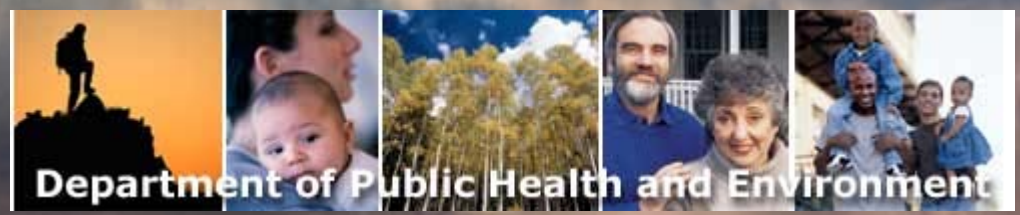
Water From Las Animas County Coal Bed Methane Wells

Public Forum
November 20, 2002
Trinidad, Colorado

Colorado Oil and Gas Conservation Commission

COLORADO DIVISION OF WATER RESOURCES
DEPARTMENT OF NATURAL RESOURCES



A G E N D A

1:00 – 1:15 Welcome and Meeting Introduction

Shane Henry, DNR

A G E N D A

1:15 – 1:30 State of Colorado Divisions Overview

Panel members

Progressive Responsibilities

- Public Safety
- Water Administration
- Interstate Compacts
- Hydrographic Program
- Ground Water
- Public Information Services
- Additional Program Activities

Public Safety

- Water Well Construction
  - Groundwater protection and public safety
  - Rules for Well Construction revised in 2000
  - 336 Licensed contractors
  - 120 Enforcement actions
  - Outreach and education
  - Well construction observation
  - Court action against unlicensed
  - Well Inspection Program

Water Administration

- Water Allocation (annually)
  - 173,151 water rights
  - 104,953 structures
  - 389,244 observations of structures
  - 30,584 water diversions and storage records
  - 1592 water court consultations
  - 48 pending court litigations
  - 320 subdivision reviews
  - 200 substitute water supply plans

Interstate Compacts

- Ensure compact deliveries and protect entitlements
- Administration of 9 Compacts
- Commissioner 5 Compacts

Hydrographic Program

- Streamflow measurements
  - 260 Stream gages
  - 600 Ditch and canal gages
  - 2700 measurements annually
- Publication of streamflow records -215
- Satellite Monitoring System - 316
- 1881 to 2001 120 Years
    - » 1 station in 1881
    - » 316 in 2001

Ground Water

- Integral part of Colorado's water supply
- Investigations and studies
- Well permitting and enforcement
- Residential and municipal supplies
- Irrigation > 2 million acres
- Well permits 80% residential

Public Information Services

- Water records
  - Decrees
  - Diversions
  - Aquifer water level data
  - Well permits
  - Tabulations
  - Streamflow
  - Dam plans, specifications and inspection reports

Additional Program Activities

- Groundwater and Surface Water Modeling
- Colorado Decision Support System
- Engineering and Geotechnical Support
- Information Technology
  - » Internet, GIS, Imaging, Data Management
- Administration
  - » Records, Files, Support Services

