



California Geologic Energy Management Division

SB 1147 Report

OFFSHORE OIL & GAS OPERATIONS ABANDONMENT

**Prepared Pursuant to Senate Bill 1147
(Hertzberg, Chapter 607, Statutes of 2018)**

January 20, 2022

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ABOUT THE CALIFORNIA GEOLOGIC ENERGY MANAGEMENT DIVISION

The California Geologic Energy Management Division (CalGEM) prioritizes the protection of public health, safety, and the environment in its oversight of oil, natural gas, and geothermal operations in California. To do that, CalGEM uses data, science and sound engineering practices to regulate the drilling, operation, and permanent closure of energy resource wells. CalGEM also regulates certain pipelines and facilities associated with production and injection. These regulatory duties include witnessing tests, inspections, and operations.

When CalGEM was established in 1915, the initial focus of regulation was the protection of oil and gas resources in the State from production practices that could harm the ultimate level of hydrocarbon recovery. Early CalGEM regulations included well spacing requirements and authority to limit production rates. However, those regulations and the focus of CalGEM evolved and came to emphasize the protection of public health, safety, and the environment.

CalGEM has grown significantly since it was established in 1915 and has taken major steps to ensure it will be able to handle challenges in a manner consistent with public expectations for a modern, efficient, collaborative, and science-driven regulatory agency.

In 2019, the mission of CalGEM changed to include protecting public health and safety, environmental quality, and the reduction and mitigation of greenhouse gas emissions associated with the development of hydrocarbon and geothermal resources in a manner that meets the energy needs of the state.

CalGEM Districts

CalGEM operates five offices in three districts to best serve the needs of the State: Northern, Inland, and Southern.



<https://www.conservation.ca.gov/calgem>

EXECUTIVE SUMMARY

This report regarding the cost of decommissioning offshore oil operations in California is required by State law. Senate Bill 1147 (Hertzberg, Ch. 607, Statutes of 2018) created Public Resources Code Section 3205.6, which requires the State Oil and Gas Supervisor of the Department of Conservation's California Geological Energy Management Division (CalGEM), in close consultation with the State Lands Commission (SLC), to estimate the costs necessary to decommission, plug, and abandon all oil and gas wells in state waters; compare these estimated costs with current industry-provided financial surety levels; and, if necessary, create a schedule of bonding increases to close this gap.

Highlights of the report include:

- CalGEM's average cost estimates for decommissioning offshore facilities range from \$768MM to \$1.07B depending on whether the THUMs Islands remain intact or are removed.
- CalGEM's cost (derived from the average cost estimates of the operators, CalGEM's independent contracted consultant, and CalGEM's own staff) for plug and abandoning and decommissioning attendant offshore facilities stands at \$768MM, exclusive of removal of the THUMs islands.
- Under the terms of its leases, State Lands Commission retains liability, an estimated \$617MM of the total decommissioning cost for the THUMs Islands. There is currently a \$300MM sinking fund oil trust account to address this liability, leaving an estimated unfunded liability of \$317MM.
- The estimated share of total decommissioning costs that operators are collectively responsible for is \$151MM. CalGEM has successfully secured the full \$151MM in financial assurance from responsible operators.

There are close to 1,500 wells in state waters, spread throughout eight different facilities, and run by three different companies. Some of these facilities exist on artificial islands. Dismantling these islands as part of the abandonment process would cost more money overall (\$1.07B), while leaving them intact would prove less costly (\$768MM). CalGEM's estimates for abandonment are higher than estimates provided by the operators as well as those produced by DrilTek, an independent firm hired by CalGEM to provide a third-party opinion. This is largely due to different assumptions made in the analysis. CalGEM's assumptions account for site remediation, additional contracting and engineering costs, and lack of economies of scale and time.

Upon release of the report, CalGEM plans to continue to work with operators and the State Lands Commission to track operational changes, update cost estimates, and require additional financial sureties as necessary to ensure state liability is covered.

INTRODUCTION

Objective and Scope of Report

This report has been prepared in compliance with Public Resources Code (PRC) Section 3205.6, added by Senate Bill (SB) 1147 (Hertzberg, Chapter 607, Statutes of 2018), that states:

Before July 1, 2020, the supervisor shall do all of the following:

- (a) Evaluate and estimate the costs associated with the decommissioning, including plugging and abandonment pursuant to Section 3208, of the offshore oil and gas wells under its jurisdiction.
- (b) If necessary, based on the estimates made pursuant to subdivision (a), develop a schedule to increase the bond amounts or other financial surety provided by an operator of an offshore oil or gas well to ensure sufficient moneys are available to the state to decommission the well if no other entity is responsible for those decommissioning costs.
- (c) Coordinate with the State Lands Commission to ensure the actions taken pursuant to this section and Section 6829.3 are not duplicative and are consistent with Section 3205.1.

The Department of Conservation's California Geologic Energy Management Division (CalGEM) had compiled estimates of the current offshore oil and gas facility abandonment liability, compared these estimates to current bonding levels, and developed a proposed bonding and financial surety schedule regarding the possible increase to the aforementioned bonds to appropriate levels.

As of August 2021, CalGEM secured additional bonding from California Resources Corporation (CRC) in the amount of \$40MM and from Freeport McMoRan (FMOG) in the amount of \$60MM. The operator bonding deficiency was determined to be collectively \$151MM and CalGEM has successfully secured the full \$151MM in financial assurance from the responsible operators.

The California State Lands Commission (SLC) provided information to CalGEM regarding its leases. With the exception of the Long Beach Tidelands, the SLC is the lessor, on behalf of the State, for each offshore operation and manages bonding and abandonment liability reduction contractually through lease terms.

The scope of this analysis includes all oil and gas wells which have wellheads located in offshore California State waters and any associated production facilities (tanks, oil/water separators, injection pumps, etc., whether located offshore or onshore) that service these wells. Offshore leases that are being drilled from onshore wellhead locations were not included in this analysis, however, to the extent that these operations share facilities with the offshore operations, the facilities were considered in the costs¹.

Contact

For questions regarding the content of this report, please contact DOC's Public Affairs Office at pao@conservation.ca.gov.

¹ An example of the distinction between onshore and offshore wells, as defined in this report and as generally applied by CalGEM, is the offshore portion of the Huntington Beach oil field. Many wells are drilled to offshore bottom hole locations from wellheads located northeast of the Pacific Coast Highway. These wells are designated "onshore" as their wellheads are located onshore. On the other hand, the wellheads on Platform Emmy are manifestly offshore and fall within the scope of this report. When the wells at Platform Emmy are abandoned and the associated facilities (including the platform) are removed, the locations of the wellheads will be underwater. When the wells drilled from onshore locations are abandoned, the locations of those wellheads will be on land.

METHODOLOGY OF ANALYSIS

The methodology used by CalGEM was based on previous work conducted by the Division as well as various other sources². These inputs included Federal Bureau of Safety and Environmental Enforcement (BSEE), operator submitted information, SLC documents, actual abandonment costs compiled from throughout the district, and the Driltek report that was contracted as an independent third-party abandonment estimate.

The BSEE report of 2015 is the federal government's assessment of costs for abandonment and reclamation of Pacific Outer Continental Shelf (OCS) Region oil and gas facilities. This document was used as a guide and BSEE's assumptions were used as a starting point for CalGEM estimates.

Operators were also consulted in this process and asked to supply their estimates for abandonment of their offshore operations. The City of Long Beach, California Resources Corporation (CRC), Dos Cuadras Offshore Resources (DCOR) and Freeport McMoRan (FMOC) all submitted cost estimates. The level of detail submitted, and the range of cost estimates varied between the operators but were still useful in our analysis. The operator supplied costs were lower than CalGEM estimates, this was primarily due to inherent cost efficiencies and internal organization expertise that an operator has that the State does not.

Data was also collected in cooperation with the SLC from their records. The data supplied from SLC included cost estimates for ongoing decommissioning projects such as Platform Holly, actual well abandonment costs from Rincon Island and other recent and relevant abandonments.

Platform Holly and Rincon island were deserted by their respective operators and left for the State to remediate, abandon and decommission. Valuable information has been gathered from these ongoing State-led operations that has aided in refining CalGEM's cost estimates. Costs still to be incurred by the State in the future, as allocated by the Legislature, that were not addressed by industry include costs for remediation of neglected sites, remediation of surface locations, environmental impact assessments, costs for third party engineering and contractors, contract labor for site supervision and operations.

Lastly, a contract was issued by the State for a third-party assessment to provide CalGEM with independent estimates for the abandonment and reclamation of the offshore wells and platform/islands. Driltek was awarded the contract and provided CalGEM with their report.

All of these various sources were compiled, and cross referenced for accuracy, validity and relevancy. Tables 1.1 – 3.2 in Appendix D show the submitted data from each source and the ultimate blended average of those estimates.

CalGEM's final estimate considered other factors such as remediation of the sites, repairs due to neglect, third party engineering costs, and lack of economies of scale and time.

² See Appendix C – Sources of Data

OPERATOR SUMMARY

This section includes a description (by Operator) of liability estimates, conditions, and additional considerations.³

California Resources Corporation (CRC)

Under leases from the SLC, CRC owns and operates Platform Emmy in the Huntington Beach field and produces from zones in the Belmont Offshore Field through wells drilled from Island Chaffee (one of the THUMS Islands). CRC also manages the daily operations at the Long Beach Tidelands in the Wilmington Field, as the Contractor for the Operator, the City of Long Beach.

Huntington Beach (Platform Emmy)

According to CalGEM's internal assessment, abandonment of Platform Emmy is estimated to cost \$91.9MM to abandon all wells and pipelines, decommission all facilities, and completely remove the platform from State waters. Driltek's estimate is \$73MM, which does not include costs that the State would incur for expenses such as third-party engineering and operations contracting, out-of-State equipment, economies of scale, and additional remediation costs due to neglect.

CRC supplied their estimate to CalGEM and estimated that Platform Emmy's current liability is \$34MM. This number is based on an assessment performed for the SLC in 2019. On October 1, 2017, the SLC and CRC amended CRC's Huntington Beach leases covering Platform Emmy, pursuant to which CRC agreed to:

1. Form a joint SLC/CRC abandonment committee of engineers that meet regularly.
2. Abandon all idle wells on Platform Emmy within 5 years.
3. Retain a third-party consultant to calculate the cost to plug and abandon all remaining wells on Platform Emmy and the cost to fully decommission and remove the platform and any remaining offshore facilities.
4. Abandon 10 onshore idle wells per year, to reduce idle well counts.
5. Spend no less than \$3MM annually (Annual Amount) (increased at an annualized compound rate of 3%) plugging and abandoning idle wells on the leases with any difference between the annual amount and actual abandonment costs placed into a sinking fund for end of field abandonment costs.
6. Grant the State a priority secured lien against CRC's privately-owned upland assets in Huntington Beach as collateral against its abandonment and decommissioning obligations.

