



# SINGLE PLANNING GROUP MEETING #3

September 21, 2016  
North Platte, NE

# AGENDA

- I. Administration
- II. Platte River Hydrogeology
- III. Review and Refinement of First Increment Plan Goals
- IV. Next Steps
- V. Public Comment





# I. ADMINISTRATION

# ADMINISTRATIVE ITEMS

- Meeting Purpose
- Lunch plans
- Follow-up Items





## **II. PLATTE RIVER HYDROGEOLOGY**

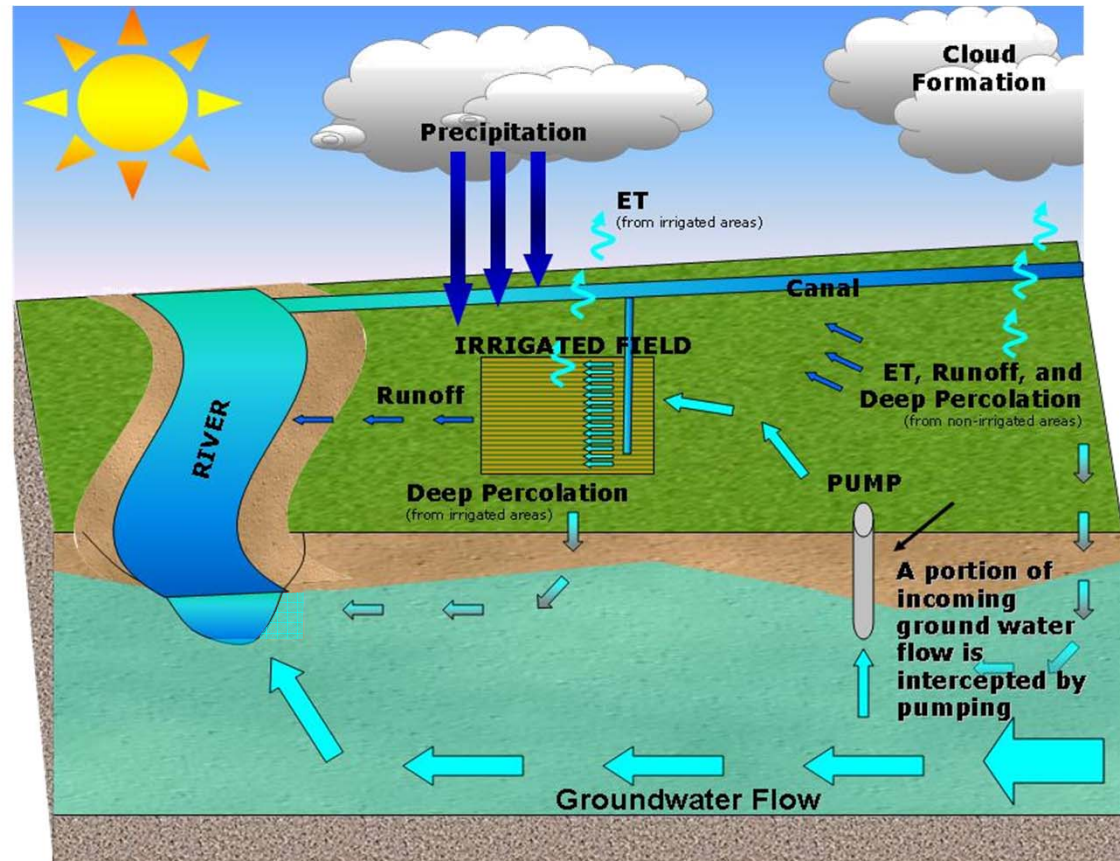
# PLATTE RIVER HYDROGEOLOGY

- I. Hydrogeology 101
- II. Platte River Hydrogeology
- III. COHYST background
- IV. Current modeling efforts

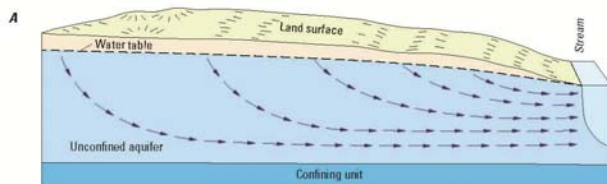


# HYDROGEOLOGY 101

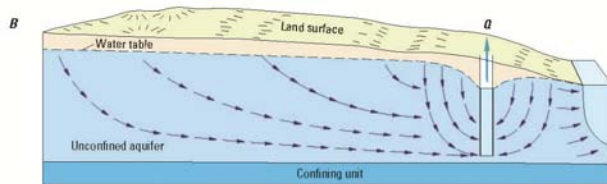
- Typical elements of ground and surface water budgets



