



# RAILROAD COMMISSION OF TEXAS

## HEARINGS DIVISION

**OIL AND GAS DOCKET NO. 01-0294048**

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**THE APPLICATION OF EQUIPMENT TRANSPORT, LLC PURSUANT TO STATEWIDE RULE 46 FOR A COMMERCIAL PERMIT TO INJECT FLUID INTO A RESERVOIR PRODUCTIVE OF OIL OR GAS, QUAILEO LEASE, WELL NO. 1, WINTER GARDEN, S. (OLMOS 2900) FIELD, DIMMIT COUNTY, TEXAS**

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**HEARD BY:** Karl Caldwell - Technical Examiner  
Cecile Hanna - Administrative Law Judge

**PROPOSAL FOR DECISION PREPARED BY:** Karl Caldwell - Technical Examiner  
Marshall Enquist-Administrative Law Judge

### PROCEDURAL HISTORY

Application Filed:	August 11, 2014
Protest Received:	August 13, 2014
Request for Hearing:	October 30, 2014
Notice of Hearing:	January 8, 2015 & March 31, 2015
Hearings Held:	May 13 & 14, 2015
Transcript Received:	May 29, 2015
Closing Statements Received:	June 22, 2015
Replies to Closing Statements Received:	July 2, 2015
Proposal for Decision Issued:	November 30, 2015

### APPEARANCES:

#### APPLICANT:

John Soule  
Arthur Streeter  
J. Dan Arthur  
Greg Casey  
Fernando De Leon  
David Channel

### REPRESENTING:

Equipment Transport, LLC

**PROTESTANT:**

Wintergarden Groundwater Conservation District

Peter Gregg  
Ed Walker  
Dr. Ronald Green  
F. Paul Bertetti

**CASE SUMMARY**

Equipment Transport, LLC (“Equipment Transport”) is applying for a commercial disposal permit pursuant to 16 Tex. Admin. Code § 3.46 for the Quaileo Lease, Well No. 1, (“Quaileo No. 1), Winter Garden, S. (Olmos 2900) Field, Dimmit County, Texas. The Applicant is requesting disposal authority for a maximum injection volume of 15,000 barrels per day (bpd), in the Olmos and San Miguel Formations between 2,500 feet and 4,500 feet, at a maximum surface injection pressure of 1,250 pounds per square inch (psi). The application is protested by Wintergarden Groundwater Conservation District (“WGCD”). WGCD is protesting the application due to a concern that a plugged and abandoned wellbore approximately 1,000 feet away may act as a conduit for injected fluids to escape the injection interval and pollute fresh water.

Based on the evidence, the Examiners conclude that the dry hole at approximately 1,000 feet that penetrates the Quaileo No. 1 injection interval has been plugged in a manner that will prevent the movement of fluids from the disposal zone into freshwater strata. The Examiners also conclude that the San Miguel and Olmos Formations are separated from freshwater formations by impervious beds which will give adequate protection to such freshwater formations. Therefore, the Examiners’ recommend the Railroad Commission of Texas (“Commission”) approve the application.

**APPLICABLE LAW**

Any person who engages in fluid injection operations in reservoirs productive of oil, gas, or geothermal resources pursuant to 16 Tex. Admin. Code §3.46 must obtain a permit from the Commission. Pursuant to Texas Water Code § 27.051(b), the Commission has authority to permit disposal and injection wells if it finds:

- (1) that the use or installation of the injection well is in the public interest;
- (2) that the use or installation of the injection well will not endanger or injure any oil, gas, or other mineral formation;
- (3) that, with proper safeguards, both ground and surface fresh water can be adequately protected from pollution; and
- (4) that the applicant has made a satisfactory showing of financial responsibility if required by Section 27.073 of this code.

## DISCUSSION OF THE EVIDENCE

### Applicant's Evidence (Equipment Transport, LLC)

#### **Application**

The application for the Qualeo No. 1 was mailed to all adjacent surface owners, the Dimmit County Clerk, and CML Exploration ("CML"), the only operator within a half-mile of the proposed disposal well. Equipment Transport owns 100% of the surface rights and 50% of the mineral rights for the tract where the subject wells will be drilled. Notice of the application was published in the *Carrizo Springs Javelin*, a newspaper of general circulation in Dimmit County, on Wednesday August 6, 2014. Due to a clerical error in identifying the formation names of injection interval, the application was re-published the *Carrizo Springs Javelin* on Wednesday August 13, 2014. Commission Staff determined that the application was administratively complete, but due to a protest by WGCD, Staff was unable to administratively approve the application.<sup>1</sup> The Applicant requested a hearing as a result of WGCD's protest.<sup>2</sup>

#### **Qualeo No. 1**

##### *Injection Interval and Well Construction*

The Applicant proposes to inject salt water and RCRA-exempt waste<sup>3</sup> between 2,500 feet and 4,500 feet in the Olmos and San Miguel Formations. The Commission's Groundwater Advisory Unit (GAU) identifies the BUQW at a depth of approximately 1,150 feet at the Qualeo Lease location, and the base of underground sources of drinking water (USDW) at a depth of approximately 1,200 feet. The Applicant submitted a letter from the GAU stating that the use of such formations will not endanger the freshwater strata in that area and that the formations to be used for disposal are not freshwater-bearing.<sup>4</sup>

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<sup>1</sup> Equipment Transport, LLC Exhibit Nos. 26 & 27.

<sup>2</sup> CML was inadvertently left off the Notice of Hearing service list when an internal memo was sent from Injection-Storage Permits to Docket Services. In a signed waiver, CML confirms that notice of the application was received and no protests were filed. In addition, a Supplemental Notice of Hearing for the application was mailed to CML and CML signed a waiver waiving objection as to timing of the notice of hearing and has no objection to approval of the applications (Equipment Transport, LLC Exhibit No. 32). Due to the returned envelope for the Notice of Hearing for the application and the uncertainty of correct addresses for Jesse Frank Guerra and John Pattison Tatum, Notice of Hearing was published in the *Carrizo Springs Javelin*, for four consecutive weeks, (April 8, 15, 22, and 29, 2015) for the application. In addition, supplemental Notice of Hearing was mailed on April 13, 2015 to corrected addresses for Jesse Frank Guerra and John Pattison Tatum.

