

# OFFSHORE OIL AND GAS INFRASTRUCTURE RE- USE IN THE GULF OF MEXICO

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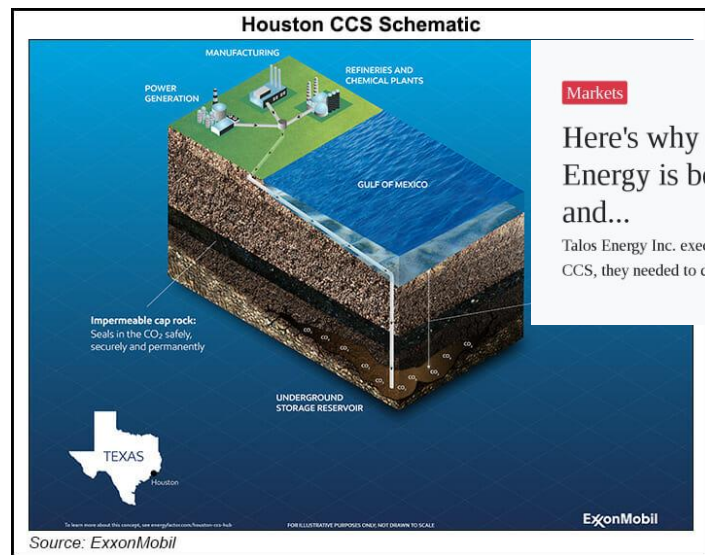
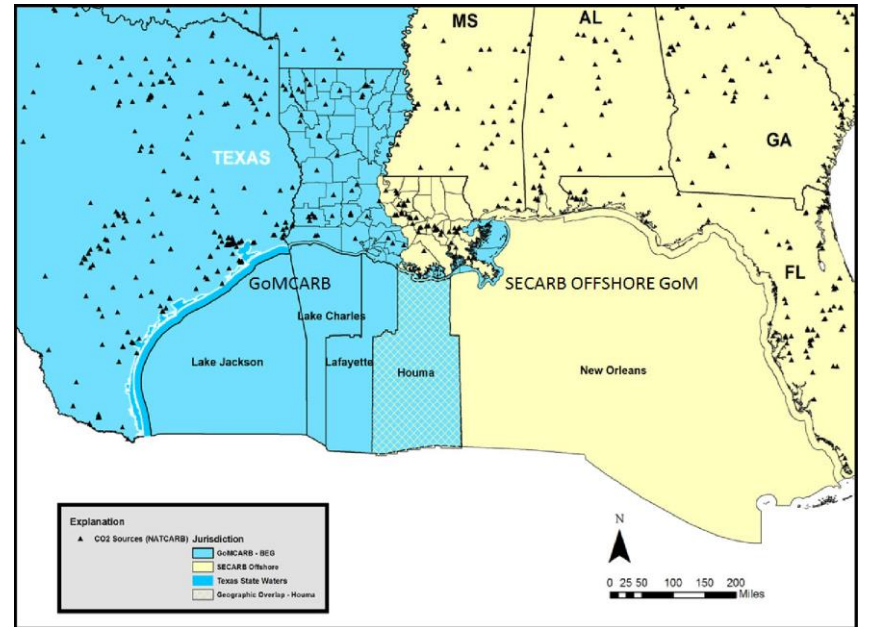
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# Disclaimer

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# Background

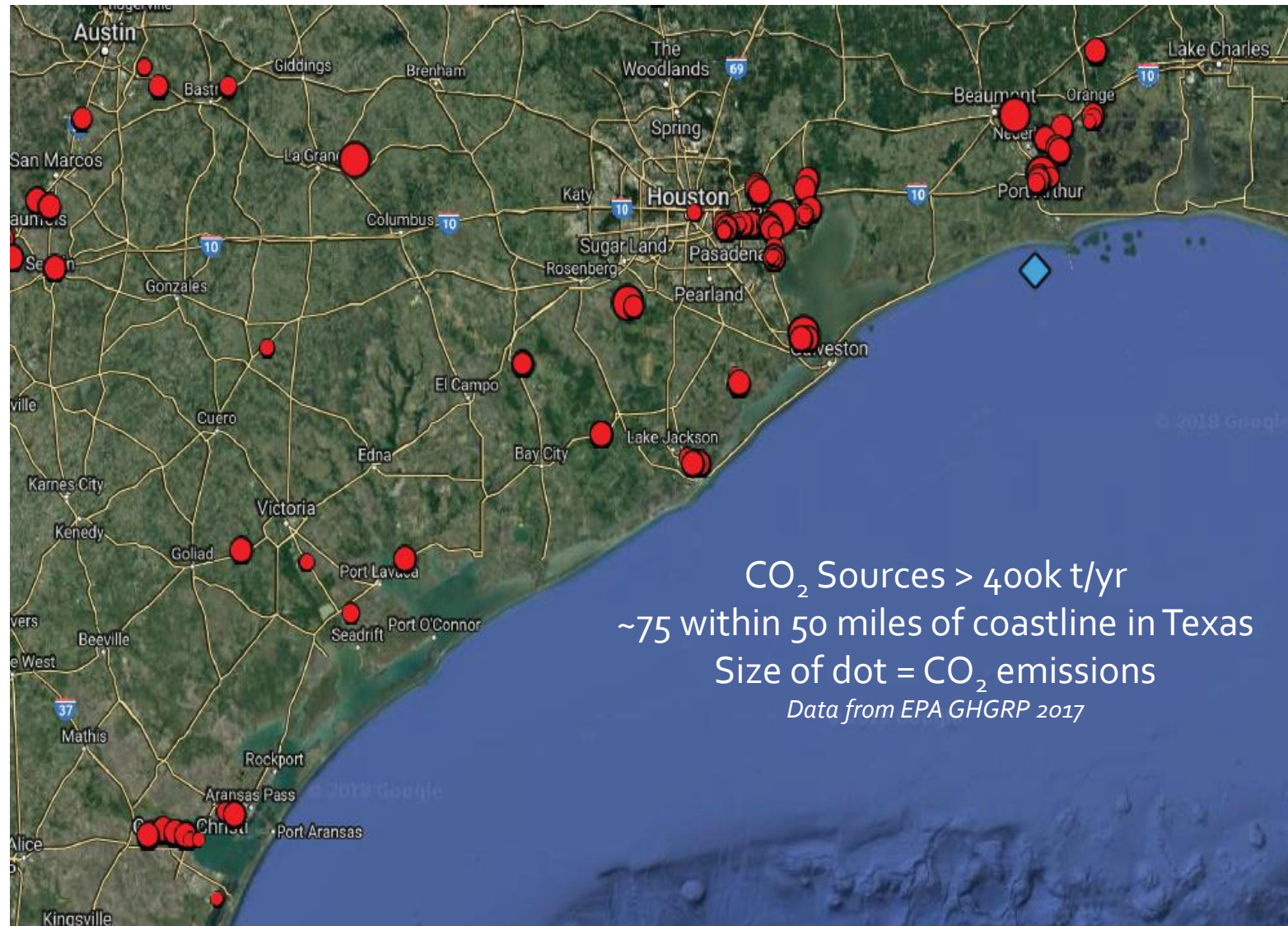
- Evaluation of Infrastructure Re-use has been a focus of **Gulf of Mexico Partnership for Offshore Carbon Storage (GoMCarb)**
- GoMCarb focus = identify gaps, challenges, needs, bigger picture trends
- Momentum building in the region for real projects



**Markets**  
Here's why offshore oil co. Talos Energy is betting on carbon capture and...  
Talos Energy Inc. executives decided that if they were going to get into CCS, they needed to do it quickly before other companies...