According to SLC staff, CRC is in full compliance with the obligations of its leases and the 2017 amendment. As additional protection, and as a condition of the assignment from Oxy USA, Inc. to CRC, in 2014, OXY USA, Inc. remains bound to the terms of the lease, which SLC staff interpret to include a guarantee to perform the lease abandonment and decommissioning obligations.

³ "Operator" means a person who, by virtue of ownership or under the authority of a lease or any other agreement has the right to drill, operate, maintain, or control a well or production facility." (PRC § 3009.)

The current performance bond held for Platform Emmy is for \$30MM, which results in a bonding gap of \$61.9MM when compared to the CalGEM internal estimate. However, SLC staff believes the State's interests are largely protected through "other financial surety" as provided for in PRC Section 3205.6, via the additional security interest in upland real property, and via the \$3MM annual amount required to be spent on plugging and abandoning or alternatively deposited in the sinking fund.

Belmont

CRC operates 35 wells in the Belmont oil field, drilled from Island Chaffee in the San Pedro Bay. These wells share facilities with Island Chaffee with a cost-sharing agreement between the City of Long Beach and CRC for use of those facilities. Prior to 2002, production occurred from Belmont Island, which has been decommissioned and removed. The lease was originally executed with the SLC in 1945 and provides no contractual ability to increase bonding beyond the original \$50,000 amount, leaving the abandonment obligations under-secured. CalGEM estimates the abandonment liability of these PRC 186 lease wells in the Belmont Offshore field at \$13.8MM.

Long Beach Tidelands

The Long Beach Tidelands consists of two units: the Long Beach Unit (East Wilmington) and the Tidelands Unit (West Wilmington). The City of Long Beach (City) is, by statute, the operator and THUMS Long Beach Co. is the City's contractor for the four offshore THUMS Islands that produce from the Long Beach Unit of the Wilmington Oil Field. The Tidelands Unit consists of wells developed from onshore. Like the Long Beach Unit, the City is the operator and Tidelands Oil Production Company is its contractor for the Tidelands Unit. The Long Beach Tidelands consist of a majority of tidelands legislatively granted to the City, including minerals, with a small section of State sovereign lands unitized in the 1950's and 60's. A majority of wells and equipment in the Long Beach Tidelands is owned by the City. Costs associated with abandonment of facilities during production is established by agreement between the City, CRC, and SLC.

CalGEM's internal assessment estimated cost to abandon and completely remove the four islands is approximately \$928.9MM. This compares closely to the City of Long Beach's own assessment of \$834MM (when accounting for removal of all four islands with inflation and excluding the Tidelands liability) as well as Driltek's estimate of \$862.5MM. An alternative abandonment plan would remove all the oil production infrastructure and leave the islands for development for other uses. CalGEM estimates the costs for that alternative are \$662MM, which is higher than the Driltek estimate of \$426.8MM. The discrepancy between the two estimates is primarily due to factors such as environmental remediation, partial versus complete removal of infrastructure, weather contingency, and estimates for permitting and timing. CalGEM's estimate assumed an average plugging and abandonment cost of \$400,000 per well.

The THUMS Islands partnership between SLC, the City of Long Beach, and CRC is a unique public-private partnership, the only such partnership that exists in the United States. Under this arrangement, the State of California, managed by SLC, has the lion's share of the responsibility for well abandonment and decommissioning. Of the total estimated cost to abandon well and decommission facilities (but not remove the islands), California's share of those potential costs is estimated to be \$617MM, CRC's share of those potential costs is estimated to be \$40.5MM (CRC Well Abandonments include THUMS and Belmont Wells), and the City of Long Beach's share of those potential costs is estimated to be \$5.13MM.

THUMS Partnership Entities	Facilities Cost	Well Abandonments Costs (\$MM)	Total Cost (\$MM)	% Share Cost
State Lands Commission	198	419	617	93.11
California Resources Corp (CRC)	1.5	39	40.5	6.11
City of Long Beach	1.36	3.76	5.13	0.77

The State of California currently maintains a \$300MM Oil Trust Fund, pursuant to PRC Section 6217.8, to finance the costs of well abandonment, pipeline removal, facility removal, remediation, and other costs associated with removal of oil and gas facilities from the all of the Long Beach Tidelands, not just the Long Beach Unit.⁴ The bond is capped at \$300MM and would need legislative approval to increase the amount. Additionally, the City of Long Beach has not officially indicated a preference for whether to remove or repurpose the islands. Repurposing the islands instead of removing them would significantly decrease costs.

⁴ This fund is held and controlled by the State, not CRC. Likewise, a separate subsidence fund is held and controlled by the City of Long Beach, to address costs related to the control of post-production subsidence. In the event of a contractor's bankruptcy, these funds would be unaffected.

Dos Cuadras Offshore Resources (DCOR) and Freeport McMoRan (FMOC)

DCOR is the responsible operator for Platforms Eva and Esther, operating, respectively, in the Huntington Beach field and the Belmont Offshore Field. DCOR is responsible for abandonment of the wells and CalGEM estimated the cost to abandon the wells at Platforms Eva and Esther to be \$46MM and \$33MM, respectively. The Driltek estimates for Platforms Eva and Esther are \$34MM and \$23MM, respectively. Driltek's estimate varies from CalGEM's estimate with respect to additional costs to the State such as potential remediation of infrastructure, timing, economies of scale and other contingencies. DCOR supplied their estimate for their wells at Eva and Esther at \$11MM and \$8MM, respectively. The DCOR estimate is the lower of the three estimates in part due to the operator ability to control costs through in-house expertise, economies of scale, and relationships with suppliers, contractors, and rigs.

DCOR currently has a \$21MM blanket bond in place which is renewed every five years. The SLC is in the process of negotiating the reduction in post-production abandonment liability with DCOR, relying on an approach similar to CRC's Huntington Beach leases⁵. FMOC's predecessor assigned these leases to DCOR, and as part of the assignment retained residual liability to cover DCOR's plugging and abandonment and remediation responsibilities. Bonding or other financial surety may need to be increased by as much as \$58MM in order to cover the expected well abandonment costs estimated by CalGEM, although ongoing negotiations between the SLC and DCOR are aimed at reducing this gap.

FMOC acquired the facilities and platforms from Neuvo Energy and is the responsible party for their abandonment, which is estimated by CalGEM's staff to be \$83MM for both platforms. Driltek estimates the facilities and platform abandonment to cost roughly \$88MM for both platforms, which is in line with CalGEM's estimate. FMOC estimated the cost to abandon the facilities and platforms Eva and Esther to be \$28MM in total. FMOC's estimate is significantly lower than both CalGEM and Driltek's estimates due primarily to using "best case" scenarios that do not take into account platform remediation, additional contracting and engineering costs, weather contingencies, economies of scale, disposal options as well as other contingencies. Currently, FMOC does not have any independent bonding in place for facility decommissioning and platform removal. Negotiations with FMOC are needed to establish bonding up to their current estimated liability of \$83 Million.

RECOMMENDATIONS AND SCHEDULE FOR INCREASING BONDING OR OTHER FINANCIAL SURETY LEVELS

Augmenting the basic bonding requirements set forth in PRC sections 3204 through 3205, companion section 3205.3 authorizes CalGEM to require operators to provide additional forms and amounts of financial security acceptable to CalGEM. The amount of the additional financial security is based on an evaluation of the risk of an operator's desertion of wells or facilities, and associated threats to the safety of the public or natural resources. CalGEM can accept various forms of effective financial assurances.

⁵ In negotiating a bonding increase with DCOR, SLC relied on actual costs for plug and abandonment at Platform Emmy to determine an average cost of \$366,000 per well. This was rounded up to \$400,000 per well, and a 25% contingency was added, for a total of \$500,000 per well. With a total of 72 wells on both platforms, this equates to \$36MM for both platforms.

PRC section 3205.3, subd. (f)(1) identifies examples of effective forms of financial assurance as letters of credit, corporate guarantees, a trust fund, or a specific demonstration of self-insurance by an operator. Other examples of acceptable forms of financial assurance might include an equitable interest in real property or negotiating an interest in a designated fund. Illustrating such examples, the SLC accepted a secondary ownership interest in a parcel of real property located in Orange County, California when amending a State lease with CRC in 2017.

The same lease amendment with CRC also created a “sinking fund” for the benefit of the SLC in the event CRC failed to meet well abandonment goals set forth in the amended lease (when well abandonment spending requirements were not met, unspent funds became earmarked for the State).

At this time a final decision has not been made to either keep or remove the islands and platforms. Further study would be required to understand the environment and ecosystems surrounding the infrastructure. This effort would most likely involve multiple agencies at the city, state and federal level.

Current Bonding Status

In 2021 CalGEM had technical discussions with CRC and Freeport MacMoran in relation to their offshore bonding deficiencies. CalGEM secured offshore bonds in the amount of \$39.73MM with CRC and \$60MM with Freeport MacMoran related to their offshore decommissioning liabilities. The Bonding documentation was complete and in place in CalGEM as of August 13, 2021.

With respect to DCOR’s offshore operations in state waters, the State Lands Commission holds a total of \$24MM in bonding. \$21MM is present to secure DCOR’s obligations under a myriad of leases all of which are supporting their oil and gas operations in state waters. The additional \$3MM bond secures a series of pipelines that traverse state waters, but the infrastructure supports DCOR’s OCS operations. The Commission is still actively working with DCOR to increase the relative security for the two platforms in state waters, through a sinking fund, by \$15MM. Freeport MacMoran retains responsibility, per the Commission’s assignment agreement, should DCOR default on any critical lease obligations.

PRC section 3205.1, subdivision (b), indicates that the amount of bonding required cannot be adjusted by CalGEM before three years is up. Accordingly, CalGEM will revisit all the offshore operator bond amounts in 2024.

ENFORCING OFFSHORE BONDING DEFICIENCY LAWS

Upon CalGEM’s discovery that bond amounts or other financial surety provided by an operator of an offshore oil or gas well is not sufficient to decommission the well, CalGEM will evaluate options to seek additional security pursuant to PRC Sections 3205.1 and 3205.6.

In the event an operator fails to comply with the PRC, a final order, or a requirement of the Supervisor, CalGEM has administrative enforcement authority that is generally found in the PRC commencing at Section 3000. There are two misdemeanor provisions in the PRC which would require referral to the local City Attorney, District Attorney or State Attorney General for enforcement.

