Basics of the UIC Program and Ground Water Protection

Three Affiliated Tribes
New Town, North Dakota

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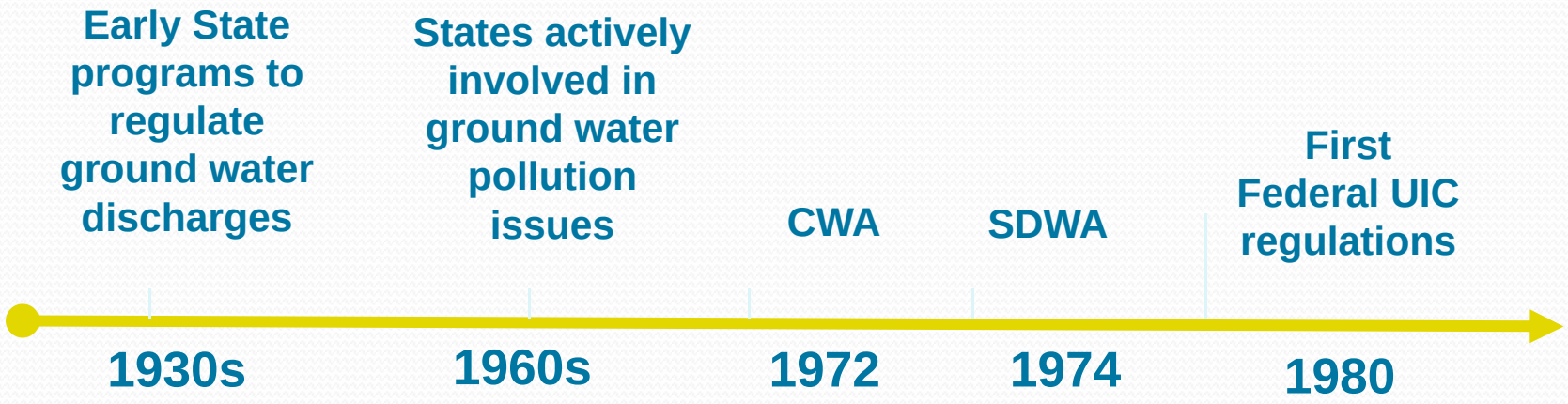
Objectives

- Regulatory Authority
- Permitting Process for the Underground Injection Control program
- Technical Overview of Permit Review and Drilling Processes
- Sustainability and Ground Water Protection

Regulatory Timeline



Regulatory Authority

1974 SDWA-Basic UIC Concepts

- Requires EPA to promulgate regulations to protect drinking water sources from contamination through underground injection
- Defines Underground Injection
- BLM: Onshore Oil and Gas Order No.2

Regulatory Requirements

1974 SDWA-Basic UIC Mandate

- Not interfere with oil and gas production
- Consider varying geologic, hydrologic, or historical conditions
- Avoid promulgating regulations that would unnecessarily disrupt existing State programs

Mission of the UIC Program

The UIC program's mission is to protect underground sources of drinking water from contamination by regulating the construction and operation of injection wells

Definitions

- **Well:** A bored, drilled, or driven shaft, or a dug well or dug hole where the depth is greater than the largest surface dimension; or an improved sinkhole; or a subsurface distribution system
- **Underground injection:** Subsurface emplacement of fluids through a well

Definitions

- **Aquifer:** Geologic formation that is capable of yielding a significant amount of water to a well or spring
- **Underground Source of Drinking Water (USDW):** An aquifer or portion of an aquifer that
  - Supplies any public water system *or* contains a quantity of ground water sufficient to supply a public water system, *and*
  - Currently supplies drinking water for human consumption, *or*
  - Contains fewer than 10,000 mg/L total dissolved solids *and* is not an exempted aquifer

Definition

Class II Wells

- Dispose of fluids associated with the production of oil and natural gas (II-D)
- Inject fluids for enhanced oil recovery (II-R)
- Inject liquid hydrocarbons for storage (II-H)

Permit Requirements

UIC Application Completeness Review - Worksheet and Checklist (handout 1)

Area of Review (AoR) **Topographic Maps of Wells-AoR** **Corrective Action Plan**

Financial Responsibility Demonstration **Geology of Injection and Confining Zones**

Monitoring Program **Stimulation Plan Operating Data** **Injection Procedures**

Construction Details (Schematic) **Formation Testing Plan** **Plan for well failure**

Plugging and Abandonment Plan (7520-14) **Name and Depth of USDWs**

Existing EPA Permits **Description of Business** **Aquifer Exemption**

Permitting Process

- Goal: Consistency , Equality and Protection
- Guidance Documents (34-40) examples:
  - G34: CBL Techniques and Interpretation
  - G37: Demonstration Part II Mechanical Integrity
  - G40: Plugging and Abandonment Requirements

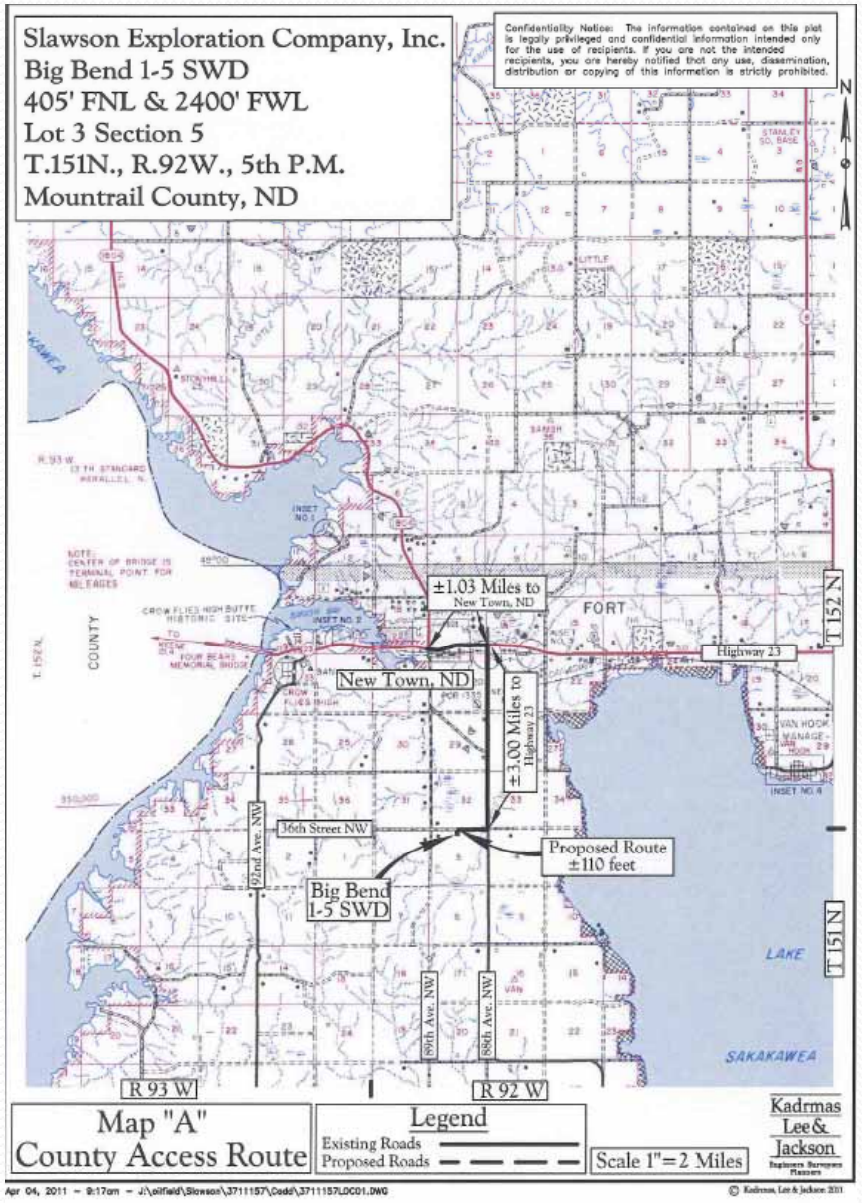
Technical Review-Worksheet and Checklist

