

University Lands Produced Water Frac Pit, Design, Construction, Operation, and Closure Specifications

Before constructing a produced water frac pit, the design criteria specified in this checklist shall be provided to University Lands (UL) in the form of a Construction Submittal Packet. Pit construction must be completed within 18 months of the date of UL approval of the Construction Submittal Packet.

The As-Built Submittal Packet shall be submitted to UL no later than 90 days after construction completion. Both the Construction and As-Built Submittal Packets shall be signed and sealed by a Professional Engineer (PE) licensed by the State of Texas. The Construction and As-Built Submittal Packets shall include a copy of this completed checklist.

I. The Construction Submittal Packet will contain, at a minimum, the following:

1. This completed checklist with applicable boxes checked
2. Pit Lessee, address, and contact information.
3. Applicant (if different than Lessee) name and contact information.
4. Acknowledgment that pit location has been approved by a UL Field Representative and the UL Right of Way Manager.
5. Survey of Pit location that includes a plat in pdf format, ESRI shape (shp) files, and a metes & bounds description.
6. Plot pit location on U.S. Geological Survey 7.5-minute Topographic Quadrangle Map and on an aerial image. Annotate aerial image with 1) circle illustrating ¼-mile radius walking receptor survey, and 2) results of survey.
7. Two scaled perpendicular cross sections of Pit illustrating Pit berm design, berm elevation, Pit bottom elevation, and elevation of regional surrounding ground surface.
8. Construction and materials specifications, including but not limited to soil preparation, liner, leak detection, and automated fluid level monitoring.
9. Pre-construction baseline soil sample locations annotated on survey plat, tabulated analytical results, and laboratory reports. Five discrete soil samples shall be collected from proposed pit area (one from each quadrant and one from the center). Soil samples should be collected from a depth interval of 0.5 – 1.0 feet below ground surface. Each soil sample shall be analyzed for the following:
 - i. Comprehensive salinity: total soluble salts (TSS), electrical conductance (EC), pH, exchangeable sodium percentage (ESP), sodium adsorption ratio (SAR), percent saturation, texture

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- ii. Anion/Cations: bicarbonate, boron, calcium, carbonate, chloride, magnesium, nitrate, nitrite, potassium, sodium, and sulfate
 - iii. Total metals: arsenic, barium, cadmium, chromium, iron, lead, lithium, manganese, mercury, selenium, silver and strontium
 - iv. Benzene, toluene, ethylbenzene, and total xylenes (BTEX)
 - v. Total petroleum hydrocarbons (TX 1005), both GRO and DRO
 - vi. Gross alpha, gross beta, and uranium
10. Statement that each of the following criteria are satisfied:
- i. Depth to groundwater is greater than fifty feet below the Pit bottom;
 - ii. Pit is located more than three hundred feet of a continuously flowing surface water, or within two hundred feet of a lakebed, sinkhole or playa lake as measured from the ordinary high-water mark;
 - iii. Pit is located more than one thousand feet from a permanent residence, school, hospital, institution or church;
 - iv. Pit is located more than five hundred feet from a spring or a water well;
 - v. Pit is not located on an unstable ground surface, faults, or subsurface karst features characterized by sinkholes, voids, caves, fractures, underground rivers, and caves. The characteristics of potential karst features located within approximately 200-ft of the ground surface shall be evaluated with an electrical resistivity tomography survey.
 - vi. Pit is located outside the one-hundred-year floodplain; and
 - vii. Pit is located more than five hundred feet from a plugged and/or abandoned water or oil wellbore. The presence of wellbores shall be evaluated by a prebuild records survey, an onsite walking survey, and a magnetometer survey.
11. Signature and seal of a currently licensed Professional Engineer (PE) registered in the state of Texas, attesting to “the best of my knowledge and belief the information given herewith is true and accurate.”

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II. As-Built Submittal:

1. The As-Built submittal will be provided to University Lands no later than 60 days after water is placed into the pit and shall contain the following:
2. As-Built cross-sections
3. As-Built bathymetric floating survey of the Pit performed with a full pit volume.
4. Pre-construction environmental baseline soil sample locations plotted on map; tabulated analytical results, and laboratory reports.
5. Third-party liner seam welding and pressure test documentation.
6. Third-party leak detection and fluid removal system performance test documentation.

III. Design and Construction Specifications:

1. Prior to constructing a containment, the lessee shall strip and stockpile the topsoil inside perimeter fence for use as the final cover or fill at the time of closure.
2. Pit will be designed and constructed to prevent overtopping due to wave action or rainfall, and prevent the run-on of surface water.
3. Produced water recycling pits shall not be constructed of a size exceeding five hundred thousand (500,000) BBL capacity. Pits larger than five hundred thousand (500,000) BBLs in capacity shall be built in a tandem fashion with a dividing wall constructed to the same standards as all berms.
4. Pit will be screened, netted, or otherwise protective of birds and other wildlife. Audible wildlife deterrents shall not be installed.
5. Pit shall be fenced or enclosed in a manner that deters unauthorized wildlife and human access and shall be maintained in good repair. The lessee shall ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite. Fences will be constructed to Texas Commission of Environmental Quality (TCEQ) Intruder Resistant standards: a minimum of 6-foot tall of chain-link material with an additional 2-foot barbed wire top section, or an 8-foot tall chain-link.
6. Signs shall be installed at all pit access points on the Premises. Each sign shall state: "PRODUCED WATER FRAC PIT". Signage shall be no less than 12 inches by 24 inches in size with lettering not less than 2 inches in height. The sign shall include the operators name, pit name and location and emergency

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contact telephone numbers. It should also state that no unauthorized water transfers (including pirate dumping) are allowed and that this is a high chloride pit that contains non-potable water.

