

## PROJECT IMPLEMENTATION PLAN

### **Project Coordination of the Bazile Groundwater Management Area Plan**

#### **Project Sponsor**

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#### **Project Partners**

Upper Elkhorn NRD: Funding and technical assistance for the Project Coordinator. Supervision of the Project Coordinator.

Lewis & Clark Natural Resources District (NRD): Funding and technical assistance for the Project Coordinator.

Lower Niobrara NRD: Funding and technical assistance for the Project Coordinator.

Lower Elkhorn NRD: Funding and technical assistance for the Project Coordinator.

Nebraska Department of Environmental Quality: Funding through the EPA Section 319 for Bazile Groundwater Management Area project coordination with a focus on information and education activities related to nitrate and irrigation management.

Nebraska Environmental Trust: Funding of six demonstrations of nitrogen and irrigation best management practices, crop tissue analysis, vadose zone sampling, and cost share for installation of irrigation well flow meters.

#### **Project Area**

The project area encompasses 756 square miles in parts of three northeastern Nebraska counties: Antelope, Knox, and Pierce. This area contains parts of four NRDs: Lewis & Clark, Lower Elkhorn, Lower Niobrara, and Upper Elkhorn as well as the communities of Brunswick, Creighton, Orchard, Osmond, Plainview, Royal, Wausa, and Winnetoon.

#### **Section 319 Funds Requested:**

\$155,000

#### **Non-Federal Match:**

\$131,550

#### **Project Duration:**

March 2014 through June 2016

## **Introduction/Background**

Nebraska's Natural Resource Districts (NRDs) are responsible for natural resource management on a watershed basis. Through Nebraska's Groundwater Management and Protection Act (NGM&PA) (revised state statutes §46-701-754) the NRDs' responsibilities include managing the groundwater resources of the state. Along with the Nebraska Department of Environmental Quality (NDEQ), the NRDs administer the water quality aspects of the NGM&PA.

Nebraska has abundant groundwater. Approximately 85 percent of the state's residents rely on groundwater as their drinking water source, and groundwater is the primary source for agricultural irrigation water. In the Bazile Groundwater Management Area (BGMA), groundwater is the source of all public drinking water and the primary source of agricultural irrigation water (Figure 1). Rural residents primarily depend on shallow wells for their domestic water supply.

Because of predominantly sandy soils in the BGMA (Figure 2), precipitation and irrigation water can infiltrate quickly and deeply. Approximately 50 percent of the BGMA has a depth to groundwater less than 100 feet. The majority of the remaining area has a depth to groundwater less than 200 feet (Figure 3). Further, due to the connection between shallow groundwater and surface water, the water quality of each is interconnected. All streams in the BGMA are gaining streams, that is, all streams gain water from groundwater discharge. Therefore, shallow groundwater contamination is quickly transferred to surface water.

Fertilizers containing nitrogen are applied to the row crops in the BGMA as well as to lawns, parklands and golf courses to improve plant growth. Nitrogen in the form of nitrate is highly mobile in water. In sandy soils, nitrate is quickly leached below the root zone and eventually to groundwater when more nitrogen is applied than plants can absorb or when it is leached below the root zone by precipitation or irrigation water before plants can absorb it. Sandy soils, shallow depth to groundwater and extensive application of nitrogen fertilizer and irrigation water make the BGMA aquifer particularly vulnerable to nitrate contamination.

In 1990 the Conservation and Survey Division (CSD) of the University of Nebraska published results from a nitrate study completed in the BGMA. The conclusions of the report indicated the aquifers appeared to be contaminated to varying degrees and the cause was likely related to fertilizer application and irrigation practices. The report also concluded that the data was insufficient at that time to implement a specific groundwater management strategy. A study completed in 2000 for the Lewis and Clark NRD by the CSD also concluded the aquifer's nitrate contamination is related to fertilizer application and irrigation practices. Monitoring by the NRDs and communities in the BGMA show that nitrates concentrations are high in groundwater (Figure 5; see following paragraph for more information).

High nitrate levels in drinking water have negative effects on human health. High nitrates can cause methemoglobinemia, or blue baby syndrome, in infants less than six months of age. Pregnant women and adults with stomach and digestive enzyme problems are also susceptible to methemoglobinemia. As a result of these negative effects on human health U.S. Environmental Protection Agency (EPA) adopted a nitrate drinking water standard of 10 milligrams per liter (mg/L). Average nitrate concentrations in individual wells in the BGMA range from 8.24 mg/L to 18.25 mg/L, thus posing a risk to human health (data is available in

the Quality-Assessed Agrichemical Contaminant Database for Nebraska Ground Water, <http://dnrdata.dnr.ne.gov/clearinghouse/> ).

Groundwater management plans have been implemented by each of the four NRDs in the BGMA. Each plan was developed, subjected to public review and comment, adopted by the NRD Boards, and approved by the NDEQ in accordance with the NGM&PA. While each NRD plan addresses groundwater quantity and quality concerns in somewhat different ways. Nitrate concentrations have not declined as hoped. Thus the four NRDs are developing a coordinated management plan for the BGMA, which encompasses parts of the four NRDs, that will provide cohesive guidance for managing groundwater and addressing nitrate pollution. Management plan development is proceeding through a community based planning process that allows stakeholders an opportunity to identify concerns and work collaboratively with technical advisors to make decisions that will protect and restore groundwater quality. The management plan, which is near completion, will be finished and initial implementation begun by the four NRDs in 2014.