<sup>3</sup> Resource Conservation and Recovery Act: Examples of RCRA exempt oil and gas waste includes produced water, drilling fluids, hydraulic fracturing flow back fluids, rig wash and workover wastes.

<sup>4</sup> 16 Tex. Admin. Code §3.9 (2)

The Applicant is requesting to inject maximum volume of 15,000 barrels per day (bpd) at a maximum surface injection pressure of 1,250 psi.<sup>5</sup> The Qualeo No. 1 application is filed pursuant to Statewide Rule 46 since there is past production from the proposed injection interval within a two-mile radius.<sup>6</sup>

The Examiners requested that Equipment Transport late-file exhibits to demonstrate that there has been current or past production from the proposed injection interval within a two-mile radius. Equipment Transport provided a two-mile radius map showing all wells that have produced from the proposed injection interval to substantiate the asserted 0.32 psi per foot pressure gradient. Equipment Transport submitted Late-Filed Exhibits 54 and 54A. Protestant WGCD did not object to these exhibits. Equipment Transport also submitted Late-Filed Exhibits 55 and 55A, which showed various bottomhole pressures and formation pressure gradients. Protestant WGCD did object to these exhibits. The Examiners concerns were satisfied by Late-Filed Exhibits 54 and 54A, which showed that the application was properly filed pursuant to Statewide Rule 46. The Examiners request for a calculation based on a normal pressure gradient was in the event there was no evidence of past production from the proposed disposal interval within a two-mile radius. The Examiners did not find it necessary to consider Late-Filed Exhibits 55 and 55A, nor were they admitted into the record.

The Qualeo No. 1 has not yet been drilled, but the proposed well construction plan is to set 9-5/8 inch, 30 lb-per-foot surface casing at a depth of 1,350 feet, which is 200 feet deeper than the BUQW. The surface casing will be cemented with cement circulated to surface. Longstring casing will be set at a depth of 4,600 feet and cemented in place with cement circulated to surface.<sup>7</sup>

### **Confining Intervals**

The presence of shale intervals above and below the proposed injection interval will confine fluids to the injection interval. The Navarro Formation is located above the Olmos Formation. According to David Channell, Equipment Transport's expert geologist, "the bottom 400 feet of the Navarro is a shale, and it is a very tight confining zone...At the base of the San Miguel...there is...300 feet [of] shale that's part of the San Miguel Formation; it's just the lower shale member."<sup>8</sup>

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<sup>5</sup> The permitted pressure will not exceed 0.5 psi per foot of depth to the top of the injection/disposal interval, unless the results of a fracture pressure step-rate test support a higher pressure. (<http://www.rrc.state.tx.us/oil-gas/publications-and-notices/manuals/injectiondisposal-well-manual/summary-of-standards-and-procedures/technical-review/>)

<sup>6</sup> Equipment Transport Exhibit No. 54.

<sup>7</sup> The longstring casing will be 7-inch, 24 lb-per-foot.

<sup>8</sup> Trans. Vol. I, pg 181, ln 6-19.

### **Nearby Wellbores**

There are two wells located within a quarter-mile radius of the proposed Quaileo No. 1 that penetrate the proposed disposal zone:

- 1) The CML Exploration Montemayor Well No. 1, API No. 42-127-35209, (“Montemayor No. 1”) is located within a quarter mile to the north. This well is cased and cemented across the proposed injection interval for Quaileo No. 1. The Montemayor No. 1 has 9-5/8-inch surface casing set at a depth of 1,203 feet and cemented with cement circulated to surface. A 7-inch production string casing was set at a depth of 4,930 feet and cemented with cement circulated to surface.
- 2) The Longhorn Gas Company Qualico 28 Lease, Well No. 1, API No. 42-127-31754, (“Qualico 28-1”) is located approximately 1,003 feet from the proposed Quaileo No. 1 location. The Qualico 28-1 is a dry hole that was plugged and abandoned. The well was drilled to a total depth (TD) of 3,000 feet, which penetrates a portion of the proposed injection interval for Quaileo No. 1. The Form W-3 shows that the well was plugged on October 1, 1978. Plug No. 1 was set from 1,052 feet to 1,152 feet (40 sacks of Class H cement), Plug No. 2 was set from 352 feet to 452 feet (30 sacks of cement), and Plug No. 3 was set from 0 feet to 10 feet (5 sacks of cement). Form W-3 also indicates that 9.8 lb per gallon mud was pumped in the well.<sup>9</sup> The Qualico 28-1 “was plugged many years ago and was approved by the Railroad Commission at that time...some of the plugging regulations have changed since then. But the lower plug is set basically two feet below the base of useable drinking water [BUQW].”<sup>10</sup>

### *Model Results*

The Applicant’s expert witness, Greg Casey, senior engineer and Vice President of ALL Consulting, LLC (“ALL”), modeled injection operations to determine whether the operation of the proposed Quaileo No. 1 would cause an upward migration of fluid in the Qualico 28-1 wellbore. Mr. Casey concludes that injection into the proposed interval with the proposed injection volumes are insufficient to initiate flow in the Qualico 28-1. Using a fluid flow mathematical model to calculate the pressure buildup at a distance of 1,003 feet, Mr. Casey concludes that “at 30 years of continuous injection at the maximum rates you’d have a pressure buildup of 361 psi at that point in the reservoir.”<sup>11</sup> In contrast, “it takes 391 psi to start fluid moving upward in the [Qualico 28-1] well, and your maximum pressure you’re going to see in the formation is 361 psi. You’re not going to overcome the weight of the mud.”<sup>12</sup>

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<sup>9</sup> Equipment Transport Exhibit No. 22.

<sup>10</sup> Tr. Vol. I, pg. 152, ln 13-18.