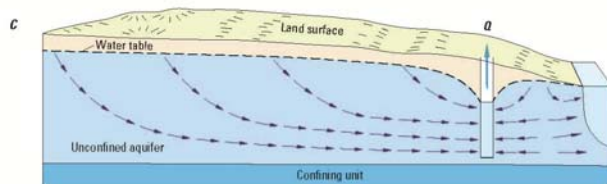
# HYDROGEOLOGY 101



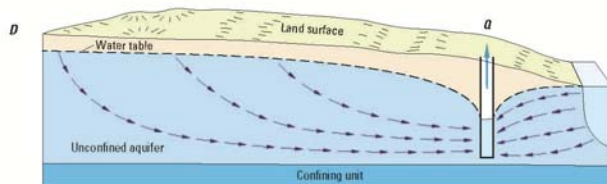
A. Pre-development Conditions



B. Pumping from aquifer storage



C. Interception of groundwater baseflow

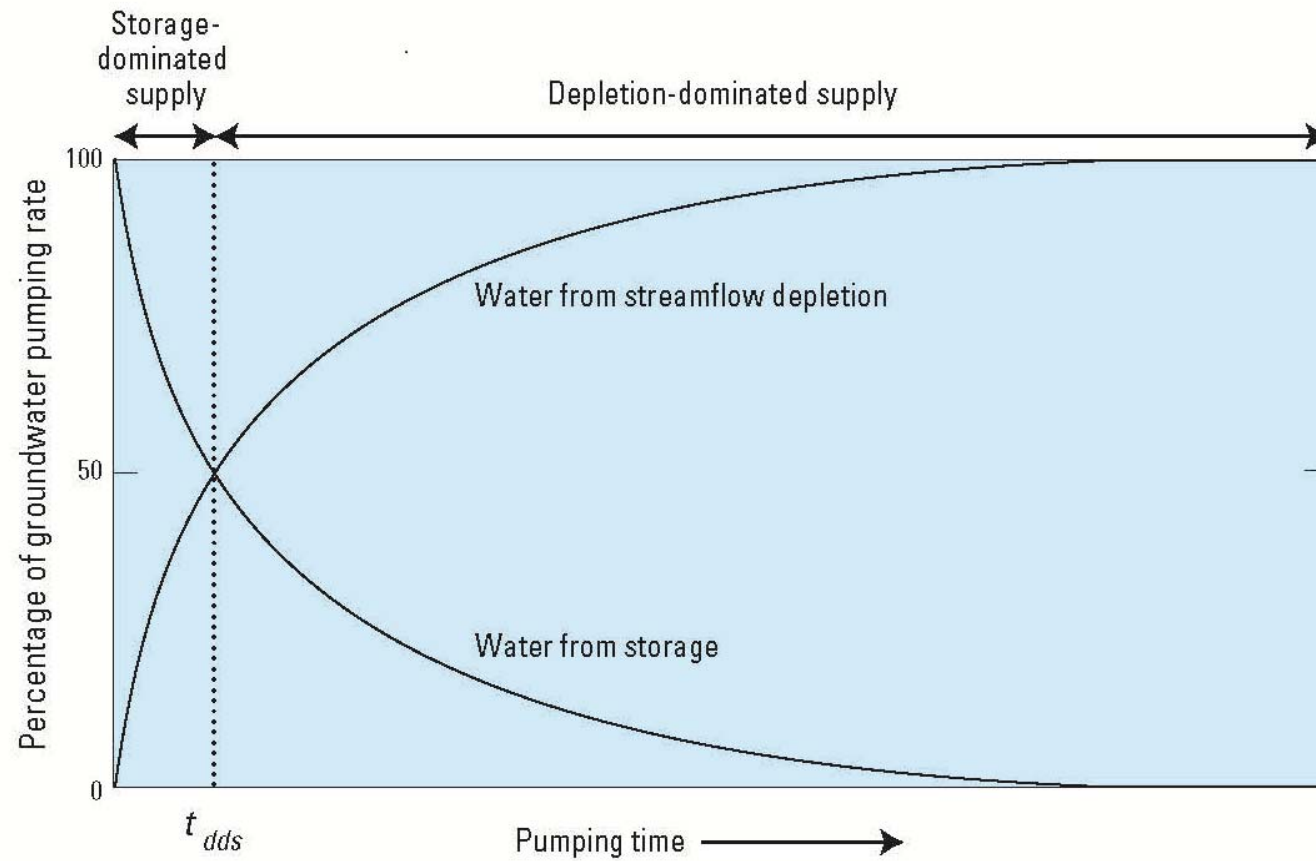


D. Interception of groundwater baseflow and induced infiltration





# HYDROGEOLOGY 101



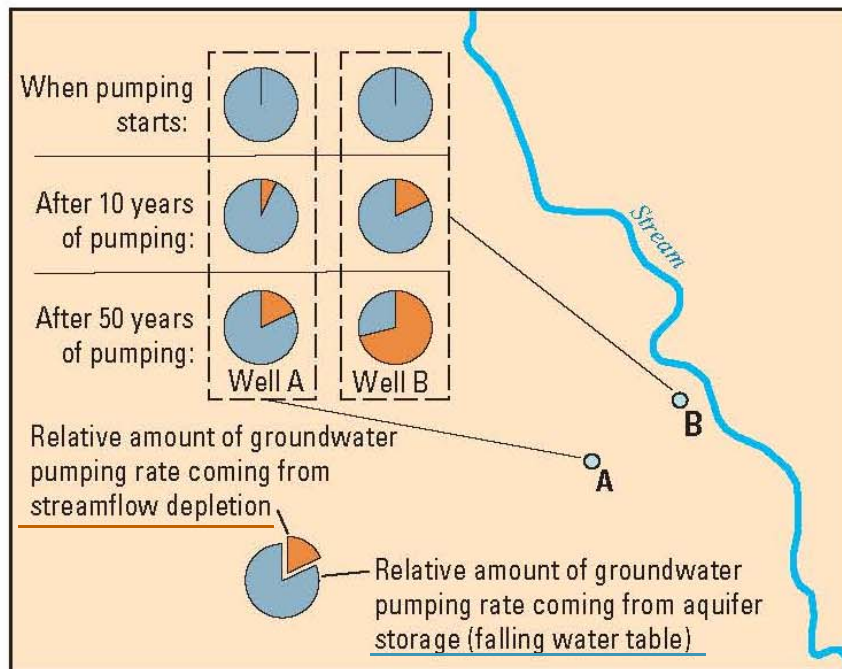
# HYDROGEOLOGY 101

- Factors that affect timing, rates, and locations of streamflow depletion:
  - Geology and Hydraulic Properties of Aquifer
  - Aquifer Size/Volume
  - Geometry of the Surface Water Streams
  - Well location (Vertical and Horizontal Distance from streams)
  - Pumping Rates and Operational Characteristics