The water quality concerns in the BGMA are the result of nonpoint source pollution and the geology of the area. Permeable soils, shallow depth to groundwater in much of the BGMA, and widespread use of fertilizers and certain irrigation practices have contributed to nitrate pollution of groundwater, which is the source of public drinking water in the area. Nitrate pollution poses a human health risk to sensitive populations within the BGMA. Also, nitrate pollution is transferred from groundwater to the streams of the BGMA because they gain part of their flow from contiguous aquifers.

The relationship between groundwater and surface water as well as the relationship of agricultural, industrial, lawn maintenance, and other activities and water quality are not always understood by residents of the BGMA. Education and understanding of these relationships are essential for protecting and improving water quality in the BGMA as insufficient management of applied nutrients and irrigation water can result in negative impacts on water quality. The first step in addressing nitrate pollution is public education, which includes explaining the problem, answering questions, and providing possible solutions that the public can implement. This project begins a local effort to overcome these deficiencies and persuade citizens to adopt practices that will improve groundwater quality in the BGMA.

## **Project Description**

The three components of this project are: 1) outreach to agricultural producers, homeowners, business and community leaders, and youth; 2) demonstration of effective nutrient and irrigation water management practices; and 3) implementation of nutrient and irrigation BMPs in the management area. In order to successfully implement the BGMA Plan, the four NRDs will hire a Project Coordinator. The Project Coordinator will provide leadership in completing the BGMA Plan early in 2014. In addition, the Project Coordinator will provide outreach to inform the public about project activities and opportunities; organize meetings, workshops and demonstrations; and recruit participants in programs to install/implement BMPs. The Project Coordinator also will be responsible for tracking BMP installations, recording project activities and accomplishments, facilitating communication among partners and preparing project reports. Outreach for the project will include communication through local media; informational meetings for the general public; targeted educational meetings for local officials,

business leaders and service providers; leadership training for community leaders; demonstrations of BMPs; and youth education through local schools, clubs and organizations. The Project Coordinator will be responsible for developing or facilitating development of outreach materials and for delivering or facilitating delivery of educational programming.

Demonstration sites will be set up with willing property owners to demonstrate practices that are effective in reducing leaching of pollutants into groundwater and run-off into streams. Agricultural demonstrations will focus on nutrient and irrigation management practices. Urban demonstrations will focus on nutrient, pesticide and water management in landscapes and on management of contaminant sources from businesses and industry. The Project Coordinator will be responsible for facilitating development of demonstration sites and delivery of educational programming through field days and tours.

Funding will be available through various programs to cost-share implementation of BMPs. The primary focus of this effort will be implementing BMPs to improve nutrient and irrigation management on agricultural lands. The Project Coordinator will be responsible for recruiting producers to participate in the conservation programs, assisting producers in enrolling in cost-share programs and delivering or facilitating delivery of technical assistance to install and manage BMPs.

## **Project Goals**

Groundwater is the source of the domestic water supply for both rural and urban residents of the BGMA. This project will initiate a multi-year effort to reduce the concentration of nitrates in the underlying aquifer. The following goals, objectives and tasks will guide this project:

**Goal 1:** The NRDs will implement a uniform strategy to reduce nitrate contamination of groundwater in the BGMA.

**Objective 1:** Uniform rules and regulations will be applied for the management of nitrogen fertilizer and irrigation water on agricultural lands in the BGMA.

Task 1: NRDs will negotiate common rules and regulations regarding the application, monitoring and reporting of fertilizer and irrigation water use on agricultural lands within the BGMA.

Task 2: NRDs separately will adopt common rules and regulations for fertilizer and irrigation water management in their areas of the BGMA.

**Objective 2:** A common strategy will be employed to implement BMPs to reduce nitrate contamination of groundwater in the BGMA.

Task 1: NRDs will develop and adopt a common management plan for the BGMA.

Task 2: NRDs will recommend and promote practices to reduce fertilizer and irrigation water use on nonagricultural lands in the BGMA.

Task 3: NRDs will hire a coordinator to facilitate implementation of the BGMS management plan.

**Goal 2:** Rural and urban landowners and managers will understand the relationship between groundwater contamination and the use of fertilizers and irrigation water.

**Objective 1:** Educational materials and hands-on learning opportunities will be available to landowners, producers, land managers and community leaders in the BGMA.

- Task 1: Develop reference materials in the form of publications, fact sheets, and brochures to be distributed quarterly to target audiences.
- Task 2: Develop on-line resources in the form of a web site and social media for citizens to obtain and share information about the project activities and BMPs.
- Task 3: Conduct annual educational meetings and workshops for key leaders and audiences to learn about management of nonpoint source pollution.
- Task 4: Conduct tours and hands-on activities at five urban and six agricultural BMP demonstration sites.
- Task 5: Conduct one-on-one interviews with landowners/operators and community leaders to provide project information, solicit participation in programs and encourage support of the project.
- Task 6: Evaluate the impact of outreach efforts through pre/post activity surveys, interviews or evaluation of installed practices.

**Objective 2:** Educational materials and learning opportunities will be available to agricultural consultants and materials suppliers, public lands managers, business and industry leaders and educators in the BGMA.

- Task 1: Develop reference materials in the form of publications, fact sheets, and brochures to be distributed quarterly to target audiences.
- Task 2: Conduct annual educational meetings and workshops for key leaders and audiences to learn about management of nonpoint source pollution.
- Task 3: Develop talking point sheets to guide discussion of local groundwater contamination issues, practices to address the issues and project activities.
- Task 4: Conduct one-on-one interviews with professional service providers and community leaders to solicit support for the project.