Key Areas of Analysis

- Geology: Injection and Confining Zone
- Ground Water: USDWs/AE
- Construction: Injection and AoR wells
- Area of Review: Potential Conduits
- Operation: MAIP
- Monitoring: Testing and Logging Requirements
- Plugging and Abandonment Plan
- Financial Responsibility

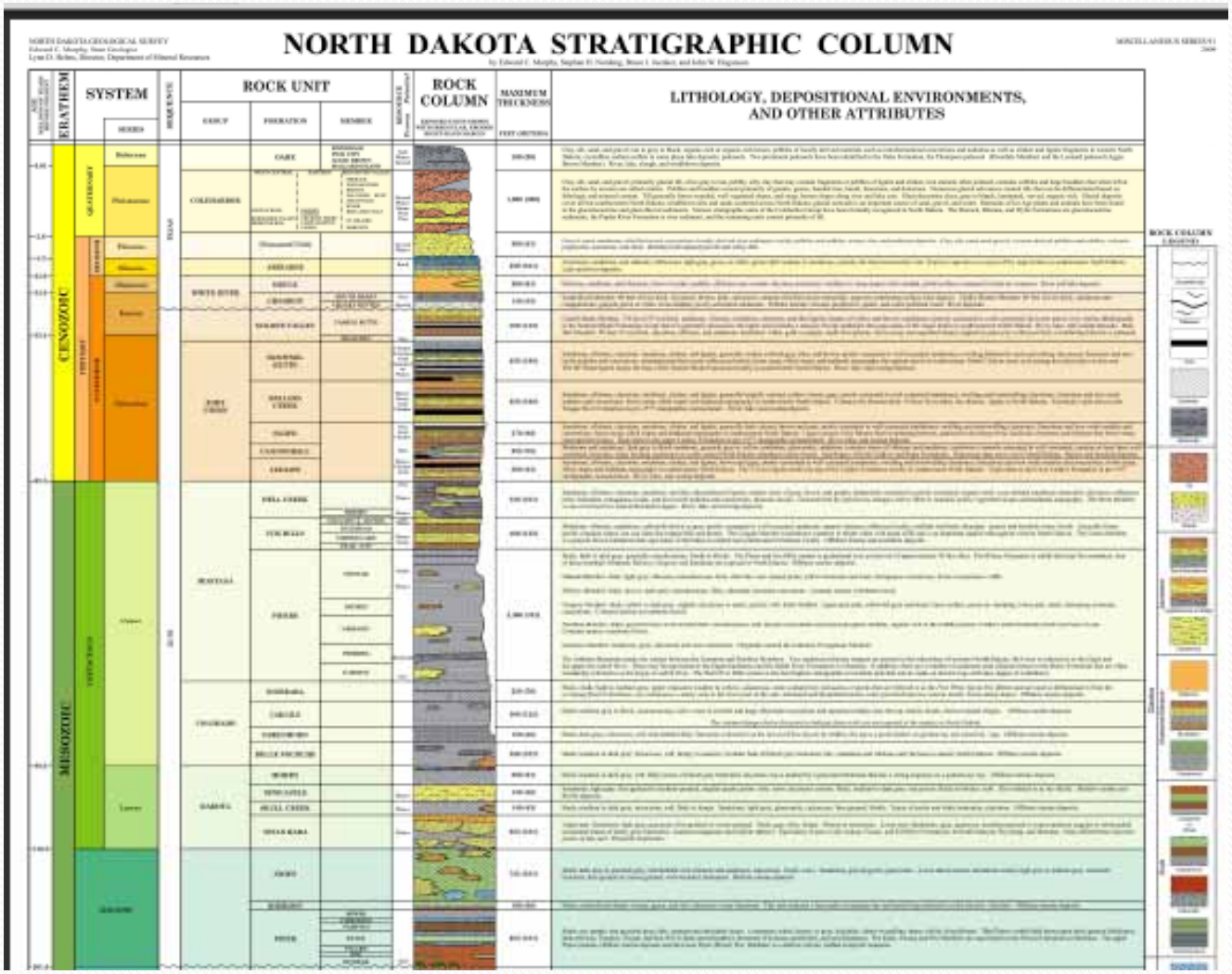
Big Bend 1-5 SWD

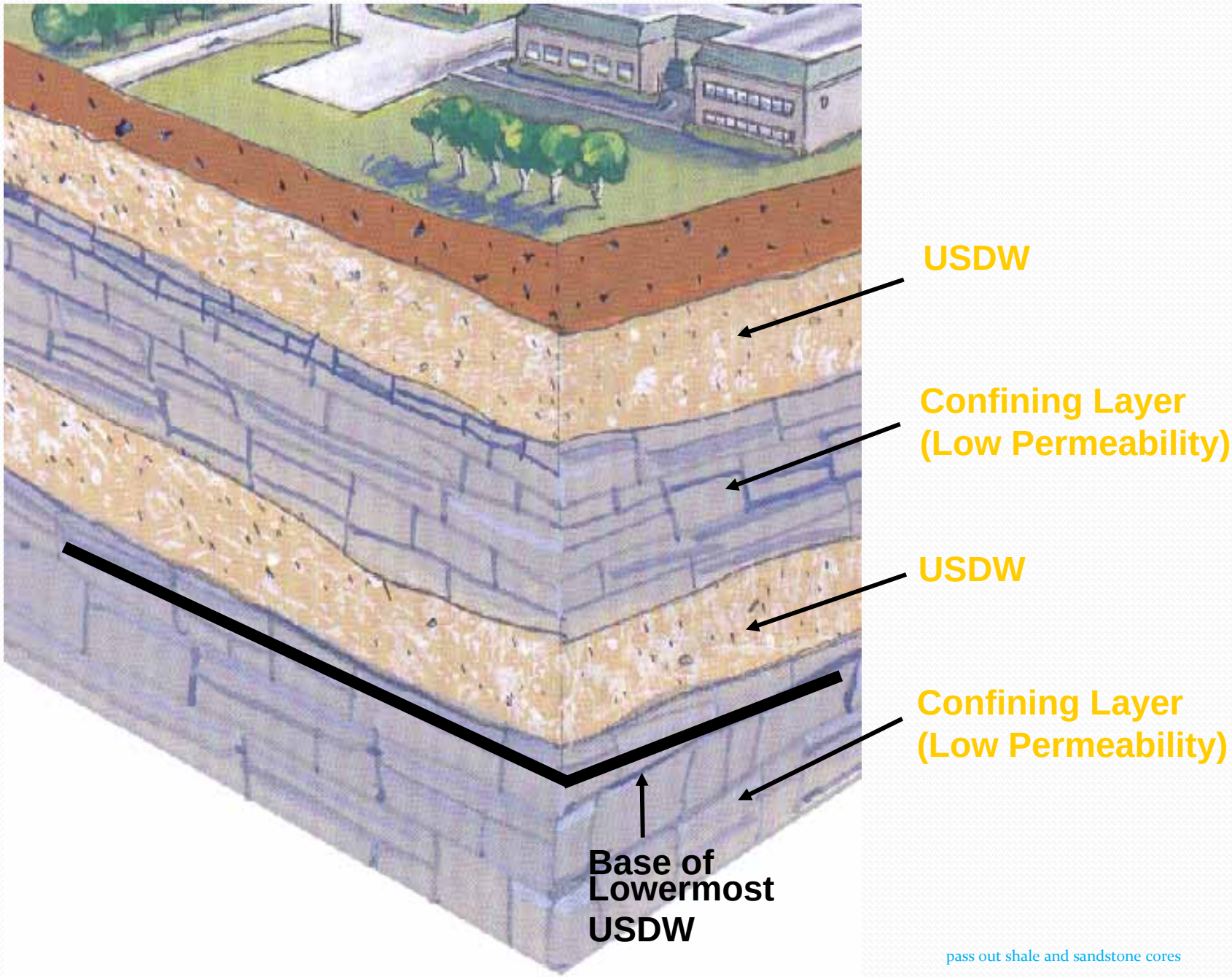
- Class II Commercial SWD-Draft Status
- Proposed Location ~3 miles south of New Town (map)
- Additional Requirements
  - Site Security
  - Manifest for tracking
  - Chemical Analysis on produced water for characterization (handout2)


Slawson Exploration Company, Inc.
Big Bend 1-5 SWD
405' FNL & 2400' FWL
Lot 3 Section 5
T.151N., R.92W., 5th P.M.
Mountrail County, ND
Confidentiality Notice: The information contained on this plat is legally privileged and confidential information intended only for the use of recipients. If you are not the intended recipients, you are hereby notified that any use, dissemination, distribution or copying of this information is strictly prohibited.
N
±1.03 Miles to New Town, ND
New Town, ND
±3.00 Miles to Highway 23
Highway 23
T 152 N
T 151 N
92nd Ave. NW
36th Street NW
Proposed Route ±110 feet
Big Bend 1-5 SWD
89th Ave. NW
88th Ave. NW
R 93 W
R 92 W
LAKE
SAKAKAWEA
FORT
COUNTY
Map "A"
County Access Route
Legend
Existing Roads
Proposed Roads
Scale 1"=2 Miles
Kadrmas Lee & Jackson

TAT Specific Geology

(poster)





