LAKE RESTORATION ANNUAL REPORT AND PLAN

SUBMITTED TO

JOINT APPROPRIATIONS SUBCOMMITTEE ON TRANSPORTATION, INFRASTRUCTURE, AND CAPITALS
AND
LEGISLATIVE SERVICES AGENCY

PREPARED BY
IOWA DEPARTMENT OF NATURAL RESOURCES

DECEMBER 26, 2006

SUMMARY

Iowans value water quality and desire safe, healthy lakes that provide a full complement of aesthetic, ecological and recreational bene ts. 2006 was a year marked by increased focus on Iowa's lakes. In large part, this emphasis was encouraged by new legislation within the 2006 Infrastructure Bill (HF2782), which appropriated $8.6 million toward lake restoration. A new section (26) of The Endowment For Iowa's Health Account established a process and criteria for completing successful lake restoration projects. It also directs the Department of Natural Resources (DNR) to report annually its plans and recommendations for lake restoration funding, as well as progress and results from projects funded by this legislation.

While the primary focus of this report is the activities and projects supported by lake restoration funds, it also describes some of the important work being done by local, state, and federal partners. DNR personnel are actively engaged with lake stakeholder groups and natural resource managers that share mutual goals. This report shows progress has been achieved in building partnerships and a technical foundation for successful lake restoration projects in the coming years.

Recent experiences from Lake Ahquabi and Lake of Three Fires show that signi cant improvement in water quality can be expected following lake restoration. At Lake Ahquabi, water clarity improved from 20 inches to more than four feet. Visits to the state park and shing trips to the lake increased three-fold following lake restoration. Based on the average economic value of visits to the lake and park, the $4 million restoration cost was estimated to be returned within two years. Important research by the Center for Agricultural Research and Development at Iowa State University is measuring Iowans willingness to pay for water quality and the local economic bene ts of clean lakes.

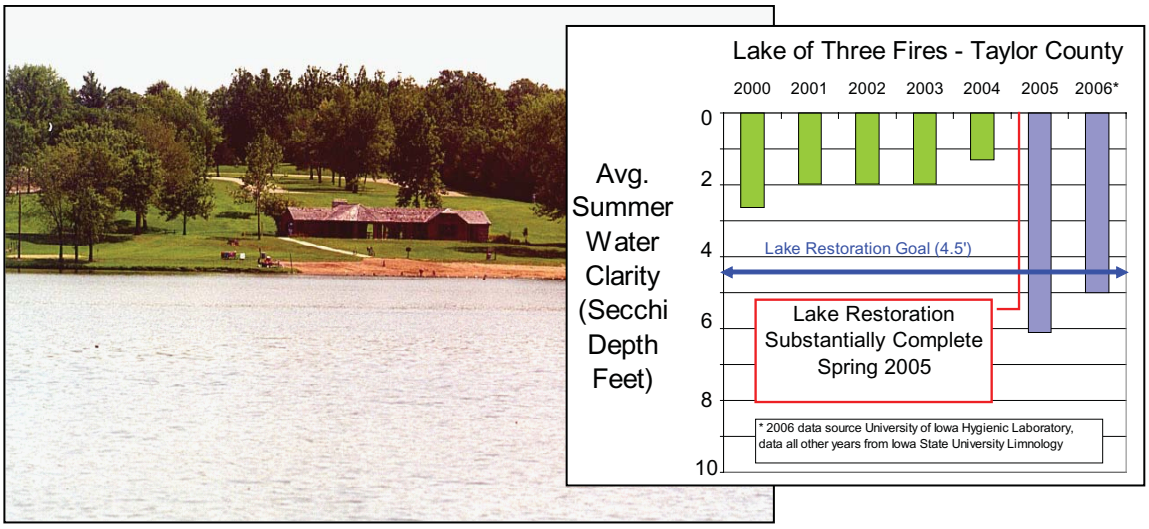
In Lake of Three Fires, summer water clarity (above) improved from an average of 2 feet (2000-2004) to 5½ feet (2005-2006) following the completion of substantial watershed improvement and lake restoration work. Approximately 500,000 cubic yards of sediment were dredged from the lake in 2004. The lake was drained and the existing shery dominated by common carp and gizzard shad was eliminated in fall 2004. The lake was re lled and sh were restocked in spring 2005. Water clarity is much improved compared with pre-restoration years and game sh (bluegill, largemouth) growth is reportedly outstanding. Plans to construct a wetland directly above the lake in 2007 will further protect water quality and provide additional environmental bene ts.

FISCAL YEAR07 BUDGET AND EXPENSES

The lake restoration budget for FY07 totals $12,192,797 including cost-share and FY06 lake restoration carry forward funds. Through November 30, 2006, $4,000,166 or 33% of budgeted funds have been expended or obligated under signed agreements. The remaining 67% are represented as estimated expenses re ecting varying stages of project development.

FY07 LAKE RESTORATION BUDGET

SOURCE	AMOUNT
06 CARRY FORWARD INFRASTRUCTURE ENVIRONMENT FIRST LAKE RESTORATION	$1,308,176
07 INFRASTRUCTURE ENVIRONMENT FIRST LAKE RESTORATION	$975,000
07 INFRASTRUCTURE IOWA HEALTH ACCOUNT LAKE WQ IMPROVEMENT	$8,600,000
LOCAL AND FEDERAL COST SHARE	$1,309,621
TOTAL	$12,192,797



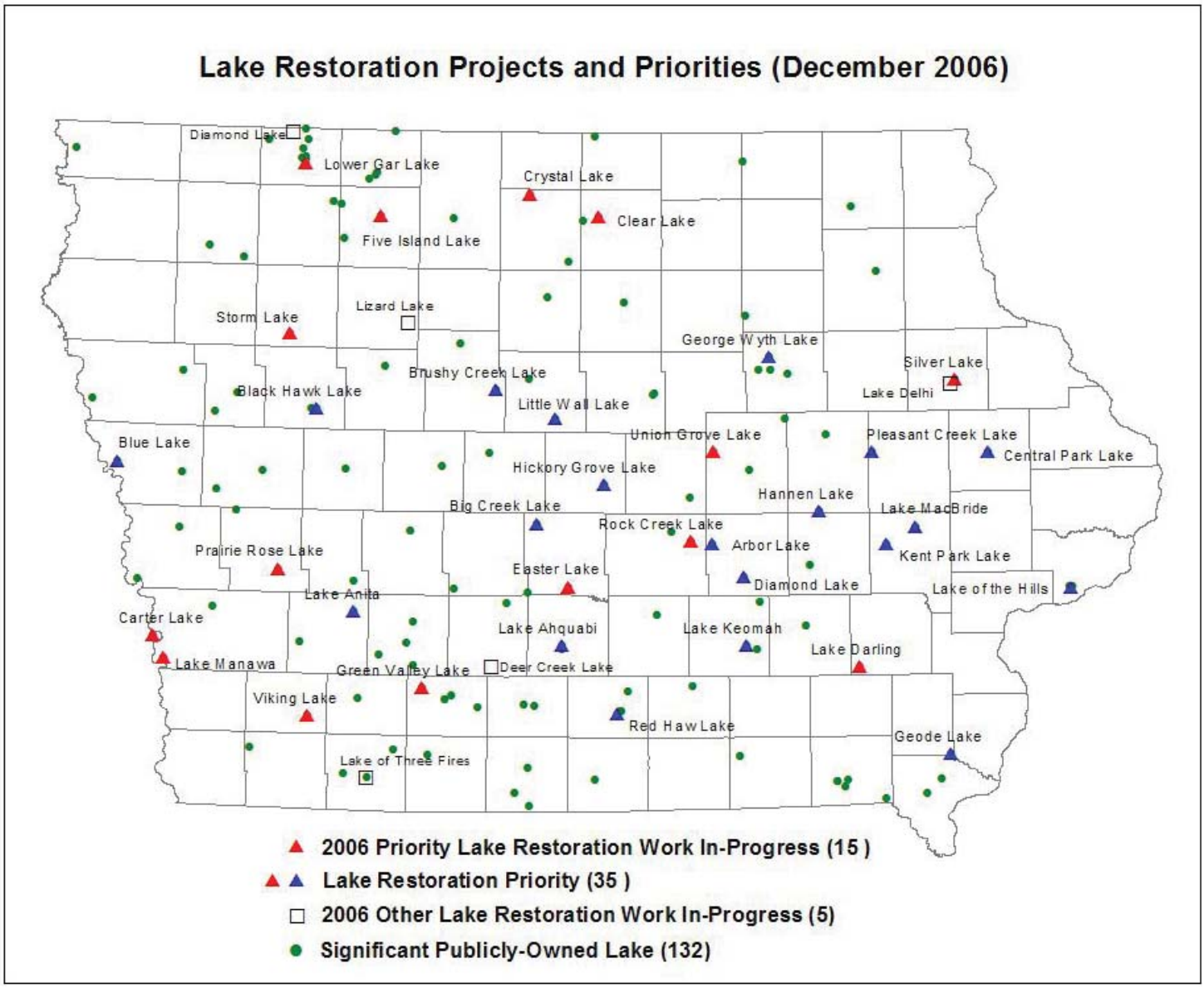
FY07 LAKE RESTORATION EXPENSES

BUDGET	$12,192,797
FY07 EXPENSES (07/01/06-11/30/06)	$1,338,539
ADDITIONAL FY07 OBLIGATED FUNDS	$2,661,627
FY07 ESTIMATED EXPENSES	$4,656,316
ADDITIONAL FY07 ESTIMATED EXPENSES REALIZED IN FY08	$3,536,315
TOTAL EXPENDED, OBLIGATED, & ESTIMATED EXPENSES	$12,192,797

LAKE RESTORATION PRIORITIES

An initial ranking of 127 public lakes for lake restoration purposes was completed in 2006. The ranking process resulted in a list of 35 lakes considered the highest priority for restoration (see map p. iii). The list serves as a starting point for considering potential lake restoration projects. Several water quality, watershed, and socio-economic factors were taken into consideration to create the priority list. A description of the ranking process and project cost estimates are provided in the main body of the report

The list of 35 lakes will be reviewed in 2007, and annually thereafter, to determine which lakes are best-positioned to proceed with lake restoration. Since restoration work can not proceed until the lake has been adequately protected by watershed best management practices, lakes having well-documented watershed protections are the best candidates to proceed with restoration. The other necessary ingredient to begin lake restoration is local commitment.



PROJECT STATUS

Three lakes received speci c appropriations in FY07: Clear Lake (Cerro Gordo Co.), Crystal Lake (Hancock Co.), and Storm Lake (Buena Vista Co.). Each lake has an active restoration project and an established local-state partnership. FY07 lake restoration funds are speci cally designated for deepening these lakes by dredging accumulated sediments.

CLEAR LAKE

The Clear Lake dredging plan includes acquiring land for a dredge spoil containment basin, building the containment basin, and hydraulically dredging approximately 2.3 million cubic yards of sediment. The estimated total project cost is $13 million, with the state pledging $9 million and local partners and other leveraged funds making up the rest.

FY07 Progress: A nal purchase agreement for the dredge spoil containment site has been obtained. Approximately $660,000 of lake restoration funds are going toward the purchase. A similar local contribution will be part of the containment site purchase. A required archeological/ cultural study of the proposed dredging-impacted area will be completed, and the design and construction of the containment site is scheduled to be completed by summer of 2007. Dredging is expected to commence fall of 2007. The DNR supported three-year plan established in 2006 is as follows:
FY07: $4,000,000; containment site acquisition and construction; dredging
FY08: $2,500,000; dredging
FY09: $2,500,000; dredging
Cost adjustments might be needed as the project progresses. Recently, for example, the estimated cost of dredge site construction was increased from $1.4 million to $1.6 million.

In addition to dredging, plans are being developed for a Section 206, U.S. Army Corps of Engineers, Aquatic Ecosystem Restoration Project in Ventura Marsh, which ows 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 abundance of carp in Clear Lake is also believed to contribute to algae and turbidity (water cloudiness) problems in the lake. Carp are aggressive bottom feeders that uproot aquatic vegetation and stir up lake sediments. Their impact to water quality and aquatic habitat can be severe. With funding from the lake restoration program and local interest groups, Iowa State University sheries scientists are monitoring the movements of carp in the lake in order to investigate potential strategies for removal through netting or chemical treatment.

CRYSTAL LAKE

Dredging is proposed for removal of 1.1 million cubic yards of sediment from Crystal Lake. This should reduce the effects of nutrient enrichment and limit areas of excessive aquatic plant growth. Dredging in Crystal Lake should be done around June 2007. Following dredging, the sh community of Crystal Lake will be renovated to remove the common carp population. The small lake outlet structure will also be modi ed to prevent future introductions of undesirable sh species. The combination of previous watershed and current lake restoration work should result in removal of Crystal Lake from the Impaired Waters List.

The small community of Crystal Lake and the surrounding rural area is an excellent example of a locally driven project that will bene t this region. Beginning with projects such as watershed work in the 1970s, to city installed sewer treatment upgrades in the 80s, followed by over two miles of shoreline rip rap work in the 90s, and nally recent additional watershed and park upgrade work, concerned area citizens through the years have contributed over $700,000 of labor, materials, equipment and donated cash to improve Crystal Lake and the nearby area. Now, with in-lake restoration activities underway, the local area will also bene t from improved shing opportunities that will add annually up to $400,000 to the local economy, in addition to improving lake water quality and expanding other water-based recreational opportunities.

The recommended lake restoration funding for Crystal Lake dredging is as follows:
FY07: $1,400,000; FY08: $250,000 (Dredging); FY09: $0.
(Note: the dredging plan also incorporates $1,425,000 of FY06 lake restoration funds).

Construction of the dredge spoil containment site was completed July 2006 at a cost of $838,000. Dredging commenced in October 2006 and should be completed by July 2007. $635,382 of lake restoration funds had been expended through November 2006. Work is continuing in the watershed to address stormwater runoff.

STORM LAKE

Dredge spoil containment site construction and dredging activities in Storm Lake initially began in 2001 and were completed in 2002 at a total project cost of $3.275 million. 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 The LPA locally raised and received federal grants totaling over $1 million to continue dredging at Storm Lake. They purchased a dredge, and

through an agreement with the DNR, each group has provided $900,000 from 2003 through 2005 to continue dredging operations. To reach project goals will require another 10 years of dredging at a projected cost of $12 million ($6 million State - $6 million Local).

The recommended budget and work plan for Storm Lake is as follows:
FY07: $500,000 (Dredging); FY08: $1,000,000 (Dredging); FY09: $1,000,000 (Dredge Containment Site Development; Dredging).

Dredging is progressing as planned. $450,000 in lake restoration funds had been expended through November 2006, and the remaining $50,000 will be used by the end of the scal year.

OTHER LAKE PROJECTS

FY07 funds were budgeted for lake and watershed improvements in 16 other priority lakes. Watershed work for a number of lake restoration projects is supported by state and federal funding sources including DNR Section 319 Nonpoint Source Pollution Control, IDALS/DSC Water Protection Fund, Watershed Protection Fund and Watershed Improvement Review Board (WIRB) Grant. Work ranged from completing diagnostic-feasibility studies to designing and constructing watershed structures to stabilizing lake shorelines and installing sh habitat.