**Objective 3:** Information will be provided to the community about local groundwater quality.

- Task 1: Develop fact sheets, talking point sheets and articles about local water quality issue and project activities for local media to be distributed quarterly and as needed for specific events.
- Task 2: Develop a packet of background information regarding local water quality issues and project activities for community leaders.
- Task 3: Develop materials and activities to be presented at youth oriented events.

**Goal 3:** Rural and urban landowners and managers in the BGMA will employ practices to reduce run-off and limit leaching of nitrate to groundwater.

**Objective 1:** Funding and technical assistance will be available to help producers and property owners install and manage nutrient, irrigation and run-off BMPs.

Task 1: Identify and partner with five urban property owners (public or private) to install landscape BMPs for demonstrations.

Task 2: Identify and partner with six crop producers to install nutrient and irrigation BMPs on 160 acres each for demonstrations.

Task 3: Solicit twenty crop producers to install agricultural BMPs on a total of 6,400 acres of crop land.

### **Pollutant Source**

Agricultural fertilizers are the primary source of nitrate pollution of groundwater in the BGMA. The form, quantity and timing of application affect the potential for nitrates to leach into groundwater. The quantity and timing of application of irrigation water also influence the potential of leaching nitrates below the crop root zone and into groundwater.

### **Load Reduction**

The primary focus of this project is education about and installation of BMPs to protect groundwater for which pollutant load reductions cannot be calculated. Success in reducing pollutant delivery to ground water will be measured indirectly by estimating reduction in nitrate leaching from installed BMPs: reduced application of nutrients and irrigation water will have the greatest impact. Reportable load reductions are not expected from this project. However, some BMPs may have incidental effects in reducing run-off to local streams. Where possible, pollutants and load reductions will be determined for these situations.

### **Management Practices**

This primarily is an information and education project that focuses on motivating local community leaders, agricultural producers and landscape managers to learn about and adopt best management practices that reduce nitrate contamination of ground water. Media promotion, informational meetings, educational workshops and demonstration site tours will be employed to reach the target audiences.

Six sites will be developed to demonstrate effective agricultural practices to manage the application of nitrogen fertilizer and irrigation water and reduce nitrate pollution in groundwater. Nutrient management practices will include, but not be limited to: alternative nutrient sources, application timing, nutrient placement, reduced application rate and nutrient sequestration. Irrigation management practices will include, but not be limited to: improved delivery systems, application timing, reduced application rate and conservation of soil moisture. Field days and tours will be held to demonstrate these methods to area producers.

Five sites will be developed to demonstrate effective landscape practices to manage run-off and percolation of NPS pollutants in the urban environment. Demonstration sites will be placed on a mix of public property (e.g., library, school, park, golf course) and private property

(e.g., residence, business campus). Urban practices will include, but not be limited to, rain gardens, bio-swales, no phosphorus fertilizer, irrigation timing, low in-put vegetation and permeable surfaces. Field days and tours will be held to illustrate installation and effectiveness.

Cost share will be offered through various programs to assist producers in installing or implementing practices illustrated in the ag BMP demonstration sites. Practices will include, but not be limited to, soil and water testing, field mapping, alternative nutrient sources, nutrient placement, plant tissue analysis, soil moisture sensors, evaporation monitors, irrigation equipment improvements, chemigation, conservation tillage, cover crops and crop rotation. Installations will be tracked and compared to prior practices to estimate potential reduction in nitrate leaching below the root zone. Cost share will be offered through various programs to assist urban property owners in installing the urban practices illustrated in the urban BMP demonstration sites.

### **Information and Education**

This project is primarily an information and education (I&E) project to engage local property owners and land managers, political and business leaders, professional service providers, and private citizens in a common effort to improve water quality in BGMA. Outreach activities will be developed to reach each interest group with materials and assistance appropriate to their needs. A project coordinator will serve as the main contact to facilitate communication among project partners target audiences. The project coordinator also will provide leadership in facilitating the development and delivery of materials and activities to educate target audiences about groundwater pollution and project activities.

The outreach effort will use both traditional local media and social media to distribute and exchange information. The media campaign will focus on short, simple packages of information distributed frequently and repetitively to constantly engage the public.

To maximize the reach and impact of the educational campaign, providers of agricultural supplies and services will be recruited early in the project to assist in recruiting participation of agricultural producers in educational programming and implementation of BMPs. Accomplishments of producers in adopting BMPs will be recognized in outreach to the broader community.

Opportunities to learn about local water quality issues and actions to address them will be offered through print materials, service announcements, workshops, tours and demonstrations. Frequent releases to local media will be made to promote participation in project activities.

Personal contact with individuals will be used to recruit participation in some events and to solicit participation in conservation programs to install and maintain BMPs. Follow up visits will be used to assess participant knowledge about and acceptance of the BMPs.

Periodic reports will be sent to participating partners to keep them abreast of project progress. These reports will identify the type and quantity of BMPs implemented, number of participants and assessment of attitudes landowners and Ag producers express about local water quality issues and project activities.

## Schedule

The following table identifies the quarters in which project activities will be focused. Some activities will continue periodically throughout the project.

Task	2014				2015				2016	
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr
Complete Project Agreements										
Hire Project Coordinator										
Complete BGMA Management Plan										
Recruit Demo Site Participants										
Install Ag BMP Demonstration Sites										
Install Urban BMP Demonstration Sites										
Tour Ag Demonstration Sites										
Tour Urban BMP Demonstration Sites										
Recruit BMP Cost Share Participants										
Complete BMP Program Contracts										
Install Ag BMPs										
Producer BMP Meetings										
Community Leaders Workshops										
Create Project Website										
Public Meeting										
Media Outreach										
Youth Outreach										
Semi-annual Report										
Final Report										

## Milestones:

The following table contains the key project completion dates.

