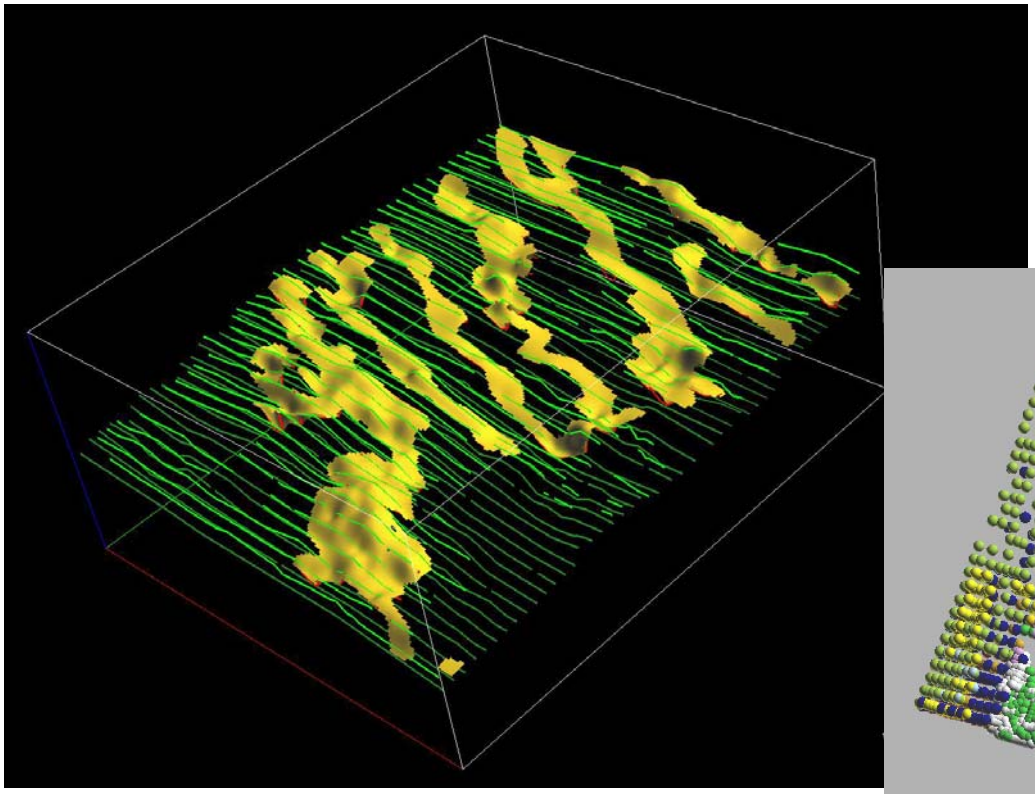
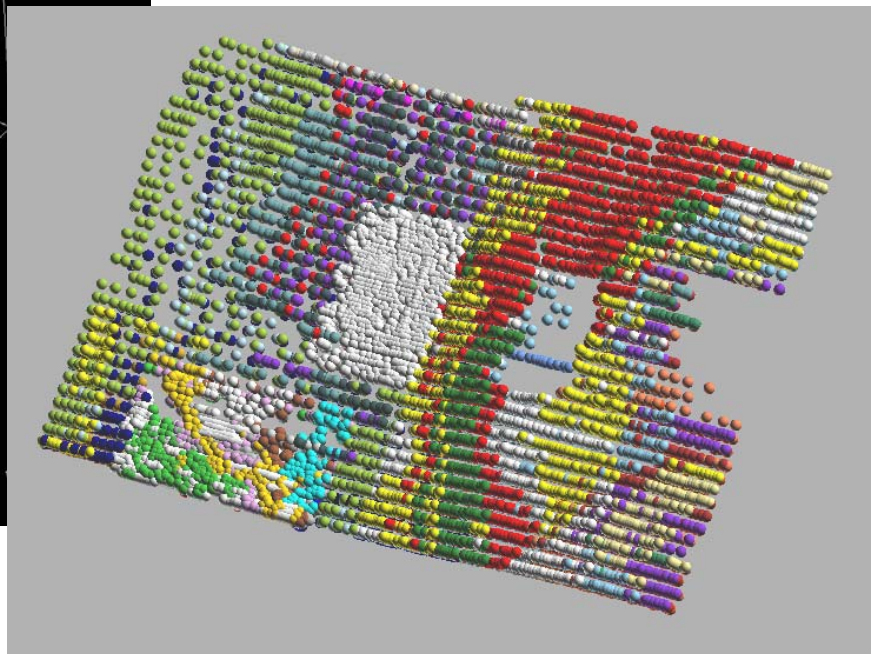
Quaternary aquifer material inventory and 3D model construction for the Fargo-Moorhead region (North Dakota and Minnesota) using GIS based geologic cross sections

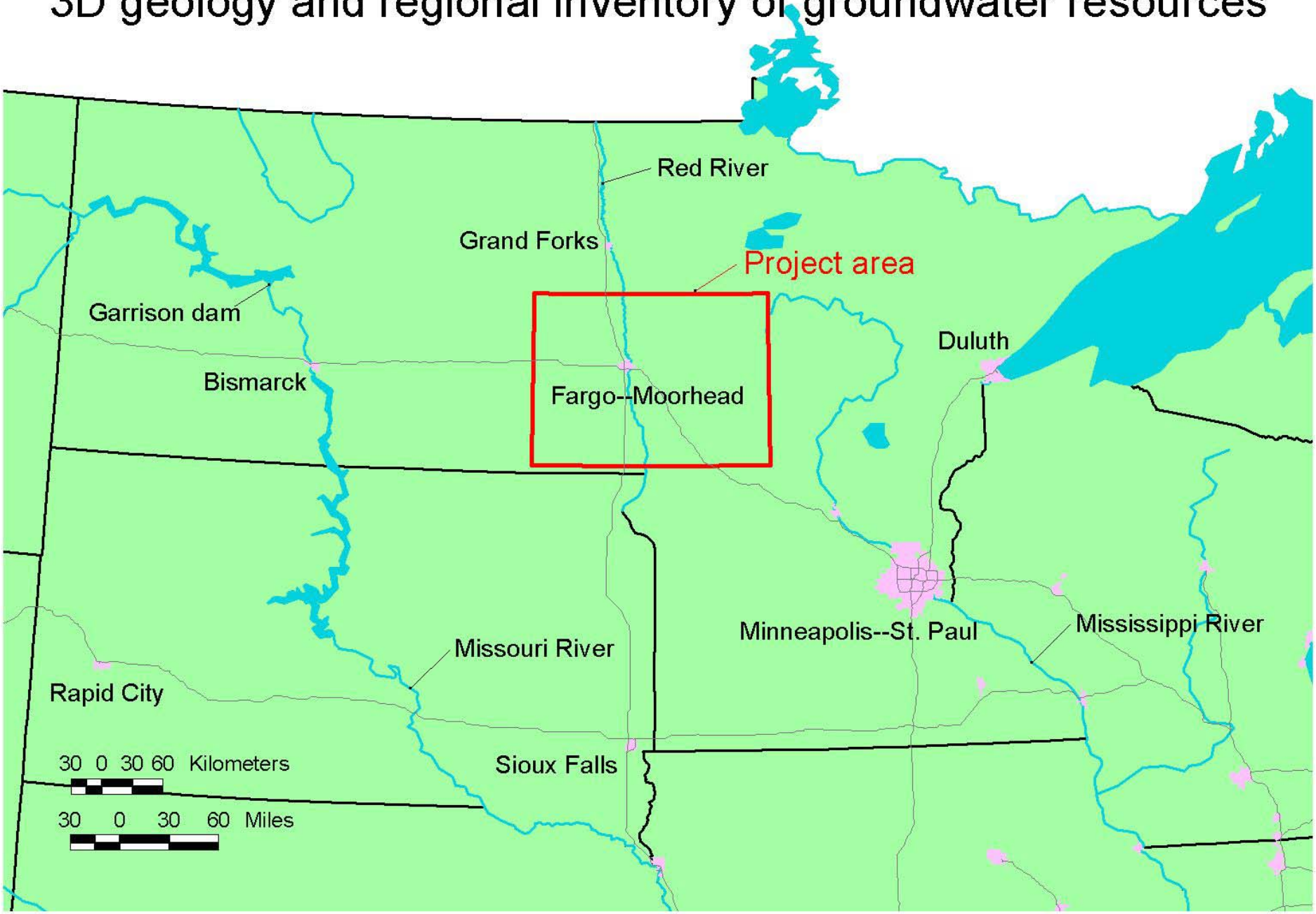
Jim Berg, Ken Harris, Zbigniew Malolepszy, Bob Tipping, and Greg Massaro