- **Carter Lake.** Shoreline stabilization and installation of raingarden storm runoff treatment; Diagnostic / Feasibility (D/F) study of lake water quality problems and solutions; D/F study developed from cooperative agreement between Iowa, Nebraska and the cities of Carter Lake and Omaha.
- **Deer Creek Lake.** Lake bottom sealing to prevent water seepage; will improve lake water quality and recreational uses.
- **Easter Lake.** D/F study of lake water quality problems and solutions; D/F study cost-share with Polk County.
- **Five Island Lake.** Lake dredging work is nearing completion; work continuing in the watershed to address stormwater runoff.
- **Green Valley Lake.** D/F study of lake water quality problems and solutions; watershed analysis and best management practice recommendations.
- **Lake Darling.** Installation of watershed improvement practices and structures; engineering study documenting and identifying solutions for dam & spillway leakage; D/F study of lake water quality problems and solutions; Search for dredge spoil containment site.
- **Lake Delhi.** Continuation of planned dredging.
- **Lake Manawa.** Hydrogeological study being done to determine hydrological connectivity between the lake and Missouri River and possible safe dredging limits; DNR working with IDOT to determine future plan of action.
- **Lake of Three Fires.** Watershed work and lake dredging completed in 2005; construction of wetland on DNR Simmons Wildlife Area is nal component of lake restoration; constructed wetland will protect lake water quality and diversify wildlife area uses; potential purchase of adjacent 80-acre parcel will provide needed storage of water back-up by wetland water control structure.
- **Lizard Lake.** D/F study of lake sheries and water quality problems and solutions; D/F study will include 25% cost-share with local partners.
- **Lower Gar Lake.** D/F study of water quality problems and solutions including 25% cost-share with local partners.
- **Prairie Rose Lake.** D/F study of water quality problems and solutions.
- Rock Creek Lake. Identify and design appropriate watershed practices and structures needed to reduce nutrient and sediment delivery to lake.
- **Silver Lake.** Engineering solutions identi ed; leaking dam to be repaired and dam embankment renovated.
- **Union Grove Lake.** Design and install curtain grouting to solve dam spillway seepage problem. Clean out lled-in sediment pond above lake.
- **Viking Lake.** Twenty-two grade stabilization structures built to prevent soil erosion and improve lake water quality; two additional watershed structures to be built; shoreline rip rapping of erosion areas, jetty shoreline deepening, and sh habitat construction to be completed.

FY08 PLANS AND RECOMMENDATIONS

A proposed budget and summary of planned work activities for FY08 is provided below. The budget includes $8.6 million from the Endowment for Iowa's Health Account / Lake Water Quality Improvement Fund and $975,000 from the Environment First / Lake Dredging and Restoration Fund. The estimated local, state, and federal cost share contribution is $5.5 million.

- Monitor work progress and coordinate with local groups engaged in active lake restoration projects (Clear Lake, Crystal Lake, Five Island Lake, Lake of Three Fires, Storm Lake).

- Complete or initiate Diagnostic / Feasibility studies to determine lake water quality problems and evaluate solution alternatives (Carter Lake, Easter Lake, Green Valley Lake, Lake Darling, Lizard Lake, Lower Gar Lake, Prairie Rose Lake, other priority lakes).

- Work with local stakeholders to plan and implement new lake restoration projects (Carter Lake, Easter Lake, Green Valley Lake, Lake Darling, Lake Manawa, Prairie Rose Lake, Rock Creek Lake, Silver Lake, Union Grove Lake, Viking Lake and other priority lakes).

- Work with DNR and IDALS/DSC managers and local watershed professionals to identify, design, and install BMPs in lake priority watersheds, including: Badger Creek Lake; Lake Macbride, Lake Wapello, Rock Creek Lake and lake watersheds identi ed in the CREP II plan.

- Incorporate new information on economic bene ts, lake water quality and watershed improvement costs to adjust lake restoration priorities accordingly.

- Begin developing public and lake stakeholder communication and outreach tools, potentially including: brochures, display/kiosk, lake restoration tool kit, newsletters, opinion surveys, web site.

A proposed budget and summary of planned work activities for FY08 is listed p. viii. The budget includes $8.6 million in Infrastructure Appropriations for Lake Water Quality Improvement and $975,000 from Infrastructure Environment First Appropriations for Lake Dredging and Restoration. The estimated local, state, and federal cost share contribution is $5.5 million for a total lake restoration budget of $15,065,000.

The proposed work is consistent with DNR and legislative criteria for lake restoration funding. With the exception of Deer Creek Lake, the watershed and in-lake work will be done in lakes given restoration priority. The exception is Deer Creek Lake, which has suffered a substantial decline in lake level that is seriously impacting lake uses. Sealing the lake bed should result in cost-effective improvements in lake water quality and lake recreational use.

Also included in the budget is funding for the Shallow Lakes Management Initiative. This work involves water level manipulation and vegetation management to convert shallow lakes from a turbid (murky) condition with poor sh assemblages, to a clear water state featuring natural aquatic vegetation and providing better quality sheries and wildlife resources. Also included is funding for improvements in priority watersheds of public lakes that is cost-shared with other funding sources.

PROPOSED FY08 BUDGET

PROJECT	DESCRIPTION	STATE[1,2]	FED/OTHER	TOTAL
[1]Infrastructure - Lake Water Quality Improvement				
Ahquabi/Hooper	Shoreline Riprap	$85,000		$85,000
Brushy Cr. Lake	Shoreline Riprap	$50,000		$50,000
Carter Lake	Watershed Improvement, Diagnostic / Feasibility Studies	$100,000	$100,000	$200,000
Clear Lake	Dredging	$2,500,000	$1,000,000	$3,500,000
Crystal Lake	Spillway Repair, Watershed Improvement, Fish Renovation	$140,000	$60,000	$200,000
Easter Lake	Watershed Improvement	$100,000	$300,000	$400,000
Green Valley	Watershed Improvement, Land for Dredge Spoil Containment	$800,000	$250,000	$1,050,000
Lake Darling	Watershed Improvement, Dam Repair, Containment Site	$1,200,000	$300,000	$1,500,000
Priority Lakes (to be determined)	Diagnostic / Feasiblity Studies	$250,000	$50,000	$300,000
Prairie Rose Lake	Watershed Improvement, Land for Dredge Spoil Containment	$850,000	$300,000	$1,150,000
Red Haw Lake	Shoreline Riprap	$25,000		$25,000
Rock Creek Lake	Watershed Improvement	$100,000	$300,000	$400,000
Silver Lake	Watershed Improvement	$100,000	$300,000	$400,000
Storm Lake	Dredging	$1,000,000	$1,000,000	$2,000,000
Union Grove Lake	Watershed Improvement, Dredging	$840,000	$250,000	$1,090,000
Viking Lake	Watershed Improvement	$10,000	$30,000	$40,000
Project Design and Implementation	Project Coordination, Engineering Design, Contracting, Inspecting, Permitting	$450,000		$450,000
	Subtotal	$8,600,000	$4,240,000	$12,840,000
[2]Infrastructure Environment First - Lake Restoration				
Deer Creek	Lakebed Sealing	$175,000		$175,000
Five Island	Dredging	$100,000	$100,000	$200,000
Lizard Lake	Dam Spillway Modi cation	$90,000		$90,000
Priority Watersheds	Watershed Protection for Lakes	$410,000	$1,000,000	$1,410,000
Shallow Lakes	Water Quality Improvement	$200,000	$150,000	$350,000
	Subtotal	$975,000	$1,250,000	$1,225,000
	Total	**$9,575,000**	**$5,490,000**	**$15,065,000**

PROGRAM CHALLENGES

Unforeseen Delays in Construction: One of the greatest challenges with construction projects in general is making sure complex projects move forward without unnecessary delays. The Lakes Water Quality Improvement projects are no exception. A top priority for 2007 will be to continue striving to expedite projects so that funds can be utilized as timely as possible.

The majority of lake restoration projects involve constructing or installing watershed or in-lake improvements. A typical construction project might include the following stages: 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.

Before construction can begin, easements or land acquisition might also be needed, followed by required approvals and permits such as archeological/cultural (SHPO), environmental (T&E species), oodplain/404 permit, and a sovereign lands permit. Sometimes delays may occur while the necessary approvals or permits are being obtained.

Of course, delays can also be caused by adverse weather, equipment breakdowns, and other unforeseen occurrences.

DNR is committed to streamlining project development and implementation. Resources have been committed to develop an improved project management tracking system for lake restoration projects and budget.

Multiple-year Projects. Timelines for larger construction projects at a minimum fall within a two-year time frame. Large dredging projects take even longer, and multiple year commitments are needed to secure contractors for this critical work. Dredging contractors are faced with substantial costs to mobilize and set up lake dredging operations. As such, the most practical and ef cient way to complete the dredging plan is as one continuous project compared with following a piecemeal approach. Clear Lake, Crystal Lake, and Storm Lake are all examples of dredging projects that require a multiple-year funding commitment from the State in order to achieve lake restoration goals.

Local partners also are looking for a multiple year funding commitment from the lake restoration program in order to pursue funding sources to match State funds. Because requests for State Infrastructure Appropriations for lake restoration are done on a yearly basis, it is dif cult to guarantee ongoing funding support. Development of a funding approach and structure that addresses the multi-year commitment needed to secure dredging contractors and local funding sources is needed.

Explaining Lake Restoration Suitability

The lake restoration priority ranking process identi ed 35 lakes based upon a number of socio-economic, lake water quality and watershed indicators. An unbiased, technically sound approach was taken to develop the list. The lake restoration program recognizes that individuals or constituent groups that are interested in improving a lake that is not on the priority list will ask to be considered. The rst step will be to review available information about the lake and watershed to determine whether the lake is appropriately ranked with respect to restoration priority. Some requests will have merit and others will not.

No doubt there will be external pressures for DNR to embark in lake restorations that are not wise investments of limited public funds. As these requests arise, DNR will need to be prepared to explain that not all lakes are equal with respect to restoration suitability. DNR lake restoration managers will be challenged to explain the project selection criteria and respond in a constructive way to helping local lake initiatives involving non-priority lakes.

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INTRODUCTION

The Department of Natural Resources is focusing on restoring impaired lakes to improve the quality of life for Iowans and demonstrate water quality improvement. Communities are rallying around their water resources as they seek population growth and economic success. Communities of the Iowa Great Lakes Region, Storm Lake, Crystal Lake, Creston and Clear Lake are obvious examples, but other communities including Osceola, Marshalltown, Newton, and Brighton are identifying the importance of lakes for their futures as well. The distribution and nature of Vision Iowa grants, Community Attraction and Tourism grants, and now, Great Places, all further emphasize the importance of water to community quality of life and economic growth.

This report has been prepared in accordance with requirements detailed in Section 26 of the Endowment for Iowa's Health Account of the Infrastructure Appropriation Bill (HF 2782) enacted in 2006. This legislation designates $8.6 million for lake restoration and outlines a process and criteria for developing successful projects. The legislation also requires the DNR to report annually (before January 1) its plans and recommendations for lake restoration. The report must also describe progress and results from projects funded under this legislation.

PROJECT SUMMARIES

LAKE-SPECIFIC FUNDING APPROPRIATIONS

CLEAR LAKE

Clear Lake (Cerro Gordo County) is a 3,625 acre natural lake in north central Iowa, with a watershed to lake area ratio of 2.3/1. A lake/watershed diagnostic/feasibility study was completed in 2001 by ISU. A number of lake restoration options were presented. During October of 2006 a local committee, DNR staff and several local state legislators met. During that meeting it was agreed that the state would seek $9 million in funding to be matched by $4 million of local funds. The project is moving forward to acquire a dredge spoil containment site, study and design the dredge site, continue with watershed work and enter into a partnership with the U.S. Army Corps of Engineers for ecological restoration of Ventura Marsh. DNR Ventura Marsh land credits will fund the majority of DNR's portion of the marsh restoration project.

Acquisition of approximately 208 acres of land was approved at the August 2006 meeting of the Natural Resource Commission. The Clear Lake dredging plan will require acquisition of a dredge containment site, construction of the site and dredging 2.3 million cubic yards of sediment. The estimated total project cost is $13,000,000.

FY07 Progress: A nal purchase agreement for the dredge spoil containment site has been obtained. Approximately $660,000 of lake restoration funds are going toward the purchase. The required archeological/cultural study of the proposed dredging-impacted area will be completed before Summer 2007.
Design and construction of the containment site is scheduled to be completed summer 2007. Dredging is expected to commence Fall 2007. The DNR three-year plan established in 2006 is as follows:
FY07: $4,000,000; containment site acquisition and construction; dredging
FY08: $2,500,000; dredging
FY09: $2,500,000; dredging
Cost adjustments will be needed as the project progresses. For example, the estimated cost for dredge site construction has increased from $1.4 million to $1.6 million.

In addition to dredging work, plans are being developed for a Section 206 U.S. Army Corps of Engineers, Aquatic Ecosystem Restoration Project in Ventura Marsh, which ows into the west end of Clear Lake. In its present degraded state, the marsh is a major source of nutrients contributing to water quality problems in the lake.

Anticipated Bene ts:
Restoration efforts and improvements in water quality have the potential to more than double the annual economic return (currently estimated at $30, million) that Clear Lake generates to the local economy. The Center for Agriculture and Rural Development at ISU has projected a 12:1 bene t to cost ratio (or more) for lake and watershed restoration efforts that would result in good water quality at Clear Lake.

CLEAR LAKE BIO-MANIPULATION (COMMON CARP REMOVAL)

"Since its arrival in North America in the late 1800s, the highly competitive common carp (Cyprinus carpio) has become one of the continent's most widely distributed sh species. Carp in search of food often physically uproot aquatic vegetation and suspend large amounts of sediment in the water column. In Clear Lake and other systems with high carp biomass, the collective activity of these sh can reduce habitat quality for the native biota and accentuate water quality decline, making reduction of carp numbers a key objective in improving lake health. To formulate an ef cient and effective control strategy, radio telemetry is being used to collect data on the seasonal locations, habitat use, movements, and aggregation areas of adult and juvenile carp in Clear Lake. Monitoring of these sh will allow investigators to quantify and characterize seasonal distribution and habitat use by common carp, providing lake managers with insight into the times and locations for removal through targeted netting or poisoning" (from

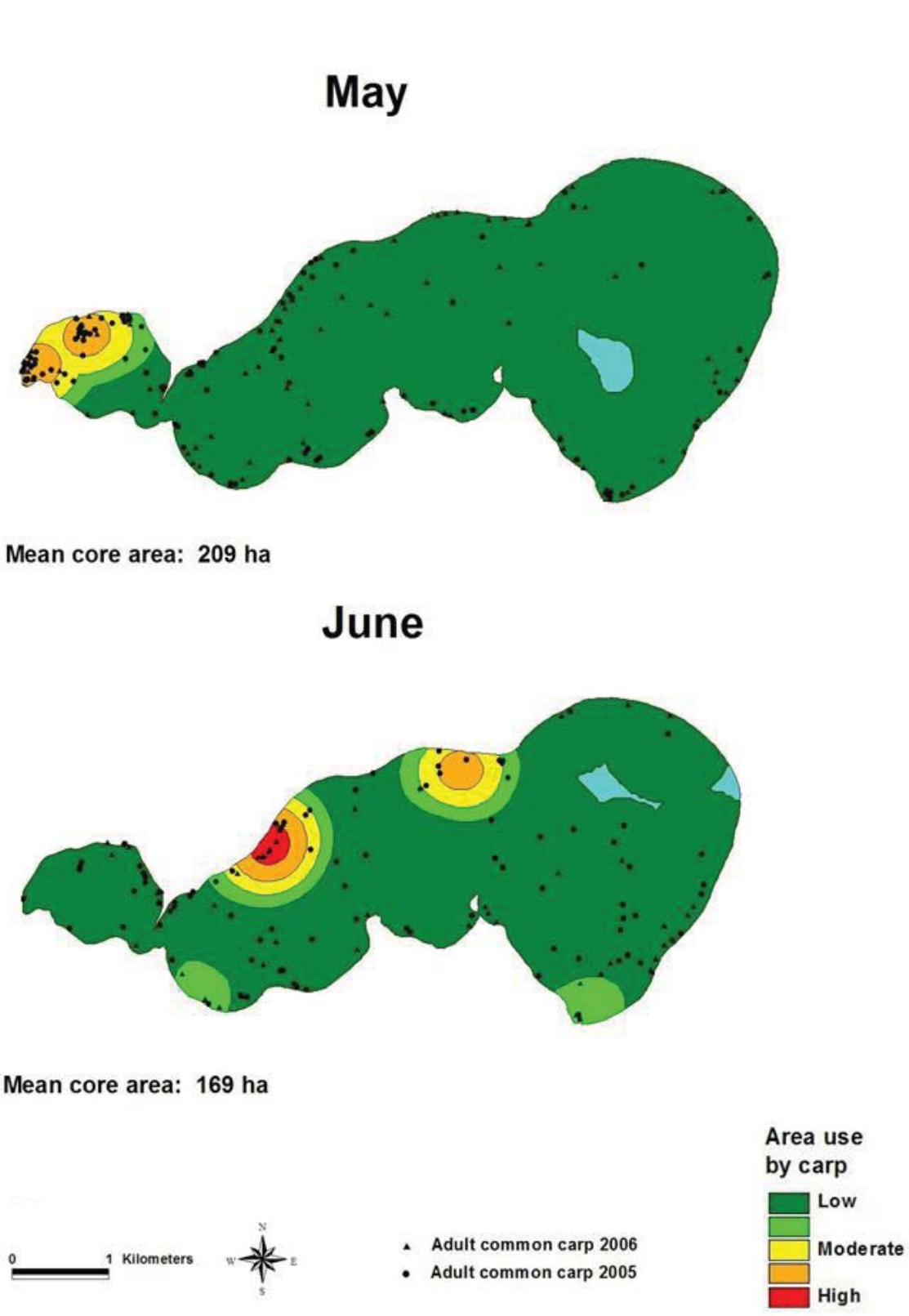
C. Penne and C. Pierce, Iowa State University – Annual Progress Report, December 2006).

