Groundwater Modeling Summary-2011
Water Resource Management

Mike Gannon and Rick Langel

Iowa Department of Natural Resources

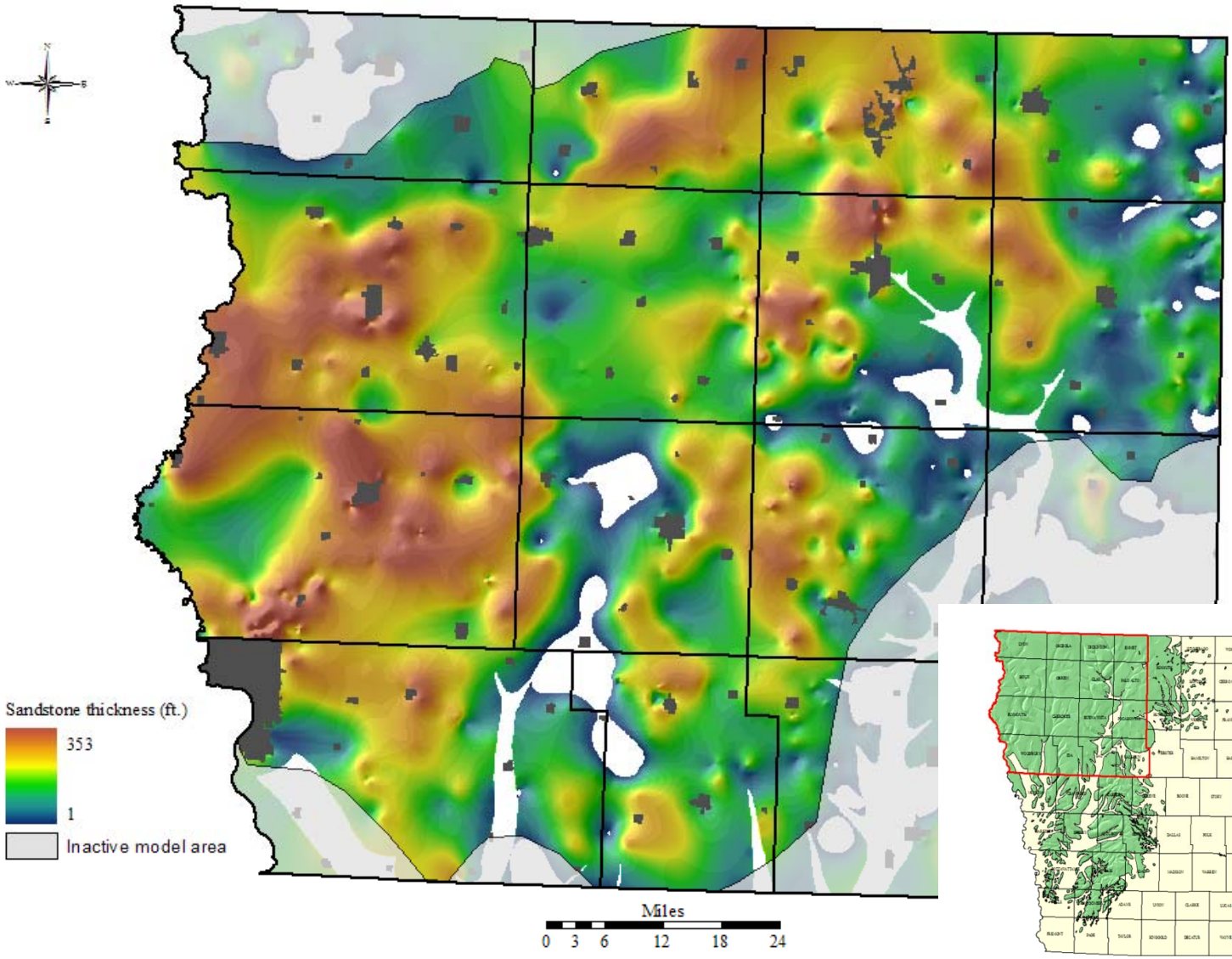
Acknowledgements -2011

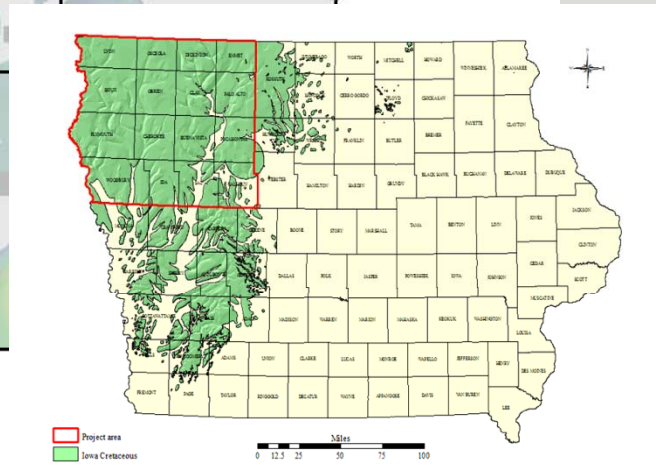
- Bob Libra, State Geologist
- Bill Bunker, Geologist
- Dennis Ostwinkle, FO6
- Joe Sanfilippo, FO1
- Lynette Seigley, Geologist
- Keith Schilling, Geologist
- Brian Witzke, Geologist
- Paul VanDorpe, Geologist