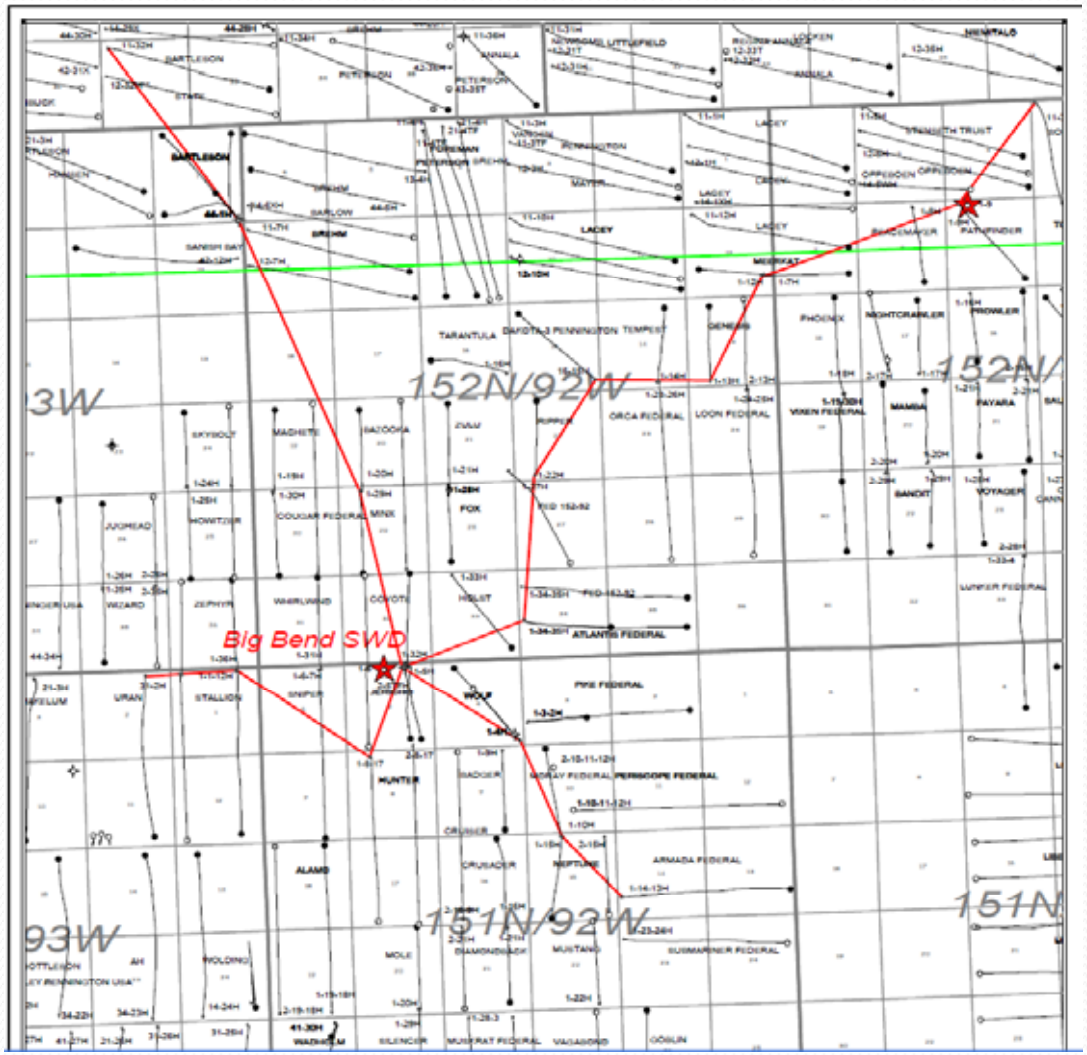
pass out shale and sandstone cores

Geology: Big Bend 1-5 SWD

Formation Name	Top (ft)	Bottom (ft)	TDS (mg/L)	Lithology
Coleharbor	0	23		sand, silt, clay
Bullion Creek	23	558	2,110	silt, sand, clay, lignite, limestone
Cannonball	558	1,043		sand, mudstone
Hell Creek	1,043	1,413	1,530	sand, mudstone
Fox Hills	1,413	1,713	1,530	silt, shale, sand, siltstone
Pierre	1,713	3,587	>10,000	shale
Niobrara	3,587	3,855		shale
Carlile	3,855	4,085		shale
Greenhorn	4,085	4,267		shale
Belle Fourche	4,267	4,488		shale
Mowry	4,488	4,845		shale
Inyan Kara (Dakota)	4,845	5,261	>10,000	sand
Swift	5261	5,706		shale
Rierdon	5,706	5,796		shale
Piper	5,796	6,244		shale
Bakken: upper	10,109	10,129		shale
Bakken: middle	10,129	10,174	244,272	siltstone
Bakken: lower	10,174	10,217		shale
Three Forks	10,217	10,230	295,557	dolostone, limestone

