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Lake Water Quality, Recreation, & Restoration: The Importance of Stakeholder Involvement

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The Importance of Stakeholder Involvement

Sustainable Tourism and Environment Program (STEP)

University of Northern Iowa

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Lake Water Quality, Recreation & Restoration: *The Importance of Stakeholder Involvement*

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Executive Summary

Historically, Iowa's lakes have been plagued with numerous water quality problems including excessive siltation, nutrients, pesticides, and bacterial contamination. Iowa places a heavy reliance on voluntary efforts to address these problems, largely in the form of best management practices (BMPs). Studies have shown that BMPs can improve lake water quality and, in turn, increase recreational activity and visitor spending. In recognition of the potential economic, recreational, and social benefits of improved lake water quality, the Iowa Department of Natural Resources (IDNR) secured significant legislative funding in 2006 to initiate a state-wide lake restoration program (LRP).

LRP case studies are presented in this report to:

- Identify and promote BMPs used to improve lake water quality and spur LRP investment;
- Illustrate the positive impact of improved water quality on recreational activity, environmental sustainability, and local economies;
- Inspire long-term, wide-scale stakeholder participation and support for BMP projects aimed at enhancing lake aesthetics, water quality conditions, and lake amenities; and
- Illustrate how the LRP initiative presents a tremendous return-on-investment opportunity for proactive stakeholders to significantly improve lake recreational amenities and aesthetics.

A questionnaire-based survey, targeting state park programs located adjacent to impaired lakes was used to gain input on recreational activity, water quality issues, barriers to BMP implementation; educational efforts; and stakeholder involvement. The survey was emailed to 27 state park managers and 20 of the surveys were returned. Survey results indicated there was moderate to high visitation at the parks and the main usage was for fishing followed by recreational boating and then swimming. Over half (60%) of the parks experienced water quality advisories because of algae blooms and bacteria levels. More than half of the respondents rated lake water clarity below "moderate" and indicated the trend in water quality has essentially remained the same for the past three years. Survey responses suggest stakeholder involvement is weak or lacking. Most managers rated stakeholder involvement as less than "good," a rating linked to poorer water quality ratings. In cases where stakeholders were more involved, the lake was assigned a higher water quality rating.

Table of Contents

List of Figures

List of Tables

List of Survey Charts

INTRODUCTION

Iowa lakes have historically been plagued with numerous water quality problems, largely because of non-point source (NPS) pollution associated with agricultural practices (Gilley & Risse, 2000; Harmel, Torbert, Haggard, Haney, & Dozier. 2004; Yu, Northcott, & McIsaac. 2004). Of the 195 Iowa lakes and reservoirs assessed by the Iowa Department of Natural Resources (IDNR) in 2010, approximately 70 percent were identified as impaired or potentially impaired (IDNR, 2011). Excessive sediment, nutrients, pesticides, and bacterial contamination (e-coli) are typically the pollutants cited for the degradation of Iowa's lake water quality. However, more recently, greater attention has also been directed toward gross pollutants (anthropogenic litter) and its impact on water quality and aesthetics (Madhani, Madhani, and Brown, 2011; Environmental Water Resources Institute Urban Water Research Council, 2007). From a holistic view, these pollutants result in high water turbidity, eutrophication, beach/swimming advisories, visual blight, and blue-green algae warnings.

The State of Iowa has placed a heavy reliance on voluntary efforts to address its water quality issues, largely in the form of best management practices (BMPs). BMPs are used in both rural and urban environments to reduce surface runoff, promote infiltration, decrease soil erosion, attenuate pollutants; and improve surface water quality (Wise, 2008; Chaubey, Chiang, Gitau, & Mohamed, 2010). BMPs may be structural or non-structural in nature. Structural BMPs are constructed controls such as sedimentation ponds; grass waterways; constructed wetlands; permeable pavement/asphalt; riparian buffer zone plantings; terraces; and stream bank/shoreline stabilization. Non-structural BMPs focus on modifying land use practices to achieve water quality, erosion control and soil conservation objectives. Examples of non-structural BMPs include grazing management; nutrient management; regulations, and no-till or contour farming.

Recent studies have shown that lake water quality, particularly as perceived through water clarity and aesthetics, has a significant impact on recreational use (i.e., tourism), surrounding land values, and local economies (Vesterinen, Pouta, Huhtala, & Neuvonen, 2010; Egan, Kling, & Downing, 2009; and Kemper & Popp, 2008). In recognition of the potential economic, recreational, and social benefits of improved lake water quality, the IDNR secured legislative funding in 2006 to initiate a state-wide lake restoration effort. This effort included prioritizing 127 public lakes for renovation-restoration work (IDNR, 2006).

Project Objectives and Report Organization

This report was completed with a number of objectives in mind. First, it was developed as a potential educational outreach tool that may be used to inform lake stakeholders (e.g., local lake communities, adjacent landowners, and surrounding state, county, and city park/recreational area managers) on the value of lake aesthetics, water quality, and the importance of stakeholder involvement in lake restoration investment. Secondly, it was also designed to complement IDNR's lake restoration efforts by: 1) identifying and promoting BMPs that have been used to improve and preserve lake water quality and spur lake restoration investment; 2) illustrating the positive impact of improved water quality on recreational activity, environmental sustainability, and local economies through case study examples; 3) identifying key barriers to BMP implementation and lake restoration investment; and, most importantly, 4) inspiring long-term stakeholder participation and wide-scale community support for BMP projects aimed at enhancing lake aesthetics, water quality conditions, and lake amenities.

For clarity and continuity, the remainder of this report is organized into four main sections. The first section outlines the study design and methodology developed to meet the project's objectives. It also serves as an avenue to provide some background information on the topic through literature review. The second section of the report consists of case studies developed for three Iowa lakes that have addressed water quality degradation through stakeholder action, BMP implementation, and lake restoration activities. The third section presents the findings of a questionnaire-based survey presented to state park managers. It highlights their survey responses in regard to stakeholder involvement, water quality, BMPs, and lake restoration. The final section of the report consists of conclusions developed from the case study write-ups and survey responses.

STUDY DESIGN AND METHODOLOGY

A multi-faceted approach, relying on both primary and secondary data was used to develop this lake water quality report. The following provides the rationale and methodology used for project completion.

First, existing literature was used to identify BMPs used to improve and protect water quality. The literature review also served as a means of recognizing the positive social, economic, and recreational benefits of improved lake water quality. Background information from the literature review was subsequently used as a foundation in preparing this report.

The next phase of the project consisted of identifying and highlighting lake restoration case studies in Iowa. Credible case studies have been shown to be an effective means of instigating change, promoting stakeholder involvement, and gaining project support. They are often used to educate and influence a larger population. However, as pointed out by Seawright and Gerring (2008), case studies must be carefully selected with respect to project objectives. Consequently, a critical aspect of the project focused on selecting case studies suitable for influential and educational outreach. Existing lake restoration efforts in Iowa were reviewed to identify case studies that: 1) provide an influential means of educating and promoting BMPs used to improve lake water quality and spur investment in lake restoration; 2) underscore the importance of community participation, policy-maker engagement, and stakeholder involvement in protecting, improving, and preserving lake water quality (Gibbons, Zammit, Youngenton, Possingham, Lindenmayer, Bekessy, Burgman, Colyvan, Considine, Felton, Hobbs, Hurley, McAlpine, McCarthy, Moore, Robinson, Salt, & Wintle, 2008; Hernandez & Uddameri, 2010); and 3) stress the need for continual, long-term investments in water quality BMPs for lake and community sustainability. Appropriate case studies were incorporated into this report to educate stakeholders on the positive benefits realized from improved lake water quality, influence decision-making, and gain support for more broad-based BMP implementation. They were also selected to reflect the importance of stakeholder participation, commitment, and ownership in lake restoration efforts.

Finally, data were collected for the study through a questionnaire-based survey targeting Iowa state park programs associated with impaired lakes. State park program managers were selected as survey recipients due to their vested interest in outdoor recreation and direct interaction with the public. A copy of the survey is provided as Attachment A. Overall, the intent of the survey was to gain insight on lake recreational activity, water quality issues facing the lake, barriers to BMP implementation; and the degree of stakeholder involvement in improving and protecting lake water quality.

The survey addressed four areas: water quality; recreation; BMP implementation; and education. The first and second portions of the survey included questions focused on lake water quality and recreational use. The third component focused on identifying BMPs that have been implemented in an effort to protect and improve lake water quality. This component was also designed to identify barriers to BMP implementation and gauge the degree of stakeholder involvement in improving lake water quality conditions. To assess how state park programs engage stakeholders, the fourth aspect of the survey included questions on educational outreach efforts and the locality of recreationists that frequent the lake.

Geographic information system (GIS) datasets obtained through the Iowa Department of Natural Resources (IDNR) were used to identify 30 state parks located adjacent to impaired lakes. A list of state parks and their associated lakes targeted by the survey are provided in Table 1. A link to the on-line survey via Survey Monkey was subsequently emailed to 27 park management offices for data collection. Park management was also contacted by telephone to encourage survey participation (for optimum response rate) and briefly explain the purpose of the study. Survey responses were subsequently compiled and analyzed using SurveyMonkey.

TABLE 1
Iowa State Parks Associated with Impaired Lakes

State Park	Lake	Park Management Office Email
George Wyth State Park	George Wyth Lake	George_Wyth@dnr.iowa.gov
Gull Point State Park	West Okoboji	Gull_Point@dnr.iowa.gov
Backbone State Park	Backbone Lake	backbone@dnr.iowa.gov
Summerset State Park	Banner Lake North & Banner Lake South	Summerset@dnr.iowa.gov
Beeds Lake State Park	Beeds Lake	Beeds_Lake@dnr.iowa.gov
Geode State Park	Lake Geode	Geode@dnr.iowa.gov
Kearny State Park	Five Island Lake	paccb@ncn.net*
Lake Keomah State Park	Lake Keomah	Lake_Keomah@dnr.iowa.gov
Nine Eagles State Park	Nine Eagles Lake	Nine_Eagles@dnr.iowa.gov
Okamanpedan State Park	Tuttle Lake	Gull_Point@dnr.iowa.gov
Pine Lake State Park	Pine Lake	Pine_Lake@dnr.iowa.gov
Swan Lake State Park	Swan Lake	info@carrollcountyconservation.com*
Trappers Bay State Park	Silver Lake	Gull_Point@dnr.iowa.gov
Union Grove State Park	Union Grove Lake	Union_Grove@dnr.iowa.gov
Lake Ahquabi State Park	Lake Ahquabi	Lake_Ahquabi@dnr.iowa.gov
Lewis & Clark State Park	Blue Lake	Lewis_and_Clark@dnr.iowa.gov
Red Haw State Park	Red Haw Lake	Red_Haw@dnr.iowa.gov
Lake Darling State Park	Lake Darling	Lake_Darling@dnr.iowa.gov
Bob White State Park	Bob White Lake	wccb@grm.net*
Blackhawk State Park	Blackhawk Lake	Black_Hawk@dnr.iowa.gov
Rock Creek State Park	Rock Creek Lake	Rock_Creek@dnr.iowa.gov
Big Creek State Park	Big Creek Lake	Big_Creek@dnr.iowa.gov
Lake Cornelia State Park	Lake Cornelia	wccb@co.wright.ia.us*
Lake of Three Fires State Park	Lake of Three Fires	Three_Fires@dnr.iowa.gov
Lake MacBride State Park	Lake MacBride	Lake_Macbride@dnr.iowa.gov
Green Valley State Park	Green Valley Lake	Green_Valley@dnr.iowa.gov
Lake Manawa State Park	Lake Manawa	Lake_Manawa@dnr.iowa.gov
Prairie Rose State Park	Prairie Rose Lake	Prairie_Rose@dnr.iowa.gov
Viking Lake State Park	Viking Lake	Viking_Lake@dnr.iowa.gov

* Indicates the state park is managed by the county.

CASE STUDIES

The State of Iowa has recognized the value of lake water quality to communities, local economies, the environment, and recreational opportunities. Consequently, in 2006, Iowa's legislature appropriated specific funding directed toward restoring Iowa's lakes. Objectives of the Iowa Lakes Restoration Program include:

- Develop a cost-effective, successful program with a positive return on investment for Iowa citizens;
- Obtain strong local community commitment to lake and watershed protection;
- Ensure significant improvements in water clarity, safety, and quality of Iowa lakes;
- Develop a sustainable, healthy, functioning lake system; and
- Ultimately de-list the renovated lake from the impaired waters list.

Figure 1 illustrates the historic funding levels directed toward lake restoration in Iowa.

