Results from Water Quality Monitoring Conducted during Project AWARE 2011 on the Little Turkey, Turkey, and Volga Rivers

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Project AWARE 2011 Volunteers

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Abstract: From July 9-16, 2011, a record number of 429 volunteers participated in Project AWARE 2011 and muscled a total of 32.36 tons of trash from 88 miles of the Little Turkey, Turkey, and Volga rivers in Fayette and Clayton counties. Breaking another record, a total of 96% of the trash was recycled. Project AWARE, which stands for **A W**atershed **A**wareness **R**iver **E**xpedition, is a 7-day, 7-night canoe trip down an Iowa river that allows volunteers to participate in a river cleanup, water quality monitoring, and evening educational programs. It is an initiative of the Iowa Department of Natural Resources IOWATER and Water Trails programs, and 2011 represented the ninth year of the event. This year's event was made possible through the financial and in-kind support of 104 sponsors.

In addition to trash removal, 40 stream and outfall sites along the canoe route and at overnight camping locations were monitored for a variety of water quality parameters using IOWATER methods. The event and monitoring occurred during below-normal stream flow conditions for the Little Turkey, Turkey, and Volga rivers. For most of the parameters, concentrations at these sites during Project AWARE varied from levels measured in streams statewide for July 2011. Results from the Project AWARE sites showed that water temperatures, dissolved oxygen, and nitrate concentrations were lower for the Project AWARE sites compared to streams statewide; phosphate concentrations were similar; and pH levels for Project AWARE sites were more variable than concentrations statewide but overall median pH levels were similar. With the exception of one Project AWARE site, chloride concentrations were low for both the Project AWARE sites and streams statewide. This report summarizes the water quality results for sites monitored during Project AWARE 2011. For more information on Project AWARE, go to *www.iowadnr.gov/Recreation/CanoeingKayaking/ProjectAWARE*.

Introduction

Project AWARE, which stands for **A W**atershed **A**wareness **R**iver **E**xpedition, is the Iowa Department of Natural Resources' weeklong volunteer river cleanup event during which hundreds of Iowans spend anywhere from a day to an entire week improving Iowa's waterways by removing trash. One of Project AWARE's goals is to bring Iowans together in a civic engagement project that provides them with an opportunity to experience and enhance their state's rivers from the seat of a canoe. In addition, Project AWARE volunteers have opportunities to participate in formal and non-formal educational opportunities, collect and analyze water quality monitoring data, and develop healthy behaviors that help benefit the environment.

Project AWARE 2011 represents the 9th year of this annual event. Previous Project AWARE events have paddled and cleaned up stretches of the Maquoketa River in northeast Iowa; the Des Moines River watershed in north-central Iowa; the Little Sioux River in northwest Iowa; the Iowa and English rivers in southeast Iowa; the Middle and North Raccoon rivers in west-central Iowa; the Winnebago, Shell Rock, and the upper Cedar rivers in northeastern Iowa; the middle Cedar River in eastern Iowa; and the East and West Nishnabotna rivers in southwest Iowa.

Water monitoring using IOWATER methods was conducted at 40 sites along the Project AWARE 2011 route. Photo by Iowa DNR.

Project AWARE 2011 began with one day on the Little Turkey River, with volunteers paddling 12.6 miles from Gouldsburg Park in Fayette County to the town of Eldorado, where the Little Turkey River joins the Turkey River. From Eldorado, volunteers spent the next five days traversing 65.7 miles of the Turkey River through the towns of Elgin, Clermont, and Elkader, before ending at Garber in Clayton County. For the last day of Project AWARE, volunteers paddled 9.7 miles of the Volga River from Osborne Park to Littleport in Clayton County.

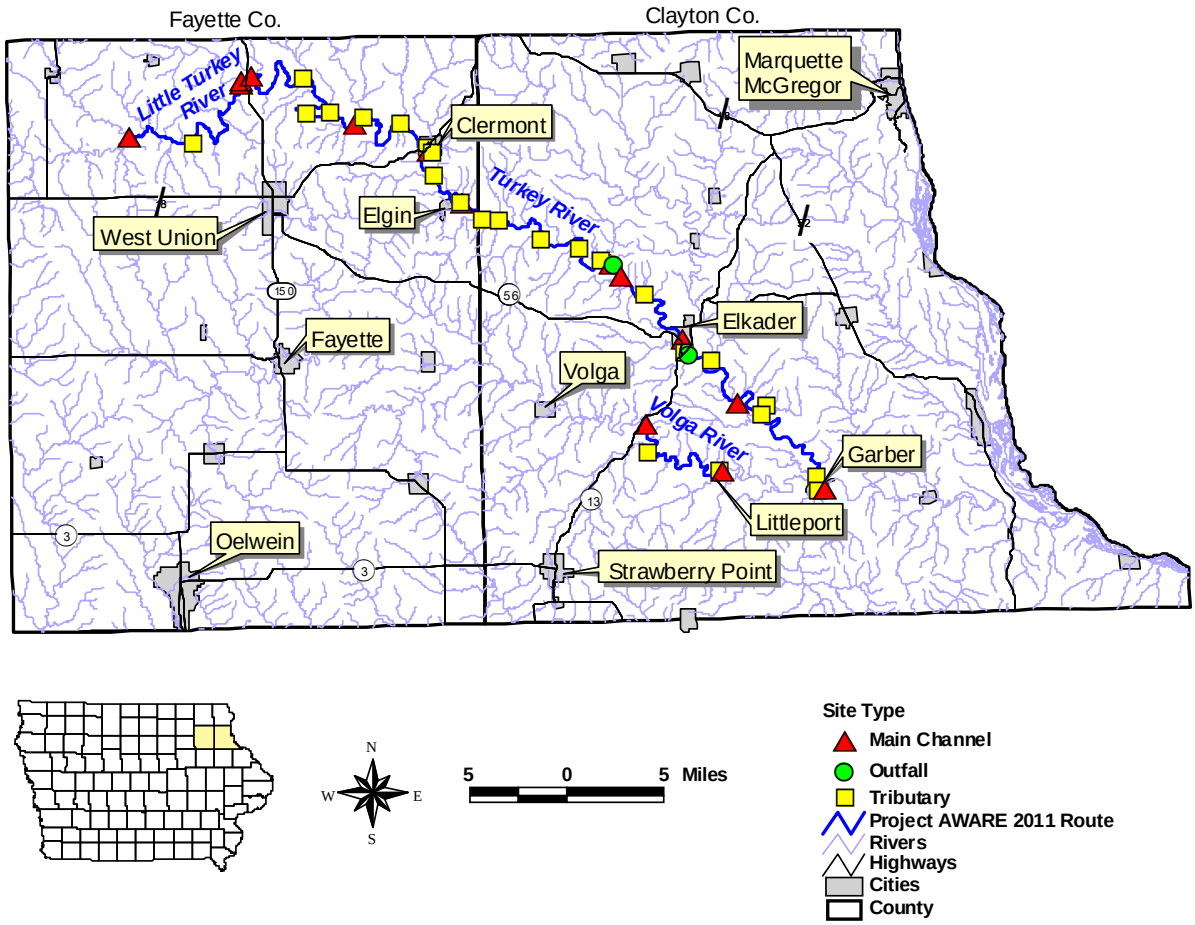

Figure 1. Location of sites sampled as part of Project AWARE 2011 on the Little Turkey, Turkey, and Volga rivers.

Each day of Project AWARE, Jim Urban and Bailey Bergthold, Project AWARE volunteers, conducted water testing at pre-determined sampling locations both along the route and at overnight camping locations. Prior to the event, potential monitoring sites were identified by Project AWARE staff. Sites were selected based on starting, half-way, and take-out points for each day; location of major tributaries entering the Little Turkey, Turkey, and Volga rivers; and other locations of interest. A total of 40 sites were sampled (Figure 1), including 14 on the main channels, 24 tributaries, and 2 outfall sites. The two outfall sites included the discharge location for the largest spring in Iowa, Big Spring, located near the trout hatchery across the river from Frieden Park in Clayton County, and the wastewater outfall for the City of Elkader's wastewater treatment facility located just downstream of the Highway 13 bridge along the Turkey River.

For all sites sampled during Project AWARE 2011, water quality data were collected using IOWATER field methods as described in the IOWATER Quality Assurance Project Plan (2010). Field data were recorded on waterproof paper field sheets. This report summarizes the water quality from the Project AWARE 2011 sampling of 40 sites (Figure 1), and includes chemical and physical results (Table 1).