<sup>11</sup> Tr. Vol. I, pg. 158, ln 13-15.

<sup>12</sup> Tr. Vol. I, pg. 161, ln 2-5.

In Mr. Casey's opinion, the minimum pressure required to initiate upward flow was calculated using conservative values, such as:

- 1) 2,250 feet as the top of the injection zone, which is 250 feet higher than the actual top of 2,500 feet;
- 2) 9.5 lb per gallon mud in the Qualico 28-1 well versus the actual mud weight of 9.8 lb per gallon;
- 3) An initial reservoir pressure gradient of 0.32 psi per foot, as measured at the Heckmann-Caterina SWD, located 10 to 12 miles to the south-southeast. Regional data for the San Miguel/Olmos Formations indicate a range from 0.30 to 0.35 psi per foot;
- 4) A porosity of 20%, which is near the low end of the 19% to 27% range in the area. Using a higher porosity would allow for more void space for the water, and would not build up as much pressure;
- 5) A permeability of 20 millidarcies (md), which is considered average for the area. The permeability ranges from 10 md to 100 md in this area, and using a lower permeability results in a higher pressure buildup than if 100 md was used;
- 6) A height of injection zone of 1,000 feet, a 50% reduction of the requested permitted height of injection interval of 2,000 feet; and
- 7) An assumption that fluids would be continuously injected over a 30-year period at the maximum requested injection volume of 15,000 bpd.

In Mr. Casey's analysis, the use of "the maximum permitted rate of 15,000 bpd...is ultra conservative...in my...20-plus years of work, I have yet to see an injection well operate; one, continuously, or two, anywhere near its maximum rate for that continuous time. Typical operation of an injection well, you're running at most, probably two-thirds of your rate on an average. And they typically shut down at different times, for...pump issues, well issues...electrical problems."<sup>13</sup> In addition, "from a safety factor...I chose 2,250 feet instead of 2,500 that's about a 40-psi difference...that's basically a 40 psi safety factor. Another item that we didn't include in our calculation was...the pressure increase due to the gel strength of the mud...drilling mud's designed to semi-harden like gelatin once it stops pumping... and it's about another 20 pounds of pressure in order to start the mud moving."<sup>14</sup>

On cross-examination, the Protestant questioned Mr. Casey on how the actual perforated interval(s) will be determined in the proposed Qualeo No. 1. "You get the information from the drilling of the well...run well logs, we'll evaluate the logs...usually we'll look at, you know,

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<sup>13</sup> Tr. Vol. I, pg. 156, ln 7 – 17.

<sup>14</sup> Tr. Vo. I, pg. 161, ln 6 – pg. 162, ln 1.

perforating as much of the zone is as available at the wellbore...once the water leaves the wellbore itself, it's available to the entire formation...so the actual injection interval ...we still consider the entire zone as the...zone that's handling the water because it's-once it leaves the well at the single perforation, it spreads out into the entire reservoir...at this point in time and right now, we're considering 2,000...the whole 2,000 feet."<sup>15</sup> Mr. Casey states that the actual perforation zone could be less than 2,000 feet, but the hope would be 2,000 feet, depending on the actual wellbore data once the well is drilled, and regardless of the perforated interval, the entire injection zone is considered to be the zone taking water. Mr. Casey asserts that "no matter where you perforate, once it moves away from the well, it's available to the entire formation...so it's going to find every available...permeable area to travel."<sup>16</sup>

Mr. Casey and David Channell, ALL's geologist, have not yet determined the exact interval(s) to be perforated within the proposed injection interval. However, they have examined other wells permitted in the Olmos and San Miguel Formations, and injection intervals range from 1,800 to 3,200 to 3,600 feet in thickness. "We looked at some logs, and you can generally tell that there's quite a bit of available zone, and well over 1,000 feet."<sup>17</sup> Mr. Channell estimates that the thickness of the Olmos and San Miguel Formations at the Shook 1-1H (API No. 42-127-33631), approximately 6 miles to the southwest, extends from 2,400 feet to 4,180 feet, a total of approximately 1,780 feet based on the well log. From a geological standpoint, Mr. Channell estimates that approximately 1,400 feet of the 1,780 feet in the Shook 1-1H is sufficiently porous, which is greater than 50% of the total thickness. Based on this offset log, Mr. Channell agrees that it was reasonable for Mr. Casey to use 1,000 feet, or 50% of the requested 2,000 feet of injection interval as the height of the injection zone in his analysis.

### ***Existing Disposal Wells in the Area***

A total of seventeen commercial disposal permits have been granted within a ten-mile radius of the proposed disposal well. The total permitted volume of all seventeen disposal permits is 232,500 bpd. However, this total includes two wells that have been plugged, leaving a total of fifteen commercial disposal well permits within a ten-mile radius. Of these fifteen permits, thirteen include the Olmos Formation, the San Miguel Formation, or both formations in the permitted disposal interval. Of these fifteen permits, only eight are currently active. The total permitted volume for the eight active permits is 97,500 bpd. The actual average daily injection volume is 40,127 bpd. The status of the remaining seven permits that have been granted but not activated is unknown. Four of the eight activated commercial disposal permits have reported a maximum injection pressure in excess of the maximum permitted injection pressure. The Applicant believes that this indicates that the facilities do not have additional disposal capacity, even though the actual average daily injection volume is less than the permitted volume. Although these facilities may have additional permitted capacity, the reporting of injection pressures at or above the maximum permitted pressure indicates that they cannot inject any more fluid.

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<sup>15</sup> Tr. Vol. II, pg. 41, ln 10 – pg. 42, ln 7

<sup>16</sup> Tr. Vol. II, pg. 129, ln 17-21.

<sup>17</sup> Tr. Vol. II, pg. 129, ln 12 – 13.