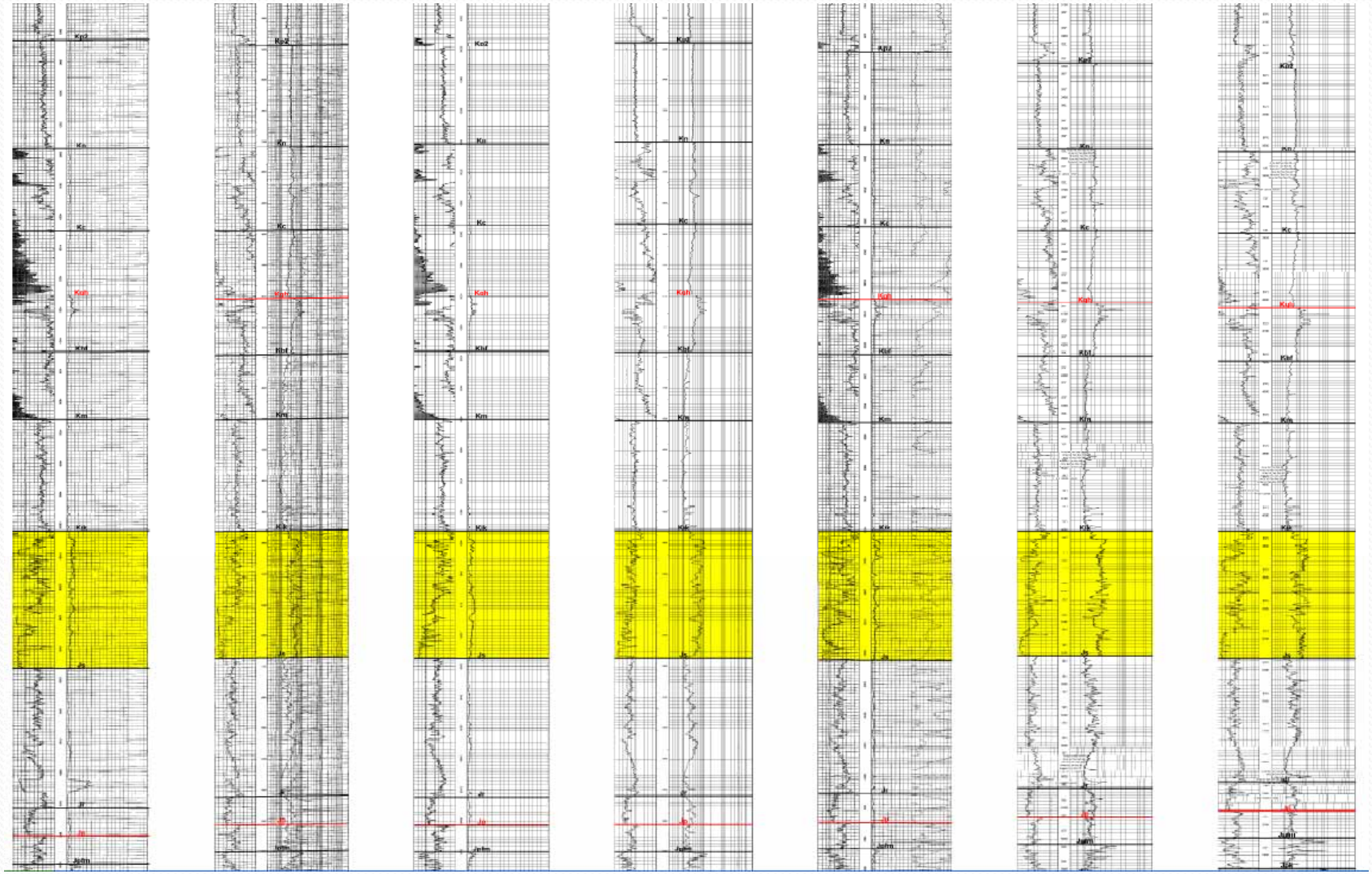
Geologic Analysis-Index Map

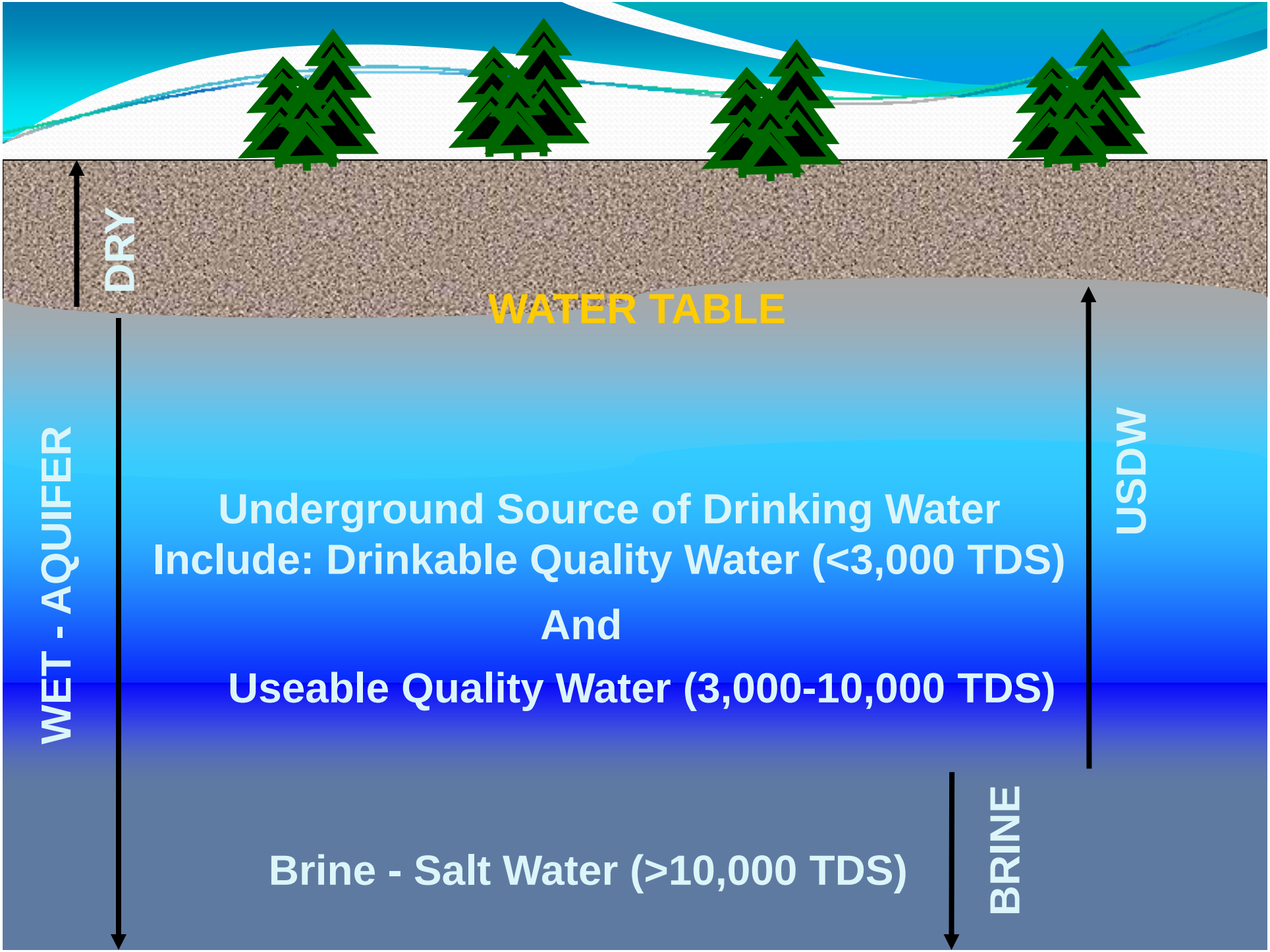
(handout 3/poster)



Cross Section Analysis

(poster)




DRY
WATER TABLE
WET - AQUIFER
USDW
Underground Source of Drinking Water
Include: Drinkable Quality Water (<3,000 TDS)
And