A G E N D A

1:30 – 1:45 A Geologic Perspective of Las Animas County

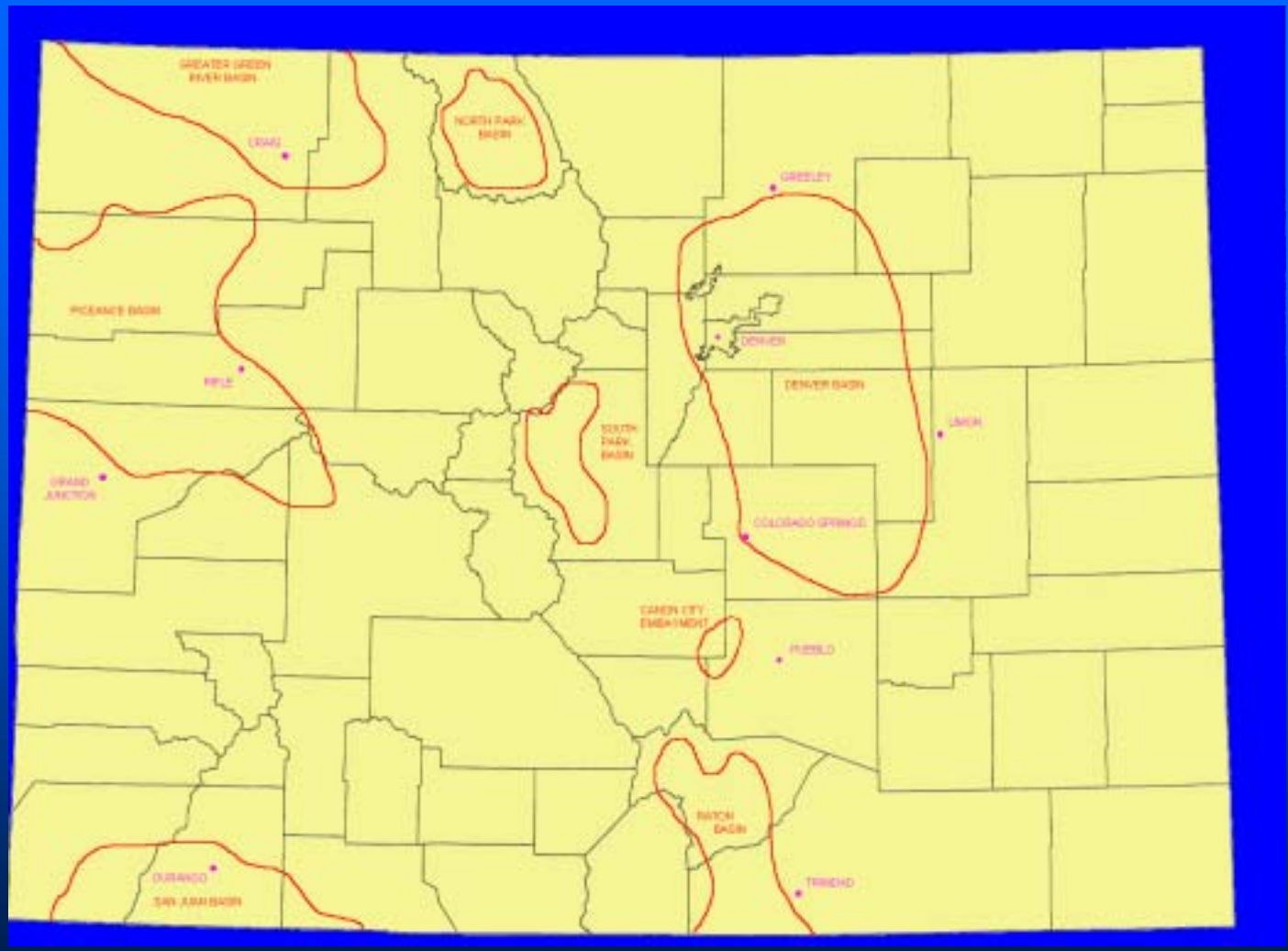
Glenn Graham, DWR

GEOLOGY AND HYDROGEOLOGY OF THE RATON AND VERMEJO FORMATIONS, RATON BASIN, LAS ANIMAS COUNTY, COLORADO

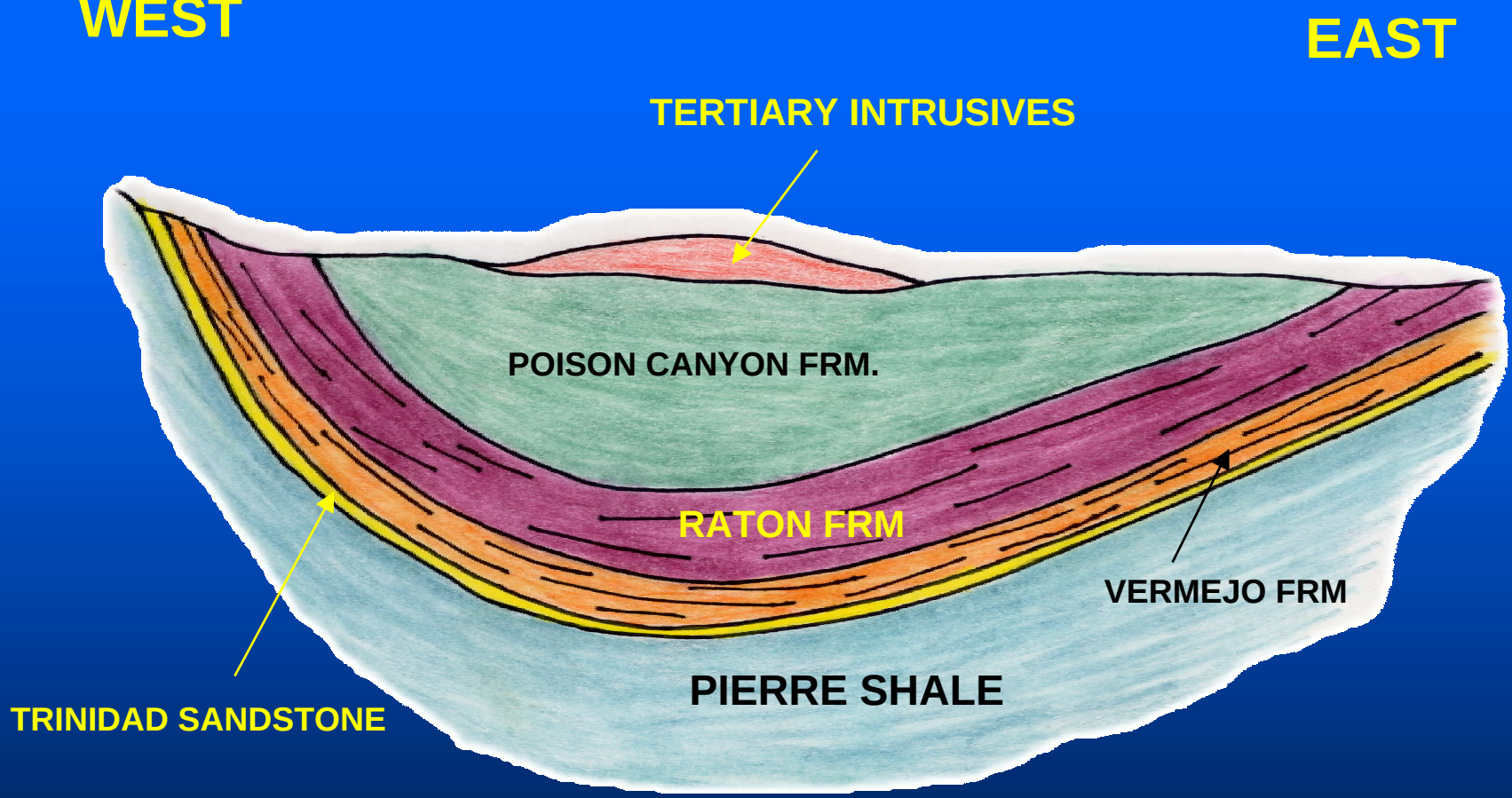
GLENN GRAHAM
SR. GEOLOGIST
GEOTECHNICAL SERVICES BRANCH
COLORADO DIVISION OF WATER RESOURCES