Where possible, water quality results from Project AWARE were compared to a network of 84 streams statewide that are monitored on a monthly basis as part of the Iowa Department of Natural Resources' (DNR) Watershed Monitoring and Assessment Ambient Stream Monitoring Program. Data from this network have been collected since 2000 and provide perspective on typical stream concentrations statewide for the various parameters. In this report, this statewide stream network will be referred to as the DNR statewide stream network. The July 2011 data from the DNR statewide stream network were also compared to Project AWARE results to determine relative concentrations for the same time period. In some instances, results are compared to data for specific DNR statewide stream network sites on the Turkey River (at Garber in Clayton County), Volga River (near Garber in

Clayton County), and the groundwater discharge for Big Spring, which are part of the DNR statewide stream network.

In addition, data from Project AWARE were compared to water quality results collected as part of the Turkey River Watershed Alliance. The Turkey River Watershed Alliance (http://turkeyriver.org/watershed-alliance/) is a partnership of businesses, organizations, groups, and individuals interested in water quality and quantity issues related to the Turkey River. In May 2011, the Turkey River Watershed Alliance began monthly monitoring of 46 sites throughout the watershed for field (pH, water temperature, transparency, dissolved oxygen, and chloride) and lab parameters (ammonia-N, nitrate+nitrite-N, total phosphate, and *E. coli* bacteria) to better understand variability in water quality throughout the watershed. Data from the July 6, 2011, sampling of these 46 sites is included for comparison purposes.

Table 1. Monitoring results from Project AWARE 2011.

Parameter	Unit	Method	# of samples	Min Value	Percentiles			Max Value
					25th	50th	75th	
Chloride	mg/L	IOWATER test strip	40	<33	<33	<33	<33	291
Dissolved Oxygen	mg/L	IOWATER field kit	39	4	5	5	6	8
Nitrite-N	mg/L	IOWATER test strip	40	0	0	0	0	0.3
Nitrate-N	mg/L	IOWATER test strip	40	1	2	5	10	20
Phosphate	mg/L	IOWATER field kit	40	0.1	0.2	0.2	0.3	0.6
pH	pH units	IOWATER test strip	40	5	7	8	9	9
Temperature, Air	degrees F	Thermometer - Field	39	58	71	75	79	88
Temperature, Water	degrees F	Thermometer - Field	40	51	64	70	72	82
Transparency	centimeters	IOWATER transparency tube	40	30	50	60	60	60

mg/L = milligrams per liter (or parts per million - ppm)
F = Fahrenheit

Precipitation and Stream Flow Conditions

Precipitation and stream flow conditions affect water quality, and in 2011, both caused river levels in the Turkey and Volga rivers to be at or below normal for most of June and July (Figure 2). Rainfall totals for the months of June and July for Elkader were 3.26 inches and 3.63 inches, respectively (source: Iowa Environmental Mesonet, http://mesonet.agron.iastate.edu/COOP/), which were both below the long-term normal for those months for Elkader. Based on stream flow data from the U.S. Geological Survey (www.usgs.gov), water levels for the Turkey and Volga rivers were at or below the long-term normal levels for these rivers during June and July 2011 (Figure 2). Flow for the Turkey River at Eldorado varied from 33 to 91% of normal during the week of Project AWARE; the Turkey River at Garber was 61 to 77% of normal; and the Volga River at Littleport ranged from 29 to 68% of normal. Volunteers only spent one day on the Volga River which was Saturday July 16. A timely rain the evening of Friday July 15 and the early morning of Saturday July 16 caused the flow in the Volga River to increase from a daily mean of 139 cfs on Friday July 15 to 178 cfs on Saturday July 16, in turn providing adequate flow for volunteers to paddle downstream and remove trash. A total of 1.05 inches of rain fell in Volga, located upstream of the town of Littleport on the Volga River that Friday evening/Saturday morning. In most of the watershed, the maximum daily temperature exceeded 85 degrees for only two of the seven days that volunteers were on the river. The highest maximum daily temperature was 88 degrees. Rain fell a few times during the week, with the most significant rain occurring the evening of Friday July 15 and early morning of Saturday July 16. Rainfall amounts for the week ranged from 1.19 inches in Elkader to 1.82 inches in Volga (source: Iowa Environmental Mesonet, http://mesonet.agron.iastate.edu/COOP/).

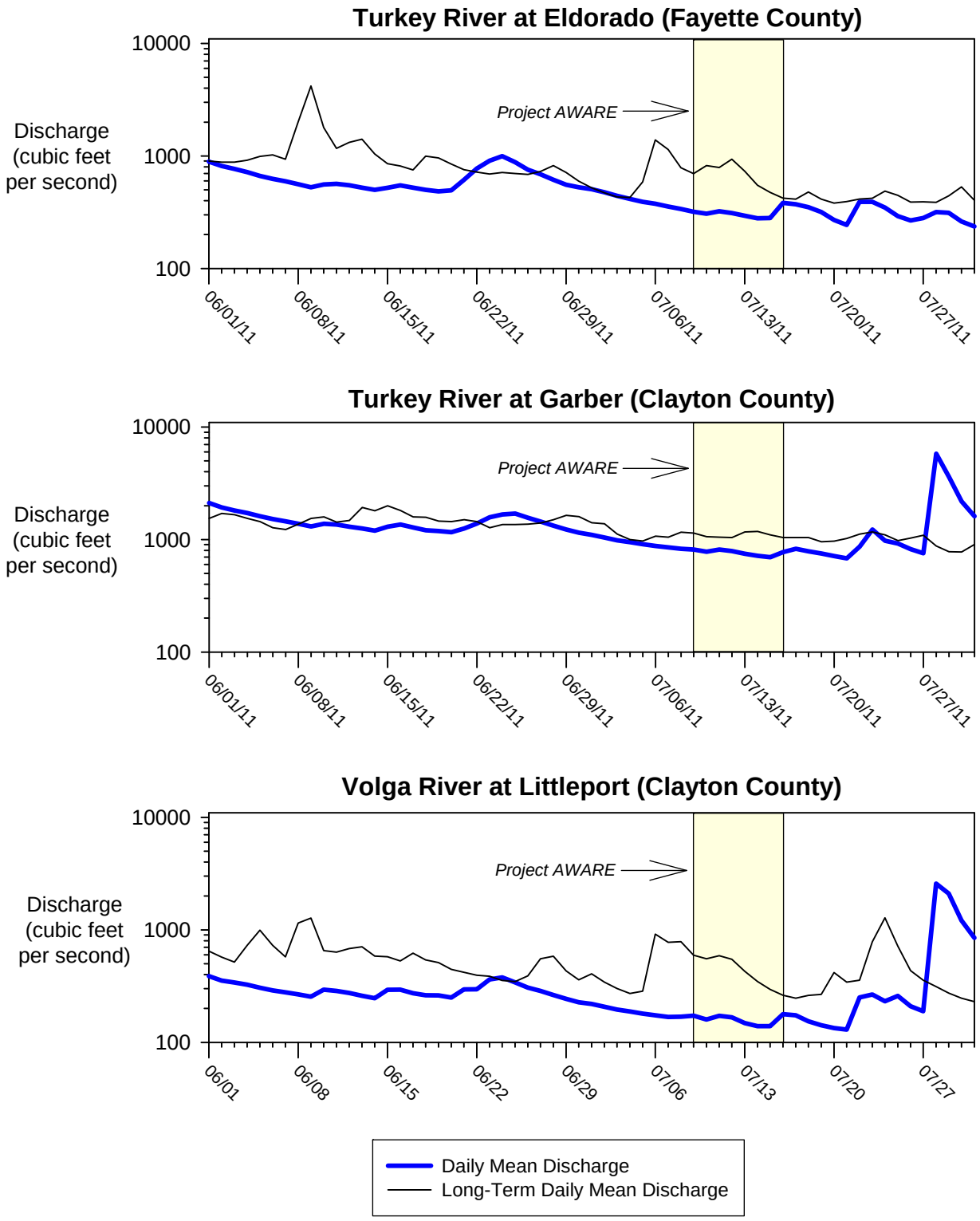

Figure 2. Discharge for the Turkey and Volga rivers for June 2011 through July 2011. The yellow shaded area represents when Project AWARE occurred from July 9-16, 2011. Data from http://ia.water.usgs.gov.