The photograph below shows the contrast in water clarity between Clear Lake (left) and Ventura Marsh (right) following carp removal in 2000 from Ventura Marsh by chemical (rotenone) treatment. According to Jim Wahl, DNR Fisheries Biologist, most of the carp recruitment in Clear Lake occurs in Ventura Marsh and the marsh exports more phosphorus to Clear Lake than the amount coming into the marsh.
Following chemical (rotenone) renovation of the sh

population in Ventura Marsh, approximately 99% of the carp were removed and water quality improved immediately. Submergent vegetation became well-established, water clarity improved and less phosphorus was exported to Clear Lake. Unfortunately carp became re-established fairly quickly in the marsh and bene ts only lasted a few years. Nonetheless, this experience demonstrated the potential usefulness of common carp management as a water quality improvement technique.

FY07 lake restoration funds are being used for an important study of the behavior and movements of common carp in Clear Lake. The study is being conducted by sheries scientists at the Iowa Cooperative Fish and Wildlife Research Unit (CFWRU), Iowa State University. This research is critical to the DNR's efforts to restore water quality in the lake. Lake restoration funds helped support a second season of radio tracking of common carp in Clear Lake (right). Information gained in this study will result in detailed knowledge of seasonal movements and aggregation of carp that can be used to accurately guide long-term strategies to reduce carp density. When combined with other lake and watershed improvements, carp removal will result in an improvement in the water quality of Clear Lake. The nal report from this study is scheduled to be completed February 2007.

According to Wahl, the study's preliminary ndings show the occurrence of a large concentration of carp during the spring in the west end of lake where there is potential to mechanically remove high densities of carp. The study also points out the need for extensive population estimates of carp and bullhead standing stock in Clear Lake so there will be baseline data to work with for mechanical removal in future years. Recent sampling, for example, shows bullhead density (< 100 lb/ac) is currently low, while carp numbers (>200 lb/ac) are up.



Distribution of adult common carp in May and June. Black shapes indicate locations of adult carp. Locations where multiple individuals are found in close proximity to one another are classi ed as high use areas while areas where individuals are found distant from one another are classi ed as low use areas (C.R. Penne and C.L. Pierce, Iowa State University - Annual Progress Report, December 2006).

CRYSTAL LAKE

Crystal Lake (Hancock County) is a small, 269-acre natural lake in north central Iowa, with a watershed to lake area ratio of 8.8/1. A lake/watershed diagnostic/feasibility study was completed in 2001 by ISU. A dredge spoil containment site was completed in 2005-2006 at a cost of $838,000. DNR acquired approximately 100 acres of land will mitigate the use of the wildlife area as a containment site. A contract to dredge has been awarded, with work to resume in spring of 2007. Dredging will be completed by July of 2007.

Plans are to remove 1.2 million cubic yards of sediment from Crystal Lake. This should reduce the effects of nutrient enrichment and limit areas of excessive aquatic plant growth. Following dredging, the sh population in Crystal Lake will be renovated to remove the common carp population. During the ood year of 1993, carp invaded the lake from the outlet creek while stream ow was extremely high. The small lake outlet structure will also be modi ed to prevent future introductions of undesirable sh species.

The recommended lake restoration funding for Crystal Lake dredging is as follows:
FY07: $1,400,000; FY08: $250,000 (Dredging); FY09: $0.
(Note: the dredging plan also incorporates $1,425,000 of FY06 lake restoration funds).

Progress: Construction of the dredge spoil containment site was completed July 2006 at a cost of $838,000. Dredging commenced in October 2006 and is planned to be completed July 2007.

Anticipated Bene ts: This small community and the surrounding rural area is an excellent example of a locally driven project that will bene t this area. Following restoration, improved shing opportunities alone could add nearly $400,000 annually to the local economy, in addition to improving water quality and bene ting other water-based recreation. The combination of this watershed and lake improvement work will remove Crystal Lake from the Impaired Waters List.

According to Jim Wahl, DNR Fisheries Biologist, additional recreational bene ts were created with recent construction of the 10-acre sediment / multi-purpose pond located above the lake in the northeast corner of the watershed. The pond will reduce sediment delivery to the lake by an estimated 18% and phosphorus will be reduced by 16%. The pond is deep enough to support a sport shery; therefore, it has been stocked with largemouth bass, bluegill, and channel cat sh, which now provide substantial angling opportunities.

STORM LAKE

Storm Lake (Buena Vista County), is a shallow natural lake (4th largest natural lake in Iowa), with a surface acreage of 3,150 acres and a watershed to lake ratio of 4.5/1. Prior to the most recent dredging effort, Storm Lake was last dredged in 1962. Lake depth maps developed in 1992 indicated that the 1962 dredging sites had lost 77% & 46% of their volume. Sediment lling these areas was not delivered from the watershed, but as a result of in-lake dynamics. DNR lake dredging in 2001-02 removed 1.32 million cubic yards of sediment from a 260-acre lake area. Dredging costs were $2.1 million with the dredge containment site lease and construction at $1.273 million.

The Lake Preservation Association (LPA) expressed a strong interest to continue dredging to achieve better water quality. The local dredging initiative is funded through a combination of local, state & federal dollars. The LPA locally raised funds and received federal grants totaling over $1 million to continue dredging at Storm Lake. Local funds were used to purchase a dredge, and in an agreement with the DNR, each group provided $900,000 from 2003 through 2005 to continue dredging operations Previously, the DNR has committed $ 300,000 to $400,000 annually, with a FY07 request for $500,000. To reach project goals will require another 10 years of dredging operation at a projected cost of approximately $12 million ($6 million State - $ 6 million Local). The locally-led project goal is to dredge 600,000 to 900,000 cubic yards of sediment annually. The City of Storm Lake leased the DNR, Weatherall site for an additional two years and has since constructed a new containment site east of Storm Lake.

Storm Lake was originally placed on the impaired waters list in 1998 for turbidity. The LPA set a goal of dredging an additional 1,500 acres of Storm Lake to an average depth of 13 feet following the guidelines of the diagnostic/feasibility study. The Iowa DNR and local sponsors will also be entering into an agreement with the United States Army Corps of Engineers to improve the Little Storm Lake and wetland area and restore the wetland's function in improving Storm Lake's water quality. The City is improving stormwater delivered to the lake, and recent improvements to local meat packing plants also are improving the storm water delivered to the lake. This aggressive dredging goal, coupled with watershed improvements and restoration of Little Storm Lake and Wetland should mean signi cant improvements in water quality. Past, current and future watershed, wetland and lake improvement projects will ultimately result in the removal of Storm Lake from the Impaired Waters List.

Recommended Budget and Work Plan for Storm Lake
FY07: $500,000; Dredging
FY08: $1,000,000; Dredging
FY09: $1,000,000; Dredge Containment Site Development; Dredging

Little Storm Lake COE Section 206 Aquatic Ecosystem Restoration

Little Storm Lake is a 190-acre state-owned marsh that is basically an extension of Storm Lake (marsh and lake elevation is the same). This joint project between the local Storm Lake Improvement Group, the U.S. Army Corps of Engineers and the Iowa DNR has as a goal to improve the aquatic species habitat in the Storm Lake watershed, and to restore the wetland function of Little Storm Lake. Reaching those goals will require the following objectives to be met: water quality improvements achieved by reducing sediment and nutrients entering Storm Lake, increasing plant species diversity, reducing the coverage of the invasive purple loosestrife plant species, and increasing the habitat suitability and coverage for aquatic species and migratory waterfowl. DNR land credits will serve as the local match for the federal funds required to initiate and complete this project. This project is slated for a fall 2008 construction start.

Anticipated Lake Restoration Bene ts: 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. With local support, the Iowa DNR is designing a $3 million renovation of the Storm Lake Marina that will improve lake access and compliment the AWAYSIS project. Preliminary analysis by the Center for Agriculture and Rural Development at ISU has projected a minimum of 2:1 bene t to cost ratio for lake and watershed improvement efforts at Storm Lake that would result in good water quality.

According to Lannie Miller, DNR Fisheries Biologist, the dredging of Storm Lake continues to provide deeper water and reduce the amount of silt in this shallow natural lake. The Section 206 aquatic ecosystem restoration project that is currently being developed will reduce silt levels in Little Storm Lake and provide better water quality entering the main lake basin. All of this combined work will greatly improve the water quality of Storm Lake and aquatic ecosystem health.

PROJECTS COMPLETED OR NEARING COMPLETION

FIVE ISLAND LAKE (PALO ALTO COUNTY)

Five Island Lake is a 950 acre natural lake located on the north side of the town of Emmetsburg, Iowa in Palo Alto County. In 1989, following ve 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: 1. Increase the lake water depth and 2. Improve the lake water quality. These goals are being accomplished by stabilizing with rip rap almost 10.5 miles of lake shoreline, hydraulic dredging of over 5 million cubic yards of silt, and working in the watershed to reduce nutrients and sediment from entering the lake. Lake dredging work is nearing completion, with work continuing in the watershed to address stormwater runoff. Funding for this project has been a combination of State and Local matching grants. Local monetary contributions to date exceed $1.2 million, with State funding approaching $980,000 by July 2007

LAKE OF THREE FIRES (TAYLOR COUNTY)

Lake of Three Fires Lake is a 95-acre constructed lake, with a watershed to lake ratio of 38/1. A diagnostic/ feasibility study was completed in 2000 and identi ed restoration alternatives. Watershed work was completed and lake dredging was also completed in 2005. The nal recommended component of the restoration project is a wetland on the DNR Simmons Wildlife Area immediately above the lake. This wetland will provide water quality protection and diversify the wildlife area. The wetland project is a cooperative venture in which NRCS will design the project, and DNR will secure easements and manage project construction and inspection. The project will be paid for using 75% Federal 319 funds and 25% State Lake Restoration funds.

Following is a chronological description of lake conditions and restoration work provided by Gary Sobotka, DNR Fisheries Biologist:

"Lake of Three Fires in Taylor County has bene ted from extensive water quality improvement practices. The 75-year-old lake had suffered from the combined affects of sediment-nutrient deposition and a proli c common carp population. Water clarity measurements were commonly between 1-and-2 feet with measurements less than six inches common after heavy rains. Historically, sh growth was slow and seldom provided quality sh. The rehabilitation project involved attacking the poor water quality problem from several angles. Sediment removal, common carp removal and soil conservation in the watershed helped greatly improve the water quality.

The shery was renovated in the early 1980s but common carp returned within a few years. The spillway of the lake was the likely entry point. Reshaping it would eliminate that possible entry point and help ensure long lasting bene ts to the sh population. Its original design was a long, gently sloping ramp. During the fall of 2003 its pro le was attened and a 10-foot sheer drop was added.

Sediment removal from the lake was accomplished by hydraulic dredging. Lake bottom soundings identi ed the quantity of sediment over the entire area of the lake. Much of the lake was covered with 3-to-6 feet of sediment with some areas exceeding 15 feet. The sediment quantities and an appropriately sized spoil sight were then designed. A sediment retention lagoon was constructed on existing State property and a dredging contractor was secured. An estimated 500,000 cubic yards of sediment were dredged during the late spring of 2004.

The lake was completely drained in the fall of 2004 and the remaining shery was renovated. All watershed ponds were sampled for the presence of common carp and none were found.

Several sh attracting structures were constructed during the 2004-05 winter. These consisted of earthen mounds with riprap sides and gravel tops. Numerous cedar trees from the immediate area were placed near existing shoreline access areas. A replacement boat ramp was constructed to allow boat launching into deeper water. The existing shing jetties were repaired and riprap was placed to 1,100 feet of unprotected shoreline. Riprap was added to 1,700 feet of existing shoreline riprap. Following completion of the shoreline and habitat improvements the water control gate was closed. The lake was restocked in the spring of 2005 and the lake re lled by late summer.

Water clarity during the lling stages far exceeded that of any most measurements taken prior. The shery was sampled several times during 2005 and 2006. Fish growth has been astounding. Fall 2006 electro- shing showed an abundant largemouth bass population with many individuals near 15 inches and extremely high numbers of individuals from 4-to-10 inches. The bluegill population has shown similar growth with many individuals near or exceeding 7 inches. Crappies have returned from ponds in the watershed. Their abundance is low to moderate but many exceed 9 inches. Many of the channel cat sh have reached over 2 1/2 pounds and 18 inches and a few individuals exceed 3 ½ pounds and 22 inches. The future of the shery looks brighter than at any point during the past 30 years.

Silt retention structures were built on nearly 20 of the lake's small sub-watersheds. Some of these retain permanent water and some provide temporary water retention. Most are on existing public property and the land use above is almost entirely timber. Several deeply cut ravines were stabilized with this practice. A wetland is being designed and ood easements have been arranged for an area of the watershed on the lake's main arm. This structure would lie on existing public property and help limit sediment delivery from neighboring private property.

Fisheries and water quality following lake restoration far exceed expectations. Fish growth and abundance is high, water clarity exceeds any previous level, and park use continues to exceed previous levels. Historically, the entire area has a high esthetic value but the poor water quality has limited the lake's contribution to the package. These water improvements along with continued efforts will make Lake of Three Fires State Park a quality area many can enjoy for many years to come."

VIKING LAKE (MONTGOMERY COUNTY)

Viking Lake is a 137-acre constructed lake, located within a 1,000-acre state park. Initially impounded in 1957, it has historically been an above-average shery, however with the introduction of yellow bass approximately 10 years ago, the shery has dramatically declined. Water quality at the lake has always been average, however following periods of heavy rainfall turbid water conditions could persist for up to two weeks, persistent algal has also been an issue. A watershed coordinator through the 319 program has been identifying corrective measures within the watershed. A Watershed Improvement Review Board (WIRB) grant will address water quality issues at Viking Village, a small home development adjacent to state property within the lake's watershed.

Twenty-two areas near the lake, on or including portions of state property were identi ed as needing grade stabilization structures to control soil erosion and improve water quality. Construction of sediment basins in these areas is nearing completion. After Labor Day 2006, the lake was drained and the shery was renovated to eliminate the problem yellow bass population. Repairs to the dam gate, shoreline protection, jetty construction, shoreline deepening, angler access and sh habitat improvements are also being completed while the lake is lowered.

