RAILROAD COMMISSION OF TEXAS

HEARINGS DIVISION

PROPOSAL FOR DECISION

OIL & GAS DOCKET NO. 7C-0299935

THE APPLICATION OF WEST TEXAS MUD DISPOSAL, LLC TO CONSTRUCT AND OPERATE A COMMERCIAL OIL AND GAS WASTE STATIONARY TREATMENT AND DISPOSAL FACILITY, SECTION 192, BLOCK 2, U. COTTON SURVEY (T&P RR CO.), A-64, REAGAN COUNTY, TEXAS

HEARD BY: Brian Fancher, P. G. – Technical Examiner
Dana A. Lewis – Administrative Law Judge

WRITTEN BY: Paul Dubois – Technical Examiner

APPEARANCES:

APPLICANT:	**REPRESENTING:**
Stephen Fenoglio Kenneth Kyle Rothlisberger Justin McIntosh Grant Jackson Mitch Hudgins Tom Freund Christopher Mathewson Mary Kay Skoruppa	West Texas Mud Disposal, LLC
PROTESTANTS:	**REPRESENTING:**
Clay Nance Grant Chumlea William J. Rogers Darrell Brownlow Katherine Sugg Patrick Shannon Ike Sugg Brian Phillips	Cal H. Sugg, Jr.

Regina Gomez

Santa Rita Underground Water Conservation District

PROCEDURAL HISTORY

Application Filed:	September 9, 2015
Application Published:	September 17, 2016
Protest Received:	October 1, 2016
Request for Hearing:	October 21, 2016
Referred for Hearing:	March 15, 2016
Notice of Hearing:	April 25, 2016
Hearing Held:	August 15 & 16, November 7 & 8, and December 13, 2016
Final Transcript Received:	January 3, 2017
Closings Arguments Received:	January 18, 2017
Replies Received:	February 3, 2017
Record Closed:	February 3, 2017
Proposal for Decision Issued:	July 14, 2017

STATEMENT OF THE CASE

West Texas Mud Disposal ("WTMD") seeks Commission authority to construct and operate a commercial oil and gas waste stationary treatment and disposal facility ("STF"), in Section 192, Block 2, U. Cotton Survey (T&P RR CO.), Abstract A-64, Reagan County, Texas. The proposed facility will occupy about 96 acres of a 457.99-acre tract. A 6-cell disposal pit will occupy approximately 40 acres, and a waste drying pad will occupy approximately 13 acres. The facility also will include a waste separating facility and a wash-out pit. Commission staff has assigned the following identification numbers to this application:

- CN-095 for the overall facility;
- CN-012269 for the collecting pit;
- CN-012270A-E for the five settling pits;
- CN-012271 for the disposal pit;
- CN-012273 for the drying pad; and
- CN-012274 for the wash-out pit.

The application was protested by Calvin H. Sugg, Jr. ("Sugg"), who owns land adjoining to three sides of the proposed facility. Mr. Sugg's representatives participated in the hearing. The application was also protested by the Santa Rita Underground Water

Conservation District ("District"). The District was present at the hearing and offered a public statement on the record, but it did not otherwise participate.

The Technical Examiner and Administrative Law Judge ("Examiners") recommend the application be denied. The proposed facility is located on and adjacent to a recharge zone of the Edwards-Trinity (Plateau) Aquifer. The evidence in the record indicates the playa[1] immediately north of the waste management units is a recharge feature for fresh groundwater below the site. The parties agree on that point. The parties disagree, however, on which aquifer is being recharged: WTMD argues the shallow recharge is not a part of the Edwards-Trinity (Plateau) Aquifer, while Sugg argues the two are one in the same. The Examiners find the evidence supports the latter. Regardless, WTMD argues the proposed facilities will be protective of all freshwater. Further, the evidence from both parties indicates a high likelihood that permeable pathways exist in the limestone underlying the site, and there is insufficient evidence of a natural confining strata or structure between the base of the waste treatment and disposal units and the shallow groundwater. The Examiners conclude that WTMD has not demonstrated the proposed facilities located in a recharge zone of a major aquifer are sufficient to protect fresh groundwater resources.

APPLICABLE LAW

This application is made by WTMD pursuant to Statewide Rule 8 [16 Tex. Admin. Code § 3.8], entitled "Water Protection." Statewide Rule 8(b) [16 Tex. Admin. Code § 3.8 (b)] states:

> *No pollution. No person conducting activities subject to regulation by the commission may cause or allow pollution of surface or subsurface water in the state.*

Statewide Rule 8(d)(1) [16 Tex. Admin. Code § 3.8 (d)(1)] states:

> *Prohibited disposal methods. ...no person may dispose of any oil and gas wastes by any method without obtaining a permit to dispose of such wastes.*

Statewide Rule 8(d)(6) [16 Tex. Admin. Code § 3.8 (d)(6)] states:

> *(A) Standards for permit issuance. A permit to maintain or use a pit for storage of oil field fluids or oil and gas wastes may only be issued if the commission determines that the maintenance or use of such pit will not result in the waste of oil, gas, or geothermal resources or the*

[1] A "playa" is landform characterized as a shallow basin with no outlet that may periodically contain water. The Texas Commission on Environmental Quality defines a "playa lake" as "a shallow (generally less than one meter deep), isolated, naturally ephemeral approximately circular lake located in an enclosed basin in the High Plains and West Central Plains areas of the state (30 Tex. Admin. Code 210.52[16])." The on-site playa and its surface and subsurface hydrologic characteristics are central to the disputed issues in this case.

> *pollution of surface or subsurface waters. A permit to dispose of oil and gas wastes by any method, including disposal into a pit, may only be issued if the commission determines that the disposal will not result in the waste of oil, gas, or geothermal resources or the pollution of surface or subsurface water (emphasis added).*
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> *(B) Application. ...The director may require the applicant to provide the commission with engineering, geological, or other information which the director deems necessary to show that issuance of the permit will not result in the waste of oil, gas, or geothermal resources or the pollution of surface or subsurface water (emphasis added).*

To implement Statewide Rule 8, the Commission has adopted Form H-11, "Application for a Permit to Maintain and Use a Pit," and it has established a Surface Waste Management Manual,[2] which contains the application requirements and operator guidance for commercial and non-commercial waste facilities regulated by the Commission. WTMD's proposal is for a commercial facility. The Commission's application requirements for commercial waste storage and disposal pits is described in the Surface Waste Management Manual.[3]

Of particular concern to this case, the Commission's Surface Waste Management Manual states that, for facilities located in major or minor aquifer outcrop areas:

> *A more critical review of applications for pits placed in these areas will be required. Each major and minor aquifer should have significant amounts of clay, shales, mudstones or other impervious materials as part of its makeup.*[4]

DISCUSSION OF THE EVIDENCE

Five days of hearings were held on August 15 & 16, November 7 & 8, and December 13, 2016. Per the agreement of the parties at the close of the hearing, written closing statements were submitted by both parties, and the Applicant submitted a response to the Protestant's closing statement.

APPLICANT WTMD'S EVIDENCE

WTMD's direct and rebuttal case included the testimony of six witnesses and 52 exhibits that were admitted into the record. WTMD's witnesses were as follows:

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[2] *See* http://www.rrc.state.tx.us/oil-gas/publications-and-notices/manuals/surface-waste-management-manual/ .

[3] *See* http://www.rrc.state.tx.us/oil-gas/applications-and-permits/environmental-permit-types-information/pits/commercial-disposal-pit-requirements/

[4] WTMD Ex. No. 50.

- Kenneth Rothlisberger is the General Manager of Weeks Environmental, LLC, an entity related to WTMD that operates a facility in Dimmit County (Permit Nos. STF-068, LT-0310) similar to the subject facility. (Direct Witness)

- Mitch Hudgins, P.E., Project Engineer and owner of Modern Technology—Modern Environment, LLC ("MTME"), signed and sealed the permit application for WTMD, and was accepted as an expert witness in the field of civil engineering. (Direct and Rebuttal Witness)

- Tom Freund, P.G., assisted in the preparation of the permit application and was accepted as an expert witness in the fields of geology and hydrogeology. (Direct Witness)

- Justin McIntosh, a project manager for Nor-Tex Resources, LLC, was accepted as an expert witness in the fields of water well drilling and the design and operation of salt water disposal wells and related facilities. (Rebuttal Witness)

- Mary Kay Skoruppa, a biologist for Hanson Professional Services, was accepted as an expert witness in the fields of biology, habitat characterization, conducting environmental assessments, wetlands determination, and endangered species habitat determinations. (Rebuttal Witness)

- Christopher Mathewson, Ph.D., Regents Professor Emeritus, Texas A&M University, was accepted as an expert witness in the fields of hydrogeology, engineering geology, environmental geology, and applied geomorphology. (Rebuttal Witness)

Site Description and Characterization

WTMD conducted site characterization activities by means of (1) reviewing readily-available public information sources, and (2) conducting site-specific observation, investigation, and analysis. The proposed WTMD site is located about 22 miles north of Big Lake, Texas, on the north side of Strawberry Patch Road about one mile east of FM 33. WTMD acquired the 457.99-acre tract on October 31, 2014.[5] The tract is situated and generally centered within T&P RR CO Survey, Block 2, Section 192, Abstract A-64. The proposed waste disposal facility will occupy about 96 acres on the south end of the tract.[6] The tract is currently mostly pasture with some oil & gas development, primitive roadways, and an aggregate storage area. A limestone quarry, a commercial disposal well, and a water well are located on the Holt property adjacent to the southwest part of the tract (*see* Attachment A).[7] The surrounding lands are similarly situated and consist mostly of pasture,

[5] WTMD Ex. No. 3.

[6] Tr. Vol. 1, page 48.

[7] Attachment A is modified from WTMD Ex. No. 8. The Examiners have added the location of certain salient features discussed in this proposal for decision.

center-pivot irrigated land, and oil and gas infrastructure. The proposed disposal facilities include:

- A concrete-lined separation facility, to receive wastes having free liquids;
- A clay-lined drying pad to receive wastes that do not contain visible free liquids but require additional drying before being placed in the disposal pit;
- A lined disposal pit to contain wastes that are dry enough for final disposal; and
- A concrete-lined wash-out pit.

Topography

As shown on WTMD Exh. Nos. 22 and 35, the proposed site is located on the edge of a topographic transitional axis trending from the southwest to northeast. Generally, the lands to the northwest of the transition, including the subject tract, are level and playas are numerous. That is, this topography is characterized by drainage into local playa basins from which there is no outlet for drainage. There are no surface streams that drain these lands and the playas are the dominant surface drainage features. Lands to the southeast of the transitional axis, however, exhibit an abrupt change in tophographic relief; dendritic surface drainage patterns of intermittent streams with surface drainage to the south and east are evident. Aerial photographs indicate drilling and production is occurring throughout the area, including within and around the numerous playas.[8]

The surface topography of the site tract itself is fairly level and most of the land surface slopes toward the center of the tract into a shallow playa basin, which is located north of the portion of the site designated for the proposed waste disposal facilities. The highest mapped elevation on site is about 2,645 feet on the southeast part of the tract, and the lowest elevation is about 2,630 feet in the center of the playa.[9] The playa is the dominant local surface drainage feature on the subject tract itself. Most of the 457.99-acre tract (and possibly some of the adjacent lands to the west, north and east) drain into the playa. Mr. Hudgins, WTMD's expert engineering witness, stated that during the application process, Commission staff requested that waste management facilities not be placed within the playa area, and WTMD has complied with this request.