Chemical and Physical Parameters

Water Temperature

Water temperature affects many of the biological, chemical, and physical processes in a stream, including the amount of oxygen gas that can dissolve in water, the rate of photosynthesis by algae and plants, as well as the metabolic rate of aquatic animals.

Water temperature was measured at 40 sites during Project AWARE 2011 and varied from 51 to 82 degrees Fahrenheit (F) (Table 1; Figure 3). Warmer water temperatures occurred on the main channel sites, with temperatures at these sites ranging from 66 to 82 degrees with an average of 73 degrees. Temperatures for the tributary sites ranged from 51 to 76 degrees, with an average of 65 degrees. One of the outfall sites sampled was the outfall from Big Spring, Iowa's largest spring, located in Clayton County. Water from the spring is used for the fish raceways at the DNR's Big Spring Trout Hatchery. The DNR's Watershed Monitoring and Assessment Program has monitored the water quality of Big Spring on a monthly basis since 2001. A water temperature of 60 degrees for Big Spring was measured while on Project AWARE, which is a temperature similar to the average July water temperature for Big Spring of 56 degrees based on the past 10 years of monitoring.

Five tributary sites had low water temperatures ranging from 51 to 59 degrees F which is unusually cold temperatures in general for Iowa streams statewide. However, coldwater streams are common in northeast Iowa due to the geology of the area and groundwater dominated nature of these streams. To be considered a coldwater stream, both the flow and temperature need to be such to support a coldwater fish population. There is an estimated 480 miles of coldwater streams in northeast Iowa (personal communication, John Olson). To be cold enough to support trout, water temperatures normally need to be less than 75 degrees Fahrenheit during the summer months. Some of the sites sampled during Project AWARE are classified as coldwater streams.

Figure 4 compares the results of selected parameters from Project AWARE to the DNR statewide stream network and those sites sampled as part of the Turkey River Watershed Alliance. Water temperatures for sites monitored on Project AWARE were lower and had a greater range than temperatures for the streams monitored statewide during July 2011 and those sites sampled July 6 for the Turkey River Watershed Alliance. Water temperatures for sites sampled as part of the Turkey River Watershed Alliance were slightly lower than for streams statewide. The difference has to do with the presence of coldwater streams in northeast Iowa and the greater input of shallow groundwater to the sites sampled as part of Project AWARE and for those associated with the Turkey River Watershed Alliance. The streams monitored as part of the DNR statewide stream network are primarily warm water streams.

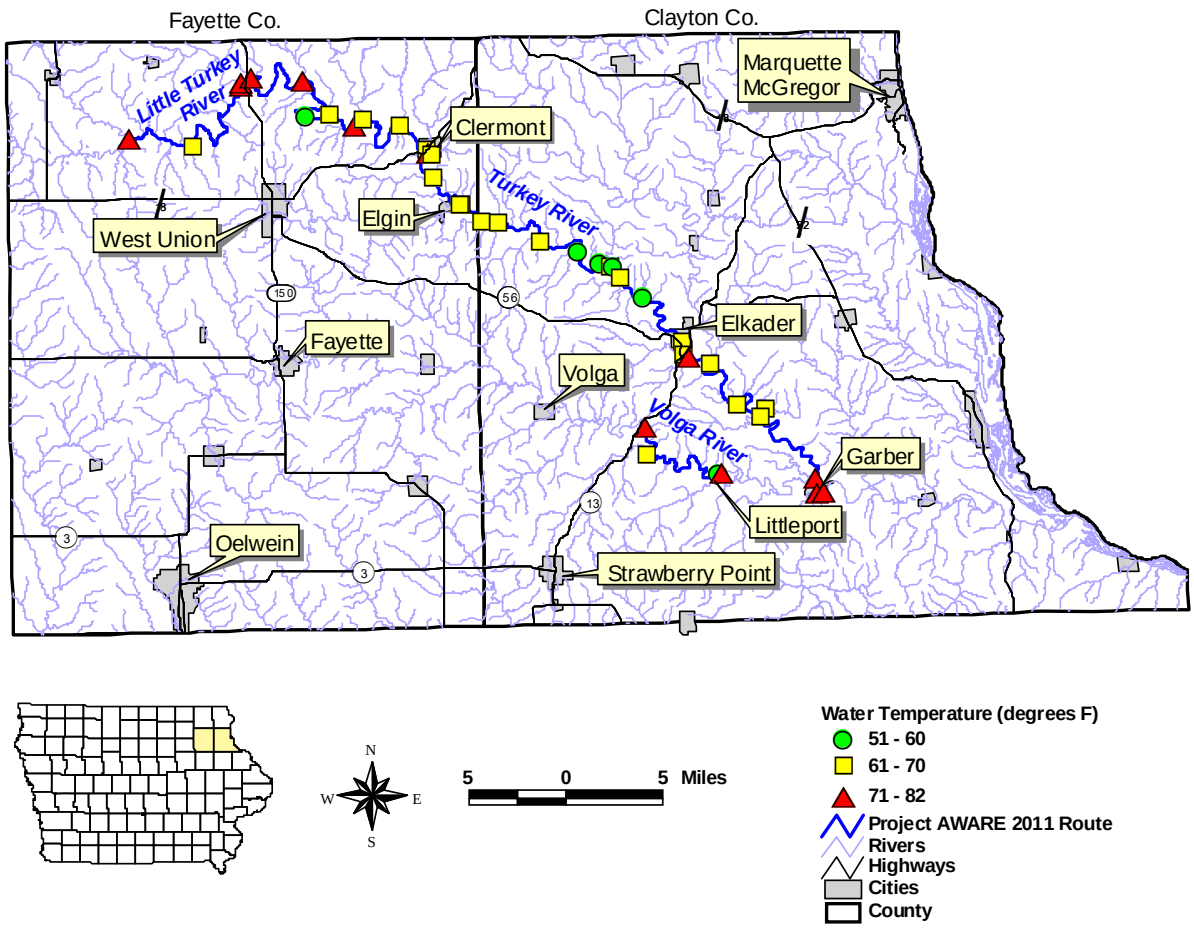

Figure 3. Water temperature (IOWATER method) for sites sampled as part of Project AWARE 2011 on the Little Turkey, Turkey, and Volga rivers.

pH

pH is a measure of water's acid/base content. Changes in pH can be caused by atmospheric deposition of acid rain, the types of soils and bedrock that the water comes in contact with, wastewater discharges, and acid mine drainage. A pH of 7 is neutral; pH values greater than 7 are alkaline or basic, while a pH less than 7 is acidic. pH levels for sites sampled during Project AWARE ranged from 5 to 9 using the IOWATER test strip (Table 1; Figure 5). A pH value of 5 was measured on the Turkey River just upstream of the confluence with the Little Turkey River in Fayette County. However, a site on the Turkey River located a short distance downstream of the confluence of the Little Turkey River and Turkey River had a pH value of 8, indicating the pH quickly returned to a pH level more typical for this river. Eleven sites had pH levels of 6 or 7. All 11 were tributary sites and also included the outfall from Big Spring.

The pH levels measured at sites sampled as part of Project AWARE were more variable than those measured as part of the DNR statewide stream network for July 2011 and for sites sampled as part of the Turkey River Watershed Alliance (Figure 4), however median values were similar, with a median pH of 8 for the Project AWARE sites, 8.3 for DNR statewide stream network, and 8.4 for Turkey River Watershed Alliance sites. The overall difference in pH values has to do with the method used to measure pH. For Project AWARE, pH test strips were used which measure pH in whole number increments whereas for the DNR statewide stream network and Turkey River network, calibrated pH meters that measure in tenths are used. For both the Turkey River at Garber and the Volga River near Elkport that are sampled as part of the DNR statewide stream network, the median pH for

those sites based on monthly data collected since 2000 is 8.2.

