

*Lake Restoration
2010 Report and 2011 Plan*

Submitted To

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

Submitted By

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Executive Summary

The Department of Natural Resources (DNR) Lake Restoration Program (LRP) focuses on restoring impaired lakes to improve the quality of life for Iowans. Communities are rallying around their water resources as they seek population growth and economic success. Communities of the Iowa Great Lakes Region, Storm Lake, Creston and Clear Lake are obvious examples, but other communities including Carter Lake, Lake View and Brighton are identifying the importance of lakes for their futures as well.

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's Center for Agriculture and Rural Development (CARD) found that in 2009 there were 11,977,623 household trips to Iowa lakes, spending on the average \$49.60 per household on single day trips and \$262.96 per household on multiple day trips. This translates to six of ten Iowans visiting our lakes multiple times each year, spending \$1.6 billion per year, in their pursuit of outdoor lake recreation. The number of household trip visitations to Iowa lakes continues to increase; lake use in 2009 was 26.6% greater than visitation rates from 2002 through 2005. In addition, visitations at lakes that have completed watershed and lake improvements efforts continue to exceed state average and their own pre-renovation visitation levels.

In the 81st 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 (Appendix A). It directs the IDNR 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.

Lake Restoration Program

The Lake Restoration Program is modeled after the Federal Clean Lakes Program established in the 1970's.

- The DNR began by ranking 128 of Iowa's Significant Public Lakes (SPOLs) for lake restoration potential (see definition for SPOL - Appendix B).
- Ranking based on a 5-year Iowa State University (ISU)/IDNR assessment of water quality, technical feasibility of restoration, potential economic benefits, use by Iowans, and local support.

[Note: The following directives to the department regarding Project Goals, Process and Criteria, and Restoration Plan Guidelines are summarized from 2006 State Legislation (HF2782)]

Lake Restoration Program - Project Goals

The department shall recommend 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 and for lake restoration projects, shall be as follows:

- The department shall develop an initial list of not more than thirty-five significant publicly owned lakes (Appendix C) to be considered 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.
- The department shall meet with representatives of communities where lakes on the initial list 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 a preliminary lake restoration assessment and explanation of the funding process and criteria.

Lake Restoration Program - Restoration Plan Guidelines

The department shall work with representatives of each community to develop a joint lake restoration action plan.

- At a minimum, each joint action plan shall document 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 TMDL (total maximum daily load) Water Quality Improvement Plan.

Each joint lake restoration plan shall comply 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 a **mean depth of at least ten feet** to gain 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.

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

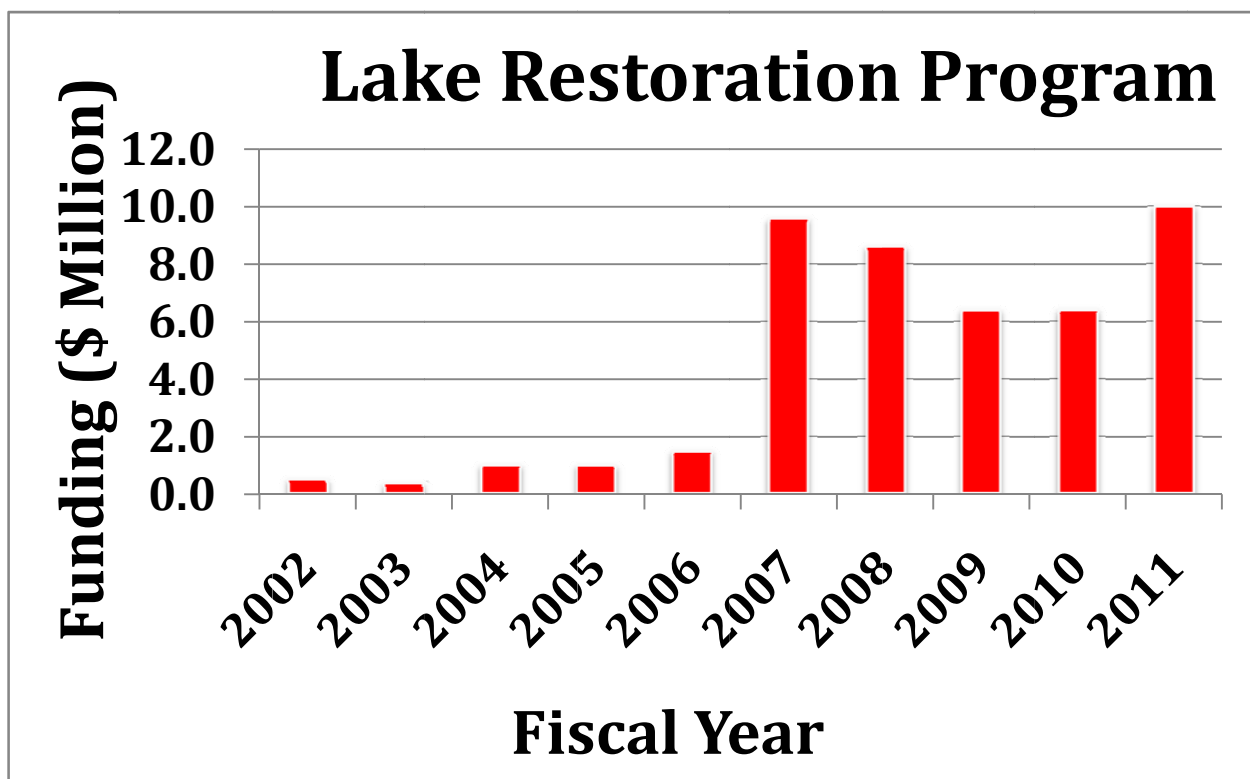
- Clarity. A four and one half foot secchi depth will be achieved fifty percent of the time from April 1 through September 30.
- Safety. Beaches will meet water quality standards for recreational use.
- Biota. A diverse, balanced, and sustainable aquatic community will be maintained.
- Sustainability.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

The department shall evaluate the joint action plans and prioritize the plans based on the criteria required by the program.

Lake Restoration Program - Funding

Funding from FY2007 through FY2011 of \$41 million (approximately \$8.2 million per year) has enabled the IDNR to improve several 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.

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 IDNR 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.



In addition, 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 permits.

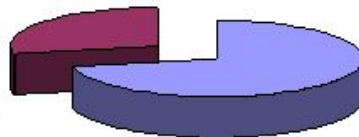
Estimated Restoration Costs for the Thirty-Five Priority Lakes/Watersheds

The 2008 US EPA Watershed Survey supported an initial \$197 million dollar need by Iowa to address lake restoration efforts throughout the state. However, no additional federal dollars have been allocated to states for these types of projects. Depicted below is the DNR/ISU estimate for restoring 35 of our high priority Iowa Lakes.

Restoring our 35 High Priority Lakes



**Watershed
\$75,000,000**



**In-Lake
\$190,000,000**

In FY2011, the source of funding for the Lake Restoration Program was an appropriation from the bond proceeds of the Revenue Bonds Capitols Funds. The LRP received \$10.0 million dollars to meet contracted obligations and FY2011 budgeted program activities. The legislature appropriated funding under SF2389, which specified \$2.0 million for Lost Grove Lake (Scott Co.), \$250,000 for Twin Ponds (Chickasaw Co.) and \$100,000 for Lake Delhi (Delaware Co.) Maintaining future funding and flexibility in where the Lake Restoration Program can allocate dollars will be a critical component to moving these multiple year projects forward and plan for new projects.

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.

As indicated above, the department initially ranked 128 public lakes to prioritize lake restoration efforts. A group of thirty-five lakes, classified highest in priority for restoration, was established and served as a starting point for identifying potential lake restoration projects. An additional eleven lakes have either successfully petitioned or been added into the program. Major water quality improvement initiatives are completed or near completion at eight lakes. Current program activities are in progress at twenty-seven lakes throughout the state and either in the planning or initial community outreach stage at an additional eleven lakes (Figure 1).



Timelines for many of these projects usually fall within a two-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 1 highlights major work activities planned for the remainder of FY2011 and FY2012.

IDNR Lakes Restoration Program

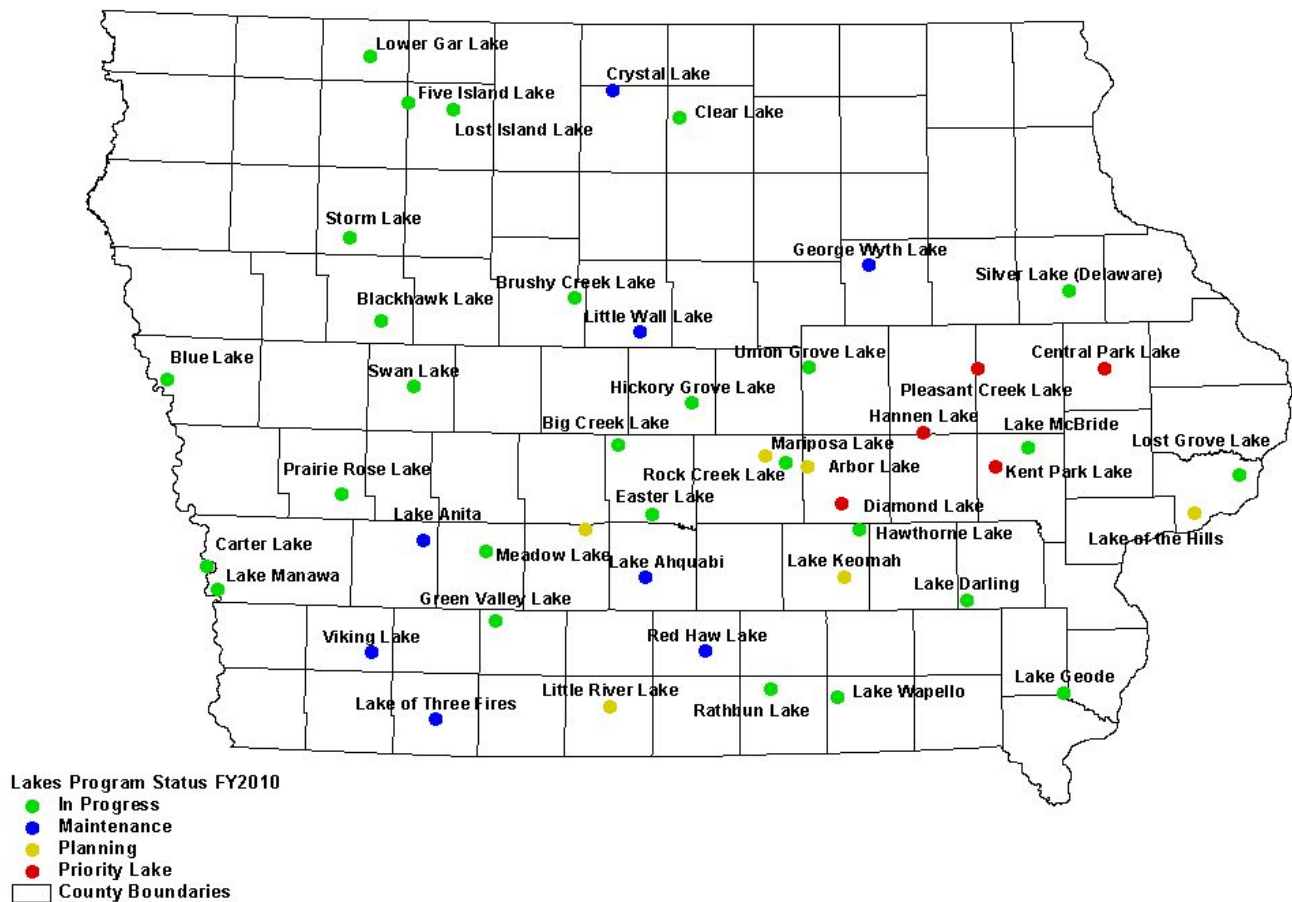


Figure 1. FY2010 Lake Restoration Program Project Status

Clear Lake, Green Valley Lake and Storm Lake are all examples of projects that currently have required a multiple-year funding commitment from the State in order to achieve lake restoration goals. Lake Restoration spent a significant portion of the FY09 and FY2010 budgets on the three, above mentioned, multi-phase projects. Final components to the Green Valley Lake restoration includes removal of approximately 250,000 yards of sediment targeted from both existing sediment retention basins and in-lake areas, added a silt dike within the lake and installing a water/sediment control structure on newly acquired state land. The DNR and local partner City of Storm Lake continued working toward their long-term sediment removal goals and restoration of Little Storm Lake. In addition, the contractor has completed dredging efforts at Clear Lake and construction has started on a Section 206 Aquatic Ecosystem project at the Ventura Marsh region of the Clear Lake system.

Tables 3 and 4 summarize current and planned expenditures for FY2011 and FY2012. A descriptive project summary by lake follows. The program continues to develop new projects and make contact with local communities about the lakes in their area prioritized for restoration. We continue to focus efforts on completion of projects where restoration efforts have already been initiated.

Table 1. Work schedule for select multi-year lake restoration projects

Project Name	County	Projected Timeline	Project FY2010 and FY2011 Work Schedule
Blackhawk Lake	Sac	2010 - 2015	Diagnostic / Feasibility (DF) study and TMDL reports completed Fall 2010. Public meeting to develop implementation plan. Local advisory committee will apply for a watershed improvement grant Spring 2011.
Carter Lake	Pottawattamie	2008 - 2012	Engineering and design for implementation plan being completed; partnership includes the States of Iowa and Nebraska and the cities of Omaha and Carter Lake; Phase I - watershed improvement projects, lake alum treatment and fish renovation completed in 2010.
Clear Lake	Cerro Gordo	2000 - 2011	Dredging completed fall of 2009; targeted removal of 2.4 million cubic yards of sediment; continued work in the watershed; Ventura Marsh restoration – partnership with Army COE, construction phase began Summer 2010
Easter Lake	Polk	2011 - 2015	Diagnostic Study will be completed spring 2010, including NRCS assessment of Yeader Creek. A public meeting will take place in spring of 2010 to inform the public of the results found during the surveys and studies and to develop a restoration plan.
Five Island Lake	Palo Alto	1990 - 2012	Continued support of local dredging project. DNR Lakes Program will work with local stakeholders to evaluate watershed/water quality improvement needs to compliment local dredging efforts
Green Valley Lake	Union	2008 - 2011	Silt removal and silt dike construction underway; construction scheduled for winter 2010 through spring 2011.
Lake Darling	Washington	2008 - 2012	Spillway repair/replace investigation completed; design for dam reconstruction completed; lake drained fall 2008; Dam construction, in-lake restoration (shoreline deepening, silt dike construction, fish renovation) and dredging will begin in November 2010 through November 2012; final watershed work on state property was completed fall 2010
Lake Manawa	Pottawattamie	2009 - 2014	DF study is completed; the DNR is exploring the option of utilizing dredge materials for future Iowa DOT highway projects. This will include an archeological survey followed by a pilot dredging project.
Prairie Rose Lake	Shelby	2011 - 2013	DF Study has been completed; the Shelby County Soil and Water Conservation District was awarded a \$510,611 Water Quality / Watershed Protection Project Grant and work is underway; completed an acquisition of a containment site; submitting requests for in-lake restoration efforts.
Rock Creek Lake	Jasper	2008 - 2015	Purchased containment site adjacent to lake; construction of five sediment control structures is scheduled for Spring 2011.
Storm Lake	Buena Vista	2000 - 2014	Continued support of local dredging project; locally sponsored WIRB Grant to improve Little Storm Lake water quality; five-year project completion plan was developed with local sponsors and will be implemented. Little Storm Lake restoration under contract with construction starting February 2011

