ARS Field Station
Lake Dam Rehabilitation
Environmental Assessment

Woodward, Oklahoma

December 2019

Prepared for:

United States Department of Agriculture
Agricultural Research Service
Southern Plains Range Research Station

Prepared by:

United States Department of Agriculture
Natural Resource Conservation Service

Proposed Action:

Rehabilitation of the ARS Field Station Lake Dam to meet NRCS high hazard dam and Oklahoma Water Resources Board safety criteria.

Project Location:

Woodward, Oklahoma

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Plan Designation:

FINAL REPORT

Comment Period:

Open December 27, 2019 – January 27, 2020

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1.0 Purpose and Need for Action

1.1 Introduction

The City of Woodward, Oklahoma was founded in 1887 as a cattle shipping point along the Great Western Cattle Trail. Agriculture, including beef and dairy cattle and wheat farming, has been a major industry in the County. In support of this, the US Department of Agriculture (USDA) Agricultural Research Service (ARS) established the Great Plains Field Station in the city of Woodward in 1913. The Field Station was renamed to the Southern Plains Range Research Station (Field Station) in 1978. The mission of the Field Station is to develop sustainable production practices through improved management of energy flow, nutrient cycling, and hydrologic dynamics for Southern Plains rangeland and associated agricultural ecosystems.

1.2 Purpose and Need

An *Investigative Study/Evaluation of Field Station Lake Dam* (Schnabel Engineering 2016) completed for the ARS, concluded that the dam and spillway structures were in fair to poor condition. The dam had been reclassified as a high-hazard dam by Natural Resource Conservation Service (NRCS), which means that dam failure may cause loss of life and serious damage to homes, industrial or commercial buildings, important public utilities, main highways, or railroads. The hazard classification is based on four potential damage locations (two roads and two structures) located downstream of the dam. The 2016 investigative study recommended that the dam remain classified as a high-hazard dam and provided potential alternatives for dam and spillway rehabilitation.

This dam does not currently meet NRCS TR-60 standards for a high-hazard dam. Therefore, rehabilitation is necessary to bring the dam and spillway up to current safety standards to minimize the risk for loss of life due to a dam breach.

1.3 Previous Studies

A number of investigative studies have been conducted of the ARS Field Station Lake Dam to assess and evaluate existing conditions of the dam and spillway structures and to inform the decision-making process. Several of these studies are referenced throughout this Environmental Assessment (EA) document:

- Geologic Investigation Report Supplement (NRCS, 2019)
- Soil Mechanics - Supplemental Report, Seepage Analysis (NRCS, 2018)
- Design Report (NRCS, 2018)
- Soil Mechanics – ARS Field Station Lake Dam (NRCS, 2017)
- Investigative Study/Evaluation of Field Station Dam (Schnabel Engineering, 2016)

2.0 Affected Environment

2.1 Project Setting

A variety of natural and man-made environments exist within and immediately adjacent to the proposed project site. Information on these environments provides the baseline necessary to assess the potential impacts of the proposed action.

<u>Project Location</u>

Field Station Lake is located on the property of the ARS Field Station in the City and County of Woodward, Oklahoma (Figure 1). The lake is one block south of Oklahoma Avenue on the eastern side of 34th Street. The lake, referred to by city residents as Experiment Lake, is readily accessed by the City of Woodward's Goetzinger Walking Trail and is noted for its captivating natural beauty that attracts people seeking a high quality of life. The lake is open to the public as a catch-and-release fishing lake.

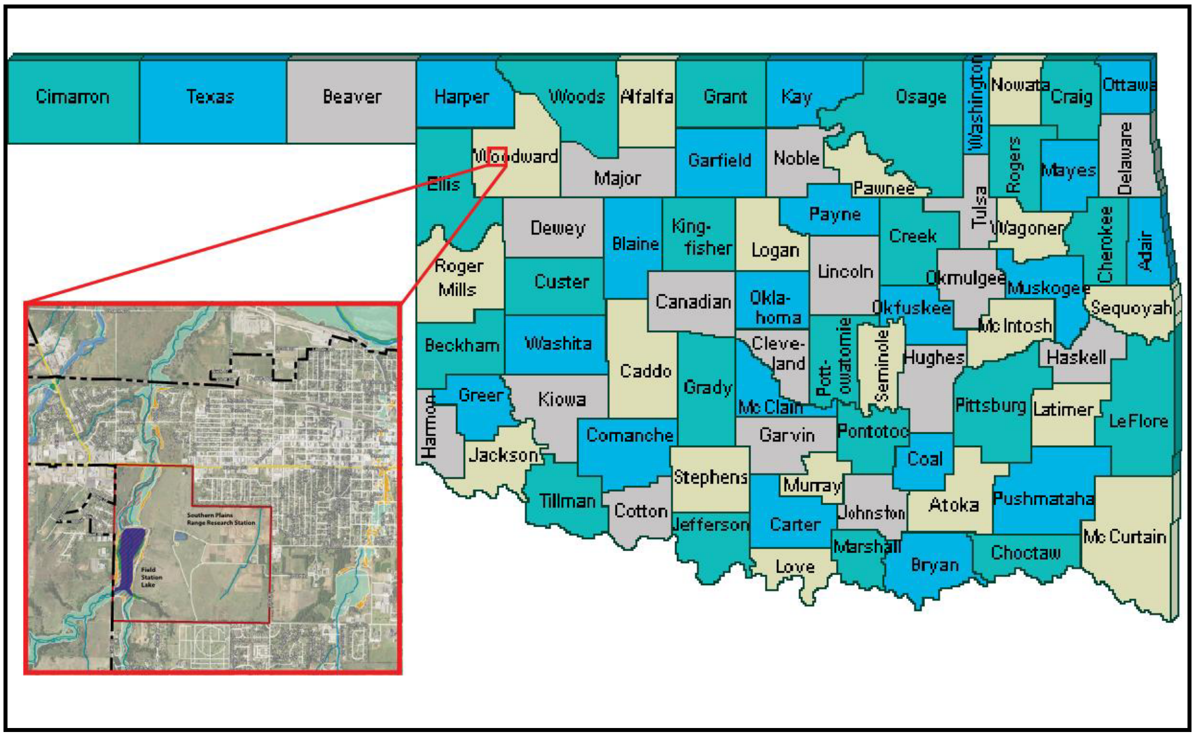

Figure 1. Location of ARS Field Station Lake in Woodward, Oklahoma

<u>Climate</u>

Woodward County is part of the Central Great Plains ecoregion, encompassing some of the best agricultural land in Oklahoma. Average annual precipitation ranges from about 24 inches in northern Woodward County to 30 inches in the south. May and June are the wettest months, on average, but much of the spring through fall receives sufficient rainfall for vegetative growth. Nearly every winter has at least one inch of snow, with most years having 10 or more inches. Prevailing winds in Woodward are generally south and south-southwesterly at about 27 percent of the time, with northerly winds nearly 6 percent of the time. Temperatures average near 60 degrees, with a slight increase from north to south, and range from an average daytime high of 95 degrees in July to an average low of 22 degrees in January. Woodward County averages a 186-day growing season, but plants that can withstand short periods of colder temperatures may have an additional three to five weeks (Oklahoma Climatological Society 2004).

Geology

Woodward County located in northwestern Oklahoma, has an area of 1,232 square miles with an elevation ranging from 1,440 to 2,250 feet mean sea level. The city of Woodward lies within the High Plains geomorphic unit, which is part of an extensive fluvial plan that stretches northward from western Texas and southeastern New Mexico, across northwestern Oklahoma, western Kansas and Nebraska, into southwestern South Dakota. This fluvial plain is composed of flat uplands; low hills; gentle erosional slopes; wide, shallow valleys; low escarpments; and sand dunes (USGS 1965).

Soils

Soils within the larger study area are characterized by a range of soil conditions from poorly and somewhat poorly drained to well and somewhat excessively drained. Well-drained soils represent the predominant drainage classification (see Figure A-1 in Appendix A). Two of the soil types within the larger study area are classified as eroded. Soils within the project area are comprised of loams and sandy loams that are generally well-drained (NRCS 2018).

According to the Soil Mechanics Report (NRCS 2017) prepared for the facility, the current dam embankment is constructed on alluvial materials, which are a heterogenous mix of sands, silts, and clays, overlying weathered bedrock. Alluvial soils encountered at the principal spillway were predominantly silty sand, poorly graded sand with silt, and well graded sand with silt.

Natural Resources

The rolling red hills ecoregion includes gently to steep sloping hills, breaks, and gypsum karst features. It is mostly used as rangeland, but cropland occurs on the suitable, nearly level sites. Upland natural vegetation is mostly mixed grass prairie. In addition, shinnery oak (*Quercus havardii*) grows on sand flats and hills in the west, and short grass prairie is found on higher elevation, sandy sites in the northwest. Eastern red cedar (*Juniperus virginiana*) is becoming increasingly widespread on the uplands. Ravines are wooded and provided cover for wildlife.

During the 1930s, drought and poor soil conservation practices contributed to widespread farm abandonment. Subsequently, many areas have been planted with introduced forage grasses and converted to managed grasslands (Oklahoma State University 2017). Vegetation in the project area is consistent with the surrounding area and includes little bluestem (Schizachyrium scoparium), plains bristle grass (Setaria leucopila), buffalograss (Bouteloua dactyloides), Bermuda grass (Cynodon dactylon), goldenrod (Solidago spp.), annual sunflower (Helianthus annuus), sumac (Rhus lanceolata), buttonbush (Cephalanthus occidentalis), sycamore (Platanus occidentalis), cedar elm (Ulmus crassifolia), eastern red cedar (Juniperus virginiana) and black willow (*Salix nigra*).

Fish and Wildlife Resources

A survey for the fish community within the project area was not conducted. Common game fish species likely present include crappie (*Pomoxis spp.*), largemouth bass (*Micropterus salmoides*), and channel catfish (*Ictalurus punctatus*). Additional fish likely present which are often targeted by recreational anglers include sunfish (*Lepomis spp.*) (ODWC, 2019). Correspondence with the Oklahoma Department of Wildlife Conservation's (ODWC) Regional Fisheries Supervisor indicated that the ODWC has surveyed the lake at least once in the last 7 years and have previously stocked the lake with fish. ODWC expressed a willingness to restock the lake and improving fishing opportunities after construction is complete (ODWC 2019).

White-tailed deer (*Odocoileus virginianus*), fox squirrel (*Sciurus niger*), and eastern cottontail (*Sylvilagus floridanus*) were observed during the site visit. Other common terrestrial vertebrates found in this area of Oklahoma include: black tailed jackrabbit (*Lepus californicus*), nine-banded armadillo (Dasypus novemcinctus), and bobcat (*Lynx rufus*).

No amphibians or reptiles were observed during the site visit. Common amphibians and reptiles found in this area of Oklahoma include: western chorus frog (*Pseudacris triseriata*), great plains toad (*Anaxyrus cognatus),* Woodhouse's toad (*Anaxyrus woodhousii*), collared lizard (*Crotaphytus collaris*), Texas horned lizard (*Phrynosoma cornutum*), red-eared slider (*Trachemys scripta elegans*), ornate box turtle (Terrapene ornata ornata), spiny softshell turtle (*Apalone spinifera*), speckled kingsnake (*Lampropeltis holbrooki*), bullsnake (*Pituophis catenifer sayi*), rat snake (*Pantherophis obsoletus*), diamondback water snake (*Nerodia rhombifer*), plain-bellied watersnake (*Nerodia erythrogaster*), prairie rattlesnake (*Crotalus viridis*) and western massasauga rattlesnake (*Sistrurus tergeminus*) (ODWC, 2019a).

Threatened and Endangered Species

According to the U.S. Fish and Wildlife Service's Information for Planning and Consultation (IPaC) resource list (USFWS 2019a), the following federally listed threatened or endangered species may occur or could potentially be affected by construction activities in the project area located within Woodward County, Oklahoma:

The whooping crane (*Grus americana*) is listed as *endangered* in Woodward County. Whooping cranes breed in Canada and winter on the Texas Gulf Coast at the Aransas National Wildlife Refuge and may migrate through northern Oklahoma during the spring (April) and fall (October). The project area is located within the known whooping crane migration corridor. Potential habitat is present within the project area and the immediate vicinity. Due to the location within the corridor, proximity to urban development, and quality of habitat, whooping cranes are not likely to utilize habitat within the project area during migration.

The least tern (*Sterna antillarum*) is listed as *endangered* in Woodward County. Least terns nest on sand and gravel beds on large braided rivers and on lake shores. No potential habitat was observed within the project area.

The piping plover (*Charadrius melodus*) is listed as *threatened* in Woodward County. Piping plovers nest on wide, flat, open, sandy beaches with very little grass or other vegetation. No potential habitat was observed within the project area.

The red knot (*Calidris canutus rufa*) is listed as *threatened* in Woodward County. Red knot habitat during migration and the winter is found on coastal mudflats and tidal zones, sometimes on open sandy beaches. No potential habitat was observed within the project area.

Additionally, a file search from the Oklahoma Natural Heritage Inventory (ONHI) was performed for the project area and vicinity. No occurrences of threatened and endangered species have been recorded within the project area or immediate vicinity. The biological resource assessment report is in Appendix B.

<u>Cultural Resources</u>

An Area of Potential Effects (APE), defined as the entirety of the Project footprint, including Field Station Lake and bounded by the topographic contour corresponding to the top of dam rehabilitation elevation, was recommended for the Project in which to assess the potential effects the Project may have on historic properties. The APE includes approximately 29.76 acres of water comprising Field Station Lake and 54.38 acres of land surrounding the lake and dam. Because of the nature of the Project, it is recommended that this APE be applied for both direct and indirect effects. Documentary research was conducted within a larger area, identified as the Study Area, which encompasses the APE and a 1-mile radius around the APE.

Research identified that the Field Station Lake Dam is a historic resource that has not been previously documented and may be a contributing component to the USDA ARS United States Field Station Historic District. No previously identified archaeological sites were located within the Project boundary. Given that archaeological deposits are unlikely and that because the Project is located within the existing footprint of the dam and lake, archaeological survey is not warranted for this project. See Appendix C for the Cultural Resources Review Report.

The cultural resources review was followed by a reconnaissance-level architectural survey designed to document the Field Station Lake Dan within the United States Field Station Historic District. The survey was designed to obtain sufficient information to make recommendations about the research potential of the dam based on the resource’s potential eligibility for listing on the National Register of Historic Places (NRHP). See Appendix C for the Phase I Architectural Survey Report. The NRHP-eligible United States Field Station Historic District was surveyed in 1995/1996, which in addition to the main core complex of buildings located off of 18th Street and the buildings within the parcel on the western side of 22nd Street, also includes the area of the dam (see Section 6.0 and Figure 15 of the Phase I Architectural Survey Report in Appendix C). The retention pond located northeast of the dam, provides water storage for irrigation, weather stations, and large areas of experimental grass plantings while included in the NRHP-eligible United States Field Station Historic District, were not included within the architectural survey.

2.2 Social and Economic Conditions

Readily available data was reviewed to provide a baseline of social and economic conditions within the city and county and how these conditions may affect or be affected by the proposed action.

Social and Economic Data

The city of Woodward is the county seat for Woodward County, Oklahoma. In 2018, the US Census Bureau estimated the population of the city at 12,162 and the county at 20,222. Woodward and Woodward County have seen little growth in population from 2010 to 2018 (1.5 and 0.7 percent respectively), well behind the state average (5.1 percent) The city's population is 78 percent white, 15 percent Hispanic, and 1.6 percent Native American (US Census Bureau 2010).

As of 2016, approximately 87 percent of the city's residents are high school graduates or higher, and 23 percent have a bachelor's degree or higher (City Data 2019). Northwestern Oklahoma State University has a campus location across 34th St on the western side of the Field Station Lake.

In 2016, the median income within the city ($51,801) and county ($57,602) were higher than for the entire state ($49,767). The per capita income in 2016, was estimated at $26,081. As of February 2019, the U.S. Bureau of Labor Statistics estimated the unemployment rate for the county at 2.8 percent, compared with 3.2 percent for the State of Oklahoma (US Department of Labor 2019).

Real Estate

Estimated median house or condominium values in 2016 were $130,000, which is up from $58,100 in 2000. This is slightly below the state average value of $132,200 (City Data 2019).

The results of a dam breach analysis (Schnabel Engineering 2016) indicated that a sudden release of water from the Field Station Lake dam would impact several habitable structures and portions of roads (see Figure A-2 in Appendix A). The Field Station's Emergency Action Plan (ARS 2017) identified six potential damage locations (PDLs) that include: Oklahoma Avenue (the primary east-west thoroughfare in the City), Cheyenne Drive, Western Avenue, and the Burlington Northern Santa Fe Railroad line.

Recreation

The city of Woodward has over 200 acres of parkland that includes several parks, two golf courses, an aquatics center, and 7 miles of walking trails. The city's largest park located on the southeastern side of the city, includes: Crystal Beach Lake, Fuller Park, Woodward Aquatics Center, Crystal Beach Water Park, and the Crystal Beach Municipal Golf Course. The city also has parkland on the western side of the ARS Field Station Lake that includes the Goetzinger Walking Trail. The park and lake are popular with residents for fishing, walking, and as a gathering place (Red Carpet Country 2019). Fishing in the lake is catch and release only.

2.3 Description of Existing Dam

The ARS Field Station Lake and dam are located on Spring Creek that flows south to north into the North Canadian River, which is part of the greater Arkansas River Basin. Of the 15,038 square miles that is the North Canadian River basin, 9,097 square miles is within the state of

Oklahoma. The North Canadian River drains the southern two-thirds of Woodward County (USGS 1965).

Structural Data

The ARS Field Station Lake Dam was constructed in 1938, as a rolled earth fill embankment dam to provide irrigation water for agricultural fields located on the SPRRS. While Field Station Lake remains the primary source of irrigation for the SPRRS, it also serves as a recreational site for the Woodward community. Table 1 provides existing structural data for the Field Station Lake Dam.

Table 1. Existing Dam and Spillway Structural Data

Drainage Area	**14.4 sq mi**
Dam Height	**35 ft**
Dam	
Type	**Earthen**
Crest Length	**950 ft**
Crest Width	**12 ft**
Crest Elevation	**1985.0 ft**
Capacity	**803 acre-ft**
Principal Spillway	
Type	**Concrete Drop Box into 12" Pipe**
Drop Box Dimensions	**2.5 x 3.5 ft**
Crest Elevation	**1973.3 ft**
Capacity	**224 acre-ft**
Auxiliary Spillway	
Type	**Concrete drop structure**
Weir Length	**475 ft**
Width	**175 ft**
Crest Elevation	**1973.6 ft**

Based upon visual inspections performed for the 2016 Schnabel Engineering Study, the dam and appurtenances are in fair to poor condition. The primary deficiencies observed were:

- Dense brush and woody vegetation present on the embankment and in the auxiliary spillway inlet channel.
- The embankment has a relatively steep downstream slope and narrow crest. The upstream slope exhibits areas of instability and breaching, likely the result of wave action.
- The principal spillway is not functional, as over time it has become buried and filled with soil.
- There is significant loss of soil upstream of, and adjacent to, the auxiliary spillway control section.
- The concrete of the auxiliary spillway control section is damaged and deteriorated.
- There is no means to effectively lower the lake in the event of a dam safety emergency.

Hazard Classification

The Field Station Lake Dam was originally constructed as a low-hazard Class (a) dam. The NRCS conducted a Hazard Dam Classification Review in 2008, which identified four potential damage locations (PDLs) downstream of the dam, resulting in the recommendation that the dam be assigned a high-hazard classification. Subsequently, the 2016 Schnabel Engineering Study identified six PDLs, including habitable structures and portions of roads, within the dam breach zone. The High Hazard classification is based upon the risk to life and property downstream in the event of a dam breach or failure.

3.0 Project Scoping

The purpose of scoping is to involve agencies, the public, and others interested in the project, in a process that determines the scope of issues to be addressed and identifies significant issues related to the proposed action.

3.1 Scoping Process

A scoping process was used to confirm resource concerns and identify any additional economic, environmental, or social issues. Stakeholders and the public were provided opportunities to express concerns at meetings and a public open house held at the ARS Field Station Research Center.

3.2 Identified Resource Concerns

Through the scoping process, the following resource concerns were identified for consideration with this project:

- Air Quality
- Floodplains
- Hazardous Waste
- Historic & Cultural
- Geology
- Noise
- Recreation
- Relocation & Condemnation
- Socioeconomic
- Threatened & Endangered Species
- Transportation
- Utilities/Energy Sources
- Vegetation
- Water Supply
- Water Quality
- Wetlands
- Wildlife

4.0 Formulation of Alternatives

The Field Station Lake Dam rehabilitation project is formulated to bring the dam and associated structures into compliance with NRCS standards for high-hazard dams, reduce the risk of property damage and loss of life, and extend the lifespan of the lake and dam.

4.1 Formulation Process

The ARS Field Station Lake Dam Rehabilitation project is formulated to allow for the lake to remain the primary source of irrigation for the SPRRS, while reducing the risk to life and property downstream. The consensus of federal, state, and local planners involved in the planning process is that installation of the planned measures will satisfy this objective. Additional objectives of prime importance to the project sponsor are:

- To construct the Field Station Lake dam and spillway structures to meet or exceed current NRCS high hazard design criteria and Oklahoma Water Resources Board (OWRB) safety standards.
- To provide capacity in the auxiliary spillway to safely pass the probable maximum flood (PMF) rainfall event.
- To allow for lowering of lake levels in the event of a dam safety emergency.
- To identify the operation, maintenance and repair items that must be accomplished to keep the structure functioning as designed for the planned life of the structure (100 years).

The formulation process began with an evaluation of rehabilitation alternatives presented in the 2016 investigative study (Schnabel Engineering 2016). The investigative study evaluated three alternatives, which are described in Section 5.0.

4.2 Breach Analysis

A dam breach and inundation analysis was performed to evaluate the hazard classification for the Field Station Lake Dam (Schnabel Engineering 2016), using both “sunny day” and PMF conditions. The breach parameters were calculated according to the methodology presented in the Dam-Break Flood Forecasting (DAMBRK) program manual. A breach was assumed to occur with the lake at a normal pool elevation of 1973.3 for the “sunny day” condition and at the time of peak lake elevation for the PMF condition. The limit of the evaluation was approximately 2.2 miles downstream of the dam at the confluence of Spring Creek with the North Canadian River. This analysis confirmed that the dam should be classified as a high-hazard dam according to NRCS criteria.

The results of the breach analysis under modeled conditions indicated that several habitable structures and portions of roads would be impacted due to a sudden release of water from the dam. Table 2 below illustrates the potential damage locations (PDL) and flood depths for two roads and two residential buildings that would be impacted by flooding (see Figure A-3 in Appendix A).

Table 2. Potential Damage Locations Due to Flooding (Schnabel Engineering, 2016)

PDL	Structure Elevation (ft)	PDL Flood Depth for Sunny Day Breach (ft)	PDL Flood Depth for PMF No Breach (ft)	PDL Flood Depth for PMF Breach (ft)
Oklahoma Avenue	1940.6	No Flooding	8.0	9.5
Cheyenne Drive	1932.5	1.2	10.1	11.1
3117 Cheyenne Drive	1935.0	No Flooding	7.6	8.6
3235 Cheyenne Drive	1941.0	No Flooding	1.6	2.6

In addition to the safety concerns due to flooding of the roadways, the depths and velocities of the PMF and PMF-with-breach events create a safety concern due to scour for the roadway and railroad bridges. None of the studies indicated that any analysis for scour was completed for the bridges. It should be noted that the PMF and PMF-with-breach events are much greater events than generally accepted for bridge design purposes.

4.3 Evaluation of Potential Failure Modes

The Field Station Lake Dam is operational under existing conditions, however, the principal and auxiliary spillways are not functional. This section describes the hydrologic capacity, seepage and seismic factors related to the dam and potential for failure.

Hydrologic Capacity

A hydrologic analysis was completed as part of the Schnabel investigative study (Schnabel Engineering 2016). The analysis used current NRCS methodologies and results of the US Army Corps of Engineers (USACE) HEC-HMS modeling to evaluate existing conditions. The results of the analysis indicated that the dam has inadequate capacity to pass the 6-hour duration PMF, the controlling storm, which is the NRCS required design storm for high-hazard potential dams. The existing spillway has the capacity to pass approximately 58 percent of the PMF without overtopping the embankment.

Seepage

The on-site inspection for the 2016 investigative study (Schnabel 2016) identified a wet area at the toe of the dam embankment, indicative of seepage through the embankment. The Study also noted that this seepage has been identified in previous reports and that the groundwater downstream of the dam is relatively shallow. The purpose of the 2018 Soil Mechanics Report was to provide a seepage analysis of the project site. The report noted that seepage paths should have fully developed over the 79 year lifetime of the dam and that the structure doesn't appear to be suffering from instability due to seepage. The report also noted that maintenance of the permanent pool at its current elevation would result in no change to the structure hydraulics.

Seismic

The 2017 Soil Mechanics report noted that the project site has a peak ground acceleration (PGA) of 0.0608g, which is less that the NRCS TR-60 criteria of 0.07g. The dam embankment should not be adversely affected by this low level of earthquake loading and therefore, no further seismic analysis is required.

4.4 Consequences of Dam Failure

As noted in Section 3.2, the breach analysis of the dam indicated that the structure has inadequate capacity to pass the PMF and that the spillway only has capacity to pass about 58 percent of the PMF without overtopping the embankment. If the dam were to fail, the downstream impacts would be similar to those described in the breach analysis section.

5.0 Description of Alternative Plans

Alternatives were developed and evaluated to determine the appropriate action ARS should take to accomplish the project purpose and need. The action alternatives described below were developed and evaluated in the 2016 Schnabel investigative study referenced throughout this document. All of the proposed action alternatives would occur within the same footprint of the dam and lake.

5.1 Alternative 1: No Action

Under the "No-Action" alternative, the Field Station Lake Dam and associated features would be maintained as-is with no further improvements (Figure 2). Under this alternative, the ARS Field Station would be unable to resolve existing structural issues; meet the NRCS high-hazard dam criteria and OWRB safety criteria; provide capacity in the spillway to safely pass the PMF; or allow for lowering of lake levels in the event of a dam safety emergency.

Figure 2. Existing Dam shown on left and Auxiliary Spillway with Vegetation on right

5.2 Alternative 2: New Labyrinth Spillway Through Embankment

This alternative includes construction of a new labyrinth in the inlet channel of the existing auxiliary spillway. A labyrinth spillway is a weir (a low dam designed as a barrier across the width of a stream or river) that is “folded” to significantly increase the length of the spillway. Figure 3 shows a labyrinth spillway constructed at the abutment of a dam.

The 2016 Schnabel investigative study noted that a four-cycle labyrinth with a total width of 110 feet and a weir height of 12.5 feet was found to pass the modeled PMF without overtopping the embankment. The spillway would include a reinforced concrete weir, chute, and energy dissipator in the auxiliary spillway inlet channel, with a weir crest elevation of 1973.6. A short weir would be incorporated into the labyrinth spillway at an elevation of 1973.3 to maintain the normal pool elevation. The labyrinth weir wall would have an integrated sluice gate to allow the lake to be drawn down to an elevation of 1962, which represents approximately 90 percent of the lake’s normal storage capacity.

Additionally, dense brush and woody vegetation would be removed from the dam and spillway. The existing crest of the dam would be graded to a constant elevation of 1985.0 feet and a width of 14 feet, and the downstream slope would be flattened to 2.5 feet horizontal by 1 foot vertical (2.5H:1V). An embankment filter and drain system would be installed to filter and collect seepage and the upstream slope near the normal pool elevation would be regraded and covered with riprap. Turf grass would be established on all disturbed areas outside of the proposed spillways and riprapped areas.

Figure 3. Labyrinth Spillway Located at the Abutment

For this alternative, the existing concrete spillway control section would be demolished and removed from the site to create an outlet channel for the new spillway.

5.3 Alternative 3: New Labyrinth Spillway on Embankment with RCC Chute

This alternative includes construction of a new labyrinth spillway through/over the embankment. The labyrinth configuration is essentially the same as Alternative 2, however, the spillway would be on top of the embankment with the addition of a roller compacted concrete (RCC) reinforced chute. Figure 4 shows a labyrinth spillway constructed over an embankment dam.

In this alternative, the existing auxiliary spillway would be abandoned by constructing a new embankment with a crest elevation of 1985.0 feet across the inlet channel, tying into the left abutment, adjacent to 34th Street. The existing concrete spillway could be demolished and removed from the site, or it may be more cost effective to bury the existing spillway in place.

As with Alternative 2, the existing crest of the dam would be graded to a constant elevation of 1985.0 feet and a width of 14 feet, the downstream slope would be flattened to 2.5H:1V, an embankment filter and drain system would be installed to filter and collect seepage, and the upstream slope near the normal pool elevation would be regraded and covered with riprap. Dense brush and woody vegetation would be removed from the dam and spillway and turf grass would be established on all disturbed areas outside of the proposed spillways and riprapped areas.

Figure 4. Labyrinth Spillway Over the Embankment

5.4 Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway

This alternative includes construction of a RCC auxiliary spillway over the embankment in conjunction with a reinforced concrete principal spillway conduit. Armoring the embankment with RCC to prevent dam failure during an overtopping event is considered an acceptable means of passing the PMF, and RCC construction is conducive to a stepped downstream face for overtopping protection and energy dissipation, as illustrated in Figure 5 below.

Use of the existing spillway location was evaluated and ruled out due to the presence of power line easements downstream; sandy soils within the spillway would not tolerate high stresses; and due to site topography, the spillway would need a curved outlet to direct water back into the main stream channel. Therefore, the existing auxiliary spillway would be abandoned in this alternative, and a new spillway constructed to maintain base flow and pass relatively frequent flows. A stilling basin would be provided for energy dissipation.

Figure 5. RCC Auxiliary Spillway Over the Embankment.

A reinforced concrete principal spillway would be required to pass flows up to the 10-year (10 percent storm) flood, above which there would be flow in the RCC auxiliary spillway. The principal and auxiliary spillways would be sized to have crest elevations of 1973.3 and 1977.5 and weir lengths of 50 and 415 feet, respectively. This meets the criterion to pass the PMF without overtopping the remaining portions of the embankment.

A foundation drain, seepage diaphragm and an RCC blanket drain would be used to manage seepage through the embankment.

6.0 Effects of Alternative Plans

The following section describes the existing and affected environment as they relate to the resource concerns listed in Section 3.2 and the alternatives described in Section 5.0. A summary and comparison table of the alternative plans is presented in Table 3 at the end of this section.

6.1 Geology, Soils, and Prime Farmland

Existing Conditions – As previously noted in Section 2.3, the dam embankment consists of alluvial soils resting on top of weathered bedrock. There are two proposed soil borrow sites located within close proximity to the existing dam, one on each side of the lake and immediately south of the dam (see Figure A-1 in Appendix A). Soils within these borrow sites are clay or sandy clay materials similar to the embankment soils.

The City of Woodward's Comprehensive Plan (G+PFP 2014) indicates that current land use within the project area that was previously agricultural, now includes the existing lake and dam, the Field Station fields, and mixed residential and urban development (see Figure A-4 in Appendix A). According to the Web Soil Survey, prime farmland is not present within the project area (NRCS 2018).

Alternative 1: No Action – There would be no effect on this resource concern.

Alternative 2: New Labyrinth Spillway through Embankment – There would be no effect on this resource concern.

Alternative 3: New Labyrinth Spillway on Embankment – There would be no effect on this resource concern.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - There would be no effect on this resource concern.

6.2 Floodplains and Wetlands

Existing Conditions – The lake and dam are located within the 100-year (1 percent probability) floodplain of Spring Creek, a tributary to the North Canadian River (see Figure A-5 in Appendix A). According to the USFWS' National Wetland Inventory (USFWS 2019b) and Freese and Nichols pedestrian survey data, in addition to the perennial stream Spring Creek (S1), there are forested (FW1), herbaceous (EW1 and EW2), and shrub-scrub (SWI) wetlands present within the project area (see Figure A-6 in Appendix A).

Alternative 1: No Action – Under this alternative, the floodplain and wetlands would only be affected during PMF and PMF-with-breach events where the embankment is overtopped. Effects would be temporary until flood conditions no longer exist.

Alternative 2: New Labyrinth Spillway through Embankment – The Field Station Lake Dam was previously authorized by USACE and is currently serviceable. The proposed rehabilitation would not change the function or use of the original design. The proposed project would have the potential to permanently impact approximately 2.7 acres of herbaceous wetland, 0.25 acres of forested wetland, 0.13 acres of shrub-scrub wetland, and 180 feet of stream. Impacts to Waters of the U.S. (WOTUS) would result from fill caused by the destruction/rehabilitation of the existing auxiliary spillway as well as construction activities resulting in fill related to the rehabilitation of the principal spillway and/or new auxiliary spillway.

It is anticipated that the proposed project would be permitted under a Nationwide Permit 3 (NWP 3). All impacts noted above would be considered permanent losses to WOTUS and are assumed to not extend further than 200 feet from existing structures. If the terms and conditions of the NWP 3 are met with the requirement of a pre-construction notification (PCN), and provided that no existing or new cultural resources are identified within the proposed project area, mitigation for the loss of WOTUS would not be required per NWP 3 General Condition 23 (see Appendix B for a copy of the NWP 3). Consultation with the USACE will be necessary to determine the presence of jurisdictional WOTUS, Section 404(b)1 permit requirements, and any potential mitigation requirements.

Alternative 3: New Labyrinth Spillway on Embankment – Effects on this resource concern would be the same as Alternative 2.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - Effects on this resource concern would be the same as Alternative 2.

6.3 Vegetation

Existing Conditions –Trees and shrubs have been cleared from the dam and spillway structures as part of ongoing operations and maintenance (O&M). Vegetation within the adjoining City park on the western side of the lake is maintained by the City and is predominantly turf grass. Vegetation on the eastern side of the lake is a mix of native warm season and cool season grasses and other herbaceous vegetation that is maintained by the Field Station.

Alternative 1: No Action – Vegetation would continue to be managed under current O&M protocols.

Alternative 2: New Labyrinth Spillway through Embankment – Existing vegetation on the dam and spillway would be removed prior to construction and turf grass established after construction on all disturbed areas outside of the proposed spillway structures.

Alternative 3: New Labyrinth Spillway on Embankment – Effects on this resource concern would be the same as Alternative 2.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - Effects on this resource concern would be the same as Alternative 2.

6.4 Fish and Wildlife Habitats

Existing Conditions – The Field Station Lake and surrounding property provides habitat for a variety of wildlife species as noted in Section 2.1. Correspondence with the Oklahoma Department of Wildlife Conservation's (ODWC) Fisheries Supervisor (2019) indicated that the ODWC has surveyed the lake at least once in the last 7 years, and have previously stocked the lake with fish.