FRONT RANGE OF COLORADO 65 MYBP

DENVER MUSEUM OF NATURE AND SCIENCE AND
DIANE BRAGINETZ WITH PERMISSION



CRETACEOUS SEDIMENTARY BASINS OF COLORADO



RATON BASIN GENERALIZED CROSS SECTION

GAMMA RAY AND BULK DENSITY TYPE LOG VERMEJO FORMATION SPANISH PEAKS FIELD LAS ANIMAS COUNTY

PEAKS HIGHLIGHTED IN BLACK INDICATE COAL SEAMS

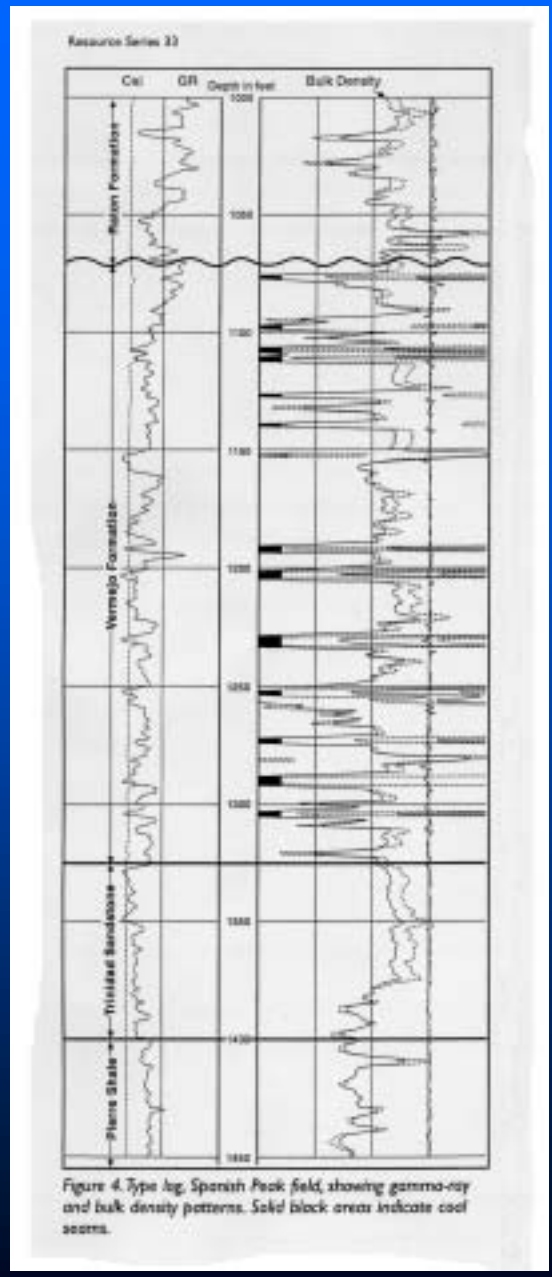
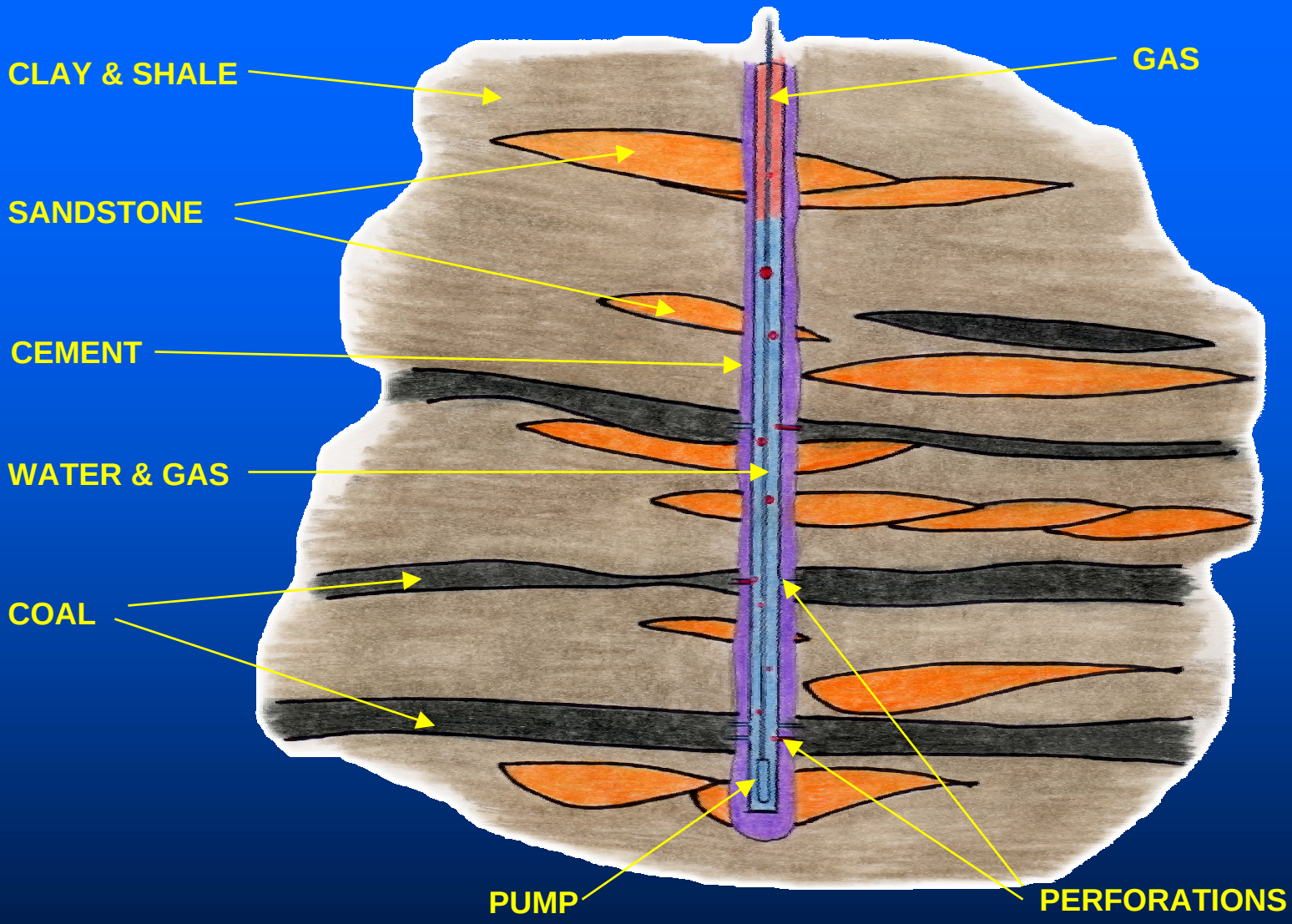
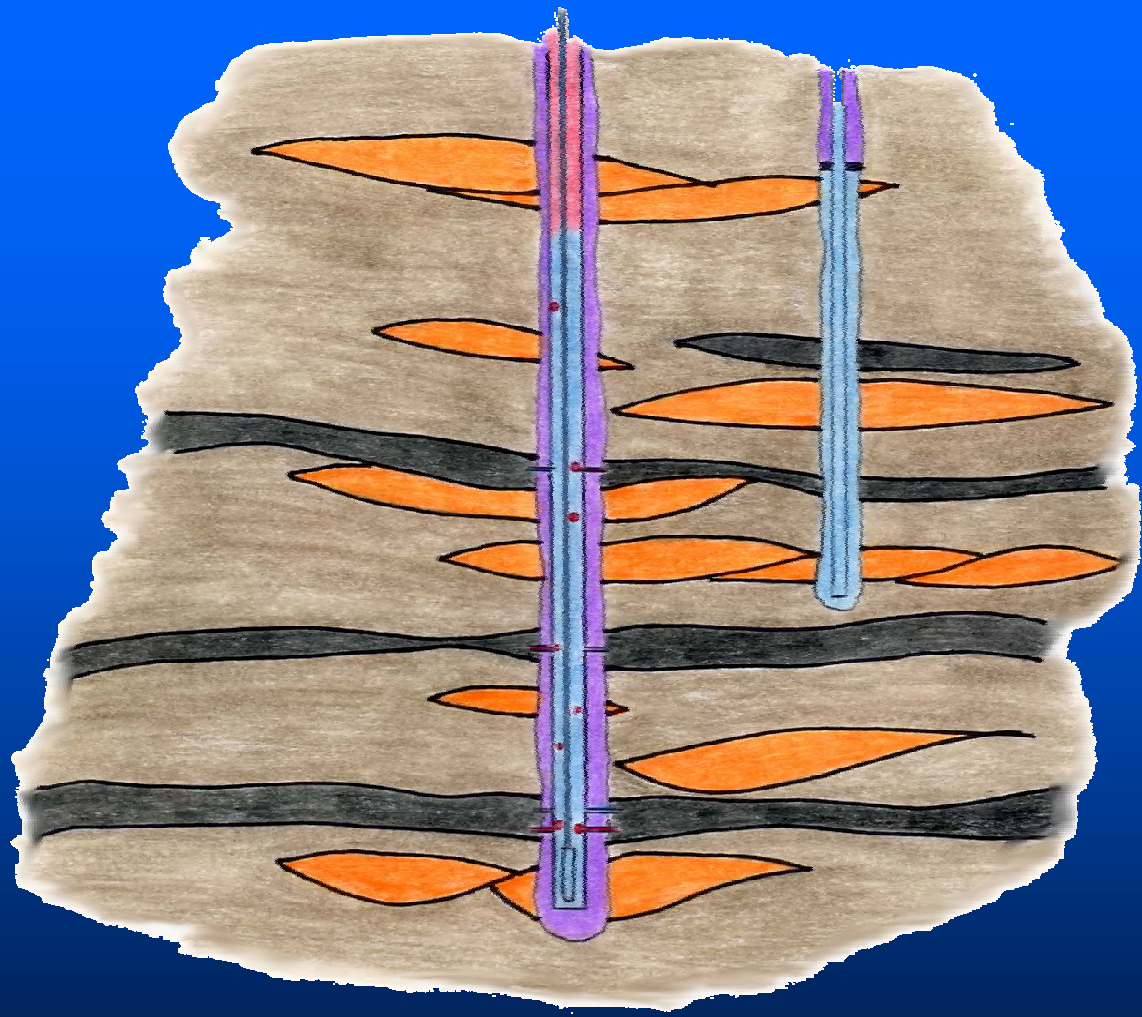


Figure 4. Type log, Spanish Peak field, showing gamma-ray and bulk density patterns. Solid black areas indicate coal seams.