CalGEM can issue a Notice of Violation (NOV) or an order with a deadline to comply. If the Operator fails to comply with an NOV or order of the Supervisor, CalGEM can seek civil penalties pursuant to authority in PRC Section 3236.5. CalGEM can also deny approval of proposed well operations until the operator brings its existing well operations into compliance with the order pursuant to authority in PRC Section 3203 and/or

refer any enforcement matters to the local District Attorney, City Attorney or Attorney General for criminal enforcement.

APPENDIX A: INVENTORY OF CALIFORNIA OFFSHORE WELLS AND FACILITIES⁶

There are 10 distinct oil and gas production assets in State Waters, including five manmade islands, four platforms, and the Belmont Offshore field. All assets are along the southern California coast near the communities of Huntington Beach, Long Beach, Mussel Shoals, or Goleta; see Figure 1.



Figure 1: Map of State of California Offshore Oil and Gas Operations

⁶ Descriptions in this section have been adapted from the CalGEM commissioned report, “Abandonment Cost Estimate for Oil and Gas Assets in California State Waters” (Driltek, Bakersfield, California, April 27, 2020) and from various SLC publications reviewed in preparing this report.

Platform Emmy

Platform Emmy is a fixed-base drilling and production platform located on State Lease PRC425, approximately 1¼ miles from Huntington Beach, California in 45 feet of water. The state leases are an offshore extension of the Huntington Beach Field originally discovered by Standard Oil Company on May 4, 1929 when oil was struck at 2,199 feet in the city of Huntington Beach. This field has produced more than one billion barrels of oil in its history and is listed as the sixth largest oil field in California.

Signal Oil & Gas Company originally announced plans in February 1961 to construct a \$2,000,000 offshore platform to be named “Emmy.” Permits were approved and construction was completed with drilling operations beginning in March 1963. In 1981, a satellite platform was added to the platform by Shell to support steam and water flooding operations. The platform is currently operated by CRC. Figure 2 shows a well base map for Platform Emmy and Figure 3 a recent photograph. There are currently 44 active or idle wells and ten undrilled conductors on the platform. The active wells are all producers.

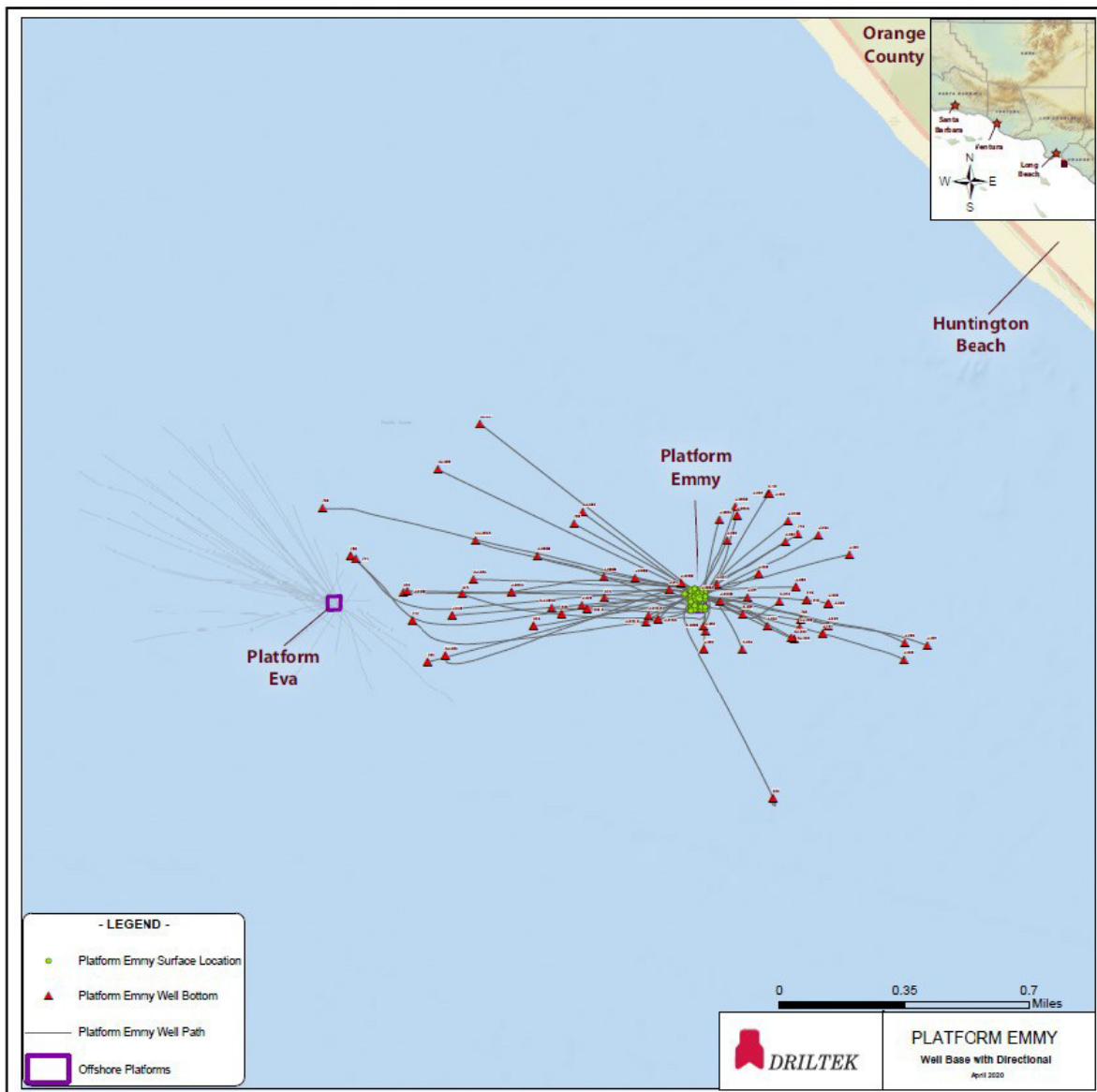


Figure 2: Platform Emmy with directional and bottom hole well locations



Figure 3: Platform Emmy

Platform Eva

Platform Eva is a fixed-base drilling and production platform located above State Leases PRC 3033.1 and PRC 3413.1, approximately two miles from Huntington Beach, California in fifty-eight feet of water. The first well at this location was drilled from the “Wodeco I” barge in July of 1963 to access the Huntington Beach oil field. Union Oil of California (Unocal) installed Platform Eva later that year and the initial Well “A-1” was tied back into the platform.

Currently, Platform Eva has 42 active or idle wells. There are 16 active producers, 11 active water injection wells, 14 idle wells, and one gas injection well. Four wells have been plugged in zone and partially abandoned. All the well slots are utilized, so each conductor has an inner casing string cemented to the surface. There are no water source wells drilled from Platform Eva.

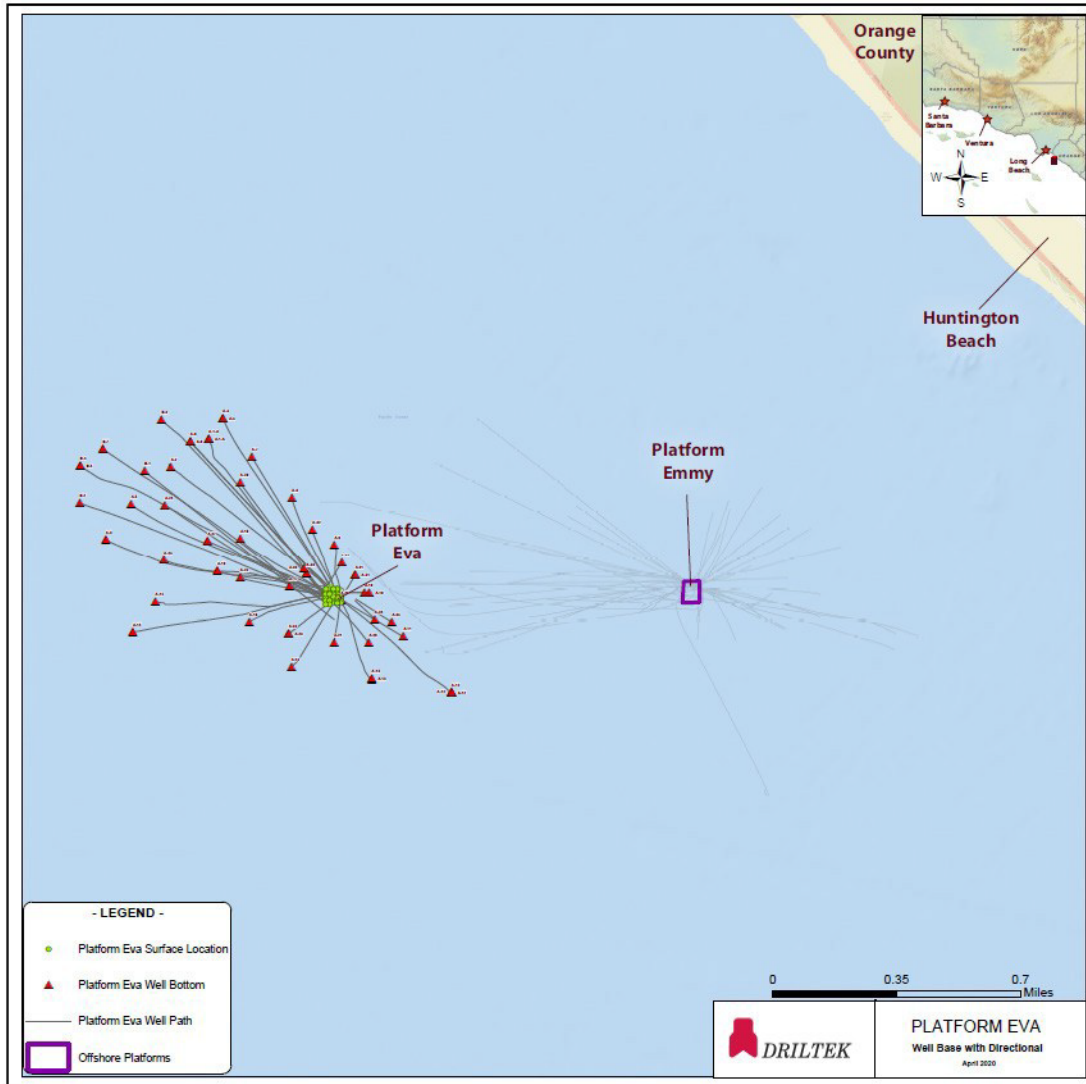


Figure 4: Platform Eva with directional and bottom hole well locations



Figure 5: Platform Eva

Platform Esther

Platform Esther is a fixed-base drilling and production platform located in the San Pedro Channel about 1.5 miles offshore of Seal Beach, California, on State Lease PRC 3095.1 in 38 feet of water. Oil and gas access to the Belmont Offshore Field was originally via a manmade island constructed in 1964 by Standard Oil Company of California (later named Chevron). In March 1983, a winter storm washed away the island and facilities. Construction of a new platform on the submerged rubble began a year later and Platform Esther was commissioned in 1985. At that time, all but 21 wells were plugged and abandoned, and the new platform tied into the salvageable conductors.

