mariposa Lake (Jasper Co.), North/South Twin Lakes (Calhoun Co.) and Silver Lake (Palo Alto Co.).

### **Lake Restoration Prioritization Process**

The Lake Restoration Program initially ranked 127 public lakes for lake restoration priorities in 2006. A group of thirty-five lakes, considered highest priority for restoration, was established and served as a starting point for identifying potential lake restoration projects. Ranking indices used lake water quality data and watershed characteristics to create groups of good, fair, or poor lakes and watersheds. The department used these descriptions to categorize lakes into management action groups.

The initial list of thirty-five significant publicly-owned lakes was prioritized for funding based on the feasibility of each lake for restoration and the use or potential use of the lake, if restored. The list included lake projects under active development that the department recommended be given priority for funding so long as progress toward completion of the projects remained consistent with the goals of the program. An additional twenty lakes, not included on the initial list of thirty-five significant publicly-owned lakes eligible for funding, have since been added to the priority list after communities have successfully petitioned the director of the department or were prioritized by the department based on the feasibility of the lake for restoration and the use or potential use of the lake, if restored.

DNR annually reviews projects to determine which lakes should proceed with lake restoration. Until watershed best management practices protect the lake, restoration work cannot move forward, therefore lakes with well-documented watershed protections are the best candidates for restoration. The other necessary ingredient to begin lake restoration is local commitment. In order to better document how lake restoration will benefit Iowa we will use cost benefit analysis, as well as identifying non-economic benefits to people and our natural resources. Computing and documenting the economic benefits, recreation benefits, health benefits, and natural resource/environmental benefits of lake improvements will be a great asset to the lake restoration process. This information will also go a long way in communicating the need of lake restoration projects to local communities and the legislature.

### **Local, State and Federal Partnerships**

In order to achieve lake restoration goals it is critical that the DNR form effective watershed partnerships. This includes partnerships at the local level, but also at administrative levels of government. Local, state and federal programs offer a multitude of programs for financial assistance to landowners for soil conservation and other water quality protection practices. The strategy pursued in the lake restoration program will be to seek out key individuals with expertise at the local level and the program administration level. This expertise will maximize access to financial incentives for landowner participation in watershed improvement and lake restoration projects. Listed below are several examples of potential partners in watershed improvement and lake restoration.

Local:

- Chamber of Commerce, City/Town Mayors and Councils
- Conservation and Recreation Clubs and Organizations
- County Board of Supervisors, County Conservation Board
- DNR Field Offices (Environmental Services, Fisheries, Forestry, Parks, Wildlife)
- IDALS/ Division of Soil Conservation – Project Coordinators
- IOWATER Volunteers / Educators / Interested Citizens
- Lake Associations / Groups / Watershed Organizations / Private Landowners
- NRCS Soil and Water Conservation Districts (SWCD)
- USDA Resource Conservation and Development (RC&D)

State:

- IDALS/ Division of Soil Conservation
- Iowa Department of Transportation
- Iowa Environmental Council
- Iowa Farm Bureau
- Iowa Natural Heritage Foundation

Federal:

- U. S. Environmental Protection Agency / U.S. Fish and Wildlife Service
- Natural Resources Conservation Service
- U.S. Army Corps of Engineers / U.S. Geological Survey

## **Communication Tools and Strategies**

The DNR, in cooperation with Iowa Department of Agriculture Land Stewardship (IDALS), has worked to develop a holistic approach to locally led watershed projects and information to help guide communities through the process of water quality improvement projects.

### **First Steps for Cleaner Water**

<http://www.iowadnr.gov/Environment/WaterQuality/LakeRestoration.aspx>

### **Community Watershed Improvement Framework for Lakes**

<http://www.iowadnr.gov/Environment/WaterQuality/LakeRestoration.aspx>

People will find these brochures useful as handouts at meetings. In addition to brochure type handouts, a number of communication and outreach tools for the public and lake stakeholders will be considered as deemed appropriate, including: display/kiosk, lake restoration tool kit and workshop, newsletters, opinion surveys, web site. For example, the Lakes Program developed a one-page handout that summarizes the Lake Restoration Process. This has proved to be a useful tool in communicate the important aspects of the program to the public.