The other four active permits have not reported a maximum injection pressure in excess of the permitted maximum. However, three of the four have reported a maximum injection pressure that is 85% or greater of the maximum permitted injection pressure. Fernando DeLeon, the Applicant's engineering witness with experience in injection well permitting, monitoring, and testing states that there is a large discrepancy between permitted and actual capacity, as "the injection disposal permits are requested in hope of any possible anticipated volume and pressure that might be used, so they're maximized so as to not require a permit amendment down the road."<sup>18</sup>

ALL works with oil and gas companies in managing waste and wastewater disposal. Mr. Casey has performed numerous audits of facilities in the area, and has first-hand knowledge of disposal operations in this area of Dimmit County. Mr. Casey states that when he conducts an audit "we have a copy of the injection permit with us, and we physically look at the gauges on the well and talk with the people on-site...we do a complete audit to determine how they're operating a facility."<sup>19</sup>

The Applicant is aware that the Protestant is concerned about potential surface breakouts, such as the Sandy-Mogford breakout event. Protestant WGCD is concerned that the proposed Quaileo No. 1 may cause a breakout at the Qualico 28-1, similar to the Mogford-Sandy event. Mr. Casey is familiar with the operations at the Sandy facility which may have contributed to a breakout at the Mogford well, as Mr. Casey audited the Sandy SWD in mid-October 2012.<sup>20</sup> "That site, when we audited it, it failed the audit...it was operating significantly above its maximum allowable injection pressure."<sup>21</sup> Mr. Casey states that "the State sets that [maximum surface injection] pressure for a reason, and that's to prevent...fractures being created or potential breakout at the well itself."<sup>22</sup> "When you consistently inject at a much higher pressure than you're allowed, you can create pathways within your reservoir...I can't say that's what caused it [breakout at the Mogford well], but it could be a contributing factor in causing...high pressure in the reservoir."<sup>23</sup> Mr. Casey states "we won't be operating above our maximum allowable pressure, which could have been the whole cause of any issues they [Sandy SWD and Mogford well] had."<sup>24</sup>

Disposal wells within a ten-mile radius of the Equipment Transport Quaileo Lease include Texas Energy Services, LLC's Frost National Bank, Well No. 1. At the time of the audit, this facility was operating near maximum capacity and only accepting water from their own trucks. In addition, Basic Energy Services, L.P.'s Carrizo Springs SWD, Well No. 1 was

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<sup>18</sup> Tr. Vol. I, pg. 54, ln 12-15.

<sup>19</sup> Tr. Vol. II, pg. 139, Ln 10-14.

<sup>20</sup> The Sandy SWD was identified by WGCD as the cause of a breakout at a nearby "Mogford well"; *See Protestants evidence.*

<sup>21</sup> Tr. Vol. II, pg. 127, ln 4-7.

<sup>22</sup> Tr. Vol. II, pg. 235, ln 7-9.

<sup>23</sup> Tr. Vol. II, pg. 235, 1-3, 10-13.

<sup>24</sup> Tr. Vol. II, pg. 140, ln 21-23.



accepting approximately 90% of their own water, experiencing injection issues, and operating close to maximum capacity. During ALL's study for Murphy Oil, Mr. Casey visited two Olmos/San Miguel Formation disposal wells, and "both of the facilities I visited...they're running...at or above their maximum allowable injection pressure...one of the reasons why I didn't approve them for use by Murphy."<sup>25</sup>

### **Equipment Transport's Proposed Facility and Current Operations**

According to Arthur Streeter, Vice President of legal permitting and compliance, Corporate Secretary, and General Counsel for Equipment Transport, the company has been involved in the fluid transportation business since 2010. Equipment Transport's business operations include transporting produced water, flowback water, and fresh water for oil and gas companies. Equipment Transport's Texas operations are mainly conducted in Dimmit, Webb, and Maverick Counties. Derrell Hardison, General Manager of Texas operations, has over 20 years of experience in the oil and gas industry, which includes injection wells. Equipment Transport has an active P-5 and a hauler's permit (Permit No. 5377) with the Commission. Equipment Transport's current business does not require financial assurance, but if the permit is granted, Mr. Streeter stated that the company is prepared to forward a \$25,000 letter of credit.

The proposed disposal well location is the Qualeo Lease, which is also the location of Equipment Transport's Texas operations center. The proposed disposal facility will be located on FM 186, approximately five miles southwest of Carrizo Springs. Current operations on the lease include a shop with eight full-time mechanics to service trucks, as well as administrative offices for Texas operations. Equipment Transport currently operates approximately fifty-five transport trucks with 130 to 150 barrel trailers. These trucks currently haul produced and flowback water to other disposal sites, requiring the trucks to travel past Equipment Transport's own yard to dispose of the water. If the applied-for permit is approved, Equipment Transport anticipates water that is currently hauled to other disposal wells will be disposed of at their own well. A large volume of the produced and flowback water gathered is generated southwest of Carrizo Springs. If the permits are granted, Equipment Transport trucks will not have to travel as far to do the same amount of work, which would increase efficiency. The proposed well will also reduce the number of highway miles traveled, as well as reducing truck traffic through Carrizo Springs.

Equipment Transport has determined that there is a need for additional disposal in the vicinity of their Texas operations. Commission documents show 6,287 permitted locations representing pending oil or gas wells, where either the operator has not yet filed completion paperwork with the Commission, or the completed well has not yet been set up with a Commission identification number. There are 8,026 oil wells on schedule and 4,102 gas wells on schedule in the Eagle Ford Shale play as of April 2, 2015. Between May 1, 2014 and April 30, 2015, a total of 1,898 drilling permits were issued for Dimmit, Zavala and Webb Counties. Of the 1,898 permits issued, 1,620 were for Eagle Ford wells.

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<sup>25</sup> Tr. Vol. 1, pg 133, ln 6-10.

In Mr. Casey's opinion, many facilities are not designed to adequately filter oilfield fluids prior to injection. In Mr. Casey's nearly 30 years of experience with injection wells, typical problems occur due to a lack of filtration of the disposal waste prior to injection, to filter out solids and to remove contaminants that tend to cause scaling issues and bacteria growth downhole. Over time, these fluids damage the wellbore, resulting in declining injection rates over the life of disposal wells, requiring remedial work of the wellbore. ALL's design for the proposed disposal facility incorporates desander-type systems to remove solids and specialized equipment to reduce oil and oil particulates to less than 20 parts per million (ppm) prior to injection.