Unocal acquired the platform from Chevron in 1988 and Nuevo Energy of Houston Texas bought Unocal's California assets in 1996. In May 2004, PXP took over operatorship in a merger with Nuevo Energy and a few months later the platform was sold to DCOR and operations resumed in October 2005. Figure 6 is a well base map for Platform Esther and Figure 7 is a recent photograph.

Currently Platform Esther has a total of 64 well slots, and 62 wells drilled. Of the 62 wells, 26 are active wells, four are idle wells and 32 are abandoned wells. Two well slots remain undrilled.

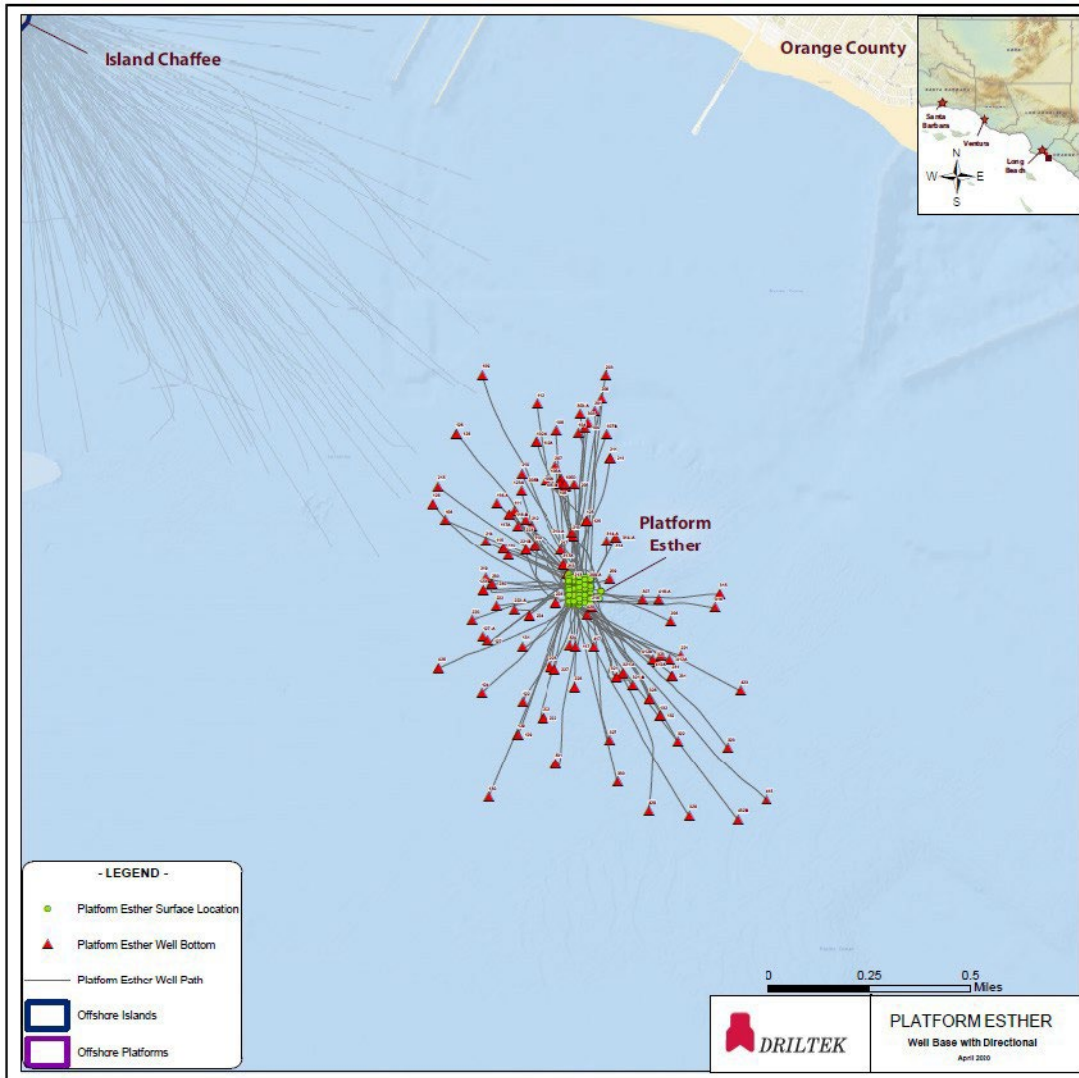


Figure 6: Platform Esther with directional and bottom hole well locations



Figure 7: Platform Esther

THUMS Islands⁷

From 1911 through 1935, the State of California granted to the City of Long Beach all of the tidelands within its city limits, from the mean high tide line to three miles offshore. The City received these properties from the State in trust, for the purposes of developing commerce, navigation, fisheries, and recreation.

The giant Wilmington Oil Field was discovered in 1932. It is one of the largest oil fields in North America and includes an onshore portion and an offshore portion, the latter extending through the tidelands area of the City. In Long Beach, the field is divided into the West Wilmington Field, which covers the City's harbor area first developed more than 70 years ago, and the East Wilmington Field (also now known as the Long Beach Unit), which covers the offshore area not developed until the mid-1960s. (See Figure 8).

In 1939, the City's Harbor Department created a petroleum division and drilled the first well under the tidelands. The Long Beach Oil Development Company (LBOD), a consortium of oil companies, was selected as the City's first oil contractor. As development progressed during the 1940s and 1950s, the ground surface in the harbor area began to subside. The rate of subsidence exceeded two feet per year in 1951, and by 1958 the "subsidence bowl" reached 29 feet deep at its center and affected 20 square miles. The City and State

⁷ The following introductory discussion of the THUMS Islands and the Long Beach Unit is adapted from Mineral Resources Management Division, SLC, "Exhibit D, Long Beach Unit, Briefing Document," April 2011.

joined to pass legislation that forced unitization of the subsided areas, and through the newly created units, waterflooding operations were initiated to halt subsidence and to increase oil production.

With subsidence under control in the West Wilmington Field, the City explored the area east of the harbor with eight core holes in 1961 and confirmed that the oil field extended offshore. In 1962, City voters approved a referendum for offshore development of the East Wilmington Field. In 1964, Chapter 138 was enacted by the State Legislature to settle disputes between the City and the State, such as the boundary between the tidelands and uplands, and the sharing of revenues to be derived from tidelands oil production in the East Wilmington Field.

Chapter 138 provided for the formation of the Long Beach Unit (LBU) as the mechanism for developing the oil reserves beneath the offshore area, with the City being designated the unit operator with control over day-to-day operations. The State was provided a voice in budgetary matters, and certain approval rights relating to the annual development and budget plans proposed by the City. Chapter 138 provided the City would receive a small share of tidelands oil revenue each year, which would gradually decrease over the years to a minimum of \$1MM per year in the late 1980s. The State would receive the remainder of the oil revenue, which was by far the greatest portion, and all revenue derived from dry gas sales.

The LBU was officially formed in 1965. The City selected THUMS, a consortium of oil companies consisting of Texaco, Humble, Union, Mobil, and Shell, as the contractor. The contract would run for 35 years, and enable the City, as trustee for the State, to retain approximately 96% of the net profits attributable to the unit. The LBU provides for the operation of both publicly owned tidelands and privately-owned uplands as a single producing entity and consists of three major areas. Tract 1 includes tidelands granted in trust to the City and comprises about 87% of the unit. Tract 2⁸, comprising about 3%, is the parcel of Alamitos Beach Park Lands where the State owns the mineral interest. The remaining 10% is the upland area known as the Townlot and owned by numerous individuals (See Figure 8).

Due to restrictions imposed by the City, development of the LBU had to be done from offshore drilling islands, and only with a pressure maintenance program to prevent subsidence of the land surface. The four artificial drilling islands built in the mid-1960s are now familiar landmarks along the City shoreline. Each island is about 10 acres in size and landscaped with palms and other vegetation, waterfalls, sound-blocking sculptures, and decorative lighting to obscure the oil operations. The islands are named in honor of four astronauts – Grissom, White, Chaffee, and Freeman – who perished in the early years of the U.S. space program. The commingled production from all four islands is routed to onshore facilities located on Pier J for final processing and sales.

⁸ Tract 2 is also sometimes referred to as PRC 3455 as an administrative designation associated with the Unit operations.

The individual islands are each discussed below.



Figure 8: THUMS Islands

Island Chaffee

Island Chaffee is a man-made drilling and production island located in Los Angeles County, approximately one mile offshore from Long Beach, California in San Pedro Bay. It is the furthest southeast, of the four THUMS islands constructed to extract and process oil and gas from the Wilmington Oil Field. The island was constructed in 1966 by the THUMS consortium in forty feet of water.

The primary purpose of Island Chaffee is, like the other THUMS islands, for exploitation of the Long Beach Unit (LBU) of the Wilmington oil field. For that purpose, the island is currently operated by CRC on behalf of the City of Long Beach and the SLC. As part of the LBU operations, there are currently 350 active or idle wells and no undrilled conductors. Two-thirds of the active wells are producers and one-third are injectors. Approximately 17% of these wells are currently classified as idle wells.

In addition to these LBU operations, CRC holds the lease for PRC 186, which is part of the Belmont Offshore field, east of Island Chaffee. Through an agreement with the City of Long Beach, CRC has been developing the PRC 186 lease by drilling from Island Chaffee. The agreement between City of Long Beach and CRC also covers the use of

the island's infrastructure to support these wells and their production. There are currently 31 active and 4 idle wells on Island Chaffee that are completed in the Belmont Offshore field.

See Figure 9 for an Island Chaffee well base map and Figure 10 for a recent aerial photograph.