COLORADO GEOLOGIAL SURVEY
RESOURCE SERIES 33, 1998



TYPICAL CBM WELL COMPLETION



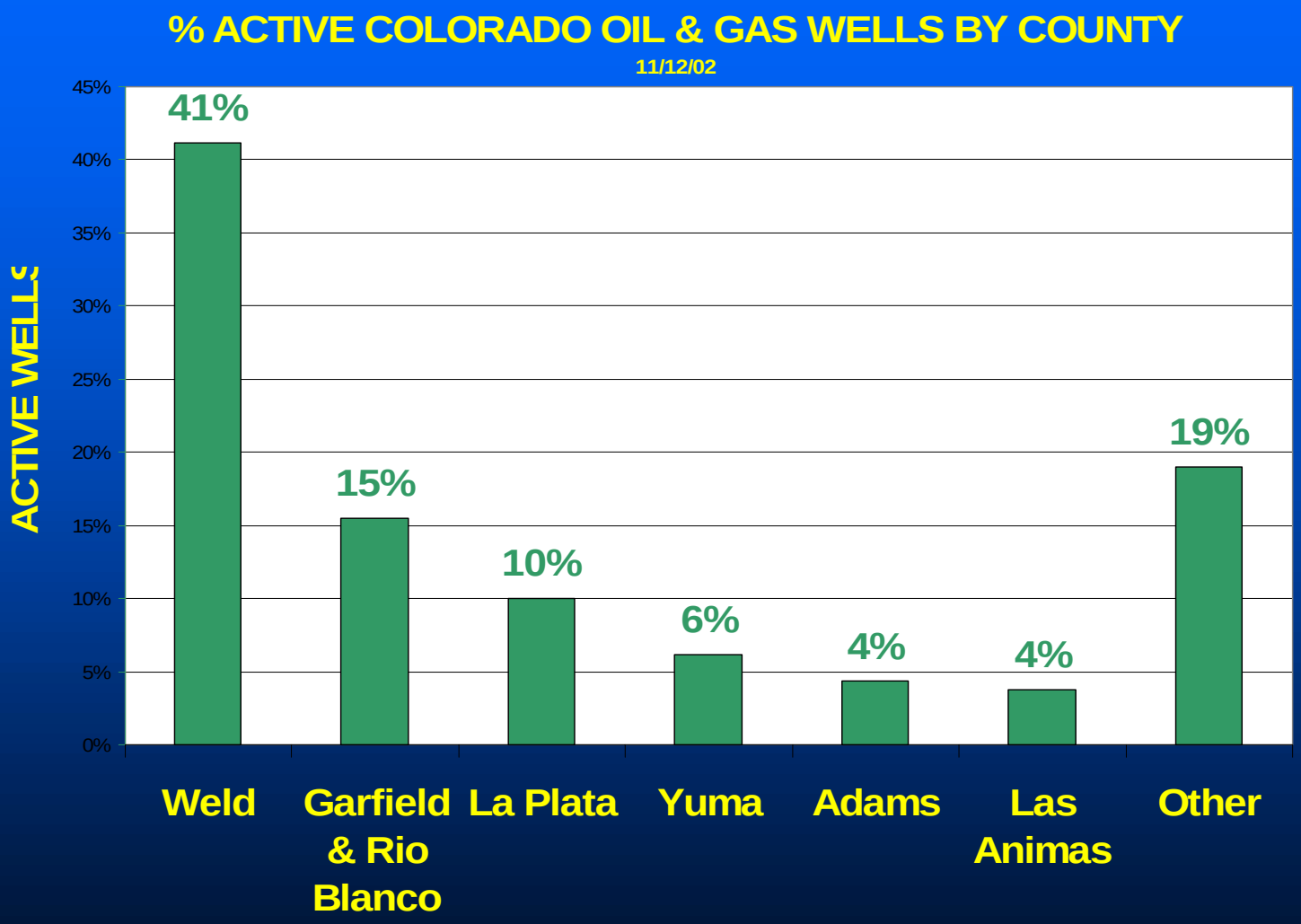
WATER WELL IN CBM PRODUCING INTERVAL

Questions?

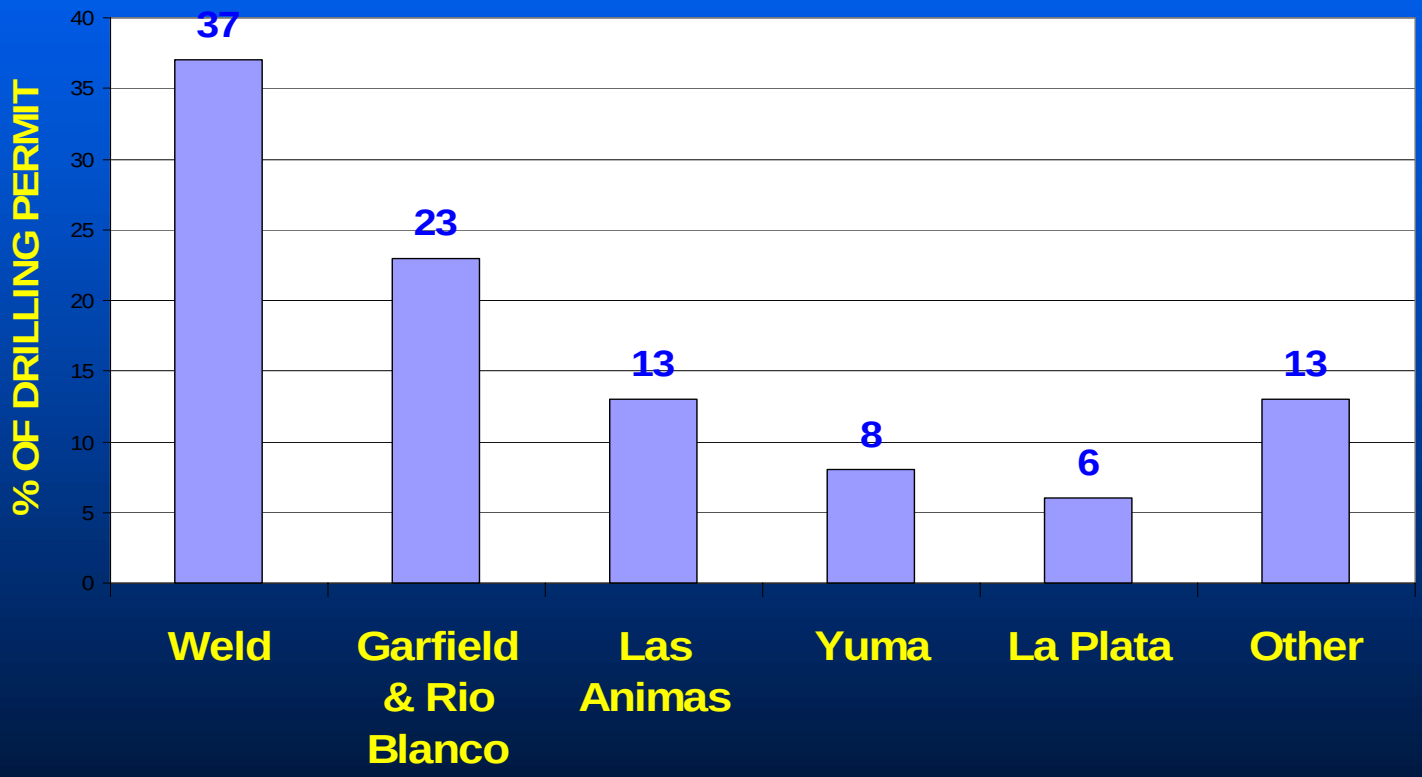
A G E N D A

1:45 – 2:15 CBM Gas Production and Regulation in Las Animas County

Rich Griebling, COGCC


% ACTIVE COLORADO OIL & GAS WELLS BY COUNTY
11/12/02
ACTIVE WELLS
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
41%
15%
10%
6%
4%
4%
19%
Weld
Garfield & Rio Blanco
La Plata
Yuma
Adams
Las Animas
Other