7. Pit foundation and berm

- i. Pit foundation and interior slopes will be smooth and free of rocks, debris, sharp edges, and irregularities.
- ii. Berm design and construction shall adhere to Texas Administrative Code Title 30 Chapter 321.38
<https://www.tceq.texas.gov/assets/public/legal/rules/rules/pdflib/321b.pdf>
- iii. Berm inside and outside grades shall not exceed 2H:1V.
- iv. Minimum width of berm top shall be five feet.

8. Liners

- i. Liners compatibility shall meet or exceed Environmental Protection Agency (EPA) SW-846 method 9090A Compatibility Test for Wastes and Membrane Liners
- ii. Primary (upper) liner material shall be resistant to ultraviolet light, petroleum hydrocarbons, salts, and acidic and alkaline solutions. Primary liner material shall be either:
 - a. 30-mil flexible PVC,
 - b. 45-mil Linear Low-Density Polyethylene (LLDPE) string reinforced,
 - c. 60-mil High Density Polyethylene (HDPE).
- iii. Secondary liner material shall be either 40-mil LLDPE, 30-mil LLDPE string reinforced or equivalent with a hydraulic conductivity no greater than 1×10^{-9} cm/sec.
- iv. Geotextile is required under the secondary liner to reduce localized stress strain or protuberances.
- v. Anchor trench may be located on top of or at the base of outside berm wall.
- vi. Anchor trench minimum depth shall be 18 inches.
- vii. Liner seams will be thermally welded, overlap a minimum of 4-inches, and oriented vertically on berms.

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- viii. There shall be no horizontal seams within five (5) feet of the berm toe.
- ix. Field-welded seams shall be pressure tested.
- x. Third-party personnel will observe and document field seaming and test results in the as-built submittal.
- xi. Liner will be protected from excessive hydrostatic force and mechanical damage.
- xii. Transfer lines will not penetrate the liner and no liner boots shall be installed.

9. Leak detection and leak removal system

- i. A leak detection system will be installed in a sump area which is sloped to a central collection point between the upper and lower liners consisting of a 200-mil geonet or 2-feet of compacted soil with a minimum saturated hydraulic conductivity of 1×10^{-5} cm/sec.
- ii. Actionable Leakage Rates (ALR) of <1000 gal/acre-day should be maintained as cited in *Action Leakage Rates for Leak Detection Systems*, EPA 530-R-92-004.

<https://nepis.epa.gov/Exe/ZVNET.exe/2000DXKG.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1991+Thru+1994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C91thru94%5CTxt%5C00000004%5C2000DXKG.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75q8/r75g8/x150y150q16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL>

- 10. Pit shall be equipped with an automated high level alarm that notifies Operator locally (audible and visual) and remotely via SCADA, SMS text messages and/or emails.
- 11. Pit shall be equipped with load line auto shut-off valve(s) activated by the high level alarm.

IV. Operation, Maintenance, and Recordkeeping

- 1. Pit inspections shall be performed weekly. Each inspection event shall document:
 - i. Berm integrity
 - ii. Liner integrity
 - iii. Netting / screening integrity
 - iv. Sump pump operation

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- v. Perimeter fence
 - vi. Functional high-level alarm and load line shut-off valve(s)
2. Inspection records and checklists
- i. Shall include name of inspector and inspection date
 - ii. Document all repair and routine maintenance
 - iii. Level monitoring data
 - iv. Leak detection & water removal data
 - v. Shall be provided to UL on request
3. By no later than January 30 of each calendar year, provide UL an O&M report containing the following
- i. Cumulative water volumes managed (in/out) of pit
 - ii. Third-party liner integrity inspection results and conclusions
 - iii. Condition of perimeter fence
 - iv. Date of leak discovery, leak volume, and corrective / repair measures implemented
 - v. Current photographs of fence, berm, leak detection equipment, level monitoring system, and transfer lines
 - vi. Verification of current Pit reclamation bond
4. A minimum of three (3) foot of freeboard shall be maintained.
5. Any visible layer of oil shall immediately be removed from the surface of the pit
6. If the primary liner is compromised below the fluid's surface as defined above, the lessee shall remove all fluid above the damage or leak within forty-eight (48) hours of discovery, notify the Lessor and repair the damage or replace the primary liner.
7. If the primary liner is compromised above the fluid's surface, the lessee shall repair the damage or initiate replacement of the primary liner within forty-eight (48) hours of discovery or seek an extension of time from the Lessor.

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V. Closure and Reclamation

1. A Pit shall be deemed to have ceased operations if less than twenty percent (20%) of the maximum design fluid volume is stored or managed during any 6-month period following the first withdrawal of produced water.
2. Lessee shall report cessation of operations to UL.
3. Water shall be removed from the pit within 60 days of ceasing operations.
4. Pit shall be reclaimed within 6-months of ceasing operations.
 - i. Fluids, solids, and liner material shall be disposed in approved disposal facilities. This material shall not be buried on University Lands.
 - ii. Once all liners are removed, with Lessor present, Lessee shall collect soil samples from the floor and interior berms of chemical analyses. Additionally, all stained and/or wet soils shall also be sampled for analysis. All pre-closure samples shall be analyzed for the same constituents described in the pre-construction analyses.
 - iii. Lessor will inspect the containment excavation and review all pre-closure analytical reports before Lessor grants approval for backfill.
 - iv. Soil remediation, as necessary, and site reclamation to establish a vegetative cover will be performed per UL's direction.
 - v. Within sixty (60) days of completion of reclamation, submit to UL a Closure Report that documents all closure and remediation activity. The Closure Report shall bear the signature and seal of a currently licensed Professional Engineer (PE) registered in the State of Texas.