



## ***Fox Engineering Solutions, Inc.***

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September 3, 2017

Eric DeKam  
Production/Construction Superintendent  
TEP Energy Partners  
1058 County Road 215  
Parachute, Colorado 81635

Re: TR 11-5-697 Pit; COGCC Facility #450948 – Hydrostatic Pit Integrity Tests  
NW ¼ NW ¼ of Section 5, Township 6 South, Range 97 West, 6th P.M.  
Garfield County, Colorado

Dear Eric,

Attached are the results of the 72-hour hydrostatic test conducted August 31 through September 3, 2017 at TEP's TR 11-5-697 Pit, COGCC #450948. The hydrostatic test indicated no observed loss in liner system integrity. The summary results, attached, include a data and calculation sheet, survey plat with water surface area and elevation data, and an outline of the procedures employed.

As per COGCC requirements, the hydrotest was conducted over a 72 hour period with the pit filled to 72% of operating capacity. A weather station, consisting of a National Weather Service Class A evaporation pan and two precipitation gauges, was installed at the facility. Survey data including vertical and horizontal control points along with pit water elevations and surface areas, were established and collected by a registered land surveyor from Sexton Surveying Services, Inc.

The pit lining system consists of a primary 60 mil HDPE liner and a secondary 60 mil HDPE liner underlain with a tertiary geo-synthetic clay liner. A 200 mil geonet is located between the primary and secondary liners. Visible portions of the liners had no visible tears, delamination or seam failures. The liner was installed in July/August of 2017 and appeared to be in excellent condition.

The fluid level of the TR 11-5-697 pit dropped 0.900 inches over the 72-hour test duration. Correspondingly, evaporation and precipitation measurements provide a calculated fluid level drop of 0.835 inches. The hydrostatic pit test results indicated no observed loss in liner system integrity.

Should you have any questions or require additional information, please let us know.

Respectfully submitted,

David Fox, P.E.  
***Fox Engineering Solutions, Inc.***  
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Grand Junction, CO 81507  
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Email: [coloradofox@bresnan.net](mailto:coloradofox@bresnan.net)

# Hydrostatic Pit Testing Data Collection & Computation Form

Fox Engineering Solutions, Inc.



**Pit Owner:** TEP ROCKY MOUNTAIN LLC  
**Pit Name:** TR 11-5-697  
**COGCC Facility No.** 450948  
**Pit Location:** NW 1/4 NW 1/4 Section 5, T6, R97W, 6th P.M.  
 Latitude: N 39.561491° Longitude: W-108.252052° (NAD83)  
**Reported Liner:** 60 mil HDPE Primary / 60 mil HPDE Secondary/ GCL Tertiary  
**Approximate Elevation:** 8375 ft. msl  
**Test Conducted By:** David Fox P.E., Fox Engineering Solutions, Inc.

## Test Initiation:

Date: 8/31/2017  
 Time: 9:30 AM  
 Total Duration: 72 hours

## Test Termination:

Date: 9/3/2017  
 Time: 9:30 AM

	Length	Width	Area	Comments
Tributary Pit Liner Surface Area (ft <sup>2</sup> ):	-	-	58,123 ft. <sup>2</sup>	Surveyed by Sexton Survey
Initial Pit Water Surface Area:	-	-	44,296 ft. <sup>2</sup>	Surveyed by Sexton Survey
Final Pit Water Surface Area:	-	-	44,296 ft. <sup>2</sup>	Surveyed by Sexton Survey
Average Pit Surface Area:			44,296 ft. <sup>2</sup>	
Initial Pit Fluid Level:				8368.960 ft.
Final Pit Fluid Level:				8368.885 ft
Difference				0.075 ft or
Est. Fluid Depth:	12 - 13 ft.			0.900 inches
Evaporation Pan Installed: Yes	Location: West side of TR 11-5-697 Pit	Measured Pan Evaporation: (Fresh Tap Water)	1.044 inches	
		Adj. Evaporation w/ Pan Coeff. 0.72 & PW Brine/Water Evap Ratio = 0.90	0.835 inches	
Rain Gauge Installed: Yes - 2 Gauges	Location: W & E sides of TR 11-5-	Recorded Precipitation:	0.000 inches	
		Equiv. 72-Hour Precip. Inflow:	0.000 inches	
Other Inflow/Outflow:	Inflow (gal) 0	Equivalent Inflow:	0.000 inches	
	Outflow (gal) 0	Equivalent Outflow:	0.000 inches	
Calculated Fluid Level Change in Inches:	(+ indicates fluid level increased) (Inflows - Outflows + Precipitation - Evaporation)			-0.835 inches
Measured Level Change in Inches:	(+ indicates fluid level increased)			-0.900 inches
Difference between Calculated and Measured Pit Fluid Level:				0.065 inches

**Summary:** No observed loss in liner integrity. Fluid level drop correlated with evaporation & precipitation measurements.  
**Weather:** Mostly sunny with intermittent clouds. No precipitation. Temperatures 50s - 80s.