Alternative 1: No Action – As long as the Field Station is present, the grasslands around the lake that provide habitat for wildlife will continue to remain.

Alternative 2: New Labyrinth Spillway through Embankment –The proposed project would require the lake to be drained during construction, which would result in fish mortality. NRCS will coordinate with the ODWC on potential relocation of some fish and the on-site disposal (burial) of the remaining fish. City officials may also relax the catch and release restrictions and allow fish to be harvested in accordance with state regulations. The ODWC has expressed a willingness to restock the lake and restore fishing opportunities following the completion of construction.

Alternative 3: New Labyrinth Spillway on Embankment – Effects on this resource concern would be the same as Alternative 2.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - Effects on this resource concern would be the same as Alternative 2.

6.5 Threatened and Endangered Species

Existing Conditions – Preliminary investigations revealed no recorded occurrences of threatened and endangered species within the project area or immediate vicinity.

Alternative 1: No Action – There would be no effect on this resource concern.

Alternative 2: New Labyrinth Spillway through Embankment – There would be no effect on this resource concern.

Alternative 3: New Labyrinth Spillway on Embankment – There would be no effect on this resource concern.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - There would be no effect on this resource concern.

6.6 Recreation

Existing Conditions – While the primary purpose of the lake is an irrigation water supply for the Field Station, it also serves the greater Woodward community as a recreational site. The public can access the western side of the Lake from 34th Street. Recreational amenities include a canoe and kayak launch area, benches, tables, parking areas, waste receptacles, bird observation platform, and unimproved pedestrian trails.

Alternative 1: No Action – The lake and adjoining parkland will continue to be used for recreation. Fishing will continue to be catch and release only.

Alternative 2: New Labyrinth Spillway through Embankment – Construction activities for the new spillway could temporarily impact the lake as a recreation facility by reducing water levels during construction and limiting access in and around the construction area. In order to complete construction of the new principal spillway, the lake will need to be drained during construction. The permanent pool elevation of 1973.3 would be re-established upon completion of construction.

Alternative 3: New Labyrinth Spillway on Embankment – Effects on this resource concern would be the same as Alternative 2.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - Effects on this resource concern would be the same as Alternative 2.

6.7 Socioeconomics, Environmental Justice & Civil Rights

Existing Conditions – Non-Hispanic Whites are the largest racial group in the City of Woodward, Woodward County, and the State of Oklahoma. Hispanics are the second most populous race with 4 percent more Hispanics living in the City and about 2 percent more in the County than in the State. Slightly more foreign-born people live in the City of Woodward than in the County or State. Over half of foreign-born residents (32.5 percent) live east of 9th Street, which is almost 2 miles from the eastern edge of Field Station Lake. About 1/3 of Woodward Hispanics live south of Oklahoma Avenue in the low-density census tract surrounding the lake. More native-born residents (43.9%) live south of Oklahoma Avenue in the same census tract than foreign-born residents (US Census Bureau 2010 and 2013-2017).

According to USDA Regulation No. 4300-044, civil rights impact centers on “the consequences of policies, actions, and decisions which impact the civil rights and opportunities of protected groups or classes of persons who are USDA employees or program beneficiaries" (USDA 2016). This Regulation indicates the minimum civil rights impact analysis (CRIA) elements fall into the following three categories:

- Significant rules, non-significant rules, notices, and departmental regulations
- Reorganizations
- Advisory committees

The ARS Field Station Lake Dam Rehabilitation project falls into none of the categories, as it is a construction project, does not require reorganization, and does not involve an advisory committee.

<u>Alternative 1: No Action</u> – There would be no effect on this resource concern.

<u>Alternative 2: New Labyrinth Spillway through Embankment</u> – There would be no effect on this resource concern.

<u>Alternative 3: New Labyrinth Spillway on Embankment</u> – There would be no effect on this resource concern.

<u>Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway</u> - There would be no effect on this resource concern.

6.8 Cultural and Historical Properties

<u>Existing Conditions</u> – The Field Station Lake Dam is part of the early-to-mid-twentieth century development of irrigation for experimental crops after the devastation of the 1930s Dust Bowl, and is one of a few examples of the built history of irrigation dams in this area of Oklahoma during this time period. Additionally, the dam and spillway retain a high degree of integrity of setting, location, materials, workmanship, and design. Based on the fieldwork and subsequent research, the resource is recommended as eligible for listing on the NRHP under Criterion A for its role in the development of irrigation as it relates to the experimental station, and is an integral part of the Field Station's history and its efforts in promulgating grasses and other plants for improving grazing lands. The dam is also integral to the Field Station; thus, it is also recommended that the structure is a contributing resource to the NRHP-eligible United States Field Station Historic District. The Cultural Resource Assessment and Architectural Survey reports are in Appendix C.

<u>Alternative 1: No Action</u> – There would be no effect on this resource concern.

<u>Alternative 2: New Labyrinth Spillway through Embankment</u> – A determination regarding an adverse effect has not been made. If it is determined by the NRCS, ARS and the Oklahoma State Historic Preservation Office (OKSHPO) that there is an adverse effect on this resource, mitigation and a Memorandum of Agreement (MOA) between the OKSHPO and ARS would be required. The MOA would be the vehicle to complete Section 106 of the National Historic Preservation Act (NHPA) and memorialize the mitigation and responsibilities of the OKSHPO and the ARS.

Alternative 3: New Labyrinth Spillway on Embankment – Effects on this resource concern would be the same as Alternative 2.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - Effects on this resource concern would be the same as Alternative 2.

6.9 Utilities and Energy

Existing Conditions – There are electrical power and water lines within the project area, located north of the existing dam embankment.

Alternative 1: No Action – There would be no effect on this resource concern.

Alternative 2: New Labyrinth Spillway through Embankment – Construction of this alternative would require adjustments to and permanent relocation of these utilities. These facilities would be restored to full operation upon completion of construction. Diesel fuel and gasoline would be used for construction equipment and vehicles.

Alternative 3: New Labyrinth Spillway on Embankment – Effects on this resource concern would be the same as Alternative 2.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - Effects on this resource concern would be the same as Alternative 2.

6.10 Water Quality and Supply

Existing Conditions – Water quality within the lake appears to be relatively good. No water quality monitoring was conducted during the planning process. However, there are no streams or tributaries, including Spring Creek, within this watershed that are listed by the Oklahoma Department of Environmental Quality (DEQ) on the state's Section 303(d) list of impaired streams or waterbodies (DEQ 2016).

The primary purpose of the lake is to provide irrigation for the Field Station fields. The existing pump used for irrigating these fields is currently located near the downstream toe of the embankment. Due to issues with the pump system, the Field Station is currently unable to use the lake for irrigation purposes.

Alternative 1: No Action – Under this alternative, water quality within the lake would remain the same. If overtopping of the dam were to occur during PMF or PMF-with-breach conditions, flooding could temporarily impact water quality downstream of the lake and dam. If the irrigation pump is not repairable, the Field Station would continue to be unable to use the lake for irrigation.

Alternative 2: New Labyrinth Spillway through Embankment – Under this alternative, the proposed project would result in the lake being drained during construction and then refilled upon completion of construction. The existing irrigation pump would be moved to a site on the eastern side of the lake and a new pipe would be installed from the lake to the existing pond for irrigation purposes. This would allow the Field Station to use the lake for irrigation purposes.

There are two primary methods for the dewatering lakes. The first is through the use of pumps that are typically driven by diesel motors. The second method is to use a siphon to drain the lake. Beyond the initial construction and installation, there would be little noise associated with the operation of the siphon. If the lake needs to be completely dewatered, the most expeditious way to do that is to drain the lake 24-hours per-day until it is empty. If noise from the pumps is a concern for the nearby neighborhood, then the construction schedule would be extended to run the pumps during working hours only for the project. Pumps powered by gasoline or diesel motors would create noise and release exhaust. It is not expected that the noise or exhaust would reach harmful levels for the adjacent neighborhood as the prevailing winds are south-southwest as noted in Section 2.1, and away from nearby homes.

As part of the lake dewatering, there will be sustained flows downstream for a period of time. These sustained flows would not be expected to reach levels that will result in erosion of the stream. The dewatering may result in the release of sediment from behind the dam. The dewatering process would likely be conducted to take the cleaner water above the sediment layer to minimize the sediment discharge. Should sediment discharge occur, the contractor will be required as part of the NPDES permit for construction activities to provide sediment removal from the discharge line used for dewatering. This would filter the sediment from the water prior to its discharge to the stream.

The construction contractor for this proposed project would be required to prepare a Stormwater Pollution Prevention Plan (SWPPP) that complies with National Pollutant Discharge System (NPDES) regulations. The construction contractor will also be responsible for preparing a Spill Prevention, Control, and Countermeasures Plan (SPCC) with the SWPPP. The permitting process will be conducted under the Oklahoma Pollutant Discharge Elimination System (OPDES) General Permit (OKR10).

<u>Alternative 3: New Labyrinth Spillway on Embankment</u> – Effects on this resource concern would be the same as Alternative 2.

<u>Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway</u> - Effects on this resource concern would be the same as Alternative 2.

6.11 Hazardous, Toxic, and Radioactive Waste (HTRW)

<u>Existing Conditions</u> – The HTRW assessment did not identify any evidence of recognized environmental conditions (RECs) including controlled RECs (CRECs), historical RECs (HRECs), or *de minimis* conditions in connection with the site. Based on the data reviewed and analysis preformed, no hazardous substances including raw materials; finished products and formulations; hazardous wastes; hazardous constituents and pollutants including intermediates and byproducts were known to be historically present at the site. The HTRW screening report is in Appendix D.

<u>Alternative 1: No Action</u> – There would be no effect on this resource concern.

<u>Alternative 2: New Labyrinth Spillway through Embankment</u> – There would be no effect on this resource concern.

Alternative 3: New Labyrinth Spillway on Embankment – There would be no effect on this resource concern.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - There would be no effect on this resource concern.

6.12 Transportation

Existing Conditions – The City is currently improving 34th Street from a two-lane to four-lane street, which will provide greater north to south traffic flow on the western side of the Field Station Lake. Access to the city park and lake will continue to be provided from 34th Street.

Alternative 1: No Action – Under this alternative, the Emergency Action Plan (EAP) for the Field Station (ARS 2017) identified a number of transportation related facilities located downstream of the dam that could potentially be impacted by either the PMF or PMF-with-breach event (see Figure A-3 in Appendix A). These facilities include: Oklahoma Avenue/Oklahoma 3/U.S. 183; Cheyenne Drive; Western Avenue; Commanche Drive; Apache Court; and Chisolm Drive, Osage Drive, BNSF Railroad, and Northwestern Oklahoma Railroad.

Alternative 2: New Labyrinth Spillway through Embankment – Under this alternative, the transportation facilities located downstream of the dam would not be at risk of being impacted by either the PMF or PMF-with-breach event as the new spillway structures would be capable of handling the storms that previously would have resulted in the PMF or PMF-with-breach event. Construction would temporarily increase traffic on 34th Street, which should be able to accommodate it due to the roadway expansion.

Alternative 3: New Labyrinth Spillway on Embankment – Effects on this resource concern would be the same as Alternative 2.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - Effects on this resource concern would be the same as Alternative 2.

6.13 Air Quality and Noise

Existing Conditions – Development along the western edge of the Field Station Lake is increasing. The City, in an effort to improve traffic flow north and south along the western side of the lake, is currently improving 34th Street from a two-lane to a four-lane road, as noted above. The road improvements will result in more traffic using this street, which will likely result in increased air pollution due to vehicle emissions, and more noise, generally during peak commute times in the morning and evening.

Alternative 1: No Action – Effects noted under existing conditions would continue in this No-Build alternative.

Alternative 2: New Labyrinth Spillway through Embankment – The construction of the spillway structures will produce noise and exhaust from worker vehicles, materials delivery and construction equipment. The nearest neighbor appears to be approximately 100 feet from the construction area for removing the existing auxiliary spillway. This construction activity will not be continuous for the full project construction period. Odor from dead fish resulting from draining the lake for construction would be temporary and mitigated by burial of the fish.

Exhaust should be expected from traffic on the 34th Street from worker vehicles and materials delivery throughout the project. Exhaust from the delivery and removal of construction equipment will occur at the project beginning, project end and intermittently through the project. The exhaust from these activities would not be expected to reach significant levels as the prevailing winds are south-southwest as noted in Section 2.1, and away from nearby homes.

Construction of the proposed project will generate dust and construction equipment exhaust. The dust will be controlled according to the construction specifications for the project, which typically include the requirement for water trucks to keep construction road dust to a minimum. The earthwork on and around the dam will have a required moisture content for compaction that will limit the amount of dust. Once complete, the earthwork areas will have erosion control in-place for stormwater quality, but these practices will also aid in reduction of dust from the completed grading until permanent vegetation is established.

The demolition of the existing auxiliary spillway and the construction of the proposed new spillway will create noise and some vibration. The noise will be generated by the construction equipment and, if used, the batch plant for the concrete production. Vibration would be expected to be minimal and would result from any existing concrete removal and compaction of roller-compacted concrete. None the noise and vibration levels would be expected to reach significant hazard levels for the nearby neighborhood.

Furthermore, noise conditions will be controlled by the construction specifications, which typically limit working hours for the project so that construction noise is eliminated in the evenings, night and early mornings. During construction, noise levels will rise due to equipment and truck traffic around the construction site as well as adjacent roadways.

Alternative 3: New Labyrinth Spillway on Embankment – Effects on this resource concern would be the same as Alternative 2.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - Effects on this resource concern would be the same as Alternative 2.

6.14 Relocation and Condemnation

Existing Conditions – The Field Station Lake Dam is located entirely within Field Station property that is owned and operated by the ARS. No additional property or easement acquisitions are required for operations and maintenance work on the dam and spillway structures.

Alternative 1: No Action – There would be no effect on this resource concern.

Alternative 2: New Labyrinth Spillway through Embankment – There would be no effect on this resource concern.

Alternative 3: New Labyrinth Spillway on Embankment – There would be no effect on this resource concern.

Alternative 4: RCC Auxiliary Spillway and Reinforced Principal Spillway - There would be no effect on this resource concern.

Table 3. Summary and Comparison of Alternative Plans of Action

Effects	**No Action**	**New Labyrinth Spillway through Enbankment**	**New Labyrinth Spillway On Embankment w/RCC Chute**	**RCC Auxiliary Spillway & Reinforced Principal Spillway**
Structural	Dam would not meet NRCS high-hazard or OWRB safety criteria; On-going structural issues	Dam would meet NRCS high-hazard and OWRB safety criteria	Dam would meet NRCS high-hazard and OWRB safety criteria	Dam would meet NRCS high-hazard and OWRB safety criteria
Project Investment (Construction Cost)	$0	$9,190,707	$8,587,151	$7,137,745
Environmental Quality				
Geology, Soils, & Prime Farmland	No effect	No effect	No effect	No effect
Floodplains & Wetlands	Continued discharge during PMF or PMF w/breach events would impact the floodplain and wetlands downstream of dam	Permanent adverse effects on 2.7 ac herbaceous, 0.25 ac forested, 0.13 ac shrub-scrub wetlands, and 180 ln ft of stream, requiring permitting under CWA Section 404(b)1	Permanent adverse effects on 2.7 ac herbaceous, 0.25 ac forested, 0.13 ac shrub-scrub wetlands, and 180 ln ft of stream, requiring permitting under CWA Section 404(b)1	Permanent adverse effects on 2.7 ac herbaceous, 0.25 ac forested, 0.13 ac shrub-scrub wetlands, and 180 ln ft of stream, requiring permitting under CWA Section 404(b)1
Vegetation	No effect	Short-term negative effect	Short-term negative effect	Short-term negative effect
Fish & Wildlife Habitats	No effect	Short-term negative effect	Short-term negative effect	Short-term eegative effect
T&E Species	No effect	No effect	No effect	No effect
Cultural & Historic Properties	No effect	There are long-term effects on the existingl resources that could require mitigation under the NHPA	There are long-term effects on the existing resources that could require mitigation under the NHPA	There are long-term effects on the existing resources that could require mitigation under the NHPA
Water Quality & Supply	Potential decrease in water quality due to overtopping events; unable to use for irrigation	Water quality protected due to sediment trapping; irrigation restored	Water quality protected due to sediment trapping; irrigation restored	Water quality protected due to sediment trapping; irrigation restored
HTRW	No effect	No effect	No effect	No effect
Air Quality & Noise	No effect	Short-term negative effect	Short-term negative effect	Short-term Negative Effect
Other Social Effects				
Recreation	No effect	Short-term Negative Effect	Short-term Negative Effect	Short-term negative effect
Socioeconomic Conditions, Environmental Justice, & Civil Rights	No effect	No effect	No effect	No effect
Utilities & Energy	No effect	Permanent relocation of electrical power and water lines	Permanent relocation of electrical power and water lines	Permanent relocation of electrical power and water lines
Transportation	Continued discharge during PMF or PMF w/breach events would impact roads downstream of dam	Protect downstream roads and structures from flooding	Protect downstream roads and structures from flooding	Protect downstream roads and structures from flooding
Relocation & Condemnation	No effect	No effect	No effect	No effect

7.0 Environmental Consequences

Assessment of cumulative effects is a requirement of the Council on Environmental Quality (CEQ) for implementing the National Environmental Policy Act (NEPA). This section addresses cumulative effects, risk and uncertainty, and the rationale for selection of the recommended plan.

7.1 Cumulative Effects

Construction of the Field Station Lake Dam has had long-term direct effects on the environment through site excavation, development of a permanent impoundment (the lake) that now provides irrigation for the Field Station; flood control, incidental recreational opportunities, fish and wildlife habitat, and other incidental benefits.

The dam has indirectly affected the natural environment by permanently flooding areas, temporarily inundating the floodplain upstream of the dam during storm events, and by trapping sediment that would otherwise move downstream during storm events. The dam has reduced downstream peak flows during storm events, and consequently protects property and people in otherwise flood-prone areas.

Rehabilitation of the dam under the alternatives considered would not change the hydrology downstream except for protecting the downstream area from catastrophic flooding that could occur if the dam were to fail. Rehabilitation of the dam under the Preferred Alternative would allow downstream areas within the floodplain to support current uses.

A 3-step procedure was used to evaluate whether cumulative impacts to any resources would result from the Proposed Action, and if so whether those impacts would be environmentally significant. The process included the following steps:

Step 1: Create a Baseline – As defined by environmental impacts of past and present actions.

a. Define the current environmental baseline
b. Identify reasonably foreseeable future actions, and define/quantify
c. Add/superimpose reasonably foreseeable future actions onto baseline

Step 2: Determine whether all past, present, and reasonably foreseeable impacts, including from the Proposed Action, would exceed significance thresholds according to six (6) significance tests: 1) Receptor, 2) Regulatory/Compliance, 3) Risk/Uncertainty Test, 4) Cumulative, 5) Precedence, and 6) Controversy.

Step 3: If any of the Step 2 tests indicate that significant cumulative impacts will occur, determine whether the incremental impact of the proposed action itself will exceed any significance thresholds, using the same significance tests.

Based on this analysis it was noted that impacts to floodplain, ambient noise, air quality, and transportation resources would be temporary in nature. Potential hazardous waste impacts from construction would be minor and temporary; and would be mitigated by implementation of the required SPCC plan. Impacts to wetlands and streams would be adverse and permanent, and could require mitigation. Impacts to cultural and historic properties could be adverse and permanent, and could require mitigation.

7.2 Irreversible and Irretrievable Use of Natural Resources

If the proposed action is implemented, construction materials in the form of borrow soil, concrete, and steel would be committed to the project. Soil would be obtained on-site as noted in Section 6.1, from the locations shown on Figure A-1 in Appendix A. As such, the site would be balanced.

To be cost-effective, concrete would be obtained from sources within the project vicinity, including local aggregate, and sand that is replenished through natural processes such as fluvial sediment transport. Steel in the form of reinforcements would be irretrievably used in project construction. Construction of the proposed action would consume fuel, mostly in the form of diesel. This would be an irreversible use of nonrenewable fossil fuels.

Impacts from the irretrievable use of natural resources would be negligible due to the project's limited size and scope in relation to available commodity supplies and markets.

7.3 Short-Term Uses vs. Long-Term Productivity of the Human Environment

Based upon the cumulative impact analysis, there are no long-term, cumulative impacts on the natural environment. For this reason, no impacts on the long-term productivity of the human environment are anticipated.

7.4 Risk and Uncertainty

The city of Woodward's Comprehensive Plan (G+PFP 2014) shows that future land use within the project area will continue to be a mix of residential, institutional, and agricultural uses (see Figure A-7 in Appendix A). Future land use immediately south along Oklahoma Avenue/ Oklahoma 3/U.S. 183 will continue to include a mix of commercial, corridor commercial, and residential uses. Because development within this area has already occurred and future land uses are not expected to change development patterns, impacts from each alternative on potential future development were not considered.

Uncertainties with the analysis of environmental impacts lie with the identification of wetland areas, riparian habitat, and streams. Trained specialists identified environmentally-significant areas using standard, well-established protocols.

Within the context of this study, all alternatives were considered on a comparable basis. There does not appear to be any area that would have resulted in a different decision by using different procedures or conducting more intensive studies.

From a financing and administrative standpoint, ARS is committed to funding 100 percent of the cost to implement the Recommended Plan and to performing the required maintenance on the upgraded structure for the next 50 years.

7.5 Rationale for Recommended Plan

When compared to the action alternatives, the No-Action alternative does not meet the NRCS criteria for high hazard dams. Alternative 4 provides the most cost effective means to meet the ARS' objectives of bringing the Field Station Lake Dam and related structures into compliance with NRCS standards for high hazard dams, resolving existing structural issues, providing capacity in the auxiliary spillway to safely pass the PMF rainfall event, and allowing for lowering of lake levels in the event of a dam safety emergency.

8.0 Consultation and Public Involvement

This section discusses the efforts to include agency coordination and public participation in this planning process. Agencies and the general public were involved early in the scoping process and during evaluation of the draft EA document.

8.1 Agency Consultation

Two stakeholder meetings were held on September 26, 2019 to explain the Dam Rehabilitation Project and to scope resource problems, issues, and concerns of federal, state, and local agencies and municipalities. Representatives from the City of Woodward, Woodward County, OWRB, Northwestern Oklahoma State University, Rural Development "A" Team, and local financial institutions were in attendance. A summary of stakeholder input received during the stakeholder meetings is in Appendix E. No additional comments were received for the Scoping portion of this project. NRCS is consulting with the USACE, OKSHPO, and the appropriate Tribal Historic Preservation Offices (THPOs). See Section 12 for a list of agencies and organizations who will receive a link to download electronic copies of the Final EA and Finding of No Significant Impact (FONSI).

8.2 Public Participation

A public open house was held on September 26, 2019 to explain the project and to scope resource problems, issues, and concerns of local residents. Potential alternative solutions to bring the dam into compliance with current NRCS and OWRB dam safety criteria were presented. No comments were received during the 30-day public scoping comment period. The 30 day public comment period for the Final EA and FONSI will be December 27, 2019 through January 27, 2020. Notice of document availability will also be published in the Woodward News.

9.0 Recommended Plan

The recommended plan resulted from evaluation of the No Action alternative, the no-build option, and the three action alternatives, and weighing out the potential impacts, costs, and benefits of each.

9.1 Measures Proposed

RCC Auxiliary Spillway and Reinforced Principal Spillway.

This alternative plan consists of construction of a RCC auxiliary spillway over the embankment in conjunction with a reinforced concrete principal spillway conduit. This option would upgrade both spillways to meet NRCS high-hazard dam criteria and OWRB safety criteria.

The proposed principal spillway consists of a standard 30-inch x 90-inch x 20-foot reinforced concrete baffle top, drop inlet with a 30-inch inner diameter (ID) reinforced concrete pipe conduit. The principal spillway inlet conforms to current seismic requirements. The principal spillway crest would be at an elevation of 1973.3, which is the same as the existing conditions. The proposed design will accommodate an additional 71 acre-feet of aerated sediment in addition to the 236 acre-feet of submerged sediment. Since this is not a floodwater retarding structure, a sedimentation rate was not calculated in the plan. However, a sedimentation rate was calculated using nearby watershed sites. A RCC stilling basin outlet is proposed for energy dissipation at the conduit outlet. Front slope wave action damage protection would be provided by riprap. Table 4 below provides a comparison of existing and planned conditions for the dam.

Table 4. Comparison of Structural Data for Existing and Planned Conditions

Field Station Lake Dam	Unit	As Built	Planned
Surface Area	Acres	31	31
Elevation, Top of Dam	MSL	1973.3	1973.3
Elevation, Principal Spillway	MSL	1973.3	1973.3
Elevation, Auxiliary Spillway	MSL	1973.6	1977.5
Length of Dam	Feet	950	950
Length of Auxiliary Spillway	Feet	475	415
Principal Spillway	Type	Concrete	Reinforced Concrete
Auxiliary Spillway	Type	Concrete	Roller Compacted Concrete
Sediment Storage	Acre-Feet	236	307

9.2 Mitigation

Mitigation for WOTUS is only required for projects authorized by NWP 3 if a PCN is required and 0.1 acre of WOTUS are permanently impacted by the project. It is anticipated that the project would be constructed under the authorization of a NWP 3 without the requirement of a PCN. Therefore, no wetland or stream mitigation would be required for the recommended plan. Under General Condition 20 of the NWP 3, if existing or new cultural resources are identified within the project's area of potential affect, a PCN will be required for the project and would in turn, mitigation would be required for impacts to WOTUS over 0.1 acre. Consultation with the USACE will be necessary to determine the presence of jurisdictional WOTUS, Section 404(b)1 permit requirements, and any potential mitigation requirements.

Because no likely habitat for threatened or endangered species occurs within the proposed project area, no mitigation would be required. Concerns regarding potential loss of fish including sportfish species have been discussed with ODWC staff. Some level of options under consideration, including the capture and relocation to other water bodies, will be pursued with ODWC, making sure that strict protocols are adhered to in order to mitigate against any potential adverse effects; or allowing citizens to keep fish caught rather than releasing as current policy dictates. ODWC has expressed a willingness to assist with improving fish habitat during construction and will restock the lake once the rehabilitation work is completed. Additionally, the idea of creating a wetland bench around the lake perimeter was discussed during the public scoping meetings as another option for creating additional habitat and reducing bank erosion due to wave action along the lakeshore.

If the dam is eligible for NRHP listing, is a contributing resource to the NRHP-eligible United States Field Station Historic District, and it is determined that there is an adverse effect, then, under Section 106 of the NHPA, mitigation and a Memorandum of Agreement (MOA) between the OKSHPO and ARS would be required. The MOA would be the vehicle to complete Section 106 and memorialize the mitigation and responsibilities of the OKSHPO and the ARS.

Mitigation, if required for impacts to WOTUS or Cultural Resources, would be sufficient to reduce these effects to non-significant levels.

9.3 Permits and Compliance

Implementation of the selected plan will bring the ARS Field Station Lake dam and spillway into compliance with current dam safety criteria in an environmentally acceptable manner. The list below includes the permit and compliance issues addressed during this planning process, along with their final disposition.

- Permit – Section 404 Clean Water Act – will be required. This action falls under Nationwide Permit Number 3 (NWP3): Maintenance.
- Permit – OWRB Permit to Construct, Enlarge, or Alter Dam and/or Spillway – will be required.
- Permit – Oklahoma Pollution Discharge Elimination System General Permit - will be required in conjunction with the SWPPP.
- Permit – Floodplain Permit – will be required through the City.
- Compliance – Endangered Species Act, Section 7 Consultation – Not required per consultation with the USFWS and Oklahoma Natural Heritage Inventory (ONHI) due to a lack of observed habitat within the project area.
- Compliance – Migratory Bird Treaty Act – Not required unless tree removal during construction would result in the intentional “take” or possession of a migratory bird, or the parts, nest, or eggs of a migratory bird. Project sequencing and pre-construction surveys will be used to prevent this occurrence.
- Compliance – Bald and Golden Eagle Protection Act - – Not required unless project activities would “take” or disturb an eagle or nest. Project sequencing and pre-construction surveys will be used to prevent this occurrence.
- Compliance – National Historic Preservation Act – will be required as the resource may be eligible for NRHP listing and a contributing resource to the NRHP-eligible United States Field Station Historic District.

9.4 Costs

The estimated cost for installing the project is $7.14 million. ARS will fund 100 percent of the installation cost.

9.5 Installation and Financing

Construction of the rehabilitation measures will be completed in year one of the evaluation period. If possible, construction should be completed in one construction season in order to minimize the disturbance to wildlife, vegetation, and human communities. During installation, construction equipment will not be allowed to operate when conditions are such that soil erosion, water, air, and noise pollution cannot be satisfactorily controlled. Vegetation will be established immediately following construction on all land disturbed by construction activities. Selection of vegetative species will be based upon soils, surrounding vegetation, installation season, and ARS staff preference.

NRCS will be responsible for the following implementation components of the Recommended Plan:

- Providing all construction plans, specifications, and cost estimates.
- Providing contract administration technical assistance.
- Providing construction management technical assistance.
- Certifying, in conjunction with OWRB, completion of all installed structures.

ARS will be responsible for the following implementation components of the Recommended Plan:

- Installation of all planned structures.
- Providing 100 percent of the project costs.
- Securing all needed permits, easements, and rights for installation, operation, and maintenance.
- Providing local administrative services necessary for project construction.
- Providing contract administration for project construction.
- Completing an OWRB "Application to Construct, Enlarge, or Alter Dam and/or Spillway" prior to construction of the project.
- Completing an OWRB "*Notice of Completion of Works*" upon completion of installed measures.
- Updating the existing Emergency Action Plan.

9.6 Operation, Maintenance, and Replacement

Measures installed in this plan will be operated and maintained by the sponsors for the life of the project (50 years) with technical assistance from federal, state, and local agencies in accordance with their delegated authority. A new O&M agreement will be developed for the ARS Field Station Lake Dam based on guidance found in the NRCS National Operations and Maintenance Manual and will be executed prior to signing a project agreement. The O&M agreement will specify the responsibilities of the sponsor including all operation, maintenance, repair, and replacement of installed measures.

9.7 Emergency Action Plan

The project sponsors will provide leadership in updating the Field Station's EAP. The purpose of the EAP is to outline appropriate actions and to designate parties responsible for those actions in the event of a potential dam failure. The EAP will be updated annually according to OWRB requirements and with input from local emergency response officials. The NRCS will provide any necessary technical assistance in updating the EAP and ensure that an updated plan is in place prior to rehabilitation construction.

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11.0 List of Preparers

The following individuals contributed to the preparation of this EA document.

