**COMMENTS IN OPPOSITION TO THE ISSUANCE OF AN EXPLORATORY OIL WELL PERMIT TO SPOONER PETROLEUM IN WETLANDS OF GULF COUNTY**

*Submitted by Apalachicola Riverkeeper and Healthy Gulf*

Apalachicola Riverkeeper is a 501(C)(3) non-profit organization dedicated to the protection, restoration, and stewardship of the Apalachicola River and Apalachicola Bay. It has over 1400 members, most of whom use and enjoy the river, its estuary, Apalachicola Bay, and related watersheds. Its mission is to protect the watershed and ecosystem of the river and related waters, and along with its members, is committed to restoring and protecting the Apalachicola River area to preserve it for future generations. In advancing that mission, Apalachicola Riverkeeper engages in education and advocacy to the public and to executive, legislative, and adjudicative bodies of Federal, State, and local governments. If necessary, Apalachicola RiverKeeper engages in litigation to enforce environmental laws.

Healthy Gulf is a nonprofit, 501(C)(3) corporation based in New Orleans, with staff working in all five U.S. Gulf of Mexico states including Florida. The mission of Healthy Gulf is to protect and restore the natural resources of the Gulf of Mexico Region. It has approximately 1000 members and almost 23,000 e-supporters, a substantial number of whom use and enjoy the ecological resources of northern Gulf County and ecosystems directly connected to it. In advancing its mission, Healthy Gulf educates and advocates to the public and to executive, legislative, and adjudicative bodies of Federal, State, and local governments. If necessary, Healthy Gulf engages in litigation to enforce environmental laws.

These comments are submitted in opposition to DEP permits to Spooner Petroleum Inc. (hereinafter "Spooner") for an exploratory oil well near the headwaters of Wetappo Creek in Gulf County, application number 1393. The drilling pad would be located in wetlands tributary to Wetappo Creek, a perennial stream tributary to East Bay, the eastern bay of St. Andrew bay. It would also be located entirely inside the 100-year flood plain of Wetappo Creek. During major flood events, the drilling pads would be surrounded by flowing water tributary to Wetappo Creek, East Bay, and St. Andrew Bay. Spooner is a royalty partner with Bear Creek Timber, LLC, which is the fee owner of the underlying land of the proposed drilling site, and also owns 12 square miles of wetlands and uplands around that site. This fact makes drilling in wetlands in the floodplain entirely inappropriate, especially in light of the availability of directional drilling. There is no proven or indicated likelihood of recovering commercially profitable quantities of oil or gas, and in any event, the infrastructure needed to manage oil production would be extremely ill-suited to the wetlands of Gulf County.

Part I of these objections describes the governing statutes. Part II discusses the first statutory criterion, which is the nature and character of the lands involved in the proposed permit. Part III briefly addresses how the second statutory criterion applies to the issue of the nature and extent of this applicant's legal interest in the property. Part IV addresses the third statutory criterion, which is the proven or indicated likelihood of recovering commercially valuable oil or natural gas. Part V discusses directional drilling as a technology to avoid drilling at inappropriate locations. The need to construct an industrial plant nearby to remove hydrogen sulfide if a Smackover oil field were to be discovered is explained in Part VI. Finally, Part VII shows that application of the statutory standards indicates that drilling into the Smackover formation from a drilling site in a wetland within the flood plain of Wetappo Creek should not be permitted.

## I.

## GOVERNING STATUTES

Section 377.241 Criteria for issuance of permits[1]

> The division, in the exercise of its authority to issue permits as hereinafter provided, shall give consideration to, and be guided by the following criteria:
>
> (1) The nature, character and location of the lands involved; whether rural, such as farms, groves, or ranches, or urban property vacant or presently developed for residential or business purposes or are in such a location or of such a nature as to make such improvements and developments a probability in the near future.

[1] A fourth criterion applicable only to natural gas storage tanks is part of section 377.241 but is not included in this discussion. That fourth criterion reads "(4) For activities and operations concerning a natural gas storage facility, the nature, structure, and proposed use of the natural gas storage reservoir is suitable for the storage and recovery of gas without adverse effect to public health or safety or the environment."

(2) The nature, type and extent of ownership of the applicant, including such matters as the length of time the applicant has owned the rights claimed without having performed any of the exploratory operations so granted or authorized.

(3) The proven or indicated likelihood of the presence of oil, gas or related minerals in such quantities as to warrant the exploration and extraction of such products on a commercially profitable basis.

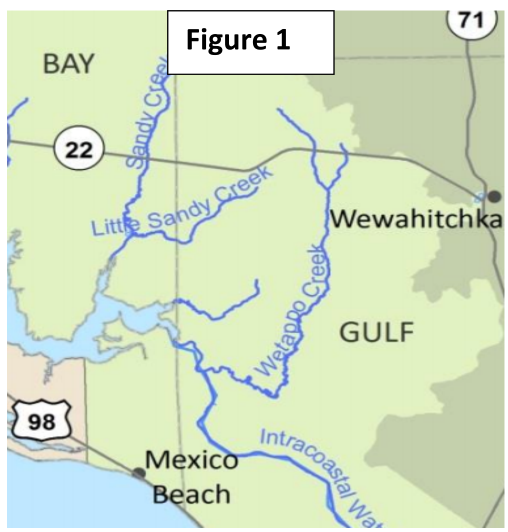
Section 377.241 calls for balancing of the three criteria in parts one, two, three to decide whether the permit should be issued. Thus, the potential for environmental devastation from accidents or blowouts is balanced against the likelihood of extracting oil on a commercially profitable basis. *Coastal Petroleum Company v. Florida Wildlife Federation,* 766 So.2d 226, 228 (Fla. 1st DCA 1999). (affirming DEP denial of offshore oil exploration drilling permit on ground that environmental risks outweighed applicant's right to drill for oil).

**II.**

**§ 377.241(1) – NATURE AND CHARACTER OF THE LANDS INVOLVED**

THE WETAPPO CREEK FLOODPLAIN ECOSYSTEM

**Figure 1**




Wetappo Creek flows about 85 miles from its headwaters in northern Gulf County down to East Bay, which is the East Bay of Saint Andrew Bay. Figure 1 shows its stream course in Gulf County. It is a perennial stream that drains 3,500 square kilometers,[2] and much of the upper half of the stream courses through wetlands that are hydrologically part of the stream during periods of high flow. Its upper watershed is mainly forested, including forested wetlands, but is used for large-scale silviculture operations. Part of the intracoastal waterway traverses its lower course before it discharges into the East Bay of St. Andrew Bay. The upper third of the river course is essentially undeveloped and most of it is bottomland forest and mesic flatwoods. Its floodplain contains a diverse assortment of aquatic and wetland habitats.

[2] *See,* S. H. Wolfe, *Ad Ecological Characterization of The Florida Panhandle,* p.74 (1988).

Mixed bottomland hardwoods are dominated by water hickory, sweet gum,


overcup oak, green ash, and sugarberry, and grow in the areas of higher elevation in the floodplain (levees, ridges, and flats). Tupelo-cypress forested wetlands, also called swamps, grow in depressions and areas of lower elevation.  Some of these swamps are covered with standing water year-round; others are inundated much of the year. Streams, sloughs, ponds, lakes, and swamps in these floodplains are alternately connected and disconnected from the Wetappo Creek channel as water levels fluctuate. Complex relationships exist between biological communities in floodplain habitats and creek flow, with floral and faunal distributions varying spatially, seasonally, and annually.  During low-flow periods, shallow waters in the flood-plain provide refuges for fishes.[3] During flood events, fishes use inundated floodplain forests for food, protective

---

[3] H.M. Leitman, M.R. Darst, and J.J. Nordhaus, 1991, *Fishes in the Forested Floodplain of the Ochlockonee River, Florida, during flood and drought conditions,* U.S. Geological Survey Water Resource Investigation Report 90-4202, 36p.

cover, spawning sites and nursery grounds.[4] The headwaters of Wetappo Creek have been documented as habitat for endangered wildlife such as Red Cockaded Woodpeckers,[5] and are thought to provide habitat for rare Florida species including Florida Longbeak Crayfish, Gopher Tortoises Bachman's Sparrow, Gulf Coast Lupine, and Saint John's Blackeyed Susan. The Wetappo Creek floodplain also supports an extraordinary level of species diversity of reptiles, amphibians, birds, fish, mammals and innumerable species of plants and trees. Nearly the entire floodplain of the Wetappo Creek headwaters is identified by the Florida Natural Areas Inventory as rare species habitat.

