Lake Restoration Program
2011 Report and 2012 Plan

Submitted To

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

Submitted By

Iowa Department of Natural Resources
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Table of Contents

Executive Summary

The Iowa Department of Natural Resources (IDNR) Lake Restoration Program (LRP) focuses on restoring impaired lakes to improve the quality of life for Iowans. 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 six of ten Iowans visit our lakes multiple times each year, spending $1.6 billion per year, in their pursuit of outdoor lake recreation. The most popular lake use activities in descending order were fishing, picnicking, wildlife watching, boating, hiking/biking and swimming/beach use. 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 the state average and their own pre-renovation visitation levels.

Iowa's Top 20 Lakes for Visitation in 2009

Saylorville
Coralville
Clear Lake
West Lake Okoboji
Big Creek Lake
Red Rock
East Lake Okoboji
Lake Macbride
Spirit Lake
Lake Rathbun
Storm Lake
George Wyth Lake
Pleasant Creek Lake
Lake Manawa
Brushy Creek Lake
Lake Ahquabi
Easter Lake
Lake Geode
Black Hawk Lake
Swan Lake

Easter Lake Park, Polk Co.

Of the four lakes with the largest increase in total visitation from the 2002-05 average to 2009 (Saylorville, Clear Lake, Lake Macbride, and Storm Lake), three of them are undergoing restoration projects (Clear Lake, Lake Macbride, and Storm Lake).

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 IDNR reviewed 127 of Iowa's Significant Public Lakes (SPOLs) for lake restoration potential (see definition for SPOL - Appendix B).
- Ranking was 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 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. An additional seventeen lakes, not included on the initial list of thirty-five significant publicly-owned lakes prioritized for funding, have since been added to the priority list after communities have successfully petitioned the director of the department or were prioritized by the department based on the feasibility of the lake for restoration and the use or potential use of the lake, if restored (Appendix C).

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

The source of FY2012 funding for the Lake Restoration Program was an appropriation from the Rebuild Iowa Infrastructure Fund under HF648. The LRP received $5.459 million dollars to meet contracted obligations and budgeted program activities. In addition, this legislation specified that of the amount appropriated $350,000 would be allocated to Lake Delhi for purposes of completing a preconstruction dam restoration study that would include a geotechnical evaluation, hydrological studies, restoration alternatives, and construction specifications.

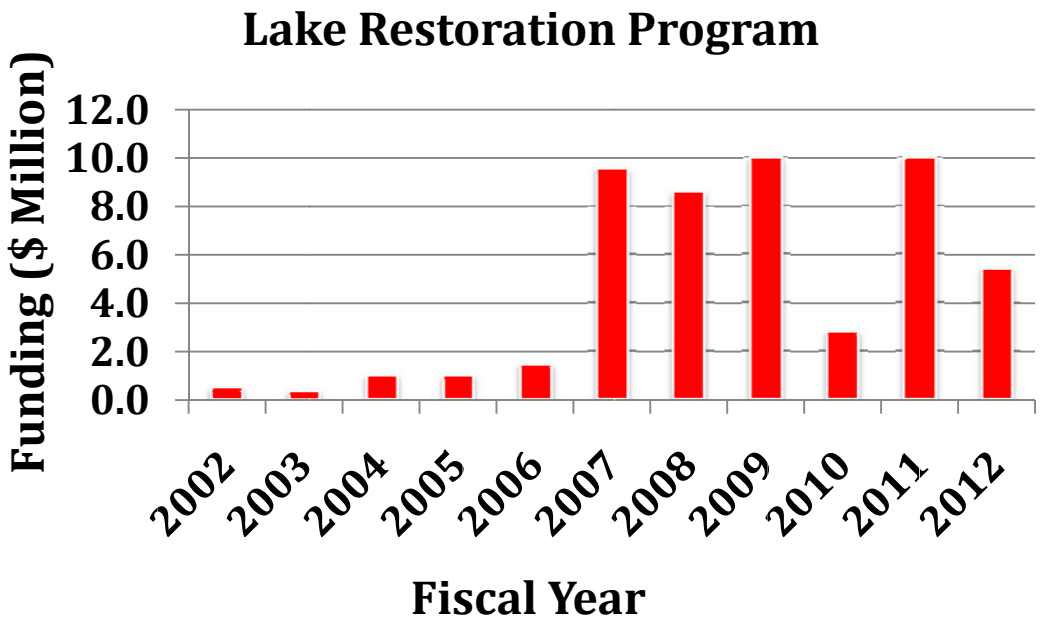
IDNR Lake Restoration Program (LRP) Funding as of FY12 (11/30/2011)

Carry Forward from FY10	$7,553,633
FY11 Lake Restoration Program Funding	$10,000,000
FY12 Lake Restoration Program Funding	$5,459,000
Total Available Funding at Start of FY12	$23,012,633
Lake Restoration Program Spent Funding as of FY12 (11/30/2011)	($10,809,345)
Lake Restoration Program Available Balance as of FY12 (11/30/11)	$12,203,288
Under Contract (Actual Amount Due)	($9,526,684)
Under Contract by 4/30/12 (Estimated Cost)	($2,671,344)
Program balance as of FY12 (11/30/2011)	**$5,260**

Funding from FY2007 through FY2012 of $46.4 million (approximately $7.7 million per year) has enabled the IDNR to improve many Iowa's lakes and proceed with implementing projects at a number of our other priority systems. However, the Lake Restoration Program has matured to the

point where a number of multi-step projects are nearing the implementation phase; therefore, we now have more projects ready to start in a given year than we have available dollars. Maintaining flexibility in where the Lake Restoration Program can allocate funding is critical to moving these multiple year projects forward and plan for new projects.

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 IDNR floodplains / sovereign lands permits.

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 127 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 seventeen 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-five lakes throughout the state and in the initial community outreach, evaluation or planning stage at an additional nineteen lakes (Figure 1).

Timelines for many of these projects usually fall within a three-year period. However, dredging or major construction projects may take even longer. Contractors face substantial costs to mobilize and set up lake dredging operations and this critical work needs multiple year commitments to secure contactors. 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 FY2012 into FY2013.

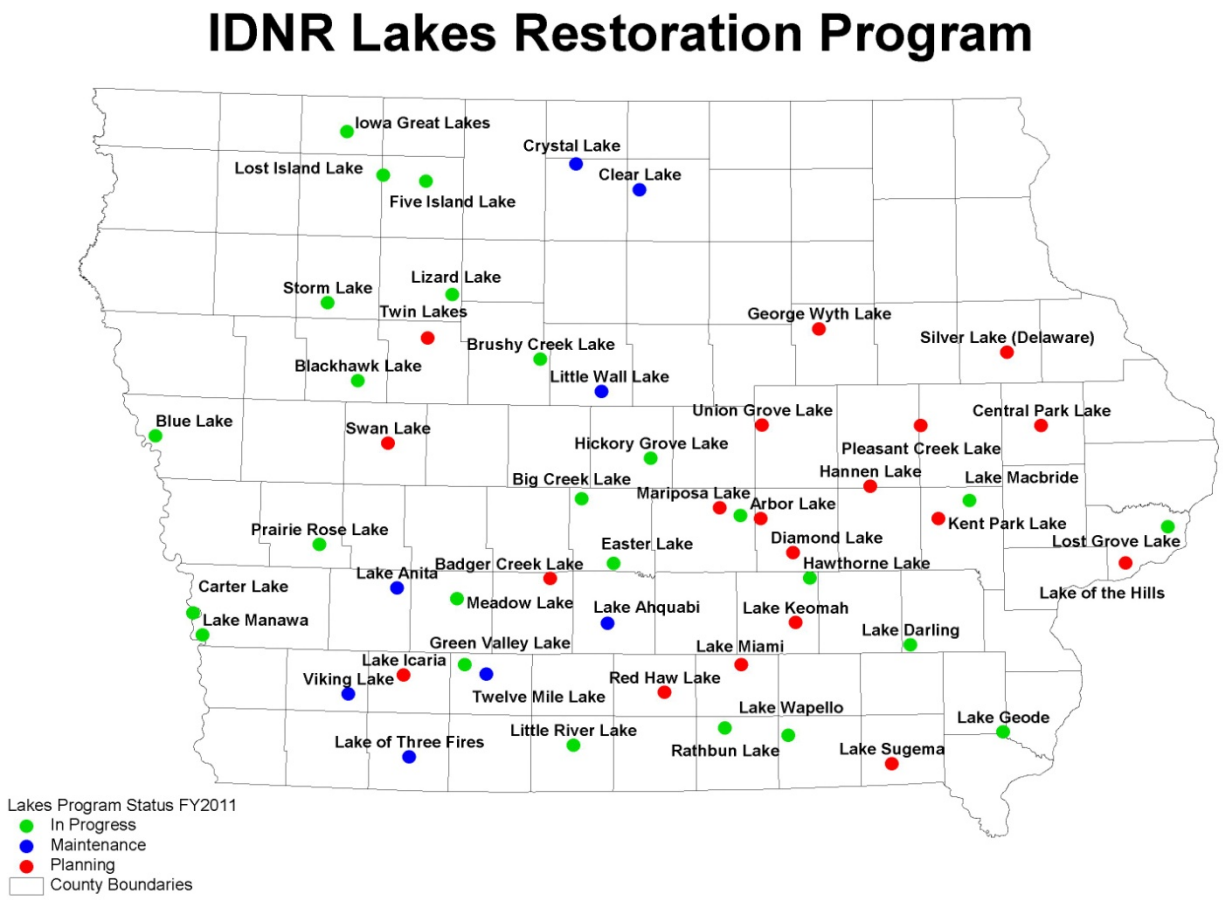


Figure 1. FY2011 Lake Restoration Program Project Status

Carter Lake, Lake Darling, Prairie Rose 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 (Table 1). Tables 3-5 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 received a watershed improvement grant Fall 2011.
Carter Lake	Pottawattamie	2008 - 2012	Engineering and design for implementation plan is 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. Phase 2 – dredging, shoreline improvements and wetland enhancement is under contract.
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 was completed Fall 2011. Water level in Ventura Marsh has been drawn down to start renovation.
Easter Lake	Polk	2011 - 2016	Diagnostic Study completed Fall 2010, including NRCS assessment of Yeader Creek. Public meetings took place during 2011 to inform the public of the project and to form a local citizen group. A consultant will be in place by February 2012 to assist with developing a restoration plan.
Five Island Lake	Palo Alto	1990 - 2014	Continued support of local dredging project. IDNR Lakes Program is working with local stakeholders to evaluate watershed/water quality improvement needs to compliment local dredging efforts.
Green Valley Lake	Union	2008 - 2012	Silt removal and silt dike construction completed; final seeding and clean up scheduled for Spring 2012.
Lake Darling	Washington	2008 - 2012	Spillway repair/replace and dam reconstruction is completed; In-lake restoration (shoreline deepening, silt dike construction and fish habitat work) is underway; a final phase of work, starting Spring 2012, will involve shoreline stabilization, beach re-location and boat ramp improvements.
Lake Manawa	Pottawattamie	2009 - 2015	DF study is completed; the IDNR is exploring the option of utilizing dredge materials for future Iowa DOT highway projects. Project was delayed due to floodwaters and will resume in 2012.
Prairie Rose Lake	Shelby	2011 - 2013	The Shelby County Soil and Water Conservation District was awarded a $510,611 Water Quality / Watershed Protection Project Grant and work is near completion; Work under contract includes mechanical sediment removal, shoreline stabilization and fish habitat. Construction of the containment site, spillway replacement and hydraulic dredging is planned for 2012/2013.
Rock Creek Lake	Jasper	2008 - 2015	Construction of five sediment control structures is scheduled for Spring 2012.
Storm Lake	Buena Vista	2000 - 2015	Continued support of local dredging project; a five-year project completion plan was developed with local sponsors and will be implemented. Little Storm Lake restoration is under construction and planned for Spring 2012 completion.