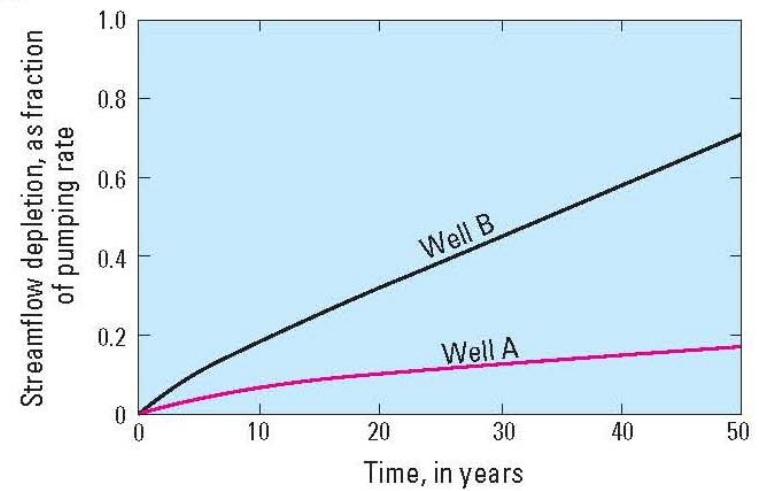


# HYDROGEOLOGY 101

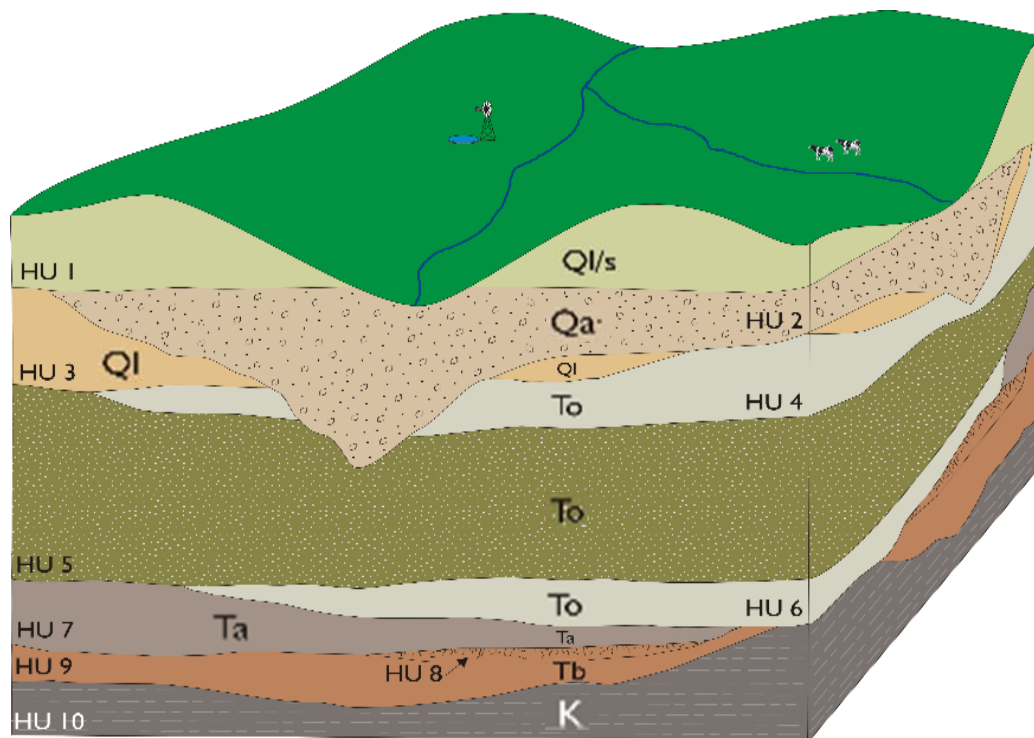
**A**



**B**

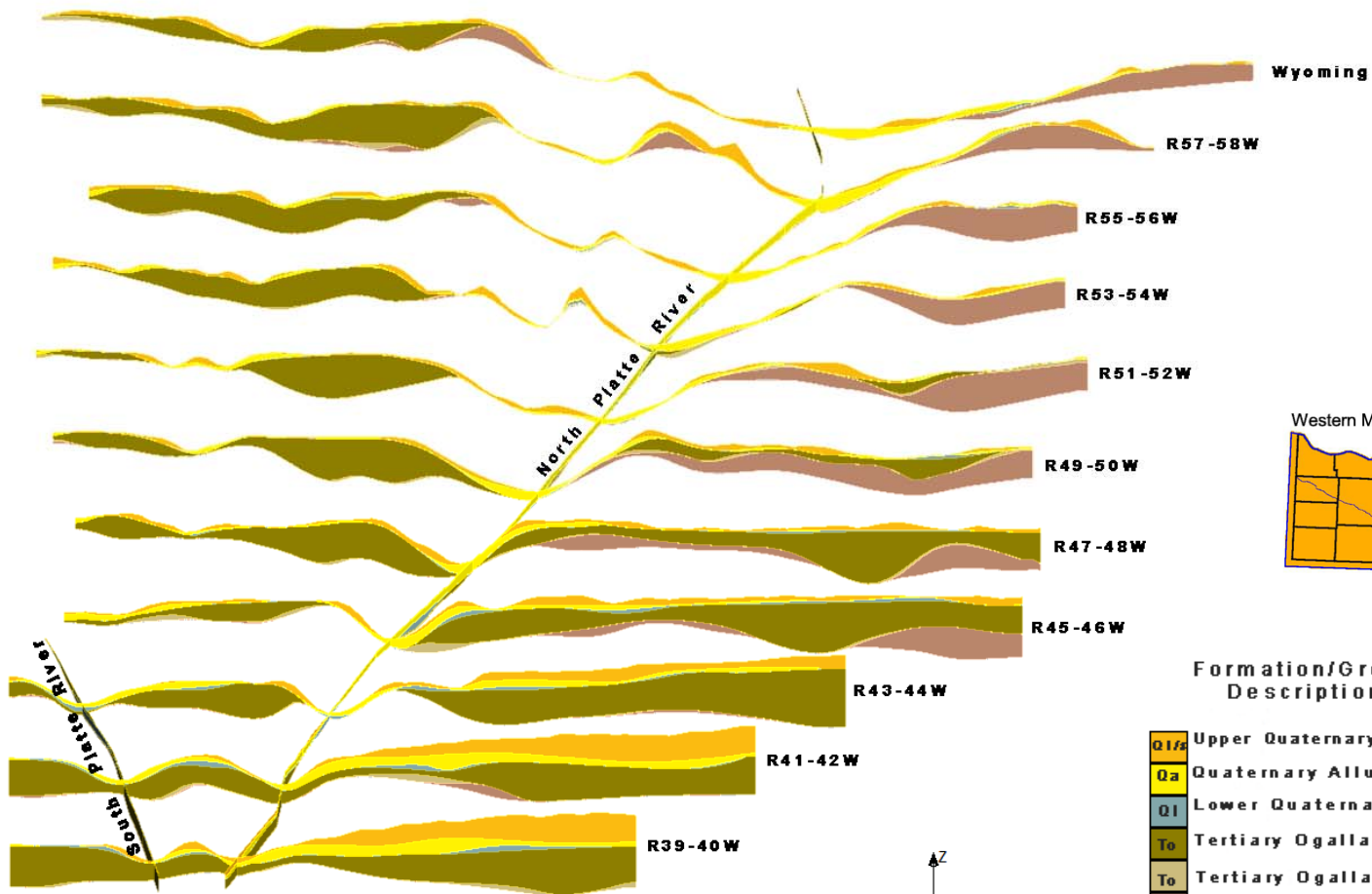


# PLATTE RIVER HYDROGEOLOGY

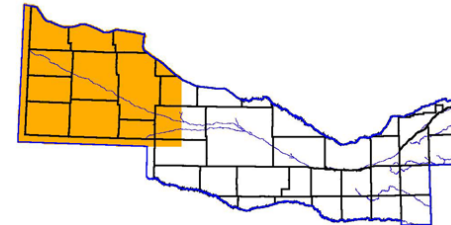


## Formation/Group Description

- |     |      |                                                            |
|-----|------|------------------------------------------------------------|
| 1   | Ql/s | Upper Quaternary Fines (Loess or Dune Sand)                |
| 2   | Qa   | Quaternary Alluvial/ Valley Fill Deposits                  |
| 3   | Ql   | Lower Quaternary Fines (Loess/Silt)                        |
| 4,6 | To   | Tertiary Ogallala Group Silts/Siltstones                   |
| 5   | To   | Tertiary Ogallala Group Sands/Sandstones                   |
| 7   | Ta   | Tertiary Arikaree Group Sandstones/Siltstones              |
| 8   | Tb   | Tertiary White River Group Fractured Brule Fm. Siltstones  |
| 9   | Tb   | Tertiary White River Group Brule Fm. Siltstones/Sandstones |
| 10  | K    | Undifferentiated Cretaceous Units - (Base of Aquifer)      |



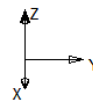
Western Model Area

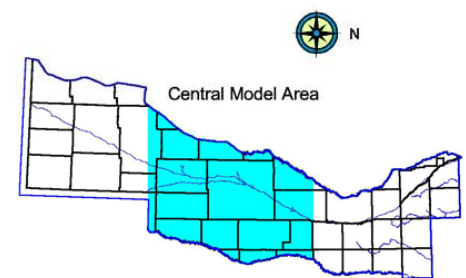
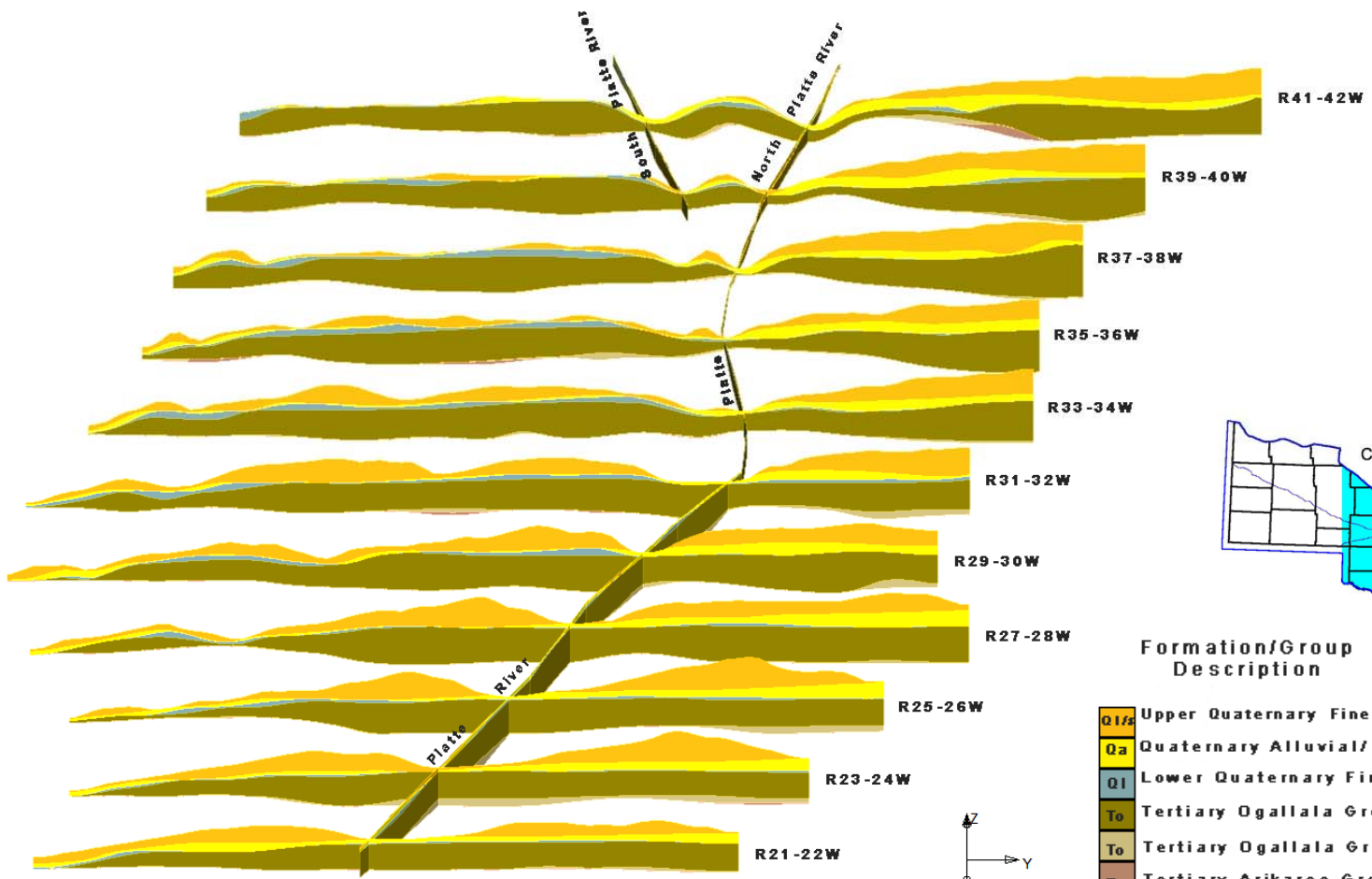


