

**Water Quality in Iowa During 2004 and 2005: Assessment Results  
Lakes, Wetlands, and Flood Control Reservoirs: Pottawattamie**

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**Arrowhead Pond**

Pottawattamie County, S29,T77N,R41W, 1.5 mi SE of Neola

LAKE SIZE: 14 Acres

Waterbody ID No.: IA 06-WED-00270-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS:

Assessment is based on results of (1) ISU lake survey in 2000-04, (2) surveys by IDNR Fisheries Bureau, (3) ISU information on lake plankton communities, 2000-05 and (4) IDNR investigation of a fish kill in July 2005.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Partial

Aquatic Life Support -- Partial

Fish Consumption -- Not assessed

Primary Contact (Recr) -- Partial

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses are assessed (monitored) as "partially supported" due to poor water transparency and due to high levels of pH that violate state water quality criteria. The Class B(LW) aquatic life uses are assessed as (monitored) as "partially supporting" primarily due to high levels of pH that violate state water quality criteria and secondarily due to sediment, nutrients, turbidity, and algae. Fish consumption uses remain "not assessed." The sources of data for this assessment include (1) results of the statewide survey of Iowa lakes conducted in 2000 through 2004 sponsored by IDNR and conducted by Iowa State University (ISU), (2) information from the IDNR Fisheries Bureau, and (3) information on plankton communities at Iowa lakes from 2000 through 2005 from the IDNR/ISU statewide lake survey.

Note: A TMDL for siltation at Arrowhead Pond was prepared by IDNR and approved by EPA in 2001; thus, this lake was placed into IR Category 4a (TMDL approved) for the 2004 assessment/listing cycle. Not all Section 303(d) impairments identified for the current (2006) assessment/listing cycle (algae and pH), however, are addressed in the TMDL. Thus, this waterbody was moved from IR Category 4a to Category 5a (impaired; TMDL required) for the 2006 assessment/listing cycle.

EXPLANATION: Results from the ISU statewide survey of Iowa lakes suggest that non-algal turbidity and presence of nuisance aquatic organisms (bluegreen algae) may affect full support of the Class A and Class B(LW) uses of Arrowhead Pond. Using the median values from this survey from 2000-04 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 82, 62, and 66, respectively. According to Carlson (1977), the index value for total phosphorus places this lake in the range of hyper-eutrophic lakes; the index values for chlorophyll-a and secchi depth place this lake in the range between eutrophic and hyper-eutrophic lakes. These index values suggest (1) extremely high levels of phosphorus in the water column, (2) moderately high levels of chlorophyll-a, and (3) poor water transparency. The TSI value for Secchi depth suggest impaired conditions.

According to Carlson (1991), the occurrence of a high TSI value for total phosphorus with relatively low and similar values for chlorophyll-a and secchi depth indicate that some factor (e.g., nitrogen limitation, zooplankton grazing, or some other factor) other than phosphorus limits production of suspended algae. Results from the ISU survey suggest the following non-phosphorus limitations at Arrowhead Pond: (1) nitrogen limitation, (2) zooplankton grazers, and (3) non-algal turbidity. Based on median values from ISU sampling from 2000-04, the ratio of total nitrogen to total phosphorus for Arrowhead Lake is 8. This TN:TP ratio suggests the possibility that nitrogen limitation, at times, suppresses the production of suspended algae at this lake.

In addition, data from the ISU survey show relatively large populations of zooplankton species at this that graze on algae. Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., Daphnia) comprised approximately 70% of the dry mass of the zooplankton community and that Arrowhead Pond had the nineteenth highest per summer sample level of zooplankton (Cladoceran) grazers of the 131 lakes sampled.

The levels of inorganic suspended solids at this lake are moderately high and suggest possible light limitation that suppresses growth of suspended algae. The overall median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l; the median level at Arrowhead Pond was 7.9 mg/l; this was the 39th highest overall median of the 131 lakes sampled.

Data from the ISU survey from 2002-2004 suggest that the presence of nuisance aquatic species (i.e., bluegreen algae) may also impair support of the Class A uses. Sampling during this time showed that the percent wet mass of bluegreens was nearly 90%. In addition, Arrowhead Pond had the ninth highest median mass of bluegreen algae of the 131 lakes sampled: 84.0 mg/l. This median is in the worst 10 % of the 131 Iowa lakes sampled. The presence of a large population of bluegreen algae at Arrowhead Pond suggests a potential violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life. This assessment, however, is based strictly on a distribution of the lake-specific median bluegreen algae values for the 2000-2004 monitoring period. Median levels greater than the 90th percentile of this distribution were arbitrarily considered to represent "potential impairment; not supported." No other criteria exist, however, upon which to base a more accurate identification of impairments due to bluegreen algae. Thus, while the accuracy of this (2006) assessment has improved over that of the previous (2004) assessment due to collection of additional data, the assessment category for assessments based on level of bluegreen algae nonetheless remains "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

The eutrophic conditions at this lake, information from the IDNR Fisheries Bureau, and the occurrence of a fish kill in July 2005 suggest that the Class B(LW) aquatic life uses should remain assessed (evaluated) as "partially supported" due primarily to impacts of siltation but also to excessive nutrient loading to the water column, moderately high levels of non-algal turbidity, and presence of large populations of bluegreen algae. The ISU lake survey data suggest an impairment due to high levels of pH at this lake. Only one violation of the Class B(LW) criteria for dissolved oxygen occurred in the 14 samples collected during summers of 2000 through 2004. Based on IDNR's assessment methodology, the occurrence of 1 violation in the 14 samples collected at this station does not suggest an impairment of aquatic life uses at this lake. Four of 15 samples, however, violated the Class A,B(LW) criterion for pH (maximum = 9.2; minimum = 8.1 pH units). Based on IDNR's assessment methodology, these results suggest an impairment of the Class A and Class B(LW) uses of this lake due to high levels of pH that violate state criteria. These violations, however, likely reflect primary productivity at Arrowhead Pond and do not reflect the input of pollutants into this lake.

A fish kill that occurred in this lake on July 26, 2005 also suggests "impairment" of the Class B(LW) uses. The kill was identified as a summerkill due to low levels of dissolved oxygen related to an algal die-off. According to the IDNR investigation, approximately 500 bluegill, 1,500 yellow bass, and 600 channel catfish (including all cage catfish at this lake) were killed. The estimated value of the fish killed was \$39,000.

Fish consumption uses remain "not assessed" due to the lack of fish contaminant monitoring in this lake.

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**Big Lake (incl Gilbert's Pond)**      Pottawattamie County, S14,T75N,R44W, N edge Council Bluffs      LAKE SIZE: 21 Acres  
Waterbody ID No.: IA 06-WEM-00260-L      Waterbody Type: Freshwater Lake      Significant Publicly-owned Lake?: No      Use Classes.: Class B(LW)

ASSESSMENT COMMENTS:      Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support    -- Not assessed      Aquatic Life Support    -- Not assessed      Fish Consumption      -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

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**Carter Lake**

Pottawattamie County, S23,T75N,R44W, at Carter Lake.

LAKE SIZE: 315 Acres

Waterbody ID No.: IA 06-WEM-00265-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Assessment based on (1) beach monitoring by Nebraska DEQ in summer 2000, (2) surveys by IDNR Fisheries Bureau, (3) fish tissue monitoring conducted by the Nebraska DEQ, (4) results of ISU lake surveys from 2000-04, (5) ISU reports of plankton communities from 2000-05 and (6) an IDNR investigation of a fish kill in April 2004.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not supporting      Aquatic Life Support -- Partial      Fish Consumption -- Not supporting      Primary Contact (Recr) -- Not supporting

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses remain assessed (monitored) as "not supported" due primarily to high levels of algal turbidity that reduce water transparency. Results of monitoring for indicator bacteria (fecal coliforms) in summer 2000 by the state of Nebraska also suggests impairment of the Class A uses. Data from the ISU lake survey suggests that very large populations of bluegreen algae (noxious aquatic plant) at this lake may also impair the Class A uses. The Class B(LW) aquatic life uses remain assessed (evaluated) as "partially supporting" due to nuisance blooms of algae, nutrient loading to the water column, and occurrence of a fish kill in April 2004. Fish consumption uses remain assessed (monitored) as "not supported" due to the existence of a fish consumption advisory issued by the state of Nebraska. The sources of data for this assessment include (1) results of monitoring for indicator bacteria conducted by the Nebraska Department of Environment Quality in summer of 2000, (2) the listing of fish consumption advisories for the state of Nebraska, (3) results of Iowa State University (ISU) lake surveys in from 2000-2004, (4) surveys by IDNR Fisheries Bureau, (5) ISU reports on lake plankton communities in summers of 2000 through 2005, and (6) results of an IDNR investigation of a fish kill in April 2004.

EXPLANATION: Levels of indicator bacteria at Carter Lake were monitored once per week during the primary contact recreation season (May through September) of 2000 as part of ambient monitoring by the Nebraska DEQ. According to U.S. EPA guidelines for determining support of primary contact recreation uses (U.S. EPA 1997b, page 3-35), the geometric mean of fecal coliform bacteria levels from at least five samples collected over a thirty-day period is compared to the water quality standard of 200 fecal organisms/100ml. If a thirty-day geometric mean exceeds 200 orgs/100 ml, the primary contact recreation uses are assessed as "not supported." In addition, the U.S. EPA guidelines state that if more than 10% of the total samples taken during any thirty-day period has a bacterial density that exceeds 400 fecal coliform organisms/100 ml, the primary contact recreation uses are assessed as "partially supported." Due to the relatively low numbers of samples collected during any thirty-day period (N=5), the use of single-sample maximum values to assess beaches is problematic. With less than 10 samples collected during any thirty-day period, the occurrence of a single level of bacteria above the single-sample maximum value will result in more than 10% violation of the single-sample maximum value and thus suggest impairment of the primary contact recreation uses. The use of less than 10 samples in an assessment based on a critical value of 10% results in large probabilities (approximately 60%) of incorrectly concluding that an impairment exists. For this reason, the single-sample maximum value is not used to assess support of primary contact recreation uses with data having a collection frequency of less than 10 samples over a thirty-day period.

At Carter Lake, six of the 19 thirty-day geometric means for summer 2000 exceeded the Iowa Water Quality Standard of 200 orgs/100 ml (maximum geometric mean = 2,823 orgs/100 ml; maximum sample value = 12,500 orgs/100 ml). According to U.S. EPA guidelines for Section 305(b) reporting, if a thirty-day geometric mean based on at least five samples is greater than 200 orgs/100ml, the primary contact recreation uses are "not supported" (see pgs 3-33 to 3-35 of U.S. EPA 1997b). Thus, based on multiple geometric mean values greater than 200 orgs/100 ml in summer 2001, the Class A uses of this lake are assessed as "not supported."

Results of monitoring conducted by ISU from 2000 through 2004 as part of the statewide survey of Iowa lakes also suggest impairment of the Class A (primary contact recreation) uses at Carter Lake. Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 79, 74, and 76 respectively. According to Carlson (1977), these index values place this lake in the range of hyper-eutrophic lakes and suggest extremely high levels of phosphorus in the water column, very high levels of chlorophyll-a, and extremely poor water transparency. The good agreement between the TSI values does not suggest the likelihood of a strong non-phosphorus limitation at this lake. Based on median values from ISU sampling in 2000 through 2004, the ratio of total nitrogen to total phosphorus for this lake is 11. This ratio suggests the possibility that algal production at this lake is limited by nitrogen availability.

The results of ISU plankton monitoring from 2000 through 2005 show a relatively small population of zooplankton grazers at Carter Lake. Carter Lake had the seventh lowest per summer sample mass of zooplankton (Cladoceran) grazers of the 131 lakes sampled. This low level of zooplankton grazers would likely be unable to suppress algal production.

Data from the ISU survey suggest that this lake has moderately high levels of inorganic suspended solids and thus has potential problems with high levels of non-algal turbidity. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l. The median level of inorganic suspended solids at Carter Lake during this period was 7.5 mg/l. This moderately high level suggests that non-algal turbidity presents some light-limitation to the production of

**Lake Manawa**

Pottawattamie County, S13,T74N,R44W, S edge Council Bluffs

LAKE SIZE: 714 Acres

Waterbody ID No.: IA 06-WEM-00235-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Assessment is based on (1) ISU lake survey from 2000-04, (2) ISU report on lake plankton communities from 2000-05, (3) surveys by the DNR Fisheries Bureau, (4) DNR beach monitoring from 2002-04, (4) EPA/DNR fish tissue (RAFT) monitoring in 1996, and (5) an IDNR investigation of a fish kill in 2004.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not supporting      Aquatic Life Support -- Partial      Fish Consumption -- Fully      Primary Contact (Recr) -- Not supporting

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses are assessed (monitored) as "not supporting" due to presence of aesthetically objectionable conditions caused by high levels of suspended inorganic materials in the water column and by blooms of algae. An additional concern is the presence of moderately large populations of nuisance algal species (i.e., bluegreen algae). Results of IDNR beach monitoring, however, indicate low levels of indicator bacteria and "full support" of the Class A uses. The Class B(LW) aquatic life uses remain assessed (evaluated) as "fully supporting". Algal blooms, however, remain a concern at this lake. Fish consumption uses remain assessed (evaluated) as "fully supported" based on results of fish contaminant monitoring in 1996. The sources of data for this assessment include (1) the results of the IDNR-UHL beach monitoring program in summers of 2002, 2003, and 2004, (2) results of the statewide survey of Iowa lakes conducted from 2000 through 2004 by Iowa State University (ISU), (3) information from the IDNR Fisheries Bureau, (4) information on plankton communities collected from 2000 through 2005 for the ISU lakes survey, (5) results of U.S. EPA / IDNR fish tissue monitoring in 1996, and (6) results of an IDNR investigation of a fish kill in 2004. Note: In the absence of the impairment of Class A uses (IR Category 5a (=303(d) list)), this waterbody would be placed into Category 2b (at least one use assessed as "fully supported" with at least one other use "evaluated" as "impaired").

EXPLANATION: Results of IDNR beach monitoring at Lake Manawa from 2002 through 2004 suggest that the Class A uses are "fully supported." Levels of indicator bacteria were monitored once per week during the primary contact recreation seasons (May through September) of 2002 (30 samples), 2003 (29 samples), and 2004 (16 samples) as part of the IDNR beach monitoring program. According to IDNR's assessment methodology, two conditions need to be met for results of beach monitoring to indicate "full support" of the Class A (primary contact recreation) uses: (1) all five-sample, thirty-day geometric means for the three-year assessment period are less than the state's geometric mean criterion of 126 E. coli orgs/100 ml and (2) not more than 10 % of the samples during any one recreation season exceeds the state's single-sample maximum value of 235 E. coli orgs/100 ml. This assessment approach is based on U.S. EPA guidelines (see pgs 3-33 to 3-35of U.S. EPA 1997b).

At Lake Manawa beach, the geometric means of all 63 thirty-day periods during the summer recreation seasons of 2002, 2003 and 2004 were below the Iowa water quality standard of 126 orgs/100 ml. Also, the percentage of samples exceeding Iowa's single-sample maximum criterion did not exceed 10% in any of the three recreation seasons (2002: 0%; 2003: 3%; 2004: 6%). According to IDNR's assessment methodology, these results suggest "full support" of the Class A (primary contact recreation) uses.

Although results of IDNR beach monitoring continue to suggest "full support" of the Class A uses, results from the ISU statewide survey of Iowa lakes suggest that very high levels of turbidity related primarily high levels of inorganic suspended solids and secondarily to algal blooms adversely affect the Class A uses of Lake Manawa. Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 71, 64, and 75, respectively. According to Carlson (1977), the index value for total phosphorus is in the lower range of hyper-eutrophic lakes, and the value for chlorophyll-a is in the middle range between eutrophic and hyper-eutrophic lakes. The index value for Secchi depth is in the range of hyper-eutrophic lakes. These index values suggest very high levels of phosphorus in the water column, moderately high production of suspended algae, and very poor water transparency. The results of ISU monitoring suggest that the very high levels of inorganic suspended solids and the somewhat elevated levels of chlorophyll likely combine to reduce water transparency and impair designated uses at this lake.

The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l. Of 131 lakes sampled, Lake Manawa had the 24th highest median level of inorganic suspended solids (12.3 mg/l), thus suggesting that non-algal turbidity limits algal production as well as contributes to reductions in water transparency that impair the primary contact recreation uses.

These conditions suggest impairments to the Class A (primary contact) uses through presence of aesthetically objectionable conditions (very poor water transparency) caused primarily by very high levels of inorganic suspended solids and secondarily by blooms of algae.

The IDNR Fisheries Bureau concurs that this lake is impaired by algal blooms. Algal production at this lake appears to be limited by availability of phosphorus. Based on median values from ISU sampling from 2000 through 2004, the ratio of total nitrogen to total phosphorus for this lake is 13; this ratio does not suggest a significant potential for nitrogen limitation.

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suspended algae and may contribute to the poor water transparency at this lake. These conditions indicate impairments to the Class A (primary contact) uses through presence of the aesthetically objectionable conditions due to (1) blooms of algae and (2) very poor water transparency.