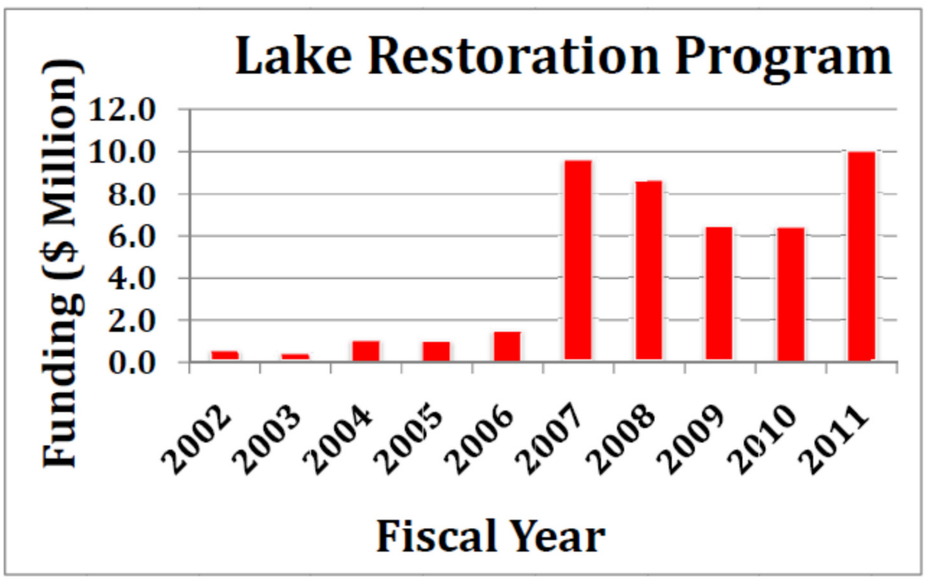

Figure 1 - State of Iowa lake restoration funding, 2001 – 2011 (IDNR, 2010).

To accomplish its objectives, a number of ambitious water quality goals have been defined by the program with respect to water clarity, safety, biota, and sustainability. These include:

- **Achieve a water clarity of 4 ½ feet (as determined with a Secchi disk) 50 percent of the time from April through September:**
- **Create conditions where beaches meet water quality standards for recreational use;**
- **Produce and maintain a diverse, balanced, and sustainable aquatic community; and**
- **Sustain lake restoration water quality benefits for a period of at least 50 years.**

Because funding is limited and lake renovation tasks are often quite expensive, a high degree of lake stakeholder involvement, support, and commitment is a requirement of the Iowa Lake

Restoration Program. This level of support is essential in meeting program objectives and water quality goals. Additionally, restoration efforts cannot begin until a lake has been adequately protected by watershed BMPs that effectively control nutrient and sediment delivery to the lake. In short, lakes with well documented, effective BMPs and strong community participation are more likely to be recipients of state lake restoration investment.

The following case studies on Lake Darling, Lake Ahquabi, and Five Island Lake (see Figure 2) are provided to inform stakeholders on the types of BMPs used to improve and protect lake water quality and, in turn, spur state investment toward enhancing lake amenities and aesthetics through Iowa's lake restoration program. They are also intended to enlighten stakeholders on benefits realized by lakes that have experienced improved water quality conditions and lake restoration investment. The primary intent of highlighting these case studies, however, is to underscore the importance of stakeholder commitment and stress the need for a wide spread - high degree of stakeholder involvement in BMP implementation.

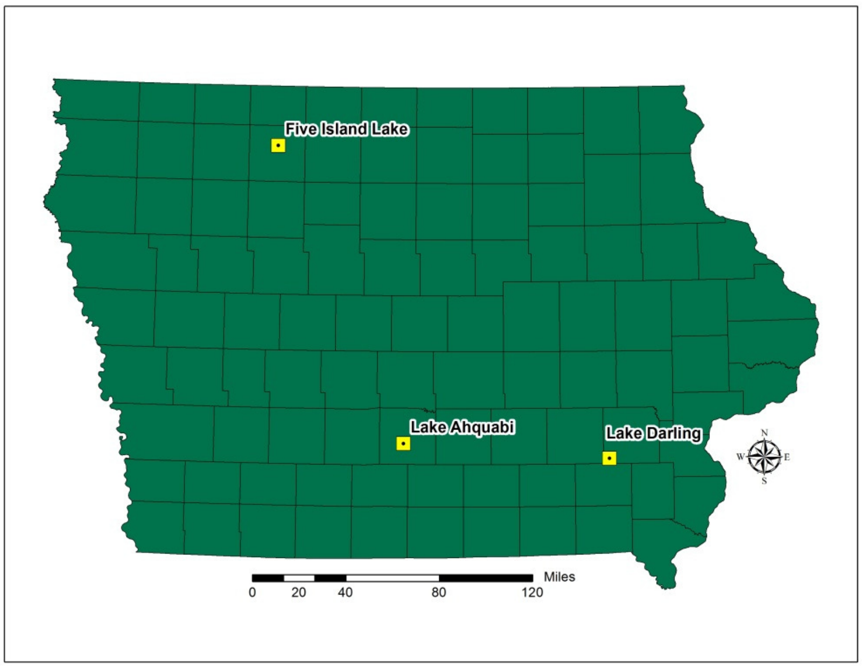

Figure 2 - Case study lake locations.

Lake Darling

Lake Darling is an impoundment (i.e., man-made lake) located within Lake Darling State Park, a 1,417 acre park area in Washington County. The watershed containing Lake Darling is roughly 12,179 acres. Like most Iowa watersheds, land use is dominated by agricultural row crop production (54.5%). A land use diagram for the watershed is shown as Figure 3. The remaining land use consists of grassland (27.7%), forested area (12.2%), water (2.9%) and developed area (2.7%).

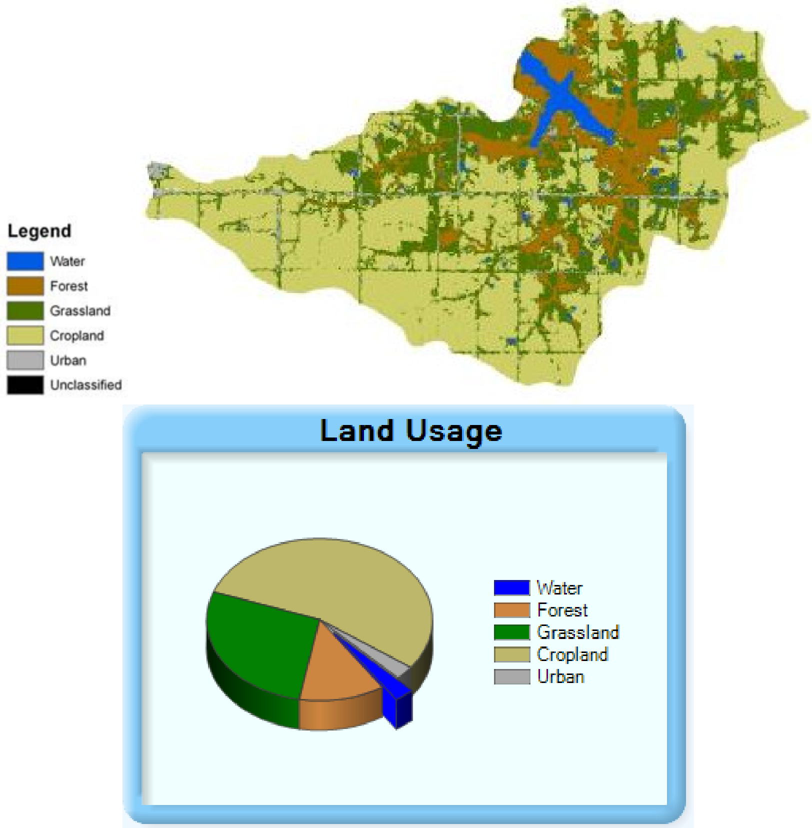

Figure 3 - Lake Darling land use characteristics (Source: http://limnoweb.eeob.iastate.edu/minireport/Default.aspx).

After its construction in 1950, the lake was approximately 302 acres in area reflecting a watershed to lake area ratio of approximately 40.3 to 1. Now, because of sedimentation (Iowa's greatest water quality problem), the lake has shrunk to 267 acres, its maximum depth decreased from 22 to 18 feet, and the USGS estimated siltation had reduced its volume by 24% (IDNR, 2010; Friends of Lake Darling, 2008). Figure 4 includes aerial photographs of the area from the 1930s (pre-construction) to its current condition represented by 2010 imagery. The gradual decline of the lake's shoreline through time is readily evident in the color infra-red imagery taken of the lake in 1980 and 2002. In addition to sedimentation, the lake has also been plagued by agricultural nutrients and high bacteria levels, contaminants that often accompany high sedimentation rates. As a result, Lake Darling has been designated as an impaired lake due to excessive sediment and high bacteria levels.

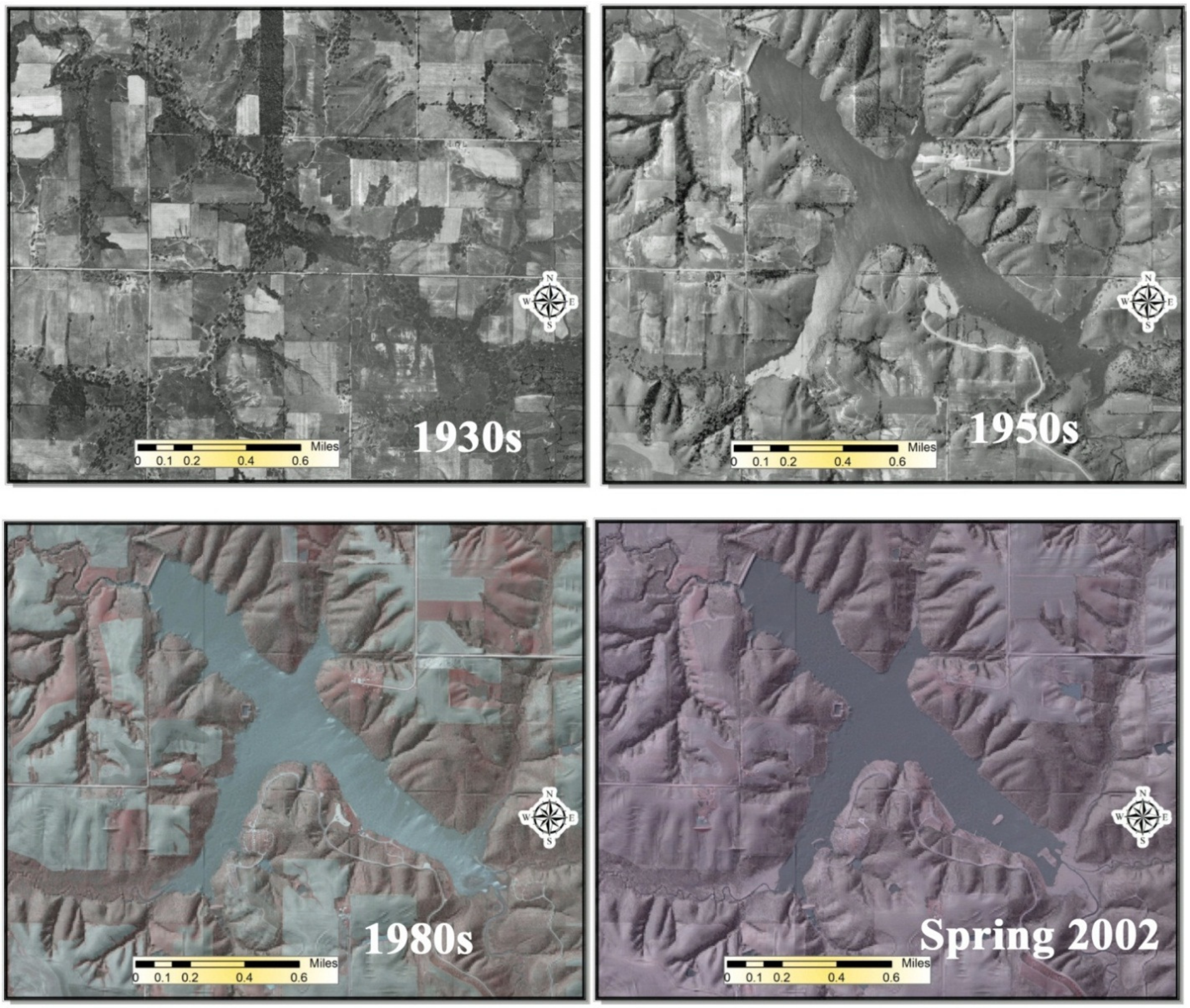

Figure 4 - Historic aerial imagery of Lake Darling, 1930s – 2002 (Imagery source: http://www.igsb.uiowa.edu/nrgislibx/gishome.htm).

It's estimated that Lake Darling State Park once received approximately 200,000 visits per year. However, intensive agricultural practices of the mid-1970s mobilized sediment to the lake and caused a rapid decline in water clarity. Degrading water quality conditions, increasingly poor fisheries, and e-coli beach advisories created a negative public image of the lake which led to decreased park visitation and tourism dollars to the region.

After recognizing the detrimental consequences of poor lake water quality, the local community and surrounding landowners organized and began an intensive campaign to implement structural and non-structural BMPs throughout the lake watershed. This high degree of community involvement was key to Lake Darling's restoration investment. Since 2000, over 150 construction projects have been completed involving 57 of the 71 landowners in the Lake Darling watershed (IDNR, 2007; Friends of Lake Darling, 2008). Eleven of these structural BMPs were constructed within the park. Structural BMPs largely consisted of sediment control structures such as ponds; tile outlet terraces; and water control basins. Non-structural BMPs were also implemented. These included placing land in to the conservation reserve program

(CRP); no-till farming (i.e., conservation tillage); contour buffer strips; establishment of filter strips; tree plantings; and nutrient management. Structural and nonstructural BMPs have also been implemented within the park. These include water impoundments used to intercept sediment delivery to the lake and volunteer litter cleanup projects organized by the Friends of Lake Darling.