WTMD's expert biologist, Mary Kay Skoruppa, conducted a study to determine the playa perimeter based on habitat characteristics to support WTMD's rebuttal case. Major habitat types were identified based on vegetation types (grasses, forbs, shrubs, or barren) and plant species present. Statistical analysis of the species' occurence and distribution identified four elevation classes (A-D). Ms. Skoruppa defined the aerial extent of the playa based on plant habitat to be those elevations below 2,632.5 feet, which is the upper

[8] Tr. Vol. 4, page 217. WTMD Ex. Nos. 48 and 48A.

[9] WTMD Ex. No. 9

elevation limit for Class A (*see* Attachment A). Ms. Skoruppa concluded there were no wetlands associated with the playa.[10] Ms. Skoruppa calculated the area of the playa to be 46.5 acres based on the surface area contained within the 2,632.5-foot elevation contour.[11]

The southern-most part of the site, along Strawberry Patch Road, drains to the south, away from the playa, and is within the West Fork North Creek Draw watershed.

A limestone quarry is located adjacent to the southwest corner of the proposed disposal facility tract *(see Attachment A)*.[12] The quary has been excavated to a depth of about 20 feet.[13] The quarry was excavated by blasting.[14]

Rainfall and Evaporation

Northern Reagan County receives an average of 18.03 inches of precipitation a year, and the average annual evaporation is 68.12 inches. The 25-year 24-hour rainfall event for Reagan County is approximately 5.86 inches.[15] The 50-year 24-hour rainfall event for Reagan County is approximately 6.68 inches, and the 100-year 24-hour rainfall event is approximately 7.37 inches.[16]

Soils and Geology

Mr. Freund conducted a geologic and hydrogeologic study of the proposed facility (WTMD Ex. No. 7, Attachment 4) that combined his review and analysis of published regional literature, well records of nearby water wells, site observations, and the findings of WTMD's subsurface investigations. Mr. Freund identified three geologic horizons based on the Geologic Atlas of Texas. The surface consists of wind-blown cover sand ranging from 1 to 15 feet deep that overlies the Cretaceous-aged Edwards Group. The Segovia Formation, a member of the Edwards Group, consists of cherty dolomitic limestone with some interbedded sands and has a maximum thickness of about 300 feet. The Fort Terrett Formation underlies the Segovia Formation, and also consists of cherty dolomitic limestones with interbedded sands.[17]

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[10] WTMD Ex. No. 40. This study was conducted in October 2016, and the results were included in WTMD's rebuttal case.

[11] Tr. Vol. 3, pages 134-136.

[12] WTMD Ex. No. 19.

[13] Tr. Vol. 1, page 103.

[14] Tr. Vol. 1, page 212.

[15] WTMD Ex. No. 7.

[16] WTMD Ex. No. 43.

[17] WTMD Ex. No. 7. Examiners' Note: The Geologic Atlas of Texas (WTMD Ex. No. 22) also identifies Quaternary-aged playa deposits, and one such deposit is mapped on the site, in the location of the playa. Mr. Freund did not describe the playa deposit stratum in his report.

At the site, much of the Segovia Formation has been eroded away, and only about 12 feet of the formation remains in place according to Mr. Freund.[18] The contact between the Segovia and Fort Terrett Formations is exposed in the adjacent quarry and is indicated by a color change from the Segovia (lighter, tan) to the Fort Terrett (darker, gray). Mr. Freund indicated the limestone in the quarry walls exhibited "cracked appearance" that was attributed to blasting during excavation.[19] Mr. Freund also testified that naturally-occurring fractures occur and were observed in the limestone apart from blasting activities.[20]

A "Custom Soil Resources Report" obtained from the U.S. Department of Agriculture Natural Resources Conservation Service ("NRCS") identified several soil types at the site.[21] The dominant soil types indicated on the NRCS report are Angelo silty clay loam, Reagan loam, and Conger-Reagan association, all of which are alluvial soils derived from limestone. In addition, the Tabosa clay, a calcareous clayey alluvium, is indicated in the area of the playa.

WTMD performed three separate subsurface investigations at the site to characterize the surficial soils, subsurface geology, and hydrogeology. The first investigation was conducted in November 2014 by NTG Environmental, in which four borings were drilled and four groundwater monitoring wells were installed on the site.[22] The second investigation was conducted in July 2015 by Modern Technology-Modern Environment ("MTME") in preparation of the disposal permit application in this case. MTME drilled three additional borings, two of which were completed as groundwater monitoring wells.[23] The third investigation was conducted by MTME in September and October 2016, which was during a two-month break between the second and third days of the hearing. During the third investigation period, MTME: (1) excavated three shallow test pits; (2) drilled three soil new borings and completed one as a monitoring well (for a total of 7); and (3) re-drilled four borings to confirm the earlier work done by NTG.[24]

Mr. Hudgins oversaw the boring installation for the MTME investigation activities. All of the borings were drilled with air rotary methods; according to the logs, surface soils

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[18] Tr. Vol. 1, pages 134 & 138.

[19] WTMD Ex. No. 24.

[20] Tr. Vol. 2, pages 14-15 and 17.

[21] WTMD Ex. No. 49. The Examiners note that page 2 of the exhibit offers a warning that the "soil map may not be valid at this scale" due to the detail of mapping and accuracy of soil line placement. The free web-based "Custom Soil Resources Report" is customized based on the area of interest provided by the user as applied to existing mapping; it is not based on a custom site visit.

[22] Tr. Vol. 1, page 30.

[23] WTMD Ex. No. 7.

[24] WTMD Ex. Nos. 42 and 45, presented as part of WTMD's rebuttal case. At the hearing there was testimony from both parties illuminating discrepancies in subsurface media descriptions between the NTG (who was not represented at the hearing) and MTME geologic investigations. On its own initiative, MTME re-drilled borings near the locations of NTG's original four borings (current monitoring wells MW-1 through MW-4) so all of the subsurface data could be logged consistently.

at locations MW-5, MW-6, and B-7 were sampled with a split-spoon. Mr. McIntosh described the air rotary drilling process and the means by which an air rotary driller could identify whether a subsurface void was incountered. In air rotary drilling, the drill bit crushes the rock and compressed air blows the "cuttings" to the surface. Undisturbed samples are not collected. Drilling into a void could be observable by the driller as (1) a reduction in air pressure; (2) diminished returns (of cuttings) at the surface; and (3) an immediate drop of the drillstring into the void space. Mr. McIntosh stated that encountering a void could cause the air pressure to fall from 150 pounds per square inch ("psi") to as little as 10 psi, with the magnitude of the pressure drop being proportional to the size of the void.[25] On cross-examination, Mr. McIntosh stated there would probably be no observable pressure drop when an air rotary drill encounters small void of about 2- to 5-millimeters.[26] Such small voids, Mr. Hudgins stated, would not affect the stability of the proposed facility, which was the main purpose of the investigation: "We were looking at the—more or less the—more the geotechnical stability of the facility."[27]

To rebut Sugg's assertion that subsurface continuous core samples should have been collected, Dr. Mathewson stated that core samples of the shallow subsurface were not necessary because air rotary drilling would provide adequate data.[28] He understood Mr. Hudgin's investigation to be primarily oriented towards identifying geotechnical properties of the subsurface.[29]

Mr. Hudgins stated the subsurface investigations reveal a generalized soil profile of the site consisting of a 1-foot to 8-foot thick soil horizon containing sandy clay and clayey gravel, which overlays limestone to the 100-foot total depth of the borings.[30] The MTME boring logs did not indicate the presence of marl, dolomite or sandstone. The soil horizons (1 to 8-feet) in the MTME borings indicate low plasticity "lean" clay ("CL"), high plasticity "fat" clay ("CH"), and lean gravelly clay ("CL-GC"), based on the Unified Soil Classification System and/or American Society of Testing and Materials ("ASTM") Nos. D2487 and D2488.[31] The CH clays were found in the three borings (MW-7, B-8 and B-10) that were drilled closest to the playa.[32] Mr. Freund described his observations within the playa area of fat clays and dessication cracks that appeared to be several feet deep. Following rainfall events, Mr. Freund stated that such cracks would quickly swell closed because of the fat clay.[33]

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[25] Tr. Vol. 4, pages 100-102.

[26] Tr. Vol. 4, page 109.

[27] Tr. Vol. 5, pages 44-45.

[28] Tr. Vol. 5, pages 147-148.

[29] Tr. Vol. 5, page 152.

[30] Tr. Vol. 1, pages 54-55.

[31] WTMD Ex. No. 7.

[32] WTMD Ex. Nos. 7 and 45.

[33] Tr. Vol. 1, pages 142-143 and 149; WTMD Ex. No. 25.

Mr. Hudgins oversaw the excavation of three shallow test pits to assess the soils in the area of the proposed drying pad. The pits were dug to a depth of refusal or to a maximum depth of 4 feet. The soil thickness ranged from 2.5 feet (refusal) on the south end of the drying pad to undetermined thicknesses (i.e., more than four feet) in the central and northern two pits, which were closer to the playa. The excavations revealed dry red-brown sandy clay (CL) and possibly sandy silt ("SM") soil types. The drying pad soil samples were analyzed in a geotechnical laboratory for Atterburg Limits (ASTM D4318), Grain Size (ASTM D6913), Classification (ASTM D2487), Standard Proctor Compaction (ASTM D698), and Hydraulic Conductivity (ASTM D5084). Mr. Hudgins concluded the drying pit area contained sufficient soil that could be recompacted to a hydraulic conductivity of $1x10^{-7}$ centimeters per second ("cm/sec") or less, as a design criteria.[34]

Groundwater

The proposed facility is underlain by the Edwards-Trinity (Plateau) Aquifer, a major aquifer in this part of Texas. Mr. Freund described the Edwards-Trinity (Plateau) Aquifer as consisting of the Fort Terrett Formation of the Edwards Group and the underlying Antlers Sand Formation, which is a member of the Trinity Group. Water wells in the area surrounding the proposed facility typically produce from depths of about 250 to 450 feet. Wells screened at depths of about 200 feet may yield 15 to 35 gallons per minute ("gpm"), while a few deeper wells screened below 300 feet have yielded 75 to 150 gpm.[35]

While drilling the 100-foot deep borings, moisture in the drill cuttings was typically noted on the boring logs beginning at a depth of about 50 to 60 feet, and in some borings the drill cuttings were noted to be dry at the total depth. The wellbores were left open for a minimum of 24 hours and static water levels were gauged. WTMD converted seven of the borings into groundwater monitoring wells (see Attachment A). Groundwater samples were collected from MW-1 through MW-4 and analyzed in a laboratory.[36] The analysis indicated chloride concentrations ranging from 31 to 61 milligrams per liter (mg/L) and total dissolved solids ("TDS") ranging from 288 to 368. No organic constituents were detected.[37] If the facility is permitted, the existing groundwater monitoring wells will continue to be used for regular periodic monitoring.

