E&E ENGINEERING
and Associates

2301 North Yellowood Avenue
Broken Arrow, Oklahoma 74012
TEL: 918-957-1300
FAX: 918-957-1313
ee-associates.com

November 4, 2024

Ms. Hillary Young, P.E.
Chief Engineer
Land Protection Division
Oklahoma Department of Environmental Quality
P.O. Box 1677
Oklahoma City, Oklahoma 73101-1677

RE: Permit Renewal Application
Class I Non-Hazardous Industrial Waste Injection Well
Real Alloy Recycling, LLC
Creek County, Oklahoma
UIC Permit No. IW-NH-3519019-R1

Dear Ms. Young:

On behalf of Real Alloy Recycling, LLC (Real Alloy), E&E Engineering and Associates, LLC (E&E) is pleased to submit the enclosed permit renewal application and associated permit renewal fee (Check No. 1482) for the Real Alloy Class I Injection Well (Well #1) located in Sapulpa, Oklahoma. This submittal includes two (2) copies of the permit renewal application consisting of one (1) hard copy and one (1) electronic copy on a flash drive.

If you should have any questions or require any further information, please do not hesitate to contact me at 918-957-1300.

Respectfully,
E&E Engineering and Associates, LLC.

Christopher J. Greenlee, P.G.
Sr. Environmental Engineer/Geologist

Deren M. Ertugrul, P.E.
Vice President

Enclosures

cc: Mr. Chuck Sudwischer, Real Alloy (via email)
Mr. Robert Wallace, Real Alloy (via email)

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2024 PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
CLASS I NON-HAZARDOUS INJECTION WELL
SAPULPA, CREEK COUNTY, OKLAHOMA
UIC PERMIT NO. IW-NH 3519019-R1

November 4, 2024
E&E Project No. 104-037

Prepared for:
Real Alloy Recycling, LLC
Sapulpa, Oklahoma

Prepared by:
E&E Engineering and Associates, LLC
Oklahoma Certificate of Authorization No. 7889
2301 North Yellowood Avenue | Broken Arrow, Oklahoma 74012
Phone: 918-957-1300 | Fax: 918-957-1313

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

%g	percent acceleration of gravity
AOR	area of review
bbl	barrel
bgs	below ground surface
bpm	barrels per minute
CFR	Code of Federal Regulations
cp	centipoise
DEQ	Oklahoma Department of Environmental Quality
EUE	external upset end
ft	feet
GIS	geographic information system
gpm	gallons per minute
hr	hour
IC	internally coated
in	inches
LTC	long threaded couplings
M	magnitude (Richter scale)
md	millidarcy
MIT	mechanical integrity test
msl	mean sea level
NHIW	non-hazardous industrial waste
OAC	Oklahoma Administrative Code
OCC	Oklahoma Corporation Commission
OD	outer diameter
OPDES	Oklahoma Pollutant Discharge Elimination System
OWRB	Oklahoma Water Resources Board
P&A	plugging and abandonment
PFOT	Pressure Fall-Off Test
PGA	peak ground acceleration
PLC	programmable logic controller
psi	pounds per square inch
psig	pounds per square inch gauge

STC	short threaded couplings
TD	total depth
TDS	total dissolved solids
TSS	total suspended solids
UIC	underground injection control
USDW	underground source of drinking water
USEPA	United States Environmental Protection Agency
WFL	Water Flow Log
ZEI	zone of endangering influence

OMB No. 2040-0042 Approval Expires 4/30/2022

United States Environmental Protection Agency

Underground Injection Control
Permit Application for a Class I Well

(Collected under the authority of the Safe Drinking Water Act. Sections 1421, 1422, and 40 CFR Part 144)

For Official Use Only

Date Received:

Permit Number: IW-NH 3519019-R1

Read Attached Instructions Before Starting

I. Owner Name, Address, Phone Number and/or Email

Real Alloy Recycling, LLC

Class I NHIW Injection Well No. 1
1508 North 8th Street
Sapulpa, OK 74066
Chuck.Sudwischer@RealAlloy.com

II. Operator Name, Address, Phone Number and/or Email

Real Alloy Recycling, LLC
1508 North 8th Street
Sapulpa, OK 74066
Creek County, Oklahoma

Plant Manager:
Chuck Sudwischer
Chuck.Sudwischer@RealAlloy.com
(918) 224-4746

III. Commercial Facility

- [ ] Yes
- [x] No

IV. Ownership

- [x] Private
- [ ] Federal
- [ ] State/Tribal/ Municipal

V. Permit Action Requested

- [ ] New Permit
- [x] Permit Renewal
- [ ] Modification
- [ ] Add Well to Area Permit
- [ ] Other

VI. SIC Code(s)

3341

VII. Indian Country

- [ ] Yes
- [x] No

VIII. Type of Permit (For multiple wells, use additional page(s) to provide the information requested for each additional well)

- [x] A. Individual
- [ ] B. Area

Number of Wells: 1

Well Field and/or Project Names:

IX. Class and Type of Well (see reverse)

A. Class	B. Type (enter code(s))	C. If type code is "X," explain.
1	Type I	

X. Well Status

- [x] A. Operating
- [ ] B. Conversion
- [ ] C. Proposed

Date Injection Started: 02/01/1990

Date Well Constructed: 10/24/1989

XI. Well Information

API Number:

Permit (or EPA ID) Number:

Full Well Name: Well No. 1

XII. Location of Well or, for Multiple Wells, Approximate Center of Field or Project

Locate well in two directions from nearest lines of quarter section and drilling unit

Surface Location

SW 1/4 of NE 1/4 of Section 26 Township 18N Range 11E

1370 ft. from (N)/S) NE Line of quarter section

600 ft. from (E)/W) NE Line of quarter section.

Latitude: 36° 0' 49.64" or 36.013790°

Longitude: -96° 6' 28.73" or -96.107981°

XIII. Attachments

In addition to this form, complete Attachments A-U (as appropriate for the specific well class) on separate sheets. Submit complete information, as required in the instructions and list all attachments, maps or other figures, by the applicable letter.

XIV. Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possiblity of fine and imprisonment. (Ref. 40 CFR § 144.32)

Name and Official Title *(Please Type or Print)*	Signature	Date Signed
CHARLES SUDWISCHER PLANT MGR		11-4-24

EPA Form 7520-6 (Rev. 4-19)

1.0 INTRODUCTION

Real Alloy Recycling, LLC (Real Alloy) owns and operates a Class I non-hazardous industrial waste (NHIW) injection well facility located in Sapulpa, Oklahoma. The injection well facility includes one (1) underground injection well designated as Well #1 which is operated in accordance with Underground Injection Control (UIC) Permit No. IW-NH-3519019-R1 issued by the Oklahoma Department of Environmental Quality (DEQ).

The injection well is located on approximately 64.5-acres of contiguous property owned by Real Alloy. The property includes a secondary aluminum smelting plant, a closed 7.5-acre NHIW landfill, and a leachate/stormwater collection pond. The injection well is permitted to dispose of ammonia and chloride contaminated storm water run-off, leachate and seepage from the landfill, and non-hazardous wastewater from the facility.

1.1 BACKGROUND

Real Alloy (formerly IMCO Recycling, Inc.) was initially issued a permit to construct Well #1 on September 6, 1988. Drilling of the injection well began on October 5, 1989 and was completed on October 24, 1989. Well completion and treatment activities were conducted between October 24, 1989 and November 3, 1989.

Well #1 was drilled to a depth of 4,055 feet and is completed as a 6-1/4 inch diameter open hole in the Cambrian-Ordovician Simpson group, Arbuckle group, and Granite Wash from a depth of 2,380 feet to 4,055 feet. The lowermost underground source of drinking water (USDW) is encountered at the site at an approximate depth of 120 to 134 feet below ground surface (bgs) in the Pennsylvanian sandstone. The surface casing is set and cemented at a depth of 545 feet to protect the USDW. A 7 inch diameter long string casing is set and cemented at a depth of 2,392 feet. Injection occurs through the 2-7/8 inch diameter tubing and injection packer. Well #1 has been in operation since 1990 without any significant incident or operational issues.

1.2 PURPOSE

The current UIC Permit No. IW-NH-3519019-R1 expires in November 2024. In accordance with the UIC permit, Real Alloy has a duty to apply for and obtain a new permit in order to continue activities regulated by this permit after the expiration date. The purpose of this application is to apply for the renewal and continuation of the current UIC permit.

This permit renewal application has been prepared in accordance with the permit conditions and applicable regulations. A copy of the current permit is provided in **Appendix A**. This document is structured to address the requirements of EPA Form 7520-6, Permit Application for a Class I Well, and Oklahoma Administrative Code (OAC) 252:652. A completed and signed copy of EPA Form 7520-6 is provided at the beginning of this document. Attachments A through K, as required by EPA Form 7520-6 and as appropriate for the specific well class, are provided in the following sections of this document.

2.0 ATTACHMENT A – MAP(S) AND AREA OF REVIEW

Section 2.0 provides information regarding the well location, area of review, maps, corrective action plans, and landowner information as required for Attachment A of the permit application form.

2.1 WELL LOCATION

Well #1 is located on approximately 64.5-acres of contiguous property owned by Real Alloy north of Interstate 44 (Turner Turnpike) and east of North 9th Street in Sapulpa, Oklahoma. The injection well is described as being 600 feet east and 50 feet south of the northwest corner of the southwest quarter (SW/4) of the northeast quarter (NE/4) of Section 26, Township 18 North, Range 11 East of the Indian Base and Meridian, in Creek County, Oklahoma. A certificate of the well site survey is provided in **Appendix B**. The surface location for Well #1 is at a latitude of 36° 0' 46.64" N and a longitude of 96° 6' 28.73" W. For purposes of this application, the injection well facility property boundary is defined as the wellbore.

2.2 AREA OF REVIEW

The Area of Review (AOR) for Well #1 was determined by calculating the radius of the zone of endangering influence (ZEI) using a modified version of the Theis well pumping equation in accordance with the United States Environmental Protection Agency (USEPA) UIC regulations (40 CFR Part 146, Subpart A, Section 146.6). The ZEI is defined as the area in which increased pressures in the formation due to injection may cause migration of the injected fluid or the fluid in the formation upward into the USDW or freshwater aquifer.

Computations of the ZEI are based on reasonable estimates for injection zone parameters including hydraulic conductivity, thickness, storativity, hydrostatic heads, and injection rates and duration. The equation is applied with the assumption that injection is continuous and that there is a vertical pathway for USDWs to be impacted when the potentiometric surface of the injection cone is higher than the hydrostatic head of the USDW. The following computations define the AOR for this application.

The modified Theis equation is as follows:

$$\boldsymbol{r = \left(\frac{2.25KHt}{S10^{x}}\right)^{1/2}}$$

Where:

- $\boldsymbol{r}$ = Radius of endangering influence (ZEI) from injection well [ft]
- $\boldsymbol{K}$ = Hydraulic conductivity of the injection zone [ft/d]
- $\boldsymbol{t}$ = Time of injection 10-years , 3650 [days]
- $\boldsymbol{H}$ = Thickness of the injection zone [ft]
- $\boldsymbol{S}$ = Storage coefficient [dimensionless]
- $\boldsymbol{x}$ = "x" exponent

$$x = \frac{4\pi kH\left(h_w - h_{bo} \cdot S_p G_b\right)}{2.3Q}$$

Where:

- x = For Radius of Investigation
- Q = Avg. Injection Rate [ft^3/d]
- h_{bo} = Observed original hydrostatic head of injection zone (length) measured from the base of the lowermost underground source of drinking water [ft]
- h_w = Hydrostatic head of underground source of drinking water (length) measured from the base of the lowest underground source of drinking water [ft]
- $S_p G_b$ = Specific Gravity of injectate = 1.01 [dimensionless]
- π = 3.142

For calculation purposes, input parameters in length, volume, and time are expressed as feet (ft), cubic feet (ft^3/day), and days.

The injection rate (Q) utilized for this calculation was based on the maximum permitted injection rate of 100 gallons per minute (gpm) or 19,251 cubic feet per day (ft^3/day). The time of injection used in the calculation was 3,650 days, which is equivalent to the 10-year period for the permit renewal application term. It is noted that this calculation is conservative as it assumes that injection will occur continuously over this period, although this is not the case for Well #1. Based on reported data, it is estimated that Well #1 operated 15,075 hours or 628.1 days during the previous 10-year period at an average injection rate of 70.0 gpm.

The hydraulic conductivity (K) for the Ordovician Cambrian Simpson/Arbuckle formation was converted from the intrinsic permeability of the reservoir based on laboratory testing of cores and logging of the injection zone when the well was constructed. The average intrinsic permeability of 8 millidarcy (mD) was converted to a hydraulic conductivity of 2.98 x 10^{-4} feet per day (ft/d) for use in the modified Theis equation based on the following equation:

$$K = k_i\left(\frac{\rho g}{\mu}\right)$$

Where:

- K = Hydraulic conductivity (cm/sec)
- k_i = Intrinsic permeability [mD]
- ρ = Density of fluid in the injection zone [gm/cc]
- μ = Viscosity of injectate [cP]

The Storativity (S) or the storage coefficient is a dimensionless value specific to the hydrogeologic conditions in the injection zone and was established by using site-specific data where available or reasonable estimates. The Storativity was calculated to be 4.47 x 10^{-2} (dimensionless) using the following equation:

$$S = \rho g(\alpha + \phi\beta)b$$

Where:

S = Storage Coefficient or Storativity (dimensionless)
α = Aquifer compressibility [Pa^{-1}] or [$m \bullet s^2/kg$]
ϕ = Total porosity [decimal]
b Aquifer thickness [ft]
ρ Density of water [kg/m^3]
g Gravitational acceleration [m/s^2]
β = Water compressibility [Pa^{-1}] or [$m \bullet s^2/kg$]

A typical jointed rock compressibility of 10^{-8} (Freeze & Cherry, 1979) was used to represent the injection zone with an effective thickness of 1,470, feet with 0.12 percent average porosity.

Drilling logs for the deep monitoring well located adjacent to the injection well show that the well was completed in a shallow freshwater sandstone zone from 120 feet to 134 feet bgs. Deeper water sampling of the Pennsylvanian sandstone aquifer (Cleveland Sand) at 450-foot depth previously confirmed that the groundwater becomes more brackish and saline with depth. For the purposes of this application, the hydrostatic head data for the USDW (h_w) and the injection zone (h_{bo}) were established by using an estimated base of USDW of 134 feet bgs which correlates to the base of the shallow freshwater sandstone at a measured depth of 134 feet bgs or a vertical elevation of 621 feet relative to mean sea level (msl).

An estimated groundwater level of 29.24 feet bgs was used to calculate a value for hydrostatic head (h_w) for the USDW which was determined to be 104.76 feet msl. The actual observed original hydrostatic head of the injection zone (h_{bo}) was more difficult to estimate, however a reasonable value of 94 feet msl was used based on the specific gravity of the injectate and resulting pressure gradient.

Using reasonable input estimates and site-specific data, calculations support an AOR radius of 287 feet, which is less than 1/4 mile. Consistent with regulatory requirements and previous permit applications for Well #1, an AOR of 1/4 mile from the location of the wellbore is considered for the purpose of this permit renewal application.

2.3 REQUIRED MAPS

Maps required by EPA Form 7520-6 and other maps relevant to OAC 252:652 are discussed in the following sections.

2.3.1 TOPOGRAPHIC LOCATION MAP

A topographical location map depicting the injection well location, Real Alloy property boundary, springs or surface bodies of water, and other pertinent surface features within the AOR is provided as **Figure A-1**. There are no hazardous waste treatment, storage, or disposal facility locations within 1 mile of Well #1, however Real Alloy does own and maintain a closed NHIW landfill within the property boundary under authorization of a DEQ solid waste permit. No surface water intake or discharge structures have been identified within 1 mile of Well #1.

A detailed search performed on March 8, 2024 using the current Oklahoma Water Resources Board (OWRB) website GIS interface did not reveal any drinking water wells within the AOR. The nearest domestic water well is located approximately 4,500 feet east-northeast of the Real Alloy injection well in the NW/4 of Section 25, Township 18 North, Range 11 East. This well was drilled to a depth of 126 feet bgs and completed on July 28, 1985 with the deepest saturated stratum encountered at 95 feet to 118 feet bgs. No other domestic drinking water wells were identified within 1 mile of Well #1.

An industrial groundwater well was also identified approximately 3,680 feet east of Well #1 in the same quarter section of Section 25. This well was drilled to a depth of 560 feet and completed on February 19, 1981 with the deepest saturated stratum encountered at 455-475 feet bgs.

According to the drilling logs for both wells, the estimated yield for these wells range between 10 to 70 gpm. Static water levels of these wells range between 14 and 66 feet. No other groundwater wells were identified within 1 mile of Well #1. These wells are depicted in **Figure A-1** and pertinent data is summarized in **Table 1**.

Table 1: Private Water Wells within 1-Mile

Owner	Address	Distance / Direction from IMCO #1	Depth of Well (ft)	Type
Glenn Wood	787 N. Moccasin	4,446 ft east-northeast	126	Domestic
Liberty Glass Co.	P.O. Box 520	3,680 ft east	560	Industrial

2.3.2 SURFACE GEOLOGY MAP

A surface geology map depicting other required information is presented as **Figure A-2**. The surface geology map does not show any surface or subsurface mines or quarries within the AOR, but does show three (3) petroleum wells undifferentiated as oil and gas, water or injection, or junked and abandoned. Surface expression geology is predominately limited to the Nellie Bly, Hogshooter, and Coffeyville Formations comprised of interbedded shales, siltstones, and sandstones of (Missourian) middle Pennsylvanian age. These formations dip westward at a low angle of approximately 2 to 5 degrees and there are no known outcrops of the injection or confining formation in the mapped area. No faulting is present at the site or in the near vicinity. There are no production wells or other injection wells, but three (3) known abandoned deep wells, or dry holes have been identified within the AOR.

2.3.3 GENERAL SITE MAP

A detailed site map of the Real Alloy property and facility is provided as **Figure A-3**. The recycling plant operations are located on the northwest side of the property and the NHIW landfill is located to the south. The landfill has been capped with a combination clay liner and a composite clay/geosynthetic liner system. The leachate from the landfill is collected by a French drain system and a series of sumps then conveyed to a leachate collection pond equipped with a composite liner system.

Eleven (11) active shallow groundwater monitoring wells associated with the NHIW landfill exist within the Real Alloy property boundary. These shallow groundwater monitoring wells range from a depth of 30 to 98 feet bgs. The shallow groundwater monitoring wells associated with the NHIW landfill are shown in **Figure A-3**.

One (1) deep monitoring well associated with the injection well is located adjacent to the injection well within the Real Alloy property. The screened interval from 117.5-137.5 ft bgs is completed primarily in a 14.5 foot thick sandstone zone at 120-134.5 feet depth. The groundwater of the deep monitoring well is sampled regularly on a monthly basis and the results are submitted to DEQ quarterly with the monthly injection reports. The deep groundwater monitoring well associated with the injection well is shown on **Figure A-3**.

2.3.4 AREA OF REVIEW MAP

A map showing all residences and roads in the AOR is provided as **Figure A-4**. There are no schools or hospitals in the AOR. A 30-inch diameter city sanitary sewer line runs in an east-west direction across the Real Alloy property through the valley just south of the Real Alloy plant facility. Several large natural gas pipelines run east-west in a pipeline corridor on county land immediately north of the Real Alloy property boundary. There are 40 homes located within approximately 1/4-mile of Well #1, 25 of which are located in the subdivision which immediately borders the western boundary of the Real Alloy property. The City of Sapulpa maintains an elevated water storage tank within 200 feet of the westernmost projection of the Real Alloy property boundary.

2.3.5 GROUNDWATER RESOURCES AND RECHARGE AREA MAP

OAC 252:652-3-1(1) states that no new Class I injection well facility may be permitted at a location over or through an unconsolidated alluvial aquifer or terrace deposit aquifer, or over or through a bedrock aquifer. Well #1 is an existing Class I injection well facility and is not located in an area of an alluvial or terrace deposit aquifer or a bedrock aquifer as shown on the "Map of Aquifers and Recharge Areas in Oklahoma" presented in **Figure A-5**.

2.3.6 FLOOD PLAIN MAP

OAC 252:652-3-1(3) states that no new Class I injection well facility may be permitted in the 100-year flood plain, unless the 100-year flood plain is subsequently redefined to not include the land area proposed for the new disposal area. Well #1 is an existing Class I injection well facility and is located outside of the 100-year flood plain as shown in **Figure A-6**.

2.4 AREA OF REVIEW WELLS AND CORRECTIVE ACTION PLANS

There are no wells present within the 1/4 mile AOR that penetrate the Devonian Woodford Shale, the primary confining zone for Well #1. Based on this information, and in accordance with 40 CFR 144.55, a Corrective Action Plan is not required for Well #1. The only wells identified within the AOR are three (3) historic oil & gas wells drilled prior to 1945. Data for these wells can be found in **Table 2**. A plugging record for the Littlehead #3 well was previously confirmed, but not for Littlehead #2 or Clarke #1.

Table 2: List of Oil and Gas Wells within the AOR

Company / Well Name	Location	Section-Township-Range	Well Type	Date Drilled	Ground Elevation (ft)	Total Depth (ft)	Deepest Formation
Sunray Oil Co. / S.L. Clarke #1	E/2, E/2, NW/4, NE/4	26-18N-11E	Oil	1/2/1928	717	1,952	Mississippi Lime?
Sooner & Oil Gas Co. / Littlehead #2	SW/4, SW/4, NE/4	26-18N-11E	Oil	1/23/1945	850	2,020	Pennsylvanian Taneha Sand
Sooner & Oil Gas Co. / Littlehead #3	NE/4, SW/4, NE/4	26-18N-11E	Dry	6/27/1945	740	2,019	Mississippi Lime

Beyond the AOR, there are four (4) deep wells drilled for oil and gas within a 1-mile radius known to have penetrated the base of the confining zone (Woodford) and into the injection zone (Simpson and Arbuckle). At least fifty-six feet of impervious Woodford and Kinderhook shale sections overlie the Simpson and form the top seal for oil and gas accumulation in that zone.

Information regarding the wells within a one (1) mile radius of Well #1 which are known to have penetrated the Simpson are tabulated in **Table 3** and copies of all available completion and plugging records for these wells are included in **Appendix C**.

Table 3: List of O&G Wells Penetrating the Simpson Group within 1-mile

Company / Well Name	Location	Section-Township-Range	Well Type	Date Drilled	Ground Elevation (ft)	Total Depth (ft)	Deepest Formation
Ross Mayo / Coyl #1	NW/4, SE/4, SE/4	22-18N-11E	Dry	1/1/1954	765	2,403	Wilcox [(1)]
Flanagan / Hughes #1	SW/4, NW/4, SE/4, NE/4	23-18N-11E	Dry	7/5/1923	N/A	2,687	Wilcox [(1)] (Turkey Mtn.)
Ganer Oil / Haubert #1	NE/4, NW/4, SW/4	24-18N-11E	Gas	12/1/1976	690	2,302	Wilcox [(1)]
Sunray Oil Co. / Shirley #1	SE/4, SW/4, SW/4	24-18N-11E	Gas	11/8/1927	~660	2,265	Wilcox [(2)]

Notes: [(1)] Plugging Record
[(2)] No Plugging Record

Figure A-7 depicts all oil and gas wells located within 1 mile of Well #1.

2.5 LANDOWNER INFORMATION

A list of the names and addresses of all landowners of record within 1/4 mile of the injection well is provided in **Appendix D**.

3.0 ATTACHMENT B – GEOLOGICAL AND GEOPHYSICAL INFORMATION

Section 3.0 provides information regarding the geological data and proposed formation testing program as required for Attachment B of the permit application form.

3.1 GEOLOGICAL DATA

Geologic data for the regional area and specifically on the formations encountered in Well #1 are presented in the following subsections.

3.1.1 REGIONAL GEOLOGIC SETTING

Well #1 is located in northeastern Oklahoma in the southwest quarter (SW/4) of the northeast quarter (NE/4) of Section 26, Township 18 North, Range 11 East of the Indian Base and Meridian in Creek County, Oklahoma. A generalized geologic section of northeastern Oklahoma is presented in **Figure B-1**.

Regionally, surface strata are comprised of Pennsylvanian age sedimentary strata. Uplands are capped with thin resistant sandstone or limestone strata separated by relatively thick shales and thin coal beds. Regional dip is gentle and toward the west and south.

The Pennsylvanian age sedimentary strata belong to the Missourian, Des Moinesian, Atokan, and Morrowan Series. These strata comprise about half, or about 2,000 feet, of the geologic formations lying between the ground surface and the granite basement. Underlying the Pennsylvanian strata are approximately 340 feet of Mississippian age shales and limestones of the Boone Formation which conformably overlie the Woodford Shale of Devonian age.

The Woodford Shale rests unconformably on the Simpson Group sediments, which include the Wilcox Sandstone of the Middle Ordovician age. The Simpson Group strata are approximately 270 feet thick and overlie the Cambro-Ordovician age Arbuckle Group carbonates. The Simpson Group sediments do not crop out at the surface, but their hydrologic characteristics are similar to the Arbuckle Group. The Arbuckle Group has a maximum thickness of 1,500 feet and overlies the Granite Wash and/or the Precambrian age granite.

The injection section (Simpson and Arbuckle Groups and Granite Wash) is regionally a homocline dipping to the southwest at approximately 45 feet per mile. The Arbuckle Group and Granite Wash are an open hydrologic system. Regional movement of water within the Arbuckle Group and Granite Wash is toward the southwest following the structure, thickness, and depositional trend of the Arbuckle sediments. The rocks of the Arbuckle Group crop out in Ottawa and Delaware Counties as indicated in **Figure B-2**. These strata comprise a regionally important aquifer in northeast Oklahoma, southeast Kansas, southwest Missouri and northwest Arkansas. With increasing depth in a southwesterly direction, freshwater supplies become brackish and saline. Southwest of Tulsa, the Arbuckle Group has a thickness of approximately 1,000 feet as indicated in **Figure B-3**. The groundwater contained in the Simpson and Arbuckle groups exhibit a total dissolved solids (TDS) concentration in excess of 150,000 ppm, as shown in **Figure B-4** and **Figure B-5**, respectively.

The feasibility of deep well disposal in northeast Oklahoma was previously investigated by Reeder (1971). Based on this work, **Figure B-6** depicts the relative feasibility of disposal and rocks suitable for disposal. This work shows that much of Rogers, Tulsa, Wagoner, Osage, and Creek Counties are considered to be suitable for deep well disposal in the Arbuckle Group.

The Seneca Fault is the most prominent fault in northeastern Oklahoma, as depicted in **Figures B-2** through **B-6**. It exhibits a northeast-southwest trend, roughly parallel to the regional dip of the geologic strata. The Seneca Fault appears at the surface and is mapped as extending into the Precambrian basement rock. The area south of the Seneca Fault is highly faulted and these faults render much of the southeastern portion of the state unsuitable for deep well disposal.

3.1.2 GEOLOGY OF THE SITE AND ADJACENT AREA

The local geology in the vicinity of Well #1 has been developed from the drilling of the injection well, previous shallow drilling on the property, and a review of available drilling logs for oil, gas, and water wells at a distance of up to three (3) miles from the facility.

At the site, the gently westward dipping surface outcrop is the Coffeyville Formation of the Skiatook Group, Missourian age of the Pennsylvanian period. A cross-section of the shallow Pennsylvanian age strata underlying the facility is depicted in **Figure B-7**. The cross-section was developed based on shallow groundwater monitoring wells at the site. The maximum depth of shallow borings at the Real Alloy property was 110 feet.

Underlying the basal 500 feet of the Skiatook Group are about 400 feet of sandstones, shales, and limestones of the Des Moinesian age Marmaton Group, the base of which is the “Oswego lime”. About 390 feet of the underlying sandstones as well as minor coals, one of which, the Tebo Coal at the base of the Senora Formation, marks the beginning of the Cabaniss Group.

The Krebs Group, which includes 600 feet of shales, sandstones and thin limestones, represents deposition of lower Des Moinesian sediments. The underlying Mississippian Boone Formation is mainly limestone with shale and siltstone interbeds. The thickness of the Boone Formation is 344 feet that includes a 30-foot shale section (Kinderhook Shale) at the base of the formation. The Boone Formation conformably overlies the Devonian Woodford Formation. The Woodford is organically rich black shale with a thickness of 26-feet at Well #1. The Woodford shale is separated by a major unconformity from the older units. At the disposal well and surrounding area, the Woodford overlies the second Wilcox sandstone and the Simpson Group.

The lower Paleozoic is represented by the Simpson Group, Arbuckle Group and Granite Wash. The Upper Ordovician, Silurian, and Lower Devonian units (Viola Limestone, Sylvan Shale, and Hunton Group) are missing in this area. The lower part of the Simpson Group is present, and is composed of dolomite, shale, and sandstone. The Simpson Group is 278 feet thick in Well #1.

The Arbuckle Group consists of dolomite with minor chert, sandstone, and shale layers. The Arbuckle Group carbonates are 1,242 feet thick in Well #1. The basal unit of the Arbuckle Group is the Reagan Sandstone which attains a thickness of approximately 55 feet. The Reagan Sandstone overlies the Granite

Wash. A 100 foot thick section of Granite Wash is penetrated in Well #1. The basement was not reached in the well, but in some nearby deep wells the granite basement has been penetrated.

The stratigraphic column of Real Alloy Well #1 is depicted in **Figure B-8**. Two (2) cross-sections depicting the local structure at and in the vicinity of Well #1 are provided as **Figure B-9** and **Figure B-10**. A cross-section location map is also provided as **Figure B-11**. There is no structural complexity in the vicinity of the injection well and the structure of the top of the Arbuckle Group is provided in **Figure B-2**. A close analysis of the cross-sections A-A' and B-B' oriented east-west and southwest-northeast that intersect at Well #1 suggests there are no faults in the vicinity of the injection well.

3.1.3 UNDERGROUND SOURCE OF DRINKING WATER

Drinking water sources in the vicinity of the Real Alloy site are the Pennsylvanian sandstone units and the alluvial deposits of the Arkansas River and its tributaries. Typically, the Pennsylvanian strata underlying the site are comprised of cyclotherms consisting of thick shales separated by thin sandstones, limestones and coal beds. Freshwater supplies may be contained in the sandstones, coals, and secondary fractures of the limestones and shales.

Knowledge of the hydrologic properties of the Pennsylvanian strata and review of logs for water wells located in the adjacent area indicate there are no regionally important freshwater aquifers underlying the Real Alloy site. With increasing depth, the waters in the Pennsylvanian system become brackish and saline. **Figure B-12** shows iso-contours for TDS concentrations of waters in the Pennsylvanian system. **Figure B-12** indicates that waters in the Pennsylvanian system exhibit TDS concentrations in excess of 150,000 ppm in the vicinity of Well #1.

The Oklahoma Corporation Commission (OCC) estimates the base of the treatable groundwater at Well #1 to be approximately 395 feet bgs as depicted in **Figure B-13**. Treatable water is considered to contain less than 10,000 mg/l TDS and less than 5,000 ppm chlorides. The established Secondary Maximum Contaminant Level for drinking water is 250 mg/l for chlorides and 500 mg/l for TDS.

The only domestic water well within 1 mile of Well #1 was drilled to a depth of 126 feet bgs on July 28, 1985. The domestic water well is approximately 4,500 feet east-northeast of Well #1 and is the closest domestic water well to the injection well site. Static water levels were recorded at 66 feet, and the deepest saturated stratum for this well is at a depth of 95-118 feet bgs. Yields are estimated to be 10 gpm.

One (1) industrial water well also exists within 1 mile of Well #1. The industrial well was drilled to a depth of 560 feet bgs approximately 3,700 feet east-southeast of Well #1 on February 19, 1981. Static water levels for this well were recorded at 14 feet. The quality of the water is unknown but is suspected to be brackish or saline based on the estimated base of treatable water map established by OCC. The deepest saturated stratum for the industrial well is at a depth of 455 to 475 feet and the estimated yield is 70 gpm.

Based on the depth of the base of treatable water estimated by OCC, a deep monitoring well was originally completed southwest of Well #1 at a depth of 450 feet bgs in the Cleveland Sandstone. The groundwater of the Cleveland Sandstone had a chloride concentration of 30,144 ppm.

Drilling results show that freshwater aquifers are generally at a depth of 100-150 feet in the vicinity of the Real Alloy site. Two (2) other domestic water wells drilled in the SE/4 of Section 15, Township 18 North, and Range 11 East, more than 1.5 miles southeast of Well #1, have the deepest saturated stratum at 124-142 feet bgs and 130-138 feet bgs. Yields from these wells were reported to be 7 and 8 gpm, respectively. Based on this information, the original deep monitoring well was plugged and the current shallower monitoring well was installed in the shallower sandstone unit at a depth of 120 to 134 feet to monitor the lowermost USDW.

The 9-5/8" surface casing for Well #1 was set at a depth of 545 feet, approximately 411 feet below the USDW at the location of Well #1.

3.1.4 OIL AND GAS WELLS

All the oil and gas producing zones within a two-mile radius of Well #1 are lenticular sandstones with the exception of the Wilcox which is a sheet-like sandstone. Thus, the Dutcher, Taneha, Bartlesville, Red Fork, Skinner, Prue, Cleveland, and Layton are found productive in stratigraphic traps while the Wilcox produces from structural traps.

The Wilcox is isolated from the Arbuckle by about 200 feet of shales, thin sandstones and dolomites, which for the most part, are impervious. The Wilcox is also isolated from the shallower lenticular sandstones by more than 300 feet of non-porous sandy limestone and shales. At least fifty-six feet of impervious Woodford and Kinderhook shale sections overlie the Wilcox and form the top seal for oil and gas accumulations in that zone.

The lenticular sandstones may be present at various horizons from the surface to approximately 2,000 feet. This interval is predominantly impervious shale; thus, these sandstones should be isolated from one another.

Assuming that all wells are properly cemented during the completion of each well, whether it is productive or dry, communication between zones should not exist. Should communication exist through faulty cement jobs or unplugged wells, the entering salt water should enhance the water drive of Wilcox reservoirs, augment water floods, or mix with the salt water of the lenticular sands.

All available plugging records for the wells within a two-mile radius of Well #1 have been previously submitted to DEQ.

3.1.5 HISTORY OF SEISMIC ACTIVITY

Based on the USGS Earthquake database, few seismic events have been recorded near the Real Alloy site location since 1900. Numerous earthquakes recorded are often too small to be felt and occur throughout the region. Since the year 1900 no earthquake events greater than 2.5M have been recorded within a 20 mile radius of Well #1. Over the past decade, four (4) notable earthquakes occurred in the state of Oklahoma each with an intensity over 4.5M, but with epicenters at least 40 miles away from the injection well site.

On February 2, 2024, a 5.1 M earthquake was recorded 1.86 miles bgs approximately 50 miles southwest of Well #1 in Lincoln County, Oklahoma. This earthquake was located along the Wilzetta Fault Zone approximately 5.5 miles northwest of Prague, Oklahoma.

On April 7, 2018, a 4.6 M earthquake was recorded 3.6 miles bgs approximately 81 miles west-northwest of Well #1 in Garfield County, Oklahoma. This event was located along the Nemeha Fault Zone near Lucien, Oklahoma.

On September 3, 2016, the largest recorded earthquake in Oklahoma was recorded at a magnitude of 5.8M, 3.45 miles bgs approximately 54 miles northwest of Well #1, approximately 9 miles northwest of Pawnee, Oklahoma.

On November 7, 2016, a 5.0M earthquake was recorded 2.75 miles bgs approximately 40 miles west of Well #1 west-northwest of Cushing, Oklahoma. **Table 4** below is a summary of earthquake activity greater than 4.5M in northeast Oklahoma within 100 miles of Well #1 over the last 10 years.

Table 4: Summary of Significant Earthquake Activity – Northeast Oklahoma

Date	Magnitude	Time	Depth	Latitude	Longitude	Location
2024-02-03	5.1	05:24:28 UTC	3.00 km (1.86 mi)	35.534°N	96.764°W	Approx. 50 mi SW of Well #1
2018-04-07	4.6	12:16:03 UTC	3.60 km (3.60 mi)	36.290°N	97.517°W	Approx. 81 mi WNW of Well #1
2016-11-07	5.0	1:44:24 UTC	4.43 km (2.75 mi)	35.991°N	96.803°W	Approx. 40 mi W of Well #1
2016-09-03	5.8	12:02:44 UTC	5.56 km (3.45 mi)	36.425°N	96.929°W	Approx. 54 mi NW of Well #1

The 2014 USGS seismic hazard map shows the risk of peak ground accelerations (PGA) having a 2 percent probability of being exceeded in 50 years for Creek County is between 6 and 8 %g. This denotes relatively low hazard probability relative to areas along the New Madrid Fault Zone in Eastern Missouri and the California west coast with hazard probability reaching over 80%g.

3.2 FORMATION TESTING PROGRAM

A formation testing program was implemented during the initial permitting and construction of Well #1. The formation testing program is presented in the following subsections.

3.2.1 LITHOLOGY

During drilling of the injection well, drill cuttings were sampled at 10 foot intervals from the surface to total depth. Drill cuttings and core samples were examined by a geologist and the detailed lithological descriptions are presented in **Appendix E**. Drilling time was recorded on a geolograph. The charts were retained with the driller's log and the time in minutes per foot was plotted on the geologist's strip log which was previously submitted with earlier permit applications.

3.2.2 CORING

To determine effectiveness of the aquiclude (seals) and the injection interval, the following cores were obtained:

1) Continuous core #1, 2270-2330 feet, Mississippian Limestone.
2) Continuous core #2, 2330-2358 feet, Kinderhook Shale – Woodford Shale. The Woodford Shale was cored only three (3) feet, because there was a risk of the core barrel jamming in the Woodford section.
3) Sidewall cores were taken from the Simpson Group, the Arbuckle Group, and the Granite Wash. The depths, lithologies and stratigraphic units of the sidewall cores are shown in **Table 5**.

Table 5: List of Sidewall Cores

Depth (ft)	Lithology	Formation/Group
2,398	Sandstone	Simpson Group
2,467	Shale	
2,528	Dolomite	
2,645	Dolomite	
2,676	Dolomite	Arbuckle Group
2,689	Dolomite	
2,720	Dolomite	
2,765	Dolomite	
3,084	Dolomite	
3,272	Dolomite	
3,502	Dolomite	
3,534	Dolomite	
3,579	Sandstone	
3,651	Sandstone	
3,672	Sandstone	
3,677	Sandstone	
3,685	Sandstone	
3,691	Sandstone	
3,706	Dolomite	
3,747	Dolomite	
3,922	Sandstone	Arbuckle Group - Regan Sandstone
3,925	Sandstone	
3,953	Sandstone	
3,989	Sandstone	Granite Wash
3,998	Conglomerate	
4,024	Sandstone	

A total of twenty-six sidewall cores were obtained from the injection section; four from the Simpson Group, nineteen from the Arbuckle Group, and three from the Granite Wash. Core samples were examined by a geologist and the detailed lithological descriptions are presented in **Appendix E**.

3.2.3 FORMATION FLUID

After drilling and electrical logging activities of Well #1 were completed, the drilling mud was displaced out with 2% KCl water. On October 30, 1989, Drumright Oil Well Service Company performed the well completion job on the well. In five swabbing runs, 268 barrels of formation water were recovered out of the injection well. Five formation water samples were collected during swabbing for analysis and background. The formation water samples taken during swabbing at depths of 2,650 and 4,040 feet were analyzed by METLAB Laboratory of Tulsa, Oklahoma. The chemical analysis report is in **Appendix F** and the results are summarized in **Table 6**. The formation water of the injection zone and the wastewater are compatible because both include a high concentration of chlorides.

Table 6: Analysis of Formation Water of the Well #1 Injection Zone

PARAMETERS	Sample 1 Swab at 2,650'	Sample 2 Swab at 2,650'	Swab 3 Swab at 2,650'	Swab #4 Swab at 2,650'	Swab #5 Swab at 4,040'
Chlorides (mg/l)	88,271*	108,271	121,771	96,956	112,377
pH (S.U.)	6.34	6.04	6.34	6.44	6.08
Magnesium (mg/l)	1,877	2,399	2,151	2,093	2,271
Iron (mg/l)	138.6	116.8	88.6	69.1	44.3
Aluminum (mg/l)	2.0	1.5	1.5	1.5	1.25
Sulfate (mg/l)	68.0	49.0	46.0	55.0	37.0
Total Dissolved Solids (mg/l)	159,632	193,992	204,078	172,078	204,078

The permeability of the injection zone to the wastewater was measured in the laboratory by Core Laboratories of Tulsa, Oklahoma. The tests were conducted by using the sidewall cores and the proposed injectate. The analysis report for these tests is in **Appendix G**.

3.2.4 TEMPERATURE

A temperature log was run for Well #1 by Halliburton Logging Services, Inc. after completing the well. The temperature log was previously submitted to DEQ with earlier permit applications. The log indicated that the geothermal gradient from the surface to total depth was approximately 1.65°F per 100 feet. The temperature of the injection interval ranged from 113°F at a depth of 2,395 feet to 129°F at a total depth of 4,051 feet, which results in a geothermal gradient of 0.97°F per 100 feet within the injection interval.

3.2.5 STATIC PRESSURE SURVEY

The static pressures of Well #1 were initially measured by the Tesco Company of Ardmore, Oklahoma on November 2, 1989. **Table 7** shows static pressure measurements at different intervals of the disposal well and the calculated pressure gradient for each corresponding interval pressure measurements.

Table 7: Initial Static Bottom Hole Pressure (November 2, 1989)

Depth (ft)	Pressure (psi)	Gradient
1	0	-
1,000	428.2	0.428
2,000	858.2	0.429
3,000	1307.5	0.436
4,000	1786.1	0.447

A recent static pressure survey was performed on October 3, 2023 prior to the performance of a downhole PFOT and approximately 6 days after the last injection event. The static pressures measured in the well are summarized in **Table 8** below and indicates a similar static pressure gradient compared to the initial static pressure gradient measured before the well was operational.

Table 8: Current Static Pressure Measurements (October 3, 2023)

Depth (ft)	Pressure (psi)	Gradient
0	13.5	-
500	230.7	0.434
1,000	451.9	0.442
1,500	672.7	0.442
2,000	893.0	0.441
2,305	1027.0	0.440
2,505	1115.0	0.440

A plot of the static pressure measurements is provided as **Figure B-14**.

3.2.6 INJECTION SURVEY

Drumright Oil Well Service Company conducted an injection test on Well #1 after the well was cleaned and swabbed. The 2-7/8 inch tubing was used with the packer set at a depth of 2,300 feet. Tailpipe joints were added to a depth of 2,467 feet. Before water injection was started, the Halliburton Logging Service Company ran a Temperature Log and pressure tested the annulus to 600 psi. The injection test was performed by pumping water into Well #1 at a rate of 2 barrels per minute (84 gpm) at an average pressure of approximately 300 psi. An injection profile survey was run which showed that the water was entering the formations from the Simpson Group to total depth. The Injection Profile Log was previously submitted to DEQ with earlier permit applications.

The UIC permit requires that Real Alloy conduct annual monitoring of the pressure buildup in the injection zone, including at a minimum, a shutdown of the well for a time sufficient to conduct a valid observation of the pressure fall-off curve in accordance with 40 CFR 146.13(d). The most recent annual PFOT was performed between October 3, 2023 and October 10, 2023. The PFOT was performed using down hole pressure gauges to monitor pressures during a 72 hour injection period and a subsequent 96 hour pressure fall-off period. The 2023 PFOT results were generally similar to the PFOT results obtained from recent years. Overall, the well exhibited good permeability characteristics with some positive skin (damage). From an operational standpoint, the general performance of the well appears to be fairly consistent with the performance observed during recent years. Injection pressures have remained in a normal operating range of 264 to 365 psi, below the maximum permitted injection pressure of 560 psi.

3.3 SUMMARY OF INJECTION ZONE CHARACTERISTICS

The injection section in the deep well includes the Simpson Group, the Arbuckle Group, and the Granite Wash as depicted in **Figure B-8**.

The Simpson Group is composed of sandstone, shale, and dolomite. The sandstone is white, glassy, fine to medium-grained, rounded to well rounded, good to excellent sorted with fair to good porosity. The shale is dark green, firm, but easily scratched and sandy. The dolomite is grayish-white, buff-cream, lithographic to fine crystalline, scattered fine quartz grains, tight to vuggy and sucrosic. The total thickness of the Simpson Group is 278 feet of which includes approximately 122 feet of sandstone, 50 feet of dolomite, and 106 feet of shale at Well #1.

The Arbuckle Group is composed of dolomite with thin layers of chert, shale, and interbedded sandstone and sandstone in the lower part. The dolomite is white, buff-cream to light gray, very fine to fine crystalline, sucrosic, stylolitic, and occasionally pyritic. The porosity of the dolomite ranges from none to good, intracrystalline and vuggy types. The sandstone sections of the Arbuckle Group are mainly encountered at a depth of 3,400 feet and deeper. The sandstone generally is white to light gray, fine to medium grained, rounded, moderately to good sorted, cemented with dolomite, and with fair to good porosity. The lower unit of the Arbuckle Group is the Reagan Sandstone (Lamotte Formation) which is composed of sandstone. The Reagan Sandstone is white to light gray, fine-grained, rounded, moderately sorted, cemented and with poor to fair porosity. The thickness of the Reagan Sandstone is 55 feet at Well #1.

The Granite Wash is composed of sandstone and conglomerate. The sandstone is gray, fine to medium-grained, subangular to rounded, poor to fairly sorted, quartz, feldspar, and glauconite grains, fair to good porosity. The penetrated thickness of the Granite Wash in Well #1 is approximately 100 feet. The portion of the Granite Wash section that has not been penetrated is not expected to be more than 300-400 feet thick.

3.3.1 INJECTION ZONE DEPTH AND THICKNESS

The top of the injection zone (top of Simpson Group) is at a depth of 2,380 feet, however, the 7 inch casing is set at 2,392 feet. The top of the Arbuckle Group is at a depth of 2,658 feet at Well #1 while the top of the Granite Wash is at a depth of 3,956 feet. The bottom of the injection zone is at a depth of 4,055 feet, which is the bottom of the drilled open hole. The total thickness of the injection section is 1,675 feet.

3.3.2 INJECTION ZONE POROSITY AND PERMEABILITY

The porosity of the injection zone varies throughout the injection section. The porosity of sandstone units of the Simpson Group are described as being fair to good based on visual examination of sidewall cores and well cuttings from these units. The Litho-Density log of these same sandstone units showed a porosity range of 10 to 22 percent where the Compensated Neutron also showed the same amount or higher.

In the sidewall core sample of the dolomite section of the Simpson Group, vuggy type porosity was detected. The porosity log (Compensated Neutron and Litho-Density) showed a porosity range from 0 to 20 percent, but mostly less than 10 percent on the Litho-Density log and about 10-12 percent on the Compensated Neutron log for the Simpson dolomite. The Compensated Neutron porosity is a more realistic value, because the Litho-Density log porosity readings require density correction from limestone to dolomite. Ten of the Arbuckle Group sidewall cores were analyzed for porosity and permeability by Core Laboratories in Tulsa, Oklahoma. The report prepared by Core Laboratories is included in **Appendix G**.

The dolomite units of the Arbuckle Group were measured in the laboratory to have a porosity between 10.8 and 15.8 percent, 14.4 millidarcies air permeability, and 11.3 millidarcies liquid permeability.

The sandstone units of the Arbuckle Group (except the basal Reagan Sandstone) were measured in the laboratory to have a porosity range of 2.5 to 15.5 percent. The permeability for the same units ranged from 0.025 to 8.5 millidarcies for air and 0.018 to 7.71 millidarcies for liquid.

The measured porosity and permeability of the Reagan Sandstone were low, at 3.6 to 6.6 percent and 0.0029 to 0.058 millidarcies, respectively.

The Granite Wash conglomerate and sandstone units were measured to have good porosity and permeabilities, with 10 to 14 percent porosity, 0.387 to 49.1 millidarcies of air permeability, and 0.249 to 43.8 millidarcies of liquid permeability.

Comparison of laboratory measured sandstone porosities and electric log (Litho-Density) porosities for the same intervals indicated that the porosity readings from the electrical log are similar or a few percent (1 to 4 percent) higher. However, the laboratory measured porosities of dolomite are quite higher than the electric log (Litho-Density) porosity readings, but they are similar to the Compensated Neutron porosity readings. The reason for the Litho-Density log porosity readings to be higher for sandstone intervals and lower for the dolomite intervals is related directly to the matrix density used in calculation of the porosity which is limestone (2.71 g/cm^3). Thus, the Litho-Density log porosity readings should be corrected. But practically, the Litho-Density log porosity readings could be used directly for the sandstone intervals which have very close matrix density (2.65-2.75 g/cm^3) to the limestone and the Compensated Neutron log porosity readings could be used for the dolomite intervals.

Using the porosity determination from the Litho-Density – Compensated Neutron log, the porosity of each lithology in each of the injection units is presented in **Table 9**.

Table 9: Neutron Log Porosity of the Injection Zone

Formation	Lithological Component	Porosity (%)
Simpson Group	Sandstone	5-21
	Dolomite	8-14
Arbuckle Group	Sandstone	2-10
	Dolomite	4-14
Arbuckle Group – Regan Sandstone	Sandstone	2-8
Granite Wash	Sandstone and Conglomerate	10-20

3.4 CONFINING UNITS

The injection intervals are overlain by the Woodford Formation. The Woodford Formation consists of organically rich black shale with a thickness of 26 feet at Well #1. The thickness of the Woodford increases eastward and westward, and probably to the south.

The Woodford Shale is overlain by a 30-foot thick Kinderhook Shale unit of the Mississippian section. Farther up the stratigraphic column, the 314-foot thick Mississippian section is mainly limestone with shale streaks. In Well #1, the section between the depth of 2,270 and 2,358 feet was continuously cored. The cored interval includes 54 feet of the Mississippian Limestone, 30 feet of the Kinderhook Shale, and 4 feet of the Woodford Shale. The whole Woodford Shale was not cored because the core barrel could have been jammed (tightened in the shale) due to characteristics of the shale. Detailed description of the cores is provided in **Appendix E**.

The limestone and shale units of the continuous cores were analyzed by Core Laboratories in Tulsa, Oklahoma for porosity and permeability. The report of the analysis is included in **Appendix G.**

Fifteen samples (eight shale and seven limestone samples) throughout 88-foot cores were analyzed for porosity, vertical and horizontal permeabilities and grain size. The shale units were measured to have a porosity range of 0.1 to 3.4 percent, but averaged 0.8 percent. The highest horizontal permeability of shale samples was 0.01 millidarcy, but most values were well below with a value of 0.004 or lower. The vertical permeability of shale was measured to be less than the 0.0005 millidarcy measurable cut-off value. The porosity and permeability of the Woodford Shale should be much less than the above mentioned values, due to its lithologic characteristics.

The porosity of limestone samples ranged from 1.1 to 5.1 percent and averaged approximately 1.8 percent. The horizontal permeability of the limestone units was measured below 0.007 millidarcy, except one sample which measured 0.115 millidarcy. The vertical permeability was measured to be less than the 0.0005 millidarcy measurable cut-off value, except one sample which measured 0.051 millidarcy.