Because of these efforts, sediment delivery to the lake decreased by an estimated 40%, water clarity has improved dramatically, fisheries have rebounded, and bacterial levels (e-coli) dropped significantly leading to fewer swimming advisories. Park visitation is also on the rise, a benefit most notably realized by residents and businesses of Brighton, a community of approximately 670 people located approximately 3 miles southeast of the park. Increased draw, brought about by improved lake conditions, has increased tourism traffic and spending in this community.

All these efforts provided a solid foundation for an investment in lake restoration projects. The following restoration projects are to be completed from 2010 through 2012: lake dredging; shoreline restoration; dam and spillway renovation; shoreline armoring; fishing pier and jetty construction; sediment retention basin, wetland and terrace construction; new boat ramp and parking lot construction; and fish habitat improvements. To date, the cost for these extensive restoration projects is projected at 4.8 million dollars (IDNR, 2010).

Lake Ahquabi

Lake Ahquabi is an impoundment located within Lake Ahquabi State Park, a 770 acre park area in Warren County south of Indianola. The watershed containing Lake Ahquabi is roughly 3,321 acres. A land use diagram for the watershed is shown as Figure 5 and consists of grassland (34.1%), forested area (32.1%), row crop production (21.8%), water (8.6%) and developed area (3.5%).

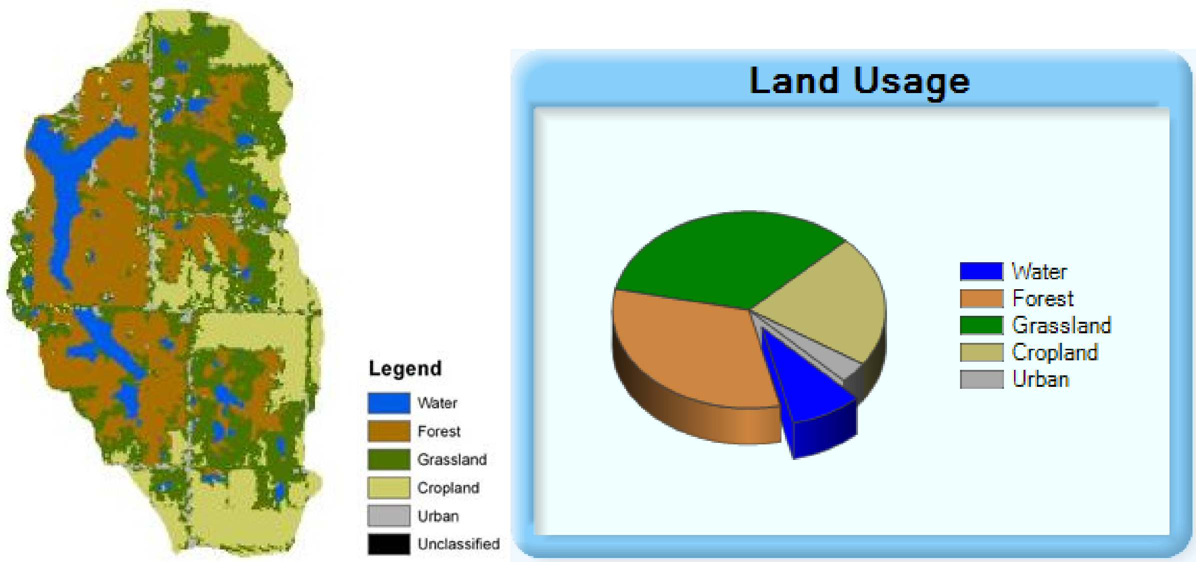

Figure 5 - Lake Ahquabi land use characteristics (Source: http://limnoweb.eeob.iastate.edu/minireport/Default.aspx).

The lake was constructed in the 1930s, was originally 125 acres in area and has a watershed to lake area ratio of approximately 26.6 to 1. By the 1980s, however, sedimentation from agriculture had reduced the size of the lake to 114 acres. Lake water quality and clarity was also being degraded by agricultural nutrients. Because of the poor water quality conditions, less desirable fish species such as carp, gizzard shad and slow-growing panfish began to dominate the lake. Attendance to the park began to suffer, diminishing to an estimated 60,000 visitor days per year.

A concentrated effort was subsequently made by lake stakeholders and government agencies to improve water quality, fishing, and park amenities. BMPs on pasture and cropland were implemented to reduce sedimentation and nutrients to the lake. These consisted of renovating two sedimentation basins and the development of five constructed wetlands. Conservation practices such as no till farming were also implemented within 95% of the cropland area of the watershed. Together it's estimated that these efforts reduced sediment delivery to the lake by 50%. Color infra-red aerial imagery of Figure 6 illustrates some of the sediment control ponds constructed since the 1980s. As shown, numerous sedimentation ponds have been constructed within and immediately adjacent to the state park.

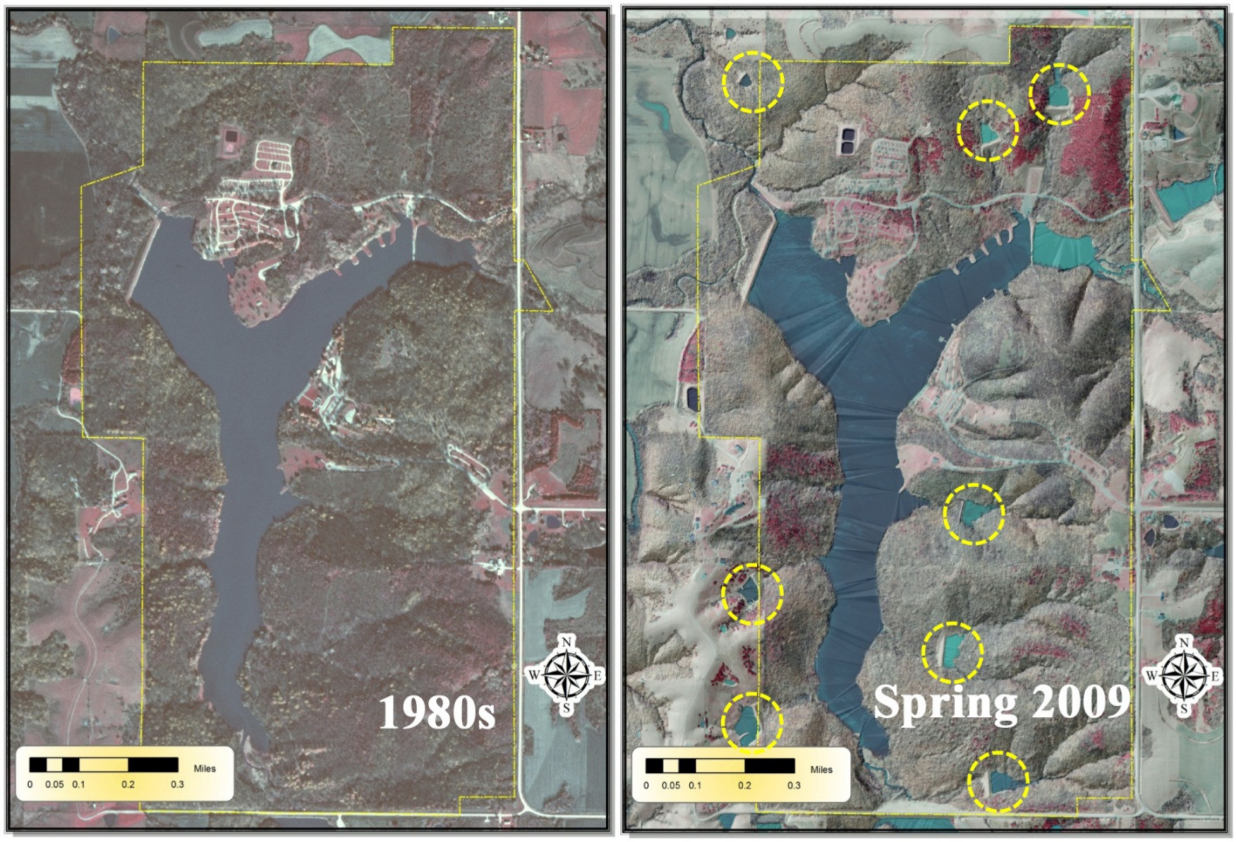

Figure 6 - Historic aerial imagery for Lake Ahquabi, 1980s – 2009 (Imagery source http://www.igsb.uiowa.edu/nrgislibx/gishome.htm).

Once BMPs were underway to protect the watershed, a four million dollar investment in lake restoration began and was completed by 1997. These projects improved lake amenities: hydraulic dredging of shallow upper reaches of the lake; spillway construction and repair; stocking game fish and fish habitat improvement; construction of a boat ramp and fishing pier; constructing and renovating fishing jetties; armoring the shoreline; and installing a lake aeration system.

Results of the BMPs and lake restoration projects have been impressive. Fishing has greatly improved and the number of undesirable fish species has diminished, water clarity has increased from under 20 inches to over four feet, and nutrient delivery to the lake has shown a marked decrease. The park also experienced an increase in visitors. By 1999, park visitor days had climbed to 206,000 per year (IDNR, 2004).

Based on estimates by Iowa State University (2007), Iowa's day-use park visitors spend roughly $50 per day while campers spend an estimated $55 per day (2006 dollars). Based on these spending figures, the jump in Lake Ahquabi State Park visitor days since the 1980s represents over $7 million of additional annual spending within the region.

Five Island Lake

Five Island Lake is a 1,002 acre natural (glacial) lake located just north of Emmetsburg, Iowa in Palo Alto County. The 8,429 acre watershed is dominated by row crop agriculture which accounts for 74.9 percent of the watershed's land use (see Figure 7). Remaining land use within the watershed includes water (12.0%), grassland (9.6%), forested area (1.8%), and developed area (1.7%). The watershed to lake area ratio is approximately 8.4 to 1.

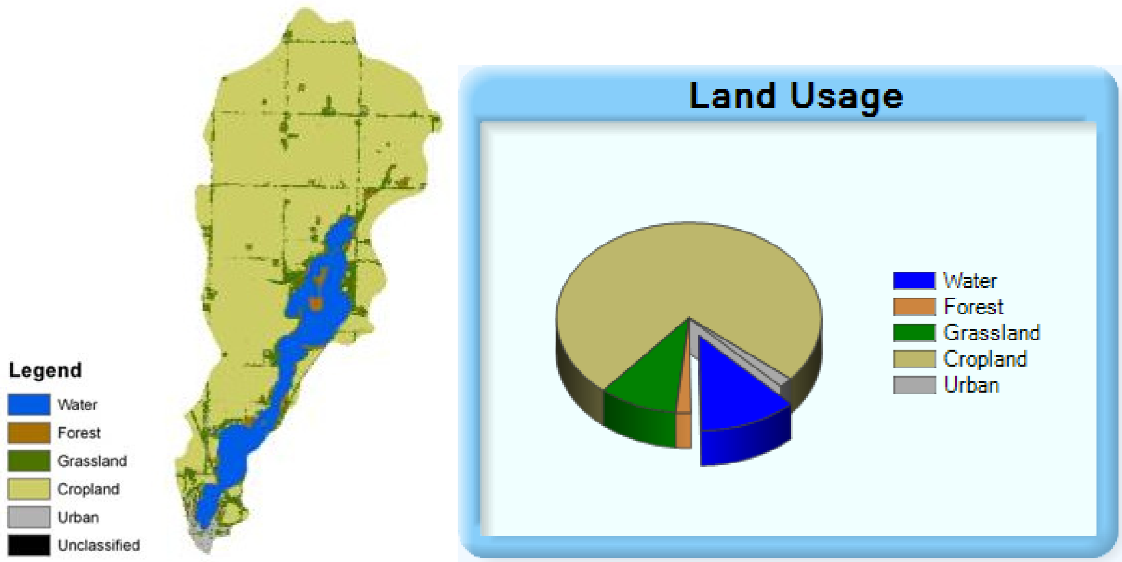

Figure 7 – Five Island Lake land use characteristics (Source: http://limnoweb.eeob.iastate.edu/minireport/Default.aspx).

Years of diminishing recreational use, poor water quality conditions, and shrinking lake levels prompted concerned local citizens to establish the Five Island Lake Board (FILB) in 1989. The major goals of FILB included increasing the depth of the lake and improving water quality (IDNR, 2006). To accomplish these goals, FILB has implemented a number of water quality BMPs and lake restoration efforts funded through a mix of local and state monies. As part of the efforts, approximately 10.5 miles of shoreline was stabilized with rip rap, over five million cubic yards of silt were hydraulically dredged from the lake, BMPs were implemented throughout the watershed to reduce nutrients and sediment entering the lake, and the City of Emmetsburg is implementing urban storm water BMPs. To date, local funding for BMPs and lake restoration efforts has topped 1.2 million dollars. Additionally, the high degree of local commitment to the effort also allowed state funding to be secured in the form of matching grants. To date, 1.1 million dollars in state restoration funds have complemented local monies directed toward this project (IDNR, 2010).

