Environmentally Friendly Drilling Project - Determining Environmental Tradeoffs

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IOGCC Annual Meeting

November 16-18 2008

Richard C. Haut, Ph.D., Houston Advanced Research Center

David Burnett, Global Petroleum Research Institute, Texas A&M University

Tom Williams, TerraPlatforms, LLC.

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NETL NATIONAL ENERGY TECHNOLOGY LABORATORY

Texas A&M University

HARC

What will be Presented

Environmentally Friendly Drilling Systems Program

Measuring Environmental Tradeoffs

Future – how you can benefit

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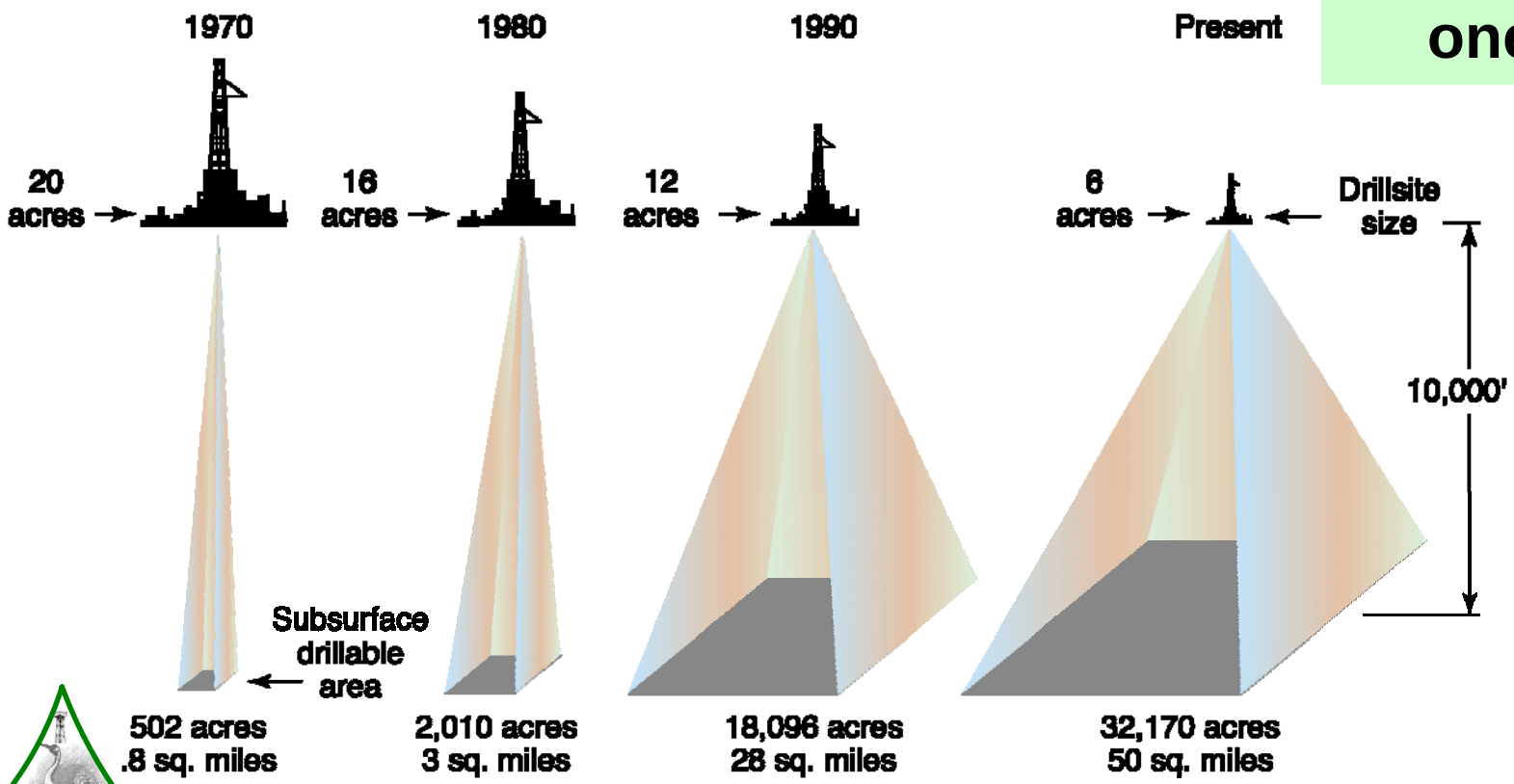
Environmentally Friendly Drilling Systems Program

Access to Environmentally Sensitive Areas

- How to access with minimal impact
- How to measure effect of low-impact practices

Program Goal is less than one acre



Source: William Harrison, Kansas Geological Survey

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EFD Program - History

- Formed Team in 2005
- Obtained U.S. Department of Energy Funding
- Formed Joint Industry Partnership
- Phase 1 ended 3Q 2008, Phase 2 will be a 3 year project, kickoff 4Q 2008
- Identification and Demonstration of low impact technologies to minimize environmental impact

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The Reality is that All Areas are Environmentally Sensitive