Nuisance aquatic (algal) species (i.e., bluegreen algae) appear to be a potential problem at Carter Lake. Data from the ISU survey from 2000-04 suggest that bluegreen algae (Cyanophyta) comprise approximately nearly the entire (98% )of the summertime phytoplankton community of this lake. The average per summer sample mass (biovolume) of bluegreen algae in summers of 2000 through 2004 at this lake (59.4 mg/l) was the 13th highest of the 131 lakes sampled. These conditions suggest the potential for impairments due to presence of nuisance aquatic (e.g., algal) species. This assessment, however, is based strictly on a distribution of the lake-specific median bluegreen algae values for the 2000-2004 monitoring period. Median (2000-2004) levels greater than the 75th percentile of this distribution (28.8 mg/l) were arbitrarily considered to represent "potential impairment: partially supported." Median levels greater than the 90th percentile of this distribution (59.4 mg/l) were arbitrarily considered to represent "potential impairment; not supported." No criteria exist, however, upon which to base an accurate identification of impairments due to bluegreen algae. Thus, while the collection of additional data has improved our ability to accurately estimate the lake-specific levels of bluegreen algae, the exact levels at which these organisms begin to violate Iowa's narrative criteria protecting against "nuisance aquatic life" or "aesthetically objectionable conditions" remains unknown. The assessment category for assessments based on level of bluegreen algae, of necessity, remains "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

The hyper-eutrophic conditions at this lake, along with information from the IDNR Fisheries Bureau, suggest that the Class B(LW) aquatic life uses are "not supported" due to excessive nutrient loading to the water column and nuisance blooms of algae. The ISU lake survey data show no violations of the Class B(LW) criteria for dissolved oxygen in the 14 samples collected during summers of 2000 through 2004. One of 15 samples (7%), however, violated the Class A,B(LW) criterion for pH (maximum = 9.1; minimum = 7.9 pH units). This violation likely reflects the high levels of primary productivity at Carter Lake and does not reflect the input of pollutants into this lake.

Although attributed to "natural causes", the occurrence of a fish kill in this lake in April 2004 is consistent with the assessment of aquatic life uses as only "partially supported". This kill occurred on April 22, 2004. The cause of the kill was identified as disease (virus). An estimated 5,000 fish were killed; the kill affected only yellow bass. No estimate of the value of the fish killed was provided. According to IDNR's assessment/listing methodology, the occurrence of a single pollutant-caused fish kill, or a fish kill of unknown origin, on a waterbody or waterbody reach during the most recent assessment period (2002-2005) indicates a severe stress to the aquatic community and suggests that the aquatic life uses should be assessed as "impaired". If a cause of the kill was not identified during the IDNR investigation, or if the kill was attributed to non-pollutant causes (e.g., winterkill), the assessment type will be considered "evaluated." Such assessments, although suitable for Section 305(b) reporting, lack the degree of confidence to support addition to the state Section 303(d) list of impaired waters (IR Category 5). Waterbodies affected by such fish kills will be placed in IR subcategories 2b or 3b and will be added to the state list of waters in need of further investigation.

Fish consumption uses remained assessed (monitored) as "not supported" due to the continuation of a fish consumption advisory for this lake issued by the state of Nebraska due to high levels of PCBs (for more information, see the following web site: <http://www.ngpc.state.ne.us/fishing/guides/fishguide/fgadvisories.asp>). The existence of, or potential for, a fish consumption advisory is the basis for Section 305(b) assessments of the degree to which Iowa's lakes and rivers support their fish consumption uses. According to IDNR's assessment methodology, the existence of a consumption advisory indicates that fish consumption uses should be assessed as "not supported".

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**Water Quality in Iowa During 2004 and 2005: Assessment Results  
Lakes, Wetlands, and Flood Control Reservoirs: Pottawattamie**

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**Desoto Bend**

Harrison County, S21,T78N,R45W, 5 mi. W of Missouri Valley.

LAKE SIZE: 811 Acres

Waterbody ID No.: IA 06-WEM-00340-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW), HQR

ASSESSMENT COMMENTS:

Assessment is based on results of (1) ISU lake surveys from 2000-04, (2) surveys by IDNR Fisheries Bureau, (3) ISU reports on lake plankton communities from 2000-05, and (4) results of U.S. EPA/IDNR fish tissue monitoring in 1998.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Partial

Fish Consumption -- Fully

Primary Contact (Recr) -- Partial

Aquatic Life Support -- Fully

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses are assessed (monitored) as "partially supporting" due to moderately high levels of inorganic turbidity and poor water transparency that violate Iowa's narrative water quality standard protecting against aesthetically objectionable conditions. The Class B(LW) aquatic life uses are assessed (evaluated) as "fully supporting". Excessive nutrient loading to the water column and elevated levels of non-algal turbidity, however, remain of concern at this lake. Fish consumption uses remain assessed (evaluated) as "fully supported" based on fish contaminant monitoring in 1998. The sources of data for this assessment include (1) results of the statewide survey of Iowa lakes sponsored by IDNR and conducted by Iowa State University (ISU) from 2000 through 2004, (2) surveys by IDNR Fisheries Bureau, and (3) information on plankton communities collected at Iowa lakes from 2000 through 2005 as part of the ISU lake survey and (4) results of U.S. EPA / IDNR fish tissue monitoring in 1998.

EXPLANATION: Results from the ISU statewide survey of Iowa lakes suggest that high levels of non-algal turbidity may adversely affect the Class A and Class B(LW) uses of DeSoto Bend Lake. Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 72, 61, and 67, respectively. According to Carlson (1977), the index value for total phosphorus places this lake in the range of hyper-eutrophic lakes; the index value for chlorophyll-a is in the lower range between eutrophic and hyper-eutrophic lakes, and the index value for secchi depth is in the middle to upper range between eutrophic and hyper-eutrophic lakes. These index values suggest (1) very high levels of phosphorus in the water column, (2) relatively low (and less than expected) levels of chlorophyll-a (suspended algae), and (3) poor water transparency.

According to Carlson (1991), the occurrence of a high TSI value for total phosphorus with relatively low values for chlorophyll-a and secchi depth indicate that some factor (e.g., nitrogen limitation, zooplankton grazing, or some other factor) other than phosphorus limits production of algae. The ISU lake data suggest that algal production at DeSoto Bend Lake is potentially limited by nitrogen availability, by zooplankton grazing, and by inorganic turbidity. Based on median values from ISU sampling from 2000 through 2004, the ratio of total nitrogen to total phosphorus for DeSoto Bend Lake is 11. This TN:TP ratio suggest the possibility that algal production at this lake may at times be limited by nitrogen availability.

Data from the ISU survey show moderately large populations of zooplankton species at this lake that graze on algae. Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., Daphnia) comprised about 50% of the dry mass of the zooplankton community. DeSoto Bend Lake had the 62nd highest per summer sample mass of zooplankton (Cladoceran) grazers of the 131 lakes sampled (96.0 mg/l). This level of zooplankton grazers may be able to suppress algal production and account for some of the discrepancy between the TSI values for total phosphorus (72) and chlorophyll-a (61).

The levels of inorganic suspended solids at this lake are very high for Iowa lakes and thus suggest the potential for limiting production of suspended algae through light attenuation. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l; the median level at DeSoto Bend Lake was 10.2 mg/l; this was the 30th highest level of ISS of the 131 lakes sampled.

Thus, the moderately high TSI value for secchi depth (67) suggests impairment of the Class A (primary contact) uses due to poor water transparency that violates Iowa's narrative water quality standard protecting against aesthetically objectionable conditions. The poor water transparency at this lake is primarily due to high levels of inorganic suspended solids. The relatively low TSI value for chlorophyll-a (61) suggests that aesthetically objectionable blooms of algae are not a serious problem at this lake. The IDNR Fisheries Bureau concurs that high levels of inorganic turbidity present an impairment of designated uses at this lake

The levels of nuisance (=noxious) algal species (i.e., bluegreen algae) at this lake do not suggest an impairment of Class A uses. While data from the ISU survey from 2000 through 2004 suggest that bluegreen algae (Cyanophyta) comprise a significant portion (nearly 50%) of this lake's summertime phytoplankton community, sampling from 2000 through 2004 showed that the median per summer sample mass of bluegreen algae at DeSoto Bend Lake was the 60th lowest of the 131 lakes sampled: 12.0 mg/l. This level is in the lower half of the 131 Iowa lakes sampled. The presence of a relatively small population of bluegreen algae at this lake does not suggest a potential violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life. This assessment, however, is based strictly on a distribution of the lake-specific median

**Water Quality in Iowa During 2004 and 2005: Assessment Results  
Lakes, Wetlands, and Flood Control Reservoirs: Pottawattamie**

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bluegreen algae values for the 2000-2004 monitoring period. Median levels less than the 75th percentile of this distribution (~29 mg/l) were arbitrarily considered by IDNR staff to not represent an impairment of the Class A uses of Iowa lakes. No criteria exist, however, upon which to base a more accurate identification of impairments due to bluegreen algae. Thus, while the ability to characterize the levels of bluegreen algae at this lake has improved over that of the previous (2004) assessment due to collection of additional data, the assessment category for assessments based on level of bluegreen algae nonetheless remains, of necessity, "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

The eutrophic to hyper-eutrophic conditions at this lake, along with information from the IDNR Fisheries Bureau, suggest that the Class B(LW) aquatic life uses should be assessed as "fully supported". Excessive nutrient loading to the water column and high levels of non-algal turbidity, however, remain of concern at this lake. In addition, results of ISU monitoring from 2000 through 2004 suggest generally good chemical water quality at this lake although periods of low dissolved oxygen do occur. Results of this monitoring show that 3 of the 14 samples collected exceeded the Class B(LW) criteria for dissolved oxygen and that none of the 15 samples collected exceeded Iowa's Class A,B(LW) criteria for pH (maximum = 8.8; minimum = 8.2 pH units). Based on IDNR's assessment methodology, the results for dissolved oxygen do not suggest that significantly more than 10 percent of the samples exceed Iowa's dissolved oxygen criteria and thus do not suggest an impairment of the Class B(LW) uses of this lake.

Fish consumption uses were assessed (evaluated) as "fully supported" based on results of U.S.EPA/IDNR fish contaminant (RAFT) monitoring at DeSoto Bend Lake in 1998. Because these data are now considered too old (greater than five years) to accurately characterize current water quality conditions, the assessment category is considered "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence). The existence of, or potential for, a fish consumption advisory is the basis for Section 305(b) assessments of support of fish consumption uses in Iowa's rivers and lakes. Prior to 2006, IDNR used action levels published by the U.S Food and Drug Administration to determine whether consumption advisories should be issued for fish caught as part of recreational fishing in Iowa. In an effort to make Iowa's consumption more compatible with the various protocols used by adjacent states, the Iowa Department of Public Health, in cooperation with Iowa DNR, developed a risk-based advisory protocol. This protocol went into effect in January 2006 (see <http://www.iowadnr.gov/fish/news/consump.html> for more information on Iowa's revised fish consumption advisory protocol). Because the revised (2006) protocol is more restrictive than the previous protocol based on FDA action levels; fish contaminant data that previously suggested "full support" may now suggest either a threat to, or impairment of, fish consumption uses. This scenario, however, does not apply to the fish contaminant data generated from the 1998 RAFT sampling conducted at this lake: levels of all contaminants from this monitoring were below advisory trigger levels, thus suggesting the continued "full support" of fish consumption uses.

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In terms of all Iowa lakes sampled, data from the ISU survey show relatively small populations of zooplankton species at this lake that graze on algae. Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., Daphnia) comprised approximately one-third of the dry mass of the zooplankton community of this lake. The average per summer sample mass of Cladoceran taxa over the 2000-2005 period (66 mg/l) was the 25th lowest of the 131 lakes sampled. These results suggest little if any non-phosphorus limitation due to zooplankton grazing at Lake Manawa.

The presence of nuisance (=noxious) algal species (i.e., bluegreen algae) may also present an impairment of the Class A uses at Lake Manawa. Data from the ISU survey from 2000 through 2004 suggest that bluegreen algae (Cyanophyta) comprise a significant portion of this lake's summertime phytoplankton community. Summer sampling during this period showed the percent wet mass of the total phytoplankton community in bluegreens (cyanobacteria) was approximately 75%. Also, the median per summer sample mass of bluegreen algae at this lake (35.6 mg/l) was the 26th highest of the 131 lakes sampled. This median is in the worst 25% of the 131 Iowa lakes sampled. The presence of a large population of bluegreen algae at this lake suggests the potential violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life. This assessment, however, is based strictly on a distribution of the lake-specific median bluegreen algae values for the 2000-2004 monitoring period. Median levels greater than the 75th percentile of this distribution (~29 mg/l) were arbitrarily chosen by IDNR staff to represent the condition of "potential impairment: partially supported." No criteria exist, however, upon which to base a more accurate identification of impairments due to bluegreen algae. Thus, while the ability to characterize the levels of bluegreen algae at this lake has improved over that of the previous (2004) assessment due to collection of additional data, the assessment category for assessments based on level of bluegreen algae nonetheless remains, of necessity, "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

Based on information from the DNR Fisheries Bureau and based on the results of ISU monitoring, the Class B(LW) aquatic life uses of this lake are assessed (evaluated) as "fully supported." The ISU lake survey data show generally good chemical water quality at Lake Manawa. None of the 14 samples collected during the 2000-2004 period violated Class B(LW) criteria for dissolved oxygen. Only one of 15 samples violated of the Class B(LW) criteria for pH (7%) during summers of 2000 through 2004 (maximum = 9.4; minimum = 8.1 pH units). Based on IDNR's assessment methodology, these results do not suggest that violation frequency for pH is significantly greater than 10% and thus does not suggest impairment of either the Class A and Class B(LW) uses of Lake Manawa. This violation likely reflects the influence of primary productivity and does not reflect the input of pollutants into this lake.

Despite indications of "full support" based on information from the IDNR Fisheries Bureau and from the ISU lake survey, the occurrence of a fish kill in this lake in May 2004 suggests that the Class B(LW) aquatic life uses should be assessed (evaluated) as "partially supported". This kill occurred on or before May 10, 2004. The cause of the kill was identified as disease (bacterial). An estimated 50 fish were killed; no estimated value of the fish killed was provided. The species killed were not identified. According to IDNR's assessment/listing methodology, the occurrence of a single pollutant-caused fish kill, or a fish kill of unknown origin, on a waterbody or waterbody reach during the most recent assessment period (2002-2005) indicates a severe stress to the aquatic community and suggests that the aquatic life uses should be assessed as "impaired". If a cause of the kill was not identified during the IDNR investigation, or if the kill was attributed to non-pollutant causes (e.g., winterkill), the assessment type will be considered "evaluated." Such assessments, although suitable for Section 305(b) reporting, lack the degree of confidence to support addition to the state Section 303(d) list of impaired waters (IR Category 5). Waterbodies affected by such fish kills will be placed in IR subcategories 2b or 3b and will be added to the state list of waters in need of further investigation.

Fish consumption uses were assessed (evaluated) as "fully supported" based on results of U.S.EPA/IDNR fish contaminant (RAFT) monitoring at Lake Manawa in 1996. Because these data are now considered too old (greater than five years) to accurately characterize current water quality conditions, the assessment category is considered "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence). The existence of, or potential for, a fish consumption advisory is the basis for Section 305(b) assessments of support of fish consumption uses in Iowa's rivers and lakes. Prior to 2006, IDNR used action levels published by the U.S Food and Drug Administration to determine whether consumption advisories should be issued for fish caught as part of recreational fishing in Iowa. In an effort to make Iowa's consumption more compatible with the various protocols used by adjacent states, the Iowa Department of Public Health, in cooperation with Iowa DNR, developed a risk-based advisory protocol. This protocol went into effect in January 2006 (see <http://www.iowadnr.gov/fish/news/consump.html> for more information on Iowa's revised fish consumption advisory protocol). Because the revised (2006) protocol is more restrictive than the previous protocol based on FDA action levels; fish contaminant data that previously suggested "full support" may now suggest either a threat to, or impairment of, fish consumption uses. This scenario, however, does not apply to the fish contaminant data generated from the 1996 RAFT sampling conducted at Lake Manawa: levels of all contaminants from this monitoring were below advisory trigger levels, thus suggesting the continued "full support" of fish consumption uses.

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**Water Quality in Iowa During 2004 and 2005: Assessment Results  
Lakes, Wetlands, and Flood Control Reservoirs: Pottawattamie**

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**Nobles Lake**

Harrison County, S35,T78N,R45W, 6 mi SW of Missouri Valley.

LAKE SIZE: 102 Acres

Waterbody ID No.: IA 06-WEM-00343-L

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Assessment remains based on (1) information from the IDNR Wildlife Bureau and (2) watershed modeling conducted by IDNR staff.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Fully

Fish Consumption -- Not assessed

Aquatic Life Support -- Fully

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class B(LW) aquatic life uses are assessed (evaluated) as "fully supported" based on information from the IDNR Wildlife Bureau. The fish consumption uses remain "not assessed" due to the lack of water quality information upon which to base an assessment. Due only to a change in IDNR's assessment/listing methodology, the 2004 assessment of the Class B(LW) aquatic life uses ["fully supporting / threatened" (minor impacts)] is changed to "fully supporting". Other than this change in methodology, this new (2006) assessment is the same as that developed for the previous (2004) assessment/listing cycle (not impaired) and does not reflect any known change in water quality. This assessment remains based on (1) information from the IDNR Wildlife Bureau and (2) results of watershed modeling by IDNR staff in 2002. Fish consumption uses remain "not assessed."