**Red Cockaded Woodpecker**

The proposed drilling site is within the Bear Creek Forest Florida Forever project boundary. Florida Forever is a long-standing conservation land acquisition program.[6] The existence of a Florida Forever project boundary in the vicinity of this proposed drilling site does not mean that the land is publicly-owned as conservation land or even that a sale is impending. It instead reflects an existing proposal by conservationists and the state to the landowner – Bear Creek Timber, LLC – to acquire and preserve it as conservation lands. That it is an existing Florida Forever project means that Bear Creek Timber, LLC is willing to consider selling it to the state.

---

[4] H.M. Light, M.L. Darst, and J.W. Grubbs, *Aquatic Habitats in Relation to River Flow in the Apalachicola River Floodplain, Florida*, U.S. Geological Survey Professional Paper 1594, at 2-7.

[5] Photo above by Robert Royce.

[6] See § 259.105, Florida Statutes. That program designated $300 million per year for conservation land acquisition throughout Florida. After a new administration took office in 2010, these programs were virtually eliminated. In response, a state constitutional amendment was proposed and adopted in the year 2014 that designates over $800 million per year for acquisition of conservation and recreation lands in Florida. *See* Art. X, § 28, Florida Constitution.

East Bay

THE EAST BAY OF ST. ANDREW BAY ECOSYSTEM

St. Andrew Bay, into which Wetappo Creek discharges, depicted in figure 4 below is a 69,000 acre estuary that flows into the Gulf of Mexico. It is a mosaic of natural habitats including expansive seagrass beds, tidal marshes, karst lakes and streams, springs, upland and wetland forests, coastal dune lakes and sand hill lakes. Over 12,000 acres of seagrass in the estuary support an abundance of fish and invertebrates, many of which are commercially and recreationally important. Corals and associated species have been documented at the jetties within St. Andrews Aquatic Preserve. Among these are the tube coral Cladocora arbsuscaush coral (Oculina diffusa).[7] Other habitats that may occur in the St. Andrew Bay estuary include sponge beds, mudflats, and octocoral beds. Rare and protected species supported by these habitats include several species of sea turtles, piping plover (Charadrius melodus), and the least tern (Sterna antillarum), among others. The estuary also provides a variety of habitats for neotropical migrants, shore birds, wading birds,


Figure 4.

[7] The above information is extracted from the 2007 Surface Water Improvement and Management Plan for Saint Andrew Bay adopted by the Northwest Florida Water Management District.

and sea birds. Importantly, the estuary has in the last decade become habitat for the endangered Florida manatee.

The headwaters of Wetappo Creek are not merely hydrologically linked but comprise a single ecosystem connecting the Creek's headwaters to the Gulf of Mexico. Contamination of those headwaters would also contaminate the waters of East Bay and of the Gulf of Mexico.

THE PROPOSED DRILLING SITE IS IN WETAPPO CREEK HEADWATERS

Figure 5 depicts the location of wetlands as depicted on the map submitted by the applicant of the proposed drilling site. It shows that almost half of the proposed site is in wetlands. Page two of the application reports that based on a review of the USGS quadrangle map, the elevation of the proposed drilling site is about 60 feet NGVD. However, the 10-foot contour lines on USGS quadrangle maps are not made from ground surveys but are estimates based on manual stereoscopic interpretation of aerial photos;[8] the actual elevation could be several feet lower. In fact, page one of the application states that the elevation is 54.5 feet[9] – five and a half feet lower, and the certified land survey attached to the application, figure 6,

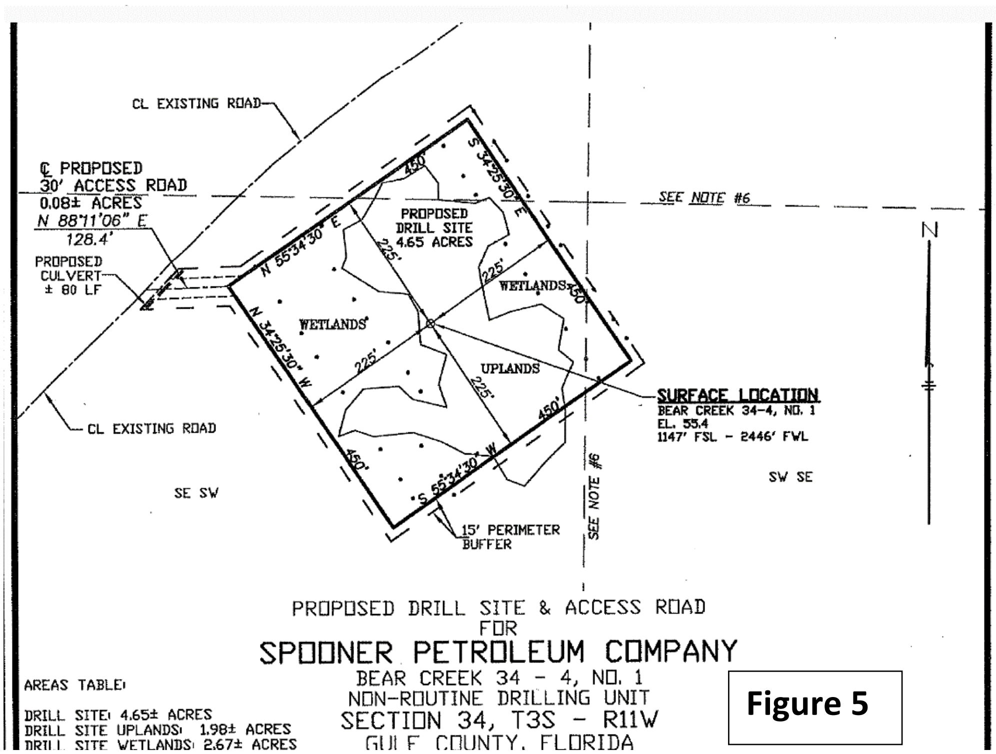


Figure 5

[8] See, *Stereoscopoſy and 3-D Measurement*, at 9-14, available at www.EDC.URI.EDU
[9] Application, attachment one, page one.

overleaf, is the sealed survey by a professional surveyor that shows the elevation as 55.4 feet, four and a half feet lower.[10]

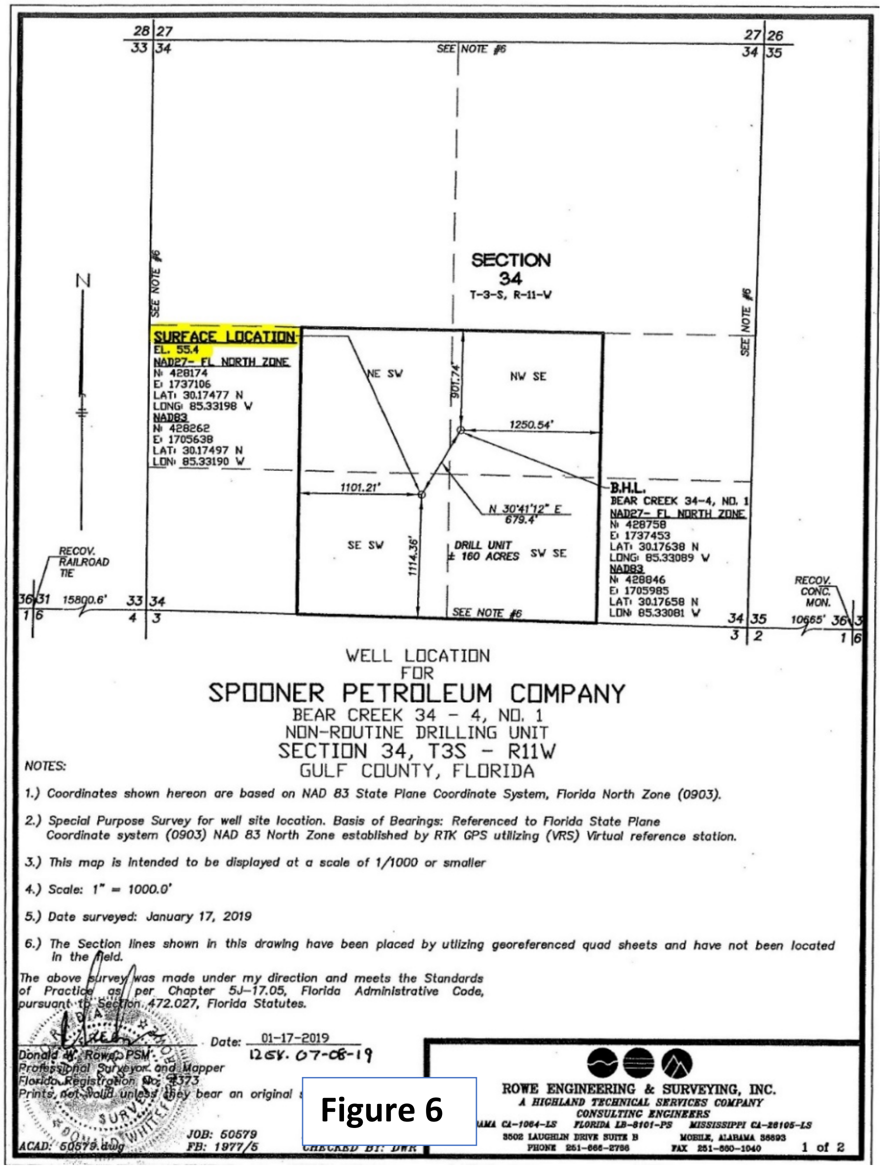


Figure 6

The drilling pad would occupy approximately 4.7 acres and be surrounded by three-foot-high berms piled up from materials excavated on the site to form a storm water percolation pond. In addition to drilling machines and generators, tanks of chemicals to mix drilling mud, drilling mud containment vessels and fuel tanks would be on the site. The amount of drilling mud stored on the site would be sufficient to drill over 2 miles below the surface of the ground.