Table 2. Actual Budget: Fiscal Year 2010

FY09 Carry Forward Funds (\$8,838,892) plus FY10 Appropriation (\$2,800,000)		FY2010 Budget	\$11,638,892		
Project Name	Description	FY10 DNR Spent	Federal	Other	Total Expense
Administration	Engineering/Project Management	\$453,033			\$453,033
Black Hawk Lake	Feasibility Study	\$52,235			\$52,235
Blue Lake	Feasibility Study	\$2,883			\$2,883
Clear Lake	Dredging/Carp study	\$1,274,193		\$250,000	\$1,524,193
Clear Lake	SEC 206 Ventura Marsh	\$634,732	\$2,177,244	\$250,000	\$3,061,976
Clear Lake	Grit Collection Chamber		\$34,790		\$34,790
Dam Safety	Signage	\$237,263			\$237,263
Feasibility Studies	Restoration Action Plans	\$397,603		\$21,746	\$419,349
Five Island	Dredging	\$200,000		\$200,000	\$400,000
Green Valley	Containment Site/Sediment removal	\$73,858			\$73,858
Hickory Grove	Feasibility Study	\$15,129			\$15,129
Lake Darling	Dam Construction/In-lake	\$114,476			\$114,476
Lake Darling	Watershed Improvement	\$33,341	\$100,023		\$133,364
Lake Manawa	Watershed Improvement	\$6,484			\$6,484
Lake Rathbun	SEC 1135 Shoreline Riprap	\$290,000	\$870,000		\$1,160,000
Lake Wapello	Watershed Improvement	\$51,914			\$51,914
Lake Wapello	Structures on Public Land	\$53,603	\$34,360		\$87,963
Lost Island	Fish Barrier/Water Control Structures	\$92,379			\$92,379
Meadow Lake	Watershed Improvement	\$15,417	\$46,250		\$61,667
Minor Projects	Minor Projects	\$120,197		\$15,000	\$135,197
Prairie Rose	Watershed Improvement	\$5,240			\$5,240
Shallow Lakes	Water Quality Improvement	\$46,987			\$46,987
Storm Lake	Dredging	\$408,358			\$408,358
Storm Lake	Little Storm Lake Restoration	\$29,460		\$29,460	\$58,920
Total FY10		\$4,608,784	\$3,262,667	\$766,206	\$8,637,658
FY10 Carry Forward to FY2011		\$7,030,108			

Table 3. Budget: Fiscal Year 2011

FY10 Carry Forward Funds (\$7,030,108) plus FY11 Appropriation (\$10,000,000)		FY2011 Budget	\$17,030,108				
Project Name	Description	FY11 DNR Budget	FY11 DNR Spent	DNR Under Contract / Obligated	Federal	Other	Total Budget
Administration	Engineering/Project Management	\$500,000	\$184,703	\$315,297			\$500,000
Black Hawk Lake	Feasibility Study/Watershed	\$175,000		\$175,000			\$175,000
Blue Lake	Feasibility Study	\$235,000	\$139,741	\$95,259			\$235,000
Carter Lake	Engineering/Design	\$355,717	\$355,717		\$961,116	\$2,195,736	\$3,512,569
Clear Lake	Dredging/Carp Study/Watershed	\$125,000	\$17,192	\$107,808			\$125,000
Clear Lake	SEC 206 Ventura Marsh	\$230,000	\$230,000		\$832,476		\$1,062,476
Clear Lake	McIntosh Woods Shoreline	\$100,000	\$100,000			\$10,000	\$110,000
Dam Safety	Signage	\$78,525	\$78,525				\$78,525
Easter Lake	Water Quality Improvement	\$50,000		\$50,000			\$50,000
Feasibility Studies	Restoration Action Plans/Monitoring	\$420,000	\$84,343	\$335,657			\$420,000
Five Island Lake	Dredging	\$200,000	\$200,000			\$200,000	\$400,000
Green Valley Lake	Sediment Removal	\$1,120,000	\$672,000	\$448,000			\$1,120,000
Hawthorn Lake	In-lake Restoration	\$300,000	\$300,000			\$246,907	\$546,907
Hickory Grove	Feasibility Study	\$150,000	\$33,429	\$116,571			\$150,000
IA Great Lakes	Watershed Protection	\$250,000	\$250,000			\$228,000	\$478,000
IJOBS	LRP Match - BMPs on Public Land	\$120,000		\$120,000			\$120,000
Lake Darling	Watershed Improvement	\$37,502	\$37,502		\$112,505		\$150,007
Lake Darling	Dam Construction/In-lake Restoration	\$5,000,000	\$1,700,860	\$3,299,140			\$5,000,000
Lake Delhi / Twin Ponds	Special Projects	\$350,000	\$250,000	\$100,000			\$350,000
Lake Manawa	Dredging/Watershed	\$1,545,000	\$33,456	\$1,511,544		\$1,500,000	\$3,045,000
Lake Wapello	Structures on Public Land	\$125,000	\$8,668	\$116,332			\$125,000
Lizard Lake	Spillway Repair/Fish Renovation	\$150,000	\$200	\$149,800			\$150,000
Lost Grove Lake	Dam Construction	\$2,000,000	\$1,271,354	\$728,646		\$2,218,641	\$4,218,641
Lost Island Lake	Fish barrier /Water Control Structures	\$650,000	\$650,000			\$180,000	\$830,000
Meadow Lake	Watershed Improvement	\$57,500	\$35,490	\$22,010	\$32,500		\$90,000
Minor Projects	Minor Projects	\$200,000	\$12,868	\$187,132			\$200,000
Prairie Rose	Containment Site	\$350,000	\$340,970	\$9,030		\$10,000	\$360,000
Prairie Rose	Watershed Structures	\$20,000		\$20,000	\$80,000		\$100,000
Rock Creek Lake	Watershed Structures	\$50,000		\$50,000	\$75,000		\$125,000
Shallow Lakes	Water Quality Improvement	\$125,000	\$19,316	\$105,684			\$125,000
Storm Lake	Dredging	\$1,322,524	\$616,138	\$706,386			\$1,322,524
Storm Lake	Little Storm Lake Restoration	\$638,340	\$638,340			\$156,020	\$794,360
Total FY11		\$17,030,108	\$8,260,812	\$8,769,295	\$2,093,597	\$6,945,304	\$26,069,009

Table 4. Proposed Budget: Fiscal Year 2012

Project Name	Description	FY12 DNR Proposed Budget	Federal	Other	Total Budget
Storm Lake	Little Storm Lake Restoration	\$200,000			\$200,000
Storm Lake	Dredging	\$1,000,000		\$100,000	\$1,100,000
Clear Lake	Dredging/Carp study/Watershed	\$50,000			\$50,000
Clear Lake	SEC 206 Ventura Marsh	\$50,000	\$192,110		\$242,110
Carter Lake	Engineering/Design	\$900,000	\$540,628	\$1,235,101	\$2,675,729
Administration	Engineering/Project Management	\$500,000			\$500,000
Five Island Lake	Dredging	\$200,000		\$200,000	\$400,000
Lake Darling	Dam Construction /In-lake Restoration	\$100,000			\$100,000
Lost Island Lake	Fish Barrier/Water Control Structures	\$150,000			\$150,000
Lake Manawa	Dredging/Watershed	\$1,825,000		\$1,825,000	\$3,650,000
Prairie Rose Lake	Sediment Removal/In-lake Restoration	\$1,500,000			\$1,500,000
Black Hawk Lake	Watershed Improvement	\$100,000		\$100,000	\$200,000
Easter Lake	Water Quality Improvement	\$25,000			\$25,000
Little River Lake	In-lake Restoration/Shoreline	\$1,500,000		\$423,900	\$1,923,900
IA Great Lakes	Watershed Protection	\$100,000		\$250,000	\$350,000
Feasibility Studies	Restoration Action Plans	\$200,000			\$200,000
Shallow Lakes	Water Quality Improvements	\$50,000		\$50,000	\$100,000
Minor Projects	Minor Projects	\$150,000			\$150,000
Total		\$8,600,000	\$732,738	\$4,184,001	\$13,516,739

2010 Report and 2011 Plan

Lake Restoration Program (LRP) Highlighted Projects

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.

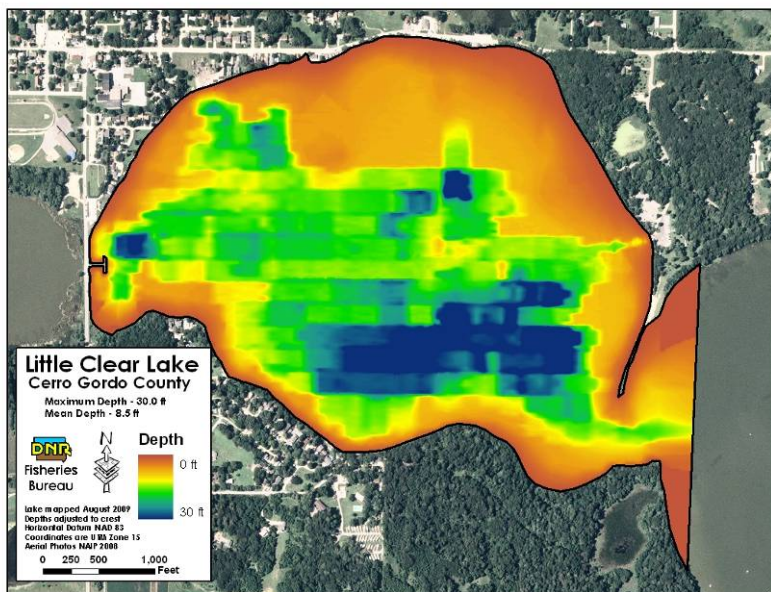
- The DNR and local sponsors purchased a 208-acre dredge spoil site with approximately \$660,000 of LRP funds and an additional \$660,000 local match. Contractors completed the \$886,000 containment site in spring of 2008.
- The estimated cost of dredging was \$8 million dollars (2.3 million cubic yards 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 cu. yds.

Little Clear Lake Pre-dredging

*(Maximum Depth: 11.9 ft,
Mean Depth 4.3 ft)*

Little Clear Lake post-dredging

*(Maximum Depth: 30.0 ft,
Mean Depth 8.5 ft)*

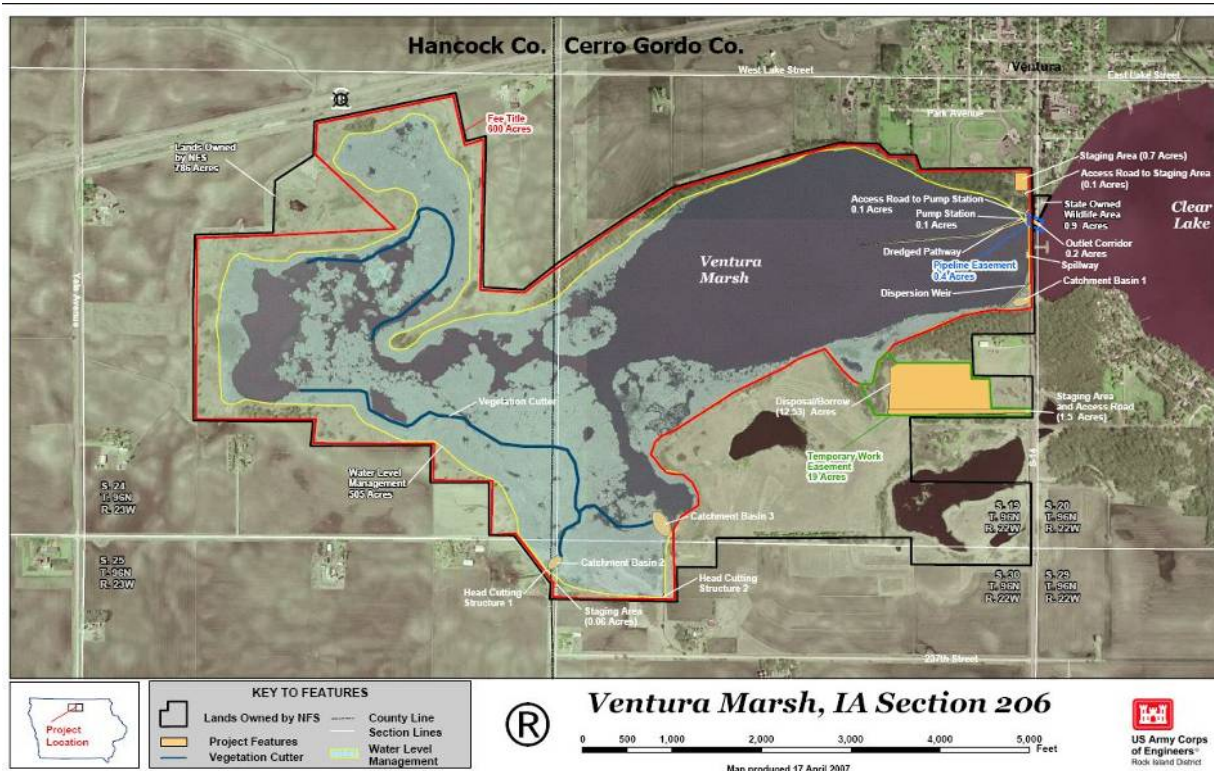


The recently dredged west end of Clear Lake has continued to show improved water quality when compared to pre-dredged conditions. The west end total phosphorus concentration has decreased from 77 ppb when dredging began in 2008 to 53 ppb in 2010 (a **31% reduction**). Likewise, total suspended solids have decreased from 27 ppm in 2008 to 12 ppm in 2010 (a **66% reduction**). Water clarity has increased from 1.8 feet in 2008 to 2.2 feet in 2010 (an **18% increase**). 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

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



- Construction has started 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) has \$3.2 million earmarked for a Ventura Marsh restoration project. Ventura Marsh state land and in-kind credits of \$840,000 and approximately \$884,062 in LRP dollars will fund the IDNR's portion of the marsh restoration project.
- The goal is to work with the COE in FY2010 and FY2011 to restore Ventura Marsh and gain water level management capabilities. This will allow for fish removal and revegetation of the marsh.
- The total cost of all above mentioned activities is approximately \$17 million. Of this amount, local and federal match represent 40% of the funds necessary to complete these restoration efforts.
- Work completed in 2010 includes a culvert placement under the S14 blacktop (Ventura Grade road) and pre-embankment loading for the pump location. The pump station, removal of old stop-log structure and fish trap, new stop-log structure, and limited dredging in Ventura Marsh will take place in 2011. The planned completion date is November 1, 2011.



Ventura Marsh Section 206 Project Area

Anticipated Benefits

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. In addition, in FY2010 the DNR and Hancock SWCD will cost share on stabilization of critical shoreline areas at McIntosh Woods State Park.

Green Valley Lake (Union County)

Green Valley Lake is a 390-acre lake constructed in 1950. It has a watershed to lake ratio of 11.3/1. 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 have completed a watershed assessment and have developed a four-year plan to make needed watershed improvements. Cost share funding is now available for 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 includes IDNR staff, NRCS and SWCD staff, the City of Creston, Southern Iowa Rural Water, Green Valley Chemical and CIPCO meet to coordinate project activities.

DNR Parks is working 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, and each site will have a new picnic tables and fire grills. The campground will have a new shower building installed this spring. DNR Parks added new pit latrines at the campground, the cabins and the north picnic area and built a third camping cabin. Green Valley will also have 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 to complete approved soil and water quality improvement projects. To-date only \$18,000 is not committed to 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 and channel catfish.
- 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 from 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. The DNR determined that over 30% of the phosphorus loading to the lake system comes from this portion of the watershed; therefore, we will construct a sediment control structure after completion of sediment removal activities.



- 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. As of December 2010, the project is approximately 40% complete with a February 2011 completion date expected.

Lake Darling (Washington County)

Lake Darling is a 267-acre man-made lake, constructed within a 1,400-acre state park, with a watershed to lake ratio of 46.5/1. Initially impounded in 1950, it has historically been a fair fishery plagued by severe in-lake siltation and poor water quality. Sedimentation has 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%.