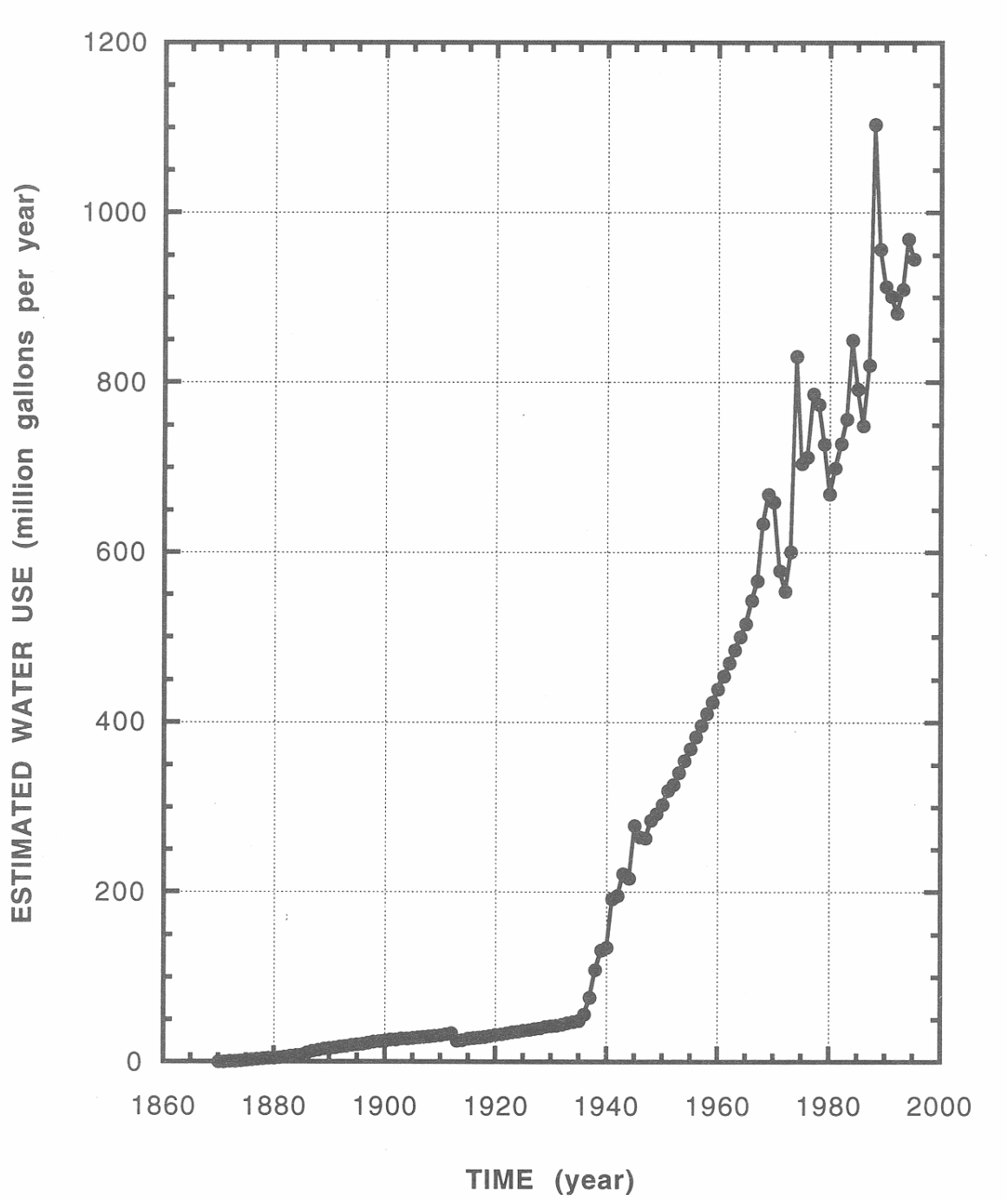




May 2005

Fargo-Moorhead area
3D geology and regional inventory of groundwater resources

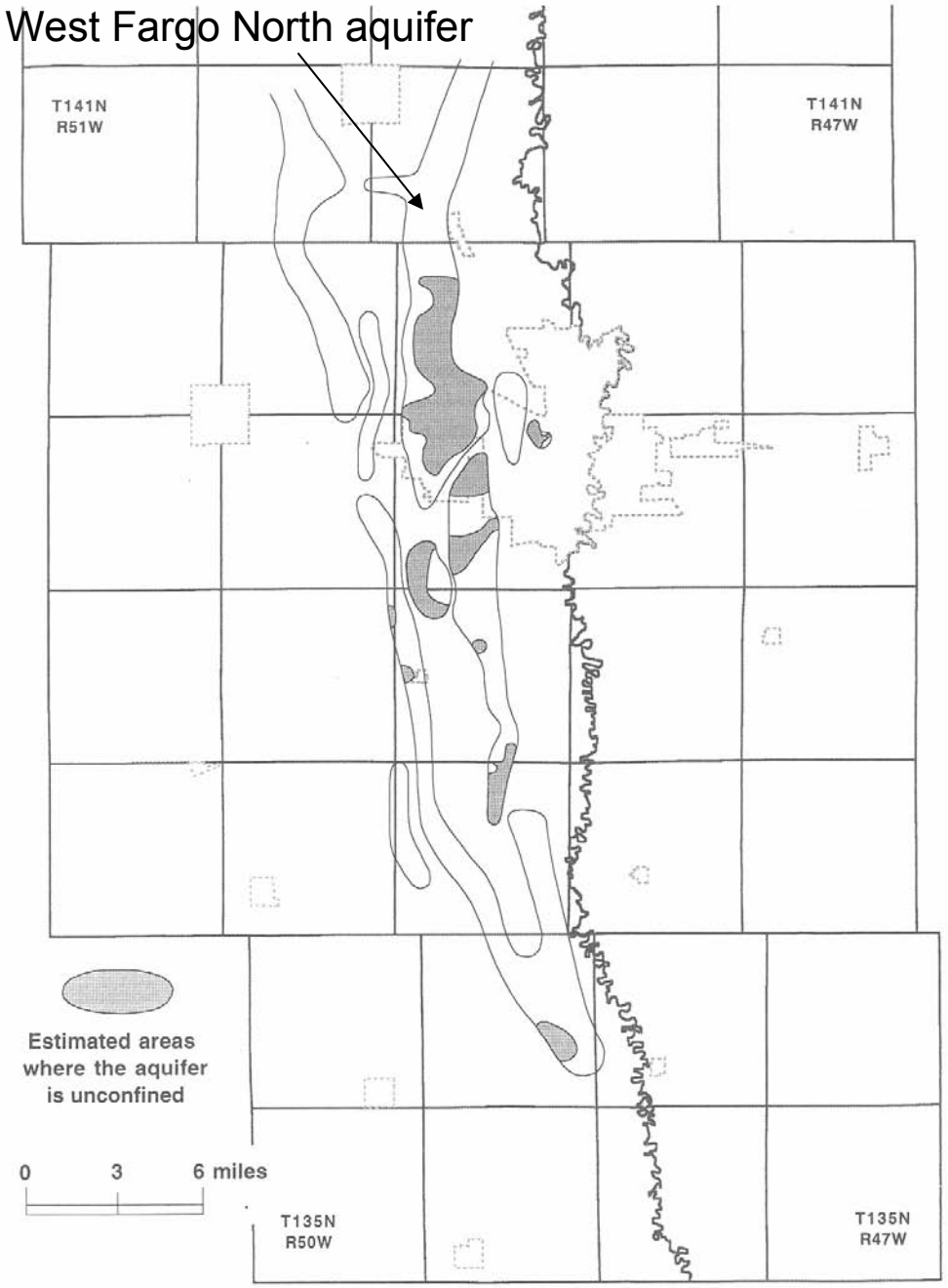




West Fargo Aquifers

Estimated water use

(Ripley, D.P., 2000)

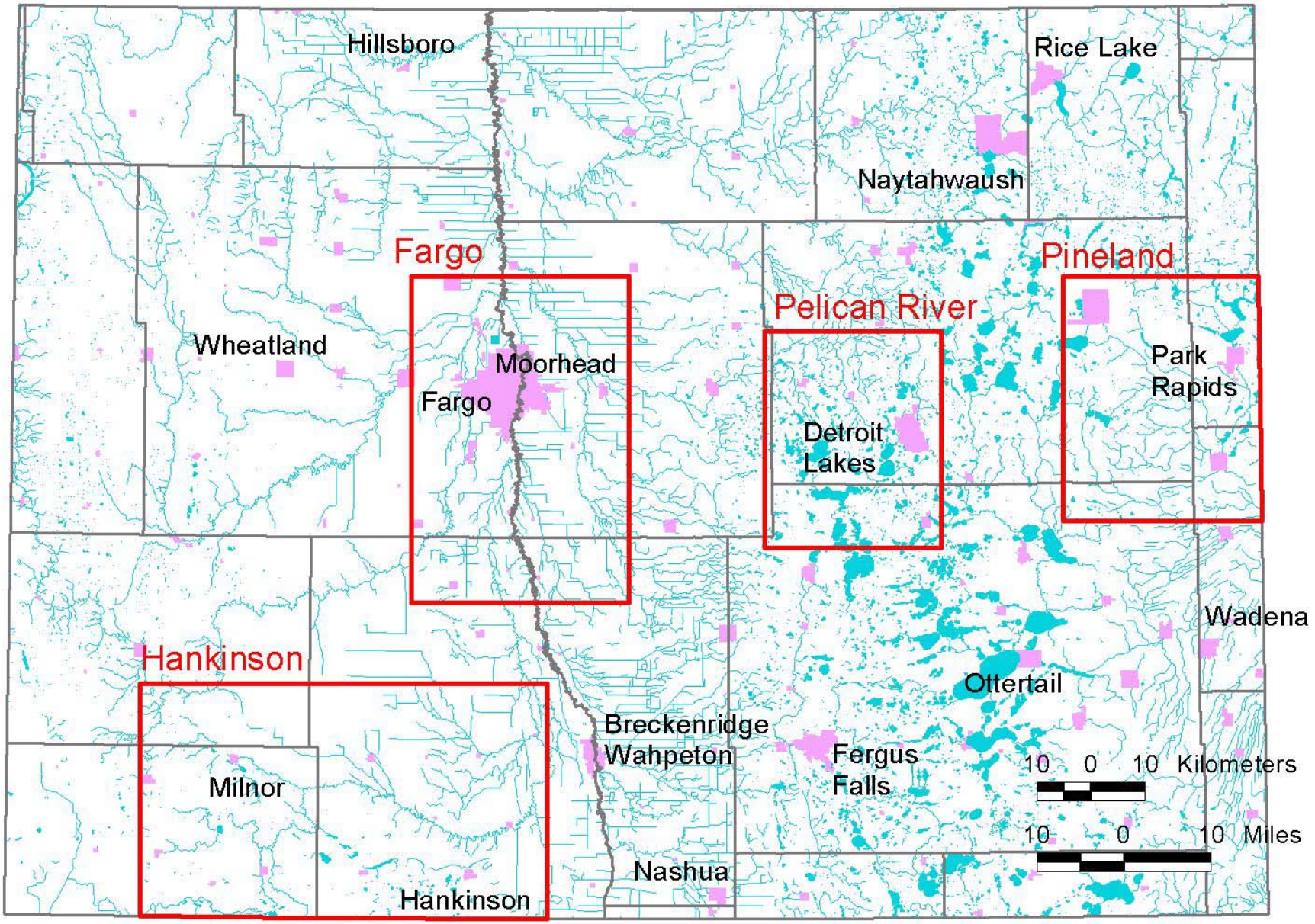


West Fargo Aquifers

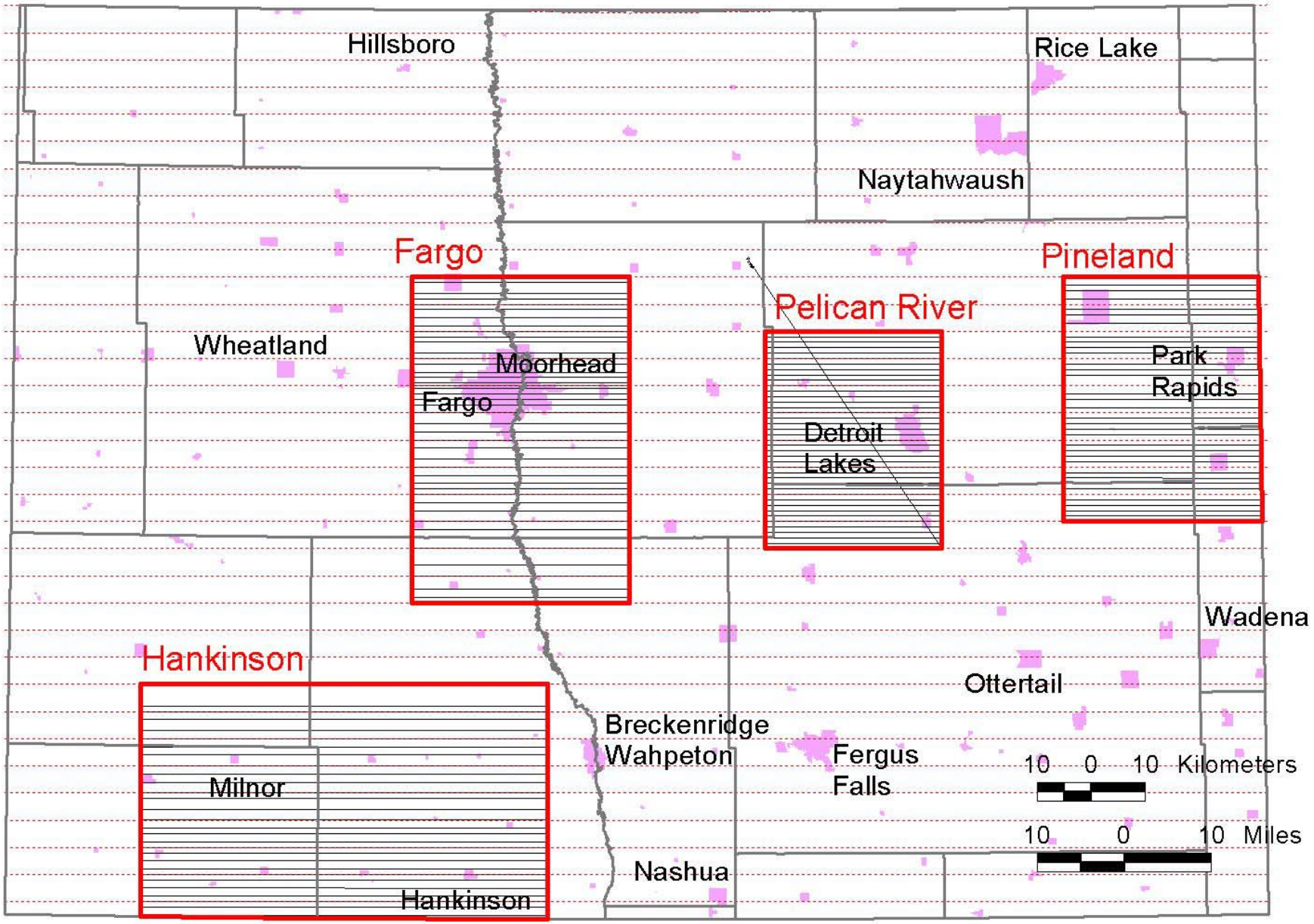
Estimated unconfined Areas (1998)