[10] One of the two is probably a typographical error.

THE PROPOSED SITE IS WITHIN THE 100 YEAR FLOODPLAIN OF WETAPPO CREEK

The proposed drilling site falls entirely within the 100-year flood elevation of Wetappo Creek. The FEMA map set out below shows that the entire drilling site is below the 100-year flood elevation established in 2007. Set out below as figure 7 is the 2007 FEMA flood map[11] with the proposed drilling site marked on it.


**Figure 7. FEMA Designated Flood Zone 2007**

FEMA's 100-year flood elevation understates the reasonably anticipated 100-year flood stage. The FEMA 100-year flood contour at the Apalachicola River at the Blountstown water gauge is 54 feet.[12] However, the water elevation at that gauge – the closest river elevation gauge to the proposed drilling site – has risen higher than the estimated 100-year flood stage of 54 feet twice in the past 25 years.[13]

[11] This is an excerpt of the FEMA map available at https://msc.fema.gov/portal/search?AddressQuery=WEWAHITCHKA#searchresultsanch or

[12] *See*, https://msc.fema.gov/portal/search?AddressQuery=BLOUNTSTOWN

[13] Water elevations at the Blountstown gauge are expressed in feet above the gauge's base elevation of 26.96 feet NGVD. On March 21, 1929, the stage was 28.60 feet, which meant that the water elevation there reached (26.96 + 28.60) 55.56 feet NGVD. On

Weather data indicate that much more extreme storms and record rainfall events should be anticipated. Future climate projections from at least five years ago predicted an increase in the intensity of extreme rainfalls.[14] Those predictions came to pass when Hurricane Harvey made landfall in Texas in August of last year. The storm dropped over sixty inches of rainfall, and the National Hurricane Center reported it as having dropped twelve inches (twenty five percent more) than any rainfall event ever recorded in the United States.[15] Studies later indicated that climate change – warmer water and a warmer atmosphere – was a major factor underlying the record rainfall.[16] Extreme weather events are becoming more severe in Northwest Florida. In October of last year, Hurricane Michael crossed the Gulf of Mexico as a tropical storm and suddenly burst into a Category 5 hurricane – the most intense hurricane ever to strike northwest Florida.[17] The cause of the sudden strengthening was attributed to unusually warm waters in the Gulf of Mexico off the Northwest Coast of Florida.[18] Until the last decade,

---

March 13, 1995, the stage was 27.23, which meant that the water elevation there reached an elevation of (26.96 + 27.23) = 54.19 feet NGVD. On July 10, 1994, the stage was reported at 27.21 feet, meaning that the water elevation there reached (26.96 + 27.21) = 54.17 feet NGVD.

[14] *See e.g.*, Jianting Zhu, *Impact of Climate Change on Extreme Rainfall across the United States*, Journal of Hydrologic Engineering, Volume 18 Issue 10 - October 2013.

[15] National Hurricane Center, *Tropical Cyclone Report for Hurricane Harvey,* May 9, 2018, at p. 6, available at https://www.nhc.noaa.gov/data/tcr/AL092017_Harvey.pdf ADD MOST INTENSE ON RECORD

[16] M.R. Riser and M.F. Wehner, *Attributable Human-Induced Changes in the Likelihood and Magnitude of the Observed Extreme Precipitation during Hurricane Harvey*, AGU100 Geophysical Research Letter, December 12, 2017, available at https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017GL075888; G.J. Van Oldenborgh et al. Environmental Research Letters, Volume 12, Number 12 2017, available at http://iopscience.iop.org/article/10.1088/1748-9326/aa9ef2/meta

[17] See, John Schwartz, *Why Hurricane Michael's Power Caught Forecasters Off Guard*, New York Times, October 11, 2018, available at https://www.nytimes.com/2018/10/11/climate/hurricane-michael-science.html

[18] *See e.g.*, Andrea Thompson, *Why did Hurricane Michael Rev Up So Quickly?*, Scientific American, October 11, 2018, available at https://www.scientificamerican.com/article/why-did-hurricane-michael-rev-up-to-category-4-so-quickly/

Category 5 hurricanes were extraordinary events, but because of warming sea waters due to climate change, they have become annual events.[19] And the increasing intensity of hurricanes was illustrated last month when Hurricane Dorian swept the Bahamas with sustained winds of up to 185 mile-per- hour winds, leaving only wreckage in its wake.[20]

The consequences of failing to anticipate unprecedented extreme rainfall events are already visible in flooding of oil production facilities in the United States. The photograph below is of a gas production platform submerged by floodwaters from Lake Texoma in Colorado in 2015. The bubbles in the foreground are natural gas leaking from the facility.[21]

**Natural Gas Well Submerged by Lake Texoma Flood Waters 2015**

The reach of the 100-year floodplain of Wetappo Creek, is likely to be flooded more frequently and with deeper waters as the reach of its waters is extended by extreme weather events. This characteristic of the land proposed for the drilling pad, combined with the pristine and vulnerable ecological character and its receiving waters in East Bay, must weigh most heavily in the balancing process as this proposed permit is considered.

---

[19] https://weather.com/storms/hurricane/news/2019-09-01-hurricane-dorian-atlantic-hurricane-category-five-history

[20] https://www.cnbc.com/2019/09/05/everything-is-gone-bahamians-struggle-in-dorians-devastating-wake.html

[21] Photo by Corbin Hiar.

## III.

## § 377.241(2) – NATURE OF THE APPLICANT'S INTEREST IN THE OIL RIGHTS

A factor to consider in evaluating drilling permit applications is whether the applicant or its partners own only oil and mineral rights acquired in the distant past or whether they own the fee interest in the land that would be drilled. Where drilling applications are based on oil and mineral rights only, and when those rights were acquired in the distant past, the possibility exists that the true purpose of the application is not to explore for oil but to force a purchase of those rights by the fee owner or by nearby fee owners. In this case, the owner of the rights is Bear Creek Timber, LLC.[22] These facts indicate that the application is not likely to be intended to force a sale of stale mineral rights rather than to explore for oil.

## IV.

## § 377.241(3) – PROVEN OR INDICATED LIKELIHOOD OF DISCOVERING COMMERCIALLY RECOVERABLE OIL OR NATURAL GAS

THE SMACKOVER AND NORPHLET FORMATIONS

The primary target of this exploratory well would be the oil-bearing Smackover formation, and the secondary target is the Norphlet natural gas formation that can be found below the Smackover. Lying two miles below the ground surface, the Smackover formation was formed in the upper Jurassic period by accumulations of benthic microorganisms that formed organized communities with extracellular polymeric substances referred to as "biofilms" that bind with fine grains of sediment. Over geologic time, these biofilms can become transformed into "microbalites." Benthic organisms growing during the upper Jurassic period formed three discrete forms of microbalites: clotted aggregations ("thrombolites"), laminated layers ("laminated stromatolites"), and unstructured aggregations ("leolites").[23]

---

[22] Gulf County Official Record, Book 360 at page 477.

[23] K.L. Day, *Upper Jurassic Microbolite Buildups In The Little Cedar Creek And Brooklyn Fields In SW Alabama*, at pp.3-5, thesis, Wichita State University, (2014)

Over the past 150 million years, geologic processes sometimes converted the microbalites into sedimentary rock containing petroleum – into oil-bearing rock.[24] Microbalites can develop in sedimentary rock consisting of fine-grained sediments or larger grained sediments; fine grained oil-bearing rock formations are almost impermeable but large grained oil-bearing rock can be so porous and permeable that it readily releases petroleum. Sands consisting of large, round grains – "Oolites"[25] – transmit oil especially well.