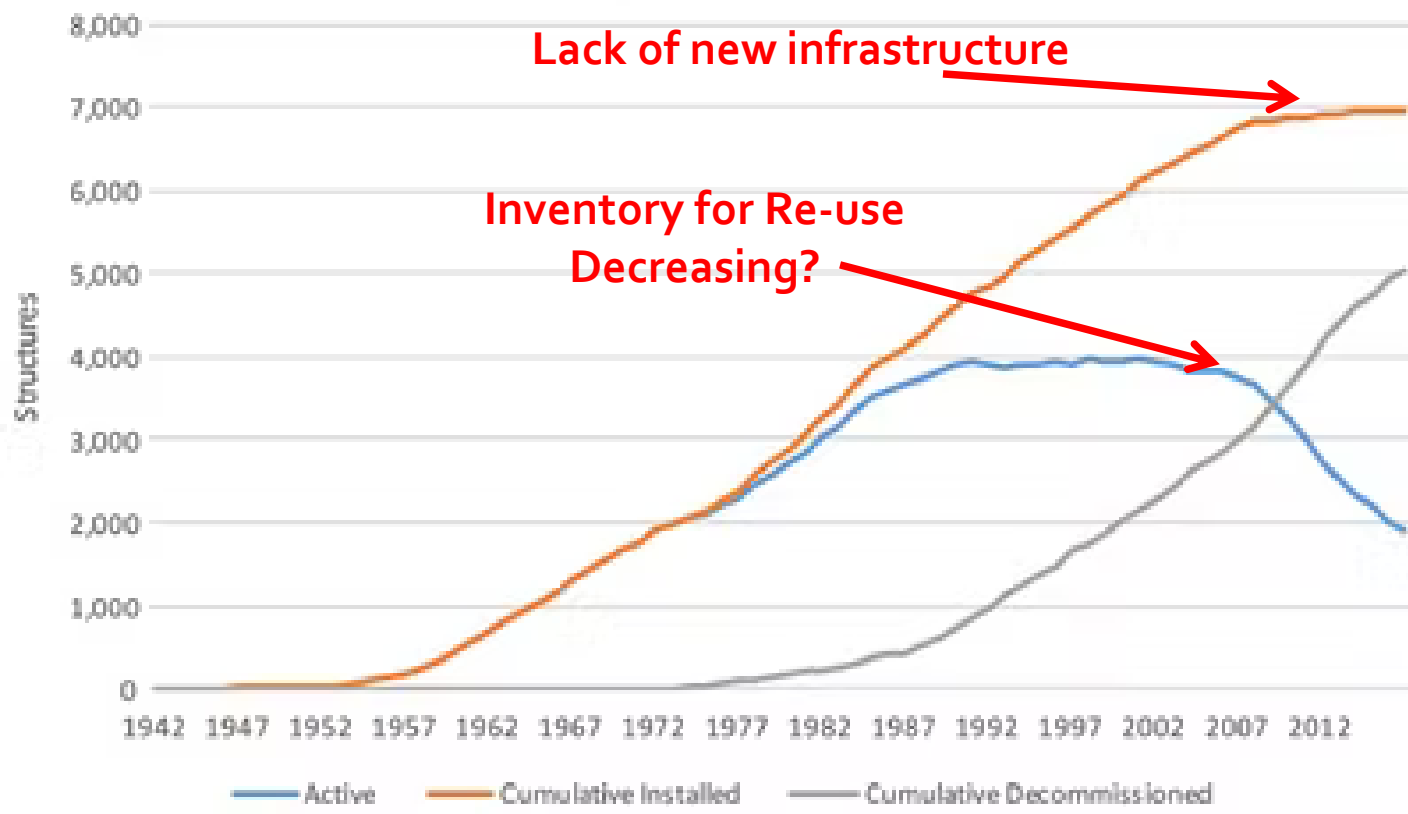


# Motivation: Source-Sink Matching



# Motivation: Existing Infrastructure

Active structures in water depth less than 400 ft, 1942-2017E.

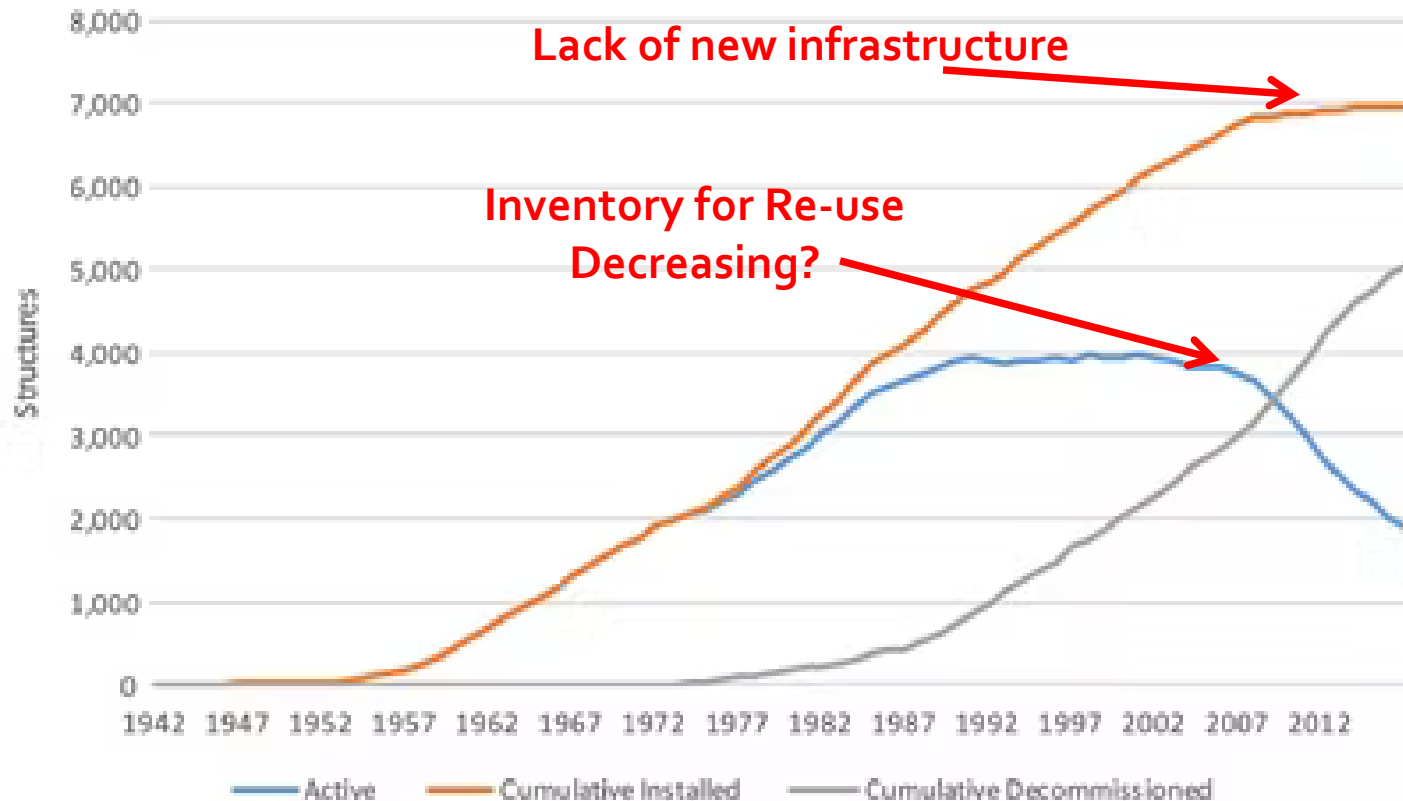


Active Inventory Circa 2017			
	Cumulative Installed	Decommissioned	Active
< 400 ft	6,933	5,025	1,908
>400	121	24	97
<b>Total</b>	<b>7,054</b>	<b>5,049</b>	<b>2,005</b>

Source: Data from BOEM/BSEE, February 2018.

# Motivation: Existing Infrastructure

Active structures in water depth less than 400 ft, 1942-2017E.



- What is the practical scale of the opportunity for re-use?
- What are risks/benefits/incentives for re-use?
- What are the challenges to assessing re-use?
- What investments & steps are required to make an assessment?
- **FOCUS ON PIPELINES AND PLATFORMS TODAY**

Source: Data from BOEM/BSEE, February 2018.