**Formation/Group Description**

Q1/s	Upper Quaternary Fines (Loess or Dune Sand)
Qa	Quaternary Alluvial/ Valley Fill
Q1	Lower Quaternary Fines (Loess/Silt)
To	Tertiary Ogallala Group Sands/Sandstones
To	Tertiary Ogallala Group Silts/Siltstones
Ta	Tertiary Arikaree Group Sandstones/Siltstones
	Base of Aquifer
	Tertiary White Group
	Brule Fm or Cretaceous

Note: Y is North South Direction. Left side south- right side of page North.  
 X is East West direction. Bottom of page is East & Top of page is West.  
 Z is thickness of Hydrostratigraphic Unit in feet using a scale factor of 1 to 50 feet.  
**R39-40W means the cross section represents a North-South line between Range 39 West and Range 40 West.**

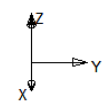


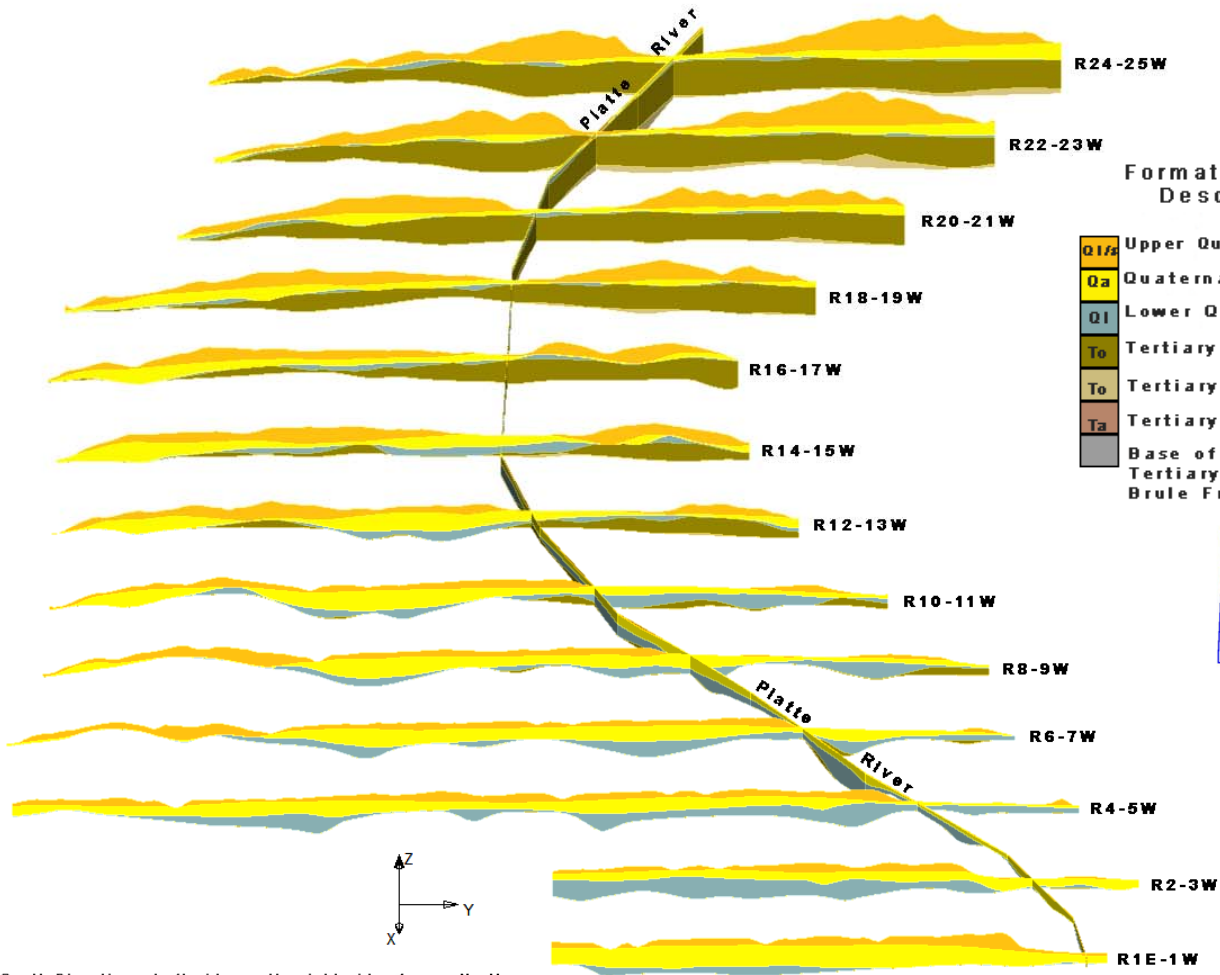


**Formation/Group Description**

Q1u	Upper Quaternary Fines (Loess or Dune Sand)
Qa	Quaternary Alluvial/ Valley Fill
Ql	Lower Quaternary Fines (Loess/Silt)
To	Tertiary Ogallala Group Sands/Sandstones
To	Tertiary Ogallala Group Silts/Siltstones
Ta	Tertiary Arikaree Group Sandstones/Siltstones
Grey	Base of Aquifer
	Tertiary White Group
	Brule Fm or Cretaceous

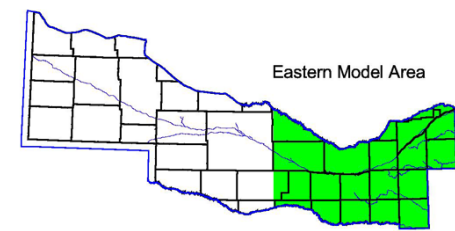
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 R21- 22W means the cross section represents a North-South line between Range 21 West and Range 22 West.