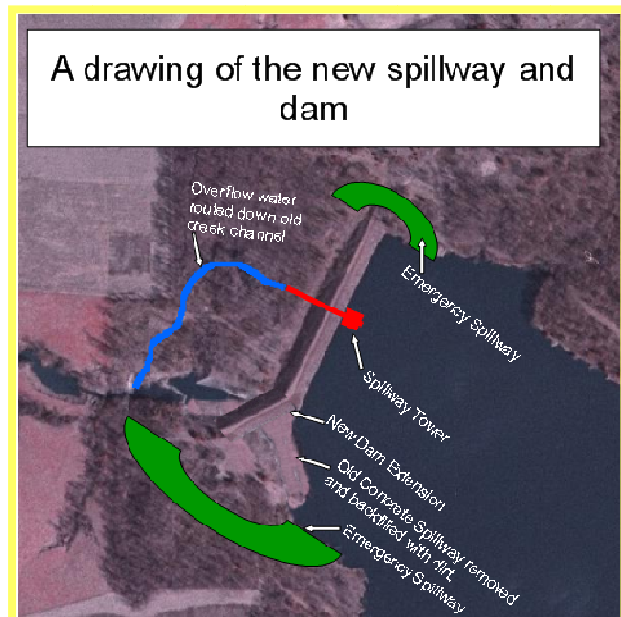
- The Management Plan includes all in-lake improvements to be done while the lake is drained and sustaining those improvements over the next 50 years. The Plan and its affects will benefit not only Lake Darling State Park but also the local community and economy.
- DNR held a public meeting in October 2010 at the Lake Darling State Park Lodge to discuss progress and obstacles encountered with the Lake Darling Restoration. We shared information with the public regarding permitting, archaeology, engineering design issues, status of Lakes Restoration Program funding and inclement weather's affect on the schedule.

Lake Darling Estimated Restoration Project Costs

Sediment removal (300,000 yd ³)	\$1,800,000
Dam reconstruction & water level increase	\$1,700,000
In-lake silt dam construction	\$500,000
Ponds, terraces, risers, wetland (DNR/319/LRP)	\$386,000
Shoreline stabilization & jetty repair	\$215,000
Spoil retention dams	\$105,000
Handicap accessible jetty (REAP Land Management)	\$75,000
New campground boat ramp & lot (MFT)	\$30,000
	Total = \$4.8 million dollars

Phase 1 – Dam and Spillway Renovation (Winter 2010 – Spring 2012)

- Acting on the recommendations of the completed engineering report, the IDNR will repair the dam and address spillway leakage.



- The NRC approved C.J. Moyna & Sons, Elkader, IA as the lowest bidder (\$1,700,809.58) for the Lake Darling dam & spillway repair on November 11, 2010. With the lake drained, DNR plans for in-lake restoration and spillway construction starting spring of 2011 with a tentative completion spring of 2012. In addition, the new spillway will increase the lake level by 2 feet.
- The Office of State Archeologists conducted archaeological surveys in areas potentially impacted by project construction activities. OSA completed all necessary archaeological work with the exception of a single site, which has valuable historical significance. Archaeologists are exploring this site further to insure they collect as much information as possible regarding past civilizations before restoration work moves forward.
- The DNR, SHPO and the USACOE signed a Memorandum of Agreement; this allowed data recovery work to commence. The DNR, SHPO and COE held an Archaeological Review Meeting in November 2010 at the SE Regional Office to assess the progress of ongoing survey work. This team informed the IDNR, USACE, and SHPO that their work was 50% complete and that a reasonable period for completion was the end of the year. The last phase of archaeological work was completed December 2010.

Phase 2 - In-Lake Construction 2011 Construction

- Sediment Retention Basins / Sediment Removal / Shoreline Armoring
- Universally Accessible Fishing Pier



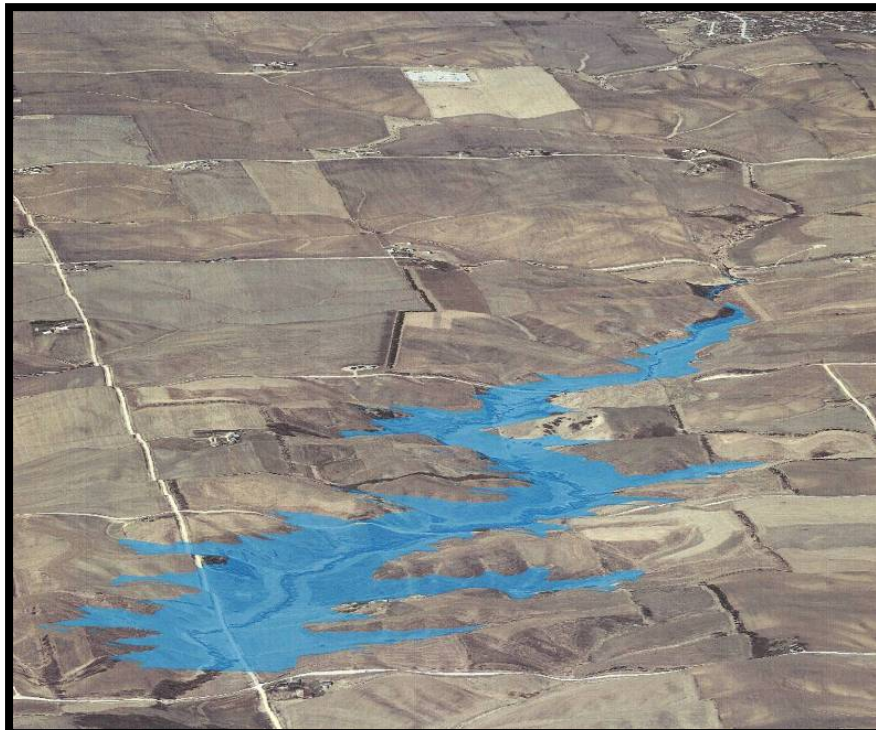
Phase 3 – Boat Ramp and Parking Lot

- The DNR Fisheries Bureau and Engineering Bureau, has also been working on plans for the construction of a new boat ramp and parking area. DNR will construct the ramp and parking lot on the shoreline before the entrance of the existing campground and will replace the current campground boat ramp.

Lost Grove Lake (Scott County)

The Iowa Department of Natural Resources has begun 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 350 surface acre lake. This recreation project has strong local support from groups such as; the Quad City Conservation Alliance, Pheasants Forever, the Izzak 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 EQUIP nutrient and pest management enrollments.

This lake site is located 10 miles north of Davenport, Iowa and will produce 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 will provide 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.

Lost Grove Lake and Recreation Area Funding

	Federal	State Match
Project cost to date	\$2,610,000	\$1,885,000
Lake Restoration Program		\$2,000,000
State Marine Fuel Tax		\$1,875,000
Federal Coast Guard MFT	\$350,000	
Federal Sport Fish Restoration	\$2,475,000	
DNR Fish and Wildlife Trust Fund		\$150,000
State Parks and Institutional Roads Fund		\$300,000
Total Estimated Project Cost	\$5,435,000	\$6,210,000
Grand Total Estimated Project Cost	\$11,645,000	

- J.B. Holland Construction was the lowest bidder (\$4,158, 640.54) on the Lost Grove Lake dam construction project. The NRC approved the bid on June 10, 2010. Dam construction began in July 2010 and will take about two years to complete the dam/access construction.

Storm Lake (Buena Vista County)

Storm Lake is a shallow natural lake (3rd largest natural lake in Iowa) with a surface acreage of 3,140 acres and a watershed to lake ratio of 4.5/1. Prior to the current dredging effort, IDNR last dredged Storm Lake in 1962. Lake depth maps developed in 1992 indicate that the 1962 dredging sites lost approximately 60% of their volume. Studies indicate that the majority of the sediment filled these areas was from in-lake dynamics with some contribution from the watershed.

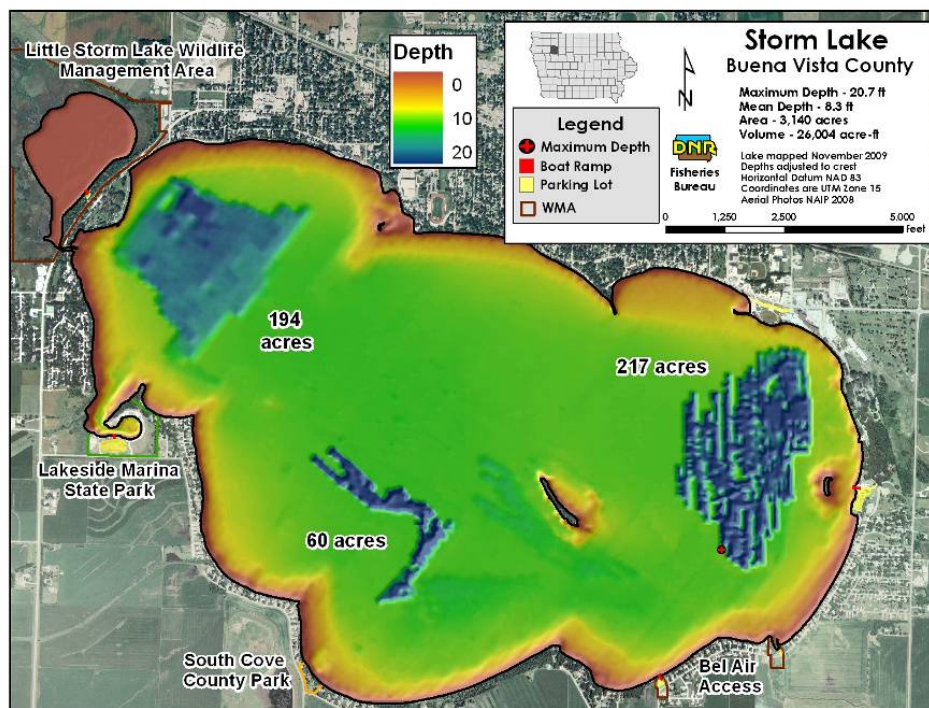
- DNR constructed a dredge spoil site at Storm Lake in 2001 and began dredging activities in 2001/2002. Lake dredging removed 1.32 million cu./yds. of sediment at a total project cost of approximately \$4.0 million during this first year of operation. Funding limitations restricted this initial dredging 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 has along state partnership has dredged an additional 3,782,652 cubic yards from 2003 to present. The City of Storm Lake leased the original IDNR containment site and has since constructed a new containment site east of Storm Lake.

Funds contributed to the project

State allocation	\$8,650,000
Federal Allocation	\$1,765,000
City of Storm Lake	\$1,297,751 (Annually contributes a portion of Hotel/Motel Tax)
City of Lakeside	\$98,577 (Annually contributes a portion of Local Option Sales Tax)
Buena Vista County	\$680,000
Private Pledges	\$1,365,964
Total	\$13,857,292

- From 2002 to 2010, a total of \$13.86 million has been spent toward the restoration of Storm Lake
- Current data supports that past restoration efforts have resulted in improvements to the water quality of Storm Lake. Water clarity averaged 29 inches in 2010 opposed to an average clarity of 10 inches in 2004. There has also been a reduction in the average concentration of total phosphorus in the water column and the City continues to improve stormwater delivery to the lake.

Year	Days	Cubic Yards	Average clarity in inches
2002		1,320,000	
2003		50,000	
2004	136	699,112	10
2005	125	548,389	12
2006	138	573,225	14
2007	111	527,837	17
2008	69	244,450	19
2009	143	559,966	21
2010	156	579,673	29
Totals	878	5,102,652	



From 2002 to 2009, the partnership at Storm Lake removed 5.1 million cu./yds. from over 500 acres of the lake

Joint (DNR/Local) Five-year Project Completion Plan (2010 – 2014)

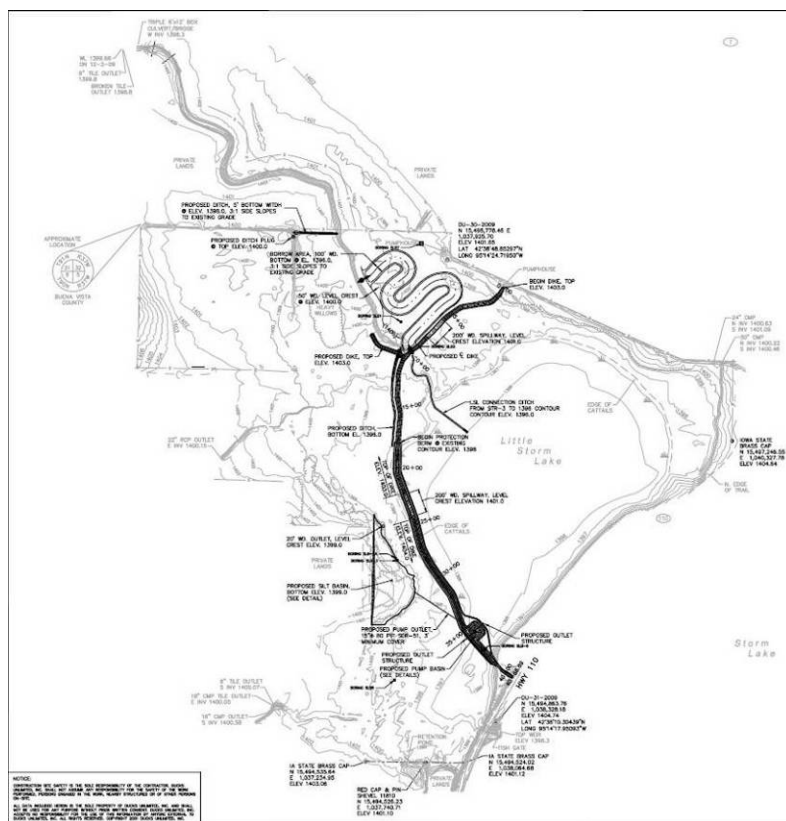
The current project goal includes a five-year plan. The plan includes dredging the lake for three years (2010 - 2012) with a goal of removing another 1.6 million cubic yards. The fourth year would focus on current work at Little Storm Lake, while allowing the spoil site to settle. The fifth year (2014) would involve the final year of dredging the lake. With the continued observed improvements in water quality, we should be able to maintain above the original water clarity goal of 28”.

- The project goal is to dredge an additional 2 million cu./yds. of sediment. This additional material can be placed within and will fill the current containment site
- To accomplish this goal will require an additional \$5 million in lake restoration funds and \$1.365 million of local match.

Little Storm Lake Ecosystem Restoration

Little Storm Lake is a 190-acre state-owned marsh that is an extension of Storm Lake (marsh and lake elevation is the same). The Lake Preservation Association (LPA) for Storm Lake applied and received a Watershed Improvement Review Board (WIRB) grant for \$200,000 to reduce the sediment and phosphorous transport from Little Storm Lake in to Storm Lake. The Lake Restoration Program will match the grant with an additional \$200,000.

- Approximately 70% of the water from the watershed flows through Little Storm Lake. Little Storm Lake originally had the ability to remove much of the sediment and nutrients from incoming waters. However, degradation has compromised proper wetland function. Under normal hydrologic conditions Little Storm Lake has the potential to function as a sediment trap for Storm Lake, but this capacity is overwhelmed during high flows. Little Storm Lake is at or near its sediment trapping capacity, which results in higher sediment transport into Storm Lake. Resuspension of sediments due to wind and other in-lake dynamics, such as rough fish, further exacerbate the total turbidity from suspended sediment and results in movement of sediment from Little Storm Lake into Storm Lake.
- This project includes a fish barrier and water retention structure between Little Storm Lake and Storm Lake and the construction of a pumping station and associated equipment. The project involves periodic dewatering of Little Storm Lake during years of favorable climatological conditions to consolidate the sediments and revegetate the area. Construction of the fish barrier would aid restoration efforts by preventing rough fish from destroying the vegetation and would decrease recruitment of rough fish by limiting their spawning area. In the future, if Little Storm Lake still does not provide adequate trapping capacity, a dredging project could be initiated to deepen the Little Lake to decrease sediment moving into Storm Lake.