The Smackover is an oil-bearing geologic trend that runs intermittently over about 1,000 miles from South Arkansas to the southeast through Texas, Louisiana, Mississippi, Alabama, and West Florida. A series of oil fields in that formation in those states has been highly productive.[26] First discovered near the town of Smackover,[27] Arkansas in 1922, a sequence of productive oilfields initially progressed to the southeast along the trend for thirty years following that discovery. Figure 8 is a USGS map of the Smackover formation.[28]

---

[24] N. Noffke, and S.M. Awramik, *Stromatolites and MISS—Differences Between Relatives*, GSA Today, v. 23, no. 9, (September, 2013) doi: 10.1130/GSATG187A.1. available at https://www.geosociety.org › gsatoday › archive › pdf

[25] Oolites are sedimentary rocks consisting of large (up to 2 millimeter) spherical grains of calcium carbonate that accrete in successive layers around a mineral grain nucleus. *See,* F.D. Siewers, *Oolite and coated grains*, in: Encyclopedia of Sediments & Sedimentary Rocks (Ed. Middleton, V.). Springer. 502-505 (2003).

[26] J. Amoruso, *Smackover Trend from Mexico to Florida*, AAPG Bulletin 55, January, 1971.

[27] Oil formations typically bear the name of the closest settlement to the first discovery of the formation. The name "Smackover" is an awkward phonetic Anglicization of the original French name "Sumac Couvert" (which translates to "covered with Sumac bushes") for the area around the settlement.

[28] T.S. Dyman and S.M. Condon, *Assessment of undiscovered conventional oil and gas resources—Upper Jurassic–Lower Cretaceous Cotton Valley Group, Jurassic Smackover Interior Salt Basins Total Petroleum System, in the East Texas Basin and Louisiana-Mississippi Salt Basins Provinces*: U.S. Geological Survey Digital Data Series DDS–69–E, Chapter 2 (2005).

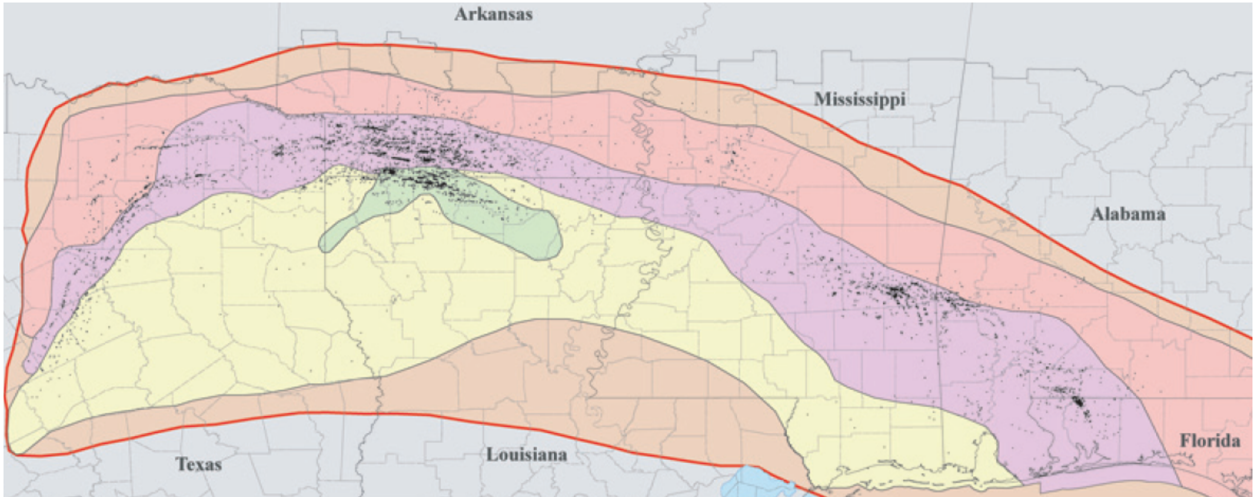



**Figure 8. Map of Smackover Formation Oil Producing Areas • = Producing Well**

Interest in the Smackover formation was rejuvenated in about 1960 with the advent of common-depth-point seismic techniques, which extended the ability of seismic testing to recognize the structural definition of rock formations at depths of up to five miles below the earth's surface.[29] During this period, exploration shifted southeast along the formation into Southern Mississippi and ultimately through Alabama and into Florida. Large numbers of exploratory wells were drilled around this time, and small producing oilfields were discovered in southeastern Alabama at Womack Hill, Chatam, Big Escambia Creek, Fannie's Church, and Chunchula. In the mid-1990s, another small oil field was discovered near Little Cedar Creek in Conecuh County, which over the ensuing 15 years was extended to include the Brooklyn and Fish Pond oil fields.[30] These more recently discovered oil fields in Southern Alabama are about 100 miles west north west of the proposed drilling site in Gulf county Florida.

All of those discoveries were overshadowed by the discovery in 1970 of a major oil field near Jay, Florida. For over a decade, this twenty square-mile field was the most productive oil field east of the Mississippi River. One additional, but much smaller

---

[29] R.D. Ottman, P.L. Keyes and M.A. Zeigler, *Jay Field Florida – a Jurassic Sedimentary Trap*, Gulf Coast Association Societies, V. 23, pp. 146-57.

[30] The latter two of these oil fields are only technically separate oil fields from Little Cedar Creek, the separation being based on slightly higher pressure and much higher productivity in the Brooklyn field, and Fish Pond being adjacent to the latter field. *An Overview of the Little Cedar Creek and Brooklyn Fields*, at pp. 2-4, Ala. Bureau of Oil & Gas (December 2012).

producing field, was discovered in 1972 near Blackjack Creek in Santa Rosa County, five miles south of Jay. Lessons from the Jay field are discussed later at pages 29-31.

The Norphlet formation is a mainly natural gas formation below the Smackover formation that follows the Smackover trend. It is named for the town of Norphlet,[31] Arkansas where the formation was first discovered in 1922. Because this formation lies below the Smackover, it can produce natural gas along with oil. All of the natural gas production in Florida is from existing oil fields and almost all of it is produced in the Jay field.[32]

In West Florida and beyond, the Smackover trend lies about two to three miles below the surface. Two major features vary widely within this trend. First, the ability of oil-bearing rock formations to contain oil that can be extracted depends on the extent to which the rock is porous and permeable. Reservoir porosity and permeability vary widely depending on the grain size of the sediments and the extent to which its porosity has been destroyed by the pressure of rock formations above it. Spooner Petroleum Company last year drilled an exploratory well into the Smackover formation in Calhoun County about 10 miles north of the proposed site in Gulf County. Although like most other exploratory wells east of the Jay Field, it found "oil shows,"[33] it did not find porous oolites or thrombolites. Instead, it reached basement rock[34] before it reached the depth at which a 1974 exploratory well – drilled three miles west of this proposed exploratory well - found oolite and thrombolitic porosity.[35] This new permit application relies

[31] The name Norphlet is a misspelling by the 1871 Post Office of the first name of Nauphlet Goodwin for whom the town was named at the time.

[32] *Florida Profile Analysis*, United Information Administration, September, 2018, available at https://www.eia.gov/state/analysis.php?sid=FL Most of that natural gas is used to pressurize the Smackover formation for the purposes of extracting oil.

[33] An "oil show" is a rock with oil stains on its surface, which shows that oil had once passed through the formation.

[34] "Basement rock" refers to the hard rock that lies below sedimentary rock in which oil-bearing formations are found.

[35] Application at 7th and 8th page (under the heading "ADEQUATE PROTECTION OF STREAMS").

primarily on the proposed drilling site's "paleogeographic position,"[36] which it asserts is similar to the Brooklyn and Little Cedar Creek oil fields 100 miles away in southern Alabama. Those oil fields were discovered through wildcat wells,[37] and the geologic evidence submitted with the application indicates this proposal too is for a wildcat well.

Second, the geologic formations in the area of the Smackover and Norphlet trend usually do not contain much petroleum. These rock formations were created during the upper Jurassic period from about 174 to 163 million years ago,[38] and the chemical conversion of carbon deposits to petroleum oil requires a unique mix of factors – carbon deposits heated to the right temperature by their depth into the earth and pressurized to exactly the right pressure by the tens of thousands of feet of rock above them. After it is created by this unique recipe, the very hot, highly-pressurized oil is much lighter than the surrounding rock, and over tens of millions of years gradually floats up through micro fissures in the overlying rock layers. The oil normally dissipates into these overlying rock layers – leaving stains referred to as "oil shows," but sometimes it floats up into a "trap" created by an impermeable rock layer above it.