Agencies & stakeholders that are working together include; IDNR (sheries, parks, & engineering), NRCS, IDALS, and private landowners.

DIAGNOSTIC-FEASIBILITY STUDIES AND WATERSHED IMPROVEMENT PROJECTS

CARTER LAKE (POTTAWATTAMIE COUNTY)

Carter Lake (Pottawattamie County) is a natural lake that is uniquely located in both Iowa and Nebraska. Carter Lake is an old oxbow of the Missouri River, 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. Land use adjacent to the lake in Nebraska is dominated by park areas and in Iowa dominated by the City of Carter Lake. A current and accurate lake depth map was generated by the State of Nebraska in 2006.

Restoration of Carter Lake will require the cooperation of Iowa, Nebraska and the cities of Omaha and Carter Lake. A local Iowa group, "The Carter Lake Preservation Society," has been active in moving this project forward. 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 sh contaminants (PCBs). A Lake and watershed group has formed and meetings were conducted on a regular basis in 2006.

A shoreline protection and storm water raingarden treatment project has already started utilizing $27,000 of Iowa Lake Improvement Funds, local labor and $163,000 from the Pottawattamie County Board of Supervisors. A WIRB Grant for additional raingarden work is under review. Iowa DNR will partner with Nebraska DEQ utilizing Nebraska 319 funds ($30,000) and Iowa Lake Improvement Funds ($20,000) to begin a Diagnostic-Feasibility study that builds from the recently completed TMDL for Carter Lake.

Carter Lake Preservation Society (CLPS) has been very active since the summer of 2005. They meet regularly on lake issues and have secured funding from IDALS for a Watershed Protection Grant $10,000, the Pottawattamie County Board of Supervisors ($163,000) and IDNR ($27,000) for shoreline and water quality improvements, and $1,000 from IDNR, REAP and Project AWARE for 2007 lake clean up. They applied, but were unsuccessful in obtaining a $49,470 WIRB grant for storm water improvements around the Iowa portion of the lake.

Water level of the lake (both high and low) has been a concern dating back to the 1920s. Most recent concerns are about persistent low water conditions and poor water quality related to the small lake watershed, diversion of part of the watershed-Epply Air eld, urban storm water runoff, low Missouri River water levels, toxic algae advisories, and below average shery.

An additional project for $27,000 was funded jointly by the cities of Carter Lake and Omaha to further research and provide recommendations dealing with water quantity problems as they relate to Carter Lake. The study suggested that obtaining water from wells located near the Missouri River was the best option. Water withdrawal options during high water periods were also discussed. Initial construction costs and operation and maintenance costs have yet to be determined (could easily exceed $1.5 million).

Carter Lake Water Quality Resource Group was formed in June of 2006 bringing together local citizens, the cities of Omaha and Carter Lake, state agencies from Iowa and Nebraska, and federal partners. Community based watershed planning has started with the formation of a Watershed Technical Advisory Committee to identify existing watershed problems.

A subgroup of the Technical Advisory Committee began meeting in December 2006 to develop a joint RFP to solicit companies for proposals in developing a Diagnostic/ Feasibility Study for Lake and Watershed Improvement at Carter Lake.

Important Decision Points and Timelines for Project Success

Dec-2006. Final Total Maximum Daily Load (TMDL) Report is available for review. IDNR and NDEQ staff will review document and utilize the information to provide nal recommendations.

Dec-2006. Advertise for prospective consultants to provide additional information (e.g. evaluation of water quality management actions, preliminary design and cost estimates). Carter Lake will be the scal agent for the project. Alternative evaluation to be completed by August 2007, with Nebraska DEQ leading the initiative, project budget estimated at $55,000 (Iowa DNR share $20,000, Nebraska DEQ $30,000. City of Omaha $2,500 and City of Carter Lake $2,500), Iowa DNR will also participate in similar additional cost share arrangements as needed information to complete the analysis

Feb-2007. IDNR and NG&P staff will meet to discuss 2007 shery sampling necessary to obtain an estimate of the sh population. This work will provide additional nutrient loading information, results would also determine if a shery renovation would be scheduled for fall of 2008

and the potential improvements in lake water quality

March-2007. Meet to discuss the lake water quantity and source issue. Concerns include:

- The water quantity source could adversely impact lake water quality
- Missouri River water brings the possibility of introduction of undesirable aquatic nuisance species – e.g. Zebra mussels, silver carp, bighead carp
- These species could also adversely impact lake usage and water quality and limit lake restoration efforts
- Alternative water source may also be required if lake dredging is one of the preferred alternatives

April-May 2007. Complete and submit additional grant proposals for storm water and watershed improvement projects, probability of obtaining a grant higher due to organized group effort between cities and states

August 2007. Jan 2008 Funding becomes available for watershed work

June 2008. June 2010 Initiate and complete lake improvement efforts following D/F plan suggestions pending funding availability, this initiative, plus watershed work will have as a goal to remove Carter Lake from the Impaired Waters List, improve water quality, increase recreational opportunities, and restore the lake's fishery. Private property values around the lake would also increase as a result of lake and watershed improvements.

EASTER LAKE (POLK COUNTY)

Easter Lake is a 178-acre constructed lake, with a watershed to lake ratio of 36/1. Built in 1967, Easter Lake began as a lake in an agricultural/suburban watershed that over the years has shifted to a highly developed urban area. Construction activities have contributed greatly to more than a 20% reduction in lake volume. Combine this with urban storm water runoff issues such as Yeader Creek, and you define the lake's problems. The area is owned and managed by the Polk County Conservation Board (CCB) and they are very interested in developing a partnership to accomplish lake and watershed improvements. A diagnostic feasibility study should be conducted by ISU, with a targeted completion date of Dec. 1, 2007.

An initial meeting with the Polk CCB was conducted in March 2006 to discuss the merits of the project. ISU was contacted to put together a D/F proposal by Aug. 15, 2006. This study will require up to a 25% financial commitment from the Polk CCB to match 75% State Lake Improvement Funds.

GREEN VALLEY LAKE (UNION COUNTY)

Green Valley Lake is a 390-acre lake that was constructed in 1950. It has a watershed to lake ratio of 11.3/1. A limited lake restoration through the State and U.S. EPA's Clean Lakes Program was undertaken in the mid 1980s, however additional watershed and in-lake work is needed. Lake restoration work will center on spillway modification, fish restoration, dredging of coves and additional watershed work. Lake size is currently 338 acres below the silt dikes.

A DNR workgroup including Parks, Fisheries, Law Enforcement, Wildlife and Engineering has been formed to review needs and project timetable. Contacts have been made to the local SWCD/NRCS to begin a partnership to identify watershed needs.

LAKE DARLING (WASHINGTON COUNTY)

Lake Darling is a 267-acre lake, constructed within a 1,400-acre state park. Initially impounded in 1950, it has historically been a fair fishery plagued by severe in-lake siltation and poor water quality. The lake was originally 305 surface acres but has been reduced to 267 acres, with a watershed to lake ratio of 46.5/1. During the last five years extensive watershed soil conservation work has reduced sediment delivery to the lake by 40%. Additional soil conservation work is scheduled on state/private land in 2007.

Work in 2007 will center around watershed work, completion on an engineering report to document and suggest dam and spillway leakage solutions, completion of a diagnostic/feasibility study and search for a dredge spoil containment site.

According to Don Kline, DNR Fisheries Biologist, some key highlights from the watershed improvement project include:

- 137 construction projects completed in the past six years involving 57 different landowners.
- Project total cost was $1,371,301 including $984,924 cost share funding.
- Runoff from 73% of the private land in the watershed flows into tile outlet terraces/basins or erosion control ponds.
- Dramatic improvement in the lake water clarity during the six years of project improvements.

Additional information about Lake Darling watershed improvements can be obtained in a brochure available at http://www.iowadnr.com/water/nonpoint/files/darling.pdf.

LAKE MANAWA (POTTAWATTAMIE COUNTY)
Lake Manawa is a 715-acre natural lake with a watershed to lake ratio of 3.5/1. Additional water to the lake is supplied from nearby Mosquito Creek. Past lake dredging work in the 1960s deepened signi cant portions of the lake. However, maximum lake depth does not exceed 13 feet with large expanses of 6-to-7 feet deep water. The Iowa Department of Transportation approached the DNR to explore the possibility of dredging the lake for sand to utilize for highway construction. However, there is concern about whether sand materials can be removed from Lake Manawa safely, while still maintaining the hydraulic seal between the lake and the uctuating Missouri River.

A cost share agreement was entered into with the Iowa DOT to hire a geo-tech rm to drill wells in Lake Manawa to determine the boundaries between the lake and the river and possible safe dredging limits. This work was scheduled for completion by Nov. 1, 2006, with a nal report by February. DOT and DNR will then meet during March 2007 to determine a future course of action.

LIZARD LAKE (POCAHONTAS COUNTY)
Lizard Lake is a 285-acre shallow natural lake. The lake is dominated by a rough sh (buffalo, bullhead, carp) population, contains very little area of aquatic vegetation, and exhibits poor water quality. A local lake group has been formed to promote lake restoration and they have met with DNR staff on several occasions. An IDALS/SWCD Development Grant was awarded in June 2006 to evaluate the watershed of Lizard Lake.

Iowa State University Limnology Laboratory has been contracted to develop a diagnostic/feasibility (D/F) study, including shallow lakes management as a de nite option for improving the lake's water quality, sh population structure and wildlife potential. This may include renovation of the sheries population, aquatic vegetation management and watershed treatment. Local funding has been verbally committed for 25% of the D/F study cost.

LOWER GAR LAKE (DICKINSON COUNTY)
The Three Lakes Improvement Association was recently formed by local concerned citizens and business owners that live on or recreate on the Iowa Great Lakes system, in particular Lower Gar, Minnewashta and Upper Gar. DNR Director Jeff Vonk and DNR Lakes Restoration Team staff met with this group several times in 2005 and 2006 to discuss lake water quality and lake water depth issues. All parties agreed that when funds became available a diagnostic/feasibility study would be undertaken to examine historic soft sediment deposition, potential removal of a portion of these sediments and the resulting impact on lake water quality. Iowa State University is preparing a diagnostic/feasibility proposal with project cost estimates to examine these issues. This proposal will be available for review and comment by January 2007. This proposal will then be reviewed by the DNR and the Three Lakes Association, with the local group responsible for 25% of the diagnostic/feasibility study costs. Due to the complex nature of this issue, and the added cautionary note that the water control structure and nutrient movement in the system for these three natural lakes can also impact West Lake Okoboji and East Lake Okoboji, this study may take up to 18 months to complete.

PRAIRIE ROSE LAKE (SHELBY COUNTY)
Prairie Rose Lake is a 215-acre constructed lake with a watershed to lake ratio of 23.5/1. Problems at the lake center on rough sh populations, historic lake siltation and poor water quality. Lake improvements in recent years include: jetties and sh structure (1998), sediment basin and shoreline riprap (2001), and sediment basins (2004). Signi cant work in the watershed has been accomplished and additional work has been outlined.

DNR Fisheries and Parks staff have been meeting with NRCS, IDALS, and others about remaining watershed work and initial lake restoration plans. A diagnostic/ feasibility study is scheduled for 2007 to develop lake improvement options.

ROCK CREEK LAKE (JASPER COUNTY)
Rock Creek Lake is a 491-acre lake that was constructed in 1952. The lake has a watershed to lake ratio of 54/1, and over the last 50 years has lost almost 40% of lake water volume and 102 lake surface acres. A D/F study by ISU was completed in 2000. While signi cant work in the watershed has been accomplished, much more work is needed. A renewed local and state effort is needed to move this project forward.

The watershed coordinator position has recently been lled. A need for several soil conservation structures on State property has been identi ed and work designing the structures and securing necessary permits and easements should move forward during 2007.

UNION GROVE LAKE (TAMA COUNTY)
Union Grove Lake is a shallow constructed lake, with a surface area of 105 acre and watershed to lake area ratio of 63/1. Union Grove Lake was last dredged in 1990. Lake depth maps were developed in 2006 to determine current lake volume. A lake watershed assessment was conducted in 2005 to determine the status of the watershed. Spillway water seepage is an on-going problem at Union Grove Lake. Attempts to repair the problem have met with limited success. A geo-tech rm was hired in 2005 to evaluate the

problem. A request proposal to construction rms to x the seepage problem was advertised in 2006. Construction will begin in Spring 2007. An initial repair estimate by DNR engineering staff is $165,000. The DNR will work with local sponsors to clean out a sediment lled pond that is located immediately above the lake and re-evaluate watershed needs for lake protection.

SILVER LAKE (DELAWARE COUNTY)

Silver Lake is a small, natural lake that has been enlarged by construction of a dam. Silver Lake is a 34 surface acre lake with a lake ratio of 6.4/1. A diagnostic feasibility study was completed in 2001 by UNI, and DNR completed a TMDL analysis in 2001. Lake depth maps and sediment borings indicated lake sedimentation depths of 0.5 to 4 feet. A lake watershed assessment was conducted in 2001 and areas of high phosphorus input were documented in the watershed. Excessive animal manure application levels are the culprit. NRCS continues to work with landowners in the watershed to reduce nutrient lake inputs.

An engineering rm was hired in 2001 to evaluate dam integrity and leakage issues. Repairs were estimated at $200,000. A project request was submitted August 2, 2006, to hire an engineering rm to identify and design either repairs to the existing dam or dam replacement. Estimated lake and watershed improvement costs are: $350,000 dam repair, $1,500,000 containment site and dredging, and $100,000 watershed work.

SHALLOW LAKES MANAGEMENT INITIATIVE

A prioritized list of at least 50 shallow lakes to be renovated over the next 10 years was established by Ducks Unlimited and the Iowa DNR's Wildlife and Fisheries bureaus. The rst lake to be renovated is Diamond Lake in Dickinson County. Renovation work began during Summer 2006. Renovations in 2007 and 2008 are planned for the next six lakes on the list. Those lakes tentatively scheduled for 2007 include: Dan Green Slough, in Clay Co., Four-Mile Lake in Emmet Co., and Pickerel Lake in Buena Vista Co. Planned renovations for 2008 include South Twin Lake in Calhoun Co., Virgin Lake in Palo Alto Co., and Lizard Lake in Pocahontas County.

The following excerpt from the 2006 Annual Report for Natural Lakes, provided by Joe Larsheid, DNR Fisheries Biologist, describes the basis and objectives for the DNR's Shallow Lakes Management Initiative.

"Shallow lake management has always been a challenge in Iowa and around the world. Shallow lakes are scattered throughout northwest Iowa and, in most of these lakes water quality is less than desired. In fact, most of these lakes are turbid, algae-dominated systems with little to no vegetation, and poor sport sheries comprised mostly of common carp (Cyprinus carpio), and black bullheads (Ameiurus melas). Lake restorations have historically focused on reducing nutrient inputs by repairing the watershed, or removing phosphorus -laden sediments from the lake. While these methods have worked well in deeper lakes, generally this approach has not been successful in shallow lakes.

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 a very turbid, algae-dominated system with little to no vegetation, or as a clear water, macrophyte dominated system. In shallow lakes, the benthivorous and planktivorous shes along with wind and wave action and in some cases heavy boating traf c can perpetuate the algae dominated system.

By controlling or removing the factors perpetuating the algae dominated turbid system it is possible to " ip" 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 sh 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 dif cult 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 sh control, heavy piscivore stockings (to control both benthivorous and planktivorous shes), 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.

Project Objectives:

- Shallow lake renovation based on alternative stable trophic states. By the year 2007, develop management guidelines that may be used to cause shallow lakes to

shift from the turbid, algae -dominated systems to the clear, macrophyte-dominated systems.
- Physical characteristics of shallow lakes before and after restoration Describe, by the year 2007, the watershed, bathymetry, sediment pro le, and water chemistry of several shallow lakes.
- Biological characteristics of shallow lakes before and after restoration Describe, by the year 2007, the plankton, macrophyte, sh community and waterfowl use of several shallow lakes assessed and relate changes to biomanipulation of benthivorous shes."