- The work at Little Storm Lake is part of an overall effort to improve water quality in Storm Lake. Ducks Unlimited finalized engineering designs and presented the proposed work at a public meeting. Construction activities will include a long dike, three water control structures, fish barriers, pump installation, excavation, and construction of a retention pond. DNR had the bid letting December 2010 with construction to follow closely. Lessard Contracting (Sergeant Bluff, IA) submitted the low bid for the project in the amount of \$789,245.

Anticipated Benefits

- This aggressive dredging goal, coupled with watershed improvements and restoration of Little Storm Lake and wetland will result in significant improvements in water quality. We anticipate being able to maintain an average summer water clarity of 30 inches (**a 300% improvement in water clarity since inception of the project**) by 2015.
- In addition, lake restoration efforts so far have encouraged a \$35 million economic development named "Project AWAYIS" that has the potential to create 690 new jobs and over \$28 million in new spending in Storm Lake and Buena Vista County.
- Completion of the Casino Bay Marina with \$3 million dollars of State of Iowa funds which allow better access and a full service boat dealership on the lake.

Lake Restoration Program (LRP) – Projects In Progress

Big Creek Lake (Polk County)

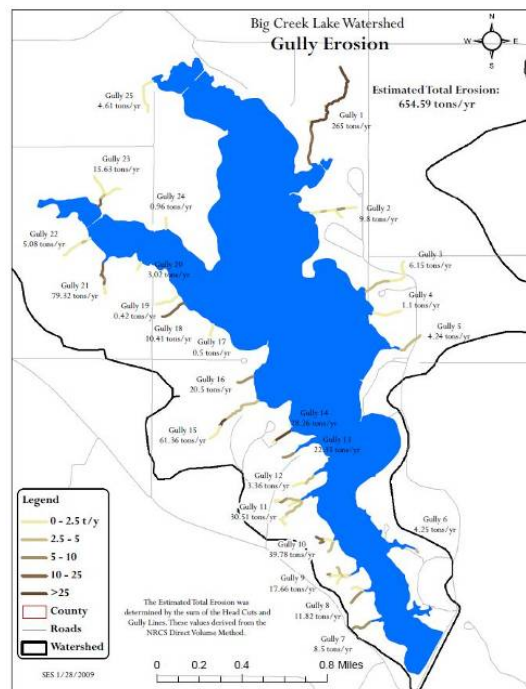
Big Creek State Park/Lake is a major recreational destination for the citizens of Iowa. Over 350,000 visitors travel to Big Creek each year and they annually generate over \$19 million in spending. Improving the lakes water quality through watershed improvements is critical to maintaining and even increasing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

- A 2007 development grant provided analyses of the Big Creek watershed. In addition, a 2008 gully analysis and 2009 land use analysis provided a better understanding of critical areas in the watershed.
- Watershed assessment identified several gullies with severe erosion on State property. DNR Engineering is taking a more detailed look at the top 10 of 25 problem gullies, since they estimated that these 10 areas accounted for the majority of sediment delivery to Big Creek. The plan over winter 2010/2011 is to determine the best location for structures, survey and provide design concepts to us so that DNR can determine the potential areas affected by construction activities; including, construction access and staging areas. We will then use this information for the environmental and archeological review of these sites. Once we have approved locations for the structures we will request that engineering proceed with final design and bid letting for construction.



- A DNR Wildlife Specialist continues to work with landowners in the Big Creek watershed to implement conservation programs, such as WRP CRP on their properties to reduce sediment and nutrient input into Big Creek. The DNR Lake Restoration Program is working in cooperation the Department of Agriculture and Land Stewardship for project management, to address stream bank erosion and/or livestock exclusion to provide additional Conservation Reserve Program incentives to landowners within the watershed.
- The Iowa DNR Watershed Improvement Section completed a Water Quality Improvement Plan in September 2010 and in March 2010 contracted 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 year duration of the project.



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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 5.15 feet. Water clarity is predominantly in the range of 0.5-1 ½ 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. In addition, the state beach portion of the lake on the 30 Acres Campground shore was closed once in 2004 and 2007, both due to high E. coli.



- 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 \$40,000 to help fund the Diagnostic / Feasibility Study; the goal of the study is 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.
- DNR Fisheries has given several tours to DNR employees and ISU personnel of the Black Hawk Lake watershed. They conducted a tour of the lake shoreline to map tile and storm sewer inlets to the lake and identified locations in need of best management practices.

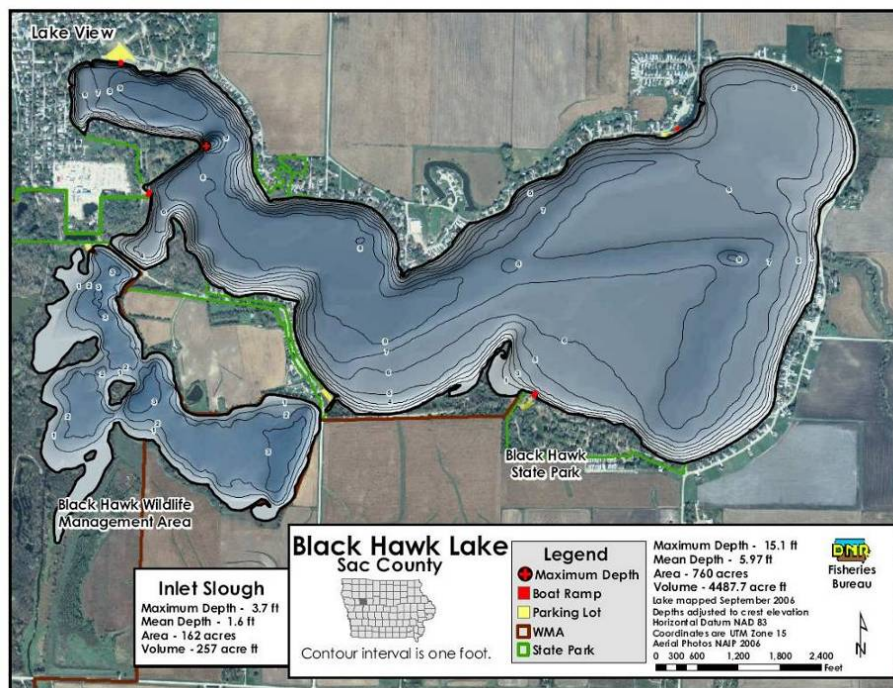
- IDALS provided planning assistance to help accurately identify existing problems and issues critical to achieve desired resource management objectives and to help local leaders inventory, assess, and develop strategies to address watershed problems.
- DNR Watershed Improvement Section completed Water Quality Improvement Plan to address the 303d listed of Blackhawk Lake. Algae and turbidity impairment continue; the bacteria impairment is new for the 2008 cycle. DNR will schedule a public meeting in January 2011 to present findings and receive comment.

Black Hawk Lake (Sac Co.) Bathymetric Map

Main Lake Area: 760 acres
Main Lake Mean Depth: 5.97 ft
Main Lake Max Depth: 15.1 ft
Main Lake Volume 4,488 ac-ft

Inlet Lake Area: 162 acres
Inlet Mean Depth: 1.6 ft
Inlet Max Depth: 3.7 ft
Inlet Lake Volume: 257 ac-ft

Total Volume: 4,745 ac-ft
Total Area: 922 acres
Mean Depth: 5.15 ft
Max Depth: 15.1 ft



- The watershed action group has met a few times to discuss the project and is currently reviewing restoration alternatives and developing a plan of action. 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 will allow the local group the ability to apply for project implementation dollars for work in the watershed.
- Project partners are also exploring the potential of several CREP sites as part of the Mississippi River Basin Initiative. The Natural Resources Conservation Service has established the Mississippi River Basin Healthy Watersheds Initiative (MRBI) to improve the health of the Mississippi River Basin, including water quality, wetland restoration, and wildlife habitat. Through this Initiative, NRCS and its partners will help producers in targeted watersheds within the Mississippi River Basin voluntarily implement conservation practices that avoid, control, and trap nutrient runoff while maintaining agricultural productivity.

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.



- DNR has altered the waterfowl refuge boundary to exclude Blue Lake and address excess nutrient inputs from geese.
- Lake Restoration contracted with MSA Professional Services to conduct a diagnostic-feasibility study on the lake. Extensive data collection occurred throughout 2010 and MSA, in cooperation with the Technical Advisory Team, is developing alternatives to address project objectives. Project leaders will plan a public for early 2011 to discuss potential restoration efforts with the community.

Brushy Creek Lake (Webster County)

Current project activity entails the construction of sediment control structures at 13 sites (estimated reduction in sediment delivery of 300 tons/year) surrounding the lake at Brushy Creek State Recreation Area. These structures, commonly referred to as terraces, are earthen dikes and control structures made of pipe and culvert material that are built at the head of gullies and valleys where erosion has occurred in the past and where sediment is entering the lake proper. The NRCS designed structures for this project and the funding source is Federal EPA and Lake Restoration Program. The NRC approved the bid from Carnarvon Sand and Gravel at a cost of \$64,618.00.

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 surface pool elevation 970.0 feet, with a watershed area of 2,675 acres (watershed area to lake area ratio of 7.6/1). 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. Impairments include nutrients/algae, indicator bacteria, and fish contaminants (PCBs).

- Carter Lake is a highly productive lake that exhibits 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.



- The IDNR, the City of Carter Lake and the City of Omaha have an agreement to develop a well on City of Omaha property that will connect to an existing infrastructure of pipes that lead to Carter Lake. The City will use the well to maintain Carter Lake at a full pool range. The DNR agreed to pay the cost of the Recharge Well System. The City of Carter Lake and City of Omaha have met their match requirements for this Recharge Well System through in-kind contribution and the City of Carter Lake will coordinate the project.
- The Iowa Legislature provided \$1,000,000 in funds for the well recharge system and water quality improvement projects at Carter Lake.
- 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 will focus on the restoration alternatives of water-budget/seepage management, dredging, and stormwater/in-lake alum treatment. By winter of 2009 project partners will have enough information on probable cost, effectiveness and permitting issues to determine how to best move forward with implementation.



Carter Lake Restoration Project Budget	
IN-LAKE	
Alum Treatment	\$1,530,000
Sediment Core Study	\$39,000
Fish Renovation	\$200,000
Targeted Dredging	\$279,300
Watercraft Management	\$87,994
SUB-TOTAL	\$2,136,294
IN-LAKE (watershed interception)	
Wetland Creation / Enhancement / Forebays	\$2,019,000
Shoreline Stabilization	\$899,000
SUB-TOTAL	\$2,918,000
WATERSHED	
Bio Swales / Wet Detention Basins / Vegetated Buffers	\$794,300
ENGINEERING	
Final Alternatives Analysis	\$319,000
Final Design / Permitting / Construction Review	\$647,104
SUB-TOTAL	\$966,104
WATER SOURCE	
Well Construction / Supply Line Modification	\$425,085
Final Design	\$74,915
SUB-TOTAL	\$500,000
OTHER	
Information / Education Program	\$30,700
Information / Education Coordinator	\$172,000
Lake Water Quality Monitoring	\$120,000
SUB-TOTAL	\$322,700
GRAND TOTAL	\$7,637,398

Anticipated 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 will be 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.
- 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
- Almost immediately, visitors to Carter Lake saw drastically improved water clarity as a result. Water quality data collected during the summer of 2010 shows that toxic algae blooms have declined, phosphorous and nitrogen concentrations are lower, and water clarity has increased. However, there is still a need to control more phosphorus to meet water quality goals; therefore, another treatment will be needed in the spring of 2011.
- Tetra Tech is engineering wetland restoration and shoreline protection measures for spring/summer construction.

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 has met several times from 2007 to 2010 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, DNR – 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.
- The most recent meeting took place on July 12, 2010. Kathy Woida and her team at NRCS presented on their Yeader Creek Assessment (e.g. channel condition, location and sources of sediment delivery, quantification of sediment delivery, stream geomorphology and location/condition of storm sewer outfalls). The purpose of the NRCS study was to complement the current Iowa State University DF Study by providing additional information specific to the tributaries draining to Easter Lake.
- There are at least 160 storm sewer outfalls in the watershed, including 135 that discharge directly into the channel system. Eighteen of these structures exhibited moderate erosion of bank material immediately around the outfall, and three structures exhibited extreme erosion.
- 12% of channel banks were severely or very severely eroding at the time of the field assessment. More than half of the very severely eroding banks were adjacent to commercial property.
- When bank stability was evaluated on the basis of erosion rate and bank height, 2,100 feet of bank were identified as “critical” and 10,000 feet as “very unstable.” Nearly half of the critical banks occur in the South Branch between Diehl Road and the soapbox racetrack.
- Under current erosion conditions, and assuming a sediment delivery rate of 95%, channel bank erosion is contributing roughly 3,000 tons of sediment from the Main Branch and roughly 1,000 tons of sediment from the South Branch to Easter Lake each year.



- John Downing at Iowa State University presented on the components, goals and status of the Diagnostic/Feasibility Study of Easter Lake. When completed, this study will include a watershed and lake monitoring component and a discussion on potential restoration alternatives for the system.
- Easter Lake is one of our significant publicly owned lakes. Both of these studies are part of Lake Restoration Program's process to document 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 and assess the economic benefits of the project.

- Polk County and the Iowa DNR are working together to design a park and lake user survey to investigate how satisfied the users are and what they would like to see improved. This survey will take place in 2011. A public meeting will take place in 2011 to inform the public of the results found during the surveys and studies and to begin development of a restoration plan.

Five Island Lake (Palo Alto County)

Five Island Lake is a 950-acre natural lake located on the north side of the town of Emmetsburg, Iowa in Palo Alto County. In 1989, following five 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.



Figure 2. Contour map showing depths in the vicinity of the dredged areas (4/22/10).

- The Lake Board has stabilized almost 10.5 miles of lake shoreline, dredged over 5 million cubic yards of silt, and worked in the watershed to reduce nutrients and sediment from entering the lake.
- Funding for this project requires a combination of state and local matching grants. Local monetary contributions to date exceed \$1.2 million. State funding as of FY11 is \$1.1 million.
- Summer 2008 tour with the DNR Director Leopold, State Senator Kibbe, local stakeholders and the DNR Lakes Program reviewed progress the need for continued watershed work to compliment local dredging efforts.
- In addition to the dredging portion of their project, the Lake Board is evaluating the need for additional work in the watershed and in-lake management strategies to achieve the desired water quality goals.
- The DNR and the City of Emmetsburg current annual agreement for dredging at Five Island Lake is \$200,000 (2010/2011 areas outlined in the map).

Hawthorn Lake (Mahaska County)

The fishery in the 170-acre lake collapsed in 2004 after gizzard shad were introduced in 2002. The DNR lowered the water level to a 20-acre pool while the in-lake restoration work takes place. Once the work is completed, DNR Fisheries will renovate to remove gizzard shad and carp. The lake restoration plan includes armoring about one mile of highly eroded shoreline, building fishing jetties and installing fish habitat. In 2011, a series of basins will be installed in the watershed to intercept nutrients and sediment before it can enter the lake. Hawthorn Lake is part of the Hawthorn Wildlife Area, in northern Mahaska County, near Barnes City.

The Mahaska County SWCD applied for and received a watershed assessment grant from IDALS. They completed the assessment during the winter of 2007. The Mahaska SWCD applied for and received a WIRB grant of \$360,900 toward Lake Restoration activities. In addition, a total of \$75,371 in Publicly Owned Lakes (POL) funds will be available through the next four years. This is in addition to \$75,247 in POL funds spent in FY 2009 and \$58,000 for FY 2010. The SWCD has spent a total of \$20,000 of the 2010 POL funding creating approximately 800 feet of terraces, grassed waterways and one grade stabilization structure to date. Lake Restoration Program will utilize funds of \$450,000 for in-lake shoreline stabilization, deepening, and watershed improvement on state lands.