Table 2. IDNR Lake Restoration Program (LRP) Funding as of FY12 (11/30/2011)

Carry Forward from FY10	$7,553,633
FY11 Lake Restoration Program Funding	$10,000,000
FY12 Lake Restoration Program Funding	$5,459,000
Total Available Funding at Start of FY12	**$23,012,633**

Project Name	County	Project Description	LRP Spent	Fed	Other	Total Spent
Meadow Lake	Adair	Watershed Improvement	$17,244	$51,733		$68,978
Storm Lake	Buena Vista	Dredging	$1,250,904			$1,250,904
Storm Lake	Buena Vista	Little Storm Lake Restoration	$150,435		$150,435	$300,870
Clear Lake	Cerro Gordo	Watershed/Shoreline/Ventura Marsh	$118,007		$6,227	$124,234
Lake Wapello	Davis	Watershed Improvement	$24,216			$24,216
Little River Lake	Decatur	In-lake Restoration/Watershed	$7,473			$7,473
Lake Delhi	Delaware	2010 Flooding	$666,049			$666,049
Lake Delhi	Delaware	Feasibility Study	$44,523			$44,523
Lake Delhi/Twin Ponds	Delaware/Chickasaw	Special Projects	$350,000			$350,000
IA Great Lakes	Dickinson	Watershed Protection	$250,412			$250,412
Hawthorn Lake	Mahaska	In-lake Restoration/Watershed	$214,011			$214,011
Blue Lake	Monona	Feasibility Study	$228,856			$228,856
Five Island Lake	Palo Alto	Dredging	$200,000			$200,000
Lost Island Lake	Palo Alto	Fish Barrier/Water Control Structures	$817,623		$180,000	$997,623
Lizard Lake	Pocahontas	Spillway Repair/Fish Renovation	$36,675			$36,675
Easter Lake	Polk	Water Quality Improvement	$16,990			$16,990
Carter Lake	Pottawattamie	Implementation of Restoration Plan	$463,325			$463,325
Lake Manawa	Pottawattamie	Feasibility Study/Water Level	$87,981			$87,981
Black Hawk Lake	Sac	Feasibility Study/Watershed	$69,168			$69,168
Lost Grove Lake	Scott	Dam Construction/Road Risers	$2,000,000			$2,000,000
Prairie Rose	Shelby	In-lake Restoration/Watershed	$383,451	$142,442	$5,000	$530,893
Hickory Grove Lake	Story	Feasibility Study	$115,961			$115,961
Green Valley Lake	Union	Sediment Removal	$757,796			$757,796
Lake Darling	Washington	Dam/In-lake Restoration/Watershed	$1,398,971	$123,376	$180	$1,522,527
Brushy Creek	Webster	Sediment Structures	$16,155	$48,464		$64,618
Administration		Engineering/Project Management	$455,177			$455,177
Dam Safety		Signage	$78,525			$78,525
Feasibility Studies		Restoration Action Plans/Monitoring	$300,373			$300,373
Minor Projects		Minor Projects	$205,848			$205,848
Shallow Lakes		Water Quality Improvement	$83,196			$83,196
Lake Restoration Program Spent Funding as of FY12 (11/30/2011)			**$10,809,345**	**$366,014**	**$341,842**	**$11,517,201**

Lake Restoration Program Available Balance as of FY12 (11/30/11) **$12,203,288**

Table 3. Lake Restoration Program Funds Under Contract as of FY12 (11/30/2011)

Lake Restoration Program Available Balance as of FY12 (11/30/11) **$12,203,288**

Project Name	County	Project Description	Under Contract	LRP Amount Due	Fed	Other
Storm Lake	Buena Vista	Dredging	$1,362,489	$1,362,489		
Storm Lake	Buena Vista	Little Storm Lake Restoration	$662,054	$541,389		$120,665
Clear Lake	Cerro Gordo	Carp / Zebra Mussel Research	$16,125	$13,706		$2,419
Little River Lake	Decatur	Shoreline Riprap and Fish Habitat	$1,403,539	$1,122,832		$280,708
Lake Delhi	Delaware	Dam Restoration Study	$263,011	$263,011		
Hawthorn Lake	Mahaska	Water Quality Improvement Project	$46,328	$46,328		
Five Island Lake	Palo Alto	Dredging	$200,000	$200,000		
Lost Island Lake	Palo Alto	Fish Barrier Construction / Restoration	$12,200	$12,200		
Big Creek Lake	Polk	Watershed Improvement	$64,695	$64,695		
Carter Lake	Pottawattamie	Management Plan Implementation	$1,393,225	$1,393,225		
Lake Manawa	Pottawattamie	Pumping for Lake Level Management	$142,424	$142,424		
Prairie Rose Lake	Shelby	Dredging / Shoreline / Structures	$844,322	$642,139	$202,183	
Hickory Grove Lake	Story	Feasibility Study / Shoreline	$37,329	$37,329		
Green Valley Lake	Union	Sediment Removal from East Arm	$750,266	$750,266		
Summit Lake	Union	Spillway Modification	$40,000	$40,000		
Lake Darling	Washington	Dam/Mechanical Dredging	$2,061,309	$2,061,309		
Silver Lake WMA	Worth	Renovation/Replace Outlet	$282,817	$106,344		$172,817
Administration		Engineering/Project Management	$291,667	$291,667		
Feasibility Studies		Restoration Action Plans/Monitoring	$691,239	$435,332		$255,907
			$10,565,037	**$9,526,684**	**$202,183**	**$832,515**

Under Contract (Actual Amount Due) **$9,526,684**

Table 4. Lake Restoration Program Funds Under Contract by April 30, 2012

Project Name	County	Project Description	Under Contract by 4/30/12	LRP Obligation for Projects in Process for Bid Letting	Fed	Other
Clear Lake	Cerro Gordo	Containment Site	$150,000	$150,000		
Lake Wapello	Davis	Water Control Structures	$60,000	$45,000	$15,000	
Little River Lake	Decatur	In-lake Silt Basin	$290,000	$290,000		
Central Park Lake	Jones	Containment Site Purchase/Watershed	$340,000	$340,000		
Hawthorn Lake	Mahaska	Water Control Structures	$420,000	$210,000		$210,000
Lost Island Lake	Palo Alto	Electric Fish Barrier	$210,000	$185,000		$25,000
Virgin Lake	Palo Alto	New Outlet Structure	$229,870	$106,344		$119,870
Deer Creek Lake	Plymouth	Geophysical Investigation	$20,000	$20,000		
Easter Lake	Polk	Management Plan	$60,000	$40,000		$20,000
Lost Grove Lake	Scott	Road Risers along Utica Ridge Rd	$30,000	$30,000		
Prairie Rose Lake	Shelby	Containment Site/Spillway	$565,000	$565,000		
Lake Darling	Washington	Phase 3 Construction	$690,000	$690,000		
			$3,064,870	**$2,671,344**	**$15,000**	**$374,870**

Lake Restoration Program Available Balance as of FY12 (11/30/11)	**$12,203,288**
Under Contract (Actual Amount Due)	**$9,526,684**
Under Contract by 4/30/12 (Estimated Cost)	**$2,671,344**
Carry Forward Funding to FY13	**$5,260**

Table 5. Lake Restoration Program Proposed Budget for Fiscal Year 2013 (based on FY2012 funding level)

Project Name	Description	Proposed FY13 Budget	Federal	Other	Total Budget
Storm Lake	Dredging / Little Storm Lake	$1,200,000		$400,000	$1,600,000
Clear Lake	SEC 206 Ventura Marsh / Shoreline	$100,000			$100,000
Carter Lake	Management Plan Implementation	$100,000	$50,000	$130,000	$280,000
Administration	Engineering / Project Management	$500,000			$500,000
Five Island Lake	Dredging / Watershed Improvement	$200,000		$200,000	$400,000
Lost Island Lake	Rough Fish Removal for Water Quality	$50,000			$50,000
Prairie Rose Lake	Containment site / Dredging	$1,300,000			$1,300,000
Lake Assessment	Restoration action plans / monitoring	$100,000		$25,000	$125,000
Black Hawk Lake	Watershed Improvement	$150,000		$150,000	$300,000
Minors	(e.g. Central Park L., Hickory Grove L., Kent Park L., L. Miami, Swan L.)	$250,000			$250,000
Shallow Lakes	Water Quality Improvements	$100,000		$100,000	$200,000
IA Great Lakes	Watershed Water Quality Improvement	$250,000		$250,000	$500,000
Lake Icaria	Wetland Repair	$100,000		$100,000	$200,000
Lake Manawa	Dredging Phase 1 / Watershed	$1,100,000		$110,000	$1,210,000
Total		**$5,500,000**	**$50,000**	**$1,465,000**	**$7,015,000**

Table 6. Potential Lake Restoration Program Projects if Additional Funding is Allocated to the Program in FY13

Project Name	Description	Proposed FY13 Budget	Federal	Other	Total Budget
Black Hawk Lake	Watershed Improvement / Containment Site	$1,300,000	$150,000	$150,000	$1,600,000
Swan Lake	Wetland Development / Land Acquisition	$900,000			$900,000
Easter Lake	Engineering / WQ Improvement	$1,000,000	$100,000	$300,000	$1,400,000
Lake Keomah	Watershed / In-lake Shoreline / Containment Site	$1,200,000			$1,200,000
Little River Lake	Watershed Work on Public Land	$200,000		$100,000	$300,000
North/South Twin Lakes	DF Study	$150,000		$50,000	$200,000
Twelve Mile Lake	Wetland Design and Construction	$300,000		$300,000	$600,000
Blue Lake	Land Acquisition/Fish Barrier	$500,000		$50,000	$550,000
IA Great Lakes	Hottes Wetland Development	$150,000		$50,000	$200,000
Center Lake	Urban Storm Water Control	$150,000		$100,000	$250,000
Silver Lake	Palo Alto Co. – Fish Barrier/Watershed	$250,000		$50,000	$300,000
Silver Lake	Dickinson Co. – Watershed Assessment	$100,000		$25,000	$125,000
Lake Manawa	Dredging Phase 1 / Watershed	$1,300,000		$130,000	$1,430,000
Total for Planned Projects if Additional Funding is Available		**$7,500,000**	**$250,000**	**$1,305,000**	**$9,055,000**

2011 Report and 2012 Plan

Lake Restoration Program (LRP) Highlighted Projects

Green Valley Lake (Union County)

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

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

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

- The local NRCS District Conservationist has implemented a four-year, $409,000, watershed improvement plan and completed approved soil and water quality improvement projects.
- Recent fish population estimates had supported the presence of high numbers of yellow bass and common carp, species both considered detrimental to sport fish populations, with common carp having the additional negative impact of contributing to poor water quality conditions. The IDNR 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.
- IDNR awarded a $348,767 contract to CL Carroll Company Inc. for in-lake fish habitat and protecting of the existing shoreline. Fish Habitat Stamp funds in cooperation with Federal Dingell-Johnson, Marine Fuel Tax and Lake Restoration Program funds paid for this aspect of the project.
- The Natural Resource Commission approved the acquisition of a parcel of land with LRP funding. The land is located 2.5 miles north of Creston, and adjacent to the northeast corner of Green Valley State Park. The Betty E. Gater Estate offered this 67.58-acre parcel for $338,000. This site is serving as a storage area for sediments removed from the Green Valley Lake during the lake restoration process and will be re-shaped and seeded down Spring 2012.