EXPLANATION: The aquatic life uses are assessed as "fully supported" based on information from the Iowa DNR Wildlife Bureau. At the recommendation of U.S. EPA Region 7, IDNR's 2006 assessment/listing methodology was changed to eliminate use of the "fully supported/threatened" (not impaired) category. Thus, previous assessments identified as "fully supported/threatened" (not impaired) were changed to "fully supported" for the 2006 assessment/listing cycle. This change does not alter the 2004 assessment: this waterbody remains in IR Category 2a. The assessment developed for the 2004 assessment/listing cycle is included below:

The aquatic life uses are assessed as "fully supporting / threatened" based on information from the Iowa DNR Wildlife Bureau. The upgrade in support of the aquatic life uses from "not supporting" (see assessments developed for the 1998 and 2000 reporting cycles) to "fully supported / threatened" is based on the following information from the Iowa DNR Wildlife and Water Quality bureaus. The DeSoto Bend Wildlife Refuge currently manages the water level of this wetland by pumping water into the wetland. In addition, watershed modeling completed by IDNR staff on Nobles Lake indicates that sediment delivery to the wetland from the watershed is very low. The local DNR biologist indicates that the Missouri River does not breach the original high bank, but occasionally (10 -15 years) flood waters do enter the wetlands directly adjacent to the river. Based on this information, the previous identification of "siltation" as impairing the aquatic life uses of this wetland was in error. In addition, the impact from hydrologic modification of the Missouri River, and the related problems with maintaining adequate water levels in this riverine wetland, have been adequately mitigated. Thus, the level of support of the aquatic life uses is upgraded from "not supported" to "fully supporting / threatened." The assessment category for this wetland is "evaluated." In terms of Section 305(b) reporting, "monitored assessments" are based primarily on recent, site-specific ambient monitoring data and thus have relatively high confidence. "Evaluated assessments" are those based on data older than five years or other than site-specific ambient monitoring data (e.g., desktop models or questionnaire surveys of fish and game biologists [=best professional judgement]) and thus have relatively lower confidence.

Fish consumption uses remain "not assessed." In general, Iowa wetlands are not managed for recreational fisheries; thus, fish contaminant monitoring is not typically conducted at these waterbodies.

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**Arbor Lake**

Poweshiek County, S20,T80N,R16W, W edge of Grinnell

LAKE SIZE: 14 Acres

Waterbody ID No.: IA 03-NSK-00330-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS:

Assessment is based on results of (1) ISU lake survey in 2000-04, (2) surveys by IDNR Fisheries Bureau (3) ISU informatin on lake plankton communities, 2000-05, and (4) results of U.S. EPA/IDNR fish tissue monitoring in 2001 and 2005.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Partial      Aquatic Life Support -- Partial      Fish Consumption -- Fully      Primary Contact (Recr) -- Partial

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation uses) are assessed (monitored) as "partially supported" due to presence of aesthetically objectionable blooms of algae and due to high levels of pH that exceed state criteria. The Class B(LW) aquatic life are assessed (monitored) as "partially supported" primarily due to high levels of pH that exceed state criteria and secondarily due to blooms of algae and impacts of nutrients and siltation in the lake. Fish consumption remain assessed (monitored) as "fully supported". Sources of data for this assessment include (1) results of the statewide survey of Iowa lakes conducted from 2000 through 2004 by Iowa State University (ISU), (2) information from the IDNR Fisheries Bureau, (3) information on plankton communities at Iowa lakes from 2000 through 2004 from the ISU statewide lake survey, and (4) U.S. EPA/IDNR fish tissue monitoring in 2001 and 2005.

Note: A TMDL for siltation and nutrients at Arbor Lake was prepared by IDNR and approved by EPA in 2002; thus, this waterbody was placed into IR Category 4a (TMDL approved) for the 2004 assessment/listing cycle. Because all Section 303(d) impairments identified for the 2006 assessment/listing cycle (algal growth, nutrients, pH, and siltation) are addressed by the TMDL, this waterbody remains in IR Category 4a.

EXPLANATION: For the 2006 reporting cycle, the level of support of the Class A (primary contact recreation) uses are assessed as "partially supported" based on results from the ISU statewide survey of Iowa lakes. Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 79, 66, and 58, respectively, for Arbor Lake. According to Carlson (1977), the index value for total phosphorus places this lake in the range of hyper-eutrophic lakes. The index value for chlorophyll-a is between eutrophic and hyper-eutrophic, and the index value for secchi depth is in the upper range of eutrophic lakes. Compared to other Iowa lakes, these index values suggest (1) extremely high levels of phosphorus in the water column, (2) high levels of chlorophyll-a and suspended algae, and (3) and relatively good water transparency. According to Carlson (1991), the occurrence of a high TSI value for total phosphorus with relatively low values for chlorophyll-a and secchi depth indicate that some factor (e.g., nitrogen limitation or zooplankton grazing) limits production of algae. Based on median values from ISU sampling from 2000 through 2004, the ratio of total nitrogen to total phosphorus for Arbor Lake is 8, thus suggesting that nitrogen availability may limit algal production at times at this lake.

In addition, data from the 2000-2005 ISU statewide lakes survey show a somewhat less than average population of zooplankton grazers at Arbor Lake, with the average (2000-05) per summer sample mass of these (Cladoceran) grazers (81.6 mg/l) ranking only 71st highest of the 131 lakes sampled. The presence of these algal grazers may, in part, explain the discrepancy between the TSI values for total phosphorus and chlorophyll-a.

Carlson (1991) also suggests that a high TSI for chlorophyll-a relative to the value for secchi depth suggests that the algal community is composed of large particulate algae such as the bluegreen alga Aphanizomenon. Such a phenomenon may explain the high TSI for chlorophyll-a (66) relative to the TSI for secchi depth (58) at this lake.

The levels of inorganic suspended solids at this lake are relatively low and do not suggest potential problems with high levels of inorganic turbidity. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l. The median level of inorganic suspended solids during this period at Arbor Lake was 3.6 mg/l, thus suggesting that non-algal turbidity contributes relatively little to either limitation on algal production or in-lake turbidity. These conditions indicate impairments to the Class A (primary contact) uses through presence of blooms of algae that violate Iowa's narrative water quality standard protecting against aesthetically objectionable conditions.

Data from five years of plankton analysis by Iowa State University conducted as part of the statewide lake survey suggest that bluegreen algae (Cyanophyta) comprise a relatively small portion of the phytoplankton community of Arbor Lake. Sampling from 2000 through 2004 showed that the median summer mass of bluegreen algae at this lake (4.3 mg/l) was the 20th lowest of the 131 lakes sampled. This low level of bluegreen algae does not suggest either a threat or impairment to support of designated uses at this lake.

Information from the IDNR Fisheries Bureau, suggest that the Class B(LW) aquatic life uses are fully supported. Nuisance blooms of algae and siltation impacts, however,

## Water Quality in Iowa During 2004 and 2005: Assessment Results

### Lakes, Wetlands, and Flood Control Reservoirs: Poweshiek

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remain concerns at this lake. The ISU lake survey data show no violations of the Class B(LW) criteria for dissolved oxygen in the 15 samples collected during summers of 2000 through 2004 or for ammonia-nitrogen in the 8 samples collected during summers of 2002 through 2004. Four of 13 samples, however, exceeded the Class B(LW) criterion for pH (maximum = 9.2; minimum = 7.9 pH units). Based on IDNR's assessment methodology, these results suggest that significantly more than 10 percent of the samples exceed Iowa's pH criteria. Thus, these results suggest an impairment (partial support/monitored) of the Class A and Class B(LW) uses of this lake due to the frequency with which high levels of pH violate state criteria. These violations, however, likely reflect the excessive primary productivity at Arbor Lake and the large populations of suspended algae and do not reflect the input of pollutants into this lake.

Fish consumption uses are assessed as "fully supported" based on results of U.S. EPA/IDNR fish tissue (RAFT) monitoring in 2001 and RAFT follow-up monitoring in 2005. While a composite sample of largemouth bass fillets collected from Arbor Lake for the 2001 RAFT contained 0.312 ppm of mercury, the 2005 RAFT follow-up composite sample of fillets from largemouth bass had a low level of mercury (0.17 ppm). These results suggest "full support" of the fish consumption uses. The existence of, or potential for, a fish consumption advisory is the basis for Section 305(b) assessments of the degree to which Iowa's lakes and rivers support their fish consumption uses. Prior to 2006, IDNR used action levels published by the U.S. Food and Drug Administration to determine whether consumption advisories should be issued for fish caught as part of recreational fishing in Iowa. In an effort to make Iowa's consumption more compatible with the various protocols used by adjacent states, the Iowa Department of Public Health, in cooperation with Iowa DNR, developed a risk-based advisory protocol. This protocol went into effect in January 2006 (see <http://www.iowadnr.gov/fish/news/consump.html> for more information on Iowa's revised fish consumption advisory protocol). Because the revised (2006) protocol is more restrictive than the previous protocol based on FDA action levels; fish contaminant data that previously suggested "full support" may now suggest either a threat to, or impairment of, fish consumption uses. This scenario, however, does not apply to the fish contaminant data generated from the 2005 RAFT follow-up sampling conducted in this lake: the levels of contaminants do not exceed any of the new (2006) advisory trigger levels, thus suggesting no justification for issuance of a consumption advisory.

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Lakes, Wetlands, and Flood Control Reservoirs: Poweshiek

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**Diamond Lake**

Poweshiek County, S2,T78N,R15W, approx 2.5 mi SW of Montezuma.

LAKE SIZE: 98 Acres

Waterbody ID No.: IA 03-NSK-00242-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class B(LW), Class C

ASSESSMENT COMMENTS:

Assessment is based on results of (1) the Iowa Voluntary Atrazine Monitoring Program from 2003-04, (2) ISU lake surveys from 2000-04, (3) ISU reports on lake phytoplankton communities from 2000-05, and (4) surveys of the DNR Fisheries Bureau.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Fully

Fish Consumption -- Not assessed

Drinking Water Supply -- Fully

Aquatic Life Support -- Fully

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class B(LW) aquatic life uses are assessed (monitored) as "fully supported." The Class C (drinking water) uses are assessed (monitored) as "fully supported." Fish consumption uses remain "not assessed" due to lack of fish contaminant monitoring at this lake. The sources of data for this assessment include (1) ) results of the statewide survey of Iowa lakes sponsored by IDNR and conducted by Iowa State University (ISU) from 2000 through 2004, (2) surveys by IDNR Fisheries Bureau, and (3) information on plankton communities collected at Iowa lakes from 2000 through 2005 as part of the ISU lake survey, and (4) results of the Iowa Voluntary Atrazine Monitoring Program conducted in 2003 and 2004 by Syngenta Crop Protection, Inc. (formerly Novartis Crop Protection, Inc.).

EXPLANATION: Using the median values from the ISU lakes survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 69, 62, and 60, respectively. According to Carlson (1977), the index value for total phosphorus places this lake at the upper range between eutrophic and hyper-eutrophic lakes; the index value for chlorophyll-a is in the lower range between eutrophic and hyper-eutrophic lakes, and the index value for secchi depth is at the upper boundary of eutrophic lakes. These index values suggest (1) moderately high levels of phosphorus, (2) somewhat elevated levels of chlorophyll-a, and (3) relatively good water transparency.

According to Carlson (1991), the occurrence of a high TSI value for total phosphorus with relatively low values for chlorophyll-a and secchi depth indicate that some factor (e.g., nitrogen limitation, zooplankton grazing, or some other factor) other than phosphorus limits production of algae. Based on median values from ISU sampling from 2000 through 2004, the ratio of total nitrogen to total phosphorus for Diamond Lake is 15. This ratio does not suggest a strong possibility that algal production at this lake is nitrogen-limited.

Data from the ISU survey show relatively small populations of zooplankton species at this that graze on algae. Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., Daphnia) comprised about 45% of the dry mass of the zooplankton community and that Diamond Lake had the 35th lowest median summer sample level of zooplankton (Cladoceran) grazers (55.6 mg/l) of the 131 lakes sampled. This relatively small population of zooplankton grazers suggests little potential zooplankton grazers to limit algal production at this lake.

The levels of inorganic suspended solids at this lake are very low and do not suggest the potential for impairing designated uses. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l; the median level at Diamond Lake was 2.7 mg/l. This median value is very low for Iowa lakes and was the 22nd lowest of the 131 lakes sampled. According to the IDNR Fisheries Bureau, water clarity problems related to algae and inorganic turbidity have lessened at Diamond Lake following completion of a watershed protection project.

The levels of nuisance (=noxious) algal species (i.e., bluegreen algae) at this lake do not suggest an impairment of Class A uses. While data from the ISU survey from 2000 through 2004 suggest that bluegreen algae (Cyanophyta) comprise a significant portion (nearly 60%) of this lake's summertime phytoplankton community, sampling from 2000 through 2004 showed that the median per summer sample mass of bluegreen algae at Diamond Lake was the 32nd lowest of the 131 lakes sampled: 6.0 mg/l. This level is in the lowest 25% of the 131 Iowa lakes sampled. The presence of a relatively small population of bluegreen algae at this lake does not suggest a potential violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life. This assessment, however, is based strictly on a distribution of the lake-specific median bluegreen algae values for the 2000-2004 monitoring period. Median levels less than the 75th percentile of this distribution (~29 mg/l) were arbitrarily considered by IDNR staff to not represent an impairment of the Class A uses of Iowa lakes. No criteria exist, however, upon which to base a more accurate identification of impairments due to bluegreen algae. Thus, while the ability to characterize the levels of bluegreen algae at this lake has improved over that of the previous (2004) assessment due to collection of additional data, the assessment category for assessments based on level of bluegreen algae nonetheless remains, of necessity, "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

Information from the IDNR Fisheries Bureau suggest that the Class B(LW) aquatic life uses should be assessed (evaluated) as "fully supported". The ISU lake survey data show generally good chemical water quality at Diamond Lake. Only one violation of the Class B(LW) criteria for dissolved oxygen occurred in the 15 samples collected during summers of 2000 through 2004. Two of 13 samples (15%), however, violated the Class A,B(LW) criterion for pH (maximum = 9.1; minimum = 8.1 pH units). Based on IDNR's

Lakes, Wetlands, and Flood Control Reservoirs: Poweshiek

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assessment methodology, however, these results do not suggest that significantly more than 10 percent of the samples exceed Iowa's pH criteria and thus do not suggest an impairment of the Class A and Class B(LW) uses of this lake. These violations likely reflect the high levels of primary productivity at Diamond Lake and do not reflect the input of pollutants into this lake.

The assessment of support of the Class C (drinking water) uses ("fully supported") was based primarily on the results of the Syngenta "Iowa Voluntary Atrazine Monitoring Program" from 2003 through 2004. This monitoring showed that the time-weighted mean levels of atrazine in samples collected from the Montezuma raw water source in calendar years 2003 and 2004 were well-below the MCL of 3.0 ug/l. The mean and median atrazine level over this two-year period (N=60) was 0.8 ug/l. The maximum value for this two-year period was 1.3 ug/l. None of the 27 moving annual averages for atrazine for the years 2003 and 2004 at Diamond Lake exceeded the MCL (maximum average = 0.8 ug/l). Based on DNR's Section 305(b) assessment methodology, if the average contaminant levels in source water is less than the MCL, the Class C (drinking water) uses of the source water should be assessed as "fully supported." The only parameter collected as part of the ISU lake survey relevant to support of Class C (drinking water) uses is nitrate. The results of the ISU survey from 2000-04 show that nitrate levels are very low at this lake (N = 15; maximum value = 1.7 mg/l; median = 0.1 mg/l) and are well-below the MCL of 10 mg/l.

Fish consumption uses were "not assessed due to the lack of fish contaminant monitoring at this lake."

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**Holiday Lake**

Poweshiek County, S23,T81N,R14W, 5 mi N of Brooklyn.

LAKE SIZE: 122 Acres

Waterbody ID No.: IA 02-IOW-00595-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed      Primary Contact (Recr) -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

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**Lake Ponderosa**

Poweshiek County, S3,T78N,R15W, 2 mi W of Montezuma

LAKE SIZE: 410 Acres

Waterbody ID No.: IA 03-NSK-00240-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Primary Contact (Recr) -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

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**Nyanza Lake**

Poweshiek Co East of Arbor Lake

LAKE SIZE: 13 Acres

Waterbody ID No.: IA 03-NSK-00331-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: General Use

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

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## Water Quality in Iowa During 2004 and 2005: Assessment Results

### Lakes, Wetlands, and Flood Control Reservoirs: Ringgold

#### Fogle Lake

Ringgold County, in S31, T70N, R30W; at NW edge of Diagonal

LAKE SIZE: 44 Acres

Waterbody ID No.: IA 05-GRA-0205-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Assessment is based on results of (1) ISU lake survey from 2000-04 and (2) ISU reports on lake plankton communities from 2000-05.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Fully

Fish Consumption -- Not assessed

Aquatic Life Support -- Fully

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class B(LW) aquatic life uses are assessed (monitored) as "fully supporting". Fish consumption uses are "not assessed" due to the lack of fish contaminant monitoring at this lake. The sources of data for this assessment include (1) results of the statewide survey of Iowa lakes sponsored by IDNR and conducted by Iowa State University (ISU) from 2000 through 2004 and (2) information on plankton communities collected at Iowa lakes from 2000 through 2005 as part of the ISU lake survey. The 2004 assessment of this lake as "threatened" due to turbidity and to bluegreen algae was in error. The TSI values for chlorophyll-a and Secchi depth for that assessment (57 and 60, respectively) are well below the impairment trigger of 65 and do not suggest a threat or impairment of the Class B(LW) uses of this lake.

EXPLANATION: Results from the ISU statewide survey of Iowa lakes suggest relatively good water quality at Fogle Lake and "full support" of its Class B(LW) uses. Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 62, 60, and 60, respectively. According to Carlson (1977), the index value for total phosphorus places this lake in the lower range between eutrophic and hyper-eutrophic lakes; the index values for chlorophyll-a and secchi depth are at the upper boundary of eutrophic lakes. These index values suggest moderately high levels of phosphorus, relatively low levels of chlorophyll-a, and relatively good water transparency.

Based on median values from ISU sampling from 2000 through 2004, the ratio of total nitrogen to total phosphorus for Fogle Lake is 25. This TN:TP ratio suggests that algal production at this lake is limited by availability of phosphorus.