Useable Quality Water (3,000-10,000 TDS)
Brine - Salt Water (>10,000 TDS)
BRINE

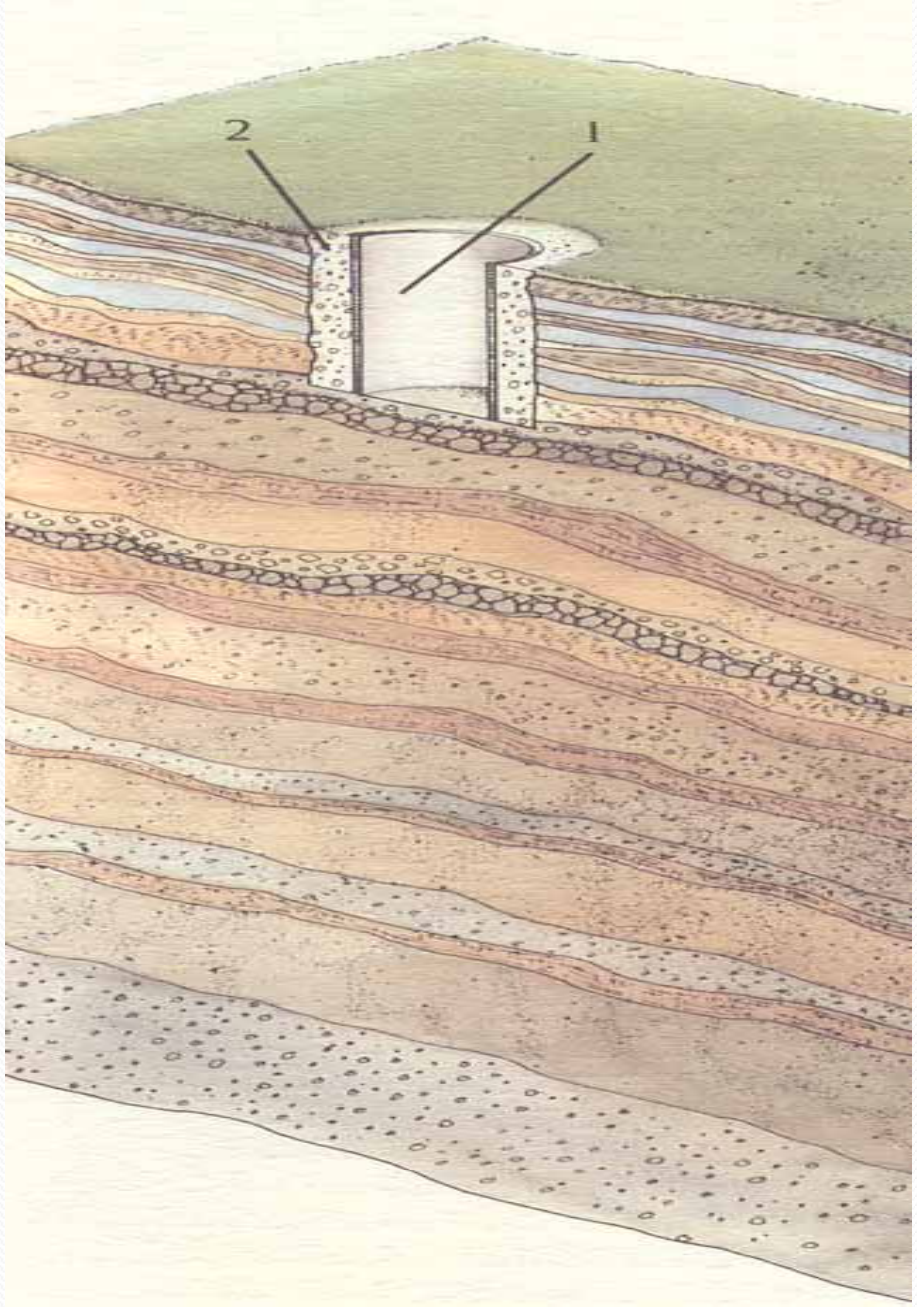
Ground Water: USDWs

- Base of USDW: Fox Hills Formation (USGS Water Resources of North Dakota/Water Resources of the Fort Berthold Indian Reservation, West Central North Dakota Report 98-4098)