- Taylor Construction & Excavation signed a contract in the fall of 2009 for removal of approximately 250,000 yards of sediment targeted from both existing sediment retention basins and in-lake areas. In addition, a new sediment dike was installed at a location below an area identified in the diagnostic study as a subwatershed area contributing significant sediment and nutrient loading and critical areas of shoreline were stabilized. As of December 2011, the project is approximately 95% complete with a February 2012 completion date expected.

Green Valley Lake Sediment Removal

Lake Darling (Washington County)

Lake Darling is a 267-acre man-make lake, constructed within a 1,400-acre state park, with a watershed to lake ratio of 47:1. 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 lakes 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.

Lake Darling Restoration Project Costs

Sediment removal (300,000 yd3)	$1,650,000
Dam reconstruction & water level increase	$1,785,000
In-lake silt dam construction, Shoreline	$1,100,000
Ponds, terraces, risers, wetland (IDNR/319/LRP)	$385,000
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 = $5.3 million dollars


Digging core trench for new dam at Lake Darling

<u>Phase 1 – Dam and Spillway Renovation (Winter 2010 – Spring 2012)</u>

- Acting on the recommendations of the completed engineering report, the IDNR is repairing the dam and addressing spillway leakage.
- The NRC approved C.J. Moyna & Sons, Elkader, IA as the lowest bidder ($1,785,000) for the Lake Darling dam & spillway repair on November 11, 2010. With the lake drained, IDNR 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.

Phase 2 - In-Lake Construction

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

Phase 3 – Boat Ramp and Parking Lot

- The IDNR Fisheries Bureau and Engineering Bureau, has also been working on plans for the construction of a new boat ramp and parking area. IDNR 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. Phase 3 will also include re-location of existing swimming beach and shoreline deepening and stabilization.

View of Lake Darling from the Dam (dry lakebed)

The Lake Darling Restoration is progressing well. The dam is for all intensive purposes complete. Sediment removal in the campground arm is 99% complete and 30% complete in the upper arm of the lake. All of the fishing jetties have been raised and repaired. IDNR Engineering has developed preliminary designs for the shoreline work near the main boat ramp, bidding planned for February 2012, with construction beginning in spring. The plan will be to impound water once the shoreline work is nearly complete and begin stocking fish in fall of 2012.

North view of new dam at Lake Darling

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 EQIP nutrient and pest management enrollments.

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

- The Lost Grove Lake and Recreation Area project 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, IDNR 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.

Building the stilling basin

- J.B. Holland Construction was the lowest bidder ($4,341,437) on the Lost Grove Lake dam construction project. The NRC approved the bid on June 10, 2010. Dam construction began in July 2010 and will not be completed until spring/early summer 2012. The dam is settling well, but is trapping water as it settles. The soil scientists assigned to the project has recommended J.B. Holland not proceed with adding fill to the top-of-dam out of concern that the excess weight will compress the trapped water. The origin of water in the dam is that allowed by engineering specifications and ground seepage; however, the lower part of the dam could slide on the compressed water resulting in bulge failure. If the water is given time to escape on its own, it will evaporate, and dam construction can proceed in the spring. Given Lost Grove Lake's small watershed to lake area ratio, the lake is expected to take 2-3 years to reach full pool.

- Langman Construction, Inc. was awarded the Fish Habitat, Riprap, and Shoreline Access phase of the project. The bid was for $1.17 million. Construction commenced the week of July 25 and was completed on October 7, 2011.
- The boat ramp, parking lot, and pit-vault toilet construction phase of the project will be bid in February 2012. Work is expected to

Construction of fishing jetty

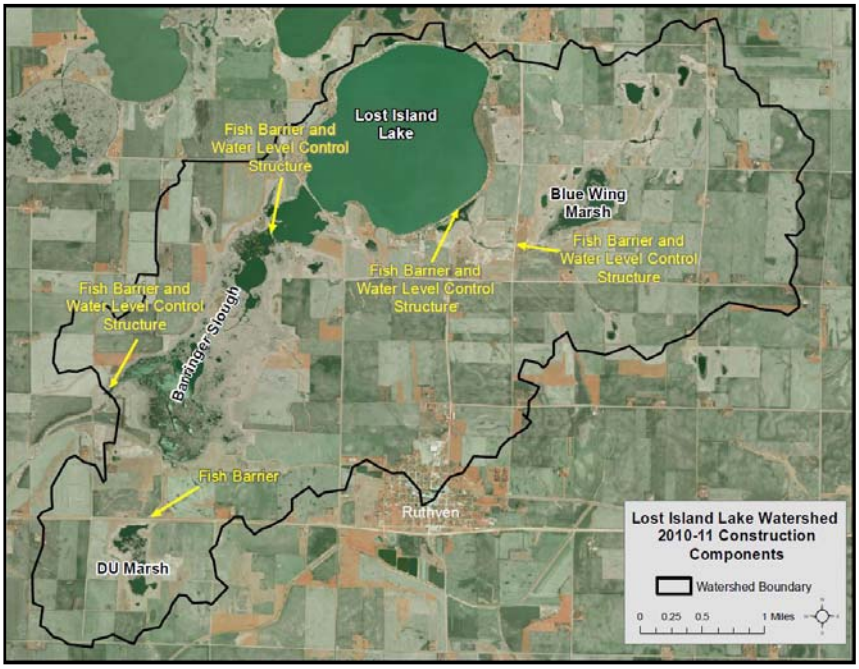
commence in May with a May 31-June 15 completion date.

- Scott County Secondary Roads are working on designs for two road culvert risers on Utica Ridge Road. These risers will temporarily impound water to allow settling of sediment and nutrients, and thus, preserve the water quality of Lost Grove Lake. It is expected that this project will be bid in February 2012 with construction to follow in the spring.

Lost Island Lake (Palo Alto County)

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

This is an aggressive and comprehensive plan to improve water quality in the > 2,200-acre complex 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 exiting carp biomass, an aggressive stocking of predatory fish and new construction or rehabilitation of four water control structures and five fish barriers throughout the complex.
- During summer 2008, IDNR-Fisheries used mark – recapture techniques to estimate in-lake carp numbers and biomass and initiated an intensive commercial fishing contract, which resulted in the harvesting of approximately 427,000 lbs of carp and 353,000 lbs of buffalo in 2010. The result has been a 90% reduction in population and 80% reduction in the biomass of rough fish.
- At present, a commercial hauler is aggressively removing rough fish from Lost Island Lake and the IDNR is stocking large numbers of predatory fish into the system. Harvesting efforts will target of additional 34,000 lbs of carp and 60,000 lbs buffalo by spring 2012.
- IDNR awarded Ducks Unlimited, Inc. a contract to design effective water control and fish barrier structures. The survey and design work began during summer/fall 2009. Local excitement regarding the project is high. Nearly 70 local stakeholders attended a December 2009 public meeting and voiced strong approval for the design work.
- The NRC approved Lake Restoration Funding toward the $834,263 bid from Landwehr Construction, St. Cloud, MN for the project. The Watershed Improvement Review Board awarded the Palo Alto County Conservation Board $180,000 to cover part of the cost (two water level control/fish barrier

systems); construction began in the fall of 2010. The $1.3 million project is a partnership between the Iowa Department of Natural Resources, Palo Alto County, Ducks Unlimited, and the Lost Island Protective Association.

DU Marsh H bar Fish Barrier

Barringer Slough Water Control Structure and Fish Barrier

- The IDNR, DU and local partners planned to construct most, if not all, the structures from winter 2010 through fall 2011. As of June 2011, Landwehr has completed the major components of the project. Various basins within the complex have been dewatered to eliminate rough fish, create favorable conditions for re-vegetation. Weather permitting; all basins should be at full pool during fall 2012 thereby providing excellent habitat for wildlife species and much-improved recreational opportunities for Iowans. Some additional minor work will be completed at several of the structures to ensure the entire system works efficiently and there are still plans to install an electric fish barrier at the Barrier Marsh site.

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 5:1. The Diagnostic / Feasibility Study and the Impaired Water's Assessment both indicate that internal loading from re-suspension of bottom sediment is the primary source of nutrient availability and water turbidity, which supports dredging as a critical restoration approach to achieve desired improvement in water quality.

- IDNR constructed a dredge spoil site at Storm Lake in 2001 and began dredging activities in 2001/2002. Lake dredging removed 1.32 million cu./yds. of sediment at a total project cost of approximately $4.0 million during this first year of operation. Funding limitations restricted this initial dredging activity to 180-acres of the lake.
- The Lake Preservation Association (LPA) expressed a strong interest to continue dredging to achieve better water quality and from 2003 to present has, along state partnership, dredged an additional 4,333,256 cubic yards of sediment. 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	$8,942,920
Federal Allocation	$1,765,000
City of Storm Lake	$1,378,995 (Annually contributes a portion of Hotel/Motel Tax)
City of Lakeside	$110,477 (Annually contributes a portion of Local Option Sales Tax)
Buena Vista County	$680,000
Private Pledges	$1,385,964
Total	**$14,263,356**

- From 2002 to 2011, a total of $14.3 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 19 inches from (2008-2010) opposed to an average clarity of 12 inches from (2004-2006). 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	18
2011		550,604	
Totals		**5,653,256**	

Joint (IDNR/Local) Five-year Dredging Plan (2010 – 2014)
We have completed year two of the current five-year dredging plan. The original plan included dredging the lake for three years (2010 - 2012) with a goal of removing another 1.6 million cubic yards. The fourth year (2013) 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 placing an additional 400,000 cubic yards of dredge material in the current containment site and would bring the current active site up to capacity.

- To accomplish this goal will require an additional $5 million in lake restoration funds and $1.365 million of local match.

Future Dredging Efforts
Plans are underway to develop a new dredge containment site on a 65-acre tract of land adjacent to the current active site. The capacity of the new site will be approximately 4 million cubic yards. Soil borings have been completed and support that good soils are present for construction of the dikes and work has been initiated for permitting aspects and initial design. The IDNR plans to work with Iowa State University during the winter of 2012 on analysis of what dredging approach (depth of dredging over what locations and area) will maximize water quality improvement with the lake and at what point will diminished return on water quality be reached.

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 IDNR initially requested that DU provide a feasibility study, conceptual designs and final design/construction plans for construction of a fish barrier structure and water control structure between Little Storm Lake and Storm Lake for the purposes of renovation and rehabilitation. The IDNR also entered into a contract amendment that allowed DU to assist the IDNR in project bidding, construction administration, project inspection and construction staking, quantity calculations, and development of as-built plans.

This project includes a fish barrier and water control structure between Little Storm Lake and Storm Lake and the construction of a pumping station and associated equipment. Future management involves periodic dewatering of Little Storm Lake during years of favorable climatological conditions. Construction of the fish barrier will aid restoration efforts by preventing rough fish from destroying the vegetation and would decrease recruitment of rough fish by limiting their spawning area. To obtain the greatest chance for success for water quality improvement, the local community and IDNR would like to renovate Little Storm Lake through periodic water level drawdown and, if needed, chemical fish renovation. This drawdown will consolidate bottom sediments, improve aquatic vegetation growth, eliminate common carp and other undesirable fish species, and ultimately improve water quality in these areas; the barrier system will prevent reintroduction of undesirable fish species.