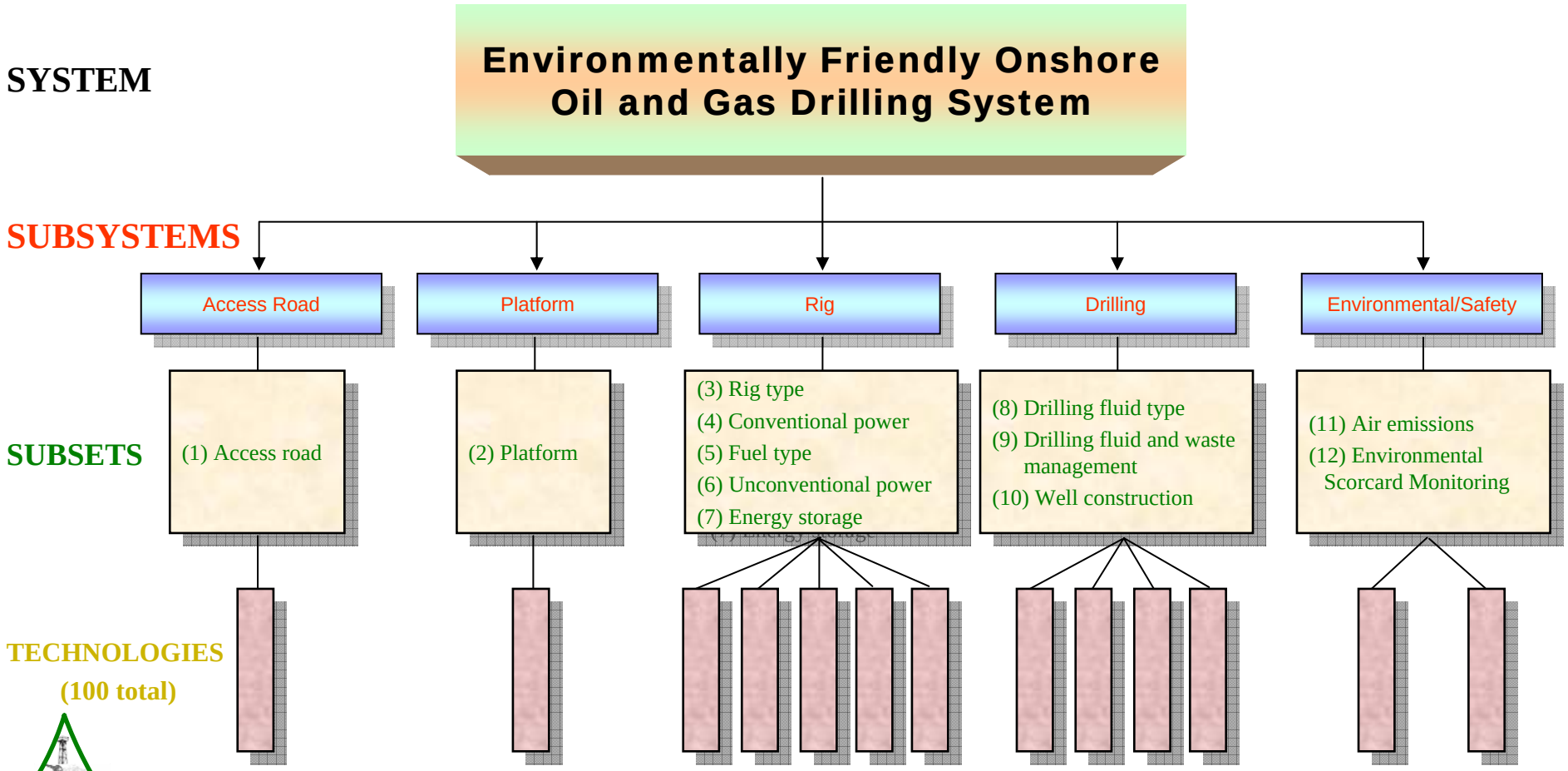
- ***The value of protecting the environment is becoming more important and it makes good business sense***
- ***The public's interest in energy development is becoming more and more significant.***
- ***The O&G Industry must engage the public in a more significant way.***

Identify and develop technologies to get access with minimal impact.

Determine how to measure the tradeoffs of low impact practices.

Systems Approach to Technology Selection

To select the optimal system
(combination of technologies)
to minimize impact and maximize profit



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Environmentally Friendly Drilling Systems Program

Advisory Council (list not complete)

Texas A&M Petroleum Engineering
Houston Advanced Research Center
TerraPlatform, LLC
Anadarko Petroleum
BP
Chevron
ConocoPhillips
Devon
Shell
StatoilHydro
National Oil Well
MI Swaco
Halliburton
Huisman

Assessments of Technologies for Environmentally Friendly Drilling Project: Land Based Operations

Compiled and Prepared by
John D. Rogers, Ph.D., PMP, P.E.
Sr. Project Manager
Noble Technologies Division
Noble Drilling Corporation

Contributors:
Bob Knoll, Consultant – Directional and Horizontal Technology
Richard Hart, Ph.D. HARC – Waste Management
Bruce McDole, BP
Greg Deskins, Noble Drilling

October 2, 2006
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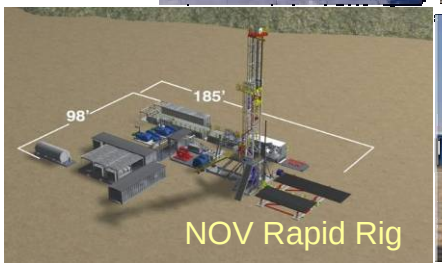