Static water levels in the monitoring wells stabilized at depths ranging from about 72 to 85 feet. Of particular note, the static water levels indicate the shallowest water is to the north, towards the playa, and the groundwater gradient is generally to the south-southwest. Groundwater levels have shown some fluctuation over time, but the southerly gradient has been consistent. Mr. Freund stated that he considers this shallow groundwater regime to be "perched," suggesting that (1) the shallow groundwater is not in hydraulic communication with the deeper Edwards-Trinity (Plateau) Aquifer, and (2) the

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[34] WTMD Ex. No. 42.

[35] WTMD Ex. No. 7.

[36] Groundwater quality analysis results were not presented for MW-5, MW-6, or MW-7.

[37] WTMD Ex. Nos. 7 & 45

water was not of sufficient quantity to be significantly useful. Nonetheless, Mr. Freund stated that WTMD was obligated to protect that groundwater. Mr. Freund stated his professional opinion is the proposed facility, as designed, would protect the shallow groundwater.[38]

On cross-examination, Mr. Freund and Mr. Hudgins affirmed the playa may be a source of groundwater recharge. However, Mr. Freund claimed the Segovia Formation, which is the first limestone horizon underlying the site to a depth of about 12 feet, is indurated (hard) and continuous in the area. Mr. Freund stated the Segovia Formation is "basically a shield to high levels of recharge." [39]

Mr. Freund testified the playa on the WTMD tract is not a sinkhole. Sinkholes, he stated, are dissolution features in which he would expect to see a large amount of limestone that has been dissolved, leaving a cavernous structure. Instead, the playa is a basin with a significant amount of clay.[40]

Dr. Mathewson, testifying in WTMD's rebuttal case, claimed the adjacent quarry "provides the best shallow, near-surface geologic investigation of the limestone because it's... a very large open excavation."[41] Specifically, he identified the fractures in the high walls, some of which were associated with blasting, and the interbedded limestone, marl and dolomite that comprises the visible section. He also emphasized the discontinuous nature of the formation, and described that one limestone bench could prevent the vertical migration of groundwater, but conditions could be different nearby:

Mr. Fenoglio: *What was on the bottom of that [quarry] floor?*

Dr. Mathewson: *Well, the floor of the quarry was a fairly continuous unfractured limestone. And when I was there in October, there was probably -- in part of it -- as much as four inches of water still on the bottom of the quarry. And if looked at the -- if you look at the high wall, you could see a vertical fracture through the brittle rock, but then it would disappear in the marl layers. So you don't have a single clear conduit. You do have fractures, so you do get groundwater moving in it.*

Mr. Fenoglio: *What does the presence of the water on the floor of the quarry tell you?*

Dr. Mathewson: *Well, it tells me that we're -- at least the area of the quarry has a very low permeability and it doesn't leak. So that section of*

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[38] Tr. Vol. 1, pages 146 - 147.

[39] Tr. Vol. 1, page 217, and Vol. 2, pages 26-27.

[40] Tr. Vol. 2, pages 61-65.

[41] Tr. Vol. 5, page 96.

> *the -- that unit in the limestone is continuous enough that it effectively prevents or holds water back.*
>
> *Now, as I said, it's heterogenous and anisotropic. So if I go 20 feet away, that water might have run down, if the quarry weren't there, to another layer at some lower depth.*[42]

Because the shallow subsurface is heterogeneous and anisotropic, Dr. Mathewson asserted the groundwater elevation data should not be interpreted as, or understood to be, a planar feature; instead, it should be considered only as a set of discrete measurement points. That is, because the subsurface is not homogenous, one should not expect homogenous groundwater flow through it. Instead, one should expect discontinuous flow.[43] As an example, Dr. Mathewson cited a discontinuity in the hydrogeologic interpretation (also described by Mr. Hudgins) regarding the shallow water level in MW-5 (about 86 feet below ground surface ["bgs"]) and the water level in the nearby Holt water well (a depth of 250 feet bgs) 120 feet to the south (off-site, see Attachment A). If there is one continuous aquifer there should be one equilibrium groundwater elevation; otherwise, there must be separate aquifer systems. Dr. Mathewson concluded, "And so there's proof that – that I see that shows that this is a discontinuous and it's not a regional recharge feature."[44]

Dr. Mathewson testified the playa on the WTMD tract is not a sinkhole, nor is it a significant recharge feature of the Edwards-Trinity (Plateau) Aquifer.[45] Instead, he argued the playa is a basin formed by the combination of wind action and surface dissolution of limestone. The limestone blocks ("float") on the playa floor are not erosional remnants, but are rather raised from the subsurface by the freeze-thaw action of the soil through geologic time.[46] However, Dr. Mathewson did state the playas are recharge sites for the shallow beds within the Edwards Formation because of the limestone and the fracture patterns, but the two water-bearing zones are not in hydraulic communication.[47]

Facility Components, Design and Operation

Waste Streams

WTMD proposes to construct and operate a facility that will treat and dispose of non-hazardous oil and gas wastes subject to the jurisdiction of the Railroad Commission, and include the following waste streams:

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[42] Tr. Vol. 5, page 102.

[43] Tr. Vol. 5, page 103.

[44] Tr. Vol. 5, page 106.

[45] Tr. Vol. 5, page 118.

[46] Tr. Vol. 5, pages 109-115.

[47] Tr. Vol. 5, pages 118-120.

- Non-hazardous oil and gas wastes that are exempt from regulation under the Resource Conservation and Recovery Act[48] ("RCRA"); and

- Wastes that are not exempt from RCRA but have been shown to be non-hazardous by waste characterization through laboratory analysis.

WTMD also requests authority to dispose of comparable wastes streams that were generated in Mexico, provided the waste would have been qualified for disposal at the facility had the waste been generated in Texas (i.e., either RCRA-exempt or non-exempt with analytical evidence).[49]

Under the draft permit prepared by Commission Staff for the Commission's consideration, WTMD would be required to document the originating source information, including knowledge of the generation processes and source and other for all waste received. Wastes may only be accepted from waste haulers permitted by the Commission. The facility may not accept wastes that do not meet the criteria above. Expressly, the facility may not accept naturally-occuring radioactive material ("NORM") from oil and gas activities or certain other waste streams. WTMD will maintain records to document the accepted waste and provide quarterly reports to the Commission.[50]

The proposed WTMD facility will receive eligible wastes for disposal. For authorized wastes, the initial matter for disposition is to make a qualitative determination of the moisture content of the waste. Some waste streams may need to be treated—specifically by gravity separation and/or drying—prior to disposal. A general overview of the proposed facilities and waste process flow includes the following elements:

- A concrete-lined separation facility, including a collecting pit and five settling pits, to receive incoming waste streams that have visible free liquids;

- A clay-lined drying pad to receive wastes that do not contain visible free liquids but require additional drying before disposal;

- A composite-lined disposal pit to contain solid wastes that do not have free liquids (as determined by a paint filter test, EPA Method No. 9095) and are dry enough for final disposal; and

- A concrete-lined wash-out pit.

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[48] 42 U.S.C. §6901 et seq. (1976).

[49] WTMD Ex. No. 7.

[50] WTMD Ex. No. 20.

Design Criteria

WTMD offered as evidence a portion of the Commission's "Surface Waste Management Manual" relating to pits to support the technical design criteria used for the proposed facility. WTMD cited several statements within the manual, especially noting the use of artificial liners, compacted clay, and stormwater controls.[51]

Separation Facility – Collecting Pit (Control No. CN-012269) and Settling Pits (Control Nos. CN-012270A-E)

The separation facility will receive all liquid wastes and solid-matrix wastes containing visible free liquids. Any authorized wastes may be placed in the separation facility. The separation facility is a waste treatment unit that uses gravity to separate incoming waste into liquid and solid media. Waste materials will be placed into the collecting pit, from which liquids will drain into the settling pits. The settling pits are a series of five below-ground pits connected by weirs that allow for the progressive settling of solid materials. Phase-separated hydrocarbons will be recovered by skimming, and liquids will be stored in tanks prior to disposal. The solid material will be sent to the drying pad for further treatment.

The separation facility will be constructed of reinforced concrete to contain the waste materials. The concrete surface will be built at a grade sufficient to facilitate efficient gravity separation. The permitted capacity of the separation facility will be 21,391 barrels, which provides for the required operational maintenance of 2-feet of freeboard. The facility will be completely emptied of all liquid and sediment at least once per year to allow for an inspection of the integrity of the concrete liner. The separation facility and adjacent land will be graded to prevent stormwater run-on.[52]

The separation facility will also include ancillary tanks and piping for the management of liquids. In addition, a spill prevention, control and countermeasures ("SPCC") plan will be prepared for the skim-oil tank and other equipment, and the SPCC plan will be submitted to the Commission's Technical Permitting Unit for approval prior to receiving waste in the separation facility.[53]

Drying Pad (Control No. CN-012273)

WTMD personel will "visually inspect each load of waste and only direct loads that do not include 'free' or separated liquids to the . . . drying pad."[54] The drying pad is a waste treatment unit that will receive wastes that do not contain visibly free liquids but are not sufficiently dry to be placed in the disposal pit. Authorized waste placed in the drying

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[51] WTMD Ex. Nos. 50 & 51.

[52] WTMD Ex. No. 7, pages 10-11 and sheets 4-1 through 4-4.

[53] Tr. Vol. 4, page 155.

[54] WTMD Ex. No. 7, page 9.

pad will remain there until it is sufficiently dry. Waste will not be placed in thicknesses greater than one foot, and the waste will be mechanically turned once a week to facilitate uniform drying.

The drying pad will have an area of about 13 acres and have a capacity of 21,194 cubic yards ("cy"). It will be constructed with a clay liner and perimeter berms. The drying pad surface will generally follow the natural grade, draining to the northwest to promote the gathering and collection of rainwater. The liquids will be taken to an appropriate off-site liquids disposal facility. The clay liner would have a hydraulic conductivity of $1x10^{-7}$ cm/sec or less.[55] Geotechnical analysis indicates there are sufficient native soils that can be recompacted to achieve hydraulic conductivity of $1x10^{-7}$ cm/sec or less.[56]

Initially, WTMD designed the drying pad to have an 18-inch clay liner, and waste would be placed directly on top of the liner. In its rebuttal case, WTMD altered the proposed design such the liner would be 24-inches thick, and a 6-inch "warning" layer material (such as gravel) would be placed on top of the liner. Waste material would be placed on top of the 6-inch warning layer, and not directly contact the liner itself. In addition, WTMD would employ global positioning system ("GPS") guided equipment that monitors elevations to prevent damage to the clay liner or warning layer. Mr. Hudgins stated the drying pad and berm system will have sufficient capacity to contain a 100-year 24-hour storm event and maintain 1-foot of freeboard.[57]

On cross-examination, Mr. Hudgins asserted that a compacted clay liner for the drying pad was a more durable liner than the synthetic composite liner planned for the disposal pit. He claimed the drying pad does not need a synthetic geomembrane or other type of liner because it is not a permanent facility. Mr. Hudgins acknowledged the operational lifespan of the drying pad could be 17 years.[58]

Disposal Pit (Control No. CN-012271)

Authorized waste that passes a paint filter test will be placed in the disposal pit.[59] The disposal pit will contain six cells, the construction and filling of which will be phased-in over the active life of the facility. It will include a below-grade portion excavated to a depth of up to 18 feet. After final closure, the top of the disposal pit will rise 40 feet to 50 feet above ground surface. The capacity of the disposal pit will be 2,878,425 cy of waste, of which 1,096,109 cy will be placed below ground surface and 1,782,316 cy will be placed above ground surface.