The porosity and permeability of the confining layers over the injection zone show very low values which verify that they serve as adequate confining units to prevent any non-hazardous wastewater from migrating upward.

In addition to the laboratory analysis, **Figure B-15** presents a map showing the shale percentage of sections overlying the Wilcox Sandstone (top of the Simpson Group) which further illustrates the degree of restriction to upward migration of waters. The map is constructed based on shale thicknesses in wells within a three (3) mile radius of Well #1 that penetrated the Wilcox Sandstone as shown in **Table 10. Figure B-15** shows that the minimum percent thickness of shale above the Wilcox Sandstone in the vicinity of Well #1 is approximately 60 percent.

Table 10: List of Wells Penetrating the Wilcox Sandstone in the Vicinity of Well #1

Well Name	Location	Section-Township-Range	Total Depth (ft)
Coil #2	SW/4, NW/4, NW/4	27-T18N-R11E	2,600
Note: Thickness of shale and sandy shale from ground surface to top of Arbuckle Group = 1,933 ft (74.3%)			
Coil #1	NE/4, NW/4, NW/4	27-T18N-R11E	2,296
Note: Thickness of shale and sandy shale from ground surface to top of Wilcox Sand = 1,664 ft (72.5%)			
Ethel Ricks #1	SW/4, SW/4, SE/4	22-T18N-R11E	2,368
Note: Thickness of shale and sandy shale from ground surface to top of Wilcox Sand = 1,587 ft (67.0%)			
Coyle #4	SW/4, SE/4, NW/4	22-T18N-R11E	2,403
Note: Thickness of shale from ground surface to top of Wilcox = 1,546 ft (64.3%)			
Walter & Jenkins #1	SW/4, NW/4, NE/4	22-T18N-R11E	2,582
Note: Thickness of shale from ground surface to top of Wilcox = 1,776 ft (68.8%)			
Maggie Bruner #2	NE/4, NW/4, NW/4	27-T18N-R11E	2,291
Note: Thickness of shale from ground surface to top of Wilcox = 1,768 ft (77.1%)			
Barnett #16	SW/4, NE/4, SW/4	13-T18N-R11E	2,326
Note: Thickness of shale from ground surface to top of Wilcox (2,060 ft) = 1,432 ft (69.5%)			
Holder #2	NE/4, NE/4, NE/4	14-T18N-R11E	2,367
Note: Thickness of shale from ground surface to top of Wilcox (2,120 ft) = 1,390 ft (65.6%)			
Smith #1	SW/4, NW/4, SW/4	14-T18N-R11E	2,793
Note: Thickness of shale from ground surface to top of Arbuckle = 2,715 ft (71.1%)			
Shirley #1	SE/4, SW/4, SW/4	24-T18N-R11E	2,265
Note: Thickness of shale from ground surface to top of Wilcox = 1,218 ft (53.9%)			
Haubert #1	NE/4, NW/4, SW/4	24-T18N-R11E	2,302
Note: Thickness of shale from ground surface to top of Wilcox (2,238 ft) = 1,755 ft (78.4%)			
Page #3	SE/4, NE/4, NE/4	28-T18N-R11E	2,289
Note: Thickness of shale from ground surface to top of Wilcox = 1,491 ft (65.4%)			
Fife #1	NE/4, NE/4, NE/4	28-T18N-R11E	2,584
Note: Thickness of shale from ground surface to top of Wilcox (2,289 ft) = 1,403 ft (61.3%)			
Real Alloy Well #1	NE/4, NW/4, SW/4, NE/4	26-T18N-R11E	4,055
Note: Thickness of shale from ground surface to top of Wilcox (2,380 ft) = 1,440 ft (60.5%)			

4.0 ATTACHMENT C – WELL CONSTRUCTION INFORMATION

Section 4.0 provides information regarding the construction and configuration of the well as required for Attachment C of the permit application form.

4.1 WELL SCHEMATIC DIAGRAM

A well schematic diagram depicting the subsurface construction details of Well #1 is provided as **Figure C-1**. The well schematic diagram identifies the USDWs as well as the confining and injection zones. The casing, cement, tubing, packer, and open hole details are also depicted in **Figure C-1**.

4.2 WELL CONSTRUCTION DETAILS

Well #1 was drilled to a total depth of 4,055 feet (4,052-foot log interval) into the Granite Wash on October 24, 1989. The initial construction details are discussed below.

4.2.1 INITIAL CONSTRUCTION PROCEDURES

The injection well was drilled between October 5, 1989 and October 24, 1989, to a depth of 4,055 feet by a rotary drilling rig operated by McLennan Drilling Company of Nowata, Oklahoma. Well completion and treatment activities were conducted from October 24, 1989 to November 3, 1989. Initially a 12-1/2 inch diameter hole was drilled to a depth of 545 feet and a 9-5/8 inch surface casing was set with 300 sacks of cement.

Drilling then continued with an 8-3/4 inch diameter hole to 2,395 feet (driller depth) where the long string (7 inch casing) was set with 400 sacks of cement. Drilling continued with a 6-1/4 inch diameter hole through the injection zone (2,395 to 4,055 feet) which was left as an open hole. The 2-7/8 inch injection tubing was set at 2,380 feet with a Baker Model DB production packer. A 10-foot tailpipe joint was attached to the packer. Copies of the drilling records were previously submitted to DEQ with earlier permit applications.

The wellhead construction includes the valves, piping, monitoring ports, annulus tank, and annulus pressure sensor. The wellhead is built in a concrete cellar for leakage containment purposes. The concrete cellar is approximately 7 feet in diameter and 7 feet deep. A schematic of the wellhead assembly is provided as **Figure C-2**.

The annulus is connected with a 2 inch diameter hose to an annulus water make-up tank. The tank is set to the west side of the well and is used to monitor the water level of the annulus which is an indicator of the integrity of the well. The annulus make-up tank details are shown in **Figure C-3**. The annulus is maintained under a minimum 10 psi positive pressure by using a nitrogen tank and pressure regulator.

4.2.2 SUMMARY OF INITIAL CASING AND TUBING PROGRAM

This section provides a summary of the casing and tubing program as originally constructed.

Surface Casing

545 feet of new 9-5/8 inch surface casing was set in the well with 300 sacks of cement. The lowest USDW is at a depth of 134 feet and the surface casing extends approximately 411 feet lower than the base of the

USDW. Pipe specifications for the surface casing are 9-5/8 inch outer diameter (OD), K-55 seamless, 36.0 lb/ft, short threaded couplings (STC) set at 545 feet in a 12-1/4 inch hole. The wall thickness of the surface casing is 0.352 inch.

Long String Casing

The 7 inch long string casing was set at a depth of 2,392 feet with 400 sacks of cement. Pipe specifications for the long string are 7 inch OD, K-55 seamless, 23 lb/ft in an 8-3/4 inch hole. The bottom joint is corrosion resistant 316 stainless steel. The long string casing wall thickness is 0.317 inch. Cement was circulated to the surface through a two-stage tool.

Injection Tubing

The injection tubing string is 2-7/8 inch OD external upset end (EUE) 8R J-55 tubing with plasticap 521 internal coating. A Baker Model DB packer is set at 2,380 feet inside the 7 inch 316 stainless steel pipe joint. A ten-foot tailpipe joint is set below the packer. The packer and the tailpipe were all externally and internally plastic coated.

Packer (Injection)

A plastic coated Baker DB casing packer, 7 inch x 2-7/8 inch was set at a depth of 2,380 feet. Packer fluids between the tubing and the long string steel casing were treated with a corrosion inhibitor (C576) to provide corrosion protection for the steel. Prior to placing the well into service, the annulus was initially tested with 540 psi pressure for one-half hour to demonstrate mechanical integrity. All casing, tubing, and other parts were inspected by Tuboscope Company before they were set in the hole.

4.2.3 CEMENT PROGRAM

This section provides a summary of the cement program implemented during construction of the well.

Surface Casing

The 9-5/8 inch surface casing was set at a depth of 545 feet and cemented with 300 sacks of Class H cement with 2% Calcium Chloride and one-fourth sack of D29 flakes. The cement was circulated to the surface with good returns throughout the annulus. The cement job ticket was submitted to DEQ through previous applications.

Long String Casing

The 7 inch carbon steel casing and the 20-foot joint of 316 stainless steel casing at the bottom was set from 2,392 feet depth to the surface then cemented through the 7 inch casing using a pump-down plug. 150 sacks of Dowell self-stress cement containing 3% CaCl were used. The upper stage of cement was pumped through the staging tool set at 1,537 feet, and cement was circulated back to the surface with 250 sacks of Dowell self-stress cement containing 3% CaCl. The Cement Bond Log for the long string casing has been previously submitted to DEQ with earlier permit applications.

4.2.4 LOGGING PROGRAM

The following logs were run in the injection well during construction:

- After setting 9 5/8-inches surface casing:

    - Cement Evaluation Log
- After drilling to depth of2,395 feet and before setting long string:
    - Gamma Ray-SP-Dual Induction-SFL
    - Gamma Ray-Caliper-Lithodensity-Compensated Neutron
- After setting long string (7" casing) and drilling to total depth (4,055 feet):
    - Cement Evaluation Log
    - Electromagnetic Thickness Log (METT)
    - Gamma Ray-SP-Dual lnduction-SFL
    - Gamma Ray-Caliper-Lithodensity-Compensated Neutron
    - Formation Microscanner
- After swabbing and cleaning the well:
    - Temperature Log
    - Injection Profile Log

Copies of the above logs have been previously submitted to DEQ with earlier permit applications.

4.2.5 STIMULATION PROGRAM

After drilling was completed, the drilling mud was removed, and the well was cleaned out with 2% KCl water to open the injection interval. The 2% KCl water was swabbed out. The open hole injection interval was not acidized, and no other well stimulation programs were implemented.

4.2.6 WELL INTEGRITY PROGRAM

All the casing pipe used in the construction of the well were purchased new at the time of construction and were manufactured in accordance with API standards. Additionally, all purchased casing and tubing pipe were inspected by Tuboscope Company for any potential defects.

Cement jobs for each casing string were inspected by running Cement Bond Logs and a Cement Evaluation Log. Copies of these logs were previously submitted to DEQ with earlier applications.

The tubing and packer were originally installed in the well on November 2, 1989 and the annulus was filled with water containing corrosion inhibitor. The packer and wellhead were pressure tested to 540 psi to demonstrate mechanical integrity.

In accordance with the UIC permit, Real Alloy performs an annulus pressure test with DEQ once every 6-months. The most recent annulus pressure test demonstrated mechanical integrity of the long string casing, tubing, injection packer, and well head. Semi-annual annulus pressure testing performed by DEQ and continuous annulus pressure monitoring performed by Real Alloy demonstrates that Well #1 has not recently experienced any significant leak in the casing, tubing, packer, or wellhead.

Mechanical integrity is further demonstrated by performing a mechanical integrity test (MIT) in accordance with 40 CFR 146.8 at least once every five (5) years during the life of the well. The most recent 5-year MIT occurred on July 20, 2020 as required by the UIC permit. Mechanical integrity was further demonstrated by utilizing oxygen activation methods to test for potential vertical fluid movement around

the well casing. Schlumberger performed a Water Flow Log (WFL) while providing steady injection from the surface. Logging was performed at four (4) specific stations as follows:

1. 2,380 feet: This station represents the base of the Woodford Formation and was tested to determine if there is vertical fluid movement past the long-string casing seat.
2. 2,360 feet: This station is near the top of the Woodford Formation and was tested to determine if there is vertical fluid movement through the Woodford Formation.
3. 1,979 feet: This station is located in the Dutcher Formation, a local production reservoir, and was tested to determine if there is vertical fluid movement within this interval.
4. 500 feet: This station is located above the surface casing seat in the Cleveland Sandstone Formation and was tested to determine if there is vertical fluid movement past the surface casing seat.

Logging at each station showed no indication of water flow within the tubing annulus or outside of the well casing. Based on the 5-year MIT and the semi-annual annulus pressure testing, the mechanical integrity of Well #1 has been adequately demonstrated.

5.0 ATTACHMENT D – INJECTION OPERATION AND MONITORING PROGRAM

Section 5.0 provides information regarding the injection operation and monitoring programs for the injection well as required for Attachment D of the permit application form.

5.1 GENERAL INJECTION PROCEDURE

The facility is permitted to dispose ammonia and chloride contaminated storm water run-off, leachate and seepage from the on-site NHIW landfill, and non-hazardous wastewater from the facility. Leachate from the on-site NHIW landfill and storm water run-off from the plant facility are conveyed to the leachate collection pond. Injectate is then pumped from the leachate collection pond to the injection pump, then to the well for disposal. A general schematic of the surface injection procedure is provided as **Figure D-1**.

5.2 INJECTION PUMPING AND MONITORING SYSTEM

Surface facilities associated with the injection well include a fluid suction system, injection pumping system, and the injection well. The surface facilities are enclosed in buildings.

The suction system consists of one (1) 15-horsepower centrifugal pump, equipped with an intake screen located in the leachate collection pond to reduce the intake of suspended solids and a bag filtration unit on the suction side of the pump. A schematic of the suction system is provided as **Figure D-2**.

The suction system pumps the injectate from the leachate collection pond to the injection pump located in the injection pump building through an underground double-walled HDPE pipe. The injection pump consists of a Wheatley Gaso triplex plunger positive displacement pump, or equivalent, with three 3.25-inch diameter plungers with a 3.5-inch stroke. The pump information and rating curves are included in **Appendix H**. In-line pulsation dampeners are present on both the suction and discharge side of the injection pump. The injection pump drive motor is an electric 3-phase, 460 volt, 40 horsepower motor.

Pressure sensors are present on the suction side of the pump and on the discharge side of the pump before the wellhead to monitor suction and injection pressures. A suction pressure of 10 psig or greater is required to start the injection pump. Injection pressures are recorded on a Partlow MRC7000, or equivalent, seven-day dual pen chart recorder. The injection pressure is recorded on a 0 to 600 psig circular chart.

An in-line Yokogawa Vortex flow meter and totalizer, or equivalent, is located between the injection pump and the wellhead and is used to measure the flow of the fluid into the injection well. Injection flow rate is transmitted to a Partlow MRC7000 seven-day dual pen chart recorder through a 4 to 20 milliamp signal. The injection flow rate is recorded on a 0 to 100 gpm circular chart.

The injection fluid temperature is monitored by a temperature sensor between the injection pump and the wellhead. Injection temperatures are recorded on a Partlow MRC7000, or equivalent, seven-day dual pen chart recorder. The injection temperature is recorded on a 0 to 600 ^{o}F circular chart.

The annulus pressure is monitored at the wellhead by a pressure sensor. Annulus pressure is recorded on a Partlow MRC7000, or equivalent, seven-day dual pen chart recorder. The annulus pressure is recorded on a 0 to 100 psig circular chart.

The injection pumping system is equipped with a programmable logic controller (PLC) system which controls and monitors the suction pump system and the injection pump system. The PLC also monitors and records the injection pressures, injection temperature, injection flow rate, and wellhead annulus pressures. A schematic of the injection and monitoring system is provided as **Figure D-3**.

5.3 PLANS FOR WELL FAILURES

Emergency procedures for the injection well are simplified because no hazardous fluids are disposed through the injection well. Furthermore, the PLC is designed to shut the injection pump down if there is an issue with the pumps, pressures, or flow rates.

In the event of an emergency situation in which a high or low pressure condition occurs, the PLC will turn off the pumps to stop fluid suction from the leachate collection pond and stop fluid injection. When the injection pump and the suction pump shut off, no injection fluid will be conveyed from the leachate pond to the injection well.

In the event of an emergency involving a spill in the vicinity of the suction system, injection pump system, or the wellhead, the first response shall be to contain any lost non-hazardous fluid around the source of the spill. Then the non-hazardous fluid will be returned to the leachate collection pond. In the event of such a spill, Real Alloy will notify DEQ within 24 hours of the occurrence and repair work shall commence as soon as emergency clean-up procedures are complete. A response and clean-up report will be prepared and submitted to DEQ.

Emergency equipment available for use shall include a portable pump and appropriate hand tools for repairs. Personnel will utilize personal protective equipment consisting of gloves, safety glasses, and rubber boots.

5.4 MONITORING PROGRAM

Real Alloy implements a monitoring program in accordance with the current UIC permit and the requirements of 40 CFR 146.13 which includes sampling and analysis of the injection fluid and monitoring of the injection pressure at the wellhead, temperature of injected fluid, annulus pressure, flow rate, and cumulative volume of injected fluid. The monitoring results are reported quarterly to DEQ.

5.4.1 INJECTION FLUID ANALYSIS

The injectate is sampled and analyzed by a chemical laboratory monthly and whenever changes are made to the injection fluid. Monthly analytical reports are submitted to DEQ on a quarterly basis. Injectate is analyzed for the parameters listed in **Table 11**.

Table 11: Monitored Parameters

INJECTION FLUID MONITORED PARAMETERS			
pH	Ammonia	Cadmium	Chloride
Lead	Magnesium	Nickel	Nitrate
Sulfate	Specific Gravity	Iron	Specific Conductivity
Total Suspended Solids (TSS)			

5.4.2 INJECTION PRESSURE

The injection pressure is monitored continuously near the wellhead and the readings are recorded on a circular chart and in an electronic database through the PLC system. In accordance with the UIC permit, the maximum allowable wellhead injection pressure for Well #1 is 560 psig. Injection pressure charts are utilized to complete the quarterly injection well monitoring reports for submittal to DEQ. Circular charts are maintained in the facility files.

5.4.3 INJECTION FLUID TEMPERATURE

The temperature of the injection fluid is monitored continuously and recorded on a circular chart and in an electronic database through the PLC system. Injection fluid temperature charts are utilized to complete the quarterly injection well monitoring reports for submittal to DEQ. Circular charts are maintained in the facility files.

5.4.4 ANNULUS PRESSURE

The annulus between the tubing and the long string casing is filled with fluid and maintained with a positive pressure of at least 10 psig. The annulus pressure is monitored continuously and recorded on a circular chart and in an electronic database through the PLC system. Annulus pressure charts are utilized to complete the quarterly injection well monitoring reports for submittal to DEQ. Circular charts are maintained in the facility files.

5.4.5 FLOW RATE AND CUMULATIVE VOLUME

The injection flow rate is continuously monitored with a flowmeter and totalizer that is set in the injection line. The flow rate is monitored continuously and recorded on a circular chart and in an electronic database through the PLC system. The totalizer maintains the running total of how much fluid has passed through the flowmeter. The totalizer readings are recorded daily or at the beginning and end of injection so that the flow rates can be calculated.

5.4.6 RECORD KEEPING

Cumulative volumes, pressures, temperature, and flow rate recorder charts and the daily record sheets are kept on file for at least 3 years and are open for inspection. After 3 years they may be disposed.

5.5 OPERATING DATA

Operational data regarding the injection fluid, flow rates, volumes, pressures, and annulus fluid are provided in the following subsections.

5.5.1 DESCRIPTION OF INJECTION FLUID

The injection fluid consists of leachate and seepage generated from the on-site NHIW landfill and stormwater runoff from the plant site. Leachate and stormwater are directed to one (1) lined leachate collection pond. The injectate is conveyed from the leachate collection pond to the injection well for disposal.

The NHIW wastes associated with the landfill were primarily characterized as having elevated chloride and ammonia concentrations. As expected, analysis of the leachate generated by the landfill indicates the presence of the same parameters (chloride and ammonia). Recent chemical analysis reports of the injectate are included in **Appendix F**.

5.5.2 INJECTION FLUID VOLUME AND FLOW RATE

Based on recorded operational data from 2014 to 2023, the average and maximum daily injection rate, injection pressure, and volume of fluid injected over the preceding 10 years is presented in **Table 12** below. Based on this information, the average injection flow rate was 70.0 gpm while injecting a total of 63,338,186 gallons were injected over the previous 10-year period.

Table 12: Daily and Maximum Injection Rates, Pressures and Volume

Year	Annual Vol. Injected (gallons)	No. of Days Injected	Avg Daily Vol. When Injecting (gallons)	Avg. Inj. Press. (psi)	Avg. Flow Rate (gpm)
2014	3,355,980	43	78,046	385	76.9
2015	6,437,390	78	82,531	383	76.7
2016	5,429,580	69	78,690	361	76.5
2017	4,887,826	63	84,773	362	73.2
2018	4,455,945	59	75,525	361	70.3
2019	10,720,326	138	77,684	366	70.9
2020	7,029,748	81	86,787	378	71.8
2021	7,371,917	98	75,224	344	69.2
2022	7,226,146	101	71,546	264	58.6
2023	6,423,328	101	63,597	291	59.3
10-yr Avg.	6,333,819	83	78,865	349	70.0

The total storage capacity of the leachate collection pond is approximately 4.2 million gallons. Annual stormwater run-off contributions have previously been estimated to range from 5 to 10 million gallons in an average year to 10 to 20 million gallons in peak years. **Table 13** shows the amount of fluid injected into the well since operation started in January 1990.

Table 13: History of Wastewater Injection

Date	Injection (Gallons)	Date	Injection (Gallons)
1990	15,966,933	2007	10,411,916
1991	14,231,163	2008	10,372,148
1992	14,890,435	2009	8,083,783
1993	11,206,951	2010	5,470,024
1994	11,601,681	2011	2,933,534
1995	9,956,681	2012	3,144,935
1996	6,770,457	2013	4,730,730
1997	5,576,874	2014	3,355,980
1998	8,339,251	2015	6,437,390
1999	9,453,007	2016	5,429,580
2000	7,234,880	2017	4,887,826
2001	5,028,954	2018	4,455,945
2002	3,831,309	2019	10,720,326
2003	5,504,020	2020	7,029,748
2004	6,009,204	2021	7,371,917
2005	3,117,187	2022	7,226,146
2006	8,422,745	2023	6,423,328

5.5.3 MAXIMUM INJECTION PRESSURE

The injection well was designed based on characteristics of the injection zone. These characteristics included formation pressure, porosity, permeability, and total thickness of the injection zone.

DEQ regulations require that the maximum total pressure gradient not exceed 0.65 psi/ft of depth from ground surface to the top of the disposal zone if the overburden pressure gradient (or fracturing pressure) has not been established. The upper limit of the Wilcox Sandstone (Simpson Group) is at a depth of 2,380 feet bgs, but in the calculation, the casing shoe depth is used, 2,395 feet. Therefore, the maximum allowable pressure is calculated as follows:

$$P_{max} = (0.65 \text{ psi/ft}) \times (2{,}395 \text{ ft}) = 1{,}556.75 \text{ psi}$$

The injected fluid has a specific gravity of less than 1.02, therefore the fluid gradient was calculated to be 0.433 psi/ft x 1.02 = 0.4416 psi/ft. The static pressure exerted by the fluid column is calculated as follows:

$$P_{fluid} = (0.4416 \text{ psi/ft}) \times (2{,}395 \text{ ft}) = 1{,}058.6 \text{ psi}$$

The difference between these pressures provides the maximum allowable pressure increase at depth created by injection. This figure would also be equivalent to the maximum wellhead injection pressure without frictional losses and is calculated as follows:

$$P_{inj} = (1{,}556.75 \text{ psi}) - (1{,}058.6 \text{ psi}) = 498.15 \text{ psi}$$

The planned operational injection rate for the well was established at 2.5 barrels per minute (bpm). Standard tables were used to account for friction loss during injection based on a 2-7/8 inch diameter tubing, a tubing length of 2,395 feet, and an injection rate of 2.5 bpm using brine fluid. Standard tables indicate that frictional losses would be approximately 3.6 psi per 100 feet of pipe, therefore the total expected frictional losses would be approximately 86.22 psi. Adding the frictional losses to the allowable pressure increase caused by injection results in a maximum allowable injection pressure of approximately 584 psi as follows:

Length 2,395, tubing size 2-7/8 inch, brine fluid, injection rate 2.5 bpm.

$P_{allowable}$ = (498.15psi) + (86.22 psi) = 584.37 psi

The well is currently permitted to allow for a maximum injection pressure of 560 psig at a flow rate of 100 gpm (2.38 bpm). The average injection pressure observed during injection over the last 10-years of operation was 349 psig. The highest injection pressure recorded during normal injection operations during this period was 477 psig.

5.5.4 CALCULATION OF FLUID MIGRATION

The distance of fluid migration from the disposal well has been calculated from the following equation (Warner and Lehr, 1981):

$$r = \sqrt{\frac{V}{\pi \cdot h \cdot \phi}}$$

Where:

r = Radial distance of wastewater front from well (ft)
V = Qt = cumulative volume of injected wastewater in ft^3 (i.e. 100 gal/min)
π = Constant, 3.14159
h = Effective thickness of the injection zone, 1470 feet
ϕ = Average porosity of injection zone [decimal] = 12% = 0.12

The above fluid migration formula was solved for 10, 25, and 50 years and the results are shown below:

- After 10 years injection, r = 356 feet
- After 25 years injection, r = 563 feet
- After 50 years injection, r = 796 feet

Since distance of travel will not be uniform in a radial direction outward from the well, because of dispersion, density segregation, and channeling through high permeability zones, an estimate of the influence of dispersion can be developed from the following equation (Bear, 1972):

$$r^1 = r + 2.3\sqrt{D \cdot r}$$

Where:

r^1 = Radial distance of travel with dispersion (ft)
r = Radial distance of water travel with uniform distribution (ft)
D = Dispersion coefficient of 65 feet for limestone or dolomite aquifer

Solving for r^1, by using r results obtained for 10, 25, and 50 years, the following values of radial distance are calculated for water travel with dispersion:

- After 10 years injection, r^1 = 706 feet
- After 20 years injection, r^1 = 1,003 feet
- After 50 years injection, r^1 = 1,319 feet

The r^1 (radial distance of water travel with dispersion) values calculated above should be considered as the maximum potential distance of fluid migration.

5.5.5 PRESSURE RISE AT THE INJECTION ZONE

Future average injection pressures can be estimated by calculating the pressure rise in the injection zone using the formula (Ferris et al, 1986; Kruseman and DeRidder, 1970; Lohman, 1972; as modified by Mathews and Russell, 1967). The same formula can also be used to estimate the life of the well. The formula is as follows:

$$\Delta P = \frac{162.6 \cdot Q \cdot u}{k \cdot b} \times \left(log \frac{k \cdot t}{\emptyset \cdot u \cdot c \cdot r^2} - 3.23 \right)$$

Where:

ΔP = Reservoir Pressure Change at Radius r and Time t [psi]
Q = Injection rate [bpd] = 3,600 bpd (100 gpm)
u = Viscosity of injectate [cP] = 0.742
k = Permeability of injection zone [md] = 8 mD
b = Effective injection zone thickness [ft] = 1470 ft.
$\emptyset$ = Average porosity of injection zone [decimal] = 12% = 0.12
(based on average reservoir porosity from electrical logs and sidewall cores)
c = Reservoir compressibility [psi^{-1}] = 5.93 x 10^{-6} psi^{-1}
r = Well radius of injection zone [ft] = 0.26 ft.
t = Time of injection [hours]

The above calculation results indicate that the flowing bottom hole pressure would be 379 psi higher than the initial reservoir pressure after fifty (50) years of continuous injection at a rate of 100 gpm. Estimated bottom hole pressure increases in the formation have been calculated based on varying distances from the well and timeframes as summarized in **Table 14** below.

Table 14: Estimated Cumulative Pressure Rise

Radius (ft)	0.5 (Yr) 4380 (h)	1 (Yr) 8760 (h)	2 (Yrs) 17,520 (h)	3 (Yrs) 26,280 (h)	4 (Yrs) 35,040 (h)	5 (Yrs) 43,800 (h)	10 (Yrs) 87,600 (h)	15 (Yrs) 131,400 (h)	20 (Yrs) 175,200 (h)	25 (Yrs) 262,800 (h)	50 (Yrs) 350,400 (h)
0.26	308	319	329	336	340	343	354	360	365	368	379
10	197	207	218	224	228	232	242	249	253	256	267
100	126	137	148	154	158	162	172	178	183	186	197
1000	56	67	77	83	88	91	102	108	112	116	126
1616	41	52	63	69	73	77	87	93	98	101	112
2640	26	37	48	54	58	62	72	78	83	86	97
3960	14	25	35	41	46	49	60	66	70	74	84
5280	5	16	26	33	37	40	51	57	62	65	76

Since the initial static wellhead pressure is essentially 0 psi, the projected pressure rise is correlated to surface injection pressure by adding the frictional losses associated with flow through the tubing at a rate of 100 gpm, resulting in an estimated average injection pressure of 465 psi, which is below the maximum permitted injection pressure of 560 psi.

5.5.6 ANNULUS FLUID

The annulus between the tubing and the long-string casing is filled with water containing corrosion inhibitor C576, or equivalent, and maintained with a positive pressure above 10 psig. The annulus pressure is monitored continuously and recorded on a circular chart. The annulus monitoring system is shown in **Figure C-2** and **Figure C-3**.

6.0 ATTACHMENT E – PLUGGING AND ABANDONMENT PLAN

Plugging and abandonment (P&A) of Well #1 shall be consistent with 40 CFR 146.10, OAC 252:652-5-1(5), and as provided for in this general P&A Plan. P&A shall be completed in a manner to permanently prevent the migration of any disposed substances out of the disposal zone, as well as the migration of oil, gas, or salt water into or out of any productive formations by means of the well bore. The P&A Plan is tentatively given below; however, Real Alloy will submit updated plans for the proper disassembly, decontamination and restoration of the site to DEQ at least one hundred-eighty (180) days prior to cessation of operations. After approval by DEQ, Real Alloy will implement and complete the P&A of the well. The tasks of the tentative P&A Plan outlined below:

1) Notify DEQ of the anticipated date that P&A operations will commence.
2) Inject all wastewater and contaminated run-off water into the well before ceasing operations.
3) Conduct annulus pressure testing to verify integrity of casing, tubing, and packer.
4) Flush the entire system with fresh water and inject the rinsate into the well.
5) Disconnect pumps and piping.
6) Move in workover rig and brief the crew on the required activities and safety procedures.
7) If there is pressure at the wellhead, pump heavy brine (or heavy fluid) to prevent wellhead pressure and fluid flow at the wellhead.
8) Dismantle wellhead and remove tubing and packer from the well.
9) Decontaminate and salvage parts.
10) Run logs to evaluate the condition of the 7 inch casing and the cement behind it.
11) If there is any problem with the 7 inch casing or cement behind it, conduct the necessary remedial actions to restore the casing and/or cement behind it to prevent contamination of the USDW.
12) Run tubing and set cement plug from total depth to surface in stages.
13) Cut off the casing approximately 5 feet below ground level and weld a steel identifying plate to the top of the casing. The plate will be permanently inscribed with the well permit number and plugging date.
14) Clean up the location, properly dispose of excess mud, cement, and materials.
15) Restore the area by regrading and seeding as necessary.
16) Within thirty (30) days after completion of well plugging operations, file a plugging report with DEQ.

7.0 ATTACHMENT F – FINANCIAL ASSURANCE

The cost to plug and abandon Well #1 is estimated to be **$61,242.95**. The updated P&A cost estimate is provided in **Appendix I**. A copy of the current financial assurance mechanism is also provided in **Appendix I**.

8.0 ATTACHMENT G – SITE SECURITY AND MANIFEST REQUIREMENTS

Well #1 is not a commercial well therefore manifests and a site security plan are not required. Real Alloy does utilize perimeter fencing to restrict access to the injection well area. Access to the facility is further restricted and monitored by the guardhouse.

9.0 ATTACHMENT H – AQUIFER EXEMPTIONS

An aquifer exemption is not required for this application.

10.0 ATTACHMENT I – EXISTING EPA PERMITS

Real Alloy maintains the following permits issued by DEQ:

1) Permit from DEQ Land Protection Division, to operate a NHIW Landfill under Permit No: 3519017.
2) Permit from DEQ Air Quality Division, to operate / construct a Minor Source Air Pollution Control Facility under Permit No: 94-115-O
3) Authorization from DEQ Water Quality Division, to discharge industrial stormwater under the Oklahoma Pollutant Discharge Elimination System (OPDES) Multi-Sector General Permit OKR05 under Authorization No: OKR053538.

11.0 ATTACHMENT J – DESCRIPTION OF BUSINESS

Real Alloy operates a secondary aluminum smelting facility in Sapulpa, Oklahoma. The facility consists of two (2) rotary furnaces, one (1) reverb furnace, and associated support and air pollution control equipment. Scrap aluminum (i.e. used beverage cans, auto parts, shavings, turnings, etc.) is imported to the facility and stockpiled either in covered bins or outside in one of the concrete surfaced storage yards. During the smelting process, the various types of aluminum scrap are charged to the furnace and melted. The "melt" is covered with a salt flux (NaCl, KCl, or Na_3AlF_6) to reduce oxidation during scrap melting. As metal ingots or anodes are cast from the molten melt, the fluxing salts and other impurities from the scrap remain in the furnace and are referred to as slag. The slag is removed from the furnace, placed in metal bins to cool, and then placed in block form for permanent disposal. In addition to the slag waste generation, the exhaust gases from the furnaces and foundry are collected and passed through baghouses where the fine particle emissions from the melting processes are collected. Prior to the closure of the on-site NHIW Landfill, the slag and baghouse dust wastes were disposed in the on-site landfill. After the closure of the on-site landfill, all waste generated by the facility has been disposed at other off-site permitted facilities. Leachate generated by the landfill contains elevated chloride and sodium concentrations. The leachate and surface water run-off from the plant site is collected and conveyed to the leachate collection pond where it is stored then transferred to the on-site injection well for disposal.

12.0 ATTACHMENT K – OPTIONAL ADDITIONAL PROJECT INFORMATION

Additional project information is not needed for this application.

13.0 REFERENCES

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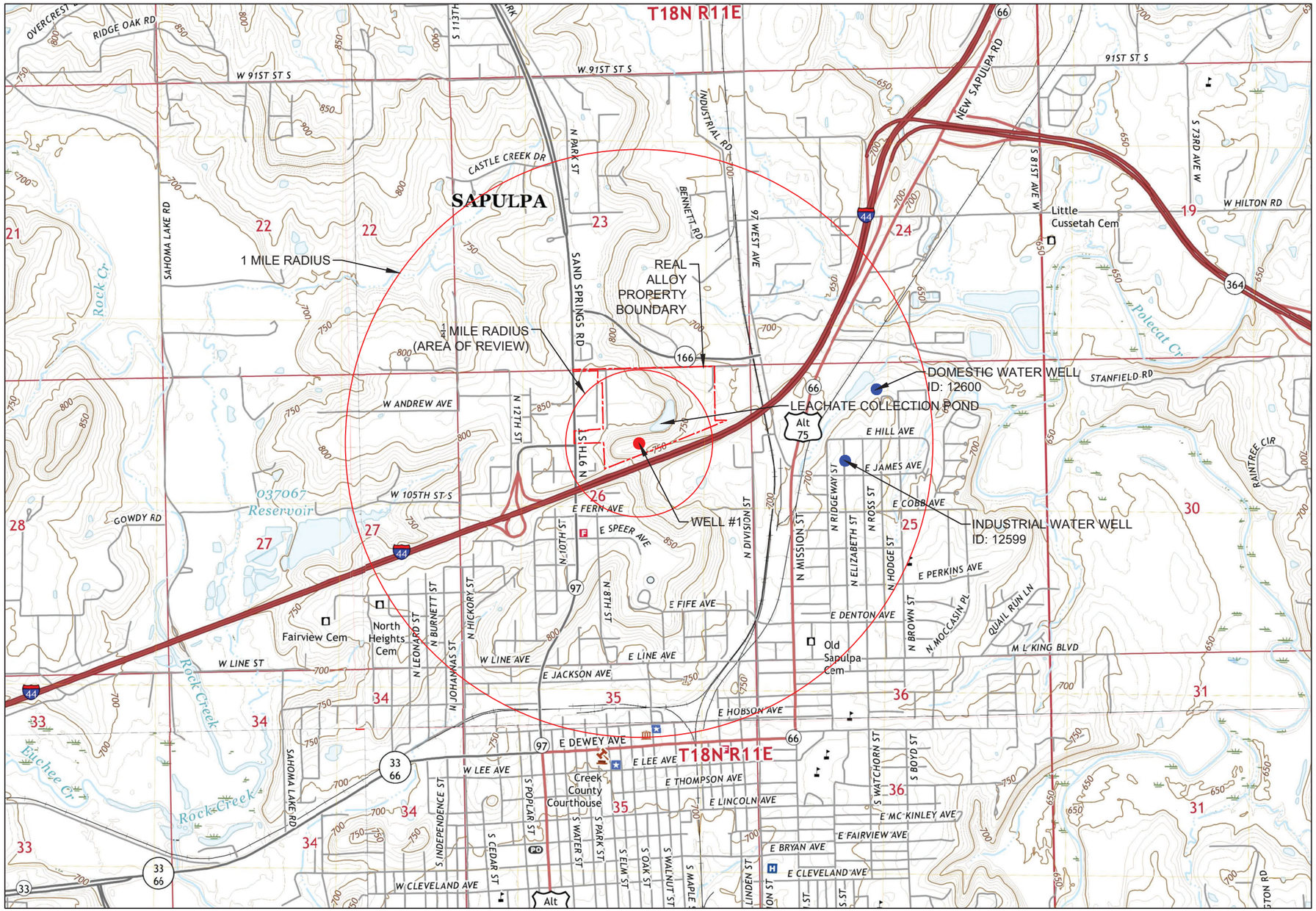
FIGURES



0 1000' 2000'
SCALE IN FEET

LEGEND

- WELL #1
- PROPERTY BOUNDARY
- GROUNDWATER WELL

NOTES:

1) BASE MAP SOURCE: U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY, LAKE SAHOMA, KELLYVILLE, SAPULPA NORTH, AND SAPULPA SOUTH QUADRANGLES, 2022
2) NO PUBLIC SURFACE WATER INTAKES OR DISCHARGE STRUCTURES WERE IDENTIFIED WITHIN A ONE-MILE RADIUS OF WELL #1.
3) TWO (2) PRIVATE WATER WELLS (ID:12599 & 12600) WERE IDENTIFIED WITHIN A ONE-MILE RADIUS OF WELL #1.
4) NO HAZARDOUS WASTE TREATMENT, STORAGE, OR DISPOSAL FACILITIES HAVE BEEN IDENTIFIED WITHIN 1-MILE OF WELL #1.

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

TOPOGRAPHIC LOCATION MAP

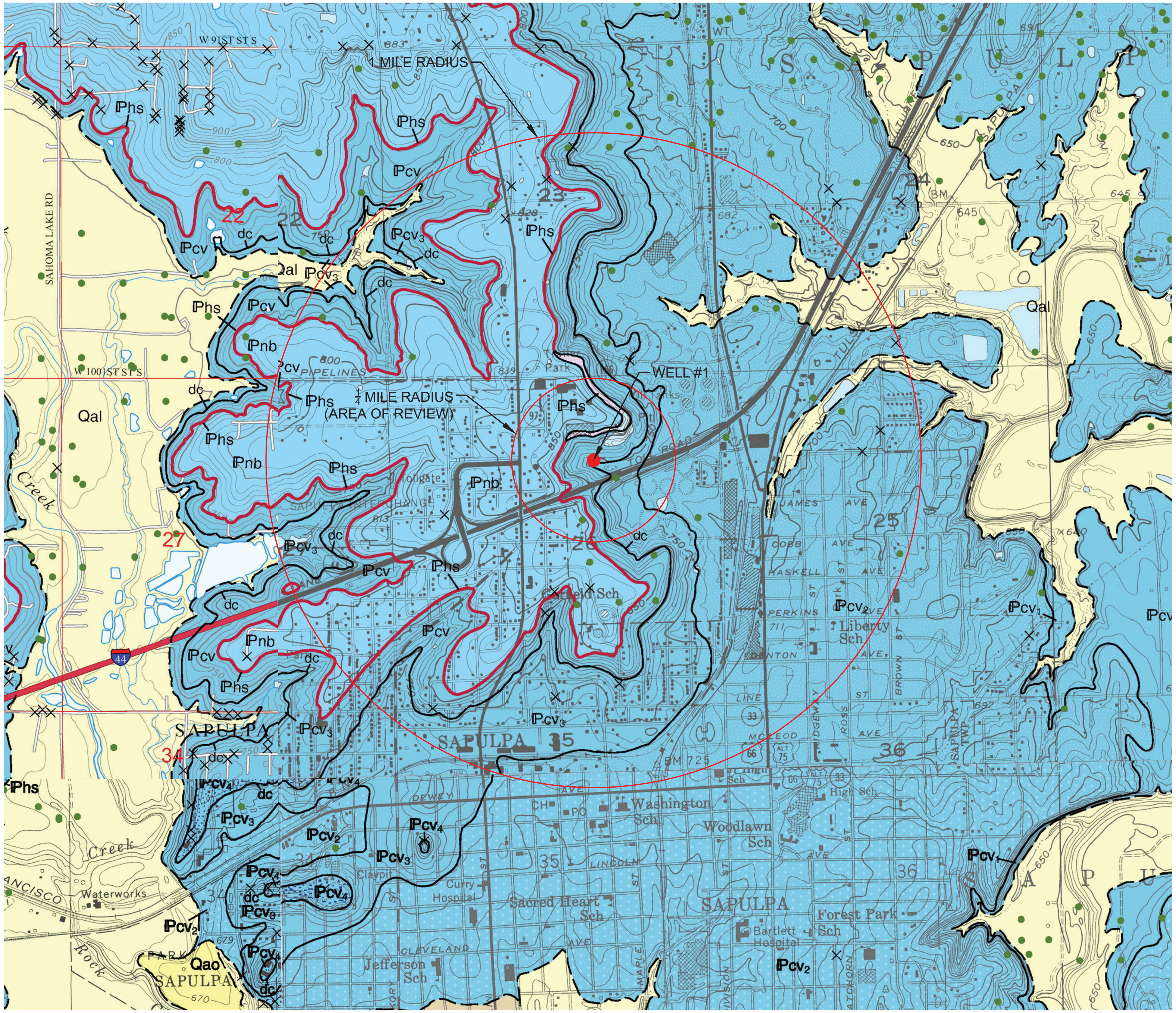
CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

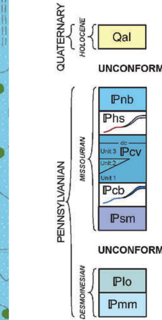
E&E ENGINEERING and Associates

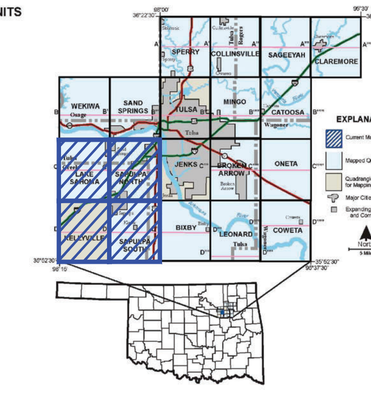
DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE A-1



CORRELATION OF MAP UNITS





DESCRIPTION OF UNITS*

Qal ALLUVIUM (Holocene)—Clay, silt, sand, and gravel in channels and on flood plains of modern streams. Includes terrace deposits of similar composition located directly above and adjacent to modern channels and flood plains. Thickness: 0 to about 30 ft.

Pnb NELLY BLY FORMATION (Pennsylvanian, Missourian)—In the Sapulpa North quad, unit consists mostly of interbedded sandstone and shale, with shale lithology being the predominant lithology near base. Shales are olive gray (5 Y 4/1) to light olive gray (5 Y 6/1), well-laminated, slightly micaceous clayshales. Sandstones are very pale orange (10 YR 8/2) to moderate yellowish brown (10 YR 5/4), rarely yellowish gray (5 Y 7/2), indurated, thin- to medium-bedded, very fine- to fine-grained, but becoming medium-grained near base of sandstone intervals, trough-cross-bedded to wavy-bedded, argillaceous sandstones; bedding and cross-bed sets vary from 2" to 3' thick but average closer to 5" thick; calcite cement common, although parts may exhibit a weak silica or iron-oxide cement; trace fossils and mud clasts common along bedding contacts.
Only the basal 70 ft of formation exposed in quad.

Phs HOGSHOOTER LIMESTONE (Pennsylvanian, Missourian)—In the northern half of quad, formation composed of an upper, thin Winterset Member and a lower, thicker Lost City Member. The Lost City member pinches out in the southern half of the map area. Total thickness of formation varies from as much as 52 ft thick to as little as 2.5 ft thick, depending on the presence or absence of the Lost City Member.
The Winterset Member is usually represented by a single bed (< 3' thick) of whole fossil packstone, with lesser amounts of wackestone and carbonate mudstone textures; thin (1"-3" thick) wavy bedding may be observed in the upper half of the member, locally. Fossils include abundant crinoid stems and ossicles, brachiopods, clams, bryozoans, corals, and algae. Packstone colors include light olive gray (5Y6/1), olive gray (5Y4/1), medium light gray (N6) and medium gray (N5). Weathered surfaces include dusky yellow (5Y6/4), moderate yellowish brown (10YR 5/4), and dark yellowish orange (10YR6/6). Carbonate mudstone is light olive gray (5Y6/1) and weathers grayish orange (10YR7/4), dark yellowish orange (10YR6/6), and light brown (5YR5/6), is well indurated, and contains few, if any, fossils; locally, carbonate mudstones may be slightly sandy or contain carbonaceous matter. Ironstone nodules are sometimes observed where internal bedding is present in the member.
The Lost City Member consists of a medium light gray (N6) to medium gray (N5) fresh, locally weathered to a light brown (5YR5/6) or moderate yellowish brown (10YR5/4) color along fractures and bedding planes, whole fossil to locally skeletal wackestone or carbonate mudstone; bedding thin to thick, varying from 1" to as much as 3' thick; thinner bedding more common in the middle third of member, where bedding is commonly wavy and varies between 1" to 5" thick, the upper and lower third of member is typically medium to thick bedded, with bedding varying from 2' to 3' thick. Enclosed fossil assemblages similar to that of the Winterset Member. Overall, member thickness between 40 to 50 ft thick.

Pcv COFFEYVILLE FORMATION (Pennsylvanian, Missourian)—In the southern part of quad, the Coffeyville can be segregated into four informal units including the Dodds Creek Member (base designated by 'dc'). The overall thickness of the formation in this quad varies from about 235 ft to as much as 410 ft thick. The individual units are described in descending order:

Dodds Creek Sandstone (dc): A grayish orange (10YR7/4), dark yellowish orange (10YR6/6), to a very pale orange (10YR8/2), but locally weathers to a distinct moderate yellowish brown (10YR5/4), weakly to moderately indurated, thin wavy-bedded to locally wavy-laminated, weakly calcareous at base, argillaceous, micaceous, fine-grained sandstone with local interlaminated and interbedded siltstones and clayshales; bedding from 0.5"-4" thick, but basal beds may be as much as 12" thick; typically, tops of beds ripple-marked, while base of beds are planar, and each bed is separated by a shale parting. Unit formally mapped as the "Layton Sandstone" by Bennison and others (1972).
Member about 40 ft thick.
unit 3 (IPcv3): A light olive gray (5Y6/1), dusky yellow (5Y6/4), to medium gray (N5), well-laminated to fissile, slightly silty, concretionary clayshale; concretions occur as discontinuous beds and elongated nodules of no more than 2-3" thick; typically pale yellowish orange (10YR8/6) to dark yellowish orange (10YR6/6) in color. Laminated, micaceous, very fine-grained sandstone and siltstone intervals occur in the upper half of unit locally and become more prevalent in the northern part of the quad; intervals usually yellowish gray (5Y 7/2) but may be grayish orange (10YR 7/4), dusky yellow (5Y 6/4), moderate yellowish brown (10YR 5/4), or dark yellowish brown (10YR 4/2), wavy- to planar-laminated with bedding from 0.5" to 2" thick, with ripple mark bedding surfaces.
Unit about 120 to 130 ft thick.
unit 2 (IPcv2): This unit is extensive in the southern and central parts of the Sapulpa North quad and pinches out in the northern third of the quad. Unit consists predominantly of planar, thin- to locally medium-bedded, fine-grained sandstone with intervals of interbedded mudstone and siltstone between major sandstone intervals.
Sandstones are yellowish gray (5Y7/2) to grayish orange (10YR7/4) but weather a distinct dark yellowish orange (10YR6/6) to light brown (5YR5/6), are friable to moderately-indurated, planar-bedded with bedding ranging from 1-14" thick, although locally some beds may be up to 24" thick; grain texture is fine, although it may be medium-grained to rarely coarse-grained near base of sandstone sequences; in general, sandstones are coarser-grained and thicker-bedded at the base of each interval and may contain a well-developed chert-pebble conglomerate; cement is a weak silica to iron oxide and clay, although rare calcareous cement does occur; current lineations and current ripples (including linguoid ripples) common. The rocks contain variable amounts of horizontal trace fossils, and a Calamites fossil was also observed.
Mudstones within unit 2 are light olive gray (5Y6/1), weakly laminated to blocky-bedded, non-calcareous, and may contain grayish red purple (5RP4/2) nodular iron concretions. Discontinuous intervals of a yellowish gray (5Y7/2), laminated siltstone may occur locally within mudstones, and just below contacts with major sandstone intervals.
Thickness of unit 2 ranges from a maximum of 165 ft in the south, thinning to 0 ft thick to the north.
unit 1 (IPcv1): Primarily a shale-dominated unit. Lower 5 to 10 ft, just above the Checkerboard Limestone, consists of a dark gray (N3) to medium dark gray (N4), weathers to an olive black (5Y2/1), well-laminated to fissile, phosphatic clayshale, which grades upward into a yellowish gray (5Y7/2), light olive gray (5Y5/2), olive gray (5Y4/1), to medium gray (N5), blocky-bedded, concretionary, silty claystone to mudstone with local occurrences of interbedded sandstone; concretions are dark yellowish orange (10YR6/6) to light brown (5YR5/6), nodular to discontinuously bedded, and primarily composed of hematite; sandstones are grayish orange (10YR7/4) to grayish orange pink (5YR7/2), friable to weakly indurated, thin-bedded, fine-, to less frequently, medium-grained; individual sandstone layers typically 2" to 3 ft thick, although some may attain a thickness of over 8 ft in some exposures; sandstone interbeds within unit appear to increase in the northern part of quad, and north of where unit 2 of Coffeyville pinches out.
Thin coal beds and streaks occur sporadically throughout, with one prominent, 8" thick coal bed occurring near the top of the unit.
Overall thickness of unit 1 about 75 ft thick.

Pcb CHECKERBOARD LIMESTONE (Pennsylvanian, Missourian)—The Checkerboard Limestone is medium gray (N5), greenish gray (5GY6/1), to dark greenish gray (5GY4/1), but weathers to a distinct moderate yellowish brown (10YR5/4) to dark yellowish orange (10YR6/6) color. Texturally, it is a skeletal to whole-fossil carbonate mudstone to wackestone; bedding is commonly absent in the formation at most exposures, although thin, planar to wavy beds of about 2" to 3" thick have been observed locally, occurring above the main, basal bed. Fossils include crinoid stems, corals, and bivalves. Thin calcite veins (~ 1 cm wide), are present in some exposures.
Thickness a consistent 3 ft.