WATERSHED IMPROVEMENTS OF OTHER PRIORITY LAKES

During the second half of FY07, speci c plans will be developed for water quality best management practices to be installed in several lake restoration priority watersheds, including: Badger Creek Lake; Lake Macbride, Lake Wapello, and Rock Creek Lake.

FISCAL YEAR 07 BUDGET SUMMARY

The lake restoration budget in FY07 totals $12,192,797 including cost-share and FY06 lake restoration carry forward funds. Through November 30, 2006, $4,000,166 or 33% of budgeted funds have been expended or obligated under signed agreements. The remaining 67% are represented as estimated expenses re ecting varying stages of project development.

FY07 LAKE IMPROVEMENT FUNDS

SOURCE	AMOUNT
06 CARRY FORWARD INFRASTRUCTURE ENVIRONMENT FIRST LAKE RESTORATION	$1,308,176
07 INFRASTRUCTURE ENVIRONMENT FIRST LAKE RESTORATION	$975,000
07 INFRASTRUCTURE IOWA HEALTH ACCOUNT LAKE WQ IMPROVEMENT	$8,600,000
LOCAL AND FEDERAL COST SHARE	$ 1,309,621
TOTAL	**$12,192,797**

A top priority during the second half of FY07 will be to expedite project development steps so that funds can be used for their intended purpose without unnecessary delays. One of the greatest challenges faced by the lake restoration program is moving projects forward through successive project stages. The majority of lake restoration projects involve constructing or installing watershed or in-lake improvements. Typical construction projects involve phases such as engineering design, work bid letting, contract development / approval, and construction. Before construction can take place various approvals and permits are needed including archeological/cultural (SHPO), environmental review for Threatened and Endangered (T&E) species, oodplain/404 permit, sovereign lands permit. During FY07, a new staff person with budgeting and project tracking responsibilities was added to the lake restoration program.

Page 18 has a summary of project-speci c expenses and cost estimates for work plans for FY07.

FY07 Expenses

Project	Budget (FY07)	FY07 Expenses (07/01/06-11/30/06)	FY07 Obligated Funds	FY07 Estimated Expenses	Estimated FY07 Costs Realized in FY08	Total Expended, Obligated, & Estimated Expenses
Carter Lake, Shoreline Stabilization, D/F Study	50,000	0	0	37,000	10,000	47,000
Clear Lake, Carp Telemetry & Aging, Environ./Archeo. Study, Dredge Contain. Acquisition & Constr., Dredging	4,039,417	10,104	0	1,214,063	2,815,500	4,039,667
Crystal Lake, Spoil Site & Dredging	3,197,235	635,382	2,561,230	0	0	3,196,612
Deer Creek Lake Bed Sealing	100,000			100,000		100,000
Easter Lake D/F Study	40,000			33,000	32,238	65,238
Five Island Lake Dredging	220,000			220,000		220,000
Green Valley D/F Study, Watershed Improv.	150,000			131,505	18,835	150,340
Lake Darling Watershed Improv., D/F Study	300,000	187	0	200,333	99,480	300,000
Lake Delhi Dredging	225,000			225,000		225,000
Lake Manawa D/F Study	70,000			70,000		70,000
Lake of Three Fires Wetland/Watershed	180,000			180,000		180,000
Lizard Lake D/F Study	40,000			45,125	15,141	60,266
Lower Gar Lake D/F Study	75,000			37,500	37,500	75,000
Prairie Rose Lake Watershed and D/F Study	160,000			99,323	60,677	160,000
Rock Creek Lake Watershed	280,000			140,000	140,000	280,000
Silver Lake Spillway Repair	50,000			120,000		120,000
Storm Lake	500,000	450,000		50,000		500,000
Union Grove Lake Spillway Repair, Dredge Sediment Pond	431,145	1,201	0	200,000	229,944	431,145
Viking Lake, 22 Grade (Erosion) Control Structures, Shoreline Riprap & Deepening , Repair Dam Gate Valve	340,000	149,666	100,397	89,937		340,000
Minor Projects	50,000	25,749				25,749
Priority Watersheds	275,000			275,000		275,000
Shallow Lakes	180,000			108,000	72,000	180,000
Statewide Dredging Grants	40,000	35,000			5,000	40,000
Stream UAA	750,000			750,000		750,000
Operations	450,000	31,250		330,530		361,780
Total	**$12,192,797**	**$1,338,539**	**$2,661,627**	**$4,656,316**	**$3,536,315**	**$12,192,797**

COMMUNICATION AND PUBLIC OUTREACH

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."

Local stakeholder groups are established and communication with the public has taken place in association with a number of active or planned lake improvement projects: Carter Lake, Clear Lake, Crystal Lake, Easter Lake, Green Valley Lake, Lake Darling, Lake Manawa, Lake of Three Fires, Lizard Lake, Lower Gar Lake, Mariposa Lake, Prairie Rose Lake, Rock Creek Lake, Silver Lake, Storm Lake, Union Grove Lake, Viking Lake.

DNR staff also met with a local stakeholder group of Lake Geode in Henry County. The meeting stimulated interest in gathering information and applying for a watershed development grant to conduct a comprehensive assessment of the Lake Geode Watershed that is needed to qualify for lake improvement funds.

Currently, DNR staff are compiling a list of local community leaders and stakeholders associated with the lakes listed below that do not have active lake improvement projects underway. Informational meetings will be scheduled with interested stakeholders representing these lakes during the second half of FY07.

Initial Contact with Local Stakeholders Needed:
Pleasant Creek Lake (Linn Co.), George Wyth Lake (Black Hawk Co.), Brushy Creek Lake (Webster Co.), Blue Lake (Monona Co.), Central Park Lake (Jones Co.), Hickory Grove Lake (Story Co.), Lake of the Hills (Scott Co.), Lake Keomah (Mahaska Co.), Hannen Lake (Benton Co.), Kent Park Lake (Johnson Co.), Diamond Lake (Poweshiek Co.), Arbor Lake (Poweshiek Co.).

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." During the first half of FY06, the DNR was contacted by local stakeholders of Manteno Park Pond in Shelby County and Mariposa Lake in Jasper County.

Manteno Park Pond is a 13-acre constructed lake with an estimated average depth of 6.6 feet. It is currently ranked as low priority for restoration because of the very large watershed to lake area (173.3) and poor socio-economic benefit to cost ranking (92nd of 127).

Local stakeholders of Mariposa Lake (Jasper County) also contacted the DNR about becoming a lake restoration project. Mariposa Lake is a 17.5-acre constructed lake with a watershed to lake area ratio of 33.0. The estimated average depth is 7.8 feet. It is currently ranked as medium priority for restoration.

The DNR is reviewing the available lake and watershed information and will be meeting with local stakeholders to provide a preliminary assessment and an overview of the funding process and criteria.

COMMUNICATION TOOLS AND STRATEGIES

No specific plans have been made yet; however a number of communication and outreach tools for the public and lake stakeholders will be considered, including: brochures, display/kiosk, lake restoration tool kit and workshop, newsletters, opinion surveys, web site.

PLANS AND RECOMMENDATIONS

LAKE RESTORATION PRIORITIES

An initial ranking of 127 public lakes for lake restoration priorities was completed in 2006. Following the ranking process described below, a list of 35 lakes considered the highest priority for restoration was established (see table p. 21). The list serves as a starting point for identifying potential lake restoration projects.

Lake water quality data and watershed characteristics were used to create indices and grouped into good, fair, or poor lakes and watersheds. These descriptions were used to categorize lakes into management action groups. Twelve lakes primarily require protection of the lake and watershed, and 115 require restoration of the lake and/or the watershed. The ranking process incorporated results from a preliminary economic benefit to cost analysis done by Iowa State University Economists and Dr. John Downing, Director of the Iowa State University Limnology Laboratory. Economic priorities (high, medium and low) were established for all lakes by considering lake use, perceived value and population within 50 miles. In-lake restoration cost is an estimation of dredging costs ($5.50/cubic yard) associated with deepening lakes to an average depth of 10 feet. This cost includes an estimated 30% for other in-lake restoration work. Lakes having a $0 value already have a mean depth greater than 10 feet. This does not preclude the possibility that other in-lake work is needed to achieve water quality goals. Permanent watershed protection was estimated for

all watersheds at costs of $150/acre (good), $250/acre (fair), and $350/acre (poor). Urban watershed acres were assessed at $1,000/acre. Some lakes were adjusted for costs because of recently completed restoration work or special needs.

ISU economists are working to develop more re ned estimates of economic bene ts. Whether a priority lake is on the impaired waters list, or if a Total Maximum Daily Load (TMDL) is planned or has been completed are also important considerations. These factors and others will be reviewed and a prioritization within the list of 35 will be done in the coming year. The goal of this work is to determine which lakes are best-positioned and can bene t the most from lake restoration. Since restoration work can not proceed until the lake has been adequately protected by water quality best management practices, lakes having signi cantly documented watershed protection are the best candidates for immediate lake restoration. The other critical ingredient needed to begin lake restoration is local commitment.

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

The cost estimates in this table represent a first attempt to approximate financial resources needed for restoring 35 priority lakes. In-lake restoration cost is an estimation of dredging costs ($5.50/cubic yd) associated with deepening lakes to an average depth of 10 ft. This cost includes an estimated 30% for other in-lake restoration work. Lakes having a $0 value already have a mean depth greater than 10ft. This does not preclude the possibility that other in-lake work and costs might be required to achieve water quality goals. Permanent watershed protection was estimated for all watersheds at costs of $150/ac (good), $250/acre (fair), and $350/ac (poor). Urban watershed acres were assessed at $1000/ac. Some lakes were adjusted for costs because of recently completed restoration work or special needs.

Lake name	County	Lake Area (acres)	Watrshd. Area (acres)	Est. Lake Restoration Cost	Est. Watershed Restoration Cost	Estimated Total Cost	Cost / Lake Acre
Arbor Lake	Poweshiek	13	1,046	187,334	674,254	861,588	64,071
Big Creek Lake	Polk	864	46,822	0	11,705,436	11,705,436	13,549
Black Hawk Lake	Sac	919	13,179	33,670,911	1,976,796	35,647,706	38,796
Blue Lake	Monona	264	5,027	10,568,625	754,011	11,322,636	42,836
Brushy Creek Lake	Webster	710	56,318	0	14,079,438	14,079,438	19,828
Carter Lake	Pottawatt.	314	2,398	3,247,972	1,366,983	4,614,955	14,678
Central Park Lake	Jones	25	370	344,951	92,606	437,557	17,777
Clear Lake	Cerro Gordo	3,669	9,538	13,289,756	2,218,904	15,508,660	4,227
Crystal Lake	Hancock	264	1,984	10,332,036	297,658	10,629,694	40,234
Diamond Lake	Poweshiek	96	2,673	809,364	668,190	1,477,554	15,424
Easter Lake	Polk	185	6,368	6,000,000	3,750,638	9,750,638	52,771
Five Island Lake	Palo Alto	964	7,726	0	1,267,289	1,267,289	1,314
George Wyth Lake	Black Hawk	44	440	236,556	65,947	302,503	6,810
Green Valley Lake	Union	420	4,756	3,011,262	1,188,891	4,200,153	10,008
Hannen Lake	Benton	37	566	225,305	141,581	366,886	10,013
Hickory Grove Lake	Story	82	3,955	0	988,653	988,653	12,000
Kent Park Lake	Johnson	26	669	463,322	100,281	563,602	21,466
Lake Ahquabi	Warren	116	1,729	1,000,000	259,315	1,259,315	10,839
Lake Anita	Cass	178	2,317	0	347,568	347,568	1,957
Lake Darling	Washington	268	12,451	4,500,000	3,112,751	7,612,751	28,435
Lake Geode	Henry	190	10,136	0	2,534,098	2,534,098	13,345
Lake Keomah	Mahaska	77	1,875	0	468,677	468,677	6,096
Lake Macbride	Johnson	870	16,163	0	4,462,871	4,462,871	5,130
Lake Manawa	Pottawatt.	733	2,425	30,128,179	1,199,843	31,328,022	42,747
Lake of the Hills	Scott	54	1,650	16,441	412,532	428,974	7,983
Little Wall Lake	Hamilton	246	187	5,000,000	28,083	5,028,083	20,453
Lower Gar Lake	Dickinson	264	10,506	14,125,036	2,747,713	16,872,749	64,027
Pleasant Creek Lake	Linn	418	2,060	0	308,934	308,934	738
Prairie Rose Lake	Shelby	190	4,450	3,203,083	1,557,394	4,760,478	25,050
Red Haw Lake	Lucas	73	947	0	236,728	236,728	3,253
Rock Creek Lake	Jasper	595	26,071	8,500,000	9,124,914	17,624,914	29,624
Silver Lake	Delaware	37	201	983,304	30,224	1,013,527	27,028
Storm Lake	Buena Vista	3,142	14,701	28,000,000	3,169,039	31,169,039	9,920
Union Grove Lake	Tama	115	6,834	3,257,200	2,392,041	5,649,241	49,009
Viking Lake	Montgomery	144	2,023	0	505,856	505,856	3,505
	Totals	**16,607**	**280,560**	**$181,100,637**	**$74,236,138**	**$255,336,775**	**$15,376**

FISCAL YEAR 08 PLANS AND RECOMMENDATIONS

A proposed budget and summary of planned work activities for FY08 is provided below. The budget includes $8.6 million from the Endowment for Iowa's Health Account / Lake Water Quality Improvement Fund and $975,000 from the Environment First / Lake Dredging and Restoration Fund. The estimated local, state, and federal cost share contribution is $5.5 million.

- Monitor work progress and coordinate with local groups engaged in active lake restoration projects (Clear Lake, Crystal Lake, Five Island Lake, Lake of Three Fires, Storm Lake).

- Complete or initiate Diagnostic / Feasibility studies to determine lake water quality problems and evaluate solution alternatives (Carter Lake, Easter Lake, Green Valley Lake, Lake Darling, Lizard Lake, Prairie Rose Lake, other priority lakes).

- Work with local stakeholders to plan and implement new lake restoration projects (Carter Lake, Easter Lake, Green Valley Lake, Lake Darling, Lake Manawa, Prairie Rose Lake, Rock Creek Lake, Silver Lake, Union Grove Lake, Viking Lake and other priority lakes).

- Continue working with partners in the Shallow Lakes Management Initiative.

- Work with DNR and IDALS/DSC managers and local watershed professionals to identify, design, and install BMPs in lake priority watersheds, including: Badger Creek Lake; Lake Macbride, Lake Wapello, Rock Creek Lake and lake watersheds identi ed in the CREP II plan.

- Incorporate new information about economic bene ts, lake water quality and watershed improvement costs to adjust lake restoration priorities accordingly.

- Begin developing public and lake stakeholder communication and outreach tools, potentially including: brochures, display/kiosk, lake restoration tool kit, newsletters, opinion surveys, web site.