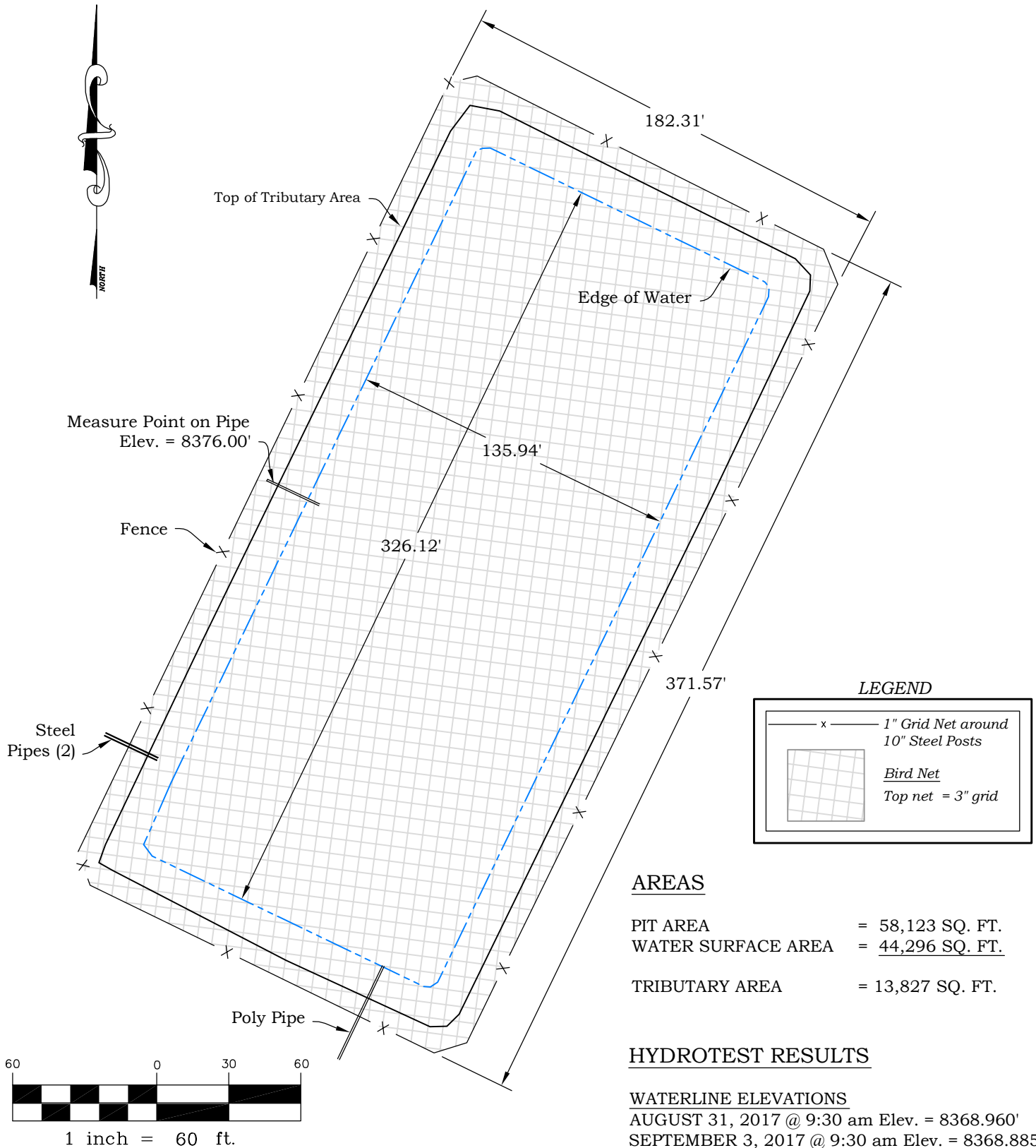
**Liner and Pit Condition:** Produced water fluid level at 72% of operating capacity. Liner was new and in excellent condition.  
 Visible portion of liner, approximately the top 13' - 15', had no visible tears, delamination or seam failures.

