

Petroleum Resources Management
GOVERNANCE & REGULATORY ISSUES
Lessons from Louisiana



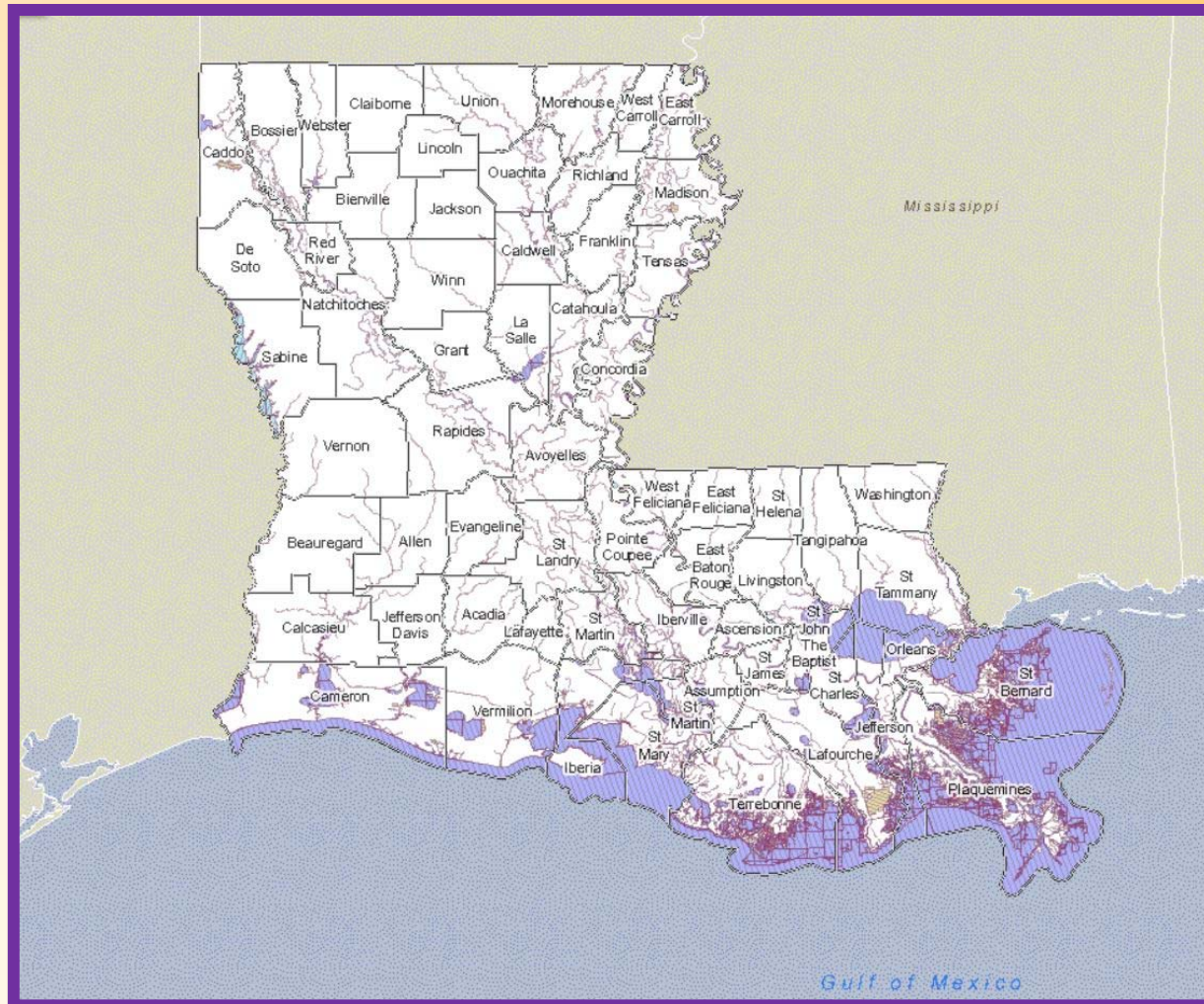
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October 16, 2017

Governance: Public & Private Lands

- Most land in Louisiana is privately owned.
 - Private contracts between landowners and oil companies predominate.
 - Private leases set royalty rates, e.g. 25% of all production is cost-free to lessor.
- State-owned lands are leased by a state agency (a division of Department of Natural Resources) under statutes and individual lease contracts.
- Drilling and Production Operations are regulated by a state agency – another division of Department of Natural Resources.

State Lands – Water Bottoms

in Purple



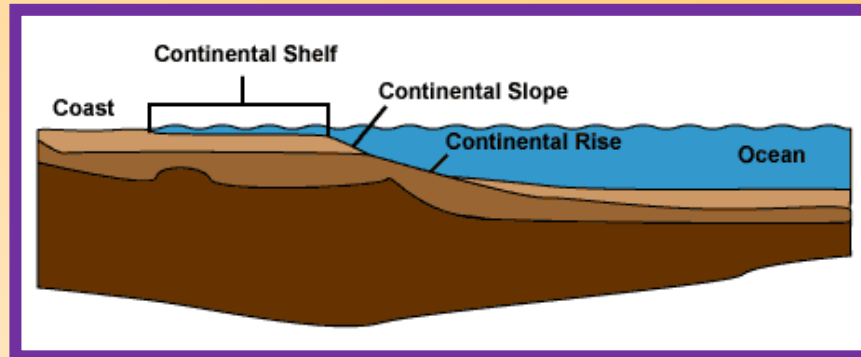
State Lands - Water Bottoms + Other

in Purple and Green

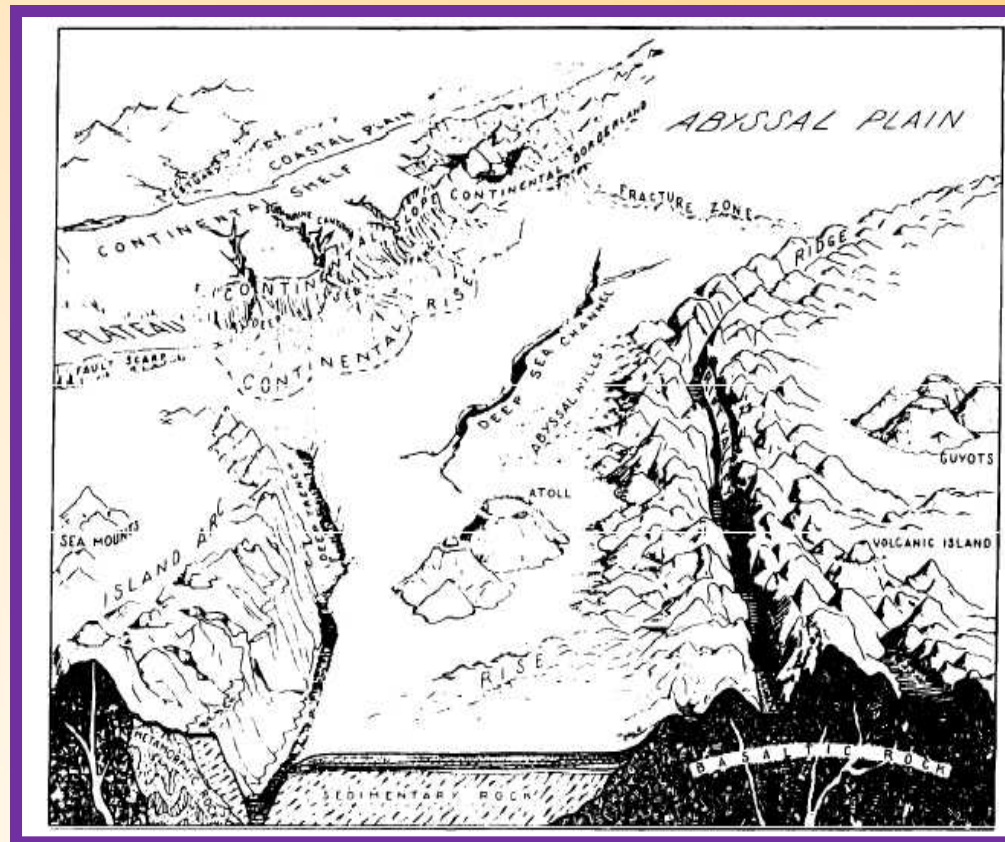


Some Geology/Geography

- **Marginal Sea:** The sea adjacent to a state/country.
- **Continental Shelf:** the extension of the continental land masses outward from the shore gradually sloping downward to an average depth of 200 meters.
- **Continental Slope:** a much steeper decline of the seabed to a depth of some 1000 to as much as 5000 meters.
- **Continental Rise:** another gentle decline in the seabed.
- **Abyssal Plain:** the deep ocean.



Source: <http://www.onr.navy.mil/focus/ocean/regions/oceanfloor2.htm>



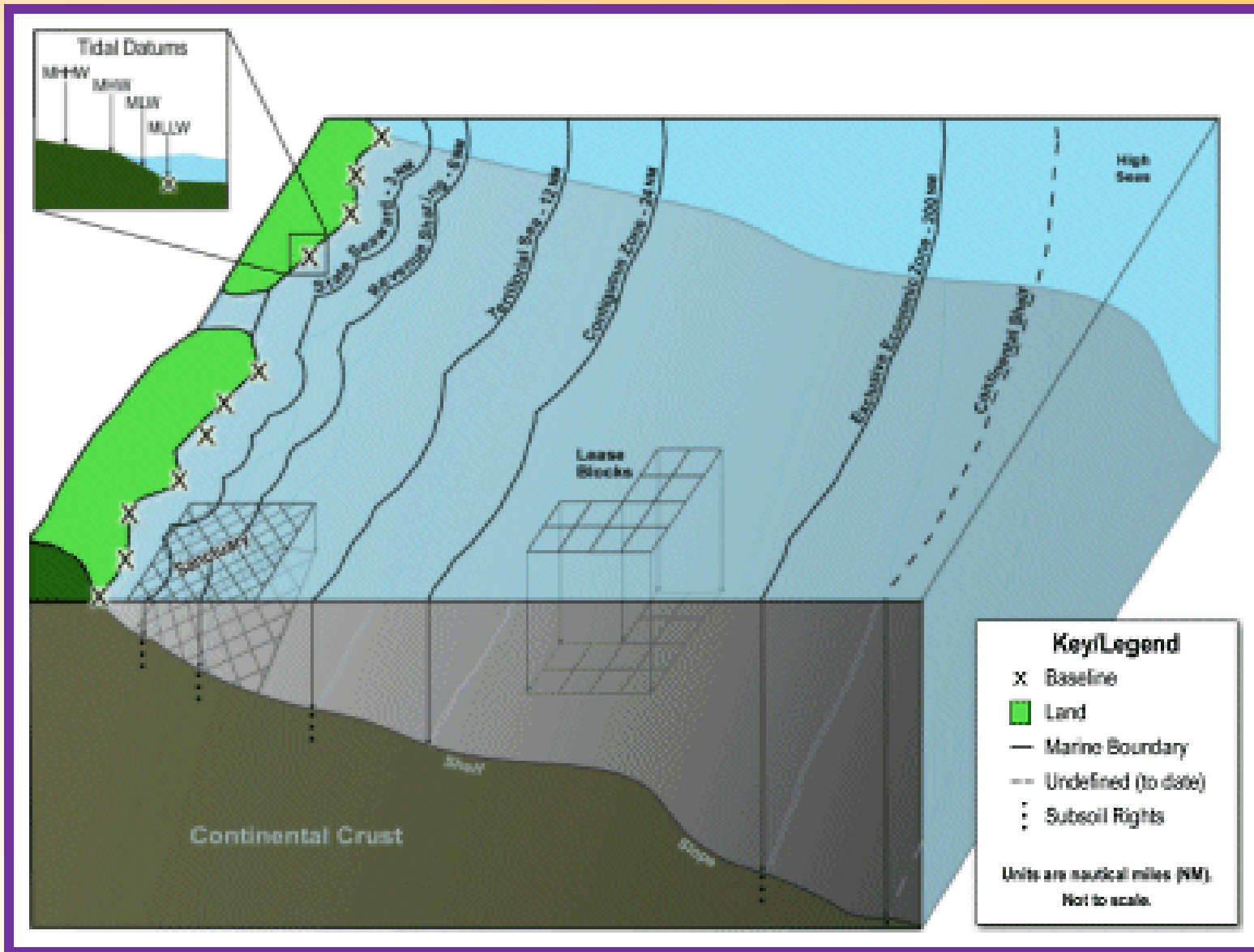
Source: <http://www.tpub.com/weather3/1-26.htm> (Integrated Publishing)