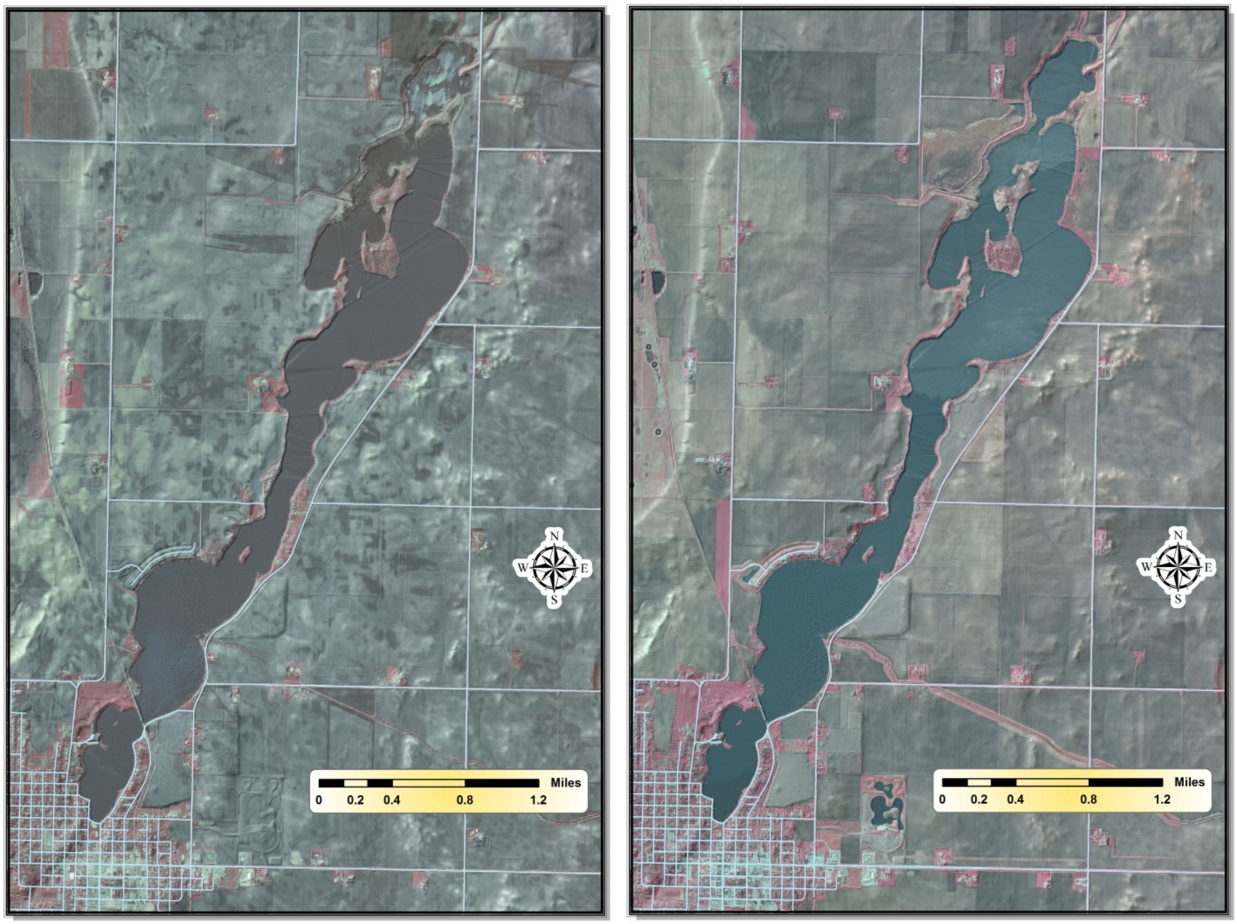

Figure 8 - Color infra-red imagery of Five Island Lake in the 1980s (left) and 2007 (right) - note the sedimentation at the northern end of the lake in 1980 (Imagery source: http://www.igsb.uiowa.edu/nrgislibx/gishome.htm).

Case Study Summary

Table 2 summarizes the physical characteristics of each lake described in this case study review. As shown, each case study lake realized significant State investment to improve lake and recreational amenities.

TABLE 2
Case Study Summary Characteristics

Lake	**Lake Area (acres)**	**Watershed:Lake Ratio**	**% Row Crop Agriculture**	**Type**	**State Restoration Funding (million $) / LRP Projects**
Lake Darling	267	40.3:1	54.5%	Impoundment	**$4.8 /** Dredging; shoreline restoration & amoring; dam & spillway renovation; fishing pier & jetty construction; boat ram & parking lot construction; fishery improvement & protection; and construction of sedimentation ponds, wetlands, & terraces.
Lake Ahquabi	114	26.6:1	21.8%	Impoundment	**$4 /** Dredging; shoreline amoring; spillway repair; fishing pier construction; jetty renovation; boat ramp construction; fishery improvement & protection; and lake aeration system.
Five Island Lake	1,002	8.4:1	74.9%	Natural	**$1.1 /** Lake dredging; and shoreline armoring

STATE PARK SURVEY FINDINGS

As indicated previously, the intent of the questionnaire-based survey was to gain insight on lake recreational activity, water quality issues facing the lake, barriers to BMP implementation; and the degree of stakeholder involvement in improving and protecting lake water quality. Responses were obtained from 20 of the 27 state park management offices that were asked to complete the project survey, reflecting a 74% response rate. The following highlights key aspects of the responses obtained and notes some of the more revealing comments provided in regard to water quality, stakeholder involvement, and BMP/lake restoration efforts.

Recreational Use

Charts 1 through 5 reflect survey responses related to recreational activity and park visitation. As shown by Chart 1, all 20 park managers rated the degree of summer park visitation as moderate to high. Eleven of the 20 respondents (55%) rated summer park visitation as "High." Chart 2 clearly indicates fishing as the dominant lake recreational activity of park visitors. This was followed by recreational boating and then swimming. As shown in Chart 3, the estimated travel distance of park visitors varied somewhat. However, the visitor travel distance for approximately 85% of the parks was estimated to be within the range of 11 to 50 miles. All 20 parks responding to the survey indicated park amenities included public access to a beach for swimming. However, only two respondents indicated there was an effort to monitor beach or lake usage.

Interestingly, when asked about the relationship between park visitation and funding (see Chart 5), a majority of the respondents (14 or approximately 70%) indicated there was no direct financial incentive (to that specific park) to increase park visitation.