% OF COLORADO 2002 OIL & GAS DRILLING PERMITS BY COUNTY 10/31/02



OIL AND GAS COMMISSION REVIEWS

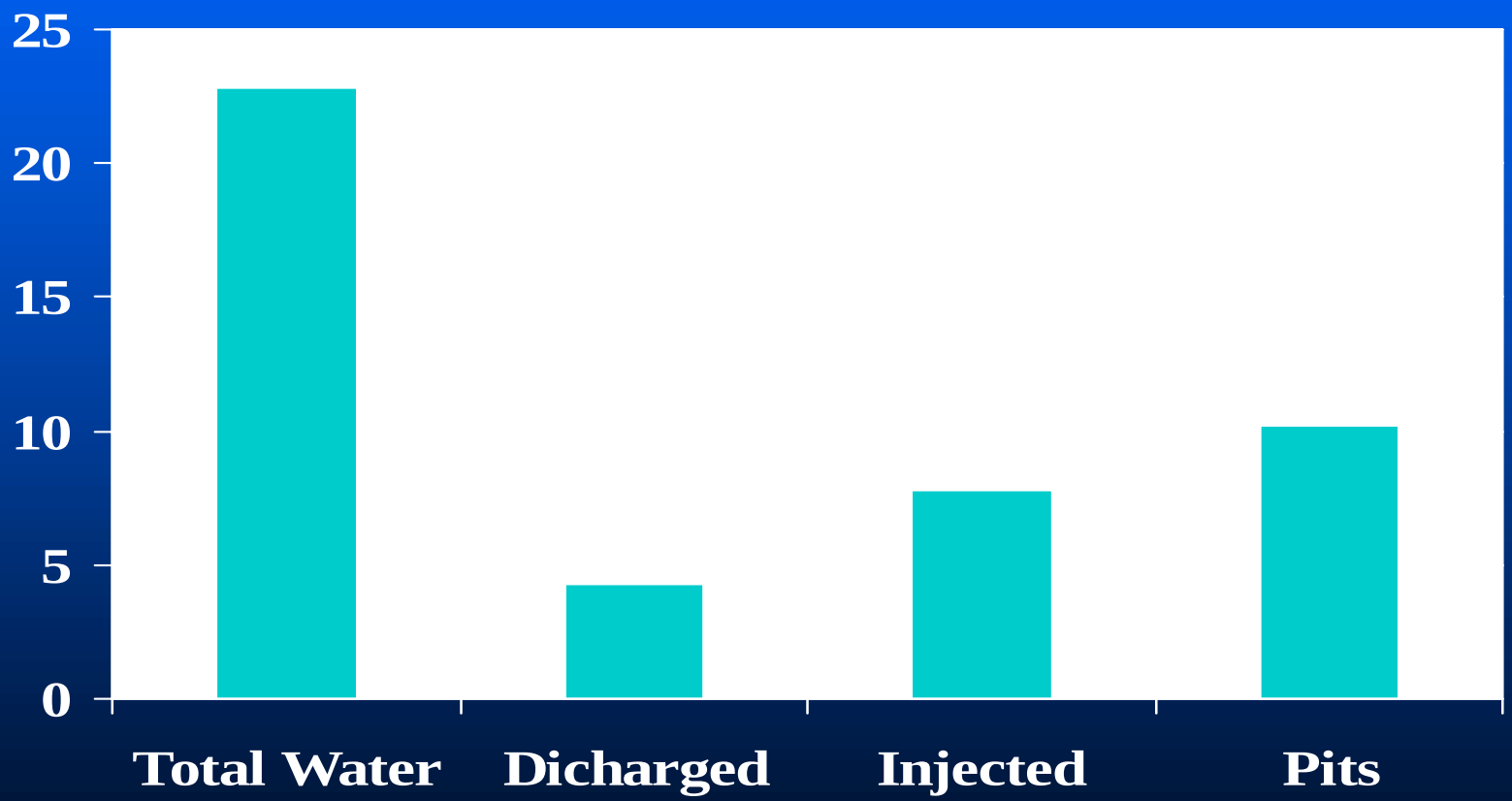
- LOCATION OF WELLS
- HOW WELLS ARE CONSTRUCTED
- SURFACE OWNER CONSULTATION
- PRODUCTION OPERATIONS
- PLUGGING THE WELL
- RESTORATION OF THE SURFACE

CBM vs GAS WELL

- COAL BED METHANE WELLS ARE DRILLED, CEMENTED, COMPLETED, PRODUCED, AND PLUGGED AS ANY OTHER WELL WOULD BE
- THE DIFFERENCE IS CBM WELLS PRODUCE MORE WATER

LAS ANIMAS COUNTY PRODUCED WATER

(Volumes in acre-ft/day)



WATER FROM LAS ANIMAS COUNTY GAS WELLS

- **700+ Coalbed Methane (CBM) Wells in Las Animas County**
- **Methane Gas & Water from Coals in Vermejo & Raton Formations**
- **Produced Water Goes to: Pits for Small Volumes; Disposal Wells; Surface Discharge if Pass WETT**

WATER FROM LAS ANIMAS COUNTY GAS WELLS

- WETT = Whole Effluent Toxicity Test, Required by the Water Quality Control Division (WQCD)

- Discharged Water Is Subject to Water Rights Claims under Colorado Water Law

- Colorado Division of Water Resources (DWR) or "State Engineer's Office" Has Jurisdiction over Surface Water & Ground Water Use

WATER FROM LAS ANIMAS COUNTY GAS WELLS

- Beneficial Use of Discharged Water Must Comply with Water Rights Act & Ground Water Mgmt. Act

- Beneficial Uses Include: Agriculture, Mining, Domestic, Manufacturing, Stock Watering, Wildlife Watering, Irrigation, Industrial, Mechanical, Commercial, Municipal, Recreation, Min. Stream Flows, Fire Protection, Evaporation, Dust Suppression

WATER FROM LAS ANIMAS COUNTY GAS WELLS

- Many Downstream Users w/ Senior Water Rights Claims in Purgatoire / Arkansas River Basin
- Courts to Consider Tributary vs. Non-Tributary Status of Las Animas Co. Produced Water Rights
- Produced Water from CBM Wells Declines & Is not a Reliable Long Term Source of Water

WATER FROM LAS ANIMAS COUNTY GAS WELLS

Summary:

- Limited Opportunity to Use Produced Water
- Much Water Won't Pass WET Test (Quality)
- Over-Appropriated Basin; Senior Water Rights
- Unreliable Long Term Source of Water
- Opportunities Have Cost & Legal Complication

Questions?