Some Jurisdictional Terms

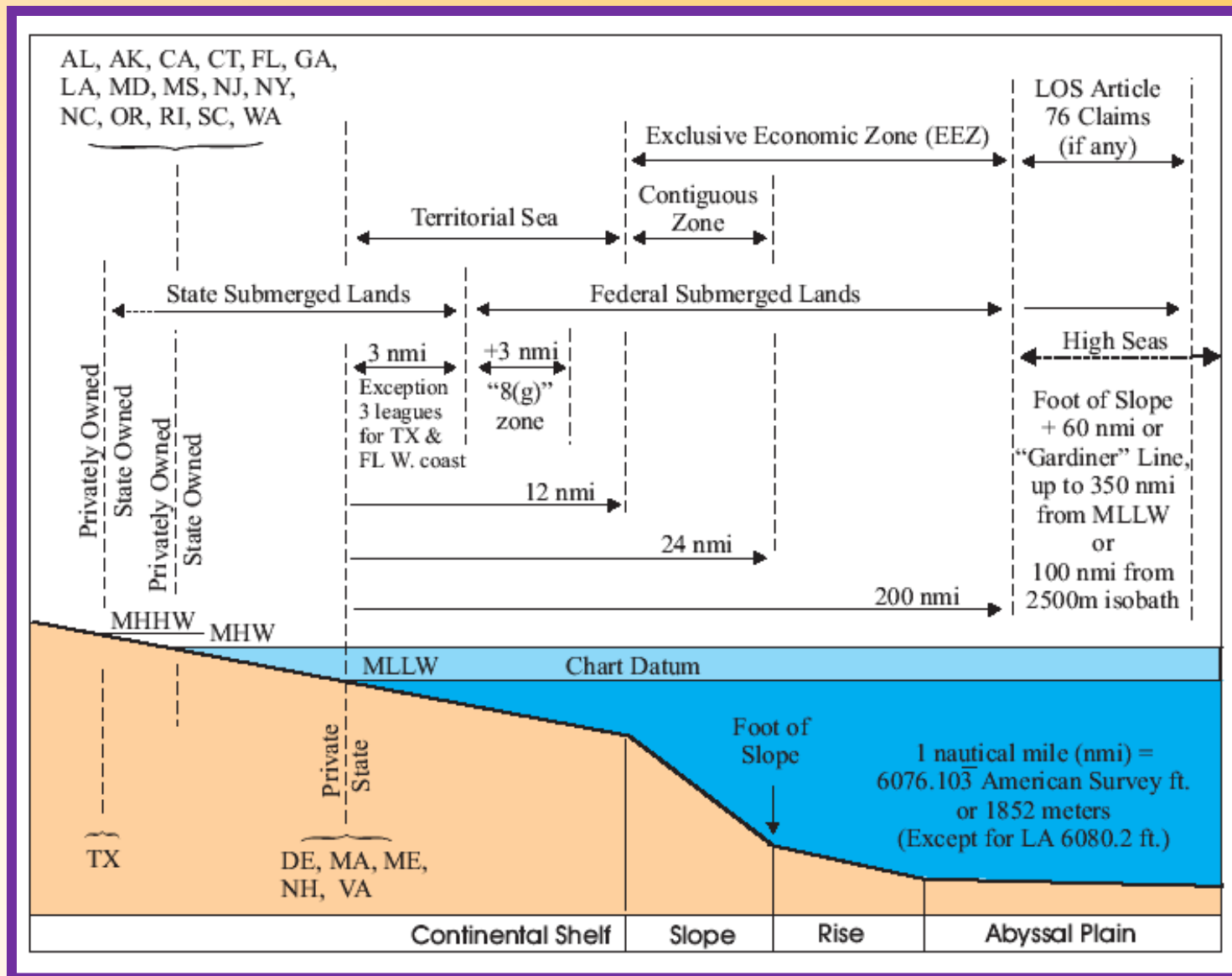
- ***Territorial Sea:*** The marginal sea over which a state/country exercises sovereignty. The traditional territorial sea was three miles from the country's coast. Proclamation No. 5928 (Dec. 27, 1988)-- extended the U.S. territorial sea from three to twelve nautical miles.
- ***Contiguous Zone:*** Proclamation 7219 (1999) -- extended the United States' contiguous zone from 12 nautical miles to 24.
- ***Exclusive Economic Zone (EEZ):*** Proclamation No. 5030 (March 1983) - established an Exclusive Economic Zone (EEZ) of the United States, extending seaward 200 nautical miles from the legal coastline of the territorial sea of the United States, the Commonwealths of Puerto Rico and Northern Mariana Islands, and other U. S. territories and possessions.
- ***Continental Shelf Limit:*** UNCLOS Article 76, 1958. "the seabed and sub-soil of the submarine areas adjacent to the coast but outside the area of the territorial sea, to a depth of 200 meters or beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources of said areas;"

State vs. Federal Jurisdiction

- ***Tidelands litigation:*** In *United States v. California*, 332 U.S. 19 (1947), the Supreme Court held that the federal government had paramount rights in and power over the lands under the marginal sea. Thus the federal government, not the state, had full dominion over the resources of the soil, including the petroleum, under the water area.
- ***Submerged Lands Act:*** Congress “recognized, confirmed, established, and vested in” the coastal states “title to and ownership of the lands beneath navigable waters within the boundaries of the respective States, and the natural resources within such land and waters.”
- ***Outer Continental Shelf Lands Act:*** the OCSLA provides the manner in which federal jurisdiction beyond the state authority is exercised.
- ***Coastal Zone Management Act of 1972:*** requires state review of Federal action that would affect land and water use of the coastal zone (consistency review).
- ***OCSLA Amendments: 8g --*** provides for a “fair and equitable” division between a coastal state and the Federal government of revenues that may be generated by a Federal lease which lies within three miles of the seaward boundary of the coastal state.
- ***Recent Legislation:*** Energy Policy Act of 2005; Gulf of Mexico Energy Security Act of 2006.
- ***Termination of Moratoria:*** 2008



Source: <http://www.csc.noaa.gov/mbwg/htm/cadastre.htm>



Source: <http://www.csc.noaa.gov/mbwg/>

ORGANIZATIONAL CHART

LOUISIANA DEPARTMENT OF NATURAL RESOURCES



Boards and Commissions

- Atchafalaya Basin Research and Promotion Board
- Atchafalaya Basin Technical Advisory Group
- Oilfield Site Restoration Commission
- Oyster Lease Damage Evaluation Board
- State Mineral and Energy Board
- Water Resources Commission
- Water Management Advisory Task Force
- Cross Unit Well Study Commission

Office of Mineral Resources: Mineral and Energy Board



- The State Mineral and Energy Board administers the state's proprietary interest in minerals and is composed of the governor, the secretary of the Department of Natural Resources, ex officio, and nine members appointed by the governor. Six members constitute a quorum.
- The governor may appoint board members engaged in the industry and related business activity and each appointment shall be submitted to the Senate for confirmation. Each appointed member shall serve a term concurrent with that of the governor making the appointment.
- The State Mineral and Energy Board is the exclusive body with the authority to lease for development and production of minerals, oil, and gas, any lands belonging to the State of Louisiana, or the title to which is in the public, including road beds, water bottoms, vacant state lands, and land adjudicated to the state at tax sale.
- The Board may lease state agency lands as well, upon agency request, and may grant exclusive and non-exclusive permits to conduct geophysical and geological surveys of any kind on state-owned lands and water bottoms.

- The Board is authorized to explore and develop state lands and water bottoms subject to its leasing authority on its own behalf or through others.
- The Board has the responsibility for administering all existing mineral leases on such state lands to ensure maximum development and production and to ensure full compliance with the terms and conditions of the respective leases. It may act to recover nonproducing leased acreage, annul or amend leases, join in pooling and unitization agreements, elect to receive in lieu unit production or proceeds or in kind royalty, or enter into agreements to offset, compensate, or recover from royalty underpayment or overpayment.
- The Board has final approval of transfers and assignments relating to state mineral leases or state-owned mineral rights, of state agency mineral leases. It also executes division orders directly or through staff and ensures proper statutory-mandated parish and dedicated funds transfers.
- Staff support to the Board is provided by the Office of Mineral Resources which conducts the day-to-day operations of the Board's business and provides it with the information and technical advice necessary for the accomplishment of business at its meetings.
- The Board meets at the call of the governor, generally holding its meetings and State Lease Sales on the second Wednesday of each month.

Office of Mineral Resources: Geology, Engineering & Lands Division

- The Geology Lands Division provides the State Mineral & Energy Board with expertise, advice and recommendations in the fields of geology, geophysics and engineering, by compiling, maintaining and analyzing varied scientific data to determine the most advantageous minerals exploration, development and production on state-owned lands and water bottoms. The division also performs the mineral leasing function on behalf of the State Mineral & Energy Board, maintains state mineral lease ownership and property data, manages the docket of items submitted for Board consideration at its monthly meetings and maintains the official state mineral lease files.
- The Division works closely with the Mineral & Energy Board's Tract Evaluation, Legal and Title Controversy, Docket Review and Lease Review Committees and its personnel provide the majority of public assistance at the public reference computer areas in the Baton Rouge office.
- The special projects geologists handle a variety of projects involving minerals activity on state acreage at the request of Department and Office administration or as a result of developing industry activity.

Office of Mineral Resources: Mineral Income Division

- The Mineral Income Division works closely with the Board's Audit Committee. This Division performs collection and accounting of revenue due the state from mineral leasing activity and production on state-owned lands and water bottoms on behalf of the State Mineral & Energy Board. To ensure that all revenues are properly classified, the Division enters the payor information on new and existing LUW codes (Lease, Unit, Well) into the SONRIS System.
- The Division also performs audits of payor companies, including audits of major companies every three years, with auditors based in Houston and Dallas, Texas as well as Baton Rouge, Louisiana. The field auditors work on-site at payor company offices, reviewing company records of items such as product allocation, volumes production and disposition, sales revenue and deductions, and oil and gas contracts, to determine compliance with payment obligations.