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[55] WTMD Ex. No. 7, pages 13-14 and sheet 6-1.

[56] WTMD Ex. No. 42.

[57] Tr. Vol. 4, pages 152-155.

[58] Tr. Vol. 1, pages 201-202.

[59] EPA Method 9095, Paint Filter Test, is used to determine whether a waste sample contains free liquids. Waste materials that fail a paint filter test—and therefore do contain free liquids pursuant to the test—may not be placed in the Disposal Pit.

WTMD proposes a composite lining system with leachate collection and leak detection. The liner system for each disposal pit is described below, from bottom to top:

- The footprint of the disposal pit cell will be excavated, and a prepared subgrade of natural soil[60] will placed on the floor of the pit and proof-rolled to meet the lining manufacturer's foundation requirements. A record survey of the prepared subgrade floor will be made.

- A geosynthetic clay liner ("GCL") having a hydraulic conductivity not greater than 1 x 10^{-6} cm/sec will be placed on the prepared subgrade.

- A secondary 60-mil high density polyethylene ("HDPE") liner will be installed directly over the GCL. All overlaps will be continuously seamed and tested.

- An HDPE geonet synthetic drainage layer will overlie the secondary liner, providing a drainage layer to monitor leakage through the primary liner.

- A primary 60-mil HDPE liner will be installed over the drainage layer.

- An HDPE geonet synthetic drainage layer will overlie the primary liner and provide a drainage layer to collect leachate.

- An initial 3-foot thick layer of debris-free waste or soil will be placed over the leachate collection geonet to provide a protective cover layer between the liner system and heavy equipment operations.

The liner system will allow for leachate to migrate through the waste to the top of the primary liner so it can be collected in a drain system and removed on least a weekly schedule. The secondary liner provides a means to detect leachate that migrates through the primary liner (through defects or hydrostatic diffusion), and some degree of leakage is expected and normal. Any leakage that exceeds 100 gallons per acre per day will require disposal activities to be suspended until investigative and corrective actions are completed, according to permit conditions.[61] Mr. Hudgins stated the leachate collection/leak detection system will be capable of gathering leakage of up to 100 gallons per acre per day. However, he would anticipate generation of about 20 gallons per acre per day through the leachate collection system and 0.25 gallons per acre per day through the leak detection system.[62]

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[60] On cross-examination, Mr. Hudgins further described the natural soil layer as being "soil from the site... sandy clay, clay sand, low plasticity clay," and not native limestone. *See* Tr. Vol. 1, pages 203-204.

[61] WTMD Ex. No. 7, sheets 7-1 through 7-7, and Attachment 5.

[62] Tr. Vol. 4, page 181. WTMD Ex. No. 44.

Washout Pit (Control No. CN-012274)

The washout pit is a waste management unit where trucks, vessels and other equipment can be cleaned and the rinsate (fluids and solids) contained. Equipment will be washed on a sloped concrete pad that will drain into a basin. The washout pit will be constructed of reinforced concrete to support the weight of trucks and to contain the waste materials. The concrete surface will be built at a grade sufficient to facilitate efficient gravity separation. The permitted capacity of the washout pit will be 3,500 barrels, which provides for the required operational maintenance of 2-feet of freeboard. The facility will be completely emptied of all liquid and sediment at least once per year to allow for an inspection of the integrity of the concrete liner. The washout pit and adjacent land will be graded to prevent fluid run-on.[63]

Liquids Disposal

The facility will not have an on-site means to dispose of separated liquids such as recovered oil or water. Recovered oil will be reclaimed, and waste liquids will be disposed of in an authorized manner, most likely by underground injection in an off-site permitted disposal well. A permitted disposal well is located on an adjacent tract, and WTMD intends to build a pipeline to access the well for liquid waste disposal.[64]

Mr. McIntosh provided a preliminary design for a plumbing system that would be capable of moving 20,000 barrels of water per day from the WTMD drying pad area to the nearby disposal well on the Holt property, a distance of about 2,500 feet. By these design parameters, Mr. McIntosh concluded that WTMD would have no difficulty moving 20,000 barrels of water per day if needed to manage contact stormwater.[65]

Storm Water Management

WTMD's application includes a stormwater management plan. Precipitation that falls on the facility will be managed based on whether it is considered to be contact water or non-contact water. Contact water is water that may come into contact with waste and waste constituents within the boundaries of one of the active waste management units (disposal cell, drying pad, separation facility, and washout pit). Contact water is considered to be waste. Contact water will be contained within the waste management unit containment structures (i.e., berms, concrete, liners, etc.) that will be constructed around each of the waste management units according to the engineering specifications in the application. Contact water within the disposal cell and drying pad will be removed within 72 hours for disposal in an authorized manner. Mr. Hudgins calculates the drying

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[63] WTMD Ex. No. 7, pages 12-13 and sheets 5-1 through 5-3.

[64] WTMD Ex. No. 38.

[65] WTMD Ex. No. 38.

pad is designed with sufficient capacity to contain a 100-year, 24-hour storm event (7.37 inches).[66]

Non-contact water is precipitation that falls on the facility but outside of the individual waste management units. Each waste management unit will be surrounded by a containment berm and/or adequate surface grading to prevent non-contact water from flowing into the waste unit and becoming contact-water. Thus, non-contact water will not come into contact with waste or waste constituents. Non-contact water will be conveyed by gravity drainage into one of the two storm water retention ponds on the north end of the facility area, between the disposal pit and the playa. A permit from the U.S. Environmental Protection Agency may be required to discharge non-contact stormwater.

The facility design includes two stormwater retention ponds. The east stormwater pond will be constructed and active while the disposal cell and drying pads are in use. The east stormwater pond will have a capacity of 168,655 barrels, which WTMD states is sufficient to contain the 25-year, 24-hour storm event design criterion. When the drying pad and disposal pit begin closure, the west stormwater pond will be built to accommodate the additional surface area exposed to non-contact water generation and provide for an additional 120,479 barrels of stormwater retention capacity.[67] In addition, the waste facility area (including all of the above-mentioned units) will be surrounded by a perimeter berm to prevent run-on and run-off.

Monitoring and Testing

The application, proposed draft permit, and stormwater management plan specify regular inspection and maintenance activities for the facility structures and units. These plans include notification of Commission District offices, required inspection items and scope, inspection and maintenance record retention, and filing quarterly operation and monitoring reports with the Commission's Technical Permitting Unit. Monitoring will be conducted through the operational, closure and post-closure periods as indicated in the permit.

The groundwater monitoring wells on the site will be gauged and sampled quarterly. Groundwater and quality control samples will be analyzed for specific analytes indicated in the permit. A quarterly groundwater monitoring report will be submitted to the Commission's Technical Permitting Unit. MW-4 is located within the confines of disposal pit cell no. 3; this wellbore will be plugged and a replacement monitoring well will be completed at a nearby offset location.[68]

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[66] Tr. Vol. 4, pages 163-164. WTMD Ex. No. 43.

[67] WTMD Ex. No. 7, Attachment 6.

[68] Note: WTMD's application identified six monitoring wells and a seventh well was installed during the course of the multi-day hearing. The Examiners assume it is WTMD's intention to keep MW-7 in service through the monitoring period.

With regard to the drying pad, Mr. Hudgins stated that "it would not be unreasonable to do testing of that (recompacted clay) liner annually. I would ask that if we do that, then it only be within the first foot . . . so that we don't risk deep penetration . . . ."[69] Mr. Hudgins raised this issue of testing as an appropriate concept for consideration; he did not provide details or a scope for a specific plan.

Closure and Post-Closure

WTMD estimates the cost to conduct all closure and post-closure activities to be $3,632,317, which includes a 10 percent contingency beyond the anticipated costs. The Commission's Technical Permitting Unit has accepted this cost estimate. If the Commission grants a permit for this facility, WTMD may not receive, store, or handle oil and gas wastes until it has established an acceptable financial security instrument in the amount of $3,632,317. In addition, WTMD has designated and will deed-restrict a 20-acre plot of land on the northern part of the facility property as a borrow source for soil to be used during closure activities.

The collecting pit, settling pits, and washout pits will be closed in a similar manner. The pits will be emptied of waste prior to closure. The concrete structures will be cleaned, demolished and disposed of as inert waste. The soils below the units will be sampled and analyzed for waste constitutents. Upon verification by the Commission's Technical Permitting Unit, the pits will be backfilled with clean fill, compacted, and graded in such a manner that rainfall will not collect on the former pit locations.

The drying pad will be closed after all waste has been removed and disposed in an authorized manner. The clay liner will be removed and disposed in an authorized manner. The soils below the drying pad will be sampled and analyzed for waste constitutents. Upon verification by the Commission's Technical Permitting Unit, the drying pad will be backfilled with clean fill, and restored to natural grade. The ground surface shall be contoured and seeded with appropriate vegetation.

Once the disposal pit has achieved its permitted capacity of 2,878,425 cy, it shall be covered with a cap and closed. The disposal pit cap shall consist of the following components (from bottom to top):

- A minimum of 12-inches of compacted clay with a hydraulic conductivity of $1x10^{-7}$ cm/sec or less will be placed on top of the compacted waste;
- A minimum 40-mil HDPE geomembrane liner with a geocomposite drainage layer shall be placed on top of the compacted clay.
- A minimum 18-inch soil layer will be placed on top of the HDPE liner, and the cover soil shall be seeded with appropriate vegetation.

[69] Tr. Vol. 4, page 158. WTMD Ex. No. 43.

- A system of swales and chutes will be installed to minimize erosion.

The post-closure period will be at least five years, and will include monitoring, inspection and maintenance activities documented with quarterly reports to the Commission. Post-closure requirements may be extended by Technical Permitting based on the quarterly monitoring reports.

PROTESTANT SUGG'S EVIDENCE

Protestant, Cal H. Sugg, Jr. ("Sugg"), offered the testimony of four witnesses and 52 exhibits were admitted into the record. Sugg's witnesses were as follows:

- Darrell Brownlow, PhD, a consultant in construction materials and water management, was accepted as an expert in the fields of geology, hydrology, mineralogy and groundwater resources.

- William Rogers, PhD, Texas A&M Regents Professor and Environmental Science Program Director, West Texas A&M University, was accepted as an expert in the fields of hazardous materials management, environmental risk assessment and toxicology, risk-based site remediation and closure, environmental compliance, and playas.

- George Veni, PhD, P.G., Executive Director of the National Cave and Karst Research Institute, was accepted as an expert in the fields of geology, hydrogeology and karsts.

- Ike Calvin Sugg, the son of Cal H. Sugg, Jr., testified as a fact witness.