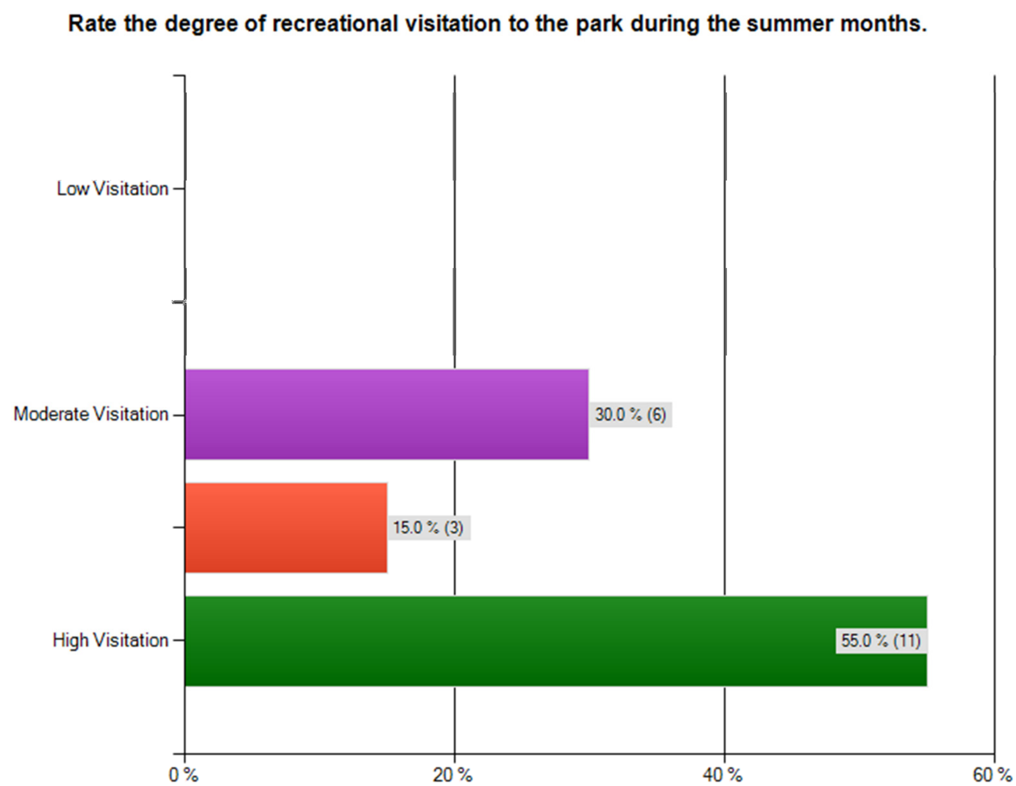

Chart 1

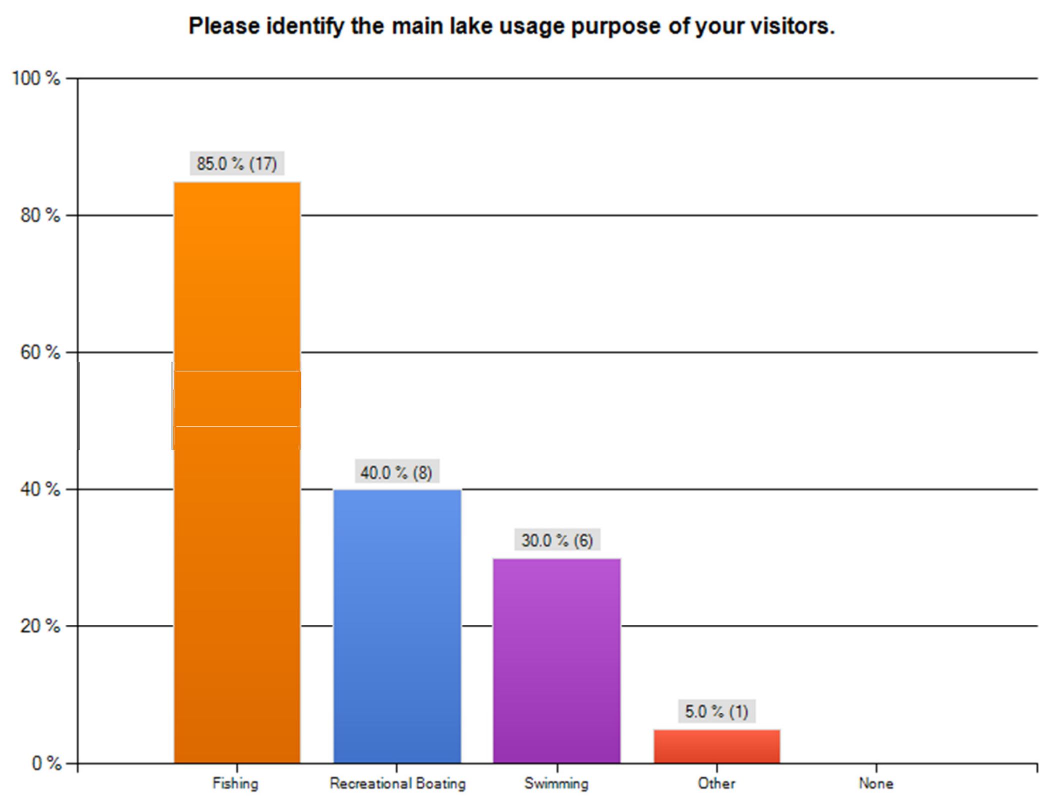

Chart 2

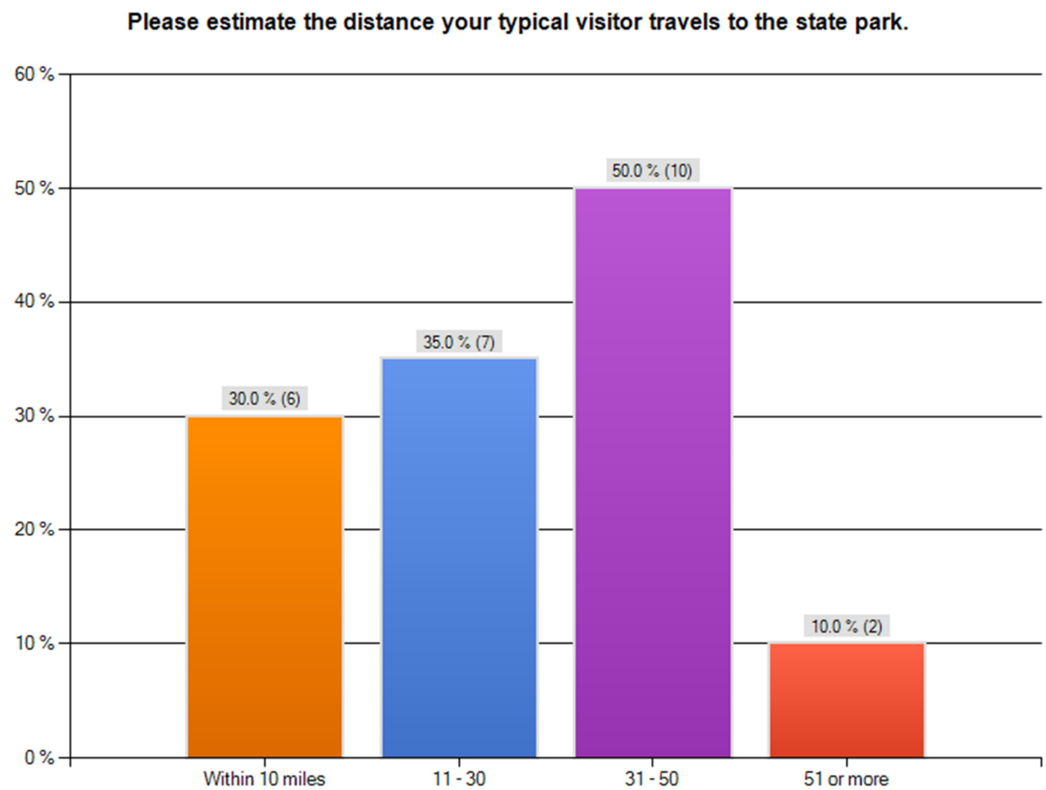

Chart 3

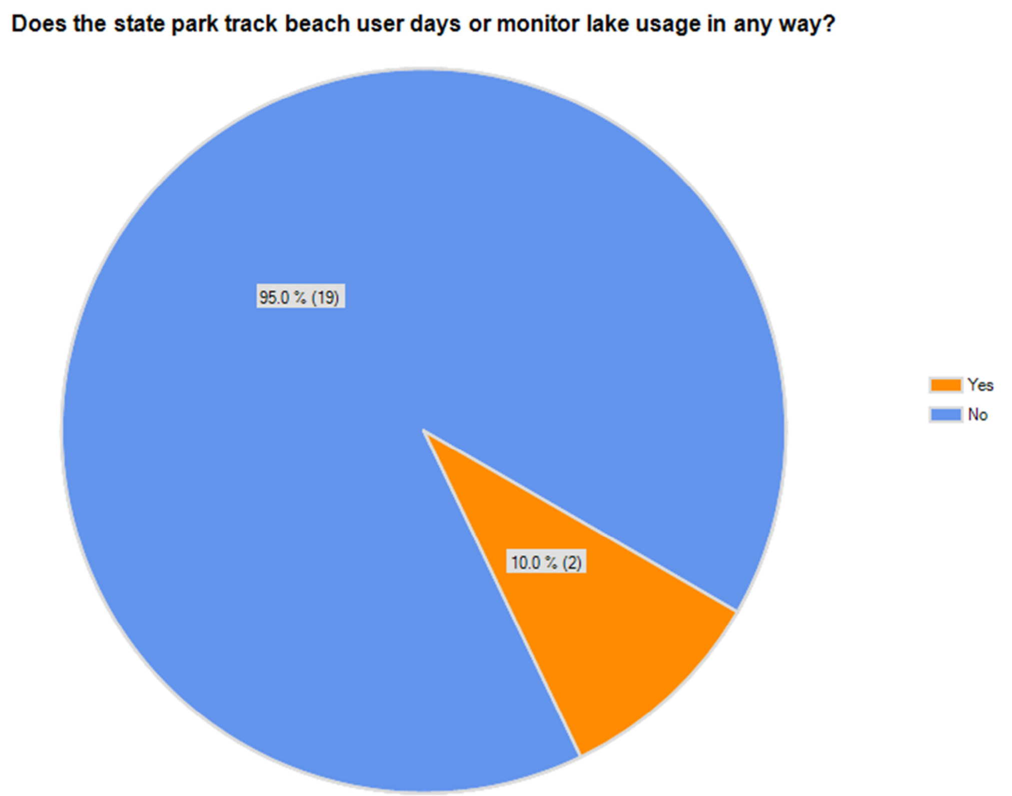

Chart 4

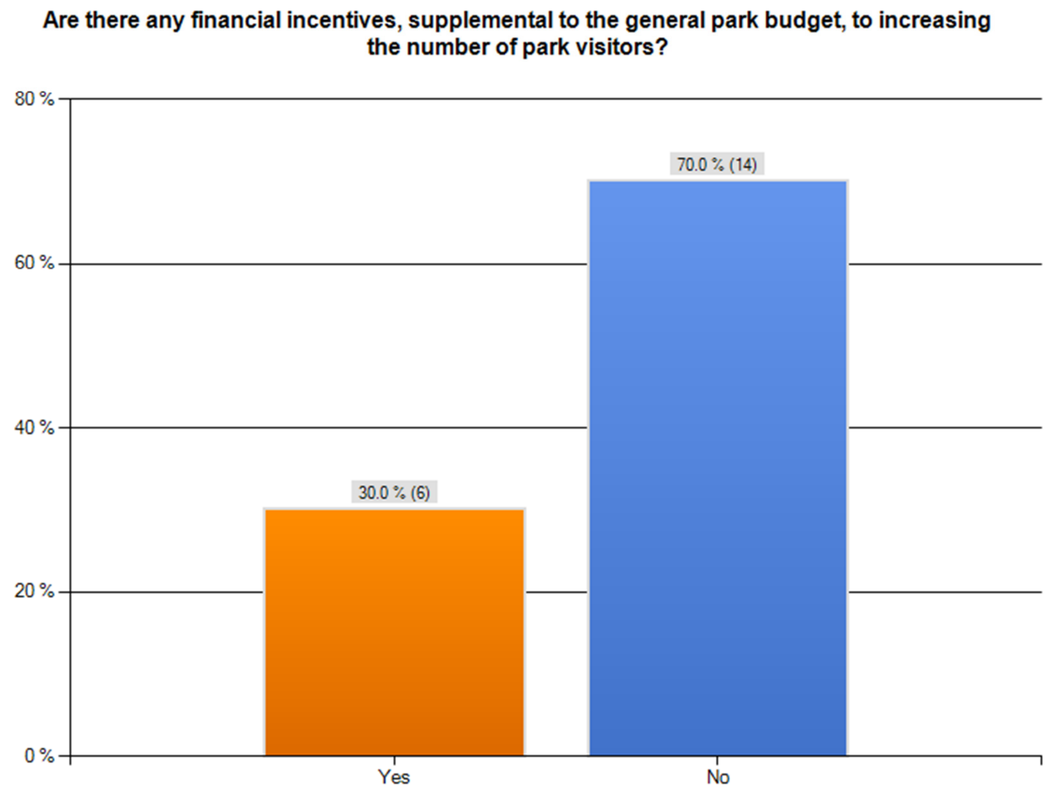

Chart 5

Water Quality

Charts 5 through 8 illustrate feedback obtained from state park managers on the water quality. As shown in Chart 5, 11 (55%) of the respondents rated the clarity of their lake water below "moderately clear." Four respondents (20%) rated the lake water quality as poor because of turbidity. Only six (30%) of the respondents perceived their lake water clarity to be better than "moderately clear."

In regard to a survey question on the perceived trend in water quality over the last three years, a majority (11 or 55%) of the respondents indicated water quality has essentially remained unchanged. Only five respondents (25%) believed lake water quality improved somewhat while four respondents (20%) indicated water quality had degraded to a certain degree.

Over the last three years, 12 of the respondents indicated water quality advisories had been issued for their lake. Of these respondents:

- **Eight indicated advisories were solely due to high bacteria (e-coli) levels;**
- **Three indicated advisories were due to a combination of bacteria levels and blue-green algae; and**
- **One respondent attributed the water quality advisory solely to algal blooms**

Sediment, followed by agricultural nutrients, is believed to be the most problematic pollutants affecting lake water quality. These water quality problems were closely followed by algal blooms, turbidity and e-coli bacteria. Pesticides along with litter/trash were viewed as more minor water quality problems by state park managers.