Summary of Construction:
Through a competitive bidding process, Lessard Contracting from Sioux City was awarded the construction contract and construction began on January 28, 2011. The $812,849 construction contract is being administered by the IDNR.

Construction began with the contractor pushing the snow and cattails off the serpentine sediment basin footprint. They then waited 2 weeks for the frost to penetrate prior to beginning work. However, within the first day the off road trucks were breaking through the frost and were unable to function. The contractor decided to continue to excavate and just pile the material in hopes the frost would deepen and the trucks could run. Since hauling the material was no longer an option and even the frost support for an excavator was diminishing, a decision was made to just complete the serpentine channel excavation and stockpile the material between the bends.

Serpentine channel excavation at the inlet of Little Storm Lake

Once the channel work was completed the contractor started on a haul road from the borrow sight to the dike. This area was a little higher and there was enough frost to support the off road trucks. Unfortunately, that only lasted about 2 days before they were once again breaking through. Work was postponed; and then the spring rains began. Work has been suspended since mid March of 2011. The hope was that a dry fall would allow construction to resume and that did happen during the week of November 14, 2011. Current conditions are very favorable for this project to proceed.

The contractor started building the dike on the north end and work the east/west section to completion then turned south and continued dike construction. Dike work is near completed and to grade and the contractor has installed one of three control structures. Even with the dike work completed this winter

months, it is possible that the dike will have to set an extended period to allow settlement prior to all the structures being installed. This will ensure that the structures will remain at their designed elevations. We anticipate that construction will be completed by January 31, 2013.

Watershed Improvement Initiative

- The local RC&D is currently working to develop a watershed management plan. Local IDNR staff has met numerous times with the RC&D to consult on development of a plan to improve the water quality through implementation of Best Management Practices in the watershed.

Anticipated Benefits

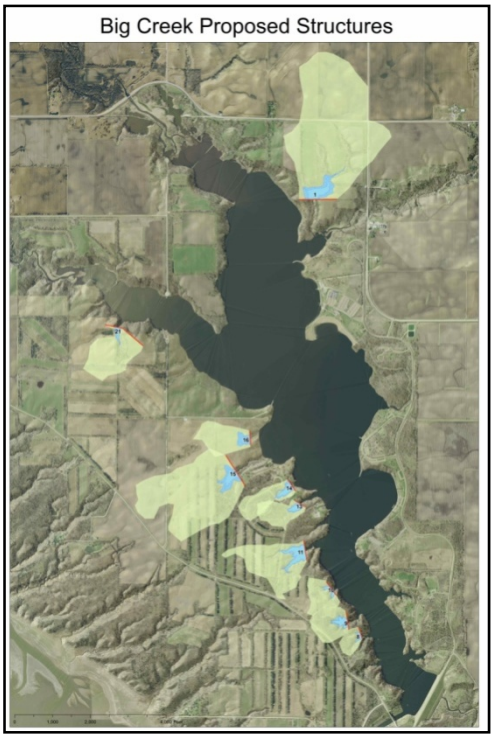
- This aggressive dredging goal, coupled with watershed improvements and restoration of Little Storm Lake and wetland will result in significant improvements in water quality.
- In addition, lake restoration efforts so far have encouraged a $35 million economic development named “Project AWAYSIS” that 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. During the past year, Blue-green algae blooms put Big Creek Lake in the news headlines multiple times this year. In addition, water quality samples revealed high E. coli levels in the tributaries and at the beach.



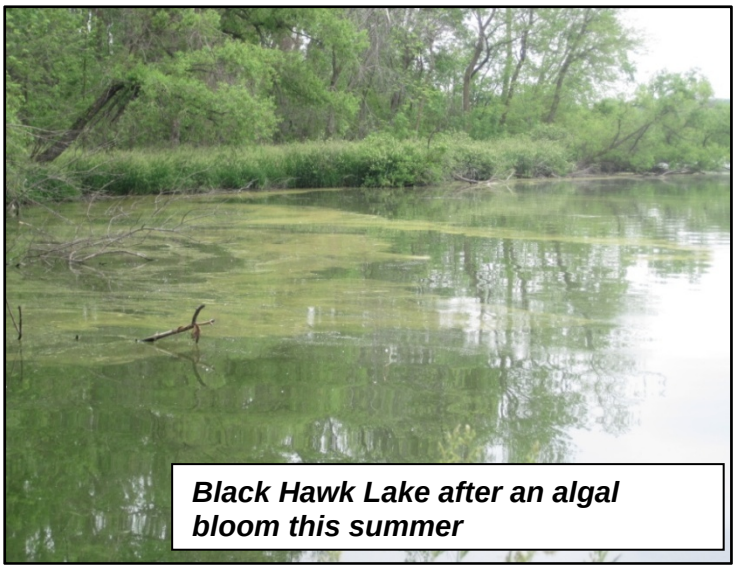
- A 2007development grant provided analyses of the Big Creek watershed. In addition, a 2008 gully analysis and 2009 land use analysis provided a better understanding of critical areas in the watershed.
- Watershed assessment identified several gullies with severe erosion on State property. IDNR Engineering 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 during 2011 is to determine the best location for structures, survey and provide design concepts to us so that IDNR can determine the potential areas affected by construction activities; including, construction access and staging areas. We will now use this information for the environmental and archeological review of these sites during spring 2012. Once we have approved locations for the structures

we will request that engineering proceed with final design and bid letting for construction.

- The Iowa IDNR Watershed Improvement Section completed a Water Quality Improvement Plan in September 2010 and in March 2010 contracted with the Iowa Department of Agriculture and Land Stewardship to provide Polk SWCD and Boone SWCD with funding to complete a Watershed Management Plan. The EPA approved the Big Creek Watershed Project for $292,834 over the five-year duration of the project.
- There are now two half-time watershed coordinators working on Big Creek Watershed and a Big Creek Citizens Advisory Committee has been formed.
- Extensive water quality sampling was completed in the tributaries and main lake during 2011. Public and landowner outreach events are being planned for 2012 to encourage more involvement.

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 – 1.5 feet, with phosphorus levels consistently 100-200 ppb. Very poor lake transparency due to turbidity and frequent algae blooms due to high phosphorus levels are common in the past few years. 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.



Black Hawk Lake after an algal bloom this summer

- Local leadership in cooperation with the IDNR 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 IDNR, 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 was to provide restoration alternatives to the IDNR and local community; IDNR contracted with Iowa State University (ISU) for the D/F study, which they completed in fall of 2010.
- IDNR Fisheries has given several tours to IDNR 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.

- IDNR 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. IDNR held a public meeting in January 2011 to present findings and receive comment.
- 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. IDNR 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.
- The SWCD has received word that it will receive funding through a 319 Grant. Money from the grant is expected to be available in February of 2012. The grant will go to funding a watershed coordinator for the Black Hawk Lake Project and for implementation of BMPs.
- The two state owned marshes south of Black Hawk Lake and within the watershed were drawn down over the winter of 2010-2011. They remained drawn down throughout the summer of 2011. Due to lack of precipitation, the marshes are now completely dry. This will aid in the elimination of carp in these systems and help reestablish much needed vegetation in the marshes. Barriers are being constructed for the marshes to impede carp movement back into them once they have been eliminated.

State Marsh during draw down. The IDNR Wildlife crew also burned part of the marsh to revitalize the native grasses.

- Black Hawk Lake is approximately one foot below crest elevation. As a result, the inlet portion of the lake has only about 6 inches of standing water. This area is prime carp spawning habitat. There is an existing fish barrier at the main channel that connects the inlet to the main lake basin. However, there is also a culvert that connects the inlet to the main lake that used to have a fish barrier, but the barrier was damaged by ice heave years ago. In anticipation of a complete winterkill in the inlet, we are installing a fish barrier on the culvert that connects the inlet to the lake.
- Black Hawk Fish Management District staff has applied for $10,000 through the Aquatic Education Grant to develop and install signage along the bike path that runs along Carnarvon Creek, which is the main tributary to Black Hawk Lake. This bike path connects Black Hawk State Park to Swan Lake State Park. However, all of the signs will be placed within Black Hawk Lake's watershed to inform trail users of the project, watershed issues, and other water quality information. Based on trail usage counts these signs would be expected to reach at least 10,000 trail users a year.
- Through personal contact with the NRCS, they have reported that select landowners have already pledged to install 52 acres of CRP and 15,000 to 25,000 feet of terraces in hot spots within the watershed.
- The City of Lake View received the "2011 Outstanding Tourism Community of the Year." Although this has little to do with the Black Hawk Lake Restoration Project, it emphasizes the popularity of the lake and the high potential for an economic return on the IDNR's investment in the resource. The

City of Lake View has a population around 1,150 and competed with larger cities, such as Altoona and Mason City, for this award.
- The Iowa Learning farm produced a video (approx. 40 minutes) about watersheds and water quality. Black Hawk Lake and the restoration project were the focus of this video.

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.

- IDNR completed a Water Quality Improvement Plan for Blue Lake in 2008 and held a public meeting to discuss the findings of the study.
- IDNR 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.
- IDNR has altered the waterfowl refuge boundary to exclude Blue Lake and address excess nutrient inputs from geese.
- A public meeting was held in March of 2011 to discuss potential restoration efforts with the community.
- Lake Restoration contracted with MSA Professional Services to conduct a diagnostic-feasibility study on the lake. Extensive data collection was conducted by local IDNR staff throughout 2010.
- The final report from MSA on the diagnostic-feasibility study was completed in November of 2011. The report proposes that construction of a storm water settling basin, dredging and removal of common carp will achieve water quality goals for the lake.
- A Technical Advisory Team meeting is scheduled for December to discuss the report and develop a restoration and implementation plan.

Brushy Creek Lake (Webster County)

Current project activity involved 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. This project was completed mid-June 2011.

Constructed water/sediment control basin

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 with a history of poor water clarity, high nutrient concentrations, frequent algal blooms, and periodically high bacteria. Given the nature of the problems at Cater 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.

Carter Lake, Pottawattamie Co

- 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 Cater Lake. The City will use the well to maintain Carter Lake at a full pool range. The IDNR 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.
- 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 projects 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	Estimated Cost
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

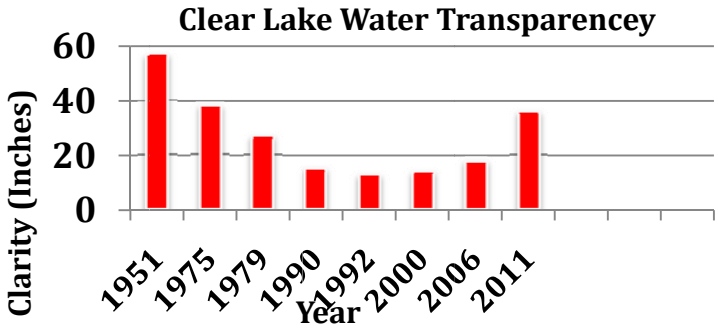
  - Physically removed 89.6 tons of fish (Approximately 600 lbs/ac)
  - Each worker handled ~ 10,000 lbs of fish twice (pitched in & out the boat) in 3 days
- Almost immediately, visitors to Carter Lake saw drastically improved water clarity as a result. Water quality data collected during the summer of 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 may be needed.
- Extremely clear conditions persisted during the summer of 2011 allowing tremendous amounts of aquatic plants to fill the water column. Lifelong residents of Carter Lake commented that they had never seen the bottom the Carter Lake before. Due to the clarity and resulting response in plant growth a BMP for aquatic plants is being drafted in consultation with the local communities to establish guidelines for future plant management efforts.
- Tetra Tech is engineering wetland restoration and shoreline protection measures for 2012 spring/summer construction.