In terms of all Iowa lakes sampled, data from the ISU survey show large populations of zooplankton species at this lake that graze on algae. Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., Daphnia) comprised approximately 70% of the dry mass of the zooplankton community of this lake. The average per summer sample mass of Cladoceran taxa over the 2000-2005 period (116 mg/l) was the 46th highest of the 131 lakes sampled.

The levels of inorganic suspended solids at this lake are somewhat elevated and suggest the potential for attenuating light and contributing to in-lake turbidity. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l; the median level at Fogle Lake was somewhat lower at 4.7 mg/l. Despite the somewhat typical levels of inorganic suspended solids, the TSI values for chlorophyll-a and Secchi depth at Fogle Lake suggests relatively good water quality and full support of the Class B(LW) uses

The levels of nuisance (=noxious) algal species (i.e., bluegreen algae) at this lake do not suggest an impairment of Class A uses. While data from the ISU survey from 2000 through 2004 suggest that bluegreen algae (Cyanophyta) comprise a significant portion (70%) of this lake's summertime phytoplankton community, sampling from 2000 through 2004 showed that the median per summer sample mass of bluegreen algae at Fogle Lake (13 mg/l) was the 71st lowest of the 131 lakes sampled. This level is in the lowest two-thirds of the 131 Iowa lakes sampled. The presence of a relatively small population of bluegreen algae at this lake does not suggest a potential violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life. This assessment, however, is based strictly on a distribution of the lake-specific median bluegreen algae values for the 2000-2004 monitoring period. Median levels less than the 75th percentile of this distribution (~29 mg/l) were arbitrarily considered by IDNR staff to not represent an impairment of the Class A uses of Iowa lakes. No criteria exist, however, upon which to base a more accurate identification of impairments due to bluegreen algae. Thus, while the ability to characterize the levels of bluegreen algae at this lake has improved over that of the previous (2004) assessment due to collection of additional data, the assessment category for assessments based on level of bluegreen algae nonetheless remains, of necessity, "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

The ISU lake survey data also show good chemical water quality at this lake. These data show no violations of the Class B(LW) criteria for dissolved oxygen in the 14 samples collected during summers of 2000 through 2004. One of 15 samples exceeded the Class A,B(LW) criterion for pH (maximum = 9.01; minimum = 7.9 pH units). Based on IDNR's assessment methodology, however, these results do not suggest that significantly more than 10 percent of the samples exceed Iowa's pH criteria and thus do not suggest an impairment of the Class A and Class B(LW) uses of this lake. This violation likely reflects levels of primary productivity at Fogle Lake and does not reflect the input of pollutants into this lake.

Fish consumption uses are "not assessed" due to the lack of fish contaminant monitoring at this lake.

**Lions Club Pond**

Ringgold County, S31,T69N,R29W, 1 mi N of Mount Ayr.

LAKE SIZE: 2 Acres

Waterbody ID No.: IA 05-GRA-01925-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Loch Ayr**

Ringgold County, S30,T69N,R29W, 2 miles N of Mt. Ayr.

LAKE SIZE: 95 Acres

Waterbody ID No.: IA 05-GRA-01920-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class A, Class B(LW), Class C

ASSESSMENT COMMENTS: Assessment remains based on results of Syngenta's Iowa Voluntary Atrazine Monitoring Program in 2000 and 2001.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Threatened      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed      Primary Contact (Recr) -- Not assessed  
Drinking Water Supply -- Threatened

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses and the Class B(LW) aquatic life uses remain "not assessed" due to the lack of water quality information upon which to base an assessment. The Class C (drinking water) uses remain assessed (monitored) as "fully supported/threatened" with a declining trend due to average levels of atrazine that appear to be approaching state water quality criteria and the U.S. EPA MCL. Fish consumption uses remain "not assessed" due to the lack of fish contaminant monitoring in this river reach. The source of data for this assessment remains the results of the Iowa Voluntary Atrazine Monitoring Program conducted in 2000 and 2001 by Syngenta Crop Protection, Inc. (Loch Ayr was not sampled as part of the Syngenta program in 2002, 2003, or 2004).

EXPLANATION: The Class A and Class B(WW) uses remain "not assessed" due to the lack of water quality information for this lake.

Due to the lack of more recent data, the assessment developed for the previous (2004) Section 305(b) reporting cycle will be used for the current (2006) reporting cycle. According to U.S. EPA guidance and according to IDNR's assessment/listing methodology, a Section 303(d) impairment cannot be removed due either to lack of more recent data or due to the age of the data upon which the impairment was based. The assessment of support of the Class C (drinking water) uses for the 2004 reporting cycle was based on the results of the Syngenta "Iowa Voluntary Atrazine Monitoring Program" in 2000 and 2001. This monitoring showed that the time-weighted mean levels of atrazine in samples collected from Loch Ayr in both calendar years 2000 and 2001 were below the MCL of 3 ug/l. The time-weighted mean of atrazine in 2000 (N=31) was 1.65 ug/l and in 2001 (N=29) was 2.94 ug/l. Yearly maximum values were 2.2 ug/l in 2000 and 7.2 ug/l in 2001. None of the 31 samples collected in 2000 exceeded the MCL; 13 of the 29 samples collected in 2001 did exceed the MCL. None of the 31 moving annual averages calculated for the 2000-2001 period exceeded the MCL of 3 ug/l (range: 1.4 to 3.2 ug/l). Note: rounding is required when comparing levels of atrazine to the MCL. Because the MCL, as published by U.S. EPA, is 0.003 mg/l, any values compared to the MCL must be in the proper MCL units and compared at the same number of significant figures. Thus, the annual time-weighted mean of atrazine for 2001 (0.00294 mg/l) rounds up to 0.003 mg/l, and the maximum moving annual average (0.0032 mg/l) rounds down to 0.003 mg/l; neither of these average values exceeds the MCL for atrazine. Thus, based on IDNR's Section 305(b) assessment methodology, if the average contaminant level in source water is less than the MCL, but the MCL is exceeded in one or more samples, the Class C (drinking water) uses of the source water should be assessed as "fully supported / threatened." However, if contaminant levels appear to be increasing, "threatened" waters can be considered as candidates for Section 303(d) listing.

Fish consumption uses remain "not assessed" due to the lack of fish contaminant monitoring at this lake.

Water Quality in Iowa During 2004 and 2005: Assessment Results

Lakes, Wetlands, and Flood Control Reservoirs: Ringgold

**Mt. Ayr Game Area Ponds**

Ringgold County, S17,T68N,R30W, 4 mi WSW of Mount Ayr.

LAKE SIZE: 5 Acres

Waterbody ID No.: IA 05-GRA-01910-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Mt. Ayr Old Reservoir**

Ringgold County, S31,T69N,R29W, 0.5 mi N of Mount Ayr.

LAKE SIZE: 12 Acres

Waterbody ID No.: IA 05-GRA-01930-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Ringgold Management Area Pond**

Ringgold County, S13,T67N,R29W, 8 mi SE Mount Ayr.

LAKE SIZE: 15 Acres

Waterbody ID No.: IA 05-GRA-01710-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

Water Quality in Iowa During 2004 and 2005: Assessment Results

Lakes, Wetlands, and Flood Control Reservoirs: Ringgold

Walnut Creek Marsh

Ringgold County, S17,T68N,R30W, 4 mi WSW of Mount Ayr.

LAKE SIZE: 60 Acres

Waterbody ID No.: IA 05-GRA-01950-L

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Assessment remains based on information from the IDNR Wildlife Bureau.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Partial Aquatic Life Support -- Partial Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class B(LW) aquatic life uses remain assessed (evaluated) as "partially supported" based on information from the IDNR Wildlife Bureau. Fish consumption uses remain "not assessed." This is the same assessment as that developed for the 2002 and 2004 assessment/listing cycles.

EXPLANATION: The Class B(LW) aquatic life uses remain assessed as "partially supported" based on information from the Iowa DNR Wildlife Bureau (see assessments developed for the 1998 and 2000 reporting cycles). The assessment category for this wetland of "evaluated" indicates that the assessment is based entirely on "best professional judgement." In terms of Section 305(b) reporting, "monitored assessments" are based primarily on recent, site-specific ambient monitoring data and thus have relatively high confidence. IDNR considers waterbodies identified as "impaired" based on "monitored assessments" as candidates for the state's Section 303(d) list. "Evaluated assessments" are those based on data older than five years or other than site-specific ambient monitoring data (e.g., questionnaire surveys of fish and game biologists [=best professional judgement]) and thus have relatively lower confidence. IDNR does not consider waterbodies identified as "impaired" based on "evaluated assessments" as candidates for the state's Section 303(d) list.

Fish consumption uses remain "not assessed." In general, Iowa wetlands are not managed for recreational fisheries; thus, fish contaminant monitoring is not typically conducted at these waterbodies.

**Water Quality in Iowa During 2004 and 2005: Assessment Results  
Lakes, Wetlands, and Flood Control Reservoirs: Sac**

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**Arrowhead Lake**

Sac County, S4,T86N,R36W, S edge of Lake View.

LAKE SIZE: 35 Acres

Waterbody ID No.: IA 04-RAC-00480-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Assessment is based on results of (1) ISU lake survey in 2000-04, (2) ISU information on lake plankton communities, 2000-05, and (3) surveys by IDNR Fisheries Bureau.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Fully

Aquatic Life Support -- Fully

Fish Consumption -- Not assessed

Primary Contact (Recr) -- Fully

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses are assessed (monitored) as "fully supporting." The Class B(LW) aquatic life uses also remain assessed (evaluated) as "fully supporting." Fish consumption uses remain "not assessed." The sources of data for this assessment include (1) results of the statewide survey of Iowa lakes conducted in 2000 through 2004 sponsored by IDNR and conducted by Iowa State University (ISU), (2) information from the IDNR Fisheries Bureau, and (3) information on plankton communities at Iowa lakes from 2000 through 2005 collected as part of the IDNR/ISU statewide lake survey.

EXPLANATION: Results from the ISU statewide survey of Iowa lakes suggest that levels of phosphorus are very low at Arrowhead Lake and do not threaten full support of the Class A uses. Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 50, 50, and 45, respectively. According to Carlson (1977), the index values for all three parameters are near the boundary between mesotrophic and eutrophic waters. These index values suggest (1) very low levels of phosphorus for an Iowa lake, (2) very low production of suspended algae, and (3) exceptional water transparency. Based on median values from ISU sampling in from 2000 through 2004, the ratio of total nitrogen to total phosphorus for Arrowhead Lake is 30. This ratio suggest that algal production at this lake is likely limited by the availability of phosphorus. The levels of inorganic suspended solids at this lake are very low and do not suggest the potential for impairing designated uses due to high turbidities. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l; the median level at Arrowhead Lake was 1.4 mg/l: this median value is the eighth lowest of the 131 lakes sampled.

Data from the ISU survey show relatively small populations of zooplankton species at this that graze on algae. Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., Daphnia) comprised only about 43% of the dry mass of the zooplankton community and that Arrowhead Lake had only the 89th highest per summer sample level of zooplankton (Cladoceran) grazers (58.5 mg/l) of the 131 lakes sampled.

The presence of nuisance algal species (i.e., bluegreen algae) does not appear to be a significant problem at this lake. Data from the ISU survey from 2002-2004 suggest that bluegreen algae (Cyanophyta) comprise a relatively small portion of the summertime phytoplankton community of this lake. The percent wet mass of bluegreen algae in the phytoplankton community of Arrowhead Lake in summers of the 2000-2004 period was approximately 59%. The median wet mass of bluegreens over this time (7.8 mg/l) ranked the 41st lowest of the 131 lakes sampled.

The water quality conditions at this lake (based on the TSI values for chlorophyll-a and Secchi depth), along with information from the IDNR Fisheries Bureau, suggest that the Class B(LW) aquatic life uses should be assessed as "fully supported." The ISU lake survey data also show good chemical water quality at this lake. These data show no violations of the Class B(LW) criteria for dissolved oxygen in the 14 samples collected, or for pH in the 15 samples collected, at Arrowhead Lake during summers of 2000 through 2004.

Fish consumption uses remain "not assessed" due to the lack of fish contaminant monitoring at this lake.

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**Water Quality in Iowa During 2004 and 2005: Assessment Results  
Lakes, Wetlands, and Flood Control Reservoirs: Sac**

**Black Hawk Lake**

Sac County, S35,T87N,R36W, at Lake View.

LAKE SIZE: 925 Acres

Waterbody ID No.: IA 04-RAC-00475-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Assessment is based on (1) surveys by the DNR Fisheries Bureau, (2) results of the IDNR beach monitoring program from 2002-04, (3) results from the ISU lake survey from 2000-04, and (4) results from the ISU lake plankton studies from 2000-05.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not supporting      Fish Consumption -- Not assessed      Primary Contact (Recr) -- Not supporting      Aquatic Life Support -- Fully

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation uses) are assessed (monitored) as "not supported" due to aesthetically objectionable conditions caused by poor water clarity; this impairment appears due primarily to inorganic turbidity and secondarily to large populations of suspended algae. Results of IDNR beach monitoring, however, show "full support" of primary contact uses during the 2002-04 period. The Class B(LW) aquatic life uses are assessed (evaluated) as "fully supported " although nuisance blooms of algae, re-suspension of sediment, and the increasing population of common carp remain water quality concerns at this lake. Fish consumption are assessed as "fully supported" based on results of fish contaminant monitoring in 2003. Sources of data for this assessment include (1) results of IDNR/UHL beach monitoring from 2002-2004, (2) results of the statewide survey of Iowa lakes sponsored by IDNR and conducted by Iowa State University (ISU) from 2000 through 2004, (3) surveys by IDNR Fisheries Bureau, (4) information on plankton communities collected at Iowa lakes from 2000 through 2005 as part of the ISU lake survey, and (5) results of U.S. EPA/IDNR fish tissue monitoring in 2003.

EXPLANATION: Results of IDNR beach monitoring at Black Hawk Lake from 2002 through 2004 suggest that the Class A uses are "fully supported." Levels of indicator bacteria were monitored once per week during the primary contact recreation seasons (May through September) of 2002 (27 samples), 2003 (28 samples), and 2004 (16 samples) as part of the IDNR beach monitoring program. According to IDNR's assessment methodology, two conditions need to be met for results of beach monitoring to indicate "full support" of the Class A (primary contact recreation) uses: (1) all five-sample, thirty-day geometric means for the three-year assessment period are less than the state's geometric mean criterion of 126 E. coli orgs/100 ml and (2) not more than 10 % of the samples during any one recreation season exceeds the state's single-sample maximum value of 235 E. coli orgs/100 ml. This assessment approach is based on U.S. EPA guidelines (see pgs 3-33 to 3-35of U.S. EPA 1997b).

At Black Hawk Lake beach (Campground Beach), the geometric means of all 59 thirty-day periods during the summer recreation seasons of 2002, 2003 and 2004 were below the Iowa water quality standard of 126 orgs/100 ml. Also, none of the 71 samples collected during the three recreational seasons exceeded Iowa's single-sample maximum criterion of 235 E. coli orgs/100 ml. According to U.S. EPA guidelines and IDNR's assessment methodology, these results suggest "full support" of the Class A (primary contact recreation) uses.

Despite the very low levels of bacteria in the lake, results of monitoring conducted by ISU from 2000 through 2004 as part of the statewide survey of Iowa lakes suggest that the Class A (primary contact) uses are "not supported" due to very poor water transparency. Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 77, 64, and 75, respectively, for Black Hawk Lake. According to Carlson (1977), these index values place this lake in the range of hyper-eutrophic lakes and suggest (1) extremely high levels of phosphorus in the water column, (2) moderately high, and less than expected, production of suspended algae, and (3) very poor water transparency.

According to Carlson (1991), the occurrence of a high TSI value for total phosphorus with relatively lower values for chlorophyll-a and secchi depth indicate that some factor (e.g., nitrogen limitation, zooplankton grazing, or some other factor) limits production of algae. The ISU lake data suggest that algal production at Black Hawk Lake is limited primarily by inorganic turbidity. Based on median values from ISU sampling from 2000-04, the ratio of total nitrogen to total phosphorus for Black Hawk Lake is 15. This ratio, although somewhat low, does not suggest a strong nitrogen limitation at this lake. During the 2000-2002 period, however, the data suggested a TN:TP ratio of 7 for this lake, this lower ratio more strongly suggests that algal production at this lake is at times limited by nitrogen availability.

In addition, data from the ISU survey show moderately large populations of zooplankton species at this that graze on algae. Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., Daphnia) comprised approximately 30% of the dry mass of the zooplankton community and that Black Hawk Lake had the 47th highest per summer sample mass of zooplankton (Cladoceran) grazers of the 131 lakes sampled. This level of zooplankton grazers may be able to suppress algal production.

Data on inorganic suspended solids from the ISU survey suggest that algal production at this lake most strongly affected by the extremely high levels of non-algal turbidity. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l. The median level of inorganic suspended

## Water Quality in Iowa During 2004 and 2005: Assessment Results

### Lakes, Wetlands, and Flood Control Reservoirs: Sac

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solids at Black Hawk Lake (18.4 mg/l) was the 14th highest of the 131 lakes, thus suggesting that non-algal turbidity limits the production of algae and accounts for the discrepancy between the TSI for phosphorus (77) and the TSI for chlorophyll-a (64).

Based on overall summer median values the 2000-04 period, Black Hawk Lake had the 17th poorest Secchi depth of the 131 lakes sampled. These conditions indicate impairments to the Class A (primary contact) uses through presence of aesthetically objectionable conditions due poor water transparency caused primarily by high levels of inorganic turbidity and secondarily by algae suspended in the water column. The IDNR Fisheries Bureau concurs that high levels of algae present an impairment of designated uses at this lake.