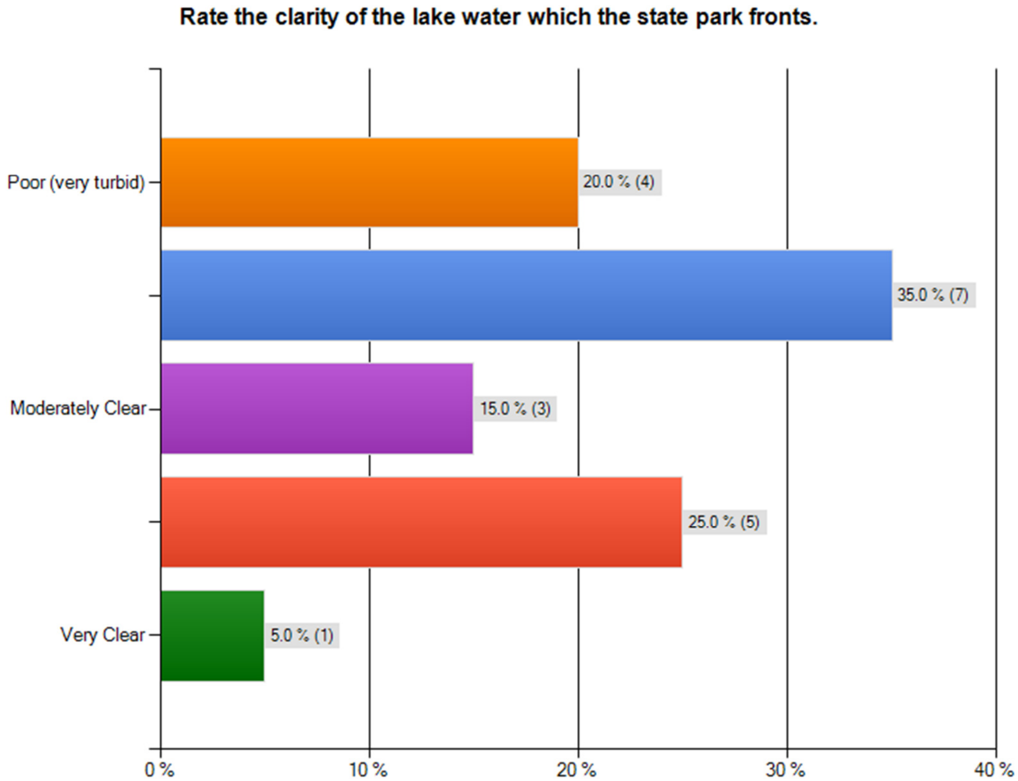

Chart 6

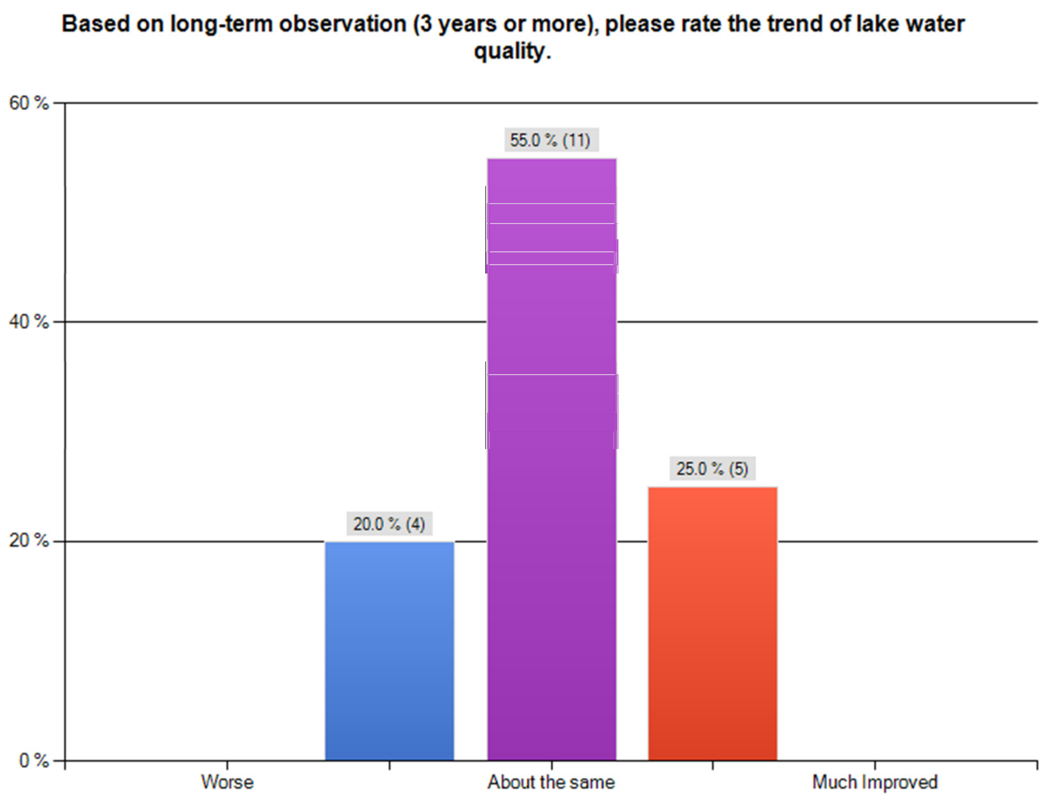

Chart 7

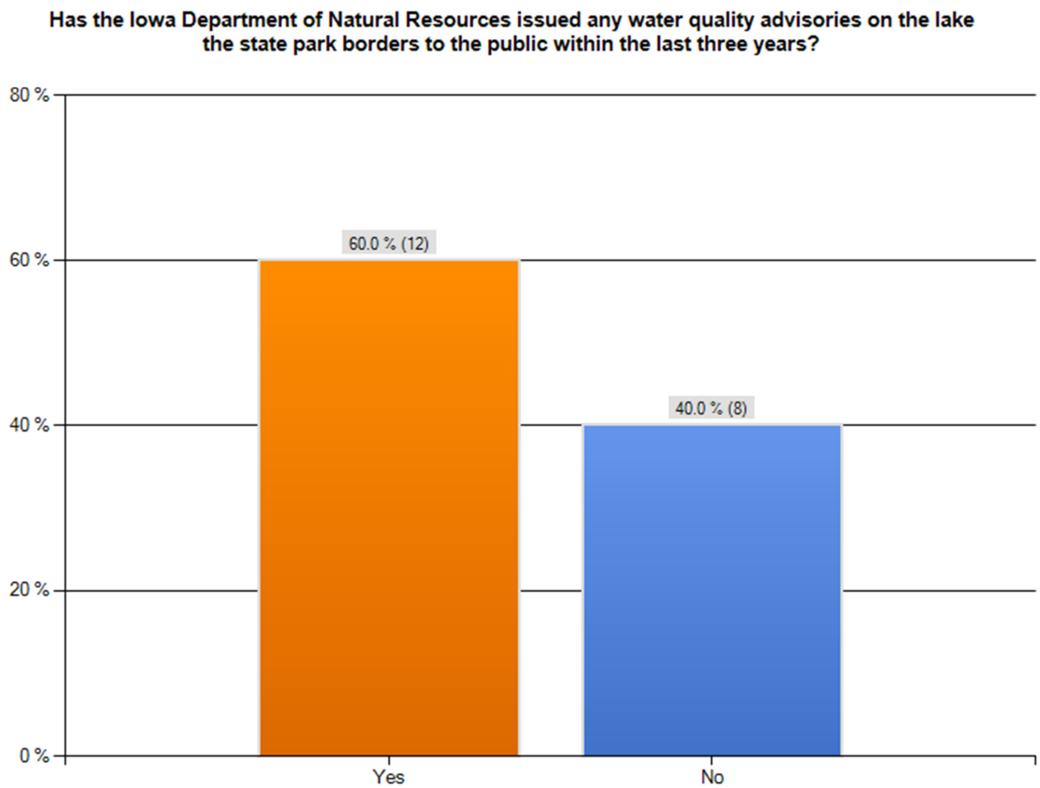

Chart 8

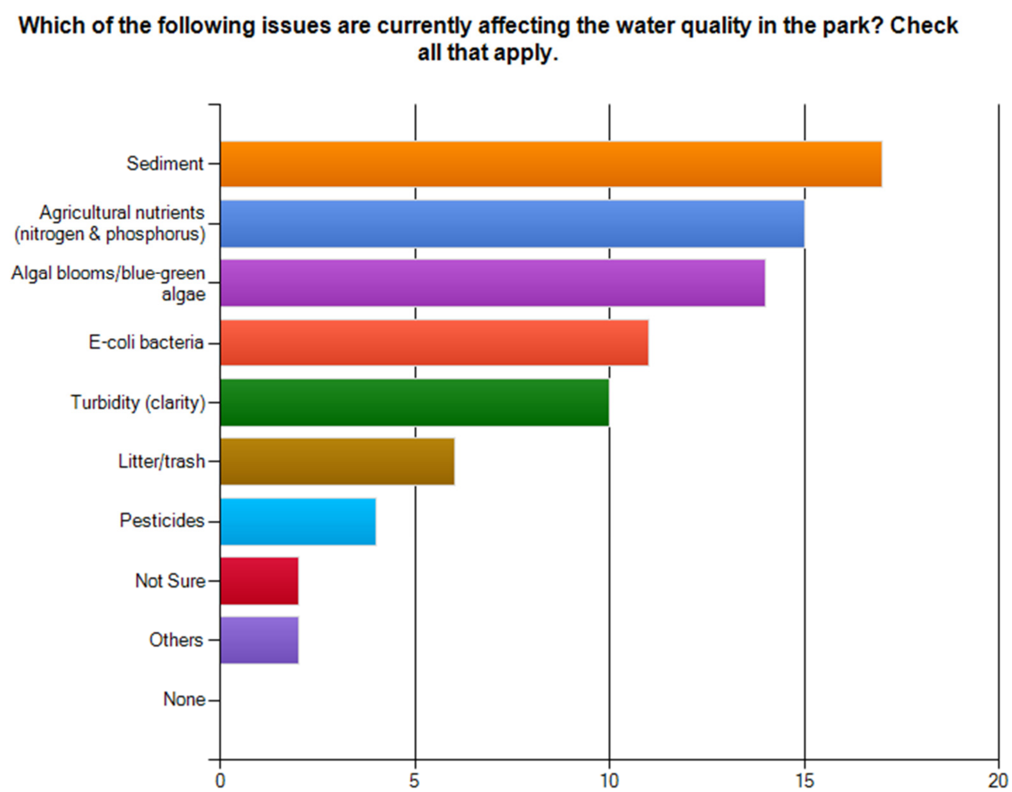

Chart 9

When asked to elaborate on the most problematic water quality issue facing beach use and the public's perception of lake water quality, the following responses were provided.

- ***Turbidity / clarity***
- ***The perception that the water is "dirty" needs to be overcome. This can be accomplished by educating people and reducing "poor" water quality tests.***
- ***Goose feces (2)***
- ***Although the beach sees regular use by the public, I believe that since the lake has high turbidity, the water is considered to be unsafe by some of the public even though our monitoring comes back safe for beach use.***
- ***Algae blooms and green water***
- ***Lack of sand, aquatic vegetation***
- ***E-coli and blue green algae***
- ***Algae***
- ***Microcystin and the algae blooms associated with it.***
- ***Bacteria, too many geese and flooding***
- ***E-coli***
- ***The idea that the water is hazardous or toxic. Especially when advisories have been posted and then lifted - people will call the park and ask if it's safe to swim in. I think the public perception of an advisory is different from what the DNR's perception of an advisory is.***
- ***Algal blooms. They do not want to swim in a green lake.***
- ***In the past,it has been algae blooms and poor water clarity, we are currently finishing up an extensive lake restoration project and expect these problems to be taken care of. During the project the beach has been closed the past three years.***
- ***Occasional e-coli advisories.***
- ***Not having a pinpoint source for bacteria issues. The public gets the information from the media which doesn't always tell all the facts but has gotten better since making friends with the media.***

Stakeholder Involvement, BMP Implementation, Restoration, and Educational Outreach

Charts 9 through 13 illustrate the responses obtained for survey questions related to stakeholder involvement, BMP implementation, lake restoration activities, and educational outreach efforts. For clarity, the following highlights survey findings by topic.

Stakeholder Involvement. When asked to rate the degree of lake stakeholder involvement, 11 of the respondents (55%) indicated it was "poor" or could use some improvement. Of the 11 cases where stakeholder involvement was rated at less than "good:"

- Approximately 73% (8) rated lake water quality as less than "moderately clear;" and
- Roughly 36% (4) of this response group rated water quality as "poor" and 27% (3) indicated the lake's water quality has degraded.

Eight respondents rated stakeholder involvement as "good" or slightly better than "good." Only one respondent rated stakeholder involvement as "very good." Of the 9 cases where stakeholder involvement was rated "good" or better:

- Approximately 67% of this grouping (i.e., 6 respondents) rated water clarity as "moderately clear" to somewhat better than "moderately clear;"
- Two respondents indicated water clarity was slightly less than "moderately clear;" and
- One respondent rated water clarity as "poor."
- Approximately 89% of this response group (8 of 9 respondents) believed the lake's water quality has remained unchanged or improved slightly over the last three years.

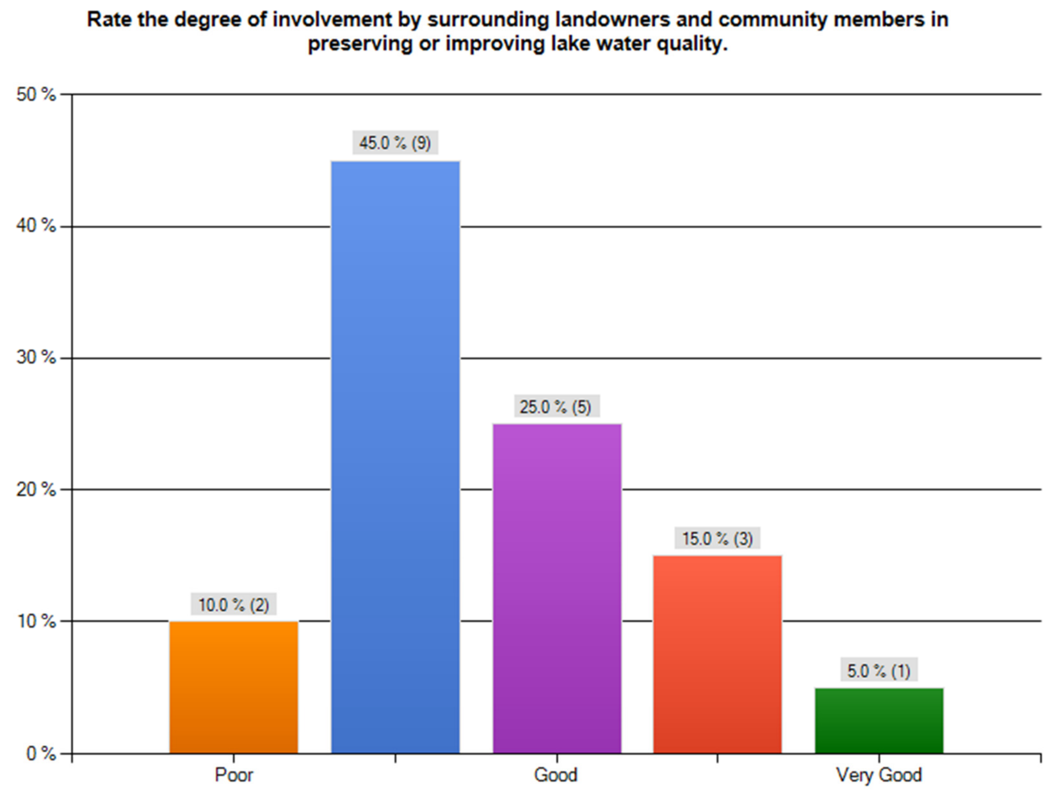

Chart 10

<u>**BMP Implementation.**</u> In regard to BMPs, 12 of the respondents were aware of BMPs that had been implemented by lake stakeholders. Of these, farming conservation practices and sedimentation ponds were the most common BMPs known to have been implemented within the lake's watershed. Survey results also found that a number of state parks had implemented BMPs of their own, the most common of which included organized litter cleanups, sedimentation ponds, and constructed wetlands (see Chart 14). However, as revealed in Chart 13, cost clearly stands out as the greatest barrier to BMP implementation within state parks.