- DNR has awarded a \$379,857 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, due for May 2011 completion, consists of the placement of in-lake habitat, shoreline armoring and deepening, and jetty construction/repair.
- DNR Engineering is developing initial design for nine water/sediment control structures on state land. The goal is to complete design by January 2011 and schedule appropriate environmental and archeological reviews for spring 2011 with construction later that year.
- Sediment delivery reduction from watershed work:
Grassed waterways constructed – two projects, 3 tons per year
Terraces constructed – sixteen projects, 263 tons per year
Terraces planned – seven projects, 66 tons per year
Sediment control structures on public land, 9 sites, 2,228 tons per year
- DNR will develop conceptual designs for the nine structures on public land by January 2011; then, initiate environmental and archeological reviews for the spring.

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 has met from the summer of 2008 - 2010 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 NRCS has identified a number of potential BMP sites, including an approximately 70-acre CREP wetland, in the watershed and is working with outreach to landowners to get these practices installed. Story County SWCD held a watershed field day in June with several watershed landowners and operators.
- Iowa DNR Lakes Restoration contracted with the Agricultural and Biosystems Technology Department at Iowa State University to complete a diagnostic / feasibility study. ISU will collect data and develop specific models that will assist Story County and Iowa DNR in protecting and improving water quality and fishery at Hickory Grove. ISU will also take part in public meetings, work closely with watershed landowners and provide a status of the project in early 2011.
- A monitoring network has been installed in Hickory Grove Lake Watershed and samples are collected at five locations: two locations for subsurface drainflow, one location for both surface runoff and drainflow, one location at the outlet of the lake and one location on the south side of the lake (behind the boating ramp). ISU collected grab samples once per week at all locations and installed ISCO (Automated samplers) at three locations to continuously monitor flow and collect daily composite water samples.
- Future Tasks for ISU:
 - Water quality monitoring will be continued until December 2011.
 - Monitoring data will be used to calibrate the SWAT model and the calibrated SWAT model will be tested with different management scenarios to develop a Water Quality Improvement Plan for Hickory Grove Lake Watershed.



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.

Water Quality Problems:

The Class A use of Lake Geode has been significantly impacted since 2000, when excessive bacterial levels resulted in the posting of warnings at the beach area. The trend of excessive bacteria has continued from 2000-2004 and has resulted in a dramatic decline of beach usage and as a consequence the loss of the concessionaire. From 2005-2007, test results have not indicated excessive bacteria, but use at the beach area has not rebounded. It is the opinion of the local working group and technical advisory committee that the public perception is a fear of contaminated water and associated risks. High levels of pH in Lake Geode periodically exceed water quality standards (WQS) and impair two of the lake's designated uses. High pH in the lake is associated with photosynthesis by algae, for which total phosphorus (TP) is the limiting nutrient. The TP load capacity for Lake Geode is 8,576 lbs/yr (average annual) and 111 lbs/day (maximum daily). To meet the target loads, a reduction of 39.8 percent of the TP load is required.

Proposed Management Measures:

The overall 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.

A variety of structures and management practices will be required to reduce both TP and bacteria contributions to the watershed.

- Sediment control basins (catchments) on public and private land, including road structures.
- Livestock fencing, Elimination of continuous livestock access to streams
- Beach landscaping (with tall grasses), goose population management, beach groomer
- Septic system inspection and repair or replacement
- Manure application rates (nutrient management plans)
- Manure management (incorporation, timing, proper application rates)
- I/E campaign for septic systems.

The district hired a watershed coordinator and is meeting with watershed landowners to establish targeted watershed improvement measures. Funding has been secured through a number of partners (e.g. DNR Lake Restoration and Watershed Improvement Section / Iowa Department of Agriculture and Land Management) to implement these practices. NRCS is completing survey and design of eight structures on DNR property and should go out for bid 2011.

DNR staff will develop a Lake Geode diagnostic/feasibility study that will outline in-lake restoration options. Implementation of these options will only take place after sufficient sediment/phosphorus watershed reduction.

Lake Macbride (Johnson County)

Lake Macbride (Johnson County) is a 940-acre lake owned by the State of Iowa. It has a 17,029-acre watershed that is mainly on private property. The watershed ratio is 18:1. The DNR Watershed Improvement Section completed a Water Quality Improvement Plan in 2005. The Lake Macbride Watershed Advisory Committee formed in 2001 and with assistance from Amy Bouska, Watershed Project Coordinator located at the Johnson County, the NRCS has \$725,000 on conservation practices and education in the watershed.

- In 2007, 900 feet of eroding shoreline was protected with rock riprap in the upper south arm of the lake.
- The DNR Lake Restoration Program and Johnson County entered into an agreement for protection of approximately 1,200 feet of shoreline along the Cottage Reserve Road with riprap. They completed the project fall 2008.
- In 2009/2010, the DNR implemented a timber management plan above a proposed gully erosion structures to reduce erosion. Practices included invasive and undesirable tree removal to open up the canopy and promote understory growth and seasonal burning.
- Repairs to shoreline, fishing jetties and islands completed in February of 2010 in response to 2008 flooding damage. Contractors used a total of 2,920 tons of riprap at a cost of \$62,000 (FEMA 90% / Lake Restoration Program 10%).

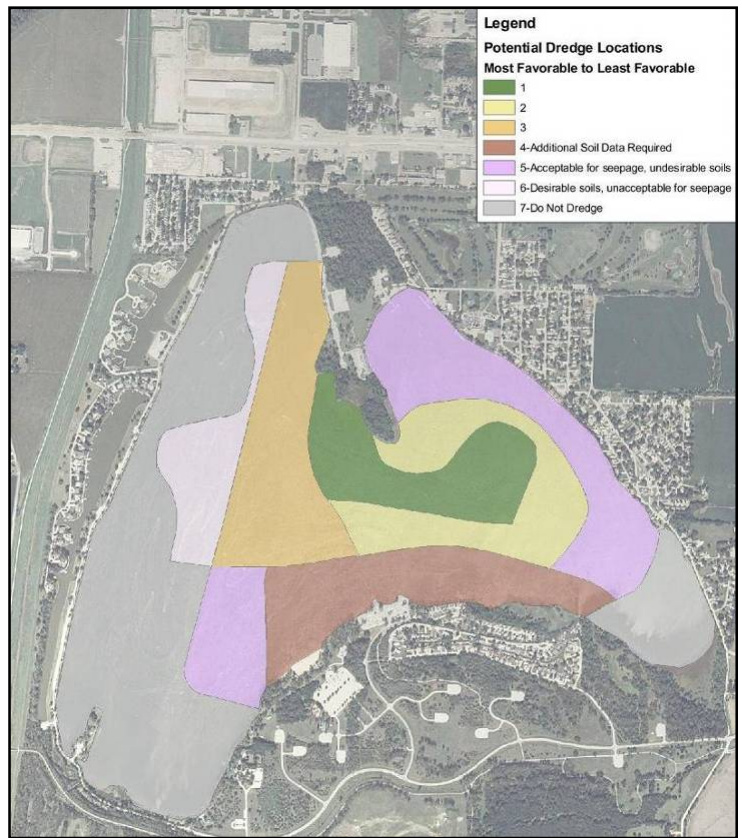


- Designs for two erosion control structures on public land are at DNR Engineering for review and bid letting. Construction should be in the summer/fall of 2011.

Lake Manawa (Pottawattamie County)

Lake Manawa is a 715-acre natural lake with a watershed to lake ratio of 3.5/1. 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 IDNR 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 IDNR met during spring of 2007 and fall of 2008 to discuss opportunities to obtain highway building materials from Lake Manawa sediments.
- The IDNR 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.
- The current phase involves working with Tetra Tech to finalize a dredging approach 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 IDNR and the Iowa Department of Transportation (IDOT).
- The IDNR 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.
- In advance of dredging, Tetra Tech has prepared a Phase I Archaeological Investigation as part of the Diagnostic and Feasibility Study of Lake Manawa.



THE KURSAAL, MANHATTAN BEACH, LAKE MANAWA
The Finest Bathing Beach in the West



Potential stockpile locations for dredge material

Lake Wapello (Davis County)

- The Lake Wapello restoration project is in the implementation phase of constructing 31 structures within the watershed, 11 of which are on state property. DNR estimates the total cost of restoration at approximately \$800,000. Structures on private land are being funded through IDALS Watershed Protection Funds (50% of total), 25% EQUIP, and 25% landowner cost share. Structures on state ground are being constructed at a cost of \$320,000; and are funded by the 319 (75%) and Lake Restoration (25%) programs.

Improved Angler Access from new fishing jetties

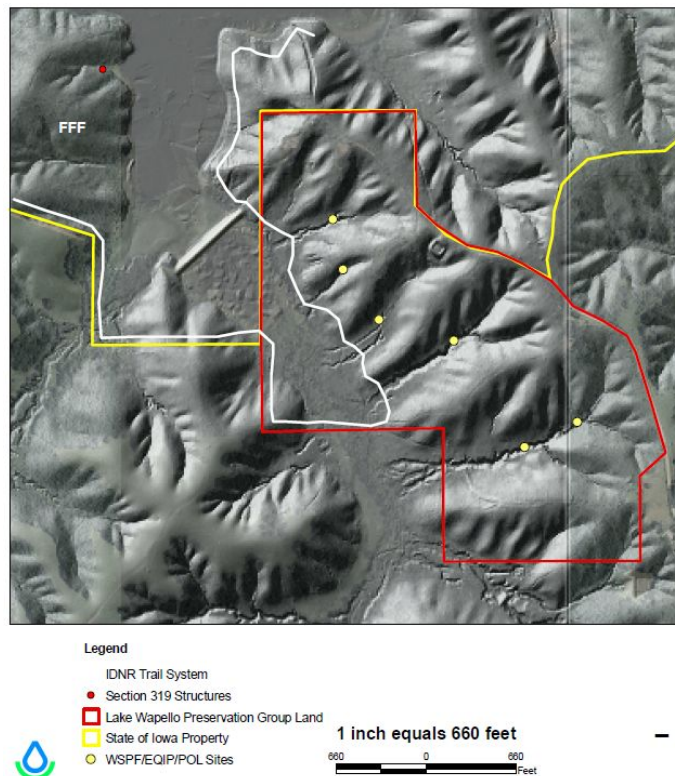


Lake Wapello during 2009 drawdown for in-lake habitat work, shoreline stabilization and outlet valve replacement

- DNR will construct an additional nine sediment control basins and one water impoundment within the park boundary during 2011.
- Contractors completed in-lake restoration activities in April 2009. Projects included in-lake fish habitat improvement (placement of approximately 1000 cedar trees and placement of approximately 440 tons of riprap and 1600 tons of gravel. All existing fishing jetties were improved and three new jetties were constructed. One existing boat ramp was improved. Fish and Wildlife Trust Fund and Federal Aid to Sport Fish Restoration funded all of these efforts. Lake Restoration funded shoreline armament and shoreline deepening

(movement of approximately 15,000 cubic yards of material and 4,000 ton of rock required to armor approximately 2,500 linear feet of shoreline). One new silt dam was constructed and the aging and unreliable outlet valve was replaced. Total in-lake construction cost was \$394,142.74, of which \$267,649.50 were Lake Restoration funds.

- DNR fisheries renovated the Lake Wapello fish population in 2008; however, this process was repeated again in 2009 due to the illegal introduction of gizzard shad into the system for a second time. Chemical cost of this renovation was approximately \$30,000 each time, funded through fish and wildlife trust fund dollars.
- DNR and the Camp Wapello Preservation Group, in cooperation with Davis County SWCD, will also construct water/sediment control basins and a grade stabilization structure at Camp Wapello (see LIDAR image). These structures will trap 252 tons of sediment annually, control future advancement of head cuts and control the flow of water, which will help maintain the crossings on DNR trail system.



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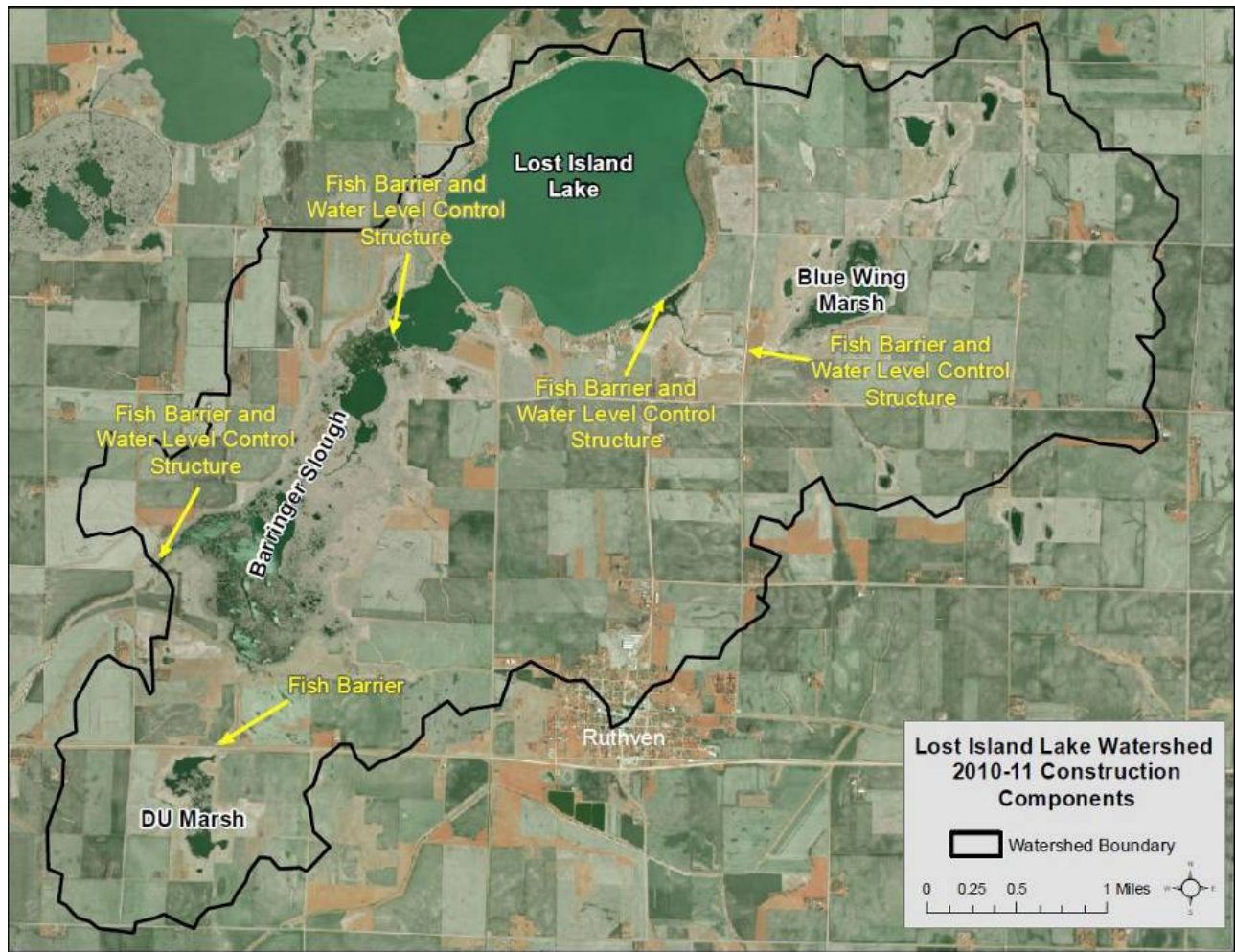
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Lost Island Lake (Dickinson County)

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 by reducing existing carp numbers, preventing remaining rough fish from entering most spawning areas, and conducting beneficial drawdowns on associated wetland areas (780-acre Barringer Slough, 150-acre Blue-wing Marsh). Eliminate rough fish, allowing germination of aquatic plants and the resulting 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 existing 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. Commercial fishing contract resulted in the harvesting of approximately 300,000 lbs since February 2010 and will target of additional 300,000 lbs by spring 2011. Predator stocking includes walleye, largemouth bass and northern pike.
- 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.