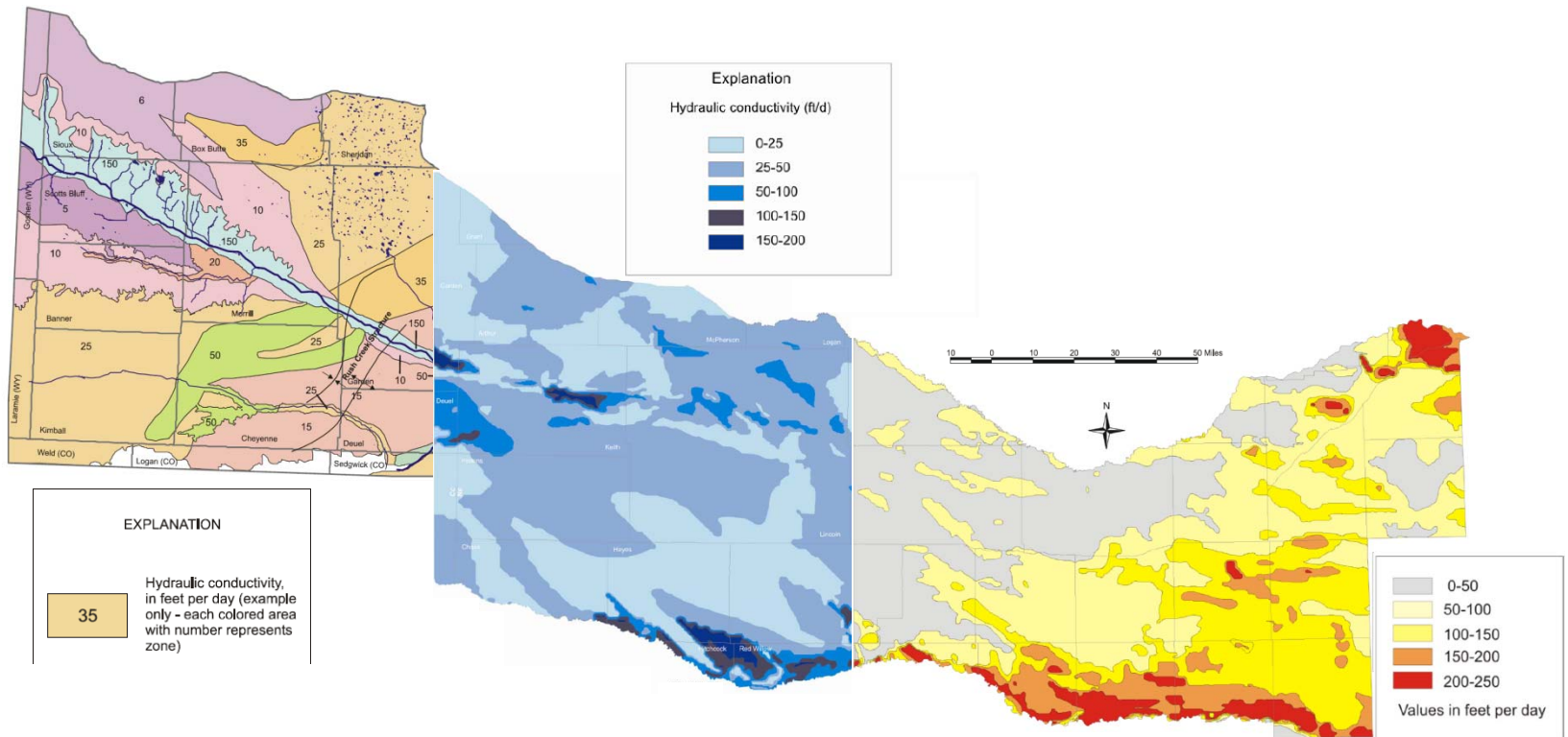
**Formation/Group Description**

- Q1/a Upper Quaternary Fines (Loess or Dune Sand)
- Qa Quaternary Alluvial/ Valley Fill
- Ql Lower Quaternary Fines (Loess/Silt)
- To Tertiary Ogallala Group Sands/Sandstones
- To Tertiary Ogallala Group Silts/Siltstones
- Ta Tertiary Arikaree Group Sandstones/Siltstones
- Base of Aquifer
- Tertiary White Group
- Brule Fm or Cretaceous



Y is North South Direction. Left side south- right side of page North.  
 X is East West direction. Bottom of page is East & Top of page is West.  
 Z is thickness of Hydrostratigraphic Unit in feet using a scale factor of 1 to 50 feet.  
**R2-3W means the cross section represents a North-South line between Range 2 West and Range 3 West**