Name	Present Title	Education	Years of Experience
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Stacey Gunter	Research Leader	Ph.D. Animal Nutrition M.S. and B.S. Animal Science	11
Michael Sams	State Biologist	M.S. and B.S. Wildlife Ecology	24
Shiela Steadman	Administrative Officer		17
Ad Astra			
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Triveece Penelton	City Planner, Public Engagement Specialist	Master of Urban Planning B.S. Architectural Studies	18
Scott Schulte	Sr. Environmental Planner	MUP Environmental & Land Use Planning, B.A. Political Science	26
Don Baker	Water Resources Engineer	M.S. Civil Engineering B.S. Engineering Physics B.S. Agricultural Engineering	27
Brad Schleeter	Engineer	B.S. Mining Engineering	19
Stantec			
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Wesley Wiegreffe	Environmental Scientist	M.S. and B.S. Biology	4
Eli Ellis	Environmental Scientist	B.S. Natural Resources, Ecology and Management	4

12.0 Distribution List

The following Tribes and agencies will receive a copy of the Final ARS Field Station Lake Dam Rehabilitation Environmental Assessment and the FONSI:

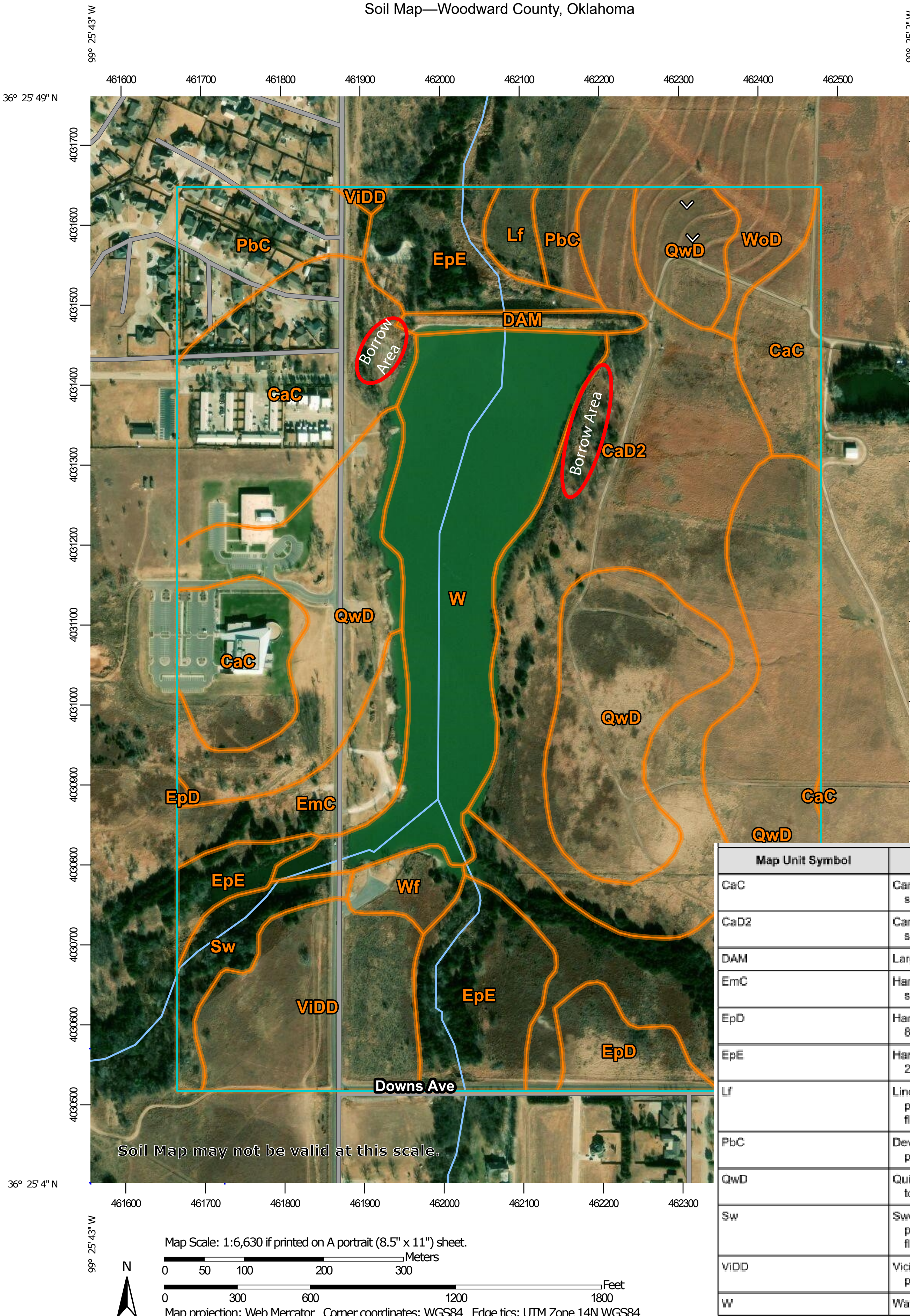
- City of Woodward Public Works
- Native American Tribes of Oklahoma
    - Comanche, Cheyenne, Arapaho, Wichita and Affiliated, Quapaw, and Osage
- Northwestern Oklahoma State University
- Oklahoma Department of Environmental Quality – Water Quality Division
- Oklahoma Department of Wildlife Conservation
- Oklahoma State Historic Preservation Office
- Oklahoma State University Extension
- Oklahoma Water Resources Board
- US Army Corps of Engineers – Tulsa District Regulatory Office
- US Environmental Protection Agency
- US Fish and Wildlife Service
- Woodward County

APPENDICES

APPENDIX A
Map Figures

FIGURE A-1

Soil Map—Woodward County, Oklahoma



Map Unit Symbol	Map Unit Name
CaC	Carey silt loam, 3 to 5 percent slopes
CaD2	Carey silt loam, 5 to 8 percent slopes, eroded
DAM	Large dam
EmC	Hardeman loam, 3 to 5 percent slopes
EpD	Hardeman-Devol complex, 5 to 8 percent slopes
EpE	Hardeman-Devol complex, 8 to 20 percent slopes
Lf	Lincoln loamy fine sand, 0 to 1 percent slopes, occasionally flooded
PbC	Devol fine sandy loam, 3 to 8 percent slopes
QwD	Quinlan-Woodward complex, 5 to 12 percent slopes
Sw	Sweetwater silt loam, 0 to 1 percent slopes, frequently flooded
ViDD	Vici-Dreyfoos complex, 1 to 8 percent slopes
W	Water
Wf	Waldeck fine sandy loam, 0 to 1 percent slopes, occasionally flooded
WoD	Woodward loam, 5 to 8 percent slopes

Breach Inundation Map

ARS Field Station Lake (Woodward)
2011 Hazard Classification Review

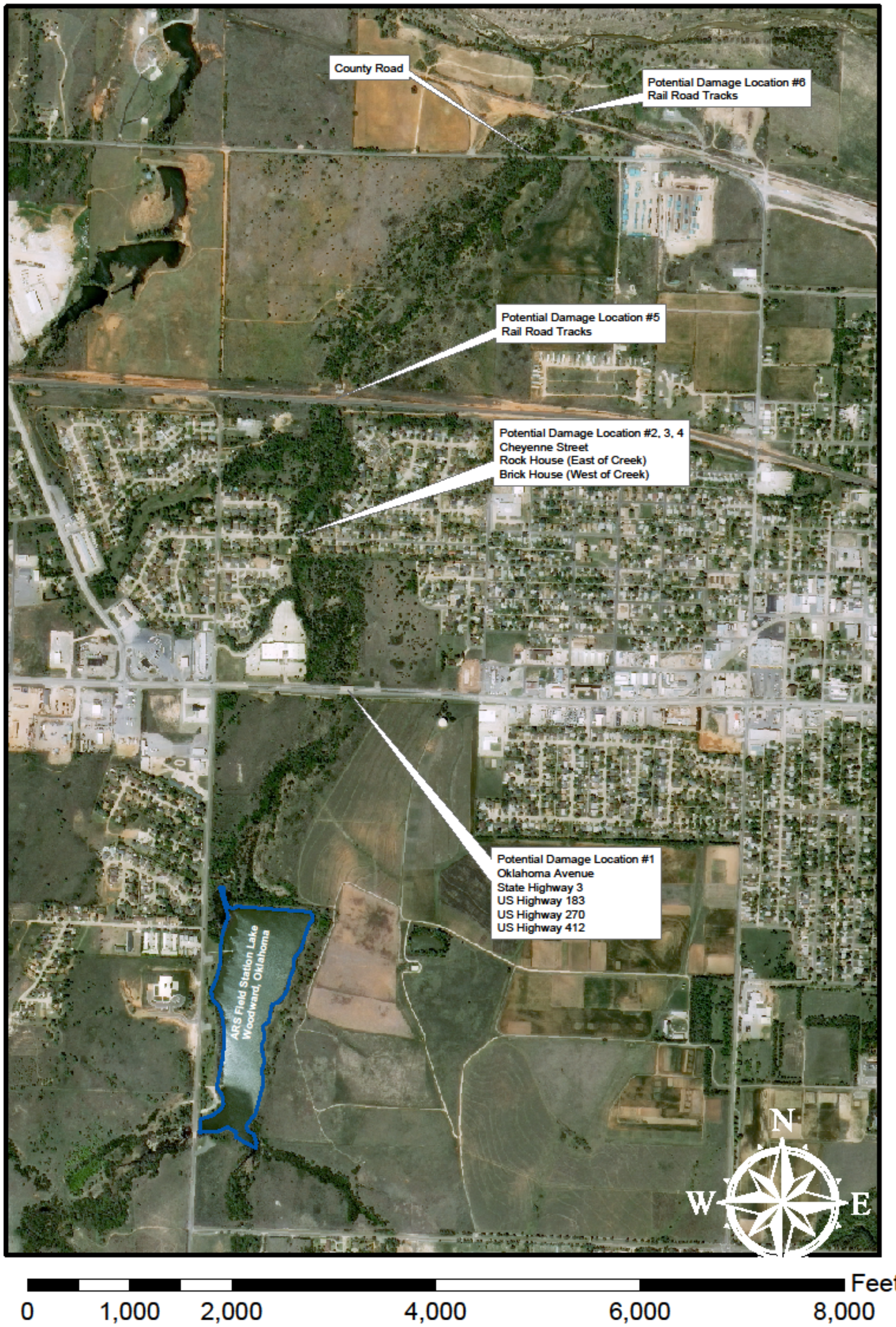


FIGURE A-3

5/5/2016 9:55:14 AM B:\GIS_Data\2015\15615025 - Field Station Dam\Projects\Working Folder\Dam Breach Inundation Map.mxd
jhalligan

FIGURE A-4

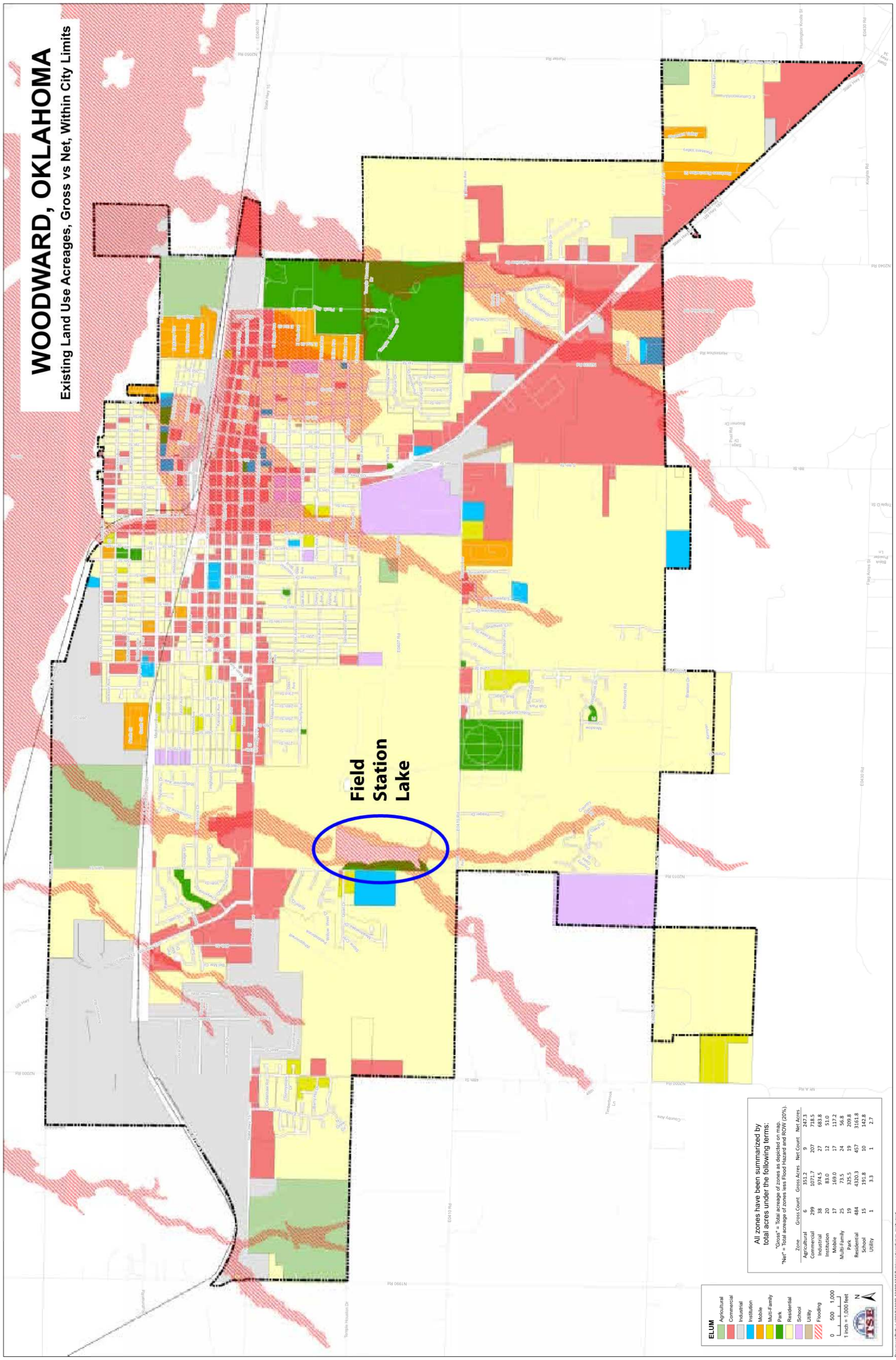

WOODWARD, OKLAHOMA
Existing Land Use Acreages, Gross vs Net, Within City Limits
Field Station Lake
ELUM
Agricultural
Commercial
Industrial
Institution
Mobile
Multi-Family
Park
Residential
School
Utility
Flooding
0 500 1,000
1 inch = 1,000 feet
N
TSE
All zones have been summarized by total acres under the following terms:
"Gross" = Total acreage of zones as depicted on map.
"Net" = Total acreage of zones less Flood Hazard and ROW (20%).
Zone | Gross Count | Gross Acres | Net Count | Net Acres
Agricultural | 6 | 351.2 | 9 | 247.3
Commercial | 299 | 1071.7 | 207 | 718.5
Industrial | 38 | 974.5 | 27 | 683.8
Institution | 20 | 83.0 | 12 | 51.0
Mobile | 17 | 169.0 | 17 | 117.2
Multi-Family | 25 | 73.5 | 24 | 56.8
Park | 19 | 325.5 | 19 | 209.8
Residential | 484 | 4320.3 | 457 | 3161.8
School | 15 | 191.8 | 10 | 142.8
Utility | 1 | 3.3 | 1 | 2.7

FIGURE A-5

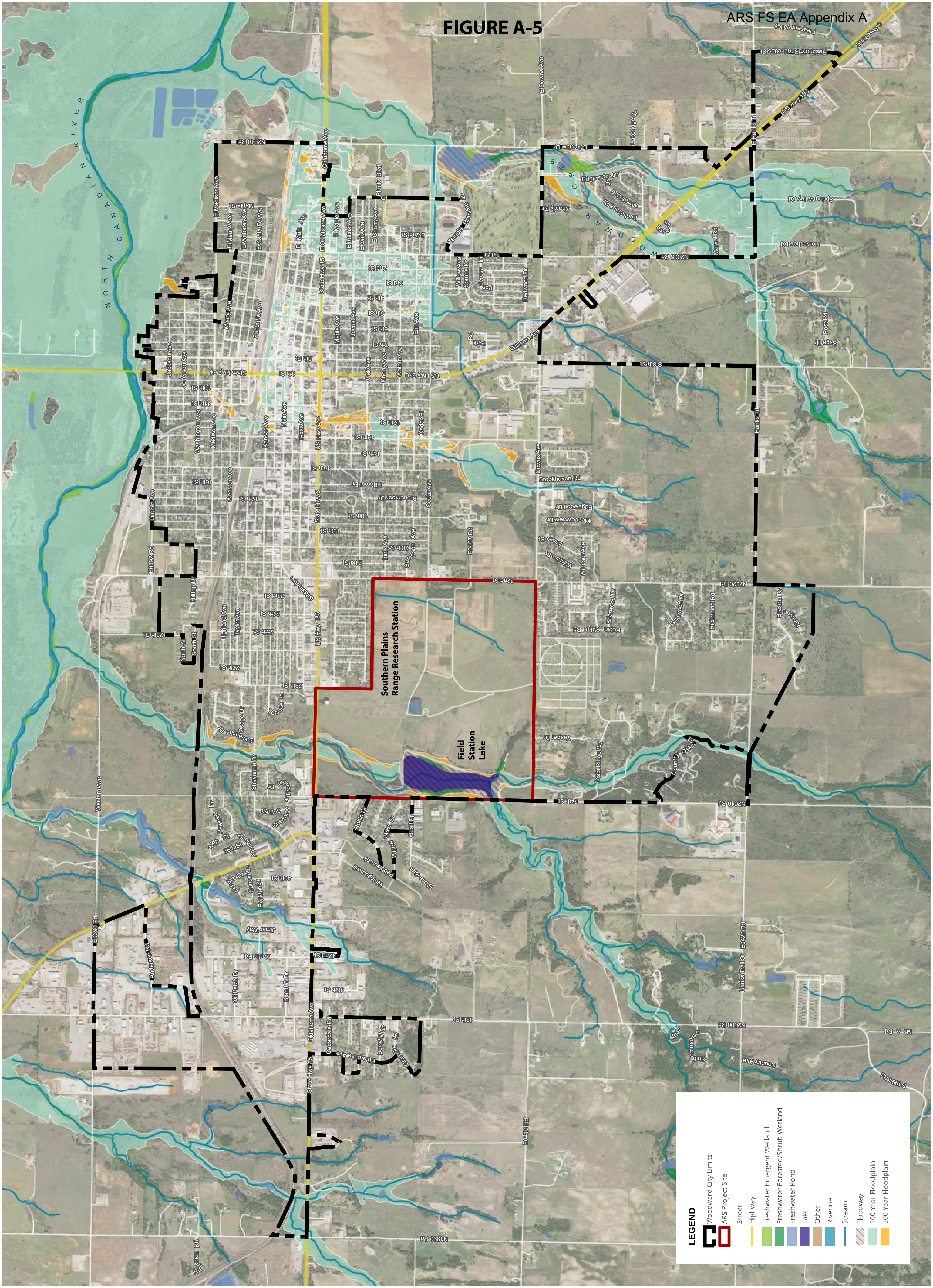
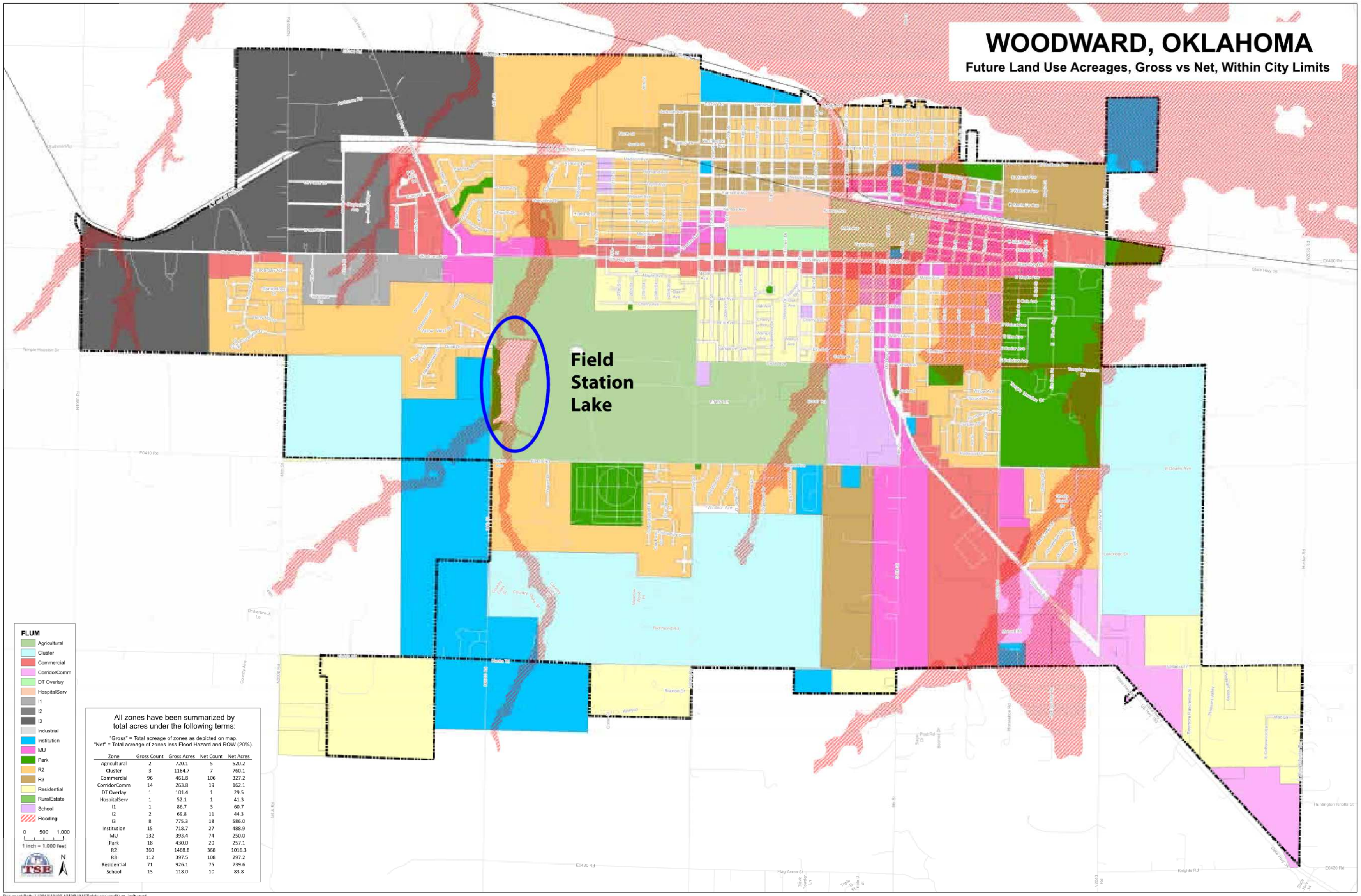

Southern Plains Range Research Station
Field Station Lake
NORTH CANADIAN RIVER
WOODWARD CREEK
0
0.25
0.5
1
MI
LEGEND
Woodward City Limits
ARS Project Site
Street
Highway
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond
Lake
Other
Riverine
Stream
Floodway
100 Year Floodplain
500 Year Floodplain

FIGURE A-6

FIGURE 1	FREESE AND NICHOLS FREESE AND NICHOLS 4055 International Plaza Suite 200 Fort Worth, Texas 76109-4895 (817) 735-7300	AD ASTRA COLLABORATIVE, LLC **ARS Field Station Dam Rehabilition** Waters of the U.S. Map	FN PROJECT NO. AAC19600 DATE CREATED 12/17/2019 DATUM & COORDINATE SYSTEM NAD83 State Plane (feet) Texas North Central FILE NAME 1_WOTUS_11x17 PREPARED BY HHM

FIGURE A-7



Zone	Gross Count	Gross Acres	Net Count	Net Acres
Agricultural	2	720.1	5	520.2
Cluster	3	1164.7	7	760.1
Commercial	96	461.8	106	327.2
CorridorComm	14	263.8	19	162.1
DT Overlay	1	101.4	1	29.5
HospitalServ	1	52.1	1	41.3
I1	1	86.7	3	60.7
I2	2	69.8	11	44.3
I3	8	775.3	18	586.0
Institution	15	718.7	27	488.9
MU	132	393.4	74	250.0
Park	18	430.0	20	257.1
R2	360	1468.8	368	1016.3
R3	112	397.5	108	297.2
Residential	71	926.1	75	739.6
School	15	118.0	10	83.8

APPENDIX B
Environmental Pedestrian Survey Memorandum

MEMORANDUM

FREESE AND NICHOLS

Innovative approaches
Practical results
Outstanding service

4055 International Plaza, Suite 200 • Fort Worth, Texas 76109 • 817-735-7300 • fax 817-735-7491 www.freese.com

TO: File: AAC19600

CC: Patrick Garnett

FROM: Eli Ellis and Wesley Wiegreffe

SUBJECT: Environmental Pedestrian Survey Memorandum

DATE: December 17, 2019

PROJECT: AAC19600 – ARS Field Station Dam Rehabilitation Project

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Introduction

Freese and Nichols, Inc. (FNI) personnel conducted a pedestrian survey at the ARS Field Station Dam in Woodward, Woodward County, Oklahoma on September 20, 2019.

The purpose of the survey was to identify potential waters of the U.S. within the proposed project area that could be regulated by Section 404 of the Clean Water Act and areas that could be potential habitat for federally listed threatened or endangered species. This memo was prepared to summarize the findings of the pedestrian survey and to document how the proposed project can be designed to be constructed to meet the terms and conditions of Nationwide Permit (NWP) 3, *Maintenance,* without triggering a pre-construction notification (PCN) requirement. Figures and site photographs are presented in Appendices A and B, respectively.

Project Description

The ARS-Woodward dam is a single purpose, high hazard class, earthen fill embankment located on Spring Creek, a tributary to the North Canadian River. The proposed maintenance and rehabilitation activities consist of a 415-foot wide RCC auxiliary spillway which will provide the capacity necessary to pass the PMP storm event. The existing auxiliary spillway will be raised to the same elevation as the top of the dam. The existing auxiliary spillway has a concrete chute, which will also be removed and flattened to 10% slope. The embankment has an average height of 35 feet and is 950 feet long. The proposed spillway consists of a standard 30” x 90” x 20’ reinforced concrete baffle top, drop inlet with a 30-inch ID reinforced concrete pipe conduit. The principal spillway crest is at elevation 1973.3 msl, which is the same as the existing conditions. The proposed design will accommodate an additional 71 ac-ft of aerated sediment in addition to the 236 ac-ft of submerged sediment.

Ecological Setting

The project area is located within the Rolling Red Hills ecoregion of the Central Great Plains. This ecoregion includes gently to steep sloping hills, breaks, and gypsum karst features. It is mostly used as rangeland, but cropland occurs on the suitable, nearly level sites. Upland natural vegetation is mostly mixed grass prairie. In addition, shinnery oak grows on sand flats and hills in the west, and short grass prairie is found on higher elevation, sandy sites in the northwest. Eastern redcedar is becoming increasingly widespread on the uplands. Ravines are wooded and provided cover for wildlife. Rainfall is limited and variable. During the 1930’s, drought and poor soil conservation practices contributed to widespread farm abandonment. Subsequently, many areas have been planted with introduced forage grasses and converted to managed grasslands. Extensive flood control projects are found throughout the Washita River Basin and have modified regional hydrology. Most streams area now entrenched and have sandy, unstable substrates and eroding banks. However, scattered reaches have cut into rock layers, increasing gradients and improving stream habitat (Woods, et al., 2005).

Site Conditions

ARS Field Station Lake is in Woodward County, Woodward, Oklahoma. The earthen dam impounds approximately 33 acres of surface water with public access. Two unnamed tributaries and the main branch of Spring Creek provide the conduit for surface water runoff to the impoundment. Adjacent land uses include agricultural, residential, a higher education campus, and transportation infrastructure. In addition, an overhead high-voltage electrical transmission line is located to the north and to the east of the structure. Recreational amenities include a canoe and kayak launch area, benches, tables, parking areas, waste receptacles, bird observation platform, and unimproved pedestrian trails.

Vegetation at the site is consistent with the surrounding area and includes little bluestem (*Schizachyrium scoparium*), plains bristle grass (*Setaria leucopila*), buffalograss (*Bouteloua dactyloides*), Bermuda grass (*Cynodon dactylon*), goldenrod (*Solidago* spp.), annual sunflower (*Helianthus annuus*), sumac (*Rhus lanceolata*), buttonbush (*Cephalanthus occidentalis*), sycamore (*Platanus occidentalis*), cedar elm (*Ulmus crassifolia*), eastern red cedar (*Juniperus virginiana*) and black willow (*Salix nigra*).

Potential Waters of the U.S.

The United States Army Corps of Engineers (USACE) regulates the discharge of dredged and fill material into waters of the U.S., including wetlands, under Section 404 of the Clean Water Act (Section 404). Waters of the U.S. (i.e., jurisdictional waters) include streams that display ordinary high water marks (OHWMs) and a hydrologic connection with traditional navigable waters (TNW) of the U.S., impoundments of such streams, and wetlands adjacent to these jurisdictional waters. The term OHWM means “that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural lines impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas” (33 CFR 328.3). Official determination of the presence or absence of waters of the U.S. can only be obtained by requesting an approved jurisdictional determination (AJD) from the USACE. Wetland Determination Data Sheets are included in Appendix C.

Five potentially jurisdictional water features were identified with the project area (defined as within 200 ft of existing structures) during site reconnaissance:

- **Emergent Wetland 1 (EW1)** is located on the north side of the existing dam. EW1 contained surface water, characteristics of hydric soils, and was dominated by cattail (*Typha latifolia*). The size of EW1 is approximately 1.256 acres within the project area.
- **Emergent Wetland 2 (EW2)** is located within the spillway located west of the existing dam. EW2 contained surface water, disturbed soils that were assumed hydric, and was dominated by cattail (Typha latifolia) and buttonbush (*Cephalanthus occidentalis*). The size of EW2 is approximately 1.705 acres within the project area.
- **Forested Wetland 1 (FW1)** is located under the existing spillway structure. This area has been altered by previous construction practices. FW1 contained surface water and was dominated by black willow (*Salix nigra*) and buttonbush (*Cephalanthus occidentalis*). The size of FW1 is approximately 0.250 acres within the project area.

- **Shrub-Scrub Wetland 1 (SW1)** is located within EW2. SW1 was dominated by buttonbush (*Cephalanthus occidentalis*). The size of SW1 is approximately 0.127 acres within the project area.
- **Stream 1 (S1)** is a perennial stream that was flowing at the time of site reconnaissance. S1 had an OHWM of approximately 3 feet with and extends from the project area for approximately 180 linear feet.

Section 404 Permitting

USACE Nationwide Permit (NWP) 3: *Maintenance*, authorizes the repair, rehabilitation, or replacement of any previously authorized, currently serviceable structure provided that the structure is not to be put to uses differing from the original design. It also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to conduct the maintenance activity. There are no acreage limits or limits on the volume of fill placed within waters of the U.S. for NWP 3. A copy of NWP 3, including terms and the Nationwide Permit General Conditions and Regional Conditions for the State of Oklahoma, is provided in Appendix E.

It is our opinion that the proposed project activities can be designed and constructed to meet the terms and conditions of NWP 3 without a PCN. Section 3(a) of NWP 3 refers to the maintenance of structures for the repair, rehabilitation, or replacement of any previously authorized, currently serviceable structure or fill. The ARS-Woodward dam is previously authorized and currently serviceable, and as proposed, the rehabilitation would not change the function or use of the original design. The proposed maintenance project impacts approximately 2.7 acres of herbaceous wetland, 0.25 acres of forested wetland, 0.13 acres of shrub-scrub wetland and approximately 180 feet of stream. All impacts to waters of the U.S. would be considered permanent losses to WOTUS and are assumed to not extend farther than 200 feet from existing structures. If all the terms and conditions of NWP 3 are met with the requirement of a PCN, mitigation for the loss of WOTUS would not be required per NWP 3 General Condition 23.

NWP 3 General Condition 20 requires a PCN if construction activities might have the potential to cause effects to properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties and archeological sites. If existing cultural resources are identified within the project's area of potential affect or an archeological survey is performed and new cultural resources are identified within the project's area of potential effects, a PCN will be required for the project. If a PCN is required for the potential effect to cultural resources, mitigation will be required for impacts to WOTUS over 0.1 acre.

Threatened and Endangered Species

According to the U.S. Fish and Wildlife Service's Information for Planning and Consultation (IPaC) resource list received on September 18, 2019, the following federally listed threatened or endangered species may occur or could potentially be affected by construction activities in the project area located within Woodward County, Oklahoma:

The **whooping crane (*Grus americana*)** is listed as *endangered* in Woodward County. Whooping cranes breed in Canada and winter on the Texas Gulf Coast at the Aransas National Wildlife Refuge and may migrate through northern Oklahoma during the spring (April) and fall (October). The project area is located within the known whooping crane migration corridor. Potential habitat is present within the project area and the immediate vicinity. Due to the location within the corridor, proximity to urban development, and quality of habitat, whooping cranes are not likely to utilize habitat within the project area during migration. This project will not affect the whooping crane.

The **least tern (*Sterna antillarum*)** is listed as *endangered* in Woodward County. Least terns nest on sand and gravel beds on large braided rivers and on lake shores. No potential habitat was observed within the project area. This project will not affect the least tern.

The **piping plover (*Charadrius melodus*)** is listed as *threatened* in Woodward County. Piping plovers nest on wide, flat, open, sandy beaches with very little grass or other vegetation. No potential habitat was observed within the project area. This project will not affect the piping plover.

The **red knot (*Calidris canutus rufa*)** is listed as *threatened* in Woodward County. Red knot habitat during migration and the winter is found on coastal mudflats and tidal zones, sometimes on open sandy beaches. No potential habitat was observed within the project area. This project will not affect the red knot.

Additionally, a file search from the Oklahoma Natural Heritage Inventory (ONHI) was performed for the project area and vicinity. No occurrences of threatened and endangered species have been recorded within the project area or immediate vicinity. The official IPaC list is included in Appendix D.

Migratory Birds and Bald and Golden Eagle Protection

Coordination with the USFWS would be required by the Migratory Bird Treaty Act of 1918 if the proposed project activities would result in the intentional "take" (e.g., pursue, hunt, shoot, wound, kill, trap, capture, or collect) or possession of a migratory bird, or the parts, nest, or eggs of a migratory bird.

The following migratory birds were observed during the site visit: American crow (*Corvus brachyrhynchos*), northern cardinal (*Cardinalis cardinalis*), northern mockingbird (*Mimus polyglottos*), scissor-tailed flycatcher (*Tyrannus forficatus*), downy woodpecker (*Dryobates pubescens*), killdeer (*Charadrius vociferus*), brown-headed cowbird (*Molothrus ater*), Mississippi kite (*Ictinia mississippiensis*), red-winged blackbird (*Agelaius phoeniceus*), Canada goose (*Branta canadensis*), field sparrow (*Spizella pusilla*), great egret (*Ardea alba*), and mourning dove (*Zenaida macroura*).
No migratory bird nests were observed during the survey; however, migratory birds are likely to nest within the project area or the immediate vicinity. Thus, the project may impact migratory birds.

Coordination with the USFWS would be required by the Bald and Golden Eagle Protection Act of 1940 if proposed project activities would "take" or disturb a protected eagle or their nest. It is generally not considered disturbance if construction activities occur greater than 660 feet from a protected nest. Bald and golden eagles or their nests were not observed during the pedestrian survey and are unlikely to use the proposed project area due to urban development.

Fish Community

A survey for the fish community within the project area was not conducted. Common game fish species likely present include crappie (*Pomoxis spp*.), largemouth bass (*Micropterus salmoides*), and channel catfish (*Ictalurus punctatus*). Additional fish likely present which are often targeted by recreational anglers include sunfish (*Lepomis spp.*) (ODWC, 2019).

The Oklahoma Department of Wildlife Conservation (ODWC) was contacted about the fish community in the lake. ODWC had surveyed the lake once in the past seven years. The pond had been stocked and an ADA compliant fishing dock was installed in cooperation with the City of Woodward for recreational purposes. ODWC will improve the habitat of the lake during construction phases of this project by using artificial structures (i.e., spider blocks). ODWC will restock the lake after the project has been completed.

Amphibian and Reptile Community

No amphibians or reptiles were observed during the site visit. Common amphibians and reptiles found in this area of Oklahoma include: western chorus frog (*Pseudacris triseriata*), great plains toad (*Anaxyrus cognatus),* Woodhouse's toad (*Anaxyrus woodhousii*), collared lizard (*Crotaphytus collaris*), Texas horned lizard (*Phrynosoma cornutum*), red-eared slider (*Trachemys scripta elegans*), ornate box turtle (Terrapene ornata ornata), spiny softshell turtle (*Apalone spinifera*), speckled kingsnake (*Lampropeltis holbrooki*), bullsnake (*Pituophis catenifer sayi*), rat snake (*Pantherophis obsoletus*), diamondback water snake (*Nerodia rhombifer*), plain-bellied watersnake (*Nerodia erythrogaster*), prairie rattlesnake (*Crotalus viridis*) and western massasauga rattlesnake (*Sistrurus tergeminus*) (ODWC, 2019).

Terrestrial Vertebrate Community

White-tailed deer (*Odocoileus virginianus*), fox squirrel (*Sciurus niger*), and eastern cottontail (*Sylvilagus floridanus*) were observed during the site visit. Other common terrestrial vertebrates found in this area of Oklahoma include: black tailed jackrabbit (*Lepus californicus*), nine-banded armadillo (Dasypus novemcinctus), and bobcat (*Lynx rufus*) (ODWC, 2019).

References

Woods, A.J., Omernik, J.M., Butler, D.R., Ford, J.G., Henley, J.E., Hoagland, B.W., Arndt, D.S., and Moran, B.C., 2005. Ecoregions of Oklahoma: Reston, Virginia, U.S. Geological Survey

U.S. Fish and Wildlife Service (USFWS). 2019. Information for Planning and Conservation. [Online] (September 2019) Available URL: http://www.fws.gov/endangered/

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Appendix A
Figures

FIGURE 1

FREESE AND NICHOLS
FREESE AND NICHOLS
4055 International Plaza Suite 200
Fort Worth, Texas 76109-4895
(817) 735-7300

AD ASTRA COLLABORATIVE, LLC

ARS Field Station Dam Rehabilition

Waters of the U.S. Map

FN PROJECT NO.	AAC19600
DATE CREATED	12/17/2019
DATUM & COORDINATE SYSTEM	NAD83 State Plane (feet) Texas North Central
FILE NAME	1_WOTUS_11x17
PREPARED BY	HHM

Appendix B
Photograph

Photo 1. View of lake and current dam, facing northeast.