## Appendix A. House File 2782 - Enrolled

PAG LIN

1 1 HOUSE FILE 2782

1 2

1 3 AN ACT

1 4 RELATING TO AND MAKING APPROPRIATIONS TO STATE DEPARTMENTS

1 5 AND AGENCIES FROM THE REBUILD IOWA INFRASTRUCTURE FUND,

1 6 ENVIRONMENT FIRST FUND, TOBACCO SETTLEMENT TRUST FUND,

1 7 VERTICAL INFRASTRUCTURE FUND, THE ENDOWMENT FOR IOWA'S

1 8 HEALTH RESTRICTED CAPITALS FUND, THE TECHNOLOGY REINVEST-

1 9 MENT FUND, THE ENDOWMENT FOR IOWA'S HEALTH ACCOUNT, THE

1 10 PUBLIC TRANSIT INFRASTRUCTURE GRANT FUND, THE IOWA GREAT

1 11 PLACES PROGRAM FUND, AND RELATED MATTERS AND PROVIDING

1 12 IMMEDIATE, RETROACTIVE, AND FUTURE EFFECTIVE DATES.

1 13

1 14 BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF IOWA:

31 13 Sec. 26. NEW SECTION. 456A.33B LAKE RESTORATION PLAN AND

31 14 REPORT.

31 15 1. It is the intent of the general assembly that the

31 16 department of natural resources shall develop annually a lake

31 17 restoration plan and report that shall be submitted to the

31 18 joint appropriations subcommittee on transportation,

31 19 infrastructure, and capitals and the legislative services

31 20 agency by no later than January 1 of each year. The plan and

31 21 report shall include the department's plans and

31 22 recommendations for lake restoration projects to receive

31 23 funding consistent with the process and criteria provided in

31 24 this section, and shall include the department's assessment of

31 25 the progress and results of projects funded with moneys

31 26 appropriated under this section.

31 27 The department shall recommend funding for lake restoration

31 28 projects that are designed to achieve the following goals:

31 29 a. Ensure a cost-effective, positive return on investment

31 30 for the citizens of Iowa.

31 31 b. Ensure local community commitment to lake and watershed

31 32 protection.

31 33 c. Ensure significant improvement in water clarity,

31 34 safety, and quality of Iowa lakes.

31 35 d. Provide for a sustainable, healthy, functioning lake

32 1 system.

32 2 e. Result in the removal of the lake from the impaired

32 3 waters list.

32 4 2. The process and criteria the department shall utilize

32 5 to recommend funding for lake restoration projects shall be as

32 6 follows:

32 7 a. The department shall develop an initial list of not

32 8 more than thirty-five significant public lakes to be

32 9 considered for funding based on the feasibility of each lake

32 10 for restoration and the use or potential use of the lake, if

32 11 restored. The list shall include lake projects under active

32 12 development that the department shall recommend be given

32 13 priority for funding so long as progress toward completion of

32 14 the projects remains consistent with the goals of this

32 15 section.

32 16 b. The department shall meet with representatives of

32 17 communities where lakes on the initial list are located to  
32 18 provide an initial lake restoration assessment and to explain  
32 19 the process and criteria for receiving lake restoration  
32 20 funding. Communities with lakes not included on the initial  
32 21 list may petition the director of the department for a  
32 22 preliminary lake restoration assessment and explanation of the  
32 23 funding process and criteria. The department shall work with  
32 24 representatives of each community to develop a joint lake  
32 25 restoration action plan. At a minimum, each joint action plan  
32 26 shall document the causes, sources, and magnitude of lake  
32 27 impairment, evaluate the feasibility of the lake and watershed  
32 28 restoration options, establish water quality goals and a  
32 29 schedule for attainment, assess the economic benefits of the  
32 30 project, identify the sources and amounts of any leveraged  
32 31 funds, and describe the community's commitment to the project,  
32 32 including local funding. The community's commitment to the  
32 33 project may include moneys to fund a lake diagnostic study and  
32 34 watershed assessment, including development of a TMDL (total  
32 35 maximum daily load).

33 1 c. Each joint lake restoration plan shall comply with the  
33 2 following guidelines:

33 3 (1) Biologic controls will be utilized to the maximum  
33 4 extent, wherever possible.

33 5 (2) If proposed, dredging of the lake will be conducted to  
33 6 a mean depth of at least ten feet to gain water quality  
33 7 benefits unless a combination of biologic and structural  
33 8 controls is sufficient to assure water quality targets will be  
33 9 achieved at a shallower average water depth.