State mineral lease acquisition process

- (1) Registration - Any party who wants to apply for a state lease.
- (2) Pre-nomination research.
- (3) Nomination of state or state agency lands or water bottoms for mineral lease
- (4) Examination and evaluation of nominations for state and state agency mineral leases
- (5) Advertisement of state and state agency tracts offered for mineral lease
- (6) Submission of bids on state and state agency tracts offered for mineral lease
- (7) Examination and evaluation of bids for state and state agency mineral leases
- (8) Award of state and state agency mineral leases and options at the state mineral lease sale
- (9) Issuance and execution of state and state agency mineral lease contracts after the state mineral lease sale
- Each general step has its own set of procedures and requirements.

Lease Terms

- Lands and minerals described.
- Cash payment – Bonus
- Term of lease –
 - Primary term – holding prior to initial operations (delay rental year-to-year)
 - Secondary term - so long thereafter as oil, gas or other liquid or gaseous hydrocarbons are produced in paying quantities or any operation is conducted, payment is made, or condition exists, which continues this lease in force.
- Royalty Clauses
- In kind Option - all or any part of the portion due lessor as royalty
- Offset drilling obligation
- Shut-in well provisions
- Pooling and Unitization provisions
- Force Majeure Clause
- Plug & abandon provisions

DNR - Data on Wells - SONRIS

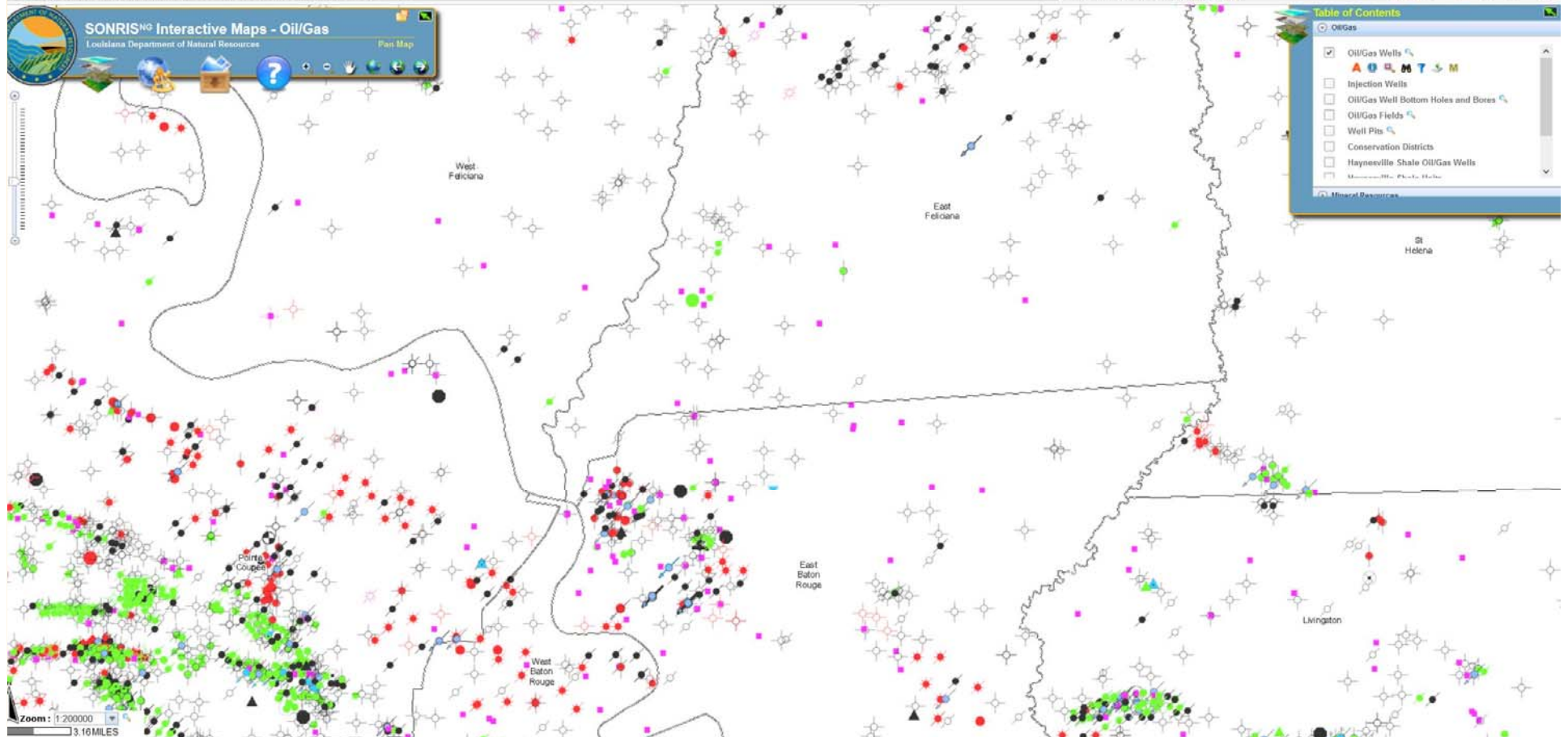
Louisiana.gov > Department of Natural Resources > SONRIS
Baton Rouge, LA Weather
79° F, Clear

NOTE NOW available for users of SONRIS, the Louisiana DNR Data Subscription Service. Effective now, you can purchase a subscription to the SONRIS data and be able to get a monthly download of all the data for integration into your own databases and application. View the details at http://sonris-www.dnr.state.la.us/Data_Subscription_Service_Announcement.pdf.

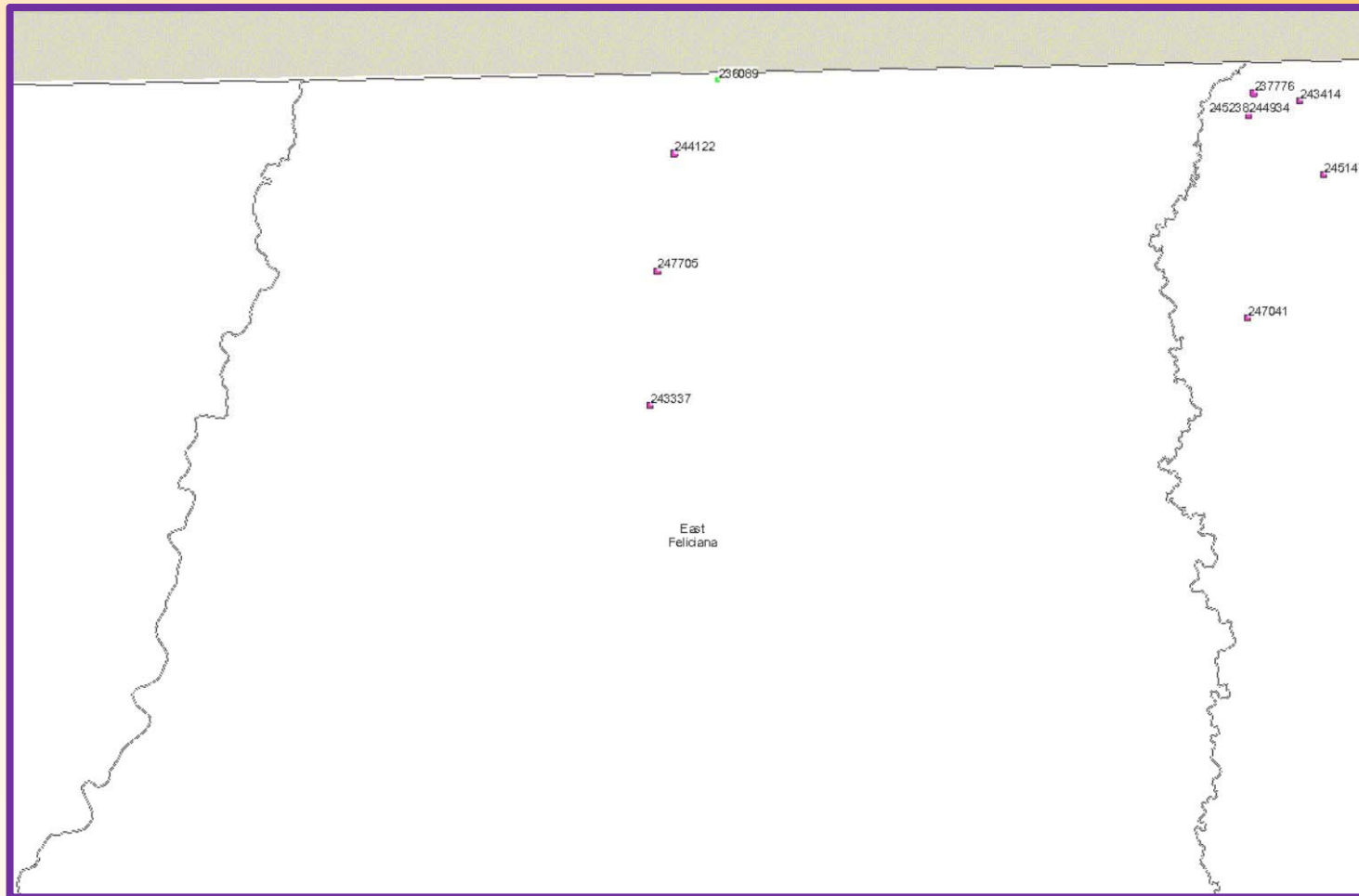
NOTE ****Register for the DNR SONRIS Workshop 2017**** <http://www.dnr.louisiana.gov/index.cfm/newsroom/detail/1152>

 GIS Access Retrieve information using interactive, geographically oriented, map capabilities, and select from a variety of layers of backgrounds.	 Data Access Oil, Gas & Ground Water information and more at your finger tips.	 Document Access Millions of documents in various formats readily available for view and print.	 Disaster Preparation Reports: Helpful reports for hurricane season. For use of Reports on Demand, view the tutorial.
 Legacy Lawsuits Helpful reports for Legal cases. For use of Reports on Demand	 CES Inspections Facility Lease & Orphan Well Inspections.	NEW Data Subscription Service Get a monthly download of all the data for integration into your databases and application.	
 Online Well Log Submission Submit your Well Log electronically. Click Here to view preliminary guidelines & training for submission.	 Online Production Reporting Report oil & gas online	 Online Royalty Reporting Report mineral royalty online, refer to Tutorial for instructions	 Online UIC Reporting Report UIC-10, UIC-24, UIC-33/34, and UIC-WH1 electronically
 Online Surface Water Apply and track surface water application online visit our Louisiana Surface Water Management Program	 Well Test/Inactive Reports Submission Submit your Well Test/Inactive Report electronically. Click on User Guide for detail instructions	 Online OR1 Submission Submit your OR1 application electronically. Click on User Guide for detail instructions	 Invoice Payments Pay invoices online; invoice number and security code are needed
 Tract Nominations Click here for detailed instructions for online tract nomination			
 UIC Online Data Entry Reports Click here for UIC online data entry reports	 Well Test Online Data Entry Reports Click here for Well Test online data entry reports	 OR1 Online Data Entry Reports Click here for OR1 online data entry reports	
 Contact/Data Request/Help Click here to contact us or submit a request for data	 FAQ Frequently Asked Questions and more....	 Downloads Click here to get required components	