There are three types of traps: anticlinal or fold traps, fault traps, and stratigraphic traps. An anticlinal or fold trap is an area of the subsurface where the strata have been pushed into forming a domed shape. If there is a layer of impermeable rock present in this dome shape, then hydrocarbons can accumulate at the crest until the anticline is filled to the spill point – the highest point where hydrocarbons can escape the anticline.[39] Fault traps are formed by the movement of permeable and impermeable layers of rock along a fault line where an upward shift in an impermeable rock layer makes it adjacent to an oil bearing formation, preventing the oil from migrating further upward.[40] Stratigraphic traps are formed as a result of variations in layers of sediment

---

[36] Paleogeographic refers to the historic geology of this region of the continent during the upper Jurassic period; in this context, "paleogeographic position" appears to refer to the geologic provenance of the entire eastern Gulf of Mexico region.

[37] *An Overview of the Little Cedar Creek and Brooklyn Fields*, at pp. 2-4, Ala. Bureau of Oil & Gas (December 2012). A "wildcat" well refers to a well drilled on the basis of intuition.

[38] R.D. Ottman, P.L. Keyes and M.A. Zeigler, *Jay Field Florida – a Jurassic Sedimentary Trap*, Gulf Coast Association Societies, V. 23, pp. 146-57.

[39] *Petroleum Traps,* available at http://www.geologypage.com/2015/02/petroleum-traps.html

[40] *Id.*

that produce pockets within impermeable rock that can trap oil and prevent it from migrating to the surface.[41]

Within the Smackover trend, low-relief anticlines, with up to about 400 ft of closure, are the most important structural traps in terms of oil production. These closures usually are associated with Louann Salt swells which underlie the Smackover section.[42] Fault traps, traps associated with high relief structures, and salt piercements are of lesser importance. Stratigraphic traps have become more frequent exploration targets in the Smackover trend and many of the most important oilfields in it were found in stratigraphic traps.[43] Entrapment generally is provided by the up-dip termination of porous carbonate zones, commonly, but not necessarily, in conjunction with low relief structural noses or closures.[44] This application asserts that there may be an anticline trap in the formation.

LIKELIHOOD OF DISCOVERING COMMERCIAL RECOVERABLE OIL

The history of development of the Smackover trend is one where exploration and production has gradually moved to the southeast along the trend.[45] In some quarters of the oil industry, there is a belief that continuing exploration of the Smackover trend in a southeasterly direction will produce new major discoveries.[46] However, the trend was identified about 100 years ago and no new oilfields have been identified in Northwest Florida since the discovery of the Jay field in 1970 and the Black Jack oil field in 1972. Scores of exploratory wells have been drilled following this southeast Smackover trend but none of them have located producing oil fields. Many of these exploratory wells were as far east as Calhoun County and beyond.

---

[41] *Id.*
[42] R.D. Ottman, P.L. Keyes and M.A. Zeigler, *Jay Field Florida – a Jurassic Sedimentary Trap*, Gulf Coast Association Societies, V. 23, pp. 146-57.
[43] *Id.*
[44] *Id.*
[45] R.D. Ottman, P.L. Keyes and M.A. Zeigler, *Jay Field Florida – a Jurassic Sedimentary Trap*, Gulf Coast Association Societies, V. 23, pp. 146-57.
[46] *Id.*

Essentially all of these exploratory wells were based on two-dimensional seismic testing results that were consistent with the existence of a trap that had captured sizable amounts of oil before it migrated up and dispersed throughout the miles of rock overlying the Smackover formation. Two-dimensional seismic testing uses shock waves from explosions or mechanical impacts to study rock formations under the ground. Referred to as seismic waves, these shock waves travel through the ground and reflect off rocks deep under the ground in the same way that ripples in a pond reflect off a boat in the water. A sequence of vibration recorders is laid out in a straight line to capture and to record the seismic waves. These "geophones" also record how long it takes the waves to leave the seismic shock wave source, reflect off a rock boundary, and return to the geophone. Because boundaries between different rocks often reflect seismic waves in different patterns, the shape of the seismic waves can be interpreted to deduce the kinds of rock present at different layers. These patterns are then compiled to assemble a hypothesized cross-section of the rock formations deep under the ground. When a cross section shows an oil-bearing formation with a line in the shape of a trap in an overlying impervious rock formation, it is possible that the trap shape could be a part of an actual trap that captured oil as it floated up.

Although this method is heralded as a method of seeing through the ground, it is more analogous to looking through the slit under a door to assess what is happening in the room on the other side of the door. Thus, two dimensional seismic surveys frequently identify cross-sections that are consistent with the existence of geologic traps containing oil but only rarely identify actual traps containing enough oil to be commercially recoverable.[47] The only way to tell if there actually is a trap that has captured recoverable oil is to drill into the formation and[48] almost all exploratory wells that are distant from known oil fields turn out to be dry holes.[49]

The fundamental reason that exploratory wells only rarely locate new viable oil fields is that the oil-producing rock formations are spread over vast areas, often encompassing

---

[47] Rigzone, *How Does Land Seismic Work*. Available at https://www.rigzone.com/training/insight.asp?insight_id=301&c_id=

[48] *See, e.g.*, Oil Exploration, at http://www.sjvgeology.org/oil/exploration.htmland

[49] A "dry hole" is a term used to refer to any oil well that does not contain enough recoverable oil or natural gas to justify any further investment in developing the well. Petropedia, *What is a dry hole?* Available at https://www.petropedia.com/dry-hole-what-is-a-dry-hole-/2/9858

several thousand square miles. Reservoirs of recoverable oil occur in only a tiny fraction of the area encompassed by the trend and tend to be extremely small by comparison. This is illustrated by the producing oilfields within the Smackover trend in Florida, where the highly productive[50] Jay field is only about 7 miles long and 3 miles wide[51] and the Blackjack field to the south is much smaller.[52]

This combination of very long odds and large payoffs make oil exploration an inherently speculative business. But the prospect of lucre – however remote – sustains the relentless optimism of oil explorers in the face of repeated failures. This syndrome is evident in the history of oil drilling in Florida.

Under Florida law, applicants for oil exploration drilling permits must report to what depth the well was drilled and what rock formations were revealed at what depths in the well.[53] Disclosure of this information facilitates informed decisions by landowners as well as future petroleum prospectors, and provides important information about the geology of the region. An interactive map[54] on the DEP website contains most of the basic information on all exploratory and production wells in Florida. The map below is reproduced from that website.

---

[50] The Jay Field reportedly has produced 432 million barrels of oil to date; at $50 per barrel, that quantity of oil would have a value of $20 billion.

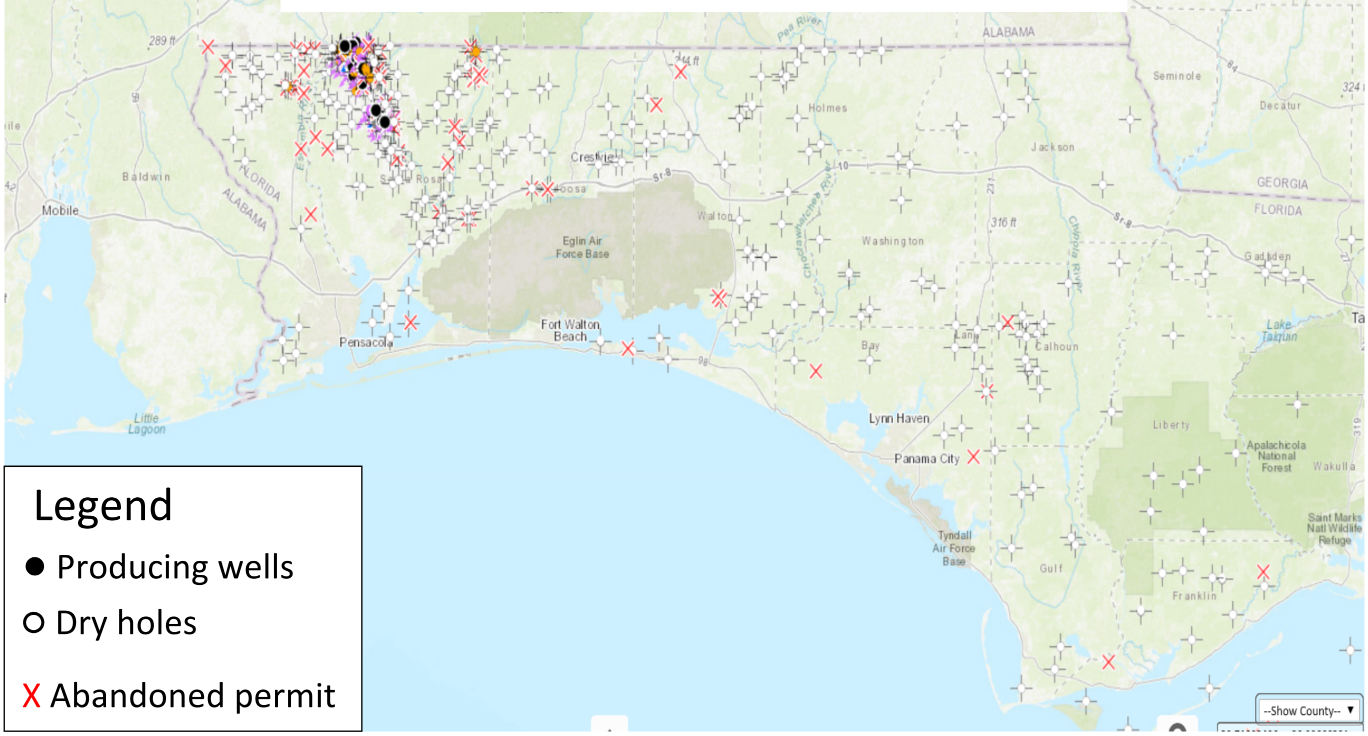
[51] *See,* Ottoman et al., note 40, *supra.*

[52] *Id.*

[53] § 377.222(h) Florida Statutes requires reports to the state showing the location of all oil and gas wells, of drilling logs, the saving of cutting and cores which cuts are to be provided to the Bureau, as well as production reports. At the request of the operator, these records can be kept confidential for one year.