PROPOSED FY08 BUDGET

Project Area	Description	State[1,2]	Fed/Other	Total
[1] Infrastructure - Lake Water Quality Improvement				
Ahquabi/Hooper	Shoreline Riprap	$85,000		$85,000
Brushy Cr. Lake	Shoreline Riprap	$50,000		$50,000
Carter Lake	Watershed Improvement, Diagnostic /Feasibility Study	$100,000	$100,000	$200,000
Clear Lake	Dredging	$2,500,000	$1,000,000	$3,500,000
Crystal Lake	Spillway Repair, Watershed Improvement, Fish Renovation	$140,000	$60,000	$200,000
Easter Lake	Watershed Improvement	$100,000	$300,000	$400,000
Green Valley	Watershed Imprvmnt., Land for Dredge Spoil Containment	$900,000	$250,000	$1,150,000
Lake Darling	Watershed Improvement, Dam Repair, Containment Site	$1,200,000	$300,000	$1,500,000
Priority Lakes (to be determined)	Diagnostic / Feasibility Studies	$250,000	$50,000	$300,000
Lizard Lake	Dam Spillway Modification	$90,000		$90,000
Prairie Rose Lake	Watershed Improvement, Land, for Dredge Spoil Containment	$950,000	$300,000	$1,250,000
Red Haw Lake	Shoreline Riprap	$25,000		$25,000
Rock Creek Lake	Watershed Improvement	$100,000	$300,000	$400,000
Silver Lake	Watershed Improvement	$100,000	$300,000	$400,000
Storm Lake	Dredging	$1,000,000	$1,000,000	$2,000,000
Union Grove Lake	Watershed Improvement, Dredging	$1,000,000	$250,000	$1,250,000
Viking Lake	Watershed Improvement	$10,000	$30,000	$40,000
	subtotal	$8,600,000	$4,240,000	$12,840,000
[2] Infrastructure Environment First – Lake Restoration				
Deer Creek	Lakebed Sealing	$175,000		$175,000
Five Island	Dredging	$100,000	$100,000	$200,000
Priority Watersheds	Watershed Protection for Lakes	$500,000	$1,000,000	$1,500,000
Shallow Lakes	Water Quality Improvement	$200,000	$150,000	$350,000
	subtotal	$975,000	$1,250,000	$2,225,000
	Total	**$9,575,000**	**$5,490,000**	**$15,065,000**

PROGRAM CHALLENGES

Unforeseen Delays in Construction: One of the greatest challenges with construction projects in general is making sure complex projects move forward without unnecessary delays. The Lakes Water Quality Improvement projects are no exception. A top priority for 2007 will be to continue striving to expedite projects so that funds can be utilized as ef ciently as possible.

The majority of lake restoration projects involve constructing or installing watershed or in-lake improvements. A typical construction project might include the following stages: 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. Before construction can begin, easements or land acquisition might also be needed, followed by required approvals and permits such as archeological/cultural (SHPO), environmental (T&E species), oodplain/404 permit, and a sovereign lands permit. Sometimes delays may occur while the necessary approvals or permits are being obtained.

Of course, delays can also be caused by adverse weather, equipment breakdowns, and other unforeseen occurrences.

DNR is committed to streamlining project development and implementation. Resources have been committed to develop an improved project management tracking system for lake restoration projects and budget.

Multiple-year Projects. Timelines for larger construction projects at a minimum fall within a two-year time frame.

Large dredging projects take even longer, and multiple year commitments are needed to secure contractors for this critical work. Dredging contractors are faced with substantial costs to mobilize and set up lake dredging operations. As such, the most practical and ef cient way to complete the dredging plan is as one continuous project compared with following a piecemeal approach. Clear Lake, Crystal Lake, and Storm Lake are all examples of dredging projects that require a multiple-year funding commitment from the State in order to achieve lake restoration goals.

Local partners also are looking for a multiple year funding commitment from the lake restoration program in order to pursue funding sources to match State funds. Because requests for State Infrastructure Appropriations for lake restoration are done on a yearly basis, it is dif cult to guarantee ongoing funding support. Development of a funding approach and structure that addresses the multi-year commitment needed to secure dredging contractors and local funding sources is needed.

Explaining Lake Restoration Suitability

The lake restoration priority ranking process identi ed 35 lakes based upon a number of socio-economic, lake water quality and watershed indicators. An unbiased, technically sound approach was taken to develop the list. The lake restoration program recognizes that individuals or constituent groups that are interested in improving a lake that is not on the priority list will ask to be considered. The rst step will be to review available information about the lake and watershed to determine whether the lake is appropriately ranked with respect to restoration priority. Some requests will have merit and others will not.

No doubt there will be external pressures for DNR to embark in lake restorations that are not wise investments of limited public funds. As these requests arise, DNR will need to be prepared to explain that not all lakes are equal with respect to restoration suitability. DNR lake restoration managers will be challenged to explain the project selection criteria and respond in a constructive way to helping local lake initiatives involving non-priority lakes.

LAKE MONITORING AND ASSESSMENT

AMBIENT MONITORING

The Iowa Lakes Survey project (2000-2005) conducted by the Iowa State University Limnology Laboratory provides invaluable water quality data and other information about 132 Signi cant Publicly-Owned Lakes (SPOL) in Iowa. Sampling data and other summarized information about survey lakes are available on the internet at http://limnology.eeob.iastate.edu/lakereport/. Beginning in 2006, ambient lake monitoring of the 132 survey lakes has been continued by the University Hygienic Laboratory (UHL) as part of their annual monitoring agreement with DNR. Funding support for ambient lake monitoring comes the DNR Water Monitoring Program through annual appropriations of the State's Infrastructure Environment First Fund.

Ambient lake monitoring data provide the basis for evaluating status and trends in lake water quality and assessing compliance with water quality standards protecting designated bene cial uses. The 2000-2005 lake survey was used as the basis for developing a lake classi cation system that helped to prioritize lakes for restoration. Looking ahead, the data will be invaluable as an historical record of water quality to measure progress in lake water quality improvement.

The lakes are monitored for basic water chemistry, nutrients, chlorophyll, phytoplankton and zooplankton at least three times during the spring and summer. Additionally, a temperature pro le is constructed for each lake to determine the thermocline and the oxygen content along the temperature pro le. The lakes have also been tested once for common herbicides, insecticides and metals in both the water and lake sediments. Sampling of lake water quality was coordinated with and augmented by the collection of sh data.

Sampling was expanded in 2006 to include 36 lakes that fall outside of the classi cation of SPOL, but are still a valuable resource for the state. These lakes were sampled using the traditional protocols and test analytes listed above. Beginning in 2006, biological monitoring on Iowa's lakes was expanded by developing a three-year project with Iowa State University Limnology to collect bottom-dwelling invertebrates that represent an important link in the food web of lake ecosystems. These data will be used to develop a lake biological quality index based on species diversity and abundances. The index will complement existing water quality indicators of lake health and provide another tool to measure progress toward lake restoration goals.

BEACH MONITORING AND SAFE LAKES INITIATIVE

The Iowa Department of Natural Resources (DNR) has conducted bacterial monitoring at Iowa's state owned beaches since the DNR's Ambient Water Monitoring Program's inception in 2000. Over the rst six years of monitoring, the DNR has noticed different patterns emerge in the bacterial occurrences at beaches.

Bacterial monitoring at swimming beaches of 37 Iowa lakes during the summer recreational period in calendar years 2000 through 2005 found the majority of Iowa's state owned lakes have a low incidence of violations of either the one-time maximum or the geometric mean bacterial standards at their beach, with 26 of these lakes violating the geometric mean standard less than one year out of ve. The remaining 11 lakes meet the requirements to be placed on Iowa's Vulnerable Beach list. In order to meet these requirements, a beach must have exceeded the state geometric mean bacterial standard for E. coli in any two years out of a running ve years.

The lakes with vulnerable beaches currently eligible for special monitoring consideration include (members of the lake restoration priority list are underlined):

Backbone Lake (Delaware), Beeds Lake (Franklin), Black Hawk Lake (Sac), Clear Lake (Cerro Gordo), West Okoboji Lake - Emerson Bay (Dickinson), George Wyth Lake (Black Hawk), Lake Darling (Washington), Lake of Three Fires (Taylor), Nine Eagles Lake (Decatur), Rock Creek Lake (Jasper), and Union Grove Lake (Tama).

Although some efforts to identify bacterial sources have been conducted for all 11 of these lakes, these efforts have only been partially successful in determining the bacterial sources responsible for the standards violations. Sources known or suspected of playing a role in these violations include: geese, deer/raccoons and other wildlife, septic system discharges, runoff from livestock pastures or manure application elds, livestock having direct access to streams and gullies, wastewater discharges from DNR park facilities, wastewater discharges from residential developments on or near the lakes, and humans and pets using the lakes for recreational purposes. For the frequency of bacterial violations in these 11 lakes to be signi cantly reduced, an initiative to directly address the bacterial problems of each lake should be undertaken.

The Safe Lakes Initiative sponsored by the DNR Watershed Improvement Section and the Watershed Monitoring and Assessment Section is an organized attempt to address these problems. The activities to be conducted under this project can generally be divided into three major categories: 1) identi cation of bacterial sources, 2) development of pollutant reduction strategies for each bacterial source, and 3) implementation of the developed pollutant reduction strategies for each lake.

Bacterial Source Identi cation. For each lake, an intensive effort to identify the contributing bacterial sources will be conducted. As part of this effort, a comprehensive watershed assessment will be completed to identify and evaluate potential contributions from such sources as open feedlots, manure application elds, septic system or other wastewater discharges from rural residences or residential developments, livestock pastures (including livestock with direct access to streams), and wildlife. Based on the results of this assessment, additional monitoring or other studies will be conducted as necessary to further de ne the magnitude of the bacterial contribution from identi ed watershed sources.

Development of Pollutant Reduction Strategies. For each identi ed potential bacterial source and each lake, a pollutant reduction strategy will be developed. In developing this strategy, consideration will be given both to current approaches and to new or innovative strategies which may be more effective in dealing with the problem.

Plan Implementation. For each lake, efforts will be undertaken to implement the developed bacterial reduction plan. As the speci c activities to be conducted may vary between lakes, the implementation efforts may also differ. For some lakes, it may be possible for DNR to carry out the bulk of the efforts internally. For others, participation by outside parties, including individual landowners, county supervisors or boards of health, the Division of Soil Conservation/IDALS, USDA's Natural Resources Conservation Service or Farm Services Agency, lake preservation associations, etc. will be needed

DNR FISHERIES / IOWATER LAKES MONITORING

This project provides exibility to tailor sampling to individual lake needs and is able to supplement existing lake data by adding water quality information for sites or times of the year not sampled by the ambient program. Sample analyses are a combination of eld tests used in the IOWATER volunteer monitoring program and laboratory analysis of chemical parameters done by the University Hygienic Laboratory.

Sampling in 2005 was conducted for 13 water quality parameters in 17 lakes selected by Fisheries Bureau staff. A number of lakes that are restoration priorities or included in the shallow lake management project were sampled, including: Brushy Creek Lake; Clear Lake/ Ventura Marsh (shallow); Diamond Lake (shallow); Lake Darling; Lake Geode.

The above lakes were included in the statewide 2005 Microcystin screening project. Microcystin is a natural toxin produced by a type of blue-green algae (cyanobacteria). At elevated levels, Mycrocystin and other cyanotoxins may represent a health threat to animals

and humans. Cyanotoxin occurrence and factors leading to levels of concern are being investigated in Iowa and elsewhere.

SHALLOW LAKES

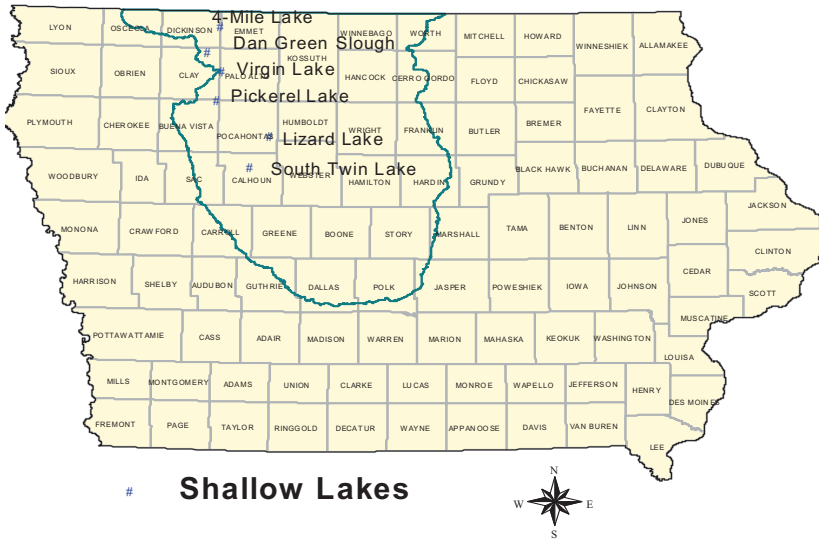
FY07 Lake Restoration Funds supported monitoring in seven shallow lakes in north central Iowa. The sampling is being done to document the biological, physical habitat, and water quality characteristics of these lakes before, during and after renovation work plans included in the Shallow Lakes Management Initiative.

Below is an excerpt from the monitoring work plan (Evelsizer and Fisher, DNR Watershed Monitoring and Assessment Section, May 2006).

PROJECT OVERVIEW

In the spring of 2006, an agreement was formed between the Iowa DNR's Wildlife and Fisheries bureaus and Ducks Unlimited as part of a Shallow Lakes Initiative Project to renovate several ecologically degraded shallow lakes across northwest Iowa. The overall goal of this agreement is to use tools developed by managers to shift and maintain shallow lakes from an ecologically degraded system to a clear water state that supports desirable sh populations, abundant aquatic plants, invertebrates, and thus increased use by waterfowl. This agreement also represents a unique opportunity to improve an already existing resource for multiple bene ts which includes water quality, conservation of wildlife and sh and higher quality recreational uses for the public.

Locations of Six Shallow Lakes to be Monitored in 2006



The Iowa DNR's Watershed Monitoring and Assessment Section was performing wetland assessments on permanent and semi-permanent wetlands throughout north-central Iowa in the summer 2006. Methods used to monitor the ecological condition of these wetlands were easily adapted for use on these shallow lake/permanent wetland environments. In order to accurately assess the condition of these shallow lakes it will be important to collect information from all aspects of each of these systems. All partners of this agreement believe that the proposed methods for shallow lake monitoring should include basic physical/chemical analysis, analysis of nutrients and suspended solids and biological (sh, macrophyte and invertebrate communities) sampling.

Water Sampling - Sampling will be conducted at the deepest location of each lake's open water zone using a canoe or johnboat. For water samples, a collection bucket will be used to gather water from the lake following our standard collection protocol (UHL 1997a). The water from this sample will then be poured into appropriate bottles and labeled accordingly. Each bottle will be placed into a cooler with ice to avoid direct sunlight and cooled until they're delivered to UHL for analysis within their designated holding time.

Chemical Sampling
Chemical contaminant sampling will consist of using the water grab samples from the middle of the open water zone of each shallow lake as mentioned above. The water samples collected from these shallow lakes will be sent to UHL for nutrient, suspended solids, and chlorophyll analysis. These parameters will be sampled bi-monthly from May through September.

Physical Component
Standard physical data will also be collected bi-monthly from the canoe/boat with a multi-parameter probe which measures dissolved oxygen concentrations, water temperature, conductivity and pH. Turbidity and secchi depth will also be recorded. The surrounding land use composition of each lake's watershed will be analyzed as well using available GIS coverages. Additional GIS coverages that display public drainage tile lines, drainage ditches, bathymetric features and other important factors will also be used. These procedures will allow managers to pinpoint potential sources of nutrient and sediment.

Biological Component
Sampling biological communities is an important aspect of shallow lake manipulations. In order to quantify such changes careful biological sampling must occur.

Aquatic Plants - An aquatic plant survey will take place once at each lake in late-July – early-August. This time period should coincide with the peak growth period to ensure the maximum overlap of species. Sampling methods were adapted from the USFWS Upper Mississippi Refuge Vegetation Survey, using a modi cation of the point transect method for site selection.

RELATED PROJECTS AND STUDIES

IOWA LAKES VALUATION PROJECT

The Iowa Lakes Valuation Project is an economic study of the use and value Iowan's place on water quality in Iowa lakes. There are two main parts to the study: willingness to pay and economic impact.