Close-up Map – All Wells in parts of 4 parishes



Close-up Map – TMS Wells in E. Fel. parishes



Well Data – Beech Grove Well

Well Information

Review Well Information

WELLS

SERIAL	WELL NAME	WELL NUM	ORG ID	FIELD	PARISH	PROD TYPE	SEC	TWN	RGE	EFFECTIVE DATE	API NUM
243337	BEECH GROVE LAND CO 68 H	001	G104	1366	19	10	068	02S	02E	09/01/2013	17037201510000

PRMT DATE	SPUD DATE	STAT DATE	ST CD
06/02/2011	07/04/2011	10/30/2011	10

WELL SURFACE COORDINATES

Surface Longitude	Surface Latitude	Lambert X	Lambert Y	Ground Elevation	Zone	Datum
91-2-58	30-53-35	2089022	809795	286.1	S	NAD-27

WELL SURFACE COORDINATES GENERATED BY DNR

UTMX 83	UTMY 83	LONGITUDE 83	LATITUDE 83
686415.35561279	3419409.18708983	-91.04966012	30.89332498

BOTTOM HOLE COORD

EFFECTIVE DATE	END DATE	PLUGBACK TOTAL DEPTH	TRUE VERTICAL DEPTH	MEASURED DEPTH	LAT DEG	LAT MIN	LAT SEC	LONG DEG	LONG MIN	LONG SEC	COORDINATE SOURCE	LAMBERT X	LAMBERT Y	ZONE	COORDINATE SYSTEM
06/02/2011	10/23/2011		13750	18590	30	54	19	91	2	29	02	2091542	814209	S	01
10/24/2011	10/29/2011	17153		17153	30	54	19	91	2	29	02	2091542	814209	S	01
10/30/2011		17153		17153	30	54	19	91	2	29	02	2091542	814209	S	01

WELL HISTORY

SERIAL	WELL NAME	WELL NUM	ORG ID	FIELD	ST CD	PT	WELL CLASS	EFF DATE	END DATE	STAT DATE
243337	BEECH GROVE LAND CO 68 H	001	G104	1366	10	10		09/01/2013		10/30/2011
243337	BEECH GROVE LAND CO 68 H	001	D151	1366	10	10		10/30/2011	08/31/2013	10/30/2011
243337	BEECH GROVE LAND CO 68 H	001	D151	1366	01	00		06/02/2011	10/29/2011	06/02/2011

SCOUT INFO

REPORT DATE	WELL STATUS	MEASURED DEPTH	TRUE VERT DEPTH	DETAIL
12/02/2011	10	17153		COMPLETED 10/30/11 AS A OIL WELL IN THE TUSCALOOSA MARINE SHALE RES;PM F 120 BOPD; 100 MCFD; 950 CP FTP; 30/64 CK; 312 BWPD; 833 GOR; 42 GRVTY PERFS 14275-17013' (ST: 10)
10/03/2011	06	17153		INSTALLED TBG HEAD & TSTD; INSTALLED DHT; R/R 9/28/11; WOCCR; LAST BOP TST 9/8/11;
09/26/2011	05	17153		RAN 5-1/2" CSG T/ 17125' & CMT W/ 620 SXS; N/D BOPS;
09/19/2011	05	17153		DRLD, LOGGED, & SURVEYED T/ 17153';
09/12/2011	05	17030		DRLD; CBU; L/D DIR ASSY; TST BOPS 9/8/11 (250/3500, VALVES & RAMS 250/5000); P/U DIR ASSY; DRLD; LOGGED; SURVEYED LATERAL SECTION FM 15742-17030'
09/06/2011	05	15110		DRLD; BOP FUNCTION TEST 9/2/11
08/29/2011	05	14154		RAN 7-5/8" LINER F/ 12904-14154' & CMT W/ 180 SXS; TSTD BOPS 8/28/11;
08/22/2011	05	14154		DIR DRLD T/ 14154; TSTD BOPS 8/20/11;
08/15/2011	05	14200		DIR DRLG @ 13760; TSTD BOPS 8/7/11;
08/08/2011	05	14200		LOGGED; SET CMT PLUG F/ 14200-13575 W/ 220 SXS; SET CMT PLUG F/ 13575-12950 W/ 210 SXS; DRESSED CMT T/ 13200' & SET WHIPSTOCK; MILLED WINDOW F/ 13170-13184'; TSTD BOPS 8/
08/01/2011	05	14200		TSTD CSG; DRLD T/ 14200; TOH & R/U LOGGING EQUIP;
07/25/2011	05	13368		DRLD T/ 13368; LOGGED; RAN 9-5/8" CSG T/ 13331' & CMT W/ 630 SXS; TSTD BOPS 7/24/11; P/U 8-1/2" BHA & TIH;
07/18/2011	05	12280		DRLD T/ 11000; P/U DIR TOOLS, DRLD, LOGGED & SURVEYED T/ 12280';
07/11/2011	05	3725		DROVE 20" CP T/ 332' W/ 302' PENETRATION; SPUD 7/4/11; DRLD T/ 3715; RAN 13-3/8" CSG T/ 3715' & CMT W/ 3340 SXS; N/U & TSTD BOPS 7/9/11; TSTD CSG; DRLG; (BOP INFO: 13-5/8", SC SCHEMATIC RECD 10/24/11 (WOCCR PER RDH); CONF EL(11,000-17,150) RECD 2/27/12 FORM COMP WH-1 & SCHEMATIC RECD 11/29/11
06/02/2011	01	18590		S 89 D 36' 10" W - 5453.12' FROM NGS MONU. "IRWIN" IN SEC 68. PBHL: N 29 D 43' 12" E - 5082.81' FROM SURF LOC IN SEC 64.

PERFORMANCES

SERIAL NUM	COMPLETION DATE	UPPER PERF	LOWER PERF	SANDS	RESERVOIR
243337	10/30/2011	14275	17013	TUSC MARINE SHALE	

WELL TESTS

RPT TYP	TEST DATE	RPT DATE	OIL POT	COND	GAS DEL	WATER	BSW%	FLOW PRES	SHUTIN PRES	CHOKE	UPPER PERF	LOWER PERF	BOT HOLE PRES
DM-1R	04/16/2017	05/01/2017	35		0	19	35.1	35	525		14275	17013	
DM-1R	10/02/2016	11/01/2016	23.34		18	23	49.6	90	450	12.0/6	14275	17013	
DM-1R	04/20/2016	05/01/2016	23		9	2	8	155		10.0	14275	17013	
DM-1R	09/22/2015	11/01/2015	3		4	8	72.7	50	0		15	14275	17013
DM-1R	04/09/2015	05/01/2015	17		8	9	34.6	40		20	14275	17013	
DM-1R	10/09/2014	11/01/2014	23		23	27	54	25	40	26	14275	17013	
DM-1R	03/04/2014	05/01/2014	8			8	.1	100		26	14275	17013	
DM-1R	09/12/2013	11/01/2013	8			5	.1	100		26	14275	17013	
DM-1R	03/19/2013	05/01/2013	13			6	.1	100		26	14275	17013	
DM-1R	10/22/2012	11/01/2012	23			15		100		8	14275	17013	
DM-1R	04/21/2012	05/01/2012	25			20		230		8	14275	17013	

WELL ALLOWABLES

EFFECTIVE DATE	END DATE	LWU CODE	LWU TYPE CODE	ALLOWABLE	ESTIMATED POTENTIAL	CURRENT ALLOWABLE TYPE
07/01/2017	12/31/2017	050845	1	1800	35	1
01/01/2017	06/30/2017	050845	1	1800	23	1
07/01/2016	12/31/2016	050845	1	1800	23	1

Conservation Regulation: Overcoming the Rule of Capture

DNR - Office of Conservation

- The Office of Conservation is charged with conserving and regulating oil, gas, and lignite resources of the state. This statutory responsibility is to regulate the exploration and production of oil, gas and other hydrocarbons and lignite; to control and allocate energy supplies and distribution; and to protect public safety and the environment from oilfield waste, including regulation of underground injection and disposal practices.
- The Commissioner of Conservation is responsible for administering all activities involving the conservation and development of all natural and mineral resources of the state. The Commissioner also oversees the administration of six divisions and three district offices within the Office of Conservation.

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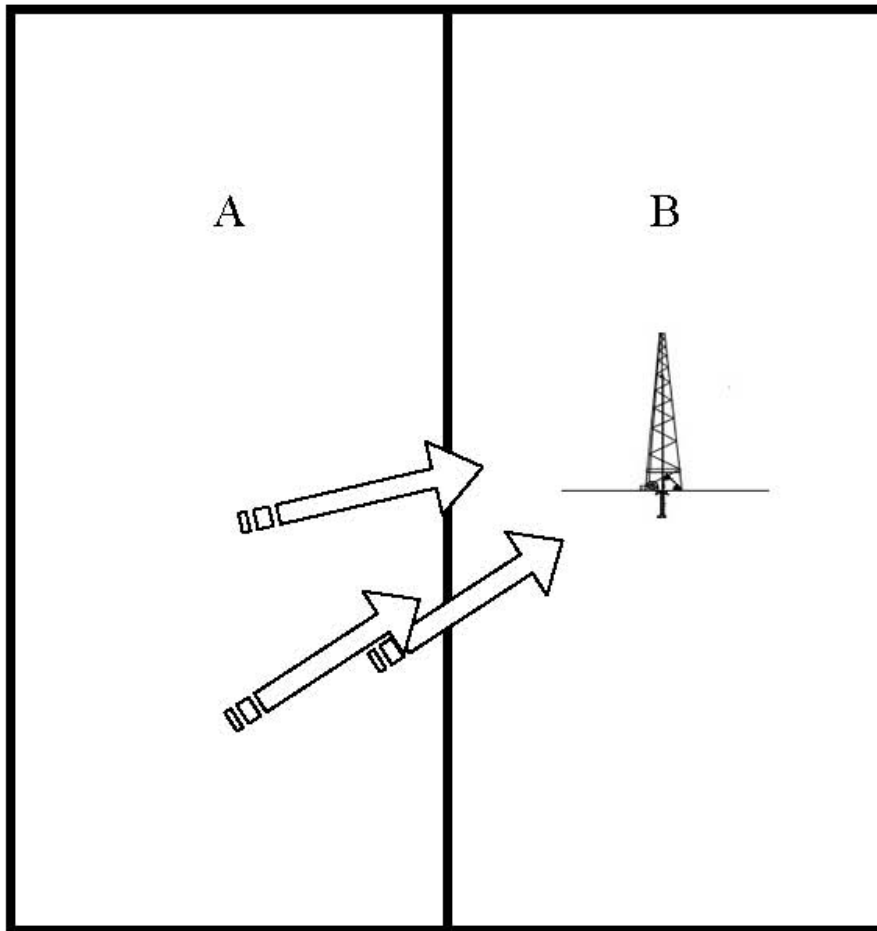
Engineering - Administrative Division

- The Engineering Division is responsible for the prevention of waste of oil and gas underground (in the reservoirs in which it accumulated), in storage and in transportation and is responsible for the protection of property rights of all persons concerned or affected thereby insofar as those rights relate to oil and gas exploration and exploitation in the state of Louisiana.
- Engineering - Administrative Division handles:
 - • Unitization
 - • Permit and Reservoir
 - • Imaging
 - • Production Audit
 - • Well Files and Well Status
 - • Operators are required to provide well logs in electronic format.
 - • Louisiana Oil and Gas Operators are required to file their DT-1 and DM-1R Well Tests, and Inactive Reports on-line.