(Ripley, D.P., 2000)

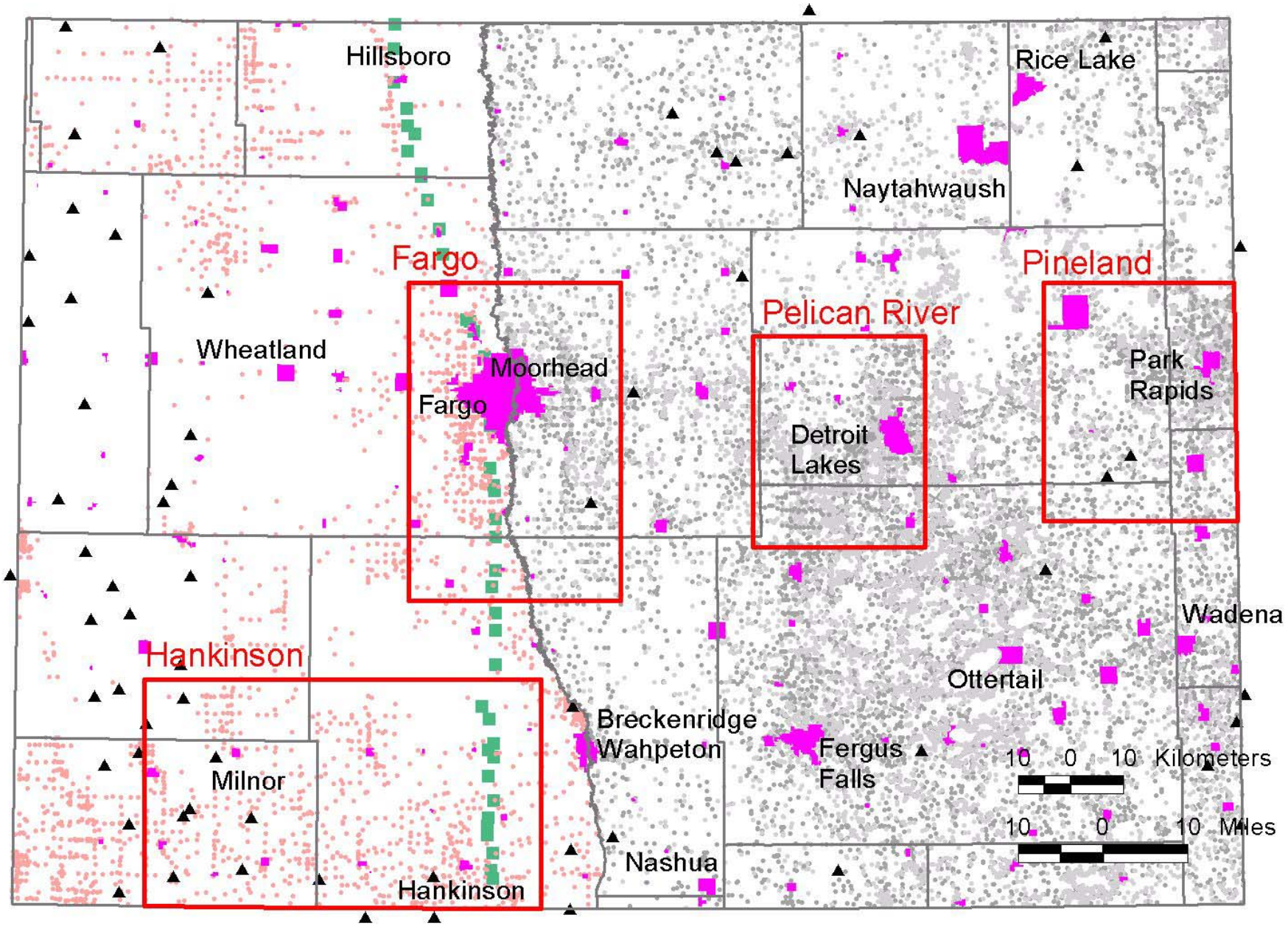
Fargo-Moorhead region and detail areas

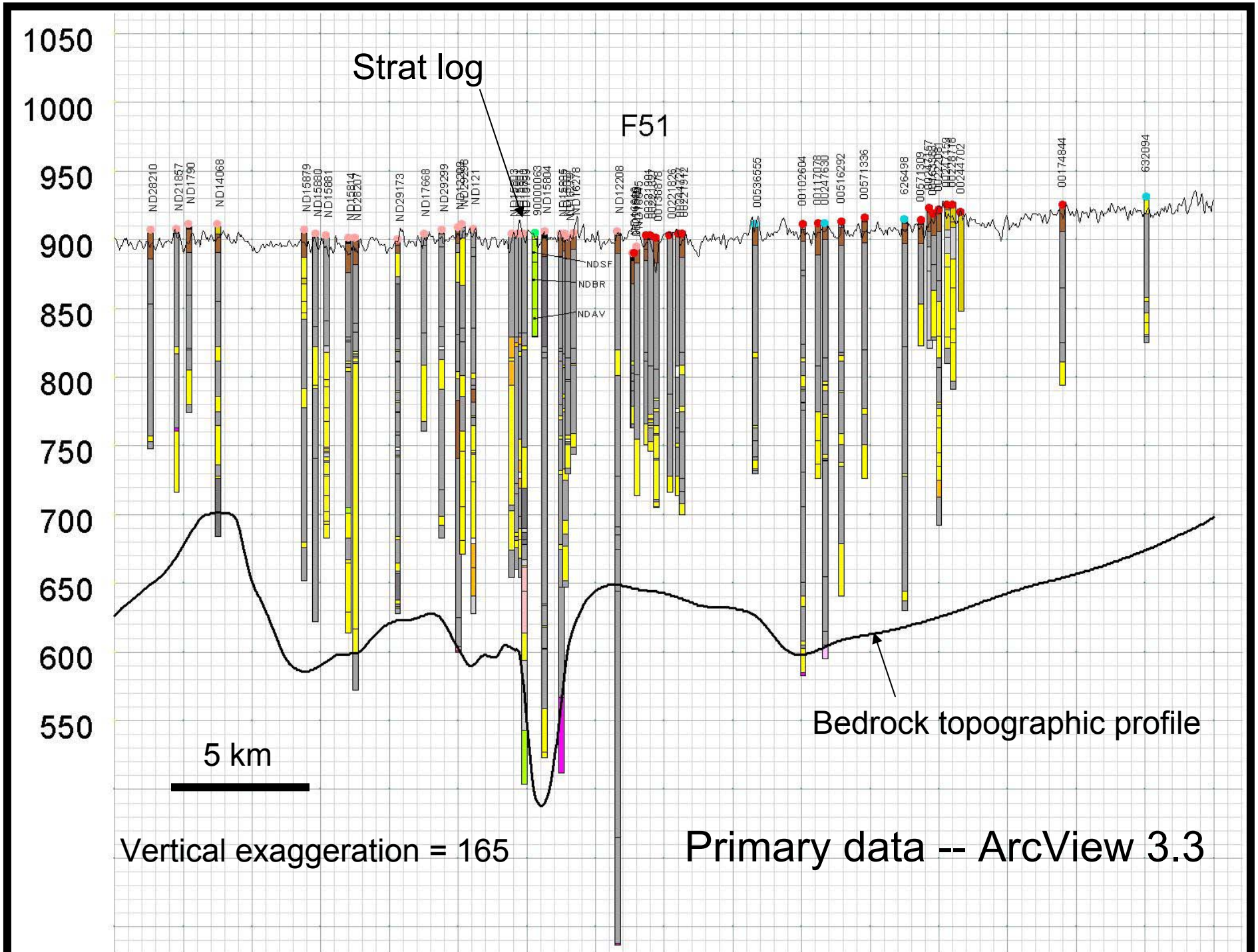


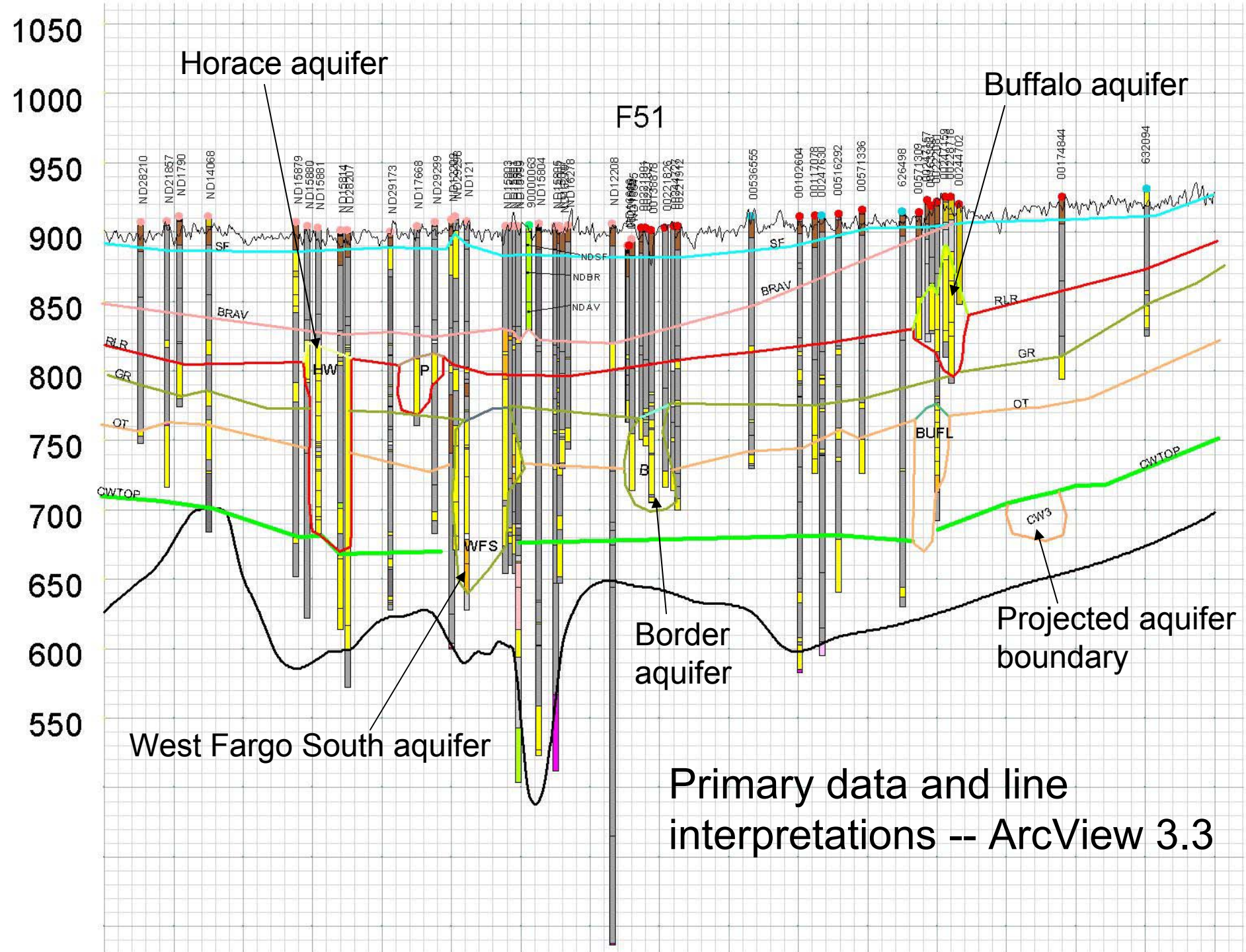
Geologic cross section locations

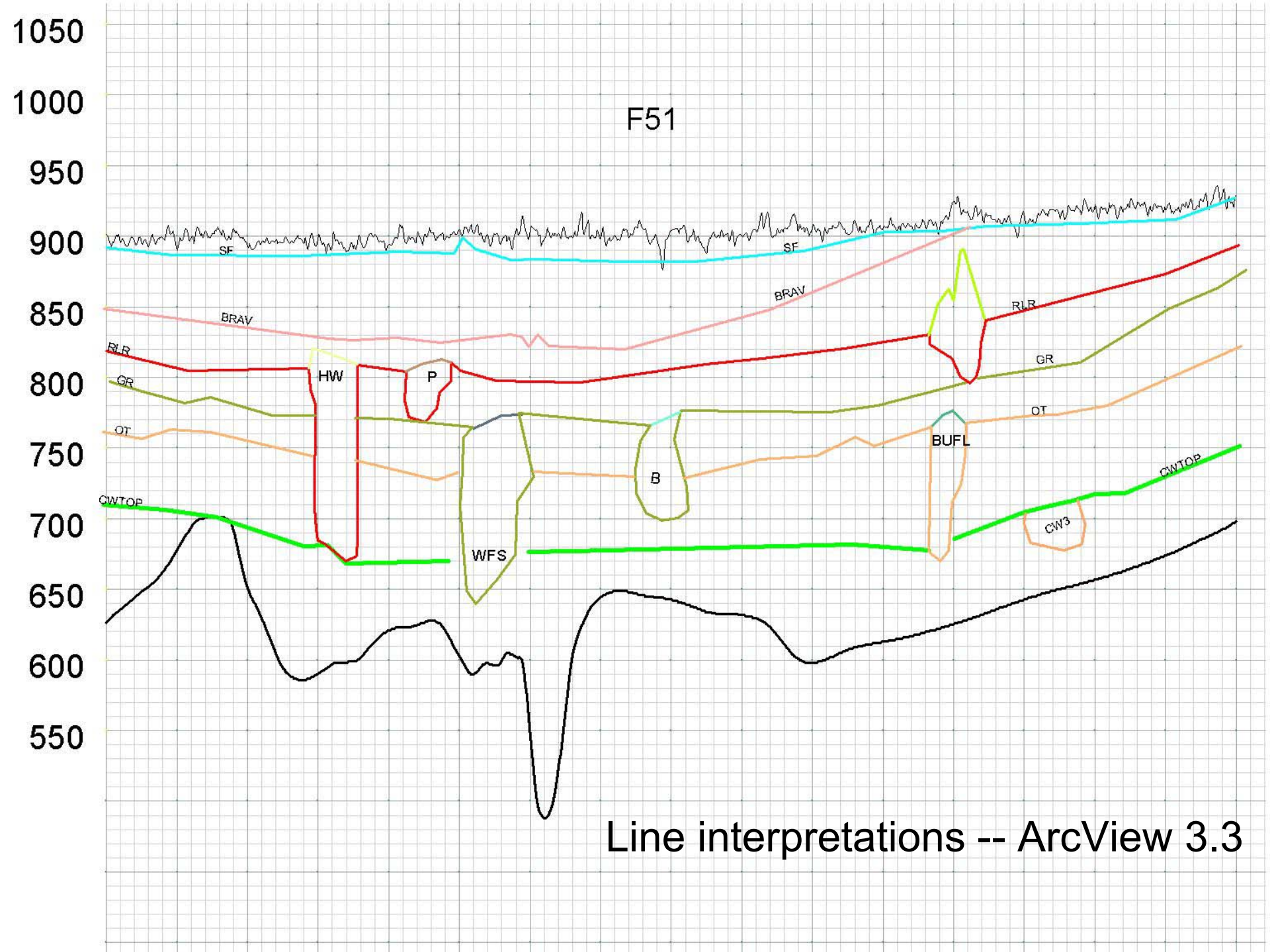


Lithologic and stratigraphic log locations




1050
1000
950
900
850
800
750
700
650
600
550
Strat log
F51
NDSF
NDBR
NDAV
5 km
Vertical exaggeration = 165
Bedrock topographic profile
Primary data -- ArcView 3.3


1050
1000
950
900
850