Psm SEMINOLE FORMATION (Pennsylvanian, Missourian)—Formation consists of a lower sandstone interval, called the Tulsa Sandstone, and a basal and upper suite of interbedded laminated, concretionary, silty clayshales, mudshales and siltstones. The Tulsa coal also occurs within the uppermost shale interval, just above the top of the Tulsa Sandstone.
The Tulsa Sandstone starts anywhere from 6 to 15 ft above the base of the formation and consists of a pale yellowish orange (10YR8/6), light brown (5YR5/6), grayish red (5R4/2), very pale orange (10YR 8/2), to yellowish gray (5Y7/2), with dark yellowish orange (10YR6/6) spots, weak- to moderately-indurated, thin- to medium-bedded, very fine- to fine-grained argillaceous and micaceous sandstone; sandstone mostly siliceous but may have a weak calcite cement within some bedding intervals. Unit appears as a series of stacked channel sequences, where an individual sequence may vary between 2 to 4 ft thick, and which are separated by a 6-12" thick interval of interlaminated calcareous, silty clayshale and siltstone; bedding at base of each sequence is thicker (varying from 12-24") and has channel-form lower surfaces, which grade up into a thinner (3-5" thick), planar-bedded sequence. Horizontal burrows and tool marks common along the base of beds, while tabular cross-bedding evident within bed interiors. Beds often appear pitted due to the weathering out of horizontal burrows. Thickness of the member varies from 5 to 10 ft.
Dark yellowish orange (10YR6/6), pale yellowish orange (10YR8/6), to light olive gray (5Y6/1), laminated, slightly silty, concretionary clayshales interlaminated with mudshales and siltstones occur above and below the Tulsa Sandstone. Siltstone intervals are ripple-marked and also have abundant horizontal trace fossils. Concretionary material occur as discontinuous lenses and beds within clayshales that vary from 1-6" thick.
Float chips of the Tulsa coal have been observed in various localities near the upper contact with the Tulsa Sandstone.
Thickness of the Seminole Formation about 80 ft thick.

Plo LOST BRANCH FORMATION (Pennsylvanian, Desmoinesian)—Poorly exposed, except for the Glenpool Limestone bed. Overall, a light brown (5YR6/4) to pale yellowish brown (10YR6/2), locally medium light gray (N6), laminated, slightly calcareous, micaceous, silty clayshale. Basal 3 ft of formation, just above the Dawson Coal, consists of a medium dark gray (N4) to dark gray (N3), well-laminated to fissile, phosphatic mudshale to clayshale called the Nuyaka Creek shale bed. The top of the formation is marked at the top the Glenpool Limestone, which is a dusky yellow (5Y6/4) to pale olive (10Y6/2), 1-1.5 ft thick, laminated, wavy-bedded packstone to whole fossil wackestone in upper half, grading down into an argillaceous unfossiliferous carbonate mudstone in lower part of bed; brachiopods, gastropods, and crinoid debris the most common fossils. Thickness of the Lost Branch ranges from 35 to 40 ft thick, but averages closer to 35 ft thick across the map area.

Pmm MEMORIAL FORMATION (Pennsylvanian, Desmoinesian)—Poorly exposed in quad. The top of the formation is represented by the Dawson Coal, which was unobserved in map area except for the presence of a few workings and a reclaimed strip pit in the southeast part of map, as well as reports of its occurrence by Oakes (1952) and Bennison and others (1972). The rest of the formation consists of a light olive brown (5Y5/6), grayish orange pink (5YR7/2), to grayish yellow (5Y8/4), interbedded sandy, weakly calcareous mudstone and friable, fine-grained sandstone. Sandstones may have light brown (5YR6/4) oxide spots. Mudstone is blocky-bedded, with numerous concave fractures and slickensides that are indicative of paleosol development. Sandstones generally laminated, occurring as discontinuous beds and lenses within mudstones; sandstone cement most likely clay or a weak iron-oxide.
Only the upper 30-40 ft of the Memorial Formation is exposed in the quad.

LENAPAH FORMATION (Pennsylvanian, Desmoinesian)—A thin, skeletal to whole-fossil wackestone- to packstone-textured limestone; found only in the subsurface.

NOWATA FORMATION (Pennsylvanian, Desmoinesian)—A blocky-bedded to weakly laminated, slightly silty, concretionary clayshale; found only in the subsurface.

OOLOGAH FORMATION (Pennsylvanian, Desmoinesian)—A thin- to medium-bedded, skeletal carbonate mudstone to wackestone; found only in the subsurface.

LABETTE FORMATION (Pennsylvanian, Desmoinesian)—Laminated, very silty to sandy, micaceous, concretionary clayshales, interbedded with fine-grained sandstones near top; found only in the subsurface.

FORT SCOTT FORMATION (Pennsylvanian, Desmoinesian)—Thin- to medium-, wavy-bedded whole-fossil wackestones and mudstones, interbedded with fissile, phosphatic clayshale; found only in the subsurface.

SENORA FORMATION (Pennsylvanian, Desmoinesian)—Complex sequence of silty and concretionary clayshales, interbedded with very fine-grained sandstones and siltstones; includes the Verdigris Limestone; found only in the subsurface.

REFERENCES CITED

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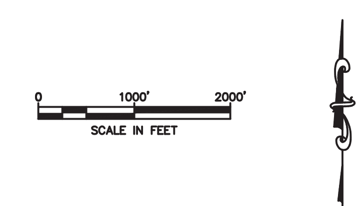
Oakes, M.C., 1952, Geology and mineral resources of Tulsa County, Oklahoma (includes parts of adjacent counties): Oklahoma Geological Survey Bulletin, 69, 234 p.

*Detailed descriptions only include mappable units observed in the field. Formal member and bed names are indicated by capitalization (i.e., Glenpool Limestone), whereas informal names are given in lowercase (i.e., Nowata flagstone). Color of units based on fresh surfaces, unless stated otherwise.

SYMBOLS

- Unit contact; dashed where approximate
- × Outcrop, geologic observation
- • Petroleum well. Includes oil, gas, oil and gas, dry service (water supply or injection), junked and abandoned, unknown. Modified from Natural Resources Information System database
- Drill hole with well number, lessee, and projection (cross section only)



NOTES:

1. MAP SOURCE: OKLAHOMA GEOLOGICAL SURVEY QUADRANGLE MAPS
   1.1. OGQ-83 GEOLOGICAL MAP OF THE SAPULPA NORTH 7.5' QUADRANGLE, CREEK AND TULSA COUNTIES, OKLAHOMA, CHUNG AND STANLEY, 2011.
   1.2. OGQ-76 GEOLOGICAL MAP OF THE SAPULPA SOUTH 7.5' QUADRANGLE, CREEK AND TULSA COUNTIES, OKLAHOMA, CHUNG AND STANLEY, 2009.
   1.3. OGQ-82 GEOLOGICAL MAP OF THE LAKE SAHOMA 7.5' QUADRANGLE, CREEK COUNTY, OKLAHOMA, STANLEY AND CHUNG, 2011.
   1.4. OGQ-84 GEOLOGICAL MAP OF THE KELLYVILLE 7.5' QUADRANGLE, CREEK COUNTY, OKLAHOMA, CHUNG AND STANLEY, 2012.
2. THERE ARE NO KNOWN OUTCROPS OF THE CONFINING FORMATION IN THE MAPPED AREA.
3. NO SURFACE WATER INTAKE OR DISCHARGE STRUCTURES HAVE BEEN IDENTIFIED WITHIN 1-MILE OF WELL #1.
4. NO HAZARDOUS WASTE TREATMENT, STORAGE, OR DISPOSAL FACILITIES HAVE BEEN IDENTIFIED WITHIN 1-MILE OF WELL #1.
5. THERE ARE NO PRODUCTION WELLS, OTHER INJECTION WELLS, ABANDONED DEEP WELLS, DRY HOLES, OR DRINKING WATER WELLS WITHIN THE AREA OF REVIEW.
6. ACTIVE SHALLOW GROUNDWATER MONITORING WELLS ASSOCIATED WITH THE PERMITTED LANDFILL OPERATIONS EXIST WITHIN THE REAL ALLOY PROPERTY.
7. THERE ARE NO ACTIVE SURFACE OR SUBSURFACE MINES OR QUARRIES WITHIN THE AREA OF REVIEW.

REVISIONS

NO.	DATE	DESCRIPTION	REV BY	CHK BY

SURFACE GEOLOGY MAP

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE A-2

FACILITY ENTRANCE

GATE HOUSE

PLANT AREA

CLOSED LANDFILL

LEACHATE COLLECTION POND

NORTH 9TH STREET (HIGHWAY 97)

FRENCH DRAIN SUMPS

FRENCH DRAIN SUMPS

MW #14

MW #18

MW #15

MW #17

MW #4

MW #21

INJECTION WELL BUILDING

INJECTION WELL

INJECTION PUMP BUILDING

SUCTION PUMP BUILDING

CUT-OFF TRENCH

MW #16

MW #19

MW #20

CUT-OFF TRENCH SUMP

DEEP MONITORING WELL

MW #13

MW #10

INTERSTATE 44 (TURNER TURNPIKE)

LEGEND

- ELEVATION CONTOUR
- PROPERTY BOUNDARY
- APPROXIMATE FINAL COVER BOUNDARY
- UNPAVED ROAD
- MW #4 — MONITOR WELL
- SUMP

0 100' 200'
SCALE IN FEET

NOTES:

1. TOPOGRAPHIC MAP BASED ON AERIAL SURVEY PERFORMED BY AERIAL DATA SERVICE, INC. ON JULY 18, 2007.

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

SITE MAP

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
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ISSUE DATE:	5/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE A-3

LEGEND

PROPERTY BOUNDARY

APPROXIMATE FINAL COVER BOUNDARY

0 250' 500'

SCALE IN FEET

NOTES:

1. MAP SOURCE: GOOGLE EARTH AERIAL DATED NOVEMBER 10, 2020.
2. NO SCHOOLS OR HOSPITALS ARE PRESENT WITHIN THE AREA OF REVIEW (AOR).
3. FORTY RESIDENCES ARE PRESENT WITHIN THE AOR.

REVISIONS

NO.	DATE	DESCRIPTION	REV BY	CHK BY

AREA OF REVIEW MAP

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

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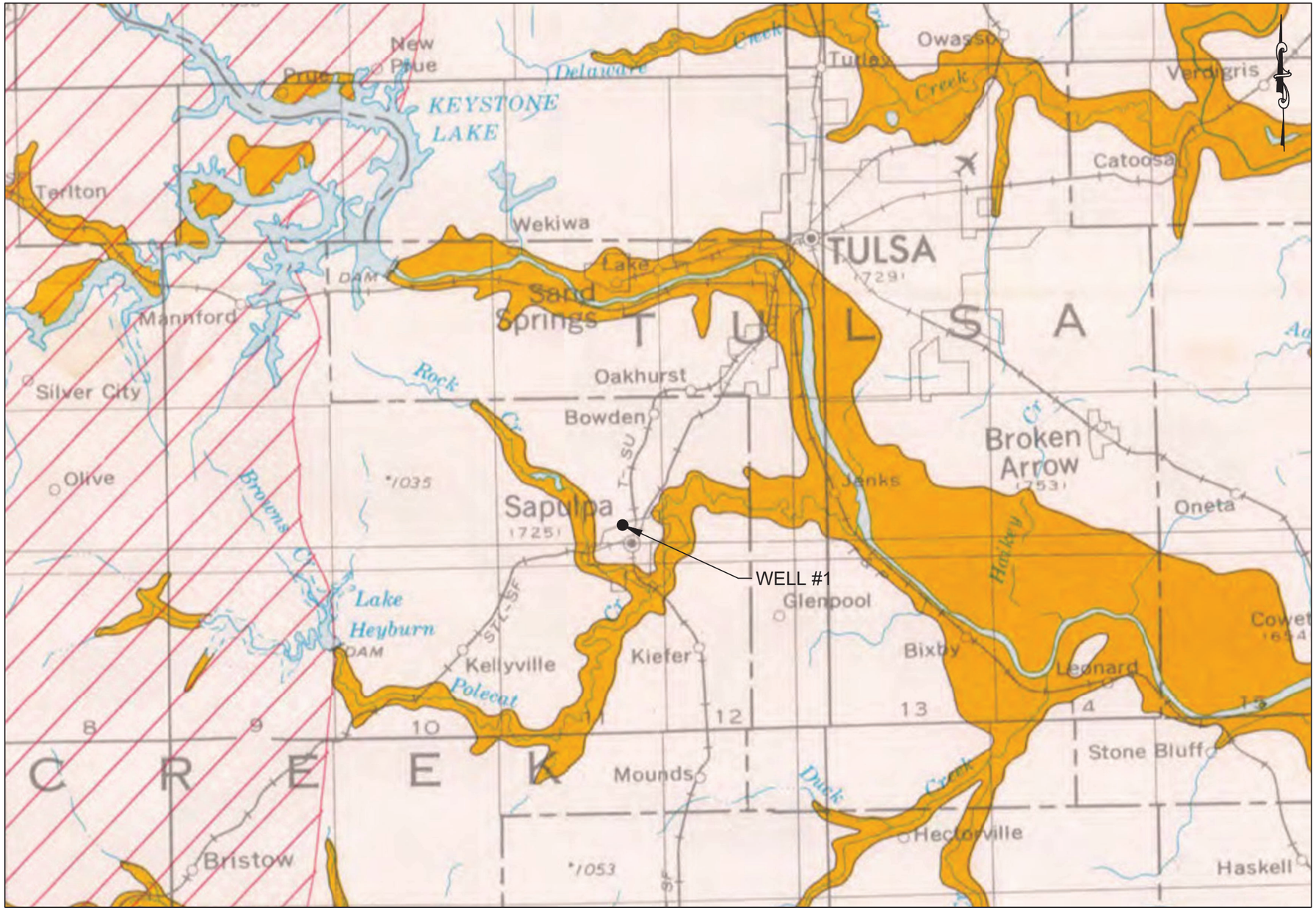
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	5/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE A-4



EXPLANATION

Alluvium and Terrace Deposits and Their Recharge Areas (Quaternary in age). Unconsolidated deposits of sand, silt, clay, and gravel that occur along or adjacent to modern and ancient streams. Thickness generally ranges from 10 to 50 ft (locally as much as 100 ft). Wells generally yield 10 to 500 gpm cf water (locally several thousand gpm), and most water is of good quality (less than 1,000 mg/L dissolved solids). Recharge areas arc essentially the same as distribution of the alluvium and terrace deposits.

Bedrock Aquifers and Their Recharge Areas (Cambrian through Tertiary in age). Rock units and sediments that generally are favorable or moderately favorable for development of groundwater resources. Thickness of aquifers generally ranges from 100 ft to several thousand ft. Depths to fresh water range from a few feet to more than 1,000 ft., with most wells 100-400 ft deep. Wells drilled into these aquifers generally yield 25–300 gpm, although wells in some aquifers yield up to 600–2,500 gpm. Water in most aquifers is of good to fair quality (300–1,500 mg/L dissolved solids). Pattern on map also includes known and potential recharge areas for bedrock aquifers.

0 1 2
SCALE IN MILES

NOTES:
1) BASE MAP SOURCE: "MAP OF AQUIFERS AND RECHARGE AREAS IN OKLAHOMA" COMPILED BY KENNETH S. JOHNSON, OKLAHOMA GEOLOGICAL SURVEY (1991).

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

GROUNDWATER RECHARGE AREAS MAP

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

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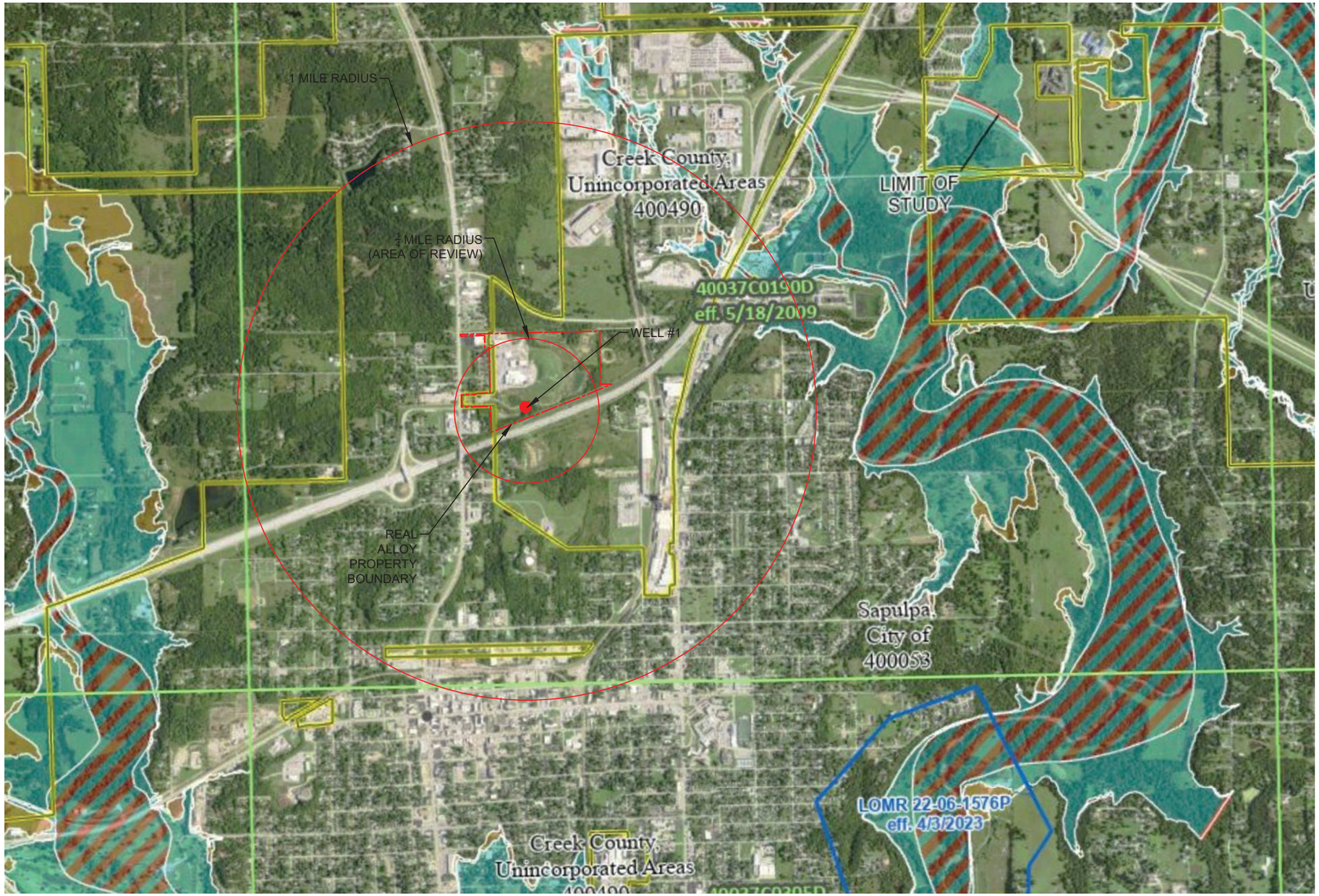
FIGURE A-5



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP
FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

0 1000' 2000'
SCALE IN FEET

NOTES:

1. BASE MAP SOURCE: FEMA NATIONAL FLOOD HAZARD FIRM PANEL 40037C0190D (EFFECTIVE 5/18/2019)

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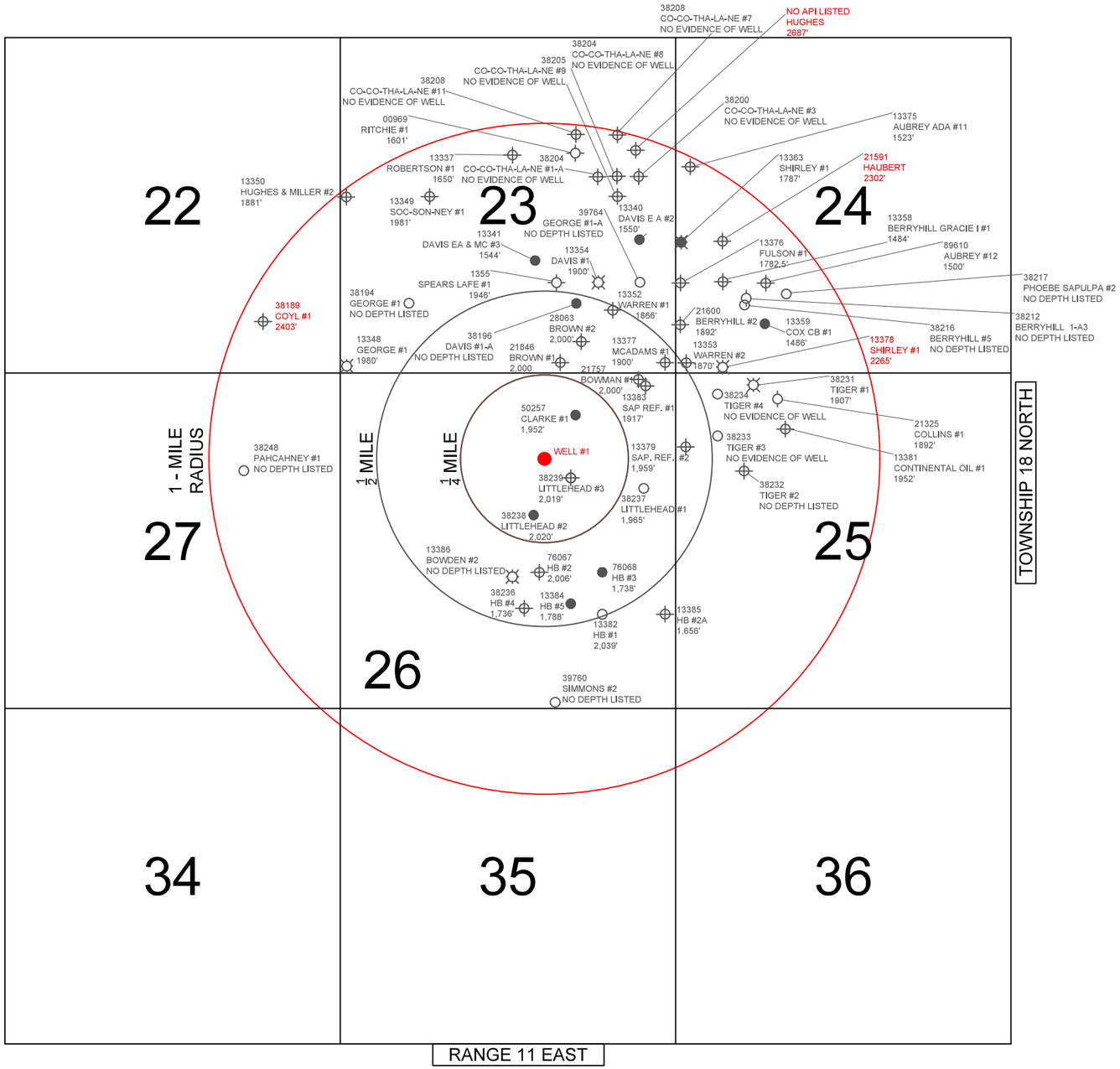
FLOOD PLAIN MAP
CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION
REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE A-6

LEGEND	
●	OIL
☼	GAS
✹	OIL/GAS
⊕	PLUGGED
☼	DRY
○	ORPHAN
○	OTHER



NOTES:

1. WELL DATA OBTAINED FROM THE OKLAHOMA CORPORATION COMMISSION RECORDS.
2. WELL SPOTS INDICATE API NUMBER, WELL NAME, AND TOTAL DEPTH.
3. DEPTHS ARE FROM GROUND LEVEL DATUM.
4. RED VALUES REPRESENT WELLS THAT PENETRATE THE BASE OF THE CONFINING ZONE AND EXTEND INTO THE INJECTION ZONE.

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

OIL AND GAS WELLS WITHIN 1-MILE
CLASS 1 INJECTION WELL
PERMIT RENEWAL APPLICATION
REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
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APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE A-7

GENERAL GEOLOGIC SECTIONS OF OKLAHOMA AND NORTHERN ARKANSAS

Revisions are shown in red. Revised 1975. OAC 165:10-1-28

NOTE: *PONTOTOC RESTRICTED TO PERMIAN SYSTEM ONLY. DOES NOT INCLUDE CISCO RED BEDS (PENNSYLVANIAN) BECAUSE OF MAJOR OROGENY SEPARATING TWO SYSTEMS.*

Revisions are shown in red. Revised 1975. OAC 165:10-1-28

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

GENERALIZED GEOLOGIC SECTIONS

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

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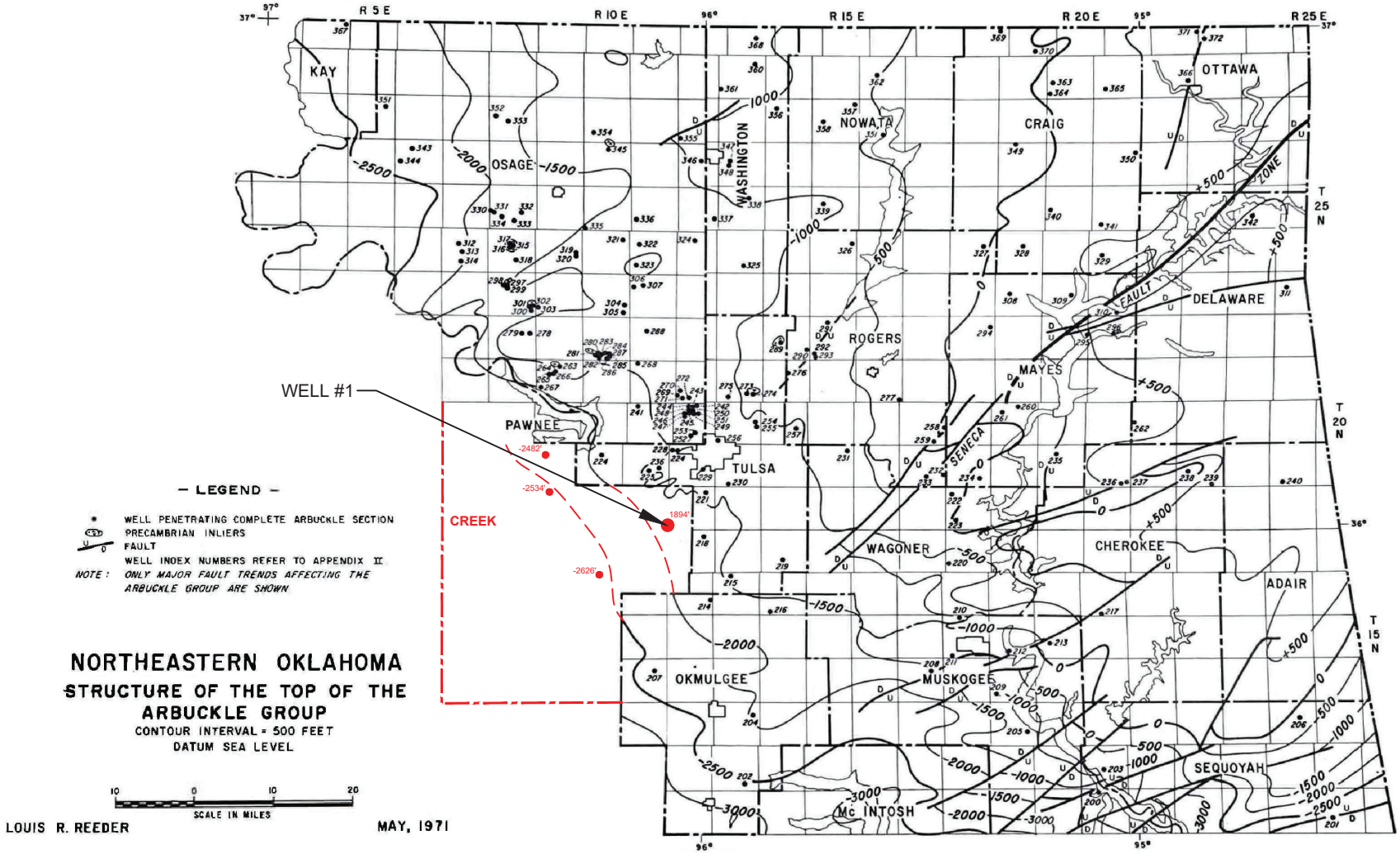
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	NOT TO SCALE

FIGURE B-1

SOURCE MAP: LOUIS R. REEDER, MAY 1971.



NOTE: RED LINES WERE INFERRED IN PREVIOUS APPLICATIONS USING EXISTING DATA.

0 10 20
SCALE IN MILES

N W E S

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

GEOLOGICAL STRUCTURE TOP OF THE ARBUCKLE GROUP

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

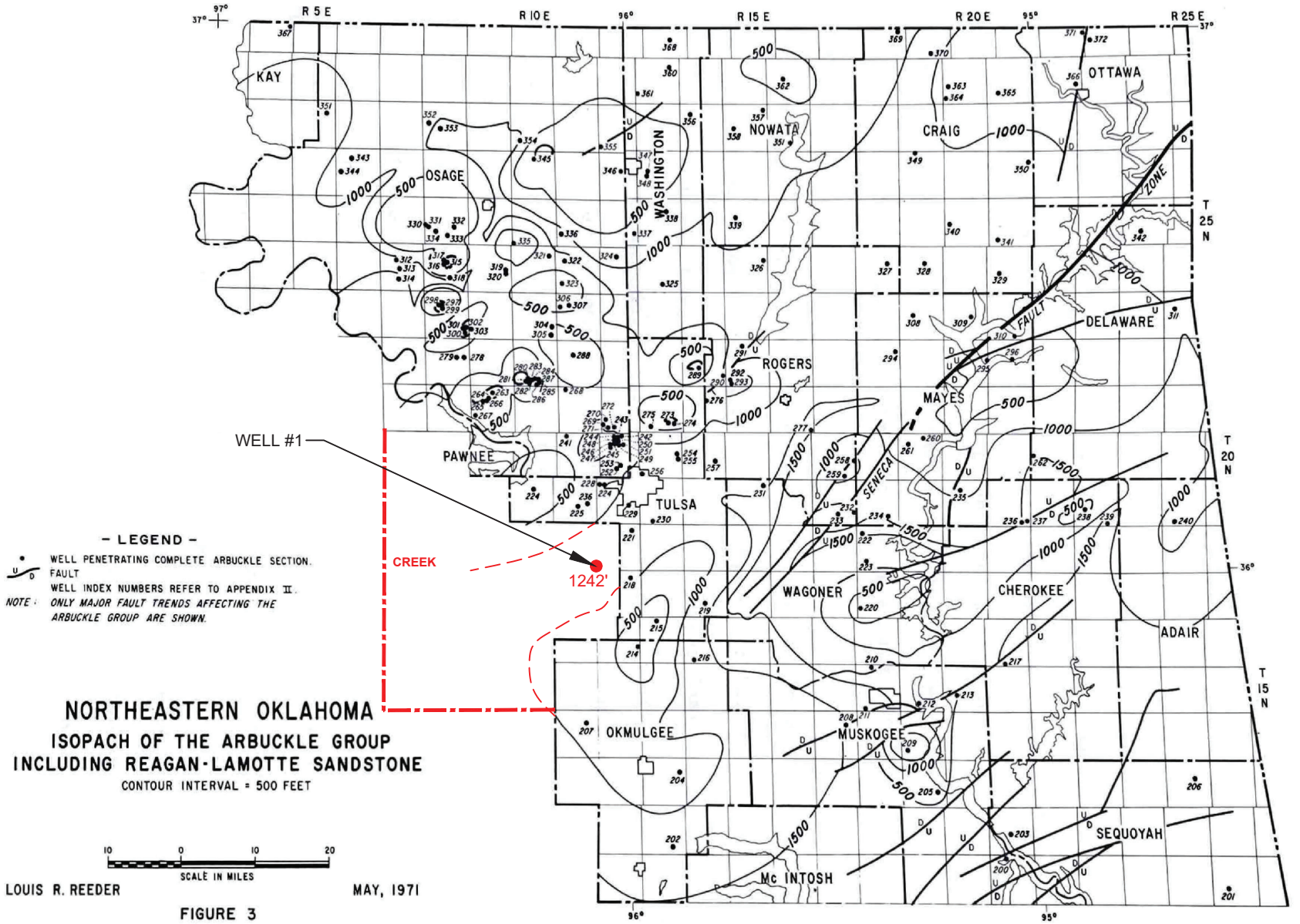
REAL ALLOY RECYCLING, LLC SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE B-2

SOURCE MAP: LOUIS R. REEDER, MAY 1971.



NOTE: RED LINES WERE INFERRED IN PREVIOUS APPLICATIONS USING EXISTING DATA.

0 10 20
SCALE IN MILES

N W E S

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

ISOPATCH OF THE ARBUCKLE GROUP WITH REAGAN-LAMOTTE SANDSTONE

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
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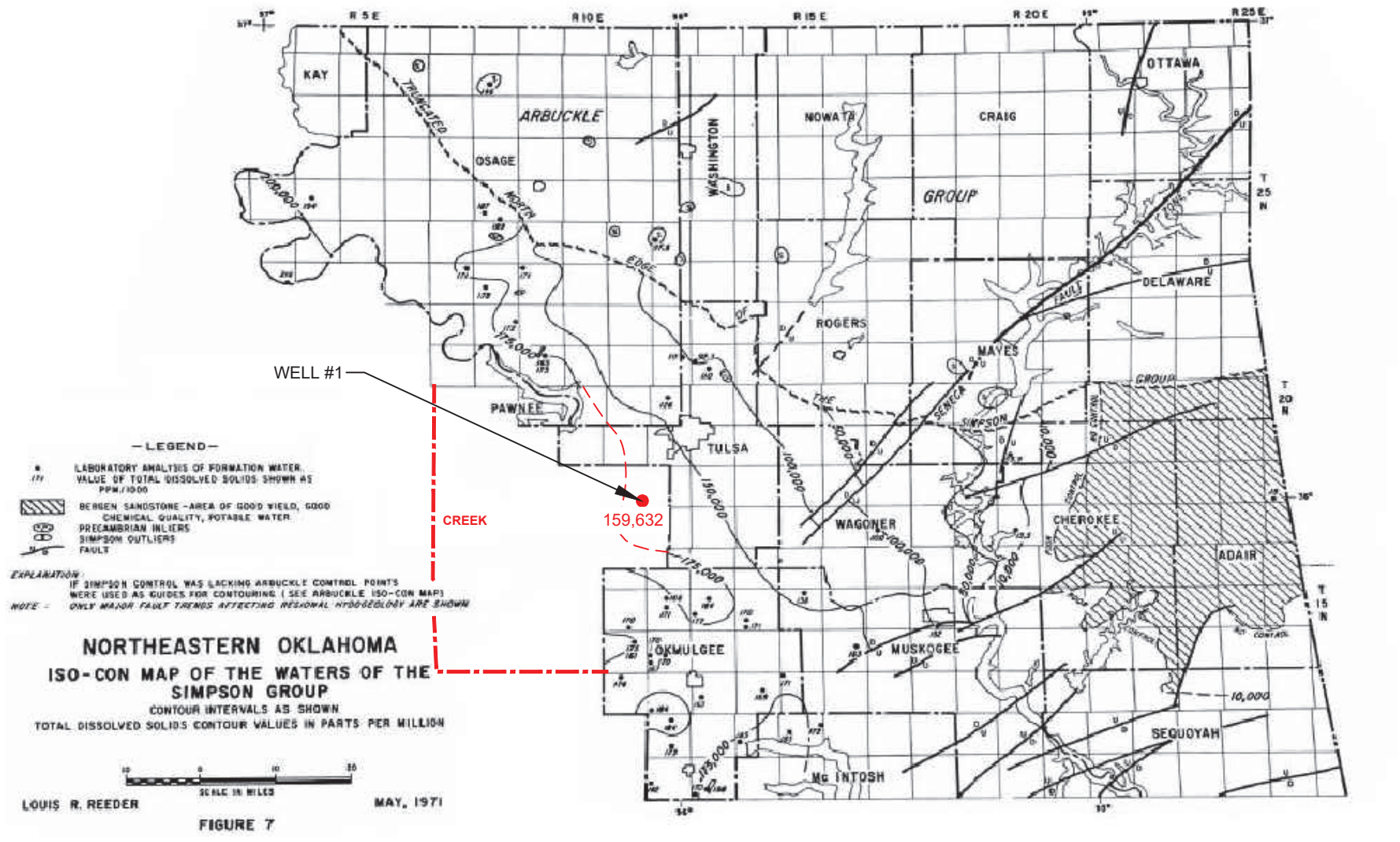
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE B-3

SOURCE MAP: LOUIS R. REEDER, MAY 1971.



NOTE: RED LINES WERE INFERRED IN PREVIOUS APPLICATIONS USING EXISTING DATA.

0 10 20
SCALE IN MILES

N W E S

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

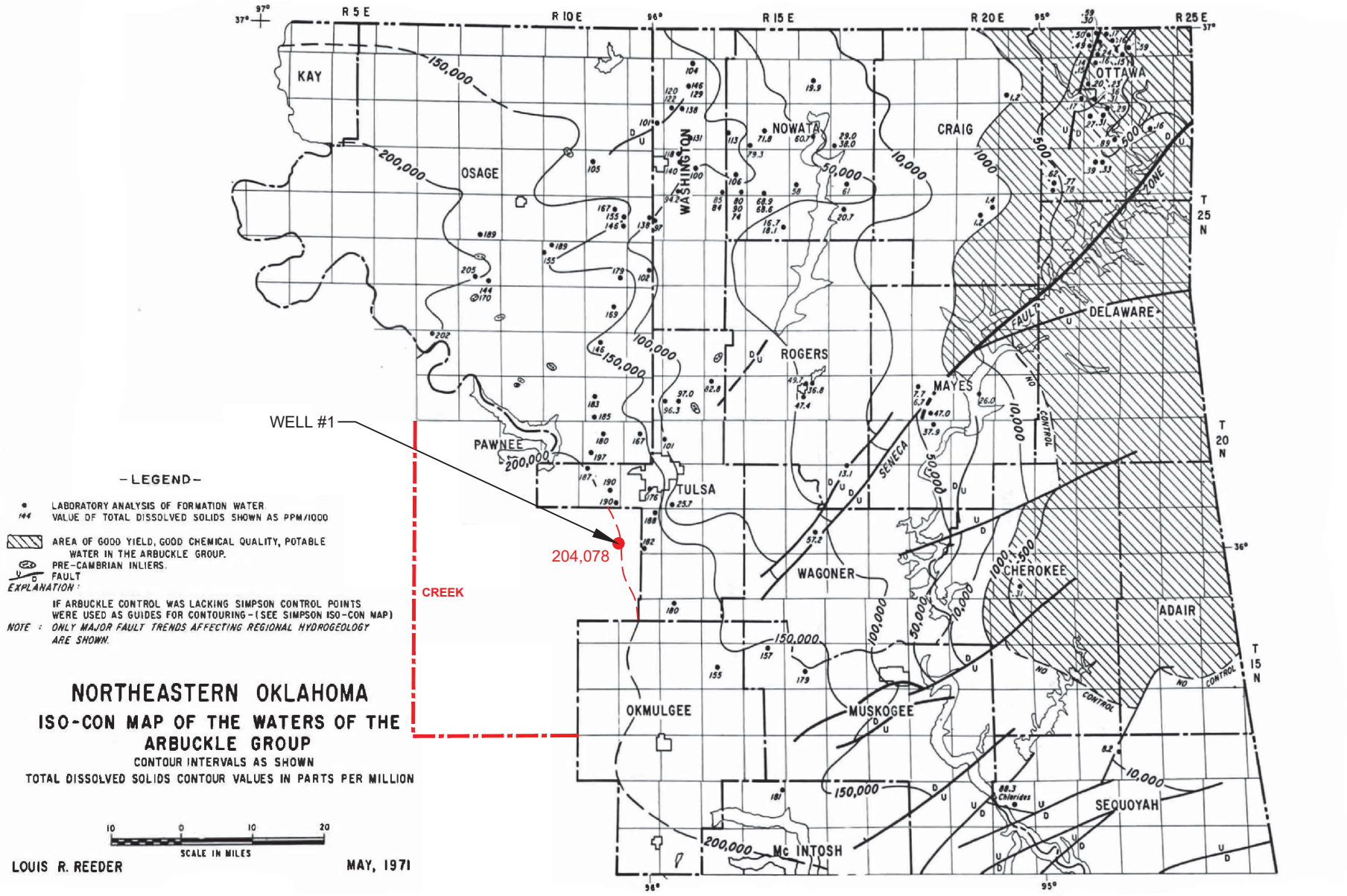
WATERS OF THE SIMPSON GROUP
CLASS 1 INJECTION WELL
PERMIT RENEWAL APPLICATION
REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING
and Associates

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE B-4

SOURCE MAP: LOUIS R. REEDER, MAY 1971.



NOTE: RED LINES WERE INFERRED IN PREVIOUS APPLICATIONS USING EXISTING DATA.

0 10 20
SCALE IN MILES

N W E S

REVISIONS

NO.	DATE	DESCRIPTION	REV BY	CHK BY

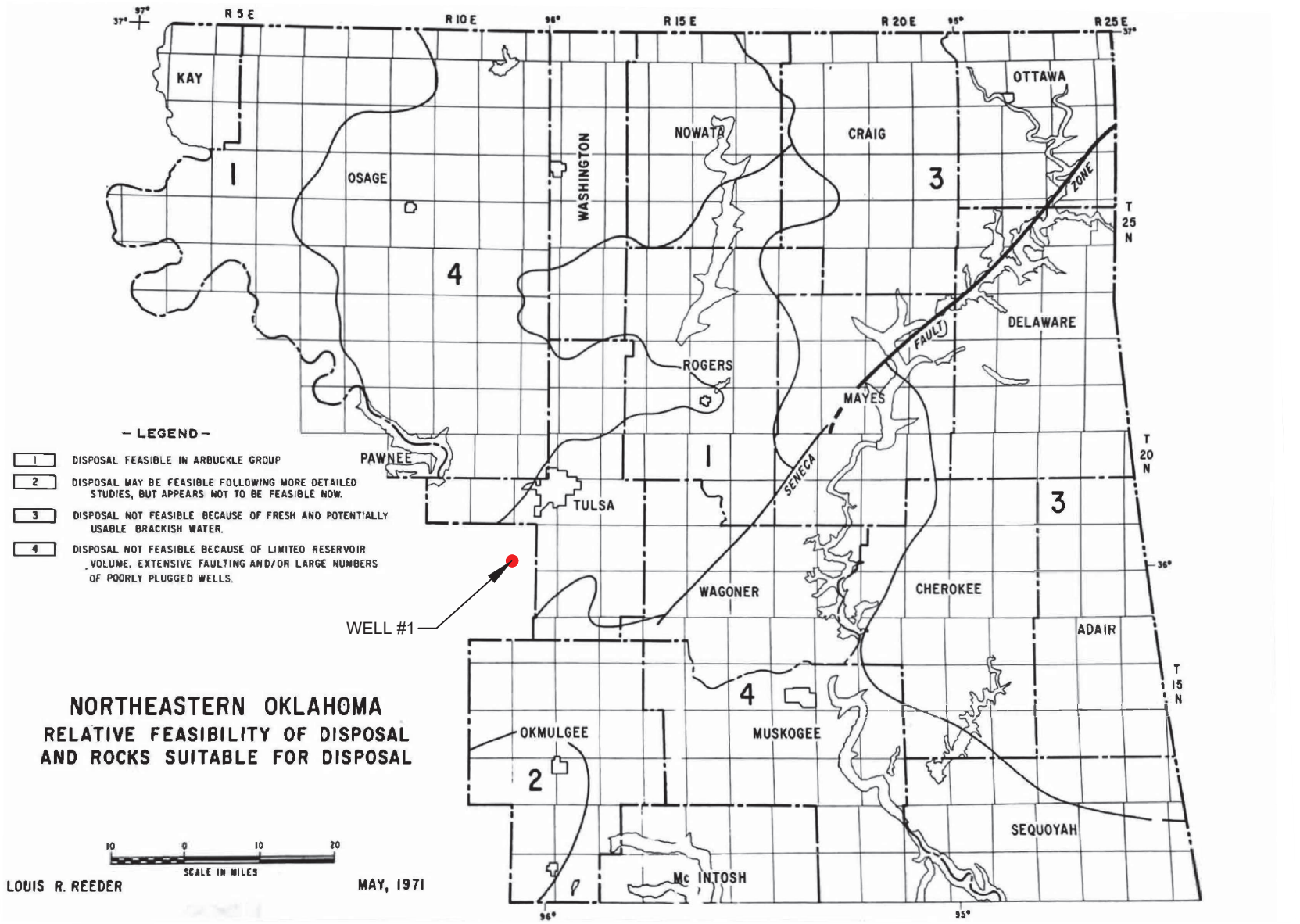
WATERS OF THE ARBUCKLE GROUP
CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION
REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE B-5

SOURCE MAP: LOUIS R. REEDER, MAY 1971.