[54] The map is at https://ca.dep.state.fl.us/mapdirect/?focus=oilandgas A review of the interactive map reveals that the whole area of West Florida has been extensively drilled since the 1950s until as recently as last year.

**Figure 9. Map of Permitted Oil Wells in West Florida**




This map shows that about 100 exploratory wells have been drilled over the area and that the only producing wells are in and immediately around the Jay field discovered in 1970. Because the Smackover trend crosses West Florida, most of the deep exploratory wells found oil *present* in the form of oil smears or stains in drilling cores, indicating that some quantity of oil had passed through the formation at some time during the last 150 million years. But absent porous and permeable rock with a lot of oil in it, combined with a sizable trap that captured it as it floated up, no oil or gas was or could be commercially recovered.

Spooner does not contend that there is, as required by section 377.241 (3), Florida Statutes, a "proven or indicated likelihood of discovering *commercially recoverable oil or natural gas*."[55] Instead it asserts only that exploratory wells in the area had "oil shows," that an exploratory well 3 miles away found porous oolite and thrombolitic rock, and that a two dimensional seismic survey shows the Smackover signature, basement rock deep enough that porous oil-bearing rock might be above it, and that the seismic lines are consistent with an anticline trap.[56] That evidence can hardly support a finding that

[55] Emphasis supplied.
[56] Application at 7th to 9th pages.

there is a proven or indicated likelihood of discovering commercially recoverable oil or gas.

Many of the unsuccessful exploratory wells shown in the map depicted above were drilled before the discovery of the Jay field in 1970, and if a long history of failed exploratory wells were by itself a justification to deny further permits, the Jay field might never have been discovered. However, a fifty-year record of dry holes in the area requires the conclusion that the statutory criterion of a "proven or indicated likelihood of discovering commercially recoverable oil and gas" does not weigh significantly in favor of issuance of a permit. Instead, it is a factor that militates against issuance of permits to drill in areas that could be severely damaged by oil drilling.

## V.

## DIRECTIONAL DRILLING

It is unnecessary to site the drilling pad in the wetlands tributary to Wetappo Creek or within its floodplain because directional drilling would allow the applicant to drill from nearby uplands. Such uplands are available. Bear Creek Timber, LLC – the applicant's royalty partner and licensor – owns 12 square miles of land around the proposed drilling site, a substantial fraction of which is uplands above the established floodplain of Wetappo Creek.

Directional drilling has been used in the United States petroleum industry since the 1920s and the technology has substantially advanced over the past several decades. Although it was apparently first used to illicitly extract oil from beneath adjacent lands, directional drilling came into vogue in 1934 when portable drilling rigs driven by power takeoffs on trucks were used to drill relief wells that helped extinguish the Great Conroe Fire in the Conroe, Texas oil field. Exceptionally high natural gas pressure had made the fire impossible to put out, and the portable drill rigs rapidly drilled a series of slant wells that relieved the pressure and saved one of the largest oilfields in the United States.[57]

Since then, directional drilling has become an integral part of the oil industry. Although the technology has grown more sophisticated in recent decades, the concept has remained unchanged: by drilling at angles rather than straight down, oil wells can be

---

[57] B. Wells, *Technology and the "Conroe Crater"*. American Oil & Gas Historical Society, 23 September 2014.

sited to avoid areas inappropriate for drilling, such as urban and environmentally sensitive areas.[58] The technique is used extensively for other purposes: to drill multiple wells from a single location, greatly reducing environmental impact as well as costs; drilling into multiple target zones by intersecting multiple targets with a single wellbore; "sidetracking," the well bore around obstructions such as a lost string of pipe[59] or an exceptionally hard rock formation; drilling around a steeply-inclined fault plane to prevent the wellbore from being deflected or possibly causing slippage or movement along the fault; drilling around or at a flat angle through salt domes to reduce the risk of washouts[60] or lost circulation; drilling "relief wells" to intersect a well undergoing an uncontrolled blow-out, allowing drilling mud to be pumped into the relief well to block flow of oil.[61]

---

[58] J. Lavis, *Directional Drilling: Everything You Ever Wanted To Know* (2014), available at https://drillers.com/directional-drilling-everything-you-ever-wanted-to-know/
[59] The first directional drilling was due to sidetrack around a ''fish,'' a term that refers to unrecoverable drilling tools lost in the borehole. As early as 1895 special tools and techniques were developed to deal with "fish." *See,* M. Tianshou, C. Ping, and Z. Jian, *Overview of Vertical and Directional Drilling Technologies for the Exploration and Exploitation of Deep Petroleum Resources*, Geomech. Geophys. Geo-energ. Geo-resour. (2016) 2:365–395, at 367.
[60] Oil bearing rock formations frequently contain water, *id.* at 372, which can dissolve salt. Salt can also corrode drilling equipment.
[61] D. Chen, *Petroleum Engineering Handbook,* V. 2, Ch. 6, at pp 265-86, Society of Petroleum Engineers (2006).

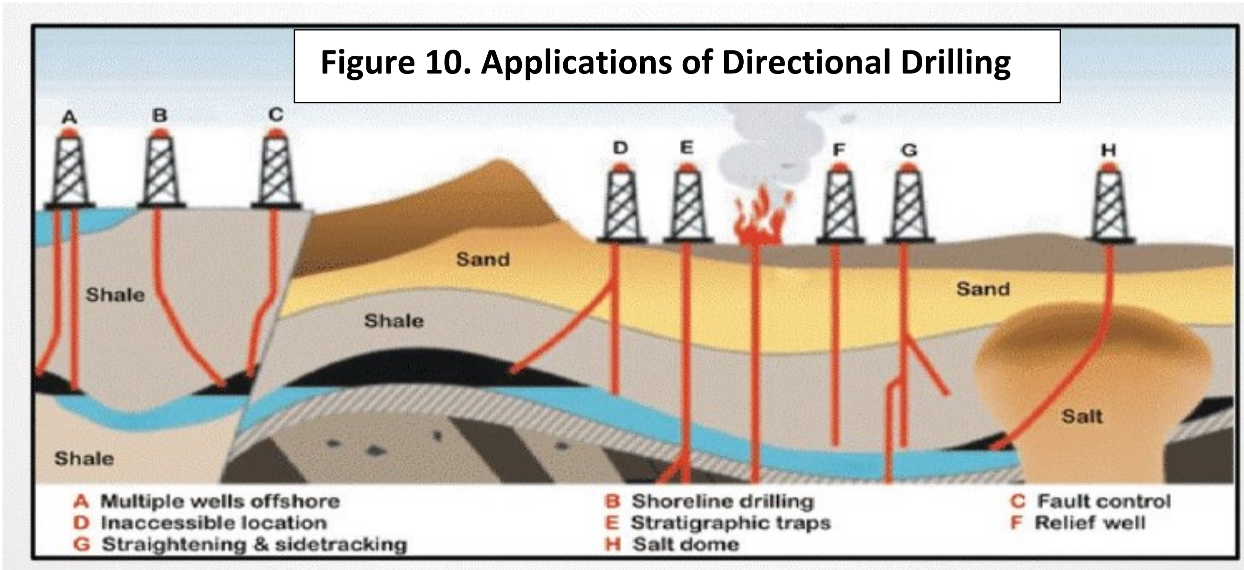



**Figure 10. Applications of Directional Drilling**

Directional drilling is fully capable of accurately reaching a targeted point in a deep rock formation, as vividly illustrated by the relief well drilled to stop the Deepwater Horizon blowout. There, the relief well was drilled using directional drilling and successfully intersected the Macondo well borehole from almost 3 ½ miles away.[62] But directional drilling can also be as simple as pointing the drill in the desired direction to reach the targeted point under the ground. Known in the industry as the "build and hold" method, the initial deflection angle is obtained at a shallow depth, and from that point on the angle is maintained as a straight line to the target zone.[63] A more complex method of directional drilling shifts the angle of the bore hole part way along its course. One several decades old method is to shift the bore hole off of the vertical by inserting a tapered concave steel wedge known as a "whipstock."[64] In the past two decades,

---

[62] Paula Dittrick, *Relief Well Intercepts Macondo Well in Gulf*, Oil & Gas Journal, September 17, 2010, available at https://www.ogj.com/articles/2010/09/relief-well-intercepts.html

[63] D. Chen, Petroleum Engineering Handbook, V. 2, Ch. 6, at pp. 369-75, Society of Petroleum Engineers (2006).