Groundwater Modeling Projects Completed for the Water Plan

- Lower Dakota aquifer in NW Iowa – 2008

Lower Dakota Aquifer Thickness

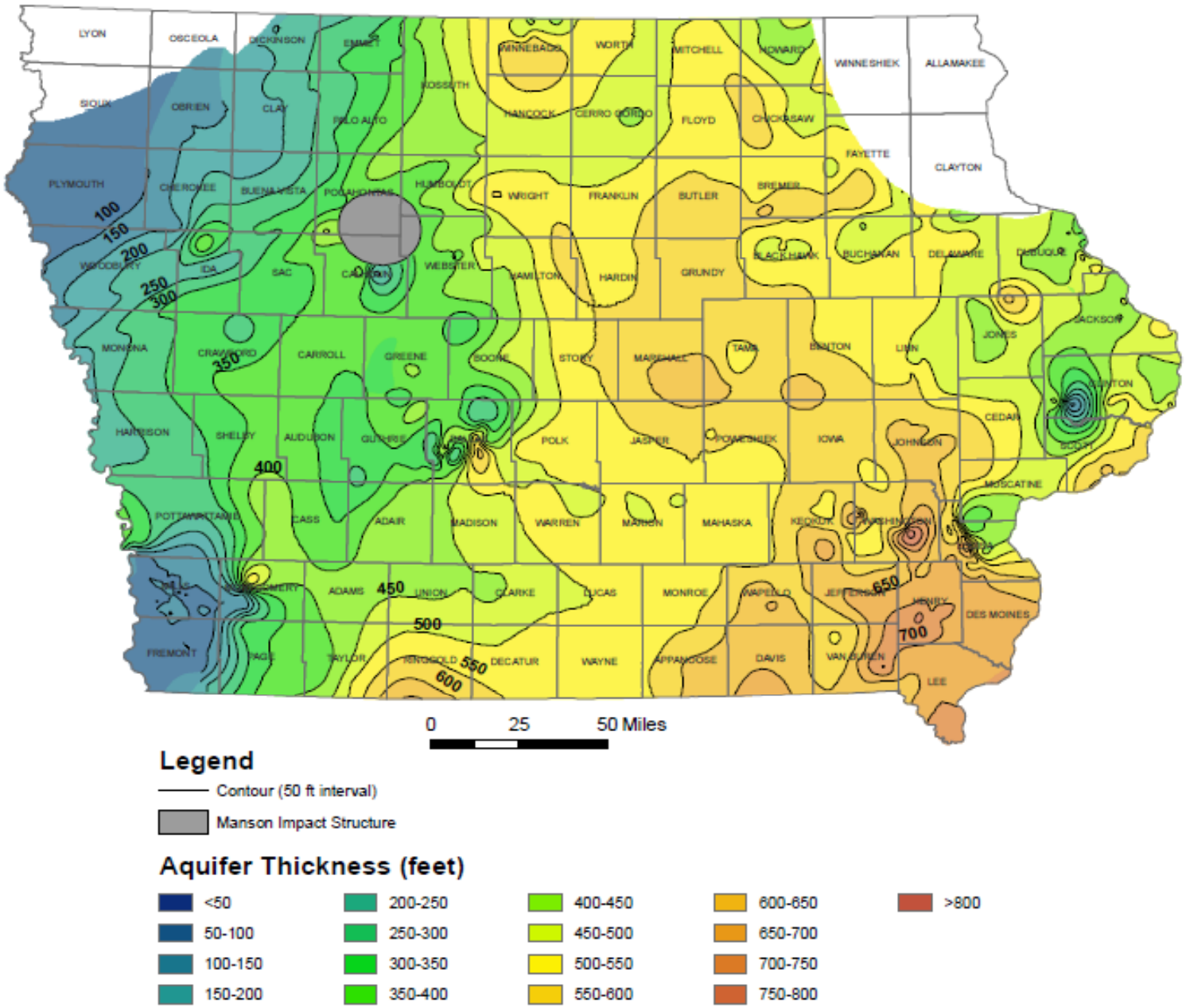




Groundwater Modeling Projects Completed for the Water Plan

- Cambrian-Ordovician (Jordan) aquifer Statewide – 2009

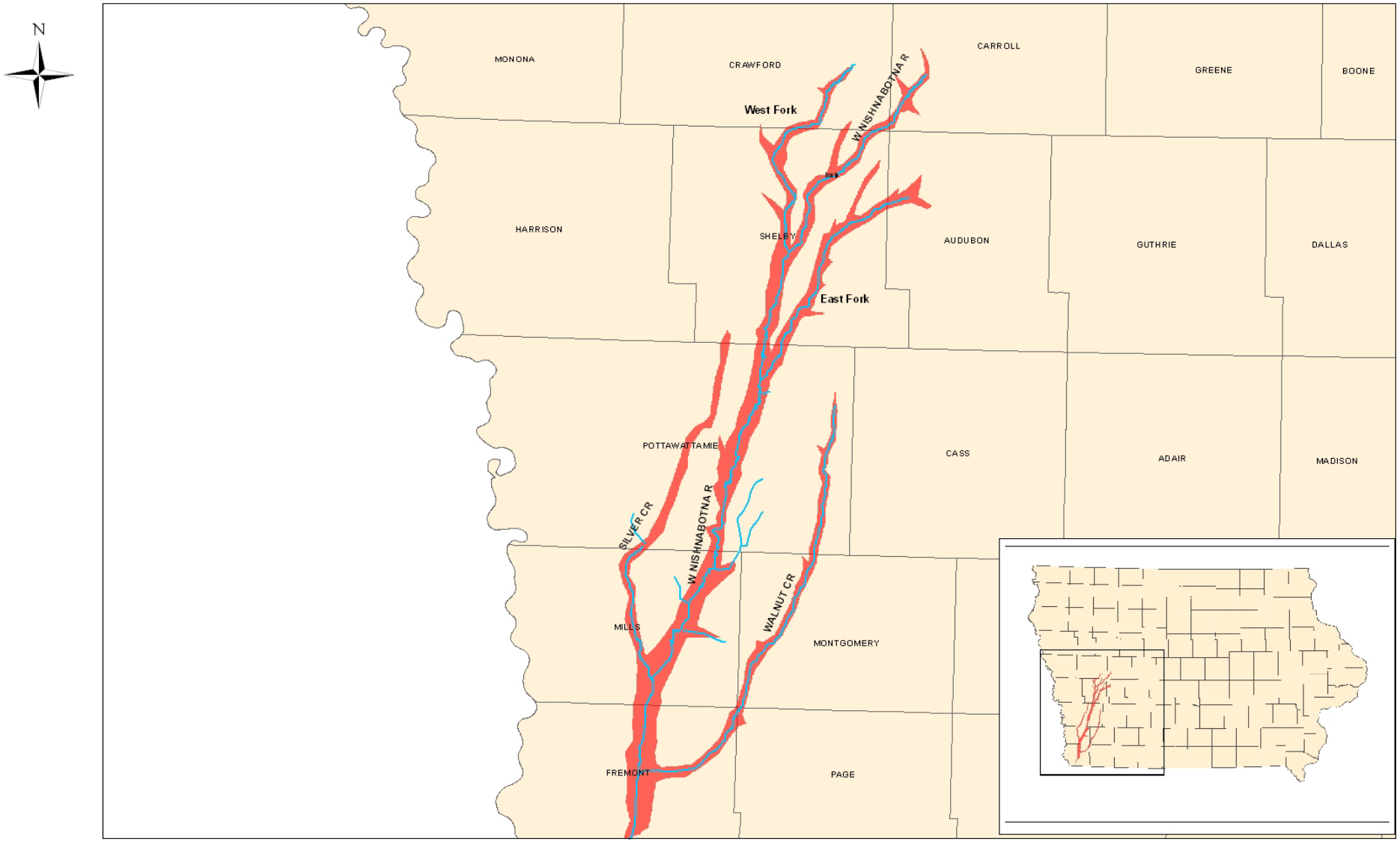
Cambrian-Ordovician (Jordan) Aquifer



Groundwater Modeling Projects Completed for the Water Plan

- West Nishnabotna alluvial aquifer – 2010

West Nishnabotna Aquifer Location



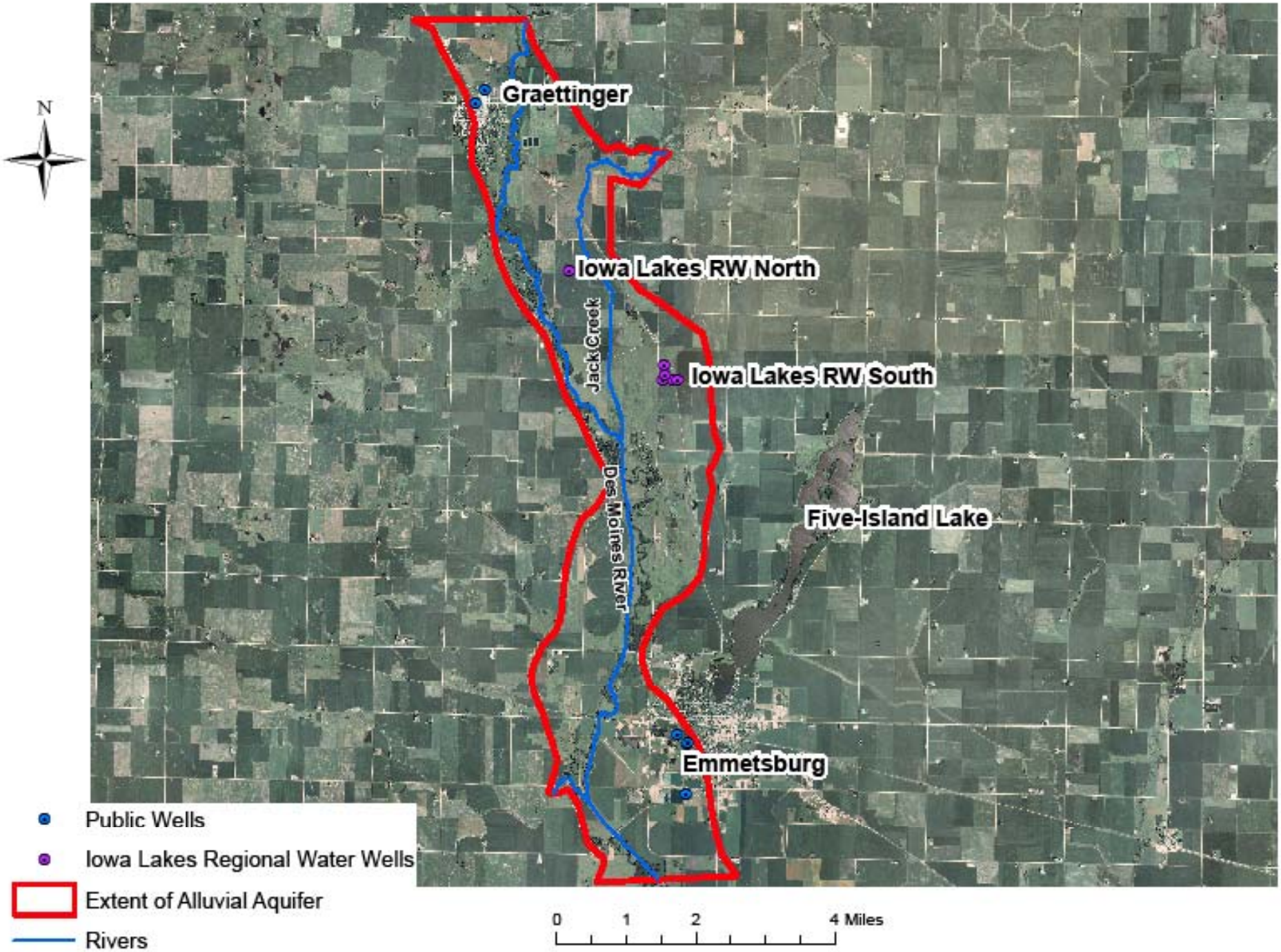
West Nishnabotna Aquifer

W. Nishnabotna River

0 3.75 7.5 15 Miles

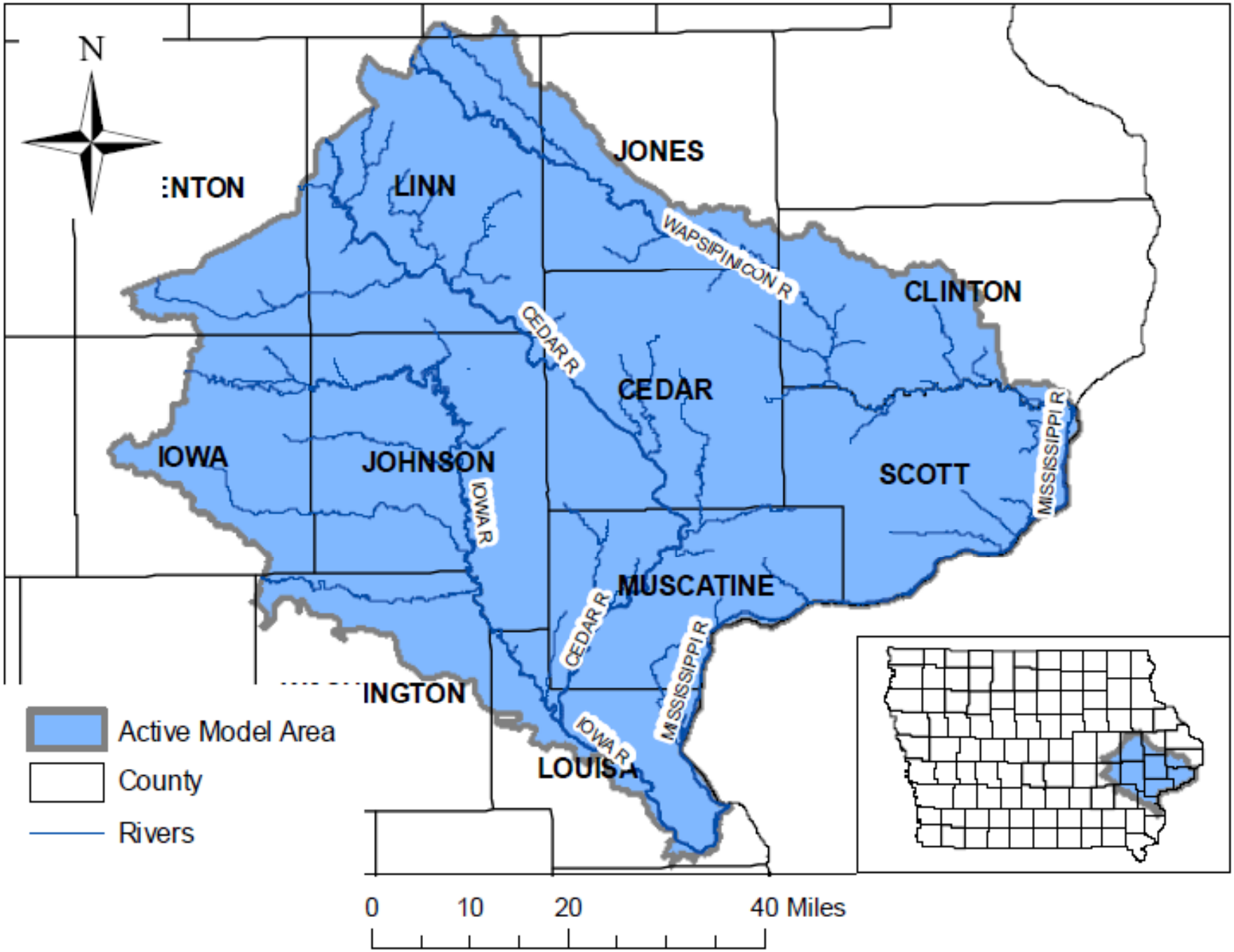
Groundwater Modeling Projects Completed for the Water Plan

- Des Moines River alluvial aquifer in Palo Alto County – Spring 2011


N
Graettinger
Iowa Lakes RW North
Jack Creek
Iowa Lakes RW South
Des Moines River
Five-Island Lake
Emmetsburg
Public Wells
Iowa Lakes Regional Water Wells
Extent of Alluvial Aquifer
Rivers
0
1
2
4 Miles

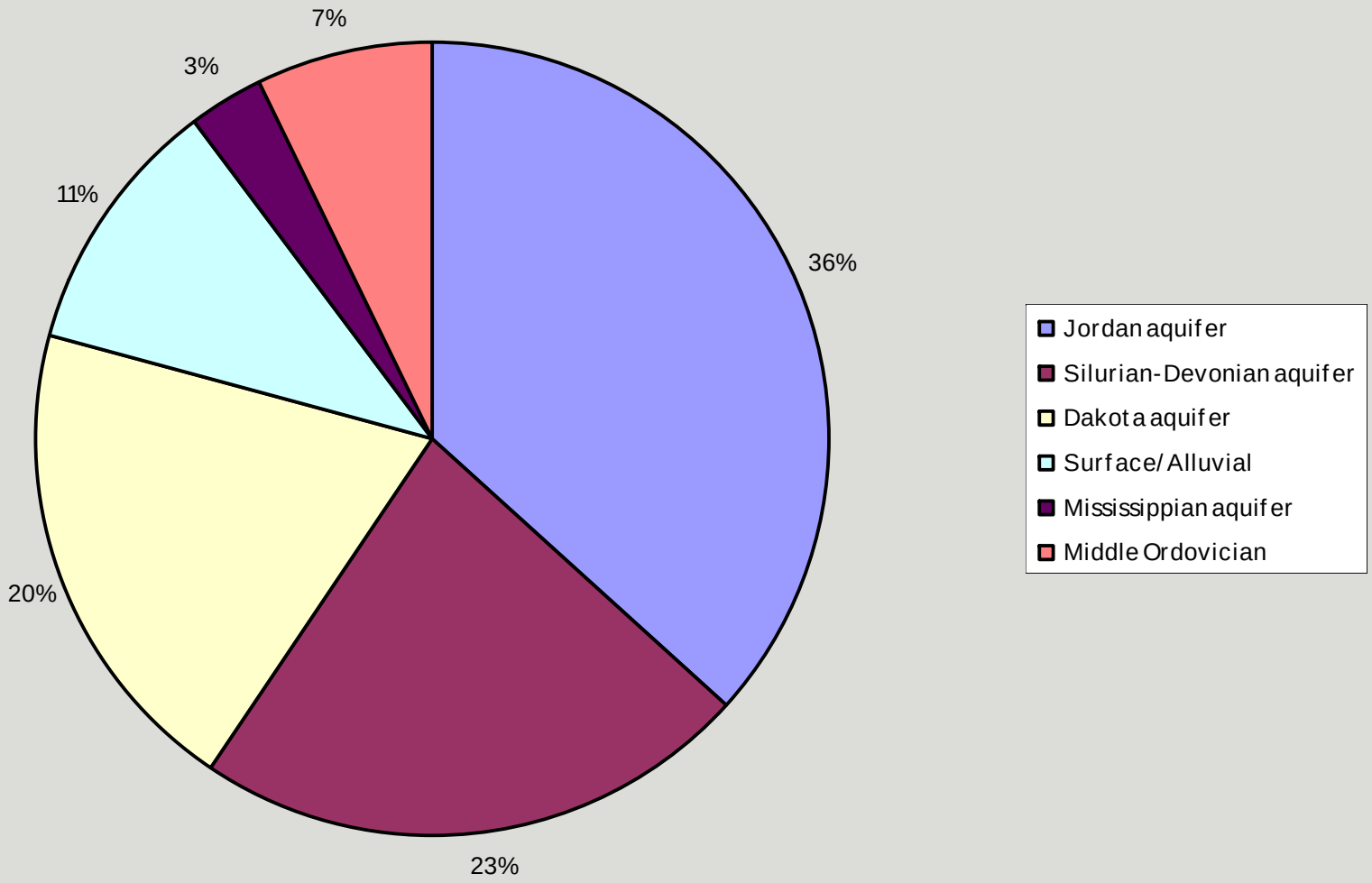
Groundwater Modeling Projects Completed for the Water Plan

- Silurian aquifer in East-Central Iowa – Spring 2011


N
:NTON
LINN
JONES
WAPSIPINICON R
CLINTON
CEDAR R
CEDAR
IOWA
JOHNSON
IOWA R
SCOTT
MISSISSIPPI R
MUSCATINE
CEDAR R
MISSISSIPPI R
INGTON
IOWA R
LOUISA
Active Model Area
County
Rivers
0
10
20
40 Miles