0 10 20
SCALE IN MILES

N W E S

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

FEASIBILITY OF DISPOSAL AND ROCKS SUITABLE FOR DISPOSAL

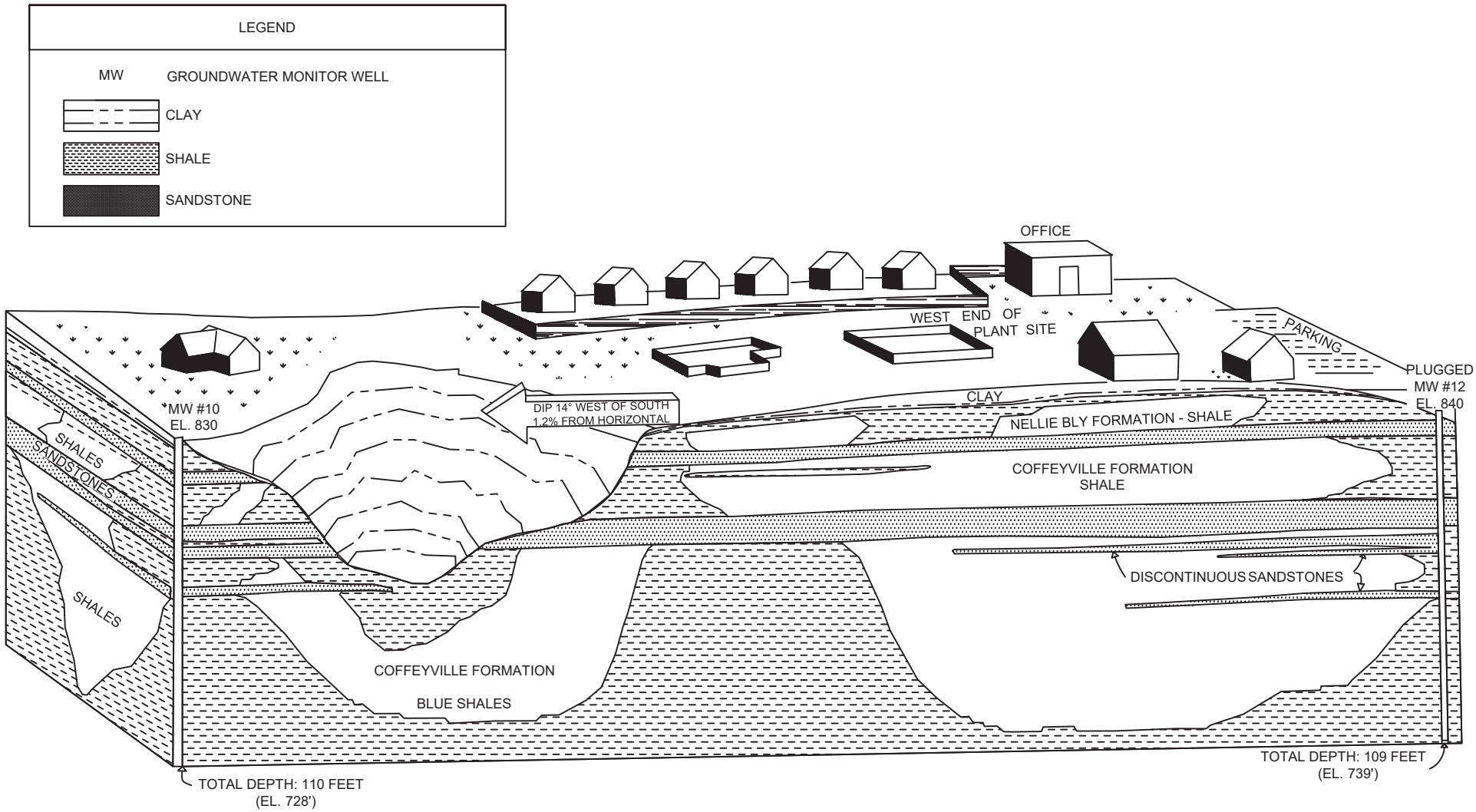
CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE B-6



NOTE: ADAPTED FROM 2001 PERMIT RENEWAL APPLICATION

HORIZONTAL SCALE: 0 100' 200' SCALE IN FEET

VERTICAL SCALE: 0 25' 50' SCALE IN FEET

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

PENNSYLVANIAN STRATA OF THE SITE

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

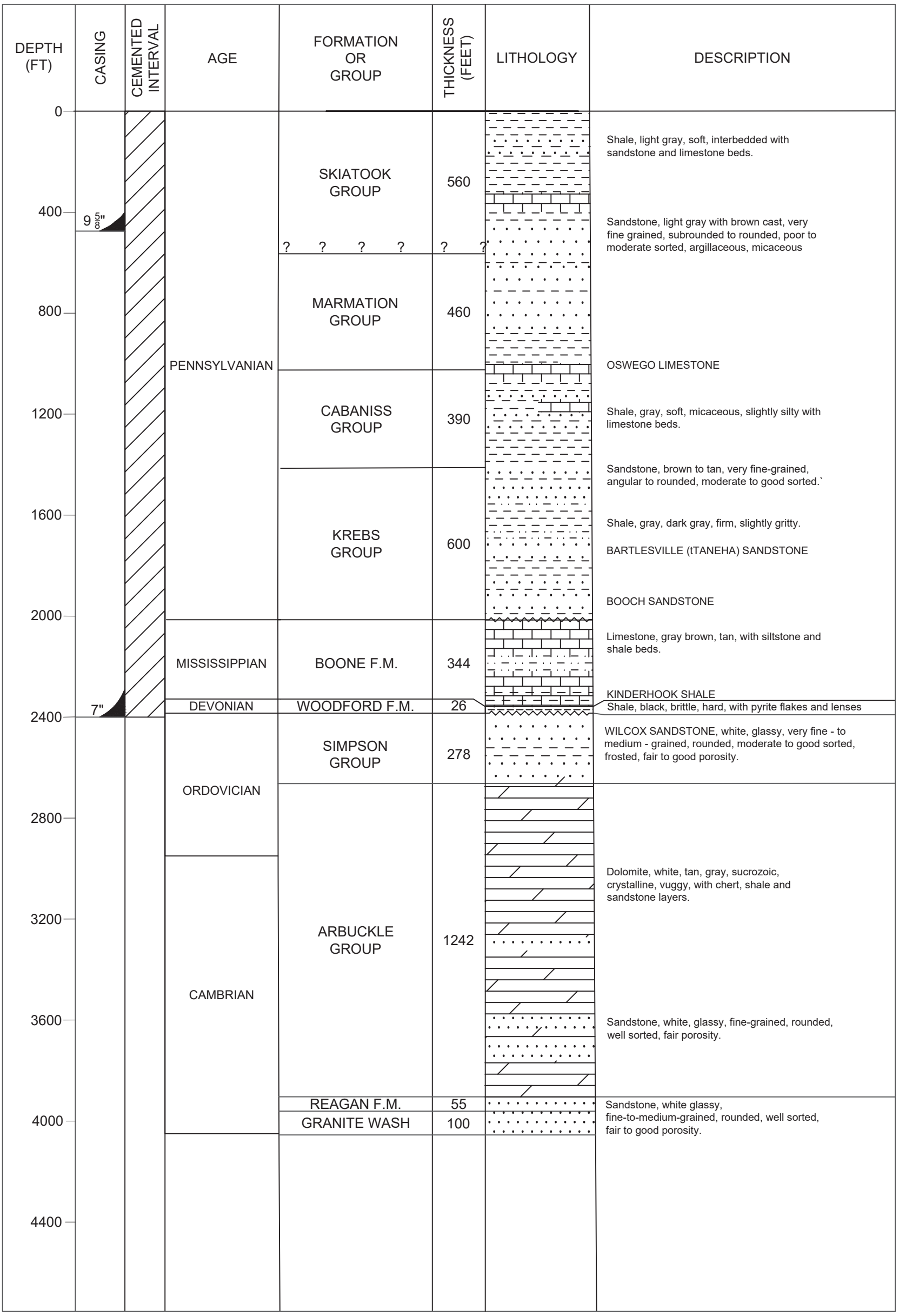
FIGURE B-7

REAL ALLOY INJECTION WELL #1 STRATIGRAPHIC COLUMN

LOCATION: NE NW SW NE, SECTION 26, T 18 N, R 11 E, I.M., CREEK COUNTY, OKLAHOMA

GROUND ELEVATION: 755 FEET

TOTAL DEPTH: DRILLING - 4055 FEET (4052 FEET LOG)



0 200 400
SCALE IN VERTICAL FEET

REVISIONS

NO.	DATE	DESCRIPTION	REV BY	CHK BY

STRATIGRAPHIC COLUMN OF WELL #1

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
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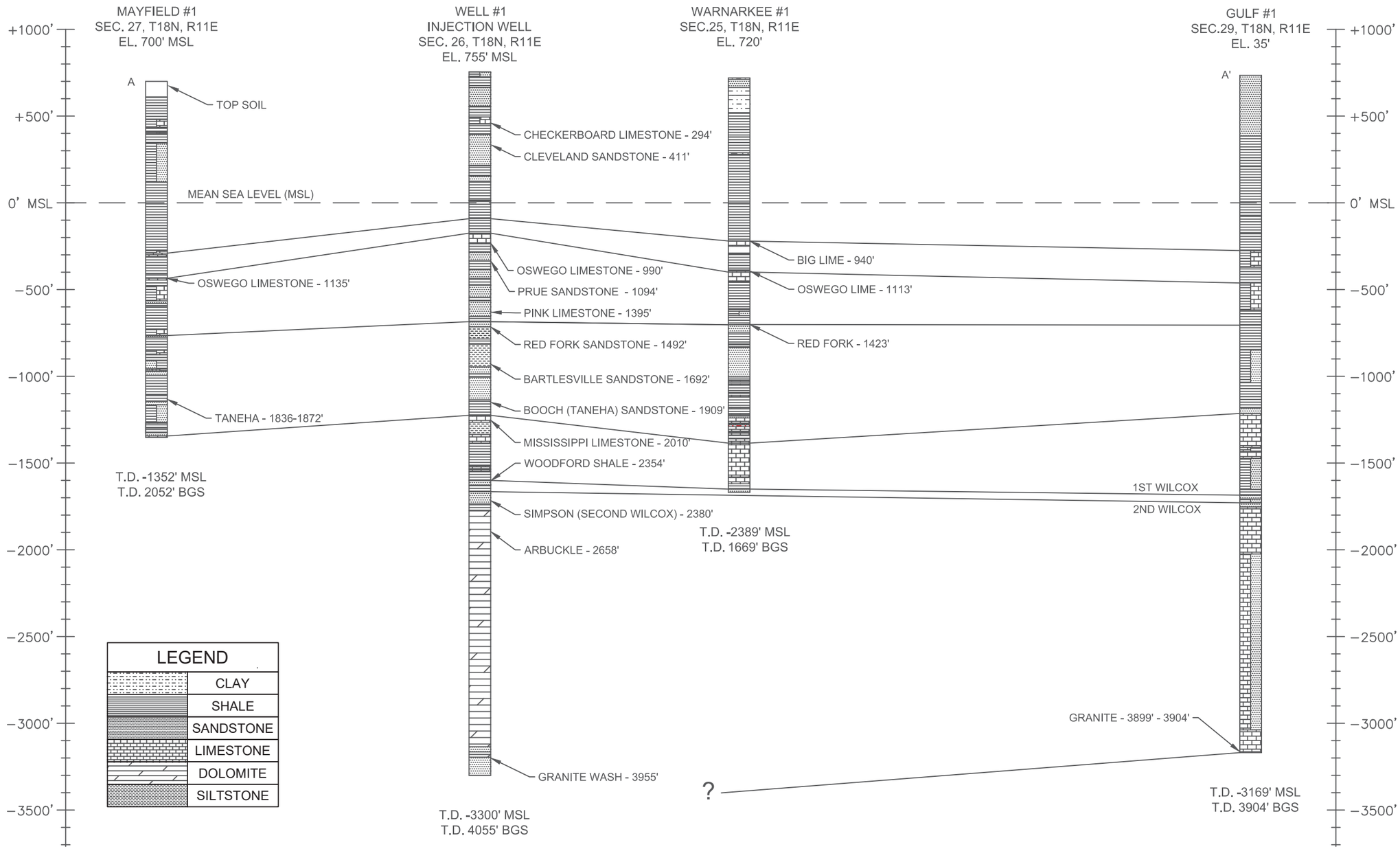
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE B-8

A — WEST

A' — EAST



REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

EAST-WEST GEOLOGIC CROSS-SECTION

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
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APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE B-9

B

SOUTH

B'

NORTH

+1000'

+500'

0' MSL

−500'

−1000'

−1500'

−2000'

−2500'

−3000'

−3500'

MEAN SEA LEVEL (MSL)

WICKHAM #1
SEC. 34, T18N, R11E
EL. 750' MSL

B

RED FORK - 1508'-1516'

BARTLESVILLE SANDSTONE - 1714'-1728'

TANEHA - 1890' - 1902'

T.D. -1286.5' MSL
T.D. 2036.5' BGS

WELL #1
INJECTION WELL
SEC. 26, T18N, R11E
EL. 755' MSL

CHECKERBOARD LIMESTONE - 294'

CLEVELAND SANDSTONE - 411'

OSWEGO LIMESTONE - 990'

PRUE SANDSTONE - 1094'

PINK LIMESTONE - 1395'

RED FORK SANDSTONE - 1492'

BARTLESVILLE SANDSTONE - 1692'

BOOCH (TANEHA) SANDSTONE - 1909'

MISSISSIPPI LIMESTONE - 2010'

WOODFORD SHALE - 2354'

SIMPSON (SECOND WILCOX) - 2380'

ARBUCKLE - 2658'

GRANITE WASH - 3955'

T.D. -3300' MSL
T.D. 4055' BGS

SHIRLEY #1
SEC. 24, T18N, R11E
EL. 660' MSL

BIG LIME

OSWEGO LIMESTONE - 1056'

TANEHA SAND

WILCOX SAND

T.D. -1605' MSL
T.D. 2265' BGS

CINDA LEE #1
SEC. 13, T18N, R11E
EL. 738' MSL

B'

BIG LIMESTONE

OSWEGO LIMESTONE

RED FORK SANDSTONE

MISSISSIPPI LIMESTONE

DUTCHER - 1786' - 1820'

1ST WILCOX

WILCOX - 2071' - 2324'

ARBUCKLE - 2315' - 2324'

T.D. -1586' MSL
T.D. 2324' BGS

LEGEND

- CLAY
- SHALE
- SANDSTONE
- LIMESTONE
- DOLOMITE
- SILTSTONE

VERTICAL SCALE 0 400' 800'
SCALE IN FEET

HORIZONTAL SCALE 0 1200' 2400'
SCALE IN FEET

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

NORTH-SOUTH GEOLOGIC CROSS-SECTION

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

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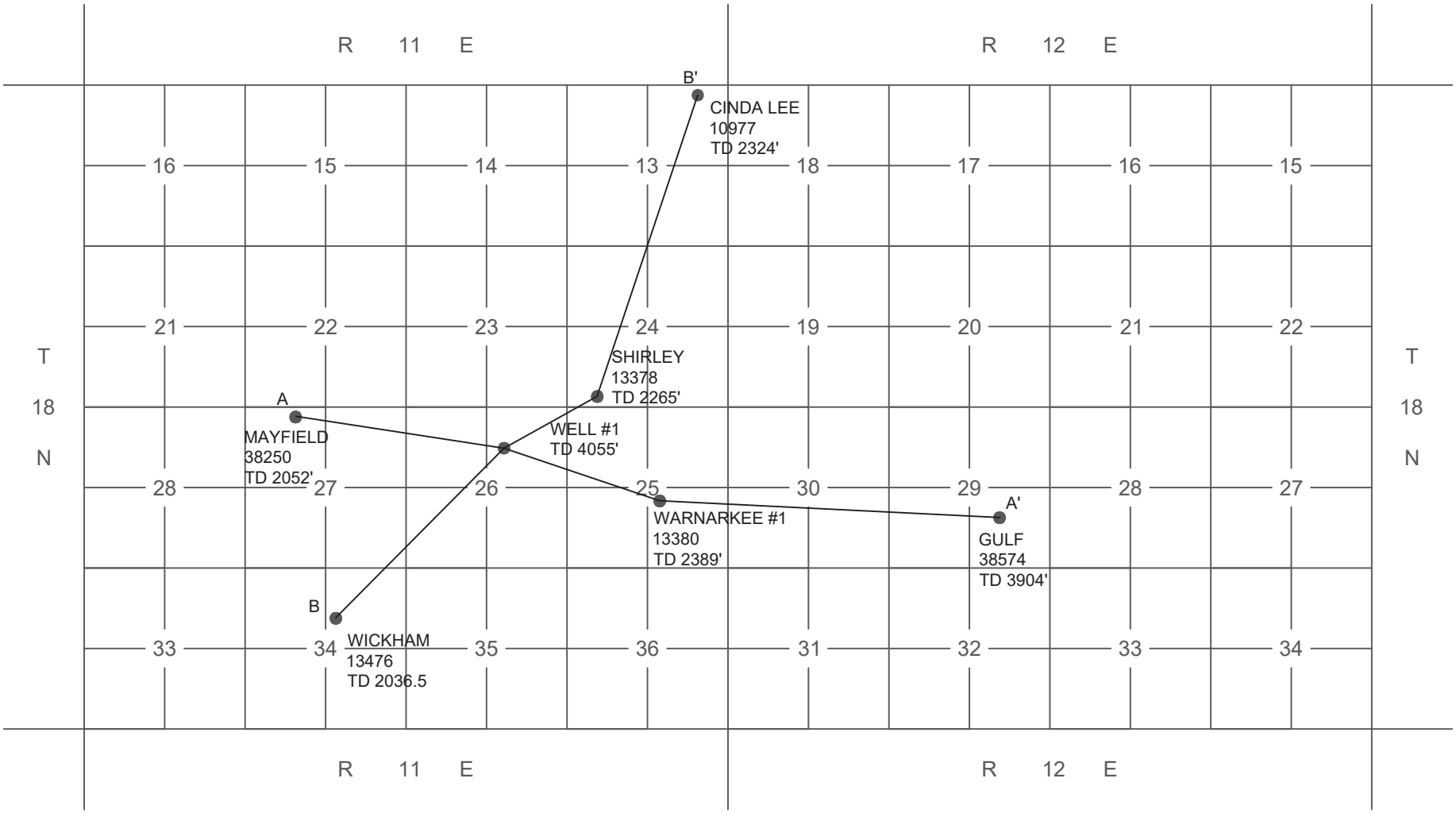
SCALE:	AS SHOWN

FIGURE B-10



0 0.5 1.0
SCALE IN MILES

N W E S

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NO.	DATE	DESCRIPTION	REV BY	CHK BY

CROSS-SECTIONS LOCATION MAP

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

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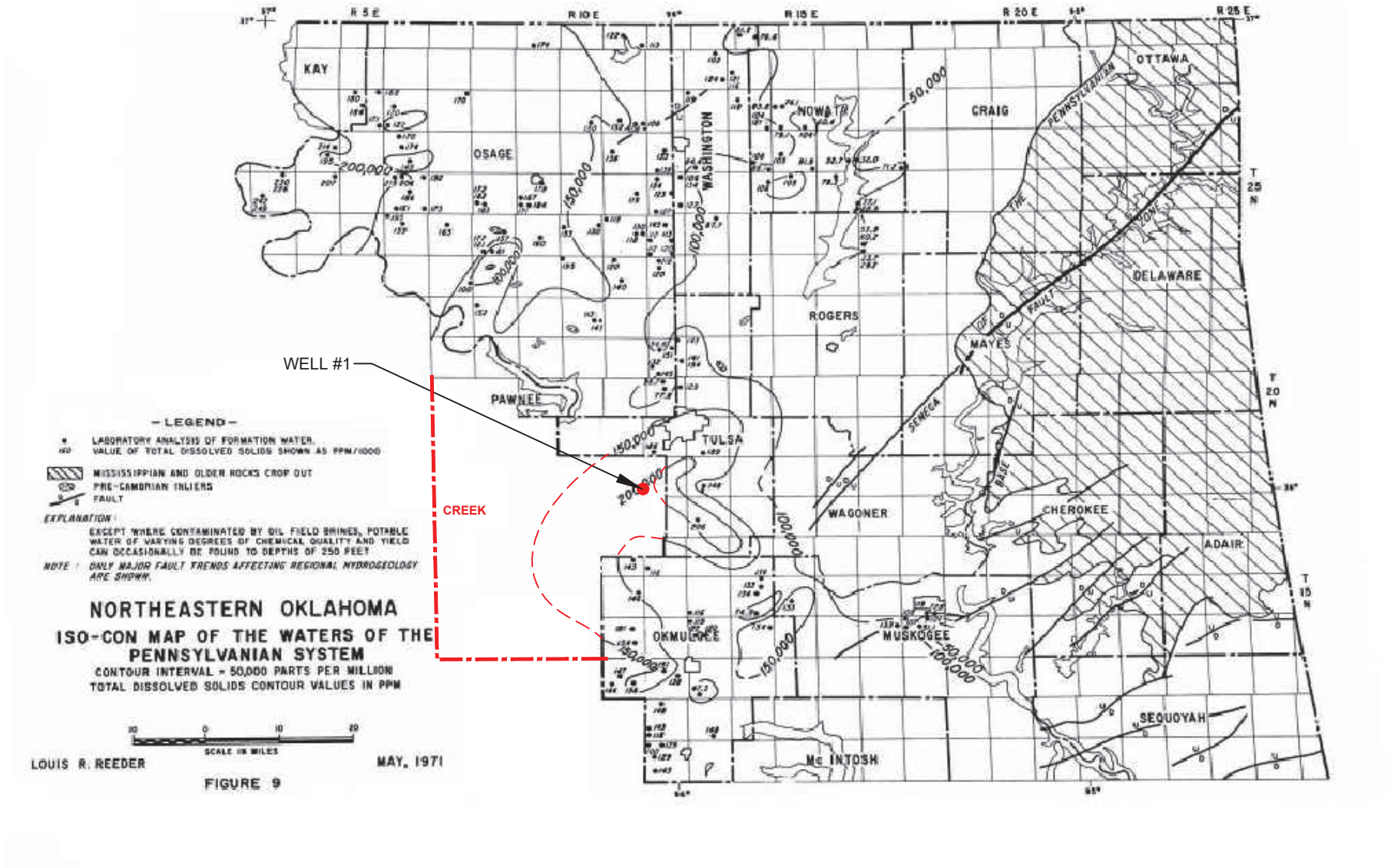
SCALE:	AS SHOWN

FIGURE B-11

SOURCE MAP: LOUIS R. REEDER, MAY 1971.



NOTE: RED LINES WERE INFERRED IN PREVIOUS APPLICATIONS USING EXISTING DATA.

0 10 20
SCALE IN MILES

N W E S

REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

WATERS OF THE PENNSYLVANIAN SYSTEM

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

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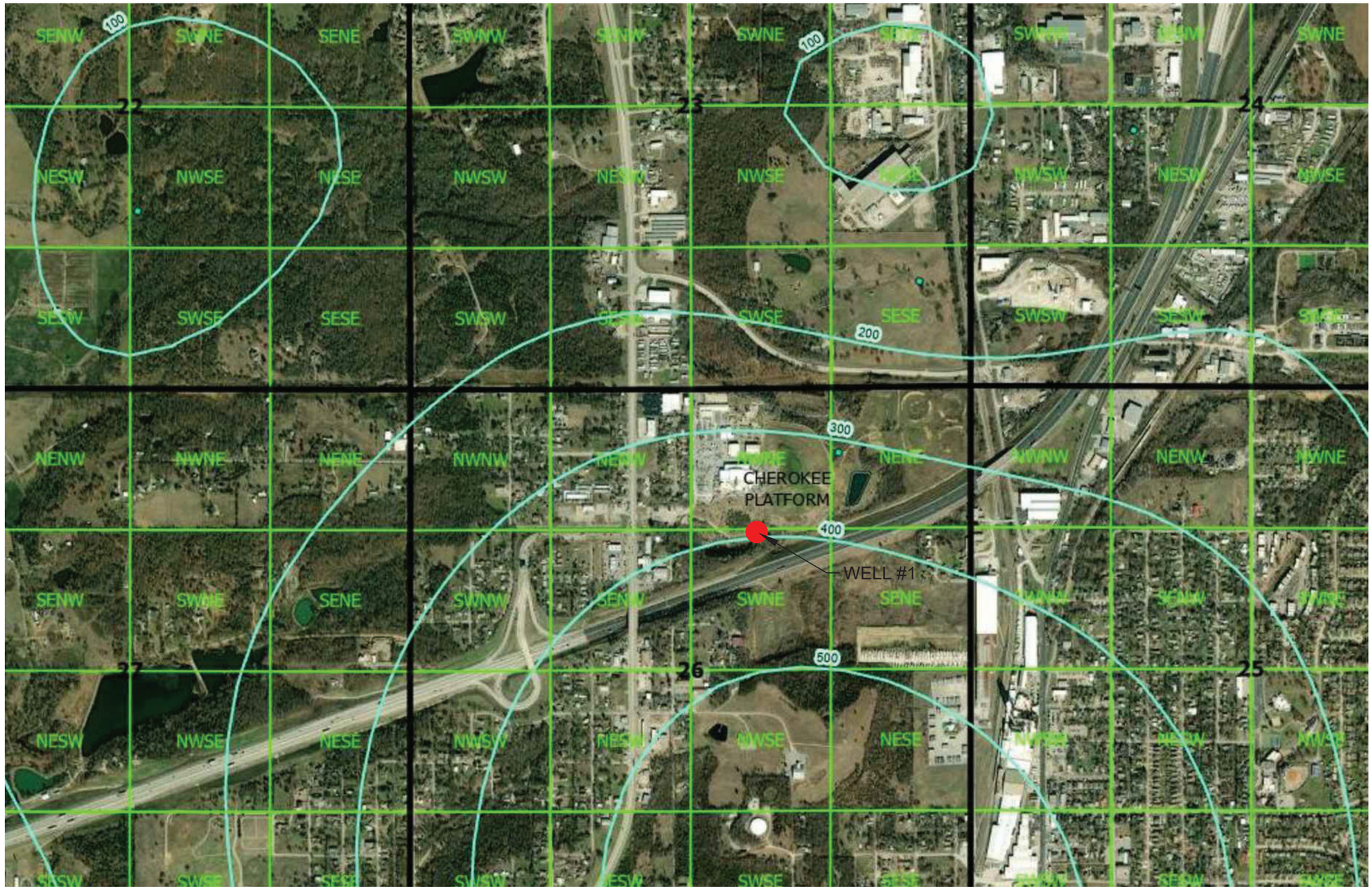
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE B-12



0 500' 1000'

SCALE IN FEET

NOTES:

1) BASE MAP SOURCE: OKLAHOMA CORPORATION COMMISSION, BASE OF TREATABLE WATER MAP.
2) CONTOURS REPRESENT THE ESTIMATED BASE OF TREATABLE WATER RELATIVE TO THE GROUND SURFACE.

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BASE OF TREATABLE WATER

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING
and Associates

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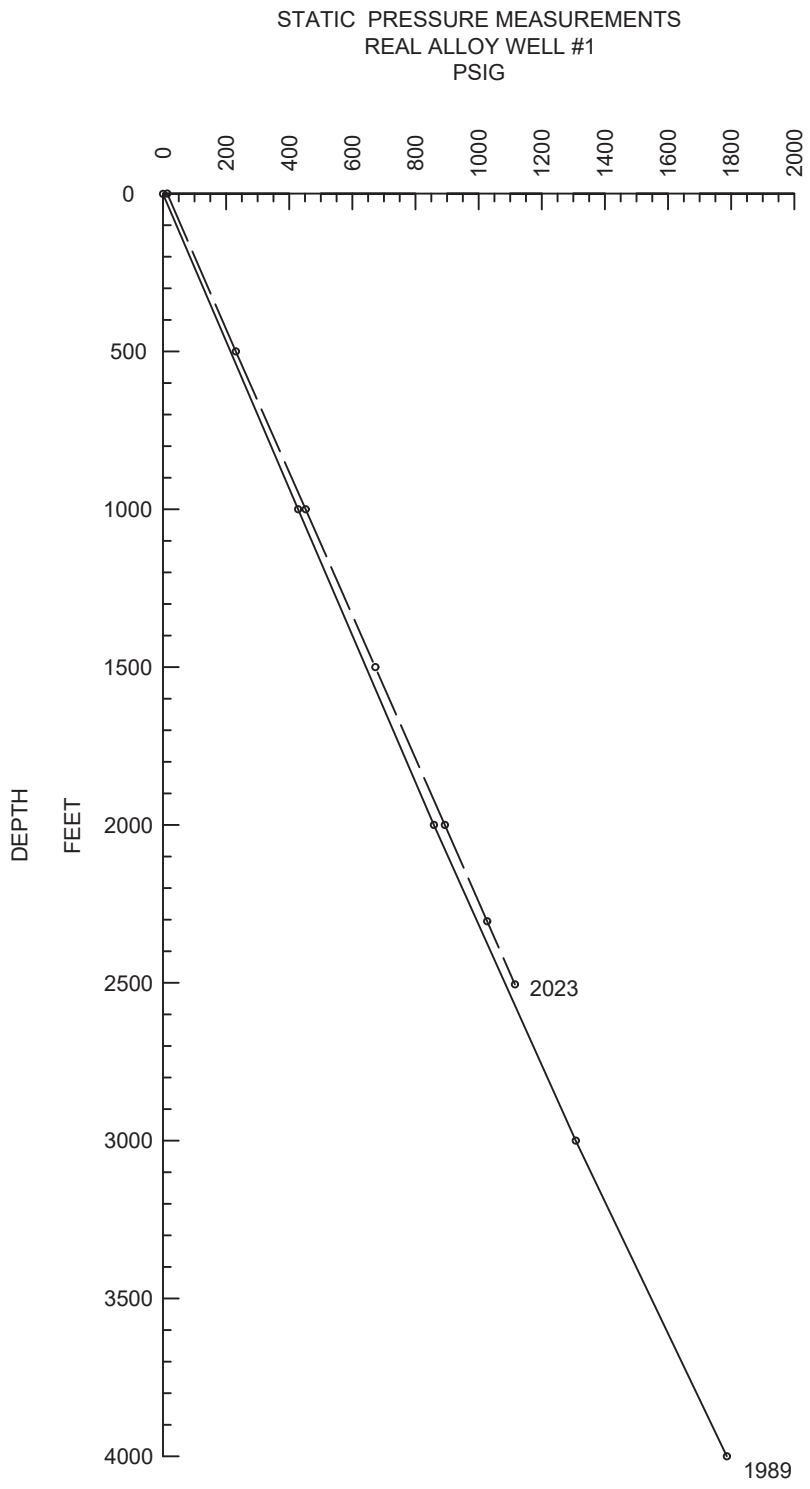
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE B-13



E&E ENGINEERING and Associates

STATIC PRESSURE MEASUREMENTS

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

DESIGNED BY:	
DRAWN BY:	SBH
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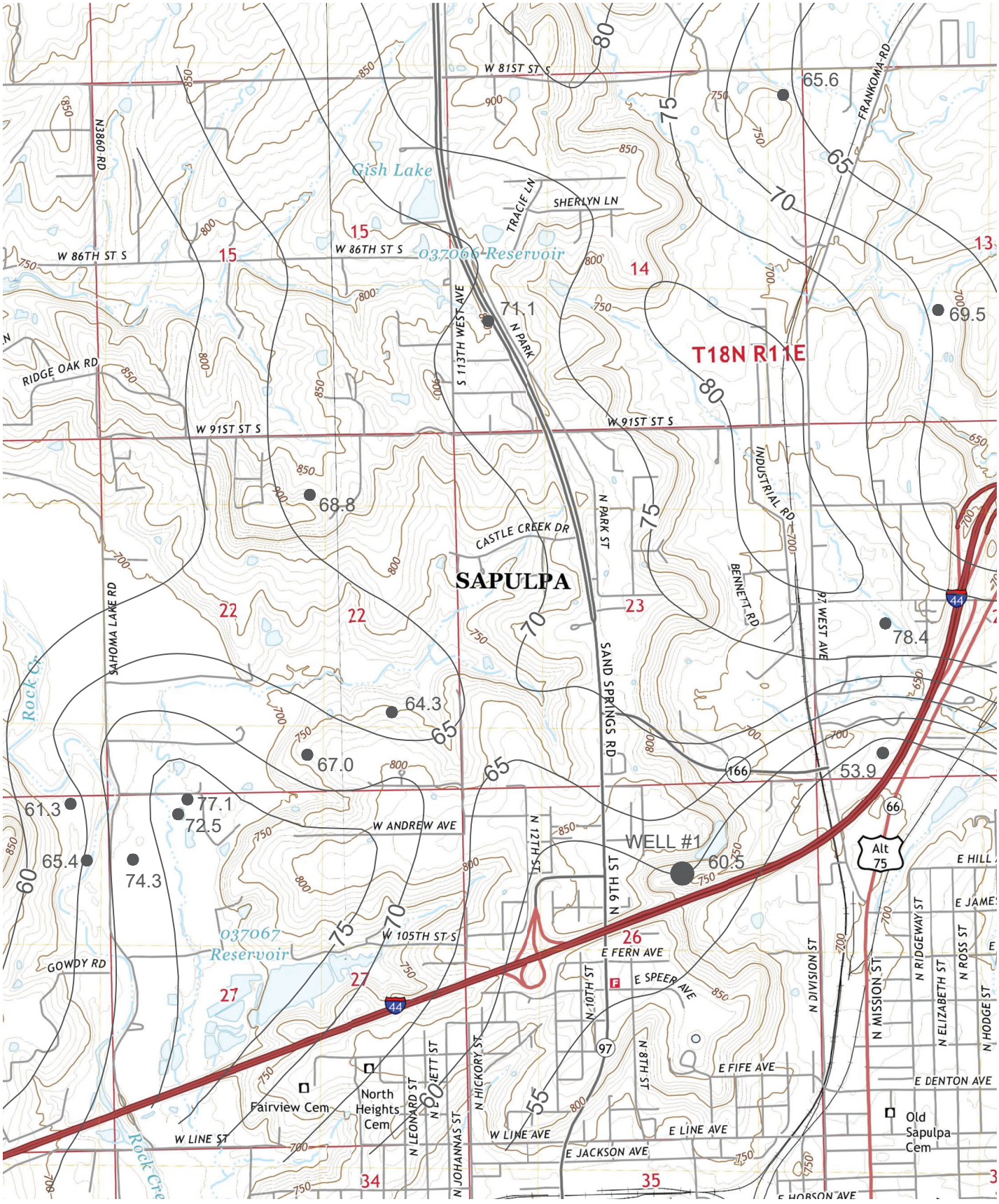
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE B-14

SOURCE MAP: U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY, LAKE SAHOMA, KELLYVILLE, SAPULPA NORTH, AND SAPULPA SOUTH QUADRANGLES , 2022



NOTE: ADAPTED FROM 2001 PERMIT APPLICATION.

SCALE IN FEET

ISO-PERCENT SHALE IN STRATA ABOVE WILCOX SANDSTONE

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

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APPROVED BY:	DME
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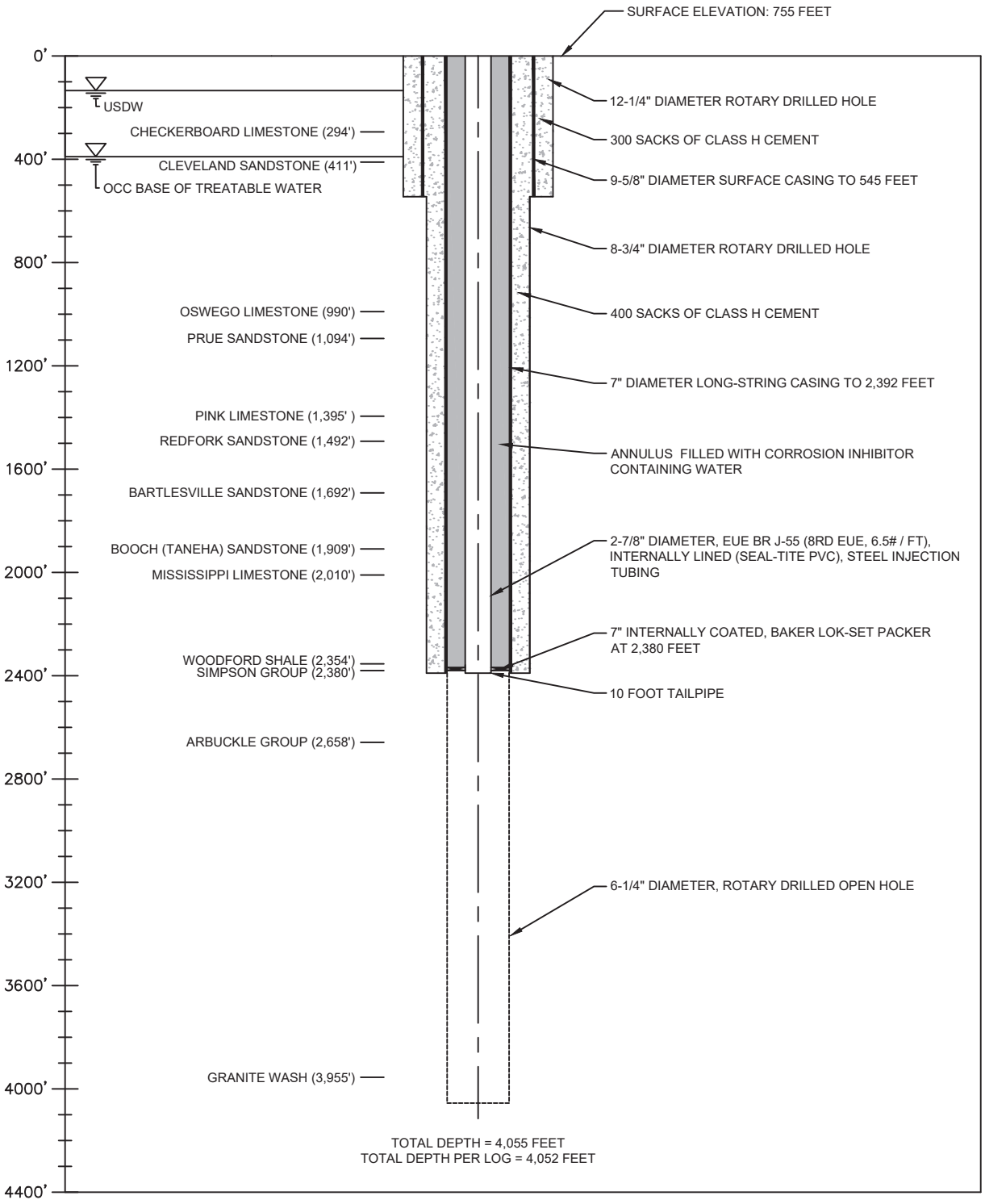
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE B-15



NOTES: 1) CROSS-SECTION ADAPTED FROM PERMIT RENEWAL APPLICATION, DATED APRIL 2013.
2) CITED GEOLOGIC UNIT DEPTHS REFERENCE TOP OF THE UNIT.

0 300 600
VERTICAL SCALE IN FEET

E&E ENGINEERING and Associates

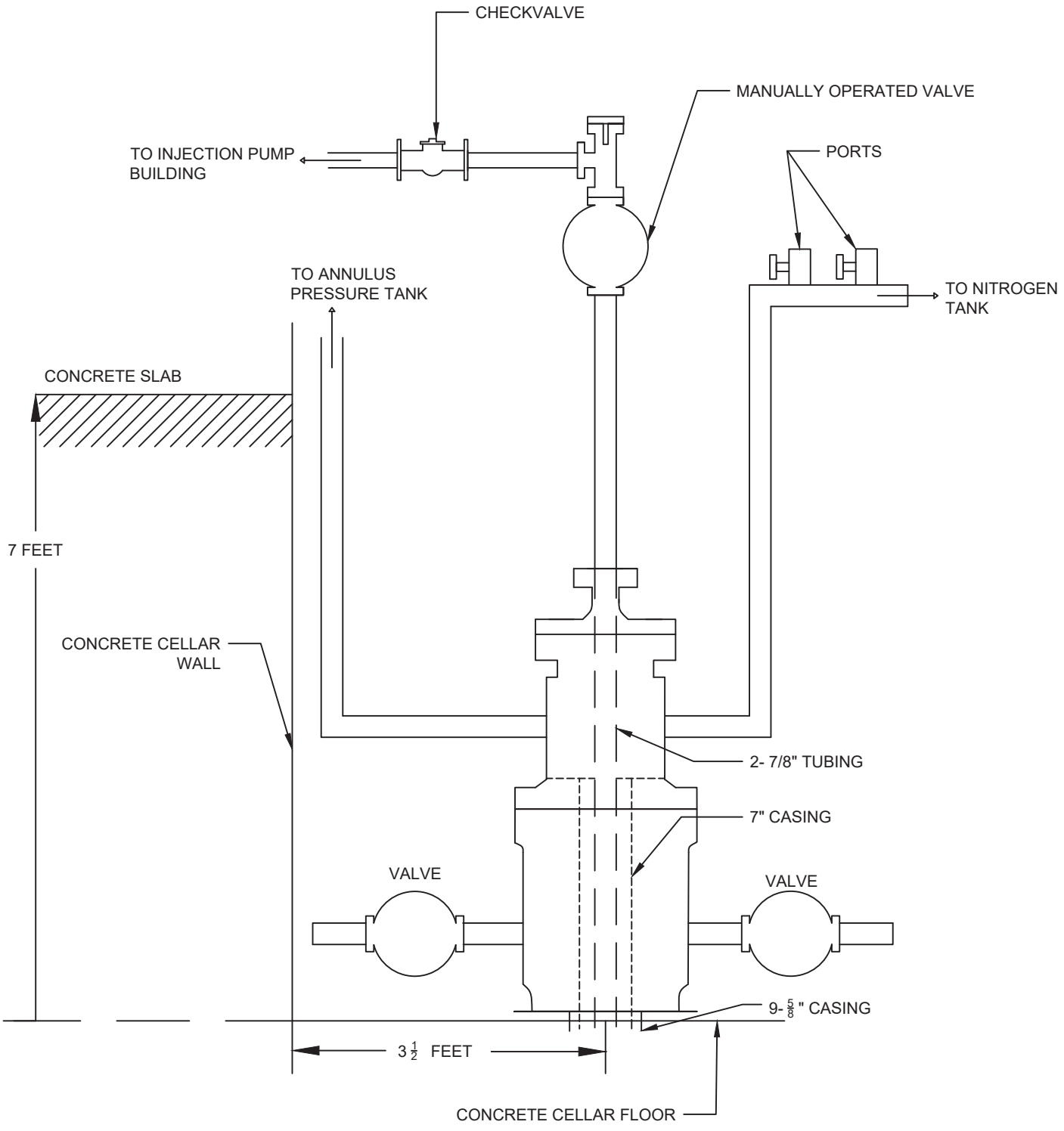
REAL ALLOY CLASS I INJECTION WELL CONSTRUCTION DETAIL

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE C-1



E&E ENGINEERING and Associates

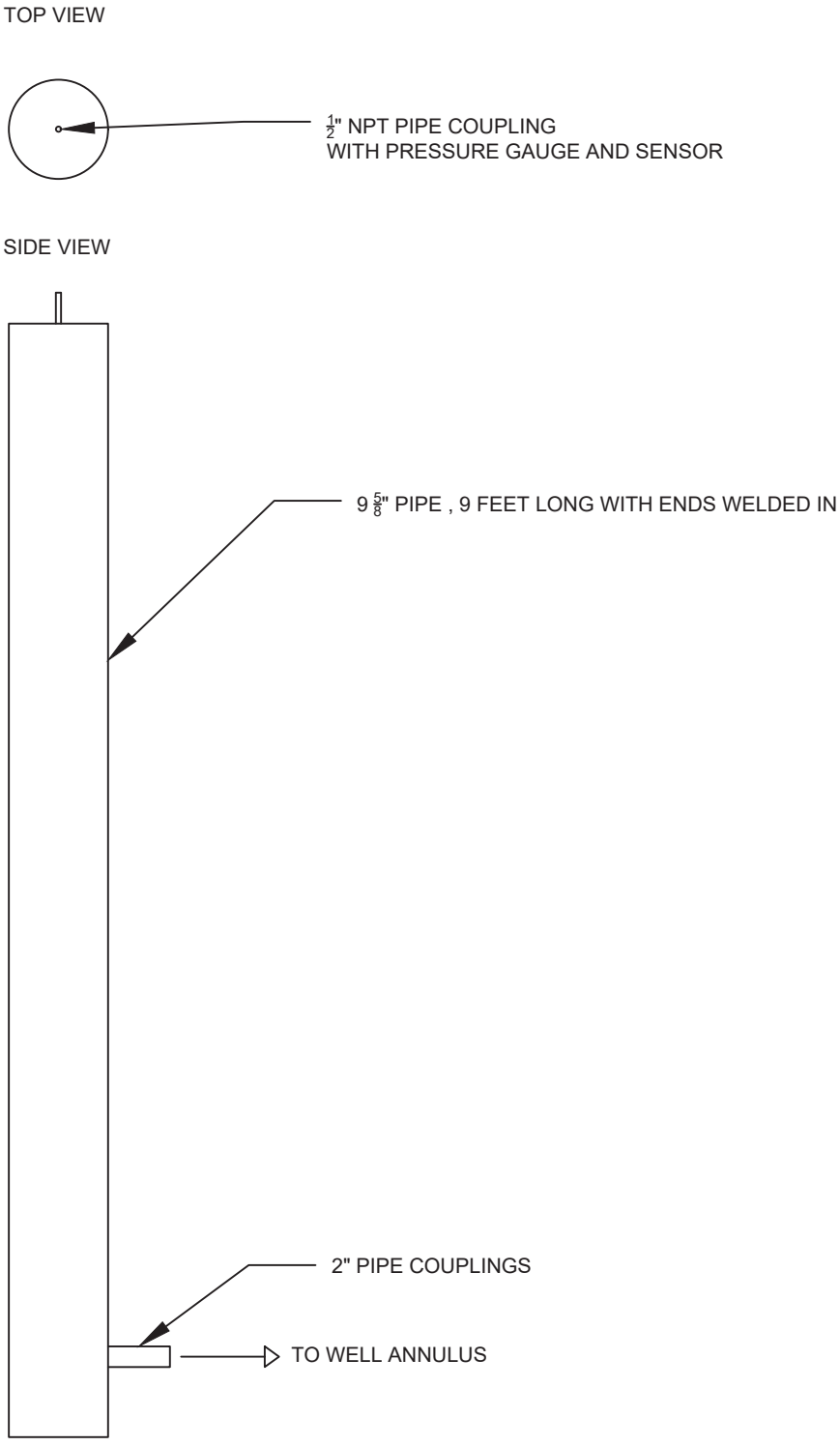
WELLHEAD SCHEMATIC

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	NOT TO SCALE

FIGURE C-2



E&E ENGINEERING and Associates

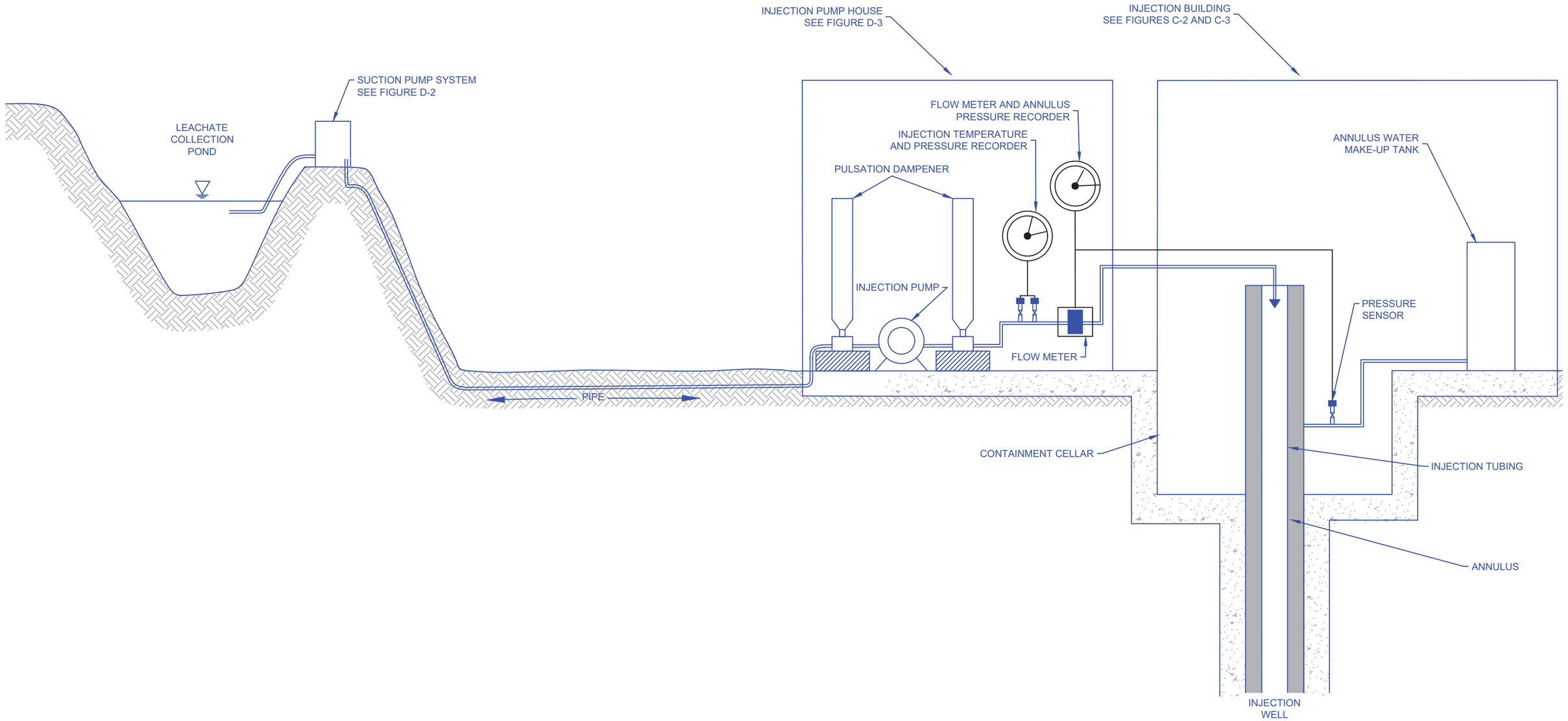
ANNULUS TANK SCHEMATIC

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE C-3



REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

GENERALIZED SCHEMATIC OF THE INJECTION PROCEDURE

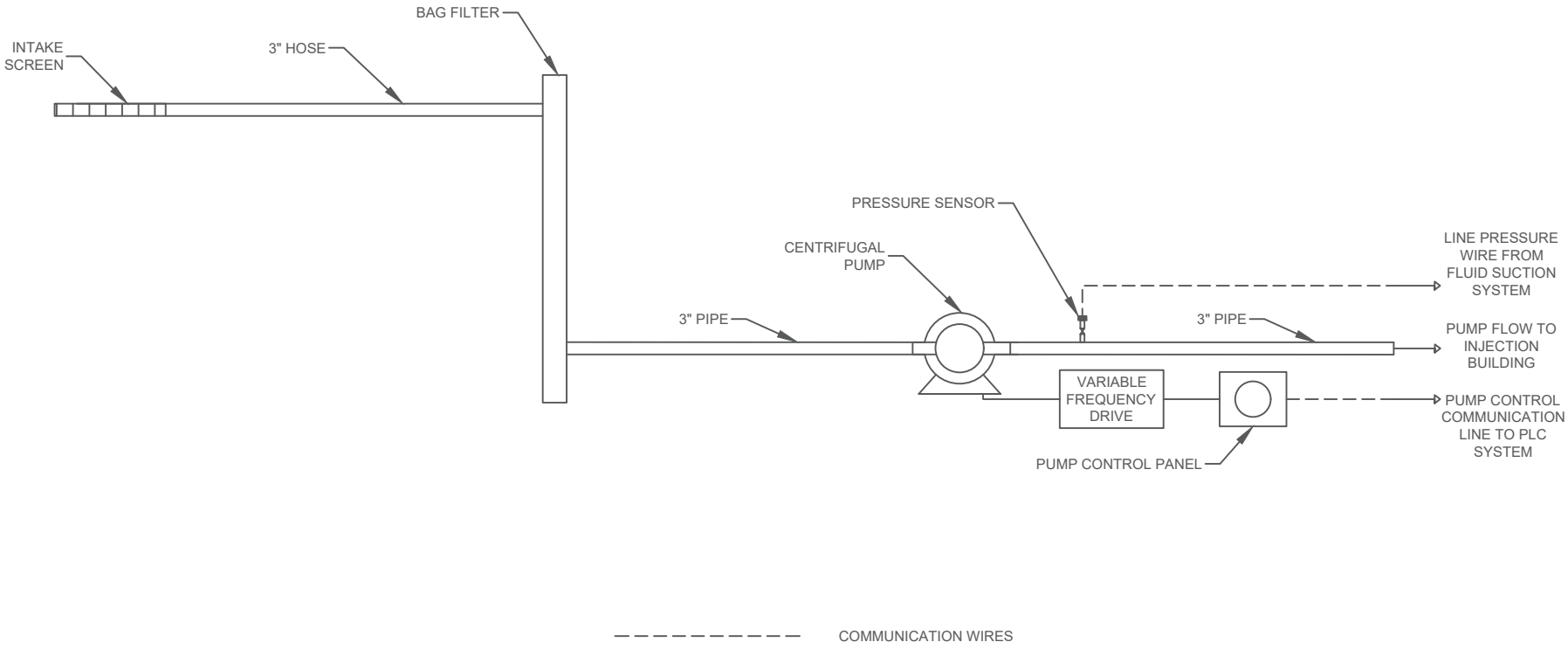
CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	DME
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	NOT TO SCALE

FIGURE D-1



REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

SUCTION SYSTEM SCHEMATIC

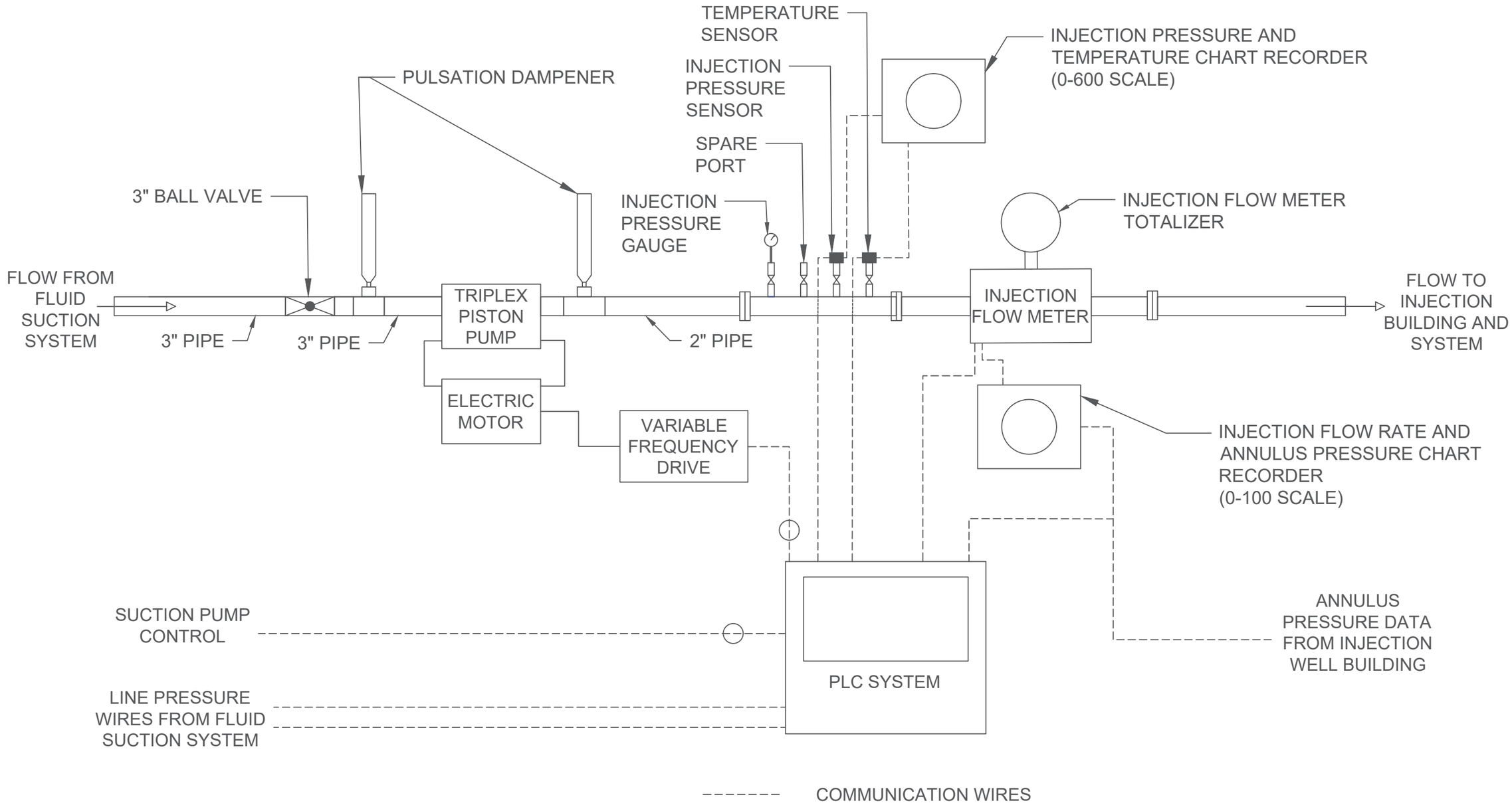
CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC
SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	AS SHOWN

FIGURE D-2



REVISIONS				
NO.	DATE	DESCRIPTION	REV BY	CHK BY

INJECTION AND MONITORING SYSTEM SCHEMATIC

CLASS 1 INJECTION WELL PERMIT RENEWAL APPLICATION

REAL ALLOY RECYCLING, LLC SAPULPA, OKLAHOMA

E&E ENGINEERING and Associates

DESIGNED BY:	
DRAWN BY:	SBH
CHECKED BY:	CJG
APPROVED BY:	DME
ISSUE DATE:	05/24/2024
PROJECT NO:	104-037-06
SCALE:	NOT TO SCALE

FIGURE D-3

APPENDIX A

UIC Permit

OPERATIONS PERMIT
FOR AN
INJECTION WELL FACILITY

Aleris Recycling, Inc.
P.O. Box 1070
Sapulpa, Oklahoma 74067

Permit Number: IW-NH 3519019-R1
Effective Date: November 10, 2014
Expiration Date: November 10, 2024

Having complied with the requirements of the law, Aleris Recycling, Inc. is hereby granted permission to operate, maintain and monitor a Class I non-hazardous industrial waste injection well facility located at 1503-1511 North 8th Street, Sapulpa, Oklahoma in the SW ¼, NW ¼, NE ¼, Section 26, Township 18 North, Range 11 East of Indian Meridian, in Creek County, Oklahoma, specifically to inject non-hazardous wastes generated on-site.