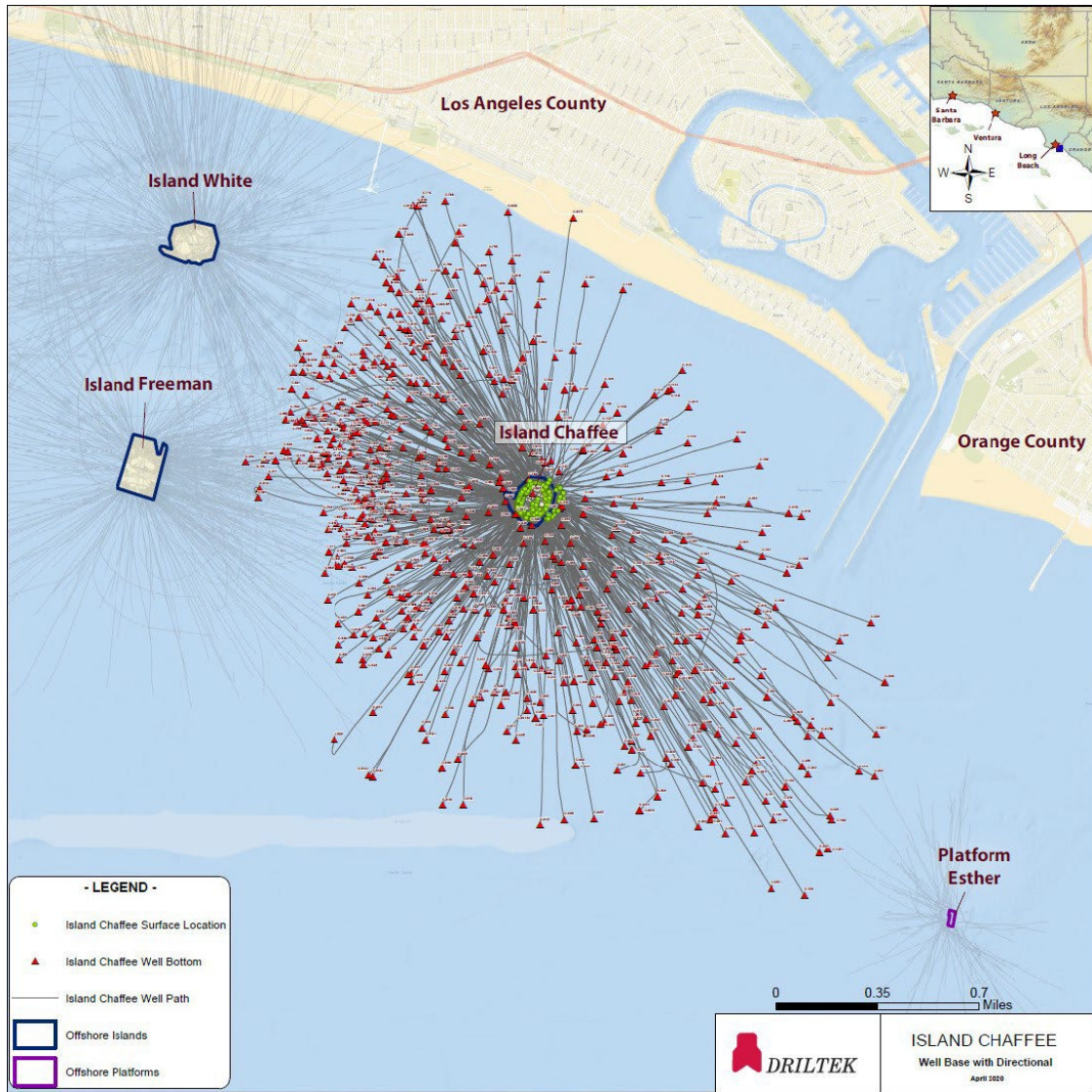


Figure 9: Island Chaffee with directional and bottom hole well locations



Figure 10: Island Chaffee

Island Freeman

Island Freeman is an artificial drilling and production island located in Los Angeles County, approximately 1.25 miles offshore from Long Beach, California in San Pedro Bay. It is the largest, and furthest from the shore, of the four THUMS islands constructed to extract oil and gas from the Wilmington Oil Field. The island was constructed in 1966 by the THUMS consortium in forty feet of water. The island is currently operated by contractor CRC on behalf of the City of Long Beach (operator). The well base map for Island Freeman is in Figure 11. A recent aerial photograph appears as Figure 12.

There are currently 323 active or idle wells and 34 undrilled conductors on the island. Two-thirds of the active wells are producers and one-third are injectors. Approximately 20% of the wells are currently classified as idle wells.

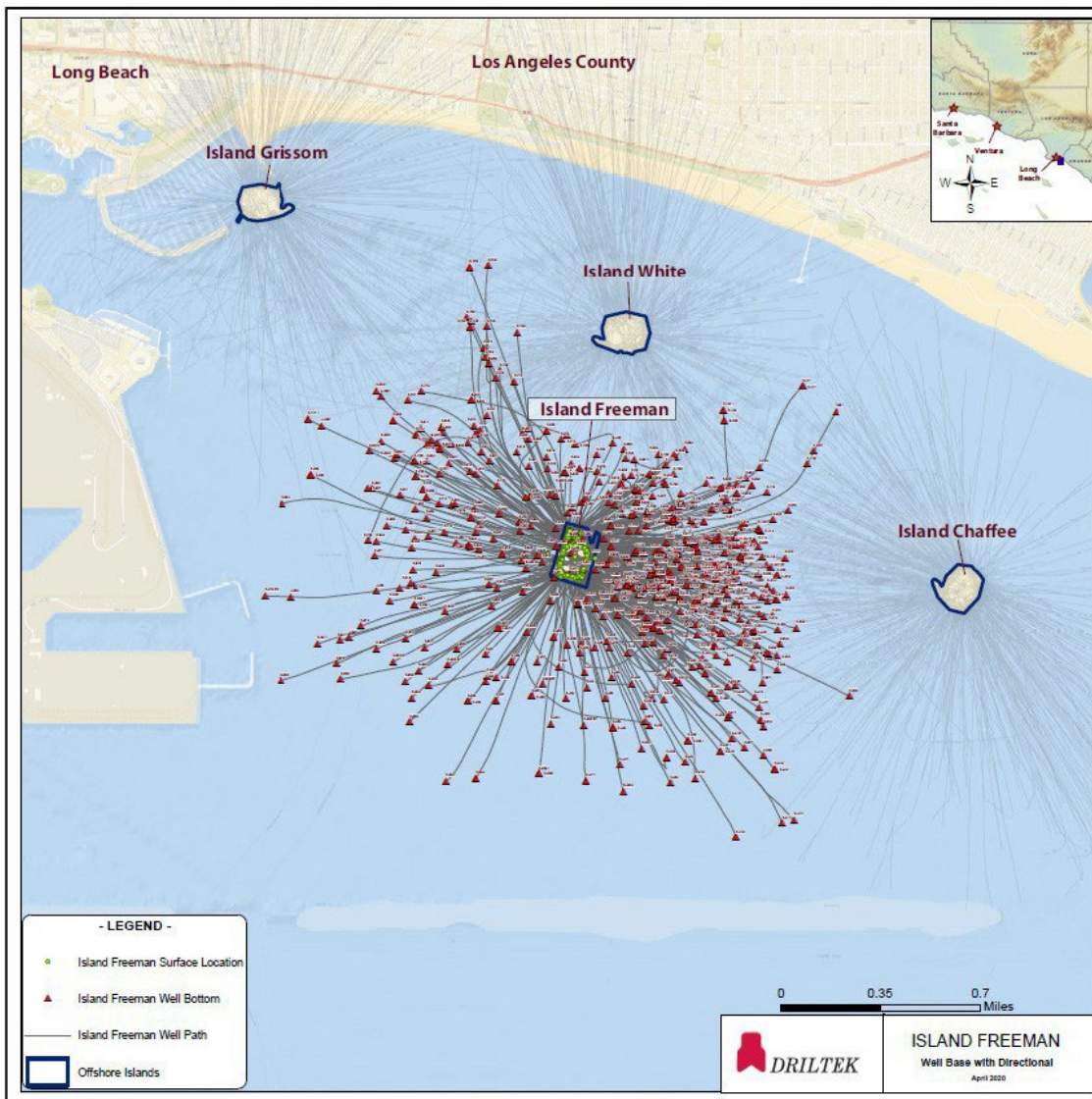


Figure 11: Island Freeman with directional and bottom hole well locations



Figure 12: Island Freeman

Island White

Island White is a man-made drilling and production island located approximately one and one quarter miles offshore from Long Beach, California used to produce and process oil from the Wilmington Oil Field. The island was constructed in 1966 by the THUMS consortium in forty feet of water. The island is currently operated by contractor CRC on behalf of the City of Long Beach (operator). See Figure 13 for a well base map of Island White and Figure 14 for a recent aerial photograph.

There are currently 334 active or idle wells and four undrilled conductors on the island. Two-thirds of the active wells are producers and one-third are injectors. Approximately 11% of the wells are currently classified as idle wells.