Ethanol Water Use in 2009 by Aquifer by Percentage

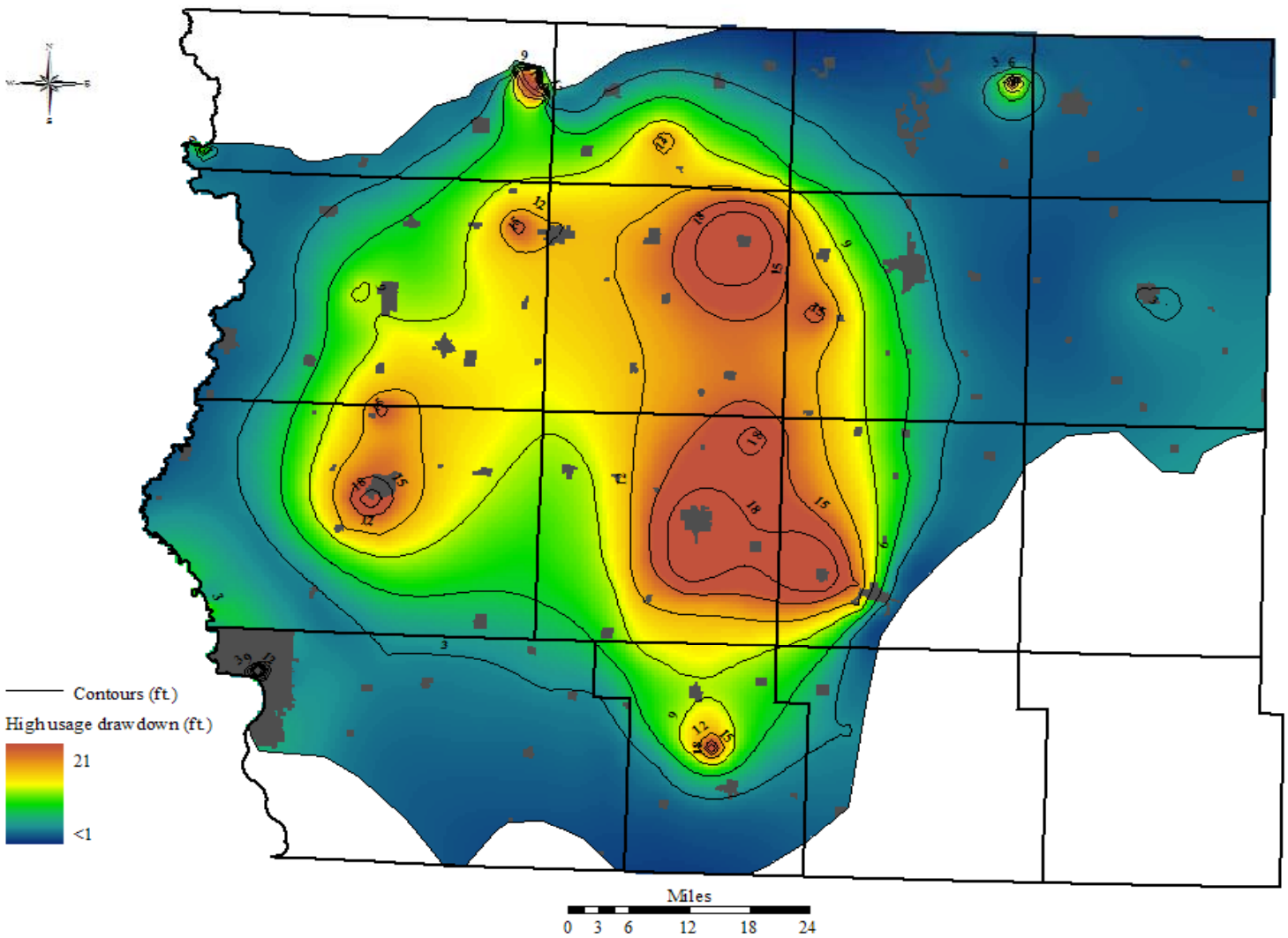
Aquifers Representing 79% of the water used for ethanol have been studied



Applications of Models

- Lower Dakota aquifer
  - Local modeling of Storm Lake area 2009
  - Local modeling of Cherokee area 2009
  - Local model for proposed Poet cellulose-based ethanol plant near Emmetsburg
  - Evaluation of the potentiometric surface of the Dakota on the Iowa Great Lakes

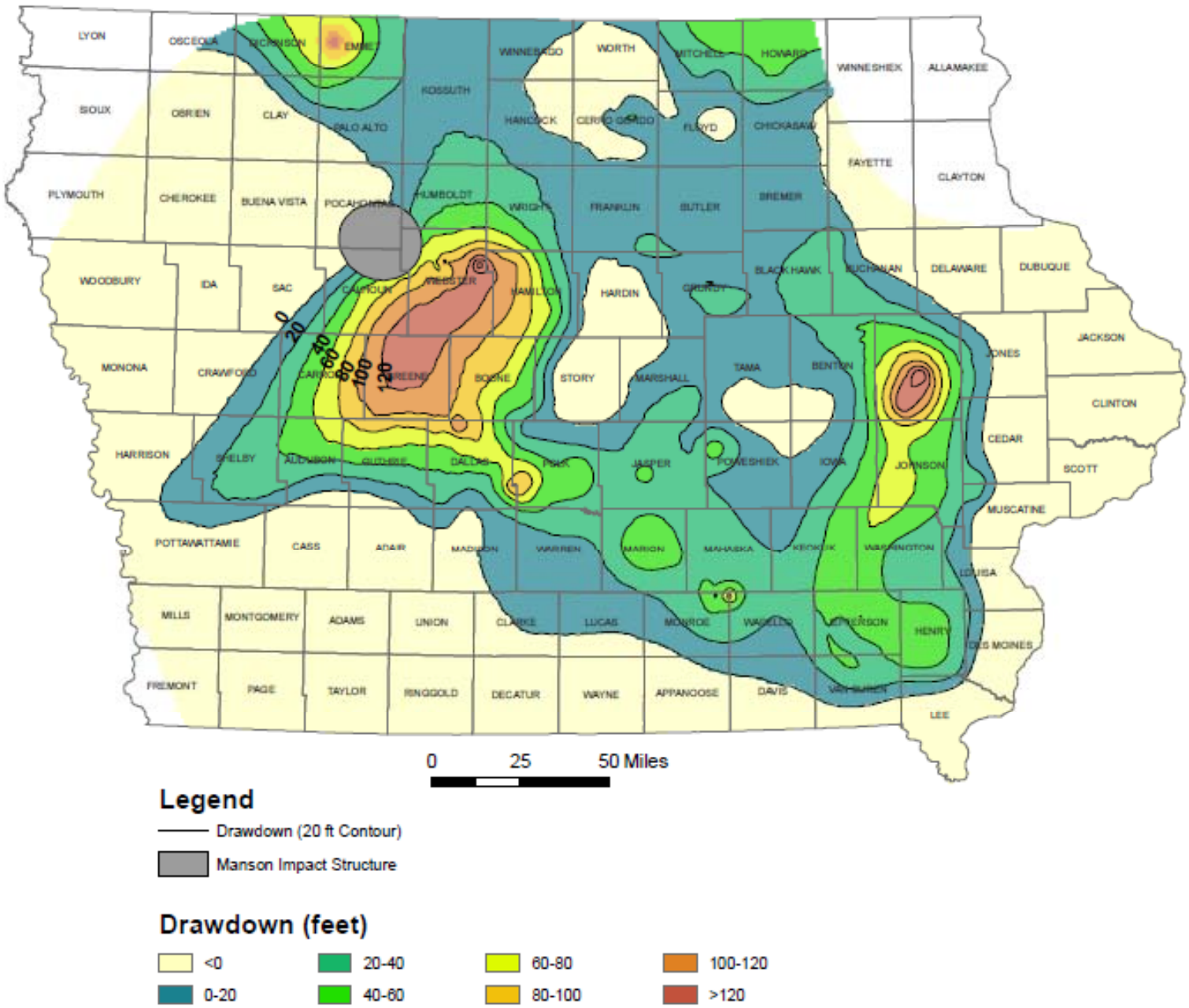
Additional Drawdown for High Future Water Use – 50% increase in water use