[64] At the desired depth the drill is withdrawn to the surface, a concave wedge – a whipstock – is inserted into the borehole, a narrower drill bit is inserted in the borehole and is deflected by the wedge so that it cut a pilot hole at a new angle. The pilot drill bit and the whipstock are then retracted from the borehole and the drilling resumes, following the path of the pilot hole. *See,* M. Tianshou, C. Ping, and Z. Jian, *Overview of Vertical and Directional Drilling Technologies for the Exploration and Exploitation of*

directional drilling more commonly employs methods of steering the drill bit as it turns in the bore hole using devices in the bottom hole assembly.[65] Two basic problems are addressed in directional drilling technology: 1) how to steer the drill bit to achieve the correct inclination bore hole; and 2) how to acquire data about the location and direction of the bore hole.

DRILL BIT STEERING

Two distinct technologies are now used throughout the world to steer drill bits as the well bore is drilled: rotary steerable systems and down-hole motors. A rotary steerable system essentially aims the drill bit as the drill string rotates by placing hydraulic or mechanical force against the bore hole on one side of the drill bit.[66] The pressure on one side of the drill bit forces it to cut more on the opposite side and thereby shifts the direction of the bore hole. Another rotary steering system method is to alter the borehole angle by bending a housing or shaft inside the body of the drill bit assembly. By slightly bending the axis of the assembly, the direction of the drill bit is changed so that it points in a different angle.[67] Rotary steering systems all use continuous rotation from the engine on the drilling rig at the ground surface. This feature improves transportation of the drill cuttings in the mud recirculating back to the surface.

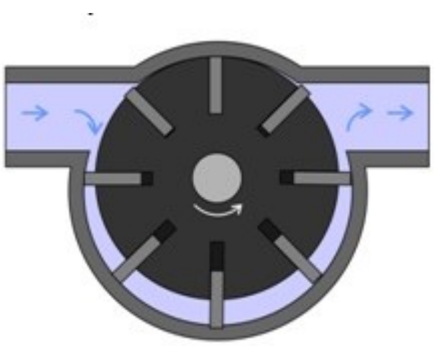


**Figure 11. Down-hole Motor**

The other method is down-hole motors, which use a progressive cavity positive displacement pump placed in the drill string to provide additional power to the bit while drilling. These motors use a powerful pump on the surface to drive drilling mud under high pressure down the drill string where the flow of drilling mud forces the drill bit to rotate. Figure 11 is a diagram of a down-hole drilling mud motor. Steering is achieved by using an approach similar to Rotary Steering Systems where a bend or mechanical force changes the orientation of the drill bit face. Down-hole motors do not rotate the drill string with the result that the drill string is more

---

*Deep Petroleum Resources*, Geomech. Geophys. Geo-energ. Geo-resour. (2016) 2:365–395, at 372.

[65] *Id.*

[66] S. Daleel, *Directional Drilling*, (2019) at 2. Available at SCMDaleel.com

[67] *Id.* at 4.

likely to stick and transport of drill cuttings up the drill string to the surface may be diminished. In general, Rotary Steering Systems are used in geologic formations where precise directional control is needed, and the much less expensive Down-hole Motor System is used in less complex formations.

WELL BORE LOCATION AND DIRECTION SURVEYS

The location and direction of the bore hole are surveyed by measuring three parameters at multiple locations along the well path: the measured depth of the hole, along with its inclination and azimuth. Measured depth is the actual depth of the hole drilled to any point along the wellbore or to total depth, as measured from the surface location.[68] Inclination is the angle by which the wellbore axis varies from the vertical line. [69]Azimuth is the angle, measured in degrees, of the horizontal direction of the axis of the borehole with reference to due north.[70] A recording of bore hole depth, inclination, and hole direction is taken at a series of survey stations along the well path, and together, the measurements are used to calculate the three dimensional coordinates.[71]

There are two types of survey instruments: magnetic and gyroscopic. Magnetic sensors can be mechanical or electronic. Mechanical compasses use a compass card that orients itself to magnetic north, and is similar to the round compasses used by hikers. These mechanical compasses also measure inclination by using a pendulum suspended over a fixed grid; the pendulum is allowed to move and points to different locations on the grid as the inclination changes. A variant on the pendulum is a float device suspended in fluid so that the float moves to a different position as the inclination changes.[72] At each location surveyed, a picture is taken to

---

[68] Depth can easily be measured by counting the number of pipes in the drill string. Drill pipe is usually 31 feet long but lengths up to 45 feet are also used. https://www.Globalspec.com/learnmore/specialized_industrial_products/mining_equipment/drill_pipe

[69] An inclination of 0° is vertical and an inclination of 90° is horizontal.

[70] An azimuth of 0° is due north, and an azimuth of 270° is due west. Direction is often also expressed in quadrant form - NE, SE, SW, or NW. *Petroleum Engineering Handbook, supra* at p. 375.

[71] D. Chen, *Petroleum Engineering Handbook*, V. 2, Ch. 6, at p. 374-75, Society of Petroleum Engineers (2006), available at Petrowiki.org.

[72] *Petroleum Engineering Handbook, supra* at p. 375.

record the inclination and azimuth shown on the mechanical compass grid. Mechanical compasses are inexpensive but are not widely used because they are difficult to operate and maintain.[73]

Electronic compasses are solid-state, self-contained instruments that measure the Earth's magnetic field and its gravitational forces. Inclination is measured by gravity accelerometers – essentially solid-state electronic pendulums. Azimuth is measured by "fluxgate magnetometers" – which measure components of the Earth's magnetic field on all three axes.[74] These electronic compasses record the data collected for a single shot or for multiple shots. The data recorded is retrieved when the drill string is periodically pulled out of the well hole. Advanced electronic compass systems provide location and direction survey measurements while drilling is underway by encoding the survey data in mud pulses that are transmitted and decoded at the surface.

Gyroscopic sensors are used when the accuracy of a magnetic survey system may be impaired by local magnetic influences, such as steel casings, or production tubing, local geologic magnetic anomalies, or nearby oil wells. A gyroscope is essentially a spinning top mounted in a pair of gimbals that allow the spinning top to assume any axis of rotation. Because of the Conservation of Angular Momentum, the energy in the spinning top ("rotor") keeps the rotational axis from shifting. Gyroscopic sensors use extremely high speed gyroscopes – rotating at over 40,000 RPM – powered by an electric motor.[75] When the axis of rotation of the spinning rotor is vertical, it remains vertical in the gyroscope, thereby providing a reference line against which to measure shift in inclination; if the axis or rotation is horizontal and pointing north, it provides a reference line against which to shift in azimuth. In addition, solid-state accelerometers can measure and record acceleration on different axes and thereby function as a solid-state gyroscope.[76] Gyroscopic sensor systems come in a wide variety of designs and can

[73] *Id.* at 376.

[74] *Id.* at 376-77.

[75] *Id.* at 377.

[76] Like gyroscopes, accelerometers are based on the conservation of inertia. Vibrations maintain their plane of vibration when the vibrating material is turned (when a rod in the chuck of a lathe is twanged, the plane of the vibration of the rod remains unchanged when the chuck is slowly rotated), providing a reference line against which changes in inclination or azimuth can be measured.

combine spinning gyroscopes and accelerometers, some of which also measure azimuth by measuring the Coriolis force to determine north.[77]

For well over a decade, most directional-well planning is done on computer, using technologies such as 3D visualization and 3D earth models. These methods provide geoscientists and engineers with interactive tools to create, visualize, and optimize well paths. Indeed, the Petroleum Engineering Handbook, published by the Society of Petroleum Engineers states that the "future is the real-time integration of the drilling and logging-while-drilling data with geosteering and the earth model."[78]

Most available directional drilling equipment is patented to major drilling services providers. Schlumberger, GE Baker Hughes, Halliburton, and Weatherford are the top four service companies, controlling more than 70% of the market, with Schlumberger being the global leader. This includes all the services associated with directional drilling, such as drill string location sensors and down-hole motors. There are smaller niche companies in the market, but they are typically limited to narrow applications, such as one type of mud motor, or one type of gyroscopic sensor.[79] On average, directional drilling services represent between 5 and 15% of a well's cost.[80]

Because this proposed exploratory well targets a formation that is 12,900 feet deep – well over two miles – it needs to use only the simplest directional drilling technology to shift to a surface location in uplands above the Wetappo Creek floodplain. Indeed, five of the six proposed drilling permits in the Bureau's most recent exploratory well applications would use directional drilling with offsets from the surface of about 1,000 feet.[81] For this reason alone this permit should be denied.