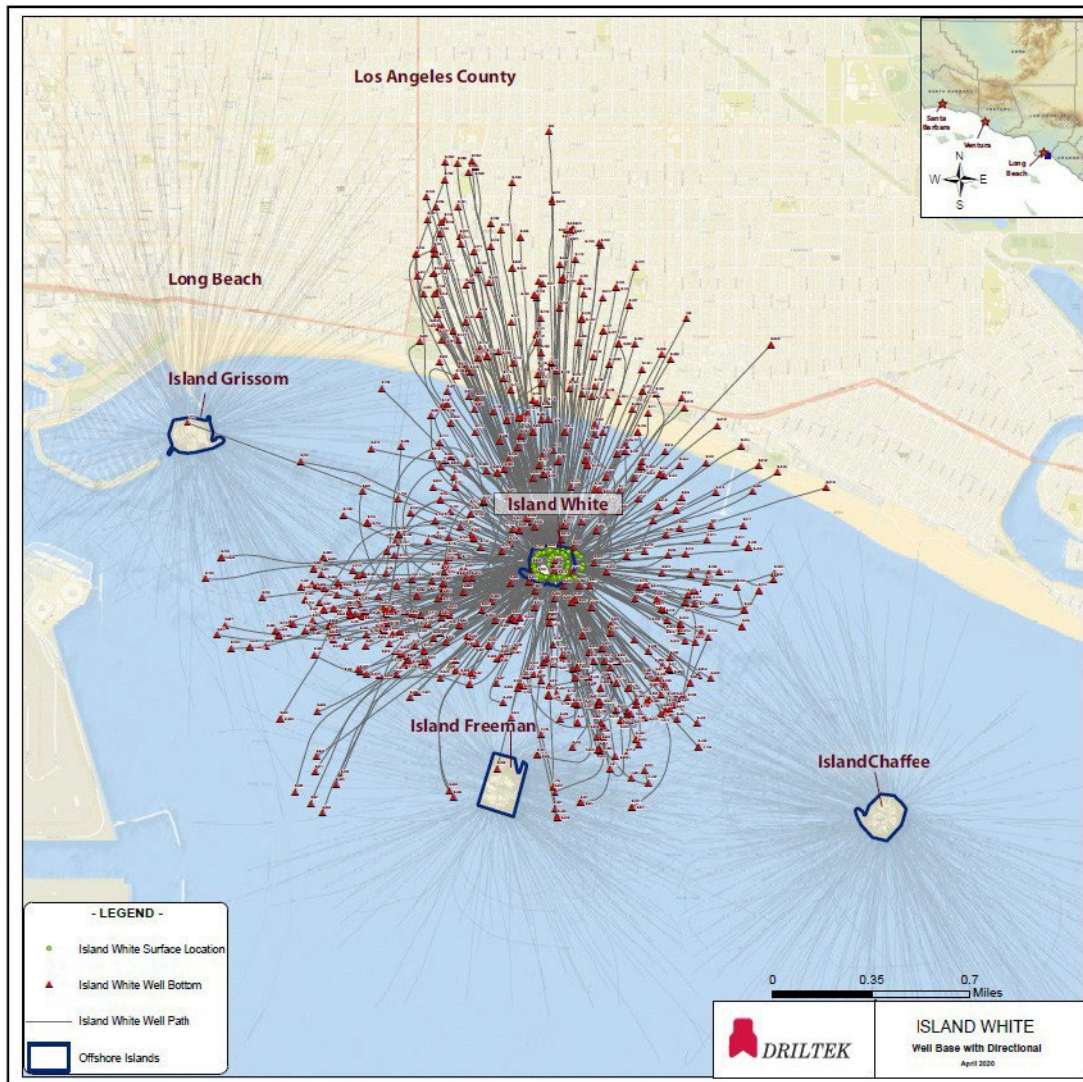


Figure 13: Island White with directional and bottom hole well locations

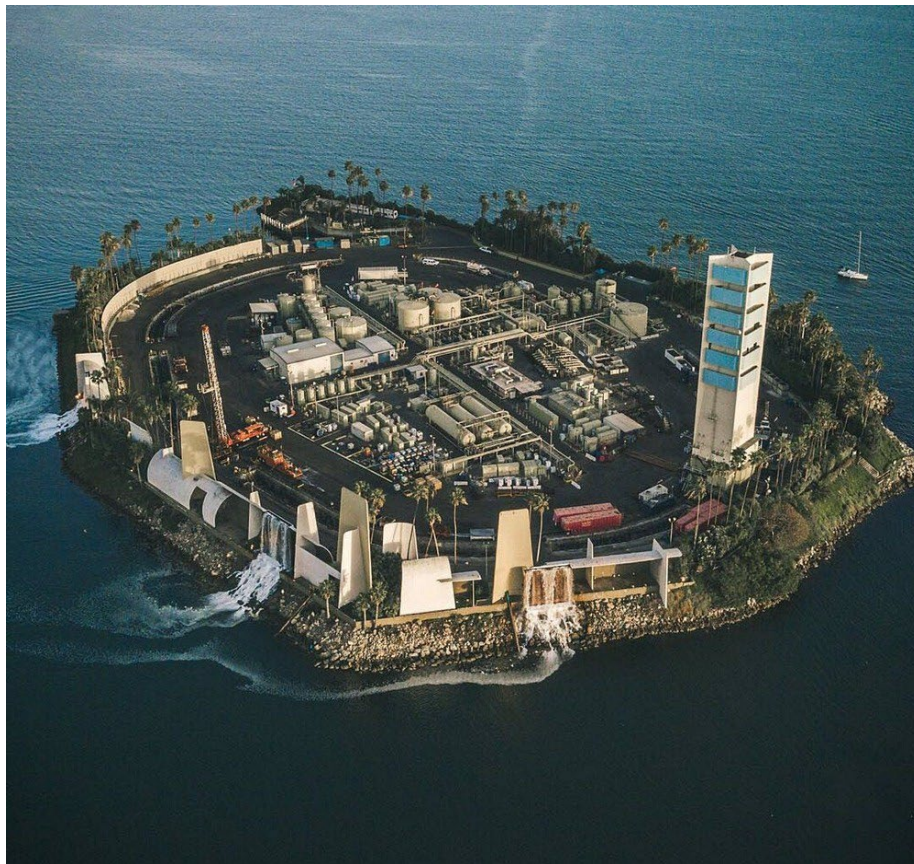


Figure 14: Island White

Island Grissom

Island Grissom is a man-made drilling and production island located in San Pedro Bay in forty feet of water, approximately 0.25 miles offshore from Long Beach, California. The island was constructed in 1966 by the THUMS consortium to extract oil and gas from the Wilmington Oil Field. The island is currently operated by contractor CRC on behalf of the City of Long Beach (operator). See Figure 15 for a well base map for Island Grissom and Figure 16 for an aerial photograph.

There are currently 339 active or idle wells and 55 undrilled conductors on the island. Two-thirds of the active wells are producers and one-third are injectors. Approximately 17% of the wells are currently classified as idle.

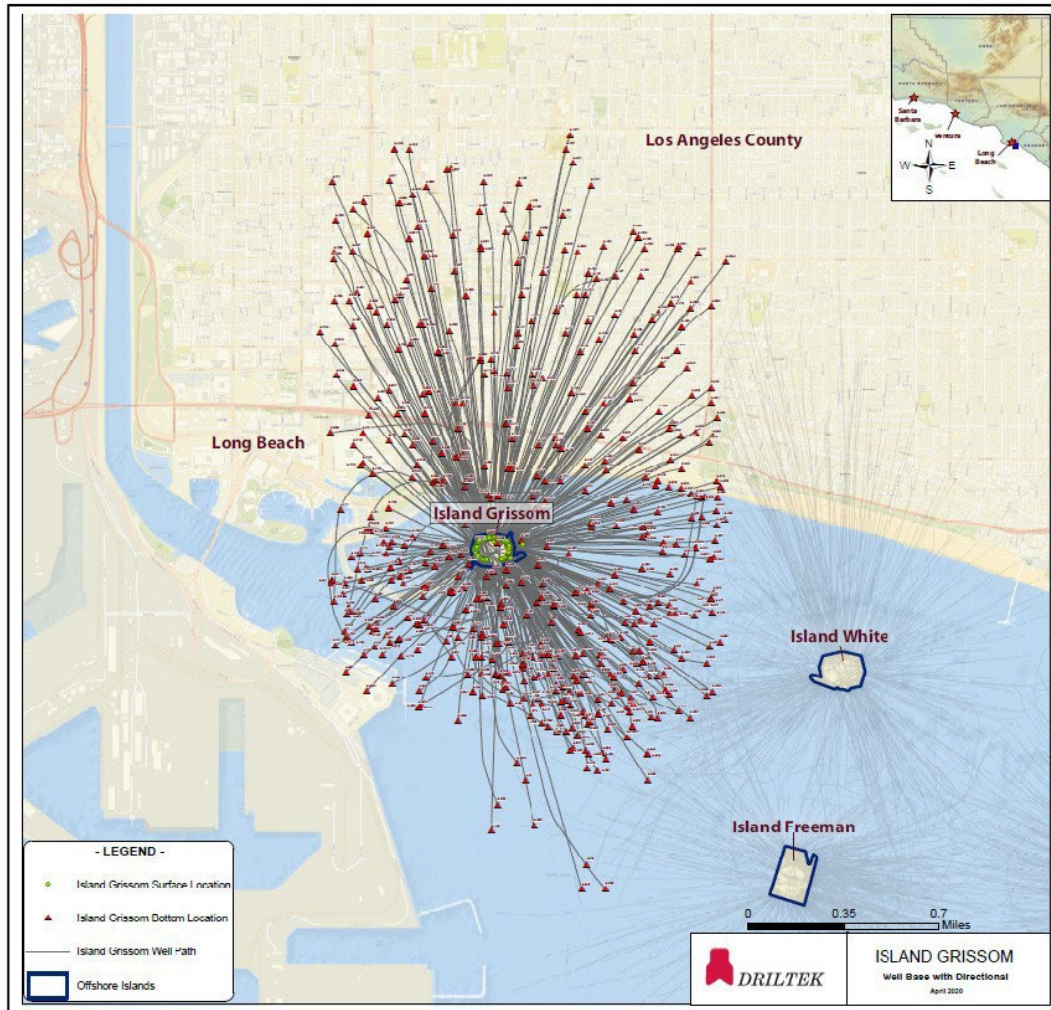


Figure 15: Island Grissom with directional and bottom hole well locations



Figure 16: Island Grissom

Rincon Island

Rincon Island is a two-acre artificial island located approximately one-half mile off the coast of California, adjacent to the unincorporated Mussel Shoals community in Ventura County. The island was constructed by Richfield Oil Corporation in 1958 and is connected to the shore via a 3300-foot causeway in a maximum depth of 55 feet of water (see Figures 17 and 18).

There are fifty wells and nineteen undrilled conductors on the island. Of the fifty total wells, forty-seven are oil and gas wells (producers or water injectors) and three are water source wells. Abandonment operations for this asset commenced in July of 2018 after the SLC awarded Driltek the contract after completing a Request for Qualifications process. As of February 2021, Driltek had successfully abandoned all fifty wells discussed on Rincon Island. All wells on the island are contained within a 160 foot by 15 foot well bay. All processing, injection and storage facilities are located on the island with very minimal onshore support facilities (Figure 18).