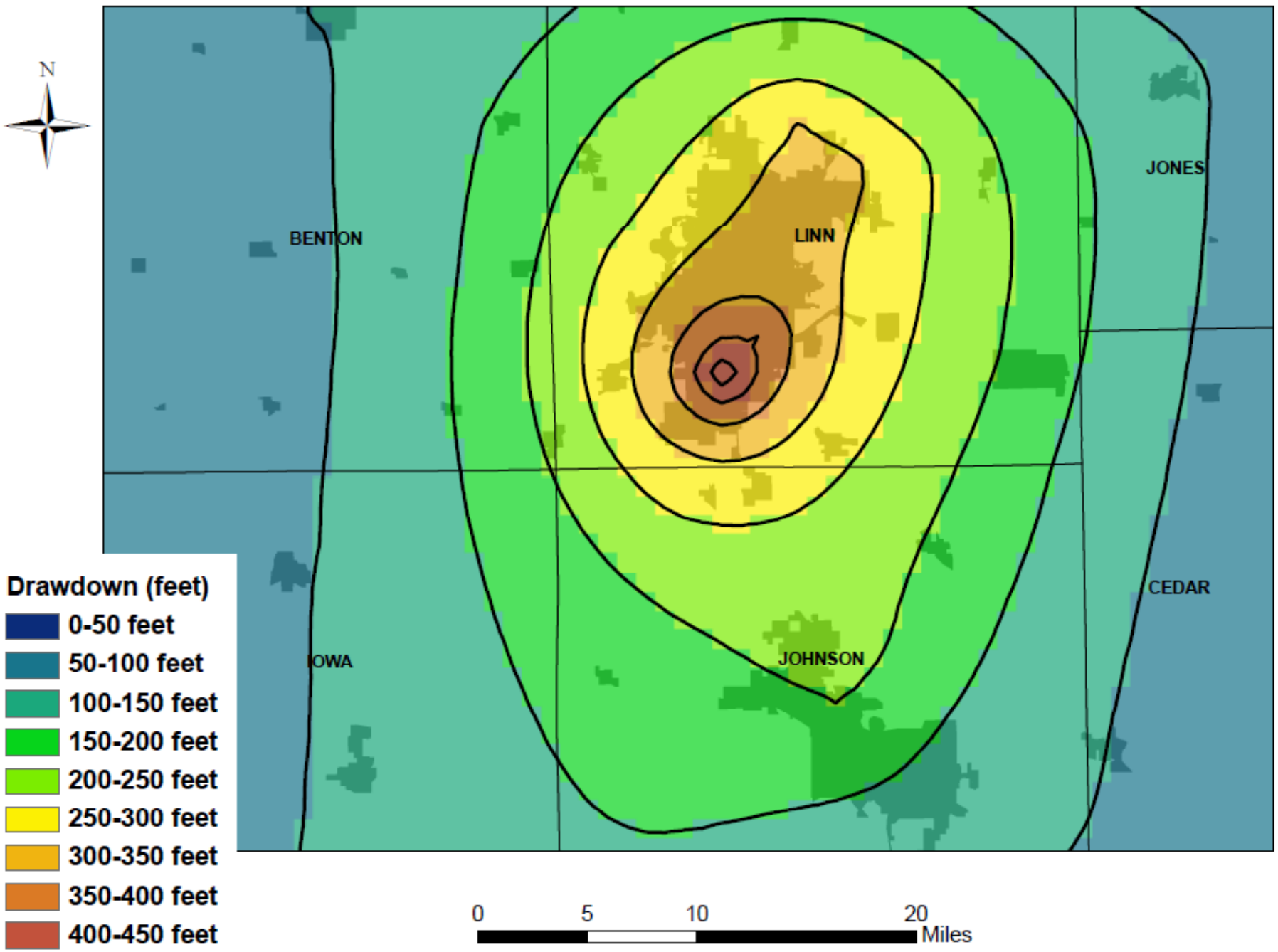
Applications of Models

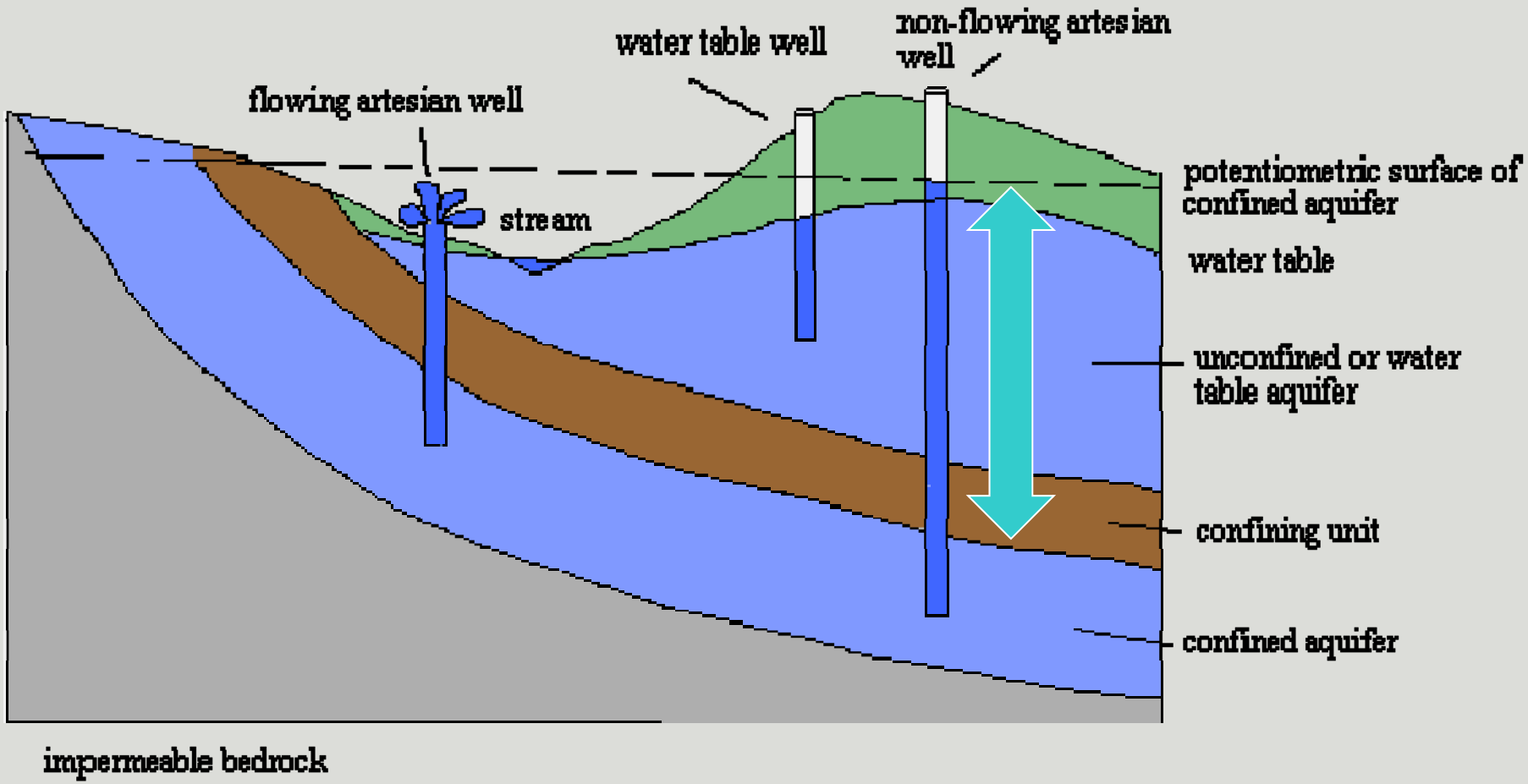
- C-O (Jordan) aquifer
  - Local modeling of the Marion area, Pella area, and Fort Dodge area to evaluate the regulatory limit.
  - New Ethanol Plant near Lawler, Iowa
  - Proposed Changes in Chapter 52 in IAC involving available head concept versus 200 ft. drawdown limit (from 1977).
  - Evaluate potential well interference in the Cedar Rapids/Marion area during summer drought - 2011 (Marion, ADM, Penford)

Drawdown Since Horrick's 1977 GW Elevation Map

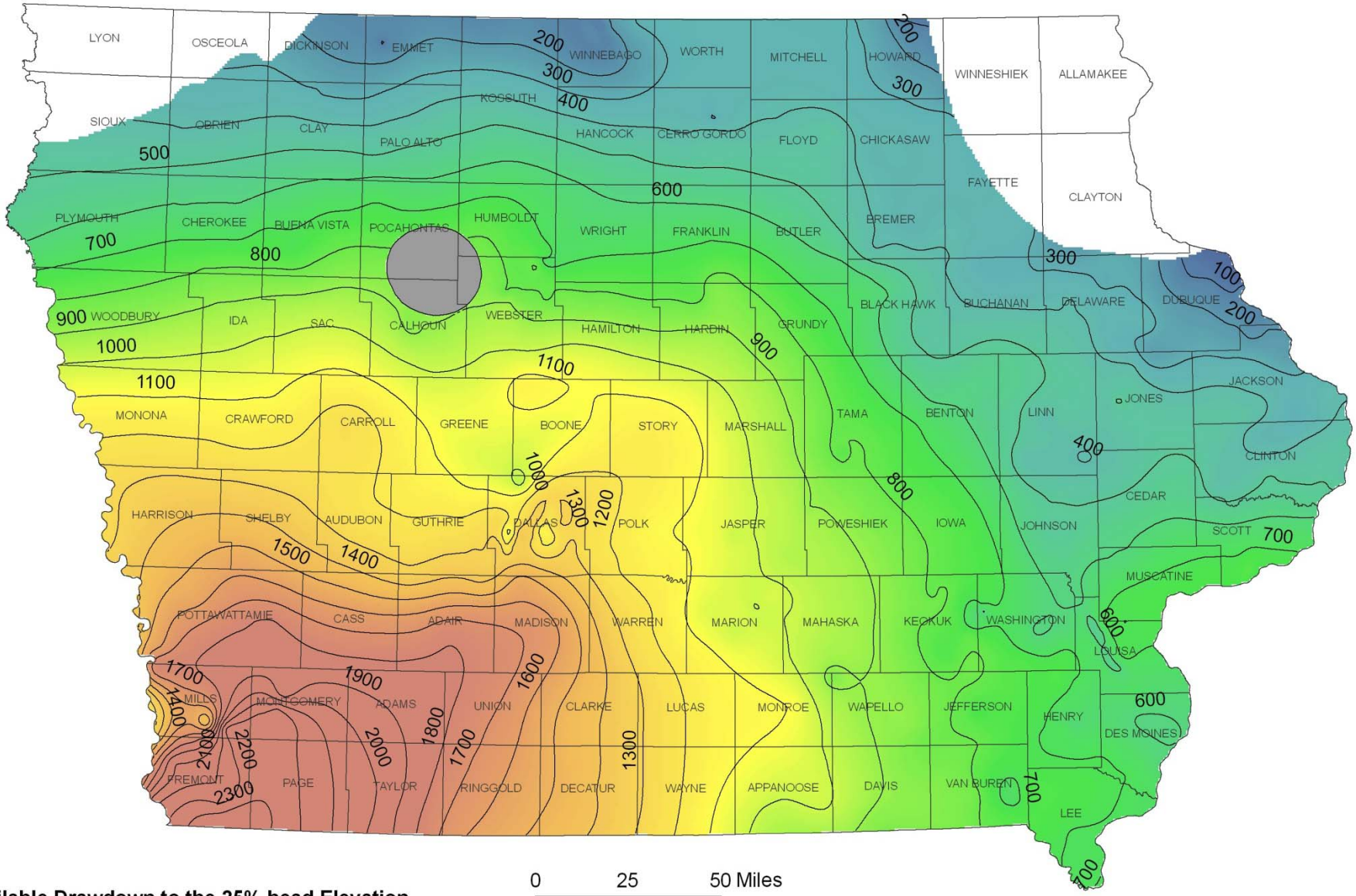


Drawdown in feet From Horick and Steinhilber in 2020 Using Permitted Water Use

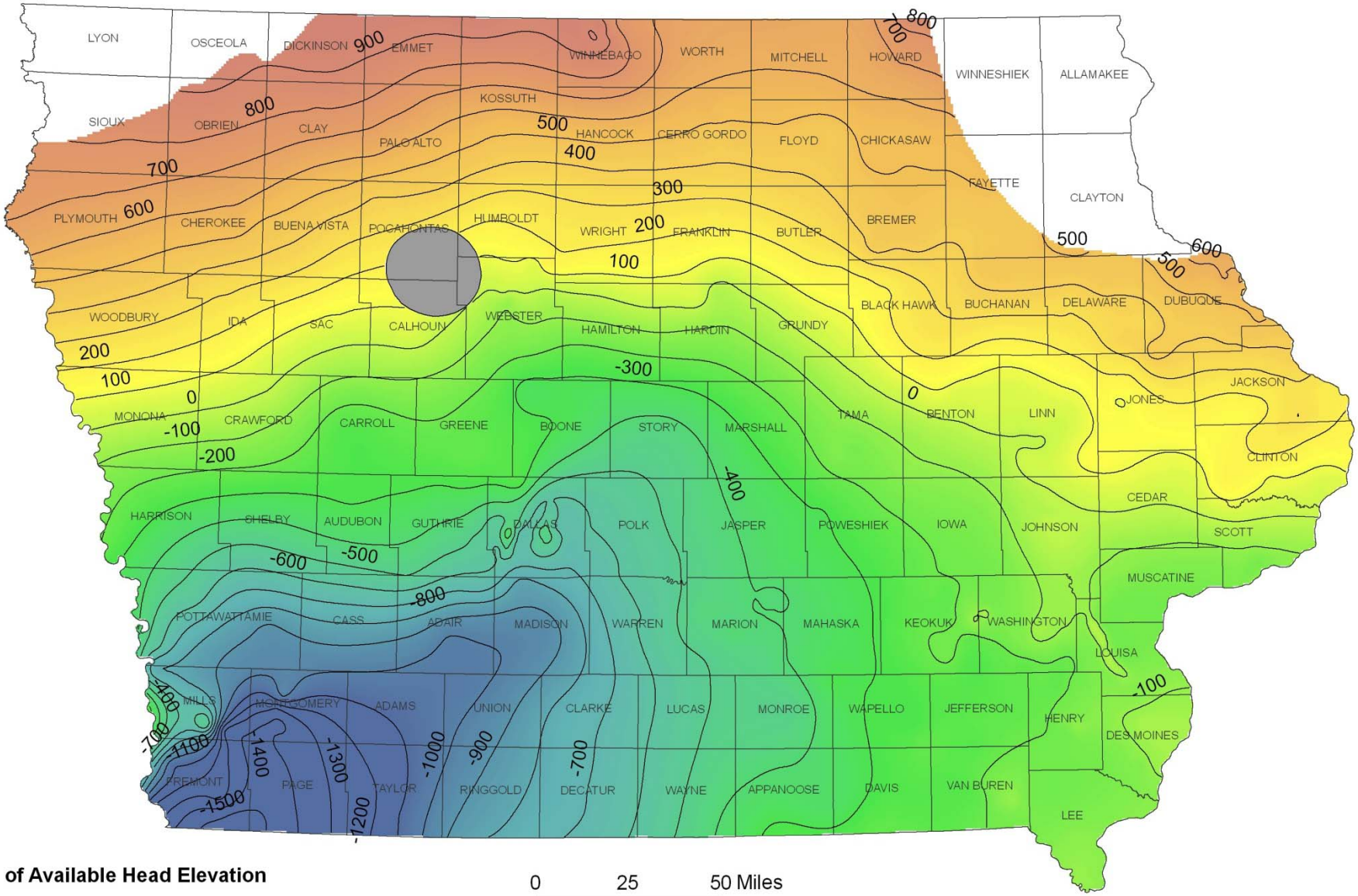



water table well
non-flowing artesian well
flowing artesian well
stream
potentiometric surface of confined aquifer
water table
unconfined or water table aquifer
confining unit
confined aquifer
impermeable bedrock