Photo 2. View of top of dam, facing east.

Photo 3. View of Emergent Wetland 1, north of existing dam, facing north.

Photo 4. View of Stream 1, facing north (upstream)

Photo 5. View of Forested Wetland 1, facing west.

Photo 6. View of Emergent Wetland 2, facing north.

Photo 7. View of Scrub-Shrub Wetland 1, facing north.

Appendix C
Wetland Determination Data Sheets

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: ARS Field Station Dam Rehabilitation City/County: Woodward Sampling Date: 9/20/19

Applicant/Owner: Ad Astra Collaborative, LLC State: OK Sampling Point: EW1- WDP

Investigator(s): EJE, WWW Section, Township, Range: Section 35, T23N, R21W

Landform (hillslope, terrace, etc.): swale Local relief (concave, convex, none): concave Slope (%): 0-1

Subregion (LRR): LLR H Lat: 36.428117 Long: -99.423183 Datum: NAD83

Soil Map Unit Name: Hardeman-Devol complex, 8 to 20 percent slopes NWI classification: PEM1Cx

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐
Hydric Soil Present?	Yes ☒	No ☐
Wetland Hydrology Present?	Yes ☒	No ☐

Is the Sampled Area within a Wetland? Yes ☒ No ☐

Remarks:
All three wetland indicators were observed.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: --)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
	-- = Total Cover		
Sapling/Shrub Stratum (Plot size: --)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	-- = Total Cover		
Herb Stratum (Plot size: 5')			
1. *Typha latifolia*	80	☒	OBL
2. *Lemna minor*	5	☐	OBL
3. *Persicaria punctata*	5	☐	OBL
4. *Phragmites australis*	5	☐	FACW
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
	95 = Total Cover		
Woody Vine Stratum (Plot size: --)			
1.		☐	
2.		☐	
	-- = Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC−): 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	90	x 1 = 90
FACW species	5	x 2 = 10
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	95 (A)	100 (B)

Prevalence Index = B/A = 1.05

Hydrophytic Vegetation Indicators:

- ☒ 1 - Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☒ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks:
Positive indicators for hydrophytic vegetation were observed.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-18	5YR 3/1	85	7.5YR 4/6	15	C	M	Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR F**)
- ☐ 1 cm Muck (A9) (**LRR F, G, H**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) (**LRR G, H**)
- ☐ 5 cm Mucky Peat or Peat (S3) (**LRR F**)
- ☐ Sandy Gleyed Matrix (S4)
- ☒ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ High Plains Depressions (F16) (**MLRA 72 & 73 of LRR H**)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (**LRR I, J**)
- ☐ Coast Prairie Redox (A16) (**LRR F, G, H**)
- ☐ Dark Surface (S7) (**LRR G**)
- ☐ High Plains Depressions (F16) (**LRR H outside of MLRA 72 & 73**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ______
Depth (inches): ______

Hydric Soil Present? Yes ☒ No ☐

Remarks:
Positive indicators of hydric soil were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☒ Surface Water (A1)
- ☐ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☒ Hydrogen Sulfide Odor (C1)
- ☐ Dry-Season Water Table (C2)
- ☐ Oxidized Rhizospheres on Living Roots (C3) (**where not tilled**)
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3) (**where tilled**)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☒ FAC-Neutral Test (D5)
- ☐ Frost-Heave Hummocks (D7) (**LRR F**)

Field Observations:

Surface Water Present?	Yes ☒	No ☐	Depth (inches): 1
Water Table Present?	Yes ☒	No ☐	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ☒	No ☐	Depth (inches): 0

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Positive indicators of hydrology were observed.

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: ARS Field Station Dam Rehabilitation City/County: Woodward Sampling Date: 9/20/19

Applicant/Owner: Ad Astra Collaborative, LLC State: OK Sampling Point: UDP 1

Investigator(s): EJE, WWW Section, Township, Range: Section 35, T23N, R21W

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): none Slope (%): 2-3

Subregion (LRR): LRR H Lat: 36.428032 Long: -99.423267 Datum: NAD83

Soil Map Unit Name: Hardeman-Devol complex, 8 to 20 percent slopes NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☐ No ☒	Is the Sampled Area within a Wetland? Yes ☐ No ☒
Hydric Soil Present? Yes ☐ No ☒	
Wetland Hydrology Present? Yes ☐ No ☒	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: --)	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
	-- = Total Cover		
Sapling/Shrub Stratum (Plot size: --)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	-- = Total Cover		
Herb Stratum (Plot size: 5')			
1. *Ambrosia artemisiifolia*	45	☒	FACU
2. *Andropogon gerardii*	20	☐	FACU
3. *Erigeron canadensis*	15	☐	FACU
4. *Tridens flavus*	10	☐	UPL
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
	90 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.		☐	
2.		☐	
	= Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC−): 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species	80	x 4 =	320
UPL species	10	x 5 =	50
Column Totals:	90 (A)		370 (B)

Prevalence Index = B/A = 4.11

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☐ No ☒

Remarks:

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-18	7.5YR 4/4	100					sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR F**)
- ☐ 1 cm Muck (A9) (**LRR F, G, H**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) (**LRR G, H**)
- ☐ 5 cm Mucky Peat or Peat (S3) (**LRR F**)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ High Plains Depressions (F16) (**MLRA 72 & 73 of LRR H**)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (**LRR I, J**)
- ☐ Coast Prairie Redox (A16) (**LRR F, G, H**)
- ☐ Dark Surface (S7) (**LRR G**)
- ☐ High Plains Depressions (F16) (**LRR H outside of MLRA 72 & 73**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soil Present? Yes ☐ No ☒

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Dry-Season Water Table (C2)
- ☐ Oxidized Rhizospheres on Living Roots (C3) (**where not tilled**)
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3) (**where tilled**)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ FAC-Neutral Test (D5)
- ☐ Frost-Heave Hummocks (D7) (**LRR F**)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): ____
Water Table Present? Yes ☐ No ☒ Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): ____

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: ARS Field Station Dam Rehabilitation City/County: Woodward Sampling Date: 9/20/19

Applicant/Owner: Ad Astra Collaborative, LLC State: OK Sampling Point: EW2 - WDP

Investigator(s): EJE, WWW Section, Township, Range: Section 35, T23N, R21W

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): concave Slope (%): 0-1

Subregion (LRR): LRR H Lat: 36.428125 Long: -99.424603 Datum: NAD83

Soil Map Unit Name: Hardeman-Devol complex, 8 to 20 percent slopes NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation No, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐
Hydric Soil Present?	Yes ☒	No ☐
Wetland Hydrology Present?	Yes ☒	No ☐

Is the Sampled Area within a Wetland? Yes ☒ No ☐

Remarks:

All three wetland indicators were present. This area is located in the spillway of the dam. Construction of the dam and spillway has altered the natural soil and hydrology of the area.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: --)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
= Total Cover	--		
Sapling/Shrub Stratum (Plot size: 15')			
1. *Cephalanthus occidentalis*	30	☒	OBL
2.		☐	
3.		☐	
4.		☐	
5.		☐	
= Total Cover	30		
Herb Stratum (Plot size: 5')			
1. *Thypa latifolia*	45	☒	OBL
2. *Echinochloa crus-galli*	25	☐	FAC
3. *Xanthium strumarium*	20	☐	FAC
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
= Total Cover	90		
Woody Vine Stratum (Plot size: --)			
1.		☐	
2.		☐	
= Total Cover	--		

% Bare Ground in Herb Stratum 10

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC−): 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	75	x 1 = 75
FACW species		x 2 =
FAC species	45	x 3 = 135
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	120 (A)	210 (B)

Prevalence Index = B/A = 1.75

Hydrophytic Vegetation Indicators:

- ☒ 1 - Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☒ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks:

Positive indicators of hydrophytic vegetation were present.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	7.5YR 3/1	100					Sandy Loam	
2-18	2.5YR 4/6	100					Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5) (**LRR F**)
- [ ] 1 cm Muck (A9) (**LRR F, G, H**)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1)
- [ ] 2.5 cm Mucky Peat or Peat (S2) (**LRR G, H**)
- [ ] 5 cm Mucky Peat or Peat (S3) (**LRR F**)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Loamy Mucky Mineral (F1)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] High Plains Depressions (F16) (**MLRA 72 & 73 of LRR H**)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (**LRR I, J**)
- [ ] Coast Prairie Redox (A16) (**LRR F, G, H**)
- [ ] Dark Surface (S7) (**LRR G**)
- [ ] High Plains Depressions (F16) (**LRR H outside of MLRA 72 & 73**)
- [ ] Reduced Vertic (F18)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [x] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ______
Depth (inches): ______

Hydric Soil Present? Yes [x] No [ ]

Remarks:

Soil has been disturbed. Soil is assumed hyrdic due to surface water and hydrophytic vegetation.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- [x] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Salt Crust (B11)
- [ ] Aquatic Invertebrates (B13)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Dry-Season Water Table (C2)
- [ ] Oxidized Rhizospheres on Living Roots (C3) (**where not tilled**)
- [ ] Presence of Reduced Iron (C4)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Oxidized Rhizospheres on Living Roots (C3) (**where tilled**)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [x] FAC-Neutral Test (D5)
- [ ] Frost-Heave Hummocks (D7) (**LRR F**)

Field Observations:

Surface Water Present?	Yes [x]	No [ ]	Depth (inches): 1
Water Table Present?	Yes [x]	No [ ]	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes [x]	No [ ]	Depth (inches): 0

Wetland Hydrology Present? Yes [x] No [ ]

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of hydrology were present.

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: ARS Field Station Dam Rehabilitation City/County: Woodward Sampling Date: 9/20/19

Applicant/Owner: Ad Astra Collaborative, LLC State: OK Sampling Point: FW1- WDP

Investigator(s): EJE, WWW Section, Township, Range: Section 35, T23N, R21W

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): concave Slope (%): 0-1

Subregion (LRR): LRR H Lat: 36.428625 Long: -99.424723 Datum: NAD83

Soil Map Unit Name: Hardeman-Devol complex, 8 to 20 percent slopes NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes [X] No [ ] (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes [ ] No [X]

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes [X]	No [ ]
Hydric Soil Present?	Yes [X]	No [ ]
Wetland Hydrology Present?	Yes [X]	No [ ]

Is the Sampled Area within a Wetland? Yes [X] No [ ]

Remarks:

All three wetland indicators were present. The hyrdology of the area has been altered by the construction of a dam spillway.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30')			
1. *Salix nigra*	90	[X]	FACW
2.		[ ]	
3.		[ ]	
4.		[ ]	
	90	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. *Cephalanthus occidentalis*	80	[X]	OBL
2.		[ ]	
3.		[ ]	
4.		[ ]	
5.		[ ]	
	80	= Total Cover	
Herb Stratum (Plot size: --)			
1.		[ ]	
2.		[ ]	
3.		[ ]	
4.		[ ]	
5.		[ ]	
6.		[ ]	
7.		[ ]	
8.		[ ]	
9.		[ ]	
10.		[ ]	
	0	= Total Cover	
Woody Vine Stratum (Plot size: --)			
1.		[ ]	
2.		[ ]	
	--	= Total Cover	

% Bare Ground in Herb Stratum 100

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC−): 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	90	x 1 = 90
FACW species	80	x 2 = 160
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	170 (A)	250 (B)

Prevalence Index = B/A = 1.47

Hydrophytic Vegetation Indicators:

- [X] 1 - Rapid Test for Hydrophytic Vegetation
- [X] 2 - Dominance Test is >50%
- [X] 3 - Prevalence Index is ≤3.0[1]
- [ ] 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes [X] No [ ]

Remarks:

Positive indicators for hydrophytic vegetation were observed.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
--	--	--	--	--	--	--	--	No pit dug due to access

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR F**)
- ☐ 1 cm Muck (A9) (**LRR F, G, H**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) (**LRR G, H**)
- ☐ 5 cm Mucky Peat or Peat (S3) (**LRR F**)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ High Plains Depressions (F16) (**MLRA 72 & 73 of LRR H**)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (**LRR I, J**)
- ☐ Coast Prairie Redox (A16) (**LRR F, G, H**)
- ☐ Dark Surface (S7) (**LRR G**)
- ☐ High Plains Depressions (F16) (**LRR H outside of MLRA 72 & 73**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☒ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ______
Depth (inches): ______

Hydric Soil Present? Yes ☒ No ☐

Remarks:
No pit was dug. The soil is assumed hyrdic due to the presence of surface water and hydrophytic vegetation.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☒ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Dry-Season Water Table (C2)
- ☐ Oxidized Rhizospheres on Living Roots (C3) (**where not tilled**)
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3) (**where tilled**)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☒ FAC-Neutral Test (D5)
- ☐ Frost-Heave Hummocks (D7) (**LRR F**)

Field Observations:

Surface Water Present?	Yes ☒	No ☐	Depth (inches): 1
Water Table Present?	Yes ☐	No ☐	Depth (inches): No Pit
Saturation Present? (includes capillary fringe)	Yes ☐	No ☐	Depth (inches): No Pit

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Area could not be accessed for sample pit. Surface water was observed within the wetland.

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: ARS Field Station Dam Rehabilitation City/County: Woodward Sampling Date: 9/20/19

Applicant/Owner: Ad Astra Collaborative, LLC State: OK Sampling Point: SW1 - WDP

Investigator(s): EJE, WWW Section, Township, Range: Section 35, T23N, R21W

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): concave Slope (%): 0-1

Subregion (LRR): LRR H Lat: 36.427857 Long: -99.424999 Datum: NAD83

Soil Map Unit Name: Carey silt loam, 3 to 5 percent slopes NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation No, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☒

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐
Hydric Soil Present?	Yes ☒	No ☐
Wetland Hydrology Present?	Yes ☒	No ☐

Is the Sampled Area within a Wetland? Yes ☒ No ☐

Remarks:

All three wetland indicators were present. This area is located in the spillway of the dam. Construction of the dam and spillway has altered the natural soil and hydrology of the area.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: --)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
= Total Cover	--		
Sapling/Shrub Stratum (Plot size: 15')			
1. *Cephalanthus occidentalis*	40	☒	OBL
2.		☐	
3.		☐	
4.		☐	
5.		☐	
= Total Cover	40		
Herb Stratum (Plot size: 5')			
1. *Typha latifolia*	5	☒	OBL
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
= Total Cover	5		
Woody Vine Stratum (Plot size: --)			
1.		☐	
2.		☐	
= Total Cover	--		
% Bare Ground in Herb Stratum 95			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC−): 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	40	x 1 = 45
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	45 (A)	45 (B)

Prevalence Index = B/A = 1.00

Hydrophytic Vegetation Indicators:

- ☒ 1 - Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☒ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks:

Positive indicators of hydrophytic vegetation was observed.

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	7.5YR 2.5/1	90	10YR 5/6	10	C	M	Loamy Sand	
6-18	10YR 4/3	50	7.5YR 5/6	50	C	M	Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR F**)
- ☐ 1 cm Muck (A9) (**LRR F, G, H**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) (**LRR G, H**)
- ☐ 5 cm Mucky Peat or Peat (S3) (**LRR F**)
- ☐ Sandy Gleyed Matrix (S4)
- ☒ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ High Plains Depressions (F16) (**MLRA 72 & 73 of LRR H**)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (**LRR I, J**)
- ☐ Coast Prairie Redox (A16) (**LRR F, G, H**)
- ☐ Dark Surface (S7) (**LRR G**)
- ☐ High Plains Depressions (F16) (**LRR H outside of MLRA 72 & 73**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☒ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ______
Depth (inches): ______

Hydric Soil Present? Yes ☒ No ☐

Remarks:

Soil has been disturbed by construction of the spillway. Indicators of hydric soils were present.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Dry-Season Water Table (C2)
- ☐ Oxidized Rhizospheres on Living Roots (C3) (**where not tilled**)
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3) (**where tilled**)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☒ FAC-Neutral Test (D5)
- ☐ Frost-Heave Hummocks (D7) (**LRR F**)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?	☐	☒	
Water Table Present?	☒	☐	10
Saturation Present? (includes capillary fringe)	☒	☐	0

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: ARS Field Station Dam Rehabilitation City/County: Woodward Sampling Date: 9/20/19

Applicant/Owner: Ad Astra Collaborative, LLC State: OK Sampling Point: UDP 2

Investigator(s): EJE, WWW Section, Township, Range: Section 35, T23N, R21W

Landform (hillslope, terrace, etc.): hilltop Local relief (concave, convex, none): none Slope (%): 0-1

Subregion (LRR): LRR H Lat: 36.426982 Long: -99.42487 Datum: NAD83

Soil Map Unit Name: Carey silt loam, 3 to 5 percent slopes NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☒
Hydric Soil Present?	Yes ☐	No ☒
Wetland Hydrology Present?	Yes ☐	No ☒

Is the Sampled Area within a Wetland? Yes ☐ No ☒

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Celtis laevigata*	10	☒	FAC
2.		☐	
3.		☐	
4.		☐	
	10 = Total Cover		
Sapling/Shrub Stratum (Plot size: --)			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
	-- = Total Cover		
Herb Stratum (Plot size: 5')			
1. *Cynodon dactylon*	70	☒	FACU
2. *Bothriochloa saccharoides*	10	☐	UPL
3. *Bothriochloa ischaemum*	10	☐	UPL
4. *Tridens flavus*	10	☐	UPL
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
	100 = Total Cover		
Woody Vine Stratum (Plot size: --)			
1.		☐	
2.		☐	
	-- = Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC−): 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species	70	x 4 = 280
UPL species	30	x 5 = 150
Column Totals:	100 (A)	430 (B)

Prevalence Index = B/A = 4.3

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☐ No ☒

Remarks:

SOIL

Sampling Point: UDP 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-18	7.5YR 4/4	100					Fine Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR F**)
- ☐ 1 cm Muck (A9) (**LRR F, G, H**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 2.5 cm Mucky Peat or Peat (S2) (**LRR G, H**)
- ☐ 5 cm Mucky Peat or Peat (S3) (**LRR F**)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ High Plains Depressions (F16) (**MLRA 72 & 73 of LRR H**)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (**LRR I, J**)
- ☐ Coast Prairie Redox (A16) (**LRR F, G, H**)
- ☐ Dark Surface (S7) (**LRR G**)
- ☐ High Plains Depressions (F16) (**LRR H outside of MLRA 72 & 73**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☐ No ☒

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Dry-Season Water Table (C2)
- ☐ Oxidized Rhizospheres on Living Roots (C3) (**where not tilled**)
- ☐ Presence of Reduced Iron (C4)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Oxidized Rhizospheres on Living Roots (C3) (**where tilled**)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ FAC-Neutral Test (D5)
- ☐ Frost-Heave Hummocks (D7) (**LRR F**)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): ______

Water Table Present? Yes ☐ No ☒ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): ______

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Appendix D
USFWS Official IPaC List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Oklahoma Ecological Services Field Office
9014 East 21st Street
Tulsa, OK 74129-1428
Phone: (918) 581-7458 Fax: (918) 581-7467
http://www.fws.gov/southwest/es/Oklahoma/

In Reply Refer To:
Consultation Code: 02EKOK00-2019-SLI-3330
Event Code: 02EKOK00-2019-E-08269
Project Name: Woddward ARS Dam Rehab

September 18, 2019

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Non-federal entities conducting activities that may result in take of listed species should consider seeking coverage under section 10 of the ESA, either through development of a Habitat Conservation Plan (HCP) or, by becoming a signatory to the General Conservation Plan (GCP) currently under development for the American burying beetle. Each of these mechanisms provides the means for obtaining a permit and coverage for incidental take of listed species during otherwise lawful activities.

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit through our Project Review step-wise process http://www.fws.gov/southwest/es/oklahoma/OKESFO%20Permit%20Home.htm.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Oklahoma Ecological Services Field Office
9014 East 21st Street
Tulsa, OK 74129-1428
(918) 581-7458

Project Summary

Consultation Code: 02EKOK00-2019-SLI-3330

Event Code: 02EKOK00-2019-E-08269

Project Name: Woddward ARS Dam Rehab

Project Type: DAM

Project Description: Rehabilitation of the ARS Lake Dam in Woodward Oklahoma, involving replacement of the auxiliary and principal spillways and widening of the dam face.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/36.42534844793104N99.42307233810425W

Counties: Woodward, OK

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Least Tern *Sterna antillarum* Population: interior pop. No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8505	Endangered
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *Calidris canutus rufa* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane *Grus americana* Population: Wherever found, except where listed as an experimental population There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/758	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Harris's Sparrow *Zonotrichia querula* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

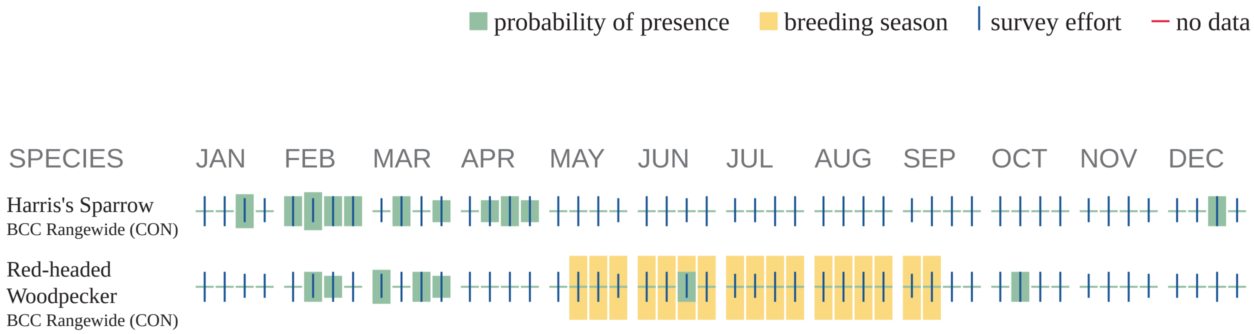
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ “What does IPaC use to generate the migratory birds potentially occurring in my specified location”. Please be aware this report provides the “probability of presence” of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the “no data” indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ “Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds” at the bottom of your migratory bird trust resources page.

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER EMERGENT WETLAND

- PEM1Cx

FRESHWATER FORESTED/SHRUB WETLAND

- PFO1A
- PFO1Ah

LAKE

- L1UBHh

RIVERINE

- R5UBF

Appendix E
Nationwide Permit 3, Maintenance

NATIONWIDE PERMIT 3
Maintenance
Effective Date: March 19, 2017
(NWP Final Notice, 82 FR 4)

3. Maintenance. (a) The repair, rehabilitation, or replacement of any previously authorized, currently serviceable structure or fill, or of any currently serviceable structure or fill authorized by 33 CFR 330.3, provided that the structure or fill is not to be put to uses differing from those uses specified or contemplated for it in the original permit or the most recently authorized modification. Minor deviations in the structure's configuration or filled area, including those due to changes in materials, construction techniques, requirements of other regulatory agencies, or current construction codes or safety standards that are necessary to make the repair, rehabilitation, or replacement are authorized. This NWP also authorizes the removal of previously authorized structures or fills. Any stream channel modification is limited to the minimum necessary for the repair, rehabilitation, or replacement of the structure or fill; such modifications, including the removal of material from the stream channel, must be immediately adjacent to the project. This NWP also authorizes the removal of accumulated sediment and debris within, and in the immediate vicinity of, the structure or fill. This NWP also authorizes the repair, rehabilitation, or replacement of those structures or fills destroyed or damaged by storms, floods, fire or other discrete events, provided the repair, rehabilitation, or replacement is commenced, or is under contract to commence, within two years of the date of their destruction or damage. In cases of catastrophic events, such as hurricanes or tornadoes, this two-year limit may be waived by the district engineer, provided the permittee can demonstrate funding, contract, or other similar delays.

(b) This NWP also authorizes the removal of accumulated sediments and debris outside the immediate vicinity of existing structures (e.g., bridges, culverted road crossings, water intake structures, etc.). The removal of sediment is limited to the minimum necessary to restore the waterway in the vicinity of the structure to the approximate dimensions that existed when the structure was built, but cannot extend farther than 200 feet in any direction from the structure. This 200 foot limit does not apply to maintenance dredging to remove accumulated sediments blocking or restricting outfall and intake structures or to maintenance dredging to remove accumulated sediments from canals associated with outfall and intake structures. All dredged or excavated materials must be deposited and retained in an area that has no waters of the United States unless otherwise specifically approved by the district engineer under separate authorization.

(c) This NWP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to conduct the maintenance activity. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. After conducting the maintenance activity, temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

(d) This NWP does not authorize maintenance dredging for the primary purpose of navigation. This NWP does not authorize beach restoration. This NWP does not authorize new stream channelization or stream relocation projects.

Notification: For activities authorized by paragraph (b) of this NWP, the permittee must submit a pre-construction notification to the district engineer prior to commencing the activity (see general condition 32). The pre-construction notification must include information regarding the original design capacities and configurations of the outfalls, intakes, small impoundments, and canals. (Authorities: Section 10 of the Rivers and Harbors Act of 1899 and section 404 of the Clean Water Act (Sections 10 and 404))

Note: This NWP authorizes the repair, rehabilitation, or replacement of any previously authorized structure or fill that does not qualify for the Clean Water Act section 404(f) exemption for maintenance.

Nationwide Permit General Conditions

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. Navigation. (a) No activity may cause more than a minimal adverse effect on navigation.

(b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.

(c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. Aquatic Life Movements. No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3. Spawning Areas. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. Migratory Bird Breeding Areas. Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. Shellfish Beds. No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. Suitable Material. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

7. Water Supply Intakes. No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. Adverse Effects From Impoundments. If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. Management of Water Flows. To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. Fills Within 100-Year Floodplains. The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. Equipment. Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. Soil Erosion and Sediment Controls. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow, or during low tides.

13. Removal of Temporary Fills. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. Proper Maintenance. Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. Single and Complete Project. The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. Wild and Scenic Rivers. (a) No NWP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status.

(b) If a proposed NWP activity will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, the permittee must submit a pre-construction notification (see general condition 32). The district engineer will coordinate the PCN with the Federal agency with direct management responsibility for that river. The permittee shall not begin the NWP activity until notified by the district engineer that the Federal agency with direct management responsibility for that river has determined in writing that the proposed NWP activity will not adversely affect the Wild and Scenic River designation or study status.

(c) Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: http://www.rivers.gov/.

17. Tribal Rights. No NWP activity may cause more than minimal adverse effects on tribal rights (including treaty rights), protected tribal resources, or tribal lands.

18. Endangered Species. (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless ESA section 7 consultation addressing the effects of the proposed activity has been completed. Direct effects are the immediate effects on listed species and critical habitat caused by the NWP activity. Indirect effects are those effects on listed species and critical habitat that are caused by the NWP activity and are later in time, but still are reasonably certain to occur.

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. If pre-construction notification is required for the proposed activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed activity or that utilize the designated critical habitat that might be affected by the proposed activity. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the activity, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification that the proposed activity will have "no effect" on listed species or critical habitat, or until ESA section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species-specific permit conditions to the NWPs.

(e) Authorization of an activity by an NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

(f) If the non-federal permittee has a valid ESA section 10(a)(1)(B) incidental take permit with an approved Habitat Conservation Plan for a project or a group of projects that includes the proposed NWP activity, the non-federal applicant should provide a copy of that ESA section 10(a)(1)(B) permit with the PCN required by paragraph (c) of this general condition. The district engineer will coordinate with the agency that issued the ESA section 10(a)(1)(B) permit to determine whether the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation conducted for the ESA section 10(a)(1)(B) permit. If that coordination results in concurrence from the agency that the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation for the ESA section 10(a)(1)(B) permit, the district engineer does not need to conduct a separate ESA section 7 consultation for the proposed NWP activity. The district engineer will notify the non-federal applicant within 45 days of receipt of a complete pre-construction notification whether the ESA section 10(a)(1)(B) permit covers the proposed NWP activity or whether additional ESA section 7 consultation is required.

(g) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the FWS and NMFS or their world wide web pages at http://www.fws.gov/ or http://www.fws.gov/ipac and http://www.nmfs.noaa.gov/pr/species/esa/ respectively.

19. Migratory Birds and Bald and Golden Eagles. The permittee is responsible for ensuring their action complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting appropriate local office of the U.S. Fish and Wildlife Service to determine applicable measures to reduce impacts to migratory birds or eagles, including whether "incidental take" permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

20. <u>Historic Properties</u>. (a) In cases where the district engineer determines that the activity may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of section 106 of the National Historic Preservation Act. If pre-construction notification is required for the proposed NWP activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation is not submitted, then additional consultation under section 106 may be necessary. The respective federal agency is responsible for fulfilling its obligation to comply with section 106.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the NWP activity might have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties might have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of, or potential for, the presence of historic properties can be sought from the State Historic Preservation Officer, Tribal Historic Preservation Officer, or designated tribal representative, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted in the PCN and these identification efforts, the district engineer shall determine whether the proposed NWP activity has the potential to cause effects on the historic properties. Section 106 consultation is not required when the district engineer determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). Section 106 consultation is required when the district engineer determines that the activity has the potential to cause effects on historic properties. The district engineer will conduct consultation with consulting parties identified under 36 CFR 800.2(c) when he or she makes any of the following effect determinations for the purposes of section 106 of the NHPA: no historic properties affected, no adverse effect, or adverse effect. Where the non-Federal applicant has identified historic properties on which the activity might have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects to historic properties or that NHPA section 106 consultation has been completed.

(d) For non-federal permittees, the district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA section 106 consultation is required. If NHPA section 106 consultation is required, the district engineer will notify the non-Federal applicant that he or she cannot begin the activity until section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(e) Prospective permittees should be aware that section 110k of the NHPA (54 U.S.C. 306113) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. Discovery of Previously Unknown Remains and Artifacts. If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. Designated Critical Resource Waters. Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.

(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38, and 54, notification is required in accordance with general condition 32, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. Mitigation. The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects.

(d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation to ensure that the activity results in no more than minimal adverse environmental effects. Compensatory mitigation for losses of streams should be provided, if practicable, through stream rehabilitation, enhancement, or preservation, since streams are difficult-to-replace resources (see 33 CFR 332.3(e)(3)).

(e) Compensatory mitigation plans for NWP activities in or near streams or other open waters will normally include a requirement for the restoration or enhancement, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, the restoration or maintenance/protection of riparian areas may be the only compensatory mitigation required. Restored riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to restore or maintain/protect a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or maintaining/protecting a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of minimization or compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(f) Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in no more than minimal adverse environmental effects. For the NWPs, the preferred mechanism for providing compensatory mitigation is mitigation bank credits or in-lieu fee program credits (see 33 CFR 332.3(b)(2) and (3)). However, if an appropriate number and type of mitigation bank or in-lieu credits are not available at the time the PCN is submitted to the district engineer, the district engineer may approve the use of permittee-responsible mitigation.

(2) The amount of compensatory mitigation required by the district engineer must be sufficient to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). (See also 33 CFR 332.3(f)).

(3) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, aquatic resource restoration should be the first compensatory mitigation option considered for permittee-responsible mitigation.

(4) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) through (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)).

(5) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.

(6) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan (see 33 CFR 332.4(c)(1)(ii)).

(g) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any NWP activity resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that an NWP activity already meeting the established acreage limits also satisfies the no more than minimal impact requirement for the NWPs.

(h) Permittees may propose the use of mitigation banks, in-lieu fee programs, or permittee-responsible mitigation. When developing a compensatory mitigation proposal, the permittee must consider appropriate and practicable options consistent with the framework at 33 CFR 332.3(b). For activities resulting in the loss of marine or estuarine resources, permittee-responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(i) Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. <u>Safety of Impoundment Structures</u>. To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. Water Quality. Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. Coastal Zone Management. In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. Regional and Case-By-Case Conditions. The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. Use of Multiple Nationwide Permits. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. Transfer of Nationwide Permit Verifications. If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

"When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."

____
(Transferee)

____
(Date)

30. Compliance Certification. Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards,

will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

(a) A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;

(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and

(c) The signature of the permittee certifying the completion of the activity and mitigation.

The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. Activities Affecting Structures or Works Built by the United States. If an NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a "USACE project"), the prospective permittee must submit a pre-construction notification. See paragraph (b)(10) of general condition 32. An activity that requires section 408 permission is not authorized by NWP until the appropriate Corps office issues the section 408 permission to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. Pre-Construction Notification. (a) Timing. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act

(see 33 CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Pre-Construction Notification: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed activity;

(3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposed activity;

(4) A description of the proposed activity; the activity's purpose; direct and indirect adverse environmental effects the activity would cause, including the anticipated amount of loss of wetlands, other special aquatic sites, and other waters expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; a description of any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed activity; and any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings for linear projects that require Department of the Army authorization but do not require pre-construction notification. The description of the proposed activity and any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the need for compensatory mitigation or other mitigation measures. For single and complete linear projects, the PCN must include the quantity of anticipated losses of wetlands, other special aquatic sites, and other waters for each single and complete crossing of those wetlands, other special aquatic sites, and other waters. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the activity and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(5) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(6) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation

requirement will be satisfied, or explaining why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(7) For non-Federal permittees, if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed activity or utilize the designated critical habitat that might be affected by the proposed activity. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with the Endangered Species Act;

(8) For non-Federal permittees, if the NWP activity might have the potential to cause effects to a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, the PCN must state which historic property might have the potential to be affected by the proposed activity or include a vicinity map indicating the location of the historic property. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with section 106 of the National Historic Preservation Act;

(9) For an activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a “study river” for possible inclusion in the system while the river is in an official study status, the PCN must identify the Wild and Scenic River or the “study river” (see general condition 16); and

(10) For an activity that requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, the pre-construction notification must include a statement confirming that the project proponent has submitted a written request for section 408 permission from the Corps office having jurisdiction over that USACE project.

(c) Form of Pre-Construction Notification: The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is an NWP PCN and must include all of the applicable information required in paragraphs (b)(1) through (10) of this general condition. A letter containing the required information may also be used. Applicants may provide electronic files of PCNs and supporting materials if the district engineer has established tools and procedures for electronic submittals.

(d) Agency Coordination: (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity’s compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the activity’s adverse environmental effects so that they are no more than minimal.