Task	Completion Date
Hire Project Coordinator	03/2014
Initiate Outreach Activities	4/2014
Complete BGMA Management Plan	6/2014
Identify Locations and Complete Plans for Demonstration Sites	9/2014
Complete 10 2014 Contracts for Installation of Ag BMPs	9/2014
Complete Installation of 6 Ag BMP Demonstration Sites	3/2015
Complete Installation of 5 Urban BMP Demonstration Sites	6/2015
Conduct BMP Demonstrations	4-9/2015
Complete 10 2015 Contracts for Installation of Ag BMPs	9/2015
<b>Final Report</b>	<b>06/2016</b>



## **Monitoring**

Vadose zone sampling and plant tissue analysis will be performed by NRD personnel using their authority and quality assurance plans. Vadose zone sampling will establish pre-project concentrations of nitrates in the soil. Over time, future sampling should detect a decline in nitrate concentration in the deeper soil profile. Plant tissue analysis along with standard soil sampling is useful in quantifying the removal of nitrogen from the soil into plant tissue. That information is then useful in improving the accuracy of determining fertility needs for the subsequent crop.

Application of irrigation water to demonstration plots will be measured with commercially available flow meters installed in the irrigation system or by portable flow meters attached to delivery pipes. Plots will be designed to show the impact of various application rates and intervals on crop production.

The NRDs will continue collecting nutrient concentration and groundwater level data through their groundwater monitoring networks. No improvement in groundwater quality is expected to be observed within the time frame of this project.

## **Evaluation Criteria**

Representatives of the four NRDs and NDEQ and the Project Coordinator will develop a detailed annual plan of work for the upcoming year. This plan will be reviewed annually to evaluate achievements, problems, and developments in the past year and to refine the roles, responsibilities and activities of the NRD personnel and the Project Coordinator as needed in a plan of work for the next year. The Project Coordinator will submit quarterly reports to the NRDs to track short-term progress. Additionally, the amount of participation in cost-share programs will be reviewed to see if the I&E activities are effective in increasing producer interest in adopting nutrient and irrigation BMPs. The number of cost-share contracts and number of acres of BMPs installed in the BGMA will be tracked to measure potential impact of better management practice on improving groundwater quality over time.

## Project Budget

Activity	Section 319	NET Grant <sup>[1]</sup>	Participating NRDs <sup>[1]</sup>	Total
<b>Personnel</b>				
Salary	72,310	0	13,690	86,000
Benefits @ 26%	25,406	0	4,810	30,216
<b>Travel</b>				
Mileage	10,560	0	0	10,560
Conference/Training Expenses	1,500	0	0	1,500
<b>Operating Costs</b>				
Office Supplies	2,500	0	0	2,500
Office Space	0	0	6,500	6,500
<b>Information &amp; Education</b>				
Signage and Artwork	1,500	0	0	1,500
Advertising/Printing	2,000	0	0	2,000
Demonstration Sites	37,724	68,320	0	106,044
Honoraria	1,500	0	0	1,500
<b>Contractual</b>				
BMP Cost-share	0	18,000	0	18,000
Monitoring	0	20,230	0	20,230
<b>TOTAL</b>	<b>\$155,000</b>	<b>\$106,550</b>	<b>\$25,000</b>	<b>\$286,550</b>

<sup>[1]</sup> Non-federal match will consist of NET and NRD funds and in-kind services.

## Additional Resources

**NRCS Liaison:** NDEQ and the U.S. Department of Agriculture, National Resources Conservation Service (NRCS) fund a liaison position to facilitate communication and cooperation between the two agencies. The NRCS Liaison can assist in coordinating contact and planning activities with the local NRCS office.

**National Water Quality Initiative:** The Nebraska NRCS is proposing 3 HUC-12 areas in the BGMA be included in the National Water Quality Initiative starting in 2014. This will provide cost share funds to agricultural landowners and producers for nitrogen fertilizer and irrigation BMPs.

**UNL Extension Liaison:** NDEQ and the University of Nebraska Extension Service fund a liaison position to facilitate communication and cooperation between the two agencies. This individual can provide guidance and input on developing outreach activities and coordinating contact and planning activities with the local Extension office.