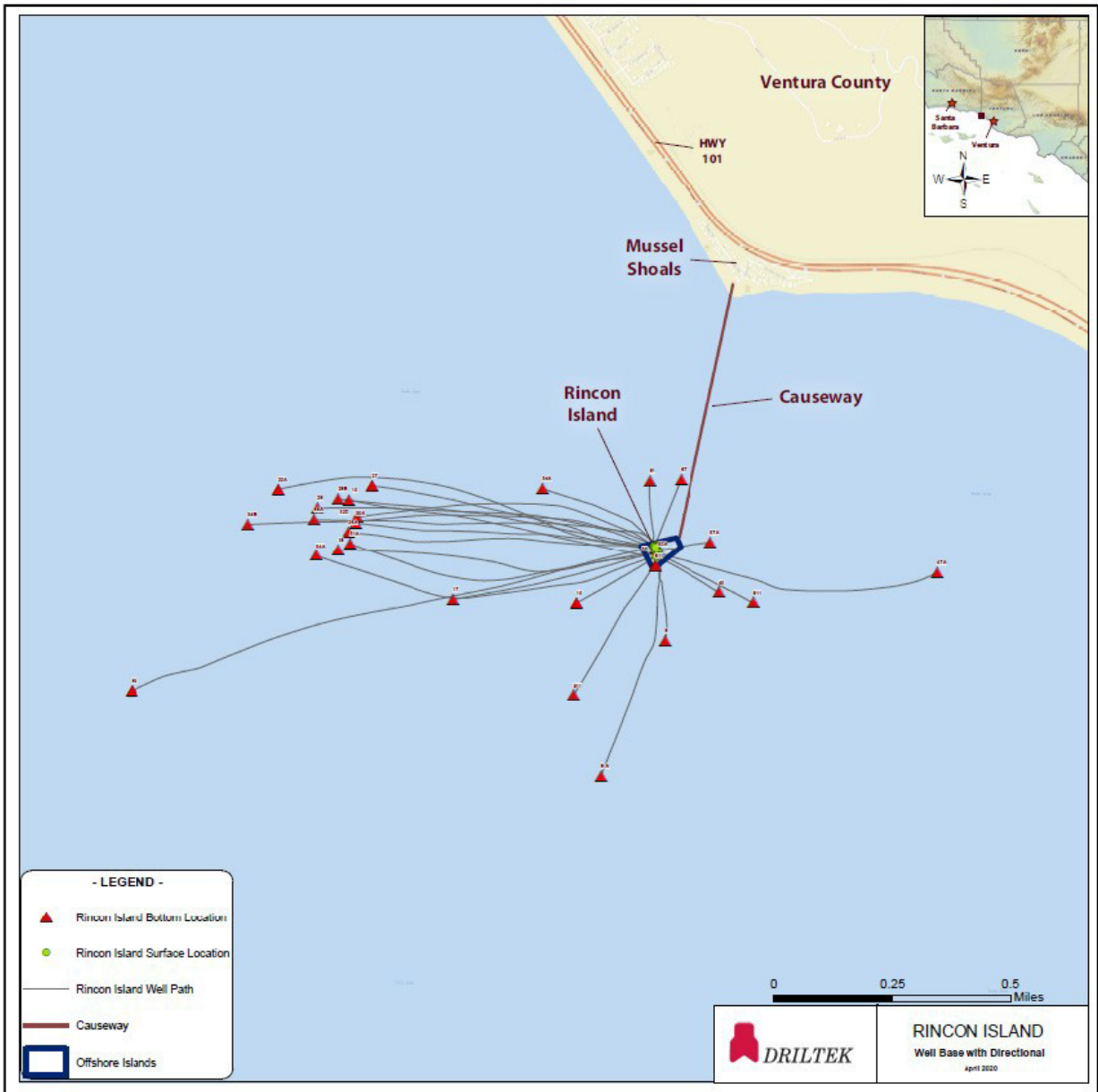


Figure 17: Rincon Island with directional and bottom hole well locations

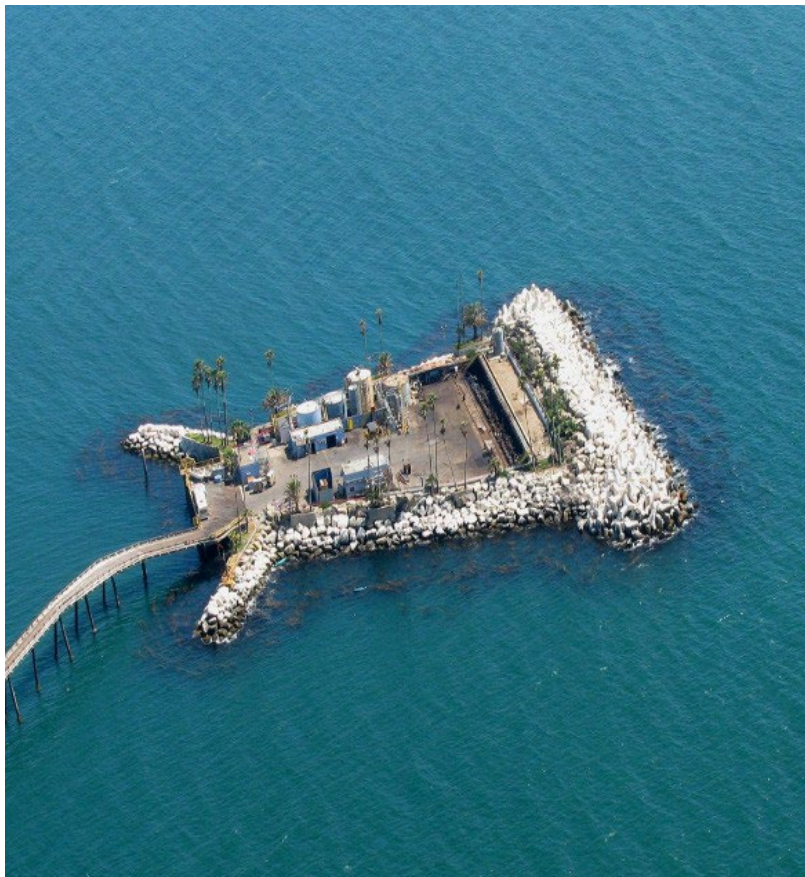


Figure 18: Rincon Island

Platform Holly

Platform Holly is a fixed base drilling and production platform in 211 feet of water in the Santa Barbara Channel, approximately two miles from Goleta, California. Holly is situated in the deepest water of the platforms located in California State Waters. The platform was built in 1966 by ARCO and Mobil to produce oil and gas from State Leases PRC 3120 and PRC 3242 in the South Ellwood Oil Field. Mobil assumed control of the platform in 1993 and sold the facility to Venoco, Inc. in 1997. In May 2015, the platform was idled after the PlainsAll American pipeline ruptured onshore and was shut in, idling its only sales point. In April 2017, Venoco quitclaimed its interest back to the State. The platform is currently operated by Beacon West Energy Partners on behalf of the SLC while Exxon Mobil completes well and platform abandonment operations. Figure 19 shows a well base map for Platform Holly and Figure 20 is a recent photograph.

Holly has gross production separation, water treatment and injection, well testing, gas compression and partial gas dehydration equipment. Wet oil and gas production are sent to the Ellwood Onshore Facility (EOF) for additional processing.

There are twenty-nine idle wells and one partially abandoned well on Platform Holly. All thirty platform slots contain a well cemented to surface. There are 22 idle producers, 3 idle water injection wells, 2 idle slurry injection wells, 2 idle gas injection wells, and one partially plugged well. Well 3242-6 is the single partially abandoned well that is plugged in zone and abandoned up to 353.' No wells are on production, but the gas off the casing annuli is piped to shore to minimize casing pressure build up.

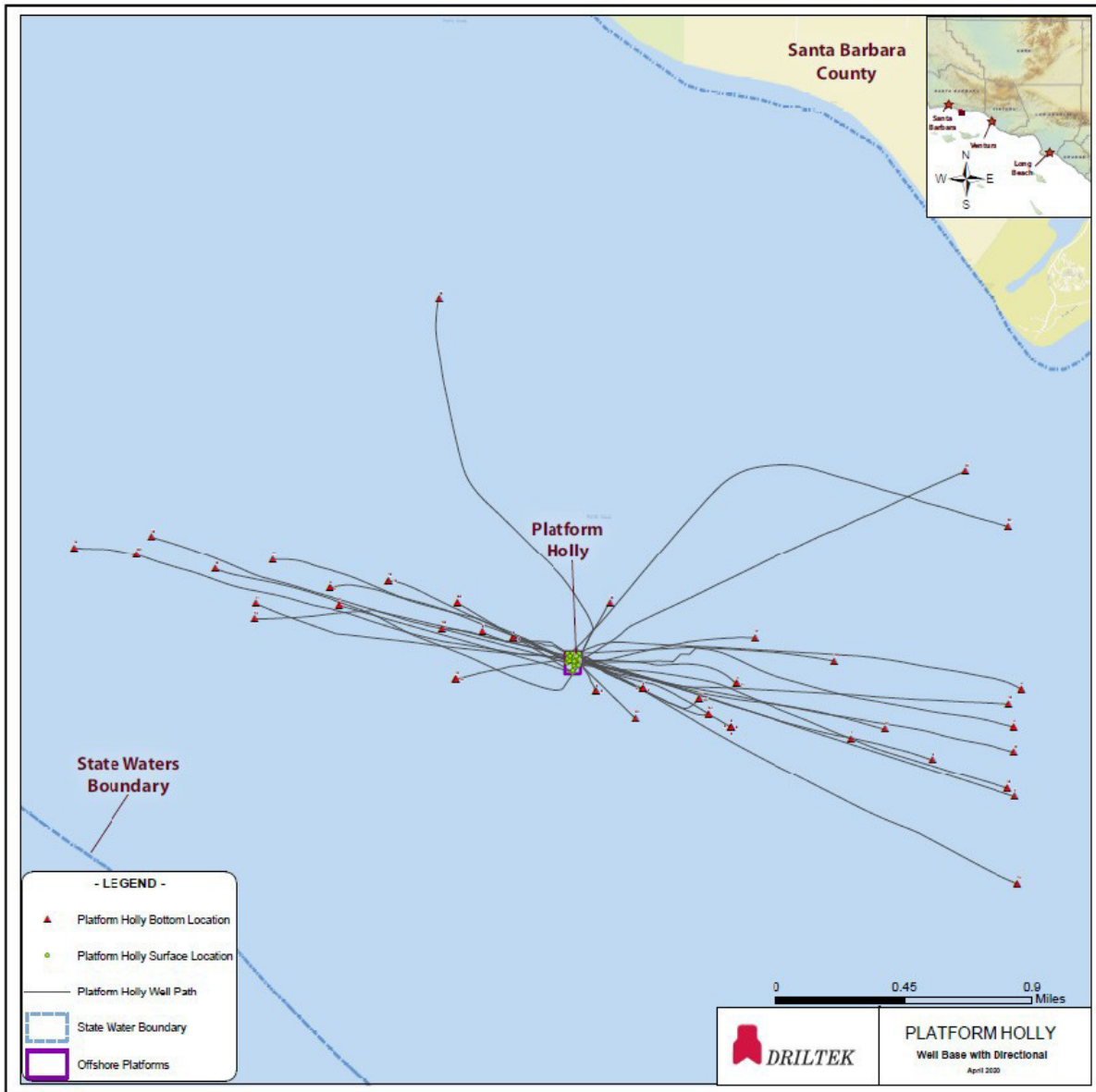


Figure 19: Platform Holly with directional and bottom hole well locations



Figure 20: Platform Holly

APPENDIX B: COST CATEGORIES

Each of the cost estimates submitted by the interested parties used various cost categories that can be grouped into Well Abandonment & Conductor Removal, Platforms, and Island Facilities and Associated Onshore Facilities. Each cost category was developed to most accurately reflect the stages or subprojects used to prepare the actual estimates.