Engineering - Regulatory Division

- The Engineering Regulatory Division is responsible for inspecting oil and gas wells and the associated facilities to ensure compliance with Statewide Order No. 29-B; the processing of Unit Termination applications (Statewide Order No. 29-L-3); and the approval of Unit Survey Plats. The Division is responsible for implementing and administering the Oilfield Site Restoration Program as well as the Underwater Obstruction Removal Program.
- Engineering - Regulatory Division handles:
 - • Inspection and Enforcement
 - • Onsite E&P Waste
 - • Underwater Obstruction
 - • Oilfield Site Restoration
 - • District Offices

Rule of Capture



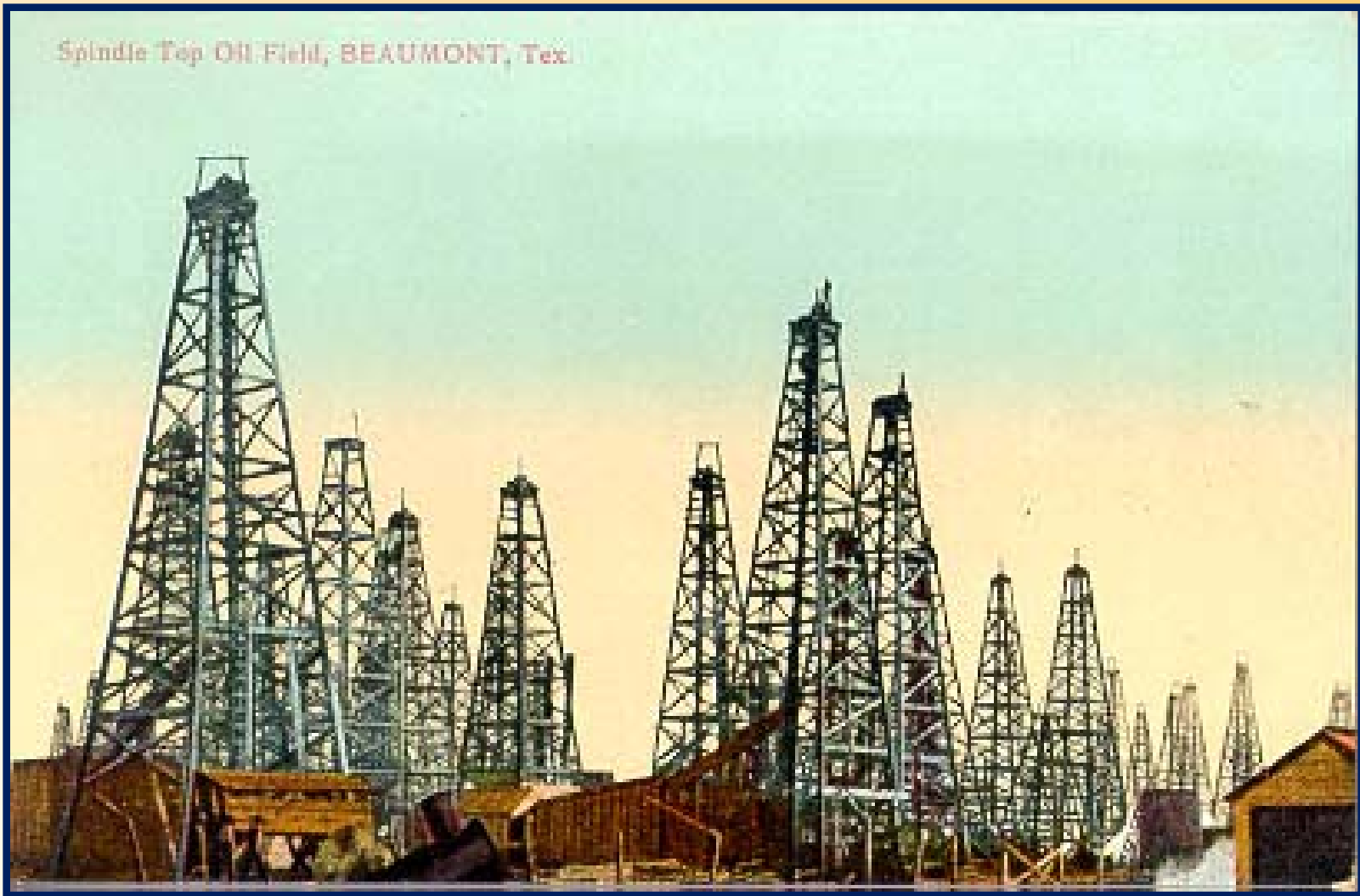
I Drink Your Milkshake!

The Effects of the Rule of Capture.

- The rule of capture leads to the drilling of wells that are unnecessary to drain a reservoir.
- It leads to excessive rates of production of oil that may cause coning, fingering, and premature loss of reservoir energy as gas cap gas or solution gas is depleted.
- Surface effects may include production in excess of storage and marketing facilities.
- Improper practices by operators can cause waste. Incorrect plugging of a well, for example, can lead to migration of oil out of a reservoir to pollute the surface or can lead to communication between formations thus damaging a productive formation.

Rule of Capture - Excessive Drilling

Spindle Top Oil Field, BEAUMONT, Tex.



Production Limitations

- [1] MER...Maximum efficient rate of recovery
- [2] Market Demand
- [3] Protection of correlative rights within a reservoir; prevention of net drainage.

Well Spacing

- Well spacing is concerned with the location of wells and the density of drilling into a reservoir. Rules or orders of the state conservation agency may limit the proximity of wells to property lines and to other wells.
- Such regulations have the effect of protecting correlative rights in areas of diverse ownership and of limiting the number of wells that may be drilled into a reservoir in a given area.
- Well-spacing is done both by state-wide order and by individual field or reservoir rules. Exceptions may be granted on a well-by-well basis.

Louisiana Statewide Order No. 29-E:

- (1) No spacing shall be required for wells drilled in search of oil to depths less than 3,000 feet subsea
- (2) Wells drilled in search of OIL to depths below 3,000 feet subsea shall not be located closer than 330 feet from any property line nor closer than 900 feet from any other well completed in, drilling to, or for which a permit shall have been granted to drill to, the same pool.
- (3) Wells drilled in search of GAS shall not be located closer than 330 feet to any property line nor closer than 2,000 feet to any other well completed in, drilling to, or for which a permit shall have been granted to drill to, the same pool.

Compulsory unit

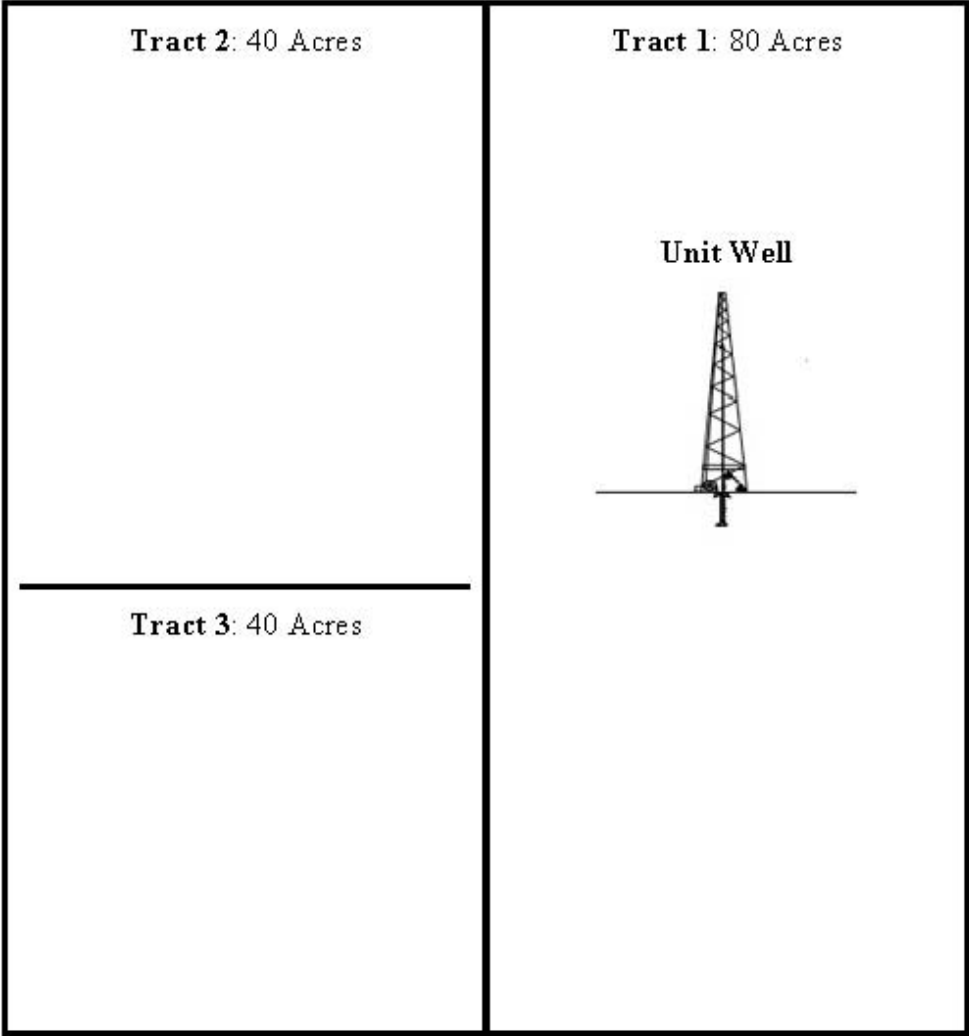
- A unit formed by order of a governmental agency.

Spacing Unit or Drilling Unit— often single well.

Pooled Unit – A spacing/drilling unit in which the rights to share in production have been merged.

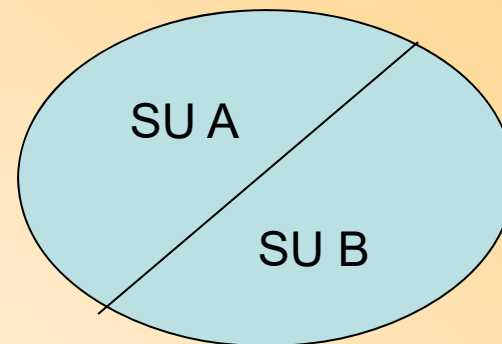
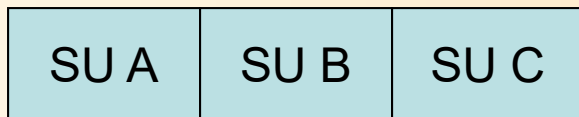
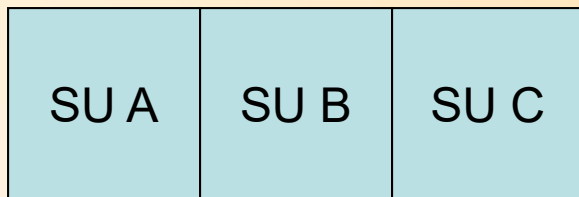
Fieldwide or Reservoirwide unit -- The consolidation of all or a substantial portion of the interests in an entire field or pool for the purpose of operating the reservoir as a single producing mechanism.