800
750
700
650
600
550
Horace aquifer
F51
Buffalo aquifer
SF
BRAV
RLR
GR
OT
CWTOP
HW
P
WFS
B
BUFL
CW3
NDSF
NDBR
NDAV
Border aquifer
Projected aquifer boundary
West Fargo South aquifer
Primary data and line interpretations -- ArcView 3.3


1050
1000
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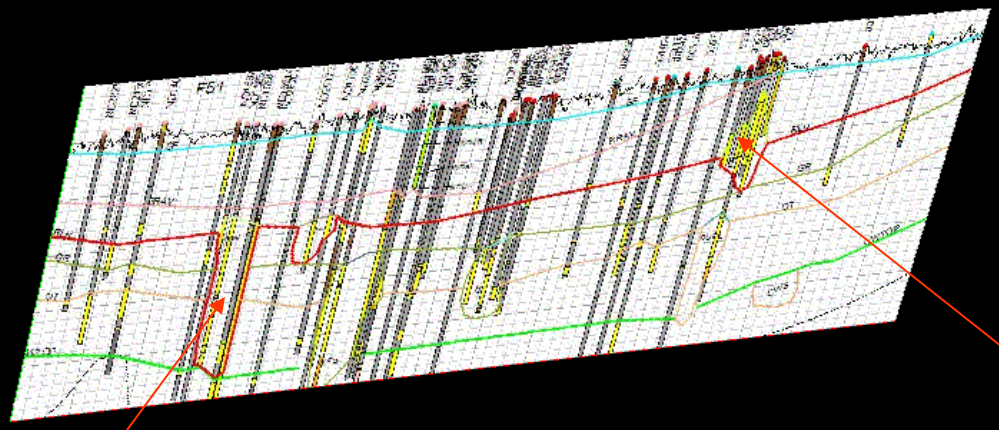
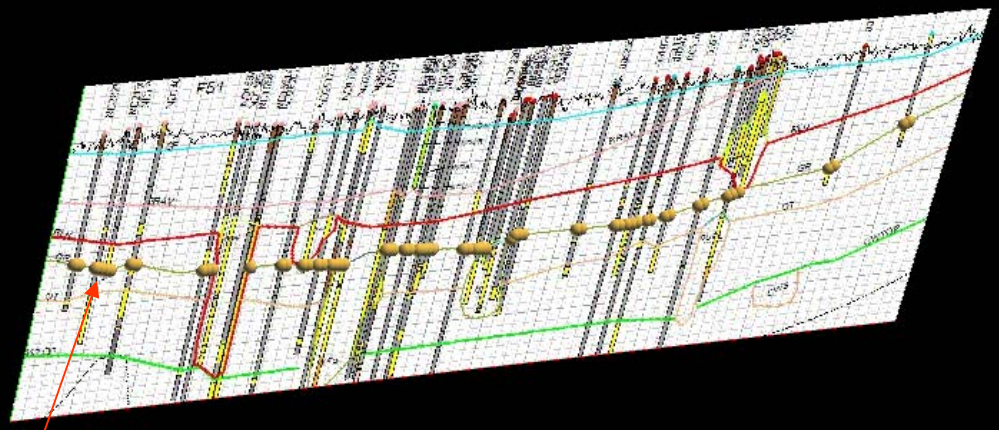
F51
SF
SF
BRAV
BRAV
RLR
RLR
GR
GR
OT
OT
HW
P
B
BUFL
WFS
CWTOP
CWTOP
CW3
Line interpretations -- ArcView 3.3