A G E N D A

2:15 – 2:45 Types of Ground Water – CBM Water Rights & Ownership

Dick Wolfe, DWR

Types of Ground Water in Colorado

- Tributary
- Nontributary
- Not-nontributary
- Designated
- Geothermal

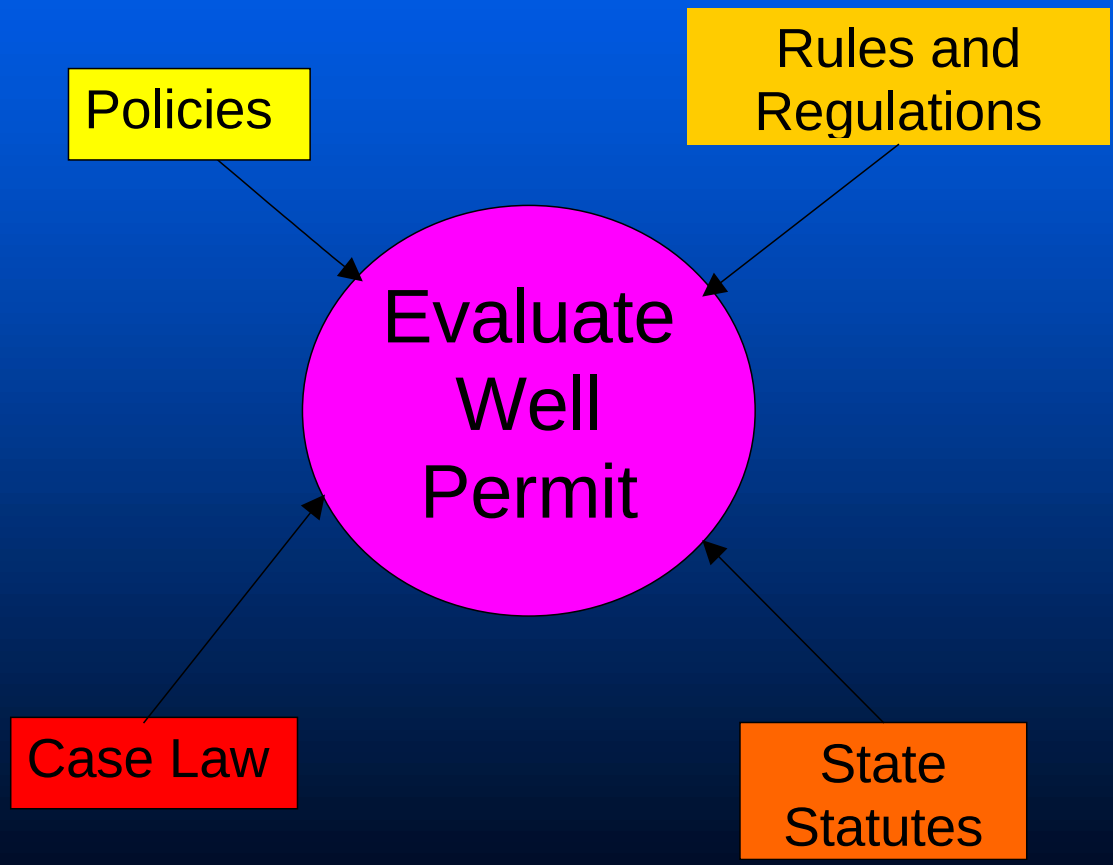
CBM Water Rights and Ownership

- Doctrine of Prior Appropriation (First in time-first in right)
- CDWR has jurisdiction over administration of water – right of use
- Comply with the "Water Rights Acts"
  - Ground Water Management Acts
  - Water Right and Determination and Administration Act

Differences Between a Well Permit and a Water Right

- Well Permit
  - Issued by DWR
  - Permit to Construct and use limitations
  - Does not convey a water right
  - Does not Guarantee Quantity or Quality of Water
- Water Right
  - Issued by Water Court
  - Absolute or Conditional
  - Does not Guarantee Quantity or Quality of Water

Well Permit Evaluation



CBM Water Rights and Ownership

- Ground Water Permitting by CDWR
  - Nontributary 37-90-137(7)
    - » No permit required unless beneficially used
    - » Use not based on land ownership
    - » Do not need to determine if unappropriated water is available
    - » Must prevent material injury to vested water rights

CBM Water Rights and Ownership

- Ground Water Permitting by CDWR
  - Tributary 37-90-137(1) & (2)
    - » Permit required
    - » Must determine if unappropriated water is available
    - » Must prevent material injury to vested water rights

Conclusions

- Must comply with Water Rights Acts (subject to appropriation)
- Most basins over-appropriated
- Water quality
- Unreliable as long-term source
- Collaboration
- Educate and communicate

Questions?

A G E N D A

2:45 – 3:00 Break

A G E N D A

3:00 – 3:30 CBM Water Quality

Rich Griebling, COGCC

Christopher Gates, CDPHE – Water Quality Control Division

Dick Wolfe, DWR

Total Dissolved Solids (TDS)
TDS Values in mg/l

Produced Water Values Provided by Evergreen Resources

Las Animas County
Evergreen Resources
Range of TDS from 111 wells
(6000 TDS - High Value)
(1230 TDS - Low Value)
(2731 TDS - Avg. Value)

From Colorado State Extension Bulletin 4.908

High risk for pregnant livestock.
Unfit for poultry.
(7000 to 10,000 TDS)

Reasonably safe for livestock.
Unfit for poultry.
(5000 to 7000 TDS)

Satisfactory for livestock.
Poor for poultry.
(3000 to 5000 TDS)

Satisfactory for all livestock and poultry.
(1000 to 3000 TDS)

Maximum TDS for human drinking water (500 TDS)

Note: Water may be used on Crops up to 2000 TDS
TDS varies with crop
(Montana Bureau of Mining & Geology)

COGCC, November 06, 2002

The Water Quality Control Division's Role in CBM Development

By

Christopher L. Gates

Environmental Protection Specialist

Water Quality Control Division

Colorado Department of Public Health and Environment

History of Water Quality Standards in Colorado

- 1972: Federal Water Pollution Control Act established a framework for which states could develop standards
- 1977: Clean Water Act is an amendment to the Federal Act
- 1973: Colorado Water Quality Control Act: Provides Colorado authority to set standards

Clean Water Act Goals:

- Eliminate the discharge of pollutants into the nation's waters.
- Achieve water quality at levels that are protective of the classified uses that apply to that stream segment.