---

[77] *Id.* at 378-79

[78] *Petroleum Engineering Handbook, supra* at p. 374.

[79] S. Daleel, *Directional Drilling*, (2019) at 5-7, available at Https://www.scmdaleel.com/category/directional-drilling-lwd-mwd/90

[80] *Id.* at p. 4.

[81] Applications 1374 through 1379 by Cholla Petroleum, Inc.

## VI.

## CHEMICAL PROCESSING OF HYDROGEN SULFIDE CRUDE OIL IN OR NEAR A POSSIBLE OIL FIELD

Oil from the Smackover formation in Florida contains extremely high fractions of hydrogen sulfide.[82] In general, almost all oil produced in the Jay field is from the Smackover formation and contains nine percent hydrogen sulfide.[83] In general, West Florida and Southeast Alabama Smackover reservoirs have very high sulfur concentrations when they are found deeper than 13,000 feet.[84]

"Sour crude" refers to crude oil containing high levels of sulfur,[85] and is defined in the industry as meaning crude oil that contains more than ½ percent sulfur. "High sulfur crude" is defined as crude containing 1 to 5 percent sulfur by weight.[86] Hydrogen sulfide in sour crude oil can pose grave health problems or even be fatal.[87] At moderate concentrations, hydrogen sulfide causes respiratory and nerve damage, and at high concentrations, it can be immediately fatal. Exposure to high levels of hydrogen sulfide is thought to be in part responsible for Gulf War Syndrome, which manifests as chronic

---

[82] High sulfur content is a feature of the Smackover formation, M.A. Vinet, *Geochemistry and Origin of Smackover and Buckner Dolomites (Upper Jurassic), Jay Field Area, Alabama – Florida* (1990), pp. 95-105 Louisiana State University and Agricultural & Mechanical College (dissertation).

[83] R.D. Ottman, P.L. Keyes and M.A. Zeigler, *Jay Field Florida – a Jurassic Sedimentary Trap*, Gulf Coast Association Societies, V. 23, pp. 146-57.

[84] W.J. Wade, *Stratigraphy, Diagenesis, and Petroleum Geology of the Smackover Formation, Southwest Alabama*, Louisiana State University and Agricultural & Mechanical College (dissertation), pp. 148-52 (1993); in small oil fields both south and east of Jay, minor amounts of sweet crude (i.e., crude oil with less than ½ percent sulfur) are produced from Norphlet sandstones. *See* Ottoman et al, *supra* at p. 152-54.

[85] The expression "sour crude" comes from the practice of early oil prospectors tasting crude oil to determine its quality, with low sulfur oil actually tasting sweet. See, http://www.petroleum.co.uk/sweet-vs-sour.

[86] Crude is currently considered sweet if it contains less than 0.5% sulfur. See, http://www.petroleum.co.uk/sweet-vs-sour and Definition of Sour Crude Oil in Petropedia, available at http://www.petroleum.co.uk/sweet-vs-sour

[87] *Id.*

fatigue, headaches, dizziness, memory failure, and serious breathing problems.[88] The Occupational Safety and Health Administration prohibits exposure to hydrogen sulfide gas at levels higher than 20 parts per million, while the National Institute for Occupational Safety and Health recommends a ten minute ceiling of exposure to 10 parts per million.[89] High sulfur crude oil may also contain variable amounts of benzene and N-Hexane. Long-term exposure to these chemicals has been shown to lead to systemic toxicity such leukemia and peripheral neurotoxicity.[90]

Hydrogen sulfide is also highly corrosive. Over time, it can corrode rail cars, trucks, and other transport vessels. It is also highly flammable, which can lead to explosions during the transport of crude with significant fractions of hydrogen sulfide.[91] For that reason, most rail truck and pipeline facilities now require high sulfur crude oil to be processed to remove hydrogen sulfide before transporting it.[92] In the past five years, the Federal Energy Regulatory Commission has adopted rules governing the oil industry that allow oil conveyance facilities to reject crude with hydrogen sulfide concentrations of 10 parts per million[93] – which is over 10,000 times lower than concentrations in crude oil extracted from the Jay oil field.

For these reasons, crude from the Smackover formation in West Florida must be chemically processed to remove hydrogen sulfide before it is transported by pipeline to Gulf Coast refineries in Alabama and elsewhere. This process requires a sizable

---

[88] *Id.*

[89] *See*, 29 CFR 1910.1000 Table Z-2. The National Institute of Occupational safety recommends a limit of 10 ppm for 10 minutes, while OSHA allows exposure for up to 50 parts per million is permitted for 10 minutes during one eight-hour shift, if no other exposure takes place. https://www.osha.gov/SLTC/hydrogensulfide/standards.html

[90] *See*, Whiting Safety Data Sheet, available http://www.whiting.com/wp-content/uploads/Crude-Oil-Sour-SDS.pdf

[91] *See,* Analytical Systems, *Measuring Crude for Transportation Safety*, available at https://liquidgasanalyzers.com/measuring-sour-crude-oil-transportation-safety-analytical-systems-international/

[92] *See* Petropedia description of high sulfur crude oil at http://www.petroleum.co.uk/sweet-vs-sour

[93] *Id.*

industrial plant, as shown by this aerial photo of the sulfur removal plant for the Jay oil field.

Aerial Photo of Jay Field Hydrogen Sulfide Removal and Processing Plant


The scale of the plant is indicated by the size of the parked cars below the white rectangular building on the upper right of the aerial photo. This facility is close to the center of the Jay oil field. If oil in commercially recoverable amounts were to be discovered by the proposed exploratory wells, a hydrogen sulfide removal plant of this character would be necessary, and it would likely have to be sited in or near the headwaters of Wetappo Creek.

## VII.

## CONCLUSION

Application of the statutory criteria in this circumstance requires a balancing of the nature, character and location of the lands involved, the extent of the applicant's interest in the mineral rights, and the likelihood of discovering commercially valuable quantities of oil or gas.

The nature of the applicant's interest is not a factor in the balance here because the purpose of this criterion is to protect against permit applications that are in reality calculated not to explore for oil and gas but to induce a sale to the fee owner or adjacent owners. Here, the owner of the mineral rights has spent substantial sums on seismic testing and is a licensee or partner with the underlying fee owner. These facts undermine any inference that the true purpose of the permit application is to induce a sale of stale mineral rights rather than to explore for oil and gas.

As to the first factor – the nature and character of the land – the extraordinarily valuable and unique ecological features of the Wetappo Creek watershed and East Bay weigh against issuance of this permit at this site. Included in the consideration of the nature and character of the land at issue must also be the potential impacts to the land reasonably foreseeable from the conduct to be permitted. If these exploratory wells were to discover a sizable oil field, the drilling pads would be used for production wells. And were a viable oilfield to be developed, it would require an industrial-scale hydrogen sulfide removal plant and processing plant to be constructed nearby those drilling pads.

Considered in conjunction with these producing well and chemical processing plant issues must be the foreseeable future increases in major floods in Northwest Florida. Hurricanes that enter the Southern United States from the Gulf of Mexico will in the future carry more rainfall than they did in previous centuries. Only two years ago, Hurricane Harvey brought so much rainfall to South Texas that it exceeded by twenty-five percent the highest rainfall ever recorded in the United States. It goes without saying that the unprecedented rapid development of Hurricane Michael last year brought the flavor of that change to Northwest Florida. Indeed, the 2018 Congressionally-mandated Fourth National Climate Assessment concluded that increasing extreme rainfall events are foreseeable and should be factored into siting and engineering decisions;[94] this permit presents one such decision. The nature and character of the land weighs heavily against exploratory drilling at this site in the headwaters of Wetappo Creek.

As to the proven or indicated likelihood of discovering commercially recoverable oil or gas, the odds are strongly against discovery of a new producing oil field. This low probability of finding a viable oil field, combined with the availability of directional drilling, weigh against issuing permits for exploratory oil drilling at this site. For these reasons, a considered balance of the relevant statutory factors reveals that drilling permit 1393 should be denied.

---

[94] Fourth National Climate Assessment, Volume II, *Impacts, Risks and Adaptation in the United States*, Chapter 3, Available at https://nca2018.globalchange.gov/