### **Seismic Survey**

A survey of information from the United States Geological Survey (USGS) shows that there are no historical seismic events within an 18 km radius, or a circular area of 397.6 square miles around the proposed disposal well locations.

### **WGCD's Evidence, Quaileo No. 1**

Ed Walker, WGCD General Manager, states that the WGCD is protesting the Quaileo No. 1 application because of the potential for groundwater contamination. WGCD is concerned that the Qualico 28-1 may act as a conduit for injected fluids to migrate and cause the pollution of fresh water. Mr. Walker stated that the WGCD is concerned that the subject application creates a scenario similar to the Sandy SWD and the Mogford well surface breakout. According to Mr. Walker, even though the Sandy SWD was located greater than a quarter mile from the Mogford well, the Mogford well was a conduit for fluid migration: "obviously, that fluid, after four years, took the path of least resistance."<sup>26</sup>

### *Sandy-Mogford Well History*

The Sandy-Mogford event refers to a breakout that occurred at the the Alamo Lumber Company Lease, Well No. 1 ("Mogford well") in March, 2011.<sup>27</sup> According to the Protestant, the breakout at the Mogford well occurred four years and one month after injection operations commenced at the Sandy SWD. The Sandy SWD was drilled to a depth of 4,025 feet in December, 2006, and perforated in the Olmos Formation between 3,547 feet and 3,576 feet.<sup>28</sup> The Mogford well was identified as a plugged dry hole, located 1,747 feet (0.33 miles) from the Sandy SWD. Injection commenced at the Sandy SWD in February, 2007, and the Mogford breakout occurred in March, 2011. According to Dr. Ronald Green, a groundwater hydrologist, "at the time, the Railroad Commission discontinued the injection at Sandy and the flow [at the Mogford well] stopped."<sup>29</sup> The Mogford well was re-plugged by the RRC in May 2011.

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<sup>26</sup> Tr. Vol. II, pg. 162, ln 6-7.

<sup>27</sup> The proposed Quaileo No. 1 well location is 6.2 miles west-southwest from the Mogford well, WG Exhibit No. 6.

<sup>28</sup> WG Exhibit No. 6.

<sup>29</sup> Tr. Vol. II, pg. 73, ln 23-25.

The plugging records for the Mogford well show that the well was drilled to a TD of 3,525 feet on July 28, 1949, and was subsequently plugged on August 6, 1949.<sup>30</sup> The records also indicate that a cement plug consisting of 20 sacks of cement was set above a set of perforations at 3,416 feet, another plug consisting of 20 sacks of cement was set at the top of 4 ½ inch casing string inside the surface pipe, and an additional 5 sacks of cement were pumped at top of surface casing. The report also indicates that mud-laden fluid was pumped in the hole.

In Dr. Green's opinion, injection operations at the Sandy SWD caused the Mogford well surface breakout: "When they were injecting...very close to the permitted pressure...the geologic system was not able to confine ...into the targeted injection zone, and fluid was able to escape the injection zone via this abandoned well that was plugged...a number of years ago."<sup>31</sup> Dr. Green used a mathematical equation, consisting of known inputs such as the distance between the Mogford well and the Sandy SWD, a time to break-out of four years and one month, a Sandy SWD average injection rate of 2,000 bpd, an average injection pressure of 1,700 psi, and an injection interval of 29 feet. Dr. Green assumed other inputs required by the equation and was able to replicate a breakout at the Mogford well location.

Dr. Green considers the proposed location of the Quaileo No. 1 to be "a poor location to place an injection well that would inject into the Olmos and San Miguel Formations."<sup>32</sup> Dr. Green's opinion is based on the Qualico 28-1 well located approximately 1,000 feet away. Dr. Green disagrees with the Applicant's conclusion that injection operations at the proposed Quaileo No. 1 will not cause fluids to migrate from the injection interval.

On cross-examination, Dr. Green stated that he had two concerns with the Applicant's analysis: the input value of 1,000 feet for the injection zone, and the conceptualization that the Qualico 28-1 borehole was filled with mud with properties that will act to prevent fluid flow.<sup>33</sup> In Dr. Green's opinion, "this would only be a conservative calculation in terms of pressure if they...could effectively inject over an entire 1000-foot section. Wouldn't have to be [all together]. It could be piecemeal...through the formation. But if it's anything less than 1,000 it is not conservative. Because when you reduce the injection interval, these numbers go up considerably."<sup>34</sup> In Dr. Green's opinion, "the vertical permeability is a factor of 100 to 1,000 times less than the horizontal permeability. So the injected fluids, where they go in, tend to go in a lateral direction, and those intervening shale layers are an impediment for the flow to expand beyond the injection interval-pardon me, the perforation interval as we're describing it."<sup>35</sup>

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<sup>30</sup> WG Exhibit No. 5.

<sup>31</sup> Tr. Vol. II, pg. 73, ln 1-6.

<sup>32</sup> Tr. Vol. II, pg. 51, ln 20-22.

<sup>33</sup> Tr. Vol. II, pg. 83, ln 21 – pg. 54.ln 1.

<sup>34</sup> Tr. Vol. II, pg. 66, ln 10-18.

<sup>35</sup> Tr. Vol. II, pg. 53, ln 25 – pg. 54, ln 7.