Classified Uses

- Aquatic Life
- Drinking Water Supply
- Recreation
- Agriculture

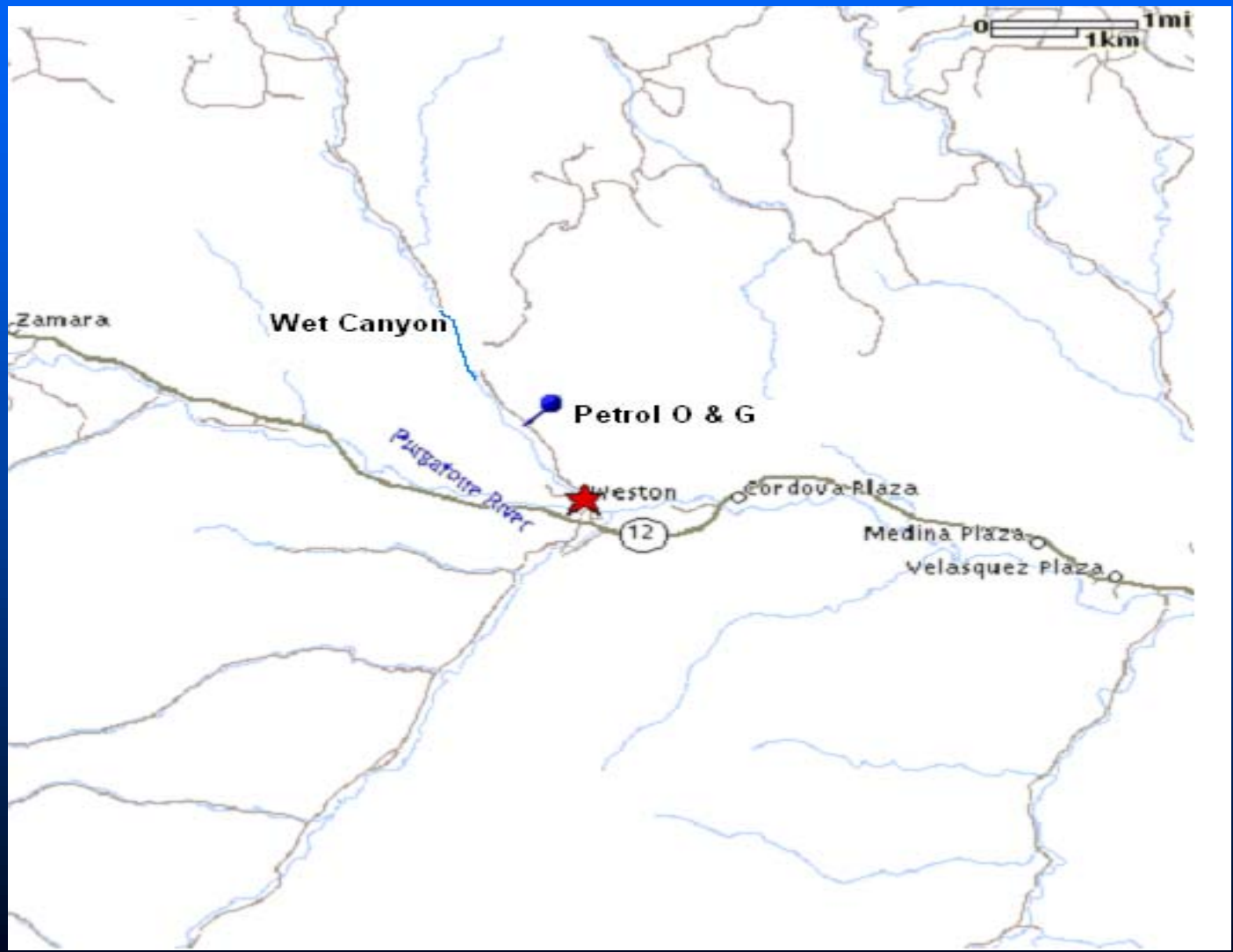
Segmentation

- Based on known water quality of the reaches in a stream.
- Example: Arkansas River Basin, Lower Arkansas River Sub-basin, Segment 6 (this includes all tributaries to the Purgatoire River, incl. wetlands, lakes and reservoirs, from the source to I-25)

Segment 6

- Scenario:
  - Petrol Oil and Gas has CBM wells that will flow into Wet Canyon, this stream has the following use classifications:
    - –Cold Water Aquatic Life Class 2
    - –Class 1a Recreation
    - –Agriculture
    - –Designated “Use Protected”

Wet Canyon


0
1mi
1km
Zamara
Wet Canyon
Petrol O & G
Weston
Cordova Plaza
Medina Plaza
Velasquez Plaza
12

Wet Canyon is Designated "Use Protected"

- When a segment is designated "Use Protected," the Commission has determined that this segment does not warrant the special protection provided by the outstanding waters designation or the antidegradation review process.

- Antidegradation review provides for another level of protection when it is deemed necessary.

Water Quality - DWR

- MOU with CDHPE regarding water quality issues
- Replacement or substituted water must comply with SB 89-181

Questions?

A G E N D A

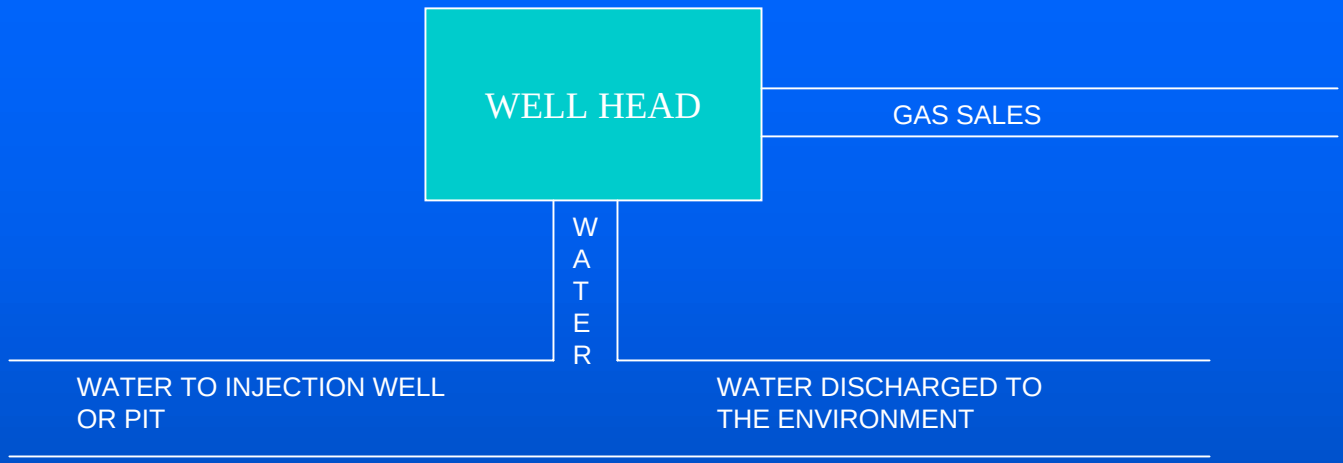
3:30 – 4:00 Allowed Methods of Use and Disposal of CBM Water

Rich Griebling, COGCC

Dick Wolfe, DWR

Christopher Gates, CDPHE - Water Quality Control Division

WHO REGULATES PRODUCED WATER?



THESE WATER DISPOSAL METHODS ARE UNDER THE JURISDICTION OF THE COLORADO OIL AND GAS CONSERVATON COMMISSION.

THIS METHOD OF WATER DISPOSAL IS UNDER THE JURISDICTION OF THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIROMENTAL - WATER QUALITY CONTROL DIVISION FOR APPROVAL TO DISCHARGE WATER. AFTER THE WATER IS DISCHARGED IT IS UNDER THE JURISDICTION OF THE DEPARTMENT OF WATER RESOURCES FOR ISSUES CONCERNING WATER RIGHTS.

Methods of Use and Disposal

- COGCC Rule 907
  - Inject into a disposal well
  - Place in lined or unlined pit
  - Dispose at a commercial facility
  - Road spreading
  - Discharge into waters of the state
  - Reuse for recovery, recycling and drilling
  - Mitigation

Methods of Use and Disposal

- Types of Beneficial Uses
  - Irrigation
  - Municipal
  - Domestic
  - Stock watering
  - Minimum streamflows
  - Augmentation

How does this apply to CBM?

•One of the options of disposal of produced water from Coal Bed Methane operations is to discharge to surface waters of the State.