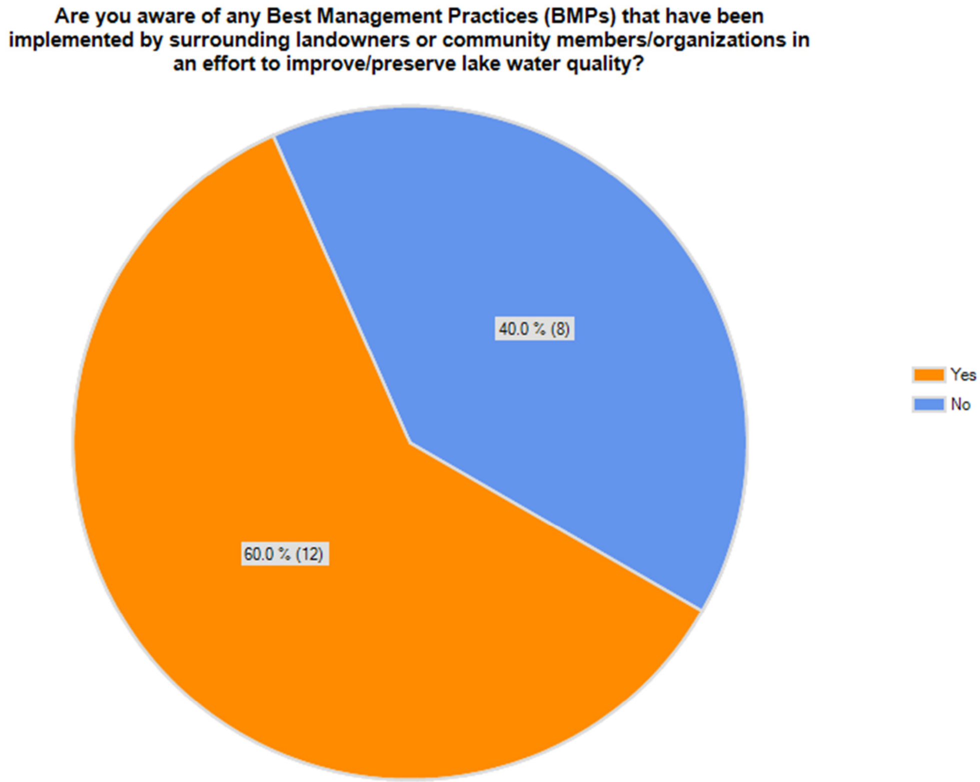

Chart 11

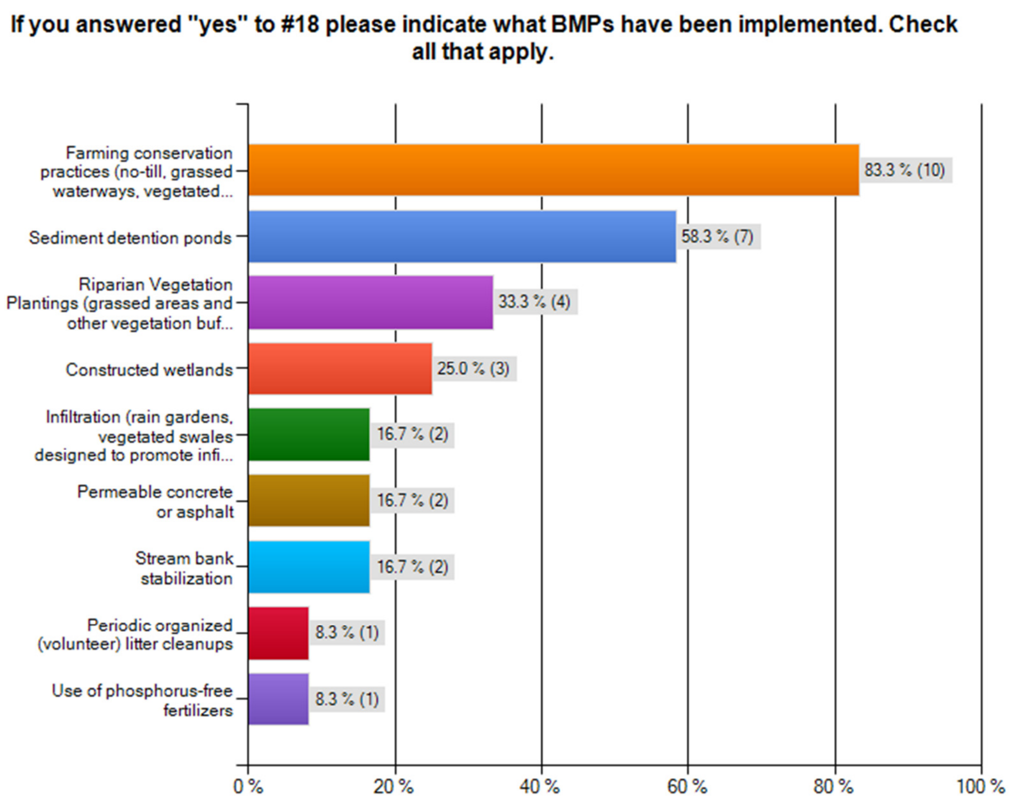

Chart 12

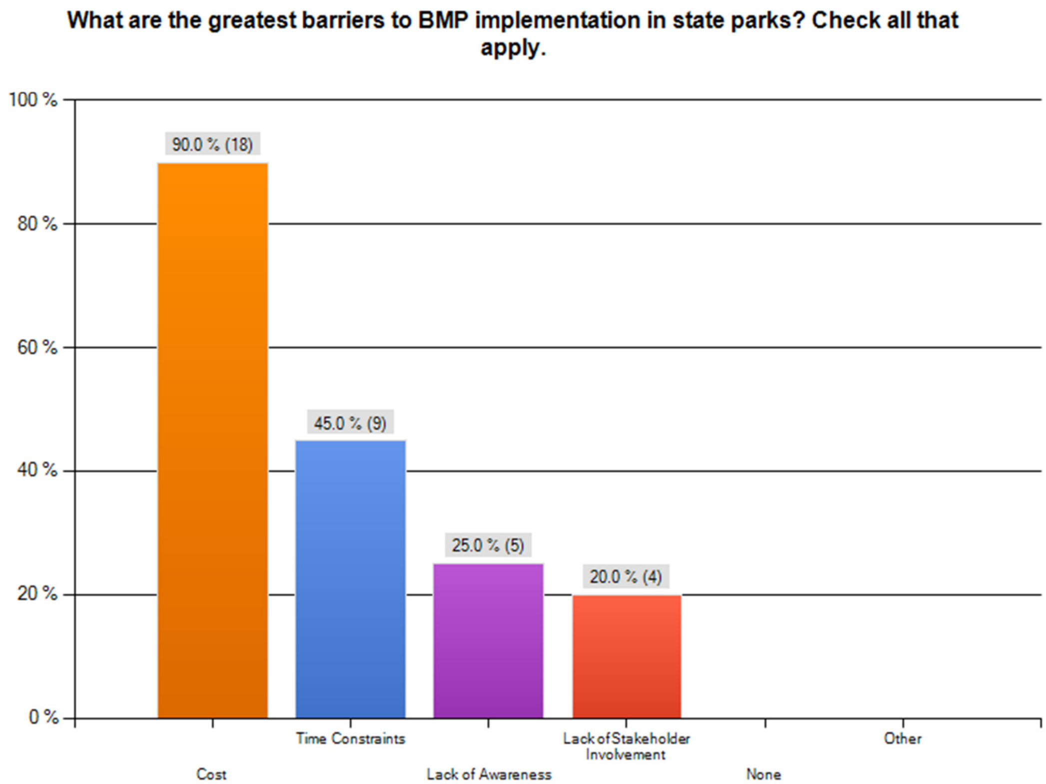

Chart 13

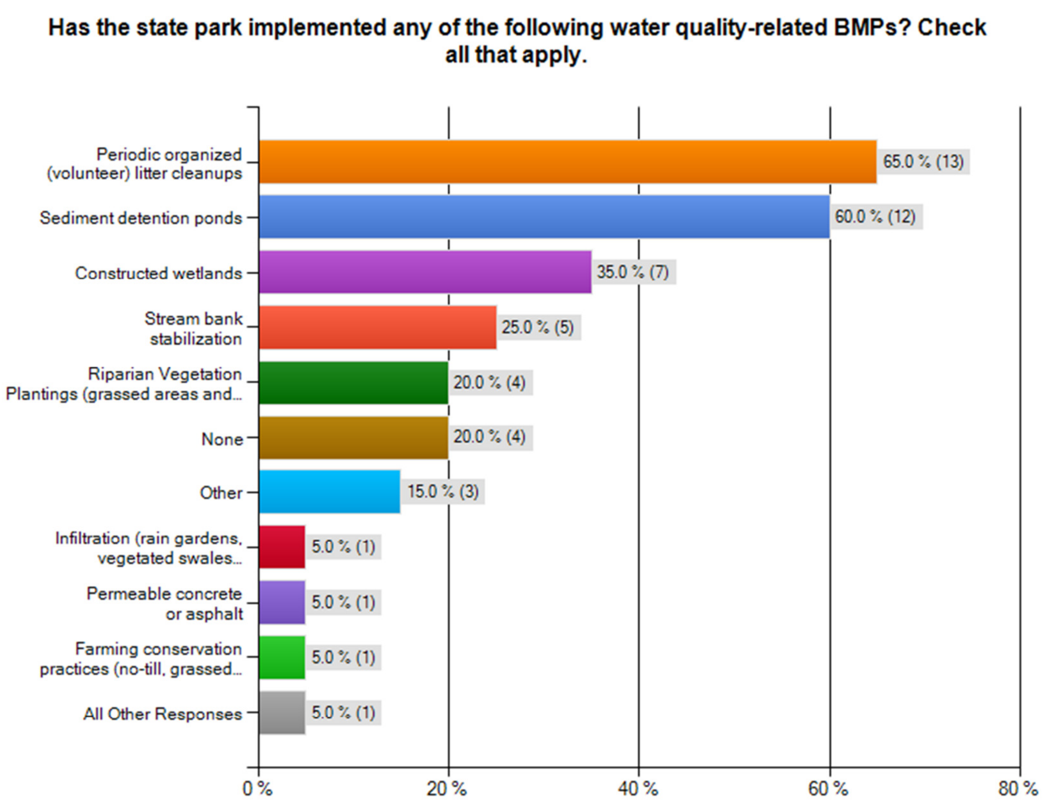

Chart 14

Lake Restoration. As shown in Chart 15, 16 respondents (80%) indicated the lake associated with their state park had experienced some degree of lake restoration activity. As indicated in the case studies of this report, state restoration undertakings are often multi-faceted projects aimed at improving water quality a variety of lake recreational amenities. Specific restoration activities identified by park managers included: lake dredging; sediment control ponds/structures; shoreline improvement; fishery renovation, rejuvenation and protection efforts; and prairie development. Of the 16 respondents that reported renovation activity:

- Only seven rated lake water clarity as being "moderately clear" or better;
- Approximately 60% (12 respondents) believed their lake water quality has remained unchanged or slightly degraded within the last three years; and
- 44% (7 respondents) rated stakeholder involvement at "good" or above.

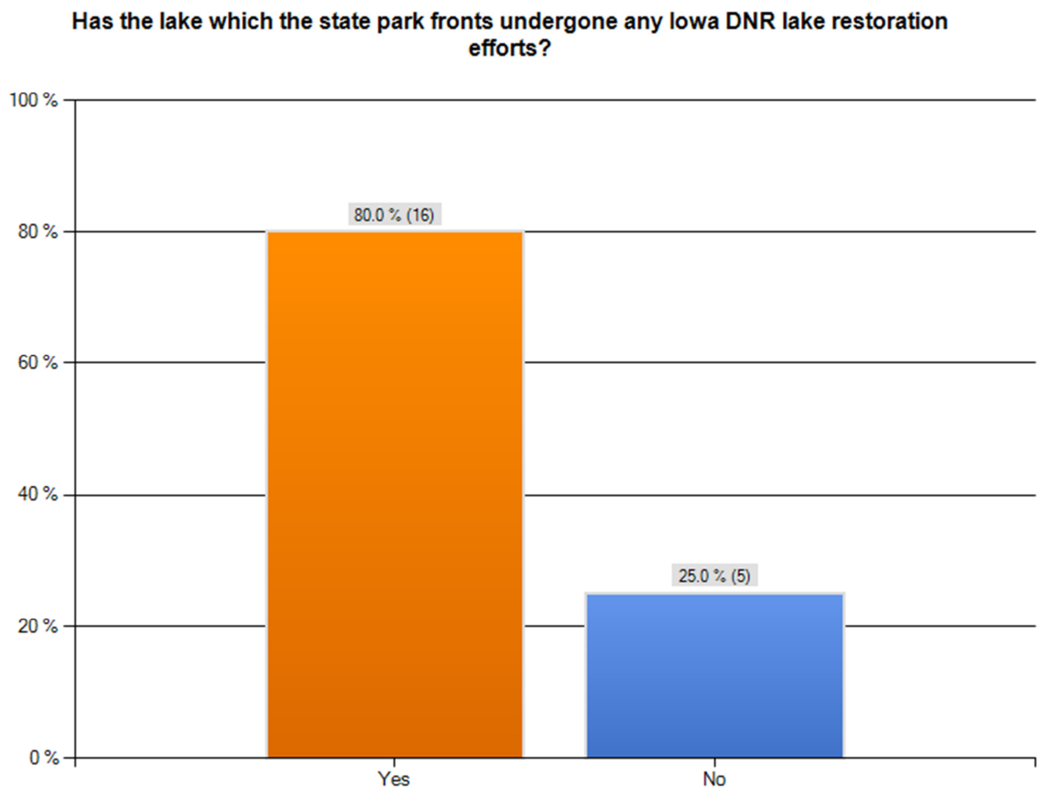

Chart 15

Public Education and Outreach. All 20 respondents indicated the state park has employed a variety of educational tools to promote water quality awareness. Promoting water quality awareness in the form of printed materials was the most common type of educational tool selected by state parks. This was followed by programs, educational classes/meetings, and outreach efforts. As shown in Chart 17, the importance placed on educating the public on the lake's water quality was essentially centered on a "moderate" rating.