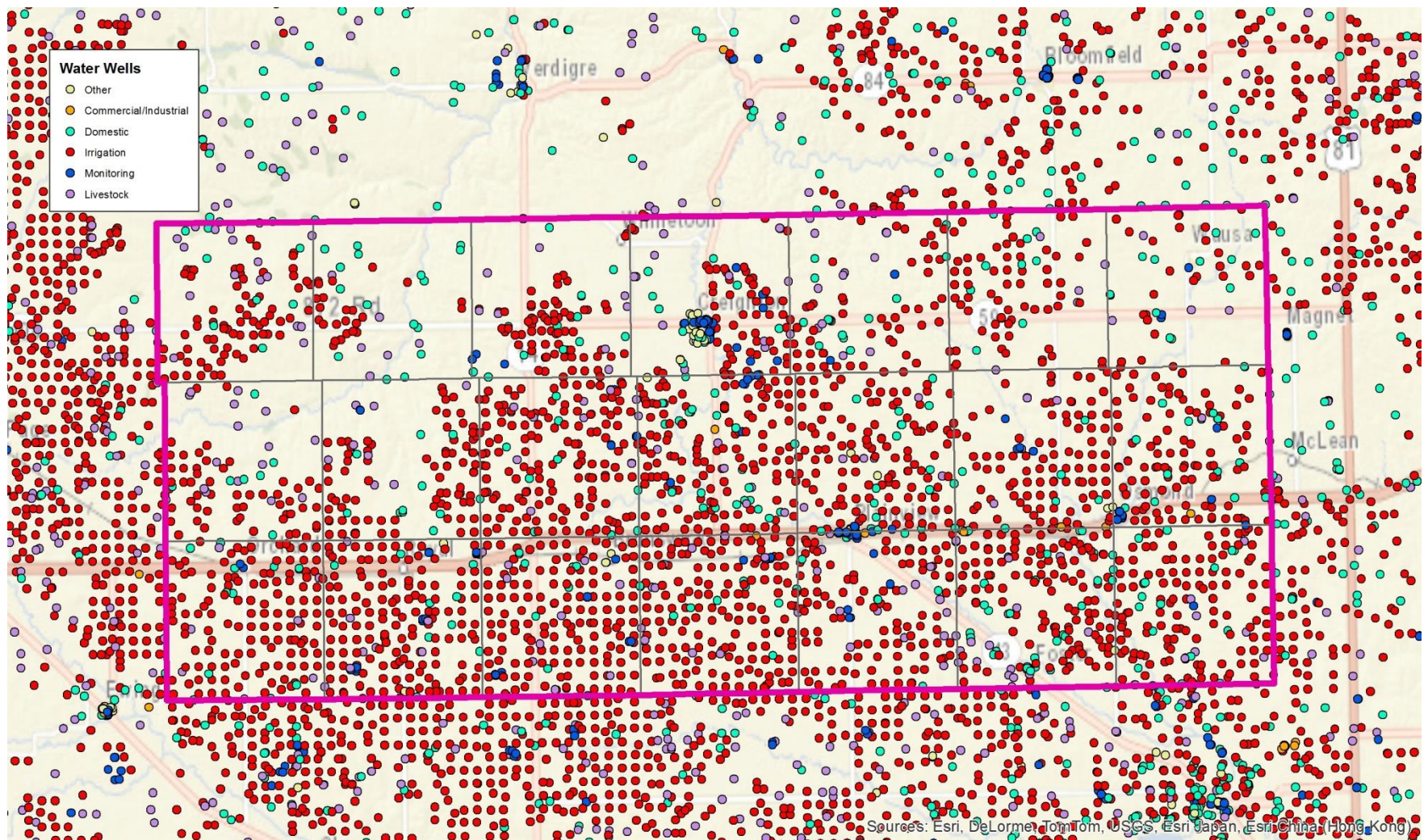


Figure 1. Wells in the Bazile Groundwater Management Area



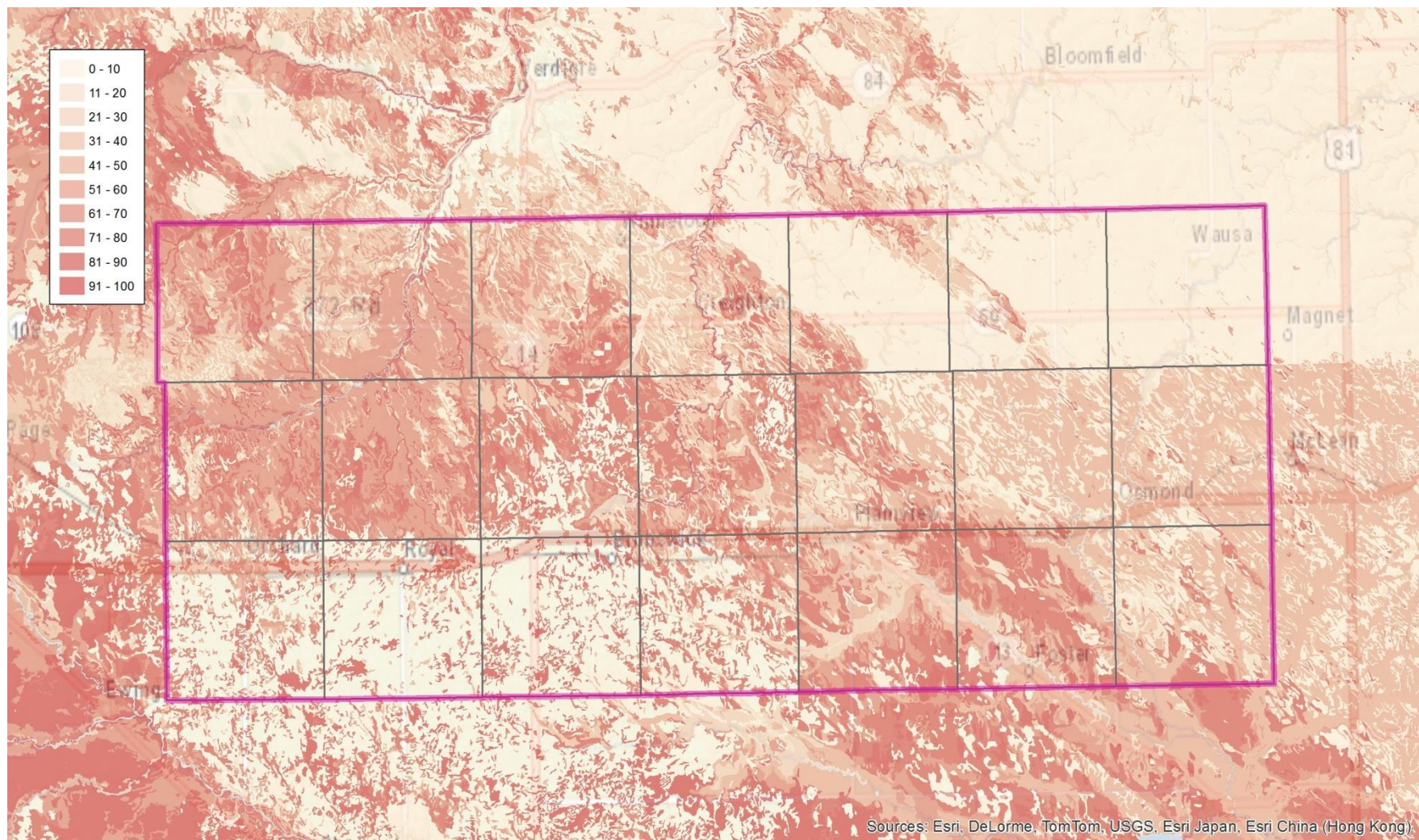


Figure 2. Percentage of Sand in the Top Soil Profile of the Bazile Groundwater Management Area