Ike Sugg testified that his father, Cal H. Sugg, Jr., owns property on three sides of the proposed WTMD facility. The Suggs are protesting the proposed application because they believe it will harm their groundwater, and the facility may harm their use and enjoyment of their property.[70] As will be describe below, Sugg's experts assert the proposed facility is located on top of a recharge zone of the Edwards-Trinity (Plateau) Aquifer. The playa is actually a karst sinkhole structure and a surface expression of the recharge zone. Sugg further argues there are no natural confining strata between the ground surface and the shallow aquifer intervals, and the proposed facilities will not adequatey contain waste to protect the freshwater resources. Sugg's expert witnesses reviewed publically available information resources, reviewed the application materials, and conducted site visits of the WTMD tract and nearby playas.

[70] Tr. Vol. 3, page 194.

The Playa Is a Sinkhole And a Significant Recharge Feature[71]

Dr. Brownlow asserts the playa on the site is actually a sinkhole, and that it is a significant groundwater recharge feature of the Edwards-Trinity aquifer.[72] The site, and most of Reagan County, is located on the Central Edwards Plateau karst region—an area susceptible to limestone dissolution and karst formation, including sinkholes.[73]

During a site visit on May 24, 2016, Dr. Brownlow and Dr. Rogers observed evidence of limestone dissolution and sinkhole formation on the site. Limestone rocks (referred to as "float") were present across the floor of the playa and exhibited dissolution features, or holes dissolved in the rock, as evidence of karst formation. Dr. Rogers testified there was no mud in the playa, but four days before the site visit the area had received 4-inches of rain in two days. Photographic evidence corroborates this testimony, indicating mud-free shoes, green vegetation, and abundant wildflowers. In addition, 3-foot deep cracks in the clay floor remained open four days after the rain.[74] Dr. Brownlow estimated the areal extent of the playa to be about 100 acres based on a topographic map, and the northern part of the disposal facility encroached upon the southern edge of the playa (see Attachment A).[75] Dr. Rogers asserted the playa is a wetland. Specifically, it is a recharge wetland not a water-holding wetland.[76]

Dr. Veni stated the playa on the site is a solution sinkhole—not a collapse sinkhole, which is the more dramatic but a far less common type. Further, he stated the Segovia Formation, which is the uppermost limestone strata on the site, is known for containing large caverns and solution features in Texas; it is not an impermeable shield. Dr. Veni cited Texas Water Development Board Report No. 312, which states that, "The greatest amount of recharge from precipitation probably occurs where the limestone bedrock is exposed allowing water to percolate unhindered through highly permeable joints, crevices and solutional openings."[77]

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[71] For consistency, the Examiners will continue to refer site feature as a "playa", and may also make reference to "sinkhole" or "karst" as appropriate for technical clarity given the context. Generally, we will view the "playa" as the surface basin or depression landform; "karst" or "karsting" to refer to landforms or rock features created by the acidic dissolution process that forms cavities and voids in carbonate rock; and "sinkhole" as a subsurface structure of networked dissolution cavities (karsts) with topographic expression on the ground surface.

[72] Tr. Vol. 2, page 124.

[73] Tr. Vol. 2, page 138; Sugg Ex. No. 7.

[74] Tr. Vol. 2, pages 86, 88, and 124-125. Sugg Ex. No. 7, page 8. The Examiners note that Sugg Ex. No. 9, also taken on May 24, 2016, indicated considerable standing water on part of the floor of the adjacent quarry.

[75] Tr. Vol. 2, page 135; Sugg Ex. Nos. 6 & 8.

[76] Tr. Vol. 2, page 87.

[77] Tr. Vol. 3, pages 109-110 and 114. Sugg Ex. No. 23.

Similarity of Other Nearby Playas

Further, the on-site playa is not an anomaly. Regionally, the proposed site is located on the edge of a topographic transitional axis that runs from the southwest to northeast. Generally, the lands to the northwest of the transition, including most of the subject tract, are level and playas are numerous. That is, this topography is characterized by drainage into local playa basins, from which there is no outlet for drainage. There are no surface streams that drain these lands and the playas are the dominant surface drainage features. Lands to the southeast of the transitional axis exhibit greater tophographic relief, and dendritic surface drainage patterns of intermittent streams with surface drainage to the south and east are evident. These landforms are confirmed by geologic maps that describe the surface geology and topographic features.[78]

On November 2, 2016, Dr. Veni conducted a site visit to several tracts adjacent to the WTMD site that included other playa/sinkhole features; he did not enter the WTMD site itself. Dr. Veni examined six sinkhole/playas within about three-miles of the WTMD site, all of which exhibited similar topographic and karst features (about 14 similar but smaller landforms were identified in the same area, but were not visited).[79] Numerous vertical holes in the ground, or soil pipes, indicating the erosion of soil through voids created by dissolution of rock, were observed at all six of the sinkhole/playas visited. On one of the sinkhole/playas, more than 22 soil pipes were observed in an area of 2,500 square feet. Exposed limestone with visible fractures was observed on floors of some of the playas.[80] Dr. Veni concluded the six nearby sinkhole/playas are representative of the WTMD sinkhole/playa (which he did not visit) based on a review and comparison of similar evidence, including aerial photographs.[81] Dr. Veni further concludes the limestone underlying the WTMD sinkhole/playa is fractured and is also a recharge feature for the Edwards-Trinity Aquifer.

Subsurface Characterization

Dr. Brownlow stated the native Segovia Limestone is naturally fractured. However, the entire proposed disposal pit is located from about 200 feet to 1,800 feet from the adjacent quarry, which was subject to continuous blasting. He affirmed the limestone itself is fairly impermeable to fluid movement, but water is readily transmitted through fractures, solution cavities, and fissures. The quarry blasting may have caused or exascerbated fractures beyond the confines of the quarry. Dr. Brownlow articulated his concern that Commission staff was not aware of the risks and hazards presented by the quarry activities or the playa as a recharge feature because this information was not included in the application materials reviewed by staff.[82]

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[78] Tr. Vol. 2, pages 151-155; Sugg Ex. No. 11.

[79] Sugg Ex. Nos. 27-28

[80] Sugg Ex. Nos. 29-34.

[81] Sugg Ex. Nos. 35-41.

[82] Tr. Vol. 2, pages 144-146.

Sugg's experts testified that WTMD's geological investigations failed to identify any naturally-occuring barriers to groundwater migration in any of the borings drilled at the site. Dr. Brownlow noted the absence of any clay strata in the subsurface based on the WTMD's own geological evidence.[83] Although the bulk limestone may be relatively impermeable, there is ample evidence the rock is fractured and therefore a potential conduit for groundwater migration. Sugg's experts assert that WTMD's investigation was insufficient to characterize the subsurface.

Both Dr. Brownlow and Dr. Veni stated the air rotary method of drilling used by WTMD is not capable of identifying fractures or small karst features. Air rotary drilling pulverizes the rock and returns it to the surface in granular form. Coring, however, would have been useful to retrieve undisturbed rock samples to visually evaluate the rock matrix and structure or to conduct physical analysis of core samples in a laboratory. In addition, Dr. Brownlow suggested falling head permeability tests could have easily been performed on any of the borings or monitoring wells to obtain a preliminary understanding of the shallow aquifer characteristics.[84]

Groundwater

During the site visit, Sugg's representatives also measured the water depth in the monitoring wells (there were six at the time). A potentiometric surface map of the water depths was consistent with the information reported by WTMD in their application: The groundwater gradient is down to the south. Dr. Brownlow interpreted the groundwater data to suggest that mounding in the area of the playa is further evidence that it is a recharge feature and, consequently, should also be considered an environmentally sensitive area.[85] Dr. Brownlow also indicated that monitoring wells are located only on the south flank of the playa, and radial flow outward in all directions from the recharge would be expected.[86] Dr. Brownlow concluded the groundwater quality was very good based on laboratory analysis.

Dr. Brownlow reviewed historic water quality information and concluded the quality of the shallow groundwater at the site is very comparable to water analyzed from nearby wells and collected from deeper within the Edwards-Trinity (Plateau) Aquifer, based on a 1972 report by the Texas Water Development Board. In addition, the water level in the aquifer has declined over time. In the 1940s and 1950s, the supply wells were typically screened at depths from 200 to 300 feet bgs and the static water level was about 80 to 100 feet bgs, which is comparable to the static water levels in the existing monitoring well

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[83] Sugg Ex. No. 14.

[84] Tr. Vol. 4, pages 21-25 and 89-90.

[85] Tr. Vol. 2, pages 139-140; Sugg Ex. No. 6

[86] Tr. Vol. 2, pages 118-119.

network. Dr. Brownlow also asserted the evidence indicates the various groundwater-bearing zones in the Edwards-Trinity (Plateau) Aquifer are in pressure communication.[87]

Dr. Veni described groundwater flow in a karst aquifer, and he concluded that effective groundwater monitoring in a karst environment is very difficult. Groundwater gradient maps derived from the monitoring well data may provide a general flow direction, but they cannot account for the actual flow path of water in the subsurface. In a karst environment, groundwater flow is constrained by the orientation of fracture planes and solution cavities, which is unlike flow in a conventional aquifer. Dr. Veni concluded that a release to groundwater from most of the drying pad and disposal pit would go undected by the existing monitoring well network.[88]

Facility Design

Dr. Brownlow argued that a waste disposal facility should never be built in a recharge zone, and this is a fact that has been recognized by other regulatory authorities. He specifically cited two rules. First, Title 40 CFR Part 258 (Criteria for Municipal Solid Waste Landfills) requires demonstration of additional engineering measures for facilities located in unstable areas, which include karst terranes. Second, 30 Tex. Admin. Code 335.584, relating to commercial industrial nonhazardous waste landfills, states that such facilities may not be located in areas overlying a regional aquifer, "unless the regional aquifer is separated from the base of the containment structure... by a minimum of ten feet of material with a hydraulic conductivity towards the aquifer not greater than 10^{-7} cm/sec . . . ."[89]

In addition, Dr. Brownlow cited a recent Commission permit issued for a Pyote Reclamation Systems, LLC disposal facility in DeWitt County overlying a regional aquifer, in which a single continuous 25-foot thick clay layer was documented in the subsurface. Dr. Brownlow asserts the 25-foot clay layer at the Pyote facility is corroborating evidence the Commission anticipates substantial geologic isolation below disposal facilities, especially those that overlie major aquifers.[90]

Dr. Rogers stated his expert opinion the drying pad design was not sufficient to contain waste treated within it, and he identified several concerns, including (1) the clay liner will likely deteriorate over 17 or more years of use; (2) WTMD has not evaluated the effect of salt on the compacted clay permeability; and (3) the drying pad will not adequately contain contact stormwater. Dr. Rogers compared the inadequacy of the WTMD drying pad design with the superior design of a drying pad at the referenced Pyote Reclamation Systems, LLC facility in DeWitt County, which included 1-foot of compacted clay, a

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[87] Tr. Vol. 2, pages 158, 160, 161, and 163. Sugg Ex. No. 12.

[88] Sugg Ex. Nos. 23-25.

[89] Sugg Ex. No. 16.