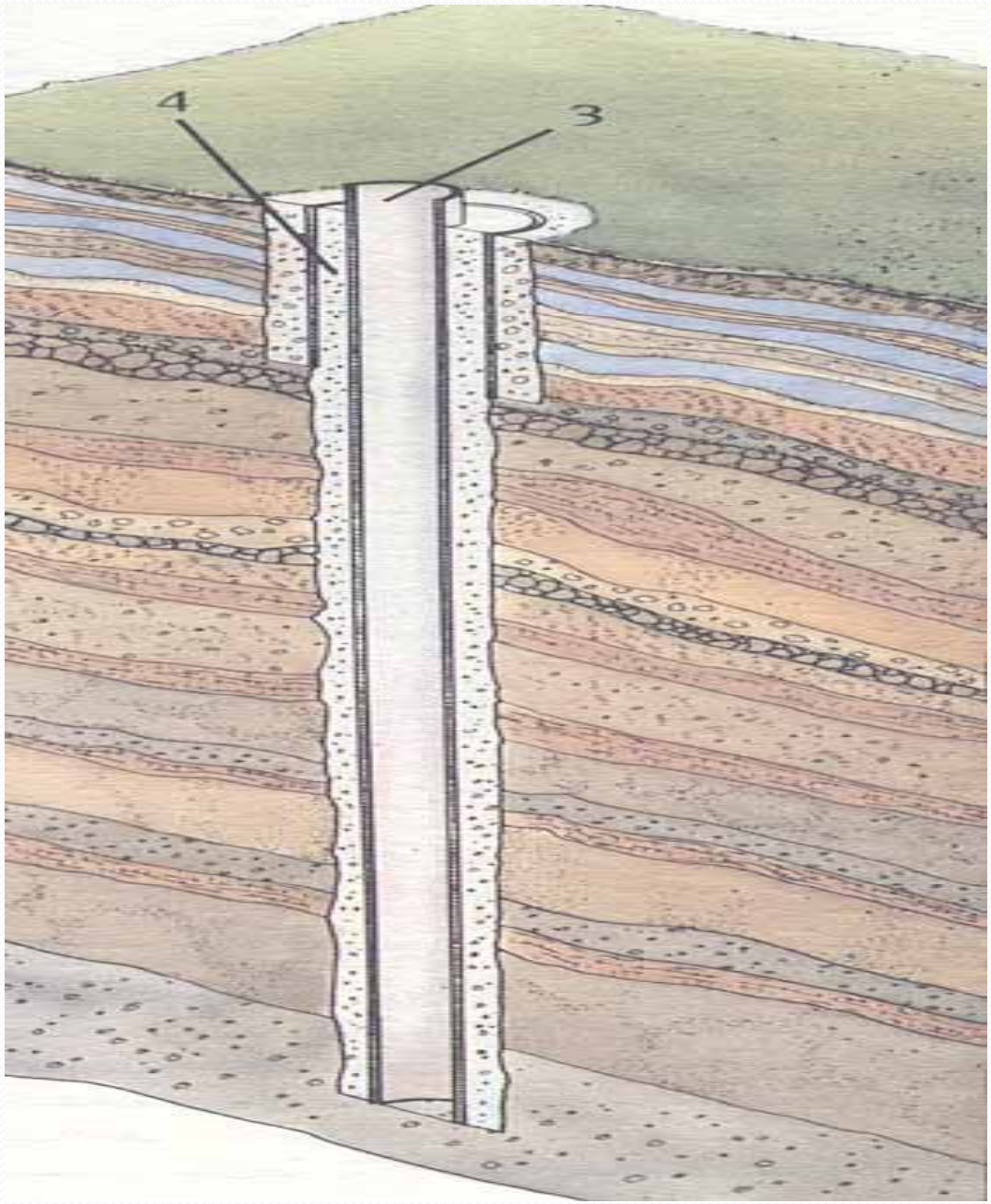
- Fox Hills: ~1,700 ft bgs ~1,500 ppm
- Bakken: ~10,000 ft bgs ~250,000 ppm

Construction

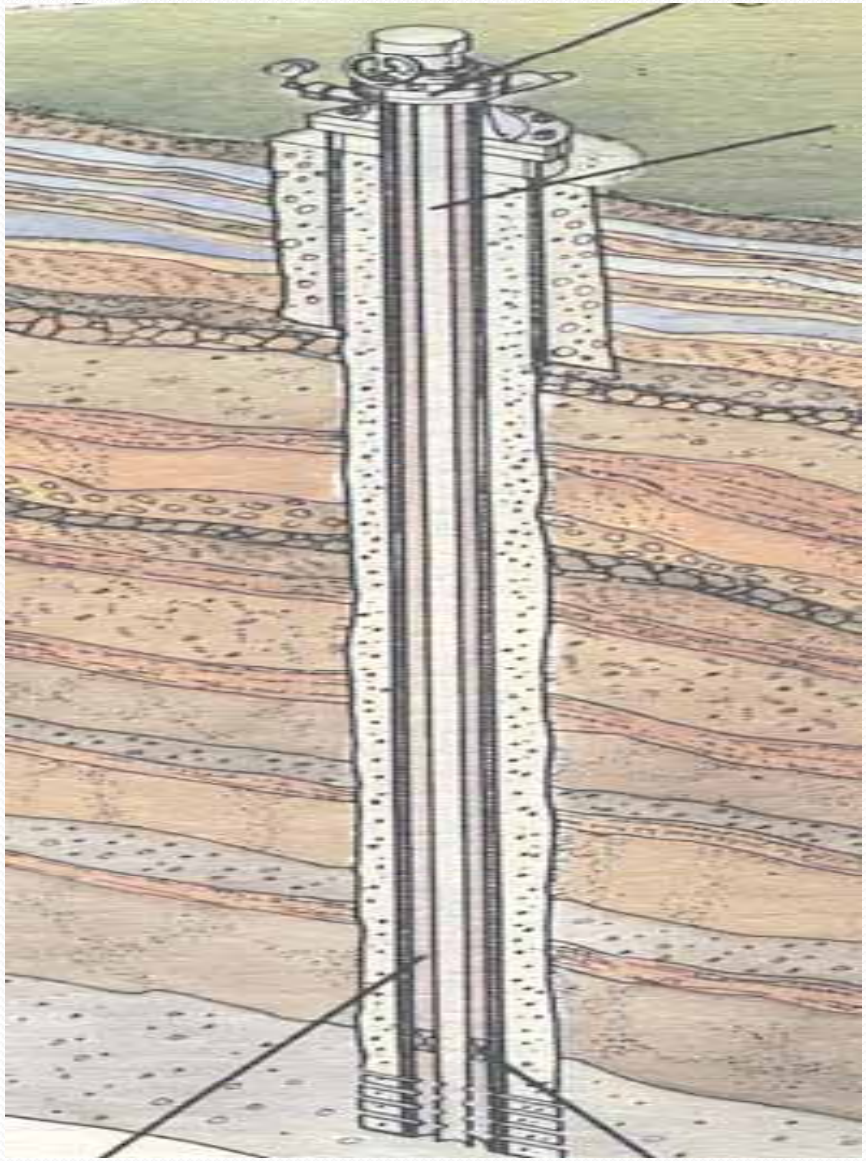
- Youtube: search Oil Drilling Animation
- Click: An example **animation** from the Faculty Innovation Center at UT Austin. fic.engr.utexas.edu
- http://www.youtube.com/watch?v=U2ms95HXol4