Source: Kaiser and Narra, LSU Center for Energy Studies; Offshore Magazine, March 2018



# Pipelines

# Pipeline Re-Use: Incentives

- Existing Pipelines: ~20k in federal waters (+ more in state waters)
- New Pipeline Costs
  - Offshore Lines: ~2 – 3x cost of onshore “equivalent”
  - MAJOR CAVEATS
    - Data comparing on- and offshore is almost exclusively for NG lines
    - Large range in costs - highly project and route-specific
- Hidden risks/costs of new pipelines
  - Shore crossing through env. sensitive/challenging geography
  - Routing risks (right of way, new regulatory requirements vs. existing lines)



# Pipeline Re-Use: Challenges

- Pressure Rating
  - ANSI Class 600 (working P = 1,480 psig @100 F)
  - ANSI Class 900 (working P = 2,220 psig @100 F)
  - Actual pressure rating of an existing line?
  - Reminder – sCO<sub>2</sub> density + offshore slope = overpressure risk?
- Age
  - Pipeline broker – Up to 85 years usable life
  - Older lines = higher risks (especially out of service lines)
- Condition of Line
  - Corrosion, repairs, thickness, cathodic protection
  - Existing records (or lack thereof) represent essential data

Case	Inlet Pressure (psig)	CO <sub>2</sub> Flow (Mt/yr)
New Class 900	2,000	~3.2
Existing Class 600	1,400	~1.8

- **8", 5-mile pipeline**
- **P<sub>Outlet</sub> > 1,200 psig (CO<sub>2</sub> always above P<sub>Critical</sub>)**

# Pipeline Screening Results – Federal Water Lines

FEDERAL WATERS	Number of Segments	
	Inactive* Line Screening (Near-Term Opportunity)	Active Line Screening (Lower-Risk Opportunity)
<b>Total</b>	20,274	
<b>Service Status (Inactive/Active)</b>	11,195	5,568
<b>8” or larger</b>	2,335	1,676
<b>MAOP &gt; 1000 psig</b>	1,927	1,451
<b>&gt; 2 miles long</b>	951	755
<b>Water Depth &lt; 100’</b>	520	327
<b>In Service 1980 or later</b>	355	Not Applied
<b>Key Segments**</b>	11	47
<i>Median Diameter</i>	<i>16”</i>	<i>20”</i>
<i># of Lines MAOP &gt; 1,440 psig</i>	<i>0</i>	<i>10</i>

\*Inactive = Abandoned in place, Proposed abandonment, Out of service

\*\*Key Segments = Come onshore/near-shore (TX, LA)

# Pipeline Re-Use: Discussion

- **Scale** of pipeline re-use opportunity limited by size and pressure rating
  - Re-use vs. new is not binary
  - Incremental Capacity: Pair existing with new (reduce total investment)
  - “Phased” Investment: Start-up with existing, build-out new (flexibility)
- What does business model look like for re-use of pipelines?
  - Outright sale of pipelines
  - “Pipeline as a service”: Operators sell “access” to pipelines, potentially provide O&M Support
    - Reduces risks for the project developer (likely increases lifetime cost vs. purchase)
- If CO<sub>2</sub> is transported at lower P, how does offshore compression (incl. access to power) impact economics?



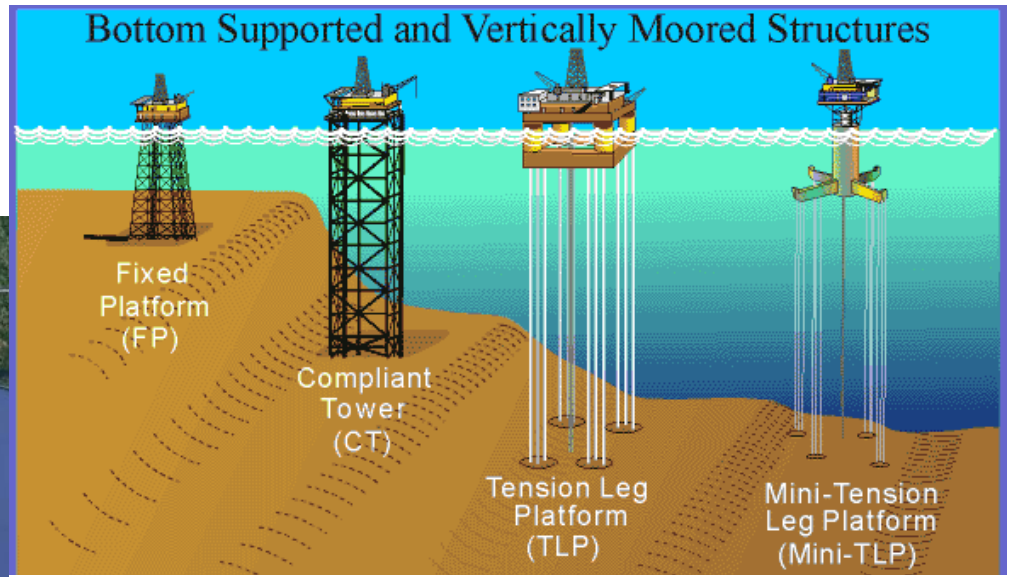
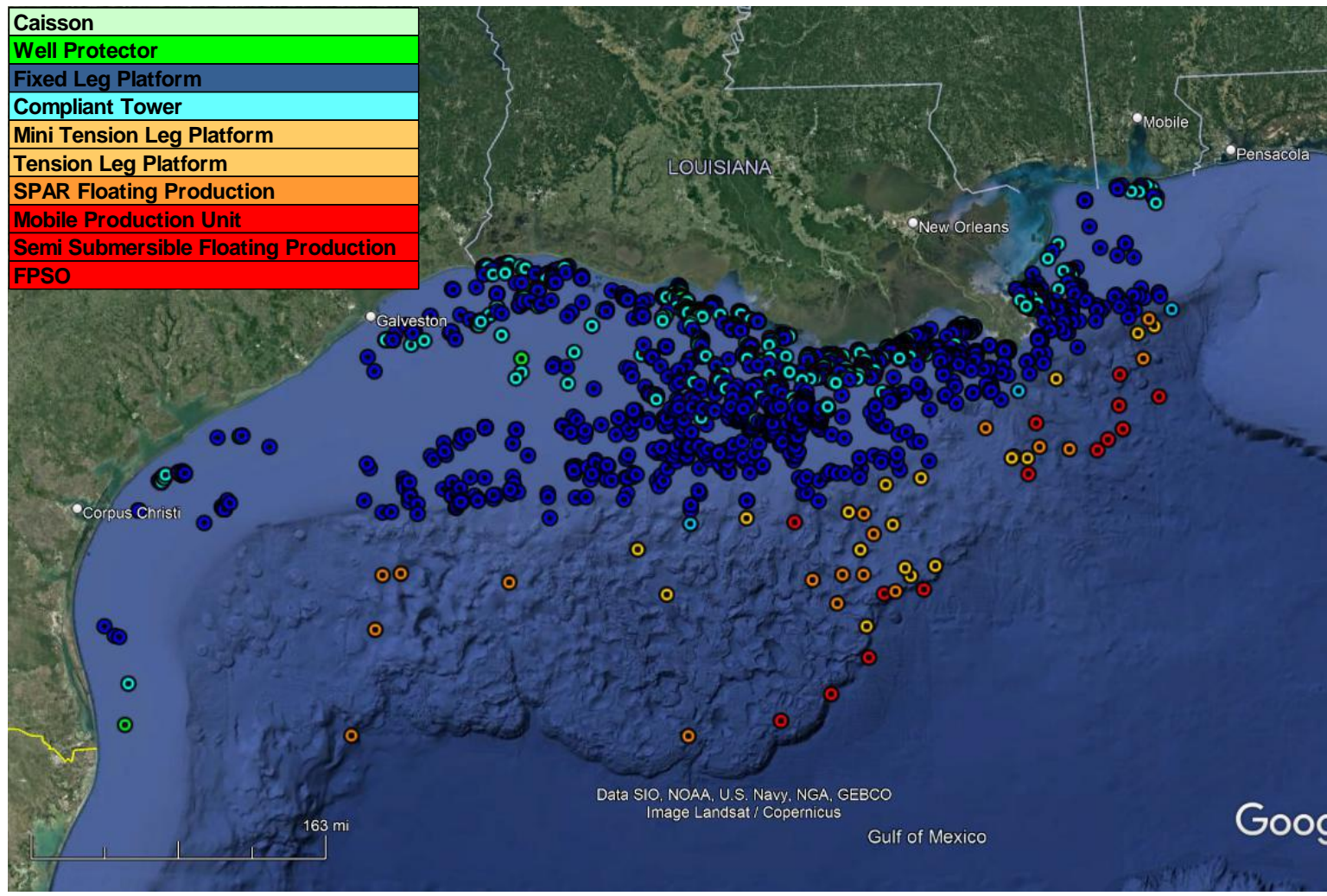
# Platforms