33 10 (3) The costs of lake restoration will include the  
33 11 maintenance costs of improvements to the lake.

33 12 (4) Delivery of phosphorous and sediment from the  
33 13 watershed will be controlled and in place before lake  
33 14 restoration begins. Loads of phosphorous and sediment, in  
33 15 conjunction with in-lake management, will meet or exceed the  
33 16 following water quality targets:

33 17 (a) Clarity. A four-and-one-half-foot secchi depth will  
33 18 be achieved fifty percent of the time from April 1 through  
33 19 September 30.

33 20 (b) Safety. Beaches will meet water quality standards for  
33 21 recreational use.

33 22 (c) Biota. A diverse, balanced, and sustainable aquatic  
33 23 community will be maintained.

33 24 (d) Sustainability. The water quality benefits of the  
33 25 restoration efforts will be sustained for at least fifty  
33 26 years.

33 27 d. The department shall evaluate the joint action plans  
33 28 and prioritize the plans based on the criteria required in  
33 29 this section. The department's annual lake restoration plan  
33 30 and report shall include the prioritized list and the amounts  
33 31 of state and other funding the department recommends for each  
33 32 lake restoration project. The department may seek public  
33 33 comment on its recommendations prior to submitting the plan

33 34 and report to the general assembly.

## **Appendix B. Significant, Publicly-owned Lakes - Defined**

### **Bachmann (1980). “Clean Lakes Classification Study of Iowa’s Lakes for Restoration”.**

Authors: Roger W. Bachmann, Mark R. Johnson, Marianne V. Moore, Terry A. Noonan  
Iowa Cooperative Fisheries Research Unit, Iowa State University, Department of Animal Ecology

#### Introduction

Approximately 175 lakes and reservoirs were considered by the Iowa Conservation Commission (ICC) staff for inclusion into the list of lakes to be surveyed and classified. Many of these 175 lakes are contained in “Iowa Fishing Guide”, a publication of the ICC. Time and money precluded survey and classification of all the lakes; therefore, the list was reduced to include only significant lakes in public ownership.

#### Significant Lakes – Defined and Explained

Significant publicly-owned lakes were defined as those lakes which are principally maintained for public use containing a minimum surface area of 10 acres and capable of supporting fish stocks of at least 200 pounds per acre. Species diversity in water bodies containing less than 10 acres is habitually low resulting in a fish density with minimal potential for maximum sustained yields via sport or foodfish fisheries. Shallow lakes, which are most characteristic of wetlands and marsh-like habitat that are subject to chronic and extensive fish winterkills, were excluded from the survey. Establishment of productive fish populations is hopeless where massive mortality results from the lowering of life supporting oxygen concentrations under ice cover each winter. Federal-owned on-stream impoundment constructed for floodwater supplies were excluded because of Clean Water Act regulations. Multi-purpose lakes providing domestic water supply as only one of several major management objectives were included in the study. Impoundments containing a watershed to surface area ratio greater than 200:1 acres were omitted from the list since they are mainly on-stream impoundments formed by lowhead dams and emulate riverine habitat rather than lake environment.

### **Section 305 (b) report (2000)**

Section 314 (a) (2) of the federal Clean Water Act of 1987 requires each state to include in its biennial Section 305 (b) report specific information on the water quality conditions and trends of the state’s “significant, publicly-owned lakes,” as well as a description of the state’s lake protection and restoration programs. In Iowa, “significant, publicly-owned lakes” are defined as those publicly-owned lakes that meet all of the following criteria:

- are maintained principally for public use;
- are capable of supporting fish stocks of at least 200 pounds per acre;
- have a surface water area of at least 10 acres;
- have a watershed to lake surface area ratio of less than 200:1;
- are not shallow marsh-like lakes, federal flood control impoundments, or used solely as water supply reservoirs.

As such, the 115 significant, publicly-owned lakes (SPOLs) represent a subset of the Iowa’s approximately 5,400 lakes, ponds, and reservoirs.

### **Lake Restoration Program (2014)**

For the purpose of Iowa’s Lake Restoration Program, “significant, publicly-owned lakes” are defined as those publicly-owned lakes that meet all of the following criteria:

- are maintained principally for public use;
- are multi use systems capable of supporting a viable sport fishery and recreational opportunities;
- have a surface water area of at least 10 acres;
- have a watershed to lake surface area ratio of less than 200:1;
- are not federal flood control impoundments (exception is Rathbun Reservoir due to a watershed to lake surface area ratio that is less than 200:1); and
- are not shallow marsh-like lakes; or lakes used solely as water supply reservoirs.