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 IDNR 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.). IDNR 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.
- 1,500 feet of publically owned shoreline was protected with native stone rip rap in 2011. This work took place on the ice along the shorelines of McIntosh Woods State Park. One hundred twenty five feet of this project was along the State Dock area on North Shore Drive.
- An additional 750 feet of native riprap is planned for the State Dock area in 2012.

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



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

- Construction is near completion on a Section 206 U.S. Army Corps of Engineers Aquatic Ecosystem Restoration Project for Ventura Marsh, which flows into the west end of Clear Lake. In its present degraded state, the marsh serves as a major source of nutrients contributing to water quality problems in the lake and is a major reproduction area for common carp.
- The Army Corp of Engineers (COE) budgeted $3.2 million for the Ventura Marsh restoration project. Ventura Marsh state land and in-kind credits of $1,331,200 and approximately $884,062 in LRP dollars will fund the 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 activities is approximately $17.0 million. Of this amount, local and federal match represent 40% of the funds necessary to complete these restoration efforts.
- A new 20,000 gallon per minute pump station was built in 2011. This will be used to dewater the marsh, remove rough fish, and restore the aquatic plant community.
- The old stop log structure was removed and replaced with a new structure in 2011. The stop log structure will be used to control water levels from the marsh crest elevation down to Clear Lake's water level. For water level manipulations below Clear Lake's level, the pumping station will need to be used.
- A flow path was dredged in 2011 to allow the deeper portions of the marsh basin to drain towards the pumping station. This will allow nearly a complete drawdown.
- Planned work in 2012 will be the construction of a catch basin and a water flow path in the southwest corner of the marsh. This feature will treat water entering the marsh from two large tile sources and allow for longer retention of water entering the marsh before it gets to Clear Lake.

New 20,000 gallon per minute pump station

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

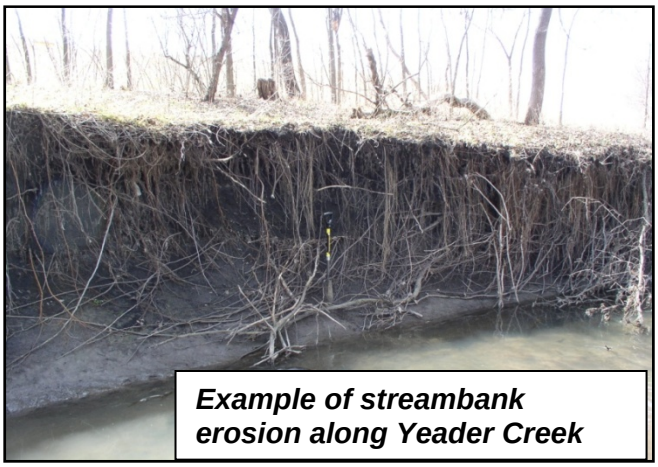
the Carp population under control. Local groups and IDNR Section 319 continue to pursue watershed projects that have the potential to decrease sediment delivery to Clear Lake. In addition, in FY2010 the IDNR and Hancock SWCD shared cost on stabilization of critical shoreline areas at McIntosh Woods State Park. Additional shoreline work at the remaining critical areas is planned for 2012.

Easter Lake (Polk County)

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

- A Technical Advisory Team met several times from 2007 through 2011 to discuss plans for Easter Lake and the watershed. Representatives from the Polk County Conservation Board, City of Des Moines – Parks and Recreation / Public Works, IDNR – Environmental Services Division / Fisheries / Watershed Improvement Section, Iowa Department of Agriculture and Land Stewardship, Iowa State University, and the Natural Resources Conservation Service have attended these meetings.
- The NRCS has completed an assessment of Yeader Creek (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 Iowa State University Diagnostic/Feasibility Study by providing additional information specific to the tributaries draining to Easter Lake. In addition, the NRCS completed a planning level cost analysis to address critical areas of streambank and channel erosion.
- 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 based on 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.



Example of streambank erosion along Yeader Creek

Algae bloom on Easter Lake

- Dr. John Downing from Iowa State University has reported on watershed and lake monitoring component and provided 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,

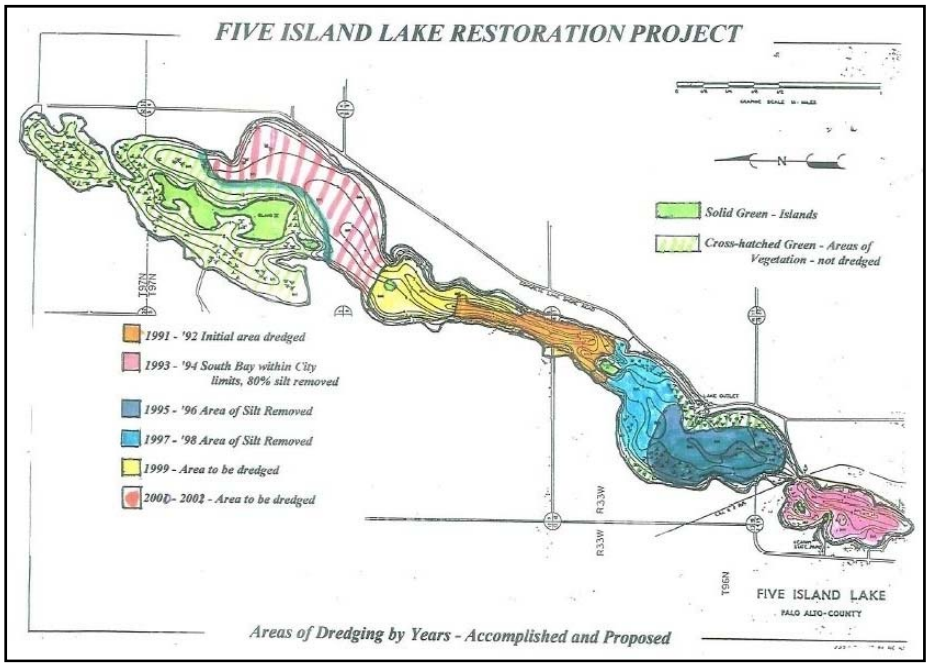
establish water quality goals and a schedule for attainment and assess the economic benefits of the project.
- Public meetings took place in 2011 to inform the public of the results found during the surveys and studies and to begin development of a restoration plan.
- The Technical Advisory Team is working to form a local steering committee to assist with developing a Water Quality Improvement Plan and a Request For Proposals is in process to hire a firm to lead the effort in completing the plan.

Five Island Lake (Palo Alto County)

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

The 1994 Diagnostic Feasibility Study included goals for dredging and shoreline stabilization. The original goal was to dredge an additional 3,300,000 cu. yds. beyond 91'-93' efforts for a total of 4,690,000 cu. yds. Since the early 90's, the Lake Board has stabilized almost 10.5 miles of lake shoreline, dredged over 6 million cubic yards of silt, and has worked in the watershed to reduce nutrients and sediment from entering the lake. Funding for this project has required a combination of state and local matching grants. Local monetary contributions and State funding as of FY11 exceeds $2.2 million

Year	Cubic Yards
1991-1999	4,418,000
2002	89,527
2003	269,962
2004	318,700
2005	385,000
2006	164,325
2007	143,675
2008	140,002
2009	140,180
2010	168,220
2011	106,705
Total	**6,344,296**



The 2006 TMDL for Five Island Lake lists the lake as impaired water for algae and turbidity. Large source of turbidity is from internal re-suspension of sediment. A TP load reduction of 17% is needed to achieve water quality goals and protect the designated uses. The Palo Alto SWCD received an IDALS-DSC development grant for assessment of Five Island Lake and its watershed. This was completed in 2007.

Recent Activities

- Summer 2008 tour with the IDNR Director Leopold, State Senator Kibbe, local stakeholders and the IDNR Lake Restoration Program reviewed progress and the need for continued watershed work to compliment local dredging efforts.

- On November 3, 2011, the IDNR met w/ the City of Emmetsburg, Palo Alto SWCD, Palo Alto CCB, IDALS and members of the Lake Board to discuss status of project and potential future work.
- In addition to wrapping up the dredging portion of their project, the 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 current plan is to dredge approximately 420,000 cu. yds. in total over the next three years (2012-2014) in order to complete deepening in the areas approved for dredging.
- The City of Emmetsburg and Palo Alto SWCD will meet to discuss submitting a Watershed Management Planning Grant application to the IDNR by April.
- If the grant is approved, the city and county will prepare a Watershed Management Plan for the watershed, which will then make them eligible for a variety of funding opportunities.

Hawthorn Lake (Mahaska County)

The fishery in the 170-acre lake collapsed in 2004 after gizzard shad were introduced in 2002. The IDNR lowered the water level to a 20-acre pool while the in-lake restoration work was completed in the winter of 2010. The fishery was renovated in the spring of 2011. Restocking took place in the summer and fall of 2011. Nine structures are currently designed for watershed improvement. Five of these structures will be advertised for bid in January 2012 and be ready for immediate construction with the remaining four sites bid in the spring.

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 utilized funds of $450,000 for in-lake shoreline stabilization, deepening, and watershed improvement on state lands.

- IDNR awarded a $384,854 contract to Cornerstone Excavating, Inc. of Washington Iowa for in-lake restoration work at Hawthorn Lake ($147,824 Fish and Wildlife Habitat Funds, $132,033 Lake Restoration Program, $100,000 Mahaska County SWCD WIRB grant). The project, completed April 201, consists of the placement of in-lake habitat, shoreline armoring and deepening, and jetty construction/repair.

Shoreline protection at Hawthorn Lake

- IDNR Engineering developed initial design for nine nutrient/sediment control structures on state land and construction will begin in the winter / spring of 2012. Appropriate environmental and archeological reviews have been completed for this construction.
- 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
- Early secondary succession woody vegetation is being eradicated from targeted areas on the Hawthorn Wildlife area. This is a joint IDNR Lake Restoration Program / IDNR Wildlife Bureau / Mahaska County Conservation Board project. Lake Restoration provided up to $15,000 for removal

of these trees, which will allow for the stabilization and restoration of native grasses, providing overall better watershed protection while improving wildlife habitat.

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 - 2011 to discuss water quality improvement efforts at the lake. The NRCS received Development grant was in 2008 to determine critical areas in the watershed with significant quantities of sediment and nutrient delivery to the lake and completed a land use assessment in 2009.
- The Story SWCD has listed the Hickory Grove Lake Watershed as an Environmental Quality Incentives Program (EQIP) priority watershed. The EQIP is a voluntary program that provides financial and technical assistance to agricultural producers to help plan and implement conservation practices.
- Spring 2011, ISU received an IDNR Planning Grant for development of a Watershed Management Plan for Hickory Grove Lake. In October 2011, Dr. Michelle Soupir, from Iowa State University, named Aaron Andrews, from the Iowa Learning Farms (ILF) as the Watershed Project Coordinator. ISU will continue water quality monitoring throughout 2011. ISU will complete the Watershed Management Plan by Spring 2013.
- Story County Conservation Board staff continues to work on timberstand improvement and oak savanna restoration and clearing of invasive species from around lake including mechanical removal and prescribed burns.
- In Fall 2011 the Iowa Learning Farms and the Story CCB hosted a Hickory Grove Lake watershed Field Day
- Shoreline stabilization will continue in Winter 2011/2012 if ice becomes thick enough to move erosion stone and heavy equipment.