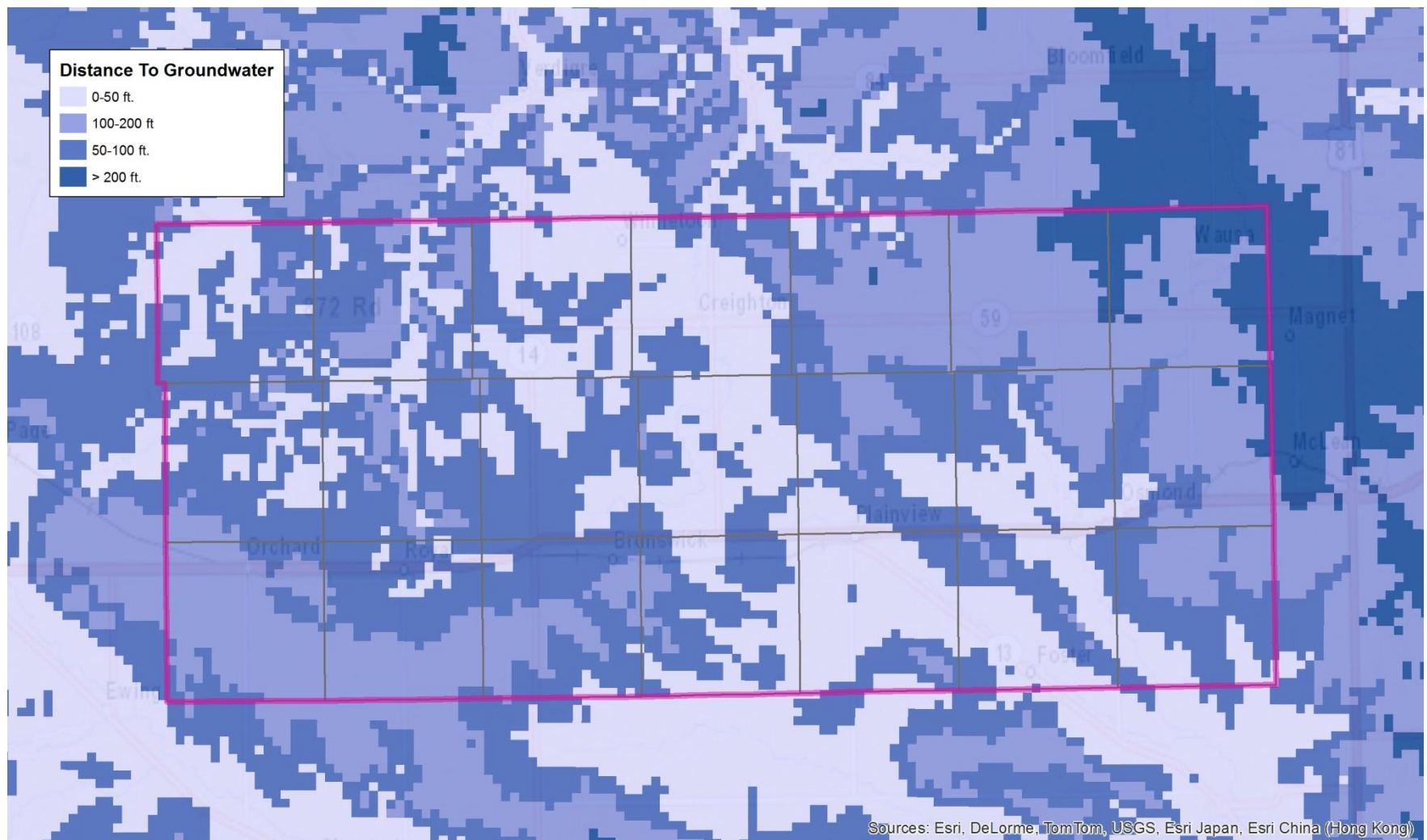


Figure 3. Depth to Groundwater in the Bazile Groundwater Management Area



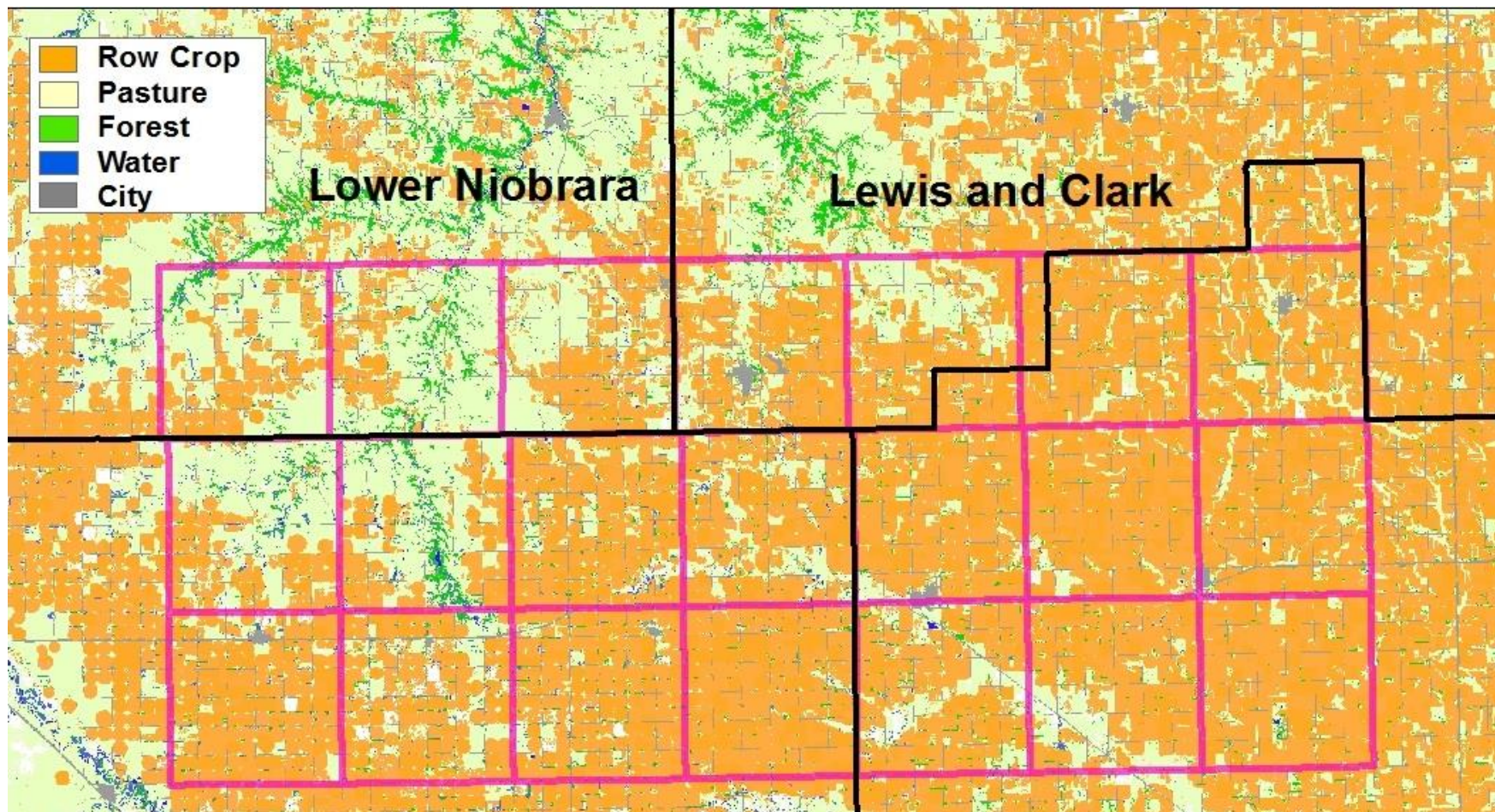


Figure 4. Land Use in the Bazile Groundwater Management Area.