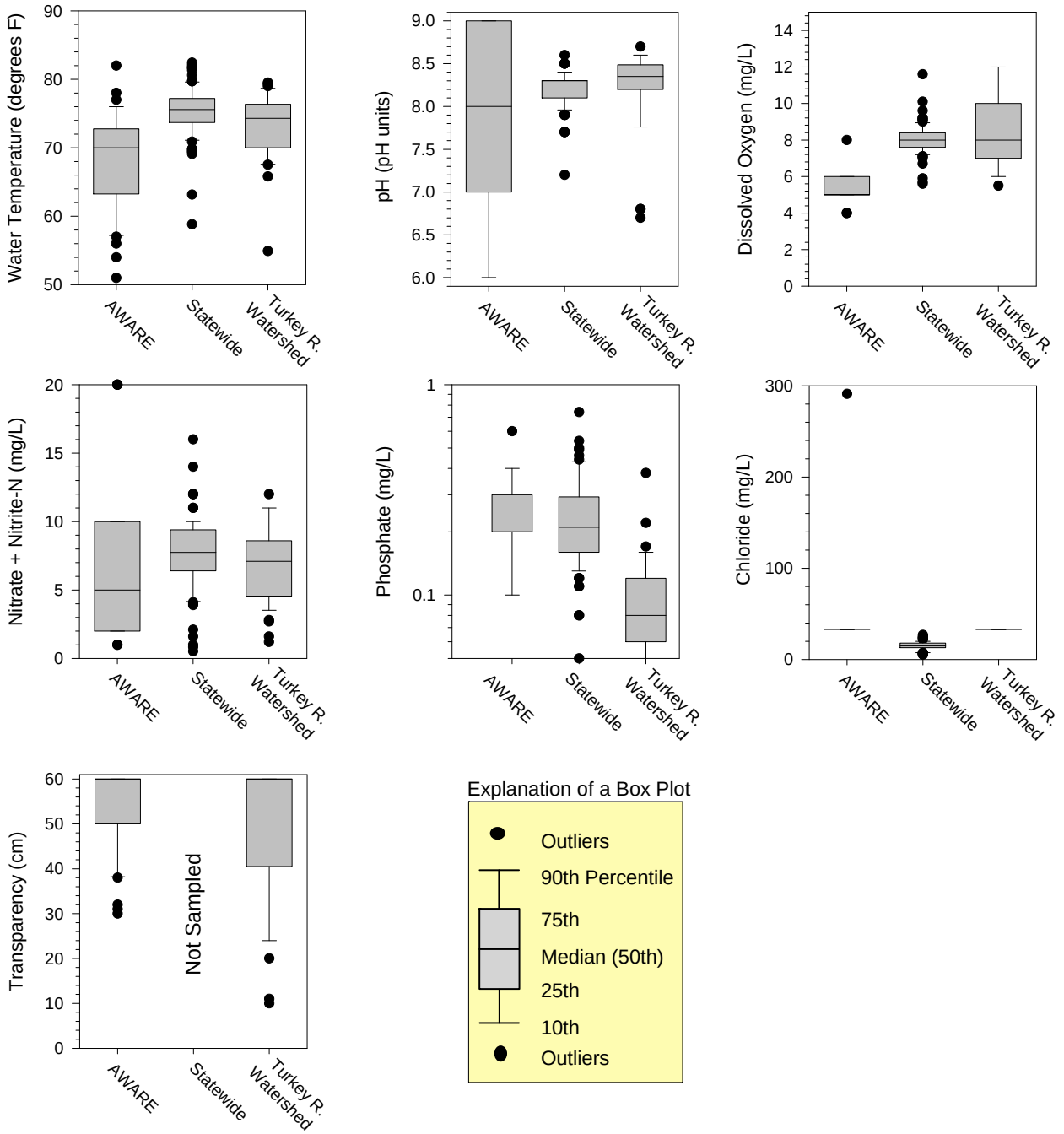

Figure 4. Box plots comparing water quality results for sites sampled during Project AWARE 2011 to the DNR statewide stream network for July 2011.

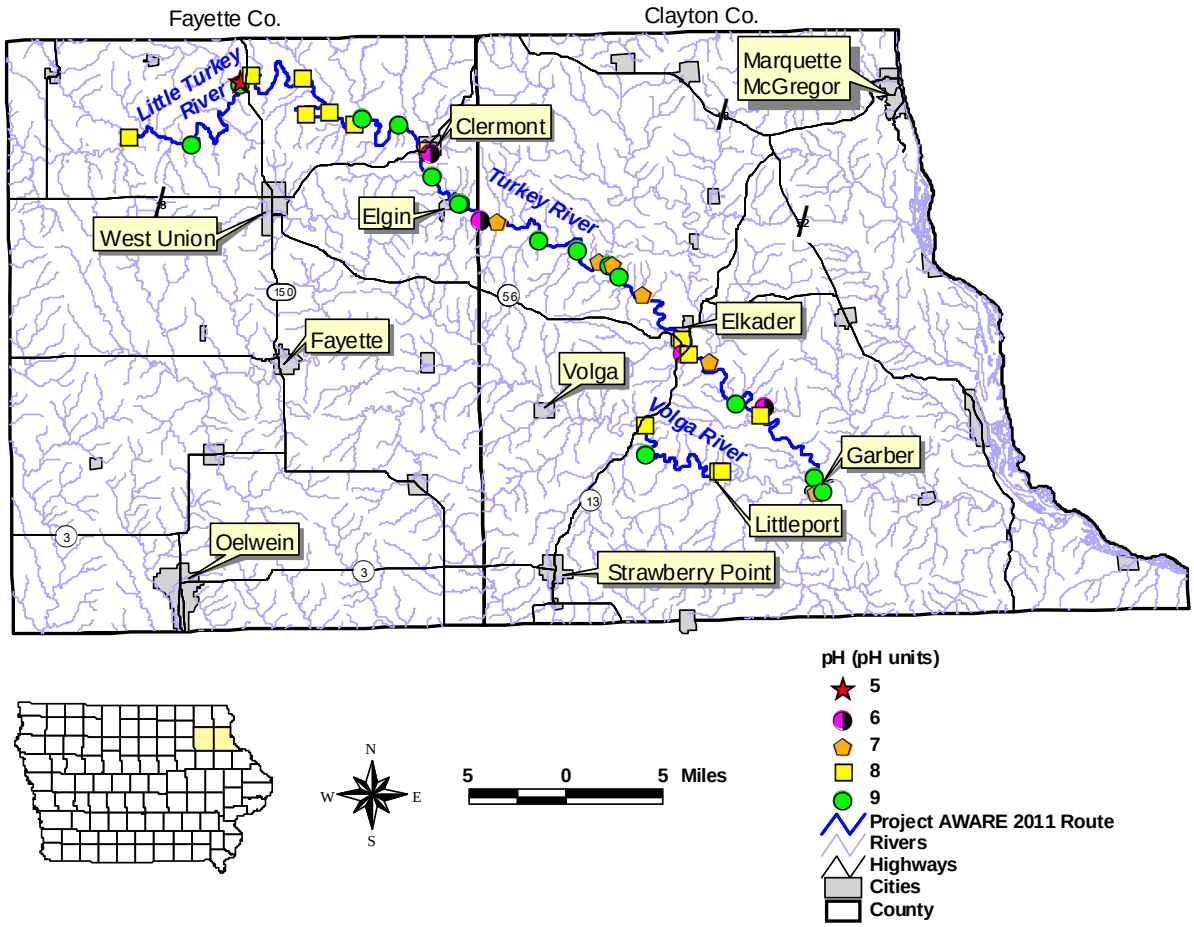

Figure 5. pH (IOWATER method) for sites sampled as part of Project AWARE 2011 on the Little Turkey, Turkey, and Volga rivers.

Transparency

Transparency is a measure of water clarity and is affected by the amount of material suspended in water. As more material is suspended in water, less light can pass through the water, making it less transparent (or more turbid). These materials include soil, algae, plankton, and microbes.

Transparency ranged from 30 to 60 centimeters (cm) for all Project AWARE sites (Table 1; Figure 6). Overall, transparency levels were extremely high when compared to transparency levels measured during previous Project AWARE events, especially when compared to transparency levels for Project AWARE 2010 on the East and West Nishnabotna rivers where the median transparency was 5 cm. The overall median transparency for sites sampled for Project AWARE 2011 was 60 cm, which is the upper limit that can be measured using the transparency tube. Two of the lowest transparency readings, 30 and 32, occurred on the main stem of the Volga River and a tributary to the Volga River, both of which were sampled Saturday July 16 after a one-inch rainfall had occurred Friday evening/early Saturday morning. The other low transparency (31 cm) occurred earlier in the week on Nutting Creek, a tributary to the Turkey River located upstream of the town of Clermont. The overall high transparency greatly aided volunteers in their search for trash located beneath the water's surface.