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. IDNR estimates that Lake Geode State Park attracts approximately 180,000 annual visitors who camp, hike, fish, and boat within the park.

The goals of the Lake Geode Watershed Project are to reduce bacteria, sediment and phosphorus from loading into Lake Geode. Project partners plan to achieve these goals through a combination of best management practices that will target identified source contributors from state and private land. The following agencies are working in partnership to achieve this goal, Iowa Department of Natural Resources (IDNR), 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. The district hired a watershed coordinator and he is meeting with watershed landowners to establish targeted watershed improvement measures. Funding has been secured through a number of partners (e.g. IDNR Lake Restoration and Watershed Improvement Section / Iowa Department of Agriculture and Land Management) to implement these practices. IDNR staff will help develop a Lake Geode Management Plan that will outline in-lake restoration options, with implementation of these options will only take place after sufficient sediment/phosphorus watershed reduction.

The Natural Resources Conservation Service, Iowa Department of Agriculture and Land Stewardship and the Iowa Department of Natural Resources have been working together to install Best Management Practices (BMP's) on state property.

- At this time, five grade stabilization structures (Ponds) and four sediment control basins have been surveyed and designed within Geode State Park. Each site has been selected by the partnering agencies to control gully erosion within the park. Each site that has been selected was identified through a gully assessment that was conducted during the early stages of the project.
- All nine structures have been designed, approved by the Iowa Department of Natural Resources state office and bid let. Contractor, James Waterhouse Construction, was awarded the $124,109 contract for construction and completion date is set at June 2012.

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 IDNR 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 IDNR 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 IDNR 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%).
- Construction of two erosion control structures on public land was completed in August 2011.

Lake Manawa (Pottawattamie County)

Lake Manawa is a 715-acre natural lake with a watershed to lake ratio of 4/1. Mosquito Creek supplies additional water to the lake. Past lake dredging work in the 1960s deepened significant portions of the lake. However, maximum lake depth does not exceed 13 feet with large expanses of 6 to 7 feet deep water. The Iowa Department of Transportation approached the 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 have met periodically between of 2007 and present 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 and finalized a dredging plan that will reduce the risk involved both in providing the materials to the specifications required and in the ability to control additional seepage from areas along the lake bottom. The project remains a viable opportunity for both 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.

<u>2011 Flooding</u>

Historic flood events in the Missouri River basin this summer resulted in Governor Branstad declaring Pottawattamie County as a disaster emergency area; this proclamation is in place until October 28, 2011. The following conditions existed at Lake Manawa because of the floods: high waters have inundated critical public infrastructure (such as parking lots, docks, trails, shorelines and fishing jetties) as well as neighboring private property. The damage caused to these areas from high water levels could not be assessed, repaired or prepped for winter (when there is a threat of further damage from ice) until the waters were lowered and the high waters were unlikely to recede naturally in sufficient time before winter to make all necessary assessments and repairs.

Pump set up at the shore of Lake Manawa to facilitate drawdown

Sand/silt deposited by the flooded Missouri River within Lake Manawa State Park

The IDNR conducted draw-down pumping at Lake Manawa (Pottawattamie Co.) pursuant to emergency response authority found in DAS rules 11 Iowa Administrative Code 106.3 and 106.8. "Emergency" is defined by 11 I.A.C. 106.3 as including, but not limited to, "a condition…in which there is a need to protect public health, welfare, or safety of persons occupying or visiting a public improvement or property located adjacent to the public improvement….". On September 30, 2011, the IDNR received written confirmation from the Governor's Office that the high water levels at Lake Manawa are currently threatening critical public and private infrastructure, justifying an emergency response.

Additionally, 11 I.A.C 106.8 authorizes emergency procurements for service contracts without competitive bid letting, although using some degree of completion is still encouraged. The IDNR's Engineering Bureau has pre-qualified multiple firms to provide on-going engineering consulting services;

under this retainer contract, the IDNR consulted with Ehrhart, Griffin & Associates to provide recommendations and specifications for effective drawdown of Lake Manawa in an efficient manner as possible. This information was then used to define the scope of work and informally solicit cost estimates from contractors.

Pump lines running from Lake Manawa to Indian Creek

Discharge to Indian Creek

- Four contractors were hired at Lake Manawa at a cost of $284,171 with an original target drawdown elevation of 2" below the invert elevation of the 18" CMP lake overflow pipe, which is at 966.89.
- Pumping began with 12" pump on Saturday, October 8. Lake Water Surface Elevation (WSE) on October 8th was 968.9 feet.
- First 18" pump started on Tuesday, October 11. Lake Water Surface Elevation (WSE) on October 12th was 968.72 feet.
- Second 18" pump came on-line on Friday, October 14. Lake Water Surface Elevation (WSE) on October 15th was 968.4.
- The last pump was shut down on Wednesday October 26t. Lake Water Surface Elevation (WSE) on October 27th was 967.26 and reached 967.22 on October 31st.
- The final target drawdown elevation, as determined by the IDNR, was based on the normal lake pool elevation of 967.0. It was determined on the 31st of October that the lake drawdown had reached a range acceptable to all parties and the contractor was directed to remove the pumps and associated piping from the area.

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. IDNR 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% EQIP, 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.
- 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.

- IDNR 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.
- IDNR and the Camp Wapello Preservation Group, in cooperation with Davis County SWCD constructed six water/sediment control basins and a grade stabilization structure at Camp Wapello. These structures will trap 252 tons of sediment annually, control future advancement of the head cuts and control the flow of water, which will help maintain the crossings on the IDNR trail system.
- IDNR will construct nine sediment control basins and one water impoundment within the park boundary during 2012.

Little River Lake (Decatur County)

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

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

- Decatur County, Southern Iowa Rural Water Association, Decatur County Conservation Board, Decatur County Soil and Water Conservation District, the City of Leon, and the Iowa Department of Natural Resources began planning water quality improvement efforts in 2008. Since that time, the group has met to plan and implement water quality improvement practices for the watershed.
- The Decatur County Soil & Water Conservation District and NRCS personnel assessed the watershed's problems, quantified soil erosion, and identified best management practices, (BMPs). The Watershed Improvement Review Board (WIRB) awarded the Decatur SWCD a $423,900 grant to cost-share improvement costs with landowners. The group also received a letter of support from the IDNR Lake Restoration Program to consider Little River Lake for future funding for in-lake improvement projects. Pending adequate implementation of watershed soil conservation practices, Lake Restoration funding will address in-lake improvements such as shoreline stabilization, rough fish management and silt basin improvements.
- The restoration process during 2011 involves implementation of remaining targeted watershed practices with available WIRB funding. Re-assessment of the watershed will guide planners to any remaining areas of the watershed to address before potential work in-lake.
- The local NRCS District Conservationist has implemented $384,419 of WIRB funding, $214,359 of EQIP funds, $192,471 of Public Owned Lakes funding, $100,865 of State cost share funding, $14,793 REAP funding, and $316,439 of landowner commitments totaling $1.2 million to improve the watershed and complete approved soil and water quality improvement projects. To-date less than $20,000 of WIRB funding remains available. Landowners in the watershed receive bonus points when competing for countywide funding from the Soil District and NRCS.
- Recent fish population estimates had indicated a dense common carp. Their feeding for bottom organisms suspends fine clay sediments causing poor water clarity. The IDNR renovated the fishery

in October 2011 and will restock the lake with walleye, largemouth bass, bluegills, crappies, and channel catfish in the spring of 2012.

- The IDNR awarded a $1.4 million contract to TK Concrete of Pella for shoreline deepening, shoreline stabilization, and in-lake fish habitat. The Lake Restoration Program funds paid for $1.15 million of shoreline improvements and Fish Habitat Stamp funds in cooperation with Federal Dingell-Johnson, Marine Fuel Tax funds paid for fish habitat improvements. Completion is expected by April of 2012.
- Future work will involve expansion of the wetland area above Little River Lake, which will double the area, improve sediment trapping capabilities above the lake and allow for water level management of the wetland. The IDNT is also working with the NRCS to design/construct fifteen basins on public land for $228,825 (75% LRP / 25% Local cost-share).

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 in 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, IDNR 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 IDNR hired Ducks Unlimited to conduct survey work during winter 2009 and plans to construct a water control structure and fish barrier. Construction of a new water control structure, fish barrier, and improved draw down channels was completed in 2011. IDNR drained the lake to eliminate high populations of common carp and other problems fish, allow for the consolidation of loose bottom sediments, and promote the growth of aquatic plants. These plants will help keep water in the lake clean by holding down bottom sediments, reducing wave energy, using up nutrients otherwise available for growing algae, and provide habitat for the small invertebrates that eat algae. Aquatic plants will also provide excellent habitat for sport fish and a multitude of game and nongame wildlife species that depend on clean-water lakes for survival. Pending appropriate weather patterns, Lizard Lake will be refilled in fall 2012 and quality sport fish will be stocked soon after.

- Lizard Lake was drawn down during the winter/spring of 2011 as planned. The draw down went very well and the wildlife biologist was able to achieve a complete draw down. Cooperating weather conditions allowed vegetation to flourish in the exposed lakebed. After the lake gets enough water, Lizard Lake will be restocked with northern pike and yellow perch.

Lizard Lake during the early phase of the draw down (right).

Lizard Lake after the draw down is complete (right). Note the vegetative response after the draw down.

- Construction activities on and around Lizard Lake were completed as planned. A new outlet and water control structure was installed to replace the antiquated one. A private firm was contracted to survey the outlet structure to assure local citizens that the new outlet structure was installed at the same elevation as the old one. A velocity tube fish barrier was installed just downstream of the outlet structure at Lizard Lake. This fish barrier is the first of its kind as it allows debris to flow through the structure, but does not allow fish to pass through it because it is installed at a steep enough grade.

The old outlet structure at Lizard Lake (left). The new outlet structure at Lizard Lake with all of the stop logs removed to allow the lake to drain (below). The elevation of the new structure (with all stop logs in place) matches the elevation of the old outlet at the bottom of the notch.

A velocity tube is installed downstream of the outlet structure on Lizard Lake to control re-introduction of rough fish back into the lake.

Iowa Great Lakes (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 IDNR listed Meadow Lake as an impaired water in 2004 for algae and added impairment for turbidity in 2008. The presence of aesthetically objectionable blooms of algae and poor water transparency impair the primary contact recreational uses at the lake. 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).