Injection Well Technology 1st Step: Surface Casing

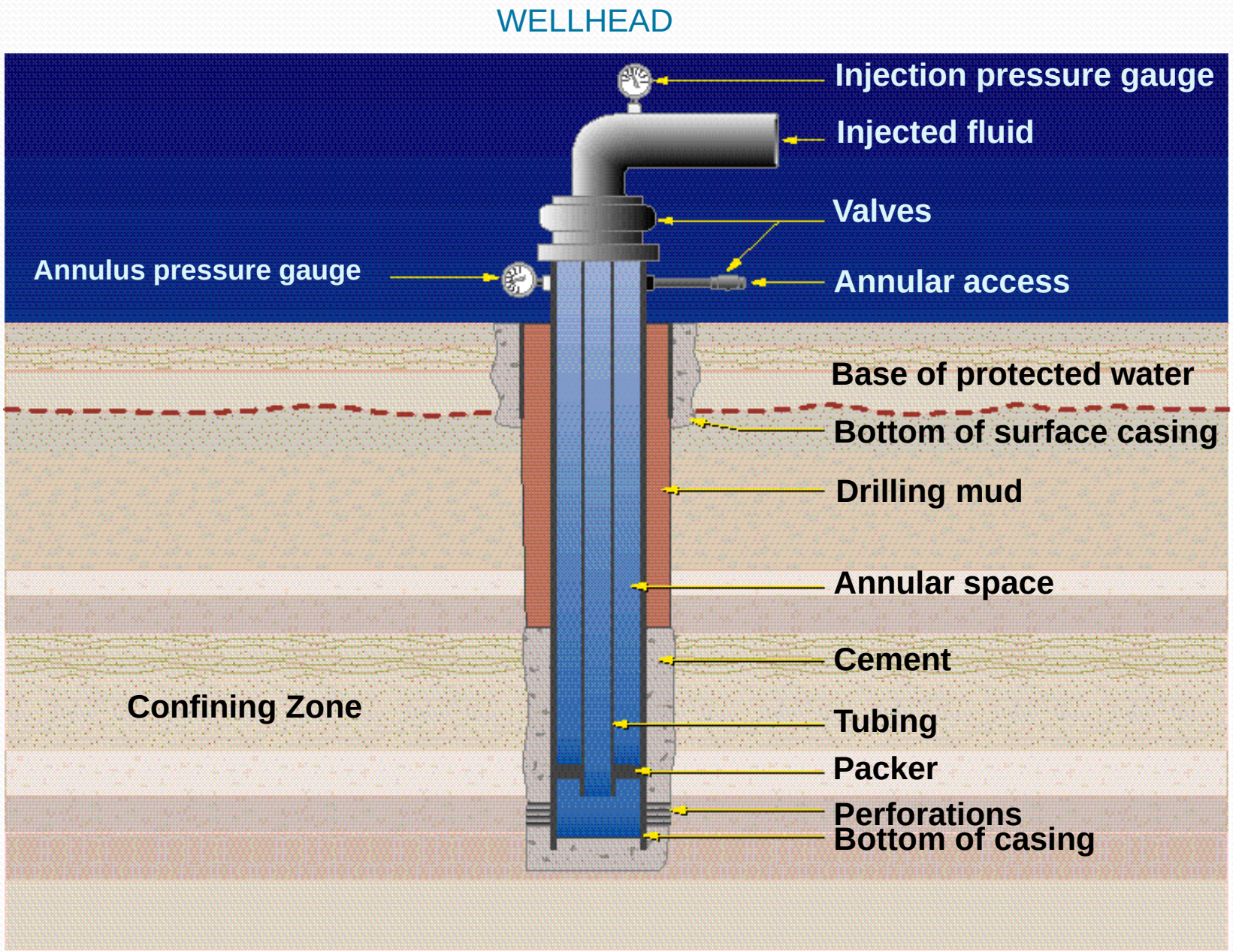


2nd Step: Long-String Casing



3rd Step: Tubing and Packer

Class II Salt Water Disposal Well



SLAWSON
exploration company, inc.

WELLBORE DIAGRAM
BIG BEND 1-5 SWD

GL ELEVATION – 1900.5'
KB ELEVATION – 1904.5'
API#

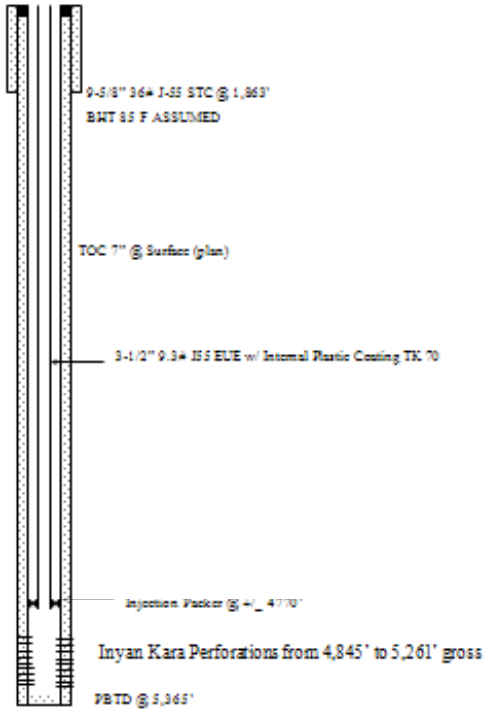
NE NW SEC 5 T151 R92
405' FNL and 2400' FWL
Mountrail County, North Dakota