•This can be authorized through a **Colorado Discharge Permit**.

•This can be done in lieu of either reinjection, or evaporation, depending on feasibility.

•To determine feasibility of surface water discharge, the facility must look at the quality of the produced water to be discharged.

•This is then compared to the applicable water quality standards that is for that stream segment to which the operation would potentially discharge to.

•Let's refer back to our example. Petrol O & G wants to discharge to Segment 6 (Wet Canyon).

Water Quality Standards

The following water quality standards apply to the receiving water Segment 6 of the Lower Arkansas River Sub-basin

Physical and Biological		
D.O.	=	*6.0 mg/l, 7.0 mg/l spawning*
pH	=	*6.5 - 9.0 s.u.*
Fecal Coliforms	=	*200/100 ml*
E. coli	=	*126/100 ml*

Inorganic		
Boron	=	*0.75 mg/l*
Cyanide	=	*0.2 mg/l*
Nitrite (NO_2) as N	=	*10 mg/l*
Nitrate (NO3) as N	=	*100 mg/l*

Metals	***Criteria***	***Standard***	***Analytical Method***
Arsenic (As)	*Chronic*	*100 ug/l*	*Total Recoverable*
Beryllium (Be)	*Chronic*	*100 ug/l*	*Total Recoverable*
Cadmium (Cd)	*Chronic*	*10 ug/l*	*Total Recoverable*
Chromium, tri (Cr III)	*Chronic*	*100 ug/l*	*Total Recoverable*
Chromium, hex (Cr VI)	*Chronic*	*100 ug/l*	*Total Recoverable*
Copper (Cu)	*Chronic*	*200 ug/l*	*Total Recoverable*
Lead (Pb)	*Chronic*	*100 ug/l*	*Total Recoverable*
Nickel (Ni)	*Chronic*	*200 ug/l*	*Total Recoverable*
Selenium (Se)	*Chronic*	*20 ug/l*	*Total Recoverable*
Zinc (Zn)	*Chronic*	*2,000 ug/l*	*Total Recoverable*

Assessment of Treatment

- Once the permittee knows the quality of it water, it knows what treatment will be required to meet the applicable water quality standards.

- For example, to treat for iron, manganese, or zinc, aeration is an viable option.

- This in combination with settling in concurrent ponds, which can be used to further reduce the concentrations of these and other pollutants.

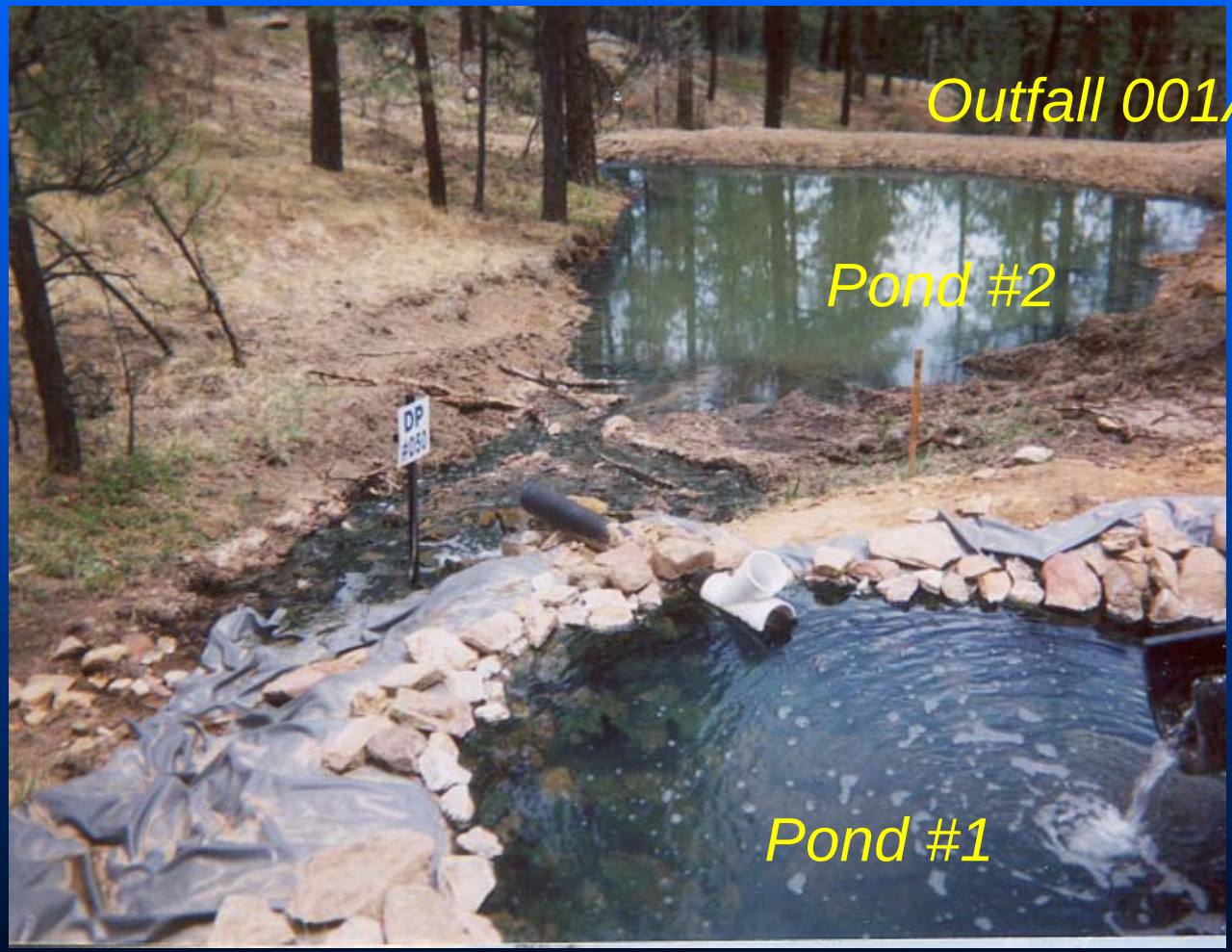
- After settling, the outfall is located at a point that is prior to reaching State waters.

- The permittee would then be required to meet the limits set forth in their discharge permit.

Treatment Through Aeration

Conveyance to First Settling Pond

Secondary Treatment -Settling



Monitoring from Outfall 001A

- The discharge permit will have limitations and monitoring requirements for :

  Flow, TSS, O&G, pH, Salinity, and Zinc

- The basis for placing these limitations in the discharge permit were assessing the water quality of the discharge to the numeric water quality standards.

Narrative vs. Numeric Standards

- The discharge permit addresses both numeric water quality standards, and narrative water quality standards.
- To protect the narrative standard of “no toxics in toxic amounts,” the permit has provisions for whole effluent toxicity limitations or biomonitoring.

WET Testing

- WET testing includes monitoring for both Ceriodaphnia dubia and Fathead minnow.
- The discharge is introduced to both species at 25, 50, 75, and 100% gradations. The population of each species must remain above 50%.

Protective of Existing Uses

- Through the authorization of discharge permits, the primary goal is to protect the existing water quality of the receiving stream and not allow for further degradation.

Water Quality Control Division

Questions?

A G E N D A

4:00 – 5:00 Discussion Wrap-Up – Questions and Answers

Panel Members


Without time everything would happen all at once!