Phase I

Identify challenges, Engineering Design Systems

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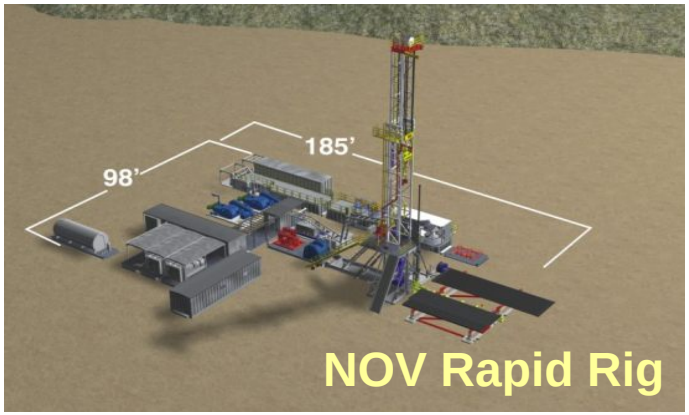
New Rigs Shrink the Physical Footprint



Rig Manufacturer	Foot Print Area			Depth Rating	
	Sq Ft	acres	HP	Drill Pipe	Casing
Huisman	7500	0.17	1000	11,500	18,000
Rapid Rig	10,290	0.24	1000	11,000	15,000
Ideal Rig	39,474	0.9	1500	18,000	
H&P	36,200	0.83	1500	18,000	
DrillMec	6375	0.15	1500	<11,000	

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Initial Plans for Next Stages

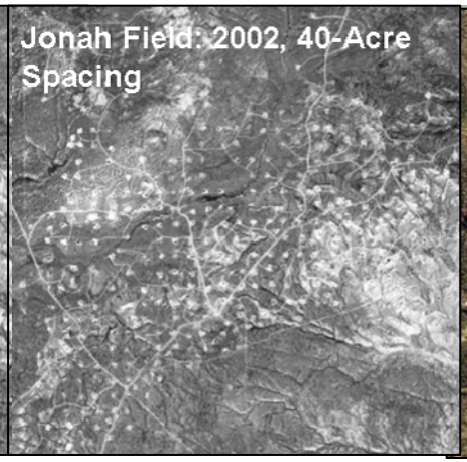
- **Hold workshops to identify technologies and measurements**
  - **Technologies that reduce environmental impact**
  - **Environmental indicators for wetland biodiversity: what can/should be measured**
- **Develop Conceptual Design/Plans**

Reducing our Footprint

Identifying new technologies, best practices and opportunities

rigs, roads, excessive equipment, drilling innovations and people + emissions + waste management + safety

Roads Have Significant Impact



Impact of Oil and Gas Development

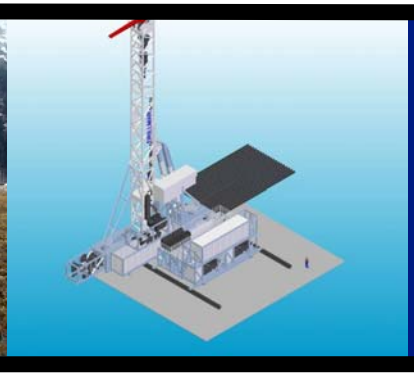
Exploration and Production in Environmentally Sensitive Arctic Areas

Collaborative effort designed to reduce environmental concerns for ecologically sensitive areas currently open for development.

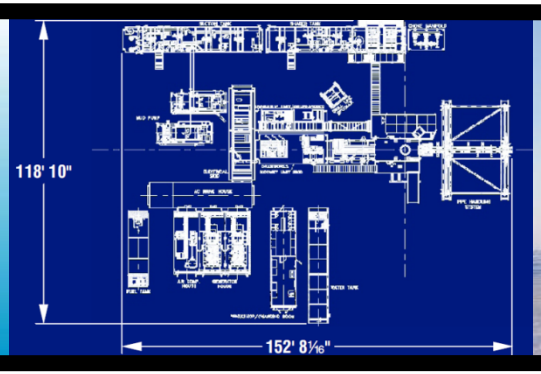
<u>Objective</u>:

Identify access barriers and other issues concerning Arctic resources

Durabase (mat) Road Construction



Small Modular Rig

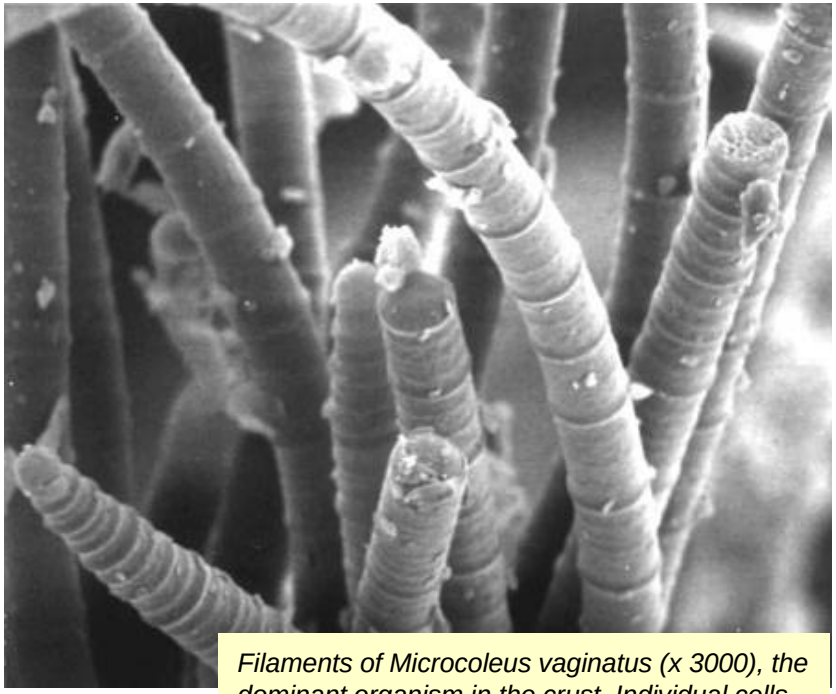


Prototype Inland Platform being Installed

Protect Sensitive Ecologies

Cryptobiotic soils in semi arid area

- **Found in similar types of environments around the world**
- **Very sensitive and have little mechanical strength**
- **Challenge is to drill and exploit without significant damage**
- **Cryptobiotic soils are the essential first step in producing arable soils**



Filaments of Microcoleus vaginatus (x 3000), the dominant organism in the crust. Individual cells abut each other to form the filaments.

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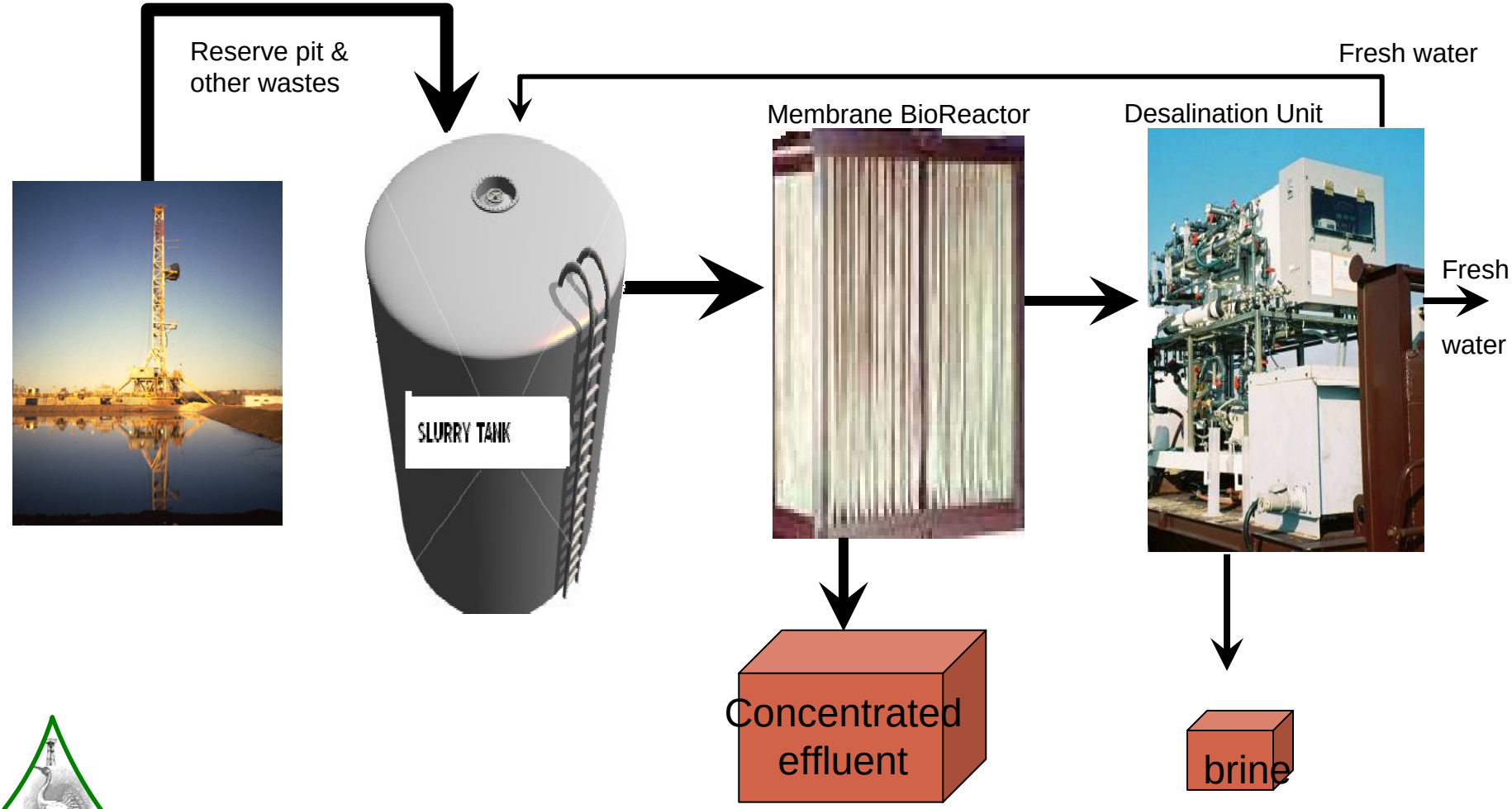
Bioremediation