**Comments:** Sexton Survey utilized a Trimble Total Station for required area and elevation measurements.  
 TEP staff indicated that no fluids were transferred from or to the pit during the duration of the test.  
 Evaporation pan placed within the fenced area on the west side of the pit.

Fox Engineering Solutions, Inc.

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# HYDRO-TEST EXHIBIT



Section 5  
T. 6 S., R. 97 W. of the 6th P.M.  
COSP NAD 83 CENTRAL ZONE  
N: 1641119.3  
E: 2224186.5

JOB. NO: 17087  
NAME: HYDRO  
DATE: 9/3/17

Hydro-test Exhibit Prepared for:

TERRA ENERGY

TRAIL RIDGE PIT 11-5-697  
Hydrostatic Pit Test

# Pit Liner Integrity Observation Procedures For Earthen Pits

Version 8.0 9/03/2017 ©



Fox Engineering Solutions, Inc.

The observation methodology utilizes a mass balance approach by accurately measuring and monitoring the pit's water surface level and comparing level changes with precipitation, evaporation and other inflow and outflow measurements and estimates. The observation period is generally 72 hours. These procedures are specific to existing or active earthen pits holding oil and gas related fluids including, but not limited to, produced water. The pit shall have a fluid level as high as practical or warranted, without encroaching into the freeboard, and shall be monitored for a minimum of 72 hours, if practical. Visible portions of the liner, including the anchor trench and seams, shall be inspected for defects. The observation period shall be scheduled and coordinated with personnel to ensure that oil and gas activities do not interfere. Procedures may be subject to changes as dictated by field and climatic factors. All involved personnel, while onsite, shall comply with their respective EH&S requirements.

- If practical, a sign shall be placed in a conspicuous location stating "Liner Integrity Observation in Progress, Pit Closed to All Water Transport Activities". Contact information shall also be placed on the sign. Locked gates at the pit facility are recommended.
- Semi-permanent datum elevation point(s) shall be established at the pit location. The pit fluid level; fluid surface area; the lined surface area tributary to the pit, and evaporation pan water levels shall be measured and recorded at the beginning of the observation period. The pit fluid level and evaporation pan water levels shall be measured again at the end of the period. A survey grade total station shall be utilized for accuracy to capture this information. The date and time of measurements shall be documented.
- A minimum of one 4" diameter NWS rain gauge with funnel inlet shall be installed at the pit site. Precipitation shall be recorded for the duration of the liner integrity observation period.
- Pan evaporation shall be measured following the procedures established by the National Weather Service – NOAA in the document entitled "National Weather Service - Observing Handbook No. 2, dated July 1989. A Class A evaporation pan shall be placed at the site, or as near as practical, with evaporation measured per established procedures. During ice-over periods at the pit, evaporation is assumed negligible and evaporation measurements will not be taken.
- All inflows and outflows, such as truck and piped transfers, shall cease. Surveillance monitoring may be warranted to prevent inadvertent fluid transport. If the cessation of inflows and outflows is not practical, all pit inflows and outflows shall be accurately metered and documented.
- If no precipitation has occurred, compare the change in the pit fluid level with the recorded pan evaporation. Pan coefficients shall be applied as per NOAA Technical Report NWS 33, USGS Water Supply Paper 2437 and Texas Water Development Board Report 77. During ice-over periods, compare the pit levels taken at the start and end.
- If precipitation has occurred, precipitation falling onto tributary portions of the liner, outside of the fluid surface area, may be added as an inflow to the pit and converted into inches of depth over the fluid surface area. During ice-over and snow conditions, precipitation inflow from tributary portions of the liner may be estimated from snow depth and corresponding water equivalent comparisons at the start and termination of the observation period. Other factors may also be utilized.
- The calculated change in pit level is:  
$$\Delta L = P + I - O - E \text{ (all measurements converted to inches)}$$

Where:  $\Delta L$  = Change in pit fluid level      P = Precipitation Inflow      E = Evaporation  
          I = Measured Inflows                      O = Measured Outflows
- The measured change in the pit fluid level shall be compared to the calculated change utilizing precipitation and evaporation data collected. The procedures and results will be reviewed and analyzed for discrepancies. The observation period may be extended if the results indicate integrity issues with the lining system.