Unit Diagram

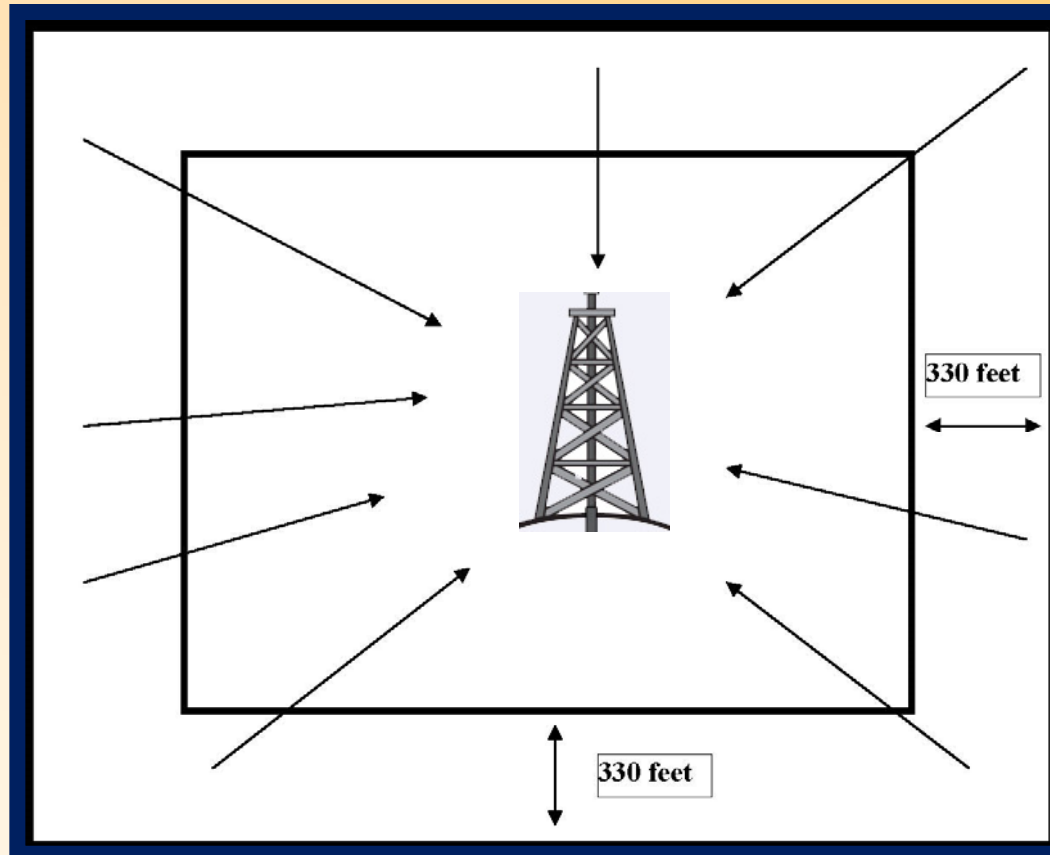


Unit Configuration

- Regular – Geographic
- Rectangles - Laydown and Standup
- Geological

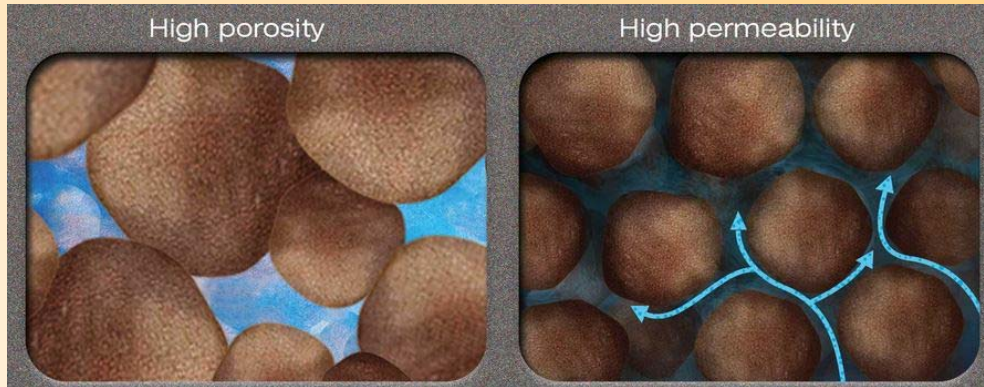


Standard Single Well Unit: The Vertical Model



- Assumptions:
- 1) One well will drain entire unit
 - 2) Uniform drainage across unit
 - 3) All owners share on surface acreage

Porosity & Permeability



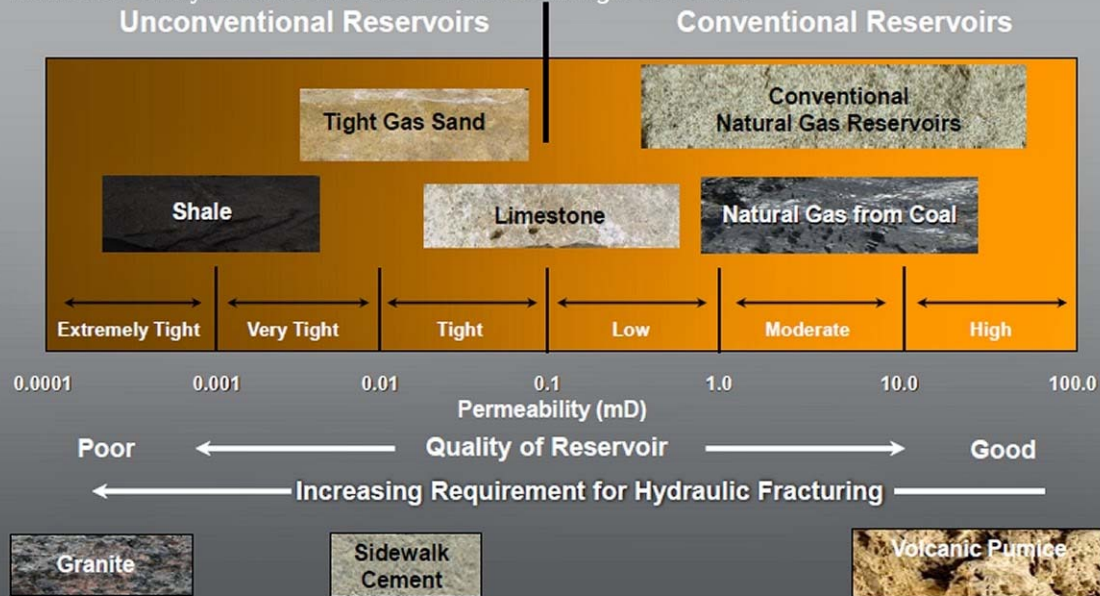
Source: <http://www.co2crc.com.au>



High porosity, low permeability

What Makes an Unconventional Reservoir ?

Humboldt County's Natural Gas resource is locked in Tight Gas Sands



Note: Natural Gas from Coal reservoirs are classified as unconventional due to type of gas storage modified from US DOE

The Technology Revolution: **Horizontal-Fracking Model**

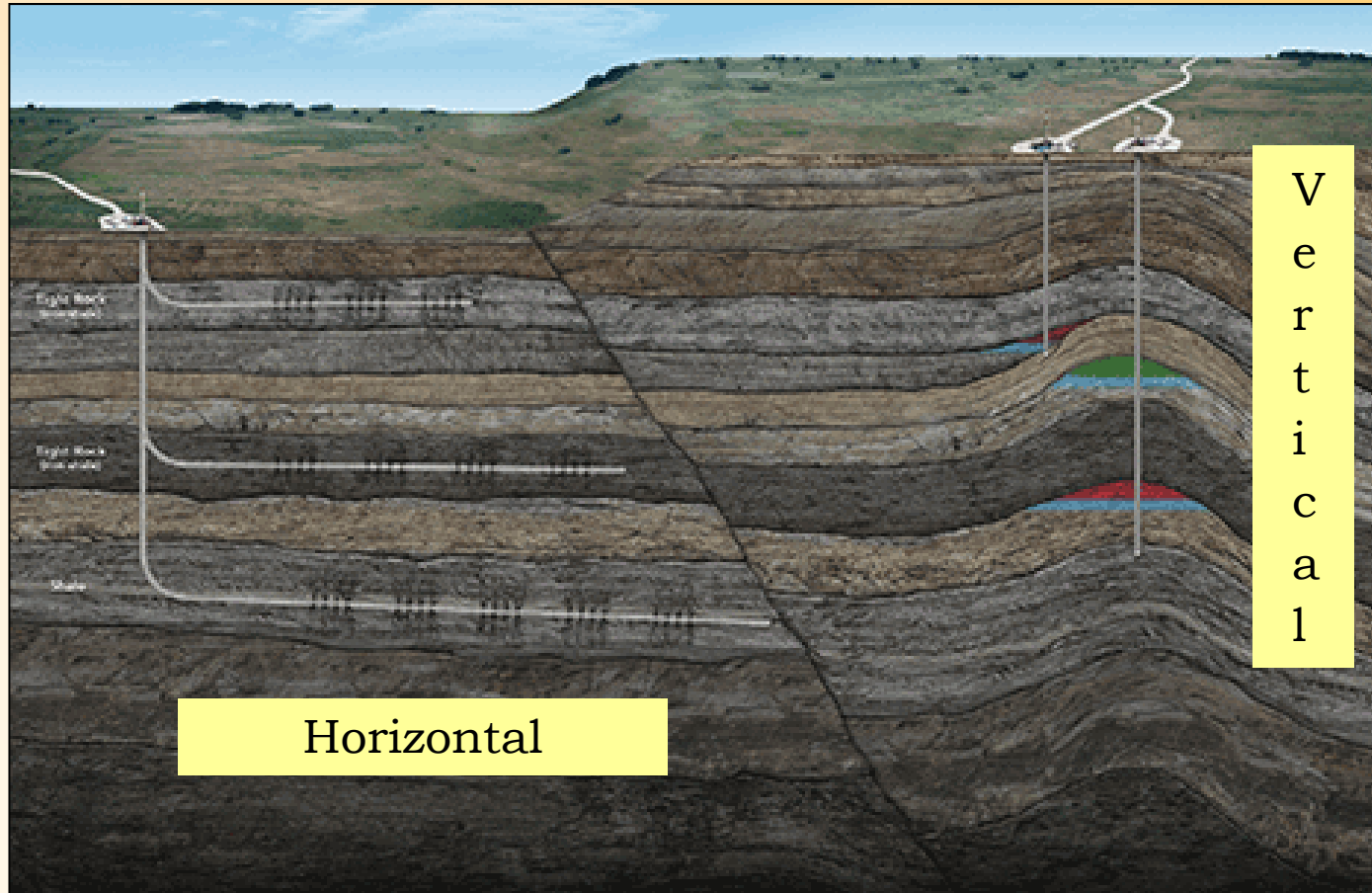
Two components:

- 1) Horizontal drilling.
- 2) Formation fracturing.