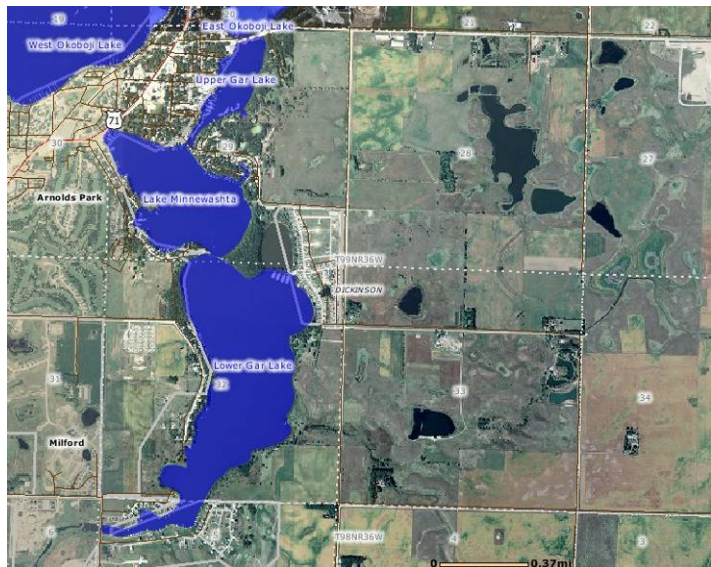
- The NRC approved Lake Restoration Funding toward the \$789,000 bid from Landwehr Construction, St. Cloud, MN for the project. The Watershed Improvement Review Board awarded the Palo Alto County Conservation Board \$180,000 to cover part of the cost (two water level control/fish barrier systems); Construction Pre-construction meeting November 16 Construction to begin November 16.



- 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 DNR, DU and local partners plan to construct most, if not all, the structures from winter 2010 through fall 2011. 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. Various basins were dewatered within the complex to eliminate rough fish, create favorable conditions for re-vegetation, and to prepare areas for fall construction.
- As of December 2010, Landwehr has installed the Blue Wing, DU Marsh, and Barringer Slough water control structures and fish barriers and had completed several necessary draw down channels. In January, the crew plans to install the electric fish barrier at the Barrier Marsh site and possibly start on the water control and fish barrier at the Lost Island Lake outlet. Once all structures are in place, all basins except Lost Island Lake will be dewatered to eliminate rough fish and allow for the germination of beneficial aquatic plants. Weather permitting; all basins should be at full pool during fall 2012 thereby providing excellent habitat for wildlife species and much-improved recreational opportunities for Iowans.
- The \$1.2 million project is a partnership between the Iowa Department of Natural Resources, Palo Alto County, Ducks Unlimited, and the Lost Island Protective Association.

Lower Gar Lake (Dickinson County)

- Local concerned citizens and business owners that live on or recreate on the Iowa Great Lakes system, specifically Lower Gar, Minnewashta and Upper Gar, formed The Three Lakes Improvement Association.
- IDNR Lakes Restoration staff has met with this group several times in the past years to discuss lake water quality and water depth issues and contracted with Iowa State University to conduct a diagnostic/feasibility to examine lake issues. This study was completed November 2011.
- The Iowa Department of Natural Resources hosted an informational meeting to discuss the results of a diagnostic and feasibility study of the Lower Chain of the Iowa Great Lakes (Upper Gar Lake, Minnewashta Lake, and Lower Gar Lake). Iowa State University conducted this study over the past three years in an effort to understand the factors influencing water quality in these lakes. The results will also provide guidance to resource professionals, lake residents, and the local community for improving lake water quality. The meeting was held June 2010 at the Milford Community Center.
- 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 will contain 54 acres of native prairie plantings and 35 acres of restored wetlands. The Lake Restoration Program continues to budget and work with local partners to pursue opportunities for targeted watershed improvement.



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 an impaired water (303d) 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.

The IDNR lowered the water level in Meadow Lake starting late summer of 2008 to facilitate a significant fish habitat and shoreline stabilization project, which included 740 feet of shoreline stabilization, rock reefs (2), pea gravel spawning beds (3) and a rock field. This project will enhance the fish habitat in Meadow and have water quality benefits. The shoreline stabilization work addressed all the actively eroding shoreline in the lake. The total cost of this project was \$65,000 including \$22,200 for stabilizing eroding shoreline. Three sources contributed to this project the state of Iowa Fish and Wildlife Trust Fund (\$15,250), Sportfish Restoration (\$45,750), and the Jensen-Butler Conservation Foundation (\$4,000).



- 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, we constructed two wetlands above Meadow Lake by the fall 2010. The larger of the two wetlands will impound 14 acres of water when filled.

Meadow Lake Restoration Project			
	Watershed Protection (319) Funds (75%)	Lake Restoration Funds (25%)	Total
In-Lake Sediment Retention Structure	\$46,250	\$15,417	\$61,667
14-Acre Wetland	\$36,923	\$12,308	\$49,230
2.5-Acre Wetland	\$14,811	\$4,937	\$19,748
Total	\$97,984	\$32,662	\$130,645

Prairie Rose Lake (Shelby County)

Prairie Rose Lake is a 173-acre constructed lake with a watershed to lake ratio of 23.5/1. Problems at the lake center on low fish populations, historic lake siltation and poor water quality. Lake improvements

in recent years include; jetties and fish structure (1998), sediment basin and shoreline riprap (2001) and sediment basins (2004). Local efforts have accomplished significant work in the watershed and identified additional work for completion.

- IDNR Fisheries and Parks staffs have been meeting with NRCS, IDALS, and others about remaining watershed work and initial lake restoration plans, based in part, on findings from the diagnostic/feasibility study completed by Iowa State University in 2008.
- Selby 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
- Now in the final year the Prairie Rose Water Quality Project has constructed over 100,000 feet of terraces and completed designs four wetlands around the lake.

Harlan Community High School students sample water in the Prairie Rose watershed

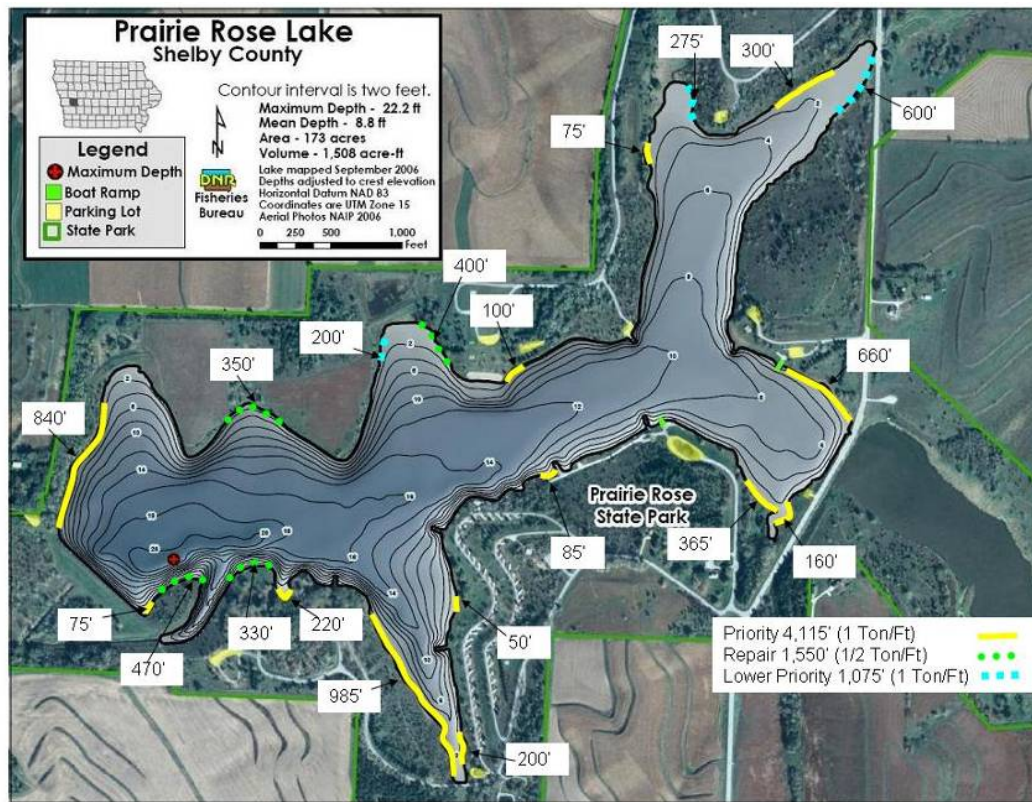


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Prairie Rose Restoration Plan	Estimated Cost
Containment site purchase	\$340,000
Phase 1: Begin to drain lake July 11, 2011	Fall 2011 - Fall 2012
Two road risers and two wetland rock chutes	\$80,000
Replace M47 road structure / raise water level	\$100,000
Spillway modification	\$250,000
Repair gate valve	\$15,000
Containment site construction	\$200,000
Mechanical dredging (South-east basin)	\$450,000
Shoreline armoring	\$275,000
Fish habitat construction	\$150,000
Fish renovation	\$10,000
Phase 2: After lake re-fills	2013
Hydraulic dredging	\$1,300,000
Total	\$3,170,000

- IDNR, in partnership with Pheasants Forever, acquired a 77-acre dredge spoil containment site in 2010, an important component to the in-lake restoration work. Archeological survey is being done on state lands that will be disturbed by construction and engineering plans are being developed for in-

lake construction to begin late in 2011 including shoreline stabilization, wetland dredging, spillway modification, gate valve repair, and fish habitat.



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 planned in-lake work to protect vital habitats and improve water quality in several bays on the lake by protecting the channel-side points. Stabilized shoreline loss will reduced erosion and improve water quality.
- The USACOE is constructing the Rathbun Lake Habitat Restoration Project under Section 1135 of the Water Resources Development Act (WRDA) of 1986. The Department of Natural Resources and the Corps of Engineers have mutually agreed upon the addition of 2000 feet of shoreline restoration below Honey Creek resort.



- The proposed new total project cost estimate is \$6,076,000 (total requirement for State cash and contributions for in-kind and land credit is \$1,519,000, Federal cost requirement is \$4,557,000).
- To date, the State has provided a total of \$939,000 in State cash toward the cost share of the project, and \$26,000 of work in-kind at the South Fork Wetland component of the project. This new total project cost requires an additional State cash contribution of \$500,000 for the Shoreline Restoration work, and the additional Federal funding requirement of approximately \$1,300,000.

Rathbun Section 1135 Cost and Cost Sharing Estimate - Update December 2010

Total Project Cost	\$6,076,000
Federal Share (Cash)	\$4,557,000
IDNR Share	\$1,519,000
IDNR Share Breakdown:	
Cash	\$1,439,000
In-Kind South Fork Construction	\$26,000
In-Kind S-13 Wetland Design	\$25,000
Lands for S-13	\$29,000

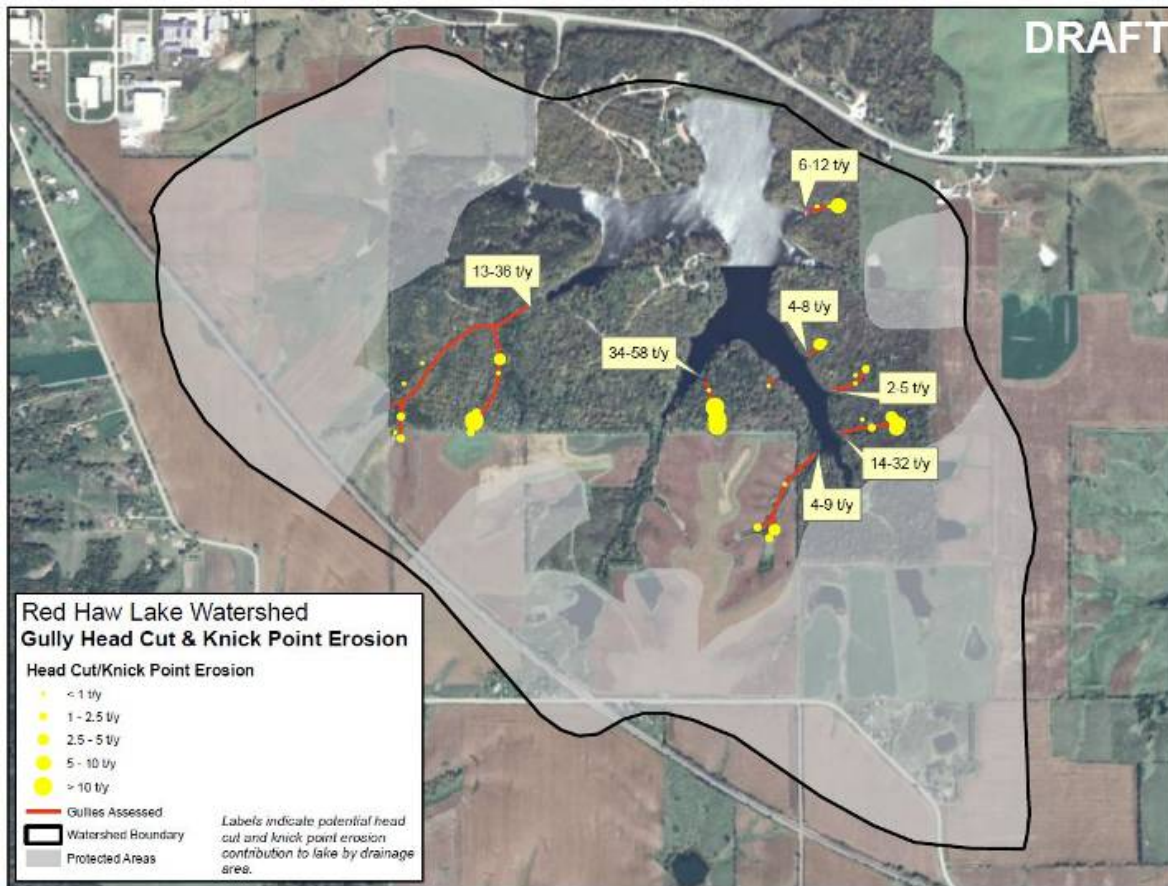
IDNR Cash Requirement = \$1,519,000 - \$939,000 provided - \$80,000 in-kind = \$500,000 FY11

Federal Cash Requirement = \$1,400,000

- The Section 1135 project will address nine sites and total rock placement will exceed 45,000 tons of riprap. In addition to water quality improvements, fish habitat will be improved for a number of important game fish species.

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 District and NRCS required additional assistance in funding for the design and construction of six to eight structures within the State park. DNR will survey / design / construct these grade stabilization and sediment basin structures in 2011/2012.

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 subwatershed 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 these sites for the placement of three ponds and two large basins to address critical areas of gully erosion. NRCS has completed design and DNR is planning for spring/summer 2011 construction.
- This challenging watershed will require this and 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 (Delaware County)

Silver Lake is a small, natural lake enlarged by the construction of a dam. It has a 34-acre surface area lake and a lake ratio of 6.4/1. University of Northern Iowa completed a diagnostic feasibility study in 2001 and the IDNR completed a Water Quality Improvement Plan analysis in 2001. Lake depth maps and sediment borings indicated excessive lake sedimentation depths ranging from 0.5 to 4 feet. A lake watershed assessment conducted in 2001, documented areas of high phosphorus input in the watershed. The assessment also identified excessive manure application levels as a problem. NRCS continues to work with landowners in the watershed to reduce nutrient and sediment lake inputs.