Data from the ISU survey from 2002-2004 suggest that the presence of nuisance aquatic species (i.e., bluegreen algae) may threaten support of the Class A uses. Sampling during this time showed the percent wet mass of bluegreens comprised nearly 80% of the phytoplankton community. Black Hawk Lake, however, had only the 38th highest per summer sample mass of bluegreen algae (24.4 mg/l) of the 131 lakes sampled. While elevated relative to most Iowa lakes, this median is not in the worst 25% of the 131 Iowa lakes sampled.

Information from the IDNR Fisheries Bureau suggest that the Class B(LW) aquatic life uses are "fully supported". The following factors, however, remain of concern at this lake: nuisance blooms of algae, re-suspension of sediment; the increasing population of common carp, and their tendency to increase levels of turbidity through re-suspension of sediment and algal nutrients. The ISU lake survey data also show good chemical water quality at this lake. Results of this monitoring show no violations of the Class A,B(LW) criteria for pH in the 15 samples collected during summers of 2000 through 2004 (maximum = 8.7; minimum = 6.8 pH units). One of the 14 samples collected exceeded the Class B(LW) criterion for dissolved oxygen. Based on IDNR's assessment methodology, however, these results do not suggest that significantly more than 10 percent of the samples exceed Iowa's dissolved oxygen criteria and thus do not suggest an impairment of the Class B(LW) uses of Black Hawk Lake.

Fish consumption uses were assessed (monitored) as "fully supported" based on results of U.S.EPA/IDNR fish contaminant (RAFT) monitoring at Black Hawk Lake in 2003. The composite samples of fillets from common carp and black crappie had low levels of contaminants. Levels of primary contaminants in the composite sample of common carp fillets were as follows: mercury: <0.0181 ppm; total PCBs: 0.09 ppm; and technical chlordane: <0.03 ppm. Levels of primary contaminants in the composite sample of black crappie fillets were as follows: mercury: <0.0181 ppm; total PCBs: 0.09 ppm; and technical chlordane: <0.03 ppm. The existence of, or potential for, a fish consumption advisory is the basis for Section 305(b) assessments of the degree to which Iowa's lakes and rivers support their fish consumption uses. Prior to 2006, IDNR used action levels published by the U.S Food and Drug Administration to determine whether consumption advisories should be issued for fish caught as part of recreational fishing in Iowa. In an effort to make Iowa's consumption more compatible with the various protocols used by adjacent states, the Iowa Department of Public Health, in cooperation with Iowa DNR, developed a risk-based advisory protocol. This protocol went into effect in January 2006 (see <http://www.iowadnr.gov/fish/news/consump.html> for more information on Iowa's revised fish consumption advisory protocol). Because the revised (2006) protocol is more restrictive than the previous protocol based on FDA action levels; fish contaminant data that previously suggested "full support" may now suggest either a threat to, or impairment of, fish consumption uses. This scenario, however, does not apply to the fish contaminant data generated from the 2003 RAFT sampling conducted at this lake: the levels of contaminants do not exceed any of the new (2006) advisory trigger levels, thus indicating no justification for issuance of a consumption advisory for this waterbody.

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Water Quality in Iowa During 2004 and 2005: Assessment Results  
Lakes, Wetlands, and Flood Control Reservoirs: Sac

**Black Hawk Wildlife Area**

Sac County, S9,T86N,R36W, 2 mi S of Lake View.

LAKE SIZE: 50 Acres

Waterbody ID No.: IA 04-RAC-00477-L

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Assessment remains based on information from the IDNR Wildlife Bureau.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Partial      Aquatic Life Support -- Partial      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Waterbody was not designated for beneficial uses in the Iowa Water Quality Standards as of June 1996. This publicly-owned waterbody was added to the list of Iowa wetlands in 1994 at the suggestion of the DNR Wildlife Bureau.

[NOTES: For the 2002 report, the waterbody identification number for this wetland was changed from "IA-WETLAND-50" to "IA 04-RAC-00477-L." This wetland was not in the July 2003 version of the Iowa Water Quality Standards and is thus classified only for "general uses." This wetland however, has been proposed for inclusion to the standards as a Class B(LW) waterbody.]

SUMMARY: Continued to assess (evaluate) support of the aquatic life uses as "partially supported." Other beneficial uses remain "not assessed." This assessment is the same as that developed for the 2002 and 2004 assessment/listing cycles.

EXPLANATION: The previous (2000) assessment of support of the aquatic life uses ("partially supported") was reviewed and approved by the DNR Wildlife Bureau in 2002. According to the local DNR Wildlife Biologist (Mahn), this wetland remains impaired by purple loosestrife. Biological control of this exotic plant species does not appear to be working; the native wetland edge vegetation is slowly being replaced by purple loosestrife. There are no data, however, to verify that the wetland is receiving excessive amounts of sediment. This wetland area also suffers from water level fluctuations in the past which may influence judgement on how much sediment is present in the wetland. The assessment category for this wetland of "evaluated" indicates that the assessment is based primarily on "best professional judgement." In terms of Section 305(b) reporting, "monitored assessments" are based primarily on recent, site-specific ambient monitoring data and thus have relatively high confidence. IDNR considers waterbodies identified as "impaired" based on "monitored assessments" as candidates for the state's Section 303(d) list. "Evaluated assessments" are those based on data older than five years or other than site-specific ambient monitoring data (e.g., questionnaire surveys of fish and game biologists [=best professional judgement]) and thus have relatively lower confidence. IDNR typically does not consider waterbodies identified as "impaired" based on "evaluated assessments" as candidates for the state's Section 303(d) list.

Fish consumption uses remain "not assessed." In general, Iowa wetlands are not managed for recreational fisheries; thus, fish contaminant monitoring is not typically conducted at these waterbodies.

Water Quality in Iowa During 2004 and 2005: Assessment Results

Lakes, Wetlands, and Flood Control Reservoirs: Sac

**Burrows Wetland**

Sac County, S29,T89N,R36W, 3 mi NE of Early.

LAKE SIZE: 30 Acres

Waterbody ID No.: IA 04-RAC-01695-L

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Assessment remains based on informaiton from the IDNR Wildlife Bureau.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Fully Fish Consumption -- Not assessed Aquatic Life Support -- Fully

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :[NOTES: Prior to the 2002 cycle, the Waterbody ID number for this wetland was IA-WETLAND-51. This wetland is not in the July 2003 version of the Iowa Water Quality Standards but is proposed for inclusion to the standards as a Class B(LW) waterbody. Drainage for this wetland is difficult to determine from maps; potential routes include (1) Indian Cr. -> N. Raccoon R. and (2) Buck Run -> N. Raccoon R.]

SUMMARY: The aquatic life uses are assessed (evaluated) as "fully supported" based on information from the IDNR Wildlife Bureau. The fish consumption uses remain "not assessed" due to the lack of water quality information upon which to base an assessment. Due only to a change in IDNR's assessment/listing methodology, the 2004 assessment of the aquatic life uses ["fully supporting / threatened" (minor impacts)] is changed to "fully supporting". Other than this change in methodology, this new (2006) assessment is the same as that developed for the previous (2004) assessment/listing cycle (not impaired) and does not reflect any known change in water quality.

EXPLANATION: The aquatic life uses are assessed as "fully supported" based on information from the Iowa DNR Wildlife Bureau. At the recommendation of U.S. EPA Region 7, IDNR's 2006 assessment/listing methodology was changed to eliminate use of the "fully supported/threatened" (not impaired) category. Thus, previous assessments identified as "fully supported/threatened" (not impaired) were changed to "fully supported" for the 2006 assessment/listing cycle. This change does not alter the 2004 assessment: this waterbody remains in IR Category 2a.

Fish consumption uses remain "not assessed." In general, Iowa wetlands are not managed for recreational fisheries; thus, fish contaminant monitoring is not typically conducted at these waterbodies.

**Hallet Pits**

Sac County, S5,T86N,R36W, 1 mi S of Lake View.

LAKE SIZE: 20 Acres

Waterbody ID No.: IA 04-RAC-00485-L

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed Primary Contact (Recr) -- Not assessed Aquatic Life Support -- Not assessed Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

Water Quality in Iowa During 2004 and 2005: Assessment Results

Lakes, Wetlands, and Flood Control Reservoirs: Sac

**Kiowa Marsh**

Sac County, S1,T88N,R37W, 2 mi E of Early

LAKE SIZE: 180 Acres

Waterbody ID No.: IA 04-RAC-01450-L

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Assessment remains based on information from the IDNR Wildlife Bureau.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Fully      Aquatic Life Support -- Fully      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :[NOTES: Prior to the 2002 cycle, the Waterbody ID number for this wetland was IA-WETLAND-52. This wetland is not in the July 2003 version of the Iowa Water Quality Standards but is proposed for inclusion to the standards as a Class B(LW) waterbody.]

SUMMARY: The aquatic life uses are assessed (evaluated) as "fully supported" based on information from the IDNR Wildlife Bureau. The fish consumption uses remain "not assessed" due to the lack of water quality information upon which to base an assessment. Due only to a change in IDNR's assessment/listing methodology, the 2004 assessment of the aquatic life uses ["fully supporting / threatened" (minor impacts)] is changed to "fully supporting". Other than this change in methodology, this new (2006) assessment is the same as that developed for the previous (2004) assessment/listing cycle (not impaired) and does not reflect any known change in water quality.

EXPLANATION: The aquatic life uses are assessed as "fully supported" based on information from the Iowa DNR Wildlife Bureau. At the recommendation of U.S. EPA Region 7, IDNR's 2006 assessment/listing methodology was changed to eliminate use of the "fully supported/threatened" (not impaired) category. Thus, previous assessments identified as "fully supported/threatened" (not impaired) were changed to "fully supported" for the 2006 assessment/listing cycle. This change does not alter the 2004 assessment: this waterbody remains in IR Category 2a.

Fish consumption uses remain "not assessed." In general, Iowa wetlands are not managed for recreational fisheries; thus, fish contaminant monitoring is not typically conducted at these waterbodies.

**Water Quality in Iowa During 2004 and 2005: Assessment Results****Lakes, Wetlands, and Flood Control Reservoirs: Sac**

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**Tomahawk Marsh**

Sac County, S9,T87N,R36W, 3 mi N of Lake View.

LAKE SIZE: 45 Acres

Waterbody ID No.: IA 04-RAC-01455-L

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Assessment remains based on information from the IDNR Wildlife Bureau.SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Fully

Aquatic Life Support -- Fully

Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :[NOTES: Prior to the 2002 cycle, the Waterbody ID number for this wetland was IA-WETLAND-53. This wetland is not in the July 2003 version of the Iowa Water Quality Standards but is proposed for inclusion to the standards as a Class B(LW) waterbody.]

SUMMARY: The aquatic life uses are assessed (evaluated) as "fully supported" based on information from the IDNR Wildlife Bureau. The fish consumption uses remain "not assessed" due to the lack of water quality information upon which to base an assessment. Due only to a change in IDNR's assessment/listing methodology, the 2004 assessment of the aquatic life uses ["fully supporting / threatened" (minor impacts)] is changed to "fully supporting". Other than this change in methodology, this new (2006) assessment is the same as that developed for the previous (2004) assessment/listing cycle (not impaired) and does not reflect any known change in water quality.

EXPLANATION: The aquatic life uses are assessed as "fully supported" based on information from the Iowa DNR Wildlife Bureau. At the recommendation of U.S. EPA Region 7, IDNR's 2006 assessment/listing methodology was changed to eliminate use of the "fully supported/threatened" (not impaired) category. Thus, previous assessments identified as "fully supported/threatened" (not impaired) were changed to "fully supported" for the 2006 assessment/listing cycle. This change does not alter the 2004 assessment: this waterbody remains in IR Category 2a.

Fish consumption uses remain "not assessed." In general, Iowa wetlands are not managed for recreational fisheries; thus, fish contaminant monitoring is not typically conducted at these waterbodies.

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**Water Quality in Iowa During 2004 and 2005: Assessment Results**

**Lakes, Wetlands, and Flood Control Reservoirs: Scott**

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**Blue Grass Lake**

Scott County, S26,T78N,R2E, at west edge of Davenport.

LAKE SIZE: 12 Acres

Waterbody ID No.: IA 01-NEM-00162-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

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**Cody Lake**

Scott County, S20,T80N,R4E, 5 mi NNE of Eldridge

LAKE SIZE: 5 Acres

Waterbody ID No.: IA 01-WPS-00110-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

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**Water Quality in Iowa During 2004 and 2005: Assessment Results  
Lakes, Wetlands, and Flood Control Reservoirs: Scott**

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**Lake Of The Hills**

Scott County, S25,T78N,R2E, 1/4 mi W of Davenport.

LAKE SIZE: 56 Acres

Waterbody ID No.: IA 01-NEM-00160-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Assessment is based on results of (1) ISU lake survey from 2000-04, (2) surveys by IDNR Fisheries Bureau, and (3) ISU reports on lake plankton communities in 2000-05.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Threatened      Fish Consumption -- Not assessed      Aquatic Life Support -- Threatened

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class B(LW) aquatic life uses are assessed (monitored) as "fully supported/threatened (impaired)" due to increasingly high levels of suspended algae that reduce water transparency. Siltation also remains a concern regarding full support of the aquatic life uses at this lake. Fish consumption are "not assessed" due to the lack of recent information upon which to base an assessment. [This lake is not designated for Class A (primary contact recreation) uses in the Iowa Water Quality Standards.] The sources of data for this assessment include (1) results of the statewide survey of Iowa lakes sponsored by IDNR and conducted by Iowa State University (ISU) from 2000 through 2004, (2) surveys by IDNR Fisheries Bureau, and (3) information on plankton communities collected at Iowa lakes from 2000 through 2005 as part of the ISU lake survey.

EXPLANATION: Results from the ISU statewide survey of Iowa lakes suggest that moderately high levels of algal and non-algal (inorganic) turbidity may impair the Class B (aquatic life) uses of Lake of the Hills. Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 63, 62, and 65, respectively. According to Carlson (1977), the index values for all three parameters are in the range between eutrophic and hyper-eutrophic lakes. These index values suggest (1) somewhat elevated levels of phosphorus, (2) moderately high production of suspended algae, and (3) marginally good water transparency.

The levels of inorganic suspended solids at this lake are moderately high and suggest the potential for limiting algal production as well as contributing to problems with in-lake turbidity. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l; the median level at Lake of the Hills was 6.7 mg/l. This moderately high level of ISS suggests the potential for light attenuation due to inorganic turbidity that could limit algal production.

Other potential non-phosphorus limitations (low TN:TP ratio and zooplankton grazers) do not appear to limit algal production at Lake of the Hills. Based on median values from ISU sampling from 2000 through 2002, the ratio of total nitrogen to total phosphorus for Lake of the Hills is 20; this ratio does not suggest that algal production at this lake is limited by the availability of nitrogen. In terms of all Iowa lakes sampled, data from the ISU survey show extremely small populations of zooplankton species at this lake that graze on algae. Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., Daphnia) comprised about 25% of the dry mass of the zooplankton community of this lake; the average per summer sample mass of Cladoceran taxa (24 mg/l) was the 13th lowest level of the 131 lakes sampled. These results suggest little if any non-phosphorus limitation due to zooplankton grazing at Lake of the Hills.

The levels of nuisance (=noxious) algal species (i.e., bluegreen algae) at this lake do not suggest an impairment of beneficial uses at this lake. While data from the ISU survey from 2000 through 2004 suggest that bluegreen algae (Cyanophyta) comprise a significant portion (about 60%) of this lake's summertime phytoplankton community, sampling from 2000 through 2004 showed that the median per summer sample mass of bluegreen algae at Lake of the Hills (11.2) was the 60th lowest of the 131 lakes sampled. This level is in the lower half of the 131 Iowa lakes sampled. The presence of a relatively small population of bluegreen algae at this lake does not suggest a potential violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life. This assessment, however, is based strictly on a distribution of the lake-specific median bluegreen algae values for the 2000-2004 monitoring period. Median levels less than the 75th percentile of this distribution (~29 mg/l) were arbitrarily considered by IDNR staff to not represent an impairment of the Class A uses of Iowa lakes. No criteria exist, however, upon which to base a more accurate identification of impairments due to bluegreen algae. Thus, while the ability to characterize the levels of bluegreen algae at this lake has improved over that of the previous (2004) assessment due to collection of additional data, the assessment category for assessments based on level of bluegreen algae nonetheless remains, of necessity, "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

These conditions suggest impairments to the Class B(LW) uses through presence of aesthetically objectionable conditions (poor water transparency) caused primarily by very high levels of suspended algae and secondarily by high levels of inorganic suspended solids. Annual summer TSI values for Secchi depth have generally been stable over the five-year period with the index values over the last three years being above the impairment threshold of 65 : 2000: 65; 2001: 58; 2002 = 67; 2003 = 66; and 2004 = 67 (the 2005 TSI for Secchi depth was 64). A comparison of annual TSI values for chlorophyll-a for the 2000-2004 period at Lake of the Hills suggests a potential adverse trend at this lake. Based on ISU lake survey monitoring data, annual summer TSI values for chlorophyll-a have generally worsened over the five-year period: 2000: 43 (or approximately 4 ug/l); 2001: 53; 2002 = 66; 2003 = 61; and 2004 = 68 (or approximately 45 ug/l) (the 2005 TSI for chlorophyll-a was 66). The adverse trend in the annual TSI values for chlorophyll-a at Lake of the Hills suggests that suspended algae is primarily responsible for the poor water transparency at this lake. Based on results of ISU lake survey

Lakes, Wetlands, and Flood Control Reservoirs: Scott

monitoring that show a tendency for annual TSI values to equal or exceed the IDNR's trigger levels for impairment, this Class B(LW) uses are assessed as "fully supported/threatened (impaired)".