Buffalo aquifer

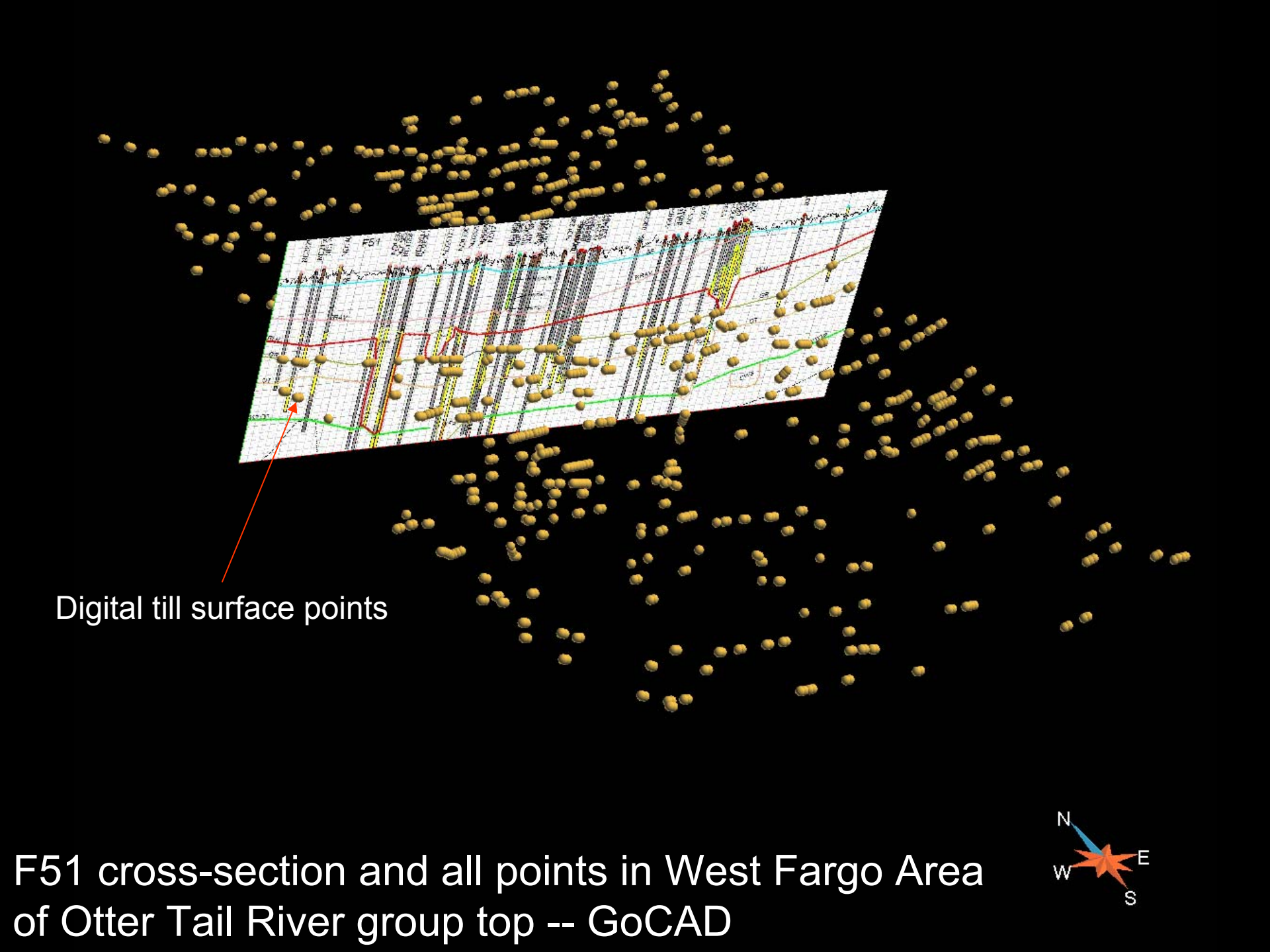
Horace aquifer

F51 cross-section -- GoCAD

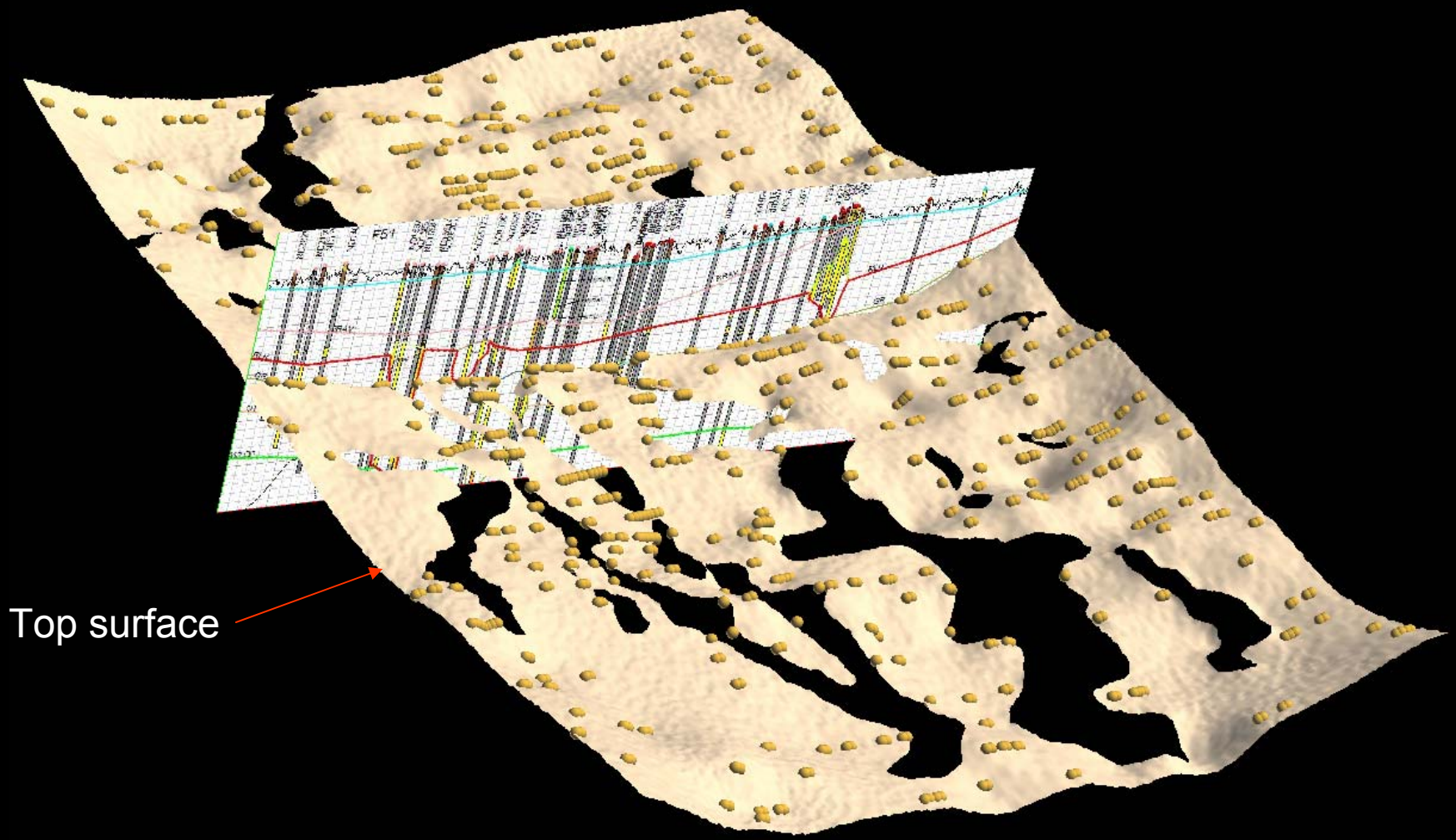


Digital till surface points

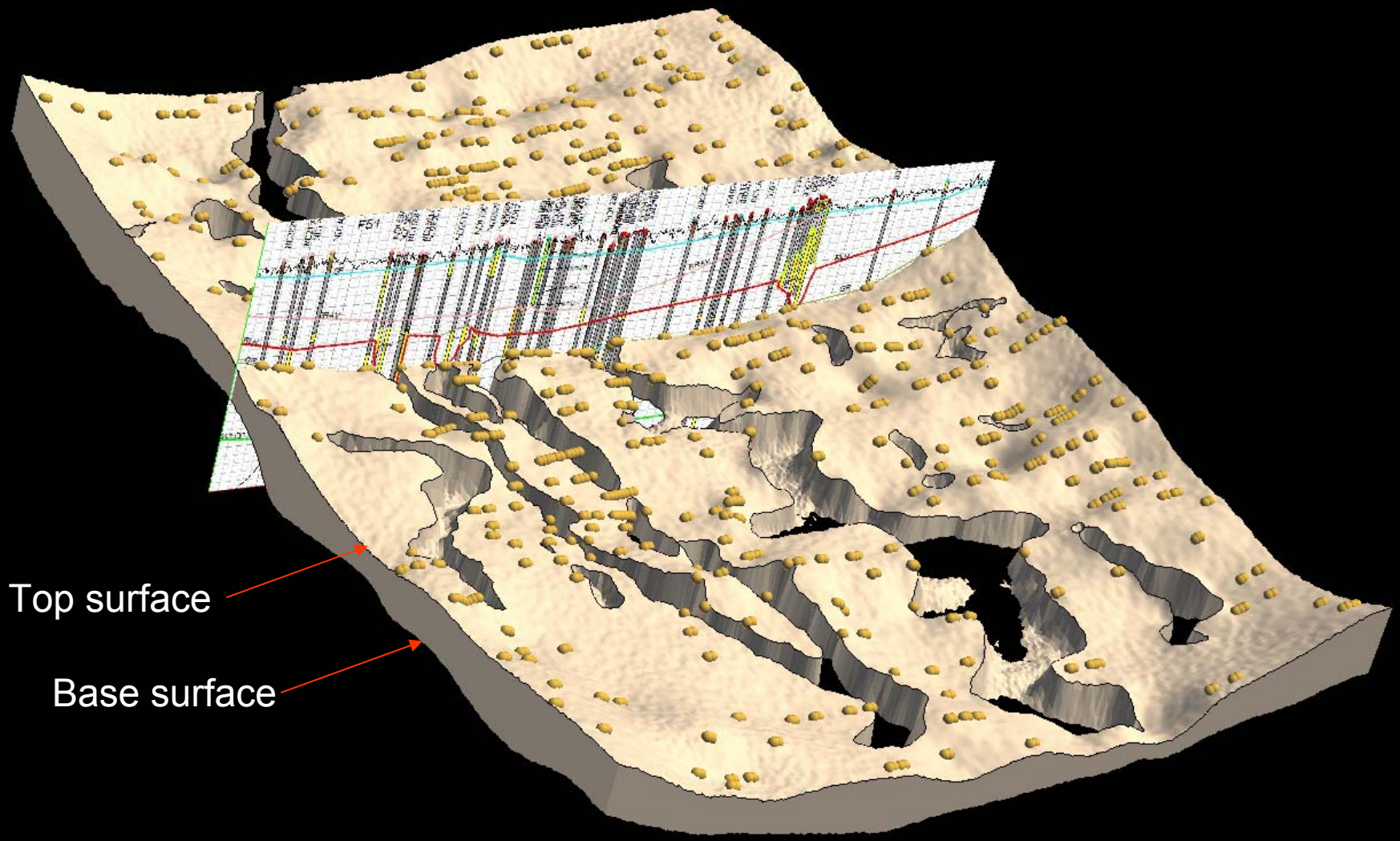
F51 cross-section and digitized points of Otter Tail River group top -- GoCAD