The injection well facility includes Well Number 1, which is positioned at the following latitude and longitude (NAD-27 CONUS):

Well No. 1 – lat.: 36 degrees, 00 minutes, 49.23 seconds, North,
long.: 96 degrees, 6 minutes, 27.53 seconds, West,

And other appurtenances as described in the permit application.

The disposal zone is defined as and limited to the strata of the Simpson and Arbuckle Groups or their geological equivalents. No injection shall be allowed into any stratum above the base of the Woodford (Chattanooga) Formation or its geological equivalent.

This permit is renewed by the Oklahoma Department of Environmental Quality (Department) pursuant to its authority under the Oklahoma Environmental Quality Act (27A O.S. §1-1-101 *et seq.*) the Oklahoma Environmental Quality Code (27A O.S. §2-1-101 *et seq.*), the federal Safe Drinking Water Act (42 U.S.C. 300f) and rules promulgated thereunder at 40 Code of Federal Regulations 144, 145 and 146 and Oklahoma Administrative Code 252:652.

Hillary Young, P.E., Chief Engineer
Land Protection Division

Kelly Dixon, Division Director
Land Protection Division

PREAMBLE

The Permittee shall operate the facility in compliance with the terms and conditions of this permit, the provisions of the Code, OAC 252:652 (effective July 1, 1998), the Safe Drinking Water Act, 40 CFR 144 and 146 and with the approved permit application. The approved permit application, hereby incorporated by reference, for this permit consists of the original application submitted on May 23, 2013, and all subsequent submissions up to and including July 1, 2014. The provisions herein are severable. If any provision of this permit or its application to a given circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected hereby.

A. Conditions Specific to this Facility

1. **Maximum injection pressure and rate:** The applied surface injection pressure shall be limited to:

Well #	Pressure (psig)	at Flow Rate (gpm)
1	560	100

2. **Annulus pressure:** The annulus pressure shall be maintained above 10 psig.

3. **Waste types:** Waste types are ammonia and chloride contaminated storm water run-off, leachate and seepage from the landfill, and non-hazardous wastewater from the facility.

4. **Waste analysis:** Injectate shall be sampled at least monthly and analyzed for the following parameters: pH, ammonia-N, cadmium, chlorides, lead, magnesium, and nickel. Results of the waste analyses shall be reported to DEQ in the Permittee's quarterly report.

5. **Groundwater monitoring:** Permittee shall monitor groundwater in one (1) deep monitor well. A representative sample of groundwater shall be taken from the well monthly or as required by DEQ and analyzed for the following parameters: pH, ammonia-N, cadmium, chlorides, lead, magnesium, and nickel. Static water level shall be measured and recorded in the monitoring well prior to acquisition of samples. Results of all groundwater static water levels and analyses shall be submitted with the operator's quarterly report.

6. **Well testing:** Every six (6) months, or more frequently if necessary, the annulus of each injection well shall be tested by pressurizing the annulus to a minimum of 300 pounds per square inch or one hundred twenty-five percent (125%) of the highest operating annulus pressure, whichever is greater, for a period of two (2) hours. Pressure loss or gain exceeding –5% or + 10%, respectively, from the initial test pressure will require additional tests and/or immediate repairs to ensure the mechanical integrity of the well.

7. **Annual fall-off test:** The permittee shall conduct annual monitoring of the pressure buildup in the injection zone, including at a minimum, a shut down of the well for a time sufficient to conduct a valid observation of the pressure fall-off curve [40 CFR 146.13(d)]. The permittee shall submit a report of the pressure fall-off test to DEQ within thirty (30) days of conducting the test. The report shall include a comparison of the calculated reservoir parameters with the parameters presented in the permit application.

8. **Other reporting:** The permittee shall submit a report including test data, logs (where applicable) and expert interpretation thereof within thirty (30) days after completion of any of the following tests:
    a. Mechanical integrity tests;
    b. Workovers; or
    c. Any other test of the injection well(s) or injection zone.

9. **Retention of records:** If the Permittee elects not to retain records concerning the nature and composition of all injected fluids after the required three-year retention period, the Permittee shall transfer them to DEQ [40 CFR 144.51(j)(2)(ii)].

10. **Financial Assurance:** The Permittee must adjust the plugging and abandonment cost estimate for inflation within thirty (30) days after each anniversary of the date on which the first plugging and abandonment cost estimate was prepared [40 CFR 144.62(b) and OAC 252:652-5-1(7)].

11. **Plugging and Abandonment:** The Permittee is required to follow the requirements of OAC 252:652-5-1(5) and 40 CFR 146.10 for plugging and abandonment.

12. **Prohibition of Injection of Hazardous Waste:** The Permittee is prohibited from injecting hazardous waste as defined in 40 CFR 261.3.

13. **Mechanical Integrity:** The Permittee shall complete a demonstration of mechanical integrity pursuant to 40 CFR 146.8 at least once every five years during the life of the well [40 CFR 146.13 (b)(3)]

B. Federal Conditions Common to All UIC Permits

As required by 40 CFR 144.51 and adopted by OAC 252:652-1-3, the following conditions apply to all UIC permits.

1. **Duty to comply:** The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Safe Drinking Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application; except that the permittee need not comply with the provisions of this permit to the extent and for the duration such noncompliance is authorized in an emergency permit under 40 CFR Sec. 144.34.

2. **Duty to reapply:** If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit.

3. **Need to halt or reduce activity not a defense.** It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

4. **Duty to mitigate:** The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.

5. **Proper operation and maintenance:** The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

6. **Permit actions:** This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

7. **Property rights:** This permit does not convey any property rights of any sort, or any exclusive privilege.

8. **Duty to provide information:** The permittee shall furnish to the Director, within a time specified, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

9. **Inspection and entry:** The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

    a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the SDWA, any substances or parameters at any location.

10. Monitoring and records:

a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.
b. The permittee shall retain records of all monitoring information, including the following:
    i. Calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report, or application. This period may be extended by request of the Director at any time; and
    ii. The nature and composition of all injected fluids until three years after the completion of any plugging and abandonment procedures specified under 40 CFR Sec. 144.52(a)(6), or under 40 CFR part 146 subpart G as appropriate. The Director may require the owner or operator to deliver the records to the Director at the conclusion of the retention period. For EPA administered programs, the owner or operator shall continue to retain the records after the three year retention period unless he delivers the records to the Regional Administrator or obtains written approval from the Regional Administrator to discard the records.
c. Records of monitoring information shall include:
    i. The date, exact place, and time of sampling or measurements;
    ii. The individual(s) who performed the sampling or measurements;
    iii. The date(s) analyses were performed;
    iv. The individual(s) who performed the analyses;
    v. The analytical techniques or methods used; and
    vi. The results of such analyses.

11. Signatory requirement: All applications, reports, or information submitted to the Administrator shall be signed and certified. (See 40 CFR Sec. 144.32.)

12. Reporting requirements:

a. Planned changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility.

b. Anticipated noncompliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.
c. Transfers. This permit is not transferable to any person except after notice to the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Safe Drinking Water Act. (See 40 CFR Sec. 144.38; in some cases, modification or revocation and reissuance is mandatory.)
d. Monitoring reports. Monitoring results shall be reported at the intervals specified elsewhere in this permit.
e. Compliance schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 30 days following each schedule date.
f. Twenty-four hour reporting. The permittee shall report any noncompliance which may endanger health or the environment, including:
    i. Any monitoring or other information which indicates that any contaminant may cause an endangerment to a USDW; or
    ii. Any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between USDWs.

    Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.
g. Other noncompliance. The permittee shall report all instances of noncompliance not reported under paragraphs (9) (d), (e), and (f) of this section, at the time monitoring reports are submitted. The reports shall contain the information listed in paragraph (12)(f) of this section.
h. Other information. Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information.

13. **Duty to notify:** The permittee shall notify the Director at such times as the permit requires before conversion or abandonment of the well or in the case of area permits before closure of the project.

14. **A Class I, II or III permit shall include and a Class V permit may include:** conditions which meet the applicable requirements of 40 CFR Sec. 146.10 to insure that plugging and abandonment of the well will not allow the movement

of fluids into or between USDWs. Where the plan meets the requirements of 40 CFR Sec. 146.10, the Director shall incorporate it into the permit as a permit condition. Where the Director's review of an application indicates that the permittee's plan is inadequate, the Director may require the applicant to revise the plan, prescribe conditions meeting the requirements of this paragraph, or deny the permit. For purposes of this paragraph, temporary or intermittent cessation of injection operations is not abandonment.

15. **Plugging and abandonment report:** For EPA-administered programs, within 60 days after plugging a well or at the time of the next quarterly report (whichever is less) the owner or operator shall submit a report to the Regional Administrator. If the quarterly report is due less than 15 days before completion of plugging, then the report shall be submitted within 60 days. The report shall be certified as accurate by the person who performed the plugging operation. Such report shall consist of either:
    a. A statement that the well was plugged in accordance with the plan previously submitted to the Regional Administrator; or
    b. Where actual plugging differed from the plan previously submitted, and updated version of the plan on the form supplied by the regional administrator, specifying the differences.

16. **Duty to establish and maintain mechanical integrity:** Duty to establish and maintain mechanical integrity.
    a. The owner or operator of a Class I, II or III well permitted under this part shall establish prior to commencing injection or on a schedule determined by the Director, and thereafter maintain mechanical integrity as defined in 40 CFR Sec. 146.8. For EPA-administered programs, the Regional Administrator may require by written notice that the owner or operator comply with a schedule describing when mechanical integrity demonstrations shall be made.
    b. When the Director determines that a Class I, II, or III well lacks mechanical integrity pursuant to 40 CFR Sec. 146.8 of this chapter, he shall give written notice of his determination to the owner or operator. Unless the Director requires immediate cessation, the owner or operator shall cease injection into the well within 48 hours of receipt of the Director's determination. The Director may allow plugging of the well pursuant to the requirements of 40 CFR Sec. 146.10 or require the permittee to perform such additional construction, operation, monitoring, reporting and corrective action as is necessary to prevent the movement of fluid into or between USDWs caused by the lack of mechanical integrity. The owner or operator may resume injection upon written notification from the Director that the owner or operator has demonstrated mechanical integrity pursuant to 40 CFR Sec. 146.8.
    c. The Director may allow the owner or operator of a well which lacks mechanical integrity pursuant to 40 CFR Sec. 146.8(a)(1) to continue or resume injection, if the owner or operator has made a satisfactory demonstration that there is no movement of fluid into or between USDWs.

APPENDIX B

Certificate of Well Survey

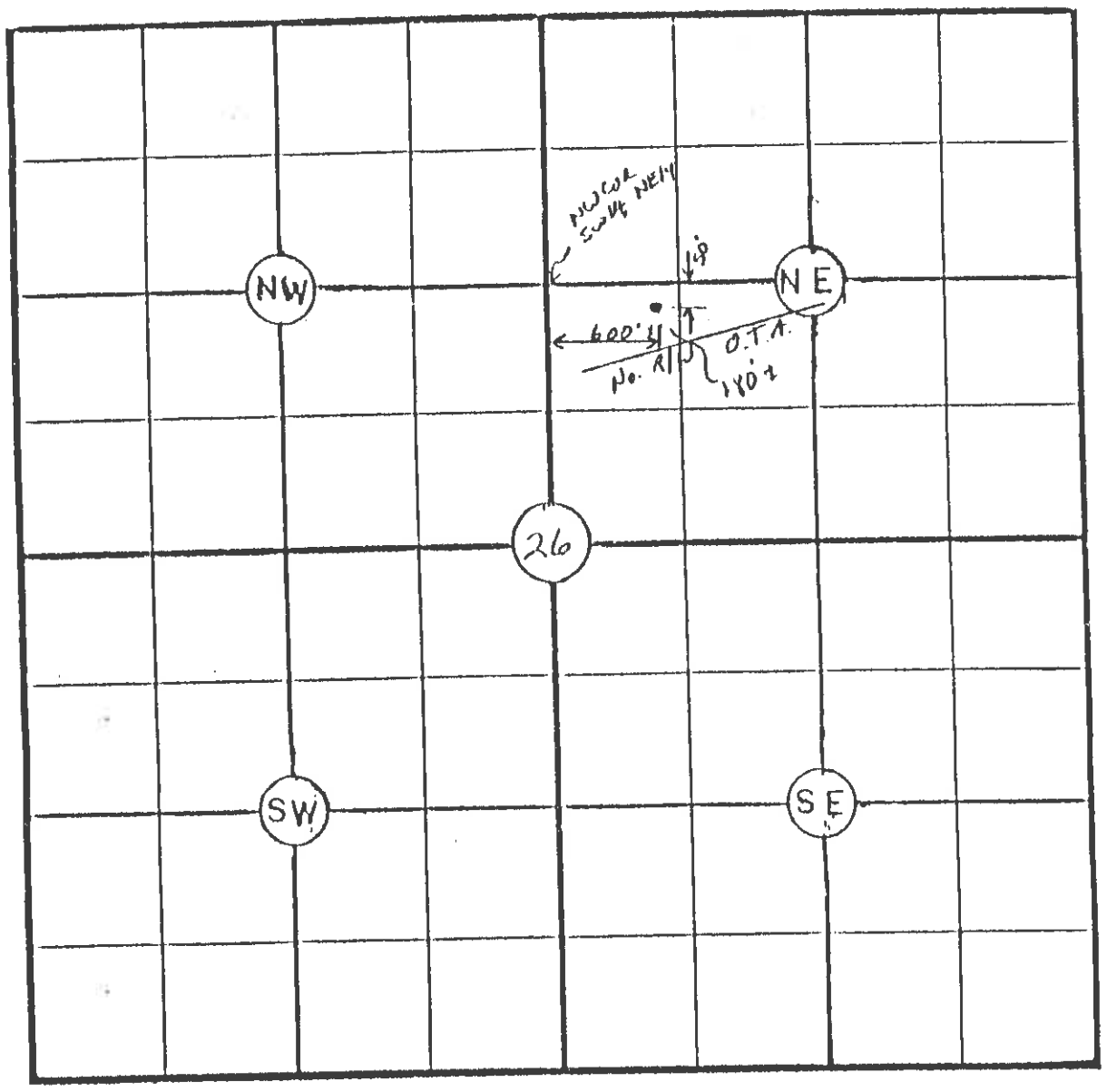
CREEK County, State of OKLAHOMA

Section 26 Township 18N Range 11E

OPERATOR _____

LEASE NAME _____ WELL NUMBER _____ ELEVATION _____

LOCATION 600' East and 50' South of NW corner of SW/4 of NE/4



This location has been very carefully staked on the ground according to the best official survey records, maps, and photographs available to us, but its accuracy is not guaranteed. When elevation is shown hereon it is the ground elevation at the location stake.

Review this plat and notify us immediately of any possible discrepancy.

CERTIFICATE OF SURVEY

I, Billie D. Schooley, a Registered Land Surveyor, do hereby certify that a survey was made under my supervision of the above shown well location in the NE/4, Section 26, T 18 N, R 11 E, I.M., Creek County, Oklahoma, and that to the best of my knowledge the above plat is a correct representation of said survey, with elevations and dimensions as shown.

LINCOLN LAND SURVEYORS, INC.
6018 Manvel Avenue Box 423
CHANDLER, OKLAHOMA 74834

NO: CS-89-15
Date 8-17-89
Revised 12-10-89-DAJ

Billie D. Schooley
Registered Land Surveyor
Oklahoma L. S. 1068

APPENDIX C

Oil and Gas Completion and Plugging Records

Form 1002A

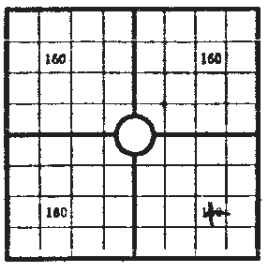
(Mail to Corporation Commission Oklahoma City Oklahoma)

OKLAHOMA CORPORATION COMMISSION

OIL AND GAS CONSERVATION DEPARTMENT

WELL RECORD

640 Acres N



Locate well correctly

COUNTY Creek SEC 22 TWP 18N RGE 11E

COMPANY OPERATING Ross L. Mayo

OFFICE ADDRESS 715 Liberty Bank Bldg. Okla. City

FARM NAME Coyl WELL NO 1

DRILLING STARTED 11-27-53 DRILLING FINISHED Jan 1 19 54

DATE OF FIRST PRODUCTION COMPLETED

WELL LOCATED NW ¼ SE ¼ SE ¼ North of South Line and ft East of West Line of Quarter Section

Elevation (Relative to sea level) DERRICK FLOOR GROUND

CHARACTER OF WELL (Oil gas or dryhole) dry hole

OIL OR GAS SANDS OR ZONES

Name	From	To	Name	From	To
1 Stray - H.F.W.	1670	1673	4 Misner	2382	2394
2 Bartlesville	1677	1785	5 Wilcox	2396	2403
3 Dutcher	1922	1945	6		

Perforating Record If Any / Shot Record

Formation	From	To	No of Shots	Formation	From	To	Size of Shot

CASING RECORD

Amount Set Size	Wt	Thds	Make	Ft	In	Ft	In	Amount Pulled Size	Length	Packer Record Depth Set	Make
10 3/4"	32.75	8		566				10 3/4	566		
8 5/8"		8		1792				8 5/8	1792		
7"	20	8		2028					2028		

Liner Record Amount Kind Top Bottom

CEMENTING AND MUDDING

Size	Amount Set Ft	In	Sacks Cement	Chemical Gal	Make	Method of Cementing	Amount	Mudding Method	Results (See Note)

Note What method was used to protect sands if outer strings were pulled? mudded

NOTE Were bottom hole plugs used? no If so state kind depth set and results obtained

TOOLS USED

Rotary Tools were used from feet to Cable tools were used from 0 feet to 2403

feet and from feet to feet and from feet to

Type Rig

INITIAL PRODUCTION TEST

Describe initial test whether by flow through tubing or casing or by pumping dry

Amount of Oil Production bbls Size of choke if any Length of test Water

Production bbls Gravity of oil Type of Pump if pump is used describe

FORMATION RECORD

Give detailed description and thickness of all formations drilled through contents of sand whether dry water oil or gas

Formation	Top	Bottom	Formation	Top	Bottom
Sandy shale	25	60	Lime	1085	1090
Shale	60	110	Shale	1090	1100
Blue shale	110	145	Lime	1100	1110
Blue shale	145	185	Shale	1110	1130
Shale(blue)	185	245	Shale	1130	1149
Shale	245	265	Lime	1149	1155
Sandy lime	265	280	Hard sand	1155	1169
Shale	280	297	Shale	1169	1175
Sandy lime	297	301	Shale	1175	1227
Hard sand	301	310	Lime	1227	1238
Shale	310	315	Black shale	1238	1245
Gray shale	315	355	Lime	1245	1249
Dark shale	355	365	Shale	1249	1295
Gray shale	365	375	Shale	1295	1370
Shale	375	383	Dark shale	1425	1460
Hard lime	383	390	Gray shale	1460	1505
Shale	390	405	Shale	1505	1510
Shale	405	455	Broken sand	1510	1518
Shale	455	460	Sand	1518	1527
Sandy lime	460	475	Shale	1527	1540
Sand	475	520	Sand	1540	1550
Sand	520	545	Sandy shale	1550	1575
Sand-shale	545	555	Gray shale	1575	1610
Shale	555	560	Shale	1610	1640
Blue shale	560	600	Sand	1640	1650
Sandy lime	600	625	Sand	1650	1655
Sandy shale	625	675	Broken sand	1655	1670
Gray shale	675	740	Sand	1670	1673
Shale	740	785	Sand& lime	1673	1677
Shale	785	835	Sandy lime	1677	1680
Shale	835	905	Sand	1680	1698
Shale	905	955	Sand	1698	1705
Lime	955	960	Sand	1705	1735
Shale	960	1020	Sand	1725	1747
Shale	1020	1040	Sand	1747	1775
Shale	1040	1055	Sand	1775	1785
Lime	1055	1060	Shale	1785	1799
Big lime	1060	1072	Blue shale	1799	1806
Lime	1072	1085			

I the undersigned being first duly sworn upon oath state that this well record is true correct and complete according to the records of this office and to the best of my knowledge and belief

Harold Crisman

Name and title of representative of company

Subscribed and sworn to before me this 22nd day of January 1954

My Commission expires. 9-19-57 Wilma Jean Harrison

Notary Public

FARM NAME Coyle WELL NO 1 COUNTY Creek - SEC. 22 - TWP 18 - RGE 11

Form 1002A

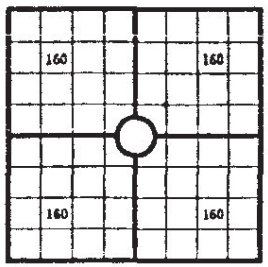
(Mail to Corporation Commission Oklahoma City Oklahoma)

OKLAHOMA CORPORATION COMMISSION

OIL AND GAS CONSERVATION DEPARTMENT

WELL RECORD

640 Acres N



Locate well correctly

COUNTY Creek, SEC 22 TWP 18 N RGE 11 E

COMPANY OPERATING Ross L. Mayo

OFFICE ADDRESS 715 Liberty Bank Bldg.

FARM NAME Coyl WELL NO 1

DRILLING STARTED Nov 27 1953 DRILLING FINISHED Jan 11 1954

DATE OF FIRST PRODUCTION COMPLETED

WELL LOCATED ¼ ¼ ¼ North of South Line and ft East of West Line of Quarter Section

Elevation (Relative to sea level) DERRICK FLOOR GROUND

CHARACTER OF WELL (Oil gas or dryhole) dry hole

OIL OR GAS SANDS OR ZONES

	Name	From	To		Name	From	To
1				4			
2				5			
3				6			

Perforating Record If Any / **Shot Record**

Formation	From	To	No of Shots	Formation	From	To	Size of Shot

CASING RECORD

Amount Set								Amount Pulled		Packer Record	
Size	Wt	Thds	Make	Ft	In	Ft	In	Size	Length	Depth Set	Make

Liner Record Amount Kind Top Bottom

CEMENTING AND MUDDING

Size	Amount Set Ft	Amount Set In	Sacks Cement	Chemical Gal	Chemical Make	Method of Cementing	Amount	Mudding Method	Results (See Note)

Note What method was used to protect sands if outer strings were pulled?

NOTE Were bottom hole plugs used? If so state kind depth set and results obtained

TOOLS USED

Rotary Tools were used from feet to Cable tools were used from feet to

feet and from feet to feet and from feet to

Type Rig

INITIAL PRODUCTION TEST

Describe initial test whether by flow through tubing or casing or by pumping

Amount of Oil Production bbls Size of choke if any Length of test Water Production bbls Gravity of oil Type of Pump if pump is used describe

FORMATION RECORD

Give detailed description and thickness of all formations drilled through contents of sand wne water oil or gas

Formation	Top	Bottom	Formation	Top	B
Lime	1806	1809	Lime & sandy shale	2328	2341
Shale	1809	1815	Broken lime	2341	2354
Shale	1815	1825	Black shale	2354	2374
Shale	1825	1837	Blak shale	2374	2382
Sand	1837	1840	Wilcox sand	2382	2389
Broken sand	1840	1850	Sand	2389	2394
Sandy shale	1850	1875	Green shale	2394	2396
Shale	1875	1910	Sand	2396	2403
Shale	1910	1922			
Sand	1922	1945			
Shale	1945	1980			
Shale	1980	2005			
Shale & shells	2005	2015			
Lime	2015	2030			
Lime	2030	2035			
Mississippi lime	2035	2045			
Lime	2045	2055			
Lime	2055	2075			
Lime	2075	2090			
Lime	2090	2120			
Lime	2120	2130			
Lime	2130	2145			
Lime	2145	2165			
Hard lime	2165	2171			
Lime	2171	2177			
Lime	2177	2184			
Lime	2184	2192			
Lime	2192	2212			
Lime	2212	2225			
Lime	2225	2240			
Lime	2240	2265			
Lime	2265	2279			
Lime	2279	2285			
Shale	2285	2290			
Domite	2290	2294			
Lime	2294	2307			
Lime (broken)	2307	2320			
Hard lime	2320	2328			

I the undersigned being first duly sworn upon oath state that this well record is true correct and complete according to the records of this office and to the best of my knowledge and belief.

Name and title of representative of company

Subscribed and sworn to before me this 22nd day of January 19 54

My Commission expires 9-19-57 Notary Public.

FARM NAME Coyl WELL NO 1 COUNTY Creek , SEC. 22 , TWP 18 — RGE 11

FORM NO 1003

8 2 0 0 0 9 2 2 0 0 2 2

PLUGGING RECORD

313791

Mail To
OKLAHOMA CORPORATION COMMISSION
Oil and Gas Conservation Department
Oklahoma City, Oklahoma

640 Acres
NORTH
WEST
EAST
SOUTH
Locate Well Correctly

NOTICE All questions on this form must be satisfactorily answered

Company Operating Ross L. Mayo

Office Address Okla - City - Okla

County Creek Sec 22 Twp. 18 N Range 11 E

Location in Section ¼ NW ¼ SE ¼ SE

Farm Name Coyl Well No 1 Field

Character of Well (whether oil, gas or dry) dry

Commenced Plugging 1-14-54 Finished Total Depth 2403

Was permission obtained from the Corporation Commission or its agents before plugging was commenced Yes

Name of Conservation Officer who supervised plugging of this well Davis King

Name of producing sand Depth top , Bottom

Show depth and thickness of all fresh water, oil and gas formations

SAND OR ZONE RECORDS				CASING RECORDS		
FORMATION	CONTENT	FROM	TO	SIZE	PUT IN	PULLED OUT
Stray - H.F.W.	2M. gas	1670	1673	10	666	666
Bartlesville	Water	1677	1785	8 5/8	1792	1792
Dutcher	½M. gas	1922	1945	7	2028	2028
Mississippi Lime	Show oil	2382	2394			
Wilcox	H F W	2396	2403			

Describe in detail the manner in which the well was plugged, indicating where the mud fluid was placed and the methods used in introducing it into the hole If cement or other plugs were used, state the character of same and depth placed

Pumped hole full of mud before starting 7". Pulled 7". Pumped more mud. Pulled 8 5/8 more mud. Pulled 10". Pumped full of mud.

Does the above conform strictly to the oil and gas regulations?

The Law requires that adjacent lease, and land-owners be notified, give their names with their addresses below

No production

REMARKS Why plugged? H. F. W. If abandoned oil or gas well, state amount and date of last production

Correspondence regarding this well should be addressed to Ross L. Mayo

Address 715 Liberty Bank Bldg. Okla. City, Okla.

I, the undersigned, being first duly sworn upon oath, state that this well record is true, correct and complete according to the records of this office and to the best of my knowledge and belief

Harold Cissna

Name and title of representative of company

Subscribed and sworn to before me this the 26th day of January, 19 54

Commission expires 9-19-57

Wilma Jean Greene

Notary Public

8 2 0 0 0 0 3 0 0 2 3

Form 1002-50M-4-23 101816

WELL RECORD

CORPORATION COMMISSION FILED SEP 25 1923

Mail to Corporation Commission, Oklahoma City, Okla

Company J. P. Flanagan et al Address Tulsa, Okla

County Creek Farm Hughes Section 23 Township 18 Range 11 Well No 1

Drilling Commenced July 5th 1923 Drilling Completed Plugged Sept 17 1923

Correspondence regarding this well should be sent to Name J. P. Flanagan Address Tulsa, Okla

CASING RECORD

SIZE	PUT IN WELL FT	PUT IN WELL IN	PULLED OUT FT	PULLED OUT IN	LEFT IN WELL FT	LEFT IN WELL IN	PACKERS AND SHOES
10	670						
8	1815	7					
6 5/8	2020						
5 3/16	2508						

Character of well Dry

Oil well, initial production ✓

Gas well, rock pressure ✓ Volume ✓ Wet or Dry Dry

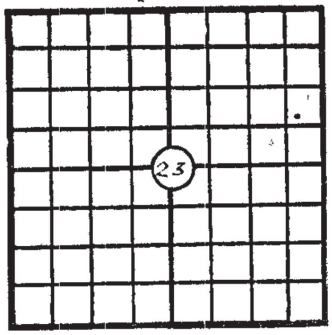
Elevation above sea level at top of casing

Location of well in Section SW¼ NE¼ SE¼ NE

General Remarks

Spot Well Correctly ✓

640 Acres



FORMATION RECORD

Show all formations, especially all sands and character and contents thereof

FORMATIONS	TOP	BOTTOM	REMARKS
Soil		10	
Black Slate	10	120	
Sandy Shale	120	150	
Blue Shale	150	320	
Lime	320	340	
Grey Shale	340	410	
Lime	410	420	
Grey Shale	420	484	
Sand	484	590	Water
White Shale	590	610	
Brown Shale	610	620	
Sandy Shale	620	635	101818
Lime	635	640	
Sandy Shale	640	670	
White Shale	670	880	
Black Shale	880	980	
Lime	980	984	
Grey Shale	984	1075	
Big Lime	1075	1115	
Black Shale	1115	1125	
Lime	1125	1130	
Black Shale	1130	1160	
Lime	1160	1165	
Grey Shale	1165	1250	
Oswego Lime	1250	1260	
Black Shale	1260	1270	
Sand	1270	1285	
Grey Shale	1285	1465	
Black Shale	1465	1505	
Grey Shale	1505	1540	
Red Fork Sand	1540	1618	
Black Shale	1618	1665	
Grey Shale	1665	1680	
Lime	1680	1685	
Black Shale	1685	1710	
Glenn Sand	1710	1815	Hole full water
White Slate	1815	1835	
Lime	1835	1840	
Grey Shale	1840	2000	

Method of shutting off water.................................... Is water completely shut off?....................

Amount of water with oil.................................... per cent Is oil cut?....................

I,.. being first duly sworn on oath, state that I have knowledge of the facts and matter herein set forth and that the same are true and correct.

O D Hennage
Representative of Company

Subscribed and sworn to before me this the 24th day of Sept. 1923

Kenneth C. Olson
Notary Public

My commission expires Sept-11-1926 192....

Form 1002-50M-4-22

WELL RECORD

Mail to Corporation Commission, Oklahoma City, Okla

Company ..... Address .....

County ..... Farm ..... Section ..... Township ..... Range ..... Well No .....

Drilling Commenced ..... 19..... Drilling Completed ..... 19.....

Correspondence regarding this well should be sent to Name ..... Address .....

CASING RECORD

SIZE	PUT IN WELL		PULLED OUT		LEFT IN WELL		PACKERS AND SHOES
	FT	IN	FT	IN	FT	IN	

Character of well .....

Oil well, initial production .....

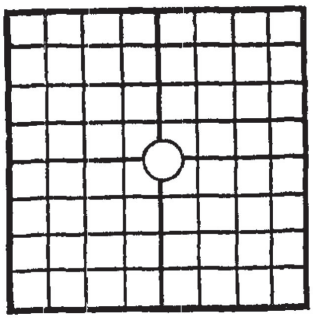
Gas well, rock pressure ..... Volume ..... Wet or Dry .....

Elevation above sea level at top of casing .....

Location of well in Section .....

General Remarks .....

Spot Well Correctly
640 Acres



101819

Hughes #1 extnsn

FORMATION RECORD 23-18N-11E Pg. 2

8200003002?

Show all formations, especially all sands and character and contents thereof

FORMATIONS	TOP	BOTTOM	REMARKS
Dutcher Sand	2000	2020	Hole full water
Black Shale	2020	2040	
Lime	2040	2405	
Black Shale	2405	2430	
Sand	2430	2492	Hole full water
Green Shale	2492	2508	
Lime	2508	2528	
Sand	2528	2574	
Green Shale	2574	2608	
Lime	2608	2613	
Green Shale	2613	2628	
Sand	2628	2649	
Lime	2649	2655	
Sand	2655	2687	Hole full water

101817

Method of shutting off water_____ Is water completely shut off?_____

Amount of water with oil_____ per cent Is oil cut?_____

I,_____ being first duly sworn on oath, state that I have knowledge of the facts and matter herein set forth and that the same are true and correct

_____
Representative of Company

Subscribed and sworn to before me this the_____ day of _____ 192____

_____
Notary Public

My commission expires _____ 192____

8200003 00 23 WR nw

313802

FORM 1003—8-20-18

Corporation Commission of Oklahoma

PLUGGING RECORD

County Creek Company J P Flanagan et al.

Farm Hughes Section 23 Township 18 Range 11 Well No. 1

Character of Well (whether it was Oil or Gas or Dry) Dry

Total depth 2687 feet Top of each producing sand feet

Was the well filled with mud laden fluid according to regulations of the Corporation Commission? yes

Was Well shot? No Show all shoulders left for casing, depth of each, and size of casing used, size and kind of plugs used, and depth placed Also amount of cement and rock

Show depth found and thickness of all fresh water, oil and gas formations

Water sand		485	to 590	Hole full water		
Pat Sand	"	1540	" 1618			
Glenn	"	1710	" 1815	"	"	"
Dutcher	"	2000	" 2020	"	"	"
Wilcox	"	2420	" 2492	"	"	"
Turkey Mountain		2655	" 2687	"	"	"

The names of adjacent lease, royalty and land-owners with their address in each instance is as follows

Date well was plugged Finished Plugging Sept 17-1923

Representative of Company

Correspondence regarding this well should be addressed to Name J P Flanagan

Address Palace Building Tulsa, Okla

I, O D Hennage being first duly sworn on oath, state that I have knowledge of the facts and matter herein set forth and that the same are true and correct.

O D Hennage

Subscribed and sworn to before me this 24 day of Sept 1923

Kenneth C Adams
Notary Public.

My Commission expires Sept, 11-1926 19

Form 1002A
1973 (Rev)
API NO
Workovers

(To be filed within 30 days after drilling is completed)

OKLAHOMA CORPORATION COMMISSION
OIL AND GAS CONSERVATION DIVISION
380 Jim Thorpe Building — Oklahoma City, Oklahoma 73105

OTC COUNTY LEASE NO

640 Acres
N
W E
LOCATE WELL CORRECTLY AND OUTLINE LEASE

COUNTY Creek , SEC 24 , TWP 18N , RGE 11 E
COMPANY OPERATING Ganer Oil Company
OFFICE ADDRESS Box 368
TOWN Blackwell STATE Okla. ZIP 74631
FARM NAME Haubert WELL NO 1
DRILLING STARTED , 19 , DRILLING FINISHED , 19
DATE OF FIRST PRODUCTION COMPLETED
WELL LOCATED NE ¼ NW ¼ SW ¼ 2310 North of South Line and 990 ft East of West Line of Quarter Section
Elevation (Relative to sea level) DERRICK FLOOR 684 GROUND
CHARACTER OF WELL (Oil, gas or dryhole) gas well

ORDER NO
no spacing

OIL OR GAS SANDS OR ZONES

	Name	From	To		Name	From	To
1	Glenn	1460	1608	4			
2	Tennha	1790	1814	5			
3	Dutcher	1867	1894	6			

Perforating Record If Any / Shot Record

Formation	From	To	No of Shots	Formation	From	To	Size of shot
Dutcher	1890	94	9				

CASING — PACKER RECORD

CASING SET						CSG PULLED		PACKER	
Size	Wgt	Thrds	Grade	Ft	In	Size	Length	Depth Set	Make
8 5/8	28#	8		105					
4 ½	10.5	8		1970					

CEMENT AND MUDDING

Casing Set			Cement			Chemical		Method of Cementing	Casing Test (Rule 206) Pressure PSI	Bailing Fluid Build-up-Ft
Size	Ft	In	Sacks	Fill-up	Top	Gals	Make			
8 5/8	10.5		60		x	Run	200' 1" pipe between surface & long string-75 sks cement to surface			
4½	1956		125		1350					

NOTE What method was used to protect sands if outer strings were pulled?

NOTE Were bottom hole plugs used? If so, state kind, depth set and results obtained

TOOLS USED

Rotary tools were used from 0 Feet to 2302 Cable tools were used from feet to
Size of hole drilled Rotary Cable

INITIAL PRODUCTION TEST (Rule 2-101)

Date Duration hrs, Pumping ☐ Flowing ☒
Producing Thru Casing ☒, Tubing ☐ Size of Choke
Oil Production Bbls, A P I Gravity not tested
Gas Production MCF, Open Flow Potential MCF
Water Production Bbls, Gas-Oil Ratio
Casing Pressure P S I A, Tubing Pressure P S I A

RGE 11E , TWP 18N , SEC 24 COUNTY Creek WELL NO 2 4 1 0 3 0 0 0 2 0 FARM NAME Haubert

(RULE 3-205) FORMATION RECORD

Give detailed description and thickness of all formations drilled through, contents of sand, whether dry, water, oil or gas

Formation	Top	Bottom	Formation	Top	Bottom
Shale	140	260	Siltst	1628	1688
Sand	260	364	Shale	1688	1734
Shale	264	974	Sandy Shale	1734	1790
Sandy shale	774	801	Sand	1790	1838
Shale	801	876	Shale	1838	1866
Lime (Big lime	876	902	Sand	1866	1896
Shale	902	972	Shale	1896	1906
Shaly sand	972	986	Sandy lime	1906	1911
Shale	986	1040	Shale	1911	1924
Lime (oswego)	1040	1046	Lime	1924	1946
Shale	1046	1067	Shale	1946	1986
Sandy shale	1067	1103	Lime	1986	2206
Shale	1103	1150	Blk shale	2206	2238
Lime (Verdigris	1150	1166	Sand	2238	2256
Shale	1166	1278	Shale, green	2256	2261
Sandy Shale	1278	1306	Sand	2261	2286
Shale	1306	1367	Shale	2286	2302
Sandy shale	1367	1382	TD (Drilled)	2302	
shale	1382	1450			
Sand (Top Glenn	1460	1477			
Shale	1477	1498			
Sand	1498	1608			
Shale	1608	1656			
Siltst	1656	1661	Shut in		
Shale	1661	1678			

I, the undersigned, being first duly sworn upon oath, state that this well record is true, correct and complete according to the records of this office and the best of my knowledge and belief

[signature] — Owner
Name and title of representative of company

Subscribed and sworn before me this 29th day of November, 1976.

My Commission expires 9-7-80 [signature] Donna L. Field
Notary Public

24-18N-11E

8 2 0 0 0 3 0 0 2 4

Haubert #1

This is not a workover but a new well. Corrected 1002A is to be filed 8-17-79

(Spud date should be added plus test data)

24-18N 11E

Haubert #1

API # 03721591

OKLAHOMA CORPORATION COMMISSION
Oil & Gas Conservation Division
Post Office Box 52000
Oklahoma City, Oklahoma 73152-2000

Form 1003D
Rev. 2005

AFFIDAVIT OF OLD WELL STATUS

Lease Name/Well No.				API No.
HAUBERT #1				037-21591
Location	Sec.	Twp.	Rge.	County
1/4 NE 1/4 NW 1/4 SW 1/4	24	18N	11E	CREEK

The Oklahoma Corporation Commission deems it to be in the best interest of land owners and mineral owners to clear mineral titles where possible for lands where old records show there has been drilled oil and/or gas wells but for which no record has been filed for the plugging of the well. The absence of an official plugging record prevents a clear mineral title in cases of recorded drilling activity.

This document, when properly completed, will serve as a substitute for a plugging record in the Oklahoma Corporation Commission well log record files.

A physical search of the above land was made and the findings are:

[X] (1) No evidence of any well, at the surface

[ ] (2) Evidence of the well and found it to be plugged in accordance with the rules in force at the time of plugging.

[ ] (3) Evidence of unplugged well [ ] Producing [ ] Non-Producing

Attested

02/20/2015 07:19:52 pm SigPlus1

Signature OCC Field Inspector — Date 2/20/2015

Attested

Signature Individual requesting search — Date

Reason for request

District No. 1

Signature OCC District Manager — Date 2/20/2015

FORM NO 1000 1975 (REV)

FILE IN DUPLICATE

NOTICE OF INTENTION TO (X) DRILL ( ) DEEPEN ( ) PLUG-BACK ( ) OTHER – Describe

INSTRUCTIONS (please follow)

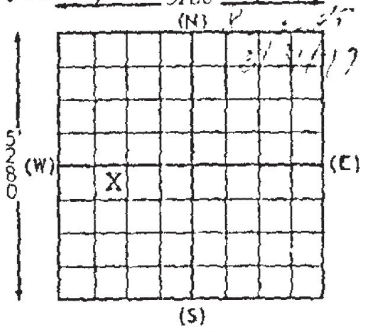
8 2 0 0 0 0 3 0 0 2 1

(1) Indicate above by (X) type of operation intended – two cards to each well
(2) Record spacing order number and location exception order number below
(3) Consult rules regarding Logs, Blowout Preventers and Surface Casing
(4) Use Form No 1001 to report intention to plug a well
(5) Use Form No 1002A to file well record
(6) This card void if drilling not started within six (6) months

Rule 3-206 – Order No 109595

API No 03721591

Spot well location and outline lease boundary on 640 acre plot below



(each square = 10 acres)

Spacing Order No N.S

Location Exception Granted

☐ No ☐ Yes Order No

COUNTY Creek DATE 9-21- 1976

WELL LOCATED IN THE NE ¼ OF THE NW ¼ OF THE SW ¼

SECTION 24 TOWNSHIP 18N RANGE 11E

WELL TO BE DRILLED 2310 FT FROM SL OF ¼ SEC & 990 FT FROM WL OF ¼ SEC

WELL WILL BE LOCATED 330 FEET FROM NEAREST LEASE LINE

ESTIMATED TOTAL DEPTH 2350 IN THE Wilcox FORMATION

OPERATOR Ganer Oil Company

ADDRESS Box 368 CITY Blackwell STATE Ok ZIP 74631

LEASE NAME Haubert WELL NO 1 GROUND ELEVATION 690

DATE OPERATION TO BEGIN 9-27 SURFACE CASING DEPTH 100

DRILLING EQUIPMENT TO BE USED ROTARY X CABLE

A SECURED OPERATOR'S AGREEMENT HAS BEEN FILED X YES ___ NO

RETURN TO

OPERATOR OR AGENT Don Ganer

ADDRESS Box 368 CITY Blackwell STATE Ok ZIP 74631

Re 11-30-76

OKLA 12-401

COUNTY Creek
FIELD Red Fork Dist Result Gas
OPER Ganer Oil
WELL NO 1 FARM Haubert

SEC 24-18N-11E DG
LOC C NE NW SW
COMP 12-1-76

Contr Wagoner Drlg API 35-037-21591
Spud 10-20-76
Csg 8 5/8" 105' - 65, 4½" 1956' - 125

TD 2302 - Logs
Perf (Dutcher) 9/1890-94, no treatment

IPF Dutcher 450 MCFGPD/24 hrs, perfs 1890-94

Log Tops	ELEV	680 GR
Glenn		1460 -780
Tanecha		1790 1110
Dutcher		1867 -1187
Wilcox		2261 1581
TD		2302 -1622

Issued 12-31-76

Petroleum Information CORPORATION

Form 1002

8 2 0 0 0/0 3 0 0 2 4

101830

WELL RECORD

Mail to Corporation Commission, Oklahoma City, Oklahoma

640 Acres

N

160		160	
160		160	

Locate Well Correctly

COUNTY Creek, SEC 24, TWP. 18 N, RGE 11 E

COMPANY OPERATING Sunray Oil Company & Industrial O & G

OFFICE ADDRESS 406 Mid-Continent Bldg., Tulsa, Okla.

FARM NAME Shirley WELL NO 1

DRILLING STARTED 11-8-1927, DRILLING FINISHED 12-23-1927

WELL LOCATED IN se ¼ SW ¼ SW ¼ ft North of South Line and ft East of West Line of Quarter Section

ELEVATION (Relative to sea level) DERRICK FLR GROUND

CHARACTER OF WELL (Oil, gas or dry hole) gas

CORPORATION COMMISSION FILED DEC 30 1927 OF OKLA

OIL OR GAS SANDS OR ZONES

	Name	From	To		Name	From	To
1				4			
2				5			
3				6			

WATER SANDS

	Name	From	To	Water Level		Name	From	To	Water Level
1					4				
2					5				
3					6				

CASING RECORD

Size	Wt.	Thds	Make	Amount Set Ft	Amount Set In	Amount Pulled Ft	Amount Pulled In	Packer Record Size	Packer Record Length	Packer Record Depth Set	Packer Record Make
14"				21	All left in						
10"				555	"						
8¼"				1900	"						

Liner Record Amount Kind Top Bottom

CEMENTING AND MUDDING RECORD

Size	Amount Set Feet	Amount Set In	Sacks Cement	Chemical Gal	Chemical Make	Method of Cementing	Amount	Mudding Method	Results (See Note)

NOTE What method was used to protect sands when outer strings were pulled?

NOTE Were bottom hole plugs used? Yes If so state kind, depth set and results obtained Limit Plug 150 bbls Lead wool Water shut off.

TOOLS USED

Rotary tools were used from feet to feet and from feet to

Cable tools were used from Top ~~feet~~ to Bottom feet and from feet to

Type Rig National Machine

PRODUCTION DATA

Production first 24 hours bbls Gravity , Emulsion per cent, Water per cent

Production second 24 hours bbls Gravity Emulsion per cent Water per cent

If gas well cubic feet per 24 hours 2 M. Rock Pressure, lbs per square inch 200 lbs

The information given above is a complete and correct record of the well and all work done thereon

SUNRAY OIL COMPANY

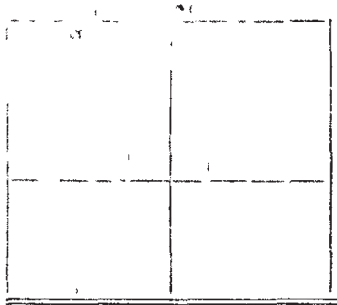
By R.P. Abele Superintendent.