[90] Sugg Ex. No. 17. *See*, Oil & Gas Docket No. 02-0289582, the Application of Pyote Reclamation Systems, LLC Pursuant to Statewide Rule 8 for a Permit to Maintain and Operate a Commercial Stationary Treatment and Disposal Facility, Hohn Road Facility, DeWitt County, Texas. Order signed on May 4, 2016.

synthetic liner, and a 1-foot protective layer, as well as a 25-foot thick natural clay strata. With regard to the disposal pit, Dr. Rogers also cited the absence of a natural impermeable barrier as an unacceptable design position given the allowed action leakage rate of 100 gallons per day per acre. In addition, Dr. Rogers expressed concern with wind-blown dust from the drying pad as a means of contaminant transport to the playa and adjacent tracts.[91]

On cross-examination, Dr. Rogers stated that double-lined disposal cells with leachate collection systems are used at hazardous waste sites, but he does not believe one would be permitted unless there was sufficient clay below the synthetic liner. Further, he does not believe such a system would be permitted directly over ground susceptible to karsting.[92]

SANTA RITA UNDERGROUND WATER CONSERVATION DISTRICT

The Santa Rita Underground Water Conservation District ("District") protested WTMD's application. Regina Gomez, District Manager, provided a public statement at the end of the evidentiary hearing.

Ms. Gomez expressed the District's agreement with Protestant Sugg and the evidence offered by Sugg's witnesses. She stated that it is the District's opinion the proposed site is not suitable or acceptable for the WTMD. She stated the District's main concern has always been the possibility of contamination of the aquifers. In particular, she noted the City of Big Lake's water supply well field is located about 2 miles south of the proposed WTMD facility. The District recommends the Railroad Commission deny WTMD's permit application.

In addition, Ms. Gomez's pre-hearing deposition was introduced into evidence by WTMD (*see* WTMD Ex. No. 41).

EXAMINERS' ANALYSIS

The Examiners conclude that WTMD has failed to demonstrate the subsurface waters will be protected from pollution, which is a permitting criteria required by Statewide Rule 8(d)(6)(A) for facilities that store or dispose of oil and gas waste. As will be discussed, the basis for this recommendation is the site itself is in a groundwater recharge zone of the Edwards-Trinity (Plateau) Aquifer; at first blush, the site is situated in a problematic and far-from-ideal location. To further—and not alleviate—this concern, the site characterization conducted by WTMD has not identified any continuous or competent natural stratum that will act as a barrier to groundwater migration through the fractured limestone, nor has the movement of water through the shallow aquifer been studied. Consequently, the engineering controls and environmental monitoring system are inadequate to ensure the protection of freshwater resources. Therefore, the Examiners recommend the Commission deny the application of WTMD for this facility.

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[91] Sugg Ex. No. 20.

[92] Tr. Vol. 3, page 239.

In many ways, the waste management units themselves—the separation facility, drying pad, disposal pit and truck wash—are designed with containment structures similar or identical to other waste facilities permitted by the Commission. For example, the disposal pit includes a composite geosynthetic liner system capable of leachate collection and leak detection. WTMD's affiliated company, Weeks Environmental, operates a similar facility in the Eagle Ford development in Dimmitt County. But the environmental setting at the proposed WTMD facility in Reagan County is completely different and poses unique challenges. Therefore, this analysis will include extensive discussion about the site-specific geology and hydrogeology: What is known, what is unknown, and why certain factors are unknown.

Groundwater Quality

The groundwater quality is very good. Groundwater samples from four monitoring wells indicate chloride concentrations ranging from 31 to 61 mg/L and TDS ranging from 288 to 368 mg/L. No organic constituents were detected.[93] Mr. Freund, WTMD's expert geologist, acknowledged WTMD was obligated under Statewide Rule 8 to protect the shallow groundwater regime.[94] *The Examiners conclude that Statewide Rule 8 requires this fresh groundwater resource, encountered in the on-site monitoring wells between about 72 to 85 feet bgs, be protected.*

The Playa

The playa is a topographic depression/basin located on the north central part of the WTMD tract. There is some disagreement as to the size of the playa (see Attachment A):

- Based on a habitat delineation study, WTMD asserts the area of the playa is about 46.5 acres, none of which overlaps with the waste management area of the site including the stormwater detention ponds.

- Sugg contends, based on the depression delineation on topographic maps the playa is about 100 acres in size and does encroach on the waste management areas of the site.

The Examiners agree that WTMD's study reasonably portrays the habitat-related playa definition. That is, the habitat and plant characteristics are likely related to ephemeral inundation of part of the playa basin, as plant species distributions have adapted to occasional inundation. However, the playa basin as a geologic structure suggests the larger estimate of about 100 acres is likely more relevant to the potential for the playa to be a recharge feature. The soil classification performed by WTMD indicates that higher-plasticity clays are located closer to the playa, but no significant exploration of

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[93] WTMD Ex. Nos. 7 & 45

[94] Tr. Vol. 1, pages 146 - 147.

the playa itself was conducted (other than one near-surface soil sample). *The Examiners conclude the playa is closer to 100 acres in size, but the areal extent has not been determined.*

There is evidence from both parties of surface cracks and/or soil pipes that extend from the playa floor into the subsurface. Depths of 3 to 6 feet have been estimated by the parties. Limestone blocks that littered the floor of the playa exhibit visible evidence of karsting. Further, Sugg's May 24, 2016 site visit occurred within about 4 days of 4-inches of rain falling on the tract. Photographic evidence indicates the cracks were visible (i.e., they had not swelled shut), the playa floor was verdant with abundant wildflowers, and there was no evidence of standing water or residual mud. *The Examiners conclude the playa is well-drained. The Examiners conclude there is evidence of karst structures and ongoing dissolution processes in the playa. The Examiners conclude there are multiple visible vertical conduits to subsurface migration on the floor of the playa. The Examiners conclude the playa is a sinkhole based on the evident karst structures and processes.*

The Subsurface Geology

The adjacent quarry provides a close-up view into a 20-foot section of what WTMD describes as a thin veneer of soil over the lower 12 feet of the Segovia Formation. WTMD testified the contact between the Segovia Formation and underlying Fort Terrett Formation was also visible. WTMD testified that interbedded limestone and marl (calcareous clay) strata are visible within the exposed section. Testimony and photographic evidence describes significantly fractured rock. The severety of the fractues may have been enhanced by blasting during the quarrying operations, but both parties agree the limestone is naturally fractured. Both parties also agree the fractures can transmit groundwater.[95] *The Examiners conclude the limestone underlying the site is fractured.*

WTMD asserts the marl strata identified in the quarry wall is softer and would likely not fracture. Water pooled on part of the quarry floor indicates the limestone matrix can impede infiltration. However, WTMD's repeated use of the word "indurated" (i.e., "hard") has little to do with the secondary permeability characteristics that dominate the hydrogeology of the Edwards Group. Namely, the documented presence of natural fractures and dissolution pathways indicates permeability and infiltration. While the rock matrix itself may or may not be permeable, the fractures are permeable, and the rock demonstrates visible evidence of fluid movement and matrix dissolution. *The Examiners conclude that fractured limestone is conducive to groundwater flow through the subsurface.*

Following its boring program, WTMD interpreted the subsurface geology to consist of three generalized strata: (1) a sand, silt and clay soil horizon from the surface to a depth of about 5 feet; (2) a light tan (with white, yellow and orange) limestone stratum to a depth of about 50 feet; and (3) a gray (with tan and brown) limestone stratum to the 100-foot total depth of the borings. WTMD asserts the original four borings that identified sandstone

[95] Tr. Vol. page 142; Vol 5, page 100.

in the subsurface were incorrect. The boring logs indicate moisture was observed in many of the cuttings retrived from the gray limestone stratum. No marl was described on any of the boring logs. There was some variation within these three generalized strata, but no other characteristics were consistently observed in such a way to be mappable across the site.[96] *The Examiners conclude the subsurface investigation activities reveal significant limestone, but no marl or other lithologies, were identified in the subsurface to a depth of 100 feet.*

The borings did not identify a contact between the Segovia and Fort Terrett Formations; the contact between the tan to gray/brown limestone was not interpreted. The Examiners note the Fort Terrett Limestone description in WTMD Ex. No. 7 states that a color change is observed from "gray to yellowish to yellowish-brown where water bearing sands are found." The color change described in the literature appears to correspond to the color of the strata in which moisture was observed as recorded on the boring logs. *The Examiners conclude the moisture observations in the borings are consistent with the literature descriptions of the Fort Terrett Formation.*

WTMD argues the extensive limestone strata will impede the migration of fluids below the waste management facilities. The Examiners, however, conclude that WTMD's ability to assert such a claim is limited by the shortcomings of their site characterization program, specifically with regard to their exclusive use of air rotary drilling methods. The subsurface investigations relied on analysis and interpretation of drill cuttings from air rotary drilling, which returns crushed rock fragments and dust to the surface. No undisturbed native rock samples were recovered.[97] No core samples were collected. Air-rotary drilling is likely the optimal method to drill groundwater monitoring and supply wells in this area. However, as a means to describe the hydrologic characteristics subsurface media it is severely limited, especially with regard to identifying the secondary porosity characteristics—fractures and matrix dissolution—known to exist in the carbonate portions of the aquifer. Continuous core sampling would have provided more reliable information for characterization to assess the occurence of such features, as well as lithologic changes (i.e., between limestone and marl beds). The recovery of continuous core samples may facilitate the identification of lithology, fracture planes, evidence of water flow and dissolution processes along the fracture planes, and evidence of other secondary porosity features. *The Examiners conclude WTMD's subsurface investigations were not capable of delivering the geologic evidence necessary to adequately characterize the subsurface.*

With regard to boring installation for subsurface investigation, the Examiners find it necessary to clarifiy their understanding of the Commission's requirements for commercial waste pit applications. The Commission's Surface Waste Management Manual states:

> *"Submit a plan for the installation of groundwater monitor wells. Should a permit be issued, the installation of monitor wells will be a permit condition*

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[96] WTMD Ex. No. 7 (cross sections in Appendix 1 to Attachment 4); Sugg Ex. No. 13.

[97] With the exception for the soil horizon in three of the 10 borings, which were collected by split-spoons. *See* the boring logs in WTMD Ex. Nos. 7 and 45.