(2) Agency coordination is required for: (i) all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States; (ii) NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of stream bed; (iii) NWP 13 activities in excess of 500 linear feet, fills greater than one cubic yard per running foot, or involve discharges of dredged or fill material into special aquatic sites; and (iv) NWP 54 activities in excess of 500 linear feet, or that extend into the waterbody more than 30 feet from the mean low water line in tidal waters or the ordinary high water mark in the Great Lakes.

(3) When agency coordination is required, the district engineer will immediately provide (e.g., via e-mail, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (FWS, state natural resource or water quality agency, EPA, and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to notify the district engineer via telephone, facsimile transmission, or e-mail that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse environmental effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects of the proposed activity are no more than minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(4) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(5) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

D. District Engineer's Decision

1. In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. If a project proponent requests authorization by a specific NWP, the district engineer should issue the NWP verification for that activity if it meets the terms and conditions of that NWP, unless he or she determines, after considering mitigation, that the proposed activity will result in more than minimal individual and cumulative adverse effects on the aquatic environment and other aspects of the public interest and exercises discretionary authority to require an individual permit for the proposed activity. For a linear project, this determination will include an evaluation of the individual crossings of waters of the United States to determine whether they individually satisfy the terms and conditions of the NWP(s), as well as the cumulative effects caused by all of the crossings authorized by NWP. If an applicant requests a waiver of the 300 linear foot limit on impacts to streams or of an otherwise applicable limit, as provided for in NWPs 13, 21, 29, 36, 39, 40, 42, 43, 44, 50, 51, 52, or 54, the district engineer will only grant the waiver upon a written determination that the NWP activity will result in only minimal individual and cumulative adverse environmental effects. For those NWPs that have a waivable 300 linear foot limit for losses of intermittent and ephemeral stream bed and a 1/2-acre limit (i.e., NWPs 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52), the loss of intermittent and ephemeral stream bed, plus any other losses of jurisdictional waters and wetlands, cannot exceed 1/2-acre.

2. When making minimal adverse environmental effects determinations the district engineer will consider the direct and indirect effects caused by the NWP activity. He or she will also consider the cumulative adverse environmental effects caused by activities authorized by NWP and whether those cumulative adverse environmental effects are no more than minimal. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type of resource that will be affected by the NWP activity, the functions provided by the aquatic resources that will be affected by the NWP activity, the degree or magnitude to which the aquatic resources perform those functions, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic resource functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. If an appropriate functional or condition assessment method is available and practicable to use, that assessment method may be used by the district engineer to assist in the minimal adverse environmental effects determination. The district engineer may add case-specific special conditions to the NWP authorization to address site-specific environmental concerns.

3. If the proposed activity requires a PCN and will result in a loss of greater than 1/10-acre of wetlands, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for NWP activities with smaller impacts, or for impacts to other types of waters (e.g., streams). The district engineer will consider any proposed compensatory mitigation or other mitigation measures the applicant has included in the proposal in determining whether the net adverse environmental effects of the proposed activity are no more than minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse environmental effects are no more than minimal, after considering mitigation, the district engineer will notify the permittee and include any activity-specific conditions in the NWP verification the district engineer deems necessary. Conditions for compensatory mitigation requirements must comply with the appropriate provisions at 33 CFR 332.3(k). The district engineer must approve the final mitigation plan before the permittee commences work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the proposed compensatory mitigation plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure the NWP activity results in no more than minimal adverse environmental effects. If the net adverse environmental effects of the NWP activity (after consideration of the mitigation proposal) are determined by the district engineer to be no more than minimal, the district engineer will provide a timely written response to the applicant. The response will state that the NWP activity can proceed under the terms and conditions of the NWP, including any activity-specific conditions added to the NWP authorization by the district engineer.

4. If the district engineer determines that the adverse environmental effects of the proposed activity are more than minimal, then the district engineer will notify the applicant either: (a) that the activity does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (b) that the activity is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal; or (c) that the activity is authorized under the NWP with specific modifications or conditions. Where the district engineer determines that mitigation is required to ensure no more than minimal adverse environmental effects, the activity will be authorized within the 45-day PCN period (unless additional time is

required to comply with general conditions 18, 20, and/or 31, or to evaluate PCNs for activities authorized by NWPs 21, 49, and 50), with activity-specific conditions that state the mitigation requirements. The authorization will include the necessary conceptual or detailed mitigation plan or a requirement that the applicant submit a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal. When compensatory mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan or has determined that prior approval of a final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation.

E. Further Information

1. District Engineers have authority to determine if an activity complies with the terms and conditions of an NWP.

2. NWPs do not obviate the need to obtain other federal, state, or local permits, approvals, or authorizations required by law.

3. NWPs do not grant any property rights or exclusive privileges.

4. NWPs do not authorize any injury to the property or rights of others.

5. NWPs do not authorize interference with any existing or proposed Federal project (see general condition 31).

F. Definitions

Best management practices (BMPs): Policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects on surface water quality resulting from development. BMPs are categorized as structural or non-structural.

Compensatory mitigation: The restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

Currently serviceable: Useable as is or with some maintenance, but not so degraded as to essentially require reconstruction.

Direct effects: Effects that are caused by the activity and occur at the same time and place.

Discharge: The term “discharge” means any discharge of dredged or fill material into waters of the United States.

Ecological reference: A model used to plan and design an aquatic habitat and riparian area restoration, enhancement, or establishment activity under NWP 27. An ecological reference may be based on the structure, functions, and dynamics of an aquatic habitat type or a riparian area type that currently exists in the region where the proposed NWP 27 activity is located. Alternatively, an ecological reference may be based on a conceptual model for the aquatic habitat type or riparian area type to be restored, enhanced, or established as a result of the proposed NWP 27 activity. An ecological reference takes into account the range of variation of the aquatic habitat type or riparian area type in the region.

Enhancement: The manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area.

Ephemeral stream: An ephemeral stream has flowing water only during, and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

Establishment (creation): The manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area.

High Tide Line: The line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm.

Historic Property: Any prehistoric or historic district, site (including archaeological site), building, structure, or other object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria (36 CFR part 60).

Independent utility: A test to determine what constitutes a single and complete non-linear project in the Corps Regulatory Program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility.

Indirect effects: Effects that are caused by the activity and are later in time or farther removed in distance, but are still reasonably foreseeable.

Intermittent stream: An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

Loss of waters of the United States: Waters of the United States that are permanently adversely affected by filling, flooding, excavation, or drainage because of the regulated activity. Permanent adverse effects include permanent discharges of dredged or fill material that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the United States is a threshold measurement of the impact to jurisdictional waters for determining whether a project may qualify for an NWP; it is not a net threshold that is calculated after considering compensatory mitigation that may be used to offset losses of aquatic functions and services. The loss of stream bed includes the acres or linear feet of stream bed that are filled or excavated as a result of the regulated activity. Waters of the United States temporarily filled, flooded, excavated, or drained, but restored to pre-construction contours and elevations after construction, are not included in the measurement of loss of waters of the United States. Impacts resulting from activities that do not require Department of the Army authorization, such as activities eligible for exemptions under section 404(f) of the Clean Water Act, are not considered when calculating the loss of waters of the United States.

Navigable waters: Waters subject to section 10 of the Rivers and Harbors Act of 1899. These waters are defined at 33 CFR part 329.

Non-tidal wetland: A non-tidal wetland is a wetland that is not subject to the ebb and flow of tidal waters. Non-tidal wetlands contiguous to tidal waters are located landward of the high tide line (i.e., spring high tide line).

Open water: For purposes of the NWPs, an open water is any area that in a year with normal patterns of precipitation has water flowing or standing above ground to the extent that an ordinary high water mark can be determined. Aquatic vegetation within the area of flowing or standing water is either non-emergent, sparse, or absent. Vegetated shallows are considered to be open waters. Examples of “open waters” include rivers, streams, lakes, and ponds.

Ordinary High Water Mark: An ordinary high water mark is a line on the shore established by the fluctuations of water and indicated by physical characteristics, or by other appropriate means that consider the characteristics of the surrounding areas.

Perennial stream: A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow.

Practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Pre-construction notification: A request submitted by the project proponent to the Corps for confirmation that a particular activity is authorized by nationwide permit. The request may be a permit application, letter, or similar document that includes information about the proposed work and its anticipated environmental effects. Pre-construction notification may be required by the terms and conditions of a nationwide permit, or by regional conditions. A pre-construction notification may be voluntarily submitted in cases where pre-construction notification is not required and the project proponent wants confirmation that the activity is authorized by nationwide permit.

Preservation: The removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

Protected tribal resources: Those natural resources and properties of traditional or customary religious or cultural importance, either on or off Indian lands, retained by, or reserved by or for, Indian tribes through treaties, statutes, judicial decisions, or executive orders, including tribal trust resources.

Re-establishment: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions.

Rehabilitation: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: re-establishment and rehabilitation.

Riffle and pool complex: Riffle and pool complexes are special aquatic sites under the 404(b)(1) Guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a course substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.

Riparian areas: Riparian areas are lands next to streams, lakes, and estuarine-marine shorelines. Riparian areas are transitional between terrestrial and aquatic ecosystems, through which surface and subsurface hydrology connects riverine, lacustrine, estuarine, and marine waters with their adjacent wetlands, non-wetland waters, or uplands. Riparian areas provide a variety of ecological functions and services and help improve or maintain local water quality. (See general condition 23.)

Shellfish seeding: The placement of shellfish seed and/or suitable substrate to increase shellfish production. Shellfish seed consists of immature individual shellfish or individual shellfish attached to shells or shell fragments (i.e., spat on shell). Suitable substrate may consist of shellfish shells, shell fragments, or other appropriate materials placed into waters for shellfish habitat.

Single and complete linear project: A linear project is a project constructed for the purpose of getting people, goods, or services from a point of origin to a terminal point, which often involves multiple crossings of one or more waterbodies at separate and distant locations. The term "single and complete project" is defined as that portion of the total linear project proposed or accomplished by one owner/developer or partnership or other association of owners/developers that includes all crossings of a single water of the United States (i.e., a single waterbody) at a specific location. For linear projects crossing a single or multiple waterbodies several times at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies, and crossings of such features cannot be considered separately.

Single and complete non-linear project: For non-linear projects, the term "single and complete project" is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers. A single and complete non-linear project must have independent utility (see definition of "independent utility"). Single and complete non-linear projects may not be "piecemealed" to avoid the limits in an NWP authorization.

Stormwater management: Stormwater management is the mechanism for controlling stormwater runoff for the purposes of reducing downstream erosion, water quality degradation, and flooding and mitigating the adverse effects of changes in land use on the aquatic environment.

Stormwater management facilities: Stormwater management facilities are those facilities, including but not limited to, stormwater retention and detention ponds and best management practices, which retain water for a period of time to control runoff and/or improve the quality (i.e., by reducing the concentration of nutrients, sediments, hazardous substances and other pollutants) of stormwater runoff.

Stream bed: The substrate of the stream channel between the ordinary high water marks. The substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed.

Stream channelization: The manipulation of a stream's course, condition, capacity, or location that causes more than minimal interruption of normal stream processes. A channelized stream remains a water of the United States.

Structure: An object that is arranged in a definite pattern of organization. Examples of structures include, without limitation, any pier, boat dock, boat ramp, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, artificial island, artificial reef, permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other manmade obstacle or obstruction.

Tidal wetland: A tidal wetland is a jurisdictional wetland that is inundated by tidal waters. Tidal waters rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by other waters, wind, or other effects. Tidal wetlands are located channelward of the high tide line.

Tribal lands: Any lands title to which is either: 1) held in trust by the United States for the benefit of any Indian tribe or individual; or 2) held by any Indian tribe or individual subject to restrictions by the United States against alienation.

Tribal rights: Those rights legally accruing to a tribe or tribes by virtue of inherent sovereign authority, unextinguished aboriginal title, treaty, statute, judicial decisions, executive order or agreement, and that give rise to legally enforceable remedies.

Vegetated shallows: Vegetated shallows are special aquatic sites under the 404(b)(1) Guidelines. They are areas that are permanently inundated and under normal circumstances have rooted aquatic vegetation, such as seagrasses in marine and estuarine systems and a variety of vascular rooted plants in freshwater systems.

Waterbody: For purposes of the NWPs, a waterbody is a jurisdictional water of the United States. If a wetland is adjacent to a waterbody determined to be a water of the United States, that waterbody and any adjacent wetlands are considered together as a single aquatic unit (see 33 CFR 328.4(c)(2)). Examples of “waterbodies” include streams, rivers, lakes, ponds, and wetlands.

ADDITIONAL INFORMATION

This nationwide permit is effective March 19, 2017, and expires on March 18, 2022.

Information about the U.S. Army Corps of Engineers regulatory program, including nationwide permits, may also be found at http://www.swf.usace.army.mil/Missions/Regulatory.aspx and http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx

APPENDIX C
Cultural Resources Assessment
and
Phase I Architectural Survey
Reports

A Cultural Resources Assessment for the ARS Field Station Lake Dam Rehabilitation Project, Woodward County, Oklahoma

September 20, 2019

Prepared for:

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Prepared by:

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Ellen Brady, Cultural Resources Practice Leader

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A CULTURAL RESOURCES ASSESSMENT FOR THE ARS FIELD STATION LAKE DAM REHABILITATION PROJECT, WOODWARD COUNTY, OKLAHOMA

Prepared by ______________________________
(signature)

Donald Sadler, Project Archaeologist

Reviewed by ______________________________
(signature)

Ellen Brady, Cultural Resources Practice Leader

Approved by ______________________________
(signature)

Jay Mazzoni, Senior Principal

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Executive Summary

In August of 2019, Stantec Consulting Services Inc. (Stantec) conducted a cultural resources assessment associated with the proposed Agricultural Research Service (ARS) Field Station Lake Dam rehabilitation Project (Project) in Woodward County, Oklahoma. The Field Station Lake Dam is operated by and located on the property of the ARS Southern Plains Range Research Station (SPRRS). The dam was constructed in 1938 to offer irrigation to SPRRS and presently also acts as a recreation site for the local community of Woodward. The Project is bordered to the west by 34th Street, to the north by Oklahoma Avenue, to the south by Field Station Lake, and to the east by property operated by the ARS. The project area is accessible via 34th Street and service roads to the east. The work was conducted on behalf of Ad Astra Collaborative, LLC.

An Area of Potential Effects (APE), defined as the entirety of the Project footprint, including Field Station Lake and bounded by the Rehab Top of Dam Elevation contour, was recommended for the Project in which to assess the potential effects the Project may have on historic properties. The APE includes approximately 29.76 acres of water comprising Field Station Lake and 54.38 acres of land surrounding the lake and dam. Because of the nature of the Project, it is recommended that this APE be applied for both direct and indirect effects. Documentary research was conducted within a larger area, for purposes of this report identified as the Study Area, which encompasses the APE and a 1-mile radius around the APE.

Documentary research was conducted via the Oklahoma Archaeological Survey (OAS) and the Oklahoma State Historic Preservation Office (OKSHPO) files for archaeological sites and historic structures. These files were examined, and information was retrieved on all sites or structures located within the Study Area. Background research also focused on relevant sources of local historical information and available historical maps. The processes of archival research and context development help to identify potentially undocumented historic properties such as domestic farmsteads, gravesites, and/or military encampment areas that may be associated with occupation in the vicinity of the Study Area, and to determine the most likely locations for earlier cultural resources such as prehistoric encampment sites.

No previously identified archaeological sites were located within the Project boundary. The Project and Study Area are located within the previously identified USDA ARS Grazinglands Research Station Historic District. One previously identified archaeological site (34WD117) is located within the Study Area but not the Project APE. One archaeological survey has been conducted within the APE for a recreational trail. No archaeological deposits were identified during this survey. The research identified that the Field Station Lake dam is a historic resource that has not been previously documented and may be a contributing component to the USDA ARS Grazinglands Research Station Historic District.

It is recommended that the Field Station Lake Dam be surveyed and evaluated for its historic significance and association with the USDA ARS Grazinglands Research Station Historic District before assessing the potential effects of the Project on this resource. It is also recommended that archaeological deposits are

unlikely and that because the Project is located within the existing footprint of the dam and lake, archaeological survey is not warranted for this project. Recommended next steps include:

- Survey and recordation of the Field Station Lake Dam
- Assessment of Eligibility for the Field Station Lake Dam and its status as a contributing element to the USDA ARS Grazinglands Field Station Historic District
- Consultation with the OKSHPO on these recommendations and findings pursuant to Section 106 of the NHPA

Abbreviations

amsl	above mean sea level
APE	Area of Potential Effects
ARS	Agricultural Research Service
EDR	Environmental Data Resources, Inc.
n.d.	no date
NHPA	National Historic Preservation Act
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
OAS	Oklahoma Archaeological Survey
OKSHPO	Oklahoma State Historic Preservation Office
PMP	Probable Maximum Precipitation
RCC	Roller Compacted Concrete
SHPO	State Historic Preservation Office
SPRRS	Southern Plains Range Research Station
Stantec	Stantec Consulting Services Inc.
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USGS	United States Geological Survey

1.0 INTRODUCTION

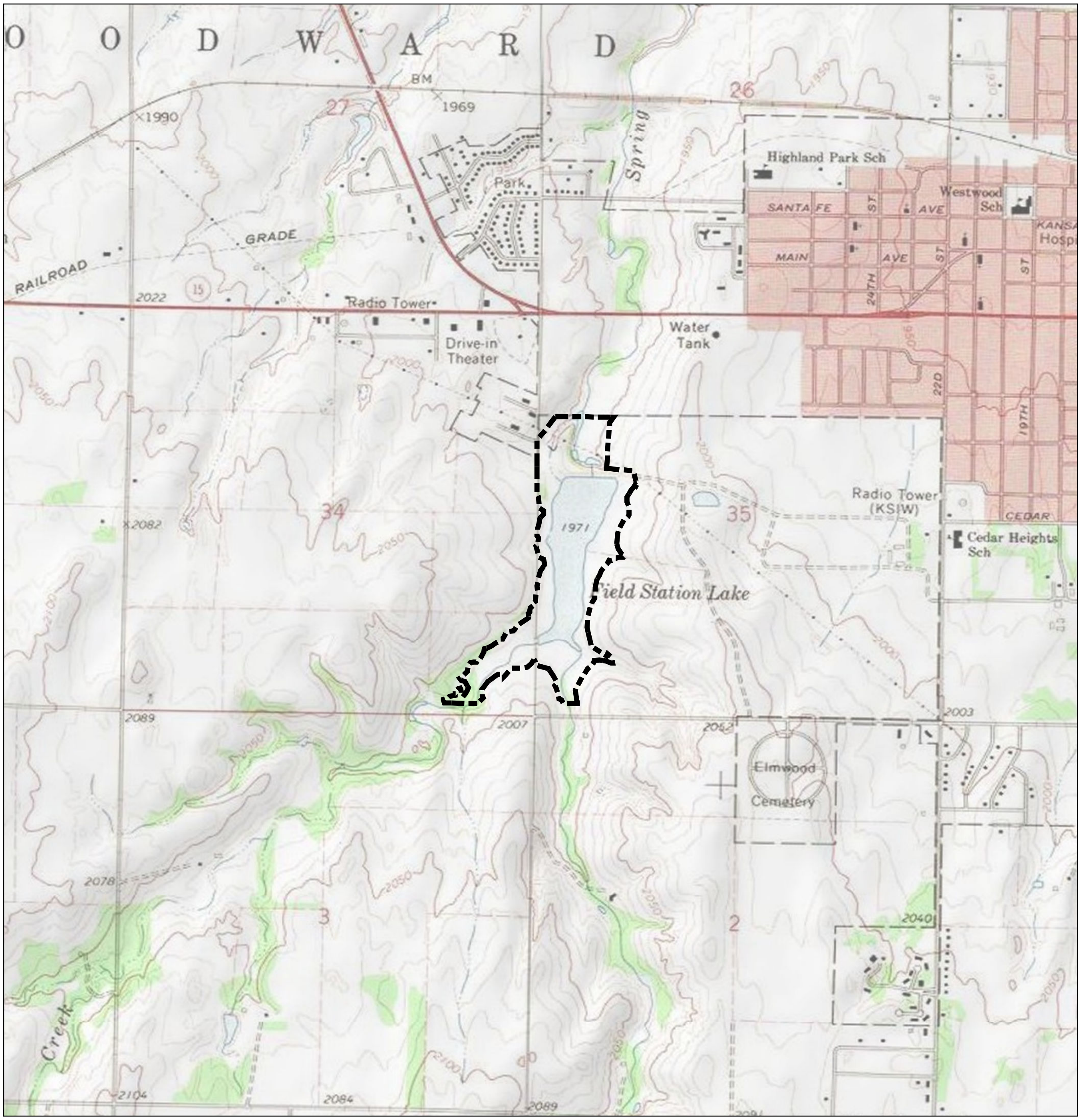
In August of 2019, Stantec Consulting Services Inc. (Stantec) conducted a cultural resources assessment associated with the proposed Agricultural Research Service (ARS) Field Station Lake Dam rehabilitation Project (Project) in Woodward County, Oklahoma. The Field Station Lake Dam is operated by and located on the property of the ARS Southern Plains Range Research Station (SPRRS). The dam was constructed in 1938 to offer irrigation to SPRRS and presently also acts as a recreation site for the local community of Woodward. The Project is bordered to the west by 34th Street, to the north by Oklahoma Avenue, to the south by Field Station Lake, and to the east by property operated by the ARS. The project area is accessible via 34th Street and service roads to the east (**Figure 1**). The work was conducted on behalf of Ad Astra Collaborative, LLC.

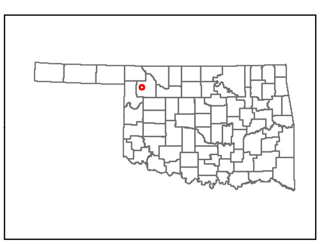
An Area of Potential Effects (APE), defined as the entirety of the Project footprint, including Field Station Lake and bounded by the Rehab Top of Dam Elevation contour, was recommended for the Project in which to assess the potential effects the Project may have on historic properties. The APE includes approximately 29.76 acres of water comprising Field Station Lake and 54.38 acres of land surrounding the lake and dam. Because of the nature of the Project, it is recommended that this APE be applied for both direct and indirect effects. Documentary research was conducted within a larger area, for purposes of this report identified as the Study Area, which encompasses the APE and a 1-mile radius around the APE.

The cultural resources investigations described herein were conducted in reference to the National Historic Preservation Act of 1966 (NHPA-PL89-665), as amended, the Archeological and Historic Preservation Act of 1974, Executive Order 11593, and relevant sections of 36 CFR 60 and 36 CFR 800. The investigations were also conducted with reference to United States Department of the Interior's (USDI), Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (USDI 1983) and the *Guidelines for the Preparation of Archaeological Reports* promulgated by the Oklahoma State Historic Preservation Office (OKSHPO) and the Oklahoma Archaeological Survey (OAS) and published in 2013.

1.1 PROJECT DESCRIPTION

The Field Station Lake Dam has been reclassified as a high hazard structure and rehabilitation is needed to meet the high hazard criteria as established by the Natural Resources Conservation Service (NRCS). The Field Station Lake Dam was originally constructed as a low hazard structure but has been reclassified necessitating the rehabilitation. The existing circa 1938 dam is a rolled earth fill embankment dam (Esenwein and Koopman-Glass 2019). The dam's primary purpose is to supply irrigation water to the SPRRS and surrounding area. The existing dam is 950 feet long, 12 feet wide at the crest, and has a maximum height of 35 feet (Esenwein and Koopman-Glass 2019). The concrete spillway is currently overgrown and there is a metal trash rack bolted to the top/center of the concrete spillway.





Project APE

0 1,000 2,000 Feet

(At original document size of 8.5x11)
1:24,000

N

Stantec

Project Location
Woodward County, Oklahoma

Prepared by ECL on 2019-09-06
TR by TPS on 2019-09-17
IR by EMB on 2019-09-16

Client/Project
175558215
AdAstra Collaborative LLC
ARS Dam Rehabilitation - Oklahoma

Figure No.
1

Title
Project Location Map

Notes
1. Coordinate System: NAD 1983 StatePlane Oklahoma North FIPS 3501 Feet
2. Project limits digitized from drawings provided by USDA Natural Resource Conservation Service
3. Topographic map © USGS 7.5 Minute Series Topographic Map

A CULTURAL RESOURCES ASSESSMENT FOR THE ARS FIELD STATION LAKE DAM REHABILITATION PROJECT, WOODWARD COUNTY, OKLAHOMA

Introduction

Rehabilitation of the dam, as currently designed, will include the installation of a new reinforced concrete principal spillway conduit and a concrete baffle topped drop riser. The auxiliary spillway will be enforced with Roller Compacted Concrete (RCC) and have the capacity to safely pass the Probable Maximum Precipitation (PMP) storm event (Esenwein and Koopman-Glass 2019; **Appendix A: 90% Construction Drawings**).

The Project proposes to construct a 41.5-foot wide RCC auxiliary spillway which would be raised in elevation to the top of the dam. The existing auxiliary spillway features a concrete chute, which will be removed and flattened to approximately 10 percent. The dam embankment is approximately 35 feet tall and is approximately 950 feet long. This structure is currently 12 feet wide at the crest and would be expanded to 14 feet in width to meet the OWRB standards (Design Report 2018). The front slope of the embankment will be largely undisturbed; however, the embankment centerline would be offset in the downstream direction by 2 feet to accommodate the expanded width. The existing principal spillway will be rehabilitated and located within the proposed auxiliary spillway at an angle of 90 degrees from the embankment centerline (Design Report 2018). Additional features include a principal spillway inlet, outlet, and stilling basin.

1.2 PROJECT METHODOLOGY

The desktop review was intended to provide information on previously identified cultural resources located within the study area and their status in regard to evaluation pursuant to the guidelines of the National Register of Historic Places (NRHP). A goal of the assessment was to identify the potential needs for cultural resource survey and also the potential effects the project may have on historic properties.

The OAS and OKSHPO files were examined, and information was retrieved on all sites, structures, or other cultural resources located within the Study Area. Background research also focused on relevant sources of local historical information and available historical maps, which were examined to provide a historical context and to check for any buildings and other cultural features present within the Study Area. Resource inventory and context development provide a foundation for the identification of unknown historic properties, such as domestic farmsteads, gravesites, and military encampment areas. Research was also carried out at the Oklahoma History Center in Oklahoma City and the Woodward Public Library, the US Geological Survey, Elmwood Cemetery, and the Plains Indian and Pioneer Museum.

1.3 PROJECT ALTERNATIVES

In addition to the selected rehabilitation alternative described in Section 1.1, four additional Project alternatives were evaluated. The four alternatives that were examined did not meet the needs for the Project and are described below.

1.3.1 No Action Alternative

Under the No Action Alternative, the Field Station Lake Dam and associated features would remain as is with no further repair or improvements. This alternative would not allow the NRCS to achieve the goal of the project which is rehabilitation to meet the high hazard criteria. The dam was first built as a low hazard structure; however, that classification has been changed.

1.3.2 Labyrinth Spillway in Auxiliary Spillway (Alternative 1)

This rehabilitation alternative includes creation of a new labyrinth spillway, located in the inlet channel of the existing auxiliary spillway. The spillway would include a reinforced concrete weir, chute, and energy dissipater in the existing auxiliary spillway inlet channel. A short weir would be incorporated into the labyrinth spillway to maintain the normal pool. A sluice gate incorporated into the labyrinth weir wall would allow the lake to be lowered, which represents an estimated drawdown of more than 90 percent of the lake's normal storage.

This alternative will also include clearing and grubbing of the dense brush and woody vegetation; grading the existing crest; flattening the downstream slope; installing an embankment filter and drain system to filter and collect seepage; regrading and placement of riprap on the upstream slope near the normal pool water line; and establishing turf on all disturbed areas outside the proposed spillways and riprapped areas. The existing concrete spillway control section will be removed from the site, creating an outlet channel for the new spillway (Schnabel 2016).

1.3.3 Labyrinth Spillway in Embankment (Alternative 2)

This alternative is comparable to Alternative 1, except the new labyrinth spillway would be constructed through/over the embankment. The labyrinth configuration would be essentially the same as Alternative 1, with the construction of a new embankment across the inlet channel, tying into the left abutment, next to 34th Street. This alternative proposes burying the existing concrete spillway instead of the cost of its deconstruction. All of the clearing and grading methods proposed in Alternative 1 would remain the same (Schnabel 2016).

1.3.4 RCC Auxiliary Spillway over Embankment (Alternative 3)

This alternative suggests reinforcing the embankment with RCC to prevent failure of the dam during an overtopping event. The existing spillways would be abandoned as part of this alternative, and a new spillway would be required to maintain base flow and pass relatively frequent floods. It is assumed that a reinforced concrete spillway would be required to pass flows up to the 10-year flood level, above which there would be flow in the RCC auxiliary spillway.

To match Alternatives 1 and 2, the lake would also be lowered in this alternative. A small intake tower would be constructed on the upstream slope and a conduit would carry flow through the embankment and outlet into the principal spillway chute. Similar to Alternative 2, the dam would be extended across the existing auxiliary spillway, and the cost saving possibility of burying the existing spillway would be considered. The clearing and grading methods previously proposed would remain similar (Schnabel 2016).

1.4 AREA OF POTENTIAL EFFECTS

The NHPA, as amended, requires that the potential effects to historic properties are assessed by federal agencies for any proposed undertakings that have the potential to affect such properties. An undertaking is a “any project, activity, or program that can result in changes in the character or use of historic properties, if any such historic properties are located in the area of potential effects. The project, activity, or program must be under the direct or indirect jurisdiction of a Federal agency, or licensed or assisted by a Federal agency. Undertakings include new and continuing projects, activities, or programs and any of their elements not previously considered under Section 106” (36 CFR 800.2[o], see also 16 USC 470w[7]).

To assess the potential effects an undertaking may have on historic properties, an APE is often designated to guide the assessment. The APE for cultural resources is defined in the NHPA as “ …the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist” (36 CFR 800.16[d]). For the Field Station Lake Dam Rehabilitation Project, it is recommended that the APE encompass the Project footprint, including Field Station Lake and bounded by the Rehab Top of Dam Elevation contour and as depicted in Figure 1. The APE includes approximately 29.76 acres of water comprising Field Station Lake and 54.38 acres of land surrounding the lake and dam. Because of the nature of the Project, it is recommended that this APE be applied for both direct and indirect effects.

1.5 PROJECT PERSONNEL

Cultural Resources Practice Leader Ellen Brady oversaw the project. Project Archaeologist Donald Sadler authored the report with assistance from Principal Investigator, Aimee Leithoff and Ms. Brady. GIS Analyst Elise Ljiko prepared the report graphics and project maps. Copies of all historical research materials are on file at Stantec’s office in Richmond, Virginia.

2.0 PREVIOUS INVESTIGATIONS AND HISTORIC MAP REVIEW

The OAS and OKSHPO files were examined, and information was retrieved on all sites, structures, or other cultural resources located within the study area. Research was also carried out at the Oklahoma History Center in Oklahoma City. Research there within the OKSHPO was conducted to gather information on the architectural history of the Study Area. Background research also focused on relevant sources of local historical information and available historical maps, which were examined to provide a historical context and to check for any buildings and other cultural features present within the Study Area. Resource inventory and context development provide a foundation for the identification of unknown historic properties, such as domestic farmsteads, gravesites, and military encampment areas. These two tasks also aid in the identification of likely locations for unidentified archaeological sites.

Maps and indexed survey cards, housed with the OAS, were researched on existing archaeological sites and archaeological surveys conducted within the Study Area. A field visit was made to Woodward by

Stantec Project Archaeologist, Donald Sadler to capture current pictures of the Field Station Lake Dam and vicinity and conduct localized historic research at the Woodward Public Library, the US Geological Survey, Elmwood Cemetery, and the Plains Indian and Pioneer Museum. Information gathered at all locations was used to create tables of existing cultural resources within the Study Area.

2.1 ARCHAEOLOGICAL SURVEYS

Eleven previously conducted and documented archaeological surveys are located within the Study Area; these surveys are summarized in **Table 1**. One of these surveys, conducted for the City of Woodward Fishing Dock and Trail, is located within or intersects the limits of the Project APE. There is little information available for the survey, but it appears that no resources were identified. The survey is located largely within the Project APE. Figure 2 illustrates the mapped locations of the previous surveys that intersect the Project APE and are also within the Study Area boundary. These surveys are typically small surveys that were conducted for road projects, utilities projects, telecommunication projects, and geothermal wells. While small areas within or near to the Project APE have been subject to survey dating from 1990 to 2014, they do not constitute comprehensive coverage for the Study Area.

Table 1 Previously Identified Surveys within the Study Area

Date	Report Title	Authors	Summary of Results	Report #
09/13/90	Northwest Electric Cooperative- BER 91-92	Unknown	Unknown	Unknown
03/02/95	City of Woodward Extension of Sewer & Water Line to Mutual of Omaha Offices	Unknown	Unknown	Unknown
07/31/95	Northwest Electric Cooperative – BER	Unknown	Unknown	Unknown
03/26/99	Northwest Electric Underground -BER 99-02	Unknown	Unknown	Unknown
01/25/05	Pioneer Telephone Proposed 190' Cell Tower	McKim, Ray	Unknown	Unknown
05/22/2007	City of Woodward Fishing Dock and Trail Survey	Unknown	Unknown	Unknown
10/28/10	City of Woodward Geothermal Wells	Unknown	Unknown	Unknown
04/18/14	Archaeological Survey Report for Branch Towers, LLC West Woodward Tower Site, in Woodward, Woodward County, Oklahoma	Holt, James	No Sites Recorded	Unknown
07/16/14	Cultural Resources Survey Report for Proposed Improvements for 34th Street from Hank's Trail to Downs Avenue in Woodward, Woodward County, Oklahoma	Cargill, Diane	34WD117	JP29808 (04)
07/16/14	Cultural Resources Survey Report for Proposed Improvements for 34th Street from Downs Avenue to US-A12 in Woodward, Woodward County, Oklahoma	Cargill, Diane	No Sites, One Building at Field Station Lake Park	JP27999 (04)
07/16/14	ODOT Temporary Bridge Replacement	Cargill, Diane	Unknown	JP29799 (04)

Highlighted row indicates survey within or along the edge of the Project APE.