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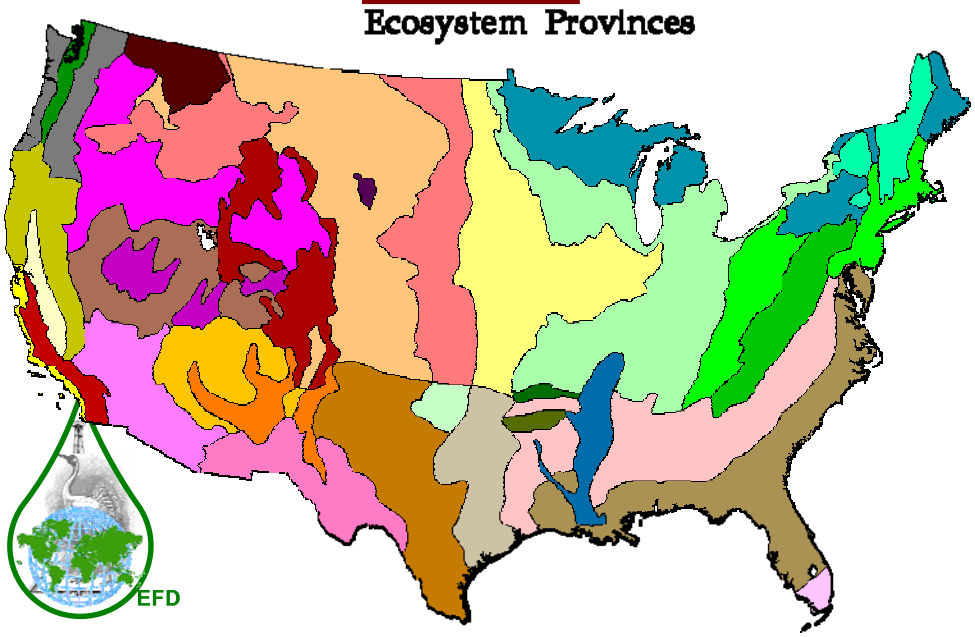
There is Only One Bus

and we are all on it

- Growing tension between energy needs and biodiversity values
- *Challenge to energy companies*
- *Challenge to conservation organizations*

Tradeoffs



Energy Production
Oil and Gas Operations

Upstream

- Field Development
  - Exploration
  - Drilling
  - Completions
- Field Operations

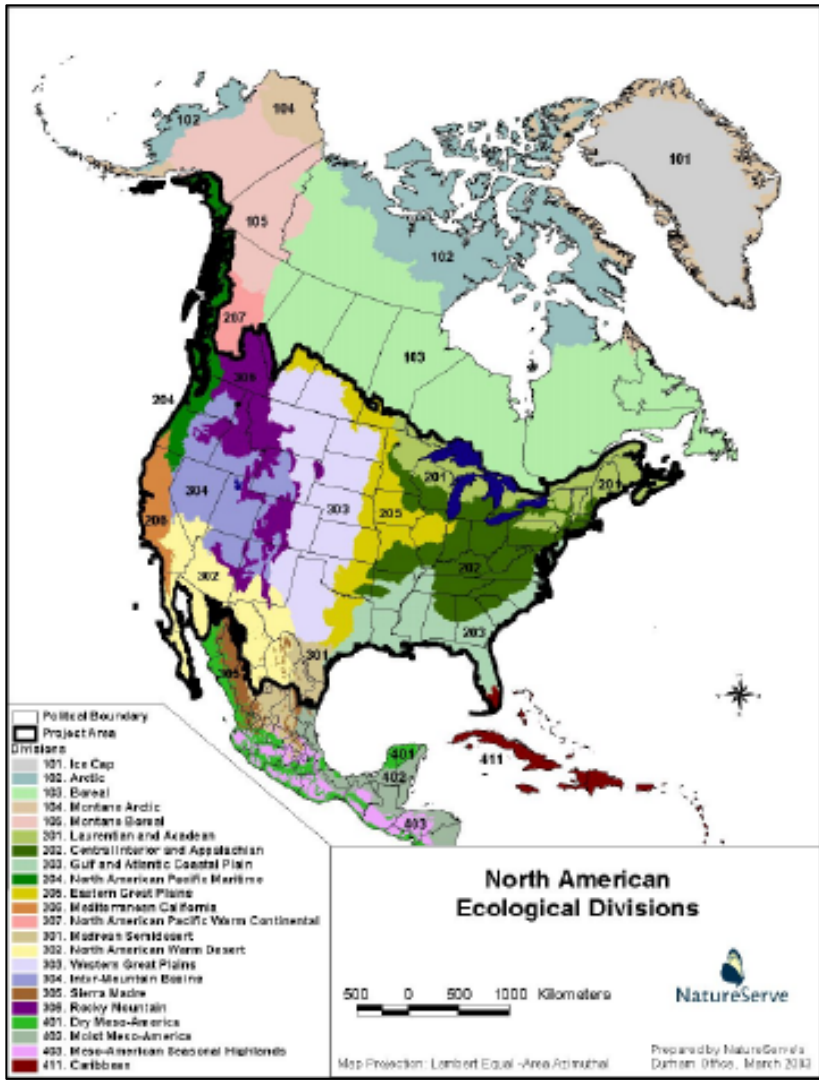
Downstream

- Processing
- Refining
- Transportation
- Distribution

Measuring Tradeoffs

- **Develop a methodology for each ecosystem that can be used to assess tradeoffs associated with the application of new technologies to secure energy.**

- **Vision is to deliver a methodology that considers:**
  - **Biodiversity**
  - **Waste Management**
  - **Air**
  - **Water**
  - **Site**
  - **Societal/Human Health Issues**



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Potential Scorecard

Concepts

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Potential Scorecard

Concept

LEED® Facts

Bronx Library Center
New York, N.Y.