(Give complete detail of log of all formation drilled through on reverse side hereof)

FORMATION RECORD

Give detailed description and thickness of all formations drilled through and contents of sands, whether dry water, oil or gas

Formation	Top	Bottom	Formation	Top	Bottom
Surface	0	15			
Shale	15	40			
Sand	40	80			
Sandy shale	80	250			
Sand	250	530			
Sand & Sahle	530	550			
Slate	550	595			
Blue shale	595	775			
Brown shale	775	815			
White shale	815	888			
Big Lime	888	925			
Black shale	925	988			
Sandy Lime	988	1994			
Shale	1994	1056			
Oswego Lime-	1056	1067			
Slate	1067	1080			
Lime	1080	1086			
Brown slate	1086	1111			
Shale	1111	1262			
Sand	1262	1267			
Black shale	1267	1272			
Lime	1272	1310			
Shale	1310	1320			
Slate	1320	1435			
Lime	1435	1482			
Shale	1482	1495			
Slate	1495	1500			
Shale	1500	1536			
Sand	1536	1552			
Broken sandy shale	1552	1575			
Sandy Lime	1575	1615			
Blue slate	1615	1625			
White shale	1625	1675			
Slate	1675	1745			
Lime	1745	1750			
Shale	1750	1770			
Sand	1770	1780			
Sandy shale	1780	1794			
Sand	1794	1807			
Taneha sand	1807	1853			
Slate	1853	1868			
Taneha Sand	1868	1896			
Slate	1896	1900			
Sand- white-hard	1900	1904	2 M gas		
Lime	1904	1920			
Shale	1920	1932			
Broken lime	1932	1938			
Shale	1938	1948			
Lime	1948	1961			
Black shale	1961	1987			
Lime	1987	2227			
Slate	2227	2260	SLM 2246		
Wilcox sand	2260	2265	Hole plugged back from 2265 to 2260 shutting off water in Wilcox. Now producing as gas well		



101831

APPENDIX D

Landowner Information

Landowners within ¼ mile

Landowner	Address	Parcel No.
Real Alloy Recycling, LLC	3700 Park East Dr., Ste 300 Beachwood, OH 44122	0000-26-018-011-0-037-00 0000-26-018-011-0-047-00 0000-26-018-011-0-009-00
Frankhoma Land Management	8544 E 11th St. Tulsa, OK 74112	3303-00-001-000-0-040-00
Turner Turnpike (I-44) Oklahoma Turnpike Authority	3500 N Martin Luther King Ave. Oklahoma City, OK 73111	0000-26-018-011-0-046-00
Sahoma Lanes, Inc.	P.O. Box 1243 Sapulpa, OK 74067	1999-26-018-011-0-230-00
Gett Holdings, LLC	11530 N 120th St. Scottsdale, AZ 85259	1095-00-002-000-0-090-00
CFB Properties, LLC	8263 S Harvard Ave., #810 Tulsa, OK	1095-00-002-000-0-091-00
River City Stone Works, LLC	1315 N 9th St. Sapulpa, OK 74066	1095-00-001-000-0-180-00
Harger Darrell H Carol Fam Rev Trust	P.O. Box 944 Sapulpa, OK 74067	1095-00-001-000-0-160-00
Brown Darrell W	P.O.Box 683 Sand Springs, OK 74063	1999-26-018-011-0-020-00
NIX Living Trust	13209 E 94th St. N Owasso, OK 74055	1095-00-002-000-0-010-00
Cowan Thomas D Patsy J Revoc Liv Trust	1445 N 8th Pl. Sapulpa, OK 74067	1095-00-001-000-0-010-00
Sawyer James Cecil	1440 N 8th Pl. Sapulpa, OK 74066	1095-00-002-000-0-020-00
Hurst Hubert	1441 N 8th Pl Sapulpa, OK 74066	1095-00-001-000-0-020-00
Ellis Joe R Kerri L	1525 W Line St. Sapulpa, OK 74066	1095-00-002-000-0-030-00
Dillon Michael Anthony	1435 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-030-00
Akers Michael Anthony	1428 N 8th Pl. Sapulpa, OK 74066	1095-00-002-000-0-040-00
Woody Jay C	1431 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-040-00
Akers Mark D Julie R	1424 N 8th Pl. Sapulpa, OK 74066	1095-00-002-000-0-050-00
Nevarez Reyna Melendez Yolanda	1427 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-050-00
Thompson Nathan	1420 N 8th Pl. Sapulpa, OK 74066	1095-00-002-000-0-060-00
Berryman Jennifer	1421 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-060-00
Evans Christine	1416 N 8th PL. Owasso, OK 74066	1095-00-002-000-0-070-00
Richardson Loletha G	1417 N 8th Pl. Owasso, OK 74066	1095-00-001-000-0-070-00
House Joyce	1410 N 8th Pl. Owasso, OK 74066	1095-00-002-000-0-080-00
CS Real Estate Services, Inc.	8743 Sunset Drive Sapulpa, OK 74066	1095-00-001-000-0-080-00
Trosper Mathew C Dana L	1405 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-090-00

Dept. of Transportation	200 N.E. 21st St. Oklahoma City, OK 73105	1095-00-002-000-0-100-00
Dept. of Transportation	200 N.E. 21st St. Oklahoma City, OK 73105	1999-26-018-011-0-010-00
Campbell Kayla	1318 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-170-00
Tankersley Chris Jeanette	1312 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-150-00
Watts Jessica	1306 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-140-00
Camp Myron	1300 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-130-00
Lost Boy Properties, LLC	1305 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-120-00
Acevedo Yasmar	1311 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-110-00
Premier Property Group, LLC	1317 N 8th Pl. Sapulpa, OK 74066	1095-00-001-000-0-100-00
Turner Turnpike (I-44) Oklahoma Turnpike Authority	3500 N Martin Luther King Ave. Oklahoma City, OK 73111	1225-00-002-000-0-031-00
Midwest Printing Publishing	P.O. Box 650 Sapulpa, OK 74067	1225-00-002-000-0-040-00
City of Sapulpa (Water Tower)	425 E. Dewey Ave. Sapulpa, OK 74066	1225-00-002-000-0-010-00
Standard Tobacco Company	P.O. Box 390 Sapulpa, OK 74067	1225-00-002-000-0-050-00
Standard Distributing Co.	P.O. Box 390 Sapulpa, OK 74067	1225-00-002-000-0-070-00
Standard Tobacco Company	P.O. Box 390 Sapulpa, OK 74067	1225-00-002-000-0-080-00
Standard Distributing Co.	P.O. Box 390 Sapulpa, OK 74067	1225-00-001-000-0-010-00
Standard Distributing Co.	P.O. Box 390 Sapulpa, OK 74067	1225-00-001-000-0-020-00
Northstar Properties, LLC	8218 SE 36th St. Mercer Island, WA 98040	1999-26-018-011-0-140-00
YGG Associates, LLC	8218 SE 36th St. Mercer Island, WA 98040	1999-26-018-011-0-191-00
Jones Brian	1310 N 9th St. Sapulpa, OK 74066	1999-26-018-011-0-170-00
Merit Enterprises, Inc.	1304 N 9th St. Sapulpa, OK 74066	1999-26-018-011-0-260-00
Turner Turnpike (I-44) Oklahoma Turnpike Authority	3500 N Martin Luther King Ave. Oklahoma City, OK 73111	1225-00-003-000-0-010-00
Dept. of Transportation	200 N.E. 21st St. Oklahoma City, OK 73105	1225-00-003-000-0-050-00
Quiktrip Corporation	4705 S 129th E Ave. Tulsa, OK 74134	1226-00-001-000-0-010-00
Dept. of Transportation	200 N.E. 21st St. Oklahoma City, OK 73105	1225-00-006-000-0-020-00
Dept. of Transportation	200 N.E. 21st St. Oklahoma City, OK 73105	1225-00-007-000-0-050-00
Smith Jack	520 N Hodge St. Sapulpa, OK 74066	1225-00-006-000-0-010-00
Smith Jack	520 N Hodge St. Sapulpa, OK 74066	1225-00-006-000-0-030-00

Turner Turnpike (I-44) Oklahoma Turnpike Authority	3500 N Martin Luther King Ave. Oklahoma City, OK 73111	1225-00-006-000-0-050-00
Standard Tobacco, Inc.	P.O. Box 390 Sapulpa, OK 74067	1225-00-007-000-0-020-00
Turner Turnpike (I-44) Oklahoma Turnpike Authority	3500 N Martin Luther King Ave. Oklahoma City, OK 73111	1225-00-007-000-0-040-00
Turner Turnpike (I-44) Oklahoma Turnpike Authority	3500 N Martin Luther King Ave. Oklahoma City, OK 73111	1225-00-007-000-0-030-00
Turner Turnpike (I-44) Oklahoma Turnpike Authority	3500 N Martin Luther King Ave. Oklahoma City, OK 73111	1225-00-007-000-0-010-00
Turner Turnpike (I-44) Oklahoma Turnpike Authority	3500 N Martin Luther King Ave. Oklahoma City, OK 73111	1225-00-008-000-0-010-00
Turner Turnpike (I-44) Oklahoma Turnpike Authority	3500 N Martin Luther King Ave. Oklahoma City, OK 73111	1225-00-008000-0-020-00
Lewis Kenneth	3409 N Glenoak Dr. Midwest City, OK 73110	1225-00-008-000-0-030-00
Turner Turnpike (I-44) Oklahoma Turnpike Authority	3500 N Martin Luther King Ave. Oklahoma City, OK 73111	1225-00-010-000-0-010-00
Jones Steve F Beustring Diana	1024 N 8th St. Sapulpa, OK 74066	1225-00-010-000-0-020-00
Parker Grace M	419 S Park St. Sapulpa, OK 74066	1225-00-010-000-0-080-00
White Isabella	1021 N 8th St. Sapulpa, OK 74066	1225-00-009-000-0-010-00
T H Const. Co.	P.O. Box 427 Kiefer, OK 74041	1225-00-009-000-0-020-00
North Heights Free Will Bap Ch	925 N 8th St. Sapulpa, OK 74066	1225-00-009-000-0-030-00
Leffler Jennifer Gregory	312 E. Paige Ave. Sapulpa, OK 74066	0000-26-018-011-0-031-00
North Heights Free Will Bap Ch	925 N 8th St. Sapulpa, OK 74066	1999-26-018-011-0-006-00
North Heights Free Will Bap Ch	925 N 8th St. Sapulpa, OK 74066	1999-26-018-011-0-035-00
Luster Charles Pamela Sue	407 E Fern Ave Sapulpa, OK 74066	1999-26-018-011-0-033-00
Guinn Glenda F	409 E Fern Ave Sapulpa, OK 74066	1999-26-018-011-0-034-00
Koetter Brandon F Darla L	P.O. Box 1238 Jenks, OK 74037	1999-26-018-011-0-028-00
Koetter Brandon F Darla L	P.O. Box 1238 Jenks, OK 74037	1999-26-018-011-0-029-00
Little Melvin L Linda	324 E Paige Ave Sapulpa, OK 74066	0000-26-018-011-0-027-00
Little Todd D Mireille L	327 E Paige Ave Sapulpa, OK 74066	0000-26-018-011-0-027-01
Carson Yocham, LLC	2530 E 71st, Ste D Tulsa, OK 74136	0000-26-018-011-0-007-00

APPENDIX E

Lithologic Description of Well Cuttings and Cores

IMCO RECYCLING INJECTION WELL - DESCRIPTIONS OF WELL CUTTINGS
(NE NW SW NE of Section 26, T18N, R11E, Creek County, Oklahoma)

Depth (feet)		Lithologic Description
0-30	Sandstone,	light gray, soft, finely micaceous, carbonaceous flakes, slightly silty, with some sandstone and limestone interbeds; sandstone, gray with buff cast, very fine-grained, argillaceous, silty, micaceous, slightly carbonaceous; limestone, light tan to buff, fine to medium crystalline, pack-wackestone fossiliferous.
30-90	Shale,	and sandstone as above.
90-150	Sandstone,	glassy, very fine to fine-grained, rounded, moderate to good sorted, hard, tight, occasional pink and green grains, mica and carbonate streaks.
150-200	Sandstone,	as above with shale and limestone; shale, light gray, silty, micaceous and carbonaceous; limestone, light tan to buff, fossiliferous packestone.
200-260	Sandstone,	white to grayish white, very fine to fine-grained, moderately sorted, rounded, friable to partly firm, carbonaceous, micaceous and interbedded wtih shale; shale, light gray, micaceous with carbonate streaks.
260-300	Shale,	black to black with brown cast, fissile, fine micaceous, thin elongate white lenses.
300-360	Shale,	gray, fine micaceous, slightly silty, carbonate streaks, with limestone beds; limestone, light brown to tan, very fine crystalline to earthy.
360-390	Shale,	and sandstone, shale, light gray, fine micaceous, soft, carbonate streaks; sandstone, light gray with brownish cast, very fine-grained, subangular to rounded, poor to moderate sorted, argillaceous, micaceous, carbonate, streaks, fragments of pyrite.
390-540	Sandstone,	light gray with brown cast, very fine-grained, subangular to rounded, poor to moderate sorted, argillaceous, micaceous, carbonate streaks, with some pyrite.
540-600	Sandstone,	as above with limestone and chert beds; limestone, buff to tan white, very fine crystalline; chert, buff to grayish-white.

600-630	Shale,	and sandstone, shale, gray, soft, very fine micaceous: sandstone, grayish-white glassy, very fine to fine-grained, friable loose grains.
630-740	Sandstone,	as above.
740-930	Shale,	gray, soft, very micaceous.
930-990	Shale,	as above with brown to tan, very fine crystalline, fossiliferous limestone.
990-1040	Limestone,	cream, buff tan, very fine crystalline, wacke to packestone.
1040-1090	Shale,	gray, soft, fine micaceous, grainy looking but not, with some limestone beds and coal.
1090-1140	Sandstone,	light gray to grayish-white, very fine-grained, fine micaceous, argillaceous.
1140-1190	Shale,	gray, soft, fine micaceous, carbonate flakes and streaks, slightly silty, with some limestone.
1190-1230	Sandstone,	grayish-white, very fine-grained, micaceaous, argillaceous and carbonaceous.
1230-1300	Shale,	gray, fine micaceous, silty, carbonate flakes, streaks and partings.
1300-1320	Sandstone,	brown to tan, very fine-grained, angular to rounded, moderate to good sorted, calcareous.
1320-1410	Shale,	gray, fine micaceaous, soft, carbonaceous, silty, with grayish-white, micaceous and carbonaceous siltstone interbeds.
1410-1440	Sandstone,	gray, very fine-grained. micaceous, carbonaceous, argillaceous, with some limestone and shale.
1440-1470	Shale,	gray, fine micaceous, carbonaceous, slightly silty.
1470-1540	Sandstone,	grayish-white, tan to brown, very fine-grained, argillaceous. silty, carbonaceous with some light gray, soft shale.
1540-1570	Siltstone,	gray, sandy, micaceous, carbonaceous, calcerous, quite friable.
1570-1660	Shale,	gray to light gray, very fine micaceous, soft, noncarbonaceous, with some limestone and sandstone.

1660-1700	Siltstone,	gray to grayish-white, argillaceous, micaceous, sandy and carbonaceous.
1700-1740	Siltstone,	as above and sandstone, grayish-white, very fine to fine-grained, rounded, moderate to good sorted, calcerous, faint tan stain, gold fluoresence, no cut.
1740-1760	Sandstone,	grayish-white, very fine to fine-grained, rounded, moderate to good sorted, calcerous, fair porosity, faint tan stain, gold fluorescence.
1760-1890	Shale,	gray to dark gray, soft, fine micaceous, occasional pyrite and siderite(?), with some limestone and sandstone beds.
1890-1980	Sandstone,	gray wtih brown cast, very fine to fine-grained, rounded, moderate sorted, silty, argillaceous, carbonate partings, good porosity, spotty gold fluoresence, very faint stain.
1980-2020	Shale,	sandstone and limestone, shale, gray, fine micaceous, some pyrite; sandstone, grayish-white, fine to medium-grained, occasional coarse-grained, moderate to good sorted, calcareous, pyrite, faint spoty gold fluoresence, faint cut; limestone, light grayish-tan to cream, earthy, very fine crystalline.
2020-2090	Limestone,	light gray to grayish-tan and cream, lithographic to fine-grained, occasionally oolitic, pack to wackestone, with some dark green shale.
2090-2140	Siltstone,	white to gray, argillaceous, calcareous with some limestone.
2140-2270	Limestone,	grayish-white to brown, fine crystalline, silty and sandy, hard and tight.
2270-2287	Shale,	dark gray with brown cast, soft, vertical fractures filled with calcite, fossiliferous, silty, petroleum smell on fresh break.
2287-2293	Limestone,	dark gray with brown cast, very fine crystalline, mott, burrowed, fine shell debris.
2293-2302	Shale,	dark gray with brown cast, fairly soft, silt size carbonate and quartz grains, calcareous, burrowed, fossiliferous, petroleum smell.
2302-2327	Limestone,	dark gray with brown cast, very fine crystalline, mott, argillaceous, fossiliferous and shelly, burrowed, vertical fractures calcite filled, with some black shale partings.

2327-2355	Shale,	dark gray with brown cast, brown streaks, soft, waxy, pyrite, with limestone interbeds.
2355-2382	Shale,	black with brown cast, brown streak, scattered small clusters of pyrite, blocky, brittle, hard.
2382-2420	Sandstone,	white glassy with light tan oil stain, very fine to fine-grained, rounded, moderate to good sorted, fair to good porosity, faint blue cut, poor show. Some fragments more gray, no fluoresence, streaks of black matter.
2420-2490	Shale,	green bluish-green, hard, silty, pyrite, with some sandstone beds.
2490-2520	Sandstone,	white, very fine-grained, with some limestone and shale.
2520-2530	Shale,	green to grayish-green, fissile, silty, pyrite.
2530-2590	Shale,	and sandstone, shale as above; sandstone, white to greenish-white, fine-grained with some medium-grained, well rounded, hard glassy, some dark green glauconite(?) and pyrite.
2590-2660	Dolomite,	light gray to whitish-gray, silt size to very fine crystalline, sucrozic, some quartz grains and pyrite.
2660-2690	Dolomite,	buff cream to tan cream silt size to very fine crystalline, sucrozic, occasional pyrite, with some sandstone interbeds.
2690-2890	Dolomite,	buff cream silt to very fine crystalline, sucrozic, firm to brittle, occasional pyrite, partly cherty and some chert and sandstone interbeds.
2890-2910	Dolomite,	tan gray to tan brown, very fine to fine crystalline, sucrozic, with some tan brown, fine-grained dolomite.
2910-3000	Dolomite,	buff cream to tan cream, silt to very fine crystalline, sucrozic, with some chert and sandstone interbeds.
3000-3030	Dolomite,	tan to brownish, fine crystalline, sucrozic.
3030-3040	Dolomite,	buff cream to tan brown, fine crystalline, sucrozic, with black shale.
3040-3080	Dolomite,	as above with some sandstone interbeds; sandstone, white, very fine to fine-grained, rounded, glauconite.

3080-3120	Dolomite	as above with some sandstone and chert.
3120-3190	Dolomite,	graylish-white to buff tan, very fine to fine crystalline, few stylolite, few small vugs, occasional rounded quartz grains.
3190-3270	Dolomite,	buff, buff tan, fine crystalline, with some chert and sandstone.
3270-3340	Dolomite,	buff, buff tan, fine crystalline, sandy, oolititic(?), with gray, milky chert.
3340-3370	Dolomite,	buff white to buff, very fine to fine crystalline, occasional small vugs, with some chert.
3370-3410	Dolomite,	light gray buff, fine to medium-grained, grainstone, well cemented, with white chert and tan brown quartz and oolitic grains.
3410-3450	Dolomite,	as above with poor to fair intercrystalline porosity.
3450-3490	Dolomite,	brownish tan, buff, fine crystalline, well cemented, a few rounded quartz grains and occasional fragments of sandstone. Sandstone, white to light grayish-white, very fine to fine-grained, rounded.
3490-3500	Dolomite,	light gray buff, fine to medium crystalline, well cemented, some intercrystalline porosity.
3500-3510	Dolomite,	as above with some sandstone. Sandstone, white to light grayish-white, fine-grained, rounded friable, occasionally medium, rounded quartz grains.
3510-3560	Dolomite,	as above.
3560-3580	Dolomite,	as above with some sandstone, sandstone, white to light grayish-white, fine-grained, rounded, well cemented with dolomite and chert.
3580-3710	Dolomite,	as above and sandstone. Sandstone, white, glassy, fine-grained, rounded, well sorted, slightly friable, fair porosity with occasional quartz grains.
3710-3740	Dolomite,	light grayish-white buff, fine to medium crystalline, well cemented with some sandstone as above.
3740-3800	Dolomite,	as above.
3800-3820	Dolomite,	as above with some sandstone. Sandstone, white glassy, fine to medium-grained, subangular to rounded, well cemented, with some rounded quartz grains.

3820-3890	Dolomite,	as above.
3890-3920	Dolomite,	as above with some sandstone. Sandstone, white glassy, fine-grained, rounded, well cemented, slightly friable.
3920-3950	Sandstone,	white, glassy, fine-grained, rounded, well cemented to friable, good sorted, fair to good porosity, with some dolomite.
3950-3960	Dolomite,	light grayish-white to buff, fine crystalline, well cemented, sandy, pyrite scams, with sandstone as above.
3960-3970	Sandstone,	light grayish-white to white, glassy, fine to medium-grained, moderate to good sorted, rounded, occasional coarse, rounded quartz grains, some flesh colored feldspar grains, some fragments possible granite(?), fair to good porosity, occasional green grains adding greenish cast to fragments, interstitial pyrite.
3970-3980	Sandstone,	as above but green grains (glauconite?) increasing.
3980-3990	Sandstone,	as above, big increase in flesh colored grains.
3990-4000	Sandstone,	as above, less feldspar but more pyrite.
4000-4020	Sandstone,	as above, very little feldspar, numerous coarse, subangular to subrounded quartz grains.
4020-4050	Sandstone,	as above.
4050-4055	Sandstone,	as above, big increase in feldspar grains, fragments of interlock feldspar grains and green grains.

TOTAL DEPTH: 4055 feet.

IMCO RECYCLING INJECTION WELL - CORE DESCRIPTIONS
(NE NW SW NE of Section 26, T18N, R11E, Creek County, Oklahoma)

Core No.1 2270 to 2330 feet, 100% Recovery
Core No.2 2330 to 2358 feet, 100% Recovery

Depth (feet)		Lithologic Description
2270-2272	Shale,	dark gray with brown cast, soft, occasionally fossiliferous fragments, brachiopods on bedding surface, calcareous, burrows, horizontal bedding, silt-size carbonate grains and quartz grains, petroleum smell on fresh break.
2272-2287	Shale,	as above with vertical fractures filled with calcite.
2287-2293	Limestone,	dark gray with brown to tan cast, very fine crystalline, mott, burrows, fine shell debris.
2293-2302	Shale-Siltstone,	dark gray with brown cast, fairly soft, silt-size carbonate and quartz grains, calcareous, burrows, brachiopods on bedding surface, horizontal bedding, petroleum smell on fresh break.
2302-2312	Limestone,	dark gray with brown cast, very fine crystalline, mott, shaly, vertical fractures filled with calcite.
2312-2313	Shale,	black, brown streaks, very slightly calcareous, numerous brachiopods.
2313-2324	Limestone,	gray, dark gray with brown cast, very fine crystalline, argillaceous. vertical fractures calcite-filled, numerous large brachiopods.
2324-2327	Limestone.	as above, but becoming more dark gray and more argillaceous.
2327-2329	Shale,	black, brown streaks, very slightly calcareous. few scattered brachiopods.
2329-2330	Shale,	as above with scattered pyrite clusters.
2330-2332	Shale,	dark gray with brown cast, brown streaks, sandy, numerous very fine crystallines giving a sparkle appearance.

2332-2333	Shale,	as above with a lense of glauconite(?), dark green, fine to medium round, pellet shaped grains, and with thin interbedded limestone, gray with brown cast, highly argillaceous, pyritic.
2333-2338	Shale,	gray, soft, waxy, grayish-white streaks, pyrite, interbedded with limestone lenses, gray with brown cast, highly argillaceous, numerous black round grains: limestone lenses appear like scoure and fill cross-bedding.
2338-2350	Shale,	gray, soft, waxy, grayish-white streaks, with calcite-filled fractures.
2350-2355	Shale,	as above with lenses of pyrite.
2355-2358	Shale,	black with brown cast, brown streaks, scattered small clusters of pyrite.

NOTE: Core depths are about 3 feet lower than electric log depths.

IMCO INJECTION WELL - SIDEWALL CORE DESCRIPTIONS
(Section 26, T18N, R11E, Creek County, Oklahoma)

Depth (ft)		Lithologic Description
2398	Sandstone,	white to grayish white, fine-grained, rounded to well rounded, good to excellent sorting, occasionally light gray shale clast, fair porosity, patches of light tan oil stain. Possible fracture.
2467	Shale,	dark green, firm but easily scratched, irregular masses of sandstone, grayish white, fine-grained, rounded, (clasts?) scattered fine quartz grains.
2528	Dolomite,	grayish white with greenish cast, fine crystalline, sucrozic, scattered fine quartz grains. medium dark greenish grains (glauconite?), tight.
2645	Dolomite,	buff cream, very fine crystalline to lithographic, a few scattered quartz grains, dense, with dolomite light gray, buff, very fine crystalline, sucrozic, some small vugs crystalline lined, scattered crystalline dolomite rhombs and patches of crystalline dolomite spar. Core broken up, possible fracture.
2676	Dolomite,	buff cream, very fine crystalline to lithographic, patches of pyrite, patches of coarse dolomite spar, tight, coarse spar filled fracture(?) looks like dolomite as above.
2689	Dolomite,	buff cream to light gray buff, fine crystalline, sucrozic, dolomite spar cement, intercrystalline to small vuggy porosity, fair porosity, stylolite, gray to light green pyrite.
2720	Dolomite,	buff cream, very fine-grained, sucrozic, pyrite sparkles, large patch pyrite, possible break on fracture(?).
2765	Dolomite,	buff cream with gray cast, very fine to fine crystalline, sucrozic, intracrystalline porosity, poor to fair stylolite, pyrite and feldspar cavities, possible fracture with fragments of country rocks cemented with spar dolomite.
3084	Dolomite,	light gray with buff-tan cast, fine crystalline, sucrozic, fair intracrystalline porosity, numerous small vugs, scattered into cavities dolomite rhombs.
3272	Dolomite,	light gray with buff-tan cast, very fine crystalline, sucrozic, slightly vuggy, fracture filled with chert, light gray and buff, and dolomite, white, coarse crystalline, pyrite.

3502	Dolomite,	light gray with buff cast, very fine crystalline sucrozic, poor to fair intracrystalline porosity, several hairline fractures, several solution vugs along fractures, a few scattered small vugs.
3534	Dolomite,	light gray with buff cast, fine crystalline, sucrozic, poor to fair intracrystalline porosity, several hairline fractures with a few solution vugs along the fractures, a few scattered small vugs, numerous flakes of pyrite, scattered medium round quartz grains.
3579	Sandstone,	light gray to grayish-white with buff cast, fine-grained, rounded, good sorted, fair to good intergranular porosity, dolomitic cement, stylolite(?), inclined bedding(?).
3651	Sandstone	light gray to grayish white with buff cast, medium to fine-grained, rounded, moderatly sorted, fair to good intragranular porosity, dolomite cement with dolomite, light gray, fine crystalline, sucrozic, intracrystalline and slight vuggy porosity, scattered quartz grains.
3672	Sandstone,	white with buff cast, fine-grained, good sorted, fine to good intergranular porosity, occasionally scattered medium, round quartz grains.
3677	Sandstone,	white to gray-white, fine to medium-grained. fair to good intergranular porosity, dolomitic cement, rounded, moderately sorted, few scattered round, coarse quartz grains.
3685	Sandstone,	white with buff cast, fine-grained, good sorted, fine to good intergranular porosity, dolomitic cement, dolomite crystallines.
3691	Sandstone,	white with buff cast, as above, but well cemented, interbedded with dolomite, light gray, fine crystalline, sucrozic, small vugs, poor intercrystalline porosity. Several fractures with solution along them.
3706	Dolomite,	grayish white to buff, fine to medium crystalline rhombs, fair porosity, scattered small vugs.
3747	Dolomite,	light gray with buff cast, fine crystalline, well cemented, poor porosity, a few very small vugs, one fracture.
3922	Sandstone,	grayish-white to light gray, fine-grained, good sorted, dolomitic cement, poor to fair intergranular porosity, numerous inclined laminates of gray argillaceous sandy material.

APPENDIX F

Chemical Analysis Report of Formation Fluid and Injectate

METLAB | Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145

REPORT NO 87-1276

LABORATORIES CHEMICAL & MECHANICAL TEST REPORT

OWNER A & M Engineering	ORDER NUMBER
DATE RECEIVED 3/26/87	SPECIFICATION
SHIPPER NUMBER	MATERIAL TYPE Water (International Metal Co., Inc.)

FORWARD TEST RESULTS TO: (NAME & ADDRESS)

Murray McComas, 4135 S. 100th E. Ave., Tulsa, OK 74146

CHEMICAL ANALYSIS in mg/l

SPECIMEN NUMBER	ELEMENTS TESTED									IDENTIFIED AS
	Cd	Cu	Pb	Ni	Zn	Mg	Al			
1	<.006	<.03	<.07	<.04	0.03	170.9	1.00			

MECHANICAL TEST

SPECIMEN NUMBER	ELONGATION (%)	REDUCTION OF AREA (%)	YIELD STRENGTH (PSI)	ULTIMATE STRENGTH (PSI)

Parameter	Content	COMMENTS
BOD 5 (mg/l)	36.0	
COD (mg/l)	45.7	
pH (Std)	7.82	
TSS (mg/l)	40.0	
Oil & Grease (mg/l)	12.0	
nide (mg/l)	0.052	
Chloride (mg/l)	2138.0	

APPROVAL/DATE 7-31-87

METLAB Testing Services, Inc.

6825 East 38th Street Tulsa, Oklahoma 74145
(918) 664-7767

MLTS 86-4881 December 30, 1986

Engineering & Environmental Services Associates
4135 S. 100th E. Ave.
Tulsa, OK 74146

Attn: Altay M. Ertugrul

Dear Mr. Ertugrul:

In accordance with your request, chemical analysis was conducted on a wastewater sample received on 12/19/86.

Parameters	Units	Content (Pond Sample E1)
BOD 5	mg/l	105
TSS	mg/l	103
COD	mg/l	320
pH	std.	9.41
Cadmium	mg/l	0.11
Copper	mg/l	0.06
Lead	mg/l	0.94
Nickel	mg/l	0.50
Magnesium	mg/l	181.7
Zinc	mg/l	0.10
Cyanide	mg/l	0.023
Oil & Grease	mg/l	22.4
Chlorides	mg/l	50975

Should you have any questions, please feel free to call.

Very truly yours,

METLAB TESTING SERVICES, INC.

Tony Mummolo

Tony Mummolo
Analytical Chemist

TM/tm

APPENDIX G

Laboratory Reports of Core Samples

CORE ANALYSIS REPORT

FOR

INTERNATIONAL METALS INC.

WASTEWATER NO.1
WASTEWATER DISPOSAL FIELD
CREEK CO., OKLAHOMA

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

October 19, 1989

Mr. Glenn Cole
P. O. Box 2109
Sapulpa, Oklahoma 74067

Subject: Core Analysis Data
Wastewater No. 1 Well
Creek County, Oklahoma
CA File: 57183-89127

Gentlemen:

Core material obtained from the subject well was submitted to the Core Laboratories facility in Tulsa for the analytical testing described on the following page of this report. This final report presents the following information:

1. Core Analysis Procedures
2. Tabular Core Analysis Results
3. Statistics
4. Histograms
5. Core Gamma Log
6. Correlation Coregraph

It has been a pleasure to be of service in the completion of this study. If there are any questions, please do not hesitate to contact us at (918) 664-9071.

Sincerely,

Michael C. Hudson
Laboratory Supervisor

MCH:reh

CORE LABORATORIES

Company : INTERNATIONAL METALS INC.
Well : WASTEWATER NO.1
Field : WASTEWATER DISPOSAL FIELD File No.: CA57183-89127
Formation : MISS/WOODFORD Date : 18-OCT-1989

ANALYTICAL PROCEDURES AND QUALITY ASSURANCE

HANDLING & CLEANING

Core Transportation : CORE LABORATORIES PERSONNEL
Solvent : NONE
Extraction Equipment :
Extraction Time :
Drying Equipment : CONVECTION OVEN
Drying Time : 24 HOURS
Drying Temperature : 240F

ANALYSIS

Pore volume measured by Boyle's Law in a Hassler holder using He
Grain volume measured by Boyle's Law in a matrix cup using He
Permeabilities measured on one in. diameter drilled plugs
Core Gamma Composite

REMARKS

CORE WILL REMAIN AT CORE LABORATORIES UNTIL FURTHER NOTICE

CORE LABORATORIES

Company : INTERNATIONAL METALS INC.
Well : WASTEWATER NO.1
Location : SEC.26-18N-11E
Co,State : CREEK CO., OKLAHOMA

Field : WASTEWATER DISPOSAL FIELD
Formation : MISS/WOODFORD
Coring Fluid : GEL
Elevation :

File No.: CA57183-89127
Date : 18-OCT-1989
API No. :
Analysts: MCH

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH ft	PERMEABILITY (HORIZONTAL) Kair md	PERMEABILITY (VERTICAL) Kair md	POROSITY (HELIUM) %	GRAIN DENSITY gm/cc	DESCRIPTION
1	2270.0- 71.0	< 0.0005	< 0.0005	0.8	2.64	SHALE CALC W/CARB-MAT GRY SLILY MIC
2	2278.0- 79.0	0.0045	< 0.0005	0.7	2.64	SHALE CALC W/CARB-MAT GRY SLILY MIC
3	2285.0- 86.0	< 0.0005	< 0.0005	1.6	2.66	SHALE CALC W/CARB-MAT GRY V-FRAC W/CALCITE-CMT SLILY MIC
4	2287.0- 88.0	< 0.0005	< 0.0005	1.5	2.69	LS SHY FOSS
5	2295.0- 96.0	0.0048	< 0.0005	0.7	2.62	SHALE CALC W/CARB-MAT BLK FOSS SLILY MIC
6	2302.0- 03.0	< 0.0005	< 0.0005	1.1	2.67	LS V SHY W/CARB-MAT V-FRAC CALCITE-CMT FOSS SLILY MIC
7	2310.0- 11.0	< 0.0005	< 0.0005	2.4	2.69	LS SHY SLILY PYR SLILY MIC DK-GRY
8	2314.0- 15.0	< 0.0005	< 0.0005	0.1	2.62	SHALE BLK FOSS SLILY PYR SLILY MIC
9	2316.0- 17.0	0.0058	< 0.0005	0.6	2.65	SHALE BLK V FOSS PYR MIC
10	2322.0- 23.0	< 0.0005	< 0.0005	1.6	2.69	LS GRY SHY
11	2329.0- 30.0	0.0018	< 0.0005	1.0	2.65	SHALE BLK FOSS MIC
12*	2338.0- 39.0	0.115	0.0510	5.1	2.75	LS W/SH-LAMS CALC PYR V-FRAC
13	2346.0- 47.0	0.0067	< 0.0005	2.5	2.76	LS W/SH-LAMS CALC PYR V-FRAC
14	2351.0- 52.0	0.0059	< 0.0005	1.5	2.84	LS LT GRY W/SH-LAMS SID
15	2357.0- 58.0	0.0108	< 0.0005	3.4	2.65	SHALE BLK V-FRAC

* DENOTES VERTICAL FRACTURE IN VERTICAL SAMPLE

CORE LABORATORIES

Company : INTERNATIONAL METALS INC.
Well : WASTEWATER NO.1

Field : WASTEWATER DISPOSAL FIELD File No.: CA57183-89127
Formation : MISS/WOODFORD Date : 18-OCT-1989

TABLE I

SUMMARY OF CORE DATA

ZONE AND CUTOFF DATA

ZONE:

Identification	MISS/WOODFORD
Top Depth	2270.0 ft
Bottom Depth	2358.0 ft
Number of Samples	15

DATA TYPE:

Porosity	(HELIUM)
Permeability	(HORIZONTAL) Kair

CUTOFFS:

Porosity (Minimum)	0.0 %
Porosity (Maximum)	100.0 %
Permeability (Minimum)	0.0000 md
Permeability (Maximum)	100000. md
Water Saturation (Maximum)	
Oil Saturation (Minimum)	
Grain Density (Minimum)	2.00 gm/cc
Grain Density (Maximum)	3.00 gm/cc
Lithology Excluded	NONE

CHARACTERISTICS REMAINING AFTER CUTOFFS

ZONE:

Number of Samples	15
Thickness Represented	15.0 ft

POROSITY:

Storage Capacity	2.6 ϕ-ft
Arithmetic Average	1.6 %
Minimum	0.1 %
Maximum	5.1 %
Median	1.5 %
Standard Deviation	±1.3 %

GRAIN DENSITY:

Arithmetic Average	2.68 gm/cc
Minimum	2.62 gm/cc
Maximum	2.84 gm/cc
Median	2.66 gm/cc
Standard Deviation	±0.06 gm/cc

PERMEABILITY:

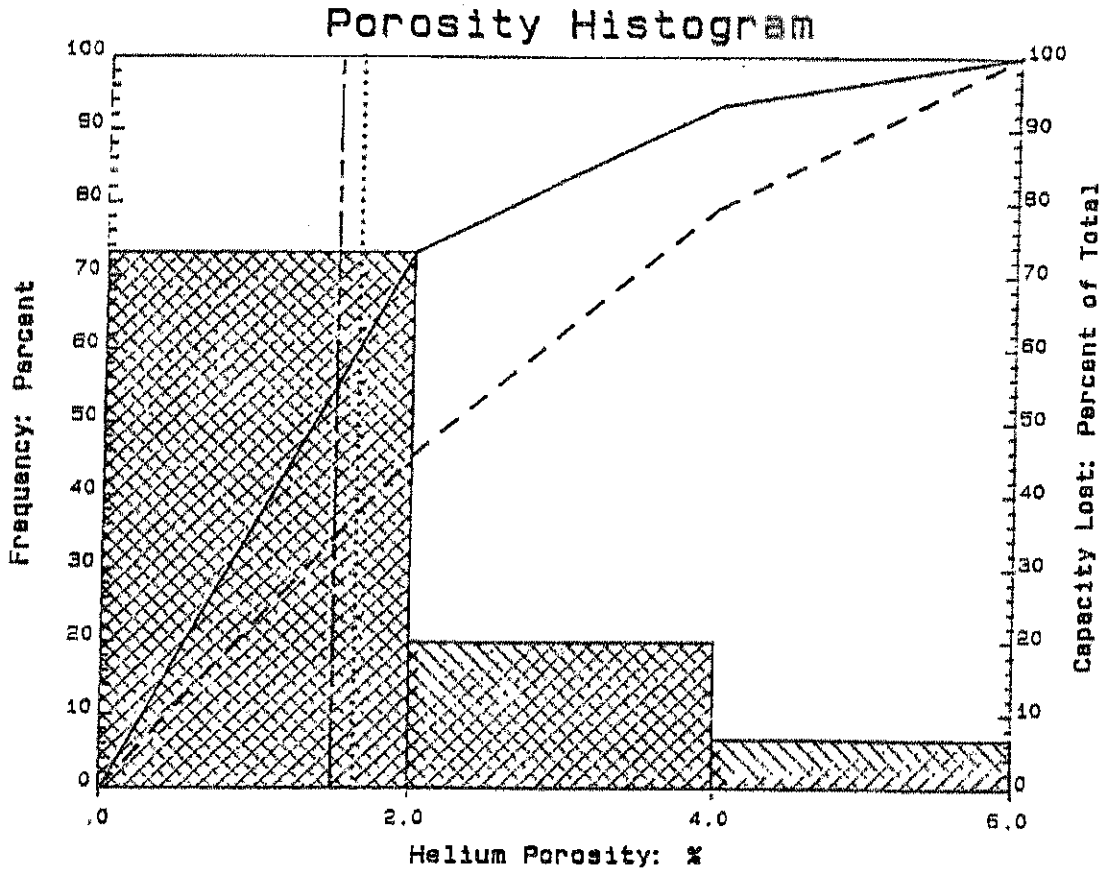
Flow Capacity	0.2 md-ft
Arithmetic Average	0.011 md
Geometric Average	0.002 md
Harmonic Average	0.001 md
Minimum	0.001 md
Maximum	0.115 md
Median	0.002 md
Standard Dev. (Geom)	$K \cdot 10^{\pm 0.714}$ md

HETEROGENEITY (Permeability):

Dykstra-Parsons Var.	0.740
Lorenz Coefficient	0.635

AVERAGE SATURATIONS (Pore Volume):

Oil	
Water	



INTERNATIONAL METALS INC.
WASTEWATER NO.1
WASTEWATER DISPOSAL FIELD

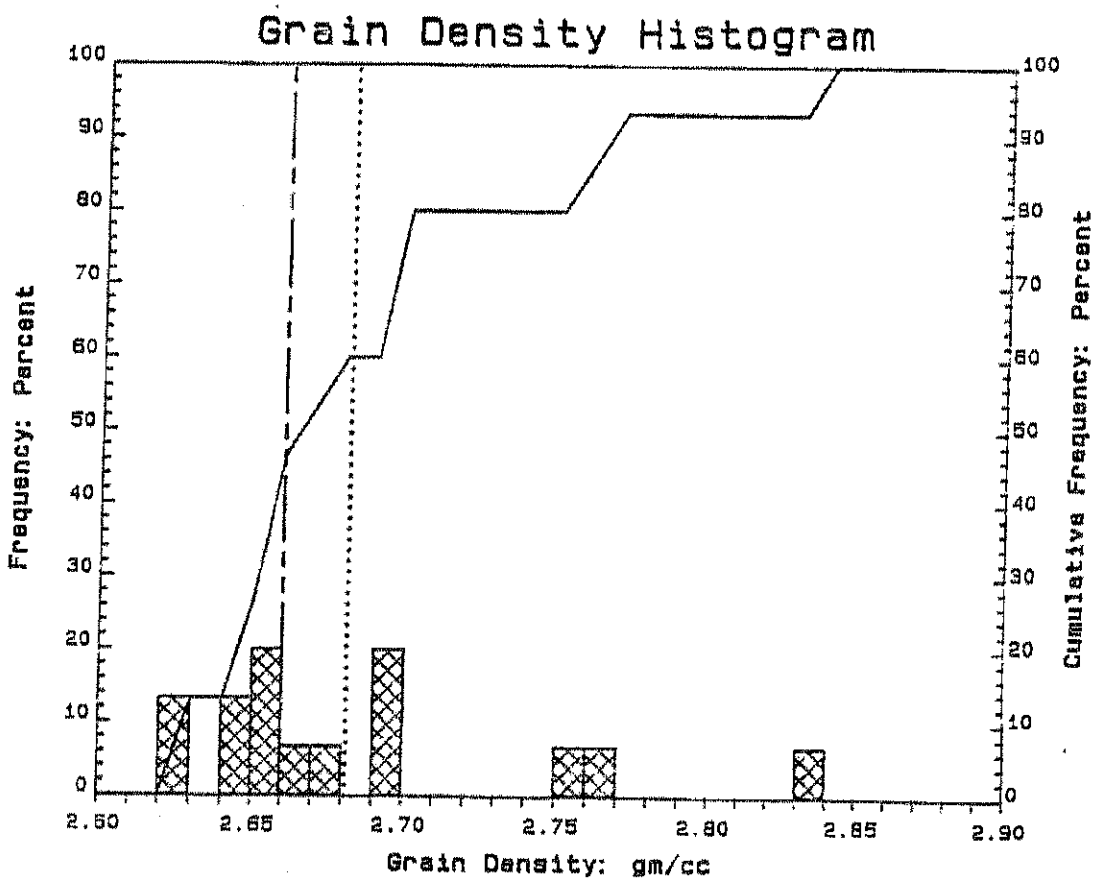
MISS/WOODFORD (2270-2358 feet)

Core Laboratories 18-Oct-1989

- LEGEND -

——— - Median Value (1.5)
····· Arith. Average (1.6)
——— Cumulative Frequency
— — — Cumulative Capacity Lost

15 Samples



INTERNATIONAL METALS INC.
WASTEWATER NO.1
WASTEWATER DISPOSAL FIELD

MISS/WOODFORD (2270-2358 feet)

Core Laboratories 18-Oct-1989

- LEGEND -

——— - Median Value (2.66)
..... Arith. Average (2.68)
——— Cumulative Frequency

15 Samples

CORRELATION COREGRAPH

INTERNATIONAL METALS INC.
WASTEWATER NO.1
WASTEWATER DISPOSAL FIELD

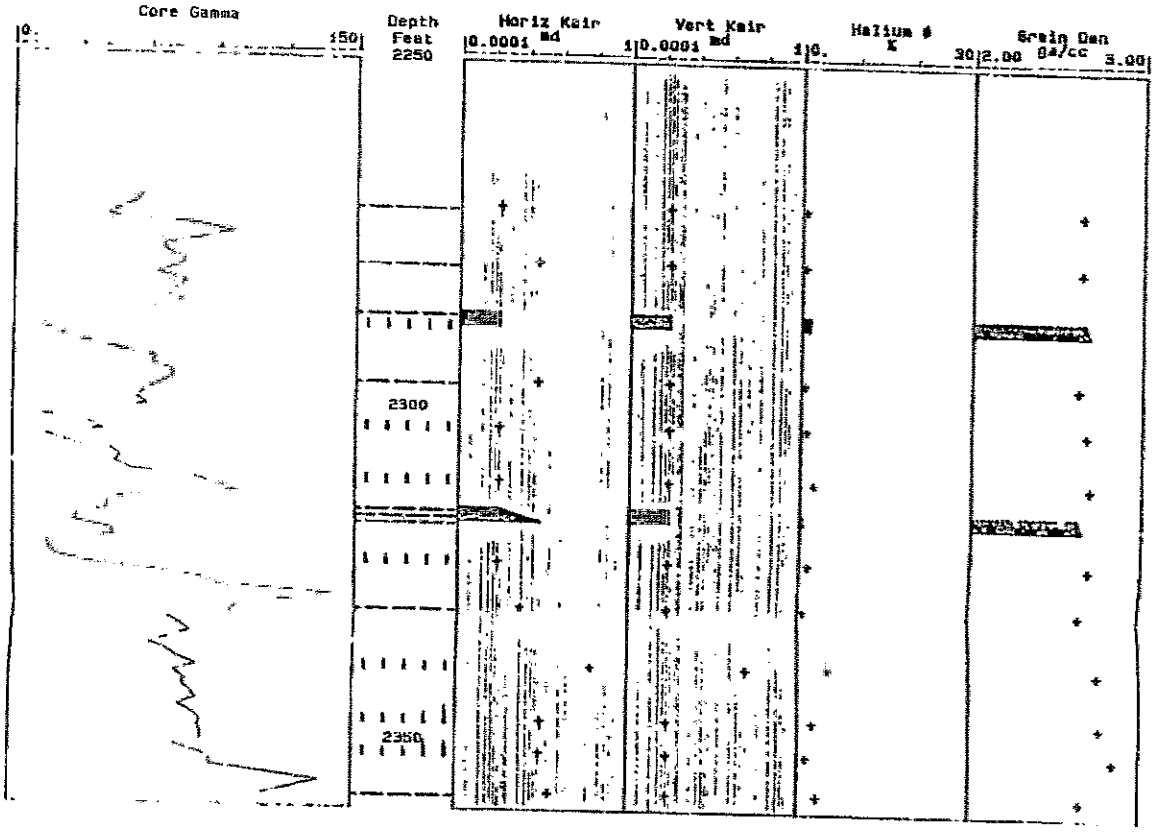
MISS/WOODFORD (2270-2358 feet)

Core Laboratories — 18-Oct-1989

Vertical Scale
5.00 in = 100.0 ft

- Lithology Legend -

Shale Limestone



CORE ANALYSIS REPORT

FOR

INTERNATIONAL METALS INC.

WASTEWATER NO.1
WASTEWATER DISPOSAL
CREEK CO., OKLAHOMA

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

October 30, 1989

A&M Engineering
3840 S. 103 E. Avenue
Tulsa, Oklahoma 74146

Attn: Mr. Leroy Knott

Subject: Core Analysis Data
Wastewater No. 1 Well
Creek County, Oklahoma
CA File: 57183-89137

Gentlemen:

Core material obtained from the subject well was submitted to the Core Laboratories facility in Tulsa for the analytical testing described on the following page of this report. This final report presents the following information:

1. Core Analysis Procedures
2. Tabular Core Analysis Results
3. Core Analysis Crossplot

It has been a pleasure to be of service in the completion of this study. If there are any questions, please do not hesitate to contact us at (918) 664-9071.

Sincerely,

Michael C. Hudson

Michael C. Hudson
Laboratory Supervisor

MCH:reh

2cc: Addressee

2cc: Glenn Cole
P. O. Box 2109
Sapulpa, Oklahoma 74067

CORE LABORATORIES

Company : INTERNATIONAL METALS INC.
Well : WASTEWATER NO.1

Field : WASTEWATER DISPOSAL
Formation : MULTI-FORMATION

File No.: CA57183-89137
Date : 30-OCT-1989

A N A L Y T I C A L P R O C E D U R E S A N D Q U A L I T Y A S S U R A N C E

HANDLING & CLEANING

Core Transportation : GLENN COLE GEOLOGICAL CONSULTING
Solvent :
Extraction Equipment :
Extraction Time :
Drying Equipment : CONVECTION OVEN
Drying Time : 12 HOURS
Drying Temperature : 240F

ANALYSIS

Pore volume measured by Boyle's Law in a Hassler holder using He
Grain volume measured by Boyle's Law in a matrix cup using He
Permeabilities measured on 7/8" in. diameter drilled plugs

REMARKS

PLUG SAMPLES WILL REMAIN AT CORE LABORATORIES UNTIL FURTHER TESTING IS COMPLETED.

CORE LABORATORIES

Company : INTERNATIONAL METALS INC.
Well : WASTEWATER NO.1
Location : SEC.26-18N-11E
Co,State : CREEK CO., OKLAHOMA

Field : WASTEWATER DISPOSAL
Formation : MULTI-FORMATION
Coring Fluid : GEL
Elevation :

File No.: CA57183-89137
Date : 30-OCT-1989
API No. :
Analysts: MCH

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH ft	PERMEABILITY (HORIZONTAL) Kair md	PERMEABILITY KLINKENBERG (EQUIV-LIQ) md	POROSITY (HELIUM) %	GRAIN DENSITY gm/cc	DESCRIPTION
			ARBUCKLE-DOLOMITE			
1*	2676.0- 77.0			15.8	2.89	DOL PYR V-FRAC W/DOL-XLN
2	2684.0- 85.0	14.4	11.3000	10.8	2.85	DOL PYR SH LAMS
			ARBUCKLE-SANDSTONE			
3	3651.0- 52.0	7.08	6.4500	7.0	2.74	SST F-MED GRN DOL-CMT
4	3672.0- 73.0	8.50	7.7100	8.6	2.69	SST F-MED GRN SLILY CALC QTZ-OVGTH
5	3677.0- 78.0	5.36	3.9500	15.5	2.66	SST F-MED GRN QTZ-OVGTH
6	3685.0- 86.0	1.78	1.6900	5.3	2.67	SST F-MED GRN QTZ-CMT
7	3691.0- 92.0	0.0250	0.0180	2.5	2.65	QTZ FRAC'D
			REAGAN SANDSTONE			
8	3922.0- 23.0	0.0580	0.0400	6.6	2.66	SST F GRN QTZ-CMT V SHY W SH LAMS
9	3925.0- 26.0	0.0029	0.0008	3.8	2.75	SST F-MED GEN QTZ-CMT SLILY SHY
			GRANITE WASH SANDSTONE			
10	3953.0- 54.0	0.0190	0.0140	3.6	2.83	SST F-MED GRN DOL-CMT
11	3989.0- 90.0	0.387	0.2490	10.4	2.65	SST F-MED CSE GRN SLILY PYR SLILY CALC
12	3998.0- 99.0	3.05	2.6100	10.0	2.65	CONGLOMERATE SST CHRT FLSPR LM SH
13	4024.0- 25.0	49.1	43.8000	14.0	2.64	SST F-LGE CSE GRN QTZ-OVGTH FLSPR

CORE LABORATORIES

Company : INTERNATIONAL METALS INC.
Well : WASTEWATER NO.1

Field : WASTEWATER DISPOSAL
Formation : MULTI-FORMATION

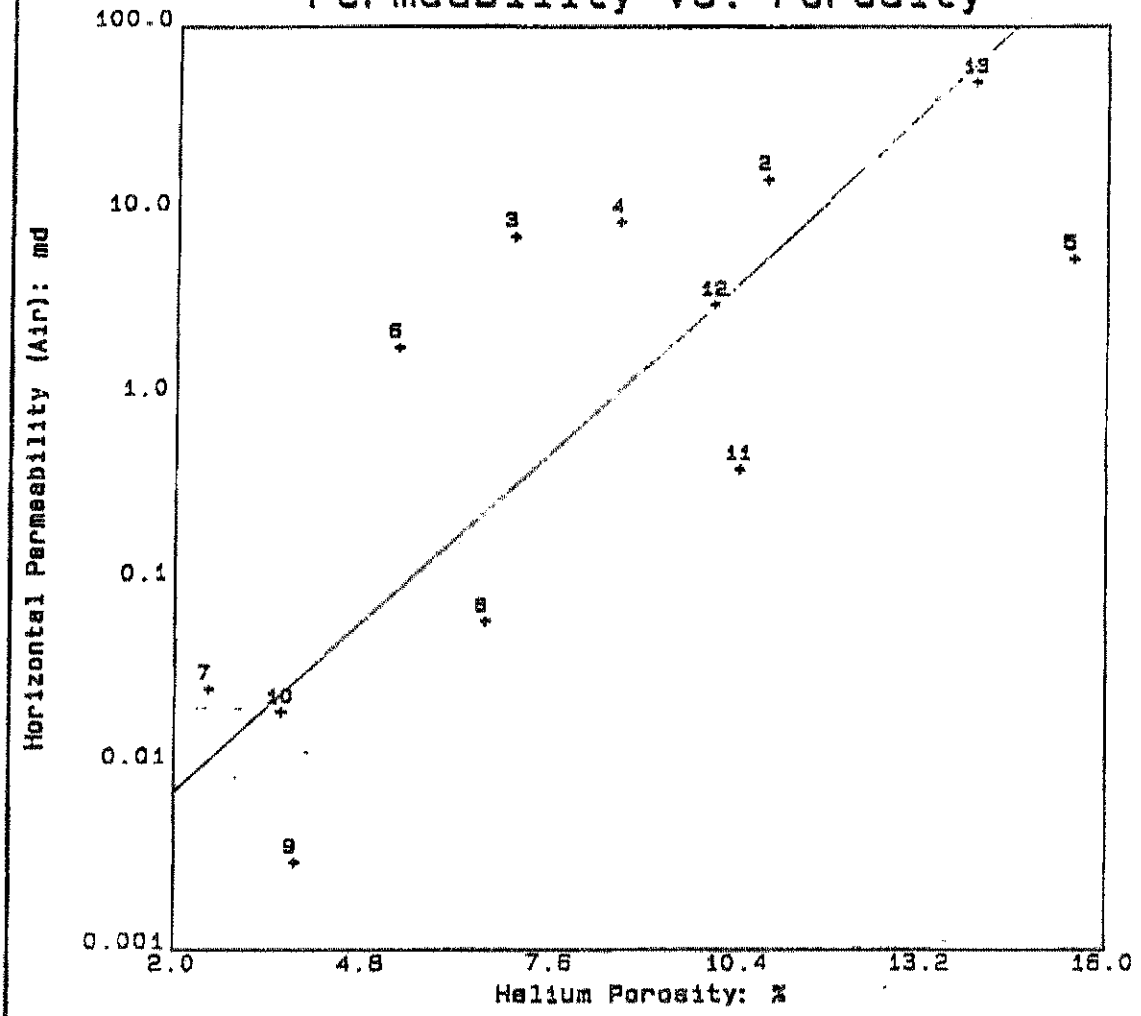
File No.: CA57183-89137
Date : 30-OCT-1989

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH ft	PERMEABILITY (HORIZONTAL) Kair md	PERMEABILITY KLINKENBERG (EQUIV-LIQ) md	POROSITY (HELIUM) %	GRAIN DENSITY gm/cc	DESCRIPTION

* DENOTES SAMPLE NOT SUITABLE FOR PERMEABILITY MEASUREMENTS

Permeability vs. Porosity



INTERNATIONAL METALS INC.
WASTEWATER NO.1
WASTEWATER DISPOSAL

MULTI-FORM. (2676-4025 feet)

Core Laboratories 29-Oct-1989

- LEGEND -
MULTI-FORMATIO

SPECIAL CORE ANALYSIS

for

A & M ENGINEERING AND
ENVIRONMENTAL SERVICES, INC.