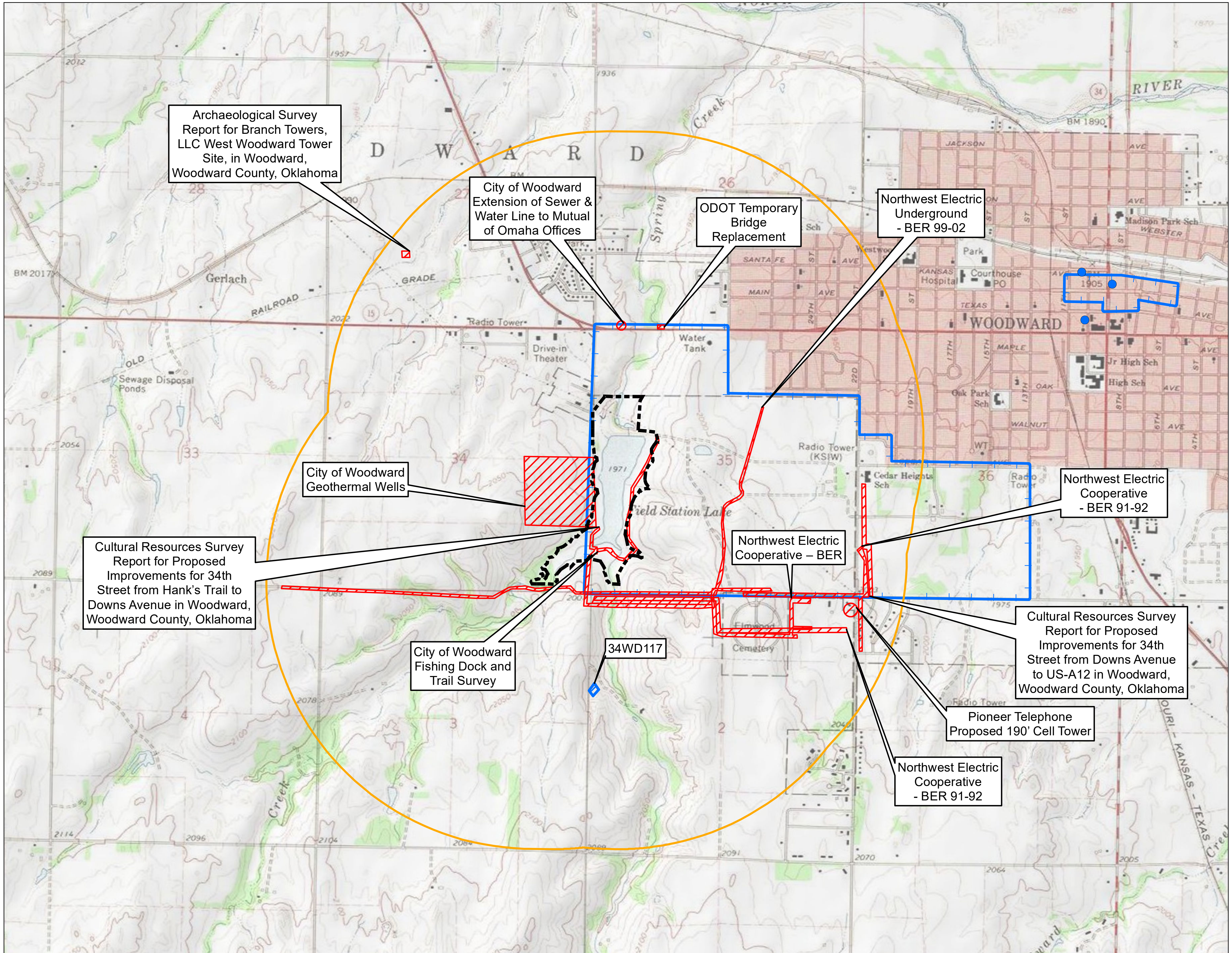


Figure No.
2

Title
Architectural and Archaeological Resource Location Map

Client/Project 175558215
AdAstra Collaborative LLC
ARS Dam Rehabilitation - Oklahoma

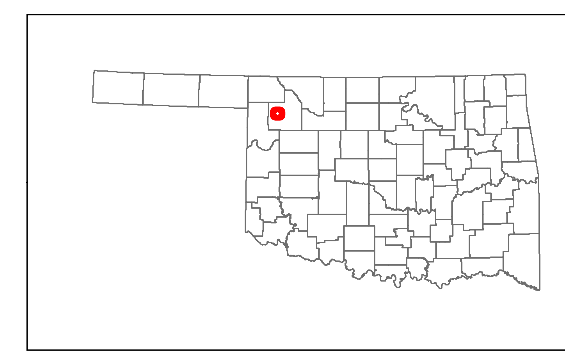
Project Location
Woodward County, Oklahoma

Prepared by ECL on 2019-09-06
TR by TPS on 2019-09-17
IR by EMB on 2019-09-16

N

0 2,000 4,000 Feet
(At original document size of 11x17)
1:24,000

- Architectural Sites
- Project APE
- Study Area Limits
- Archaeological Sites and Surveys
- Architectural Historic District
- Architectural Resource



Notes
1. Coordinate System: NAD 1983 StatePlane Oklahoma North FIPS 3501 Feet
2. Data Sources: State Historic Preservation Office Oklahoma Historical Society
3. Project limits digitized from drawings provided by USDA Natural Resource Conservation Service
4. Topographic map © USGS 7.5 Minute Series Topographic Map

Stantec

2.2 ARCHAEOLOGICAL SITES

One previously recorded archaeological site is located within the Study Area but not within the Project APE. This site, Site 34DW117, is described in **Table 2** and illustrated on **Figure 2**. No additional previously identified archaeological sites are located within the Study Area. Site 34WD117 represents a collapsed 1950s agricultural outbuilding identified during a 2014 survey by Cargill & Associates. The site was determined not eligible for listing on the NHRP.

Table 2 Previously Identified Archaeological Sites within the Study Area

Resource	Resource Type	Association	Reference	NRHP Status
34WD117	20th Century Outbuilding	Anglo-American	Cargill 2014	Not Eligible

2.3 ARCHITECTURAL RESOURCES

The Project and Study Area are located within the USDA ARS Grazinglands Research Station Historic District (see **Figure 2; Table 3**). No additional previously recorded architectural resources are located within the Study Area or within the Project APE. No properties within the USDA ARS Grazinglands Research Station Historic District are yet listed on the NRHP and none are located within the Study Area, though the district as a whole is recommended by the OKSHPO as eligible. This recommendation is described in more detail in Section 5 (D. Sadler, personal communication, OKSHPO, September 2019).

Table 3 Previously Identified Architectural Site Resources within the Study Area

ID #	Resource	Date	Reference	NRHP Status
-	USDA ARS Grazinglands Research Station Historic District	1913	Unknown	Eligible

Highlighted row indicates resource is within the Project APE.

2.4 HISTORIC MAP REVIEW

Historic maps and available aerial photographs were reviewed as part of the background research conducted for the Study Area. Online repositories, including the Library of Congress, the United States Geological Survey (USGS) Historical Topographic Map Explorer (http://historicalmaps.arcgis.com/usgs/), and others, were examined to identify historic maps which depict the Study Area. The Project is located on the Woodward, Oklahoma USGS quadrangle. **Appendix B1** depicts the Project APE on the most current version of the quadrangle map. Features noted include the Atchison Topeka and Santa Fe Railroad, the Missouri Kansas and Texas Railroad, Elmwood Cemetery, the town of Woodward, and the Field Station Lake. A review of historical topographic maps dating to 1955, available through the USGS Historical Topographic Map Explorer and through an Environmental Data Resources (EDR) package request, illustrate the changes in land use over time.

A review of available historic aerial photographs indicates that the Study Area has remained primarily rural, while residential and commercial buildings have been constructed in the vicinity. This review of historic and modern aerial photographs indicates that the Study Area was primarily unchanged within the USDA ARS Grazinglands Research Station Historic District following the completion of the dam in 1938 until the early 2000s when residential and commercial development intensified on its perimeter. The following historic maps and aerials were reviewed:

- Aerial photographs for the years 1954, 1968, 1972, 1983, 1995, 2010, 2013, 2017 (EDR 2019).
- Historical topographic maps for the years 1955, 1958, 1969, 1985, 2010, 2012, 2016, and 2018 (http://historicalmaps.arcgis.com/usgs/).
- *Map of Indian Territory and Oklahoma, 1890* (United States, Bureau of the Census 1890).
- *Oklahoma minor civil divisions and townships, 1941* (United States, Bureau of the Census 1941).
- *County Map of Texas and Indian Territory, 1874* (Lloyd et al. 1875)
- *Map of the Indian and Oklahoma territories…, 1894* (Rand McNally 1894)

Historic maps of the Study Area show little detail with the exception of major roads, streams, and towns. No specific details for the Study Area are illustrated in the late nineteenth century maps; however, the USGS topographic series maps do show changes in land use and occupation over time within Study Area. A summary of the USGS topographic maps and aerial photographs from 1954 through 2018 is provided in **Table 4**; selected map excerpts are included in **Appendix B** and aerial photographs are included in **Appendix C.**

Table 4 Summary of Observations for Historical USGS Topographic Maps and Aerials

Year	Description
1954	**Aerial:** The site is cleared and appears to be in use for agricultural (farming) purposes. Adjacent properties appear to be primarily forested or agricultural. Field Station Lake, Dam, and Spillway are visible.
1955	**Topographic Map: Woodward 1:250,000 series: Project APE shown on this map**. The Field Station Lake is present, and the Dam seems to be represented by a dark line above the lake. The Atchison Topeka and Santa Fe Railroad, an abandoned railroad, rivers, and a non-detailed block of the town of Woodward are also present.
1958	**Topographic Map: Woodward 1:250,000 series: Project APE shown on this map.** Field Station Lake is present, and the Dam seems to be represented by a dark line above the lake. The Atchison Topeka and Santa Fe Railroad, abandoned railroad is now labeled Missouri Kansas and Texas, rivers, and a non-detailed block of the town of Woodward are also present.
1968	**Aerial:** The site is cleared and appears to be in use for agricultural (farming) purposes. Adjacent properties appear to be primarily forested or agricultural. Field Station Lake, Dam, and Spillway are visible. Buildings begin to appear to the northwest.
1969	**Topographic Map**: **Woodward 1:24,000 series: Project APE shown on this map.** Field Station Lake is present as are residential and commercial buildings, power lines, the Elmwood Cemetery, and access roads within the Project APE.

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Previous Investigations and Historic Map Review

Year	Description
1972	**Aerial:** The site is cleared and appears to be in use for agricultural (farming) purposes. Adjacent properties appear to be primarily forested or agricultural. Field Station Lake, Dam, and Spillway are visible. Light tree growth and foliage is present along the lake shore.
1983	**Aerial:** The site is cleared and appears to be in use for agricultural (farming) purposes. Adjacent properties appear to be primarily forested or agricultural. Field Station Lake, Dam, and Spillway are visible. Growth and foliage are present along the lake shore. Residential neighborhoods are present to the northwest and southeast.
1985	**Topographic Map**: **Woodward 1:100,000 series: Project APE shown on this map.** Field Station Lake is present, and Dam appears as a thick black line. The Elmwood Cemetery and Woodward are present but map lacks detail around Project APE.
1995	**Aerial:** The site is cleared and appears to be in use for agricultural (farming) purposes. Adjacent properties appear to be primarily forested or agricultural. Field Station Lake, Dam, and Spillway are visible. Growth and foliage are present along the lake shore. More residential structures are present to the northwest and southeast.
2006	**Aerial:** Public fishing access visible on lake
2010	**Topographic Map**: **Woodward 1:24,000:** Field Station Lake is shown with few other details present in the vicinity.
2010	**Aerial:** Northwestern Oklahoma State University appears to the west of Project APE**;** otherwise little variation from the previous aerial.
2012	**Topographic Map**: **Woodward 1:24,000 series:** Field Station Lake is present; few details aside from Elmwood Cemetery and road names.
2013	**Aerial:** Woodward Conference Center and Convention Bureau appears to the west and immediately south of Northwestern Oklahoma State University; otherwise little variation from the previous aerial.
2016	**Topographic Map**: **Woodward 1:24,000 series:** No material change was apparent from the previous topographic map.
2017	**Aerial:** Little variation from the previous aerial. Spillway appears very overgrown.
2018	**Topographic Map**: **Woodward 1:24,000 series:** No material change was apparent from the previous topographic map.

Some of the earliest maps depicting the Study Area were created in the late nineteenth century. Figure 3, a map dating to 1874, depicts the general location of the Study Area vicinity within the Cherokee Outlet along the North Canadian River. This map also shows Camp Supply as it was known from 1868 until 1878. The map depicts Camp Supply when it served as a supply point for the Red River War of 1874–75, the final struggle in the subjugation of the tribes of the Southern Plains. An 1894 map illustrated in Figure 4 depicts the Study Area vicinity along Spring Creek, as well as Fort Supply and the newly established town of Woodward along the north fork of the Canadian River. Woodward County is shown as County N on this map. A map from 1905, Figure 5, depicts the spread of towns, and the location of the Study Area vicinity along Spring Creek. The 1955 Woodward 7.5’ USGS topographic map shown in Figure 6 illustrates the Field Station Lake Dam and Field Station Lake.

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Previous Investigations and Historic Map Review

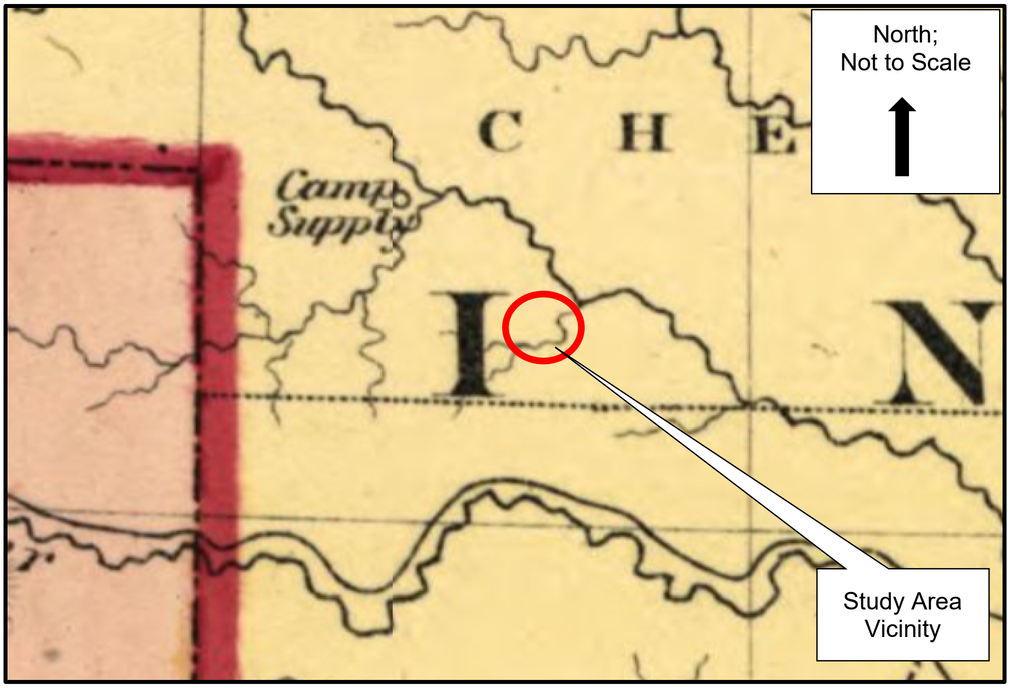


Figure 3 Detail of *County map of Texas, and Indian Territory.* (Warner & Beers 1874; Library of Congress Geography and Map Division).

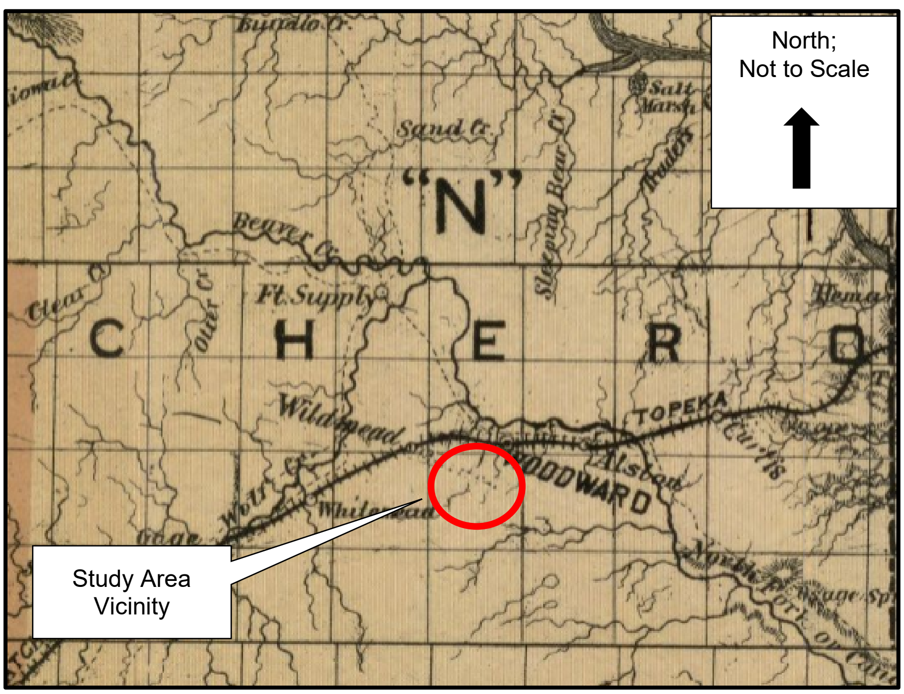


Figure 4 Detail of *Map of the Indian and Oklahoma territories, 1894; compiled from the official records of the General Land Office and other sources.* (Rand McNally and Company 1894; Library of Congress Geography and Map Division).

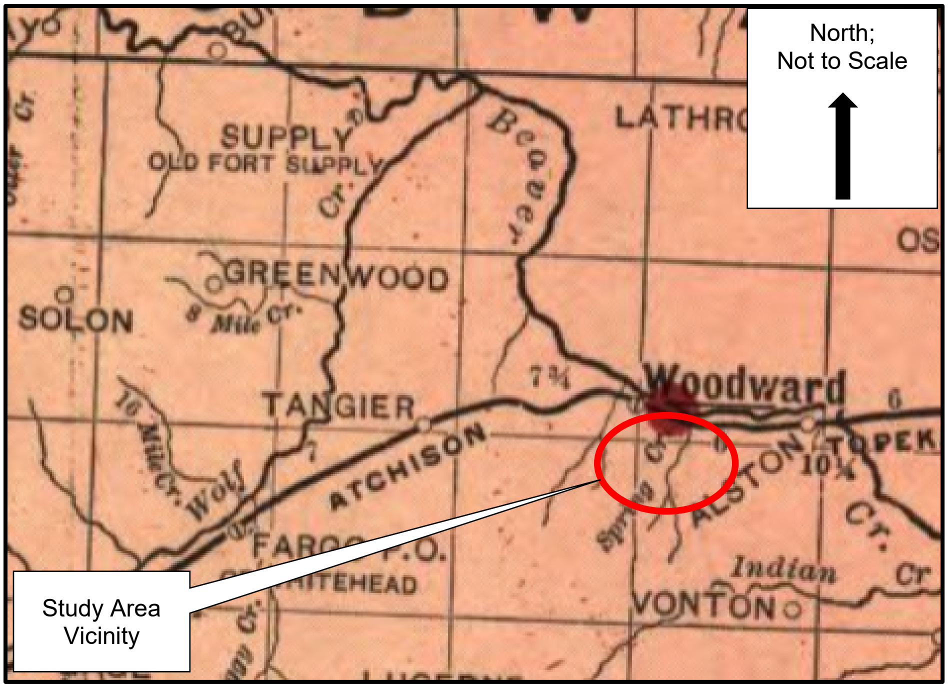


Figure 5 Detail of *Premier series map of Oklahoma and Indian Territory.* (Geographical Publishing Company 1905; Library of Congress Geography and Map Division).

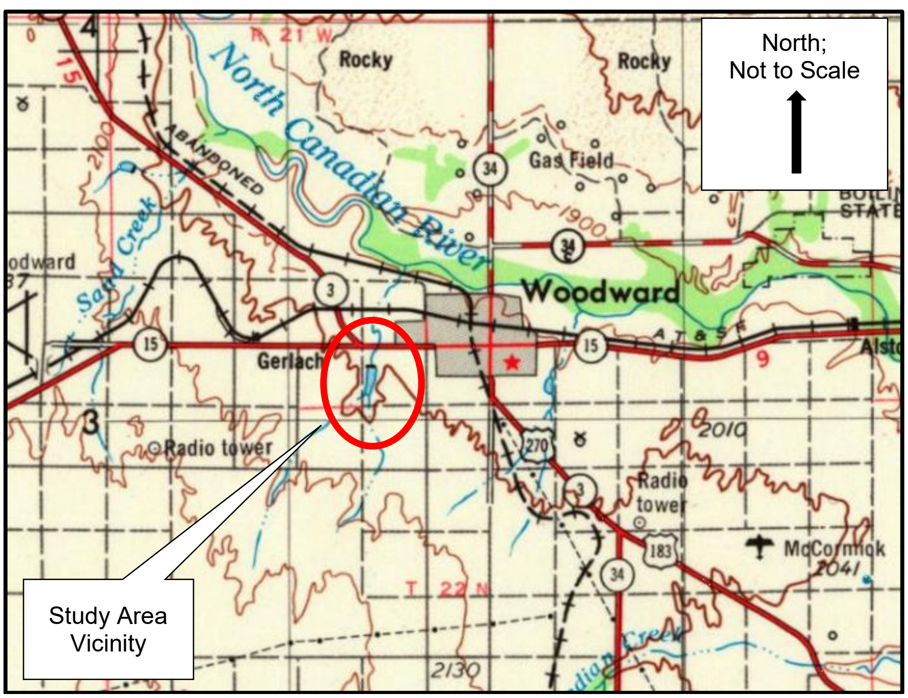


Figure 6 Detail of *Woodward, Ok 1958* (http://historicalmaps.arcgis.com/usgs/ USGS Historical Topographic Map, Accessed August 2019).

3.0 CULTURAL CONTEXT

Oklahoma's Native American prehistory typically is divided into four main periods – Paleoindian, Archaic, Woodland, and Late Prehistoric – based on changes in material culture and settlement systems. In recent decades, the possibility of a human presence in the general region that pre-dates the Paleoindian period has moved from remote to probable. For this reason, a Pre-Clovis discussion precedes the traditional divisions of Oklahoma's Native American history. The cultural context, as defined by the Secretary of the Interior's *Standards and Guidelines for Archeology*, provides the historic, social, and environmental information required for evaluation of any archaeological resources present within the Project location.

3.1 PRE-CLOVIS (PRE-12,000 BP)

The 1927 discovery, at Folsom, New Mexico, of a fluted point in the ribs of an extinct species of bison proved that ancient North Americans had immigrated during the Pleistocene. It did not; however, establish the precise timing of the arrival of humans in the Americas, nor did it adequately resolve questions about the lifestyle of those societies (Meltzer 1988). There is little data for this occupation in northwestern Oklahoma. However, the Burnham Site near Freedom, in Woods County, Oklahoma was thought to retain evidence of pre-Clovis occupation in North America. The Burnham Site revealed stone tools associated with an extinct long-horned bison species, Bison chaneyi, within ancient pond deposits dating to the Pleistocene era some 36,000 years ago (Wyckoff, Theler, Carter 2003). No previously recorded resources dating to a Pre-Clovis period are located within the limits of the Project APE or within the Study Area (OAS 2019).

3.2 PALEOINDIAN PERIOD (12,000–9500 BP)

Paleoindian Period sites are generally identified by the presence of fluted projectile points. Clovis points appear in southern North America around 12,000 years B.P., and a variety of fluted-point types (e.g. Lincoln Hills, Gainey, Folsom, Cumberland, and Hi-Lo) were produced for approximately the next millennium. The limited evidence available from North America suggests that caribou and mastodon were hunted by these groups (Funk et al. 1970; Graham et al. 1981; MacDonald 1968; Matin 1958; Palmer and Stoltman 1976; Wittry 1965), although economies were likely broad based. Paleoindian sites appear to be the products of nomadic peoples who used the area in a transitory, nonresidential, fashion.

Paleoindian subsistence strategies, settlement systems, and social organization are little known compared with other periods. However, there is general agreement amongst archaeologists that Paleoindian groups were at a band level of society. These bands were likely nomadic and may have included 25 to 50 individuals. Subsistence strategies likely included both hunting and foraging. Evidence suggests that megafauna such as mammoth and mastodon were an important food source for Paleoindian populations in some portions of North America. Paleoindian hunters were skilled enough to organize large scale hunts using arroyo entrapment to kill large amounts of bison at once. Numerous archaeological sites have documented these hunting activities in northwest, southwest, and central counties within Oklahoma (Gilbert 1979, Saunders 1979, Thurmond 1989, Hofman 1990, Bement 1999, Bement and Carter 2010). The use of an arroyo style trap for bison hunting allows archaeologists to study Clovis hunting strategies used during later Paleoindian times. Little information is known about late Paleoindian groups in northwestern Oklahoma. Several isolated finds of late Paleoindian materials have been reported in Woodward County (Stout 2005). In a 2005 study, one Paleoindian site had been documented within Woodward County (Brooks 2005; OAS 2005). No previously recorded Paleoindian resources are located within the limits of the Project APE or within the Study Area (OAS 2019).

3.3 ARCHAIC PERIOD (9500-1700 BP)

Early Archaic (9500-8000 BP) peoples likely continued to live as they had during the previous periods, existing at the band level of society and continuing to both hunt and gather. However, with the megafauna now extinct there was a shift toward smaller mammals as well as shellfish, fish, turtles, and birds. It is believed that Early Archaic peoples were still nomadic, travelling in search of seasonal resources as well as in search of high-quality raw material sources to produce stone tools. In addition, it is possible that bands congregated at certain times of year, coming together to socialize, share resources, and find mates from other bands (O'Steen et al. 2002, revised 2015).

Point styles commonly attributed to the Early Archaic period in southeastern Oklahoma include Big Sandy, Brazo Fishtail, Hardin, Jackie Stemmed, Rice Lobed, Rogers Side Hollow, and Uvalde (Perino 1971). The regular use of exotic raw materials by Early Archaic peoples is viewed as evidence for group mobility (rather than exchange) since these materials were employed for utilitarian items that were discarded in mundane contexts after clearly being used and broken or exhausted (cf. Binford 1979; Meltzer 1989). The data encoded in their heavily curated tools suggest that these people had rather extensive home ranges that allowed for regular contact with areas located 100–200 kilometers away and less frequent but observable connections (whether direct or indirect) beyond these limits. The Gore Pit Site (34CM131) in Comanche County is an example of an Early Archaic site in Oklahoma. This site was important as it revealed subsistence strategies of early hunters and gathers through the presence of numerous rock ovens or hearths, faunal material, and burned shell middens (Hammatt 1976).

In the Middle Archaic (8000–4000 BP) settlement patterns shift from the more nomadic hunting and foraging of early periods to more sedentary semi-permanent base camps with smaller procurement sites for raw materials away from the larger base camps. Even more variation in implement form is apparent during this period. This shift is reflected in base camps being occupied longer and operated more intensively by apparently larger groups (Baugh 1978). One Middle Archaic culture, Calf Creek, has been identified in Oklahoma (Stout 2005). Point styles commonly attributed to the Middle Archaic time period include small triangular side notched points such as Andice, Calf Creek, Carrolton, Dawson, Nolan, Searcy, Smith, Travis, and Wells (Perino 1971). The Dawson Site (34MY140) in northeastern Mayes County, represents a lithic collection and reduction station during the Middle Archaic (Baugh 1978).

The Late Archaic (4000–1700 BP) is the best represented Archaic subperiod within the region, likely due to an increase of population during this period. Late Archaic sites were marked with an expansion of tool kits with the addition of groundstone tools such as grooved axes, hammerstones, pestles, and manos

(Houghton et al. 2013). Point styles commonly attributed to the Late Archaic include Afton, Bottleneck, Kent, Kings, Merkle, and Table Rock (Perino 1971). The presence of large, steady populations in the major valleys at the end of the Archaic period appears to have overlapped with the use of prominent blufftop locations for burying the dead. This has been understood as reflecting a greater awareness of territoriality, and perhaps rising social complexity, that may have stemmed from an increased competition for resources caused by population packing (cf. Charles and Buikstra 1983; Houghton et al. 2013). The Late Archaic is basically a continuation of the Middle Archaic techno-economic pattern. The major difference being that the exploitation techniques may have been even more intensive. In some regions it persisted until relatively late while in other areas outside influences seem to have gradually transformed it into a formative Woodland culture. The Late Archaic has a predominance of contracting stem dart points such as Gary and Langtry (Baugh 1978). A 2005 study showed two archaic sites within Woodward County, though none have been identified within the Study Area (Brooks 2005; OAS 2019).

3.4 WOODLAND PERIOD (2000–1100 BP)

The Woodland Period in Oklahoma is one of the least understood time periods in the state. During this period, people adopted a more sedentary farming lifestyle. Pottery and arrow projectile points are indicators of the Woodland Period. Other diagnostic artifacts for the Woodland period include corner-notched dart points, shell disc beads, burials in mounds or ossuaries, and an increased frequency of grinding stones (Vehik 1984). The onset of the Woodland period traditionally also correlates with the appearance of ceramics (Willey and Phillips 1958:118). Increasing use of ceramic technology, a growing dependence upon horticulture, and a shift toward greater sedentism characterize the Woodland Period. Earlier Woodland occupations in the region are typified by relatively small, short duration camps situated adjacent to specific environmental locales. This suggests that small social groups using seasonally occupied, specialized, extraction camps were exploiting resources within defined territories (Houghton et al. 2013).

As time passed, Woodland peoples continued to become more sedentary; villages began to increase in size and complexity, becoming more permanent settlements. In addition, trade networks appear to have expanded during this period. Evidence of broader trade networks include shells from coastal settings identified on middle era Woodland sites in the interior (Depratter 1984). The middle of the Woodland period is also associated with the Hopewellian Interaction Sphere, which is characterized by specific design motifs on pottery vessels, "elite" burial mounds, the exchange of exotic materials, and the connection of distant Woodland groups by a highly developed socio-religious organization (Houghton et al. 2013). Focal points for Hopewellian activities during this period were large regional centers, which exhibit groups of conical shaped burial mounds. The pottery from the middle Woodland period is quite varied in decorative technique (Houghton et al. 2013).

Those groups in northeastern Kansas with Hopewellian influences no doubt influenced Woodland occupation in Oklahoma (Vehik 1984). It is also possible that Woodland cultures in Oklahoma developed from peoples moving from the northeast and southeast, Oklahoma peoples adopted the Woodland traits from the northeast or the southeast, or a combination of the two (Wyckoff and Brooks 1983:264). Most middle Woodland era archaeological material in Oklahoma indicates that northeastern cultures influenced Oklahoma peoples more than Woodland cultures in the southeast (Stout 2005).

The latter part of the Woodland period saw a decrease in trade and complex burial rituals and ceremonies. Later Woodland peoples returned to a more localized procurement and utilization of local resources and smaller settlement sizes. Habitation sites are located not only in the major river basins but in the smaller stream valleys and surrounding uplands. Populations started relaying on horticulture as well as hunting and gathering with corn, squash, and beans being present in archaeological contexts for the first time (Houghton et al. 2013). Small side-notched and unnotched arrow heads are diagnostic of the period along with plain and cord-marked grit and sand tempered ceramics (Perino 1971). Woodland period sites are not well documented and are hard to distinguish from other Late Prehistoric sites in Oklahoma. Few sites have been excavated or well dated (Wyckoff and Brooks 1983). In a 2005 study, no Woodland period sites had been recorded within Woodward County and none have been identified within the Study Area (Brooks 2005; OAS 2019).

3.5 LATE PREHISTORIC PERIOD (1100-300 BP)

The Late Prehistoric period, also called the Plains Village period, dates from roughly 1100-300 BP. The Plains Village period is one of the most documented archaeological time periods in the state of Oklahoma and 12 sites that date to this period have been recorded within Woodward County (Brooks 2005). The Plains Village period is characterized by large farming societies based along the major water systems in the state. Southern Plains Village characteristics include the intensification of agriculture, the use of subsistence storage pits, expanded artifact inventories, and the use of permanent houses and larger settlements (Drass 2003). These peoples relied upon the growing of corn, beans, and squash and enhanced their diet with the hunting of wild game. Southern Plains Village groups relied heavily on bison as these bones dominate the faunal remains for this time (Brooks 1989).

Plains Village inhabitants became more social and began to live in communities. The farming societies on the plains in the west differed from those in the woodlands and on the prairies to the east. Along the Washita River and its tributaries, archaeologists have found the sites of more than 200 villages, each with at least 12 dwellings (Baird and Goble 2008). The houses were square with stick walls plastered with a mixture of clay and grass. Roofs were made of grass thatch. Trade was evident as artifacts that were no produced locally were also found.

The Plains Village farmers were more effective hunters than the people of earlier periods, mainly due to the use of the bow and arrow. Greater accuracy allowed hunters to stalk not only larger game, but smaller animals as well (rabbit, squirrel, wolf, raccoon, beaver, opossum, turkey, duck, and crow). However, Bison remained the most important animal judging from the quantity of archaeological faunal remains found at sites from this period. Bison provided skin for clothing, bedding, fibers, and containers and bison bones could be fashioned into tools and household items. Villagers also fished and collecting mussels and other shellfish. Plants were gathered for food, dyes, and medicines. These plants included hickory nuts, walnuts, hackberry seeds, wild cherries, plums, and persimmons (Baird and Goble 2008).

Archaeology has also shown that the Plains Village people celebrated and contemplated the mysteries of life. Undecorated pottery and small figurines left as grave goods indicate a belief in a spiritual realm, though they did not have elaborate ceremonies, class societies, or erect burial mounds (Baird and Goble 2008).

Eventually a drier climate led to crop failure toward the end of the Late Prehistoric period in Oklahoma. The villagers abandoned their fields and turned more to the hunting of bison. Homes and villages fell into ruin as a nomadic lifestyle took precedence (Baird and Goble 2008). Three Late Prehistoric sites (Richards 34WD1, Hedding 34WD2, and Traders Creek 34WD5) have been recorded within Woodward County. The Richards site (34WD1) was first reported by James Shaeffer (1965). The site is located approximately 11.5 miles north of Mooreland, east of the Study Area. The Hedding site (34WD2) was identified during highway construction near Moreland (Shaeffer 1965). Another late prehistoric site recorded in Woodward County is the Trader’s Creek site (34WD5). Archeological investigations by Oklahoma Archeological Survey archaeologists in Woodward County identified another Late Prehistoric site (34WD88). The site is located on the top of an isolated butte overlooking the confluence of Sand Creek and the Cimarron River (Bartlett et al. 1993). A burial site is also located in Woodward County. The Fred Loomis site (34WD12) is located on a hill overlooking Doe Creek, a tributary of the Cimarron River, and contains 10 recorded burials. No sites associated with the Late Prehistoric have been identified within the Study Area (OAS 2019).