While transparency is not measured as part of the DNR statewide stream network, it was measured at the Turkey River Watershed Alliance sites. The median transparency was 60 cm for both the Project AWARE and Turkey River Watershed Alliance sites for the July 2011 sampling. Transparency for the Project AWARE sites ranged 30 to 60 cm while the Turkey River Watershed Alliance sites were more variable, ranging from 10 to 60 cm.

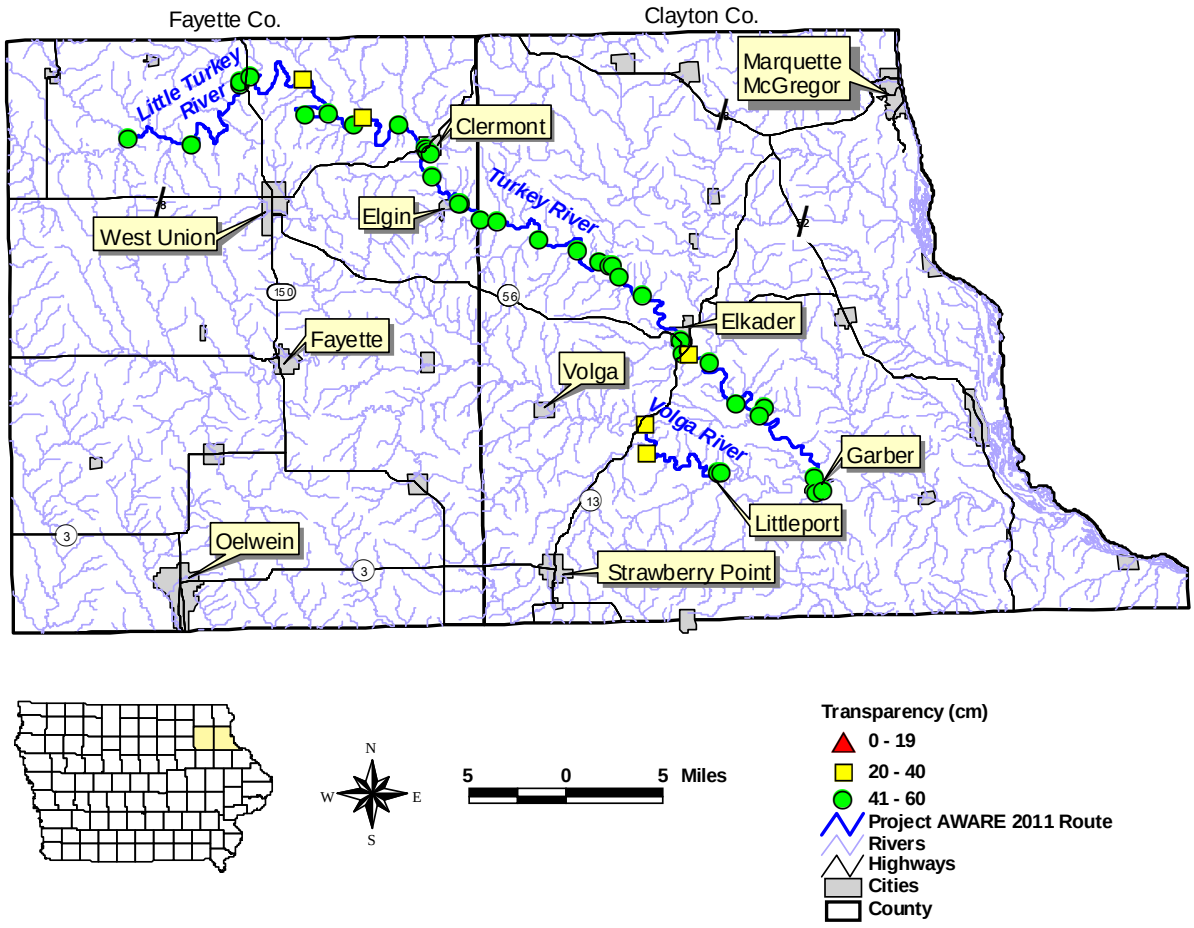

Figure 6. Water transparency (IOWATER method) for sites sampled as part of Project AWARE 2011 on the Little Turkey, Turkey, and Volga rivers.

Dissolved Oxygen

Dissolved oxygen levels in a stream can be affected by a number of variables, including water temperature, season, time of day, stream flow, presence of aquatic plants, dissolved or suspended solids, and human impacts. Oxygen enters a stream through diffusion from the surrounding air and as a product of photosynthesis from aquatic plants. Oxygen in a stream can be consumed through respiration by aquatic plants and animals, and by the decomposition of organic matter. Iowa has a water quality standard minimum of 5 mg/L of dissolved oxygen for warm water streams and 7 mg/L for coldwater streams.

For Project AWARE sites, dissolved oxygen ranged from 4 to 8 mg/L (Table 1; Figure 7), with a median of 5 mg/L. All but two of the sites monitored had dissolved oxygen concentrations that met the water quality standard minimum of 5 mg/L for warm water streams. The lowest dissolved oxygen (4 mg/L) was measured at Dry Creek, a tributary to the Turkey River located downstream of the town of Eldorado, and the outfall from the City of Elkader's wastewater treatment facility. It seems unusual that dissolved oxygen levels weren't higher given the cold temperatures associated with some of the sites. However, normal or below normal water levels for this time of year may have contributed to the lower dissolved oxygen levels.

Dissolved oxygen concentrations measured during Project AWARE were lower than levels measured in streams statewide for July 2011 and for the sites sampled July 6 as part of the Turkey River Watershed Alliance (Figure 4).

For both of these data sets, the median dissolved oxygen was 8 mg/L. A dissolved oxygen meter is used for the statewide stream network whereas the IOWATER dissolved oxygen kit, the same used for the Project AWARE monitoring, was used for the Turkey River Watershed Alliance. For the Turkey River at Garber and the Volga River near Elkport sites that are sampled as part of the DNR statewide stream network, dissolved oxygen was 8.4 mg/L and 8.2 mg/L, respectively, for July 2011. These sites were also sampled July 6 for the Turkey River Watershed Alliance, and dissolved oxygen levels were 12 mg/L for the Turkey River at Garber and 9 mg/L for the Volga River near Elkport.