LEED for New Construction
Certification awarded July 27 ,2006

Silver	**34***
Sustainable Sites	7/14
Water Efficiency	3/5
Energy & Atmosphere	3/17
Materials & Resources	7/13
Indoor Environmental Quality	9/15
Innovation & Design	5/5

*Out of a possible 69 points

LEED-NC

Bldg. 27 Astronuat Quarantine Facility
LEED® Project # 1486
LEED Version 2 Certification Level: CERTIFIED
2/24/2006

28 Points Achieved — Possible Points: 69

Certified 26 to 32 points Silver 33 to 38 points Gold 39 to 51 points Platinum 52 or more points

6	Sustainable Sites — Possible Points: 14		
Y	Prereq 1	Erosion & Sedimentation Control	
1	Credit 1	Site Selection	1
	Credit 2	Urban Redevelopment	1
	Credit 3	Brownfield Redevelopment	1
	Credit 4.1	Alternative Transportation, Public Transportation Access	1
1	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
	Credit 4.3	Alternative Transportation, Alternative Fuel Refueling Stations	1
	Credit 4.4	Alternative Transportation, Parking Capacity	1
	Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space	1
1	Credit 5.2	Reduced Site Disturbance, Development Footprint	1
	Credit 6.1	Stormwater Management, Rate and Quantity	1
	Credit 6.2	Stormwater Management, Treatment	1
1	Credit 7.1	Landscape & Exterior Design to Reduce Heat Islands, Non-Roof	1
1	Credit 7.2	Landscape & Exterior Design to Reduce Heat Islands, Roof	1
1	Credit 8	Light Pollution Reduction	1

1	Water Efficiency — Possible Points: 5		
Y			
1	Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
	Credit 2	Innovative Wastewater Technologies	1
	Credit 3.1	Water Use Reduction, 20% Reducion	1
	Credit 3.2	Water Use Reduction, 30% Reducion	1

4	Energy & Atmosphere — Possible Points: 17		
Y			
Y	Prereq 1	Fundamental Building Systems Commissioning	
Y	Prereq 2	Minimum Energy Performance	
Y	Prereq 3	CFC Reduction in HVAC&R Equipment	
1	Credit 1.1	Optimize Energy Performance, 20% New / 10% Existing	2
	Credit 1.2	Optimize Energy Performance, 30% New / 20% Existing	2
	Credit 1.3	Optimize Energy Performance, 40% New / 30% Existing	2
	Credit 1.4	Optimize Energy Performance, 50% New / 40% Existing	2
	Credit 1.5	Optimize Energy Performance, 60% New / 50% Existing	2
	Credit 2.1	Renewable Energy, 5%	1
	Credit 2.2	Renewable Energy, 10%	1
	Credit 2.3	Renewable Energy, 20%	1
1	Credit 3	Additional Commissioning	1
1	Credit 4	Ozone Depletion	1
	Credit 5	Measurement & Verification	1
1	Credit 6	Green Power	1

5	Materials & Resources — Possible Points: 13		
Y			
Y	Prereq 1	Storage & Collection of Recyclables	
	Credit 1.1	Building Reuse, Maintain 75% of Existing Shell	1
	Credit 1.2	Building Reuse, Maintain 100% of Existing Shell	1
	Credit 1.3	Building Reuse, Maintain 100% Shell & 50% Non-Shell	1
1	Credit 2.1	Construction Waste Management, Divert 50%	1
	Credit 2.2	Construction Waste Management, Divert 75%	1
	Credit 3.1	Resource Reuse, Specify 5%	1
	Credit 3.2	Resource Reuse, Specify 10%	1
1	Credit 4.1	Recycled Content	1
1	Credit 4.2	Recycled Content	1
1	Credit 5.1	Local/Regional Materials, 20% Manufactured Locally	1
1	Credit 5.2	Local/Regional Materials, of 20% Above, 50% Harvested Locally	1
	Credit 6	Rapidly Renewable Materials	1
	Credit 7	Certified Wood	1

7	Indoor Environmental Quality — Possible Points: 15		
Y			
Y	Prereq 1	Minimum IAQ Performance	
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control	
	Credit 1	Carbon Dioxide (CO_2) Monitoring	1
	Credit 2	Increase Ventilation Effectiveness	1
1	Credit 3.1	Construction IAQ Management Plan, During Construction	1
1	Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2	Low-Emitting Materials, Paints	1
1	Credit 4.3	Low-Emitting Materials, Carpet	1
	Credit 4.4	Low-Emitting Materials, Composite Wood	1
	Credit 5	Indoor Chemical & Pollutant Source Control	1
	Credit 6.1	Controllability of Systems, Perimeter	1
	Credit 6.2	Controllability of Systems, Non-Perimeter	1
1	Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	1
1	Credit 7.2	Thermal Comfort, Permanent Monitoring System	1
	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1

5	Innovation & Design Process — Possible Points: 5		
Y			
1	Credit 1.1	Innovation in Design	1
1	Credit 1.2	Innovation in Design	1
1	Credit 1.3	Innovation in Design	1
1	Credit 1.4	Innovation in Design	1
1	Credit 2	LEED® Accredited Professional	1

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Stakeholder Engagement is Important!