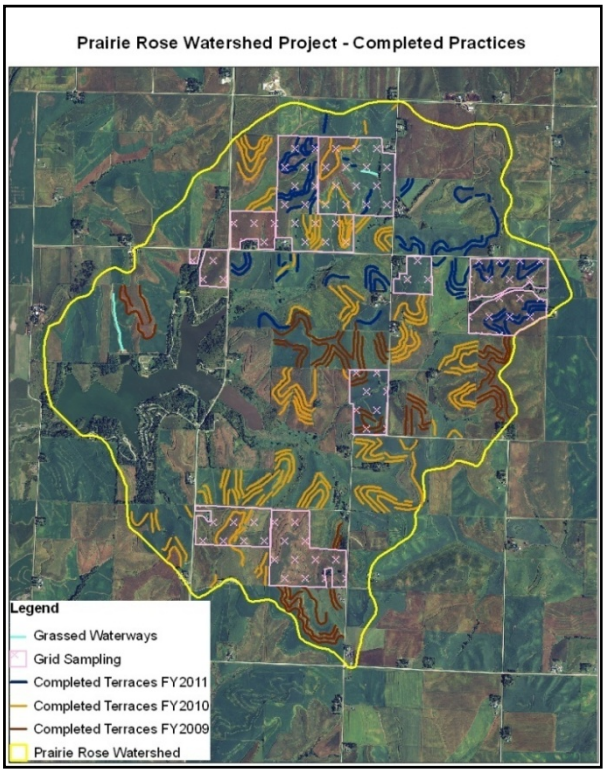
- IDNR Lake Restoration and the Watershed Improvement Section, with design from NRCS, constructed an in-lake structure in the spring of 2010 at Meadow Lake to achieve sediment and phosphorous reduction from 236 acres of the watershed. In addition, we constructed two wetlands above Meadow Lake by the 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

- Water quality monitoring will continue this summer to document if water quality improvements support removing this lake from the impaired waters list.

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 / IDNR 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 225,000 feet (40 mi.) of terraces, grassed Waterways and nutrient management plans.

Prairie Rose Restoration Plan	**Budget**
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	$378,884
Replace M47 road structure / raise water level	$100,000
Spillway modification (estimated)	$250,000
Repair gate valve	$15,000
Containment site construction	$200,000
Mechanical dredging (South-east basin)	$250,000
Shoreline armoring	$225,000
Fish habitat construction	$150,000
Fish renovation	$10,000
Phase 2: After lake re-fills	**2013**
Hydraulic dredging (estimated)	$1,300,000
Total	**$3,218,884**

- 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.
- Rock chute wetlands were constructed on public land on the two main drainages of the lake during the fall of 2011 and construction has started on two road-riser structures.
- Prairie Rose Lake was dewatered back in July 2011 to allow construction work to begin in the basin. Stabilizing the eroding shoreline and removal of 60,000 cubic yards of sediment are planned for the winter of 2011-12.
- Spillway modification to prevent rough fish entering the lake from below is planned for the spring of 2012. Additional fish habitat is being built in the lake basin utilizing IDNR Trust Fund dollars.
- Barring any construction delays this winter Prairie Rose Lake will begin to refill next summer allowing for preparation of Phase 2 hydraulic dredging.

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.

- Phase 1 of the Rathbun Lake Section 1135 project addressed seven sites with rock quantities exceeding 45,000 tons. In addition to water quality improvements, fish habitat will be improved for a number of important game fish species. This project was completed spring 2011.

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

- Phase 2 of the Rathbun Lake Section 1135 project addresses the Honey Creek Resort Point. Honey Creek is a 300+ acre arm of Rathbun Lake and provides some of the highest quality crappie spawning habitat available in the lake. Protection of the Honey Creek Resort Point will provide water quality benefits that will translate into improved crappie habitat and production, and secondarily will preserve Resort infrastructure from flood damage. The total portion of the above total cost to be expended on this phase is $1,713,465.58 of Federal / State cost share. Total rock quantities to be placed exceed 40,000 tons. Work will be completed by spring 2012.

View of section of shoreline below Honey Creek Resort Point to be armored as part of Rathbun 1135 Habitat Restoration Project

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 IDNR is planning for spring/summer 2012construction.
- 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.

Lake Restoration Program (LRP) – Projects In Outreach; Evaluation/Planning 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 IDNR 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 IDNR 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 IDNR.

- 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. IDNR 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. 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 IDNR 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.
- Fisheries Biologists introduced aquatic macrophytes into George Wyth Lake in the fall of 2009 on an experimental basis. Wild Celery and Narrow-Leaved Pondweed were introduced into two enclosures designed to exclude aquatic herbivores.
- During a vegetation inventory completed on George Wyth Lake in 2010, IDNR staff found six species of submersed aquatic plants and two species of floating-leaved aquatic plants. Wild Celery planted during 2009 was found within enclosure structures and narrow-leaved pondweed planted in 2009 was found at multiple locations in the lake.
- During 2010, 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.
- During 2011, biologists identified seven species of submersed aquatic plants and two species of floating-leaved plants. Wild Celery was not found among the plants during 2011 and plant enclosures were removed from the lake. Unfortunately, brittle naiad (an aquatic nuisance species) was found in a small section of the George Wyth during 2011. During 2012, IDNR Fisheries will work cooperatively with IDNR Parks to manage vegetation in areas with high public use (e.g., beach and boat ramp). IDNR fisheries will also treat Brittle Naiad with herbicide to eradicate or suppress it in the lake system.
- The proliferation of vegetation in George Wyth during 2010-2011 has been beneficial to the George Wyth Fishery due to increased fish habitat and improved water quality. Observational information from IDNR Parks and Fisheries staff suggest increased recreational use and improved fishery quality during 2011. During 2012, we will continue to monitor fishery response.

Lake Keomah (Mahaska County)

- IDNR 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.

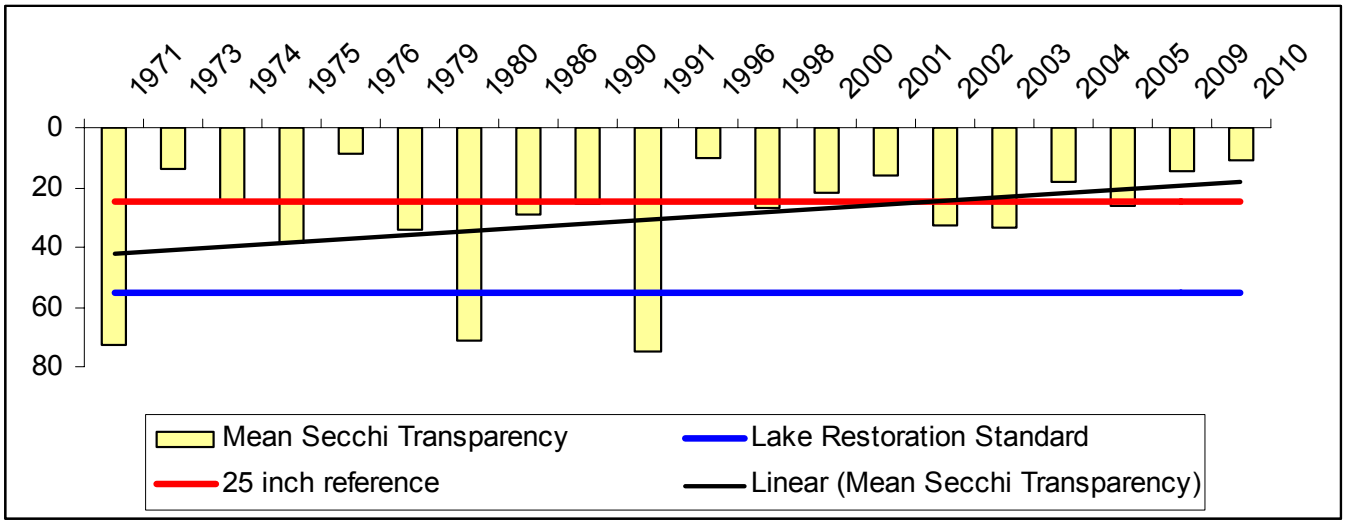
- Current activities center on the creation of a “Friends” group for the State Park, laying the groundwork for local support and participation in future restoration activities.

Lake Miami (Monroe County)

Lake Miami is a 122-acre impoundment located on the 776 Miami Wildlife Area, approximately 6 miles northwest of Albia, in Monroe County. The lake, constructed in 1961, is owned by the Iowa Department of Natural Resources. The area is cooperatively managed by the Iowa IDNR and through a 28-E agreement by the Monroe County Conservation Board, which operates campground, cabin rental, and a nature center facility on 89 additional acres of adjacent County Park. The lake and park provide facilities for boating, fishing, camping, picnicking, and hiking. Park use, as determined in the recent Center for Agricultural and Rural Development (CARD) study is estimated at approximately 43,000 visits per year. Approximately 160 hours of angling effort per acre are expended annually at Lake Miami. However, the most recent creel surveys suggest angling activity has declined in recent years.

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

Mean annual Secchi disk estimates are presented below. The standard for mean Secchi disk readings within the Iowa Lake Restoration Program is a minimum 54 inches. In years for which data are available, there are only three years when Lake Miami meets the Lake Restoration Program standard. However, the below graph demonstrates a line identifying 25 inches for reference purposes only and represents no water quality standard in particular. From 1971 to 1991 mean Secchi disk readings exceeded 25 inches eight out of 10 times (80%) while since that time mean Secchi readings have exceeded 25 inches only four out of 10 times (40%). These data indicate a substantial decline in Secchi transparencies in this time. According to the Lake Classification Report completed by ISU, Lake Miami ranks in the lower 1/3 for water clarity out of the 131 lakes studied. Possible reasons for the decline in water quality include turbidity from sediment, nutrient delivery from sheet/rill and gully erosion in the watershed, shoreline erosion due to wind and wave action and the re-suspension of these bottom sediments and their associated nutrients from wave action, and re-suspension of sediments by rooting action of Common Carp. A detailed assessment is needed to identify sources of siltation and which additional BMPs are best suited to fix the problem.



The Monroe County Soil Conservation Commission applied for and was awarded $17,000 ($15,000 from Division of Soil Conservation with $2,000 from Iowa Lake Restoration funding) for an updated watershed assessment of the Lake Miami Watershed. This assessment will be completed by spring 2012. Preliminary results indicate that while multiple structures have been completed in the Miami watershed, many of these structures have reached the end of their design life and are no longer functioning properly.

An assessment of the fishery indicated that common carp are present in excess of 400 lbs/acre while gamefish biomass is minimal. Angling quality has decline dramatically in recent years, mirroring changes in water quality. Lake Miami was listed on IDNR Fisheries Bureau 5-year capital plan for dredging in 2004; however, the project was removed from the plan due to funding limitations with the intention of returning it to the capital budget at the earliest time possible.

Mariposa Lake (Jasper County)

- The Mariposa watershed project ran through June 2011. The NRCS completed a waterway project in spring 2009. The Jasper County Conservation Board has completed bank stabilization practices along approximately 900 ft of shoreline using rock riprap and coconut fiber logs and has completed a 3-acre timberstand improvement project. An overgrown area over a gully was cleared to approximately 25% canopy cover to allow grasses to grow and seeded to native grasses and wildflowers.
- Jasper County Conservation has completed designs for a wetland project that will be located immediately above the lake. The construction is scheduled to begin 2012. This wetland will serve as a nutrient filter before water reaches the main lake.

North and South Twin Lakes (Calhoun County)

- Local IDNR fisheries and wildlife biologists met with the Twin Lakes Restoration Association (TLRA) to discuss water quality issues in the lake system. Local IDNR staff fielded a number of calls throughout 2011 in regards to water quality issues and potential projects at both lakes. The TLRA invited local biologists to attend a meeting and provide information regarding water quality projects.
- Biologists explained that the best way to start a water quality project is to conduct a comprehensive Diagnostic Feasibility Study on both lake systems. The TLRA has sent a letter to the Director of the IDNR requesting that the Twin Lakes System be included in the Lakes Restoration Program budget to fund a DF Study.