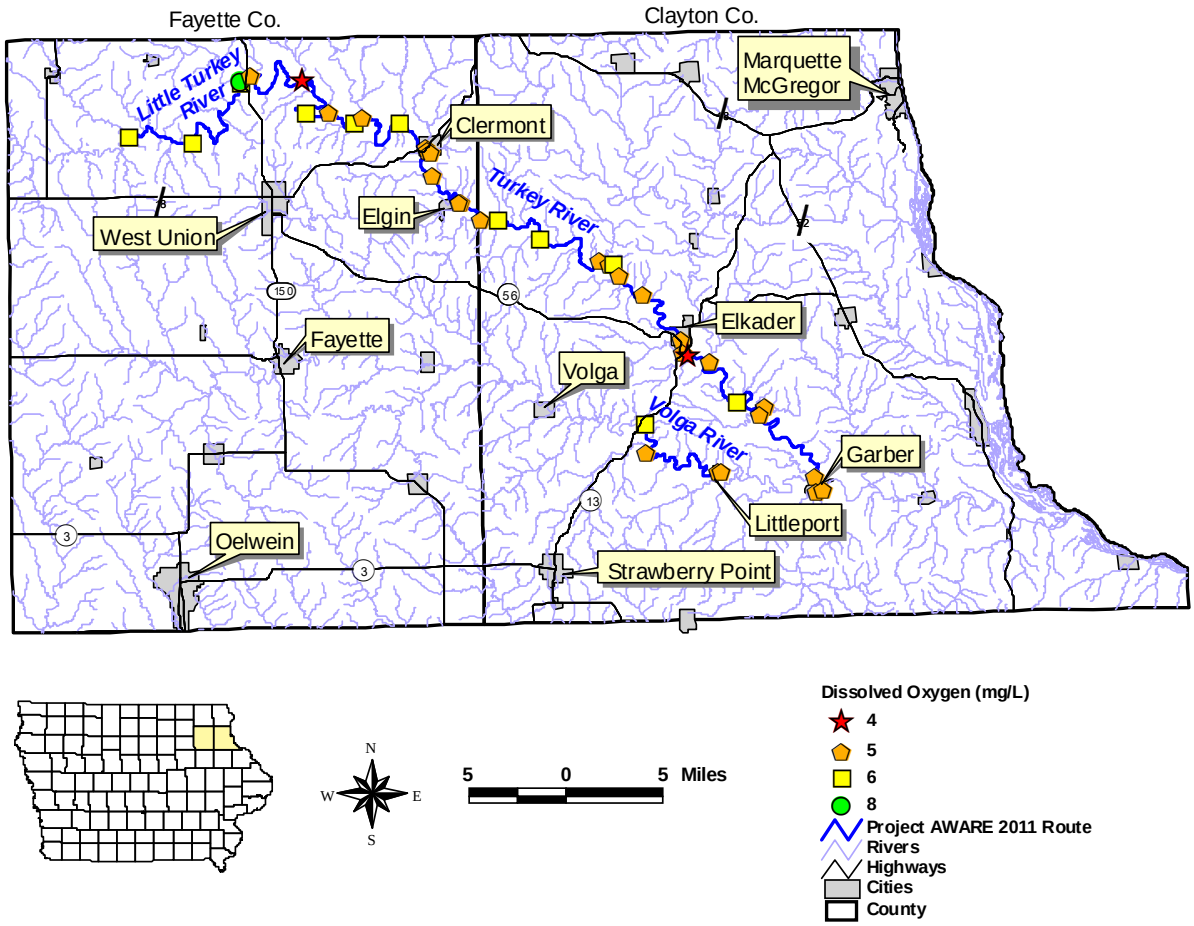

Figure 7. Dissolved oxygen (IOWATER method) for sites sampled as part of Project AWARE 2011 on the Little Turkey, Turkey, and Volga rivers.

Nitrite-N and Nitrate-N

Nitrogen is a necessary nutrient for plant growth, and includes both nitrite- and nitrate-nitrogen. Too much nitrogen in surface waters, however, can cause nutrient enrichment, increasing aquatic plant growth and changing the types of plants and animals that live in a stream. Sources of nitrogen include soils; human and animal wastes; decomposing plants; and fertilizer runoff from golf courses, lawns, and cropland. Typical nitrate+nitrite-N concentrations for Iowa streams range from 2.9 to 8.7 mg/L, with higher concentrations generally occurring in the late spring/early summer. Nitrite-N and nitrate-N are not measured separately as part of the DNR statewide stream network, rather it is measured as nitrate+nitrite-N.

Nitrite-N was measured at Project AWARE sites using the IOWATER method (Table 1; Figure 8). Concentrations ranged from 0 to 0.3 mg/L. Eight of the 40 sites had measurable levels of nitrite-N of 0.15 or 0.3 mg/L. None of the other water quality results for these eight sites were out of the ordinary. It is not known why these eight particular sites had detectable levels of nitrite-N.

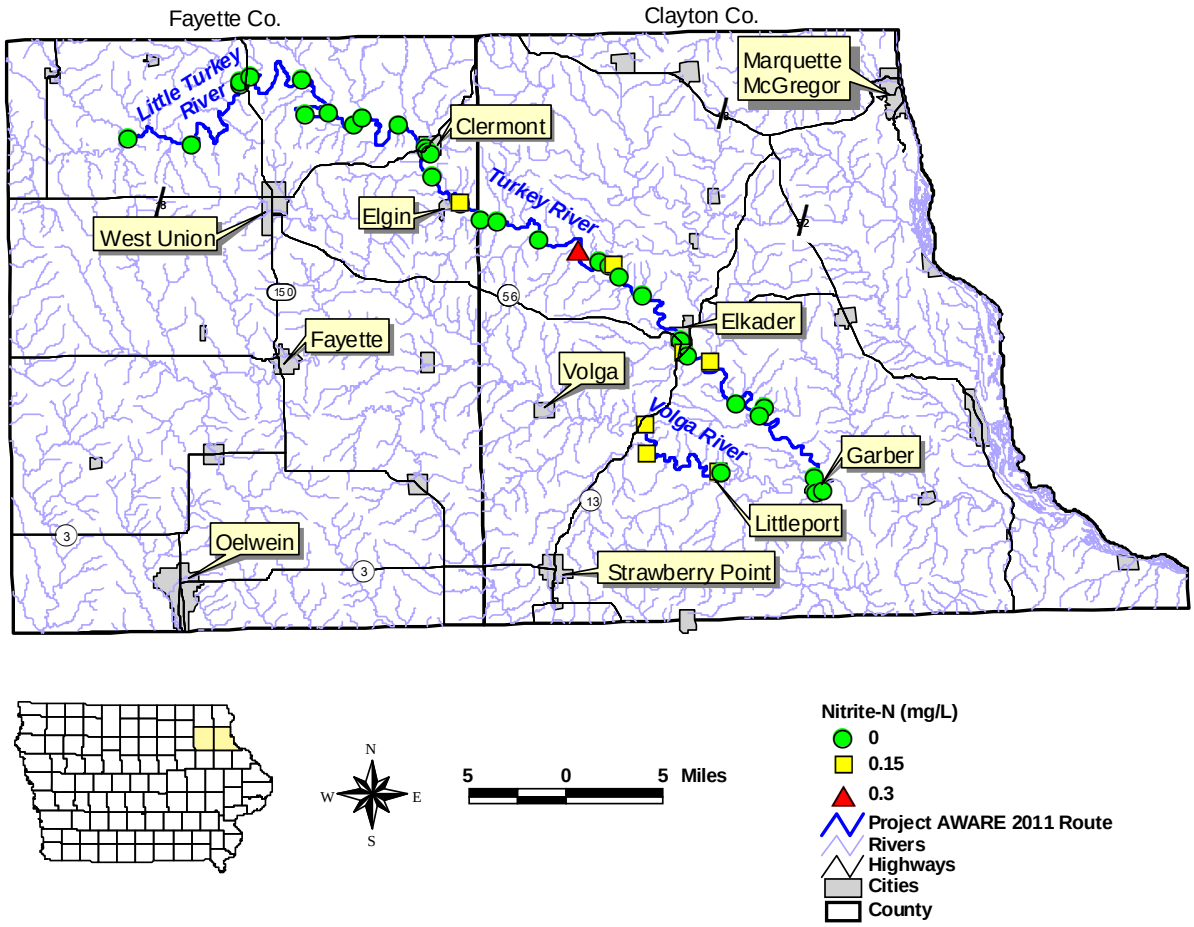

Figure 8. Nitrite-N (IOWATER method) for sites sampled as part of Project AWARE 2011 on the Little Turkey, Turkey, and Volga rivers.

Nitrate-N for sites sampled as part of Project AWARE ranged from 1 to 20 mg/L (median of 5 mg/L; Table 1; Figure 9). The lowest nitrate-N concentration was 1 mg/L and occurred at two sites (outfall from the City of Elkader's wastewater treatment facility and Panther Creek, a tributary to the Turkey River located downstream of Motor Mill). The highest concentration was 20 mg/L and occurred at three locations, all tributary sites to the Turkey River. These sites were Fitzgerald Creek, Pine Hollow, and Roberts Creek. The outfall from Big Spring was 10 mg/L. Based on data collected as part of the DNR statewide stream network, nitrate+nitrite-N concentrations for Big Spring ranged from 12 to 13 mg/L from March 2011 to July 2011, similar to what was measured during Project AWARE.

Nitrate-N concentrations varied from 1 to 20 mg/L for the tributary sites and from 2 to 10 mg/L for sites on the main stem of the Little Turkey, Turkey, and Volga rivers. The overall median concentration for all sites was 5 mg/L. Based on monthly data collected from DNR's statewide stream network, the median nitrate+nitrite-N concentration for July 2011 was 7.8 mg/L. The median nitrate+nitrite-N was 7.1 mg/L for sites sampled as part of the Turkey River Watershed Alliance. Nitrate-N results for the Project AWARE sites were lower than levels reported statewide for July 2011 and for sites with the Turkey River Watershed Alliance (Figure 4). For the Turkey River at Garber and Volga River near Elkport sites from the DNR statewide stream network, nitrate+nitrite-N concentrations were 6.7 mg/L and 4.3 mg/L, respectively, and 6.9 and 4.3 based on data from the Turkey River Watershed Alliance.