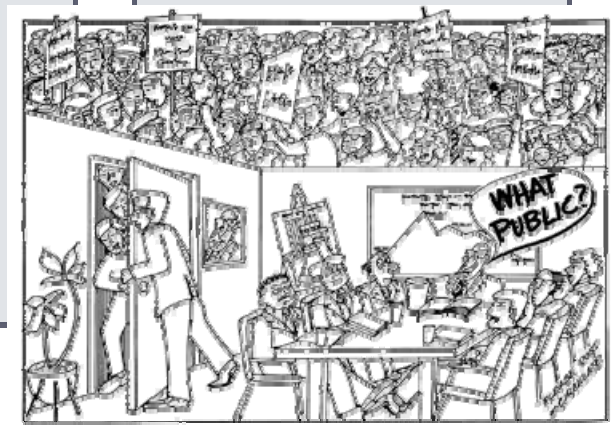
Stakeholders are all those who are affected, interested in or have the capacity to influence a project.

Academia

- Texas A&M University College Station
- Texas A&M University Kingsville
- University of New Hampshire
- UT Medical Center
- Mississippi State University
- Sam Houston State
- University of South Alabama
- John Hopkins University
- University of Arizona
- University of Texas
- University of Houston

Environmental Organizations

- NRDC
- Environmental Defense
- The Nature Conservancy
- Conservation International
- Mercer Arboretum
- Bureau of Applied Anthropology/Arizona
- Clinton Climate Initiative
- Rocky Mountain Clean Air
- McFaddin Ranch



Industry

- API
- Ballard Exploration
- BP
- Shell
- Chevron
- StatoilHydro
- ConocoPhillips
- Devon
- King Exploration
- Halliburton
- Huisman
- National Oil Well – Varco
- MI Swaco
- TerraPlatform
- T. Baker Smith
- Weatherford
- Derrick Equipment
- Composite Mats
- Ecology and Environmental Inc.
- PTTC
- IADC

State/Federal Agencies

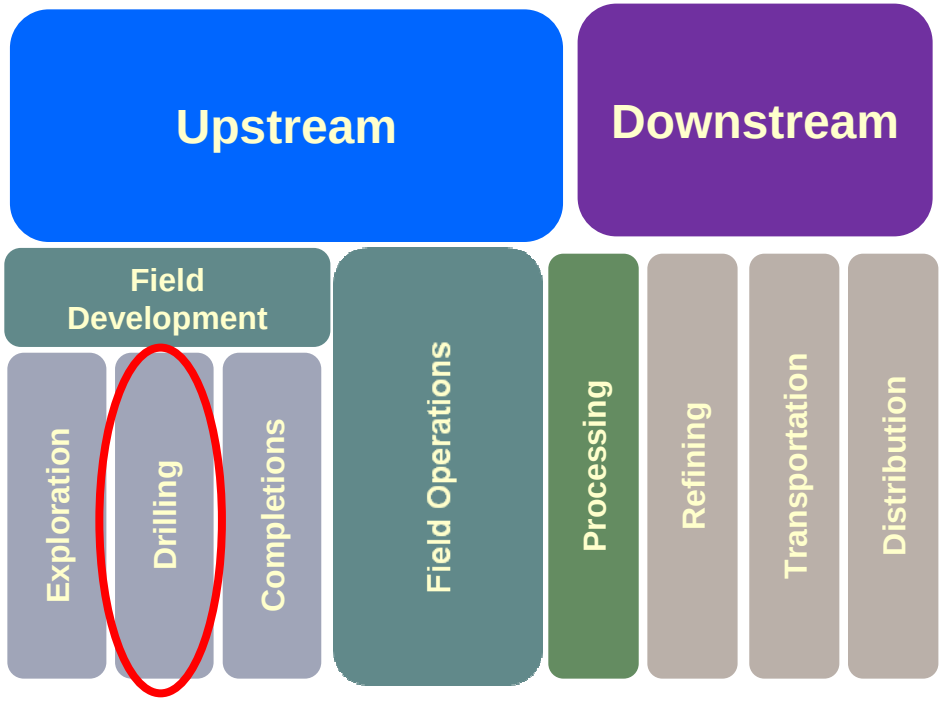
- US Department of Energy
- Bureau of Land Management
- US Park Service
- Texas Railroad Commission
- Texas General Land Office
- Texas Dept. of Agriculture
- Texas Dept. of Transportation
- US Minerals Management Services
- Texas Parks & Wildlife
- Texas Water Board
- Texas Commission on Env. Quality
- US Environmental Protection Agency
- US Fish and Wildlife
- Argonne National Laboratory
- Big Thicket Preserve
- Idaho National Laboratory

Source: Connor Development Services Ltd

Focus Scorecard on Operation

Concept – USGBC LEED Program

Energy Production
Oil and Gas Operations



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Tradeoff Scorecard Development