3.6 PROTOHISTORIC (POST 1541-1803)

The Protohistoric period refers to the period between the entrance of the first European explorers into the North American interior and the beginning of extensive European colonization. The Protohistoric period in Oklahoma relates to the period when cultures in the state first encountered European cultures and represents a time of dynamic cultural change. Hofman (1989) describes the Protohistoric beginning with Coronado’s first appearance onto the Southern Plains in 1541 until the Louisiana Purchase. In 1541 Francisco Vásquez de Coronado had to cross the Cimarron River on his journey to and his return from Quivira in central Kansas (O’Dell 2018). Archaeological study of sites from this period begin to reveal Euro-American trade goods. Trade increased between Plains peoples and the southwest pueblos and to the southeast during this time period.

European contact with native populations in Oklahoma was moderate at best. The Spanish made excursions through Oklahoma but did not have a significant impact on peoples living there. The French had a slightly greater impact on the people of Oklahoma due to their desire for trade goods (Stout 2005). For nearly 150 years the French controlled Oklahoma, promoting it as a land of promise and opportunity unlike the Spanish before them. The French recognized the fertile soils, beauty, and natural resources of the land. They also treated the native populations as potential allies in their plans for Louisiana. Thousands of Frenchmen came to Oklahoma during this time and many places in the state still bear their names. However, the French did not come to Oklahoma to share, they came to exploit natural recourses and take advantage of the fur trade, leaving native populations to lose their traditional skills, slaughter their food sources for profit, and make war on each other (Baird and Gobel 2008).

Between 1763 and 1800, Oklahoma was a domain of Spanish Louisiana. During this time, the English colonies on the North American coast declared independence, fought a revolution, established the United States, and implemented a constitutional form of government. With these historic events going on outside of Louisiana, Oklahoma was never a priority for Spanish officials at New Orleans. The Spanish ignored hostilities growing between the Washita and Osage populations, which led to the Osages trading with the English and becoming wealthy and bold. In 1800, Louisiana returned to French control and eventually was sold in 1803 to the young United States, making Oklahoma a part of the expanding new country (Baird and Goble 2008). No previously recorded Protohistoric resources are located within the limits of the Project APE or within the Study Area.

3.7 HISTORIC (1803-PRESENT)

Following the Louisiana Purchase of 1803, the land that is now Oklahoma fell under the jurisdiction of the Territory of Louisiana. In 1819 Oklahoma was attached to the Territory of Arkansas. President Jefferson rightly believed that the newly purchased land would become a foundation of a great American empire, supplying natural resources, a barrier against foreign attack, and a space for the resettlement of eastern Indians. This last notion would affect Oklahoma the most. From 1806-1822 numerous expeditions crossed through or into Oklahoma while searching for ways to utilize the topography, flora, fauna, rocks, minerals, and people of this new land (Baird and Gobel 2008).

In 1819, a treaty with Spain defined the southern border of the Louisiana Purchase from the Gulf of Mexico to the Pacific Ocean, giving Oklahoma its southern border with Texas along the 100th meridian and the Red River. By 1825, the scientific expeditions begun by Jefferson learned the nature and extent of the land that is now Oklahoma. Adjacent to a great desert and bounded on two sides by the Republic of Mexico, the area was deemed unlikely to attract American settlers and considered ideal for a resettlement zone for eastern Indians.

Oklahoma is a Choctaw word, and the great deal of the state includes the insignias of five Indian nations-the Choctaws, the Chickasaws, the Creeks, the Seminoles, and the Cherokees. There native peoples lived initially in the southwestern United States but were relocated when Andrew Jackson signed the Indian Removal Act of 1830. The land that is now Woodward County was established as a destination for the Cherokee. The Cherokees were the largest Indian tribe on the southern frontier of English America. By the eighteenth century the tribe numbered more than 10,000 and lived in scores of scattered villages. Through a series of treaties, the Cherokee land holdings were reduced until the 1820s, when the major body of the tribe (approximately 16,000) was concentrated primarily in Georgia and Tennessee. They were removed after a series of congressional and court battles and were driven by the U.S. military over what became known as "the Trail of Tears" from 1838 to 1839. Over 4,000 Cherokee people died during this march to what would become Oklahoma. Before the removal, the Cherokee resolved to keep their government in operation throughout the exile and upon arrival in the Indian Territory. Here they joined 6,000 Western or Old Settler Cherokees who had voluntarily migrated beginning as early as 1808, settling in Arkansas then the Indian Territory that became Oklahoma (Anderson 1991; Conley 2005).

A CULTURAL RESOURCES ASSESSMENT FOR THE ARS FIELD STATION LAKE DAM REHABILITATION PROJECT, WOODWARD COUNTY, OKLAHOMA

Cultural Context

On September 16, 1893, the Cherokee Outlet Opening was Oklahoma's fourth and largest land run, including lands now part of Woodward County. Economic pressures plus poor planning and inadequate enforcement by federal agencies made it even more chaotic than earlier runs, resulting in massive fraud, widespread suffering, and several deaths. The Outlet was one of three areas the Cherokees had acquired upon removal to lands in present eastern Oklahoma under the Treaty of New Echota. The United States declared the eastern third of the Outlet surplus and began moving several smaller tribes there. Railroads, cattlemen, and home seekers then began efforts to acquire the remainder for their purposes. The chaotic process of settlement continued to affect the region's development long after the land run. Towns were over-built; farmers went broke on land unsuitable for farming. Other problems guaranteed many claims were abandoned by the end of the year. The new towns, dependent on the farmers' business, faltered in a changing American economy in which the growth of industrialization had redefined the meaning of opportunity (Turner 1993).

Woodward County was part of a well-used military transportation corridor that was vital to frontier defense. Several U.S. Army expeditions evaluated the area in 1857 and 1860. In November 1868 Camp (later Fort) Supply was established as a depot in Lt. Col. Alfred Sully's impending Seventh Cavalry campaign against the Cheyenne. From Camp Supply, Col. George A. Custer took the field and engaged in the attack on Black Kettle's camp on the Washita River in late November. Fort Supply lasted because of its location at the confluence of Union Creek and the Beaver (Cimarron) River. A significant military pathway thereafter led from Fort Dodge, Kansas, south to Fort Supply. From 1876 through the 1880s immense herds of cattle passed through the southwestern corner of the county along the Great Western Trail from Texas to Kansas.

Rail transportation came to the area in the 1880s and proved imperative in the county's economic development after the Cherokee Outlet opening. In 1886–87 the Southern Kansas Railway built a line southwest from Kiowa, Kansas, through the region and into Texas. The town of Woodward emerged where the railway crossed the military road, and the company constructed a station house and other depot buildings for the crew (James 1987). A store also served local ranchers and travelers. By 1899, the line, which facilitated settlement of the Outlet after the run, was owned by the Atchison, Topeka and Santa Fe system and passed through Quinlan, Mooreland, and Woodward. The Wichita Falls and Northwestern Railway, controlled by the Missouri, Kansas and Texas Railway, constructed a line from Elk City through Sharon, Woodward, and the town of Fort Supply to Forgan, in Beaver County, in 1911–12. Via both rail systems, crops could move out of Woodward County to be marketed, and manufactured goods could supply farmers and town dwellers (James 1984, 1987; Everett 2019).

In September 1893, when the Cherokee Outlet opened for non-Indian settlement, Woodward County was created as County N, with Woodward the seat of government. The designation included present Harper and approximately half of Ellis and Woods counties (Everett 2019).

Petroleum exploration first took place in Woodward County in 1903 and 1905, and again in the World War I years, with little result other than temporary booms for small towns. In November 1956 a producing gas well was brought into production west of Woodward. Oil production gave the economy a much-needed transfusion and increased Woodward's population.

The U.S. Department of Agriculture established the Great Plains Field Station southwest of Woodward in 1913. The agricultural depression that began after World War I and continued into the 1930s affected Woodward County. The arrival of the Great Depression in late 1929 caused the collapse of banks in Mutual, Woodward, and Quinlan. The federal government aided the depressed economy with the 1937 construction of Fort Supply Lake dam and with various Civilian Conservation Corps and Works Progress Administration projects (Everett 2019).

The impact of the Great Depression was somewhat lessened by activity in the extractive industries. Mineral production in Woodward County has included salt, bentonite, and petroleum. Salt has been produced from the Big Salt Plain, a deposit that spans 5,000acres in Woodward, Harper, and Woods counties. In 1932, 8 miles northwest of Woodward the Texas Pacific Coal and Oil Company mined Bentonite and processed it at the Thurber Earthen Products Company plant (Everett 2019).

One of the county's most notable historical events occurred on April 9, 1947. That evening, a massive tornado cut a 2-mile-wide path from the Texas Panhandle through Ellis, Woodward, and Woods counties. In the town of Woodward, 200 city blocks were destroyed, with an agonizing death toll. The National Weather Service has ranked this storm as the deadliest and one of the strongest (F5 on the Fujita scale) tornadoes ever to occur in the state (James 1984).

Woodward County remained sparsely populated during the last decades of the twentieth century. The population stood at 15,537 in 1970, grew with the oil boom to 21,172 in 1980, and shrank with its demise to 18,976 in 1990 and to 18,486 in 2000.

3.7.1 The Great Plains Field Station

The Great Plains Field Station, established in 1913 in Woodward, was the gateway to the Southern Plains. Plant material including sorghums, wheat grasses, and trees were first test planted here, and eventually distributed to farmers if the testing proved the plants viable in soil and weather conditions. The station faced closing during the depression but was saved in 1934 when Earnest W. Johnson transferred from Fort Hays, Kansas, where he had served as forest nurseryman in charge of tree and shrub research. Johnson established new greenhouses by 1935, and by 1936 the station was prominent in its testing of trees, roses, windbreaks, vineyards, and farming methods (James 1988).

During the dustbowl effects of the Great Depression, Congress directed funds to the station for grass breeding and re-grassing experiments. The technology to harvest and plant grass seed was not available to Great Plains farmers before this damaging necessity of the dustbowl aftermath. The Woodward research station, led by agronomist David A. Savage, developed methods to reseed abandoned farms and crop lands which were applied to over 5 million acres in the Southern Great Plains. This breakthrough led to the government purchasing an additional 480-acre tract in 1938 for the expansion of grass studies. The dam on Spring Creek was built this year and the irrigation system completed by 1939 (James 1988).

3.7.2 The Field Station Lake Dam

In 1937, roughly 12 miles northwest of Woodward, construction began on a dam near the confluence of the Beaver River and Wolf Creek at Fort Supply. This endeavor was one of the largest projects undertaken in Northwestern Oklahoma and observation towers were built for the public to watch the growth of the massive dirt-filled dam that would impound the water. Construction of the Fort Supply Dam was one of the major events in Woodward County during the late 1930s (James 1988; Woodward County Journal 1938). Tons of earth were moved by machinery to complete the nearly 2-mile dam and 1,900-foot spillway. This required “a million dollars’ worth of heavy machinery,” and 100 men which was bolstered to 500 by year’s end (Woodward County Journal 1938). These large crews brought an economic boom to Woodward, but the problem of housing was rapidly obvious. Woodward had a housing problem before this, beginning in the oil boom days of the 1890s and continuing into the 1920s. The influx of workers for the dam only made this problem worse (James 1988). As the Fort Supply Dam was completed, it is likely that some of the Fort Supply construction workers were also employed in the construction of the Field Station Lake Dam project in circa 1938. In an article on dams dated November 3, 1938, the Woodward County Journal encourages crowd participation at Fort Supply and mentions only small details of the Field Station Lake Dam project ongoing simultaneously. The article mentioned that the acquisition by the Field Station will serve to protect the numerous blocks of grain from heavy rains (Woodward County Journal 1938). The newly created lake was roughly 50 acres and attracted over 150 pintail ducks within the year (Woodward County Journal 1939).

4.0 ENVIRONMENTAL CONTEXT

The Field Station Lake Dam was completed in 1938 to offer irrigation to SPRRS and presently also acts as a recreation site for the local community of Woodward. The terrain around the lake consists of sandy shores, grasses, small woodland and shrubs, marshland and evidence of flooded areas in the marshlands west of the dam and surrounding the concrete spillway. The concrete spillway contains trees and growth and is crumbling in areas. The dam itself appears free from erosion and is covered with grass and growth. Historically this area was open and rural prior to the construction of the dam. Since the construction of the dam little has changed; the land has served for recreational use and has remained free from development and obvious erosion. Some access roads exist on the property to the east. Currently 34th Street to the west of the property is under massive construction and the site is not easily accessible from that direction.

4.1 HYDROLOGY

The Project is drained by Spring Creek and the Field Station Lake. Spring Creek drains into the North Canadian River. The North Canadian River flows into the Canadian River, which flows into the Arkansas River, a tributary of the Mississippi River. The Mississippi River flows into the Gulf of Mexico and finally the Atlantic Ocean.

4.2 SOIL MORPHOLOGY

Soils within the Project APE are generally well-drained, comprising loams and sandy loams along the banks of Field Station Lake. However, the surrounding area is characterized by a range of soil conditions from poorly and somewhat poorly drained to well and somewhat excessively drained. Well drained soils represent the predominant drainage classification. Two of the soil types within the larger Study Area are classified as eroded (Web Soil Survey 2018). Soil types within the Project APE are provided in **Table 5** and illustrated in **Figure 7**.

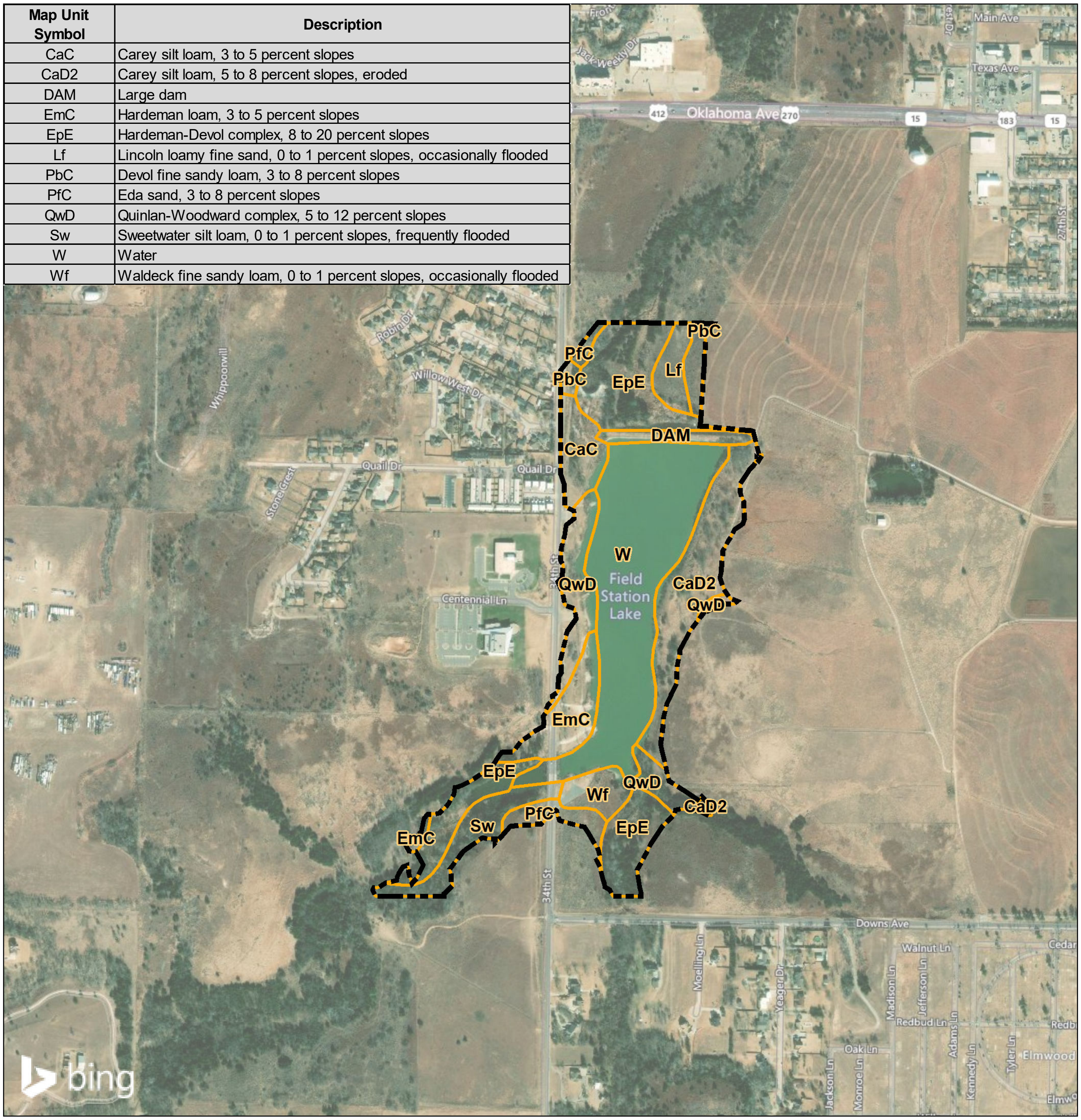
Table 5 Soils within the Project APE

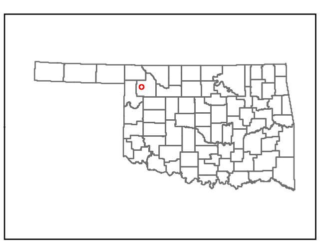
Symbol	Map Unit Name	Percent Slope	Drainage Description
CaC	Carey Silt Loam	3-5%	Well Drained
CaD2	Carey Silt Loam	5-8%	Well Drained
DAM	Large Dam	-	-
EmC	Hardeman Loam	3-5%	Well Drained
EpE	Hardeman-Devol Complex	8-20%	Well Drained
Lf	Lincoln Loamy Fine Sand	0-1%	Somewhat Excessively Drained
PbC	Devol Fine Sandy Loam	3-8%	Well Drained
QwD	Quinlan-Woodward Complex	5-12%	Well Drained
W	-	-	Water

4.1 NATURAL RESOURCES

Prairie formerly occupied the larger expanse of level uplands, with forest equally abundant along watercourses and in the dissected uplands. The Study Area is located in an area that would have been a combination of tall prairie grass a and mixed grass over eroded plains. The area would have supported a variety of flora and fauna including post oaks, blackjack oaks, eastern redcedar, hackberry bluestem, Indian grass, and switchgrass (Tyrl et al. 2002; Baird and Goble 2008; Britannica 2018). This vegetation along with the tall grass prairies would have been home to species such as bison, elk, deer, pronghorn, rabbits, wolves, coyotes, foxes, and prairie dogs (Britannica 2018).

Map Unit Symbol	Description
CaC	Carey silt loam, 3 to 5 percent slopes
CaD2	Carey silt loam, 5 to 8 percent slopes, eroded
DAM	Large dam
EmC	Hardeman loam, 3 to 5 percent slopes
EpE	Hardeman-Devol complex, 8 to 20 percent slopes
Lf	Lincoln loamy fine sand, 0 to 1 percent slopes, occasionally flooded
PbC	Devol fine sandy loam, 3 to 8 percent slopes
PfC	Eda sand, 3 to 8 percent slopes
QwD	Quinlan-Woodward complex, 5 to 12 percent slopes
Sw	Sweetwater silt loam, 0 to 1 percent slopes, frequently flooded
W	Water
Wf	Waldeck fine sandy loam, 0 to 1 percent slopes, occasionally flooded





Project APE

Soils

0 500 1,000 Feet

(At original document size of 8.5x11)
1:12,000

N

Stantec

Project Location
Woodward County, Oklahoma

Prepared by ECL on 2019-09-06
TR by TPS on 2019-09-17
IR by EMB on 2019-09-16

Client/Project
AdAstra Collaborative LLC
ARS Dam Rehabilitation - Oklahoma

175558215

Figure No.
7

Title
Soils Map

Notes
1. Coordinate System: NAD 1983 StatePlane Oklahoma North FIPS 3501 Feet
2. Data Sources: USDA NRCS SSURGO Soil Survey
3. Project limits digitized from drawings provided by USDA Natural Resource Conservation Service
4. Orthoimagery © Bing Maps
5. Microsoft product screen shot(s) reprinted with

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5.0 CONCLUSIONS AND RECOMMENDATIONS

In August of 2019, Stantec Consulting Services Inc. (Stantec) conducted a cultural resources assessment associated with the proposed Agricultural Research Service (ARS) Field Station Lake Dam rehabilitation Project (Project) in Woodward County, Oklahoma. The Field Station Lake Dam is operated by and located on the property of the ARS Southern Plains Range Research Station (SPRRS). The dam was constructed in 1938 to offer irrigation to SPRRS and presently also acts as a recreation site for the local community of Woodward. The Project is bordered to the west by 34th Street, to the north by Oklahoma Avenue, to the south by Field Station Lake, and to the east by property operated by the ARS.

5.1 RESULTS OF THE DESKTOP REVIEW

One previously identified archaeological site is located within the Study Area but not the Project APE. Site 34WD117 represents a 1950s collapsed agricultural building and was recommended not eligible for listing on the NRHP. The Study Area is located within the USDA ARS Grazinglands Research Station Historic District though no structures within this district are located within the Project APE.

The review of previously recorded historic and archaeological site data coupled with the preparation of historic context, review of historic maps, and a review of current conditions within the Study Area boundary assists in assessing the potential for previously undocumented cultural resources to exist within the Project APE and potential development area for the dam rehabilitation. A review of historic maps shows no structures located within the Project APE, although the scale of most of those maps was insufficient to show more detail than rivers and county and town names. The North Canadian River, Camp (Fort) Supply, and the town of Woodward are shown on most maps. For prehistoric resources, the desktop review not only examines sources for previously identified sites, but also examines the attributes commonly assigned to high probability locations for use and settlement by humans.

Native American sites in Oklahoma have generally been found within 1,000 to 1,500 feet of a significant water source, on moderately well- to well-drained soils on low relief landforms. While the location of the Project APE in the vicinity of Field Station Lake, created in 1938 as a result of the damming of Spring Creek, suggests a higher probability for the identification of Native American sites the overall conditions are not conducive to the identification of intact significant sites. The inundation of Field Station Lake and potential construction activities associated with the dam have likely caused some level of disturbance with the Project APE. Additionally, the Project is located within the existing footprint of the facility and in locations where water levels within the lake may fluctuate. This environment often leads to some erosional activity thus affecting the probability of identifying intact archaeological deposits.

5.2 POTENTIAL EFFECTS TO HISTORIC PROPERTIES

All of the alternatives considered share a similar footprint and APE and would have similar potential effects to historic properties. The No Action Alternative would, of course, result in a No Effect to Historic Properties recommendation. The remaining four alternatives, including the preferred, would have similar effects to historic properties and in particular to the dam itself. The following details the potential effects to historic properties identified.

The cultural resources assessment of the Project APE suggests that, because the proposed work associated with the dam rehabilitation would be within the current limits of the existing dam footprint, archaeological survey would not be necessary. Two borrow pit locations are noted on the project plans but are within the existing dam/lake property and likely have been previously disturbed. These locations would be identified as having a low probability for the identification of archaeological sites. Additionally, a survey was conducted for a City of Woodward recreational trail in 2007 that identified no archaeological resources. Details of this study are unavailable, but the lack of findings further suggests that the likelihood for the identification of intact significant sites within the proposed APE is low. Therefore, it is recommended that there would be no impact to significant archaeological deposits within the proposed Project APE.

The dam itself is a historic resource and possibly contributes to the significance and eligibility of the USDA ARS Grazinglands Historic District. This district comprises lands associated with the SPRRS and encompasses approximately 768 acres as mapped in the OKSHPO database. Field Station Lake Dam is located within the historic district boundaries. While no formal description of the district as a whole or a map of the facility was available, it appears that the potentially eligible buildings and structures associated with the historic district are located well outside the current Project APE and Study Area. However, it appears that test plots and agricultural lands are considered contributing to the significance of the district (http://oli_shpo.okstate.edu/query.aspx, accessed September 2019).

Research indicated that the dam, constructed circa 1938, is within the USDA ARS Grazinglands Research Station Historic District as mapped and defined in the records of the OKSHPO (see Figure 2). The dam has not been previously recorded and is not currently associated with the historic district, but because of the role it has played in the irrigation needs of the SPRRS, it is likely to be considered a contributing element to the larger, NRHP-eligible property. The rehabilitation work would alter the existing embankment, spillways, and other associated features of the historic dam structure potentially resulting in an Adverse Effect to the dam should the dam be determined eligible for listing on the NRHP.

Indirect effects to the USDA ARS Grazinglands Research Station Historic District should also be considered. Because the dam will continue to operate after its rehabilitation and there will be no new above-grade structures added to the landscape associated with the dam rehabilitation project, it is recommended that there would be No Adverse Effect to the USDA ARS Grazinglands Research Station Historic District.

5.3 RECOMMENDATIONS

The desktop assessment has resulted in a recommendation for no archaeological survey and a finding of no impact to significant archaeological resources and a recommendation that the Field Station Lake Dam is potentially eligible for listing on the NRHP. It is therefore recommended that next steps include the following actions:

- Survey and recordation of the Field Station Lake Dam
- Assessment of Eligibility for the Field Station Lake Dam and its status as a contributing element to the USDA ARS Grazinglands Field Station Historic District
- Consultation with the OKSHPO on these recommendations and findings pursuant to Section 106 of the NHPA

OKSHPO coordination should also include efforts to identify consulting parties and tribal groups that may take an interest in the Project location and require consultation pursuant to federal and/or state regulations. A review of Tribal Jurisdiction Maps prepared by the Oklahoma State Department of Education indicate the Project is not located within a specific jurisdictional region, however historically the area was associated with the Cherokee and the Cheyenne-Arapaho jurisdictional area is located to the south (OSDE 2016).

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A CULTURAL RESOURCES ASSESSMENT FOR THE ARS FIELD STATION LAKE DAM REHABILITATION PROJECT, WOODWARD COUNTY, OKLAHOMA

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A CULTURAL RESOURCES ASSESSMENT FOR THE ARS FIELD STATION LAKE DAM REHABILITATION PROJECT, WOODWARD COUNTY, OKLAHOMA

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A CULTURAL RESOURCES ASSESSMENT FOR THE ARS FIELD STATION LAKE DAM REHABILITATION PROJECT, WOODWARD COUNTY, OKLAHOMA

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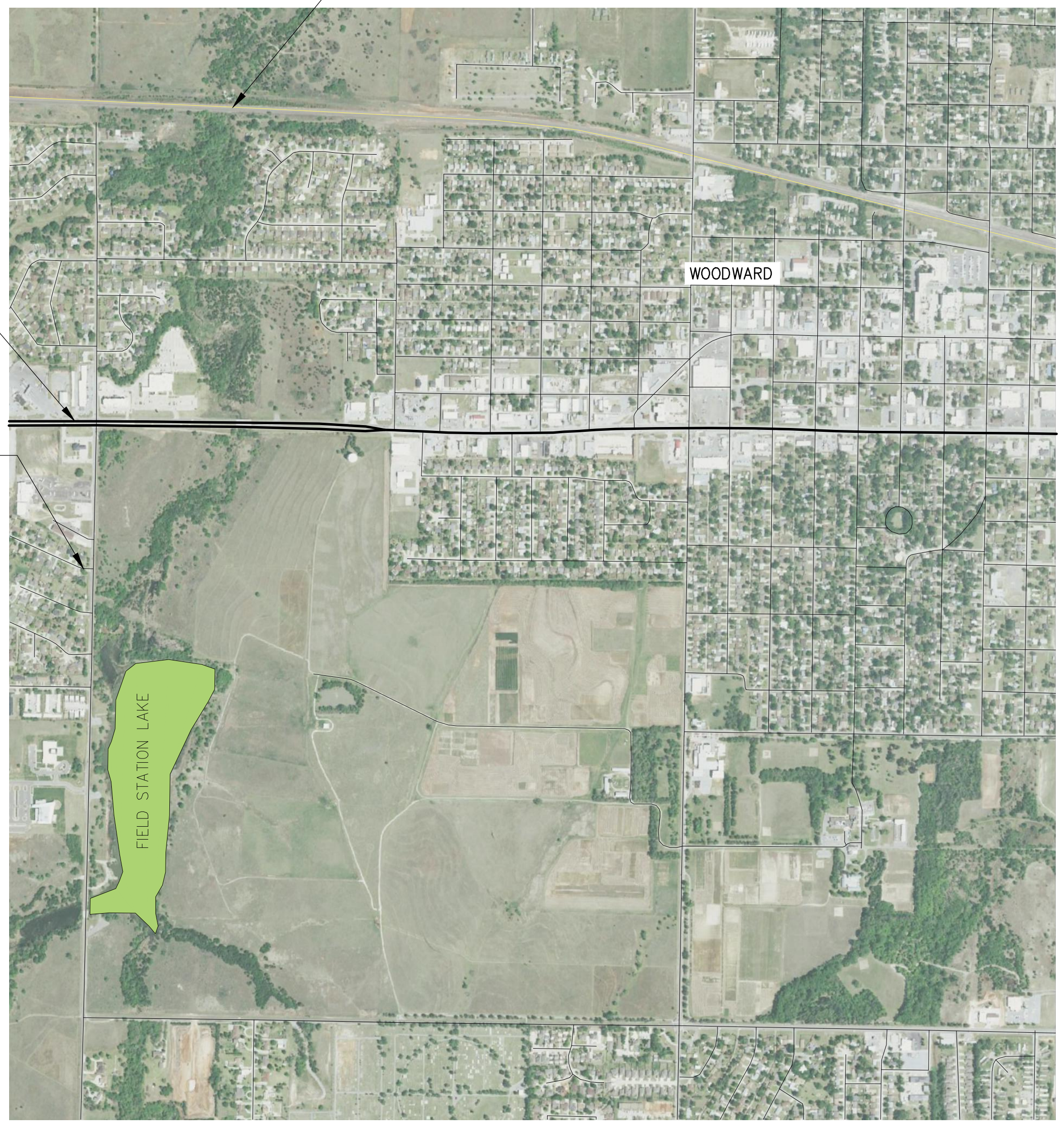
APPENDICES

Appendix A CONSTRUCTION DRAWINGS



A.R.S. FIELD STATION LAKE

DAM REHABILITATION PROJECT
WOODWARD COUNTY, OKLAHOMA

BY

AGRICULTURAL RESEARCH SERVICE

WITH THE ASSISTANCE OF THE

NATURAL RESOURCES CONSERVATION SERVICE

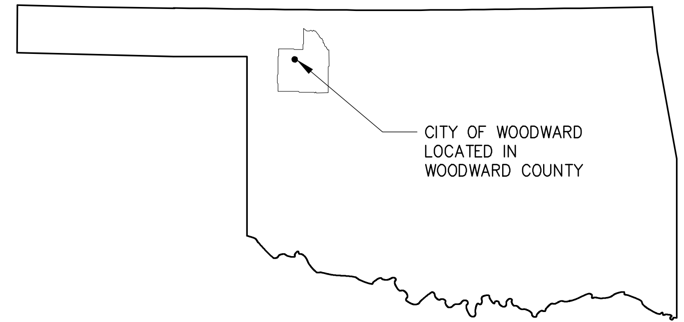
OF THE

U.S. DEPARTMENT OF AGRICULTURE

2018

DATA TABLE		
HAZARD CLASS	High	
DRAINAGE AREA	14.4	Sq. Mi
HEIGHT OF DAM	35	ft.
VOLUME OF FILL	72,500	Cu. Yd.
ELEVATION:		
Top of Dam (Effective)*	1985.0	ft.
Auxiliary Spillway Crest	1977.3	ft.
Principal Spillway Crest	1973.3	ft.
CAPACITY:		
Auxiliary Spillway (Maximum)	31,959	cfs
Principal Spillway	108	cfs
Auxiliary Spillway Maximum Depth of Flow	3.74	ft.

VICINITY MAP



INDEX OF DRAWINGS

	TITLE
1	COVER SHEET
2	RESERVOIR AREA MAP
3	PLAN OF EXISTING CONDITIONS
4	EXISTING IRRIGATION/DRAIN PIPE EXCAVATION AND DEMOLITION DETAILS
5	PLAN OF EMBANKMENT
6	EXISTING EARTHEN AUXILIARY SPILLWAY FILL PLAN
7–8	REHAB PRINCIPAL SPILLWAY – PLAN AND PROFILE
9	FOUNDATION DRAIN
10	SEEPAGE DIAPHRAGM
11	PRINCIPAL SPILLWAY INLET
12–14	STEEL PLACEMENT – PRINCIPAL SPILLWAY INLET
15	PRINCIPAL SPILLWAY INLET DETAILS
16	CONDUIT AND SLIDE GATE DETAILS
17	PRINCIPAL SPILLWAY OUTLET
18–20	STEEL PLACEMENT – PRINCIPAL SPILLWAY OUTLET
21	AUXILIARY SPILLWAY – RCC – ISOMETRIC VIEW
22	AUXILIARY SPILLWAY – RCC – PLAN
23	AUXILIARY SPILLWAY – RCC – PROFILE
24–26	AUXILIARY SPILLWAY – RCC – LIFTS
27	AUXILIARY SPILLWAY – RCC – SECTIONS
28	AUXILIARY SPILLWAY – RCC – DETAILS
29	REHAB IRRIGATION PLAN
30	REHAB IRRIGATION DETAILS
31	PLAN FOR GEOLOGIC INVESTIGATION
32–33	GEOLOGIC INVESTIGATION – TOP OF DAM PROFILE AND DOWNSTREAM TOE PROFILES
34	GEOLOGIC INVESTIGATION – EMBANKMENT CROSS SECTION & AUXILIARY SPILLWAY PROFILES
35	GEOLOGIC INVESTIGATION – BORROW GRID PROFILES
36	FENCE AND MONUMENT DETAILS

LEGEND

ROADS

STATE HIGHWAY

CONSTRUCTION DRAWINGS APPROVED

STATE CONSERVATION ENGINEER, NRCS
STILLWATER, OKLAHOMA

DATE

CHECK PRINT

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Drawing No.
OK-437

Sheet 01 of 36

REHAB STORAGE TABLE			
ELEVATION	ACRES	AC FT	LOCATION
1956.0	0.00	0.0	
1960.0	5.05	5.8	
1962.0	9.88	21.9	
1964.0	12.94	44.5	
1966.0	16.62	74.1	
1968.0	19.42	110.2	
1970.0	22.24	151.7	
1972.0	26.51	200.7	
1973.3	29.23	236.83	PRINCIPAL SPILLWAY CREST
1974.0	30.92	272.5	
1975.1	33.09	307.8	
1976.0	35.33	355.4	
1977.3	38.98	403.7	AUXILIARY SPILLWAY CREST
1978.0	40.72	451.1	
1980.0	46.37	538.3	
1982.0	51.26	635.9	
1984.0	66.39	757.5	
1985.0	69.85	825.65	TOP OF DAM
1986.0	73.86	897.5	
1988.0	83.67	1054.9	

48 hours before you dig

CALL OKIE

1-800-522-6543 or
DIAL 811

OKLAHOMA ONE - CALL SYSTEM

An effort has been made to locate and show approximate location of underground utilities lines. Buried utilities are not necessarily shown. It is the Contractor's responsibility to locate and preserve all utility services.