## **Appendix C. Significant, Publicly-owned Lakes List**

Initial list of thirty-five significant publicly-owned lakes (lake systems) eligible for funding based on the feasibility of each lake for restoration and the use or potential use of the lake, if restored. The list included lake projects under active development that the department recommended be given priority for funding so long as progress toward completion of the projects remained consistent with the goals of the program.

<b>LAKE NAME</b>	<b>COUNTY</b>
Arbor Lake	POWESHIEK
Big Creek Lake	POLK
Black Hawk Lake	SAC
Blue Lake	MONONA
Brushy Creek Lake	WEBSTER
Carter Lake	POTTAWATTAMIE
Central Park Lake	JONES
Clear Lake	CERRO GORDO
Crystal Lake	HANCOCK
Diamond Lake	POWESHIEK
Easter Lake	POLK
Five Island Lake	PALO ALTO
George Wyth Lake	BLACK HAWK
Green Valley Lake	UNION
Hannen Lake	BENTON
Hickory Grove Lake	STORY
IA Great Lakes	DICKINSON
Kent Park Lake	JOHNSON
Lake Ahquabi	WARREN
Lake Anita	CASS
Lake Darling	WASHINGTON
Lake Geode	HENRY
Lake Keomah	MAHASKA
Lake Macbride	JOHNSON
Lake Manawa	POTTAWATTAMIE
Lake of the Hills	SCOTT
Little Wall Lake	HAMILTON
Pleasant Creek Lake	LINN
Prairie Rose Lake	SHELBY
Red Haw Lake	LUCAS
Rock Creek Lake	JASPER
Silver Lake	DELAWARE
Storm Lake	BUENA VISTA
Union Grove Lake	TAMA
Viking Lake	MONTGOMERY

\*Note – IA Great Lakes (Dickinson) includes Big Spirit Lake (incl. Little Spirit Lake), East Okoboji Lake, Lower Gar Lake, Minnewashta Lake, Upper Gar Lake and West Okoboji Lake

The following twenty-two lakes (lake systems) were not included on the initial list of thirty-five significant publicly-owned lakes eligible for funding. They have since been added to the list after communities have successfully petitioned the director of the department or were prioritized by the department based on the feasibility of the lake for restoration and the use or potential use of the lake, if restored.

<b>LAKE NAME</b>	<b>COUNTY</b>
Badger Creek Lake	MADISON
Center Lake	DICKINSON
Hawthorn Lake	MAHASKA
Lacey Keosauqua Park Lake	VAN BUREN
Lake Icaria	ADAMS
Lake Miami	MONROE
Lake of Three Fires	TAYLOR
Lake Sugema	VAN BUREN
Lake Wapello	DAVIS
Little River Lake	DECATUR
Lizard Lake	POCAHONTAS
Lost Grove Lake	SCOTT
Lost Island Lake	PALO ALTO
Mariposa Lake	JASPER
Meadow Lake	ADAIR
Pine Lakes - Upper / Lower	HARDIN
Rathbun Reservoir	APPANOOSE
Silver Lake	DICKINSON
Silver Lake	PALO ALTO
Swan Lake	CARROLL
Twelve Mile Creek Lake	UNION
Twin Lakes - North / South	CALHOUN

The following lakes are the additional lakes recognized by the Iowa Department of Natural Resources Lake Restoration Program as Significant Publicly-Owned Lakes.

<b>LAKE NAME</b>	<b>COUNTY</b>
Arrowhead Lake	SAC
Arrowhead Pond	POTTAWATTAMIE
Avenue of the Saints Pond	BREMER
Badger Lake	WEBSTER
Beaver Lake	DALLAS
Beeds Lake	FRANKLIN
Belva Deer Lake	KEOKUK
Big Hollow Lake	DES MOINES
Bob White Lake	WAYNE
Briggs Woods Lake	HAMILTON
Browns Lake	WOODBURY
Casey Lake (Hickory Hills Lake)	TAMA
Cold Springs Lake	CASS
Crawford Creek Impoundment	IDA
DeSoto Bend	HARRISON
Dog Creek (Lake)	OBRIEN
Don Williams Lake	BOONE
East Lake (Osceola)	CLARKE
Eldred Sherwood Lake	HANCOCK
Fogle Lake S.W.A.	RINGGOLD