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

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. IDNR 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. The plan is for IDNR Fisheries and Parks to work cooperatively with IDALS in developing a plan to address these problems.

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 has initiated design for construction of five to eight structures within the State park to control sediment and provide additional water quality benefits. IDNR will survey / design / construct these grade stabilization and sediment basin structures in 2012/2013.

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, that marked the first spillway overflow since 1993. Silver Lake has remained near full pool throughout 2008-2011, which indicates that dam repairs completed during 2007 were very effective.
- Submersed aquatic vegetation and water clarity have responded favorably to higher water volume and water levels that are more persistent. 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, 2010, and 2011. 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.
- IDNR 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 meeting during the 3rd quarter of 2010 to discuss options for watershed improvement and in-lake water quality improvement. Activity of this group lost momentum during 2011.
- Silver Lake suffered a moderate winterkill during the severe winter of 2010-2011, which effectively eliminated largemouth bass from the system and reduced the bluegill population. IDNR Fisheries restocked Largemouth Bass in June 2011 and the bluegill have recovered favorably during the 2011

growing season. Silver Lake had reduced fishing pressure during 2011 because of the recent fish kill, but fishery use is expected to increase substantially during 2012.

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 IDNR 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 back 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.
- In Spring 2011, 8.6 acres of native seeding and 1.1 acres of grassed waterway were installed. A number of pasture improvements, a rock livestock stream crossing and 2.8 acres of waterways are scheduled for summer construction. Another 0.8 acre of waterway is ready for construction, pending contractor availability.
- The Tama SWCD Watershed Project Coordinator is working to revise and have approved their Management Plan. In addition, the Tama County Sanitarian is working to complete a report on a septic plan for the lake community.

Special Projects

Twin Ponds, Chickasaw County

Twin Ponds is a 157-acre tract that was acquired in 1962 by the Chickasaw County Conservation Board. The Twin Ponds Area is split by the Wapsipinicon River, forming an East Park and a West Park. A picnic shelter is provided on each side, and primitive camping is allowed. This is also the home of the Twin Ponds Nature Center, a facility opened for public use in 2002.

Completed pond at the Twin Ponds Nature Center

Funding for this project was appropriated during the 2010 legislative session per SF 2389 … "Of the amount appropriated in this subsection, $250,000 shall be allocated for dredging, reconstruction, and related improvements of twin ponds adjacent to a nature center in a county with a population between 13,050, and 13,100." While this is atypical of our normal lake restoration projects, it was supported through legislative direction. Consulting with DNR field staff, the CCB has developed a plan to enhance and dredge the East Pond and maintain the status of the West Pond in its current wetland floodplain condition. A 3-acre pond was constructed on CCB property immediately north of the CCB nature center and will serve as a public fishing and recreation site

Lake Delhi, Chickasaw County

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

<u>2010 Flood Event</u>

The Lake Delhi Dam is located southwest of the city of Delhi, Iowa and forms an impoundment on the Maquoketa River. During the flood event of July23-24, 2010 a portion of the southern earthen embankment of the privately owned dam was breached and eroded by the flood and the concrete spillway's gates were damaged. Floodwaters also infiltrated and seeped through a section of the northern embankment.

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

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

The IDNR, operating under the understanding that they would be re-imbursed for stabilization of the Maquoketa River, paid for the $666,049 project out of IDNR Lake Restoration Program funds with the intent of having the Program re-imbursed. Federal Emergency Management Agency (FEMA) was identified as a potential funding source. However, at this point the IDNR has not been able to secure

FEMA reimbursement. The IDNR has submitted necessary documentation to FEMA and is currently examining the opportunity to appeal if funding is denied.

Feasibility Study for Dam Restoration

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

Funding for this project was appropriated during the 2011 legislative session per HF 648.
"Of the amount appropriated in this lettered paragraph, $350,000 shall be allocated to a county with a population between seventeen thousand seven hundred and seventeen thousand eight hundred as determined by the 2010 federal census, for a lake with public access that has the support of a benefited lake district. The allocated moneys shall be used for purposes of completing a preconstruction dam restoration study that would include a geotechnical evaluation, hydrological studies, restoration alternatives and construction specifications. The preconstruction dam study shall be filed with the general assembly upon completion". This project is not typical of our current lake restoration process; however, it was supported through legislative direction. To-date, $44,523 has been billed for this project.

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 lakes 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.

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

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

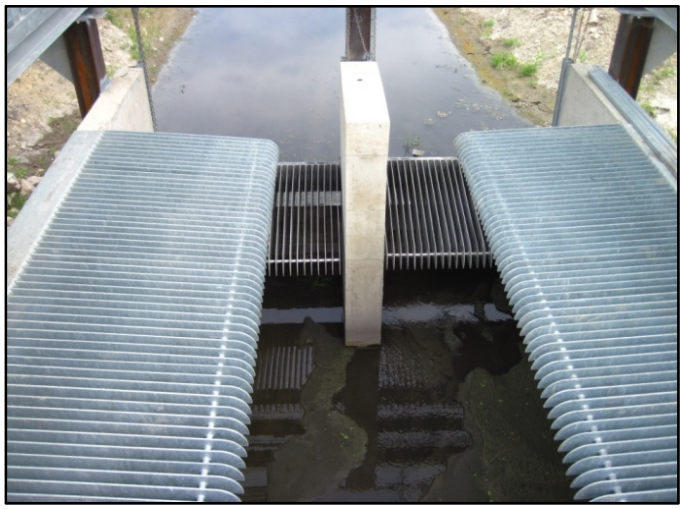
Active Shallow Lake Projects

Pickerel Lake, Buena Vista County - Pickerel 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 Pickerel Lake. Project partners will initiate intensive in-lake management this winter to enhance water quality, fish and wildlife habitat in Pickerel Lake. In addition, they will continue to work long-term throughout the watershed to ensure that soil, fertilizers, and pesticides stay on the uplands. In-lake actions 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 IDNR 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, Pickerel 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.

- Pickerel Lake was drawn down during the winter/spring of 2011 as planned. The draw down went very well and the wildlife biologist was able to achieve a complete draw down. Cooperating weather conditions allowed vegetation to flourish in the exposed lakebed. When there is enough water to sustain fish, Pickerel Lake will be restocked with walleye and yellow perch.

Pickerel Lake in drawdown condition (left)

- The outlet structure replaced at Pickerel Lake now incorporates both the ability to control water levels and a fish barrier to keep rough fish out of the lake.



The new outlet and water control structure at Pickerel Lake (above). Fish barriers on the outlet structure at Pickerel Lake (left). These overhanging fingers allow debris to flow over the barriers but keep carp from jumping up into the lake from downstream. Note the barriers on the stop logs can move up and down with the elevation of the logs.

Near-Future Shallow Lake Projects

East and West Hottes Lake/Marble Lake/Grovers Lake Complex, Dickinson County - Located within the 1,700-acre Kettleson 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, IDNR, 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 plan to complete the feasibility study by spring 2012 and begin construction in the fall.

Silver Lake, Worth County Shallow Lakes Restoration work is planned for Silver Lake in 2012. The contract has been awarded and initial construction should start in January 2012. The current water control structure will be replaced, a channel will be dug in the lakebed to aid in draining the basin, and fishery renovation will take place in the fall of 2012.

- The benefits will be improved water quality, establishment of an aquatic plant community, and a restored fishery. Silver Lake has suffered winter fish kills the last two seasons.

Old outlet structures at Silver Lake (Worth Co)

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 needs to sustain clean water and provide habitat for sport fish and aquatic wildlife. Project partners, including IDNR 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. Construction is planned to begin Winter 2012. The lake will be drained from Fall 2011 to fall 2013, with fish restocking taking place in 2014.

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 for a number of planned lake/watershed improvement projects. Including; Badger Creek Lake (Madison Co.), Central Park Lake (Jones Co.), Diamond Lake (Poweshiek Co.), Hannen Lake (Benton Co.), Kent Park Lake (Johnson Co.), Lake of the Hills (Scott Co) and Swan Lake (Carroll Co).

Lake Restoration Prioritization Process

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

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

IDNR annually reviews projects to determine which lakes should proceed with lake restoration. Until watershed best management practices protect the lake, restoration work cannot move forward, therefore lakes with well-documented watershed protections are the best candidates for restoration.

The other necessary ingredient to begin lake restoration is local commitment. In order to better document how lake restoration will benefit Iowa we will use cost benefit analysis, as well as identifying non-economic benefits to people and our natural resources. Computing and documenting the economic benefits, recreation benefits, health benefits, and natural resource/environmental benefits of lake improvements will be a great asset to the lake restoration process. This information will also go a long way in communicating the need of lake restoration projects to local communities and the legislature.

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”.

Examples of two local stakeholders groups that contacted the IDNR and successfully petitioned to have their lakes added to the priority list of restoration projects are Lake Rathbun (Appanoose Co.) and Lost Island Lake (Palo Alto Co.). Rathbun Reservoir (Appanoose Co.) is an 11,000 acre lake in south-central Iowa that is one 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.

Three lake restorations 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, Local IDNR fisheries and wildlife biologists have met with the Twin Lakes Restoration Association (TLRA) to discuss water quality issues related the entire lake system (South and North Twin Lakes) and will look to work together to complete a Diagnostic/Feasibility Study in 2012/2013. The IDNR has worked 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. With WIRB and local funds, the City has completed a number of 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/portals/idnr/uploads/water/watershed/files/fouris.pdf?amp;tabid=694

Water Quality Improvement Framework for Lakes
http://www.iowadnr.gov/portals/idnr/uploads/water/watershed/files/lake_frame.pdf?amp;tabid=694

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

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).

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

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

(2) 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.

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

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

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

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

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

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

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

Lake Restoration Program (2011)
For the purpose of Iowa's Lake Restoration Program, "significant, publicly-owned lakes" are defined as those publicly-owned lakes that meet all of the following criteria:

- are maintained principally for public use;
- are multi use systems capable of supporting a viable sport fishery and recreational opportunities;
- have a surface water area of at least 10 acres;
- have a watershed to lake surface area ratio of less than 200:1;
- are not federal flood control impoundments with a watershed to lake surface area ratio greater than 200:1; and
- are not lakes used solely as water supply 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 seventeen 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 Icaria	ADAMS
Lake Miami	MONROE
Lake Sugema	VAN BUREN
Lake of Three Fires	TAYLOR
Lake Wapello	DAVIS
Little River Lake	DECATUR
Lizard Lake	POCAHONTAS
Lost Grove Lake	SCOTT
Lost Island Lake	PALO ALTO
Mariposa Lake	JASPER
Meadow Lake	ADAIR
North Twin Lake	CALHOUN
Rathbun Reservoir	APPANOOSE
Swan Lake	CARROLL
Twelve Mile Creek Lake	UNION

The following lakes are the additional seventy-five 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

LAKE NAME	COUNTY
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 Cornelia	WRIGHT
Lake Hendricks	HOWARD
Lake Meyer	WINNESHIEK
Lake Pahoja	LYON
Lake Smith	KOSSUTH
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
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
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
- IDNR provided the 2006 legislature with a priority list of 35 lake candidates
  - Priorities based on a 5-year ISU/IDNR 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
  - 25 Active projects in-progress
  - 19 Initial public outreach, evaluation or planning stage
- IDNR 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 funding	$10.0 Million	2010 funding	$2.8 Million
• 2011 funding	$10.0 Million	2012 funding	$5.5 Million

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