Available Drawdown to the 25% Available Head Elevation

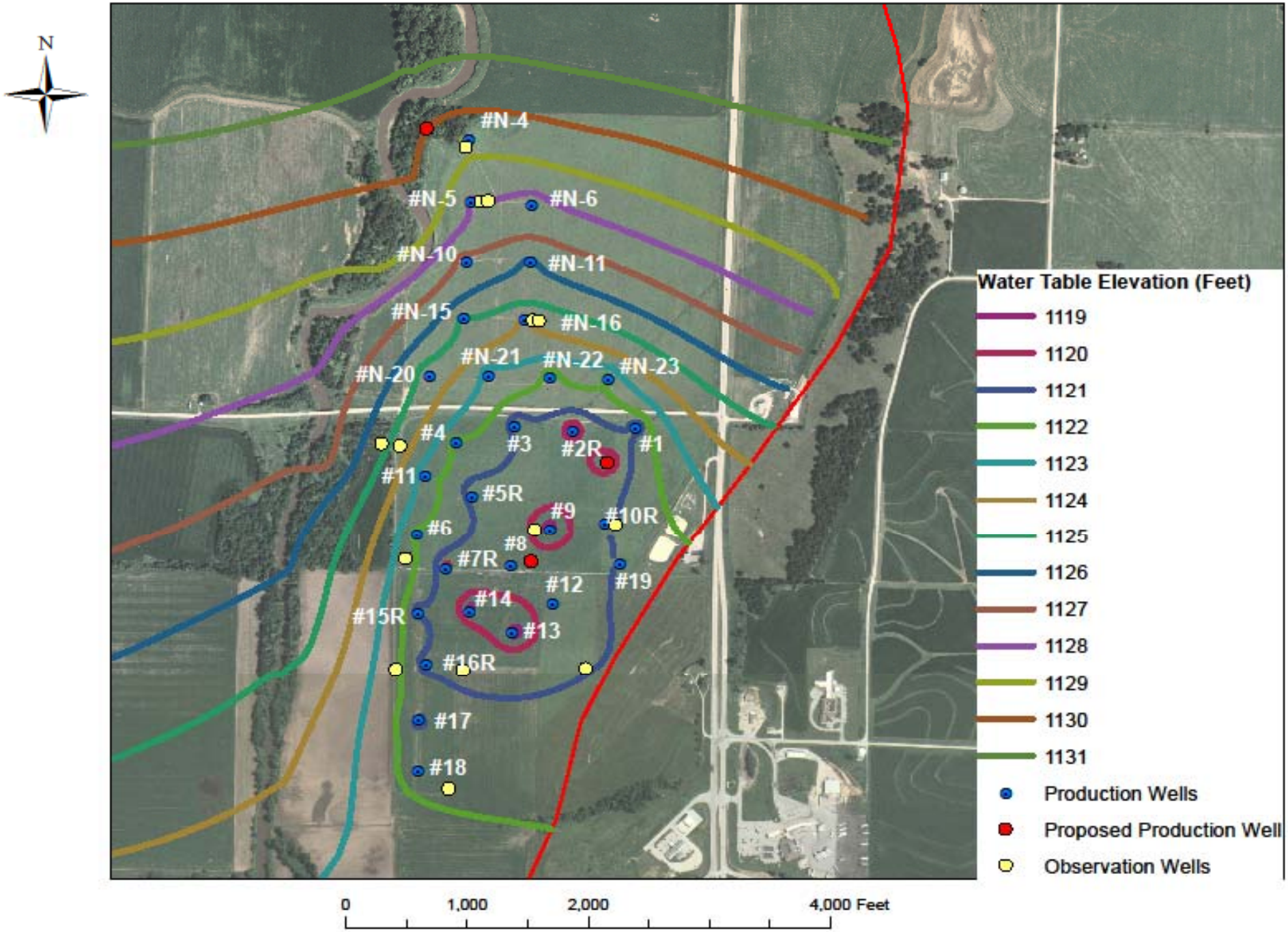


25 Percent of Predevelopment Available Head Elevation



Applications of Models

- West Nishnabotna alluvial aquifer
  - Evaluation for 1.2 mgd expansion for the City of Oakland wellfield (Oakland Foods Meat Packing)
  - Evaluation of a moderate to severe drought in the Regional Water wellfield near Avoca (requested on January 4, 2011)
  - Evaluation of a moderate to severe drought for the City of Manning wellfield


N
#N-4
#N-5
#N-6
#N-10
#N-11
#N-15
#N-16
#N-20
#N-21
#N-22
#N-23
#4
#3
#2R
#1
#11
#5R
#9
#10R
#6
#8
#7R
#12
#19
#14
#15R
#13
#16R
#17
#18
Water Table Elevation (Feet)
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
Production Wells
Proposed Production Well
Observation Wells
0
1,000
2,000
4,000 Feet

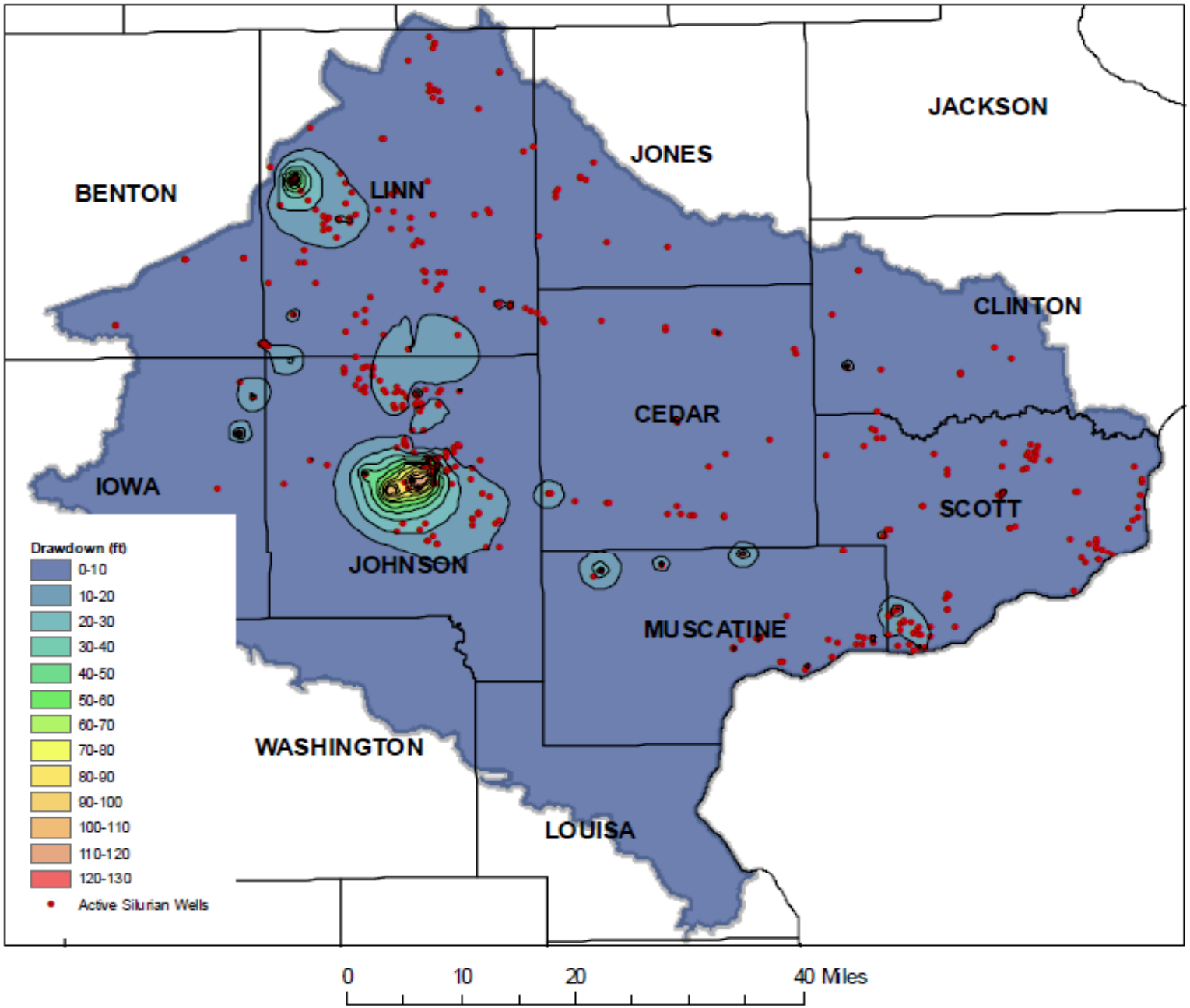
Applications of Models

- West West Fork of the Des Moines River alluvial aquifer
  - Evaluation for proposed 1.5 mgd Osgood wellfield north of Emmetsburg
  - Senator Jack Kibbie has received numerous complaints from area irrigators, and has asked the IDNR to address the farmers concerns.

Silurian aquifer in East-Central Iowa

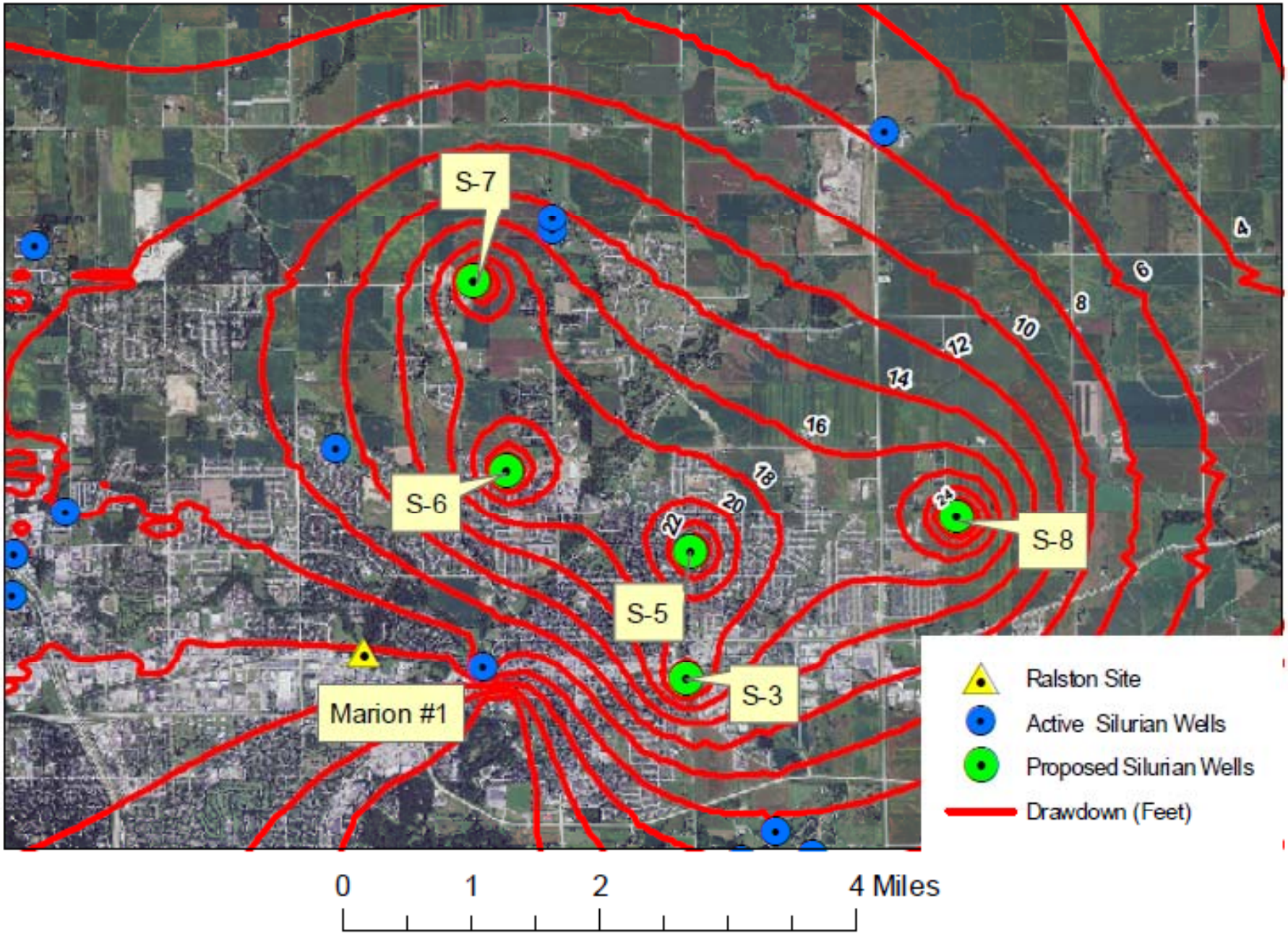
- Rapid growth in Linn and Johnson counties has placed stress on the C-O (Jordan) aquifer.
- Dennis Alt asked IGWS to evaluate the sustainability of the Silurian aquifer as an alternative to the C-O aquifer.
- City of Marion Silurian aquifer wellfield expansion (~3% growth per year).
- City of Coralville Silurian aquifer wellfield expansion (~3% growth per year).