Dr. Green performed calculations assuming an average daily injection rate of 5,000 bpd, and varied the injection interval thickness from 50 to 500 feet, concluding that when you reduce the thickness of the injection zone, you increase the pressure buildup. An injection rate of 5,000 bpd and an injection zone thickness of 50 feet resulted in an incremental pressure build-up at the Qualico 28-1 of 1,421 psi after one year, and 2,502 psi after 30 years. Assuming an average daily injection rate of 5,000 bpd and an injection zone thickness of 500 feet, the estimated incremental pressure build-up was estimated to be 142 psi after one year, and 250 psi after 30 years.<sup>36</sup> In Dr. Green's conceptual model, "I did not assume that there was an effective seal in the borehole, the dry hole [Qualico 28-1], 31754, as reflected in the ALL Consulting report in [Exhibit] 43. But it is consistent with what we've seen at the Mogford well. So this is a case where the cement and the mud that would have been in the dry hole were not sufficient to cap off that-that borehole and maintain its integrity of protecting the fresh and the USDW formations."<sup>37</sup>

WGCD's review of Commission records of the two closest injection wells to the proposed Qualeo No. 1 that listed perforation information are the Sandy SWD<sup>38</sup> and the Texas Energy Services SWD. The Sandy SWD was perforated from 3,547 feet to 3,576 feet<sup>39</sup>, an interval of 29 feet.<sup>40</sup> Form H-1, H-1A for the Texas Energy Services SWD indicates the well was to be perforated from 3,040 feet to 3,220 feet, an interval of 180 feet. Dr. Green concludes that the listed perforated intervals of the "only two wells that I found that had specific information in the vicinity, and they are considerably less [than 1,000 feet of perforated interval]. And even if, as the previous testimony indicated that they [SWD operators] would go back and reperf...there's no evidence of that...I can't imagine that they would perf 1,000 feet."<sup>41</sup> According to Dr. Green the Applicant's mathematical model "is very sensitive to the injection interval, the perforation interval."<sup>42</sup>

### **EXAMINERS' ANALYSIS OF THE EVIDENCE**

#### **Public Interest**

The Examiners conclude that the Applicant provided evidence supporting a need for additional disposal in this area, and that the proposed disposal well is in the public interest. The Protestant did not offer any contradicting evidence or rebut the Applicant's evidence that additional disposal is needed. Equipment Transport services the Eagle Ford shale play in Texas, and Commission documents show there were 6,287 permitted locations representing pending oil or gas wells in the Eagle Ford shale play as of April 2, 2015. Between May 1, 2014 and April 30, 2015, a total of 1,898 drilling permits were issued for Dimmit, Zavala and Webb Counties.

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<sup>36</sup> WG Exhibit No.4.

<sup>37</sup> Tr. Vol. II, pg 75, ln 6-15.

<sup>38</sup> WGCD refers to the Carmen Jung Lease, Well No. 1 (API No. 42-127-33416), as the Sandy SWD. (WG Exhibit No. 2)

<sup>39</sup> WG Exhibit No. 6 indicates the perforations are in the Olmos Formation.

<sup>40</sup> WG Exhibit No. 8 lists the the Sandy SWD Jung Lease, Well No. 1 injection interval to be between 3,500 feet and 3,800 feet.

<sup>41</sup> Tr. Vol. II, pg. 59, ln 19-24.

<sup>42</sup> Tr. Vol. II, pg. 60, ln 4-5.

Of these 1,898 permits issued, 1,620 were for Eagle Ford wells. Equipment Transport has knowledge of the volume of water generated in the area that requires disposal. Equipment Transport currently operates approximately fifty-five transport trucks that haul produced and flowback water to other disposal sites. The proposed disposal well will increase efficiency, in terms of reducing both truck travel time and miles driven to properly dispose of water.

### **Any Injury to Any Oil, Gas, or Other Mineral Formation**

The productive formations within two miles of the proposed well location are the Austin Chalk Formation, at a depth of approximately 4,900 feet, and the Eagle Ford Formation, at depths ranging from 5,800 feet to 6,100 feet. Both the Austin Chalk and Eagle Ford Formations are at greater depths than the injection interval. The Austin Chalk and Eagle Ford Formations will be protected by approximately 300 feet of shale at the base of the San Miguel Formation that will prevent fluids from migrating to the productive formations below the injection interval.

There is past production within two miles from at least one well that was completed in the San Miguel/Olmos Formations. As a result, the proposed Qualeo No. 1 was filed pursuant to Statewide Rule 46. The permit for Qualeo No. 1 will authorize the injection of a maximum volume of 15,000 bpd of salt water and RCRA-exempt waste in the San Miguel and Olmos Formations between 2,500 feet and 4,500 feet. There are currently no wells within a two mile radius producing from the injection interval. The San Miguel and Olmos Formations have previously been authorized for disposal by the Commission in Dimmit County. The evidence shows that thirteen of the fifteen commercial disposal well permits granted within a ten-mile radius of the proposed Qualeo No. 1 location list either the San Miguel or Olmos Formation as a formation permitted for disposal.

### **Adequate Protection of Ground and Surface Fresh Water**

The Examiners conclude that the injection interval within the Olmos and San Miguel Formations will be separated from freshwater formations by impervious beds which will adequately protect fresh water. The GAU identifies the BUQW at a depth of approximately 1,150 feet at the proposed disposal well location. The Applicant provided a letter from the GAU stating that the use of the Olmos and San Miguel Formations will not endanger the freshwater strata in that area and that the formations to be used for disposal are not freshwater-bearing. The Navarro Formation is located above the Olmos Formation, and the bottom 400 feet of the Navarro Formation is a shale interval that will be a confining zone to protect freshwater formations above the disposal interval.

Based on the evidence in the record, the Examiners conclude that there are no wellbores that will act as a conduit for fluids to escape the injection interval. Two wellbores within a quarter mile radius penetrate the proposed injection interval. The Montemayor No. 1 is located within a quarter mile to the north and is cased and cemented across the proposed injection interval for Qualeo No. 1. The Qualico 28-1 is located 1,003 feet from the proposed Qualeo No. 1 location and has been plugged in a manner that will prevent the movement of fluids from the disposal zone into freshwater strata. The Applicant's mathematical model shows that after

30 years of constantly injecting fluid at the maximum requested volume of 15,000 bpd, the pressure build-up at the Qualico 28-1 location will not result in upward flow.