# Platform Re-Use Overview

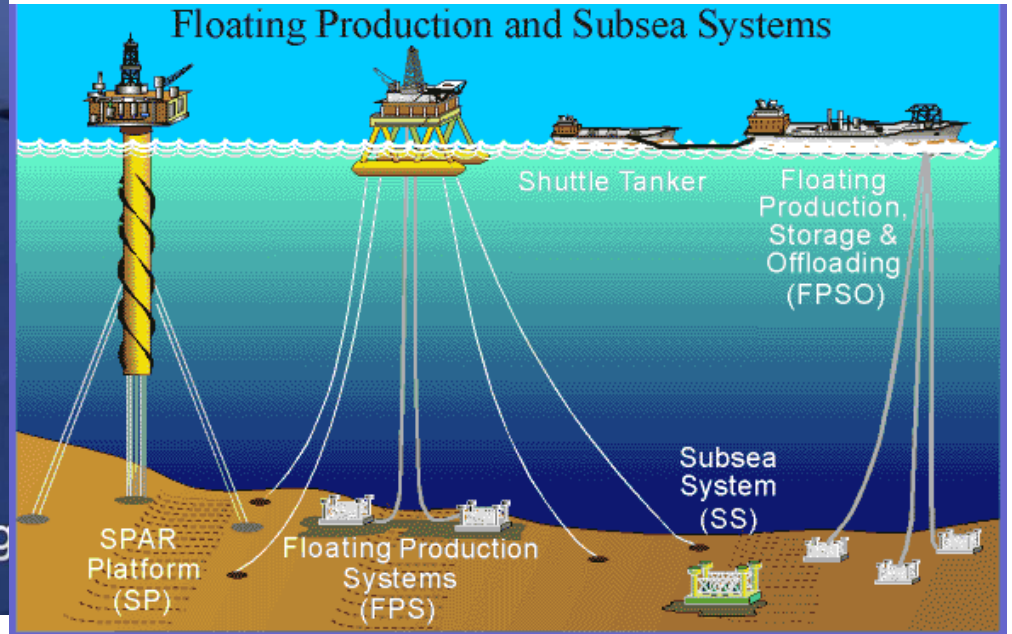
- Repurposing platforms for CO<sub>2</sub> storage = offset cost of decommissioning idled platforms (“win-win”)
- High-Level platform re-use criteria
  - Location/proximity to preferred injection site
  - Age/general condition of platform
  - Space on platform
  - Regulatory/legal considerations
    - How does liability/decommissioning responsibility transfer?

# Overview of Platforms in GoM

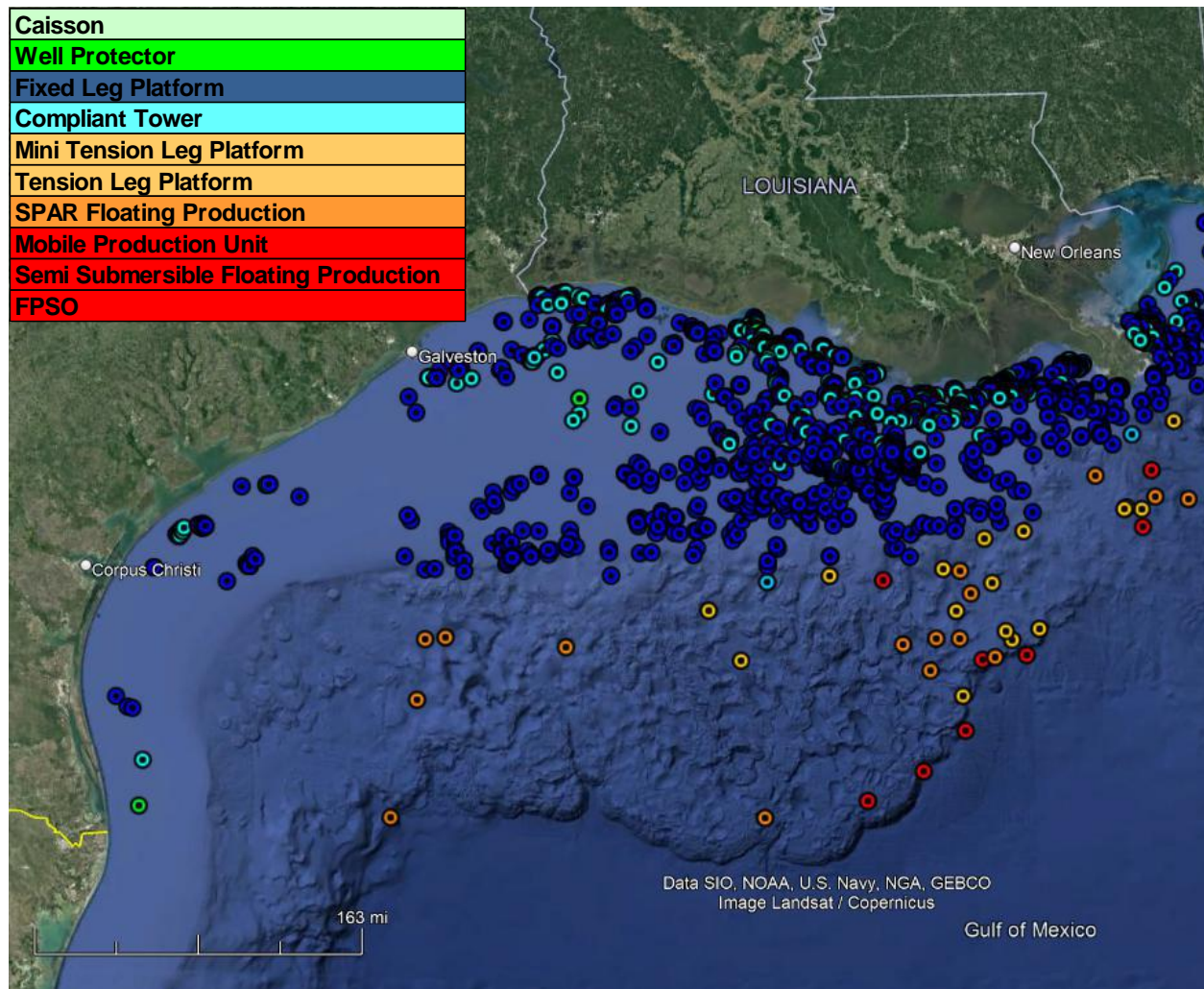
Caisson
Well Protector
Fixed Leg Platform
Compliant Tower
Mini Tension Leg Platform
Tension Leg Platform
SPAR Floating Production
Mobile Production Unit
Semi Submersible Floating Production
FPSO