IMCO WASTEWATER NO. 1 WELL
CREEK COUNTY, OKLAHOMA

Western Atlas International
A Litton Division Company

CORE LABORATORIES

December 29, 1989

A & M Engineering and
Environmental Services, Inc.
3840 S. 103rd E. Avenue
Tulsa, Oklahoma 74146

Attention: Murry R. McCamos, PhD

Subject: Special Core Analysis Study
IMCO Wastewater No. 1 Well
Wastewater Disposal
Creek County, Oklahoma
File: 57183-89149

Gentlemen:

In October 1989, Murry R. McCamos, Phd of A & M Engineering and Environmental Services, Inc. requested the Special Core Analysis Laboratory of Core Laboratories to perform liquid permeability measurements on core samples from the subject well. Data presented herein is supplemental information to be used in conjunction with previously issued data from the IMCO Wastewater No. 1 Well (See File: 57183-89137).

Liquid permeability measurements were requested on supplied samples from the subject well. Following permeability and porosity determinations, the samples were evacuated and pressure saturated with a field water supplied by a representative of A & M Engineering. Each sample was then loaded into a hydrostatic coreholder and the permeability to the field water determined. Results are presented on the following page.

It has been a pleasure working with A & M Engineering and Environmental Services, Inc. in performing this study. Should

you have any questions regarding the test procedures or the results reported, please contact me at (918) 664-9071.

Sincerely,

Core Laboratories, a division of
WESTERN ATLAS INTERNATIONAL

Mercer L. Brugler
Manager
Special Services

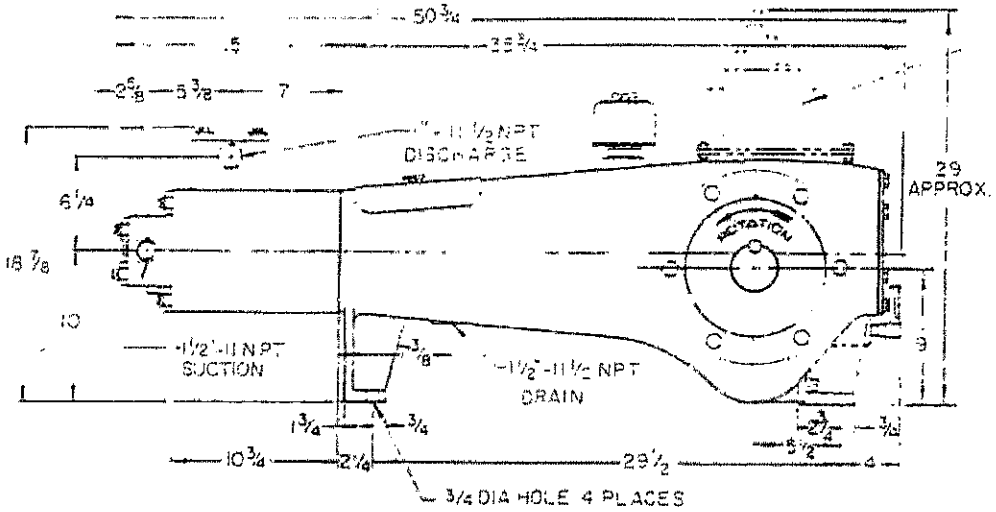
MLB:MR:reh

APPENDIX H

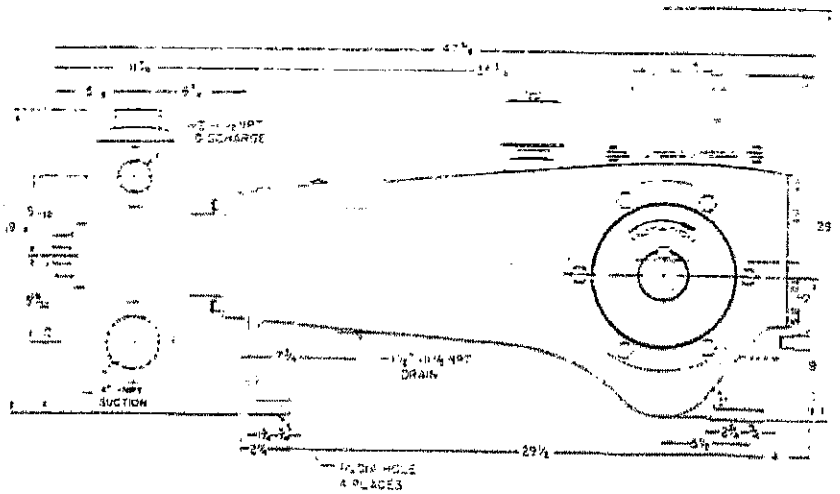
Injection Pump Information

WHEATLEY

OPERATOR'S MANUAL



HP-100L, HP-100M, HP-165L & HP-165M PLUNGER PUMPS



Introduction

Introduction

Wheatley pumps are manufactured in accordance with the highest standards demanded by the petroleum industry. Proper maintenance and care will prolong the period of satisfactory service, and reduce costs.

These instructions were written to promote the care, operation, and maintenance of your pump. When trouble arises outside the scope of this manual, our Engineering Department and all other factory facilities are ready to help you. Feel free to contact us for assistance.

To improve our products, we must be informed of the problems and solutions which occur in the field. We request that you send to us short reports of your experiences. Include the pump figure and serial numbers, the operating conditions, the problems, and the solution, if any, and forward to Wheatley, ATTENTION: Engineering Department, P.O. Box 3249, Tulsa, Oklahoma 74101. Your help will be greatly appreciated.

Service

Wheatley has distributors throughout the United States who have servicemen available in case of emergency or a major overhaul. Most of these distributors have parts available and can give you the necessary help in service work. We prefer that all service be handled through an authorized distributor; however, in extreme emergencies, Wheatley can dispatch a serviceman. This normally will require a 24-hour notice.

General

The Wheatley Figure HP-100 and HP-165 pumps, when properly installed and when given good care and regular maintenance, will operate satisfactorily for a long period of time. The following paragraphs discuss the general principles that must be considered to insure trouble-free operations.

Storage

All Wheatley pumps are tested, inspected and protected against corrosion for the period of shipment and installation only.

If the pump is not to be installed at once, refer to the section entitled "Preparation of Plunger Pumps For Extended Storage."

Location of Pump

Locate the pump in a clean, accessible place, so it can be inspected at regular intervals during operation. Place pump as close to the liquid supply as possible, so as to make suction pipe short and direct. Provide ample head room for crane, hoist or tackle.

Protection of Pump Against Seepage or Flood

If it is necessary to place the pump in a pit, provision should be made to protect the pump from water that may come into the pit from seepage or flood.

Provision for Servicing Space

Whether mounted on the floor, or a foundation above the floor level, or in a pit, sufficient room should be allowed for removal of plungers, rods, crankshafts, etc., and/or inspection of wearing parts as recommended in this manual.

Leveling The Unit

Metal blocks and shims or metal wedges having a small taper should be placed close to the foundation bolts. Small jacks made of cap screws and nuts are very convenient. In each case, the supports should be directly under the part carrying the greatest weight and spaced closely enough to give uniform support with minimum deflection of the unit.

A gap of about 3/4" to 1" should be allowed between the baseplate and the foundation for grouting.

Adjust the metal supports or wedges until the shafts or rods of the pump are level.

On pumps where couplings are used, do not connect the coupling until all pump and driver alignment operations have been completed. Check the coupling faces, suction and discharge flanges of the pump for horizontal and vertical position by means of a level. Correct the positions, if necessary, by adjusting the supports or wedges, as required.

Foundation

Pumps can be located on the floor or supporting surface, provided that the supporting installation area is sufficiently strong to support at least 150% of the total unit weight, including driver.

Pump foundations should be reinforced concrete, to rest on hard pan ledge or piling, and about 12" above the surrounding floor level. It should be entirely independent of walls or footings, building supports or floor structures. Proper concrete mixture, correct reinforcements, sufficient mass and satisfactory footing are essential to give rigid, permanent support to prevent vibration. The bearing pressures allowed on soil vary widely depending on the underlying nature of the soil, local building laws, etc. This data, available in engineering handbooks and manuals, should be carefully investigated.

Correct Tensions For V-Belt Drives

To establish correct tension in single or multiple v-belt drives requires the use of a small spring scale, applied at the center of the belt span –

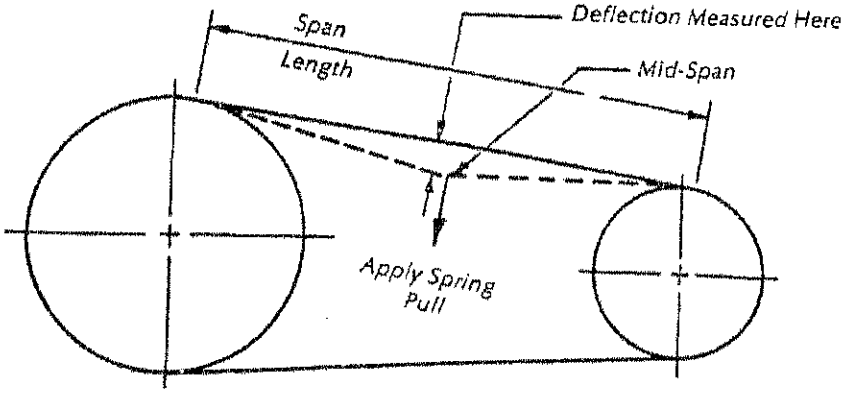


FIG 2A

Apply spring pressure to the **tightest** *belt of the set to produce the following belt deflections. Then read the scale and tighten or loosen as needed below –*

Belt Size Section	Force for Normal Tension, Pounds	Force for New Belts, Pounds	Approximate Belt Span						
			20"	24"	28"	32"	40"	48"	60"
"A"	1.5 to 2.25	2.25 to 3.0	5/16 DEFLECTION	3/8 DEFLECTION	7/16 DEFLECTION	1/2 DEFLECTION	5/8 DEFLECTION	3/4 DEFLECTION	15/16 DEFLECTION
"B"	3.25 to 5.0	5 to 6							
"C"	6.5 to 9.75	9.75 to 13							
"D"	11.0 to 16.5	16.5 to 22							
3 V	4 to 5.5	5.5 to 7							
5 V	9.5 to 11.5	11.5 to 14.5							
8 V	22 to 29	29 to 35							

For new belts initial tension values should revert to normal values after 24 hours operation

necessary to avoid joint failure and the air and liquid leaks that follow.

"V"-Belt Drive

All drives must be aligned. The driver and driven shafts must be parallel, and the "V"-belts at right angles to these shafts. Misalignment will cause undue belt wear, or turn-over in the grooves. Alignment should be checked by placing a straight edge evenly across the rims of both sheaves. If the face of the sheaves are not of equal width, the alignment can be checked by resting the straight edge across the rim of the widest sheave and measuring the distance from the straight edge to the nearest belt groove with a scale. Adjust either sheave on the shaft to equalize these dimensions.

The driver should be mounted with adequate provision for belt center distance adjustment. Provide a minus adjustment to permit belt installation without stretching and plus allowance to provide belt take-up.

Do not pry, twist, or force the belts over the sheave grooves. This will damage the belts and greatly reduce the belt life. Shorten the drive by moving the driver enough to permit fitting the belts in the proper grooves. When the belts are in place, increase the centers until proper belt tension is obtained. Adjust take-up until only a slight bow appears on the slack side. All of the belts must be pulling evenly. Belt tension should be reasonable. It is not necessary to have belts "fiddle string" tight.

During the first few days of operation, the belts will seat themselves in the grooves. Therefore, the drive must be tightened to take up the slack.

Keep belts clean and free from oil. Clean oily belts with a cloth dampened with soap and water. There should be a free circulation of air around the drive. Excessive heat reduces the life of the belts.

Never install new belts on the same drive with used belts. Do not use sheaves with chipped or worn grooves.

For hazardous locations, an antistatic-belt should be used.

Consult "V"-belt manufacturer's tables and data for recommended "V"-belt cross-sections and belt length.

When purchasing replacement "V"-belts, the same size and type should be ordered as furnished originally.

Slipping belts will result in lower capacity. Check pump speed with tachometer. It should equal driver speed multiplied by driver sheave pitch diameter divided by pump sheave pitch diameter. Squealing or smoking belts are often the clue to the slipping of belts, but not always.

General Instructions

Discharge Valves

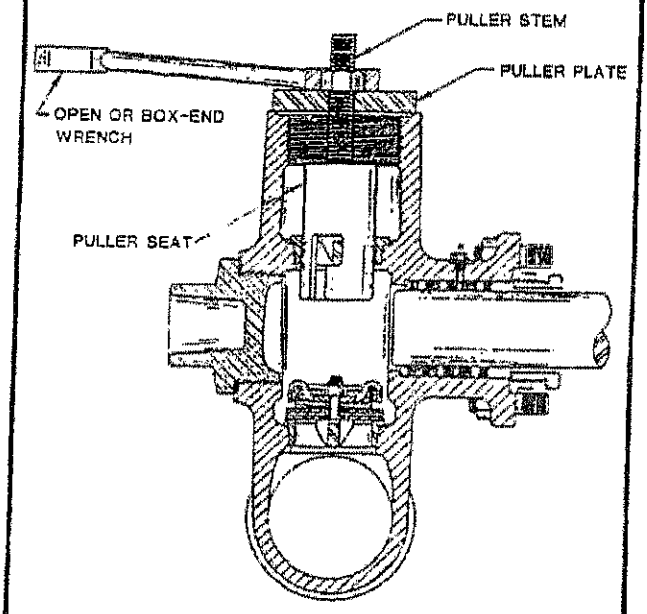
The discharge valve is located just beneath the valve cover in the upper part of the fluid cylinder body. Replacement of the spring, or disc, can be accomplished without removing the valve seats. If it is necessary to remove the discharge valve seat, remove with valve seat puller available from Wheatley Company. Be careful not to mar the tapered seat deck.

Suction Valves

The suction valve is accessible after removing the cylinder head plug. To remove the suction valve seat, it is necessary to remove first the discharge valve. To get the plunger out of the way, rotate the pump until the plunger reaches back position. Stop it before beginning the forward stroke. The next step is to remove the valve stem nut and lift out the cage, spring, disc, and spacer. Seat removal is accomplished by the use of a special tool available from the factory.

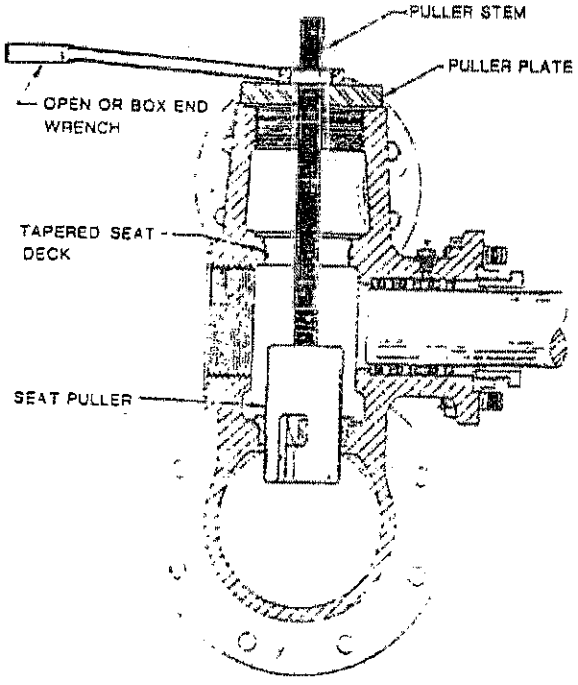
Refer to Fig. 4 when *installing* valve seats, take care to avoid damage of tapered deck seating surface. Valve seats should be **Driven** into the seat deck until firmly seated. This is done by using an old disc in its regular position and driving with a piece of pipe and a hammer. **Caution:** Never drive on the valve stem and do not use any method which will distort valve seat. Taper

FIG 2



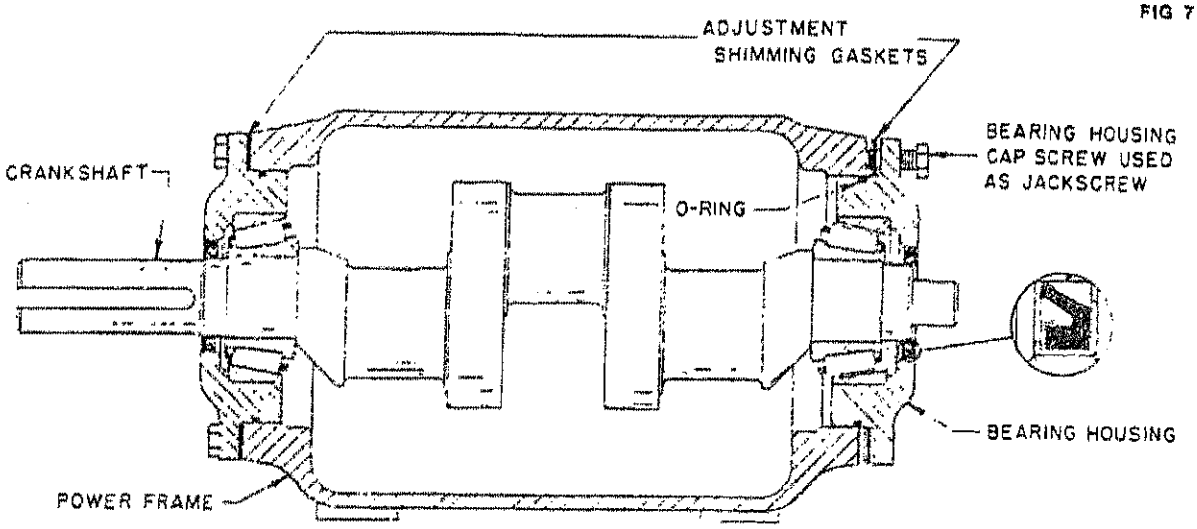
REMOVAL OF DISCHARGE VALVE SEAT

FIG 3



REMOVAL OF SUCTION VALVE SEAT

FIG 7



CROSS-SECTION OF POWER FRAME (TRIPLEX SHOWN)

Crankshaft

The crankshaft is removed through the bearing housing opening. First, remove the connecting rod cap and push the remainder of the connecting rod assembly forward all the way. Second, remove the crankshaft bearing housings by removing all cap screws. Then, using two as jack screws, retract the housings by reading thru the housing flange against the pump frame. The crankshaft should then be free for removal through the bearing housing opening.

Crankshaft Bearings

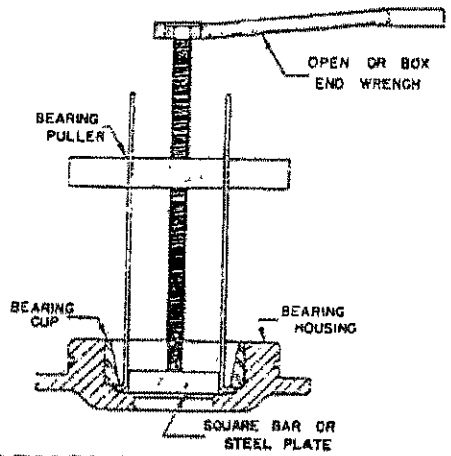
Adjustment of the crankshaft bearings is accomplished by using varying thickness of bearing housing gaskets. These gaskets are available in thicknesses of 1/16", 1/32", 1/64", and .005".

The correct adjustment is reached when the bearing housing capscrews have been drawn up tight and only the slightest drag is noticeable when the crankshaft is rotated.

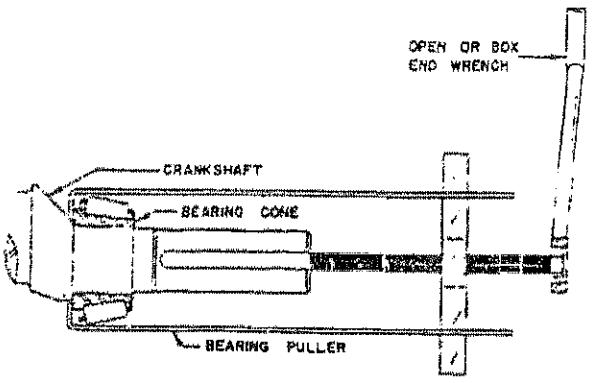
To remove the bearings, the crankshaft must be removed first. The old bearings may be pulled from the crankshaft and the outer race from the bearing housing by use of a bearing puller.

New bearings may be installed as follows: Expand bearing inner race by heating it in hot oil at 300 degrees F., drop it over the shaft and seat into position using a pipe sleeve and hammer. Shrink the outer race by packing it in dry ice for about ten minutes, then drop it into the bearing housing. **Caution:** Check the outer race to see that there is no slippage in the bearing housing. If slippage or rotation is present, the bearing housing should be replaced. If a hydraulic press is available, a preferred method is to press races into place, using no heat. Races must solidly abut the adjacent shaft or housing shoulder. **Never** use a flame on races or rollers.

Crankshaft Diameter 3.252" to 3.253"



REMOVAL OF BEARING CUP FROM HOUSING



REMOVAL OF INSIDE CONE

FIG 8

Maximum allowable running clearance *(New Pump)* are as follows:

Crosshead O.D. fit on Power Frame
..... .01" Clearance on Dia.

Wrist Pin Fit in Bushing
..... .003" to .005" Clearance on Dia.

Crankshaft Center Bearings *(Quintuplex)*
..... .005" to .007" on the side

Interference fits are as follows:

Wrist Pin Fit in Crosshead
..... .0015" to .0005" Tight

Wrist Pin Bushing Fit in Conn. Rod
..... .0025" to .0015" Tight

Outer Race Fit in Bearing Housing *(Timken)*
..... Zero to .002" Tight

Inner Race Fit on Crankshaft *(Timken)*
..... .0015" to .0005" Tight

Center Bearing Fit in Frame *(Quintuplex Only)*
..... .001" to .005" Tight

When Changing Packing

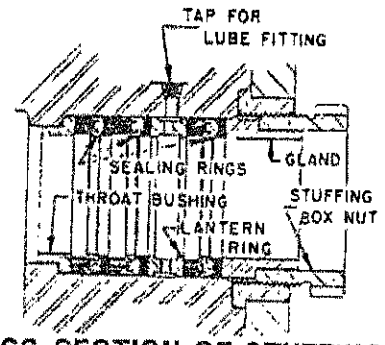
Non-adjustable packing, styles 835, 838, 842, 845, etc. Remove all old packing, clean the stuffing box thoroughly. Inspect it for wear. To repack the stuffing box, insert throat bushing and follow it with the packing unit, which has a top and bottom adapter. Care should be taken to install the packing so that the lips of each sealing ring face toward the fluid pressure. Install the parts in this order: Throat bushing, packing unit, consisting of two seal rings, each of which has a top and bottom adapter ring, then the lantern ring followed by a seal ring and its adapter rings.

After packing is in place, screw the gland nuts into the box until it is hand-tight! On packing sizes where a stuffing box adapter is used, inspect the O-rings, replacing them if any nicks or wear is found. Check all plungers showing pits or scoring. Plungers may be cleaned with solvent and fine emery cloth. Install plunger using a pipe wrench on the knurled section with plenty of force. *Plungers must be kept tight!*

Roll pump over slowly under no load for several minutes. Observe results at stuffing box. If force-feed lubricator is used, be sure it is actually delivering oil to stuffing box. Tighten stuffing box nut, and after one hour's operation, re-tighten packing thoroughly. *Stuffing box nuts must be kept tight!*

A good procedure is to apply oil liberally to each plunger, using an oil can, while packing is being *"broken-in"* to avoid heating.

FIG 11



CROSS-SECTION OF STUFFING BOX STYLE 838 PACKING SHOWN

Style 255 Packing

Style 255 is a combination set of Die-Formed Teflon Impregnated Asbestos (119) with Virgin Teflon Spacers (1140). This packing under most service conditions will give satisfactory service without lubrication. Therefore, if your pump is presently equipped with lantern rings, it should be removed and the lubrication hole plugged. On severe services where lubrication would be required, it is recommended that it be dripped on the plunger outside the stuffing box.

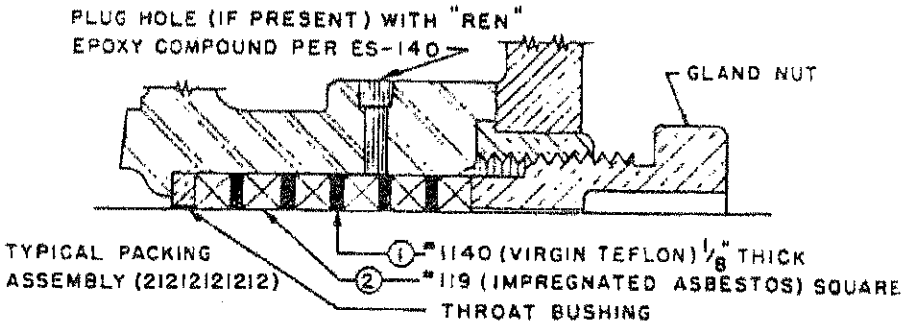
For better packing performance, the following checks and installation procedures should be followed:

1. Check all metal parts for wear or nicks. Any damaged or excessively worn parts should be replaced.
2. Check plungers and stuffing box for excessive wear or build-up. All parts should be thoroughly cleaned before they are re-installed.
3. Install packing as assembled beginning with tagged ring in bottom of box. Install one ring at a time making sure each ring is properly seated. All joints should be staggered 90° apart.
4. Make gland up tight with spanner wrench or bar furnished with pump to make sure packing is seated. Loosen and re-tighten finger tight.
5. Start pump. Tighten gland to control leakage. A slight leakage or weepage, where permissable, is desirable for best packing performance.

NOTE: Each set begins and ends with #119 (Asbestos) ring, and interior rings alternating between #119 (Asbestos) rings and #1140 (Teflon) rings.

FIG 12

STYLE 255 PACKING ASSEMBLY



LOCATING TROUBLE

Trouble	Probable Cause	Remedy
Pump fails to deliver required capacity.	Speed incorrect. Belts slipping.	Check with tachometer and change drive ratio or tighten belts if loose.
	Air leaking into pump.	Check all joints. Hydrotest. Seal with compounds.
	Liquid cylinder valves, seats, plunger packing, worn.	Valves and seats replaced; replace packing, or plungers.
	Not enough suction pressure above vapor pressure.	Increase static head or use a booster pump.
	Pump not filling.	Prime pump. Install foot valve at bottom of suction pipe if lift used on suction. Makeup in suction tank less than displacement of pump. Capacity of booster pump less than displacement of pump. Vortex in supply tank.
	One or more cylinders not pumping.	Stop. Prime all cylinders.
	Suction lift too great.	Decrease. Use charge pump.
	Stuck foot valve.	Clean.
	Fluid valve stuck open.	Stop. Remove debris beneath valve.
	Clogged suction strainer.	Clean or remove.
	Relief, bypass, valves leaking.	Check and repair.
	Low volumetric efficiency.	Liquid with low specific gravity or high discharge pressure compressing and expanding in pump. Worn valves or seats. Air in fluid.
Suction and/or discharge piping vibrates or pounds.	Piping too small and/or too long. Too many elbows.	Increase size and decrease length. Use booster pump. Use suction and/or discharge pulsation dampeners.
	Worn valves or seats.	Replace.
Fluid end cylinder failure:	Air entering suction system.	Eliminate air. Note: Pitting often leads to hairline cracks which ends in cylinder failure.
	Incorrect material.	Materials determined from customer's experience, manufacturers past applications, chemical reports, etc. On some special liquids, temperature, viscosities, specific gravities, combined with compressibility, contaminants, etc., no data is available. Pump manufacturer, therefore, recommends materials based on best available data.
	Parts used not from original manufacturer.	Use on genuine replacement parts.
	Flaws in casting.	Repair or replace.

Engineering Standards
"Preparation of Pumps For Extended Storage"

General

Responsibility for storage protection of Wheatley pumps rests with the owner or custodian of the pump. Serious deterioration of close-fitting parts can and will occur to pumps in storage — **even though storage may be in a warehouse,** or other building. Moisture condensation is the culprit. It can quickly ruin expensive bearings, gears, shafts, oil seals, rods, liners, pistons, valves, springs, and seats. It is YOUR job to see that this does not happen!

Distributor Storage

Distributors for Wheatley pumps have a dual obligation to protect pumps in their storage:

First to the Customer, who is entitled to receive his new Wheatley pump in a "factory fresh" condition.

Second, to the Manufacturer who warrants the pump, Wheatley.

Customer's Responsibility

The customer's responsibility begins the day the customer takes title to his new Wheatley pump. If not placed promptly in service, the pump will quickly deteriorate — unless **prepared** for storage.

Hence, careless storage of pumps which results in rusting of the fine finishes, close tolerances, and careful assembly of the Wheatley pump will operate against this customer, when and if premature failure of such components does occur.

The Wheatley warranty will not protect a careless customer who does not protect his pump before and during operation.

Power End Protection

Remove the piston rods (or plungers, or pony rods) from the crosshead. Plug the wiper box openings with smoothly tapered wood plugs. Drive the plugs tightly into the wiper box packing counterbore. Must be oil-tight!

Pumps having oil level gauges: Remove the gauge and close this opening with a pipe plug. Or, plug the dip stick hole — if pump utilizes a dip stick.

Fill the entire power end completely with clean S.A.E. 40 or 30 motor oil, or turbine oil (per name plate).

Oil level must completely immerse all working parts, including all gear teeth, if pump has gears.

Plug the crankcase breather opening with a tightly fitted tapered wood plug to prevent entry of air, or plug with pipe plug if opening is tapped.

Coat shaft extensions and keys with a good commercial anti-rust compound, such as "Rust-Ban".

Remove V-belts from SHEAVE. Coat sheave grooves with anti-rust compound.

If pump is equipped with a force-feed lubricator, fill the lubricator completely with oil. Remove lubricator drive belt and apply anti-rust compound to sheave grooves, and other machined surfaces.

Fluid End Protection

Packing if left in place, has a very injurious effect on plungers or piston rods. Remove all packing and store in clean boxes in a dry place.

Apply anti-rust compound to stuffing box bore, gland nut threads and screw gland nuts into stuffing box.

If a piston pump, remove the valves, springs, liners, pistons, and rods. Coat all thoroughly. Apply compound to fluid end bores, valve seats, liner cages, and jack screw threads. Remove all cylinder drain plugs. Store rods, liners, valves, and springs in clean boxes in a dry place. Valve seats should be coated and left in pump.

Apply anti-rust compound to all studs, bolts, and nuts.

Store all fluid gaskets in clean boxes in a dry place. Avoid crimping or damage to gaskets and seals.

If the pump is plunger type, remove plungers and pony rods and box carefully. Plungers must be carefully handled and stored to avoid damaging or chipping their surfaces. Protect plunger and pony rod threads.

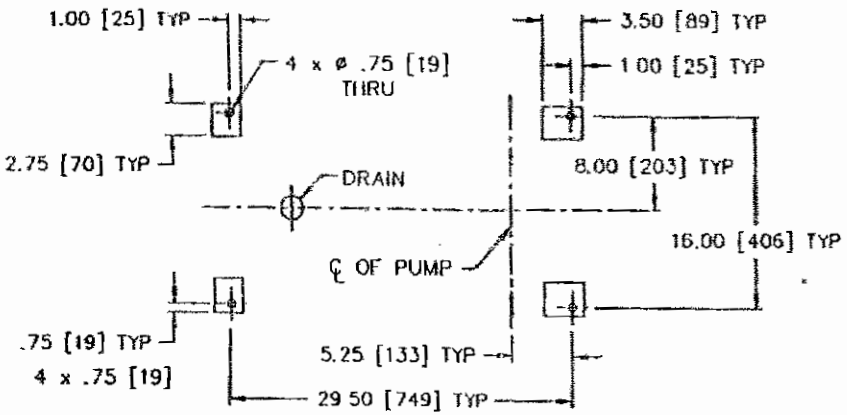
After making sure that all fluid end machined surfaces are carefully coated with rust-preventive, and that interior is dry, replace all covers, flanges, and heads. Plug suction and discharge flange openings using tightly fitted wood plugs, to exclude air and moisture.

ES-114
Date: 9-20-76
Supersedes 3-1-71

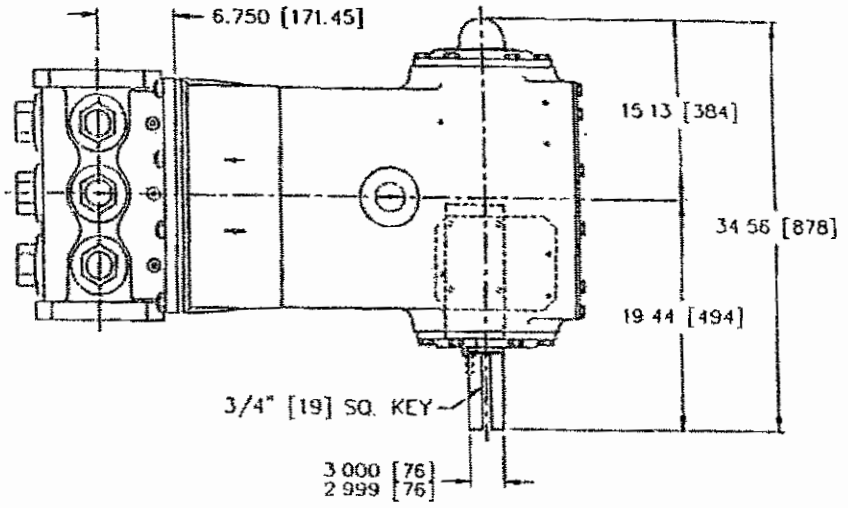
...ENSIONS SHOWN ARE FOR INSTALLATION PURPOSES.
...LERANCES FOR ALL DIMENSIONS ARE ± .125 [3]
...DIME...NS ARE IN INCHES AND [MM]

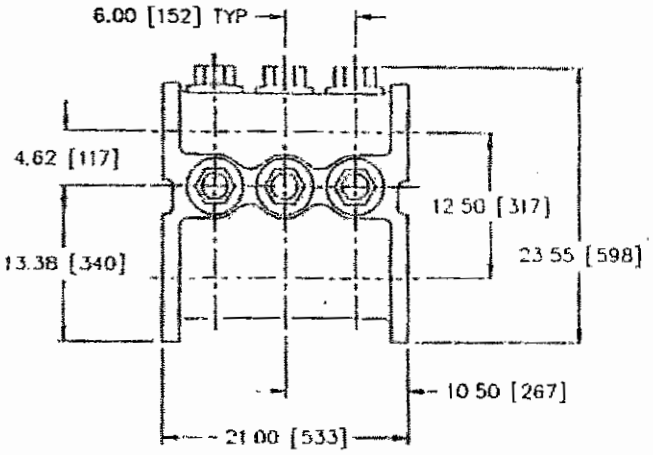
MODEL HP-100AL
-3/4" [70] TO 3-3/8" [86] x 4-1/2" [114]
TRIPLEX PLUNGER PUMP
CAST LIQUID END

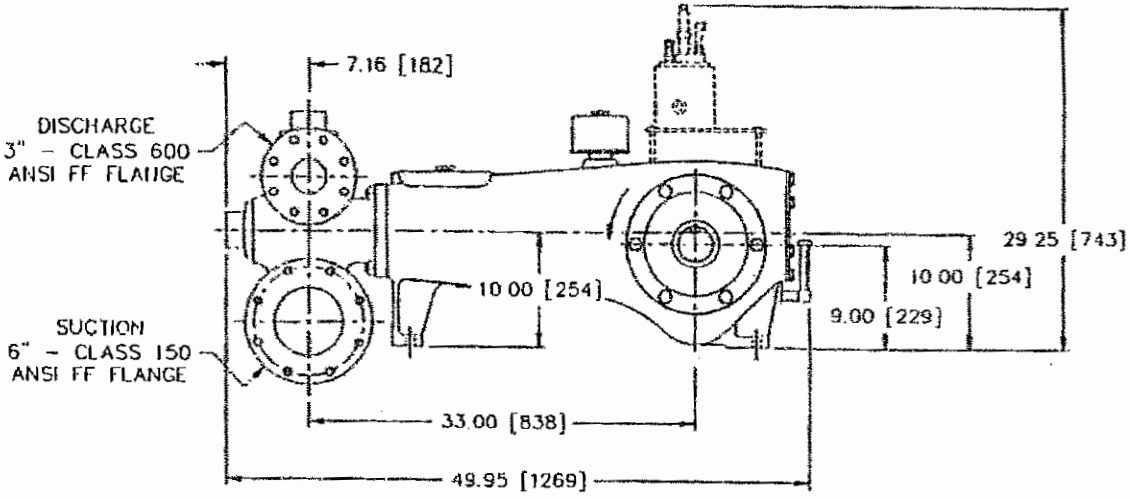
WKC LEY®
TULSA, ...AHOMA
CALGARY, ALBERTA



MOUNTING FEET DETAIL







1-025007
REV : "C"

Date: 3-21-85

Supersedes

Use with Drawing 1-24999

PARTS LIST FOR
MODEL HP-100L FLUID END
2¾" — 3⅜" x 4½" TRIPLEX PLUNGER PUMP

ITEM NO.	PART NUMBER	MATL. AVAIL.	QTY.	PART DESCRIPTION
	- - - - - - - - - - - - FLUID END - - - - - - - - - - - -			
600	008-024955-220	S	1	Fluid End Body
	008-024954-XXX	B,D	1	Fluid End Body
608	180-165000-220	-	3	Lubrication Fitting
612	001-024959-XXX	B,S	3	Adapter, F.E./P.E.
618	104-034234-271	-	8	Stud (Brz. & Ductile F.E.)
	253-034135-271	-	8	Stud (Steel F.E.)
* 619	189-034112-220	-	8	Washer (Brz. & Ductile F.E.)
620	133-034010-243	-	8	Nut
640	002-012800-XXX	B,D	5	Cylinder Head
641	204-000104-206	-	6	Gasket
650	008-024969-220	-	1	Suction Manifold
651	204-000104-206	-	3	Seal (Steel F.E.)
652	100-034200-273	-	12	Cap Screw
654	170-034002-403	-	1	Plug
681	001-007986-201	-	3	Baffle Disc
* 685	001-024970-282	-	1	Name Plate
* 686	126-004014-220	-	4	Drive Screw
* 693	002-025720-231	-	1	Spanner Wrench
	- - - - SUCTION COMPANION FLANGES - - - -			
**657	190-060151-250	-	1	Flange, Slip-on
**658	192-060151-250	-	1	Blind Flange
659	204-000054-206	-	2	Gasket
660	100-034200-273	-	16	Cap Screw (Brz. or Ductile F.E.)
	104-034400-271	-	16	Stud (Steel F.E.)
661	133-034010-243	-	32	Nut (Steel F.E.)
	DISCHARGE COMPANION FLANGES; STEEL FLUID END			
**671	002-024957-250	-	1	Flange, Weld Neck
**672	002-024958-250	-	1	Blind Flange
673	001-024960-200	-	2	Gasket
674	104-034234-271	-	8	Stud
75	133-034010-243	-	8	Nut
	DISCHARGE COMPANION FLANGES; BRZ. OR DUCTILE F.E.			
**671	190-030601-250	-	1	Flange, Slip-On
**672	192-030601-250	-	1	Blind Flange
673	204-000034-206	-	2	Gasket
674	100-034212-273	-	16	Cap Screw
	- - - - - - STUFFING BOX GLAND NUT - - - - - -			
697	001-014155-XXX	B,D	3	Gland Nut
	- - - - - - - - - - THROAT BUSHING - - - - - - - - - -			
705	001-024971-XXX	B,S	3	2-3/4" Throat Bushing
	001-025961-XXX	B,S	3	3" Throat Bushing
	001-025962-XXX	B,S	3	3-1/4" Throat Bushing
	001-024976-XXX	B,S	3	3-3/8" Throat Bushing
	- - - - - - - - - - LANTERN RING - - - - - - - - - -			
706	001-024972-XXX	B,S	3	2-3/4" Lantern Ring
	001-011195-XXX	B,S	3	3" Lantern Ring
	001-011197-XXX	B,S	3	3-1/4" Lantern Ring
	001-024975-XXX	B,S	3	3-3/8" Lantern Ring
	- - - - - - - - - - - - FOLLOWER - - - - - - - - - - - -			
707	001-024974-XXX	B,S	3	2-3/4" Follower
	001-011188-XXX	B,S	3	3" Follower
	001-011190-XXX	B,S	3	3-1/4" Follower
	001-024977-XXX	B,S	3	3-3/8" Follower
	- - - - - - - PACKING SET STYLE 238 - - - - - - -			
720	218-234318-370	-	3	2-3/4" Packing
	218-300281-370	-	3	3" Packing
	218-314214-370	-	3	3-1/4" Packing
	218-338214-370	-	3	3-3/8" Packing
	- - - - - - - PACKING SET STYLE 235 - - - - - - -			
723	437-234438-395	-	3	2-3/4" Packing
	437-300438-395	-	3	3" Packing
	437-314312-395	-	3	3-1/4" Packing
	437-338312-395	-	3	3-3/8" Packing
15	170-018002-220	-	3	Plug (Replaces Lube fitting when using Style 235 Packing)

ITEM NO.	PART NUMBER	MATL. AVAIL.	QTY.	PART DESCRIPTION
	- - - - - - - - - - - - PLUNGERS - - - - - - - - - - - -			
735	002-024961-999	-	3	2-3/4" Wheataloy Plunger
	002-024962-999	-	3	3" Wheataloy Plunger
	002-024963-999	-	3	3-1/4" Wheataloy Plunger
	002-024964-999	-	3	3-3/8" Wheataloy Plunger
* 736	002-024965-999	-	3	2-3/4" Ceramic Plunger
	002-024966-999	-	3	3" Ceramic Plunger
	002-024967-999	-	3	3-1/4" Ceramic Plunger
	002-024968-999	-	3	3-3/8" Ceramic Plunger
	- - - - - - - - - - - - VALVES - - - - - - - - - - - -			
	Cetcon Disc Stainless Steel			
800	998-016330-013	-	6	Complete Valve Assembly
	Valve Assembly Includes The Following Items:			
801	001-003591-263	SS	1	Seat
802	001-010975-320	-	1	Disc
803	001-008734-362	-	1	Spring
804	186-170058-263	SS	1	Sleeve
805	001-005735-263	SS	1	Retainer
806	130-012013-263	SS	1	Nut
	Formed Disc, Stainless Steel			
821	998-016331-031	-	6	Complete Valve Assembly
	Valve Assembly Includes The Following Items:			
823	001-021146-263	SS	1	Seat
824	001-021142-263	SS	1	Disc
825	001-021144-362	-	1	Spring
826	001-021145-263	-	1	Sleeve
827	001-021143-263	SS	1	Retainer
828	130-012013-263	SS	1	Nut
829	102-012218-263	-	1	Stud
	- - - - - - - - OPTIONAL EQUIPMENT - - - - - - - -			
* 889	001-027585-999	-	1	Cylinder Head Wrench
* 890	998-016330-017	-	1	Valve Seat Puller for Item 801 and 821

Last Three Digits XXX

On Parts with Optional Materials, Where XXX is Shown, Replace XXX with the Following Digits For:

Steel - - - - - - Use 220
Bronze - - - - - - Use 306
Ductile - - - - - - Use 353
Stainless Steel - Use 263

Material Available

B = Bronze
D = Ductile Iron
S = Steel
SS = Stainless Steel
- = No Material Selection Necessary

* Not Shown on Parts Drawing

Note: When Ordering Parts, Give:

1) Pump Serial Number
2) Pump Model Number
3) Part Number
4) Quantity
5) Part Name
6) Item Number
7) Trim Size
8) Material

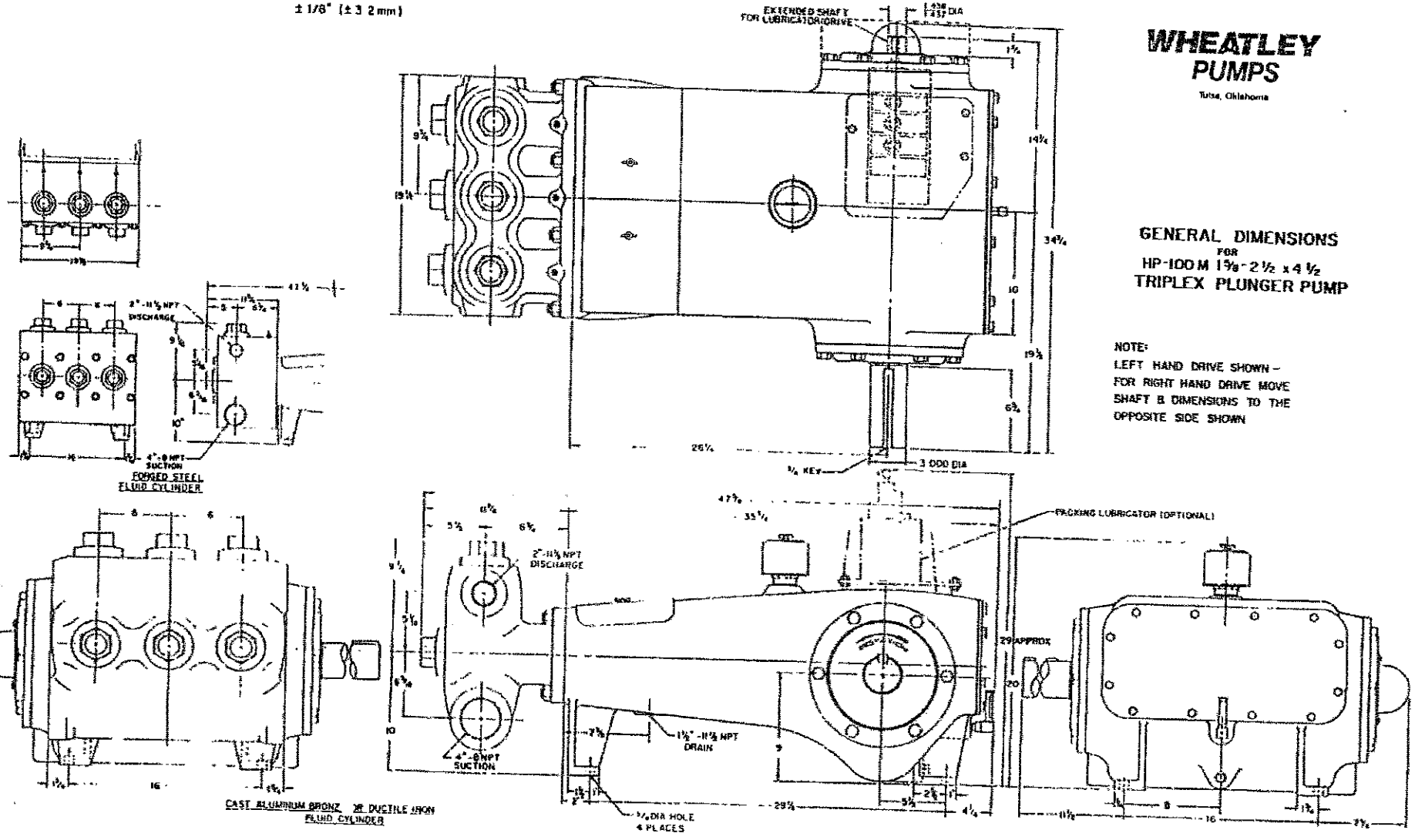
WHEATLEY PUMPS
Tulsa, Oklahoma

NOTE:
FOR INSTALLATION PURPOSES -
TOLERANCES FOR ALL DIMENSIONS
(UNLESS OTHERWISE NOTED) ARE
± 1/8" (± 3.2 mm)