<b>LAKE NAME</b>	<b>COUNTY</b>
Green Belt Lake	BLACK HAWK
Green Castle Lake	MARSHALL
Greenfield Lake	ADAIR
Hooper Area Pond	WARREN
Indian Lake	VAN BUREN
Ingham Lake	EMMET
Iowa Lake	IOWA
Lake Cornelia	WRIGHT
Lake Hendricks	HOWARD
Lake Meyer	WINNESHIEK
Lake Pahoja	LYON
Lake Smith	KOSSUTH
Little Sioux Park Lake	WOODBURY
Littlefield Lake	AUDUBON
Manteno Park Pond	SHELBY
Meyer Lake	BLACK HAWK
Mill Creek Lake	OBRIEN
Mitchell	BLACK HAWK
Moorhead Park Pond	IDA
Mormon Trail Lake	ADAIR
Nelson Park Lake	CRAWFORD
Nine Eagles Lake	DECATUR
Nodaway Lake	ADAIR
Oldham Lake	MONONA
Orient Lake	ADAIR
Otter Creek Lake	TAMA
Ottumwa Lagoon	WAPELLO
Pierce Creek Pond	PAGE
Poll Miller Park Lake	LEE
Roberts Creek Lake	MARION
Rodgers Park Lake	BENTON
Rudd Lake	FLOYD
Silver Lake	WORTH
Slip Bluff Lake	DECATUR
Snyder Bend Lake	WOODBURY
South Prairie Lake	BLACK HAWK
Spring Lake	GREENE
Springbrook Lake	GUTHRIE
Summit Lake	UNION
Thayer Lake	UNION
Three Mile Lake	UNION
Volga Lake	FAYETTE
West Lake (Osceola)	CLARKE
White Oak Lake	MAHASKA
Williamson Pond	LUCAS
Willow Lake	HARRISON
Wilson Park Lake	TAYLOR
Windmill Lake	TAYLOR
Yellow Smoke Park Lake	CRAWFORD

# **Appendix D. Lake Restoration Prioritization Process and Program**

## **Key Concepts and Facts**

- Six of ten Iowans visit lakes each year; they will visit these lakes eight times during the year
- Iowans prefer lakes with better water quality
- Statewide our lakes generate \$1.6 billion in annual spending by Iowans
- A lake is a reflection of both watershed and lake management
- Lake restoration starts in the watershed; it relies on strong local involvement and voluntary participation of landowners

## **Current Prioritization and Program**

- Modeled after the Federal Clean Lakes Program established in the 1970s
- DNR provided the 2006 legislature with a priority list of 35 lake candidates
  - Priorities based on a 5-year ISU/DNR assessment of water quality
  - Technical feasibility of restoration
  - Potential economic benefits
  - Use by Iowans, and local interest/involvement
- Projects require a lake and watershed restoration assessment and plan
- Projects require local resources in combination with state and federal funds
- Local groups can petition to have their lake added to the priority list
- Project Status
  - 22 Completed or near completion
  - 21 Active projects in-progress
  - 14 Initial public outreach, evaluation or planning stage
- DNR provides an annual progress report to the legislature that includes a work plan and budget

## **Water Quality Goals**

Stipulated in 2006 State Legislation (HF2782):

- Delivery of phosphorous and sediment from the watershed will be controlled before lake restoration begins
- Shallow lakes management will be considered among options for restoration
- Water quality targets
  - Clarity. 4 ½ foot secchi disc transparency 50% of the time from April – September
  - Biota. A diverse, balanced, and sustainable aquatic community must be maintained
  - Impairment. Water quality impairments must be eliminated
  - Sustainability. The water quality and public use benefits must be sustained for 50 years

## **Lake Restoration Program Budget**

- Funding from FY2007 through FY2015 of \$70.6 million (approximately \$7.8 million per year) has enabled the DNR to improve many Iowa's lakes and proceed with implementing projects at a number of our other priority systems

## **DNR Contacts**

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**Web Page:** <http://www.iowadnr.gov/Environment/WaterQuality/LakeRestoration.aspx>