From bsee.gov



# Overview of Platforms in GoM



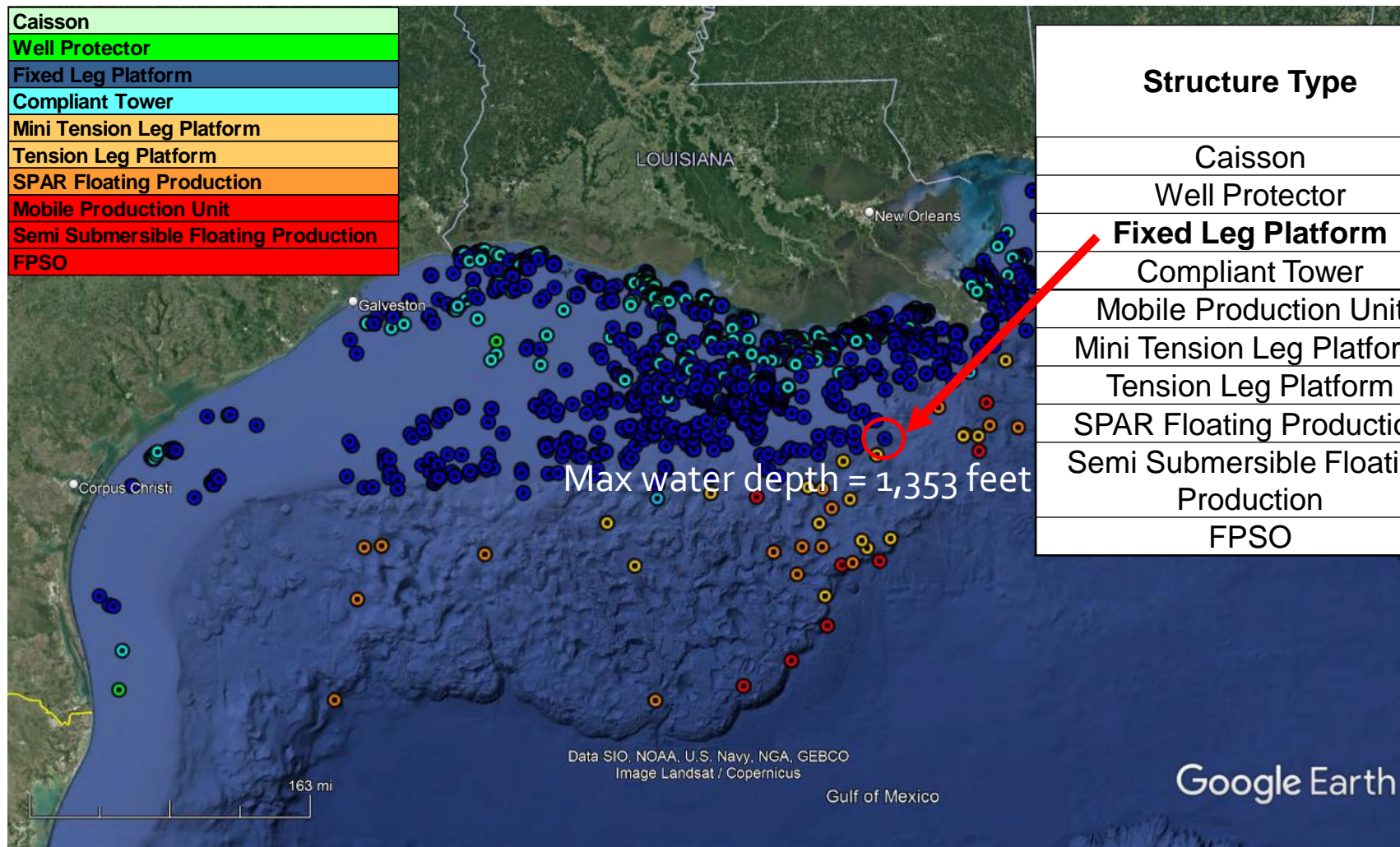
Structure Type	%of Total (~1,850)	Average Depth (ft)	Average Age (years)	Re-Use for Drilling
Caisson	24.6%	41	39	No
Well Protector	0.7%	53	84	No
<b>Fixed Leg Platform</b>	<b>71.9%</b>	<b>131</b>	<b>41</b>	<b>Yes</b>
Compliant Tower	0.2%	1,467	28	Yes
Mobile Production Unit	0.1%	2,200	13	No
Mini Tension Leg Platform	0.2%	3,024	20	Yes
Tension Leg Platform	0.8%	3,378	19	Yes
SPAR Floating Production	1.0%	4,380	17	Yes
Semi Submersible Floating Production	0.6%	5,695	22	Yes
FPSO	0.1%	8,930	9	No



Google Earth

# Overview of Platforms in GoM

- Caisson
- Well Protector
- Fixed Leg Platform
- Compliant Tower
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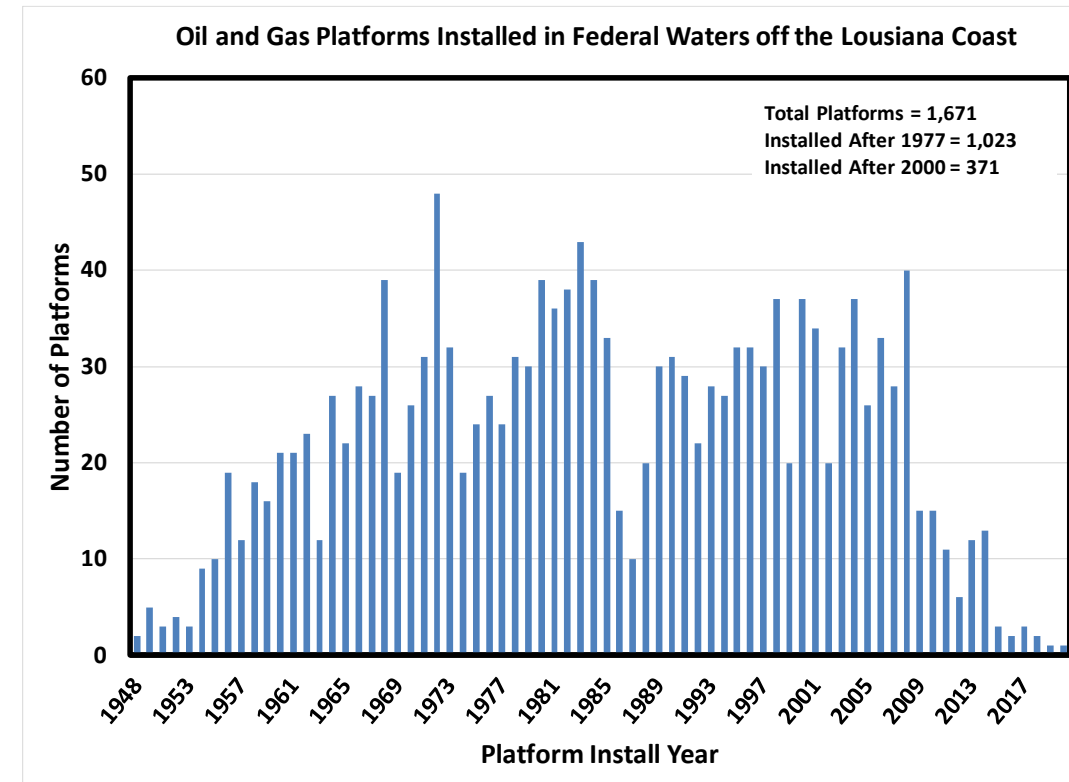
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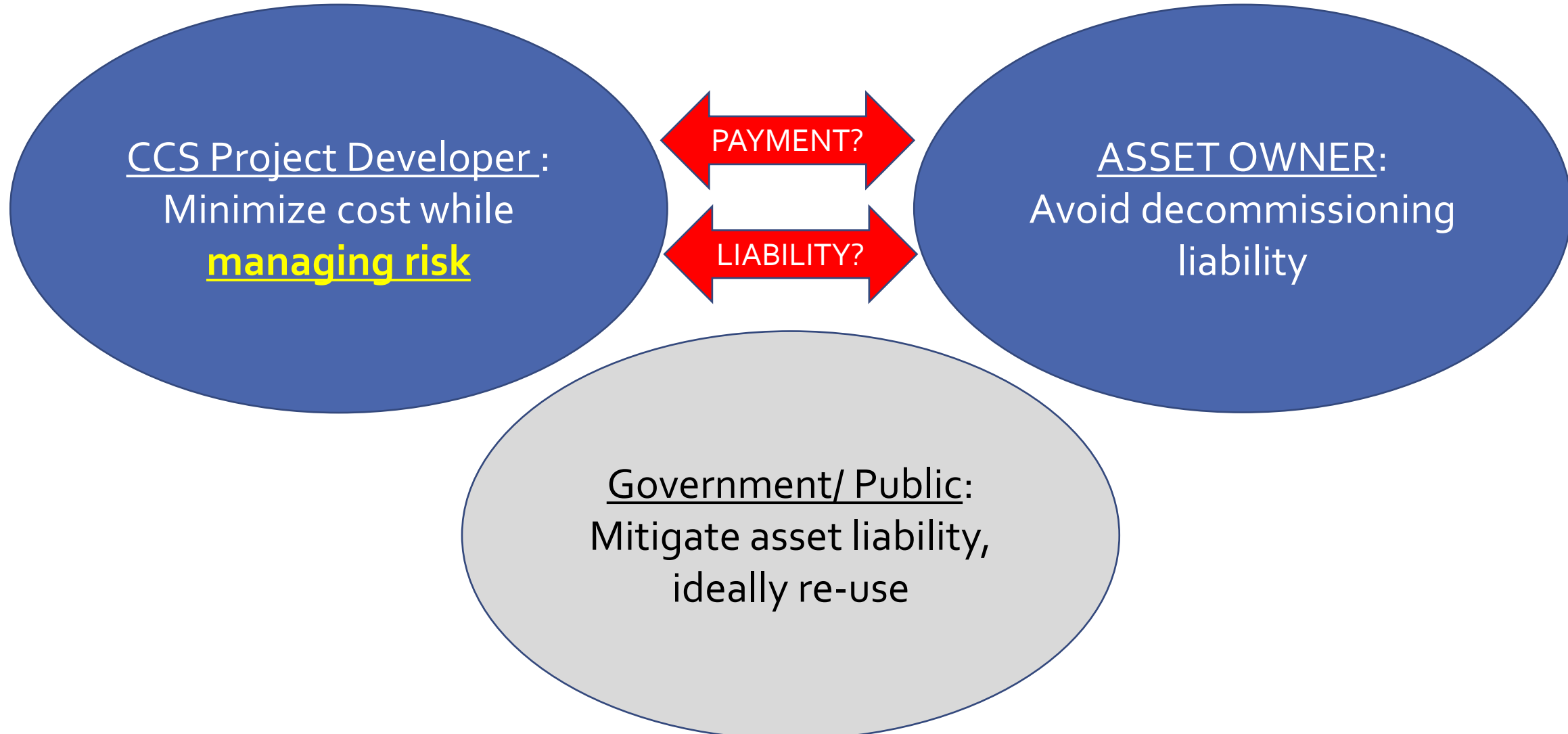