The issues they pose

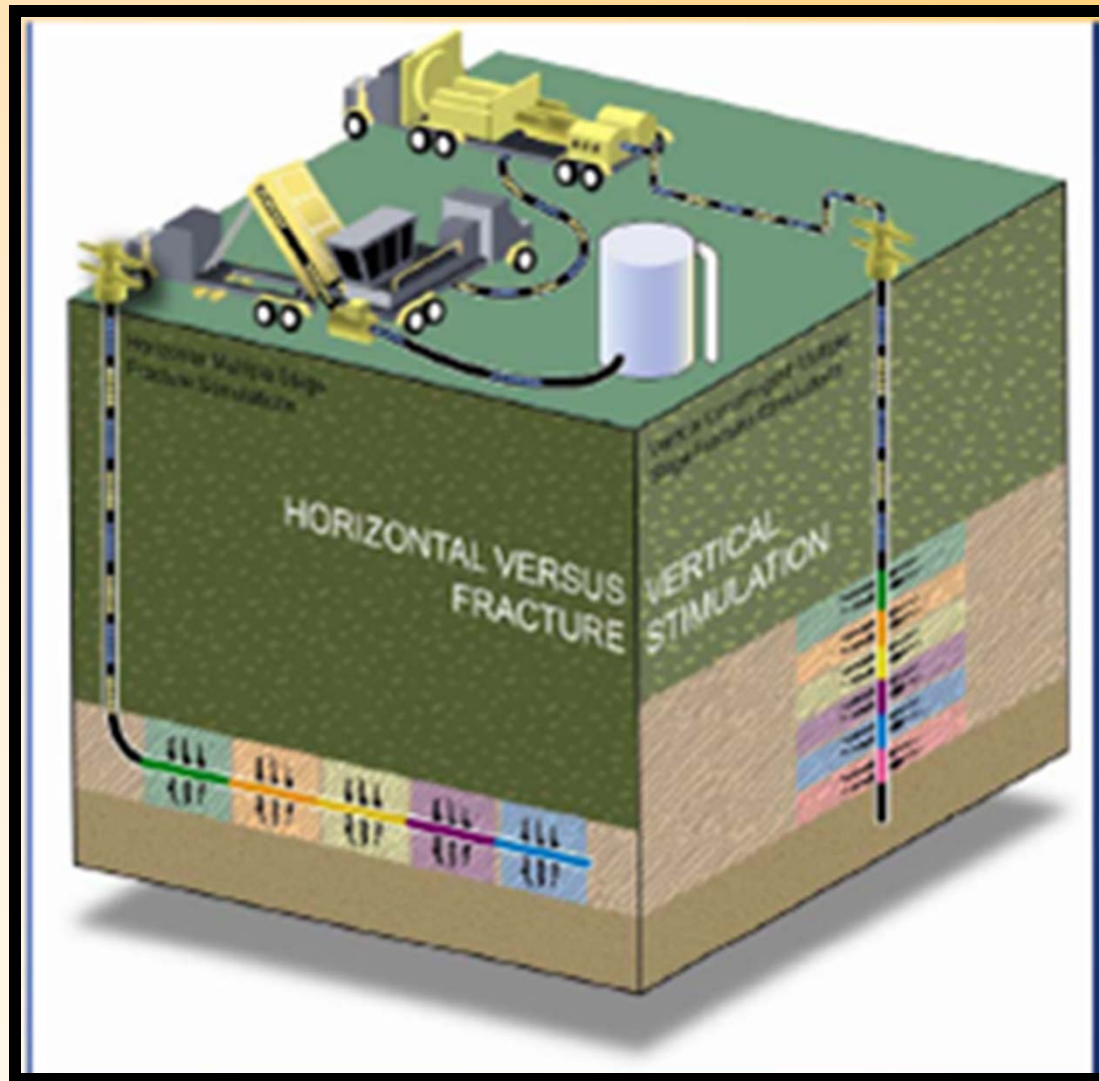
- Paradigm shift in regulatory assumptions – it is as though you have many well bores, simply lacking vertical holes. Plus limited extent of drainage, so multi-well units become the norm.
- Water demands, chemicals, recovery or disposal of same.
- Somewhat different surface use.
- Trespass (?).
- Correlative rights issues.
- Costs very high – risk penalty issues esp. multi-well units.

Unconventional vs. Conventional



Source <http://www.terraexploration.com/technology>

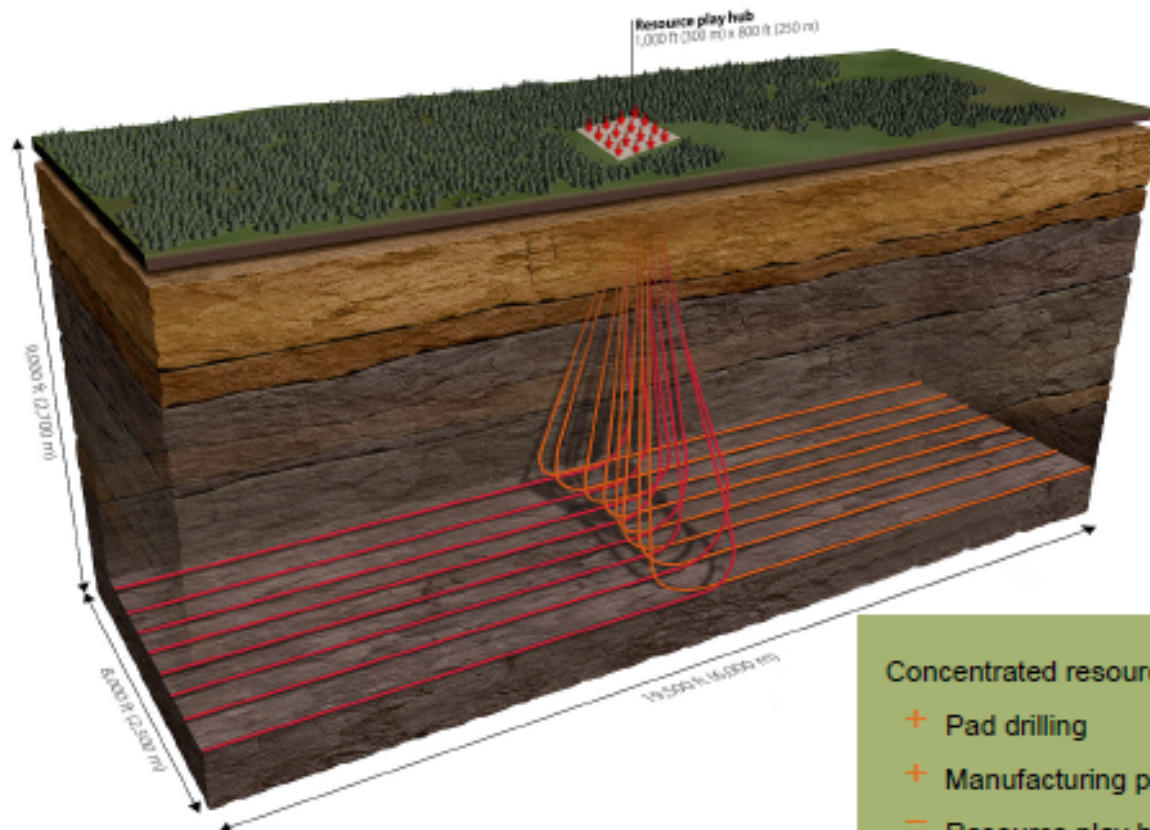
Fracking – Horizontal/Vertical



Use of Hub and Multiple Unit Wells in Haynesville

Low Cost Focus Advancing Resource Play Hub Design and Development

encana



Schematic represents 4-6 square miles of reservoir accessed from a single surface location.

Increasingly Longer Laterals

Haynesville Resource Play Hub Long Lateral

Encana Leading the Way

- 1st Cross Unit permits granted in the State of Louisiana
- 1st Cross Unit well drilled

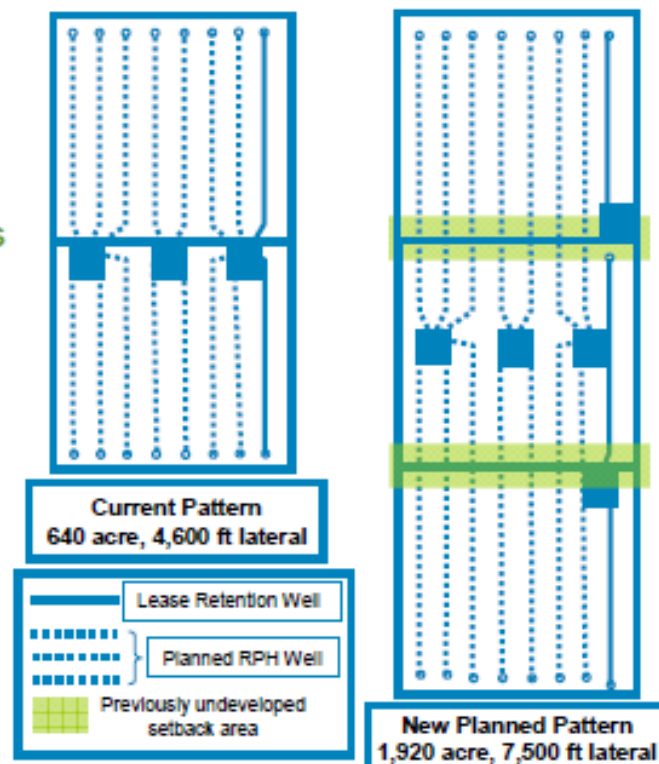
Enhancement to RPH Efficiencies

- Successfully drilled two long laterals (6,879 & 8,003 feet)
- Lower supply cost with fewer vertical parent wellbores
- 13% additional recovery
- Future plans for 10,000 feet laterals