Total Drawdowns in the Silurian Aquifer

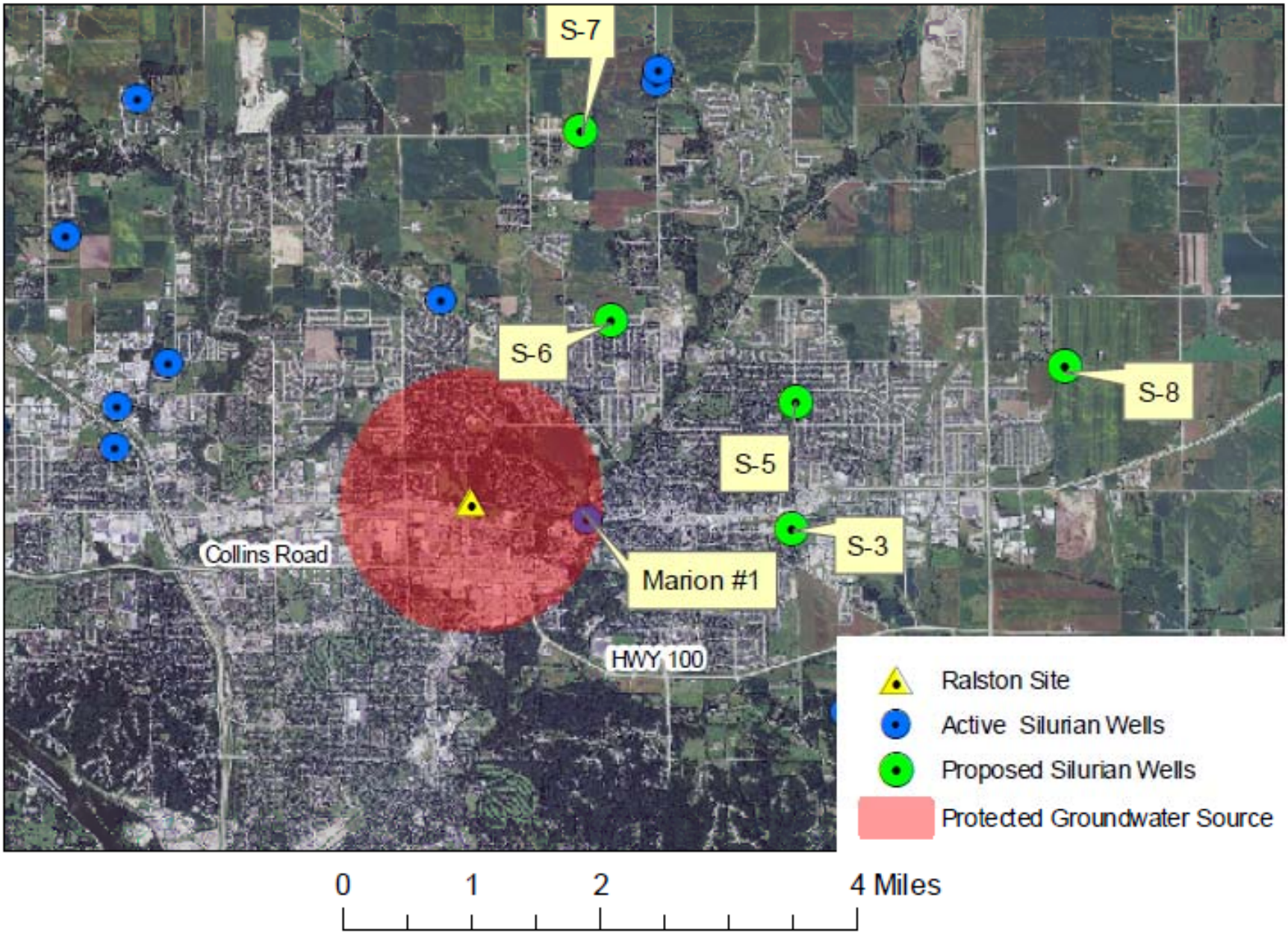


Marion Area Expansion

Proposed Marion Wellfield and Potential Drawdown



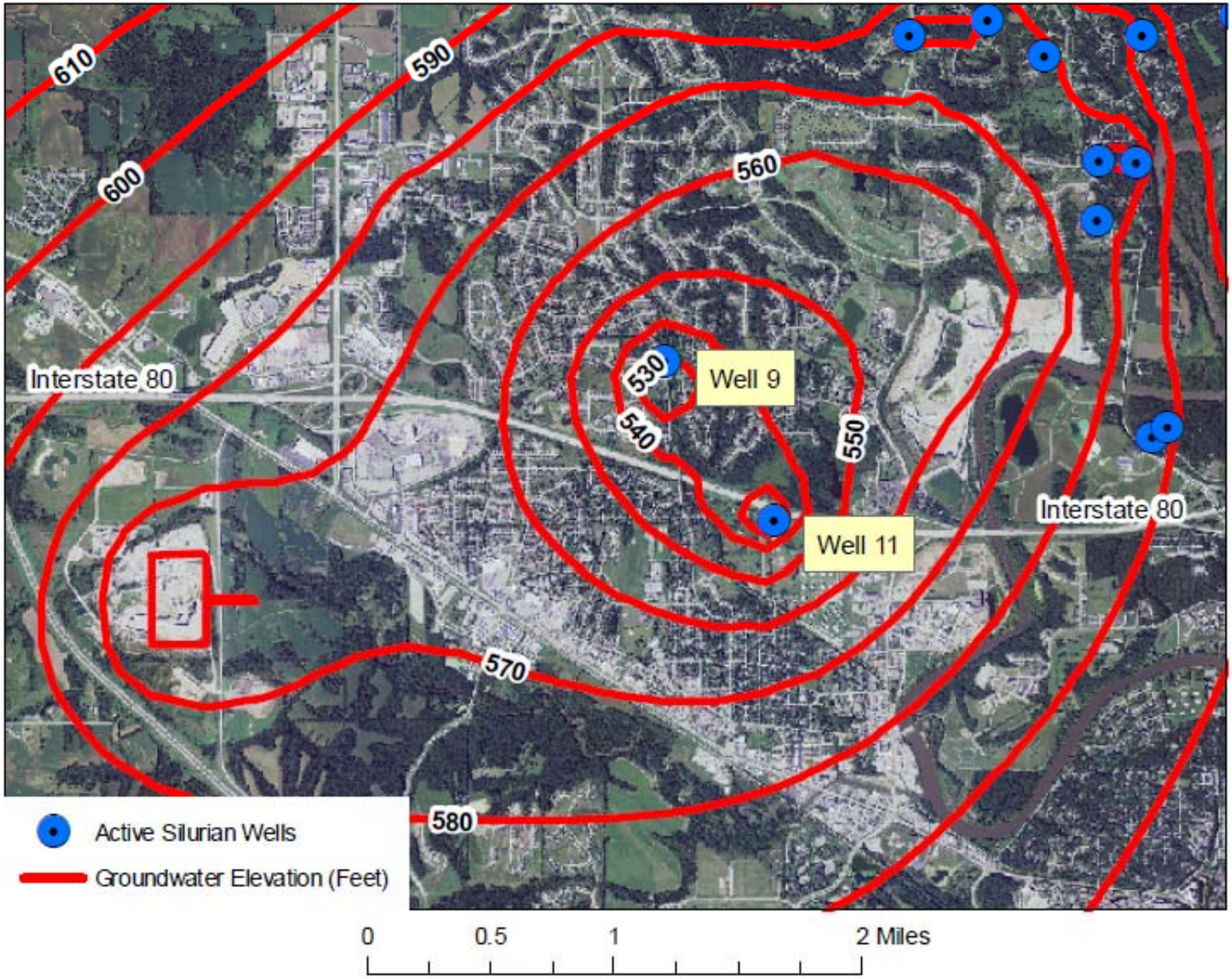
Main Concern in Marion is the Protective Water Source

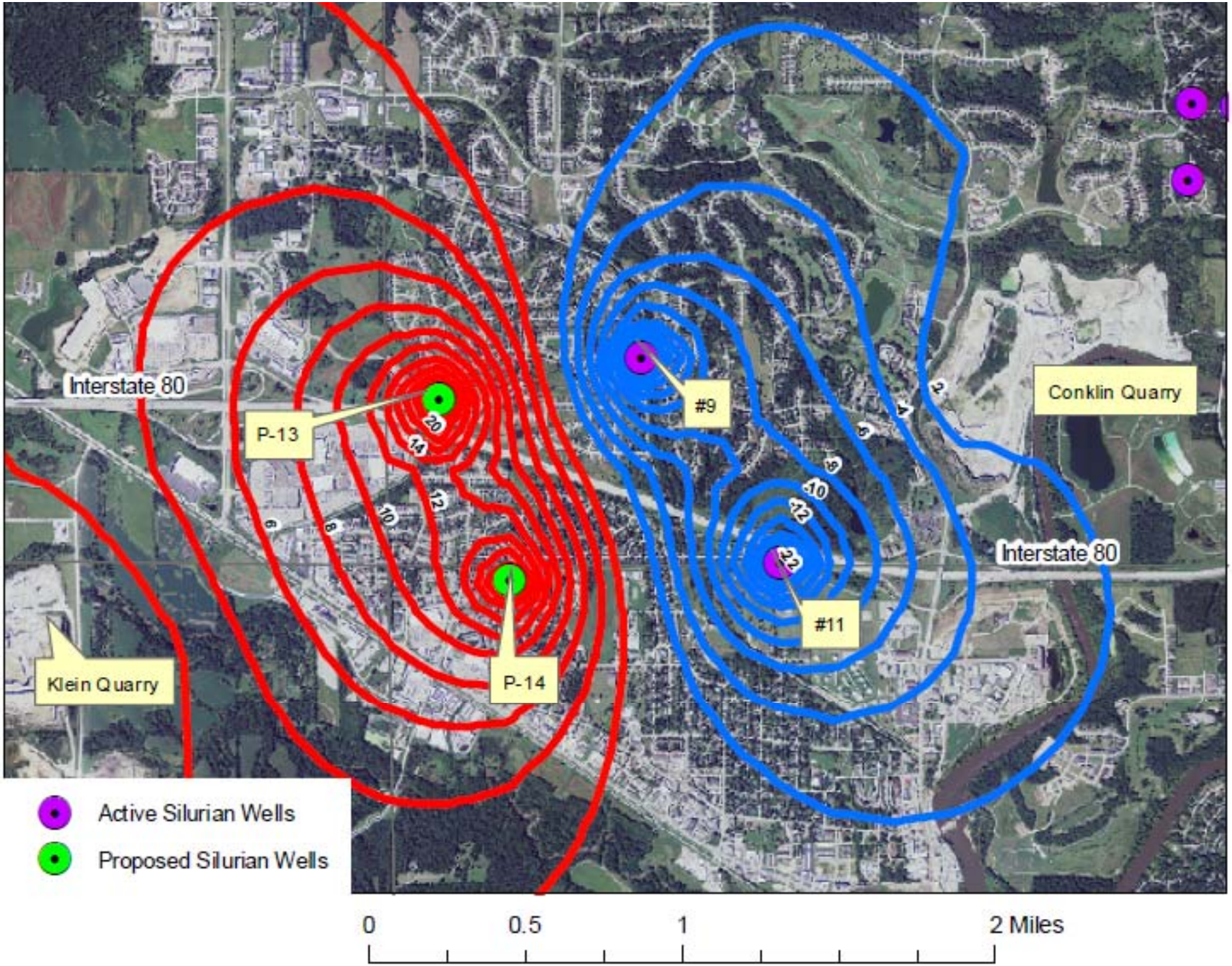


Marion Summary

- O.6 bgy of withdrawal is permitted from the Silurian aquifer.
- Using 5 proposed wells the maximum simulated additional drawdown is 30-33 feet.
- Approximately 2-10 feet of additional drawdown would occur near the City of Hiawatha wells.
- Additional hydrologic data is needed to evaluate what impact the proposed wells may have on the Ralston site.
- Groundwater quality appears to be more of a concern than quantity in the Silurian aquifer.