# Platforms

- Texas State Waters:
  - 95% of platforms (of 89 total) = inactive
  - Minimal detailed data (no age, water depth, inspect. records)
- Federal Waters:
  - 1,800+ platforms offshore TX (8%) & LA (92%)
  - High-level data (inspection reports in some cases)
- Age:
  - SME: Beyond 30 years, structural integrity risk rises
  - Important Standards/Best Practices
    - API RP 2A 9<sup>th</sup> Ed (1977): “100-year return period conditions”
    - MMS – From 1988 on, enhanced inspection requirements
- Critical information such as structural integrity, topsides space, etc. requires contact with operators



# Platforms – Are Incentives Aligned?





# Conclusions

# Summary

## • Pipelines:

- **Scale** of pipeline re-use opportunity limited by size and pressure rating
- Re-use vs. new is not binary
  - Incremental Capacity: Pair existing with new (reduce total investment)
  - “Phased” Investment: Start-up with existing, build-out new (flexibility)
- Existing right-of-way, existing routes have inherent value
- Are there different business models to de-risk pipeline re-use?

## • Platforms:

- Limited stock of “newer” platforms (mostly in deeper waters)
- Fixed platforms are most common, span large range of water depth – needs more investigation
- Platform re-use unlikely to drive a project (vs. reservoir, pipeline, wells)
- Are incentives aligned for re-use?

• Decommissioning “best practices” not always followed. **Urgency to identify assets before abandonment.**

# Thank You

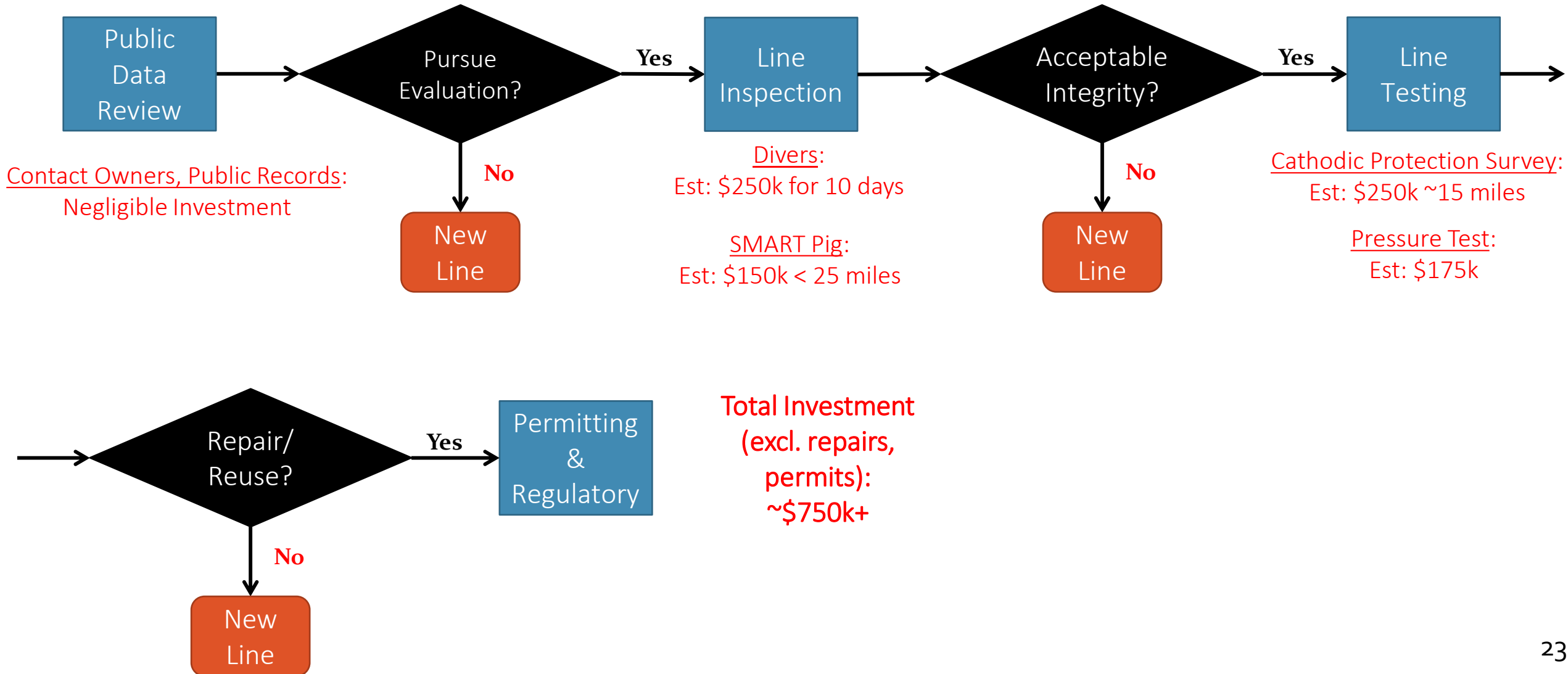
## □ Acknowledgements:

- Darrell Davis (Consultant) led efforts for pipeline and platform screening
  - [davisdw58@hotmail.com](mailto:davisdw58@hotmail.com)
  - UT BEG for data analysis support
- Trimeric Corporation  
[www.trimeric.com](http://www.trimeric.com)
- Darshan Sachde  
[darshan.sachde@trimeric.com](mailto:darshan.sachde@trimeric.com)