The Protestant's witness disagrees with the Applicant's conclusion that the proposed injection well and the manner in which the Qualico 28-1 was plugged will not cause the pollution of fresh water. The Protestant does not believe the Applicant's use of 1,000 feet as the cumulative injection interval for the proposed well is reasonable. The Applicant's witness also questions whether the properties of the mud that was pumped in the hole at the time the well was plugged can be considered to have any effectiveness in preventing fluid movement. The Examiners' conclude that the evidence in the record, consisting of the plugging record for the Qualico 28-1 indicates that 9.8 ppg mud was pumped in the hole and there is no evidence to the contrary. The Examiners also conclude that the Applicant's use of a net injection thickness of 1,000 feet (less than 50% of the gross interval thickness) is a reasonable assumption. The Applicant's witness identified nearly 1,400 feet out of a gross thickness of 1,780 feet (greater than 78%) in the Olmos and San Miguel Formations that is considered to be sufficiently porous and permeable for injection based on the Shook 1-1H well log. The Applicant's witness estimates the gross thickness at the proposed well location to be approximately 2,000 feet and therefore, an assumption that at least 50%, or 1,000 feet is a reasonable assumption.

The Protestant provided no well logs showing that less than 1,000 feet would be sufficiently porous and permeable and suitable for injection within the Olmos and San Miguel Formations. The Protestant considers the proposed Quaileo No. 1 and its potential effects on the Qualico 28-1 to be analogous to the Sandy-Mogford event. However, the evidence in the record shows that the total permitted injection interval for the Sandy SWD was 300 feet. Only 29 feet of the 300 feet was perforated. The Applicant has identified 1,400 feet of sufficiently porous interval out of a gross interval of 1,700 feet in the Olmos and San Miguel Formations in an offset wellbore suitable for injection. The Applicant's model shows that a net injection interval of 1,000 feet would not result in the upward movement of fluid in the Qualico wellbore.

The Protestant questions the Applicant's use of a 1,000 foot injection interval since they were able to simulate a breakout at the Mogford well using a calculation with the 29 feet of perforated interval in the Sandy SWD as the injection interval. The Examiners conclude that the Sandy SWD operations that caused a breakout at the Mogford well differ from the proposed Quaileo No. 1 application and its potential impact on the nearby Qualico 28-1 plugged well. In addition to a larger injection interval for the proposed well as compared to the Sandy SWD, the following evidence further differentiates the Sandy-Mogford event from the subject application.

- 1) The Protestant's own evidence shows there were two injection wells operated by Sandy SWD on the Carmen Jung Lease injecting into a similar interval during the time the break-out occurred at the Mogford well. WGCD's summary of the Sandy SWD operations are based solely on the Carmen Jung Lease, Well No. 1. WG Exhibit No. 8 shows that the Carmen Jung Lease, Well No. 2 ("Sandy SWD No. 2"), API No. 42-127-33572, is located approximately 0.4 miles northwest of the Sandy SWD or, Carmen Jung Lease, Well No. 1, and approximately 0.7 miles northwest of the Mogford well. WG Exhibit No. 8 contains a Commission letter

dated May 2, 2011 addressed to Sandy SWD, LLC regarding the intent to suspend, modify, or terminate the permits for the Sandy SWD, LLC Jung Carmen Lease, Well Nos. 1 and 2. The letter states that the office considers the existence of a breakout to be a direct result of injection into the Jung Nos. 1 and 2.

- 2) The only H-10 contained in WG Exhibit No. 8 for the Sandy SWD No. 2 is for the time period from April, 2009 to March, 2010. During this time, the listed injection interval for the Sandy SWD No. 2 was 3,210 feet to 3,356 feet, while the average surface injection pressure ranged between 1,400 psi and 1,650 psi, and the maximum surface injection pressure ranged between 1,600 psi and 1,750 psi. During two out of the twelve months both the average surface injection pressure and maximum surface injection pressure was greater than the typical Commission guideline in setting the maximum surface injection pressure of 0.5 psi per foot to the top of the injection interval. The total injected fluid volume reportedly injected during these two months was 102,327 bbl.<sup>43</sup> The maximum surface injection pressure reported exceeded 0.5 psi per foot to the top of the injection interval during ten of the twelve months during this same period. The actual permits for each of the injection wells are not in evidence. As a result it is unknown whether the maximum surface injection exceeded the maximum permitted surface injection pressure for either well.
- 3) One of the Applicant's witnesses conducted an audit of the Sandy SWD wells and noted that the wells were injecting at surface injection pressures that exceeded the maximum permitted pressures which may have been sufficient to create fractures in the the injection interval which may have contributed to the breakout at the Mogford location. The Protestant's evidence shows that the reported average and maximum injection pressures exceeded 0.5 psi per foot to the top of the injection interval for one of the Sandy wells prior to the breakout at the Mogford well.

In summary, there is evidence indicating that other factors may have contributed to the Sandy-Mogford event. The evidence shows that at least 1,400 feet of the requested 2,000 gross foot interval in the Olmos and San Miguel Formations in the subject application will be sufficiently porous to accept injected fluids. Continuous injection into at least 1,000 feet of interval in the proposed wellbore, at the maximum permitted injection rate of 15,000 bpd over a period of 30 years will not cause the upward movement of fluids in the nearby Qualico 28-1 plugged wellbore. Again, the Examiners conclude that there are no wellbores that will act as a conduit for fluids to escape the injection interval.

### **Financial Responsibility**

Equipment Transport has an active Organization Report (Form P-5) on file with the Commission. Equipment Transport's current operations do not require financial assurance. Mr.

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<sup>43</sup> The reported monthly injection volumes for the Jung Lease, Well No. 1 and Jung Lease, Well No. 2 between April 2009 and March, 2010 do not vary by more than 1 bbl during any of the twelve months.

Streeter stated that the company will file a letter of credit in the amount of \$25,000 if a disposal permit is granted.