Willingness to Pay
[from "The Iowa Lakes Valuation Project: Summary and Findings from Year One". Christopher D. Azevedo, Kevin J. Egan, Joseph A. Herriges, and Catherine L. Kling, Department of Economics, Iowa State University, Ames, Iowa.]

Data for the willingness to pay study was collected over a four-year period (2002-2005) through the implementation of annual surveys to a random sample of Iowa residents. The economic value of water quality improvements in Iowa lakes is being measured using the standard concept of maximum willingness-to-pay. The maximum amount that an individual is willing to pay for an environmental good measures the value they place on that good in that it represents the value of other goods and services they are willing to forgo in order to acquire or preserve the environmental resource. The maximum willingness-to-pay (WTP) is a standard concept of economic value for any type of good, environmental or otherwise, and thus can appropriately be used by policy makers and analysts for comparisons in deciding how to spend limited public monies.

The rst year of data collection focused on providing a baseline of information on use and attitudes towards water quality measures and economic development. Information on use was again collected in the second through fourth years, but scenarios were also provided to survey respondents to elicit their willingness to pay for quality improvements.

According to researchers, J. Herriges and C. Kling, Iowa State University, several key preliminary ndings have emerged from the willingness to pay study:

- Large water quality improvements at a few lakes are more valuable than small water quality improvements at many lakes.
- Water quality improvements that are closer to larger population centers will have larger value than those further from major populations.
- However, spreading out the sites at which water quality improves will have larger impact than clustering sites geographically.
- If the cost estimates developed to data are reasonably accurate,
  - o The return on investment from improving the most valuable lakes is substantial,
  - o However, the lowest valued lakes likely would fail a bene t-cost test.

Economic Impact
[From Herriges et al. June 2006, Workplan for Restoring Water Quality in Iowa's Lakes: Assessing the Economic Impact and Establishing a Monitoring Baseline]

Beginning in August 2006, additional work in the Iowa Lakes Valuation Project was initiated to provide information on the economic impact of water quality improvements at 15 to 30 high priority lakes to local communities. Additionally, the work will provide a comprehensive set of baseline information on the recreational usage of Iowa's primary lakes, including annual visitation patterns to those lakes over the period from 2002 – 2005, the water quality of those lakes and its changes over that time period, and a variety of related information concerning Iowan's preferences and usage of these lakes.

The economic impact analysis component of this study will follow previous work undertaken by Dr. Daniel Otto. The economic impact analysis will provide information on the direct and indirect economic activity that visitors to the lakes bring to the nearby towns and regions. Improved water quality associated with lake restoration projects can be expected to increase visitation to a lake. Visitors bring with them purchasing power and spend money on goods and services at locations near the lake. The economic impact analysis will quantify the magnitude of these effects by linking estimates of increased visitation from water quality improvements with spending patterns of visitors and the multiplier effects of that spending throughout the region. The economic impact analysis will use estimates from the surveys of increased visitation likely to result from water quality improvements as well as estimates of the amount of economic activity brought to localities as a consequence of the recreational resources in the area following the procedures that were undertaken previously for Storm Lake and Rock Creek Lake (Bong, M.S. thesis).

The second component of the project, monitoring and assessment is to provide easily accessible information on the full range of visitation data, water quality information, and economic valuation data collected and analyzed over the four years of the Iowa Lakes Project. This information will support two uses. First, additional data analysis will be undertaken and the results, along with summaries of a variety of variables, will be provided on a user-friendly website. Second, the data collected and summarized will provide a rm foundation for the long term monitoring of

both the water quality of lakes and the usage of the lakes, as well as extensive complementary information.

Key outcomes from this project include:

- Complete a series of economic impact analyses for thirty target lakes in the state.
- Provide a complete data pro le and web-accessible data base to provide the fundamental building blocks for future monitoring and assessment of water quality and socioeconomic responses.

These analyses and data resources will provide interested parties (local citizen groups, chambers of commerce, economic development interests, and state legislators) valuable information on the likely increase in economic activity that would occur in and around the target lakes if water quality projects were undertaken at the lake that resulted in increased visitor days.

FISHERIES AND LAKE WATER QUALITY RELATIONSHIPS

A study being conducted by sheries researchers at Iowa State University titled, "Assessment of the Interrelationships between the Fisheries Community and Limnological Characteristics of Iowa Lakes" is linking lake water quality and sheries quality. The research will contribute to knowledge and tools that are useful to lake restoration efforts.

The study purpose and objectives are described in the below excerpt from the June 2006 Annual Progress Report (Jackson and Quist, Iowa State University).

"The purpose of this study is to describe sh population and assemblage structure among lakes, and determine relationships between sh, limnological conditions, lake basin morphology, and watershed characteristics in Iowa lakes. This information is necessary to understand relations between sh assemblage characteristics and water quality, a relationship important to the protection and improvement of Iowa's lake resources.

Fisheries data collected from 129 Iowa lakes during 2001-2006 will be used for the study. Lakes included in the study correspond to those sampled as part of the Iowa Lakes Survey administered by Dr. John Downing at Iowa State University.

A variety of summary statistics (e.g., mean, variance, quartiles) will be calculated for each species to provide an overall description of sh populations and assemblages in lakes. Speci cally, summary statistics will focus on relative abundance estimates [i.e., catch-per-unit-effort (CPUE)]; size structure [e.g., proportional stock density (PSD), relative stock densities (RSDs); Willis et al. 1993], and condition [i.e., relative weight (Wr); Blackwell et al. 2000] of each species. Summary statistics will also focus on measures speci c to sh assemblage characteristics such as species richness and species diversity. Lastly, summary statistics will be calculated for different measures of sh assemblage composition and function.

Previous analysis of a small portion of the sheries data, in conjunction with limnological information, has revealed several interesting patterns between sh and water quality characteristics. Egertson and Downing (2004) showed that the abundance of common carp was positively related to lake trophic status; whereas bluegill and black crappie abundance declined with increasing lake productivity. Although the authors observed many important and interesting patterns, the analysis was limited to 32 Iowa lakes. In contrast, the current data set is spatially extensive (129 lakes) allowing a number of hypotheses to be tested and many additional questions to be answered. For instance, additional patterns have been observed and hypothesized regarding the in uence of lake basin morphology (e.g., basin slope, mean depth, shoreline morphology) and watershed characteristics (e.g., ratio of watershed area to water surface area, percent of row-crop agriculture, distribution of erosive soils) to sh populations.

Not only will these data provide a summarization and comprehensive overview of sh population characteristics in lakes, but these data may also be used to develop standards and prioritization frameworks. To help identify factors in uencing sh populations and assemblages, several analyses will be conducted. Potential analyses include multiple regression analyses where limnological conditions, lake basin morphology, and watershed characteristics are used to predict the abundance, condition, size structure, and growth of individual species and groups of species. Results of these analyses will be used to develop an index of sheries quality that can then be used to guide prioritization of lakes for restoration."

AQUATIC VEGETATION BMPS

This past year, the DNR entered into a cooperative study with Iowa State University to develop both short- and long-term strategies needed to address the impact of aquatic plants on sh, shing and other lake uses. The study will be conducted over a three-year period at a cost of $158,936 ($112,690 Fish and Wildlife Trust Fund and $46,246 ISU Indirects). Vegetation impacts have increased as the result of the DNR's success in improving quality and clarity of lake water. Although aquatic plants are an essential component of lake ecosystems, the combination of clear and nutrient-rich water has resulted in excessive growths of vegetation, especially in shallow water near shore. These same, near shore areas are also the portions of our lakes most used by the public. In summary, this information is critical to the DNR's efforts to restore lake water quality and maintain, even increase, the public's use of lakes Information gained in this study will result in a detailed knowledge of the relationships between lake basin shape, water quality, sh and plants. This information will be combined with an assessment of methods and techniques used to control nuisance growths of plants. The result will be implementation of those best management practices most suited to the control of overabundant vegetation in Iowa lakes.

Vegetation management is going to be an issue for lake restoration projects. Clear water is a direct result of restoration activities and with clear water comes aquatic plants. Certain plant densities and surface coverage of aquatic vegetation has been shown to increase angling effort by up to 14% and certain economic activities by up to 63%.

Aquatic vegetation is important to a healthy lake ecosystem but certain plant species and densities can become a nuisance. Lake of Three Fires, a recent lake restoration project nearing completion, is a case in point. The shallow arms of Three Fires were choked with lotus prior to dredging and lotus plants have started to re-colonize in certain areas. Lotus can become very dense and produce a canopy above the water which inhibits angling. This past fall a project to replace lotus with water lilies (left) was started. Anglers can sh around lilies and they aesthetically pleasing with their white and pink owers.

Preventative measures can be used when restoration activities involve lake draw downs or dredging operations which deepen shoreline areas where aquatic plants could potentially be a nuisance to recreational users. Chemical applications are another approach to keeping high use areas free of vegetation but can be expensive and may require more than one annual application. Mechanical removal is also an option but can be extremely labor intensive and costly. Lastly there is vegetation propagation where we plant desirable species to either replace nuisance plants or start desirable species before other plants can colonize an area.

LIDAR

LiDAR stands for Light Detection and Ranging. It is a process of scanning the earth with lasers from an aircraft to obtain accurate elevations. LiDAR is similar to sonar (depth nder) in that it uses a time of travel method of measuring distance.

LiDAR is capable of providing accurate elevational data. The statewide proposed project will generate elevation data which is within 8 inches of actual elevations (currently available statewide data has an accuracy of ± 5 feet). The DNR proposes to obtain LiDAR coverage and accompanying aerial photography for the entire state of Iowa over a two-year period (Fall 2006 – Fall 2007). Minor acquisitions will take place in fall of 2006 and fall

of 2007. The majority will be collected in the spring of 2007. The LiDAR data will be used to develop elevation maps for all Iowa counties, and make these maps and aerial photography available for public use over the Internet.

The DNR strongly believes LiDAR will provide tremendous environmental bene ts to the state in terms of improved water quality modeling; conservation practice placement, design, and implementation; and ood plain delineations. Examples related to lake restoration include:

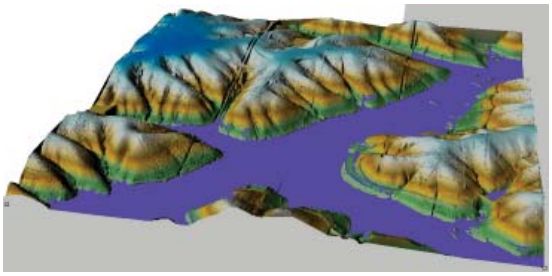
- Soil conservation structure (terraces, sediment ponds, etc.) planning and estimating
- Erosion potential measurements and modeling
- Watershed modeling
- Runoff modeling
- Conservation practice performance
- Watershed delineation

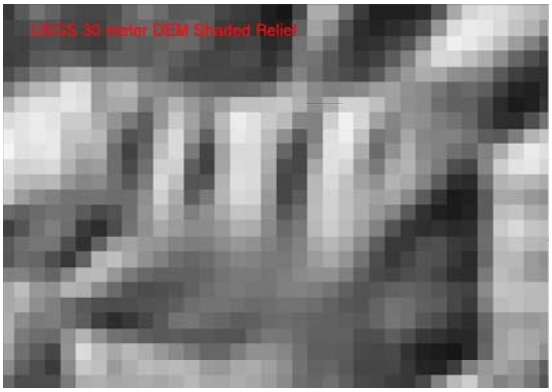
Currently, partnerships among IDOT, IDNR, NRCS, and IDALS have committed the funds needed to acquire the LiDAR data only ($4.3 million). $2.8 million is still needed to fully complete the project.

The Lake Darling Watershed was part of a pilot project of LiDAR technology in Iowa. Below are several images that demonstrate the utility of LiDAR data.

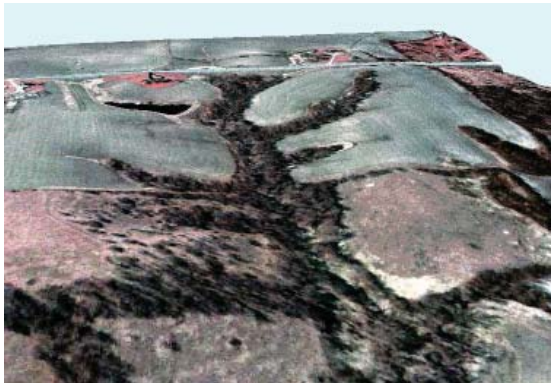
Four data samples for one area of the Lake Darling watershed are shown (below left). Color-enhanced LiDAR viewover Lake Darling, Washington County (below right). Elevation is exaggerated. Digital aerial photographs (below right) are draped over LiDAR elevation coverage of a gully in the Lake Darling watershed. A proposed dam, designed to stop sediment from moving to the lake, was incorporated into the second photo.

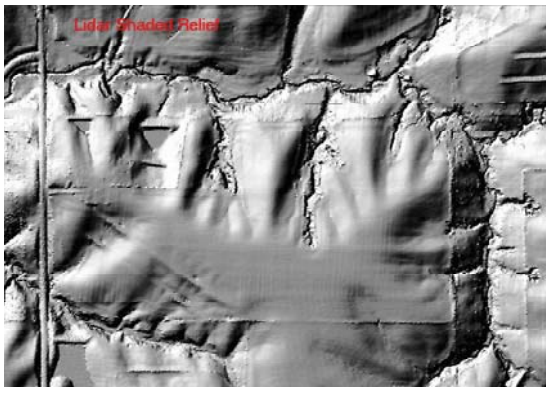
Color infrared photography 2002



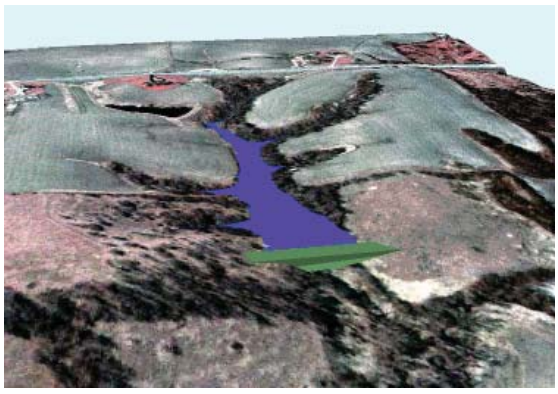


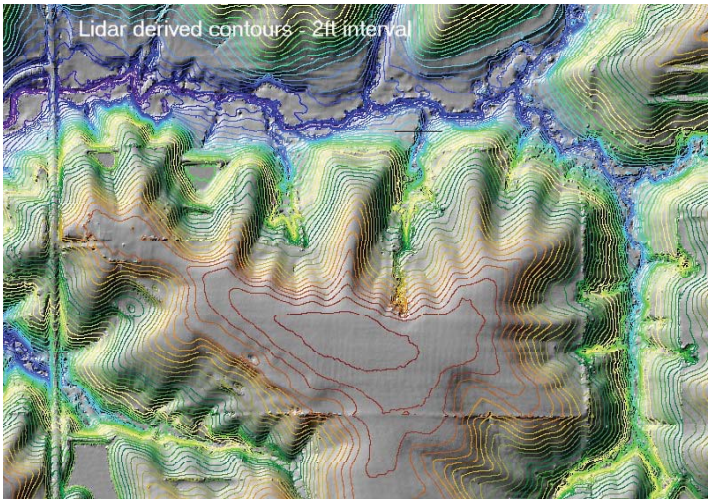
Shaded relief view with currently available elevation data





Shaded relief view with LiDAR based elevation data





Contours (2-foot intervals) derived from LiDAR

CREP II

In October 2006, the state requested an additional $20 million in funding for water quality improvement projects in Iowa. In a letter to U.S. Secretary of Agriculture Michael Johanns, Governor Tom Vilsack stated that the additional money will be targeted on 23 priority lake and stream watersheds in Iowa and be administered by the Iowa Department of Natural Resources (DNR).