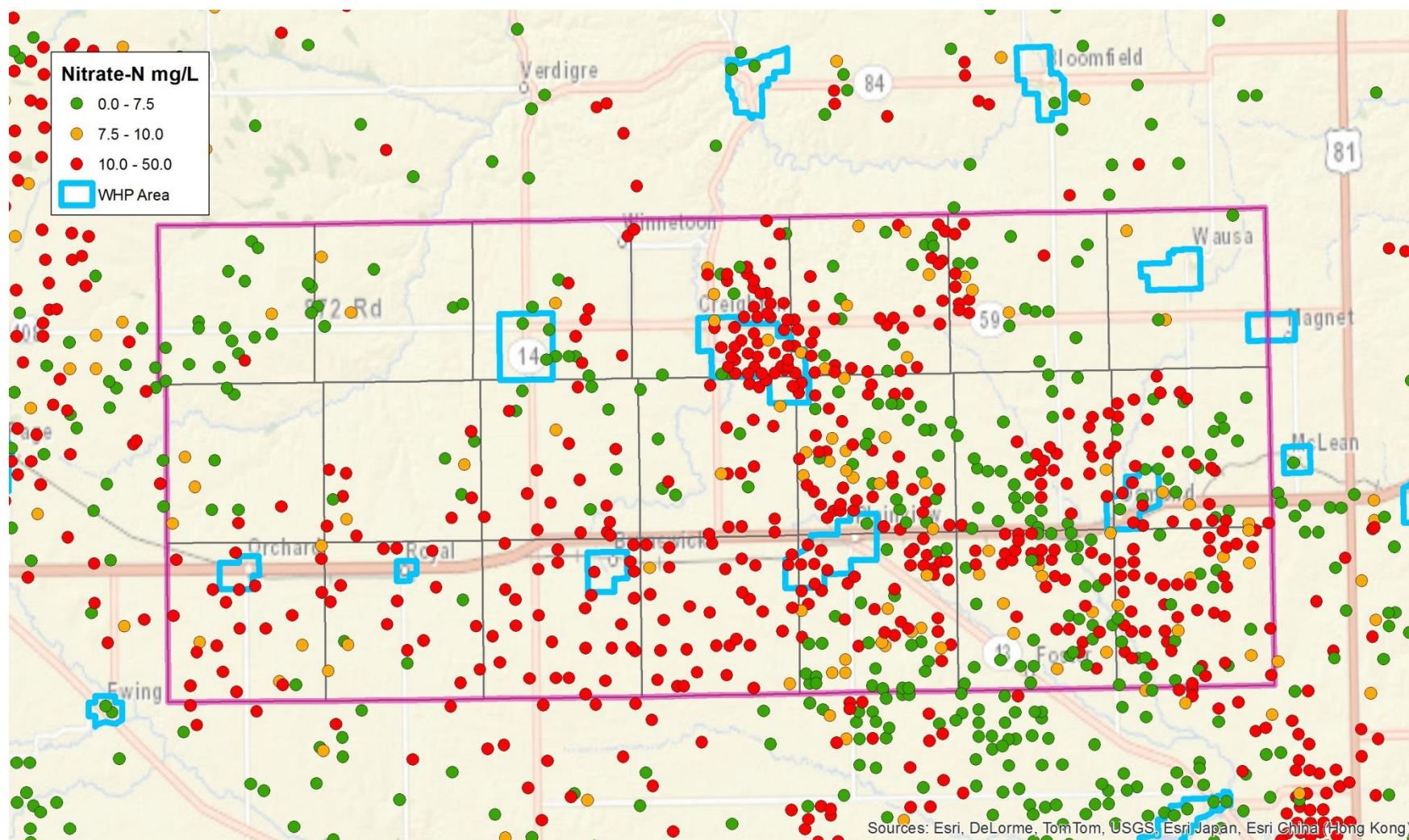


Figure 5. Nitrate Concentrations in Wells and Public Water Supply Wellhead Protection Areas (plans not yet adopted) in the Bazile Groundwater Management Area.