Significant Positive EHS Impact

- Reduced footprint
- Reduced development traffic

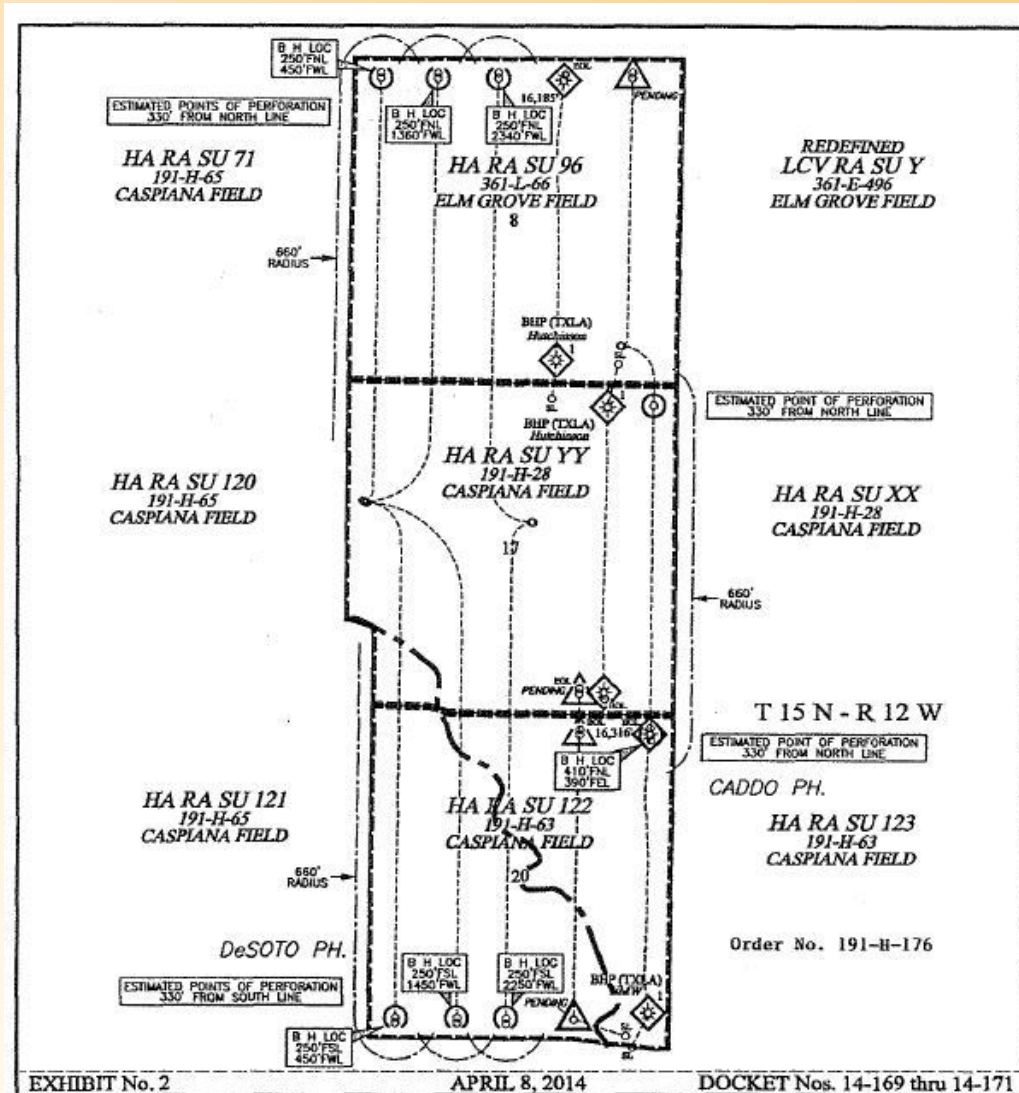
encana.



Cross-unit Wells

- Because a field rule may limit a well from being drilled or completed within say 330 feet of another unit boundary, the result is a gap of at least 660 feet which cannot be produced.
- A borehole that might be most efficiently extended to 8,000 feet must be limited to about 4,500 feet for a 640 acre square unit.
- That means the unit and rules based on the Standard Model result in an inefficient well and an unproduced gap, neither of which benefits anyone; adherence to the Standard Model causes a loss of money and hydrocarbons.
- Instead of revising units, one solution is to permit wells to cross unit boundaries. This leads to allocation issues for the adjacent units.

Louisiana Cross-unit Order



Cross-unit Well Allocation - Louisiana

Order No. 191-H-176

- That unit production from said cross unit horizontal alternate unit wells should be allocated to each unit in the same proportion as the perforated length of the lateral, as defined in the DEFINITIONS section herein, in that each unit bears to the total length of the perforated lateral, as determined by an "as drilled" survey performed after the cross unit wells are drilled and completed; and that unit production should continue to be shared on a surface acreage basis.
- 'perforated length of lateral' shall mean and is hereby defined as the length of horizontal lateral wellbore wherein perforations have been made, regardless of the number of perforated stages or individual perforations, which is measured from the lesser measured depth perforation or 'top of perforations' to the greater measured depth perforation or 'base of perforations'

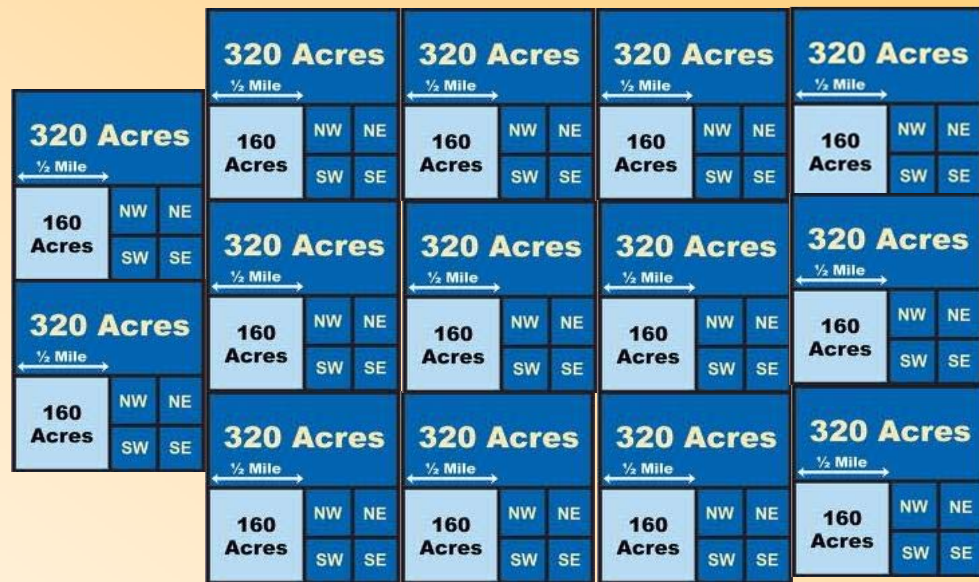
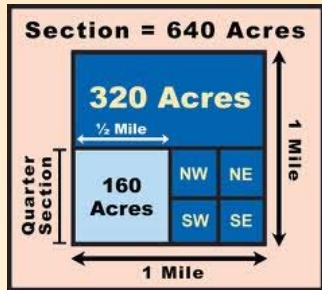
Shale Plays - Fracking Areas



LA: Act 743 – Ultra Deep Structure Unit

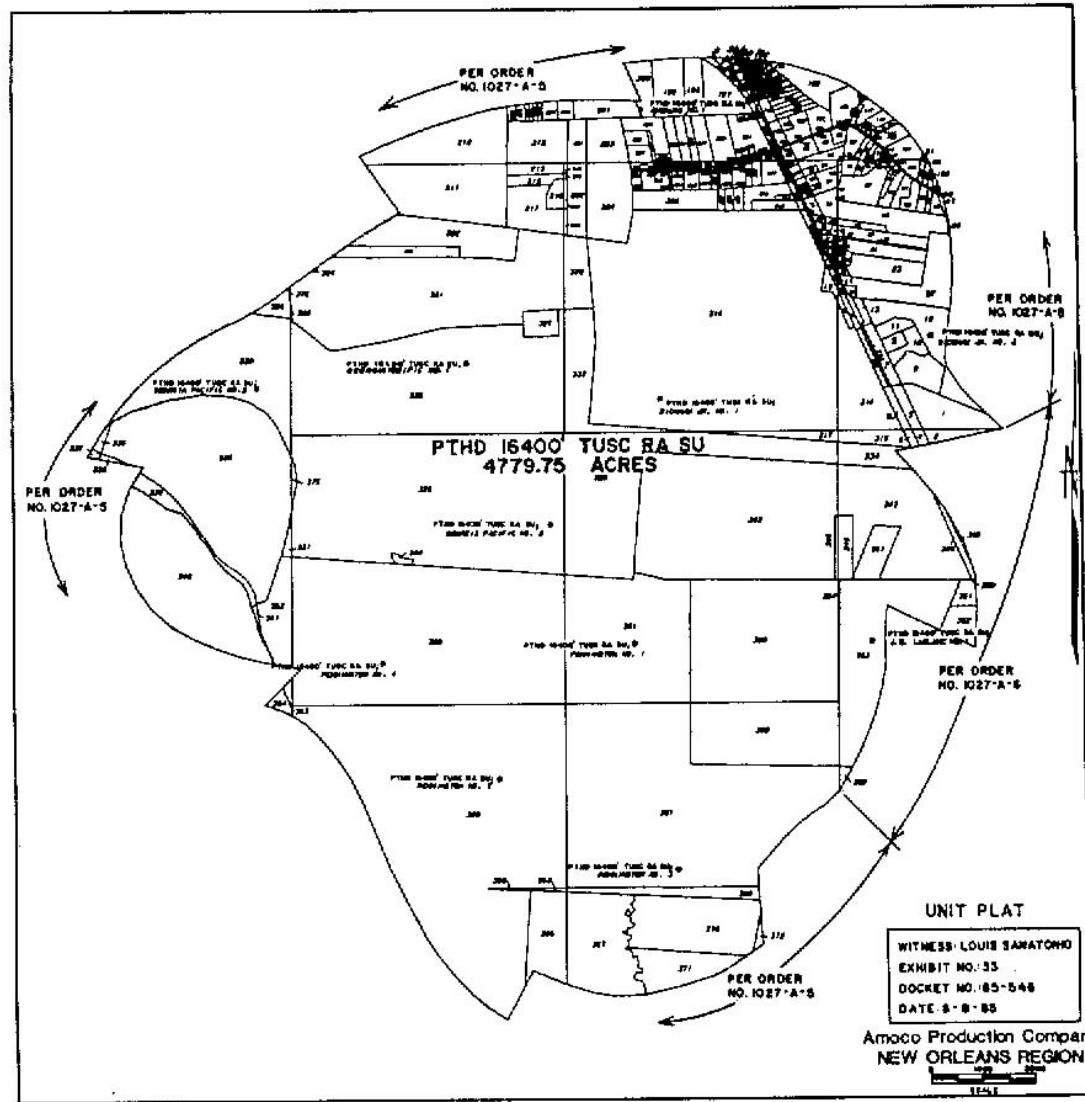
- A unit for structures at a depth in excess of twenty-two thousand feet true vertical depth.
- No greater than nine thousand acres.
- The Commissioner must approve a reasonable plan of development
- Statute presumes that the plan will include at least one well for each three thousand acres in the unit. Initial allocation of unit production is to be on a surface acreage basis.
- Wells drilled in ultra deep structure unit are subject to the risk charges specified in La. R.S. 30:10(A)(2).
- May be established without the consent requirements which are applicable to other reservoir-wide units.

9,000 Acres = 14 Sections



5 miles

Fieldwide Unit - Port Hudson



ORDER NO. 1027-A-9

Fieldwide Unit -- Allocation

- Most voluntary unitization agreements and compulsory unitization orders provide for participation of all interest owners on a formula basis that incorporates multiple factors such as number of wells, porosity, acre feet of productive sand underlying each tract, and surface acreage. It often takes years to work out the formula. A mere listing of some of the numerous and complex variables in the determination of the value of a tract proposed to be included in a unit agreement may suggest the difficulties which can be encountered in negotiating an agreement:
 - (1) the drive mechanism available in the field;
 - (2) well productivity;
 - (3) well density;
 - (4) effect of prorationing;
 - (5) acre feet of productive formation;
 - (6) oil initially in place beneath a tract;
 - (7) extent and accuracy of information that has been obtained as a result of securing electrical logs, coring, testing;
 - (8) the extent of penetration into the producing formation.

THE END