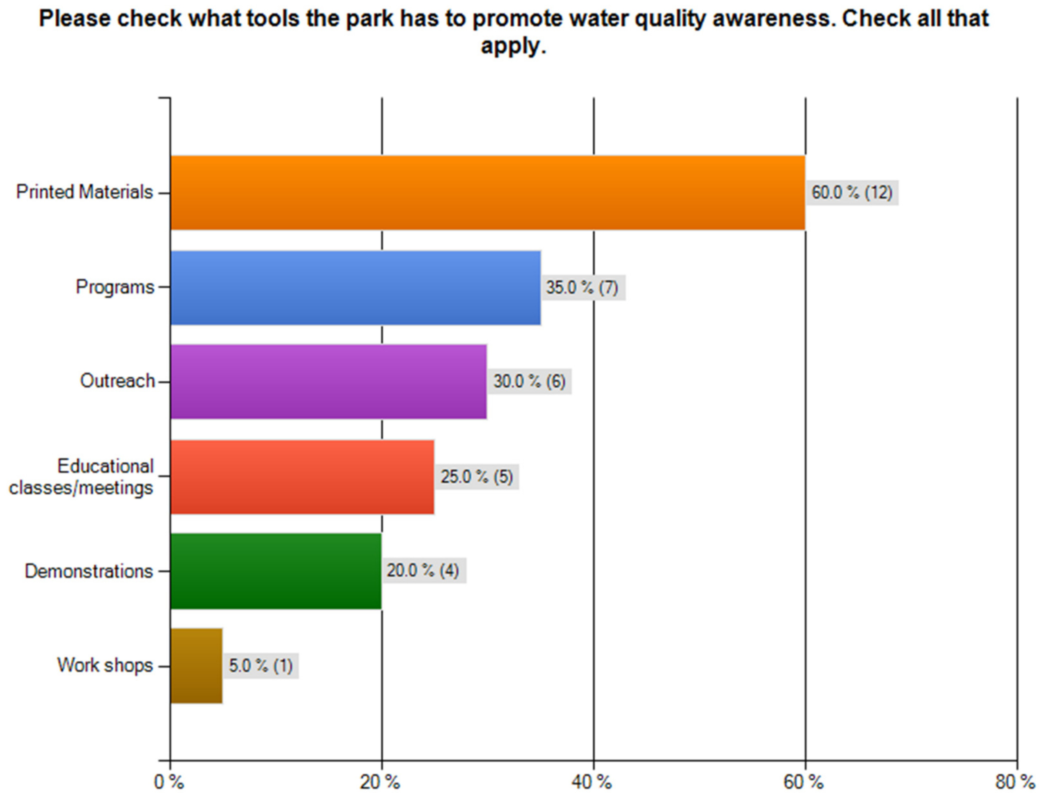

Chart 16

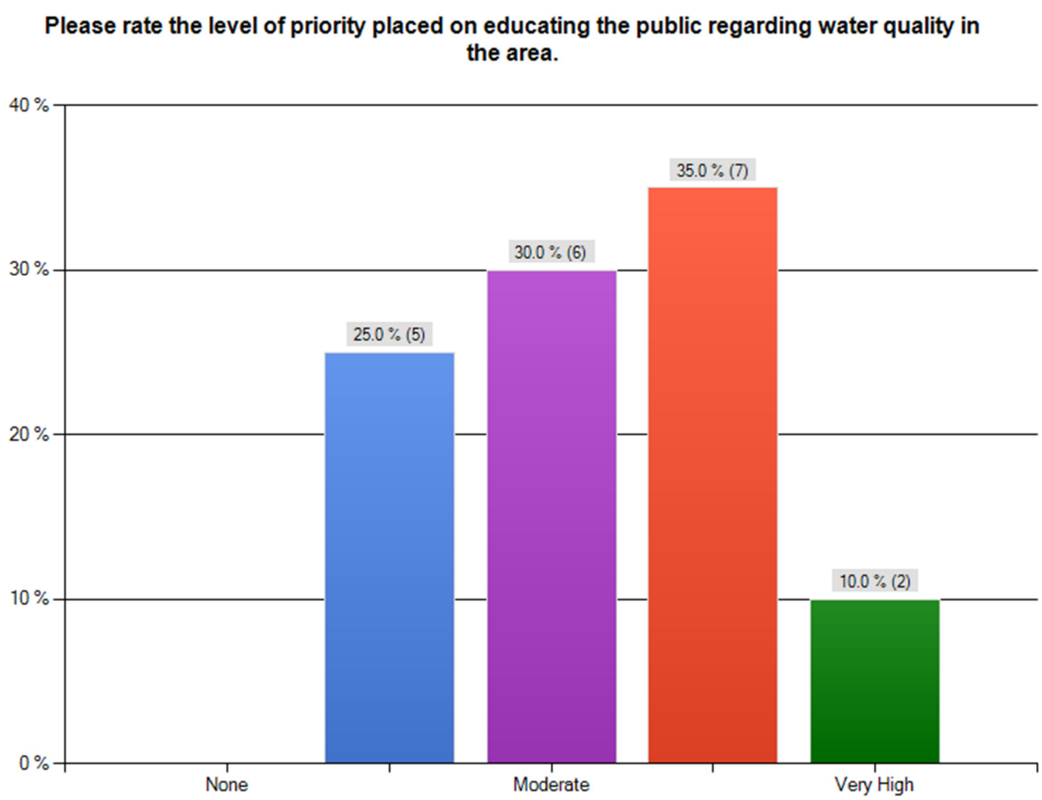

Chart 17

Open-ended Survey Comments

Open-ended responses and comments are often a revealing aspect of questionnaire-based surveys. The following includes additional comments provided by the respondents.

- ***"Some of it is just taking ownership of the area and the issues and doing what can be done locally to make small steps in getting to the big picture results".***
- ***"Due to current cuts in general fund and also lake restoration fund dollars, water quality projects throughout the state have been placed on hold."***
- ***"Since the renovation, the NRCS has actively pursued BMPs in the watershed, which has been a tremendous help. Water clarity has steadily been improving each year.***

In regard to the stakeholder involvement, three respondents made the following comments on why a "Poor" rating was assigned as the degree of stakeholder involvement:

- ***"Lack of awareness, disinterest"***
- ***"You cannot change all farming practices, they still till the land up and soil erodes."***
- ***"The watershed improvement project has been the first in the state which has run 10 years. Currently (last year) it was stopped or funding was pulled due to inactivity in the watershed. It seems that the side hills and slopes in which the problem streams are located are too productive to take out of production."***

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

The following highlights key findings drawn out by the project. Each is addressed as a bulleted item and elaborates on the findings when appropriate.

- The State of Iowa Lakes Restoration Program (LRP) represents a tremendous opportunity for proactive stakeholders to significantly improve the recreational amenities and aesthetics of their lake. As revealed in the case study examples, LRP investments are significant - often ranging from hundreds of thousands to millions of dollars. This, in turn, presents a proven and important pathway for economic development, particularly in rural areas, through increased tourism/recreational traffic and associated spending dollars.

  As indicated earlier in this report, LRP investment dollars ramped up significantly in 2006. Consequently, any recreational, economic, and water quality benefits of the program are just beginning to be realized. To assess the true impact of LRP investment, future monitoring and measurement is needed at sites that completed LRP projects. Unfortunately, with the exception of water quality monitoring, a quantitative "before and after LRP investment" comparison will be difficult, if not impossible, to make in terms of recreational and economic benefit. At best, baseline recreational and economic conditions prior to and following LRP investment appear to be qualitative estimates. Developing sound methods for measuring and assessing "before and after" recreational activity and economic benefit clearly need to be established.

  The best opportunity for a more quantitative "before and after" LRP comparison resides with water quality monitoring. An extensive amount of historic water quality monitoring data exists for many of the lakes that have undergone LRP investment. Consequently, the water quality benefit of LRP investment should be evaluated through continued monitoring followed by a water quality comparison assessment, perhaps three to five years after completion of LRP projects.

- A high degree of stakeholder involvement and commitment to improving water quality conditions improves the likelihood that a lake will be included in the LRP. According to the LRP, stakeholders seeking lake restoration investment must first ensure their lake is adequately protected by watershed BMPs that effectively control agricultural nutrients and sediment. This is supported by one respondent that indicated full scale restoration efforts were hampered by inadequate water quality results.

  LRP investment criteria, however, appear to be somewhat contradicted by the state park manager survey responses. Survey responses indicated 16 lakes had undergone some degree of lake restoration activity. Of these, seven respondents rated stakeholder involvement at "good" or better while nine ratings were below "good." Possible explanations for this discrepancy include a lack in continuity (over time) in regard to the degree of stakeholder involvement, bias in the LRP selection process, or state park manager bias.

- Survey findings indicate all respondents considered park visitation to be moderate to high during summer months, with most visitors traveling 11 to 50 miles to reach the park. In regard to lake use, fishing stands out as the dominant recreational activity followed by boating.

- Although each park offered a beach for public use, swimming was the least common summer recreational activity. Comments provided by respondents suggest that water clarity, bacteria levels, algae blooms, and geese feces are prevalent water quality problems associated with beach use. Comments also reveal that the public perception of water quality advisories combined with media sensationalism and the association of water turbidity with unsafe swimming conditions has a significant and, oftentimes, unwarranted detrimental effect on beach use.

  Study findings suggest swimming is likely the recreational activity that may benefit most from improved water quality conditions. It also represents an excellent but largely untapped means of gauging public perception of lake water quality. As other studies have shown (Vesterinen & others, 2010), swimmers are more sensitive to water quality conditions than other lake recreational activities such as boating. Beach use is also relatively easy to monitor. Consequently, monitoring beach use may prove to be a meaningful measure of public opinion on lake water quality.

- In regard to water quality, over half of the respondents (11) rated lake water clarity below "moderate" and indicated the trend in water quality has essentially remained the same for the past three years.

- Survey responses suggest stakeholder involvement is weak or lacking. Most state park managers rated stakeholder involvement as less than "good." This rating appears to be connected to poorer water quality ratings. Roughly 73% of these weak stakeholder involvement ratings were accompanied with water quality ratings that were less than "moderately clear."

  In contrast, cases where stakeholder involvement was rated "good" or better were more likely to be associated with lakes where the water quality rating was higher. Of the nine respondents that rated stakeholder involvement as "good" or better, approximately 67% rated lake water clarity as "moderately clear" or better. A high percentage of these respondents (89%) also indicated the trend in water quality as stable or improved.

  As indicated by two respondents, developing a sense of ownership among stakeholders and increasing awareness is key to increasing stakeholder involvement. Also, as noted by a number of respondents, efforts to improve and protect water quality in Iowa are in a constant (and usually losing) battle with agricultural production, particularly when grain prices are high. These challenges often cause water quality improvement efforts to stall, plateau, or backslide.

  Research suggests that diverse, broad-based community engagement is needed to take water quality protection to the next level in agricultural landscapes dominated by non-point source pollution. Morton and Wang (2009) found that farmers which solely engage with other farmers in water quality conversations were less likely to implement additional BMPs. They were more likely to be satisfied with their existing efforts and, as a result, water quality status quo was more likely to continue. However, farmers that engaged non-farming community members were more likely to be dissatisfied with their water quality conservation efforts. These findings suggest broadening connections between farmers and non-farming stakeholders is a key step in taking water quality efforts beyond the status quo.

State park programs may represent an effective avenue for engaging a diverse group of lake stakeholders. Because of their high profile in the area, vested interest in water quality and outdoor recreation, and direct interaction with the public, local community members, and surrounding landowners, state park staff may be quite effective at fostering and sustaining an increased sense of lake ownership and water quality awareness. However, as revealed by survey results, managers have little, if any, control or influence on funding for their respective park and no direct financial benefit usually accompanies efforts to increase park visitation. For this effort to have any chance to succeed, park programs would need a funding mechanism to support the mission. Conceptually, state allocated funding supplemented with funding generated from empowering parks to generate revenue for discretionary projects may prove most beneficial. Empowering parks to generate their own discretionary revenue through park recreation offers several advantages. Specifically, it strengthens the sense of park ownership among staff, creates an incentive for pursuing programs and amenities to increase park visitation, and minimizes the amount of state allocated funds needed to provide base funding for special projects.

- Most (60%) survey respondents were aware of BMPs implemented by lake stakeholders. The most common BMPs acknowledged by state park managers included agricultural conservation practices and sedimentation ponds. A majority of the respondents indicated BMPs have been or were scheduled to be completed within the state park. BMPs most commonly employed within state parks included organized litter cleanups, sedimentation ponds, and constructed wetlands. Cost was identified as the primary barrier to BMP implementation by state park programs.

- Public education and outreach efforts on water quality are commonly employed by to Iowa's state park programs. This effort is primarily in the form of printed materials although educational classes/meetings and outreach efforts are also popular promotional tools. Survey findings, combined with the fact that Iowa continues to struggle with the same water quality issues it has faced for decades, indicates these tools are essentially ineffective. Although more direct, personable interaction with a diverse number of lake stakeholders and the public may prove to be a more effective means of addressing water quality, it appears that a new approach other than a sole reliance on voluntary water quality improvement efforts is overdue in regard to water quality protection. The merit of directing monies toward strategic land purchases aimed at taking land permanently out of agricultural production should be considered. Establishment of permanent riparian buffer areas, particularly along lower order streams in more susceptible areas, may prove to be a more cost-effective, pro-active approach to sustainable lake water quality protection.

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