EFD Facts

Project:

Location:

Ecosystem:

	Max	Score
AIR	10	0
WATER	15	0
SITE	15	0
WASTE MANAGEMENT	20	0
BIODIVERSITY	20	0
SOCIETAL	20	0
	100	0

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Environmentally Friendly Drilling Scorecard

Project:
Location:
Ecosystem:
Date:

0	Points Achieved	Possible Points: 100

★ 55 - 64 points ★★ 65 - 74 points ★★★ 75 - 84 points ★★★★ 85 - 94 points ★★★★★ 95 - 100 points

0	Air	Possible Points: 10	
	Prerq 1	On-site Power - Tier 3 Engines	
	Prerq 2	Contractual Obligations for Logistics	
	Credit 1	Site Emissions - Stationary	2
	Credit 2	Site Emissions - Temporary	2
	Credit 3	Site Emissions - Logistics/Transport	2
	Credit 4	Dust Supression	2
	Credit 5	Electric Rig	1
	Credit 6	Green Completions	1

0	Site	Possible Points: 15	
	Prerq 1	Regulatory Compliance	
	Prerq 2	Erosion & Sedimentation Control	
	Credit 1	Pre-Existing Site	3
	Credit 2	Pad Drilling	2
	Credit 3	Protect and Restore Habitat	2
	Credit 4	Contractor Guidelines	2
	Credit 5	Site Restoration Plan	2
	Credit 6	Match Site/Access to Topography	1
	Credit 7	Avoidance of Archeological Sites	1
	Credit 8	Logisitics Plan - Offsite Storage	1
	Credit 9	Planting of Native Vegetation	1

0	Waste Management	Possible Points: 20	
	Prerq 1	Waste Management Plan	
	Prerq 2	Title	
	Credit 1	Closed Loop Mud System	5
	Credit 2	Title	2
	Credit 3	Title	2
	Credit 4	Title	2
	Credit 5	Title	2
	Credit 6	Title	2
	Credit 7	Title	2
	Credit 8	Title	1
	Credit 9	Title	1
	Credit 10	Title	1

0	Biodiversity	Possible Points: 20	
	Prerq 1	Species Protection	
	Prerq 2	Habitat Protection/Enhancement	
	Prerq 3	Regulatory Requirements	
	Credit 1	Restoration/Interim Reclamation	3
	Credit 2	Reduction of Surface Disturbance	3
	Credit 3	Erosion Prevention	3
	Credit 4	Voluntary Offsite Mitigation	2
	Credit 5	Invasive Species Prevention	2
	Credit 6	Restoration of Fragmented Habitat	2
	Credit 7	Reintroduction of Species, Habitat	2
	Credit 8	Avoidance of High Value Areas	1
	Credit 9	Wildlife Protection	1
	Credit 10	Habitat Enhancement	1

0	Water	Possible Points: 15	
	Prerq 1	Stormwater Mangement Plan	
	Prerq 2	Water Management Plan	
	Credit 1	Water Usage Tracking	4
	Credit 2	Setbacks from Streams/Sources	3
	Credit 3	Reduce Water Usage	2
	Credit 4	Reuse of Water/Fluids	2
	Credit 5	Recycling of Water/Fluids	2
	Credit 6	Monitor Nearby Surface Waters	1
	Credit 7	Pressure Testing of Surface Casing	1

0	Societal	Possible Points: 20	
	Prerq 1	Community Engagement	
	Prerq 2	Communication Plan	
	Credit 1	Public Outreach	5
	Credit 2	Noise Control	2
	Credit 3	Training of Local First Responders	2
	Credit 4	Remote Alarms for Toxic Releases	2
	Credit 5	Emergency Management Plan	2
	Credit 6	Dispute Resolution Plan	2
	Credit 7	Land Use Damage Plan	2
	Credit 8	Landowner Indemnification	1
	Credit 9	Water Well Mitigation Agreement	1
	Credit 10	Surface Use Agreement	1

EFD Facts

Project:

Location:

Ecosystem:

	Max	Score
AIR	10	0
WATER	15	0
SITE	15	0
WASTE MANAGEMENT	20	0
BIODIVERSITY	20	0
SOCIETAL	20	0
	100	0

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Scorecard objective is to impact access

- Assure Public and Government that the industry is (in fact) operating in an environmentally responsible manner, without adding a costly new government program
- Support Federal and State regulatory bodies
- Operators and regulators have access to best available practices
- Identify areas that could benefit from EFD advances and new R&D

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Outreach and Technology Transfer

- Following the direction of JIP sponsors and stakeholders
- Open Communication
  - RPSEA environmental forums
  - Conferences
  - PTTC
  - Bringing Parties together
  - Special Studies
- Addressing public perception

What to Remember
www.efdsystems.com

Environmentally Friendly Drilling Systems Program

- Joint industry, academia, government, non-profit program
- Focused on current and emerging technologies
- We are here to ask for your participation

Measuring Environmental Tradeoffs

- Key component of the Environmentally Friendly Drilling Systems Program – What gets measured, gets done.
  What gets identified, gets dealt with.

Prototype Environmental Tradeoffs Scorecard

- Different Scorecards for Different Ecosystems
- Six Attributes: Air, Water, Waste Management, Site, Biodiversity, Societal

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