- In 2001, an engineering firm evaluated dam integrity and leakage issues. The construction firm hired to repair the dam and eliminate dam safety issues completed the work fall of 2007 at a cost of \$314,950.
- Lake water overflowed the Silver Lake spillway in April of 2008 following dam repair and wet weather conditions. According to local reports, this marks the first spillway overflow since 1993. Silver Lake reached full pool in April of 2008 and full pool level maintained until approximately August of 2008. The lake now contains about double the volume of water it did in the period immediately prior to the dam repair during the fall of 2007. The current lake level in Silver Lake is approximately 6 inches below crest following a period of dry weather.
- Silver Lake suffered a moderate winterkill during the severe winter of 2007-2008 that effectively eliminated largemouth bass and channel catfish from the system and reduced the bluegill population. DNR Fisheries restocked Largemouth Bass in June 2008 and the Bluegill have recovered favorably following a 2008 growing season. A winterkill also occurred in the winter of 2008-2009, but it was minor. Silver supported moderate recreational fishing during the open-water season of 2009 with good harvest of 6-7.5 inch bluegill and additional catches of 10-12 inch largemouth bass and 18-26 inch northern pike. Almost no fishing occurred on Silver during the 2007 and 2008 fishing seasons, so we are pleased with the increased recreational use.
- Vegetation and clarity volume, including abundant vegetation and secchi depth transparencies that commonly exceeded 30 inches, in the lake seem to be responding favorably to increased water. Vegetation was largely absent from Silver Lake during the 2006 and 2007 growing seasons and secchi transparency commonly fell below 24 inches. Aquatic macrophytes (primarily coontail and narrow-leaved pondweed) were abundant during the summer of 2009. Increased vegetation can pose a nuisance to recreational fishing, boating, and lake aesthetics; however, the dense vegetation coverage promotes improved water clarity and reduces the abundance of free-floating algae.
- Secchi measurements from the summer of 2009 indicated transparencies from 46-61 inches.
- DNR completed a Water Quality Improvement Plan for Silver Lake in the fall of 2008 and this study highlighted watershed areas responsible for primary phosphorus delivery. The goal is to form local action committees to address watershed inputs. Following watershed improvements that reduce sediment delivery and phosphorus inputs, the community and biologists are hoping to remove phosphorus-rich sediments from Silver Lake to help reduce problems associated with internal phosphorus loading.

- During 2010, members of the Delhi Community formed a small community-led workgroup. This workgroup held two meetings during the 3rd quarter of 2010 to discuss options for watershed improvement and in-lake water quality improvement.
- Silver Lake supported a good largemouth bass fishery during 2010, but still green algae and blue-green algae blooms negatively influenced the aesthetics and water quality of Silver Lake during the late summer and fall of 2010.

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.

- Union Grove Lake is on the Iowa's 2004 impaired waters list because of four limitations: pH, bacteria, algae, and turbidity. The IDNR is working with local sponsors to develop a plan to improve the lake and water quality conditions.
- The Union Grove Lake Watershed Project has been underway since April of 2008 and is scheduled to end June 2011. The project aims to reduce the soil and phosphorus reaching the lake by 57%, as well as reduce the effects of livestock on streams in the watershed. The Union Grove watershed received \$40,000 in grants for approved soil conservation practices, stream bank protection, fencing of livestock and a RASCAL (Rapid Assessment of Stream Conditions Along Length). To date, the Union Grove Watershed Project has completed 8.1 acres of new grassed waterways with an additional 5.8 acres under construction.



- Spillway water seepage had been an on-going problem at Union Grove Lake and past attempts to repair the problem had limited success. IDNR hired a geo-tech firm in 2005 to evaluate the problem and contracted a firm in 2006 to repair the structure.
- They 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.

Lake Restoration Program (LRP) – Projects In Planning / Outreach Stage

Arbor Lake (Poweshiek County)

Arbor Lake (Poweshiek County) is a 13-acre lake owned by the City of Grinnell. It has 979 acres in the watershed in which 75% is urban runoff. The watershed to lake ratio is 75:1. Watershed Improvement Section completed a Water Quality Improvement Plan in 2002.

- In 2005, the City of Grinnell received a \$150,000 NRCS grant to improve the watershed. They installed three wetland complexes that targeted 298 acres of the watershed, storm sewer interceptors that controlled another 18 acres and riffle pools on Hazel Creek to reduce erosion and down cutting of the stream. The City also planted two acres of native vegetation filter strips along the riffle/pool structures and established one three-acre rain garden at the Windsor Assisted Living Complex east of the lake.



- In October of 2009, representatives from the DNR and City of Grinnell along with IOWATER members held a successful and informative meeting regarding Arbor Lake Restoration. The goal is to work through an Arbor Lake Restoration Advisory Council and develop a Management Plan for Arbor Lake. In October 2010, representatives from the DNR and City of Grinnell along with IOWATER members held a successful and informative meeting regarding Arbor Lake Restoration. Participants included IOWATER, Grinnell College, Grinnell Parks and Recreation Board Member, City of Grinnell, and the DNR.
- Grinnell Parks and Recreation Department installed a new message center with signage that included fish, fishing and lake information. The message center is next to the walking trail around the lake. DNR Aquatic education gave the Grinnell Parks and Recreation Department a \$2,000 grant for urban aquatic programs for the summer. They collaborated with members of the community, Grinnell High School and Grinnell College to teach youth about fish, fishing, pond studies and water quality issues.

George Wyth Lake (Black Hawk County)

George Wyth is a sand borrow-lake with relatively low overall fertility when compared to other Iowa Lakes due to predominately sand substrates and a “new” lake basin. George Wyth’s historic fishery was moderate to poor, due to relatively low productivity and a lack of aquatic vegetation. Water quality parameters in George Wyth Lake compare favorably to other Iowa lakes, due to a low watershed to lake ratio and relatively small portions of watershed in agricultural production.

- The DNR Watershed Improvement Section completed a Water Quality Improvement Plan for George Wyth Lake in 2008 to address impairment due to high bacteria levels on the beach, with the primary cause for impairment identified as resident geese. Flooding from the Cedar River in 2008 affected George Wyth Lake and the State Park.
- Biologists introduced aquatic macrophytes into George Wyth Lake in the fall of 2009 on an experimental basis. DNR will monitor the success of Wild Celery and Narrow-Leaved Pondweed introduced into two enclosures over the upcoming year. If the experimental introductions prove successful, we will expand the plantings during the upcoming years.



- During a vegetation inventory completed on George Wyth Lake in July of 2010, DNR staff found six species of submersed aquatic plants, two species of floating-leaved aquatic plants, and three species of emergent plants. Planted during 2009, we found Wild Celery within enclosure structures and narrow-leaved pondweed at multiple locations in the lake.
- At the time of the survey, about 15% of the lake was covered with aquatic vegetation. George Wyth Lake was practically devoid of vegetation from 1988 – 2009, so biologists are optimistic that an aquatic plant community will improve water quality and fishery resources in

the lake. Biologists are uncertain as to what caused the proliferation of vegetation in 2010, but the most likely explanation is that the flood of 2008 delivered sediment, seeds, and plant fragments to George Wyth Lake.

- During 2010, George Wyth Lake experienced high water levels for much of the year due to persistent flood conditions on the nearby Cedar River. High water conditions and an increased abundance of aquatic plants promoted improved water clarity and improved overall water aesthetics at George Wyth Lake during 2010.
- Biologists will continue to monitor the aquatic plant community in George Wyth Lake during 2011 and will determine if additional plant introductions are necessary. DNR Fisheries will work cooperatively with DNR Parks to manage vegetation in areas with high public use (e.g., beach and boat ramp).

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.

Little River Lake (Decatur County)

Little River Lake was created in 1983 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 753-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. Fish quality and angling activity

have steadily declined since 2000 to a point where the lake offers few sport-fish or angling opportunities today.

- A coalition of local interested entities formed a restoration committee 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 NRCS staff is currently formalizing agreements with landowners and designing BMPs to address sight specific remedies. As of December 2010, Decatur SWCD has contracted approximately 35% of the funding with another 30 % pending approval. The NRCS staff has been prioritizing areas for the remaining funding.
- The restoration process during 2011 will involve 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.

Mariposa Lake (Jasper County)

- The Mariposa watershed project is set to run 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.
- The Jasper County Conservation Board is completing final steps to install a wetland immediately above the lake on the main feeder stream and plans for construction of the wetland in spring 2011.

Pleasant Creek Lake (Linn County)

Pleasant Creek (Linn County) is a 401-acre lake owned by the State of Iowa. It has a 2,035-acre watershed in which the State owns 90%. The other 10% is mainly in timber. The watershed to lake ratio is 5:1. One specific concern with this lake is shoreline erosion. DNR staff has documented approximately five miles of shoreline in need of stabilization along with many shallow areas for deepening.

There may be some opportunity to do some gully control structures on park property and review and update land management approaches on state ground. DNR Fisheries and Parks are working cooperatively with IDALS to developing a plan to address these problems.



Shallow Lakes Management Initiative

Ducks Unlimited and the Iowa DNR's Wildlife and Fisheries Bureaus established a prioritized list of at least 50 shallow lakes to be renovated over the next ten years. The first lake to be renovated was Diamond Lake in Dickinson County. Renovation work began during summer 2006. Shallow lakes prioritized for restoration include; Dan Green Slough in Clay Co., Four-Mile Lake in Emmet Co., Pickerel Lake in Buena Vista Co., South Twin Lake in Calhoun Co., Virgin Lake in Palo Alto Co., and Lizard Lake in Pocahontas County.

The following excerpt, provided by Joe Larscheid, DNR Fisheries, describes the basis and objectives for the DNR's 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 (Scheffer 1998). Shallow lakes usually exist in either of two alternative stable trophic states with or without any change in the nutrient budget of the lake (Scheffer et al., 1993, Moss et al., 1996). 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.

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 (Scheffer, 1993). 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 (Scheffer et al., 1993). 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 (Scheffer et al., 1993). 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 (Scheffer et al., 1993). The goal of this project is to develop tools that managers can use to shift and maintain shallow lakes in a clear water state.

Shallow Lakes Management Project Components:

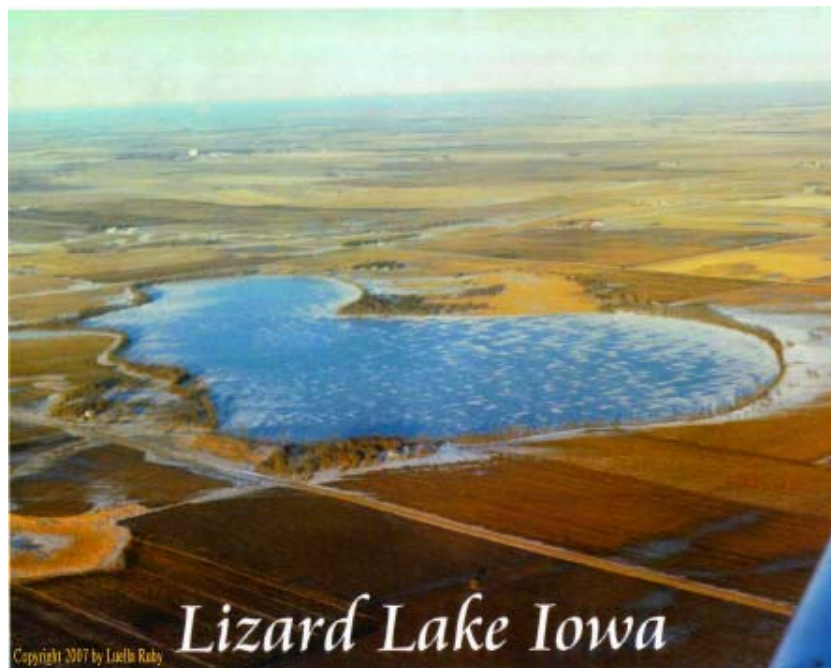
- Shallow lake renovation based on alternative stable trophic states: Management guidelines that cause shallow lakes to shift from the turbid, algae-dominated systems to the clear, macrophyte-dominated systems.
- Physical characteristics of shallow lakes before and after restoration: Characteristics include information about the watershed, bathymetry, sediment profile, and water chemistry of the lakes.
- Biological characteristics of shallow lakes before and after restoration: Characteristics include the plankton, macrophyte, fish community and waterfowl use of the assessed lakes and the related changes to benthivorous fishes from biomanipulation of these biological components.

Introduction: Natural Lakes in Northwest Iowa are mainly characterized as 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.

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.

Active Shallow Lake Projects

Lizard Lake, Pocahontas County - Lizard Lake is a highly degraded 285-acre shallow natural lake. Rough fish (buffalo, bullhead and carp) dominate the lake population. The lake contains very little area of aquatic vegetation and exhibits poor water quality. A local lake group has promoted lake restoration and they continue to meet with IDNR 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, IADNR staff has met several times with local partners and stakeholders to discuss shallow lake management options for Lizard Lake. Many stakeholders recognize 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.

Due to relatively 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. Engineering plans for a new water control structure, a fish barrier, and improved draw down channels have been completed, bid letting will occur January 2011 and installation of this infrastructure is expected to occur this late winter or next spring. Once installed, the lake will be temporarily drained 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. Pending appropriate weather patterns, Lizard Lake will be refilled in fall 2012 and quality sport fish will be stocked soon after.

Pickrel Lake, Buena Vista County - Pickrel Lake, located in extreme NE Buena Vista County, is a 170-acre basin that suffers 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 Pickrel Lake. To enhance water quality and fish and wildlife habitat in Pickrel Lake, project partners will initiate intensive in-lake management this winter and will continue to work long-term throughout the watershed to ensure that soil, fertilizers, and pesticides stay on the uplands. In-lake actions will be done this winter or early next spring and include 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 is in place, the DNR will temporarily drain the lake to allow for the elimination of problem fish, the consolidation of bottom sediments, and the establishment of beneficial aquatic plants. Weather permitting, Pickrel Lake will be allowed to refill by fall 2012 and quality sport fish, including walleye, will be restocked in the lake. Based on ecological responses of other recently restored shallow lakes, we anticipate that water quality will improve, fish and wildlife habitat will be more prevalent and diversified, and human recreational opportunities will increase.

Near-Future Shallow Lake Projects

East and West Hottes Lake/Marble Lake/Grovers Lake Complex, Dickinson County - Located within the 1,700-acre Kettleton 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. 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. Project partners, including the Big Spirit Lake Association, DNR, DU, Dickinson County, and others will provide funding and technical guidance to fund a comprehensive feasibility study to identify ways to return ecological health to this critical habitat. Final design will incorporate 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. Partners hope to complete the feasibility study by this spring and begin construction by fall 2011.

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 riding the lake of problems fish species, restoring aquatic plants, and stocking quality game fish. Plans are underway to construct an effective water control structure and fish barrier system. Partners hope to

install the needed infrastructure by fall 2011, temporarily drain the lake from spring 2012 to fall 2013, and then restock the lake in 2014.

Recently Completed Shallow Lake Projects

Center Lake, Dickinson County – Due to strong local support, the damaged and ineffective Center Lake outlet culverts were replaced at a lower elevation with a variable-crest concrete water control structure during fall 2008. Improvements to in-lake and downstream outlet channels were also completed. Collectively, these improvements will reduce flooding impacts on the 264-acre Center Lake and will allow for beneficial partial drawdowns on Center Lake and two associated Type III wetlands. Establishment of aquatic vegetation in the lake and wetlands will improve fish and wildlife habitat and will enhance water quality in Center Lake and its downstream neighbor, West Lake Okoboji.

This work on the lake outlet is only a small part of a comprehensive plan being developed for this lake. Storm water modeling and prioritization of other watershed inputs are underway. The Center Lake Improvement and Protection Association has collaborated with local agencies to develop a lake restoration plan to reverse recent declines in water quality and received a \$15,000 local grant to cost-share improvements to the outlet.