> *unless on-site borings taken to 100 feet demonstrate no shallow groundwater underlies the proposed location. Borings should be left open for a minimum of 24 hours to determine the presence of groundwater. A sufficient number of borings must be drilled at the location to accurately characterize the subsurface, and determine the lateral extent and direction of flow of any shallow groundwater" (emphasis added).*[98]

WTMD met the some of these application requirements: Borings were drilled to about 100 feet, groundwater was identified, groundwater monitoring wells were installed, and the direction of groundwater flow was reasonably determined. However, the Examiners find insufficient evidence in the record that Commission Staff was adequately informed of the potential risks posed by this facility, or that WTMD "accurately characterized the subsurface." Namely, the evidence indicating the presence of fractured limestone, karst processes, and limestone dissolution features on the site as pathways for the recharge of a major aquifer was not provided in the application materials, and only came to light through Sugg's protest. While WTMD may have installed a "sufficient number of borings" for accurate characterization, the method of boring (i.e., air rotary) was not capable of yielding the necessary information. Further, WTMD drilled borings on three separate occasions, each one offering an opportunity to collect more informative data via coring. As stated in the cited passage from the Surface Waste Management Manual, the burden falls on the applicant, consistent with Commission rules and guidance, to "accurately characterize the subsurface…". *The Examiners conclude that WTMD failed to accurately or adequately characterize the subsurface.*

Aquifer Identification

The parties disagree as to whether or not the shallow groundwater zone monitored at the site is a part of the Edwards-Trinity (Plateau) Aquifer, which is designated by the Texas Water Development Board as a major aquifer in Texas. Generally, this issue is not relevant because Statewide Rule 8 pertains to "subsurface water," and not a water resource specifically designated by the Commission or other authority as a particular category of aquifer. But specifically, the Examiners find the designation is helpful because it accurately depicts the hydrologic reality: The shallow groundwater regime (in which the on-site monitoring wells are completed) is a part of the larger Edwards-Trinity (Plateau) Aquifer system—as that system has been described in literature, understood, and functions. This finding is supported by the unrefuted geologic evidence in the record.

The shallow groundwater regime at the site is within the Fort Terrett Formation and exhibits a static water level from about 72 to 85 feet bgs. The deeper groundwater regime exhibits a static water level of about 225 feet bgs. But historical records from wells near the WTMD site (Sugg Ex. No. 12) indicate that in the 1940's and 1950's the deeper interval exhibited a static water level of 80 to 100 feet, but the water level has dropped since that time. In addition, Sugg's evidence indicates this groundwater quality in the monitoring

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[98] See the Commission's Surface Waste Management Manual at http://www.rrc.state.tx.us/oil-gas/applications-and-permits/environmental-permit-types-information/pits/commercial-disposal-pit-requirements/ .

wells is remarkably consistent with data developed by the Texas Water Development Board from deeper wells in the Edwards-Trinity (Plateau) Aquifer in 1972. Sugg documented historical groundwater quality data from 1965 to 1970 in nearby wells to average 37 mg/L chlorides and 323 mg/L TDS.[99] Groundwater samples from four monitoring wells on site indicate chloride concentrations ranging from 31 to 61 mg/L and TDS ranging from 288 to 368 mg/L.[100] *The Examiners conclude the shallow groundwater regime, in which the monitoring wells are completed, is a part of the Edwards-Trinity (Plateau) Aquifer.*

There may be discontinuities in the aquifer, but there is no evidence to suggest multiple independent aquifer systems within the Edwards Group. On rebuttal, Dr. Mathewson disagreed with the static groundwater elevation contouring and interpretation offered by Sugg; the Examiners note that this criticism applies equally to the testimony of his WTMD colleagues, who provided similar contoured interpretations. Further, Dr. Mathewson argued the shallow groundwater regime was not a part of the Edwards-Trinity (Plateau) Aquifer. He cited evidence from MW-5 (completed in the shallow regime) and the adjacent Holt water well, 120 feet to the south, which was completed in the deeper regime. The water elevations in the two wells differ by about 140 feet, even though the construction details of the Holt well indicate the two zones are in hydrologic communication. But Dr. Mathewson does not consider the historical water levels in the aquifer, which were historically much more similar than they are today. Dr. Mathewson's rebuttal is not persuasive. The higher water levels in the shallow regime can easily be explained by aquifer recharge from the playa or other near-surface recharge pathways. *The Examiners maintain their conclusion the shallow groundwater regime in which the monitoring wells are completed is a part of the Edwards-Trinity (Plateau) Aquifer.*

Aquifer Characteristics

Both parties presented evidence indicating the static groundwater gradient is to the south, with the highest static water levels to the north, near the playa. There are no monitoring wells located within the playa basin or on the north, west and east sides of the playa. Therefore, there is insufficient evidence to conclude the groundwater is mounded below the playa, as there are no observation points radially-located to the playa, except for the seven monitoring wells to the south. Given the evidence, groundwater mounding below the playa remains a possibility as a reasonable interpretation. Furthermore, there is no groundwater data to rebut that interpretation, either. Again, it is the applicant's burden to adequately characterize the subsurface. *The Examiners conclude the static groundwater gradient in the shallow groundwater regime is to the south, with the highest observed static water levels to the north, near the playa.*

Dr. Matthewson argued in rebuttal the shallow subsurface was heterogeneous and anisotropic. That is, the physical properties (including porosity and permeability) vary in all directions and may change over short distances because of the lithology (rock type)

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[99] Sugg Ex. No. 12.

[100] WTMD Ex. Nos. 7 & 45

and structure (fractures). Because the aquifer lithology is heterogeneous and anisotropic, the static groundwater level depicted as a smooth southward dipping surface is unrealistic and incorrect. Dr. Mathewson stated, "...and that's why the contour map of the hydraulic gradient doesn't make any sense, because it assumes that if I drilled on that contour line between the wells, I would get water at that depth. And the only way that assumption is valid is if it's homogeneous permeable unit."[101] The Examiners note, however, the air-rotary drilling methods are relatively incapable of discretely identifying heterogenous and anisotropic characteristics because the evidence is pulverized. Apart from the broad permeability characterization of the limestone matrix as impermeable and fracture planes being permeable, WTMD's evidence does not allow for closer scrutiny in support of its burden to adequately characterize the subsurface.

However, the history of monitoring well installation events at the proposed facility undercut Dr. Matthewson's point. Monitoring wells were installed on the site during three events in November 2014 (MW-1 through MW-4), July 2015 (MW-5 and MW-6) and October 2016 (MW-7). Groundwater elevations in monitoring wells to the south (MW-3 and MW-4) are lower than those on the north (MW-1 and MW-2), indicating a southerly groundwater flow direction. MW-5 and MW-6 were installed a year later. MW-5 is located between MW-1 and MW-4, and the static groundwater similarly intermediate. Likewise for MW-6, which is located between MW-2 and MW-3. Finally, MW-7 was installed in October 2016 between MW-1 and MW-2, and its static groundwater elevation is consistent with those off-setting wells. *Therefore, the Examiners conclude that data from the original monitoring wells was proven to be a reliable predictor of subsequent findings.*

The Examiners note that WTMD conducted no aquifer studies of the shallow regime to assess permeability or recharge characteristics. Such studies might have included a slug test, in which water is quickly added or removed from a groundwater well, and the change in hydraulic head is monitored through time, to determine the near-well aquifer characteristics. Furthermore, only one comparison of groundwater monitoring data was presented. Comparison of groundwater elevation data collected in July 2015 and October 2016 indicated the during this time interval the groundwater elevations in five of the six monitoring wells increased from 0.22 to 2.32 feet, and the elevation in one well (MW-2) decreased by 0.06 feet. The groundwater elevation changes did not significantly affect WTMD's interpretation of groundwater flow direction.[102] However, the available data is very limited and piecemeal. Regular and consistent groundwater elevation measurements taken since the first monitoring wells were installed (i.e., on a quarterly basis), could have provided substantial insight into the shallow groundwater regime. Such measurements would have been rather easily and inexpensively obtained. Correlating groundwater elevation data with on-site or nearby precipitation data could have been extremely valuable in assessing recharge potential.[103] *If the Commission grants an operating permit for this facility, the Examiners recommend daily precipitation records be maintained as a permit*

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[101] Tr. Vol. 5, pages 138-139.

[102] Tr. Vol. 5, pages 55-58. WTMD Ex. Nos. 7 and 45.

[103] WTMD Ex. Nos. 7 and 45. Sugg Ex. Nos. 6 and 26.

provision. Such a provision would contribute to the operator's and the Commission's understanding of the recharge relationships between playas and the Edwards-Trinity (Plateau) Aquifer.

The Site as a Recharge Feature

The topography of the land surface directs water into the playa, in which evidence of infiltration was demonstrably present. Similar dissolution and infiltration features were observed in other nearby playas. The static groundwater elevations indicate a local high in the direction of the playa. Texas Water Development Board Report No. 373, *"Groundwater Availability Model for the Edwards-Trinity (Plateau) and Pecos Valley Aquifers of Texas,"* dated April 2009, states:

> *"Recharge rates vary with climate conditions, surface geology, surface topography, soils, vegetation, and land use. The high evaporation rates characteristic of the semiarid to aird climate of the region suggests that large and/or frequent storm events are needed to generate effective recharge to the aquifers within the study areas. Natural recharge to the Edwards-Trinity (Plateau) Aquifer occurs from the diffuse recharge from precipitation over the aquifer's outcrop, direct recharge from surface runoff into sinkholes, and direct recharge from stream losses by numerous intermittent streams" (emphasis added).*[104]

All of the credible evidence indicates the playa is a recharge feature for the Edwards-Trinity (Plateau) Aquifer, and there is no significant evidence to suggest otherwise. *The Examiners conclude the playa, broadly defined, and the outcrop of the Edwards-Trinity (Plateau) Aquifer on the site are recharge features.*

WTMD points out there is significant oil and gas activity in the area, and the activity does not appear to strictly avoid other playas. That is, there is evidence of drilling and well sites in and around nearby playas.[105] The Examiners note that all of the oil and gas activities regulated by the Commission are subject to Statewide Rule 8's requirement to protect water from pollution. Indeed, oil and gas wells in Texas are drilled with numerous technical requirements to protect surface water and groundwater, and those technical requirements explicitly consider the overlap of both engineered (cement and steel casing) and natural (confining strata) barriers to prevent pollution. This case is different: the proposed waste disposal facility will permanently entomb more than 2.8 million cy of oil and gas waste in a fractured karst limestone aquifer recharge zone.

Groundwater Monitoring

The karst characteristics of the groundwater flow regime present challenges to designing or implementing reliable groundwater monitoring program. These issues were

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[104] Sugg Ex. No. X-6.

[105] WTMD Ex. Nos. 48 & 48a.

raised directly by Sugg's witnesses, and indirectly by Mr. Mathewson as he made his rebuttal arguments about the heterogeneous and anisotropic characteristics of the aquifer.[106] The Examiners note that only two or three of the seven monitoring wells (MW-3, MW-4, and MW-5) can be reasonably considered to be down-gradient wells, and the other four are upgradient of the waste management units. *If the Commission grants an operating permit for this facility, the Examiners recommend additional down-gradient monitoring wells be established to the south and west of the waste management units.*

Waste Management Facility Design and Operation

Sugg compared the present WTMD application to the the permit issued by the Commission for a similar facility in DeWitt County.[107] In the present WTMD case, the proposed design and operation of the waste management facilities are of a similar caliber to those approved by the Commission in the Pyote case. However, in the Pyote case, the Commission also found the presence of a continuous thick clay strata in the subsurface to be substantially relevant and protective of the freshwater resources in the Gulf Coast Aquifer. No such thick, continuous, and impermeable strata has been identified at the proposed WTMD site, and the subsurface investigation methodologies were not ideal for the task. Additionally, WTMD provided no examples of the design of similar disposal facilities permitted by the Commission directly overlying a recharge zone.