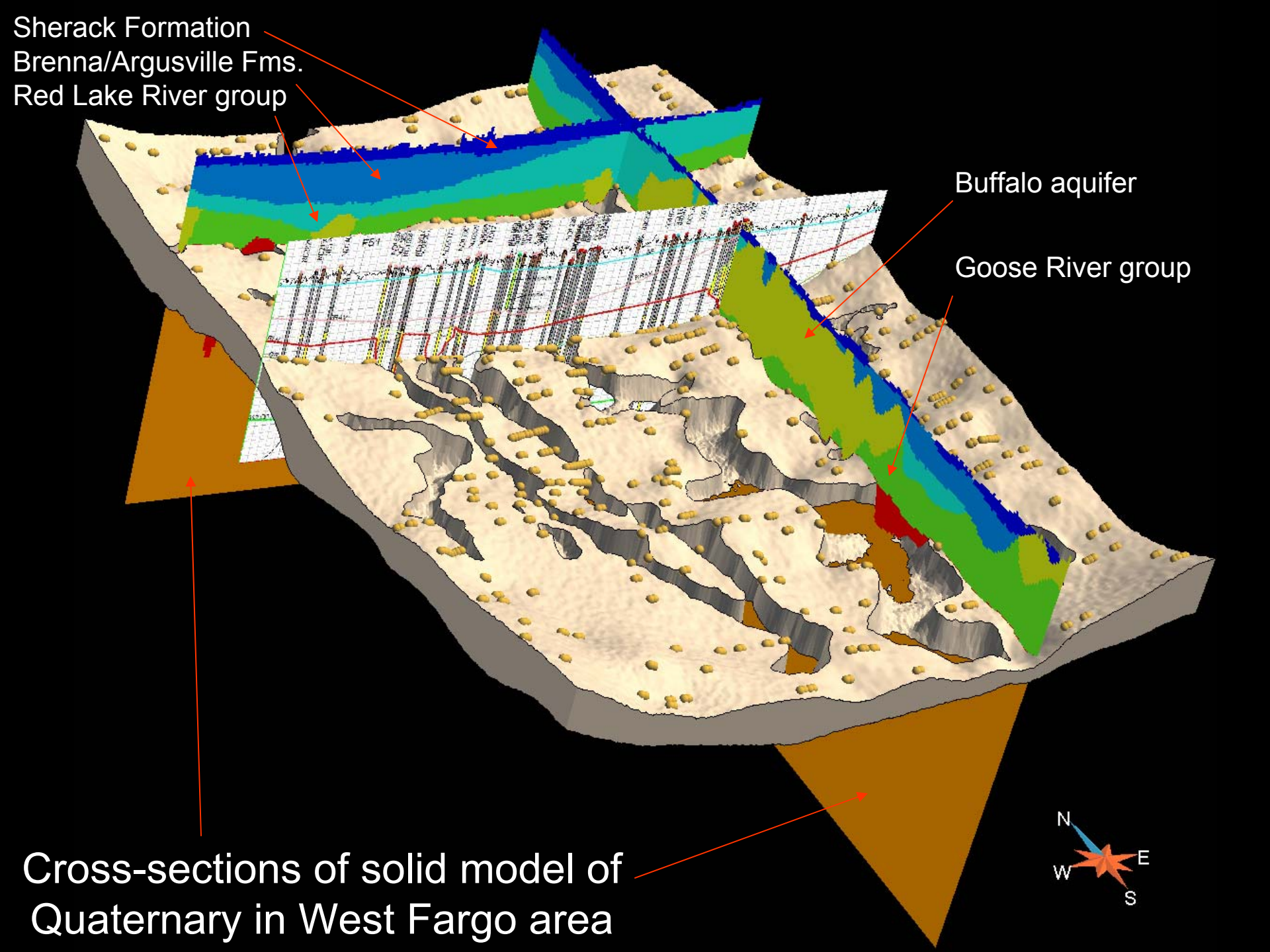
F51 cross-section and all points in West Fargo Area of Otter Tail River group top -- GoCAD



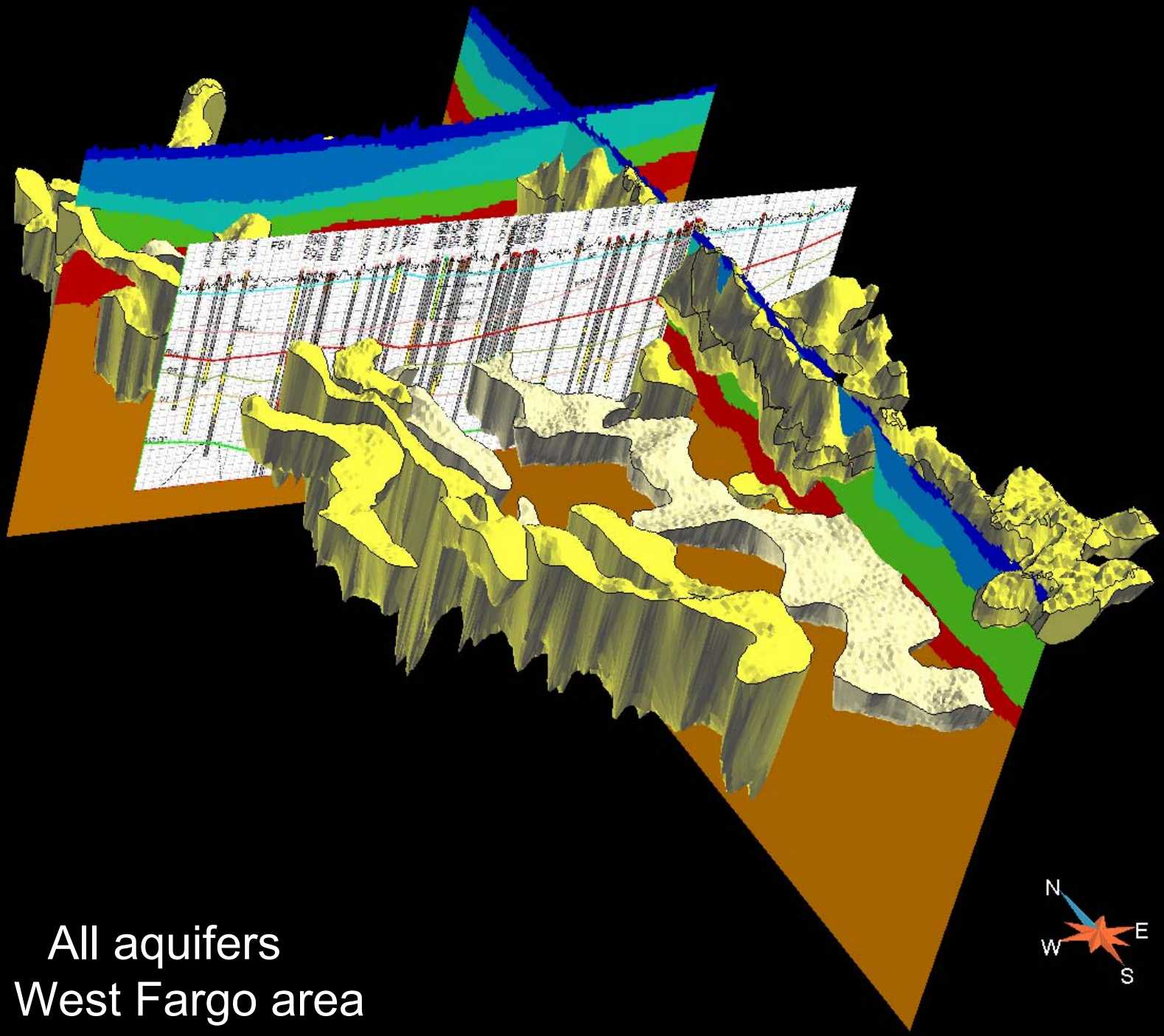
F51 cross-section, points of Otter Tail River group top and surface of Otter Tail River River group top -- GoCAD



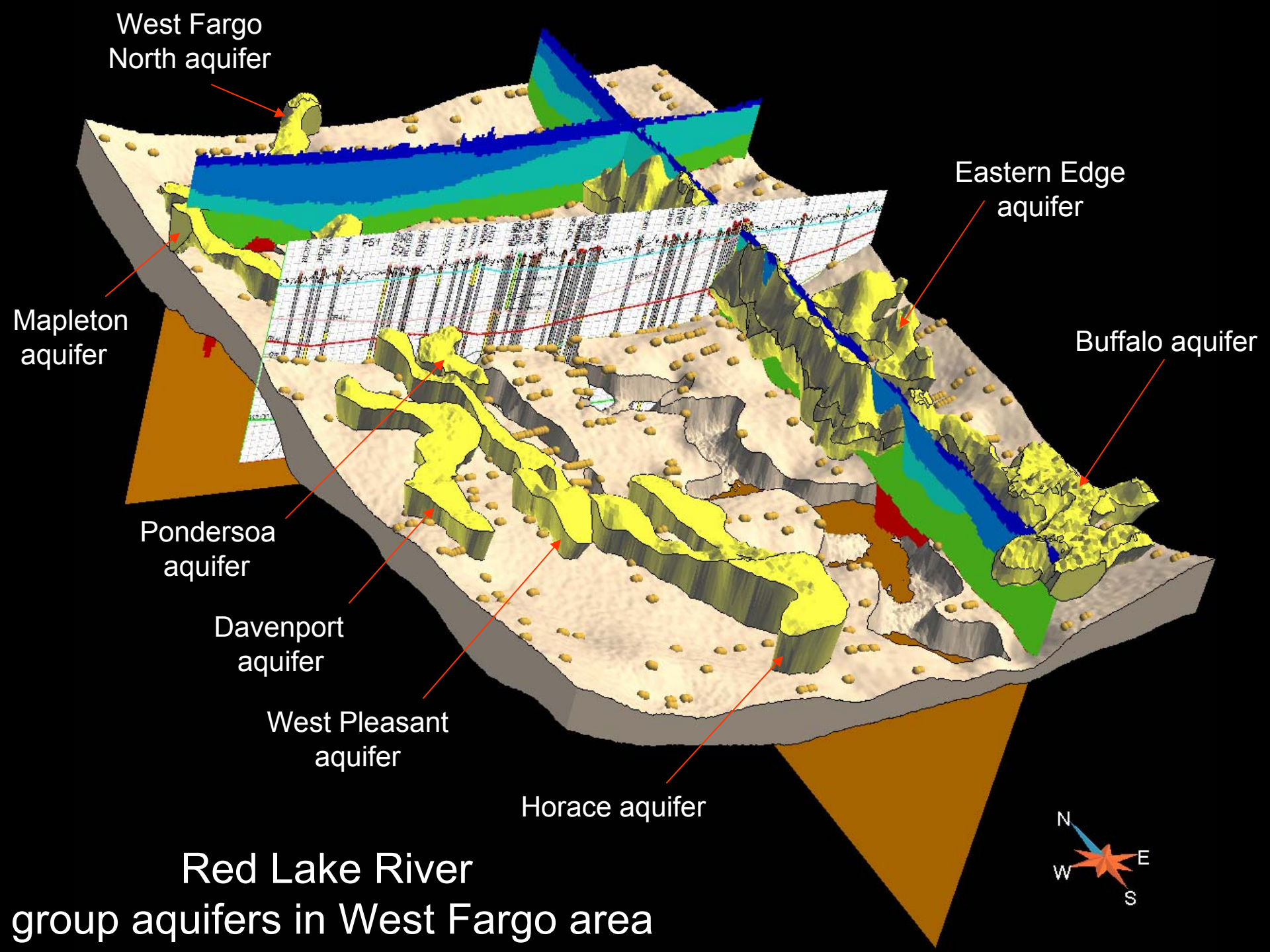
F51 cross-section, points of Otter Tail River group top and volume of Otter Tail River group -- GoCAD