# Saturated Thickness-Weighted Average Hydraulic Conductivity in COHYST Area – Spatial Distribution





# COHYST Boundary Overlaid on Nebraska 1995 Water Table Contour Map with Surface Water Features

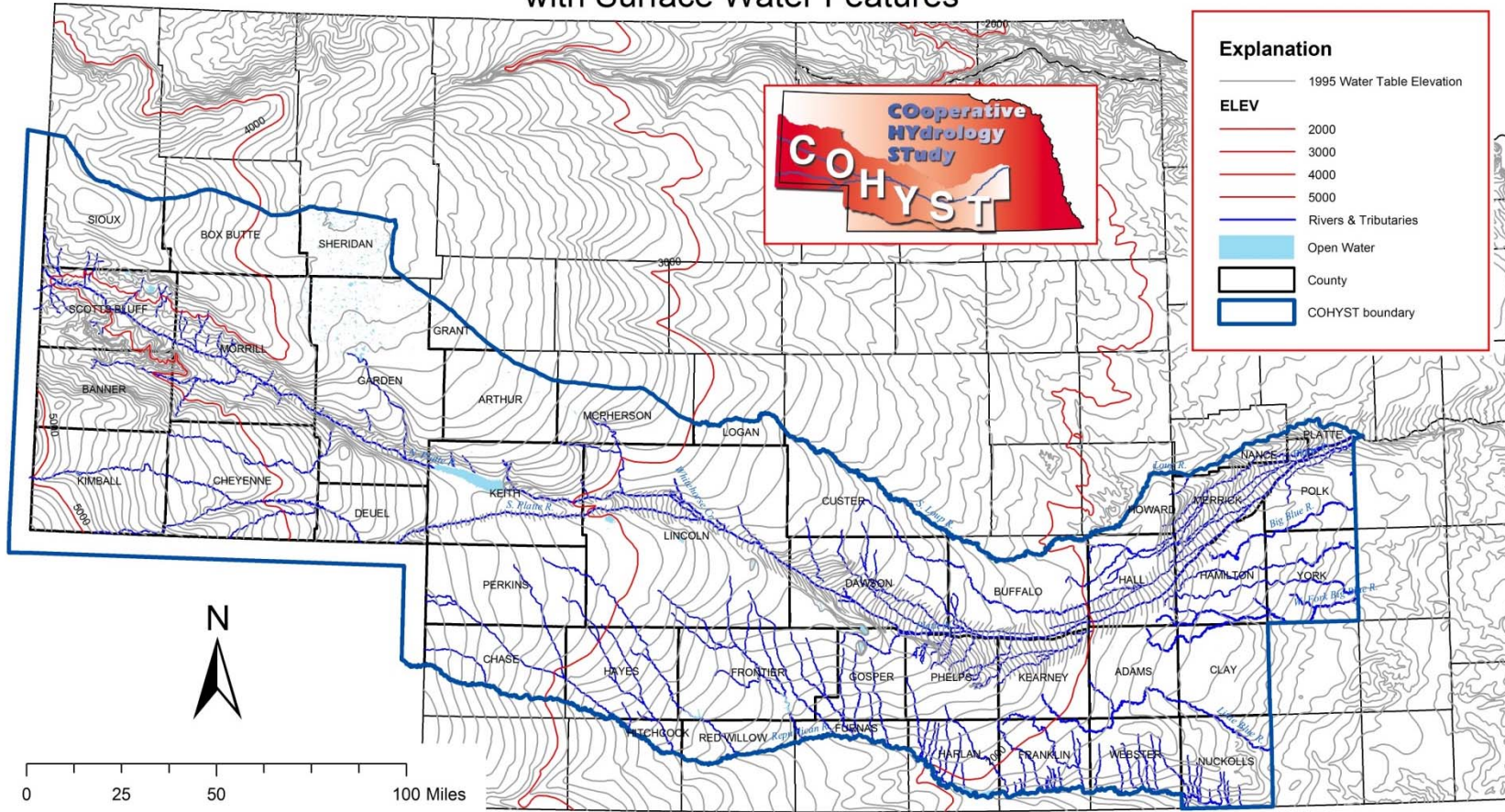


Figure 1. COHYST Boundaries established by Groundwater Divides and River Systems

## Active Irrigation Wells in COHYST Area thru June 2001

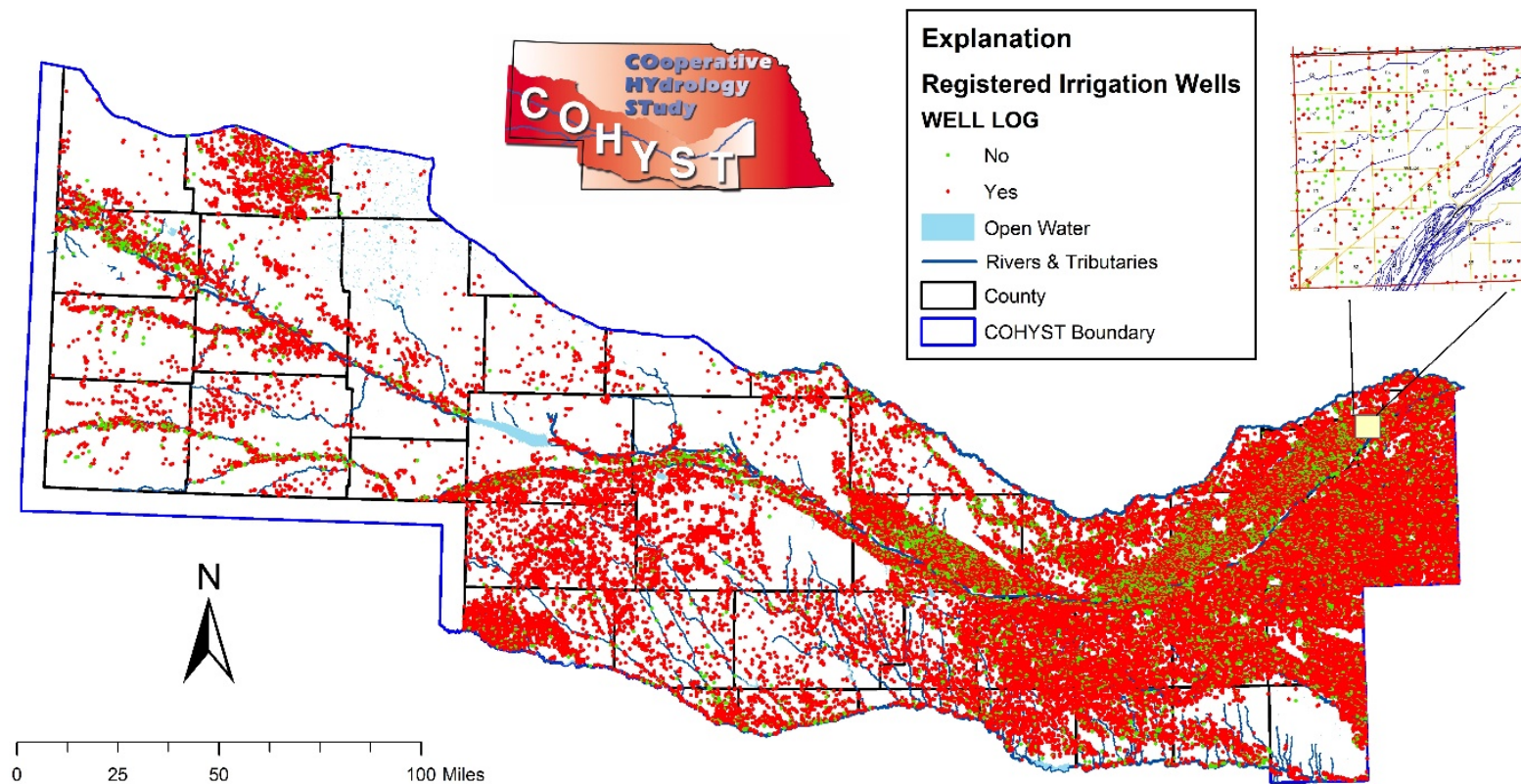


Figure 16. Registered Irrigation Wells with Lithologic Logs some of which were selected to develop Hydrostratigraphic Units

# PLATTE RIVER HYDROGEOLOGY

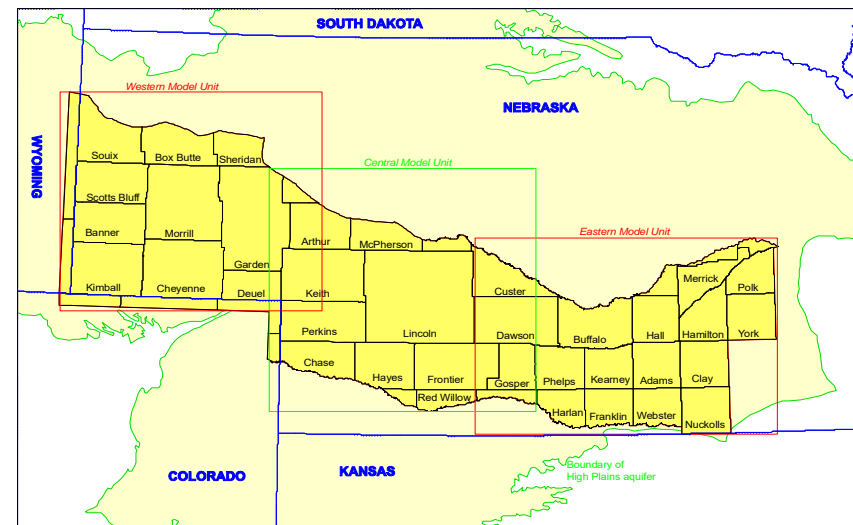
- Summary
  - High Plains Aquifer – Layer-Cake Geology / Generally Flat-Lying / Oldest at Bottom
    - Fluvial Deposits Comprise the Aquifer System
    - Hydraulic properties Vary Spatially along the Platte River Corridor (COHYST Area)
      - » Arikaree in Northwest; Ogallala in West/Central; Quaternary Deposits in Central/East
    - Bounded Beneath by Low Conductivity Shale/Chalk/Silt (Cretaceous/Tertiary)
  - Hydrogeologic Properties & Thickness/Volume Control:
    - Magnitude/Timing of Impacts from Pumping & Changes in Land Use/Climate
    - Saturated Thickness-weighted Average Conductivity = ~0 to 250 feet per day

# COHYST

- To predict, evaluate, and ultimately manage water resources in the Platte Basin requires essentially two elements:
  - Water supplies and uses (water budget terms)
  - Aquifer response and aquifer/stream interaction (timing)
- This is where modeling comes in....
  - Approximation of real world conditions (with reasonable assumptions and limitations)
  - Tool that enhances understanding and can be used in evaluations

# COHYST

- Started in 1998
- Goal: Develop scientifically supportable hydrologic databases, analyses, models and other information to assist in management of area's water resources
- Study area covers 29,300 sq. miles
  - Stateline to Columbus, NE
  - Republican River to the South
  - South Loup/Loup River to the North



# COHYST

- Objectives (from 1998 COHYST Workplan):
  - Collect existing data and models and place data into an appropriate database
  - Review existing data and models to identify data gaps
  - Collect supplemental data as necessary to be added to the database
  - Develop linked, regional models to cover the Platte basin in Nebraska above Columbus
  - Establish credibility of the data, database, and models
  - Design and develop a geographical (graphical?) user interface and GIS-based Internet link to the data and models
  - Put models to use in accomplishing purposes - management of area's water resources



# COHYST

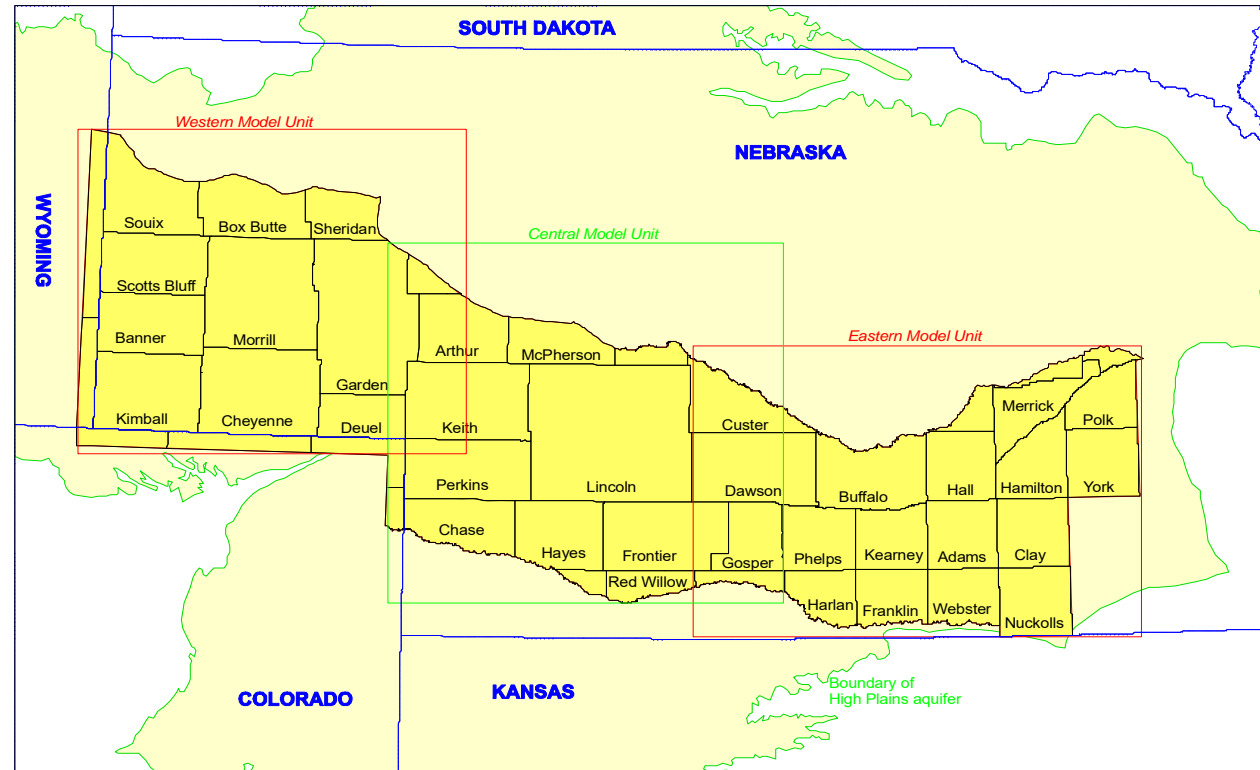
- Databases include:

Geology	Aquifer Properties
Pump test data	Topography
Water table information	Stream flow
Soils	Land Use
Climate	Consumptive uses
Groundwater recharge	Runoff
Groundwater pumping	Canal seepage
Stream reach gains and losses	