Dan Green Slough, Clay County – The donation of a key tract of land in 2008 facilitated the installation of a pump system and fish barrier on the 311-acre Dan Green Slough during fall 2008 and winter 2008-09. A subsequent temporary draw down of the basin during spring and summer 2009 resulted in the eradication of rough fish, the consolidation of bottom sediments, and the re-establishment of over 250 acres of soft stem bulrush and other beneficial emergent aquatic plants. The basin was kept partially dry during the 2010 growing season to allow for the continued growth of emergent vegetation and the establishment of submergent plants. Weather pending, the basin will be brought to full pool during fall 2010 or spring 2011.

A local bird surveyor recently informed the DNR that the wading and shore bird use was incredible this past year. He stated that he personally observed every shore/wading bird that was expected to be in this region of Iowa plus a few rare ones that were not expected. The mudflats had a tremendous response to emergents (i.e. softstem bulrush) and once water was returned, submergents (i.e. sago pondweed) flourished. Dense vegetation provided excellent fall habitat for migrating ducks. There was heavy duck hunter use throughout the season and many had a good to excellent luck.

Diamond Lake, Dickinson County - During winter 2006-07, the initial efforts to enhance this 166-acre basin were completed with the installation of a drawdown tile designed to allow the lake to be periodically dewatered to eliminate rough fish and to allow for the germination of aquatic plants and consolidation of bottom sediments. Excessive rain in late summer 2007 prevented a successful drawdown. A winter rotenone project in January 2008 eliminated the few remaining rough fish in the lake. A successful drawdown was realized in summer 2008 through the continuous use of the drawdown tile and the temporary use of an auxiliary diesel pump, which was purchased with Lake Restoration funds. The outlet of the lake was also lowered about 0.5' to a more natural elevation, which will prevent excessive shoreline erosion, tree toppling and should provide for water levels more conducive to aquatic plant growth. Despite a cool spring, regrowth of vegetation did well over the summer.

Aerial photo with Diamond Lake at approximately half pool.



Diamond Lake water clarity post renovation

A “reef” fish barrier was installed during winter 2008-09 to prevent the reinfestation of rough fish into Diamond Lake. The barrier is best described as a flow-through rock weir. At present, the lake contains exceptionally clear water and has diversified stands of emergent vegetation on the lake's perimeter and submergent vegetation within the lake. Migratory bird use has been excellent with several thousand shore birds and waterfowl observed on the lake during early fall 2009. Fingerling yellow perch were stocked spring 2009 and northern pike will be stocked in 2010. Weather permitting; the basin will be brought to full pool during spring 2010.

National Fish Habitat Action Plan unveiled Diamond Lake as one of its 2010 10 "Waters to Watch" list, a collection of rivers, streams, lakes and watershed systems that will benefit from strategic conservation efforts to protect, restore or enhance their current condition. These waters represent a snapshot of current conservation efforts that the Action Plan is undertaking to provide cleaner and healthier habitats for the many fish and wildlife species and people who call these areas home.

The Diamond Lake project focused on improving water quality by shifting the lake to a clear water state using water-level management to consolidate bottom sediments, re-establish aquatic plants, and control common carp populations. The restoration of Diamond Lake is Iowa's inaugural shallow lake restoration project providing resource management professionals with experience and expertise for managing shallow lakes. The project also provides stakeholders a demonstration of the restoration potential for other shallow lakes. Water quality, plant abundance and diversity still good. Perch and Northern Pike growth is excellent. First time in recent history that diving ducks were found using the lake in spring and

fall, which is indicative of a good food source. Hunters hunted ducks and geese on the lake this fall and had good success.

Four Mile Lake, Emmett County – A partial drawdown initiated during summer 2008 allowed for the successful addition of a fish barrier and in-lake drawdown channels in Four Mile Lake during fall 2008. Continuation of the drawdown summer 2009 allowed for the eradication of rough fish, the consolidation



of bottom sediments, and the establishment of beneficial submergent and emergent vegetation in the 200-acre basin. Presently, the basin is at full pool, contains very clear water, supports robust populations of submerged plants and associated invertebrate populations, and provided excellent migratory bird habitat. It is expected that during spring 2010, the restored Four Mile Lake will fulfill its intended function of becoming a “stepping stone” lake by providing exceptional migratory habitat for diving ducks and other migratory water birds that rely on healthy aquatic environments to complete their life cycles.

Jemmerson Slough, Dickinson County - Located at the top end of an important West Lake Okoboji watershed, the 932-acre Jemmerson Slough complex is an important water quality, wildlife habitat, and public recreation/education area. In 2006, Phase I of the Jemmerson Slough Enhancement Project was completed with the installation of two water control structures and two outlet improvements. During fall 2008, the second and final phase was completed with the installation of a pump station, new gravity-flow water control structure, and fish barrier. Intensive efforts were made during construction to prevent water quality problems in West Lake Okoboji and other downstream basins. Jemmerson Slough was temporarily dewatered during summer 2009 to rid the basin of rough fish and to allow for the re-establishment of aquatic emergent vegetation like soft stem bulrush, cattails, and other important plants. In 2010, water levels were brought up slowly to promote the continued growth of existing emergent plants and to provide a favorable environment for the growth of beneficial submergent plants like sago pondweed. Once re-hydrated, over 200 wetland acres will send cleaner water to West Lake Okoboji and other downstream basins, and will provide excellent production and migratory wildlife habitat. Excellent vegetation response and water quality throughout summer and fall. We established a ~600-acre waterfowl refuge in 2009; duck use was good during that fall and even better during fall 2010, with ~5,000 ducks and geese feeding and resting in the refuge. Development of small wetlands on recently acquired properties near the Jemmerson Slough Refuge should provide excellent duck hunting opportunities in the near future.

Lake Restoration Program (LRP) – Other Program Activities

Meetings with Local Leaders and Stakeholders

In accordance with Section 26 of House File 2782: “The department shall meet with representatives of communities where lakes on the initial list are located to provide an initial lake restoration assessment and to explain the process and criteria for receiving lake restoration funding”.

The IDNR has established local stakeholder groups or held initial technical field staffs planning. We have had these discussions with a number of active or planned lake/watershed improvement projects. Including; Big Creek Lake, Blackhawk Lake, Carter Lake, Clear Lake, Easter Lake, Green Valley, Lake Darling, Lake Geode, Lake Manawa, Lake Wapello, Lizard Lake, Lost Island Lake, Lower Gar Lake, Prairie Rose Lake, Rathbun Lake, Rock Creek Lake, and Storm Lake.

Potential Future Projects that need Meetings with Local Leaders and Stakeholders:

Badger Creek Lake (Madison Co.), Central Park Lake (Jones Co.), Diamond Lake (Poweshiek Co.), Hannen Lake (Benton Co.), Kent Park Lake (Johnson Co.), and Lake of the Hills (Scott Co).

Lake Restoration Prioritization Process

The Lake Restoration Program initially ranked 128 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.

IDNR annually reviews the list of thirty-five lakes 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.

Inquiries from Stakeholders of Lakes not on the Priority List

Also in accordance with HF2782, "Communities with lakes not included on the initial list may petition the director of the department for a preliminary lake restoration assessment and explanation of the funding process and criteria".

Local stakeholders from Lake Rathbun (Appanoose Co.), Lost Island Lake (Palo Alto Co.) and Summit Lake (Union Co.) have contacted the IDNR to consider their respective lakes for a restoration project. Rathbun Reservoir (Appanoose Co.) is an 11,000 acre lake in south-central Iowa that is one of our most significant state recreational destinations. It is distinct from several of our other large reservoirs, Saylorville, Coralville and Red Rock in that its watershed to lake ratio is only 37:1 and has great potential to maintain and improve lake water quality with a combination of watershed and lake restoration alternatives. Lost Island Lake (Palo Alto Co.) is a 1,000 ac. natural lake in northwest Iowa that is not meeting its water quality and recreational potential. The Iowa IDNR currently owns 23 percent of the watershed and proposes watershed work in parallel with current restoration efforts described in the Lost Island Lake section of this report.

Several additional restoration projects have been included to the program in the past: Badger Creek Lake (Madison Co.), Hawthorn Lake (Mahaska Co.), Lake of Three Fires (Taylor Co.), Lake Wapello (Davis Co.), Little River Lake (Decatur Co.) Lost Grove Lake (Scott Co.), Mariposa Lake (Jasper Co.), Meadow Lake (Adair Co.) and Swan Lake (Carroll Co.). Meadow Lake required less than \$135K from the LR Program and Section 319 Program to achieve success; Hawthorn Lake will utilize WIRB and LRP funding to complete the project; Little River Lake will also be included into the program; however, in-lake

work is several years off and will require significant watershed improvements before the in-lake work can begin.

Three lake restoration projects were denied entry into the LR Program: Sands Timber (Taylor Co.), South Twin Lake (Calhoun Co.), and Summit Lake (Union Co.). For South Twin Lake, the DNR recommends shallow lakes management with no dredging. The DNR is working cooperatively with local groups at Summit Lake to assist in a technical capacity and to help fund efforts associated with the ability to drain Summit Lake, future elimination of rough fish from the system and modification of the spillway to prevent migration of these fish back into Summit Lake. The City of Creston recently applied and was successful in obtaining a WIRB Grant to fund \$493,117 of a \$678,590 project. The WIRB project will focus on watershed improvements, streambank and lake shoreline stabilization and stormwater improvements.

Local, State and Federal Partnerships

In order to achieve lake restoration goals it is critical that the IDNR 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
- IDNR Field Offices (Environmental Services, Fisheries, Forestry, Parks, Wildlife)
- IDALS/ Division of Soil Conservation – Project Coordinators
- IOWATER Volunteers / Educators / Interested Citizens
- Lake Associations / Groups
- NRCS Soil and Water Conservation Districts (SWCD)
- Private Landowners
- USDA Resource Conservation and Development (RC&D)
- Watershed Organizations

State:

- Agribusiness and Community Organizations
- 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

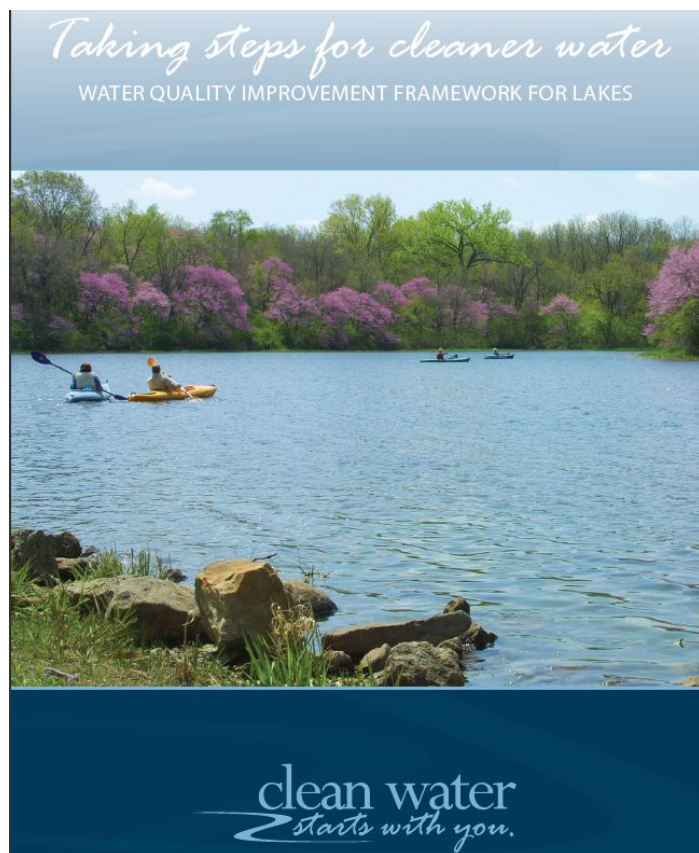
The IDNR, in cooperation with Iowa Department of Agriculture Land Stewardship (IDALS), has worked to develop a holistic approach to locally led watershed projects and information to help guide communities through the process of water quality improvement projects.

Watershed Project Planning Protocol

<http://www.iowadnr.gov/water/watershed/files/protocolguide.pdf>

Water Quality Improvement Framework for Lakes

http://www.iowadnr.gov/water/watershed/files/lake_frame.pdf



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 D).

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 ration 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.

Appendix C. Significant, Publicly-owned Lakes

Initial list of 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 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.

LAKE NAME	COUNTY
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
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
Lower Gar Lake	DICKINSON
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

Appendix C. Significant, Publicly-owned Lakes

The following eleven lakes were not included on the initial list of thirty-five significant publicly-owned lakes prioritized for funding. They 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.

LAKE NAME	COUNTY
Badger Creek Lake	MADISON
Hawthorn Lake	MAHASKA
Lake of Three Fires	TAYLOR
Lake Wapello	DAVIS
Little River Lake	DECATUR
Lost Grove Lake	SCOTT
Lost Island Lake	PALO ALTO
Mariposa Lake	JASPER
Meadow Lake	ADAIR
Rathbun Reservoir	APPANOOSE
Swan Lake	CARROLL

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

LAKE NAME	COUNTY
Arrowhead Lake	SAC
Arrowhead Pond	POTTAWATTAMIE
Avenue of the Saints Pond	BREMER
Badger Lake	WEBSTER
Beaver Lake	DALLAS
Beeds Lake	FRANKLIN
Big Spirit Lake	DICKINSON
Bob White Lake	WAYNE
Briggs Woods Lake	HAMILTON
Browns Lake	WOODBURY
Casey Lake (aka Hickory Hills Lake)	TAMA
Center Lake	DICKINSON
Cold Springs Lake	CASS
Crawford Creek Impoundment	IDA
DeSoto Bend	HARRISON
Dog Creek (Lake)	OBRIEN
Don Williams Lake	BOONE
East Lake (Osceola)	CLARKE
East Okoboji Lake	DICKINSON
Eldred Sherwood Lake	HANCOCK
Fogle Lake S.W.A.	RINGGOLD
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
Lacey Keosauqua Park Lake	VAN BUREN

LAKE NAME	COUNTY
Lake Cornelia	WRIGHT
Lake Hendricks	HOWARD
Lake Icaria	ADAMS
Lake Meyer	WINNESHIEK
Lake Miami	MONROE
Lake Pahoja	LYON
Lake Smith	KOSSUTH
Lake Sugema	VAN BUREN
Little Sioux Park Lake	WOODBURY
Little Spirit Lake	DICKINSON
Littlefield Lake	AUDUBON
Lower Pine Lake	HARDIN
Manteno Park Pond	SHELBY
Meyer Lake	BLACK HAWK
Mill Creek Lake	OBRIEN
Minnewashta Lake	DICKINSON
Mitchell	BLACK HAWK
Moorhead Park Pond	IDA
Mormon Trail Lake	ADAIR
Nelson Park Lake	CRAWFORD
Nine Eagles Lake	DECATUR
North Twin Lake	CALHOUN
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
Silver Lake	DICKINSON
Silver Lake	WORTH
Silver Lake	PALO ALTO
Slip Bluff Lake	DECATUR
South Prairie Lake	BLACK HAWK
Spring Lake	GREENE
Springbrook Lake	GUTHRIE
Thayer Lake	UNION
Three Mile Lake	UNION
Trumbull Lake	CLAY
Tuttle Lake	EMMET
Twelve Mile Creek Lake	UNION
Upper Gar Lake	DICKINSON
Upper Pine Lake	HARDIN
Volga Lake	FAYETTE
West Lake (Osceola)	CLARKE
West Okoboji Lake	DICKINSON
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
 - 8 Completed or near completion
 - 27 In progress
 - 11 Planning or initial public outreach 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

- 2007 funding \$9.6 Million
- 2008 funding \$8.6 Million
- 2009 / 2010 funding \$12.8 Million
- 2011 funding \$10.0 Million

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Web Page: <http://www.iowadnr.gov/water/lakerestoration/>