Well Abandonments & Conductor Removal

CRC, DCOR, and Driltek all submitted estimates for well abandonments and conductor removals. Each group approached the assessment differently, but all included a categorization of risk. Wellbore diagrams and Underground Injection Control (UIC) project applications, updates, and Project Approval Letters were used to develop these estimates. CalGEM used costs that were baselined using actual project management and abandonment costs for Rincon Island over the last 18 months and 55 offshore well abandonments. These actual numbers, which were supplied by SLC, were adjusted to accurately reflect the operating environment of each asset.

Costs for well abandonments are generally separated into two cost categories: well work and management and operations (M&O). Industry convention would show well work alone, but such an estimate would fail to capture indirect expenses that are often overlooked. This additional expense was accounted for in Driltek's and CalGEM's analysis and was consistent with information gathered by the SLC during the plug and abandonment operations at Platform Holly and Rincon Island.

Platforms

Driltek's analysis used SLC structural reports on individual platforms and construction details were reviewed to gather important infrastructure data. Platform layout drawings, process flow diagrams, and equipment lists were combined with this information to develop a conceptual framework for removal of the equipment, platform, and jacket structure. The removal estimates assume West Coast-based equipment and resources are available to execute the conceptual framework.

Onshore pipeline segments utilize the same SLC data as offshore pipeline, but the costs are included with the estimate for their respective onshore facility. Industry estimates submitted contained little to no detailed description of the platform decommissioning, remediation and reclamation.

CalGEM used an analysis from 2017 that was adjusted for inflation. This analysis was a thorough facilities review based on the BSEE 2015 report and analysis from the Southern Division and Division's Facilities & Pipeline group.

Island Surface Equipment & Associated Onshore Facilities

Estimates for the removal of surface equipment from the islands and the removal of onshore facilities were handled similarly. A detailed inventory of existing infrastructure and equipment was compiled from Spill Prevention, Control, and Countermeasure (SPCC) plans, regional air board operating permits, and aerial images. Cleaning and removal costs were calculated using major component counts, weights, and dimensions (primarily tanks and vessels) and piping system diagrams. All removed equipment is hauled to scrap, and no allowances were made for lead or asbestos abatement.

In some cases, onshore facilities support both on and offshore production. In this circumstance, the on and offshore systems were segregated within the estimate to limit the cost to only those that remove facilities directly supporting offshore production. Estimates do not include the removal of onshore wells or supporting facilities. Onshore estimates include the cost to restore the surface to a level grade, but remediation activities are not included. In all cases, terrestrial techniques and equipment (excavators with shears, backhoes, bulldozers, etc.) are used to execute demolition work. Demolition work assumes multiple crews working 24–hours per day simultaneously, except for urban operations which are limited to ten to 12–hour days.

Island Repurpose or Removal

Island estimates contain four major categories:

1. Removal of the well bay structures
2. Removal of the surface covering
3. Removal of the island core
4. Removal of the island barrier

All estimates assume the concrete well bays and associated rig aprons are removed using terrestrial techniques and equipment (excavators, hydraulic breakers, loaders, etc.). The concrete structures are broken, removed, processed for hauling, and recycled. The Most Likely Scenario for all islands assumes each is repurposed instead of removed.

APPENDIX C: SOURCES OF DATA

BSEE 2015 Report

State Lands Commission

- Platform Holly and Rincon Island Actuals and Estimates
- Krummrich (2017)
- Exxon-Mobil (2018)
- State Lands; Rincon Island Estimates/Actuals
- Drilteck (2018-2020)
 - Interact (2018)

THUMS Islands (2017)

- California Resources Company (CRC)
- SPEC Services
- Geosyntec
- Moffat & Nichol

CalGEM Analysis

- BSEE (2015)
- Industry cost estimates
- CRC (2020)
- DCOR (2020)
- Freeport McMoRan (2020)

Driltek (2020)

APPENDIX D: COST ESTIMATE TABLES

Table 1.1: Total Costs for abandonment and complete island removal compared to current bonding and other financial surety levels

Area	Operator	Operator High End Estimate (\$MM)	DRILTEK Estimate (\$MM)	CalGEM Estimate (\$MM)	Current Bonding & Surety Levels
Emmy	CRC	\$34.4	\$ 73.2	\$ 91.9	\$30MM Blanket Bond
Belmont Offshore Lease 186	CRC	\$9.3	\$ 13.5	\$ 13.8	\$14.4MM Bond
Eva	DCOR/ FreePort McMoran	\$24.9	\$ 75.5	\$ 85.5	DCOR \$21MM / Freeport McMoran \$30MM
Esther	DCOR/ FreePort McMoran	\$21.8	\$ 70.3	\$ 74.9	Freeport McMoRan \$30MM
Grissom	THUMS LB Co.	\$209.3	\$ 210.4	\$ 230.7	State Lands \$300MM / CRC \$26.33MM
Freeman	THUMS LB Co.	\$205.1	\$ 224.6	\$ 236.9	State Lands \$300MM / CRC \$26.33MM
White	THUMS LB Co.	\$208.0	\$ 215.8	\$ 227.1	State Lands \$300MM / CRC \$26.33MM
Chaffee	THUMS LB Co.	\$210.9	\$ 211.7	\$ 234.2	State Lands \$300MM / CRC \$26.33MM
Total		\$923.7	\$ 1,095.0	\$ 1,195.0	\$ 451.7

- Driltek Estimate does not include Holly & Rincon. Driltek Report includes cost estimates for Holly & Rincon = \$165MM (Additional Costs).
- Holly had \$22 million in bonding which has been accessed.
- ExxonMobil has significant responsibilities as prior operator and RP per contract. Rincon had \$10 million in bonding which has been accessed. No other RP available.
- THUMS Islands consist of 62% of total active & idle wells between THUMS & Tidelands.

Table 1.2 - Total Costs for abandonment without island removal compared to current bonding levels

Area	Operator	Operator High End Estimate (\$MM)	DRILTEK Estimate (\$MM)	CalGEM Estimate(\$MM)	Current Bonding & Surety Levels
Emmy	CRC	\$ 34.4	\$ 73.2	\$91.9	\$30MM Blanket Bond
Belmont Offshore Lease 186	CRC	\$ 9.3	\$ 13.5	\$13.8	\$14.4MM Bond
Eva	DCOR/ FreePort McMoran	\$ 24.9	\$ 75.5	\$85.5	DCOR \$21MM / Freeport McMoran \$30MM
Esther	DCOR/ FreePort McMoran	\$ 21.8	\$ 70.3	\$74.9	Freeport McMoRan \$30MM
Grissom	THUMS LB Co.	\$ 158.0	\$110.8	\$166.54	State Lands \$300MM / CRC \$26.33MM
Freeman	THUMS LB Co.	\$ 153.8	\$109.3	\$163.76	State Lands \$300MM / CRC \$26.33MM
White	THUMS LB Co.	\$ 156.7	\$101.7	\$163.56	State Lands \$300MM / CRC \$26.33MM
Chaffee	THUMS LB Co.	\$ 159.6	\$105.0	\$168.12	State Lands \$300MM / CRC \$26.33MM
Total		\$ 718.5	\$659.3	\$ 928.1	\$ 451.7

Table 2.1 - Well abandonment costs by operation

Area	Operator	# wells	Operator LowEnd Estimate (\$MM)	Operator HighEnd Estimate (\$MM)	DRILTEK Estimate(\$MM)	CalGEM Estimate (\$MM)
Emmy	CRC	44	\$ 9.2	\$ 11.7	\$ 34.2	\$ 47.1
Belmont Offshore Lease 186	CRC	35	\$ 7.4	\$ 9.3	\$ 13.5	\$ 13.8
Eva	DCOR	42	\$ 8.8	\$ 11.1	\$ 34.5	\$ 44.9
Esther	DCOR	30	\$ 6.3	\$ 8.0	\$ 22.8	\$ 32.1
Grissom	THUMS LB Co.	339	\$ 71.2	\$ 104.1	\$ 90.8	\$ 116.7
Freeman	THUMS LB Co.	323	\$ 67.8	\$ 99.2	\$ 90.4	\$ 111.2
White	THUMS LB Co.	334	\$ 70.1	\$ 102.5	\$ 85.7	\$ 115.0
Chaffee	THUMS LB Co.	345	\$ 72.5	\$ 105.9	\$ 87.5	\$ 118.8
Sub-Total		1492	\$ 313.3	\$ 451.7	\$ 459.4	\$ 599.6

- Higher CalGEM costs assume wells are in poor condition due to neglect/abandoned by operator, includes additional costs for third party management, lack of resources and no cost saving benefits (i.e.: economies of scale, in-house operations, contract operators)
- Avg Cost per well (CalGEM ALL-IN) estimated to be \$400,000/well for island wells, \$1,070,000/well for platform wells (Platform Holly - State lands documents)
- Operator cost estimates/actuals Avg between \$210-\$307K/ well

Table 3.1 - Facility Abandonment Cost with complete island removal (by operation)

Area	Operator	Operator Estimate (\$MM)	DRILTEK Estimate(\$MM)	CalGEM Estimate (\$MM)
Emmy	CRC	\$ 22.8	\$ 39.0	\$ 44.8
BelmontOffshore Lease 186	CRC	\$ -	\$ -	\$ -
Eva	DCOR	\$ 13.7	\$ 41.0	\$ 40.6
Esther	DCOR	\$ 13.8	\$ 47.5	\$ 42.8
Grissom	THUMS LB Co.	\$ 98.6	\$ 119.6	\$ 96.8
Freeman	THUMS LB Co.	\$ 104.6	\$ 134.2	\$ 109.3
White	THUMS LB Co.	\$ 101.9	\$ 130.1	\$ 95.2
Chaffee	THUMS LB Co.	\$ 117.4	\$ 124.2	\$ 98.0
Sub-Total		\$ 472.7	\$ 635.5	\$ 527.4

* CalGEM Facility Numbers taken from multiple sources and blended together with inflation (2.8%/annual)

Table 3.2 - Facility Abandonment Cost without island removal (by operation)

Area	Operator	Operator Estimate (\$MM)	DRILTEK Estimate (\$MM)	CalGEM Estimate (\$MM)
Emmy	CRC	\$22.8	\$39.0	\$44.8
Belmont Offshore Lease 186	CRC	\$-	\$-	\$-
Eva	Freeport McMoran	\$13.7	\$41.0	\$40.6
Esther	Freeport McMoran	\$13.8	\$47.5	\$42.8
Grissom	THUMS LB Co.	\$66.0	\$20.0	\$49.5
Freeman	THUMS LB Co.	\$66.0	\$18.9	\$54.7
White	THUMS LB Co.	\$66.0	\$16.0	\$48.0
Chaffee	THUMS LB Co.	\$66.0	\$17.5	\$48.6
Sub-Total	--	\$314.3	\$199.8	\$329.0



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