**FINDINGS OF FACT**

1. Equipment Transport, LLC seeks a permit authorizing commercial disposal operations pursuant to 16 Tex. Admin. Code § 3.46 for the Quaileo Lease, Well No. 1, Winter Garden, S. (Olmos 2900) Field, Dimmit County, Texas.
2. The application for the Quaileo Lease, Well No. 1 was mailed to all adjacent surface owners, the Dimmit County Clerk, and CML Exploration (“CML”), the only operator within a half-mile of the proposed disposal wells. 16 Tex. Admin. Code § 3.46(c)(1), (2).
3. Notice of the Quaileo Lease, Well No. 1 commercial disposal well application was published in the *Carrizo Springs Javelin*, a newspaper of general circulation in Dimmit County, Texas on August 13, 2014. 16 Tex. Admin. Code § 3.46(c)(4).
4. Wintergarden Groundwater Conservation District, which has a jurisdiction that includes Dimmit County, protested the Quaileo Lease, Well No. 1 application.
5. At least 10 days’ notice of the hearing was provided to all adjacent surface owners of the surface and to the Dimmit County Clerk. The Applicant is the owner of the surface tract. CML Exploration is the only operator within a half-mile radius of the proposed wells. A waiver signed by CML Exploration states that there is no objection as to timing of the notice of hearing and that the company has no objection to approval of the application. 16 Tex. Admin. Code § 3.46(c)(5)(A).
6. The use or installation of the Quaileo Lease, Well No. 1 is in the public interest.
  - a. As of April 2, 2015 there are 6,287 permitted locations representing pending oil or gas wells in the Eagle Ford shale play. Between May 1, 2014 and April 30, 2015, a total of 1,898 drilling permits were issued for Dimmit, Zavala and Webb Counties. Of the 1,898 permits issued, 1,620 were for Eagle Ford wells.
  - b. The proposed disposal well will be increase efficiency, in terms of reducing both truck travel time and miles driven to properly dispose of water.
7. The use or installation of the Quaileo Lease, Well No. 1 will not endanger or injure oil, gas, or other mineral formations.



- a. The productive formations within two miles of proposed Quaileo Lease, Well No. 1 are the Austin Chalk Formation, at a depth of approximately 4,900 feet, and the Eagle Ford Formation, at depths ranging from 5,800 feet to 6,100 feet;
  - b. The requested disposal formations for the Quaileo Lease, Well No. 1 are the Olmos and San Miguel Formations.
    - I. The Olmos and San Miguel Formations are located above the productive Austin Chalk and Eagle Ford Formations.
    - II. The Austin Chalk and Eagle Ford Formations will be protected by approximately 300 feet shale at the base of the San Miguel Formation that will prevent fluids from migrating to the productive formations below the injection interval.
    - III. Either the San Miguel Formation, the Olmos Formation, or both, have been authorized for commercial disposal operations in thirteen wells within a ten mile radius of the proposed Quaileo Lease, Well No. 1.
8. With proper safeguards, both ground and surface fresh water can be adequately protected from pollution.
- a. The base of usable-quality water (BUQW) occurs from the surface to a depth of 1,150 feet.
    - I. The Quaileo Lease, Well No. 1, will be constructed with 9-5/8 inch, 30 lb.-per-foot surface casing at a depth of 1,350 feet, and the surface casing will be cemented with cement circulated to surface. A 7-inch, 24 lb.-per-foot longstring casing will be set at a depth of 4,600 feet and cemented in place with cement circulated to surface;
      - i. The injection interval is between 2,500 feet to 4,500 feet in the Olmos and San Miguel Formations;
      - ii. The maximum surface injection pressure will be 1,250 psi; and
      - iii. The maximum daily injection volume for will be 15,000 bpd.
  - b. Two wellbores penetrate the Quaileo Lease, Well No. 1 injection interval within a quarter-mile radius.

- I. The Montemayor No. 1 is cased and cemented across the proposed injection interval for Quaileo No. 1;
  - II. The Qualico 28-1 is located approximately 1,003 feet from the proposed Quaileo No. 1 location
  - III. The Qualico 28-1 is a dry hole drilled to a total depth (TD) of 3,000 feet that was plugged and abandoned;
  - IV. The Qualico 28-1 was plugged on October 1, 1978. At the time the well was plugged 9.8 lb. per gallon mud was pumped in the well Plug No. 1 was set from 1,052 feet to 1,152 feet (40 sacks of Class H cement), Plug No. 2 was set from 352 feet to 452 feet (30 sacks of cement), and Plug No. 3 was set from 0 feet to 10 feet (5 sacks of cement);
  - V. The Qualico 28-1 is plugged below the depth of the BUQW;
  - VI. A mathematical model shows that injecting fluids in the permitted injection interval for the Quaileo No. 1 between 2,500 feet to 4,500 feet at the maximum permitted injection volume of 15,000 bpd for a period of 30 years will not cause the upward movement of fluid at the Qualico 28-1 location.
9. Equipment Transport has an active P-5 on file with the Commission. Equipment Transport's current operations do not require financial assurance. Financial assurance will be required prior to commencing disposal operations.

**CONCLUSIONS OF LAW**

1. Resolution of the subject application is a matter committed to the jurisdiction of the Railroad Commission of Texas. TEX. NAT. RES. CODE § 81.051.
2. The proposed fluid disposal operations will not cause the pollution of freshwater strata and will not endanger oil, gas or geothermal resources. Texas Water Code § 27.051(b)(2-3).
3. The installation and use of the proposed commercial disposal well is in the public interest. Texas Water Code § 27.051(b)(1).
4. Equipment Transport. has met its burden of proof and the application for the Quaileo Lease, Well No. 1 satisfies the requirements of Chapter 27 of the Texas Water Code and the Railroad Commission's Statewide Rule 46

**EXAMINERS' RECOMMENDATION**

Based on the above findings of fact and conclusions of law, the Examiners recommend that the application of Equipment Transport for commercial disposal authority pursuant to Statewide Rule 46 for the for the Qualeo Lease, Well No. 1, Winter Garden, S. (Olmos 290) Field, Dimmit County, Texas, be approved, as set out in the attached Final Order.

Respectfully submitted,



Karl Caldwell  
Technical Examiner



Marshall Enquist  
Administrative Law Judge