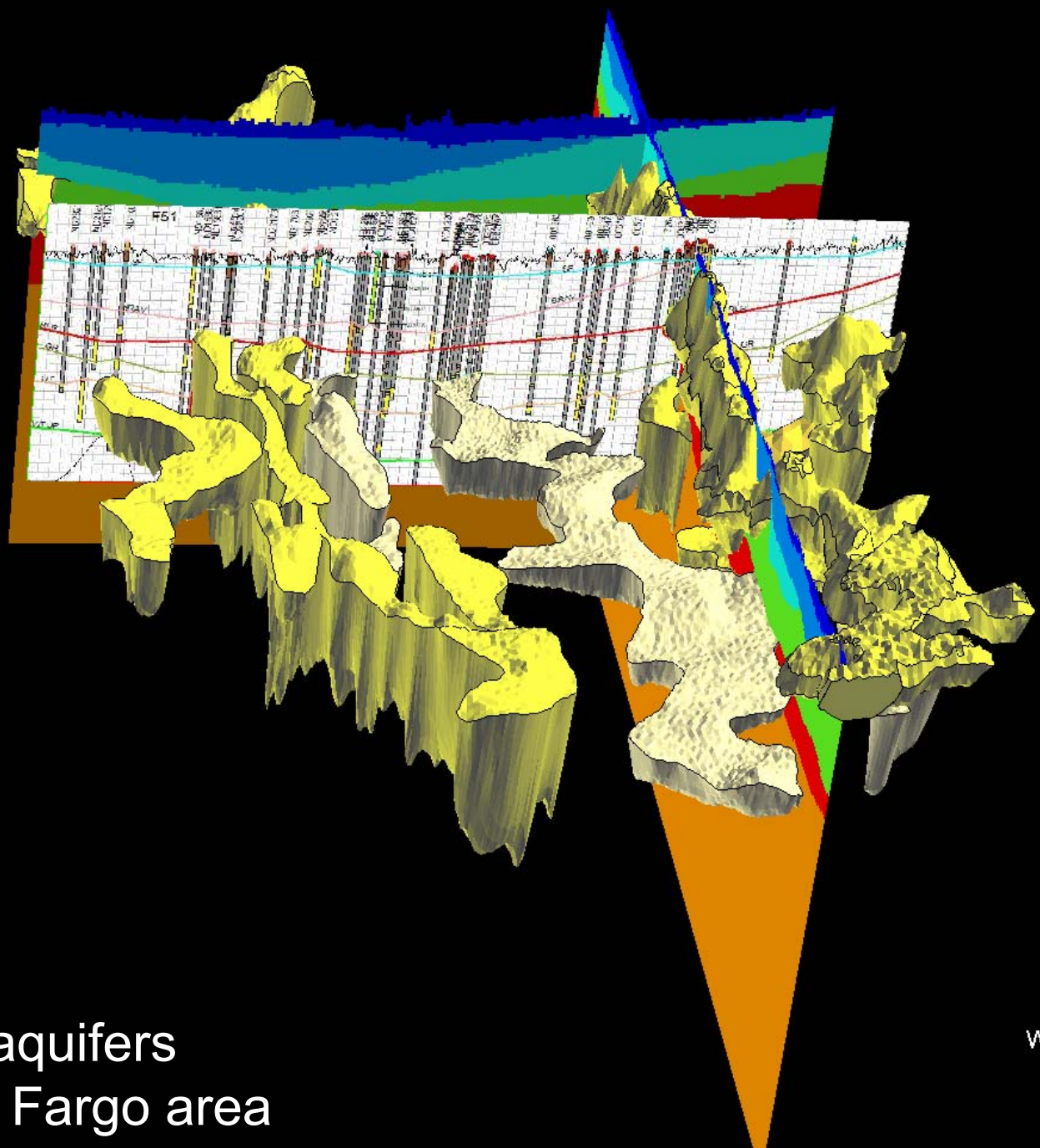
Cross-sections of solid model of Quaternary in West Fargo area



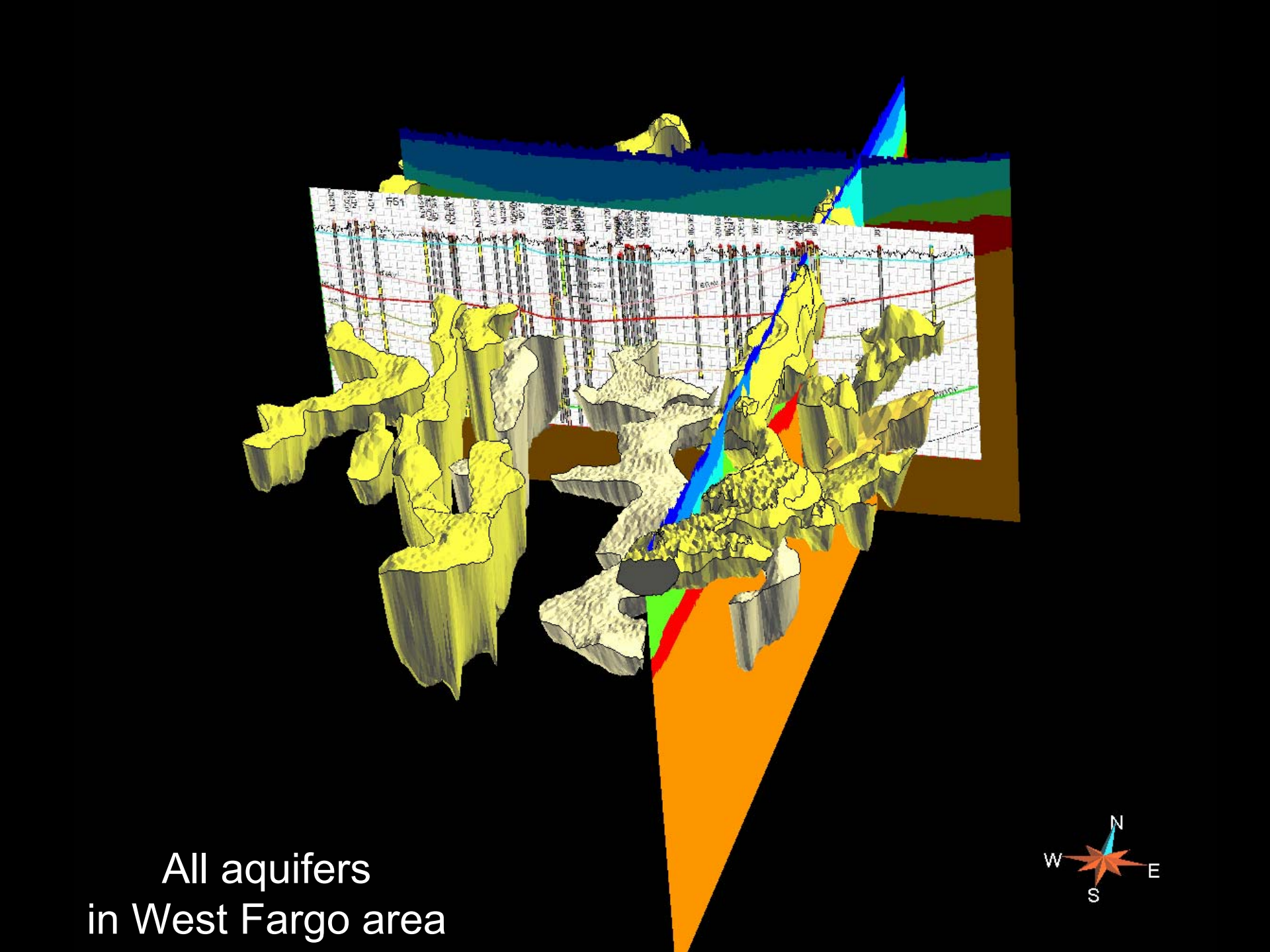
All aquifers
in West Fargo area



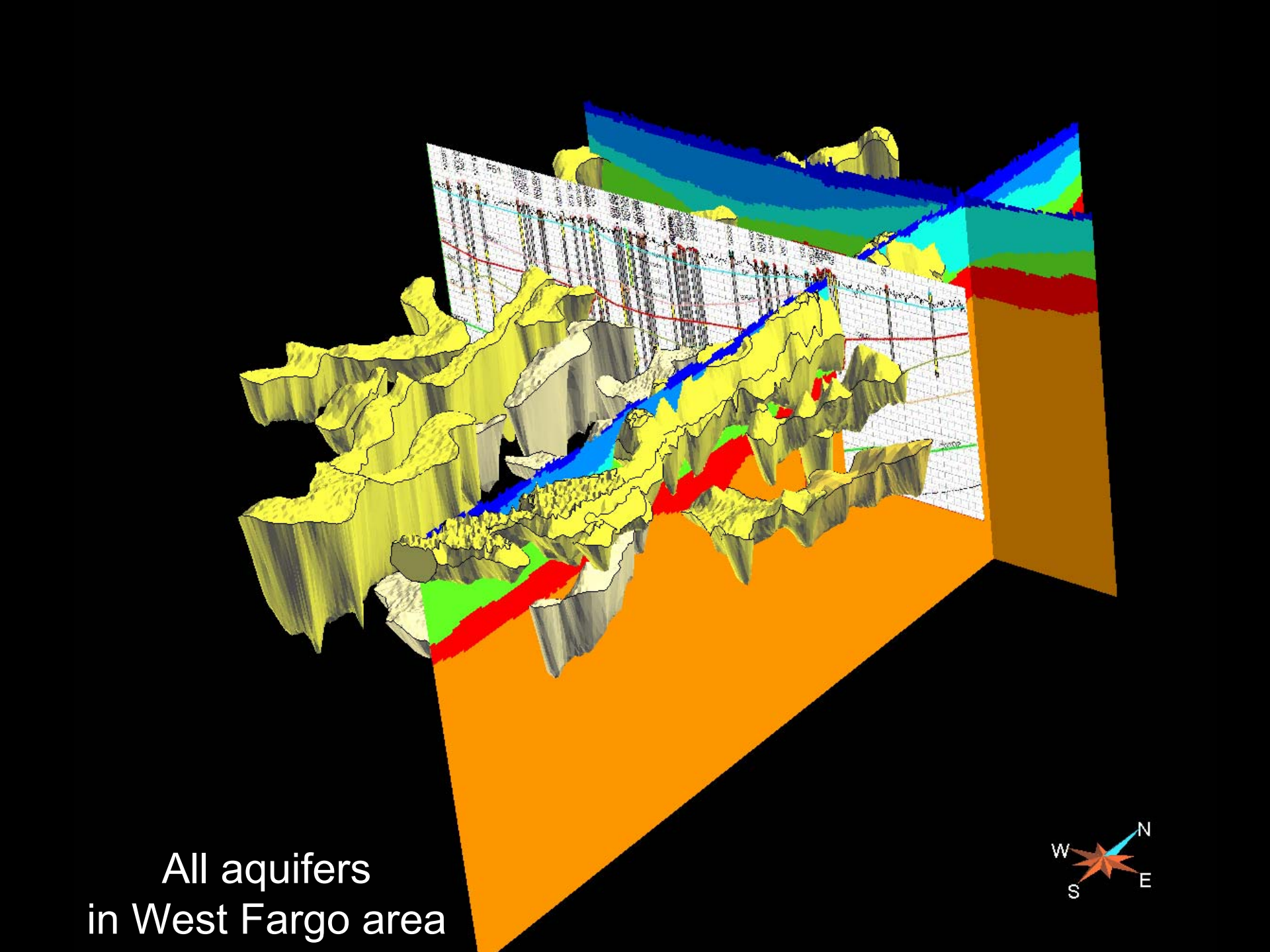
Red Lake River group aquifers in West Fargo area