WHEATLEY
PUMPS
Tulsa, Oklahoma

GENERAL DIMENSIONS
FOR
HP-100 M 1⅝ - 2½ x 4½
TRIPLEX PLUNGER PUMP

NOTE:
LEFT HAND DRIVE SHOWN -
FOR RIGHT HAND DRIVE MOVE
SHAFT & DIMENSIONS TO THE
OPPOSITE SIDE SHOWN



REV. 2-22-85 DLM

I-24214

PARTS LIST FOR

MODEL HP-100M FLUID END

ITEM NO.	PART NUMBER	QTY	PART DESCRIPTION/SIZE	
	FLUID END			
	150-165000-220	3	GREASE FITTING (OMIT W/PKG. LUBE)	
	001-023574-XXX	3	ADAPTER (B=316, S=236, SS=278)	
[illegible]	110-000236-200	3	O-RING	
620	133-034010-256	8	NUT	
640	002-023549-XXX	6	CYLINDER HEAD (B=316, D=351)	
641	204-000005-206	6	GASKET	
654	170-034002-405	1	PLUG	
661	001-007986-201	3	BAFFLE DISC	
*555	002-028270-405	1	NAMEPLATE	
*556	126-004014-405	4	DRIVE SCREW	
*893	002-027780-351	1	SPANNER WRENCH	
	FORGED FLUID END			
600	006-023553-XXX	1	BODY (B=315, S=250)	
618	253-034125-271	6	STUD	
	CAST FLUID END			
600	008-024163-XXX	1	BODY (B=316, D=351)	
618	102-034234-271	8	STUD	
697	**GLAND NUT**			
	002-007977-XXX	3	(B=304, S=227, SS=261)	
	001-007977-351	3	(D)	
705	**THROAT BUSHING**			
	001-010662-XXX	3	1-5/8"	
	001-010887-XXX	3	1-3/4"	
	001-010899-XXX	3	1-7/8"	B=302
	001-010901-XXX	3	2"	S=235
	001-010902-XXX	3	2-1/8"	
	001-007979-XXX	3	2-1/4"	
	001-025919-XXX	3	2-1/2"	
706	**LANTERN RING**			
	001-023663-XXX	3	1-5/8"	
	001-010990-XXX	3	1-3/4"	
	001-014457-XXX	3	1-7/8"	B=302
	001-010991-XXX	3	2"	S=235
	001-014456-XXX	3	2-1/8"	
	001-010288-XXX	3	2-1/4"	
	001-010804-XXX	3	2-1/2"	
707	**FOLLOWER**			
	001-023661-XXX	3	1-5/8"	
	001-010933-XXX	3	1-3/4"	
	001-014459-XXX	3	1-7/8"	B=302
	001-010931-XXX	3	2"	S=235
	001-014458-XXX	3	2-1/8"	
	001-007983-XXX	3	2-1/4"	
	001-008745-XXX	3	2-1/2"	
723	**BRAID PACKING W/SPACERS**			
	288-158300-XXX	3	1-5/8"	
	288-134318-XXX	3	1-3/4"	
	288-178331-XXX	3	1-7/8"	STYLE 228=339
	288-200300-XXX	3	2"	STYLE 241=337
	288-218314-XXX	3	2-1/8"	STYLE 255=395
	288-214338-XXX	3	2-1/4"	
	288-212278-XXX	3	2-1/2"	
720	**STYLE 838 PACKING**			
	181-158253-370	3	1-5/8"	
	181-134244-370	3	1-3/4"	
	181-178244-370	3	1-7/8"	
	181-200214-370	3	2"	
	181-218214-370	3	2-1/8"	
	181-214214-370	3	2-1/4"	
	181-212178-370	3	2-1/2"	
730	**STYLE 1059-4 PACKING**			
	428-134212-398	3	1-3/4"	
	428-178212-398	3	1-7/8"	
	428-200236-398	3	2"	
	428-218212-398	3	2-1/8"	
	428-214212-398	3	2-1/4"	
	428-212244-398	3	2-1/2"	

ITEM NO.	PART NUMBER	QTY	PART DESCRIPTION/SIZE	
729	**REPLACEMENT RING SETS**			
	428-134114-999	3	1-3/4"	
	428-178118-999	3	1-7/8"	
	428-200100-999	3	2"	
	428-218078-998	3	2-1/8"	
	428-214034-999	3	2-1/4"	
	428-212012-998	3	2-1/2"	
735	**WHEATALOY PLUNGERS**			
	002-024434-999	3	1-5/8"	
	002-024435-998	3	1-3/4"	
	002-024436-998	3	1-7/8"	
	002-024437-998	3	2"	
	002-024438-998	3	2-1/8"	
	002-024439-998	3	2-1/4"	
	002-024441-999	3	2-1/2"	
736	**CERAMIC PLUNGERS**			
	002-024693-999	3	1-5/8"	
	002-024694-998	3	1-3/4"	
	002-024695-998	3	1-7/8"	
	002-024696-998	3	2"	
	002-024697-998	3	2-1/8"	
	002-024698-998	3	2-1/4"	
	002-024699-998	3	2-1/2"	
	VALVES			
800	998-018301-013	6	CELCON DISC/BRZ ASS'Y	
	EACH ASSEMBLY CONSISTS OF THE FOLLOWING ITEMS:			
801	001-003245-316	1	SEAT	
802	001-010937-320	1	CELCON DISC	
803	001-008734-362	1	SPRING	
804	186-170058-365	1	SLEEVE	
805	002-005735-316	1	RETAINER	
806	150-012013-306	1	LOCK NUT	
800	998-018300-017	6	CELCON DISC/SS ASS'Y	
	EACH ASSEMBLY CONSISTS OF THE FOLLOWING ITEMS:			
801	001-008245-261	1	SEAT	
802	001-010937-320	1	CELCON DISC	
803	001-008734-362	1	SPRING	
804	186-170058-365	1	SLEEVE	
805	002-005735-261	1	RETAINER	
806	150-012013-278	1	LOCK NUT	
840	001-027843-999	6	ABRASION RESISTANT/SS ASS'Y	
	EACH ASSEMBLY CONSISTS OF THE FOLLOWING ITEMS:			
811	001-027843-001	1	SEAT	
812	001-027843-002	1	O-RING	
813	001-027843-004	1	BODY	
814	001-027843-003	1	POLYURETHANE INSERT	
815	001-027843-005	1	SPRING	
817	001-027843-006	1	RETAINER	
822	998-810013-018	6	SS FORMED DISC/SS ASS'Y	
	EACH ASSEMBLY CONSISTS OF THE FOLLOWING ITEMS:			
823	001-008245-261	1	SEAT	
824	001-009014-263	1	FORMED DISC	
825	001-009353-362	1	SPRING	
826	186-170038-365	1	SLEEVE	
827	001-009352-261	1	RETAINER	
828	150-012013-278	1	LOCK NUT	
	OPTIONAL TOOLS			
*889	001-027584-999	1	CYLINDER HEAD HAMMER WRENCH	
*890	998-04240M-091	1	SEAT PULLER (ITEM 811)	
	998-04240M-092	1	SEAT PULLER (ITEM 801)	

* NOT SHOWN ON PARTS DRAWING

MATERIALS AVAILABLE (XXX)
B = BRONZE
D = DUCTILE IRON
S = CARBON STEEL
SS = STAINLESS STEEL

NOTE: WHEN ORDERING PARTS, GIVE:
1) PUMP SERIAL NUMBER
2) PUMP MODEL NUMBER
3) PART NUMBER
4) QUANTITY
5) PART NAME
6) ITEM NUMBER
7) TRIM SIZE
8) MATERIAL

REVISION DATE: 06-14-88

PARTS LIST FOR

MODEL HP-100 POWER END

ITEM NO.	PART NUMBER	QTY	PART DESCRIPTION
001	008-023274-350	1	POWER FRAME
007	170-012005-353	1	PIPE PLUG, MAGNETIC
014	001-013059-999	1	FILLER/BREATHER CAP
020	001-010803-999	1	OIL LEVEL SITE GLASS
*040	001-023575-282	1	EXTENSION GUARD
*041	154-014049-220	2	LOCK WASHER
*042	113-014038-220	2	MACHINE SCREW
048	001-023380-231	1	CRANKCASE COVER
049	001-023667-204	1	CRANKCASE GASKET
050	100-038034-286	12	CAP SCREW
066	170-114003-220	1	PIPE PLUG
070	001-023501-220	1	CRADLE COVER
072	104-038100-286	1	STUD
073	187-03806-286	2	WING NUT
105	008-023061-351	1	CRANKSHAFT
109	146-034500-236	1	KEY
135	120-325066-999	2	END MAIN BEARING
141	002-023230-359	2	BEARING HOUSING
154	100-058112-286	12	CAP SCREW
157	145-318418-999	2	OIL SEAL
198	004-023120-359	3	CONNECTING ROD & CAP
200	002-028392-999	3	SHELL BEARING
202	154-058108-220	6	LOCK WASHER
203	100-058314-273	6	CAP SCREW
211	001-023129-302	3	BRONZE BUSHING
212	004-023127-359	3	CROSSHEAD
213	001-023128-236	3	WRIST PIN
216	002-025366-237	3	WIPER BOX
217	110-000248-201	3	O-RING
219	145-158238-999	9	PONY ROD SEAL
221	002-025365-231	3	GLAND
222	104-038134-286	6	STUD
223	150-038016-306	6	LOCK NUT
*263	001-004837-282	1	LUBRICATION NAMEPLATE
264	126-004014-405	4	DRIVE SCREW
276	998-810000-037	1	SHIM GASKET KIT

OPTIONAL PARTS AND KITS

*200			SHELL BEARINGS:
	002-028393-999	3	(0.010" UNDERSIZE)
	002-028394-999	3	(0.020" UNDERSIZE)
	002-028395-999	3	(0.040" UNDERSIZE)
*2122	998-810000-002	3	CONNECTING ROD KIT (CONSISTS OF ITEMS: 198, 202, 203, 211)
*9030	998-810000-010	1	PACKING LUBRICATOR KIT (LHD)
*9031	998-810000-011	1	PACKING LUBRICATOR KIT (RHD)
*9049	998-810000-036	3	WIPER BOX KIT (CONSISTS OF ITEMS: 221, 222 & 223)
*9050	998-81000-038	1	POWER END GASKET KIT (CONSISTS OF ITEMS: 049, 157, 217 & 276)

* NOT SHOWN ON PARTS DRAWING

** OMIT WHEN PACKING LUBRICATOR IS USED

NOTE: WHEN ORDERING PARTS, GIVE

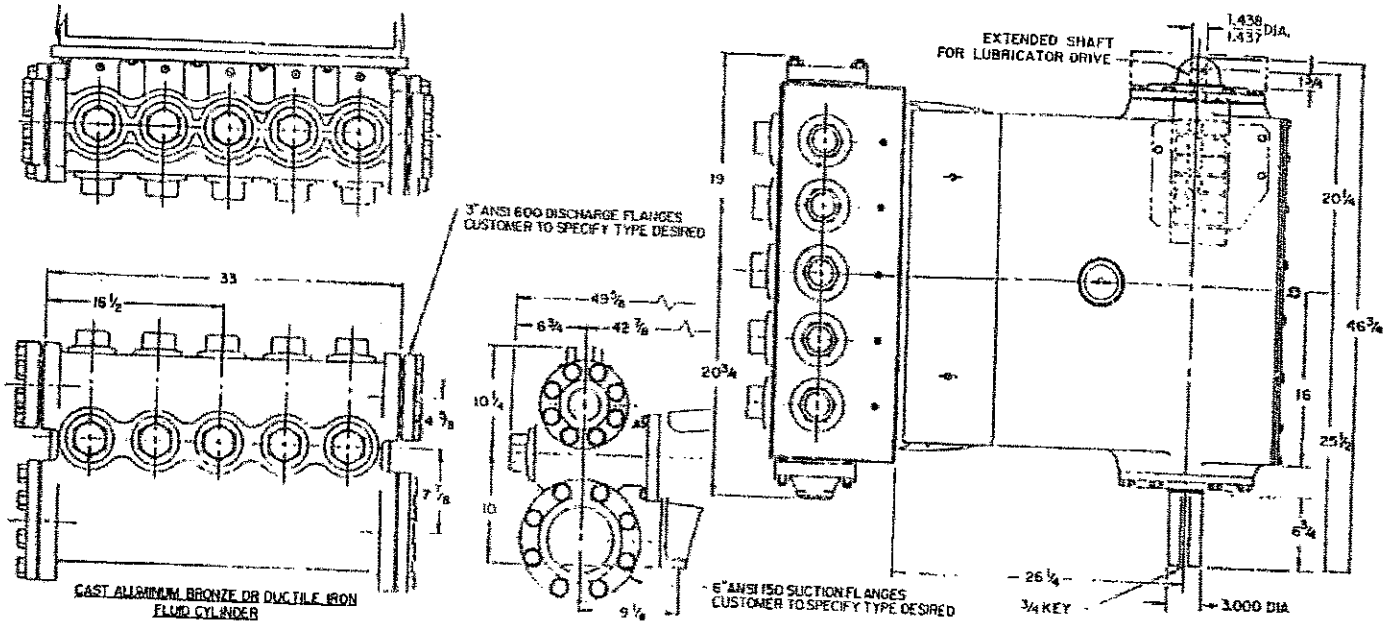
1) PUMP SERIAL NUMBER
2) PUMP MODEL NUMBER
3) PART NUMBER
4) QUANTITY
5) PART NAME
6) ITEM NUMBER

REVISION DATE: 05-03-89

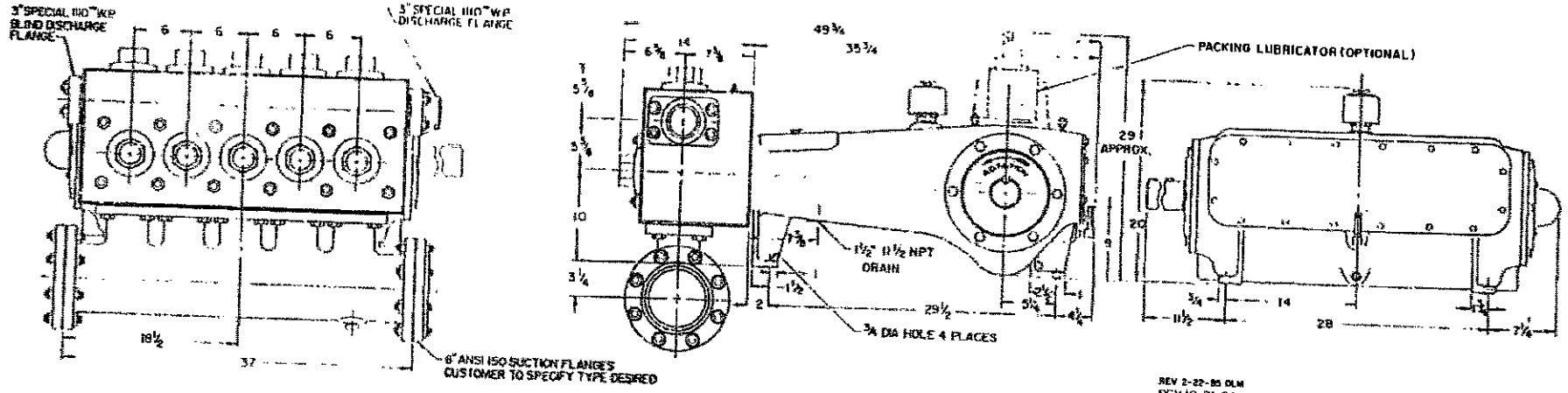
NOTE
FOR INSTALLATION PURPOSES -
TOLERANCES FOR ALL DIMENSIONS
(UNLESS OTHERWISE NOTED) ARE
± 1/8" (± 3.2 mm).

WHEATLEY
PUMPS

GENERAL DIMENSIONS
FOR
HP-165L 2¾-3⅜x4½
QUINTUPLEX PLUNGER PUMP



NOTE:
LEFT HAND DRIVE SHOWN -
FOR RIGHT HAND DRIVE MOVE
SHAFT & DIMENSIONS TO THE
OPPOSITE SIDE SHOWN.



REV 2-22-85 DLH
REV 10-23-80 J.P.N.
REV 12-7-79 B.R.W.
9-20-79 BRYAN WILSON

I-25019

Date: 3-18-85

Supersedes _____

Use with Drawing 1-25012

PARTS LIST FOR
MODEL HP-165L FLUID END
2 3/4" - 3 3/8" x 4 1/2" QUINTUPLEX PLUNGER PUMP

ITEM NO.	PART NUMBER	MATL. AVAIL.	QTY.	PART DESCRIPTION
	- - - - - - - - - - - - FLUID END - - - - - - - - - - - - - -			
600	008-025004-220	S	1	Fluid End Body
	008-025003-XXX	B,D	1	Fluid End Body
608	180-165000-220	-	5	Lubrication Fitting
612	001-024959-XXX	B,S	5	Adapter, F.E./P.E.
618	104-034234-271	-	12	Stud (Brz. & Ductile F.E.)
	253-034135-271	-	12	Stud (Steel F.E.)
* 619	189-034112-220	-	12	Washer (Brz. & Ductile F.E.)
620	133-034010-243	-	12	Nut
640	002-012800-XXX	B,D	10	Cylinder Head
641	204-000104-206	-	10	Gasket
650	008-025006-220	-	1	Suction Manifold
651	204-000104-206	-	5	Seal (Steel F.E.)
652	100-034200-273	-	20	Cap Screw
654	170-034002-405	-	1	Plug
681	001-007986-201	-	5	Baffle Disc
* 685	001-025011-282	-	1	Name Plate
* 686	126-004014-220	-	4	Drive Screw
* 693	002-025720-231	-	1	Spanner Wrench
	- - - - SUCTION COMPANION FLANGES - - - -			
**637	190-060151-250	-	1	Flange, Slip-on
**638	192-060151-250	-	1	Blind Flange
659	204-000054-206	-	2	Gasket
660	100-034200-273	-	16	Cap Screw (Brz. or Ductile F.E.)
	104-034400-271	-	16	Stud (Steel F.E.)
661	133-034010-243	-	32	Nut (Steel F.E.)
	DISCHARGE COMPANION FLANGES; STEEL FLUID END			
**671	002-024957-250	-	1	Flange, Weld Neck
**672	002-024958-250	-	1	Blind Flange
673	001-024960-200	-	2	Gasket
674	104-034234-271	-	8	Stud
675	133-034010-243	-	8	Nut
	DISCHARGE COMPANION FLANGES; BRZ. OR DUCTILE F.E.			
**671	190-030601-250	-	1	Flange, Slip-On
**672	192-030601-250	-	1	Blind Flange
673	204-000034-206	-	2	Gasket
674	100-034212-273	-	16	Cap Screw
	- - - - - - STUFFING BOX GLAND NUT - - - - - -			
697	001-014155-XXX	B,D	5	Gland Nut
	- - - - - - - - - - THROAT BUSHING - - - - - - - - - -			
705	001-024973-XXX	B,S	5	2-3/4" Throat Bushing
	001-025961-XXX	B,S	5	3" Throat Bushing
	001-025962-XXX	B,S	5	3-1/4" Throat Bushing
	001-024976-XXX	B,S	5	3-3/8" Throat Bushing
	- - - - - - - - - - LANTERN RING - - - - - - - - - -			
706	001-024972-XXX	B,S	5	2-3/4" Lantern Ring
	001-011195-XXX	B,S	5	3" Lantern Ring
	001-011197-XXX	B,S	5	3-1/4" Lantern Ring
	001-024975-XXX	B,S	5	3-3/8" Lantern Ring
	- - - - - - - - - - - - FOLLOWER - - - - - - - - - - - -			
707	001-024974-XXX	B,S	5	2-3/4" Follower
	001-011185-XXX	B,S	5	3" Follower
	001-011190-XXX	B,S	5	3-1/4" Follower
	001-024977-XXX	B,S	5	3-3/8" Follower
	- - - - - - - PACKING SET STYLE 838 - - - - - - -			
720	218-234218-370	-	5	2-3/4" Packing
	218-300281-370	-	5	3" Packing
	218-314214-370	-	5	3-1/4" Packing
	218-338214-370	-	5	3-3/8" Packing
	- - - - - - - PACKING SET STYLE 255 - - - - - - -			
723	437-234438-395	-	5	2-3/4" Packing
	437-300438-395	-	5	3" Packing
	437-314312-395	-	5	3-1/4" Packing
	437-338312-395	-	5	3-3/8" Packing
*715	170-014002-220	-	5	Plug (Replaces Lube fitting when using Style 255 Packing)

ITEM NO.	PART NUMBER	MATL. AVAIL.	QTY.	PART DESCRIPTION
	- - - - - - - - - - - - PLUNGERS - - - - - - - - - - - -			
735	002-024961-999	-	5	2-3/4" Wheataloy Plunger
	002-024962-999	-	5	3" Wheataloy Plunger
	002-024963-999	-	5	3-1/4" Wheataloy Plunger
	002-024964-999	-	5	3-3/8" Wheataloy Plunger
* 736	002-024965-999	-	5	2-3/4" Ceramic Plunger
	002-024966-999	-	5	3" Ceramic Plunger
	002-024967-999	-	5	3-1/4" Ceramic Plunger
	002-024968-999	-	5	3-3/8" Ceramic Plunger
	- - - - - - - - - - - - VALVES - - - - - - - - - - - -			
	Celcon Disc Stainless Steel			
800	998-016330-013	-	10	Complete Valve Assembly
	Valve Assembly Includes The Following Items:			
801	001-003591-263	SS	1	Seat
802	001-010975-320	-	1	Disc
803	001-008734-362	-	1	Spring
804	184-170058-263	SS	1	Sleeve
805	001-005735-263	SS	1	Retainer
806	150-012013-263	SS	1	Nut
	Formed Disc, Stainless Steel			
822	998-016331-031	-	10	Complete Valve Assembly
	Valve Assembly Includes The Following Items:			
823	001-021146-263	SS	1	Seat
824	001-021142-263	SS	1	Disc
825	001-021144-362	-	1	Spring
826	001-021145-263	-	1	Sleeve
827	001-021143-263	SS	1	Retainer
828	150-012013-263	-	1	Nut
829	102-012218-263	-	1	Stud
	- - - - - - - - OPTIONAL EQUIPMENT - - - - - - - -			
* 889	001-027585-999	-	1	Cylinder Head Wrench
* 890	998-016330-017	-	1	Valve Seat Puller for Item 801 and 823

Last Three Digits XXX

On Parts with Optional Materials, Where XXX is Shown, Replace XXX with the Following Digits For:

Steel - - - - - - Use 220
Bronze - - - - - Use 306
Ductile - - - - - Use 333
Stainless Steel - Use 263

Material Available

B = Bronze
D = Ductile Iron
S = Steel
SS = Stainless Steel
- = No Material Selection Necessary

* Not Shown on Parts Drawing

Note: When Ordering Parts, Give:

1) Pump Serial Number
2) Pump Model Number
3) Part Number
4) Quantity
5) Part Name
6) Item Number
7) Trim Size
8) Material

WHEATLEY PUMPS
Tulsa, Oklahoma

Date: 3-18-85

Supersedes _____

Use with Drawing 1-24519

PARTS LIST FOR
MODEL HP-165M FLUID END
1 5/8" - 2 1/2" x 4 1/2" QUINTUPLEX PLUNGER PUMP

WHEATLEY PUMPS
Tulsa, Oklahoma

ITEM NO.	PART NUMBER	MATL. AVAIL.	QTY.	PART DESCRIPTION
	- - - - - - - - - - - - F L U I D E N D - - - - - - - - - - - -			
600	008-024876-220	S	1	Fluid End Body
	008-024255-XXX	B,D	1	Fluid End Body
608	180-165000-220	-	5	Lubrication Fitting
612	001-023574-XXX	B,S	5	Adapter, F.E./P.E.
618	104-034234-271	-	12	Stud (Brz. & Ductile F.E.)
	253-034125-271	-	12	Stud (Steel F.E.)
* 619	189-034112-220	-	12	Washer (Brz. & Ductile F.E.)
620	133-034010-243	-	12	Nut
640	002-023545-XXX	B,D	10	Cylinder Head
641	204-000005-206	-	10	Gasket
650	008-024256-220	-	1	Suction Manifold (Steel F.E.)
651	204-000166-206	-	5	Gasket
652	100-100200-273	-	20	Cap Screw
654	170-034002-405	-	1	Plug
681	001-007986-201	-	5	Baffle Disc
* 685	001-024329-282	-	1	Name Plate
* 686	126-004014-220	-	4	Drive Screw
* 693	002-022780-351	D	1	Spanner Wrench
	- - - - S U C T I O N C O M P A N I O N F L A N G E S - - - -			
**657	190-040301-250	-	1	Flange, Slip-On
**658	192-040301-250	-	1	Blind Flange
659	204-000047-206	-	2	Gasket
660	100-034214-273	-	16	Cap Screw (Brz. or Ductile F.E.)
	104-034414-271	-	16	Stud (Steel F.E.)
661	133-034010-243	-	32	Nut (Steel F.E.)
	D I S C H A R G E C O M P A N I O N F L A N G E S; STEEL FLUID END			
**671	002-024875-250	-	1	Flange, Weld Neck
**672	002-024889-250	-	1	Blind Flange
673	001-010141-200	-	2	Gasket
674	104-078400-271	-	8	Stud
675	133-078009-243	-	8	Nut
	D I S C H A R G E C O M P A N I O N F L A N G E S; BRZ. OR DUCTILE F.E.			
**671	190-021501-250	-	1	Flange, Slip-On
**672	192-021501-250	-	1	Blind Flange
673	204-000010-206	-	2	Gasket
674	100-078254-273	-	16	Cap Screw
	- - - - - - S T U F F I N G B O X G L A N D N U T - - - - - -			
697	002-007977-XXX	B	5	Gland Nut
	001-007977-XXX	D	5	Gland Nut
	- - - - - - - - - - T H R O A T B U S H I N G - - - - - - - - - -			
705	001-023662-XXX	B,S	5	1-5/8" Throat Bushing
	001-010897-XXX	B,S	5	1-3/4" Throat Bushing
	001-010899-XXX	B,S	5	1-7/8" Throat Bushing
	001-010901-XXX	B,S	5	2" Throat Bushing
	001-010902-XXX	B,S	5	2-1/8" Throat Bushing
	001-007979-XXX	B,S	5	2-1/4" Throat Bushing
	001-025819-XXX	B,S	5	2-1/2" Throat Bushing
	- - - - - - - - - - L A N T E R N R I N G - - - - - - - - - -			
706	001-023663-XXX	B,S	5	1-5/8" Lantern Ring
	001-010990-XXX	B,S	5	1-3/4" Lantern Ring
	001-014457-XXX	B,S	5	1-7/8" Lantern Ring
	001-010991-XXX	B,S	5	2" Lantern Ring
	001-014456-XXX	B,S	5	2-1/8" Lantern Ring
	001-010266-XXX	B,S	5	2-1/4" Lantern Ring
	001-010904-XXX	B,S	5	2-1/2" Lantern Ring
	- - - - - - - - - - - - F O L L O W E R - - - - - - - - - - - -			
707	001-023661-XXX	B,S	5	1-5/8" Follower
	001-010933-XXX	B,S	5	1-3/4" Follower
	001-014459-XXX	B,S	5	1-7/8" Follower
	001-010931-XXX	B,S	5	2" Follower
	001-014458-XXX	B,S	5	2-1/8" Follower
	001-007983-XXX	B,S	5	2-1/4" Follower
	001-008745-XXX	B,S	5	2-1/2" Follower
	- - - - - - - P A C K I N G S E T S T Y L E 8 3 8 - - - - - - -			
720	181-158238-370	-	5	1-5/8" Packing
	181-134264-370	-	5	1-3/4" Packing
	181-178244-370	-	5	1-7/8" Packing
	181-200214-370	-	5	2" Packing
	181-218214-370	-	5	2-1/8" Packing
	181-214714-370	-	5	2-1/4" Packing
	181-[illegible] 8-370	-	5	2-1/2" Packing

ITEM NO.	PART NUMBER	MATL. AVAIL.	QTY.	PART DESCRIPTION
	- - - - - - P A C K I N G S E T S T Y L E 2 5 5 - - - - - - -			
723	288-158314-395	-	5	1-5/8" Packing
	288-134318-395	-	5	1-3/4" Packing
	288-178331-395	-	5	1-7/8" Packing
	288-200300-395	-	5	2" Packing
	288-218314-395	-	5	2-1/8" Packing
	288-214338-395	-	5	2-1/4" Packing
	288-212278-395	-	5	2-1/2" Packing
*715	170-018002-220	-	5	Plug (Replaces Lube fitting when using Style 255 Packing)
	- - - - - - - - - - - - P L U N G E R S - - - - - - - - - - - -			
735	002-024434-999	-	5	1-5/8" Wheataloy Plunger
	002-024435-999	-	5	1-3/4" Wheataloy Plunger
	002-024436-999	-	5	1-7/8" Wheataloy Plunger
	002-024437-999	-	5	2" Wheataloy Plunger
	002-024438-999	-	5	2-1/8" Wheataloy Plunger
	002-024439-999	-	5	2-1/4" Wheataloy Plunger
	002-024441-999	-	5	2-1/2" Wheataloy Plunger
* 736	002-024693-999	-	5	1-5/8" Ceramic Plunger
	002-024694-999	-	5	1-3/4" Ceramic Plunger
	002-024695-999	-	5	1-7/8" Ceramic Plunger
	002-024696-999	-	5	2" Ceramic Plunger
	002-024697-999	-	5	2-1/8" Ceramic Plunger
	002-024698-999	-	5	2-1/4" Ceramic Plunger
	002-024699-999	-	5	2-1/2" Ceramic Plunger
	- - - - - - - - - - - - V A L V E S - - - - - - - - - - - -			
	Celcon Disc Stainless Steel			
800	998-016300-017	-	10	Complete Valve Assembly
	Valve Assembly Includes The Following Items:			
801	001-008245-263	SS	1	Seat
802	001-010937-320	-	1	Disc
803	001-008734-262	-	1	Spring
804	186-170038-263	SS	1	Sleeve
805	002-005735-263	SS	1	Retainer
806	150-012013-263	SS	1	Nut
	Formed Disc, Stainless Steel			
822	998-810013-016	-	10	Complete Valve Assembly
	Valve Assembly Includes The Following Items:			
823	001-008245-263	SS	1	Seat
824	001-009014-263	SS	1	Disc
825	001-009353-262	-	1	Spring
826	186-170038-263	SS	1	Sleeve
827	001-009352-263	SS	1	Retainer
828	150-012013-263	SS	1	Nut
	- - - - - - - - O P T I O N A L E Q U I P M E N T - - - - - - - -			
* 889	001-027584-999	-	1	Cylinder Head Wrench
* 890	998-810013-049	-	1	Valve Seat Puller for Item 801 and 823

Last Three Digits XXX
On Parts with Optional Materials, Where XXX is Shown, Replace XXX with the Following Digits For:

Steel - - - - - - Use 220
Bronze - - - - - Use 306
Ductile - - - - - Use 331
Stainless Steel - Use 263

Material Available

B = Bronze
D = Ductile Iron
S = Steel
SS = Stainless Steel
- = No Material Selection Necessary

* Not Shown on Parts Drawing
** Flanges Listed are Standard: for Other Type Flanges, consult Factory

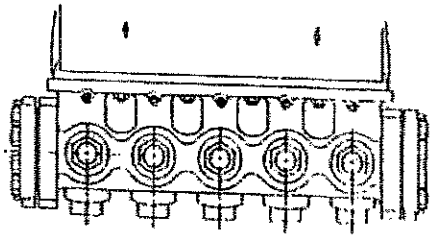
Note: When Ordering Parts, Give:

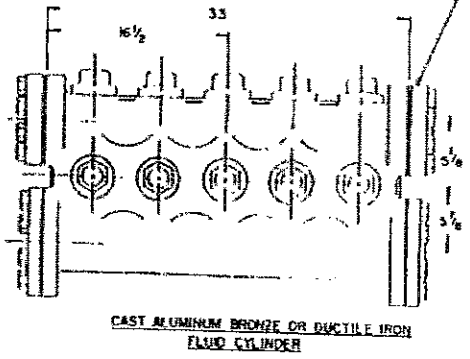
1) Pump Serial Number
2) Pump Model Number
3) Part Number
4) Quantity
5) Part Name
6) Item Number
7) Trim Size
8) Material

NOTE
FOR INSTALLATION PURPOSES -
TOLERANCES FOR ALL DIMENSIONS
(UNLESS OTHERWISE NOTED) ARE
±1/8" (3.2 mm)

WHEATLEY
PUMPS

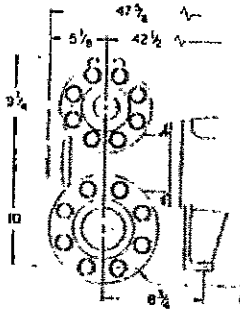
GENERAL DIMENSIONS
FOR
HP-165M 1⅝-2½x4½
QUINTUPLEX PLUNGER PUMP



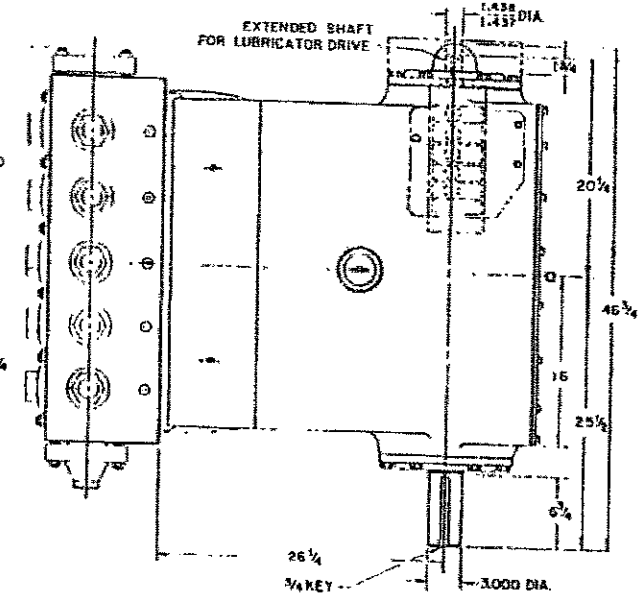


CAST ALUMINUM BRONZE OR DUCTILE IRON
FLUID CYLINDER

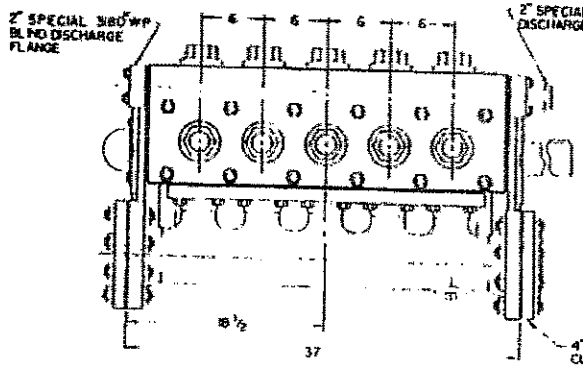
2" ANSI 1500 DISCHARGE FLANGES
CUSTOMER TO SPECIFY TYPE DESIRED



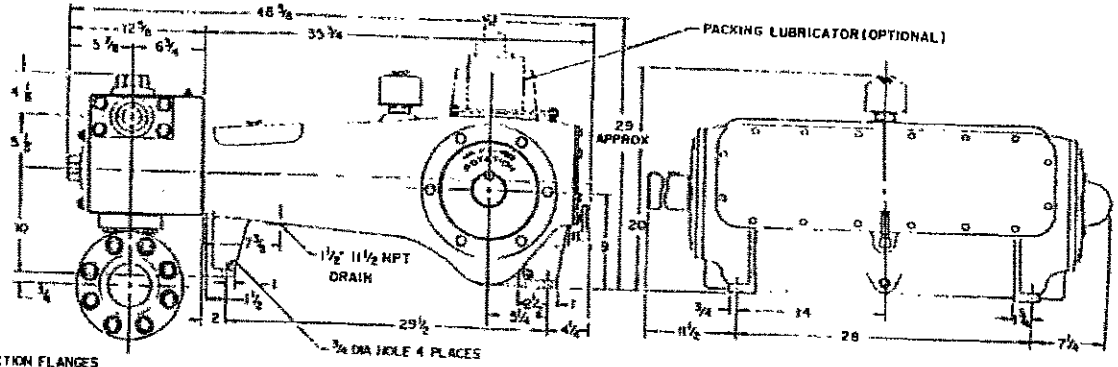
4" ANSI 300 SUCTION FLANGES
CUSTOMER TO SPECIFY TYPE DESIRED



NOTE:
LEFT HAND DRIVE SHOWN -
FOR RIGHT HAND DRIVE MOVE
SHAFT & DIMENSIONS TO THE
OPPOSITE SIDE SHOWN



4" ANSI 300 SUCTION FLANGES
CUSTOMER TO SPECIFY TYPE DESIRED
(RAISED FACE SLIP-ON TYPE STANDARD)



REV 2-27-84 BLM
REV 10-28-80 JPH
8-29-79 BRYAN WILSON

I-24542

Liquid End Parts List
Model HP165AM

ITEM NO.	PART NUMBER	QTY	PART DESCRIPTION
08	180-165000-220	5	GREASE ZERK
	170-018002-278	5	PIPE PLUG
612	001-023674-316	5	ADAPTER, BZ
6121	110-000238-200	5	O-RING
631	102-034314-286	60	STUD
632	133-034010-286	60	NUT
625	AAB-029606-316	10	VALVE COVER, BZ
627	110-000236-201	10	O-RING
681	001-007986-201	5	BAFFLE DISC
* 685	AAB-115716-405	1	NAME PLATE, SS
* 686	126-004014-405	4	DRIVE SCREW, SS
* 693	002-027780-351	1	GLAND NUT WRENCH

CAST LIQUID END

600	AAD-029613-316	1	LIQUID END, BZ
618	102-034234-286	12	STUD
620	133-034010-286	12	NUT

697 GLAND NUT

002-007977-261	5	1-3/4" to 2-1/2", SS

705 THROAT BUSHING

001-010897-XXX	5	1-3/4"	
001-010899-XXX	5	1-7/8"	BZ = 302
001-010901-XXX	5	2"	
001-010902-XXX	5	2-1/8"	
001-007979-XXX	5	2-1/4"	
001-025918-XXX	5	2-1/2"	

706 LANTERN RING

001-010990-XXX	5	1-3/4"	
001-014457-XXX	5	1-7/8"	BZ = 302
001-010991-XXX	5	2"	
001-014456-XXX	5	2-1/8"	
001-010266-XXX	5	2-1/4"	
001-010904-XXX	5	2-1/2"	

707 FOLLOWER

001-010933-XXX	5	1-3/4"	
001-014459-XXX	5	1-7/8"	BZ = 302
001-010931-XXX	5	2"	
001-014458-XXX	5	2-1/8"	
001-007983-XXX	5	2-1/4"	
001-008745-XXX	5	2-1/2"	

720 "J" PACKING STYLES

181-134244-XXX	5	1-3/4"	
181-178244-XXX	5	1-7/8"	STYLE 835 = 344
181-200214-XXX	5	2"	STYLE 838 = 370
181-218214-XXX	5	2-1/8"	STYLE 845 = 374
181-214214-XXX	5	2-1/4"	
181-212178-XXX	5	2-1/2"	

723 "BRAID" PACKING STYLES

288-134234-XXX	5	1-3/4"	STYLE 228 = 339
288-178234-XXX	5	1-7/8"	STYLE 232 = 393
288-200258-XXX	5	2"	STYLE 238 = 395
288-218234-XXX	5	2-1/8"	STYLE 241 = 337
288-214234-XXX	5	2-1/4"	STYLE 8921-K = 456
288-212234-XXX	5	2-1/2"	

730 STYLE 1068-4 PACKING SET

428-134212-340	5	1-3/4"
428-178212-340	5	1-7/8"
428-200238-340	5	2"
428-218212-340	5	2-1/8"
428-214212-340	5	2-1/4"
428-212244-340	5	2-1/2"

729 STYLE 1068-1 PACKING RINGS (FOR STYLE 1068-4 PACKING SET)

428-134114-340	5	1-3/4"
428-178118-340	5	1-7/8"
428-200100-340	5	2"
428-218078-340	5	2-1/8"
428-214034-340	5	2-1/4"
428-212012-340	5	2-1/2"

ITEM NO.	PART NUMBER	QTY	PART DESCRIPTION	
735	"HARD COATED" PLUNGERS			
	002-024435-XXX	5	1-3/4"	
	002-024436-XXX	5	1-7/8"	COLMONOY = 999
	002-024437-XXX	5	2"	TUNGSTEN/S157 = E26
	002-024438-XXX	5	2-1/8"	
	002-024439-XXX	5	2-1/4"	
	002-024441-XXX	5	2-1/2"	
736	"CERAMIC" PLUNGERS			
	002-024694-XXX	5	1-3/4"	
	002-024695-XXX	5	1-7/8"	STANDARD = 999
	002-024696-XXX	5	2"	PREMIUM = 990
	002-024697-XXX	5	2-1/8"	
	002-024698-XXX	5	2-1/4"	
	002-024699-XXX	5	2-=1/2"	

SUCTION & DISCHARGE VALVE ASSEMBLIES

800	998-T4140M0-034	10	CELCON DISC/CF8M ASSEMBLY
	EACH ASSEMBLY CONSISTS OF:		
801	AAB-029404-261	1	SEAT
802	AAB-029406-320	1	CELCON
803	AAA-030288-362	1	OUTER SPRING
8031	AAA-029392-362	1	INNER SPRING
804	AEA-030342-468	1	SLEEVE
805	AAB-030659-261	1	RETAINER
806	AAB-029394-001	1	CAP SCREW
809	998-T4140M0-030	10	HTP DISC/CF8M ASSEMBLY
	EACH ASSEMBLY CONSISTS OF:		
801	AAB-029404-261	1	SEAT
802	AAB-029406-467	1	HTP DISC
803	AAA-030288-362	1	OUTER SPRING
8031	AAA-029392-362	1	INNER SPRING
804	AEA-030342-468	1	SLEEVE
805	AAB-030659-261	1	RETAINER
806	AAB-029394-001	1	CAP SCREW
840	001-027843-999	10	ABRASION RESISTANT/SS ASSEMBLY
	EACH ASSEMBLY CONSISTS OF:		
811	001-027843-001	1	SEAT
812	001-027843-002	1	O-RING
813	001-027843-004	1	BODY
814	001-027843-003	1	POLYURETHANE INSERT
815	001-027843-005	1	SPRING
817	001-027743-006	1	RETAINER

OPTIONAL TOOLS

* 890	998-810013-053	1	SEAT PULLER, DISC VALVE
* 890	998-Q4240M-093	1	SEAT PULLER, AR VALVE

* ~ *NOT SHOWN ON THE CROSS-SECTION DRAWING*

MATERIALS LEGEND:

BZ	= BRONZE
DI	= DUCTILE IRON
CS	= CARBON STEEL
FS	= FORGED CARBON STEEL
BS	= BILLET CARBON STEEL
SS	= 316 STAINLESS STEEL
DSS	= DUPLEX SS

NOTE:
WHEN ORDERING PARTS, GIVE:

1) PUMP SERIAL NUMBER
2) PUMP MODEL NUMBER
3) TRIM SIZE
4) MATERIAL TYPE
5) PART DESCRIPTION
6) PART NUMBER
7) QUANTITY REQUIRED

PARTS LIST FOR

MODEL HP-165 POWER END

ITEM NO.	PART NUMBER	QTY	PART DESCRIPTION
001	008-024179-350	1	POWER FRAME
007	170-012005-353	1	PIPE PLUG, MAGNETIC
014	001-013059-999	1	FILLER/BREATHER CAP
020	001-010803-999	1	OIL LEVEL SITE GLASS
*040	001-023575-282	1	EXTENSION GUARD
*041	154-014049-220	2	LOCK WASHER
*042	113-014038-220	2	MACHINE SCREW
048	001-024270-231	1	CRANKCASE COVER
049	001-024271-204	1	CRANKCASE GASKET
050	100-038034-286	16	CAP SCREW
068	170-114003-220	1	PIPE PLUG
070	001-024269-220	1	CRADLE COVER
072	104-038100-286	1	STUD
073	187-038016-286	2	WING NUT
105	008-024182-351	1	CRANKSHAFT
109	146-034500-236	1	KEY
125	002-024251-999	2	CENTER MAIN BEARING
128	241-038114-273	2	SET SCREW
135	120-325066-999	2	END MAIN BEARING
141	002-023230-359	2	BEARING HOUSING
142	110-000272-200	2	O-RING
154	100-058112-286	12	CAP SCREW
157	145-318418-999	2	OIL SEAL
198	004-023120-359	5	CONNECTING ROD & CAP
200	002-028392-999	5	SHELL BEARING
202	154-058108-220	10	LOCK WASHER
203	100-058314-273	10	CAP SCREW
211	001-023129-302	5	BRONZE BUSHING
212	004-023127-359	5	CROSSHEAD
213	001-023128-236	5	WRIST PIN
216	002-025366-237	5	WIPER BOX
217	110-000248-201	5	O-RING
219	145-158238-999	15	PONY ROD SEAL
221	002-025365-231	5	GLAND
222	104-038134-286	10	STUD
223	150-038016-306	10	LOCK NUT
*263	001-004837-282	1	LUBRICATION NAMEPLATE
*264	126-004014-405	4	DRIVE SCREW
276	998-810000-037	1	SHIM GASKET KIT

OPTIONAL PARTS AND KITS

*125	002-028504-999	2	MAIN BEARING (0.040" UNDERSIZE)
*200			SHELL BEARINGS:
	002-028393-999	5	(0.010" UNDERSIZE)
	002-028394-999	5	(0.020" UNDERSIZE)
	002-028395-999	5	(0.040" UNDERSIZE)
*2122	998-810000-002	5	CONNECTING ROD KIT (CONSISTSOF ITEMS: 198, 202, 203, 211)
*9030	998-816500-010	1	PACKING LUBRICATOR KIT (LHD)
*9031	998-816500-011	1	PACKING LUBRICATOR KIT (RHD)
*9049	998-810000-036	5	WIPER BOX KIT (CONSISTS OF ITEMS: 221, 222 & 223)
*9050	998-816500-038	1	POWER END GASKET KIT (CONSISTS OF ITEMS: 049, 157, 217 & 276)

* NOT SHOWN ON PARTS DRAWING

** OMIT WHEN PACKING LUBRICATOR IS USED

NOTE: WHEN ORDERING PARTS, GIVE:

1) PUMP SERIAL NUMBER
2) PUMP MODEL NUMBER
3) PART NUMBER
4) QUANTITY
5) PART NAME
6) ITEM NUMBER

APPENDIX I

Financial Assurance and Updated P&A Cost Estimate

E&E ENGINEERING
and Associates

2301 North Yellowood Avenue
Broken Arrow, Oklahoma 74012
TEL: 918-957-1300
FAX: 918-957-1313
ee-associates.com

April 3, 2024

Ms. Hillary Young, P.E.
Chief Engineer
Land Protection Division
Oklahoma Department of Environmental Quality
P.O. Box 1677
Oklahoma City, Oklahoma 73101-1677

RE: 2024 Plugging and Abandonment Cost Estimate Update
Real Alloy Recycling, LLC Non-Hazardous Class I Injection Well
Creek County, Oklahoma
UIC Permit No. IW-NH-3519019-R1

Dear Ms. Young:

On behalf of Real Alloy Recycling, LLC (Real Alloy), E&E Engineering and Associates, LLC (E&E) is pleased to submit this cost estimate update for the plugging and abandonment (P&A) of the Real Alloy non-hazardous Class I injection well located in Sapulpa, Oklahoma.

The P&A Cost Estimate for the injection well has been reviewed and updated in accordance with the Underground Injection Control (UIC) Permit, Oklahoma Administrative Code (OAC) 252:652-5-1, and 40 CFR 144.62. The P&A Cost Estimate calculations are attached to this letter. The estimated total P&A cost has increased from $59,091.83 in 2023 to $61,242.95 in 2024.

If you should have any questions or require any further information, please do not hesitate to contact me at 918-957-1300.

Respectfully,
E&E Engineering and Associates, LLC.

Deren M. Ertugrul, P.E.
Vice President

Attachment

cc: Mr. Robert Wallace, Real Alloy (via email)
Mr. Jim Bloomer, Real Alloy (via email)
Mr. Chuck Sudwischer, Real Alloy (via email)

E&E ENGINEERING
and Associates

2301 North Yellowood Avenue
Broken Arrow, Oklahoma 74012
TEL: 918-957-1300
FAX: 918-957-1313
ee-associates.com

PROJECT: CLASS I INJECTION WELL PLUGGING AND ABANDONMENT COST ESTIMATE UPDATE

CLIENT: REAL ALLOY RECYCLING, LLC. **PROJECT NO:** 104-035-04

CALCULATED BY: Chris Greenlee, P.G. **DATE:** 4/1/2024

PLUGGING AND ABANDONMENT COST ESTIMATE UPDATE
REAL ALLOY CLASS I NON-HAZARDOUS INJECTION WELL
PERMIT NO. IW-NH-3519019-R1

PROBLEM:

1) Update the cost estimate for the plugging and abandonment (P&A) of the Real Alloy Class I injection well in accordance with the UIC Permit, OAC 252:652-5-1(7), and 40 CFR 144.62(b).

KNOWN:

1) The injection well is 4,055 feet deep and has a 7-inch diameter long string casing that is 2,392 feet long and is cemented to the surface.
2) The injection well is equipped with a 2-7/8 inch diameter injection tubing and packer.
3) No changes have been made to the well since the previous cost estimate update.

REQUIRED:

1) Determine the appropriate inflation factor to adjust the cost estimate unit prices.
2) Update the existing cost estimate for the P&A of the injection well.

ASSUMPTIONS:

1) The injection well will be plugged with a cement plug.
2) The cost estimate does not include the salvage values of the wellhead, injection pump, and tubing.
3) The inflationary adjustment for 2024 is 3.64% based on the Gross Domestic Product (GDP) Implicit Price Deflator.

SOLUTION:

2024 P&A COST ESTIMATE FOR INJECTION WELL

	Task/Service	Quantity	Units	Multiplier	2024 Unit Cost	Subtotal
1	**Coordination and Management**	1	lump sum	1	$ 4,974.26	$ 4,974.26
2	**Workover Rig**					
2.1	Mobilization/Demobilization	1	lump sum	1	$ 2,016.60	$ 2,016.60
2.2	Rig with 3 Person Crew	32	hr	1	$ 282.33	$ 9,034.56
2.3	Power tongs, elevators, and spiders	1	lump sum	1	$ 2,688.81	$ 2,688.81
2.4	Rental Tools	1	lump sum	1	$ 8,402.46	$ 8,402.46
2.5	Trucking	1	lump sum	1	$ 3,361.00	$ 3,361.00
3	**Logging (cement)**	1	lump sum	1	$ 12,771.73	$ 12,771.73
4	**Clean, Restore, and Revegetate Site**	1	lump sum	1	$ 5,744.94	$ 5,744.94
5	**SUBTOTAL**					$ 48,994.36
6	**Contingency**	1	lump sum	10%	$ 48,994.36	$ 4,899.44
7	**Technical and Professional Services**	1	lump sum	15%	$ 48,994.36	$ 7,349.15
8	**TOTAL P&A COST ESTIMATE**					**$ 61,242.95**

BANK OF AMERICA

BANK OF AMERICA - CONFIDENTIAL PAGE: 1
DATE: JUNE 20, 2024
AMENDMENT TO IRREVOCABLE STANDBY LETTER OF CREDIT NUMBER: 68133599

AMENDMENT NUMBER 8

APPLICANT
REAL ALLOY HOLDING, LLC
3700 PARK EAST DRIVE
SUITE 300
BEACHWOOD, OH 44122

BENEFICIARY
EXECUTIVE DIRECTOR OKLAHOMA
DEPARTMENT OF ENVIRONMENTAL QUALITY
707 NORTH ROBINSON, P.O. BOX 1677
OKLAHOMA CITY, OK 73101

ISSUING BANK
BANK OF AMERICA, N.A.
ONE FLEET WAY
PA6-580-02-30
SCRANTON, PA 18507-1999

THIS AMENDMENT IS TO BE CONSIDERED AN INTEGRAL PART OF THE ABOVE CREDIT AND MUST BE ATTACHED THERETO.

THE ABOVE MENTIONED CREDIT IS AMENDED AS FOLLOWS:

THE AMOUNT OF THIS CREDIT HAS BEEN INCREASED BY USD 2,152.12
THE AGGREGATE AMOUNT OF THE CREDIT IS NOW USD 61,242.95

ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.

IF YOU REQUIRE ANY ASSISTANCE OR HAVE ANY QUESTIONS REGARDING THIS AMENDMENT, PLEASE CALL 800-370-7519 .

AUTHORIZED SIGNATURE

THIS DOCUMENT CONSISTS OF 1 PAGE(S).

ORIGINAL

This is a stored electronic document that is neither negotiable nor a document of title and should not be altered in any manner.