# COHYST

- MODFLOW groundwater model developed
  - Western Unit
  - Central Unit
  - Eastern Unit

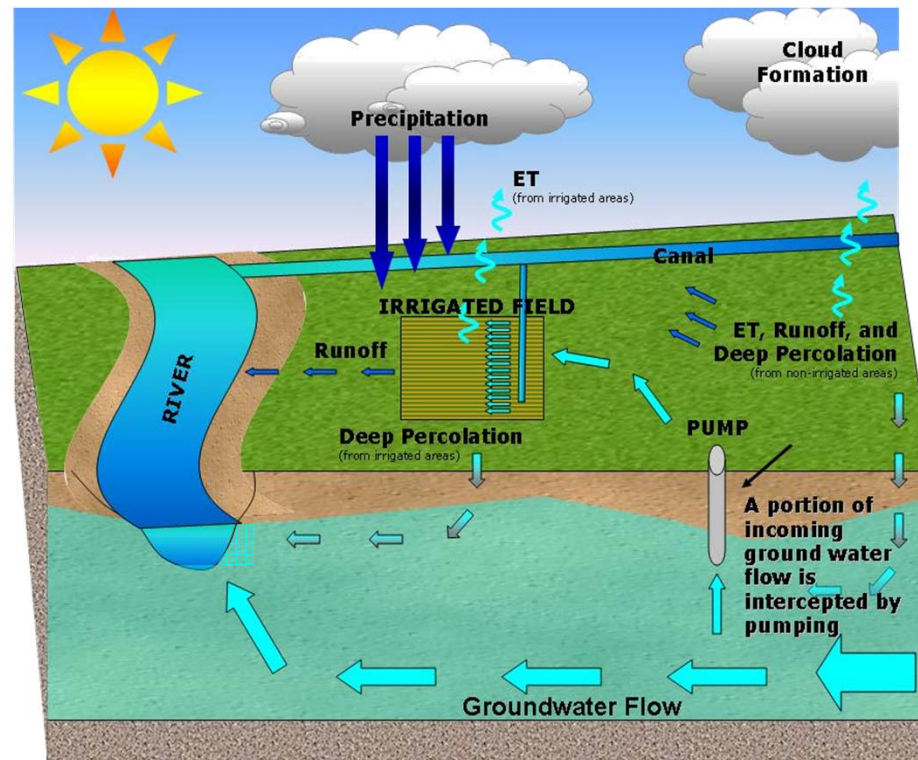




# CURRENT MODELING EFFORTS

Enhancements to the original COHYST models began in 2009 and generally included:

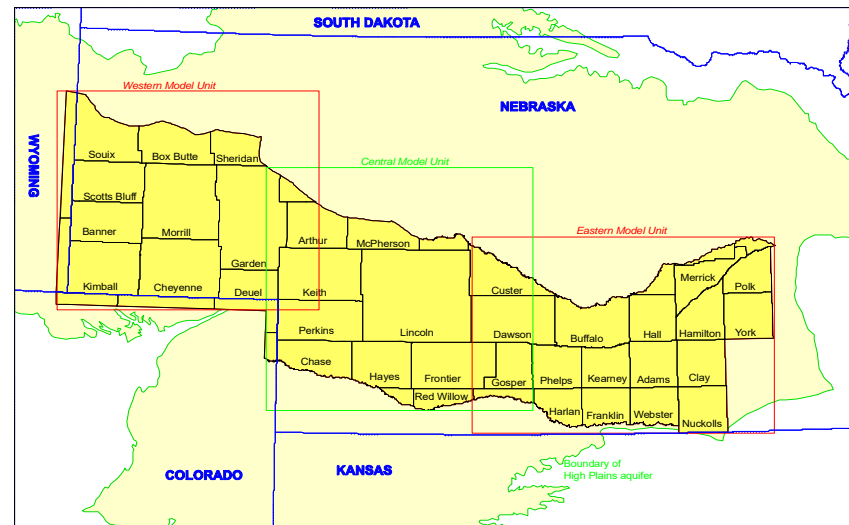
- Represent Water Budget
- Surface water component
- Transient conditions
- Ability to evaluate management alternatives



# CURRENT MODELING EFFORTS

Enhancements being completed and incorporated into the WWUM and COHYST 2010 models

- WWUM – Western Unit of original COHYST
- COHYST 2010 – Central and Eastern Units of original COHYST



# CURRENT MODELING EFFORTS

How are these models assisting in plan development? Examples include:

1. Evaluate changes in aquifer levels and streamflow over time, and the causes thereof.
2. Quantify impacts to streamflow from uses of ground water, including post-1997 uses.
3. Assess options for bringing system into full appropriation balance:
  - a) Evaluate effects of limiting pumping per acre.
  - b) Evaluate effects of changing crops.
  - c) Evaluate effects of improved application efficiencies.
  - d) Evaluate effects of eliminating specific canal systems.
  - e) Evaluate effects of replacing surface water uses with ground water – and vice versa.
  - f) Evaluate operation of canals to recharge excess flows.



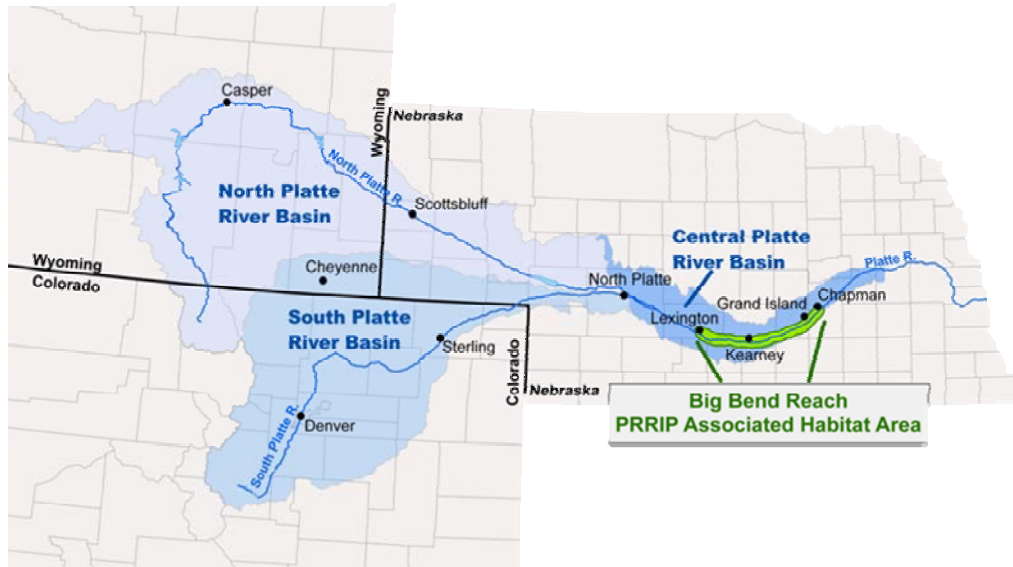
## **III. REVIEW AND REFINEMENT OF FIRST INCREMENT PLAN GOALS**

# **PRRIP & NEBRASKA NEW DEPLETIONS PLAN**

Planning for Compliance



# PRRIP BACKGROUND



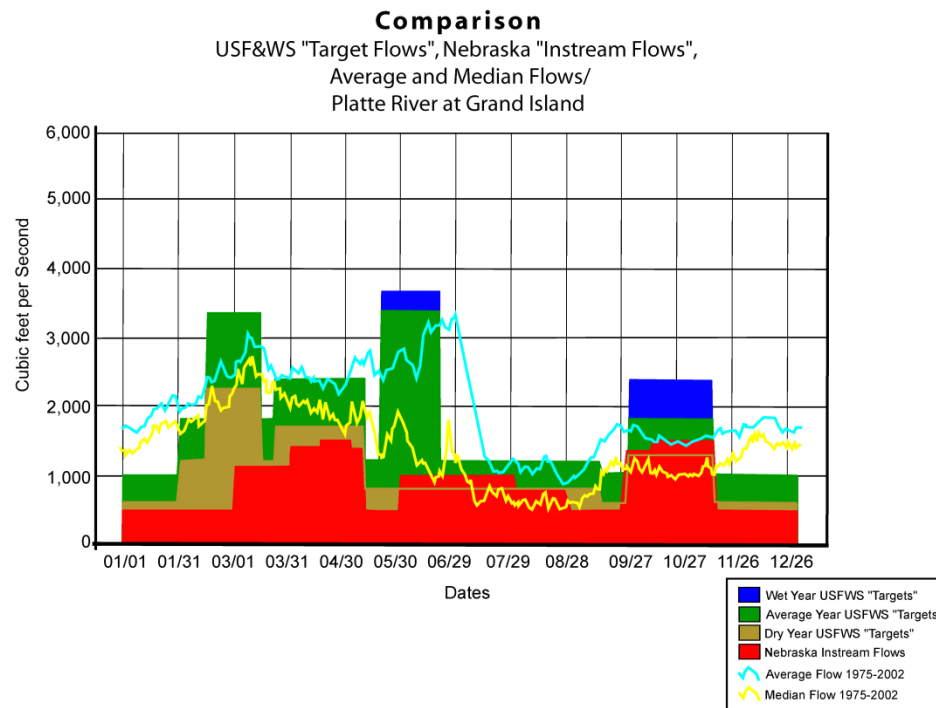
- Began January 1, 2007
- Basin-wide effort by Department of Interior, Colorado, Wyoming, and Nebraska
- Implementation of PRRIP is incremental.
  - The first increment is 13 years, through 2019.