Coralville Redistribution and Expansion


610
590
600
560
530
540
550
570
580
Well 9
Well 11
Interstate 80
Interstate 80
Active Silurian Wells
Groundwater Elevation (Feet)
0
0.5
1
2 Miles


Interstate 80
P-13
P-14
Klein Quarry
#9
#11
Conklin Quarry
Interstate 80
20
14
12
10
8
6
22
12
10
8
6
4
2
Active Silurian Wells
Proposed Silurian Wells
0
0.5
1
2 Miles

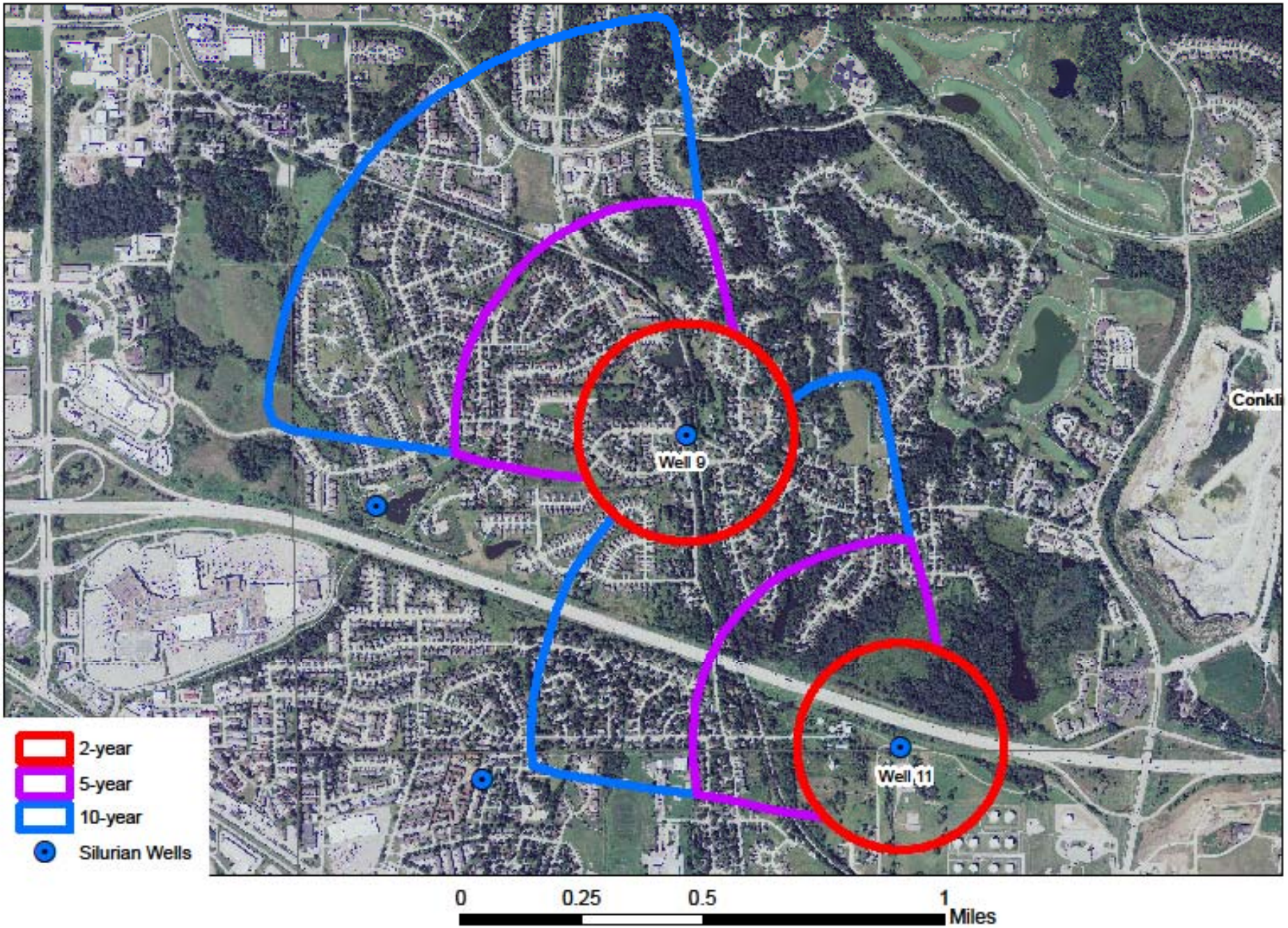
Coralville Summary

- Two quarries have lowered the potentiometric surface by 80-120 feet.
- Current GW elevations are at the Devonian-Silurian contact.
- Lowering casing and pump depths will further reduce pumping capacity.
- Silurian aquifer in the Coralville area has limited available head.
- Spreading the withdrawal out among 4 wells will reduce the total drawdown.
- Limited future expansion of the Silurian aquifer in the Coralville area.
- City is looking at expansion of the C-O aquifer and development of an alluvial wellfield.

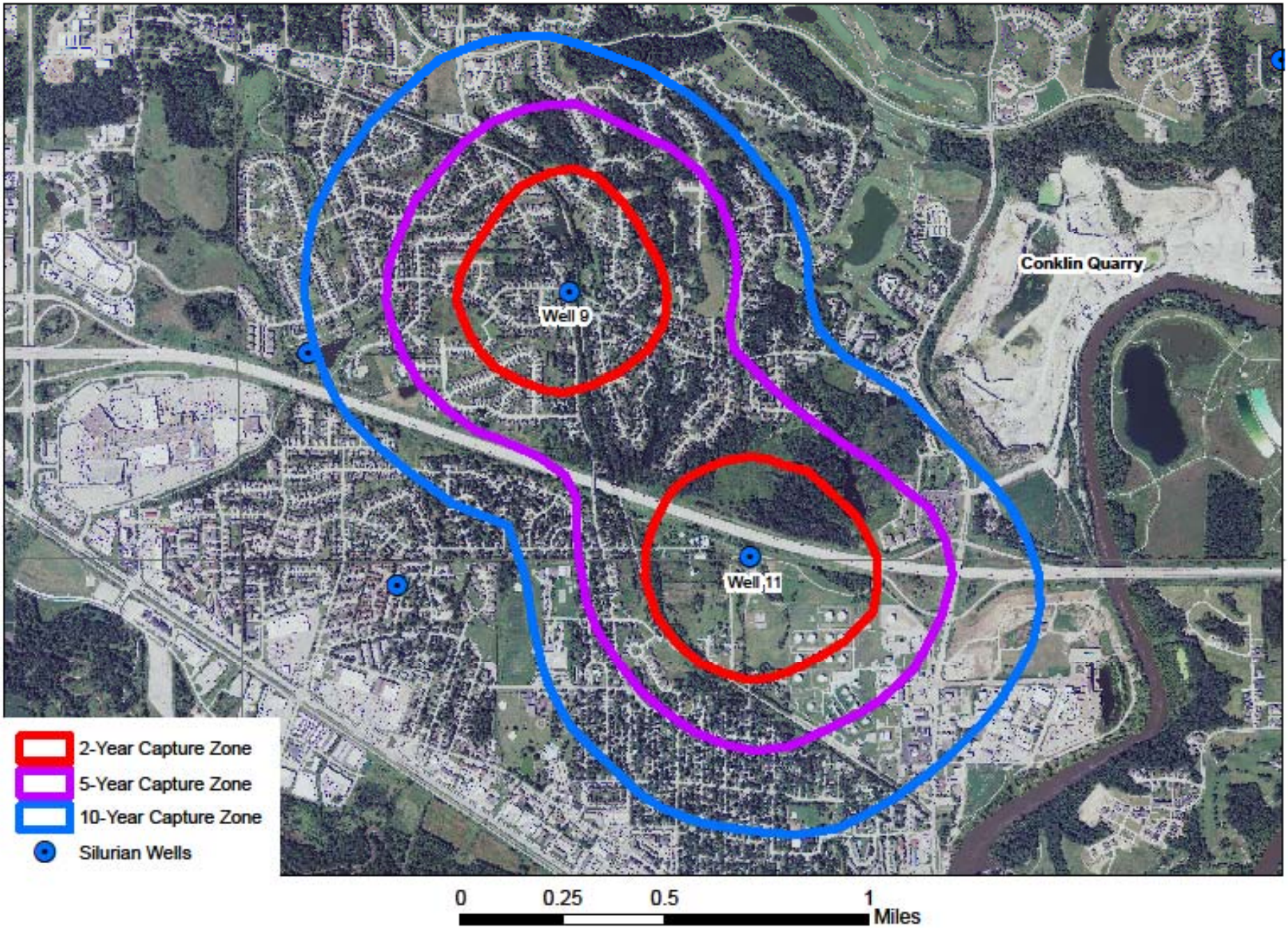
Water Resources Management (Other Applications)

- Improvements in Source Water Capture Zones.
- Interaction with Water Operator often leads to other issues (i.e. bacteria issues in Coralville Well 9, new Silurian Well at Oakdale)
- Geothermal Applications
- Contaminant Sites Section/UST Section risk assessment
- Assist communities with future water supply needs (Coralville, Oakland, Marion, U of I)

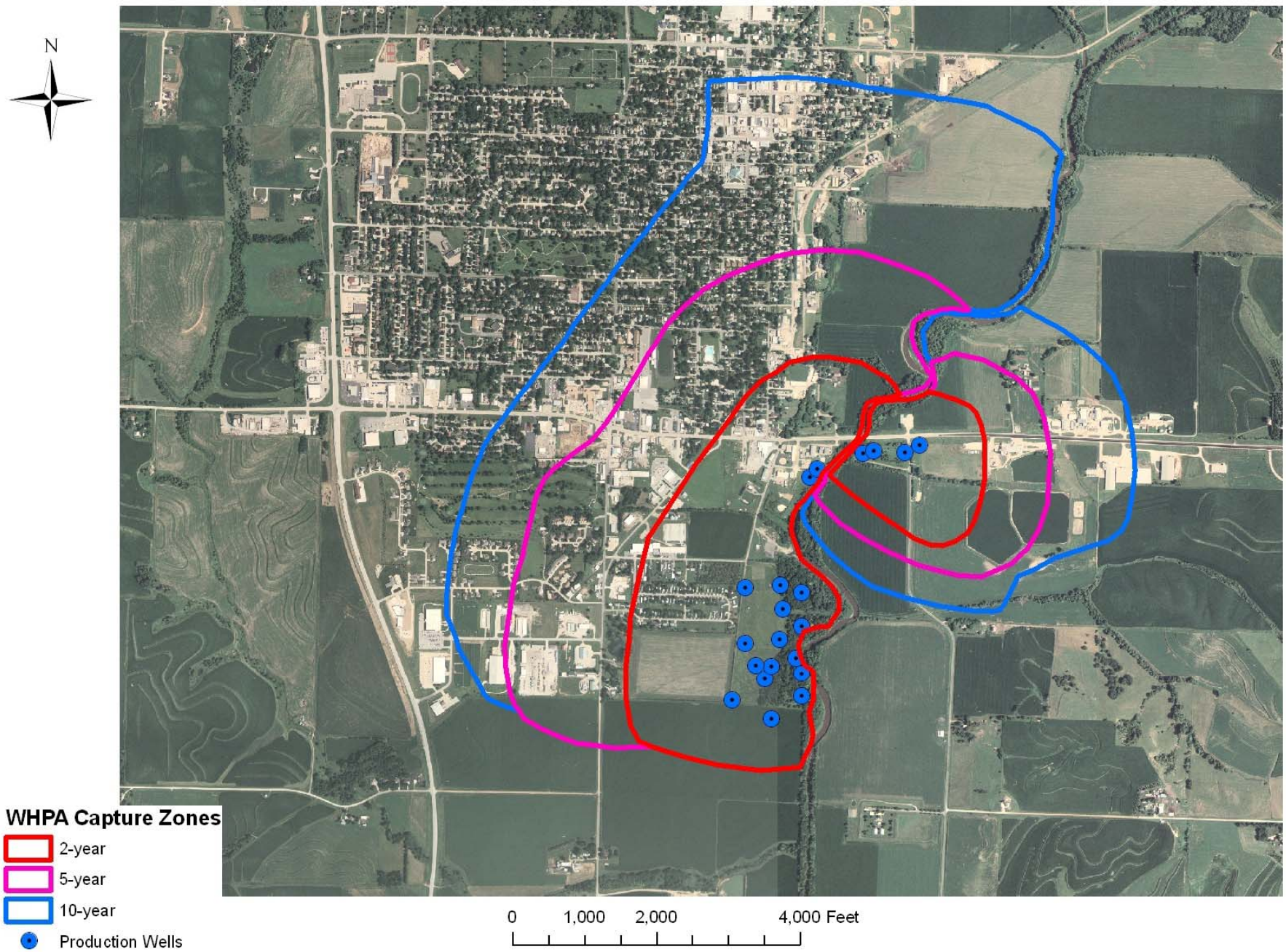
City of Coralville SWAP Capture Zones - Silurian Aquifer