Information from the IDNR Fisheries Bureau suggests that siltation remains a concern for the full support of the Class B(LW) aquatic life uses of this lake. Results of ISU monitoring from 2000 through 2004 suggest generally good chemical water quality at this lake. Results of this monitoring show that 3 of the 13 samples collected exceeded the Class B(LW) criteria for dissolved oxygen; these violations were as follows: 0.7 mg/l on July 7, 2000, 1.6 mg/l on August 1, 2000, and 4.9 mg/l on August 13, 2003. Only 1 of the 14 samples collected exceeded Iowa's Class A,B(LW) criteria for pH (maximum = 9.0; minimum = 7.8 pH units). Based on IDNR's assessment methodology, these results do not suggest violation frequencies are significantly greater than 10% for either parameter and thus do not suggest impairment of either the Class A and Class B(LW) uses of Lake of the Hills.

Fish consumption uses are "not assessed" due to the lack of recent fish contaminant monitoring at this lake. The most recent fish contaminant monitoring was conducted in 1994 as part of the U.S. EPA/IDNR (RAFT) program. Although results of the 1994 RAFT monitoring at Lake of the Hills indicated very low levels of contaminants and "full support" of the fish consumption uses, these data are now considered too old (greater than ten years) to characterize current water quality conditions.

**Lambach Lake**

Scott County, S25,T78N,R2E, W edge of Davenport.

LAKE SIZE: 11 Acres

Waterbody ID No.: IA 01-NEM-00158-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Odetta Lake**

Scott County, S20,T80N,R4E, 5 mi NNE of Eldridge.

LAKE SIZE: 7 Acres

Waterbody ID No.: IA 01-WPS-00108-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Water Quality in Iowa During 2004 and 2005: Assessment Results**

**Lakes, Wetlands, and Flood Control Reservoirs: Scott**

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**Princeton State Wildlife Area**

Scott County, S25,T80N,R5E, north of Princeton, IA.

LAKE SIZE: 350 Acres

Waterbody ID No.: IA 01-WPS-0005-L

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.: General Use

ASSESSMENT COMMENTS: Assessment remains based on information from the IDNR Wildlife Bureau.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Partial      Aquatic Life Support -- Partial

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class B(LW) aquatic life uses remain assessed (evaluated) as "partially supported" due to siltation related to annual flooding by the Mississippi River. According to the DNR Wildlife Bureau, this wetland has recently been protected from annual flood deposits by construction of a new boundary dike. This is the same assessment at that developed for the 2004 assessment/listing cycle.

EXPLANATION: The aquatic life uses remain assessed as "partially supported" based on information from the Iowa DNR Wildlife Bureau (see assessment for the 1998 and 2000 reports). The assessment category for this wetland of "evaluated" indicates that the assessment is based entirely on "best professional judgement." In terms of Section 305(b) reporting, "monitored assessments" are based primarily on recent, site-specific ambient monitoring data and thus have relatively high confidence. IDNR considers waterbodies identified as "impaired" based on "monitored assessments" as candidates for the state's Section 303(d) list. "Evaluated assessments" are those based on data older than five years or other than site-specific ambient monitoring data (e.g., questionnaire surveys of fish and game biologists [=best professional judgement]) and thus have relatively lower confidence. IDNR does not consider waterbodies identified as "impaired" based on "evaluated assessments" as candidates for the state's Section 303(d) list.

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Water Quality in Iowa During 2004 and 2005: Assessment Results

Lakes, Wetlands, and Flood Control Reservoirs: Shelby

**Elk Horn Creek Pond**

Shelby County, S10,T78N,R37W, 2.5 mi SW of Elkhorn.

LAKE SIZE: 2 Acres

Waterbody ID No.: IA 05-NSH-00460-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Little George Pond**

Shelby County, S19,T79N,R38W, S edge of Harlan.

LAKE SIZE: 2 Acres

Waterbody ID No.: IA 05-NSH-00950-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Water Quality in Iowa During 2004 and 2005: Assessment Results  
Lakes, Wetlands, and Flood Control Reservoirs: Shelby**

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**Manteno Park Pond**

Shelby County, S2,T81N,R40W, 8 mi NW of Defiance.

LAKE SIZE: 14 Acres

Waterbody ID No.: IA 06-BOY-00263-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Assessment is based on results of (1) ISU lake survey from 2000-04, (2) ISU reports on lake plankton communities from 2000-05, and (3) surveys by IDNR Fisheries Bureau.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Partial

Aquatic Life Support -- Partial

Fish Consumption -- Not assessed

Primary Contact (Recr) -- Fully

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses are assessed (monitored) as "fully supporting." The Class B(LW) aquatic life uses remain assessed (evaluated) as "partially supporting" due to siltation problems and due to a poor recreational fishery. Fish consumption uses remain "not assessed" due to the lack of fish contaminant monitoring at this lake. The sources of data for this assessment include (1) results of the statewide survey of Iowa lakes sponsored by IDNR and conducted by Iowa State University (ISU) from 2000 through 2004, (2) surveys by IDNR Fisheries Bureau, and (3) information on plankton communities collected at Iowa lakes from 2000 through 2005 as part of the ISU lake survey.

EXPLANATION: Results from the ISU statewide survey of Iowa lakes suggest that the Class A uses of Manteno Lake are "fully supported." Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 69, 58, and 56, respectively. According to Carlson (1977), the index value for total phosphorus places this lake in the upper range between eutrophic and hyper-eutrophic lakes (borderline hyper-eutrophic); the index value for chlorophyll-a is in the upper range of eutrophic lakes, and the index value for Secchi depth is in the middle range of eutrophic lakes. These index values suggest that, despite the moderately high levels of phosphorus, the production of suspended algae is relatively low and water transparency is relatively good and is better than expected. Thus, this lake does not appear to have impairments due to aesthetically objectionable conditions due either to blooms of algae or high levels of inorganic turbidity.

According to Carlson (1991), the occurrence of a high TSI value for total phosphorus with relatively low values for chlorophyll-a and secchi depth indicate that some factor (e.g., nitrogen limitation, zooplankton grazing, or some other factor) other than phosphorus limits production of algae. The ISU lake data suggest that zooplankton grazing and possibly nitrogen limitation limits algal production at Lake Manteno.

Based on median values from ISU sampling from 2000 through 2004, the ratio of total nitrogen to total phosphorus for Manteno Lake is 11. This ratio is low and suggests the possibility that algal production is limited by the availability of nitrogen.

In addition, the presence of very large populations of zooplankton at Manteno Lake that graze on algae may explain the discrepancy between the TSI value for phosphorus (69) and that for chlorophyll-a (58). In terms of all Iowa lakes sampled, data from the ISU survey show large populations of zooplankton species at this lake that graze on algae. Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., Daphnia) comprised approximately just about one-third of the dry mass of the zooplankton community of this lake. The average per summer sample mass of Cladoceran taxa over the 2000-2005 period (154 mg/l) was the 34th highest of the 131 lakes sampled. This population of zooplankton grazers suggests the potential for this type of non-phosphorus limitation on algal production at Manteno Lake.

The levels of inorganic suspended solids at this lake are relatively low and do not suggest the potential for impairing designated uses. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l; the median level at Manteno Lake was 3.5 mg/l; this is the 39th lowest median level of the 131 lakes sampled.

The levels of nuisance (=noxious) algal species (i.e., bluegreen algae) at this lake do not suggest an impairment of Class A uses. While data from the ISU survey from 2000 through 2004 suggest that bluegreen algae (Cyanophyta) comprise a significant portion (almost 60%) of this lake's summertime phytoplankton community, sampling from 2000 through 2004 showed that the median per summer sample mass of bluegreen algae at Manteno Lake (1.4 mg/l) was the 9th lowest of the 131 lakes sampled. This level is in the lowest 10% of the 131 Iowa lakes sampled. The presence of a relatively small population of bluegreen algae at this lake does not suggest a potential violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life.

Despite the indications of very good water quality at this lake, information from the IDNR Fisheries Bureau suggests that the Class B(LW) aquatic life uses at Manteno Lake should be assessed as "partially supporting" due to siltation problems in the lake and due a poor recreational fishery. Regardless, data from the ISU lake survey suggests that this lake has generally good chemical water quality. Results of this monitoring show no violations of the Class A,B(LW) criteria for pH in the 15 samples collected during summers of 2000 through 2004 (maximum = 9.0; minimum = 7.8 pH units). One of 14 samples exceeded the Class B(LW) criterion for dissolved oxygen. Based on IDNR's

assessment methodology, however, these results do not suggest that significantly more than 10 percent of the samples exceed Iowa's dissolved oxygen criteria and thus do not suggest an impairment of the Class B(LW) uses of Manteno Lake.

Fish consumption uses remain "not assessed" due to the lack of fish contaminant monitoring at this lake.

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**Prairie Rose Lake**

Shelby County, S36,T79N,R38W, 6 mi SE of Harlan.

LAKE SIZE: 219 Acres

Waterbody ID No.: IA 05-NSH-01440-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW), Class C

ASSESSMENT COMMENTS:

Assessment is based on results of (1) IDNR beach monitoring from 2002 through 2004, (2) the statewide survey of Iowa lakes conducted from 2000 through 2004 by Iowa State University (ISU), (3) information from the IDNR Fisheries Bureau, (4) ISU information on plankton communities at Iowa lakes from 2000-05, and (5) results of U.S. EPA/IDNR fish contaminant monitoring in 2003.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support	-- Not supporting	Aquatic Life Support	-- Fully	Fish Consumption	-- Fully	Primary Contact (Recr)	-- Not supporting
Drinking Water Supply	-- Not assessed						

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses are assessed (monitored) as "not supported" due to results of IDNR beach monitoring that show high levels of indicator bacteria at this lake's beach area. In addition, results of ISU lake monitoring from 2000-04 suggest "partial support" of the Class A uses due to poor water transparency caused by a combination of algae blooms and moderately high levels of inorganic suspended solids. The Class B(LW) aquatic life uses are assessed (evaluated) as "fully supporting". Drinking water uses remain "not assessed" due to the lack of information upon which to base an assessment. Fish consumption uses are assessed (monitored) as "fully supported" based on fish contaminant monitoring conducted in 2003. The sources of data for this assessment include (1) the results of the IDNR-UHL beach monitoring program in summers of 2002, 2003, and 2004, (2) results of the statewide survey of Iowa lakes conducted from 2000 through 2004 by Iowa State University (ISU), (3) information from the IDNR Fisheries Bureau, (4) information on plankton communities collected from 2000 through 2005 for the ISU lakes survey, and (5) results of U.S. EPA / IDNR fish tissue monitoring in 2003.

EXPLANATION: Results of IDNR beach monitoring at Prairie Rose Lake from 2002 through 2004 suggest that the Class A uses are "not supported." Levels of indicator bacteria were monitored once per week during the primary contact recreation seasons (May through September) of 2002 (30 samples), 2003 (29 samples), and 2004 (23 samples) as part of the IDNR beach monitoring program. According to IDNR's assessment methodology, two conditions need to be met for results of beach monitoring to indicate "full support" of the Class A (primary contact recreation) uses: (1) all five-sample, thirty-day geometric means for the three-year assessment period are less than the state's geometric mean criterion of 126 E. coli orgs/100 ml and (2) not more than 10 % of the samples during any one recreation season exceeds the state's single-sample maximum value of 235 E. coli orgs/100 ml. If a 5-sample, 30-day geometric mean exceeds the state criterion of 126 orgs/100 ml during the three-year assessment period, the Class A uses should be assessed as "not supported". Also, if more than 10% of the samples in any one of the three recreation seasons exceed Iowa's single-sample maximum value of 235 E. coli orgs/100 ml, the Class A uses should be assessed as "partially supported". This assessment approach is based on U.S. EPA guidelines (see pgs 3-33 to 3-35of U.S. EPA 1997b).

At Prairie Rose Lake beach, the geometric means of 5 of the 26 thirty-day periods during the summer recreation seasons of 2002 exceeded the Iowa water quality standard of 126 E. coli orgs/100 ml. None of the geometric means exceeded this standard during the recreational seasons of 2003 (25 geometric means) or 2004 (19 geometric means). Also, the percentage of samples exceeding Iowa's single-sample maximum criterion (235 E. coli orgs/100 ml) was greater than 10% in the 2002 recreation season (13%). Less than 10% of the samples exceeded this standard during the recreational seasons of 2003 (0%) and 2004 (4%). According to IDNR's assessment methodology and U.S. EPA guidelines, these results suggest impairment (nonsupport) of the Class A (primary contact recreation) uses.

In addition to the results of IDNR beach monitoring that suggest "nonsupport" of the Class A uses, results from the ISU statewide survey of Iowa lakes suggest that moderately high levels of algal and non-algal turbidity combine to potentially impair the Class A uses of Prairie Rose Lake. Using the median values from the ISU lakes survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 67, 65, and 67, respectively. According to Carlson (1977), the index values for all three parameters place this lake in the middle to upper range between eutrophic and hyper-eutrophic lakes. These index values suggest relatively high levels of phosphorus in the water column, moderately high levels of chlorophyll-a (suspended algae), and moderately poor water transparency.

The general agreement between the TSIs for phosphorus, chlorophyll, and Secchi depth suggests that non-phosphorus limitations—which appear to occur at most Iowa lakes—do not occur at Prairie Rose Lake. Results of ISU monitoring suggest that nitrogen limitation, zooplankton grazing, and light attenuation through inorganic turbidity may limit algal production at Prairie Rose Lake.

Based on median values from ISU sampling from 2000 through 2002, the ratio of total nitrogen to total phosphorus for Prairie Rose Lake is 22. This TN:TP ratio does not suggest significant nitrogen limitation of algal production at this lake.

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Sampling from 2000 through 2005 showed that while Cladoceran taxa (e.g., *Daphnia*) comprised only about 30% of the dry mass of the zooplankton community of this lake, the average per summer sample mass of Cladoceran taxa over the 2000-2005 period (112 mg/l) was the 50th highest of the 131 lakes sampled. The potential for zooplankton grazing to limit algal production would appear to exist at this lake. The general agreement between the TSI values for total phosphorus (67) and that for chlorophyll-a (65), however, suggests that this type of non-phosphorus limitation does not occur at Prairie Rose Lake.

The relatively high TSI value for secchi depth (67) suggests potential impairments to the Class A (primary contact) uses through presence of turbidity that constitutes an aesthetically objectionable condition. The levels of inorganic suspended solids at this lake are moderately high and thus suggest the potential for contributing to in-lake turbidity and poor water transparency. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l; the median level at Prairie Rose Lake was 7.2 mg/l. This is the 42nd highest value of the 131 lakes sampled. Although not high relative to other Iowa lakes, and although probably not solely responsible for creating aesthetically objectionable levels of turbidity and moderately poor water transparency, the level of inorganic suspended solids at Prairie Rose Lake appears sufficiently high to contribute to reductions in water transparency.

These conditions suggest impairments to the Class A (primary contact) uses through presence of aesthetically objectionable conditions (poor water transparency) caused primarily by high levels of inorganic suspended solids and secondarily by high levels of suspended algae.

The levels of nuisance (=noxious) algal species (i.e., bluegreen algae) at this lake do not suggest an impairment of Class A uses. While data from the ISU survey from 2000 through 2004 suggest that bluegreen algae (Cyanophyta) comprise a significant portion (approximately 70%) of this lake's summertime phytoplankton community, sampling from 2000 through 2004 showed that the median per summer sample mass of bluegreen algae at Prairie Rose Lake (13.2 mg/l) was only the 59th highest of the 131 lakes sampled. This level is in the lowest two-thirds of the 131 Iowa lakes sampled. The presence of the moderately high population of bluegreen algae at this lake does not immediately suggest a potential violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life. This assessment, however, is based strictly on a distribution of the lake-specific median bluegreen algae values for the 2000-2004 monitoring period. Median levels less than the 75th percentile of this distribution (~29 mg/l) were arbitrarily considered by IDNR staff to not represent an impairment of the Class A uses of Iowa lakes. No criteria exist, however, upon which to base a more accurate identification of impairments due to bluegreen algae. Thus, while the ability to characterize the levels of bluegreen algae at this lake has improved over that of the previous (2004) assessment due to collection of additional data, the assessment category for assessments based on level of bluegreen algae nonetheless remains, of necessity, "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

The Class B(LW) aquatic life uses of this lake are assessed (evaluated) as "fully supported" based on information from the DNR Fisheries Bureau. Results of ISU monitoring from 2000 through 2004 suggest generally good chemical water quality at this lake. The ISU lake survey data show no violations of the Class B(LW) criteria for dissolved oxygen in the 14 samples collected during summers of 2000 through 2004. Three of 15 samples exceeded the Class A,B(LW) criterion for pH (maximum = 9.6; minimum = 8.0 pH units). Based on IDNR's assessment methodology, however, these results do not suggest that significantly more than 10 percent of the samples exceed Iowa's pH criteria and thus do not suggest an impairment of the Class A and Class B(LW) uses of this lake. These violations likely reflect the high levels of primary productivity at Prairie Rose Lake and do not reflect the input of pollutants into this lake.

Drinking water uses remain "not assessed" due to lack of information upon which to base an assessment. The only parameter collected as part of the ISU lake survey relevant to support of Class C (drinking water) uses is nitrate. While the results of the ISU survey from 2000-04 show that nitrate levels are very low at Prairie Rose Lake (maximum value = 3.8 mg/l; median = 0.4 mg/l), these data are not sufficient for developing a valid assessment of support of the Class C uses.