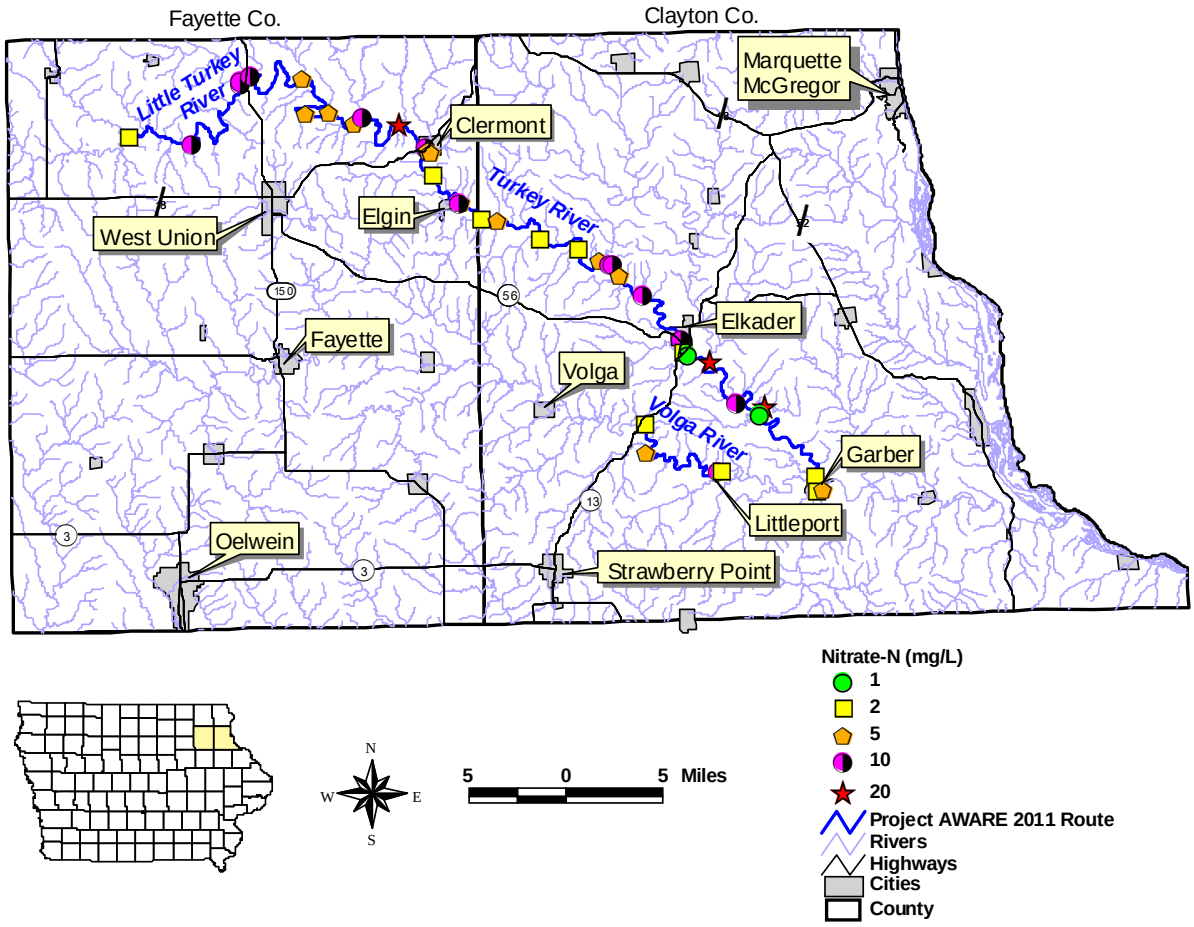

Figure 9. Nitrate-N (IOWATER method) for sites sampled as part of Project AWARE 2011 on the Little Turkey, Turkey, and Volga rivers.

Phosphorus

Phosphorus is a necessary nutrient for plant growth. Too much phosphorus in surface waters, however, can cause nutrient enrichment, increasing aquatic plant growth, and changing the types of plants and animals that live in a stream. Sources of phosphorus include certain soils and bedrock; human and animal wastes; detergents; decomposing plants; and runoff from fertilized lawns and cropland. Typical concentrations of phosphate in streams statewide vary from 0.11 to 0.33 mg/L, with a median of 0.20 mg/L.

IOWATER phosphate results for the Project AWARE sites ranged from 0.1 to 0.6 mg/L, with a median of 0.2 mg/L (Table 1; Figure 10). The highest phosphate level (0.6 mg/L) occurred at Dry Creek, a tributary to the Turkey River located downstream of the town of Eldorado. Phosphate results from Project AWARE were very similar to levels in streams statewide during July 2011 (Figure 4). The median phosphate for Project AWARE sites was 0.2 mg/L versus 0.21 mg/L for streams statewide in July 2011 and 0.08 mg/L for sites associated with the Turkey River Watershed Alliance.

For the Turkey River and Volga River sites from the DNR statewide stream network, phosphate was 0.11 mg/L for the Turkey River in July 2011 and 0.08 mg/L for the Volga River, and 0.12 and 0.07 mg/L based on the Turkey River Watershed Alliance data.

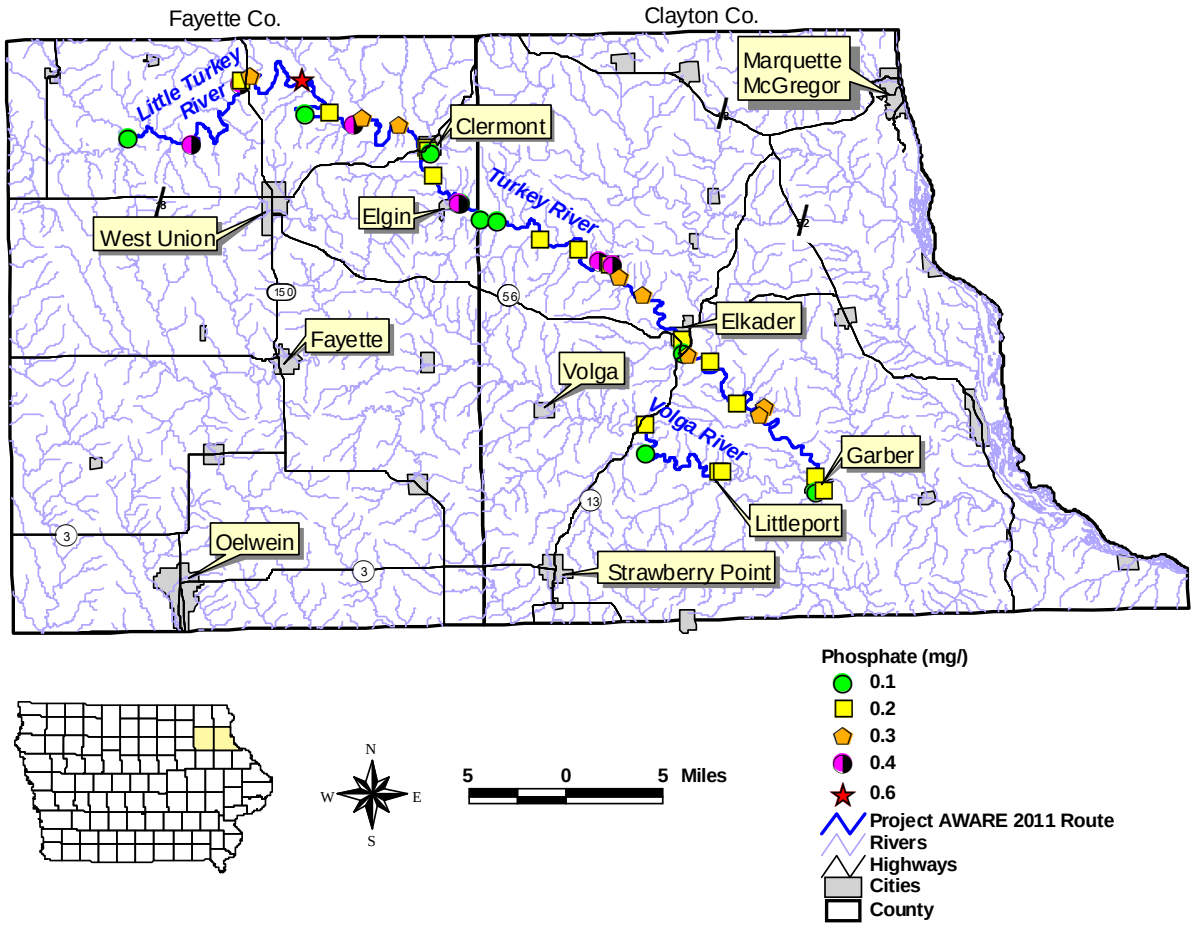

Figure 10. Phosphate (IOWATER method) for sites sampled as part of Project AWARE 2011 on the Little Turkey, Turkey, and Volga rivers.