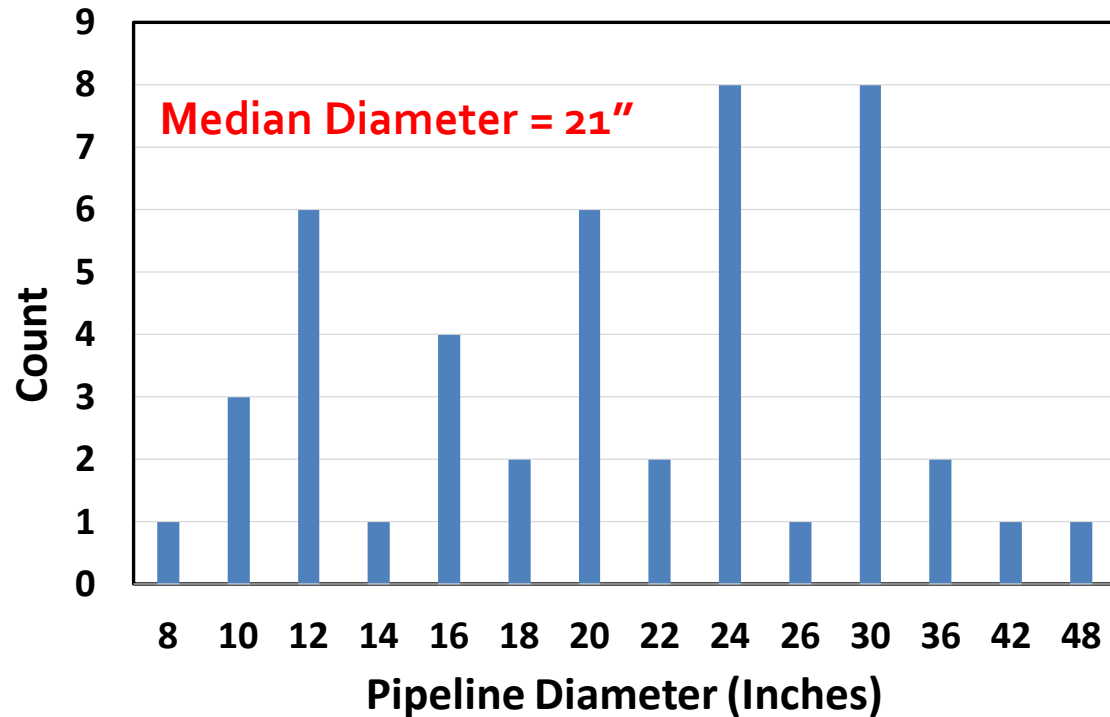
# Backup Slides

# Pipeline Re-use Workflow



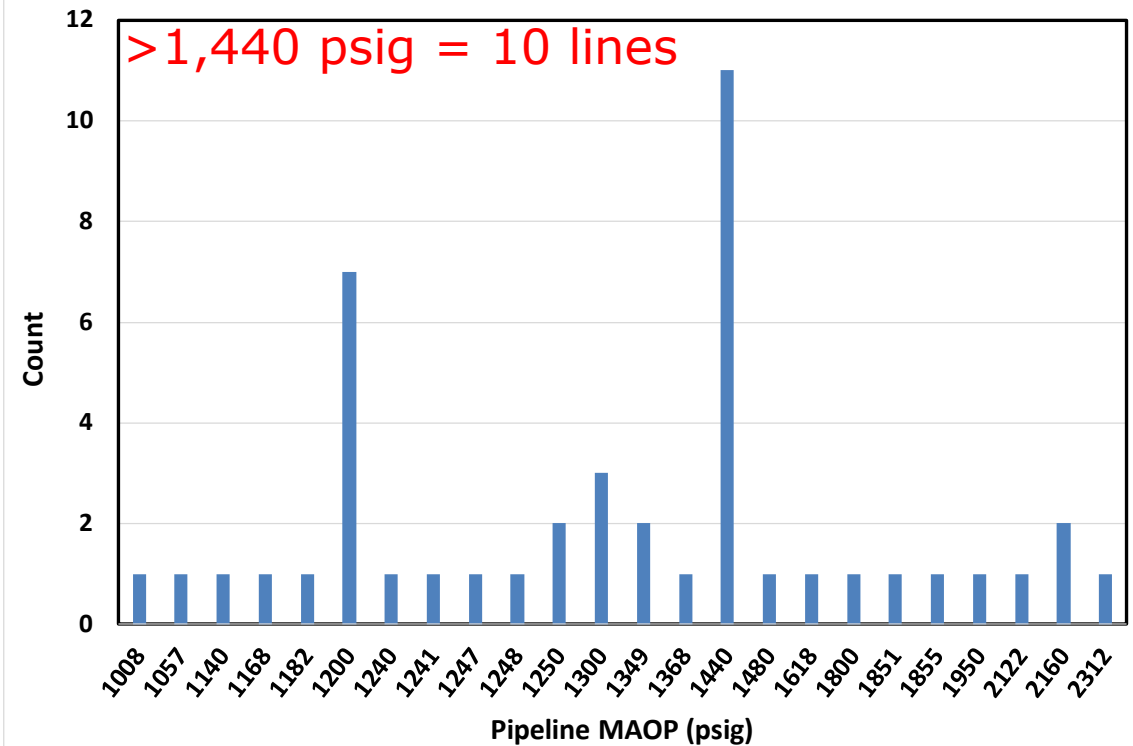
# Pipeline Screening Results – Federal Active Lines

Pipeline Size Distribution - Active Lines



Note: Out of Service Median Size = 16"

Pipeline Pressure Distribution - Active Lines



Note: Out of Service Lines > 1,440 psig = 0



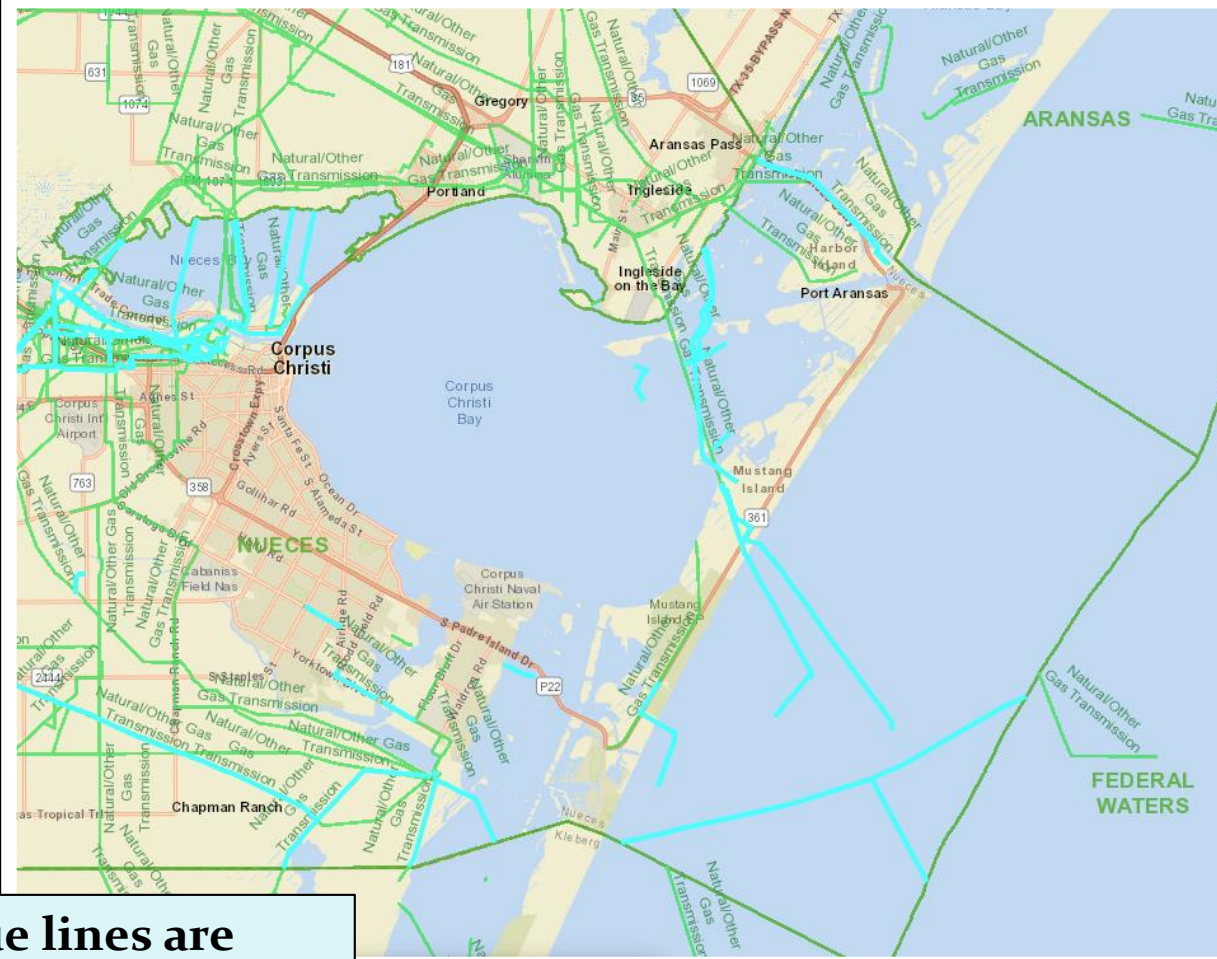
# Pipeline Screening Results – Federal Out of Service

- **Limited stock of large pipelines**
  - ~23% ≥ 8 inches
  - 41% of this subset are 8” lines
- **Class 600 pipelines are most common**
  - 61% of all pipelines at least 1440 psig
- **Nearly half of pipelines meeting size and pressure screen are active**
  - Recent (last 10 years) common practice: fill abandoned lines w/ uninhibited seawater.
- **Less than half (46%) of lines meet the age criteria (< 40 years)**

<b>FEDERAL WATERS</b>	<b>Number of Segments</b>
<b>Total</b>	20,274
<b>8” or larger</b>	4,614
<b>Max Operating Pressure &gt; 1000 psig</b>	3,875
<b>Not in Service</b>	1,927
<b>&gt; 2 miles long</b>	951
<b>Water Depth &lt; 100’</b>	520
<b>In Service 1980 or later</b>	355
<b>Key Segments*</b>	11