Fish consumption uses were assessed (monitored) as "fully supported" based on results of U.S.EPA/IDNR fish contaminant (RAFT) monitoring at Prairie Rose Lake in 2003. The composite samples of filets from channel catfish and largemouth bass had very low levels of contaminants. Levels of primary contaminants in the composite sample of channel catfish filets were as follows: mercury: <0.0181 ppm; total PCBs: 0.09 ppm; and technical chlordane: <0.03 ppm. Levels of primary contaminants in the composite sample of largemouth bass filets were as follows: mercury: <0.0181 ppm; total PCBs: 0.09 ppm; and technical chlordane: <0.03 ppm. The existence of, or potential for, a fish consumption advisory is the basis for Section 305(b) assessments of the degree to which Iowa's lakes and rivers support their fish consumption uses. Prior to 2006, IDNR used action levels published by the U.S Food and Drug Administration to determine whether consumption advisories should be issued for fish caught as part of recreational fishing in Iowa. In an effort to make Iowa's consumption more compatible with the various protocols used by adjacent states, the Iowa Department of Public Health, in cooperation with Iowa DNR, developed a risk-based advisory protocol. This protocol went into effect in January 2006 (see <http://www.iowadnr.gov/fish/news/consump.html> for more information on Iowa's revised fish consumption advisory protocol). Because the revised (2006) protocol is more restrictive than the previous protocol based on FDA action levels; fish contaminant data that previously suggested "full support" may now suggest either a threat to, or impairment of, fish consumption uses. This scenario, however, does not apply to the fish contaminant data generated from the 2003 RAFT sampling conducted at Prairie Rose Lake: the levels of contaminants do not exceed any of the new (2006) advisory trigger levels, thus indicating no justification for issuance of a consumption advisory for this waterbody.

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Lakes, Wetlands, and Flood Control Reservoirs: **Shelby**

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**Schimeroski Pond**

Shelby County, S5,T80N,R39W, at Earling.

LAKE SIZE: 1 Acres

Waterbody ID No.: IA 06-WED-00380-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed

Aquatic Life Support -- Not assessed

Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

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Water Quality in Iowa During 2004 and 2005: Assessment Results

Lakes, Wetlands, and Flood Control Reservoirs: Sioux

**Fairview Area Impoundment**

Sioux County, S14,T97N,R48W, 2 mi NE of Fairview, SD.

LAKE SIZE: 10 Acres

Waterbody ID No.: IA 06-BSR-00220-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Floyd Park Pit**

Sioux County, S11,T94N,R44W, 0.5 mi S of Alton.

LAKE SIZE: 2 Acres

Waterbody ID No.: IA 06-BSR-00385-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Sioux Center Pit**

Sioux County, S8,T95N,R45W, S edge of Sioux Center.

LAKE SIZE: 5 Acres

Waterbody ID No.: IA 06-FLO-00410-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed      Aquatic Life Support -- Not assessed      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Winterfield Pond (van Zee Pit)**

Sioux County, S21,T97N,R46W, at N edge of Rock Valley.

LAKE SIZE: 7 Acres

Waterbody ID No.: IA 06-BSR-00380-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed

Primary Contact (Recr) -- Not assessed

Aquatic Life Support -- Not assessed

Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Water Quality in Iowa During 2004 and 2005: Assessment Results****Lakes, Wetlands, and Flood Control Reservoirs: Story****Cooper's Marsh**

Story County, S21,T84N,R23W, 3 mi NE of Ames.

LAKE SIZE: 10 Acres

Waterbody ID No.: IA-WETLAND-54

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.:

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Dakin Lake**

Story County, S16,T85N,R21W, at N edge of Zearing.

LAKE SIZE: 6 Acres

Waterbody ID No.: IA 02-IOW-02530-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed

Aquatic Life Support -- Not assessed

Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

**Greenwing Marsh**

Story County, S31,T84N,R23W, 1 mi NE of Ames.

LAKE SIZE: 10 Acres

Waterbody ID No.: IA-WETLAND-55

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.:

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

Water Quality in Iowa During 2004 and 2005: Assessment Results  
Lakes, Wetlands, and Flood Control Reservoirs: Story

**Hendrickson Marsh**

Story County, S1,T82N,R21W, 3.5 mi NE of Collins.

LAKE SIZE: 240 Acres

Waterbody ID No.: IA 03-SSK-00450-L

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Assessment remains based on information from the IDNR Wildlife Bureau.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Partial      Aquatic Life Support -- Partial      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :[Note: Due to the fact that this wetland is in the watershed of the South Skunk River (and not the Iowa River), the waterbody ID was changed from IA 02-IOW-02495-L to IA 03-SSK-00450-L in May 2002.]

SUMMARY: Continued to assess support of the Class B(LW) aquatic life uses as "partially supported." Fish consumption uses remain "not assessed." This is the same assessment as that developed for the 2004 assessment/listing cycle.

EXPLANATION: The previous (2000) assessment of support of the Class B(LW) uses ("partially supported") was reviewed and approved by the DNR Wildlife Bureau in 2002. According to the local DNR Wildlife Biologist (Peterson), impacts from siltation continue at this wetland, including (1) turbid water that restricts growth of wetland vegetation, (2) decrease in water depth that limits use of outboard motors, and (3) decrease in area of the wetland. The assessment category for this wetland of "evaluated" indicates that the assessment is based entirely on "best professional judgement." In terms of Section 305(b) reporting, "monitored assessments" are based primarily on recent, site-specific ambient monitoring data and thus have relatively high confidence. IDNR considers waterbodies identified as "impaired" based on "monitored assessments" as candidates for the state's Section 303(d) list. "Evaluated assessments" are those based on data older than five years or other than site-specific ambient monitoring data (e.g., questionnaire surveys of fish and game biologists [=best professional judgement]) and thus have relatively lower confidence. IDNR does not consider waterbodies identified as "impaired" based on "evaluated assessments" as candidates for the state's Section 303(d) list.

Fish consumption uses remain "not assessed." In general, Iowa wetlands are not managed for recreational fisheries; thus, fish contaminant monitoring is not typically conducted at these waterbodies.

Lakes, Wetlands, and Flood Control Reservoirs: Story

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**Hickory Grove Lake**

Story County, S24,T83N,R22W, 2.5 mi SW of Colo.

LAKE SIZE: 88 Acres

Waterbody ID No.: IA 03-SSK-00530-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Assessment is based on results of (1) ISU lake survey from 2000-04, (2) ISU reports on lake phytoplankton communities from 2000-05, and (3) surveys by IDNR Fisheries Bureau.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Fully

Fish Consumption -- Not assessed

Primary Contact (Recr) -- Fully

Aquatic Life Support -- Fully

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses are assessed (monitored) as "fully supporting." The Class B(LW) aquatic life uses are assessed (evaluated) as "fully supporting". Siltation impacts, however, remain a concern at this lake. Fish consumption uses remain "not assessed" due to the lack of fish contaminant monitoring at this lake. The sources of data for this assessment include (1) results of the statewide survey of Iowa lakes sponsored by IDNR and conducted by Iowa State University (ISU) from 2000 through 2004, (2) surveys by IDNR Fisheries Bureau, and (3) information on plankton communities collected at Iowa lakes from 2000 through 2005 as part of the ISU lake survey.

EXPLANATION: Results from the ISU statewide survey of Iowa lakes suggest that the Class A uses of Hickory Grove Lake are "fully supported." Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 57, 53, and 53, respectively. According to Carlson (1977), the index value for total phosphorus places this lake middle range of eutrophic lakes; the index values for chlorophyll-a and Secchi depth are in the lower range of eutrophic lakes. These index values suggest very good water quality at this lake with very low levels of phosphorus, very low levels of chlorophyll, and very good water transparency. These results suggest that this lake does not have impairments due to aesthetically objectionable conditions.

Based on median values from ISU sampling from 2000 through 2004, the ratio of total nitrogen to total phosphorus for Hickory Grove Lake is 210. This ratio suggests that algal production at this lake is not limited by nitrogen availability but by phosphorus and that levels of nitrogen in the lake are very high. This very high TN:TP ratio reflects the often exceptionally high levels of total nitrogen in impoundments of the Des Moines Lobe region of north-central Iowa. The median level of total nitrogen during the 2000-02 monitoring period (8.2 mg/l) was the 11th highest of the 131 lakes sampled.

Data from Downing et al. (2002) show . In terms of all Iowa lakes sampled, data from the ISU survey show moderately to very large populations of zooplankton species at Hickory Grove Lake that graze on algae. Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., Daphnia) comprised approximately 70% of the dry mass of the zooplankton community of this lake. The average per summer sample mass of Cladoceran taxa over the 2000-2005 period (131 mg/l) was the 40th highest of the 131 lakes sampled. , thus suggesting that zooplankton grazing is not a strong limiter of algal production. Sampling in 2000 showed that Cladoceran taxa (e.g., Daphnia) comprised approximately 20% of the dry mass of the zooplankton community in both the late July and late August samples. The summer 2000 average mass of Cladocerans (1.5 mg/l) was the 16th lowest of the 131 lakes sampled.

The levels of inorganic suspended solids at this lake are low and do not suggest the potential for impairing designated uses. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l; the median level at Hickory Grove Lake was 3.3 mg/l. This median value is the 35th lowest of the 131 lakes sampled.

The levels of nuisance (=noxious) algal species (i.e., bluegreen algae) at this lake do not suggest an impairment of Class A uses. While data from the ISU survey from 2000 through 2004 suggest that bluegreen algae (Cyanophyta) comprise a significant portion (approximately 60%) of this lake's summertime phytoplankton community, sampling from 2000 through 2004 showed that the median per summer sample mass of bluegreen algae at Hickory Grove Lake (8.2 mg/l) was the 43rd lowest of the 131 lakes sampled. This levels is in the lowest one-third of the 131 Iowa lakes sampled. The presence of a relatively small population of bluegreen algae at this lake does not suggest a potential violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life. This assessment, however, is based strictly on a distribution of the lake-specific median bluegreen algae values for the 2000-2004 monitoring period. Median levels less than the 75th percentile of this distribution (~29 mg/l) were arbitrarily considered by IDNR staff to not represent an impairment of the Class A uses of Iowa lakes. No criteria exist, however, upon which to base a more accurate identification of impairments due to bluegreen algae. Thus, while the ability to characterize the levels of bluegreen algae at this lake has improved over that of the previous (2004) assessment due to collection of additional data, the assessment category for assessments based on level of bluegreen algae nonetheless remains, of necessity, "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

Information from the IDNR Fisheries Bureau suggests that the Class B(LW) aquatic life uses should be assessed as "fully supported". Siltation impacts in the lake, however, remain a concern. The ISU lake survey data also show good chemical water quality at this lake. These data show no violations of the Class B(LW) criteria for dissolved oxygen

**Water Quality in Iowa During 2004 and 2005: Assessment Results****Lakes, Wetlands, and Flood Control Reservoirs: Story**

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in the 14 samples collected, or for pH in the 13 samples collected, at Hickory Grove Lake during summers of 2000 through 2004.

Fish consumption uses remain "not assessed" due to the lack of fish contaminant monitoring at this lake.

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**Larson Marsh**

Story County, S34,T84N,R23W, 2.5 mi NW of Nevada.

LAKE SIZE: 12 Acres

Waterbody ID No.: IA-WETLAND-56

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.:

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

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**McFarland's Pond**

Story County, S7,T84N,R23W, 4 mi NNE of Ames.

LAKE SIZE: 8 Acres

Waterbody ID No.: IA 03-SSK-00320-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed Aquatic Life Support -- Not assessed Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

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**Pyle Marsh**

Story County, S5,T85N,R24W, 3 mi W of Story City.

LAKE SIZE: 20 Acres

Waterbody ID No.: IA-WETLAND-57

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.:

ASSESSMENT COMMENTS: Insufficient water quality information available to assess use support.SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :Insufficient water quality information available to assess use support. Thus, this waterbody is considered Not Assessed.

## Water Quality in Iowa During 2004 and 2005: Assessment Results

### Lakes, Wetlands, and Flood Control Reservoirs: Tama

**Casey Lake (aka Hickory Hills La** Tama County, S13,T86N,R13W, 6 mi N of Dysart.

LAKE SIZE: 54 Acres

Waterbody ID No.: IA 02-CED-03060-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Assessment is based on results of (1) ISU lake survey from 2000-04, (2) surveys of DNR Fisheries Bureau, (3) reports of ISU plankton studies from 2000-05, and (4) EPA/DNR fish tissue (RAFT) monitoring in 1999.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Partial      Fish Consumption -- Fully      Primary Contact (Recr) -- Partial      Aquatic Life Support -- Partial

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses are assessed (monitored) as "partially supporting" due to a high frequency of violation of Iowa's Class A criterion for pH. The Class B(LW) aquatic life uses are also assessed (monitored) as "partially supporting" due to the high frequency of violations of Iowa's Class B(LW) pH criterion. Siltation and excessive nutrient loading to the water column remain concerns at this lake. Fish consumption uses remain assessed (monitored) as "fully supported" based on results of fish contaminant monitoring in 1999. The sources of data for this assessment include (1) results of the statewide survey of Iowa lakes sponsored by IDNR and conducted by Iowa State University (ISU) from 2000 through 2004, (2) surveys by IDNR Fisheries Bureau, (3) information on plankton communities collected at Iowa lakes from 2000 through 2005 as part of the ISU lake survey, and (4) results of IDNR/U.S. EPA fish tissue monitoring in 1999.

EXPLANATION: Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 75, 58, and 60, respectively. According to Carlson (1977), the index value for total phosphorus places this lake in the range of hyper-eutrophic lakes; the index values for chlorophyll-a and Secchi depth are in the upper range of eutrophic lakes. These index values suggest extremely high levels of phosphorus in the water column, relatively low (and much less than expected) levels of chlorophyll-a (suspended algae), and relatively good to marginal transparency. According to Carlson (1991), the occurrence of a high TSI value for total phosphorus with relatively low values for chlorophyll-a and secchi depth indicate that some factor (e.g., nitrogen limitation, zooplankton grazing, or some other factor) other than phosphorus limits production of algae. The ISU lake data suggest that algal production at Casey Lake may be limited by nitrogen availability but is not likely limited by either zooplankton grazing or by inorganic turbidity. Based on median values from ISU sampling from 2000 through 2004, the ratio of total nitrogen to total phosphorus for Casey Lake is 12. This TN:TP ratio suggests at least the possibility that nitrogen limitation suppresses the production of suspended algae at this lake.

The results of ISU plankton monitoring from 2000 through 2005 show a relatively small population of zooplankton grazers at Casey Lake. This lake had the tenth lowest per summer sample mass of zooplankton (Cladoceran) grazers of the 131 lakes sampled. This low level of zooplankton grazers would likely be unable to suppress algal production.

The levels of inorganic suspended solids at this Casey Lake are extremely low and do not suggest either the potential for suppression of algal growth through light limitation or the potential for contributing to turbidity. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l; the median level at Casey Lake was 2.0 mg/l; this is the eighth lowest ISS median of the 131 lakes sampled.

The levels of nuisance (=noxious) algal species (i.e., bluegreen algae) at this lake do not suggest an impairment of Class A uses at this lake. While data from the ISU survey from 2000 through 2004 suggest that bluegreen algae (Cyanophyta) comprise a significant portion (80%) of this lake's summertime phytoplankton community, sampling from 2000 through 2004 showed that the average per summer sample mass of bluegreen algae at Casey Lake was the only the 45th highest of the 131 lakes sampled: 19.7 mg/l. This level is in the lowest two-thirds of the 131 Iowa lakes sampled. The presence of a relatively small population of bluegreen algae at this lake does not suggest a potential violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life. This assessment, however, is based strictly on a distribution of the lake-specific median bluegreen algae values for the 2000-2004 monitoring period. Median levels less than the 75th percentile of this distribution (~30 mg/l) were arbitrarily considered by IDNR staff to not represent an impairment of the Class A uses of Iowa lakes. No published or other criteria exist, however, upon which to base a more accurate identification of impairments due to bluegreen algae. Thus, while the ability to characterize the levels of bluegreen algae at this lake has improved over that of the previous (2004) assessment due to collection of additional data, the assessment category for assessments based on level of bluegreen algae nonetheless remains, of necessity, "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

The eutrophic to hyper-eutrophic conditions at this lake, along with information from the IDNR Fisheries Bureau, suggest that the Class B(LW) aquatic life uses should remain assessed (evaluated) as "fully supported". Siltation and excessive nutrient loading to the water column, however, remain water quality concerns at this lake. The ISU lake survey data show no violations of the Class B(LW) criteria for dissolved oxygen in the 13 samples collected during summers of 2000 through 2004. Six of 14 samples (43%), however, exceeded the Class B(LW) criterion for pH (maximum = 9.9; minimum = 8.4 pH units). Based on IDNR's assessment methodology, these results suggest that significantly more than 10 percent of the samples exceed Iowa's pH criteria. Thus, these results suggest an impairment (partial support/monitored) of the Class A and Class

B(LW) uses of this lake. These violations likely reflect the high levels of primary productivity at Casey Lake and do not reflect the input of pollutants into this lake.

Fish consumption uses were assessed (monitored) as “fully supported” based on results of U.S.EPA/IDNR fish contaminant (RAFT) monitoring at Casey Lake in 1999. The composite samples of fillets from channel catfish and largemouth bass had low levels of contaminants. The existence of, or potential for, a fish consumption advisory is the basis for Section 305(b) assessments of the degree to which Iowa’s lakes and rivers support their fish consumption uses. Prior to 2006, IDNR used action levels published by the U.S Food and Drug Administration to determine whether consumption advisories should be issued for fish caught as part of recreational fishing in Iowa. In an effort to make Iowa’s consumption more compatible with the various protocols used by adjacent states, the Iowa Department of Public Health, in cooperation with Iowa DNR, developed a risk-based advisory protocol. This protocol went into effect in January 2006 (see <http://www.iowadnr.gov/fish/news/consump.html> for more information on Iowa’s revised fish consumption advisory protocol). Because the revised (2006) protocol is more restrictive than the previous protocol based on FDA action levels; fish contaminant data that previously suggested “full support” may now suggest either a threat to, or impairment of, fish consumption uses. This scenario, however, does not apply to the fish contaminant data generated from the 1999 RAFT sampling conducted at this lake: the levels of contaminants do not exceed any of the new (2006) advisory trigger levels, thus suggesting no justification for issuance of a consumption advisory for this waterbody.