The funding is being requested through the U.S. Department of Agriculture's Conservation Reserve Enhancement Program (CREP) administered by the Farm Service Agency (FSA) and would be used in collaboration with state and local funds to improve water quality through voluntary conservation measures on sensitive lands owned by private landowners.

"The improvements that can be made with this funding have a ripple effect throughout our entire state in terms of improving water quality, improving shing opportunities and providing valuable wildlife habitat," said Vilsack. "The bottom line is that the more of these practices we can add to our landscape, the better off we are both environmentally and economically by improving the quality of life for our residents and our visitors."

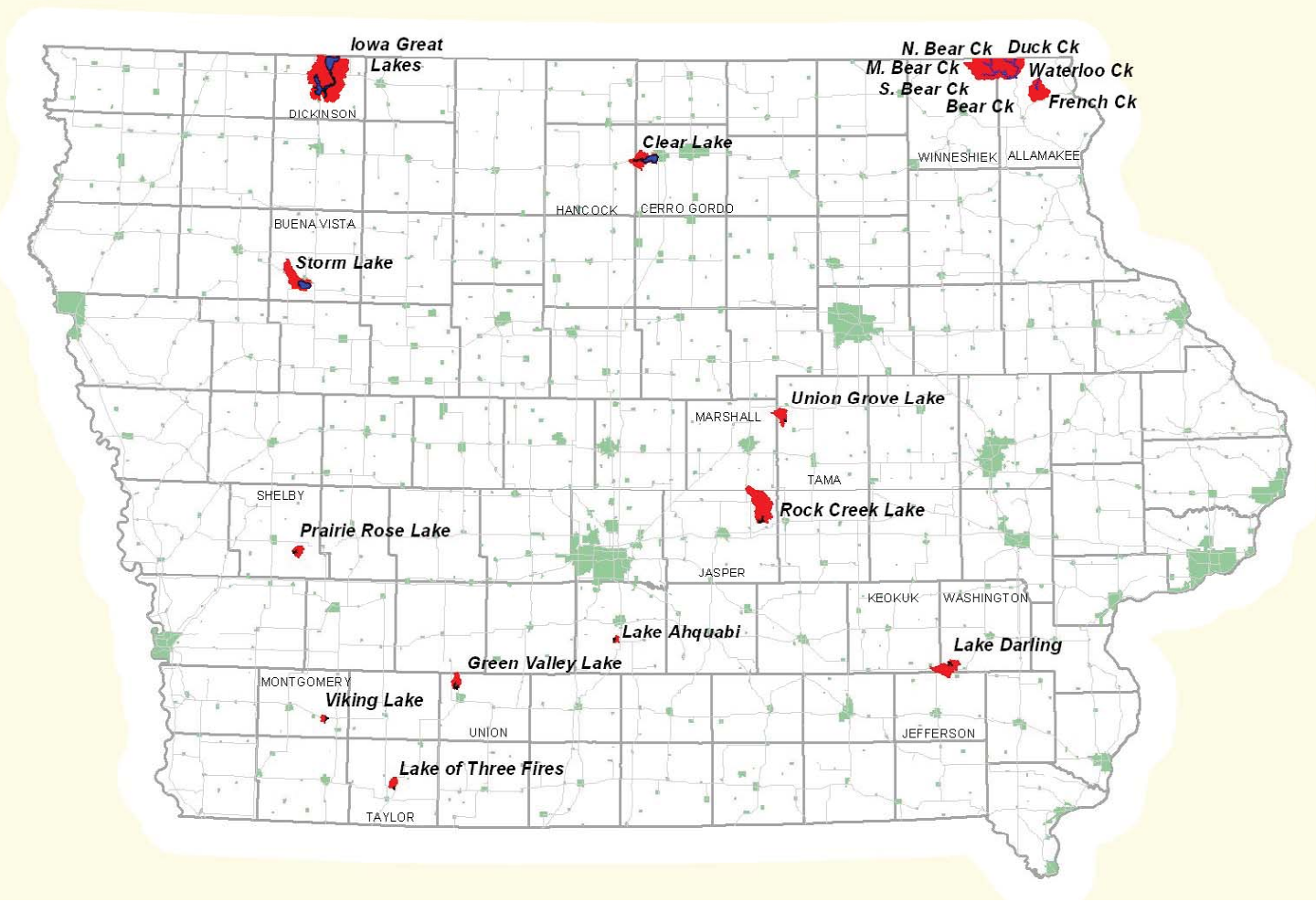
The project proposes to establish long term contracts on 7,200 acres at a total cost of $20 million. This includes $16 million from federal funds and $4 million from state and local funds, including lake restoration funds appropriated during the last Legislative session, $1 million from the Fish and Wildlife Trust Fund and another $1 million from private and local sources.

Vilsack said the CREP proposal meets Iowa's goals of improving water quality through voluntary, incentive-based approaches with landowners. "Federal funding like this would allow us to make our state commitment to water quality go even further," said Vilsack, *pointing to the proposed match with state lake restoration funds.

The CREP project proposes targeting watershed improvements to those areas of highest sediment and phosphorus delivery. This proposal builds on ndings of Iowa's watershed assessments; lake monitoring and classi cation reports; and individual lake/watershed diagnostic and feasibility reports conducted by Iowa State University. These studies have demonstrated that establishment of targeted conservation practices on 7-to-10% of the land in the watersheds could reduce sediment delivery by as much as 70%.

The project will use incentives and long term agreements to maintain existing CRP lands in CRP, encourage sign-up of new, high priority elds in CRP and enroll lter strips and riparian forest buffers in areas critical to reducing sediment and phosphorus. It is planned to offer wetland restoration practices to remove surface tile inlets reducing sediment and phosphorus. Filter strips will be offered around tile and terrace inlets to reduce sedimentation and phosphorus in those cases where wetland restorations are not practical or not desired.

This CREP proposal, known as CREP II, is supported by local partners, including the Iowa Department of Natural Resources, Soil and Water Conservation Districts of Iowa, State Soil Conservation Committee, Pheasants Forever, and Iowa Natural Heritage Foundation.



PROPOSED CREP II PRIORITY WATERSHEDS

All eleven CREP II lake watersheds include a planned, active, or recently completed lake restoration project. Following is a brief description of each of the lake watershed areas.

Lake Ahquabi (109 acres) and associated watershed is located in Warren County. The designated uses for the lake are primary contact recreation (Class A), lakes and wetlands (Class B(L/W)) and drinking water supply (Class C). Annual lake use is estimated at about 622,000 visits per year, primarily picnicking, camping, shing, and swimming. The watershed is made up of nearly at to moderately steep prairie derived soils. Soils include Adair, Grundy, Haig, Lindley, Sharpsburg, and Shelby. Soil steepness ranges from 0 – 18%. Impairments include sedimentation, excess phosphorus and nitrogen (ammonia).

Clear Lake (3684 acres) is located in Cerro Gordo County and the watershed extends into Hancock County. The designated uses for the lake are primary contact recreation (Class A), lakes and wetlands (Class B(L/W)), high quality water resource (Class HQR) and drinking water supply (Class C). Annual lake use is estimated at 567,200 visits per year, primarily picnicking, camping, pleasure boating, shing, and swimming. The watershed is made up of nearly level to moderately sloping soils developed under prairie

vegetation. Soils include Canisteo, Clarion, Nicollet, Saude, Storden, Talcot, Wadena and Webster. Soil steepness ranges from 0 – 9%. Impairments include sedimentation, excess phosphorus and nitrogen (ammonia).

Lake Darling (299 acres) is located in Washington County and the water shed extends into Jefferson and Keokuk counties. The designated uses for the lake are primary contact recreation (Class A) and lakes and wetlands (Class B(L/W)). Annual lake use is estimated at 211,350 visits per year, primarily picnicking, shing, and camping. The watershed is made up of nearly level to very steep soils developed under prairie vegetation. Soils include Adair, Clinton, Keswick, Ladoga, Lindley, Otley, and Taintor. Soil steepness ranges from 0 – 30%. Impairments include turbidity that limits swimming activity, sedimentation, excess phosphorus and nitrogen (ammonia).

Iowa Great Lakes (12,000 acres) are located in Dickinson County and associated watershed extends into Jackson County, Minn. The Iowa Great Lakes includes Spirit Lake, West Okoboji Lake, East Okoboji Lake, Upper Gar Lake, Lower Gar Lake, and Minnewashta Lake. The designated uses for the lakes are primary contact recreation (Class A), lakes and wetlands (Class B(L/W)), high quality water resource (Class HQR – West Okoboji and Spirit Lake), and drinking water supply (Class C - West Okoboji and Spirit Lake). Annual lake use is estimated at 1,000,000 visits per year, primarily picnicking and camping, shing, swimming, and pleasure boating. The watershed is made up of nearly level to moderately sloping soils developed under prairie vegetation. Depressional soils (potholes) are common. Soils include Canesteo, Clarion, Harps, Nicollet, Okoboji, and Webster. Soil steepness ranges from 0 – 9%. Impairments include sedimentation, excess phosphorus and nitrogen (ammonia).

Green Valley Lake (394 acres) and associated watershed is located in Union County. The designated uses for the lake are primary contact recreation (Class A) and lakes and wetlands (Class B(L/W)). Annual lake use is estimated at 204,370 visits per year, primarily picnicking, camping, and shing. The watershed is made up of nearly level to moderately sloping soils developed under prairie vegetation. Soils include Adair, Clarinda, Macksburg, Sharpsburg, Shelby and Winterset. Soil steepness ranges from 0 – 14%. Impairments include nuisance algal blooms, sedimentation, excess phosphorus and nitrogen (ammonia).

Prairie Rose Lake (219 acres) and associated watershed is located in Shelby County. The designated uses for the lake are primary contact recreation (Class A), lakes and wetlands (Class B(L/W)), and drinking water supply (Class C). Annual lake use is estimated at 99,300 visits per year, primarily picnicking, shing, and camping. The watershed is made up of gently sloping to moderately steep soils developed under prairie vegetation. Soils include Adair, Marshall and Shelby. Soil steepness ranges from 2 – 18%. Impairments include sedimentation, excess phosphorus and nitrogen (ammonia).

Rock Creek Lake (491 acres) is located in Jasper County and associated watershed extends into Marshall County. The designated uses for the lake are primary contact recreation (Class A) and lakes and wetlands (Class B(L/W)). Annual lake use is estimated at 198,982 visits per year, primarily picnicking, camping, shing, and swimming. The watershed is made up of nearly level to steeply sloping soils developed under prairie vegetation. Soils include Ackmore, Downs, Killduff, Muscatine, Shelby, and Tama. Soil steepness ranges from 0 – 25%. Impairments include sedimentation, excess phosphorus and nitrogen (ammonia).

Storm Lake (3,097 acres) and associated watershed is located in Buena Vista County. The designated uses for the lake are primary contact recreation (Class A) and lakes and wetlands (Class B(L/W)). Annual lake use is estimated at 168,800 visits per year, primarily picnicking and camping, shing, swimming, and pleasure boating. The watershed is made up of nearly level to moderately sloping soils developed under prairie vegetation. Depressional soils (potholes) are common. Soils include Canesteo, Clarion, Harps, Nicollet, Okoboji and Webster. Soil steepness ranges from 0 – 9%. Impairments include sedimentation, excess phosphorus and nitrogen (ammonia).

Lake of Three Fires (97 acres) and associated watershed is located in Taylor County. The designated uses for the lake are primary contact recreation (Class A), lakes and wetlands (Class B(L/W)), and drinking water supply (Class C). Annual lake use is estimated at 37,000 visits per year, primarily shing, picnicking and camping. The watershed is made up of nearly level to strongly sloping soils developed under prairie vegetation. Soils include Adair, Clarinda, Macksburg, Sharpsburg, Shelby and Winterset. Soil steepness ranges from 0 – 14%. Impairments include sedimentation, excess phosphorus and nitrogen (ammonia).

Union Grove Lake (115 acres) is located in Tama County and associated watershed extends into Marshall County. The designated uses for the lake are primary contact recreation (Class A) and lakes and wetlands (Class B(L/W)). Annual lake use is estimated at 115,100 visits per year, primarily picnicking, shing, and camping. The watershed is made up of nearly level to strongly sloping soils developed under prairie vegetation. Soils include Dinsdale, Garwin, Kenyon, Muscatine and Tama. Soil steepness ranges from 0 – 14%. Impairments include sedimentation,

excess phosphorus and nitrogen (ammonia).

Viking Lake (137 acres) and associated watershed is located in Montgomery County. The designated uses for the lake are primary contact recreation (Class A) and lakes and wetlands (Class B(L/W)). Annual lake use is estimated at 361,500 visits per year, primarily picnicking, camping, and shing,. The watershed is made up of gently sloping to moderately steep soils developed under prairie vegetation. Soils include Adair, Marshall and Shelby. Soil steepness ranges from 2 – 18%. Impairments include sedimentation, excess phosphorus and nitrogen (ammonia).

WATERSHED ASSESSMENT IMPROVEMENTS

A cooperative project involving the DNR Section 319 Nonpoint Source Control Program, IDALS Division of Soil Conservation (DSC) and the Natural Resources Conservation Service (NRCS) recently was started with the goal of improving watershed assessments for water quality projects. This interagency initiative is identifying ways to provide better technical assistance to project planners and coordinators. Varying types and levels of technical assistance may be provided through this initiative, including: access to watershed assessment experts, GIS mapping and analysis resources, use of tablet computers or PDA's for recording waterbody/watershed data, and technical consultation.

Two recent Geographic Information System (GIS) map coverages show promise of improving watershed assessment capabilities leading to better targeting of watershed practices and structures designed for lake water quality improvement and protection.

1. The National Wetland Inventory (NWI) mapping update for Iowa is providing an accurate location for all the wetlands, farm ponds and other water traps that can be used in sediment delivery calculations for lake watersheds. Most of the Upper Mississippi River Basin in Iowa is done and plans are to complete the Missouri River Basin area of western Iowa next year.

2. The Historic Aerial Photo Project is another useful coverage for planning and assessing watershed improvements. The data from this project is useful to see past farm practices (or lack of) and identify changes (wetlands drained, waterways built, sediment basins that have been built, etc.). This data coverage could help evaluate whether lake volume loss has been at a constant rate over the last 50-plus years. Additionally, this provides an accurate base map to reference old lake bathymetry and other maps that can aid in improving accuracy of lake volume estimates.

Local, State and Federal Partnerships

In order to achieve lake restoration goals it is critical that effective watershed partnerships are formed. This includes partnerships at the local level, but also at administrative levels of government. A multitude of programs offering nancial assistance to landowners for soil conservation and other water quality protection practices are offered through local, state and federal programs.

The strategy pursued in the lake restoration program will be to actively seek out key individuals with expertise at the local level and the program administration level. This expertise is needed to maximize access to nancial incentives for landowner participation in watershed improvement and lake restoration projects. The full range of possible lake restoration partners is almost limitless; however, listed below are several examples of potential partners in watershed improvement and lake restoration.

Local:

- Chamber of Commerce
- County Board of Supervisors
- County Conservation Board
- City/Town Mayors and Councils
- Conservation and Recreation Clubs and Organizations
- DNR Field Of ces (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 Commodity 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

ADDITIONAL INFORMATION

Several brochures are available on-line that offer more information about lake restoration and watershed improvement.

- Brochure highlighting Lake Ahquabi restoration success story: http://www.iowadnr.com/water/nonpoint/ les/ahquabi.pdf

- Brochures highlighting lake watershed improvement projects:

    - o Brushy Creek Lake http://www.iowadnr.com/water/nonpoint/ les/brushycreek.pdf

    - o Lake Darling http://www.iowadnr.com/water/nonpoint/ les/darling.pdf

    - o Nine Eagles Lake and Slip Bluff Lake http://www.iowadnr.com/water/nonpoint/ les/nineeagles.pdf