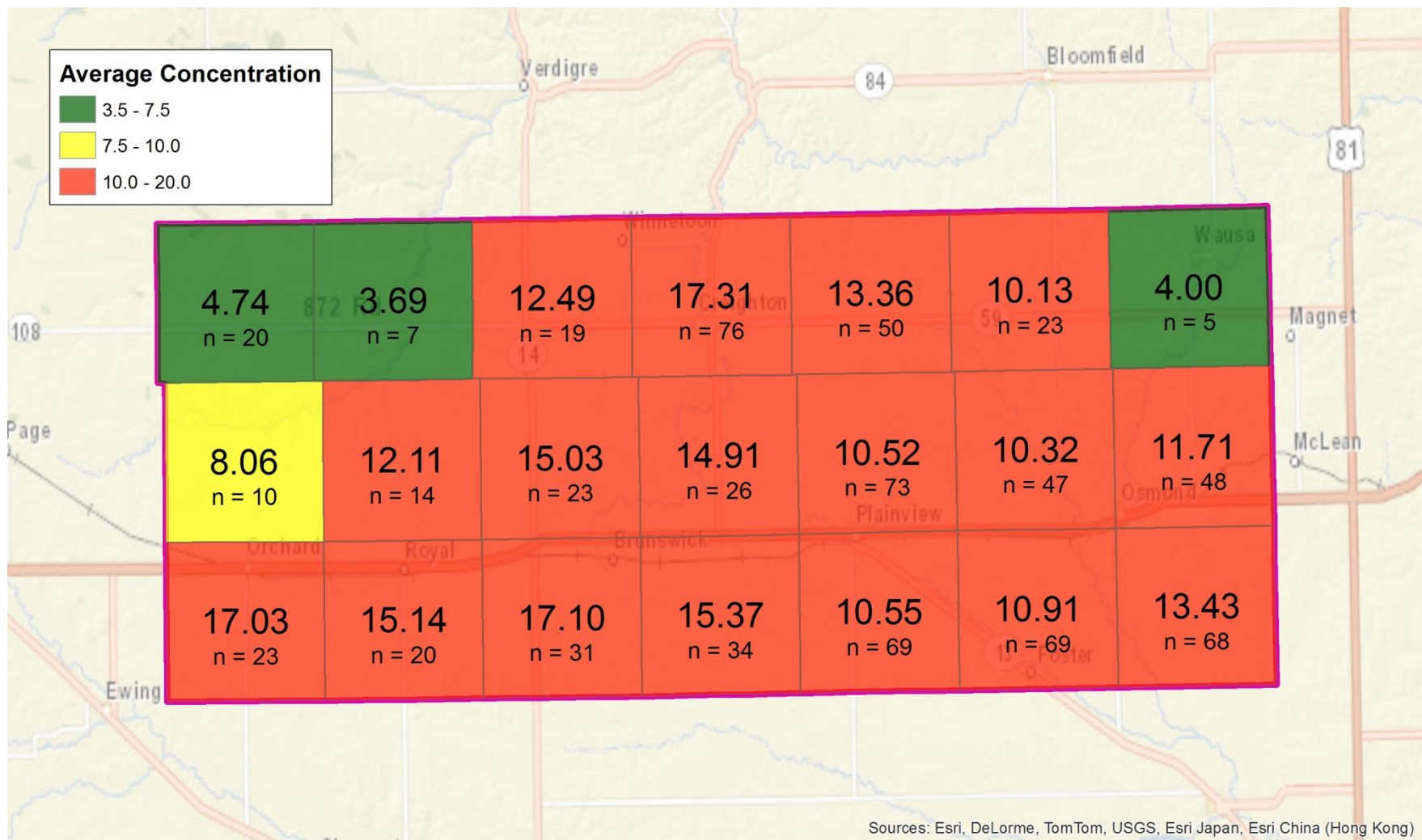


Figure 6. Average Nitrate Concentration in the Groundwater of Each Township in the Bazile Groundwater Management Area.