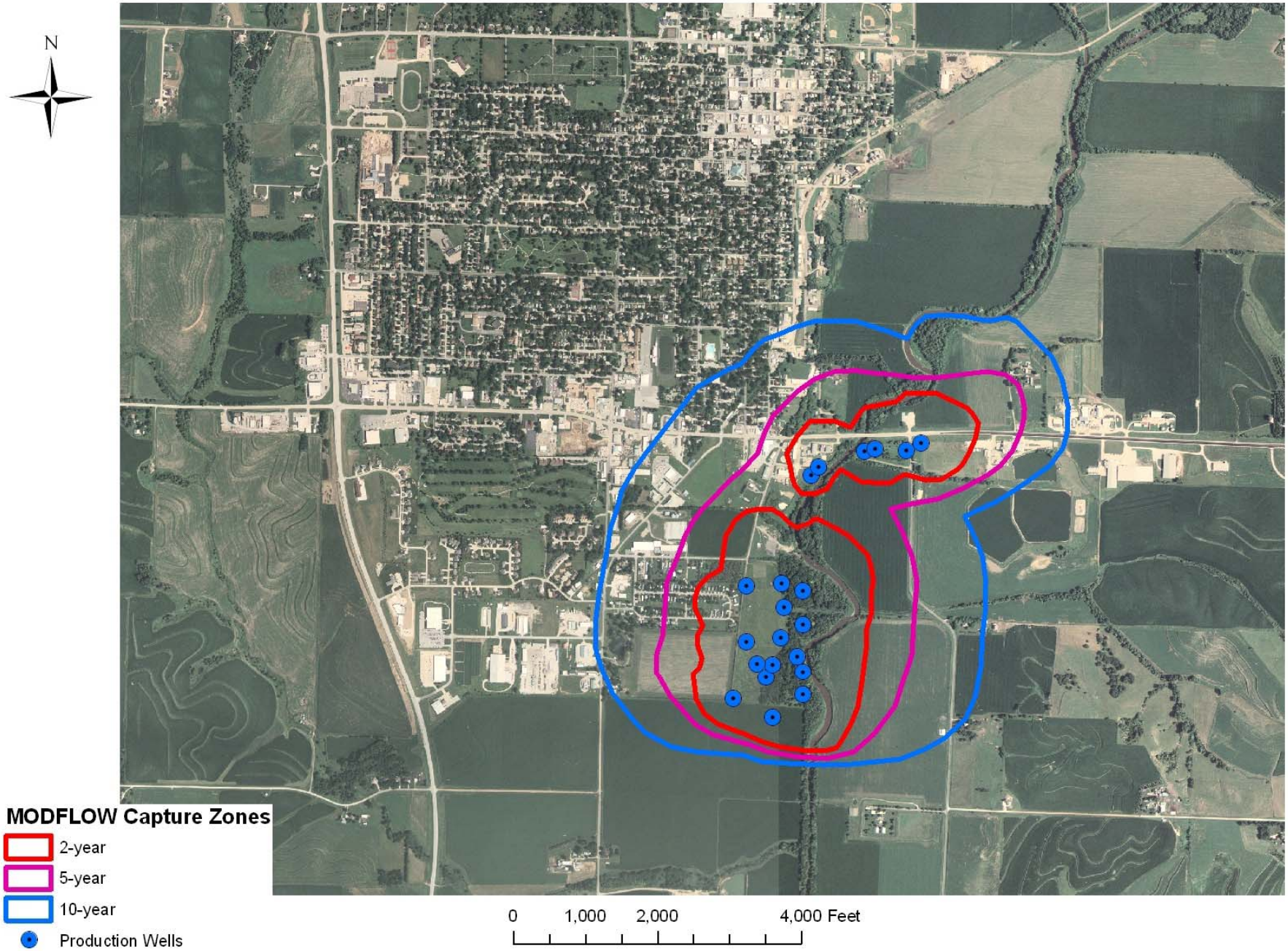
City of Coralville Capture Zones - Silurian Aquifer



Capture Zones With No Induced Recharge - City of Harlan

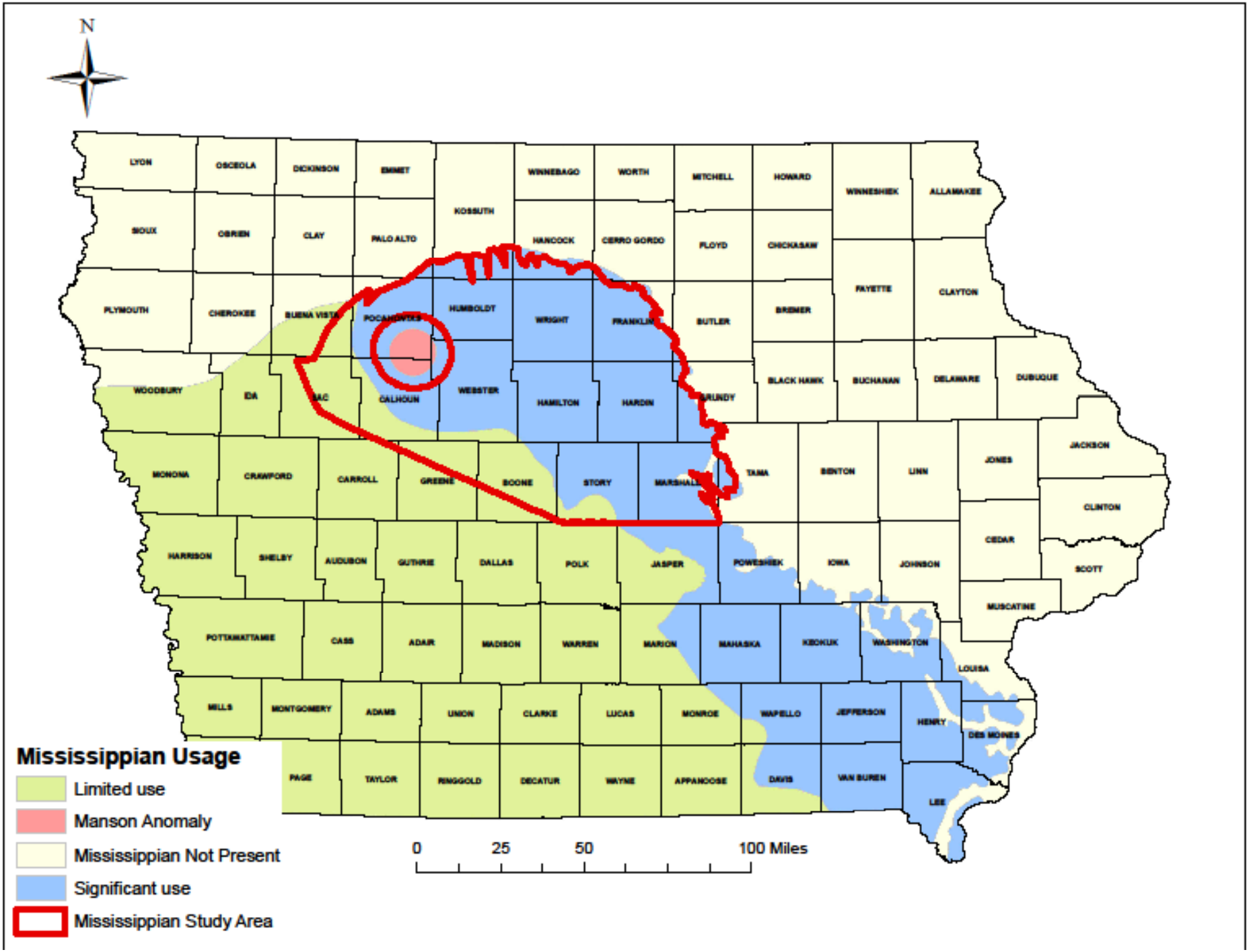


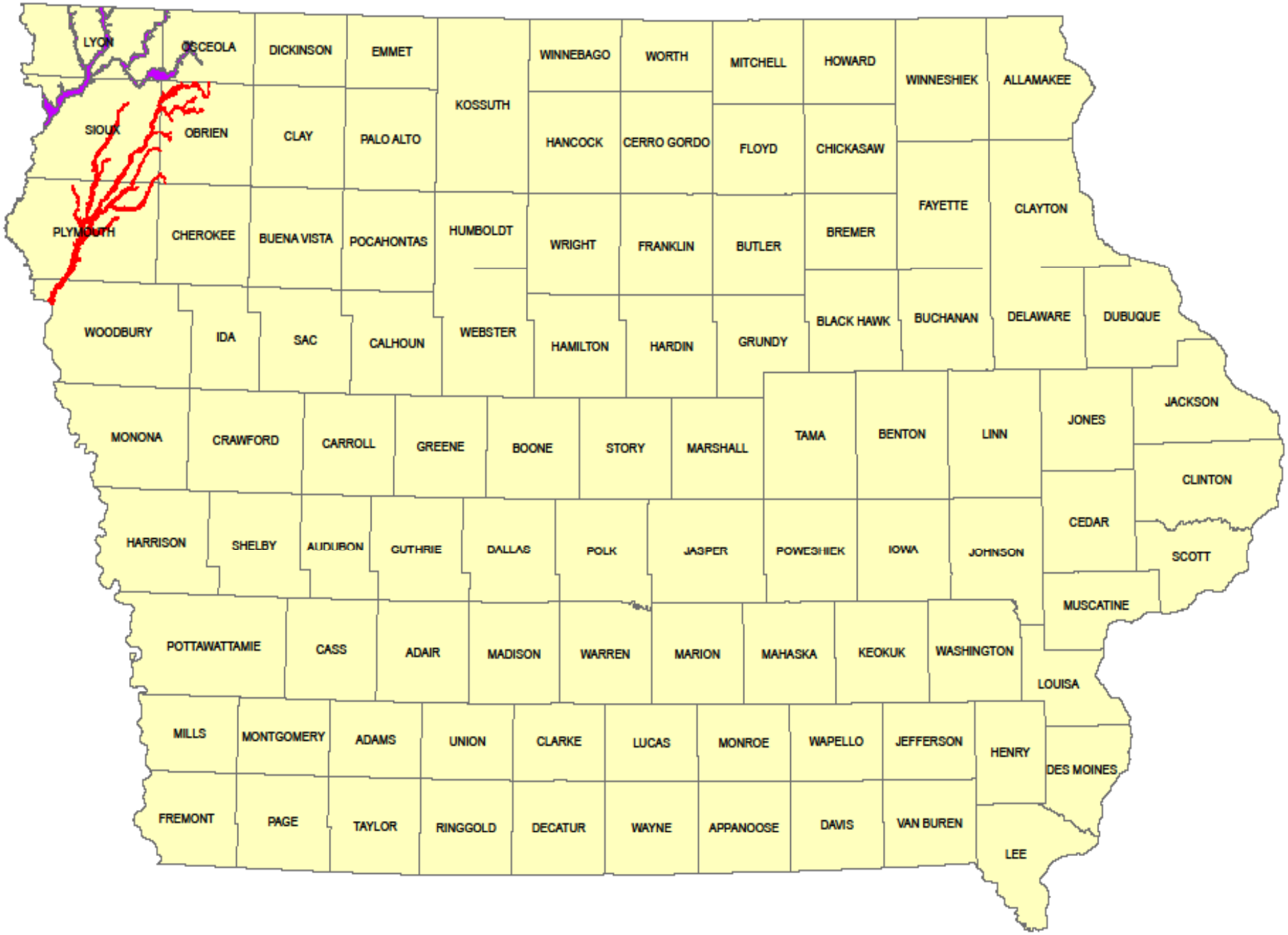
Capture Zones With 50% Induced Recharge - City of Harlan



Groundwater Modeling Projects Scheduled for 2012

- Mississippian aquifer in North Central Iowa
- Rock River alluvial aquifer characterization
- Floyd River alluvial aquifer characterization


N
LYON
OSCEOLA
DICKINSON
EMMET
KOSSUTH
WINNEBAGO
WORTH
MITCHELL
HOWARD
WINNESHIEK
ALLAMAKEE
SIOUX
O'BRIEN
CLAY
PALO ALTO
HANCOCK
CERRO GORDO
FLOYD
CHICKASAW
FAYETTE
CLAYTON
PLYMOUTH
CHEROKEE
BUENA VISTA
POCAHONTAS
HUMBOLDT
WRIGHT
FRANKLIN
BUTLER
BREMER
WOODBURY
IDA
SAC
CALHOUN
WEBSTER
HAMILTON
HARDIN
GRUNDY
BLACK HAWK
BUCHANAN
DELAWARE
DUBUQUE
MONONA
CRAWFORD
CARROLL
GREENE
BOONE
STORY
MARSHALL
TAMA
BENTON
LINN
JONES
JACKSON
CLINTON
HARRISON
SHELBY
AUDUBON
GUTHRIE
DALLAS
POLK
JASPER
POWESHIEK
IOWA
JOHNSON
CEDAR
SCOTT
MUSCATINE
POTTAWATTAMIE
CASS
ADAIR
MADISON
WARREN
MARION
MAHASKA
KEOKUK
WASHINGTON
LOUISA
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
WAPELLO
JEFFERSON
HENRY
DES MOINES
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
LEE
Mississippian Usage
Limited use
Manson Anomaly
Mississippian Not Present
Significant use
Mississippian Study Area
0
25
50
100 Miles


LYON
OSCEOLA
DICKINSON
EMMET
KOSSUTH
WINNEBAGO
WORTH
MITCHELL
HOWARD
WINNESHIEK
ALLAMAKEE
SIOUX
OBRIEN
CLAY
PALO ALTO
HANCOCK
CERRO GORDO
FLOYD
CHICKASAW
FAYETTE
CLAYTON
PLYMOUTH
CHEROKEE
BUENA VISTA
POCAHONTAS
HUMBOLDT
WRIGHT
FRANKLIN
BUTLER
BREMER
WOODBURY
IDA
SAC
CALHOUN
WEBSTER
HAMILTON
HARDIN
GRUNDY
BLACK HAWK
BUCHANAN
DELAWARE
DUBUQUE
MONONA
CRAWFORD
CARROLL
GREENE
BOONE
STORY
MARSHALL
TAMA
BENTON
LINN
JONES
JACKSON
CLINTON
CEDAR
SCOTT
HARRISON
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CLARKE
LUCAS
MONROE
WAPELLO
JEFFERSON
HENRY
DES MOINES
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
LEE

Questions?
Comments?

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