Chloride

Chloride is a component of salt and is a measure of human or animal waste inputs to a stream. Potential sources of chloride to a stream include direct input from livestock, septic system inputs, and/or discharge from municipal wastewater facilities. During winter months, elevated chloride levels in streams may occur as a result of road salt runoff to nearby streams. Typical concentrations of chloride in Iowa streams range from 16 to 28 mg/L, with a median of 21 mg/L, with higher concentrations occurring during winter months.

For Project AWARE sites, IOWATER chloride concentrations were all below the test strip detection limit of 33 mg/L (Table 1; Figure 11) except for the outfall site at the City of Elkader's wastewater treatment plant (291 mg/L). It is not unusual for elevated chloride to be associated with the outfall of a wastewater treatment facility. In 2005, the Iowa DNR conducted a study with the Iowa Water Pollution Control Association to evaluate water quality impacts from wastewater treatment facilities. Chloride concentrations were measured at 100 wastewater treatment facilities statewide. The median chloride concentration from the study for grab samples collected from the outfall of wastewater treatment facilities was 358 mg/L (Iowa DNR, 2005).

For the Turkey River and Volga River sites from the DNR statewide stream network, chloride was 17 and 12 mg/L in July 2011, respectively. Chloride concentrations at these sites ranged from 8.2 to 27 mg/L.

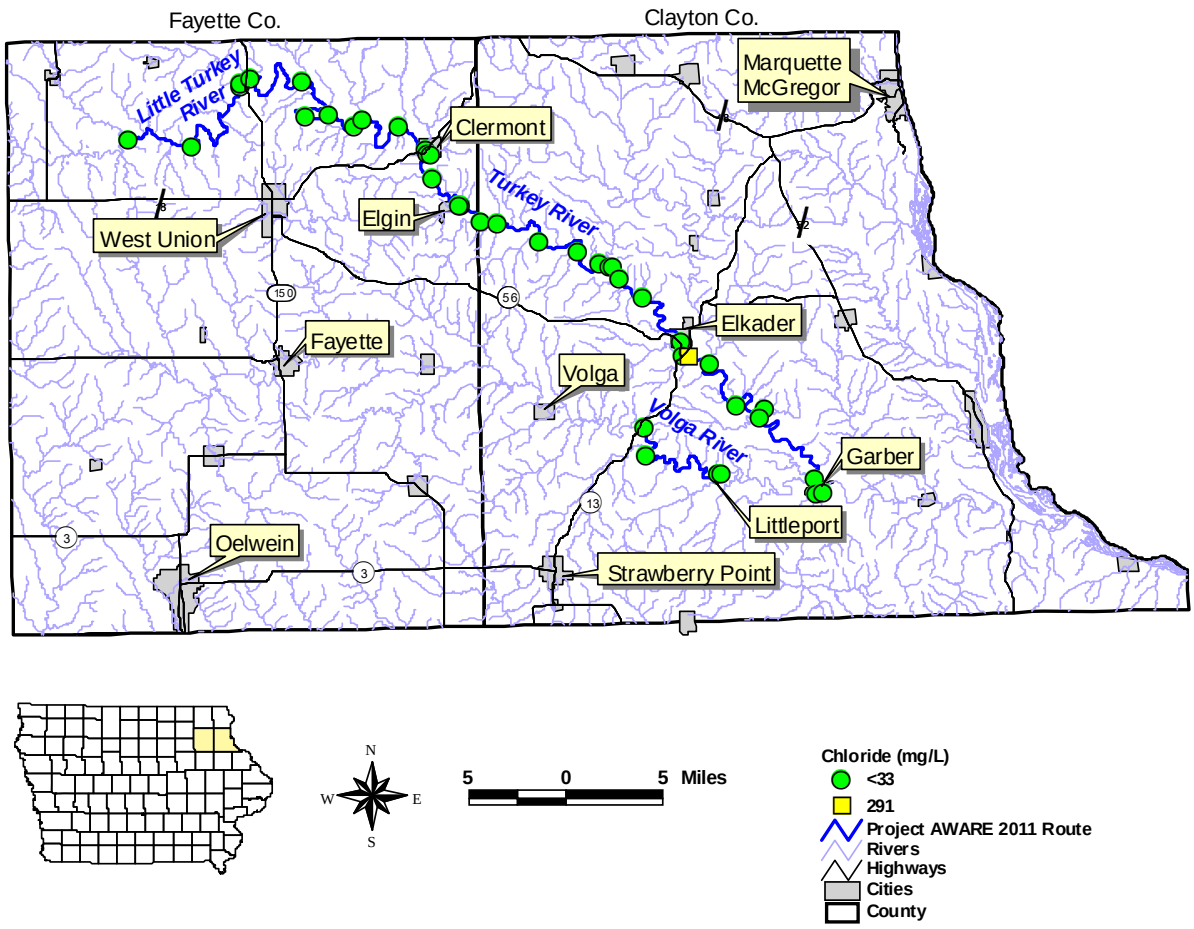

Figure 11. Chloride (IOWATER method) for sites sampled as part of Project AWARE 2011 on the Little Turkey, Turkey, and Volga rivers.

Summary

In addition to 32.36 tons of trash being removed during Project AWARE 2011, a total of 40 sites were monitored for a variety of field parameters using IOWATER methods. Below are some observations from the data.

- Project AWARE occurred from July 9-16, 2011, during below normal stream flow conditions. Flow for the Turkey River at Eldorado varied from 33 to 91% of normal during the week of Project AWARE, while the Turkey River at Garber ranged from 61 to 77% of normal, and the Volga River at Littleport ranged from 29 to 68% of normal. In most of the watershed, the maximum daily temperature exceeded 85 degrees 2 of the 7 days volunteers were on the river. Rain occurred a few times during the week, with Elkader receiving 1.19 inches and Volga receiving 1.82 inches.
- Water temperature for Project AWARE sites sampled ranged from 51 to 82 degrees Fahrenheit. These temperatures were lower than temperatures measured in streams statewide during July and also displayed a greater range in values.
- pH ranged from 5 to 9. Overall, pH was slightly lower and more variable than levels measured in streams statewide for July 2011.
- Transparency ranged from 30 to 60 centimeters and a median of 60 cm. These were some of the highest transparency readings measured in the nine-year history of Project AWARE. This was in sharp contrast to the extremely low transparency readings recorded for Project AWARE 2010 on the East and West

Nishnabotna rivers. There was no discernible trend in transparency between the tributary and main stem sites for Project AWARE 2011.

- Dissolved oxygen concentrations varied from 4 to 8 mg/L with a median of 5 mg/L. Dissolved oxygen was unusually low given the cooler water temperatures and when compared to sites monitored as part of the Turkey River Watershed Alliance. It is not known why the levels were relatively low.
- Nitrite-N concentrations ranged from 0 to 0.3 mg/L with 8 of the 40 sites having detectable levels of nitrite-N.
- Nitrate-N concentrations ranged from 1 to 20 mg/L with the highest concentrations occurring at tributary sites to the Turkey River. Overall, concentrations were slightly lower compared to levels reported in streams statewide for July 2011.
- Phosphate ranged from 0.1 to 0.6 mg/L, with a median concentration of 0.2 mg/L. Phosphate concentrations were similar to levels reported for streams statewide for July 2011, but higher than levels reported from the Turkey River Watershed Alliance sites for July.
- Chloride concentrations were all below the test strip detection limit of 33 mg/L except for one site which had a chloride concentration of 291 mg/L and represented the outfall from a wastewater treatment facility.

Acknowledgements

Project AWARE staff would like to acknowledge Jim Urban and Bailey Bergthold for conducting the water quality monitoring throughout the week of Project AWARE. IOWATER staff provided review of the report.

References

IOWATER Quality Assurance Project Plan. 2010. Iowa Department of Natural Resources. QA/WM/01-02. 94 p.

Iowa Department of Natural Resources, 2005, Monitoring of Point Source Outfalls and Receiving Streams for Common Ions and Total Dissolved Solids, 42 p.