# ENDANGERED SPECIES

- Improve habitat for four threatened and endangered species
  - Whooping Crane
  - Piping Plover
  - Least Tern
  - Pallid Sturgeon
- Provide ESA Section 7 and Section 9 coverage for all water users in the basin
  - Avoid use of alternative ESA enforcement measures



# TARGET & STATE-PROTECTED FLOWS



- Reducing deficits to FWS Target Flows by average annual of 130,000 to 150,000 AFY
- "Pulse" Flows for Adaptive Management



# OFFSETS & MORATORIUMS

- Depletions to USFWS “target flows” and to “state-protected flows” because of groundwater and surface water uses begun or expanded between **July 1, 1997, and December 31, 2005...** will be offset in quantity, time, and location...



# OFFSETS & MORATORIUMS

- **Surface Water** (administered by NeDNR)
  - Moratorium (1993) on issuance of any new surface water appropriations upstream of the Loup River confluence
  - No new direct diversions of surface water allowed without offset (2006)
- **Groundwater** (administered by NRDs)
  - No new uses of groundwater within the 28/40 area will be allowed without offset (2006)
  - Stays on new wells

# WATER ACTION PLAN PROJECTS

- CNPPID Re-regulating Reservoir
- Water Leasing
- Water Management Incentives
  - Conservation cropping, deficit irrigation, fallowing, and on farm irrigation changes
- Groundwater Management
- Dry Creek / Fort Kearney Cutoffs
- Dawson and Gothenburg Canal Groundwater Recharge
- Central Platte Power Interference
- Net Controllable Conserved Water



**GOAL 2: Prevent reductions in the flow of a river or stream that would cause noncompliance with an interstate compact or decree or other formal state contract or agreement.**

**OBJECTIVES**

<b>1. Prevent streamflow depletions that would cause noncompliance by Nebraska with the Nebraska New Depletions Plan (NDP) included within the Platte River Recovery Implementation Program (Program), for as long as the Program exists.</b>	
<b>ACTION ITEMS</b>	<p>A. Ensure that the ground water and surface water controls adopted in the individual district IMPs are sufficient to ensure that the state will remain in compliance with state and federal laws as well as decrees and other formal state agreements.</p> <p>B. Collectively, as defined in the Nebraska NDP, offset the new depletions caused by new uses within the Platte River Basin NRDs.</p>

Summarized for purposes of this document. See Basin-Wide Plan dated Sept. 11, 2009 for full content.

## GOAL 3: Keep the Plan current.

### OBJECTIVES

1. Meet at least annually to review progress toward achieving the goals and objectives of this Plan and those portions of individual NRD IMPs that implement this Plan.					
ACTION ITEMS	<p>A. The first annual meeting will be held within one year of when this Plan is adopted at a time and place designated by DNR and the Platte Basin NRDs. Thereafter, the annual meeting will be held in June or July of each year, unless agreed to otherwise.</p>	<p>B. Discussion shall include, but not be limited to the following:</p> <ol style="list-style-type: none"> <li>1. revisions to this Plan;</li> <li>2. revisions to the IMPs (the individual IMPs may be amended more frequently);</li> <li>3. new data and information, including items like consumptive use calculations for municipal, livestock and industrial uses</li> <li>4. disputes related to implementation of IMPs; and/or</li> <li>5. any other topic on which the DNR and the Platte Basin NRDs have mutually agreed.</li> </ol>	<p>C. A proposed agenda will be made available to the public, along with any available supporting documents, at least two weeks prior to the annual meeting.</p>	<p>D. As a result of actions taken at the annual meeting, the plan may be revised as necessary.</p>	<p>E. Stakeholder and/or public feedback concerning the Basin-Wide Plan or individual IMPs will be considered.*</p>
2. Gather and evaluate data and information to measure the effectiveness of controls, incentives and/or other programs in the individual NRD IMPs used to implement this Plan.					
ACTION ITEMS	<p>A. Jointly conduct a study to identify the impact of soil and water conservation measures on streamflows. Specifically, assess the impact on streamflow depletions from conservation measures, as required by Neb. Rev. Stat. § 46-715(4)(c).</p>	<p>B. Review current methodologies, as well as proposed new methodologies, and evaluate at the annual meeting discussed in goal 3, objective A.</p>	<p>C. Revise Plan, if such revisions will ensure its goals and objectives will be achieved in the timeliest and most efficient cost-effective manner possible.</p>		

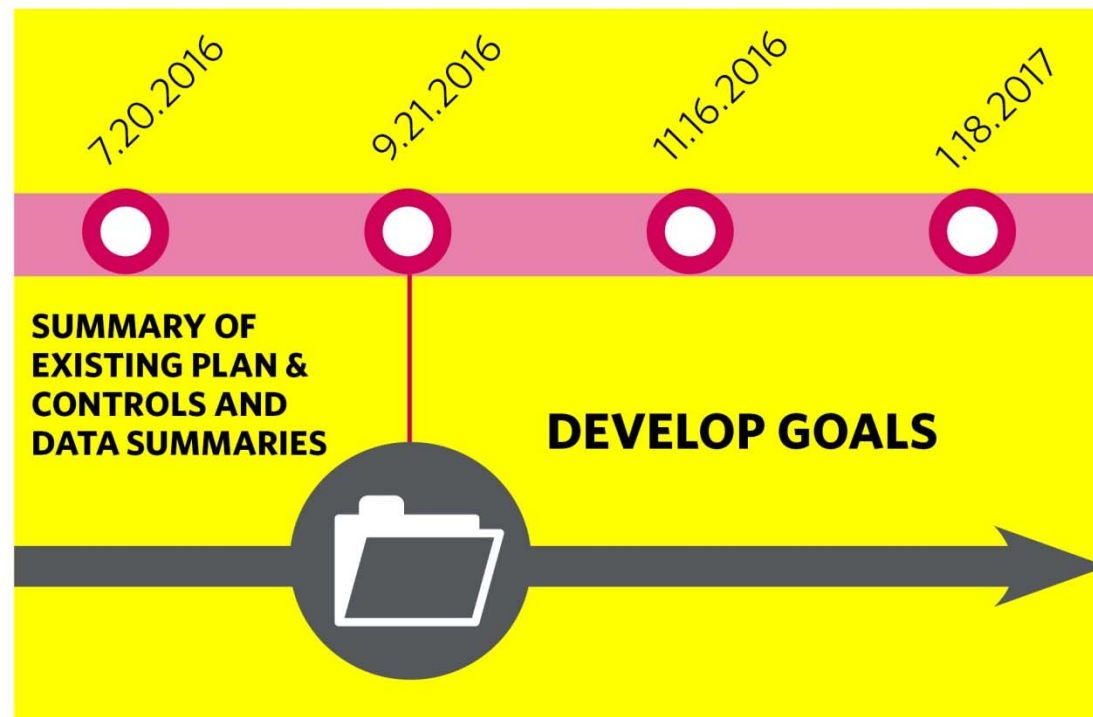
Summarized for purposes of this document. See Basin-Wide Plan dated Sept. 11, 2009 for full content.



# **IV. NEXT STEPS**

# NEXT STEPS

- November 16, 2016 and January 18, 2017 Meetings
  - Goal Development





# **V. PUBLIC COMMENT**