\*Key Segments = Come onshore & terminate near state waters offshore

# Pipeline Opportunity: Texas State Waters

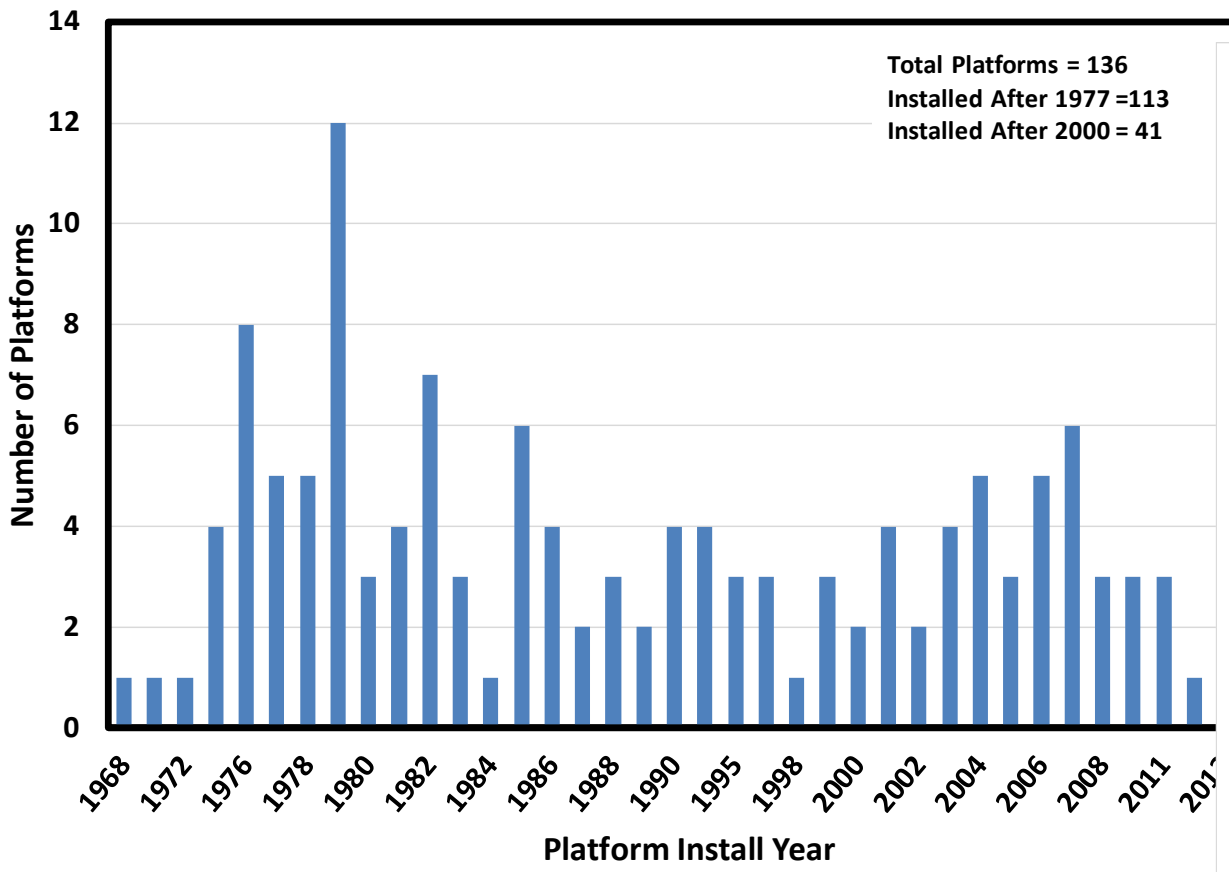


Light blue lines are abandoned lines which are 8" or greater

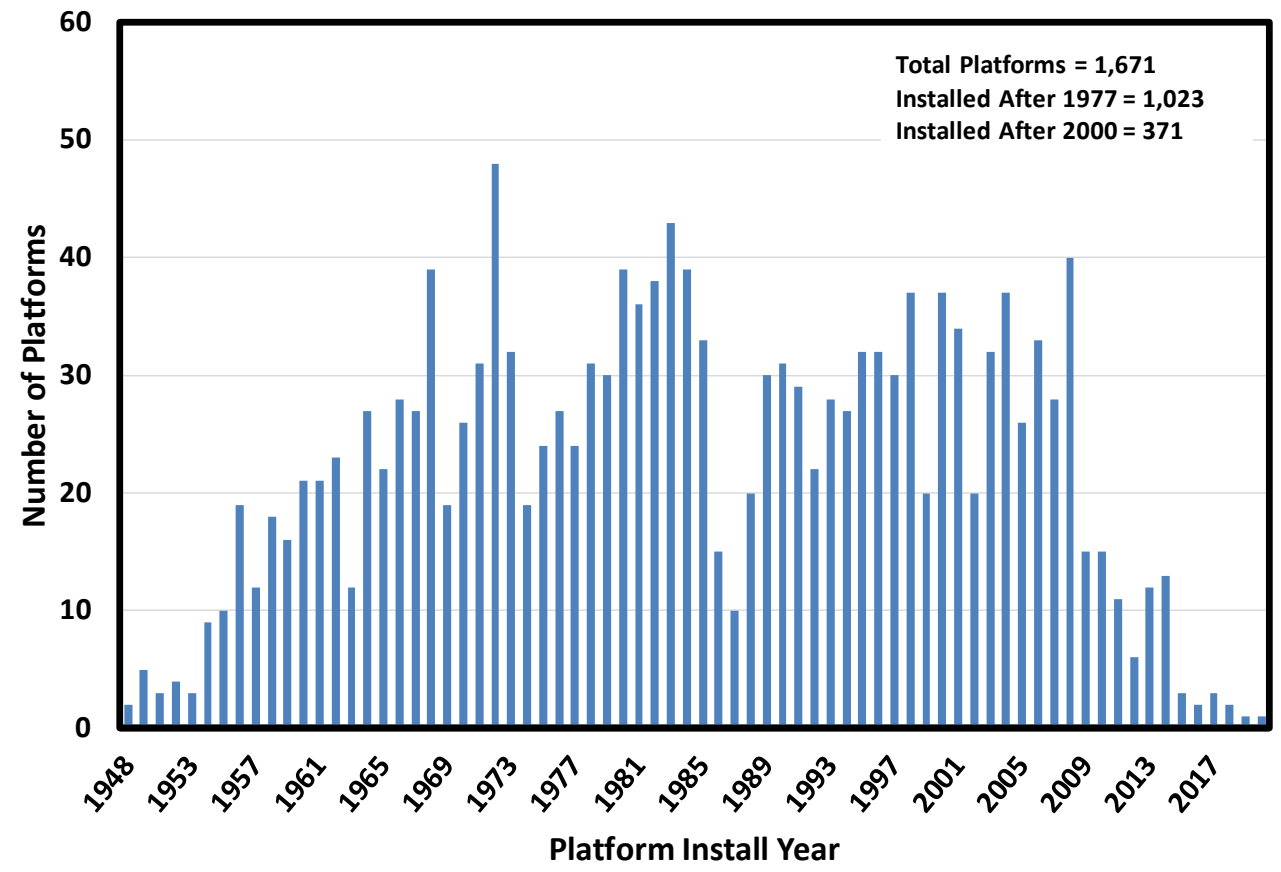
Source: Prepared by Darrell Davis for Trimeric Corporation

# Platforms – Federal Waters

Oil and Gas Platforms Installed in Federal Waters off of the Texas Coast



Oil and Gas Platforms Installed in Federal Waters off the Louisiana Coast



# Platforms – CO<sub>2</sub> Topsides Requirements

- General Equipment: Valving, instrumentation, filters, pig receivers, piping manifold, heaters
- Drill new CO<sub>2</sub> injection wells
  - Weight of a drilling rig or need a separate jack-up rig for drilling
  - Need open slots for injections wells or re-use existing wells
- Booster compression/pumping (in some cases)
  - Additional topsides weight, space, power requirements
- Materials compatibility:
  - Supercritical CO<sub>2</sub> is a solvent, P, T considerations
- **Do cost-savings of re-purposing vs. new-build hold up after modifications?**
- More detailed engineering studies will be needed to:
  - Assess the integrity and useful life of specific platforms
  - Assess modifications to the topsides for CO<sub>2</sub> injection
  - Understand the cost of a new platform