USDW Surface-1713' < 10,000 TDS
Coleharbor-Fox Hills

Formation	TVD KB
Coleharbor Group	0-23'
Buffalo Creek	23'
Cannon Ball	558'
Hell Creek	1,043'
Fox Hills	1,413'
Pierre	1,713'
Niobrara	3,587'
Carlile	3,855'
Greenhorn	4,085'
Belle Fourche	4,267'
Mowry	4,488'
Inyan Kara (Dakota)	4,845'
Swift	5,261'
TD	5,410'

Mowry Upper confining zone 4,488'

Swift Lower confining zone 5,261'



NOTE: NOT TO SCALE

String	Hole Size	Casing Size	Interval/Depth	CUFT	Yield	SXS	TOC
Surface Lead Set 'C'	13-1/2"	9-5/8"	0-1363'	1065	2.66	400	Surface
Surface Tail 500' G	60% Xcess		1363-1863'	391	1.15	357	1363'
Production Lead 'Lite'	8-3/4"	7"	0-4600'	830	2.05	405	Surface
Production Tail 810' G	20% Xcess		4600-5410'	148	1.15	140	4600'

Surface casing set below lowermost USDW through shale layers

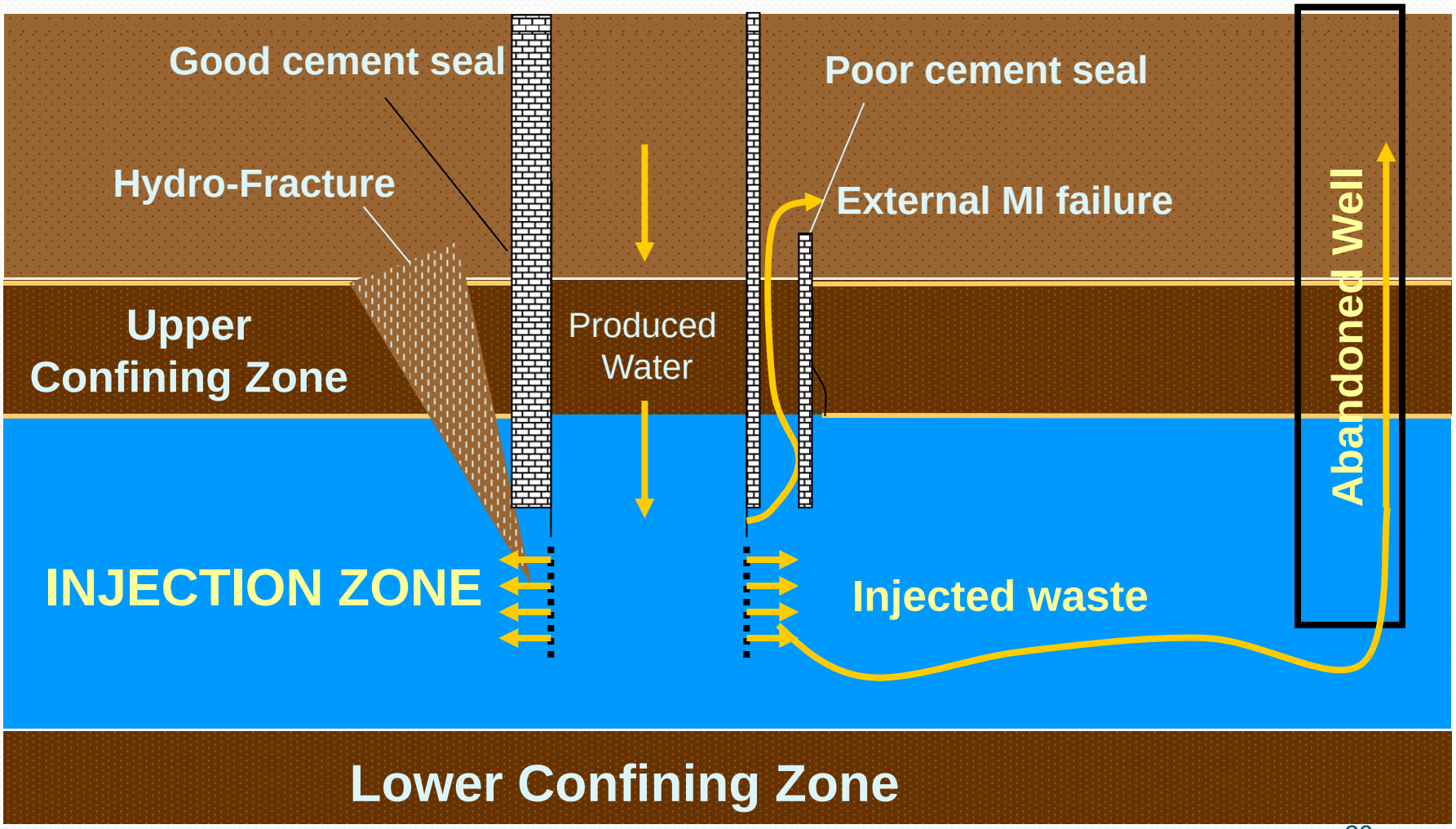
Cemented to surface: reduces conduit behavior

Area of Review

- Identify manmade and potential natural pathways that could act as a potential conduit for fluid into USDWs
- Method: calculated or fixed radius of ¼ mile
- Locate wells, faults, and surface features
  - Well type, depth, construction, date drilled, record of plugging and/or completion
  - Any other additional information required by the Director

External Pathways

Not to scale



Operation

- MAIP: Pressure effects should not reach the limits of the reservoir
- SRT: Conducted to determine the MAIP
- Draft: 1,355 psi/ft; SRT required

Monitoring

- Must demonstrate mechanical integrity at least every 5 years
- Monthly monitoring of injection pressure, flow rate, and volume
- Other Logging and Testing specific to permit

Big Bend 1-5 SWD

- No AoR wells
- Checking Braden Head Pressure on nearby production wells
- See Draft Permit: Appendix B (handout 4)

Ground Water Protection

- Not a strong regulatory framework for protecting ground water
- Growing population in the west and growing reliance on ground water for drinking water resources (water grab)
- Where aquifers are shallow: BMP should be employed during surface and shallow sub-surface activites to reduce impact to potential and currently used drinking water resources
  - Closed loop or pit less drilling
  - Monitor piping for leaks
  - Casing and Cementing requirements for production and disposal wells

Sustainability

- Better Technology: shouldn't have to develop one resource at the expense of another
  - Bakken and Three Forks: TDS ~250,000 ppm
  - Need fresh water for HF (gel jobs)
  - Recycle and Reuse leads to less produced water waste

Structure of the Program: Public Involvement in UIC

- SDWA mandates public involvement
- Opportunities
  - Public hearings for program revisions, permits, permit appeals, and aquifer exemption
  - Public information meetings may be held for permit decisions and other Agency actions

NHPA and ESA

- Federal Agency required to examine potential for impacts and consult with relevant parties
- Important to receive information from Tribe on cultural and significant properties
- Each action is a separate case