The proposed WTMD waste management facilities are comparable in design and operation to other similar facilities permitted by the Commission, notably the Pyote facility, among others. The critical difference, the Examiners find, is in the geologic and hydrogeologic situation of the WTMD site. For example, both the proposed WTMD and Pyote sites have reinforced concrete-lined separation and washout facilities. At Pyote, those facilities are underlain by 25 feet of continuous clay; at WTMD, the pits will sit atop fractured limestone. The drying pad is similar. A recompacted clay liner will be built, but it will only provide a single primary means of containment; no secondary containment is available.

The proposed WTMD disposal pit is somewhat different, in that it has a multi-component geocomposite lining system with leachate collection and leak detection. But there is no natural containment to backup the engineered containment. Based on the record in this case and the Examiners' experience, permitted waste facilities with below-ground components have historically been built with both engineered and natural containment structures in place. This is especially critical in a recharge zone. In fact, it is precisely the absence of a natural barrier that allows groundwater to be recharged at this location. *The Examiners conclude that, given the unique circumstances of the proposed WTMD facility, WTMD failed to demonstrated the proposed waste disposal activities will not pollute subsurface waters.*

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[106] Sugg Ex. Nos. 24 and 25. Tr. Vol. 5, pages 138, 139, 142, and 143.

[107] Sugg Ex. No. 17. Final Order in Oil & Gas Docket No. 02-0289582, the application of Pyote Reclamation Systems, LLC, pursuant to Statewide Rule 8 for a permit to maintain and operate a commercial stationary treatment and disposal facility, Hohn Road facility, DeWitt County, Texas.

Administrative Review

The Examiners recognize that, but for the protest, this application may have been approved administratively. The Examiners find, however, the prosecution of the protest itself brought to light significant information that was not otherwise available to Commission staff during its administrative review. At one point during the administrative review, Commission staff requested the site facilities not be located within the playa, and WTMD complied. Whether staff considered the playa to be simply an occasional surface water feature or a potentially significant hydrogeological feature is not known. Nonetheless, the preponderance of the evidence persuasively indicates the site is located in a recharge zone of the Edwards-Trinity (Plateau) Aquifer, there is no naturally-occuring strata protecting the aquifer, and there is no indication that such unique situations were considered in the facility design. It is not clear whether this information was available to Commission staff during its administrative review of the application.

Recapitulation on Pollution Prevention

Rule 8 explicitly states that no person shall cause or allow pollution of subsurface water. In addition, Statewide Rule 8 states that before issuing a permit for a waste storage or disposal facility, the Commission must find that an application will not result in the pollution of subsurface water. The general requisite system for pollution to occur at waste disposal facilities consists of three elements: sources, pathways, and receivers.

In this application, all three system components are present: (1) There are (potential) sources of pollution in the waste management units and activities; (2) the fractured limestone (evidenced by the dissolution and erosional features of playa and the visible fractures in the quarry sidewall), and the absence of any evidence of impermeable strata, provides a pathway connecting source and receiver; and (3) there is a high-quality subsurface freshwater resource as a potential receiver for pollution migration. System component nos. 2 and 3 indicate the facility is located over a recharge zone. That is, a recharge zone is explicitly indicated by the credible evidence, and contaminants that enter the pathway will likely reach the receiver because the natural processes result in groundwater being recharged through the same mechanisms.

The question then becomes: Absent geologic isolation, are the engineered sources alone, capable of preventing pollution by isolating waste from the pathway? The credible evidence in the record indicates that Commission policy and precedent affirm they are not. *The Examiners recommend the application be denied.*

FINDINGS OF FACT

1. On September 4, 2015, WTMD notified the owner of the surface tract and owners of adjacent surface tracts of the proposed disposal facility application.

2. By an application filed with the Commission on September 9, 2015, WTMD seeks Commission authority to construct and operate a commercial oil and gas waste stationary treatment and disposal facility, in Section 192, Block 2, U. Cotton Survey (T&P RR CO.), Abstract A-64, Reagan County, Texas. The facility will occupy approximately 96 acres of a 457.99-acre tract. A 6-cell disposal pit will occupy approximately 40 acres, and a waste drying pad will occupy approximately 13 acres. The facility will also include a waste separating facility and a wash-out pit.

3. Notice of the application was published in the *Big Lake Wildcat*, a newspaper of general circulation in Reagan County, Texas, on September 17 and September 24, 2015.

4. The application is protested by Calvin H. Sugg, Jr., an adjoining landowner, and the Santa Rita Underground Water Conservation District.

5. A permit to store or dispose of oil and gas wastes by any method, including disposal into a pit, may only be issued if the Commission determines the disposal will not result in the waste of oil, gas, or geothermal resources or the pollution of surface or subsurface water.

The Proposed Facilities

6. The proposed WTMD site is located on a 457.99-acre tract land about 22 miles north of Big Lake, Texas, on the north side of Strawberry Patch Road about one mile east of FM 33. The site is situated on and generally centered within the U. Cotton (T&P RR CO) Survey, Block 2, Section 192, Abstract A-64, Reagan County, Texas.

7. The proposed disposal and stormwater facilities will be located on the southern 96 acres of the site and include:

    a. A concrete-lined separation facility, to receive wastes that include free liquids;

    b. A clay-lined drying pad to receive wastes that do not contain visible free liquids but require additional drying before being placed in the disposal pit;

    c. A disposal pit with a synthetic liner system for wastes that are dry enough for final disposal;

    d. A concrete-lined wash-out pit; and

e. Two earthen stormwater detention ponds capable of storing a 100-year, 24-hour rain event.

8. The engineered design and operational aspects of the proposed facility design is consistent with similar large commercial facilities permitted by the Commission.

Surface Characteristics

9. The site is located on an outcrop of the Edwards-Trinity (Plateau) Aquifer, which is categorized as a major aquifer by the Texas Water Development Board.

10. A playa is located on the site, directly north of the 96-acre waste disposal area, and most of the site drains into the playa.

11. The playa is a catchment basin for precipitation that lands on most of the 457.99 acre tract, and possibly some portion of surrounding tracts.

12. Based on habitat characteristics, the area of the playa is about 46 acres. Based on topographic characteristics, the area of the playa is about 100 acres.

13. Surficial limestone blocks on the playa floor exhibited karst features.

14. Soil cracks were observed on the playa floor, some of which were up to 3 feet deep. The soil cracks remained open 4 days after the site received about 4 inches of rain.

15. There was no mud on the floor of the playa, and the plant life was verdant.

16. The playa is well-drained.

17. Nearby playas exhibited similar topographic, geologic, dissolution, and erosional features.

18. The playa is a solution sinkhole.

Subsurface Characteristics

19. The subsurface investigation identified a 1-foot to 8-foot thick soil horizon containing sandy clay and clayey gravel, which overlays limestone to the 100-foot total depth of the borings.

20. The surficial soils are mostly low-plasticity clay in the southern part of the site. High-plasticity clays were observed closer to and within the playa.

21. A 20-foot geologic section was exposed in the adjacent quarry, revealing a thin soil veneer overlying 12 feet of the Segovia Limestone Formation, below which was the top of the Fort Terrett Limestone Formation.

22. The Segovia and Fort Terrett Formations are both part of the Edwards-Trinity (Plateau) Aquifer and both susceptible to karst dissolution processes.

23. Visible fractures were observed in the exposed limestone section in the adjacent quarry.

24. The parties agree the limestone underlying the site is fractured.

25. Some thin marl (calclareous clay) layers were observed in the exposed quarry section.

26. The borings were drilled with air rotary drilling methods, which return crushed rock to the surface, and are not capable of discerning rock characteristics such as secondary porosity or permeability.

27. No marl other continuous impermeable strata was identified in any of the other borings drilled on the site.

28. No continuous or substantive geologic strata that may function as a natural barrier to migration of fluid from the base of the engineered waste management units to the freshwater aquifer has been identified.

Aquifer Characteristics

29. Seven groundwater monitoring wells have been installed on the site, in a shallow groundwater regime in which the static water levels were measured to be from about 72 to 85 feet below ground surface.

30. The static water levels have exhibited some variation but have been generally consistent.

31. The groundwater gradient in the shallow regime is in a southerly to southwesterly direction, such that the highest groundwater elevations were in the monitoring wells closest to the playa. The groundwater gradient has exhibited some minor variation but has been generally consistent.

32. Groundwater from the on-site monitoring wells exhibits very good quality, with chloride concentrations ranging from 31 to 61 mg/L and TDS ranging from 288 to 368 mg/L.

33. Other water wells in the area indicate a more substantial aquifer is located at depths of about 200 feet and deeper.

34. Historical groundwater quality data from 1965 to 1970 in deeper nearby wells completed in the Edwards-Trinity (Plateau) Aquifer was remarkably consistent, averaging 37 mg/L chlorides and 323 mg/L TDS.

35. The Edwards-Trinity (Plateau) Aquifer groundwater levels have been significantly depleted over time. Historical records from wells near the site indicate that in the 1940's and 1950's the deeper groundwater regime exhibited a static water level of 80 to 100 feet, which is similar to the current static water level of the shallow regime.

36. There is no continuous, substantive geologic strata that may function as a confining layer isolating the shallow and deep groundwater regimes.

37. The shallow groundwater regime and the deep groundwater regime are both part of the Edwards-Trinity (Plateau) Aquifer.

38. The playa is a natural recharge feature of the Edwards-Trinity (Plateau) Aquifer.

39. There is no evidence in the record demonstrating the fractured limestone underlying the site is hydrologically isolated from the shallow groundwater regime.

40. The proposed site is a groundwater recharge feature of the Edwards-Trinity (Plateau) Aquifer because the subsurface is fractured, there is evidence of karst structures and processes, there are no continuous substantive barriers to infiltration, and the available evidence indicates the likelihood of groundwater mounding associated with the playa.

Prevention of Pollution

41. The general requisite system for pollution to occur at waste disposal facilities consists of three elements: Sources, pathways, and receivers. In this application, all three system components are present.

42. There is no evidence in the record of a similar commercial facility with below-grade disposal units being permitted by the Commission in an aquifer recharge zone.

43. Although the recently-permitted Pyote Reclamation Systems, LLC disposal facility in DeWitt County overlies a regional aquifer, a single continuous 25-foot thick clay layer was documented in the subsurface below the entire site.

44. The below-grade commercial disposal of oil and gas waste in an aquifer recharge zone is contrary to Commission practice.

45. WTMD failed to demonstrate the engineered design and operation of the proposed facility will not result in the pollution of groundwater.

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. All notice requirements have been satisfied. 16 Tex. Admin. Code §§ 3.8 (d)(6)(C) and (D).

3. The application failed to demonstrate the proposed facilities will not result in the pollution of surface or subsurface water. 16 Tex. Admin. Code § 3.8 (d)(6)(A).

4. The application does not meet the requirements of Statewide Rule 8. 16 Tex. Admin. Code § 3.8.

EXAMINERS' RECOMMENDATION

Based on the above findings of fact and conclusions of law, the Examiners recommend the Commission enter an order denying the application of West Texas Mud Disposal, LLC for a commercial permit to dispose of oil and gas waste the proposed facility in Section 192, Block 2, U. Cotton Survey (T&P RR CO.), Abstract A-64, Reagan County, Texas.

Respectfully,

Paul Dubois
Technical Examiner

Dana A. Lewis
Administrative Law Judge