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**Otter Creek Lake**

Tama County, S31,T84N,R14W, 5 mi NE of Toledo.

LAKE SIZE: 74 Acres

Waterbody ID No.: IA 02-IOW-02095-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Assessment is based on results of (1) ISU lake survey from 2000-04, (2) surveys by IDNR Fisheries Bureau, and (3) ISU reports on lake plankton communities from 2000-05.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Fully

Aquatic Life Support -- Fully

Fish Consumption -- Not assessed

Primary Contact (Recr) -- Fully

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses are assessed (monitored) as "fully supporting". The Class B(LW) aquatic life uses are assessed (evaluated) as "fully supporting". Nutrients and siltation, however, remain concerns at this lake. Fish consumption uses remain "not assessed" due to the lack of fish contaminant monitoring at this lake. The sources of data for this assessment include (1) results of the statewide survey of Iowa lakes sponsored by IDNR and conducted by Iowa State University (ISU) from 2000 through 2004, (2) surveys by IDNR Fisheries Bureau, and (3) information on plankton communities collected at Iowa lakes from 2000 through 2005 as part of the ISU lake survey.

EXPLANATION: Using the median values from the ISU survey from 2000 through 2002 (approximately nine samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 66, 62, and 64, respectively. According to Carlson (1977), the index values for all three parameters are in the range between eutrophic and hyper-eutrophic lakes. These index values suggest relatively high levels of phosphorus, moderately high levels of chlorophyll-a, and marginally good water transparency.

According to Carlson (1991), the occurrence of a high TSI value for total phosphorus with relatively low values for chlorophyll-a and secchi depth indicate that some factor (e.g., nitrogen limitation, zooplankton grazing, or some other factor) other than phosphorus limits production of algae. The general agreement between the TSIs for phosphorus, chlorophyll, and Secchi depth suggests that non-phosphorus limitations—which appear to occur at most Iowa lakes—do not occur at Otter Creek Lake.

Based on median values from ISU sampling from 2000 through 2004, the ratio of total nitrogen to total phosphorus for Otter Creek Lake is 19. This ratio does not suggest a strong possibility that algal production at this lake is limited by nitrogen availability.

the presence of moderately large populations of zooplankton at Otter Creek Lake that graze on algae may explain the minor discrepancy between the TSI value for phosphorus (66) and that for chlorophyll-a (62). Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., Daphnia) comprised about 45% of the dry mass of the zooplankton community of this lake. The average per summer sample mass of Cladoceran taxa over the 2000-2005 period (103 mg/l) was the 57th highest of the 131 lakes sampled.

The levels of inorganic suspended solids at this lake are relatively low and do not suggest the potential for either limiting algal production or impairing designated uses. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l; the median level at Otter Creek Lake was 3.6 mg/l; this is the 40th lowest median value of the 131 lakes sampled.

Despite the moderately high levels of phosphorus, the TSI values for chlorophyll-a and secchi depth suggest relatively good water quality at Otter Creek Lake. The slight reduction in water transparency and the upward trend in annual TSI values for chlorophyll-a, however, are concerns. Additional years of monitoring data will help determine whether water transparency declines to the point that the Class A uses are impaired.

The levels of nuisance (=noxious) algal species (i.e., bluegreen algae) at this lake do not immediately suggest an impairment of Class A uses. While data from the ISU survey from 2000 through 2004 suggest that bluegreen algae (Cyanophyta) comprise a significant portion (70%) of this lake's summertime phytoplankton community, sampling from 2000 through 2004 showed that the median per summer sample mass of bluegreen algae at Otter Creek Lake (22 mg/l) was the 40th highest of the 131 lakes sampled. This level is in the lowest two-thirds of the 131 Iowa lakes sampled. The presence of a moderately large population of bluegreen algae at this lake does not immediately suggest a violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life. The levels of bluegreen algae are, however, sufficiently high to warrant concern. This assessment is based strictly on a distribution of the lake-specific median bluegreen algae values for the 2000-2004 monitoring period. Median levels less than the 75th percentile of this distribution (~29 mg/l) were arbitrarily considered by IDNR staff to not represent an impairment of the Class A uses of Iowa lakes. No criteria exist, however, upon which to base a more accurate identification of impairments due to bluegreen algae. Thus, while the ability to characterize the levels of bluegreen algae at this lake has improved over that of the previous (2004) assessment due to collection of additional data, the assessment category for assessments based on level of bluegreen algae nonetheless remains, of necessity, "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

Information from the IDNR Fisheries Bureau suggests that the Class B(LW) aquatic life uses should be assessed as "fully supported". Potential impacts from siltation and nutrient loading to the water column, however, remain concerns at this lake. The ISU lake survey data show generally good chemical water quality at this lake. Only one violation of the Class B(LW) criteria for dissolved oxygen occurred in the 14 samples collected (7%) during summers of 2000 through 2004. According to U.S. EPA guidelines (U.S. EPA 1997b, page 3-17), however, a violation frequency of less than 10 % for conventional parameters such as dissolved oxygen nonetheless suggests "full support" of aquatic life uses. Thus, the percentage of violations of the dissolved oxygen criterion at this station does not suggest an impairment of aquatic life uses at this lake. None of the 15 samples, however, violated the Class A,B(LW) criterion for pH (maximum = 8.8; minimum = 7.9 pH units).

Fish consumption uses remain "not assessed" due to the lack of fish contaminant monitoring at this lake.

**Otter Creek Marsh**

Tama County, S3,T82N,R14W, 6 mi ESE of Tama.

LAKE SIZE: 1642 Acres

Waterbody ID No.: IA 02-IOW-02015-L

Waterbody Type: Freshwater Wetland

Significant Publicly-owned Lake?: No

Use Classes.: Class B(LW)

ASSESSMENT COMMENTS: Assessment remains based on information from the DNR Wildlife Bureau.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Partial      Aquatic Life Support -- Partial      Fish Consumption -- Not assessed

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class B(LW) aquatic life uses remain assessed (evaluated) as "partially supported" based on information from the IDNR Wildlife Bureau. Fish consumption uses remain "not assessed." This is the same assessment as that developed for the 2004 assessment/listing cycle.

EXPLANATION: The aquatic life uses remain assessed as "partially supported" based on information from the Iowa DNR Wildlife Bureau (see assessment for the 1998 and 2000 reports). The assessment category for this wetland of "evaluated" indicates that the assessment is based entirely on "best professional judgement." In terms of Section 305(b) reporting, "monitored assessments" are based primarily on recent, site-specific ambient monitoring data and thus have relatively high confidence. IDNR considers waterbodies identified as "impaired" based on "monitored assessments" as candidates for the state's Section 303(d) list. "Evaluated assessments" are those based on data older than five years or other than site-specific ambient monitoring data (e.g., questionnaire surveys of fish and game biologists [=best professional judgement]) and thus have relatively low confidence. IDNR does not consider waterbodies identified as "impaired" based on "evaluated assessments" as candidates for the state's Section 303(d) list.

Fish consumption uses remain "not assessed." In general, Iowa wetlands are not managed for recreational fisheries; thus, fish contaminant monitoring is not typically conducted at these waterbodies.

**Union Grove Lake**

Tama County, S33,T85N,R16W, 2.5 mi NW of Garwin.

LAKE SIZE: 105 Acres

Waterbody ID No.: IA 02-IOW-02195-L

Waterbody Type: Freshwater Lake

Significant Publicly-owned Lake?: Yes

Use Classes.: Class A, Class B(LW)

ASSESSMENT COMMENTS: Assessment is based on (1) results from the IDNR beach monitoring program from 2002-04, (2) information from the IDNR Fisheries Bureau, (3) ISU lake survey from 2000-04, and (4) ISU reports on lake plankton communities from 2000-05.

SUMMARY OF THE DEGREE TO WHICH THIS WATERBODY SUPPORTS ITS BENEFICIAL USES:

Overall Use Support -- Not supporting Aquatic Life Support -- Partial Fish Consumption -- Not assessed Primary Contact (Recr) -- Not supporting

BASIS FOR ASSESSMENT AND COMMENTS:

2006 :SUMMARY: The Class A (primary contact recreation) uses were assessed (monitored) as "not supporting" due to high levels of indicator bacteria at the lake's swimming beach: this is a new impairment for this lake. In addition, results of the ISU lakes survey suggest "partial support" of Class A uses due to aesthetically objectionable conditions (poor water transparency) related primarily to high levels of inorganic turbidity and secondarily to blooms of algae. Additional impairments to the Class A uses are due to (1) the very high populations of nuisance (noxious) aquatic life (bluegreen algae) at this lake and (2) the relatively frequent violations of the Iowa criterion for pH. The Class B(LW) aquatic life uses are assessed (monitored) as "partially supported" due to relatively frequent violations of the Iowa criterion for pH. The high levels of algae and inorganic turbidity remain water quality concerns at this lake. Fish consumption uses remain "not assessed" due to the lack of recent fish contaminant monitoring at this lake. The assessments of beneficial uses are based on (1) the results of the IDNR-UHL beach monitoring program in summers of 2002, 2003, and 2004, (2) results of the statewide survey of Iowa lakes conducted from 2000 through 2004 by Iowa State University (ISU), (3) information from the IDNR Fisheries Bureau, and (4) information on plankton communities collected from 2000 through 2005 for the ISU lakes survey.

EXPLANATION: Results of IDNR beach monitoring at Union Grove Lake from 2002 through 2004 suggest that the Class A uses are "not supported" due to exceptionally high levels of indicator bacteria during the 2004 recreation season. Levels of indicator bacteria were monitored once per week during the primary contact recreation seasons (May through September) of 2002 (28 samples), 2003 (29 samples), and 2004 (23 samples) as part of the IDNR beach monitoring program. According to IDNR's assessment methodology, two conditions need to be met for results of beach monitoring to indicate "full support" of the Class A (primary contact recreation) uses: (1) all five-sample, thirty-day geometric means for the three-year assessment period are less than the state's geometric mean criterion of 126 E. coli orgs/100 ml and (2) not more than 10 % of the samples during any one recreation season exceeds the state's single-sample maximum value of 235 E. coli orgs/100 ml. If a 5-sample, 30-day geometric mean exceeds the state criterion of 126 orgs/100 ml during the three-year assessment period, the Class A uses should be assessed as "not supported". Also, if more than 10% of the samples in any one of the three recreation seasons exceed Iowa's single-sample maximum value of 235 E. coli orgs/100 ml, the Class A uses should be assessed as "partially supported". This assessment approach is based on U.S. EPA guidelines (see pgs 3-33 to 3-35of U.S. EPA 1997b).

At Union Grove Lake beach, the geometric means of 15 of the 19 thirty-day periods during the summer recreation season of 2004 exceeded the Iowa water quality standard of 126 E. coli orgs/100 ml. None of the geometric means exceeded this standard during the recreational seasons of 2002 (24 geometric means) or 2003 (25 geometric means). Also, the percentage of samples exceeding Iowa's single-sample maximum criterion (235 E. coli orgs/100 ml) was greater than 10% in the following recreation seasons: 2002 (11%) and 2004 (52%). Less than 10% of the samples exceeded this standard during the recreational season of 2003 (3%). According to IDNR's assessment methodology and U.S. EPA guidelines, the occurrence of geometric means above the Iowa criterion of 126 orgs/100 ml suggest impairment (nonsupport) of the Class A (primary contact recreation) uses.

Results from the ISU statewide survey of Iowa lakes also suggest impairments to the Class A uses of this lake due to poor water transparency caused by high levels of algal and non-algal (inorganic) turbidity. Using the median values from this survey from 2000 through 2004 (approximately 15 samples), Carlson's (1977) trophic state indices for total phosphorus, chlorophyll-a, and secchi depth are 68, 66, and 67, respectively. According to Carlson (1977), the index values for all three parameters place this lake in the middle to upper range between eutrophic and hyper-eutrophic lakes. These index values suggest relatively high levels of phosphorus in the water column, relatively high levels of chlorophyll-a, and relatively poor water transparency. A comparison of the total phosphorus TSI value calculated for the 2000-2002 period (79) to the value calculated for the 2002-2004 period (68) suggests an improvement in the nutrient condition at this lake. An examination of the annual TSI values, however, shows that the TSI value for the 2000-2002 period was heavily influenced by a TSI of 81 for 2000. Since 2000, annual TSI values have been variable but have generally been in the upper 60s and low 70s.

The generally good agreement between the 2000-2004 TSI values for phosphorus, chlorophyll, and Secchi depth suggests that significant non-phosphorus limitations on algal production (e.g., nitrogen limitation, inorganic turbidity, or zooplankton grazing) do not exist at this lake. Results of ISU monitoring suggest that the high level of inorganic suspended solids (inorganic turbidity) at this lake is the primary contributor to the lake's poor water transparency.

Neither nitrogen limitation nor zooplankton grazing would appear to limit algal production. Based on median values from ISU sampling from 2000 through 2002, the ratio of total

Lakes, Wetlands, and Flood Control Reservoirs: Tama

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nitrogen to total phosphorus for Union Grove Lake is 47, thus suggesting that nitrogen does not likely limit production of suspended algae at this lake. In terms of all Iowa lakes sampled, data from the ISU survey show moderately large populations of zooplankton species at this lake that graze on algae. Sampling from 2000 through 2005 showed that Cladoceran taxa (e.g., *Daphnia*) comprised about 50% of the dry mass of the zooplankton community of this lake. The average per summer sample mass of Cladoceran taxa over the 2000-2005 period (113 mg/l) was the 48th highest of the 131 lakes sampled. These results suggest the potential for non-phosphorus limitation on algal production due to zooplankton grazing at Union Grove Lake.

Turbidity due to inorganic solids suspended in the water column likely contributes to impairments at Union Grove Lake. The median level of inorganic suspended solids in the 131 lakes sampled for the ISU lake survey from 2000 through 2004 was 5.2 mg/l. Of 131 lakes sampled, Union Grove Lake had the 26th highest median level of inorganic suspended solids (11.5 mg/l). This level is high relative to other Iowa lakes, thus suggesting that non-algal turbidity contributes to impairment of the primary contact recreation uses.

These conditions suggest that the Class A uses are "partially supported" due to the relatively poor water transparency that violates Iowa's water quality standard protecting against aesthetically objectionable conditions. The poor water transparency at this lake is likely caused by (1) relatively high levels of algal turbidity and (2) by high levels of inorganic suspended solids in the water column. The IDNR Fisheries Bureau concurs that Union Grove Lake is impaired by both large populations of algae and inorganic turbidity.

The presence of nuisance (=noxious) algal species (i.e., bluegreen algae) may also present an impairment of the Class A uses at Union Grove Lake. Data from the ISU survey from 2000 through 2004 suggest that bluegreen algae (Cyanophyta) comprise a significant portion of this lake's summertime phytoplankton community. Summer sampling during this period showed the percent wet mass of the total phytoplankton community in bluegreens (cyanobacteria) was approximately 65%. Also, the median per summer sample mass of bluegreen algae at this lake (34 mg/l) was the 28th highest of the 131 lakes sampled. This median is in the worst 25% of the 131 Iowa lakes sampled. The presence of a large population of bluegreen algae at this lake suggests the potential violation of Iowa's narrative water quality standard protecting against occurrence of nuisance aquatic life. This assessment, however, is based strictly on a distribution of the lake-specific median bluegreen algae values for the 2000-2004 monitoring period. Median levels greater than the 75th percentile of this distribution (~29 mg/l) were arbitrarily chosen by IDNR staff to represent the condition of "potential impairment: partially supported." No criteria exist, however, upon which to base a more accurate identification of impairments due to bluegreen algae. Thus, while the ability to characterize the levels of bluegreen algae at this lake has improved over that of the previous (2004) assessment due to collection of additional data, the assessment category for assessments based on level of bluegreen algae nonetheless remains, of necessity, "evaluated" (indicating an assessment with relatively lower confidence) as opposed to "monitored" (indicating an assessment with relatively higher confidence).

The Class B(LW) aquatic life uses are assessed (monitored) as "partially supported" due to relatively frequent violations of the Iowa criterion for pH. The ISU lake survey data show that only one violation of the Class B(LW) criteria for dissolved oxygen occurred in the 14 samples collected during summers of 2000 through 2004. Based on IDNR's assessment methodology, the occurrence of this violation does not suggest an impairment of aquatic life uses at this lake. Four of 15 samples, however, violated the Class A,B(LW) criterion for pH (maximum = 9.3; minimum = 8.2 pH units). Based on IDNR's assessment methodology, these results suggest that significantly more than 10% of the samples exceed Iowa's pH criteria and thus suggest an impairment of the Class A and Class B(LW) uses of this lake. These violations, however, likely reflect primary productivity at Union Grove Lake and do not reflect the input of pollutants into this lake. The IDNR Fisheries Bureau, however, feels that the aquatic life uses of this lake are "fully supported" although high levels of algae and inorganic turbidity remain water quality concerns at this lake.

Fish consumption uses are "not assessed" due to the lack of recent fish contaminant monitoring at this lake (the most recent fish contaminant monitoring at this lake was conducted in 1986).

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