All aquifers
in West Fargo area

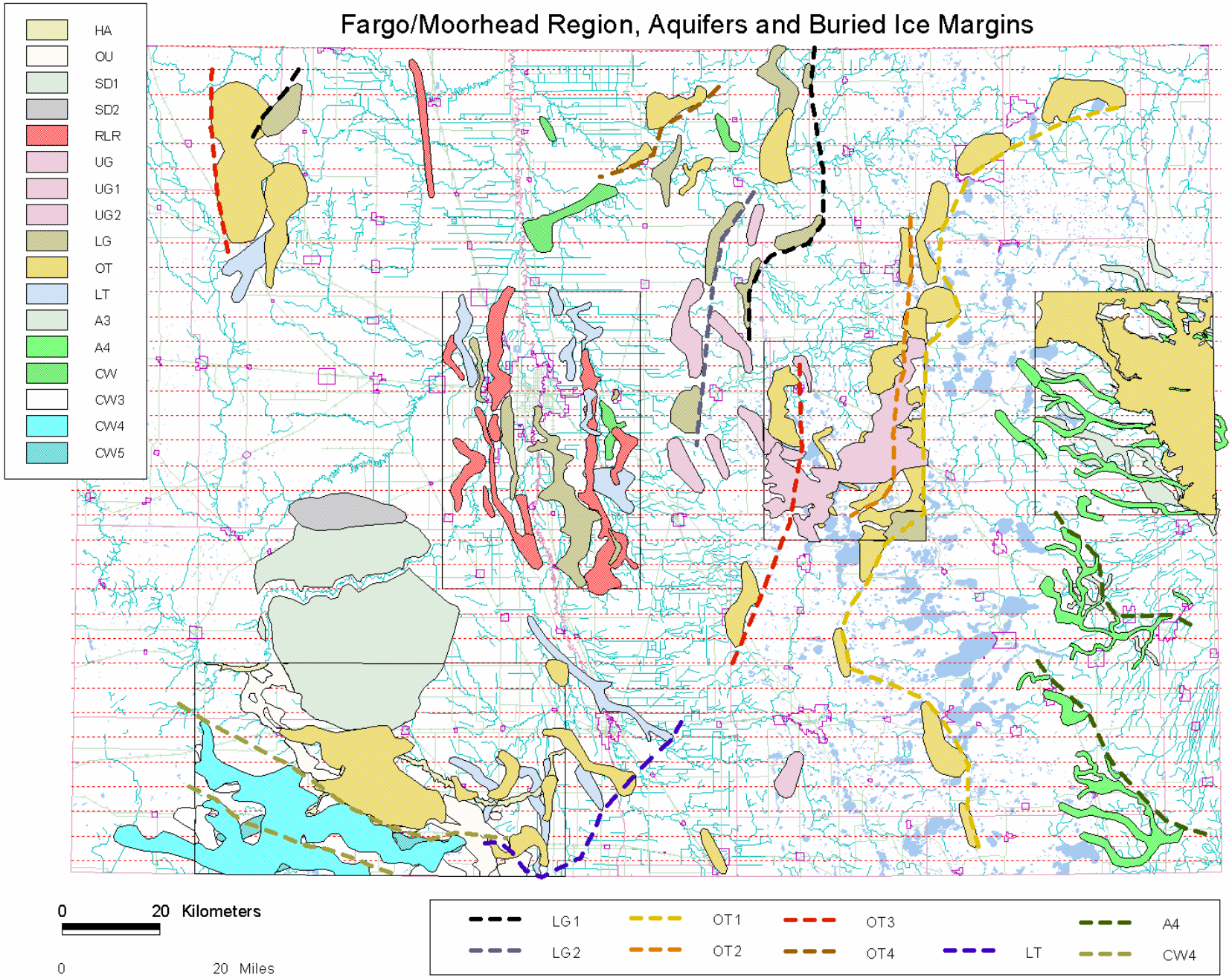


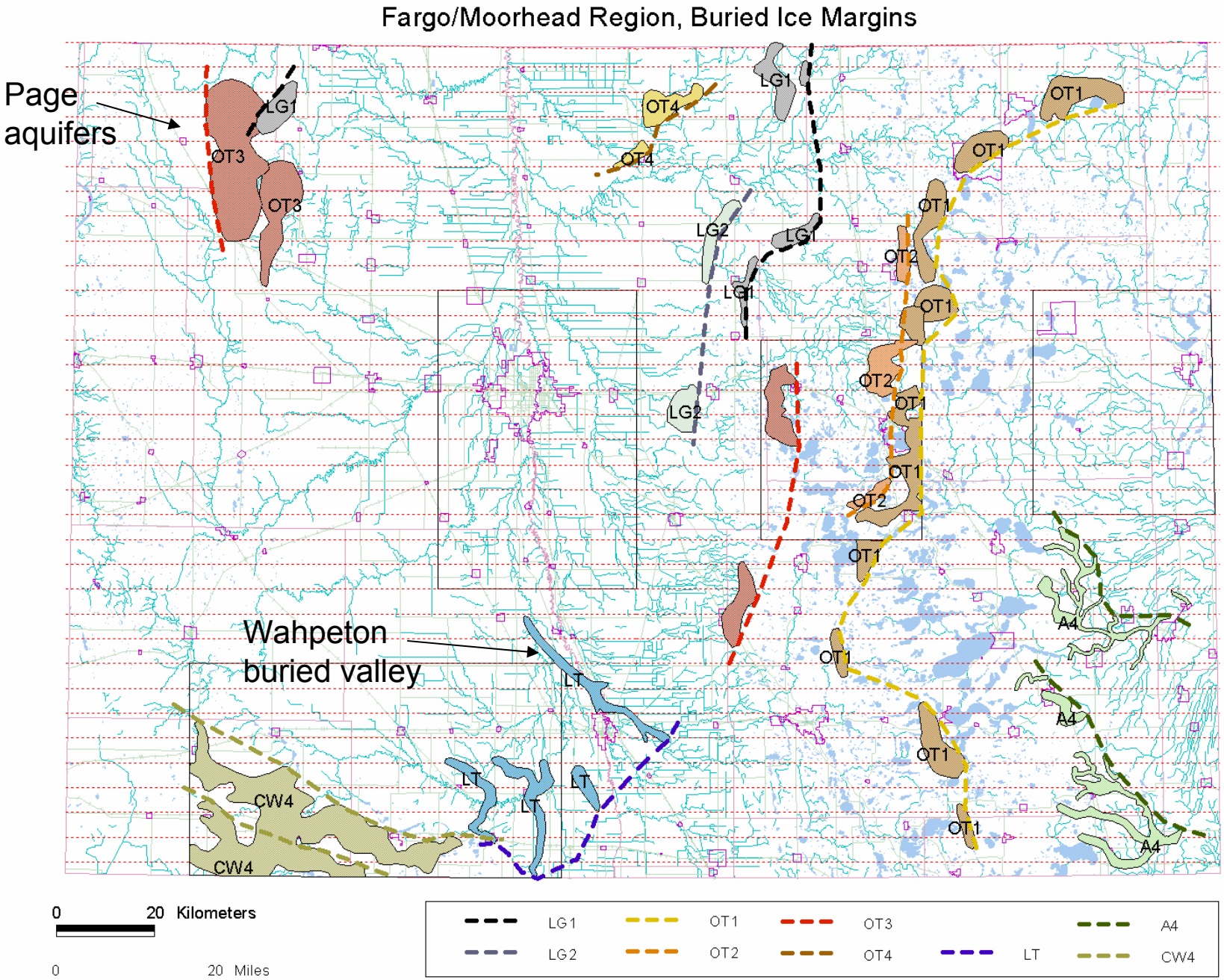
All aquifers
in West Fargo area

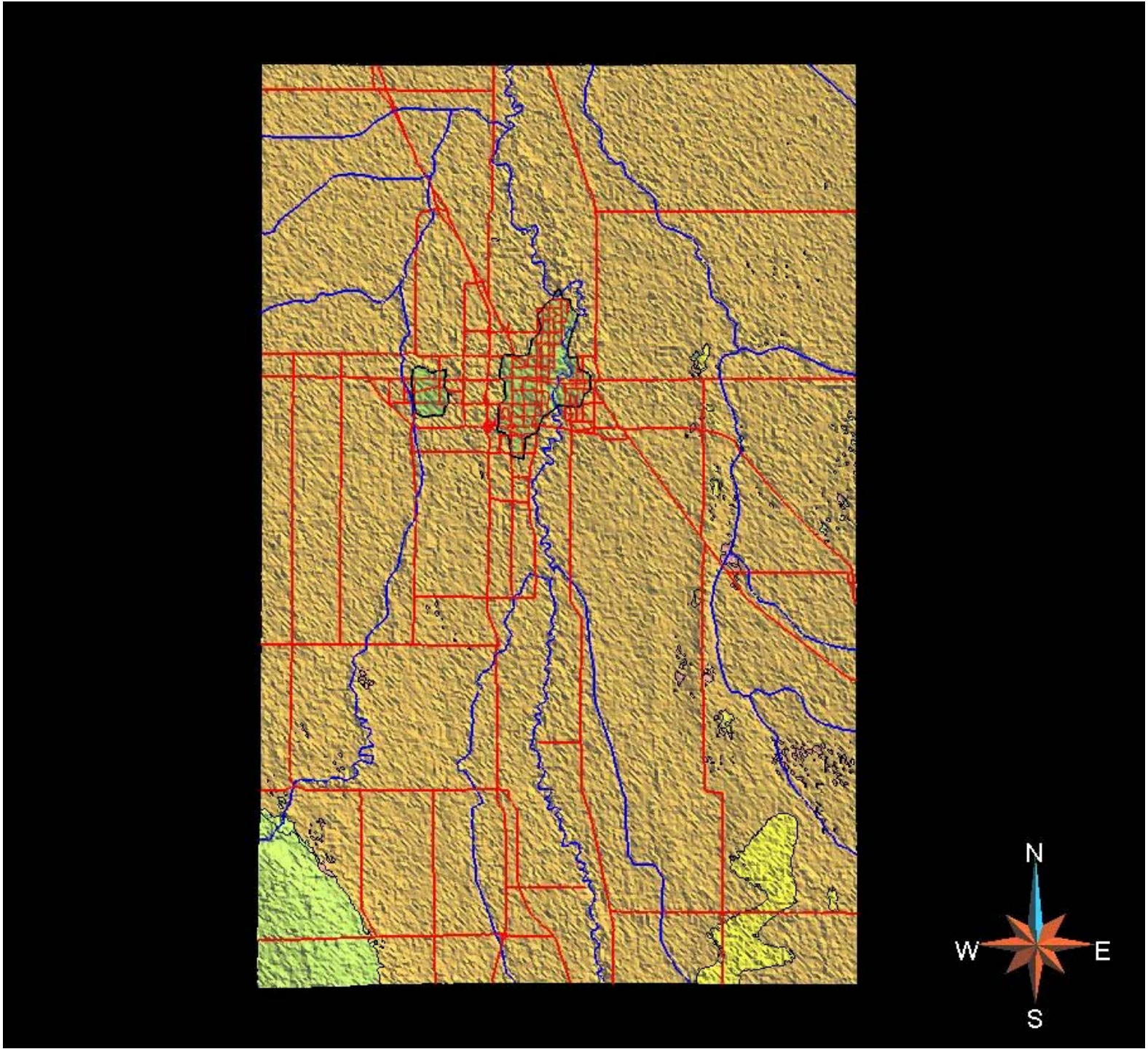


All aquifers
in West Fargo area

Fargo/Moorhead Region, Aquifers and Buried Ice Margins




Fargo/Moorhead Region, Buried Ice Margins
Page aquifers
Wahpeton buried valley
LG1
OT3
OT4
LG2
OT1
OT2
A4
LT
CW4
0 20 Kilometers
0 20 Miles


N
W
E
S

Techniques we learned:

Use batch processing and global symbolization files.

Cross sections constructed from common N-S origin line with the same bearing and regular spacing can be overlain and correlated better.

Creating digital point sets of surfaces from rectified image files in GoCAD is fast and efficient.

Value added:

Improved aquifer inventory on both sides of the border especially in Minnesota where very few buried aquifers had been mapped. Added value even in relatively well known areas.

Created 3D models with important easy to visualize relationships of geological objects (surficial vs buried aquifers, cover layers of impermeable lake clay etc.)

Began to identify buried aquifer trends and possible genetic relationships. Created foundation for future exploration.