Contractor is responsible for contacting all utility companies prior to construction.

ARS FIELD STATION LAKE IS LOCATED IN SECTION 35, TOWNSHIP 23 NORTH, RANGE 21 WEST APPROXIMATELY .75 MILES SOUTH AND 2 MILES WEST OF WOODWARD, OKLAHOMA IN WOODWARD COUNTY.

LEGEND

- WORK LIMITS
- FENCE TO BE REMOVED
- EXISTING FENCE
- TEMPORARY FENCE
- FENCE TO BE CONSTRUCTED

200 0 200 400 600

SCALE IN FEET

CHECK PRINT

Designed	V. Glasgow	07-17
Drawn	K. Dabney	08-17
Revised	K. Dabney	06-18
Approved	J. Chris Stoner	08-18

RESEVOIR AREA MAP

A.R.S. FIELD STATION LAKE DAM – REHABILITATION

WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture

USDA Natural Resources Conservation Service

E-File Location:

R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\ARS Woodward Final

Drawing No. OK-437

Sheet 02 of 36

100 0 100 200 300

SCALE IN FEET

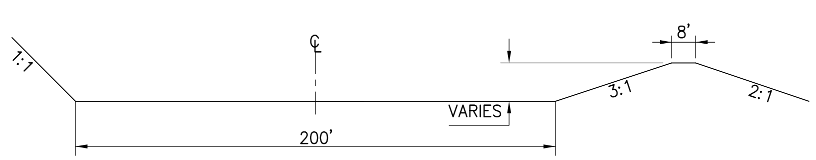
PLAN

LEGEND

EXISTING FENCE

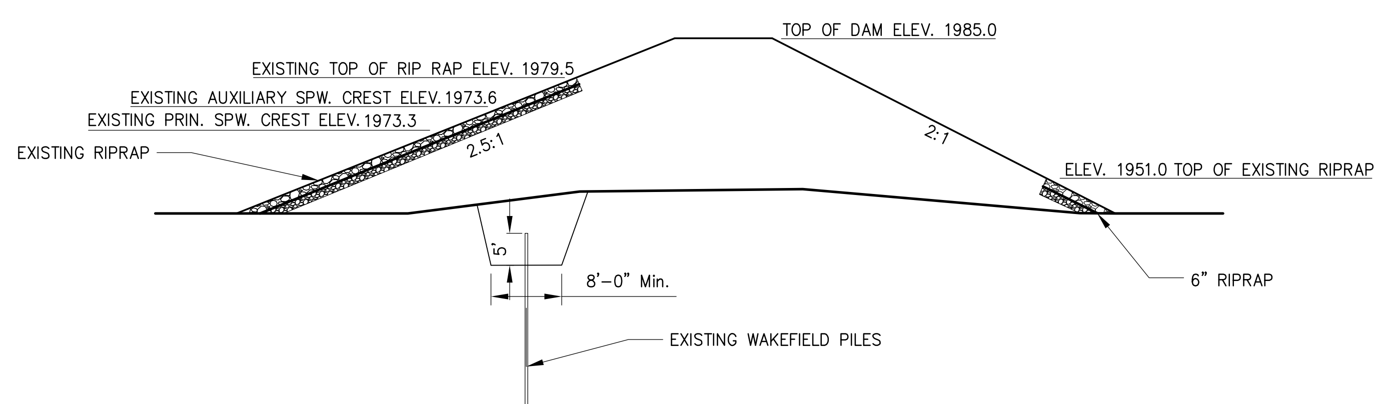
NOTES:

1. TOPOGRAPHY AND EXISTING SITE FEATURES ARE BASED ON FIELD SURVEYS CONDUCTED BY NRCS IN 2017.
2. THE HORIZONTAL CONTROL DATUM IS OKLAHOMA STATE PLANE SOUTH ZONE NORTH AMERICAN DATUM 1983 (NAD83). THE VERTICAL CONTROL DATUM IS NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88). ALL REFERENCED ELEVATIONS AND HORIZONTAL COORDINATES ARE IN UNITED STATES FEET.
3. TYPICAL CROSS SECTION IDEALIZED BASED ON 1937 RECORD DRAWINGS.
4. SEE SHEETS 32 THROUGH 36 FOR RESULTS OF 2016 GEOLOGIC INVESTIGATIONS.
5. OVERHEAD AND BURIED UTILITIES ARE NOT SHOWN. CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO THE START OF WORK IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONSTRUCTION SPECIFICATIONS.
6. LOCATION OF EXISTING STRUCTURES AND FENCES SHOWN ARE APPROXIMATE, AND MAY NOT INCLUDE ALL STRUCTURES AND FENCES IN AREA. CONTRACTOR SHALL FIELD VERIFY LOCATIONS OF ALL STRUCTURES AND FENCES IN VICINITY OF THE WORK.



TYPICAL SECTION – AUXILIARY SPILLWAY

NTS



TYPICAL EXISTING EMBANKMENT SECTION (NOTE 3)

NTS

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		Date
Designed	V. Glasgow	07–17
Drawn	K. Dabney	08–17
Revised	XXX	XXX
Approved	J. Chris Stoner	04–18

PLAN OF EXISTING CONDITIONS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
USDA
Natural Resources Conservation Service

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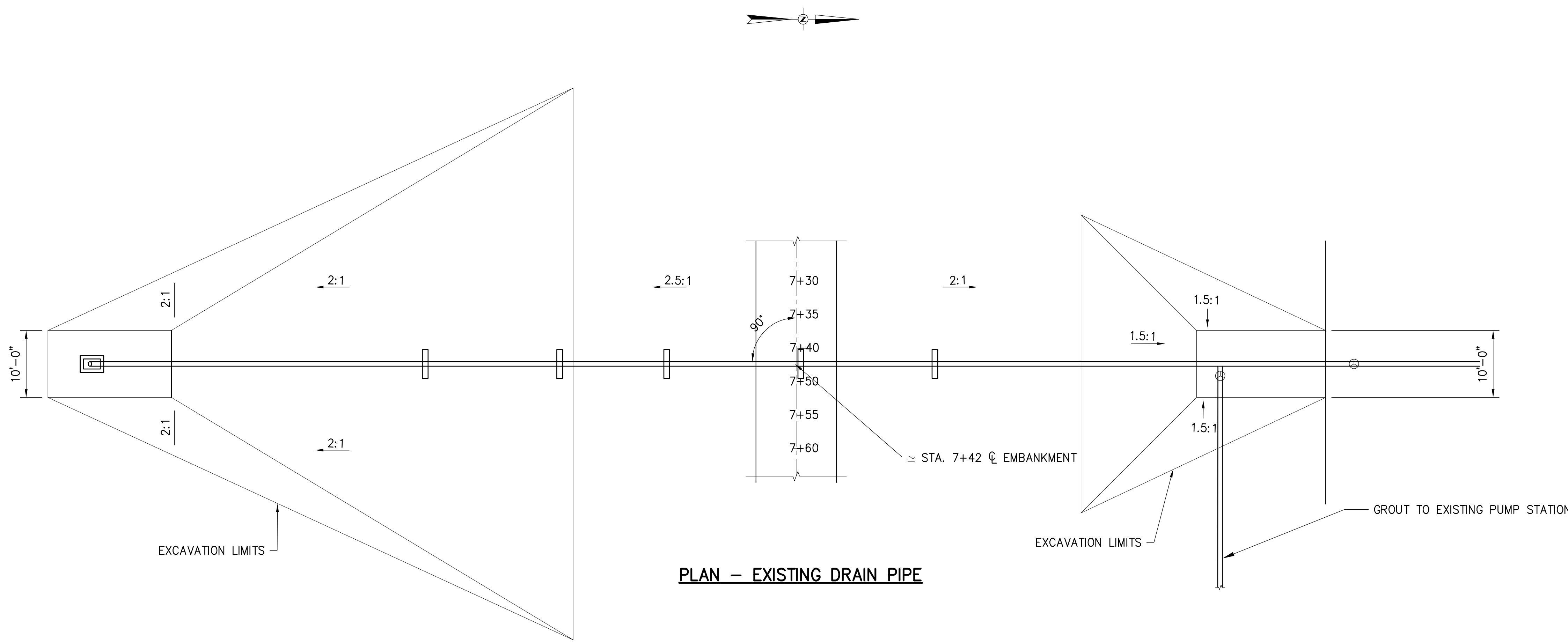
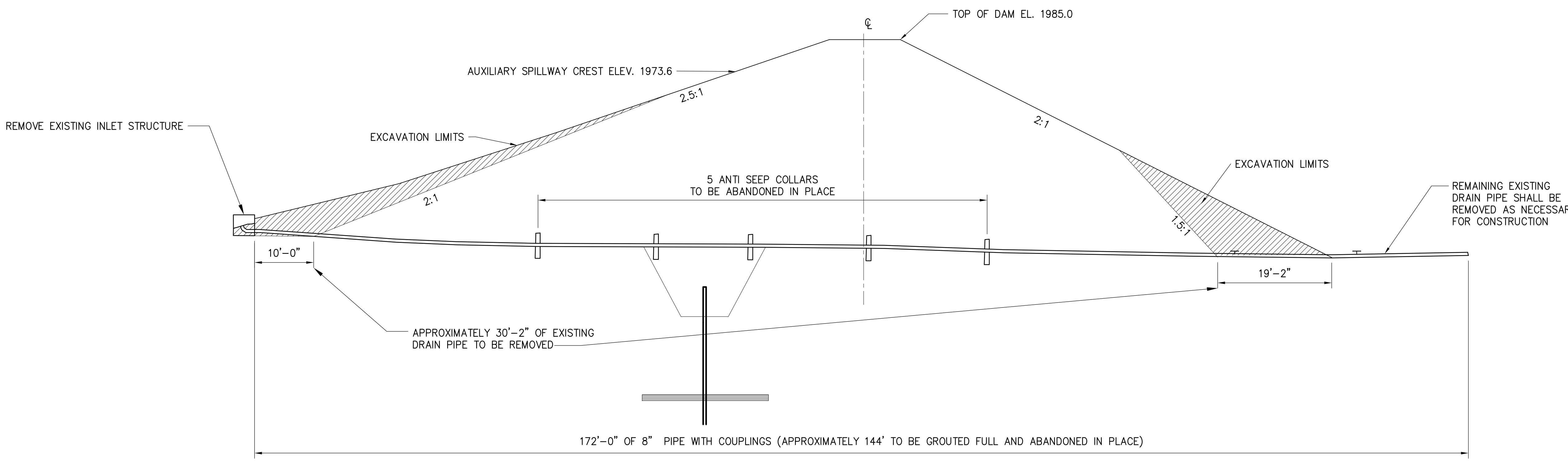


PLAN – EXISTING DRAIN PIPE



SECTION VIEW – EXISTING DRAIN PIPE

CHECK PRINT

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SCALE IN FEET

Designed	V. Glasgow	09-17
Drawn	K. Dabney	09-17
Revised	K. Dabney	06-18
Approved	J. Chris Stoner	08-18

EXISTING IRRIGATION/DRAIN PIPE EXCAVATION & DEMOLITION DETAILS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

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Natural Resources Conservation Service

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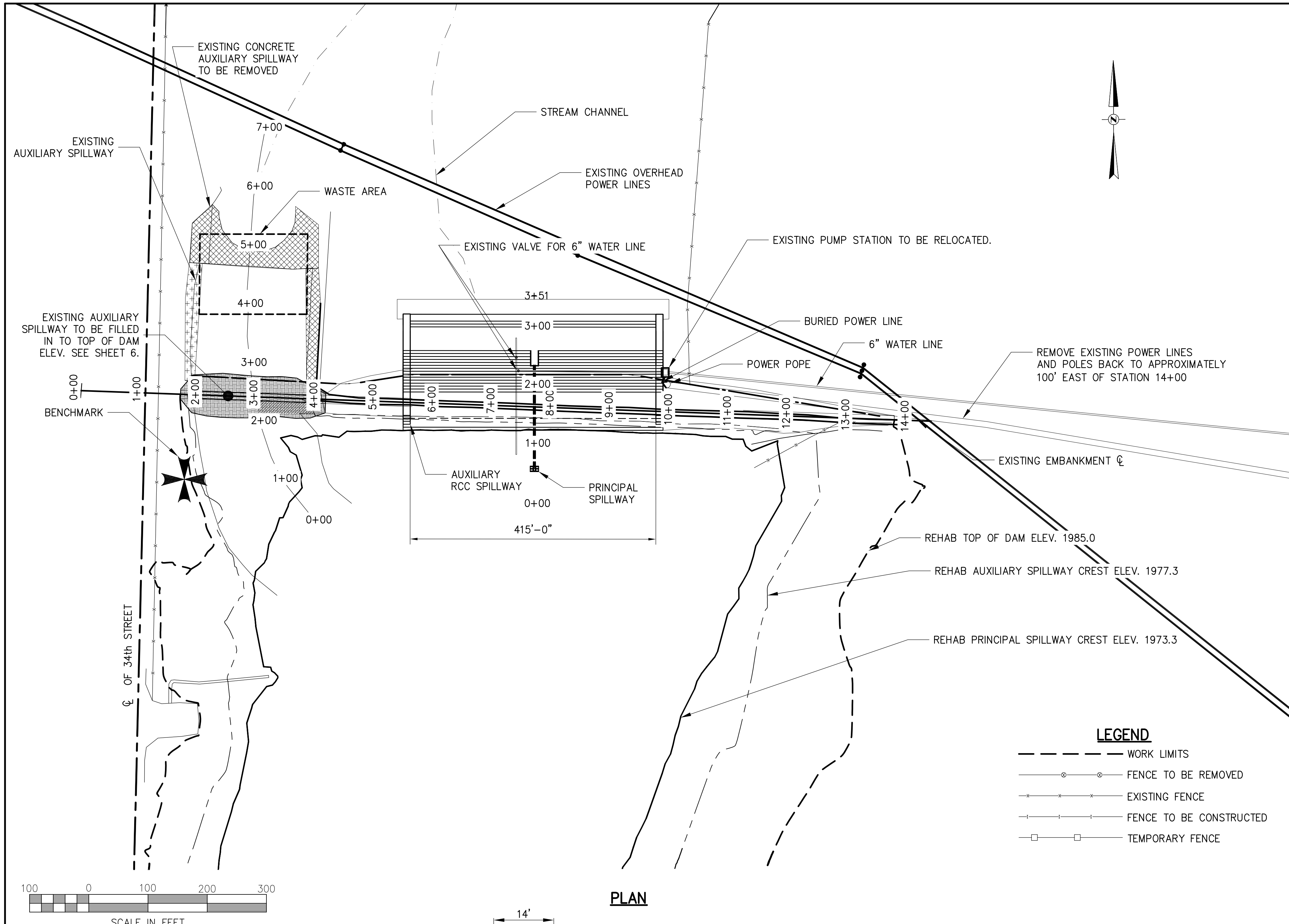
Drawing No.
OK-437

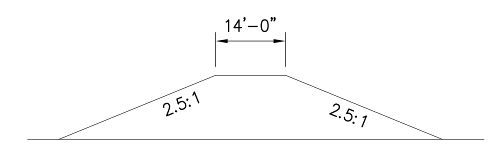
Sheet 04 of 36

CONTROL POINT TABLE		
MARKER	BENCHMARK 1	BENCHMARK 2
NORTHERN	522996.8	522496.9
EASTING	1549218	1549228
ELEVATION	1978.127	1984.133
DESCRIPTION	MANHOLE COVER	2 5/8 PILL WITH YELLOW CAP

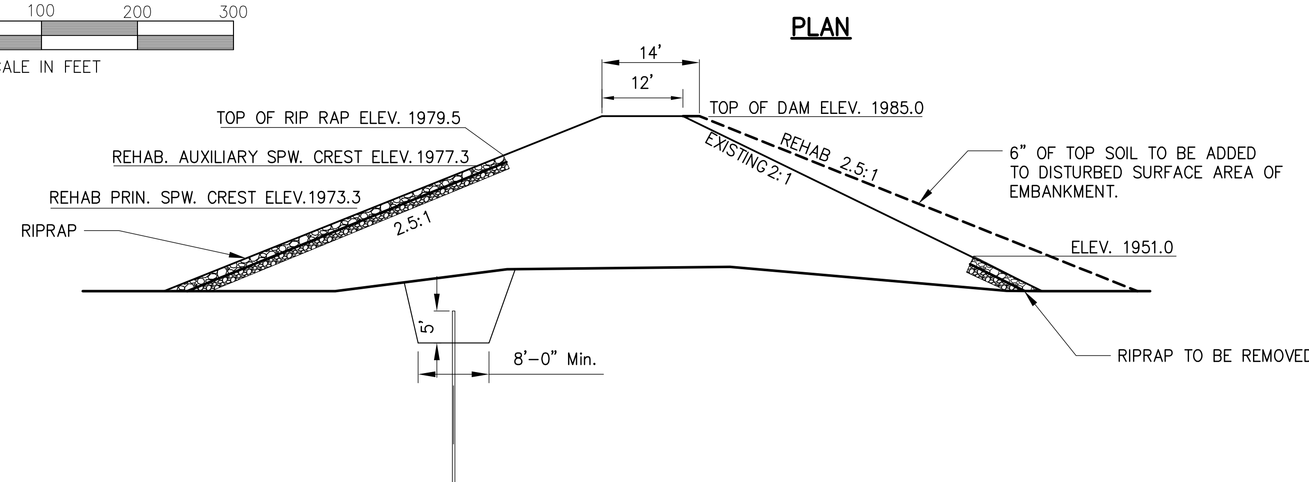
REFERENCE BASED ON NAD83, OKLAHOMA STATE PLANES, NORTH ZONE, US SURVEY FEET COORDINATE SYSTEM, VERTICAL CONTROL IS NAVD 1988.



PLAN



TYPICAL AUXILIARY SPILLWAY SECTION
NTS



TYPICAL REHAB EMBANKMENT SECTION
NTS

MATERIAL PLACEMENT DATA												
Zone	Material Source	Material Description & "Unified" Group Symbol	Typical Atterberg Limits		Maximum Particle Size Allowable	Maximum Layer Thickness Uncompacted	Class Compaction	Moisture Density Test		Percent Maximum Compaction Required	Moisture Limits ± Optimum	
			LL	PI				ASTM No.	Method		From	To
Any	Auxiliary Spillway Borrow	CL, SC, ML	20-32	3-18	6"	9"	A	D-698	A	95	Opt	+4
Any	Borrow	CL, SC, ML	20-32	3-18	6"	9"	C	D-698	A	95	Opt	+4

The above indicates estimated use of material. The Engineer will direct placement of material differing substantially in engineering properties than those indicated.

NOTE
1. ML SOILS SHALL NOT BE PLACED ON OUTER SHELL.
2. DISPERSIVE SOIL SHALL NOT BE PLACED ON OUTER SHELL.

MATERIAL PLACEMENT DATA

CHECK PRINT

Designed	Drawn	Revised	Approved
V. Glasgow 07-17	K. Dabney 08-17	K. Dabney 06-18	J. Chris Stoner 08-18

PLAN OF EMBANKMENT
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

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USDA Natural Resources Conservation Service

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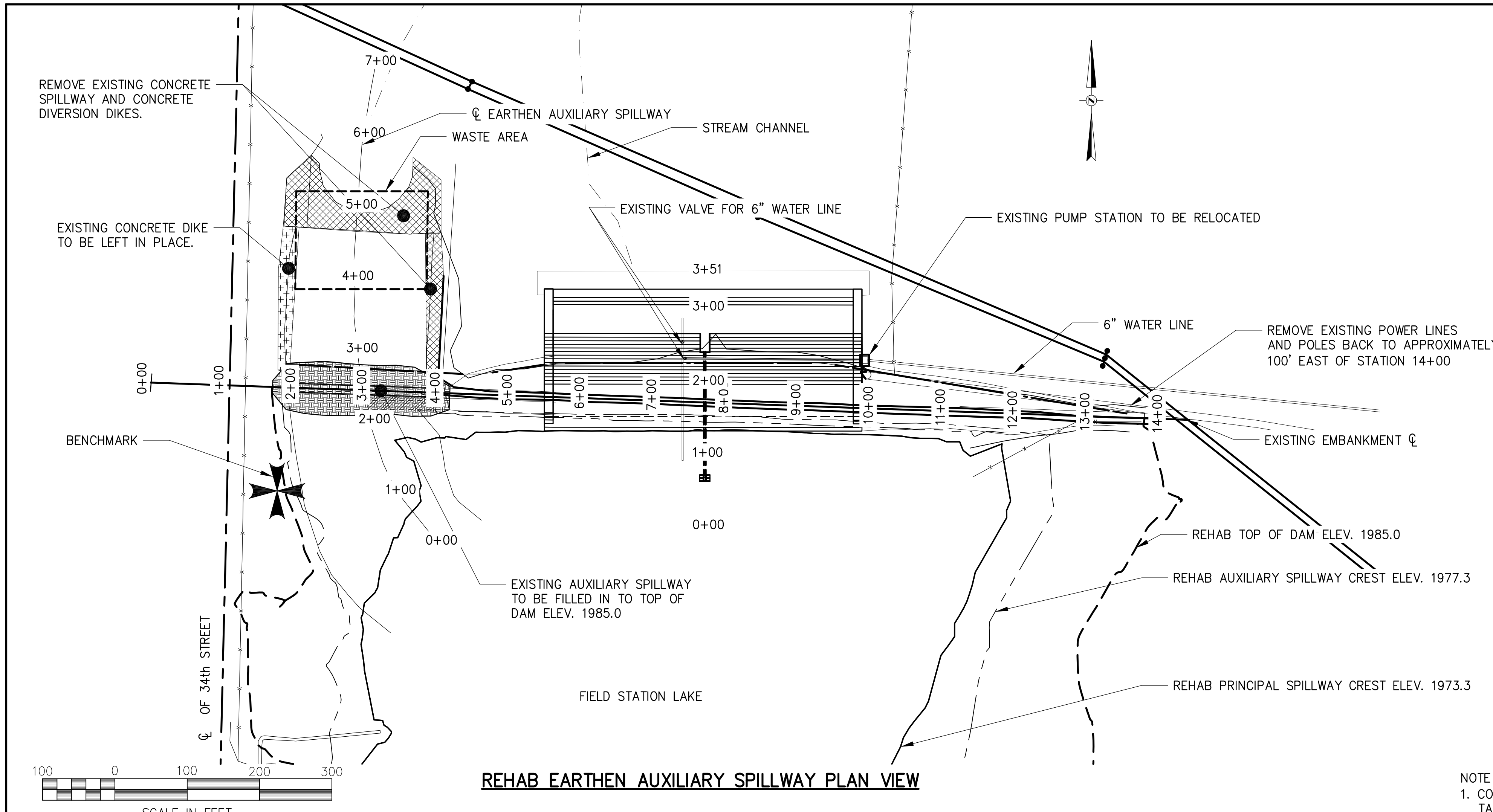
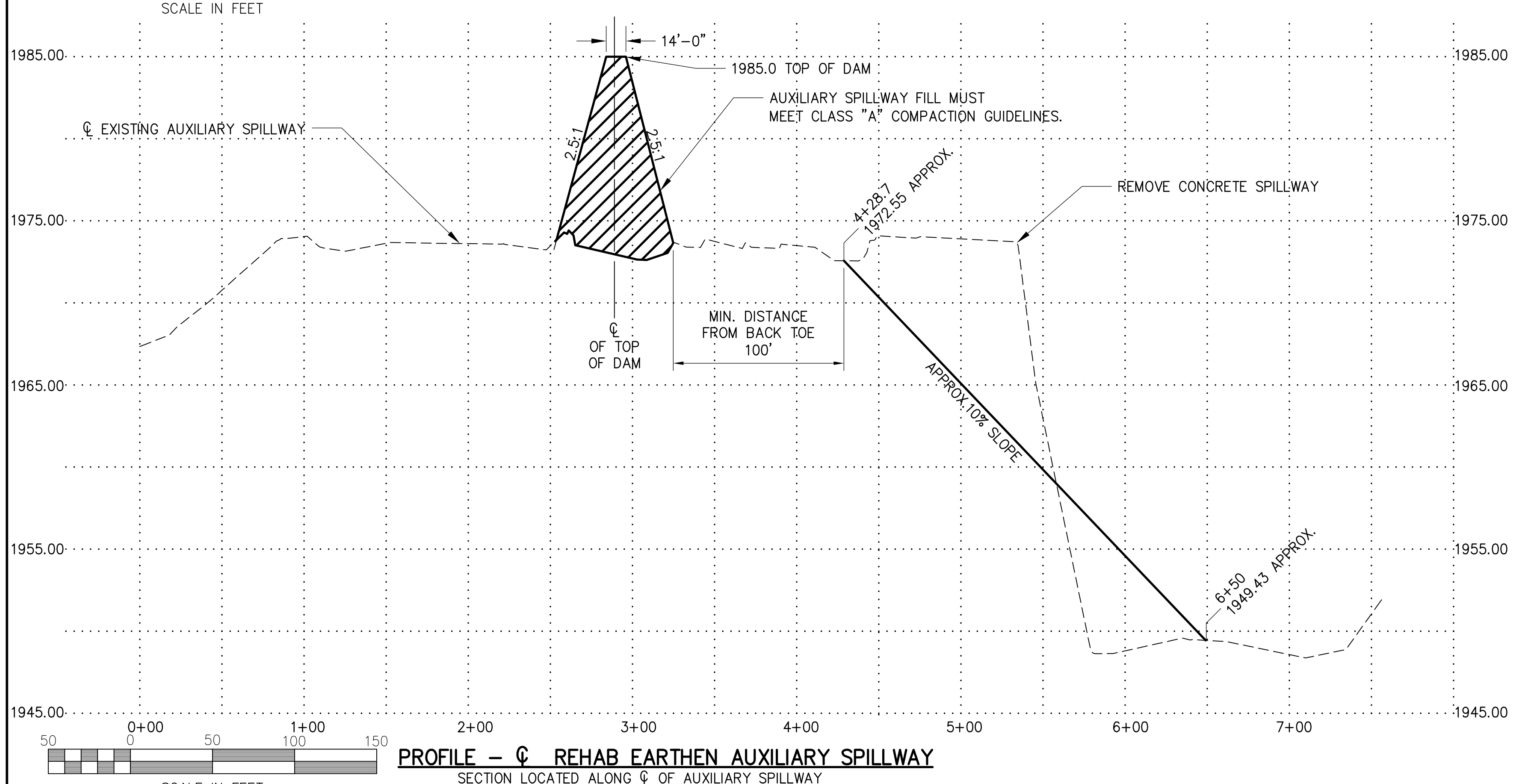
Sheet 05 of 36



REHAB EARTHEN AUXILIARY SPILLWAY PLAN VIEW

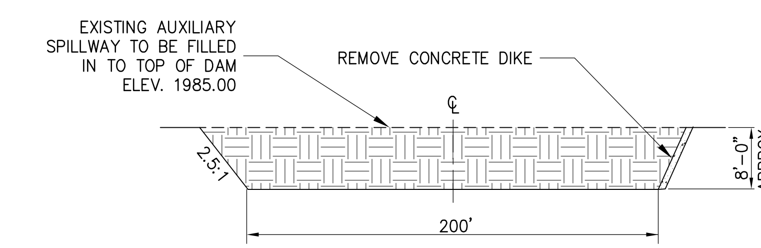


PROFILE – ℄ REHAB EARTHEN AUXILIARY SPILLWAY

SECTION LOCATED ALONG ℄ OF AUXILIARY SPILLWAY

CONTROL POINT TABLE		
MARKER	BENCHMARK 1	BENCHMARK 2
NORTHERN	522996.8	522496.9
EASTING	1549218	1549228
ELEVATION	1978.127	1984.133
DESCRIPTION	MANHOLE COVER	2 5/8 PILL WITH YELLOW CAP

REFERENCE BASED ON NAD83, OKLAHOMA STATE PLANES, NORTH ZONE, US SURVEY FEET COORDINATE SYSTEM, VERTICAL CONTROL IS NAVD 1988.



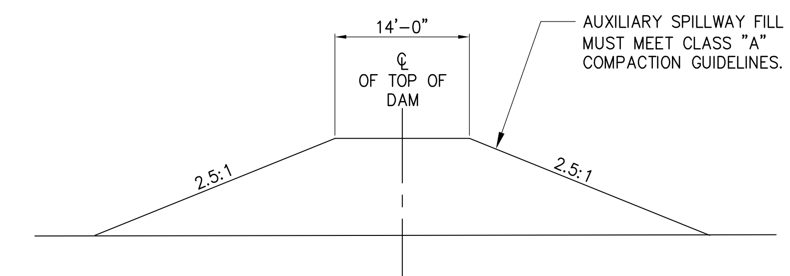
TYPICAL SECTION VIEW – REHAB EARTHEN AUXILIARY SPILLWAY

SECTION LOCATED ALONG ℄ OF TOP OF DAM — NTS

LEGEND

- WORK LIMITS
- FENCE TO BE REMOVED
- EXISTING FENCE
- FENCE TO BE CONSTRUCTED
- TEMPORARY FENCE

NOTE
1. CONCRETE DIKE IS APPROXIMATELY 320'-0" LONG BY APPROXIMATELY 8'-0" TALL.
2. AUXILIARY SPILLWAY FILL MUST MEET CLASS "A" COMPACTION GUIDELINES.
3. CONCRETE AUXILIARY SPILLWAY OUTLET CHUTE IS APPROXIMATELY 25' TALL AND 200' WIDE.



TYPICAL SECTION VIEW – REHAB EARTHEN AUXILIARY SPILLWAY FILL

SECTION LOCATED ALONG ℄ OF TOP OF DAM — NTS

CHECK PRINT

Designed	V. Glasgow	01-18
Drawn	K. Dabney	01-18
Revised	K. Dabney	06-18
Approved	J. Chris Stoner	08-18

EXISTING EARTHEN AUXILIARY SPILLWAY FILL PLAN
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
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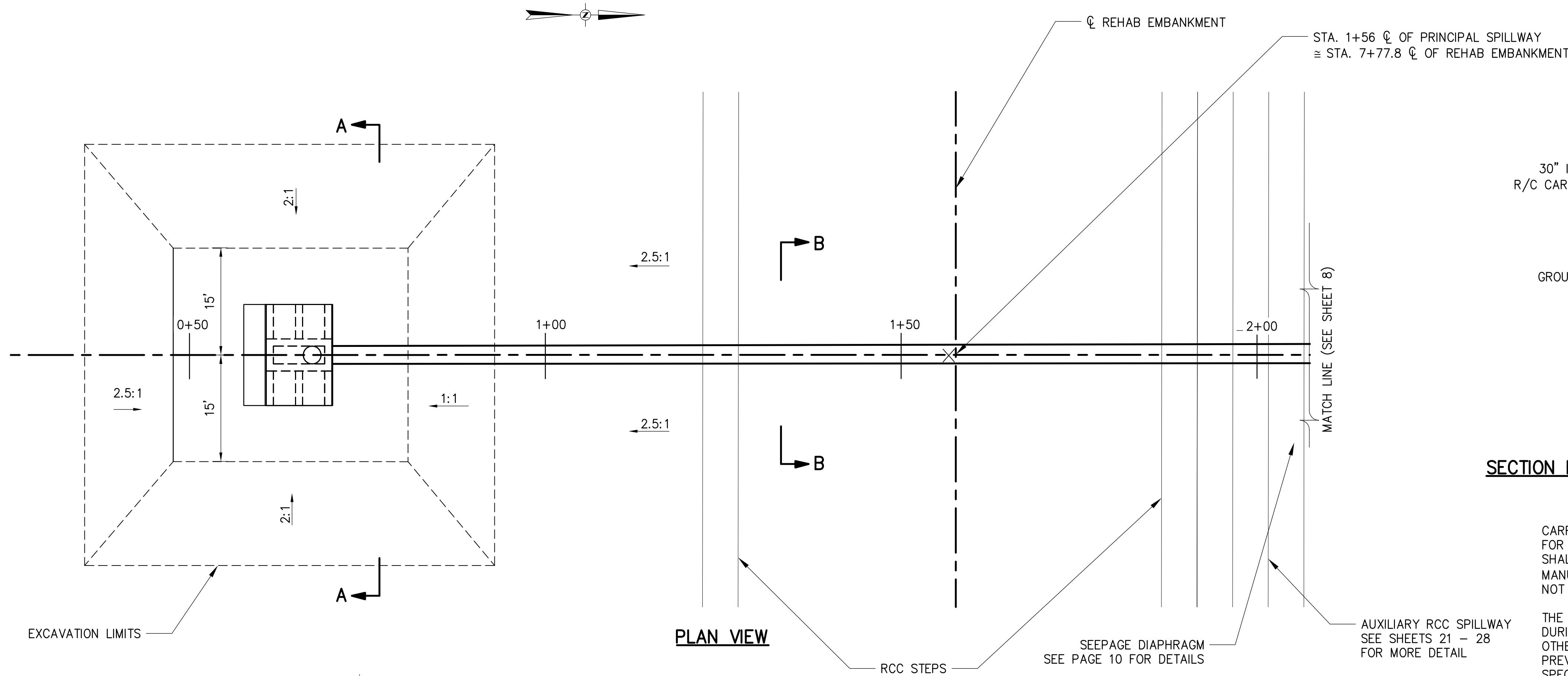
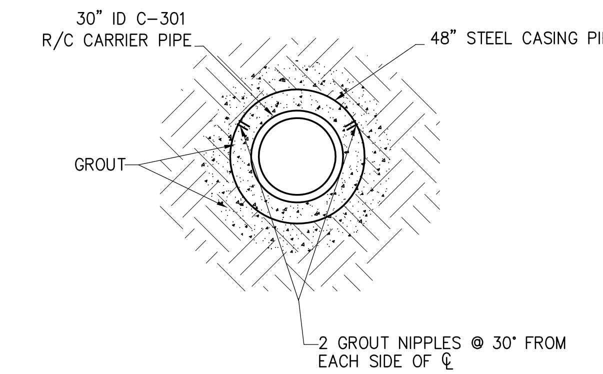
Drawing No. OK-437

Sheet 06 of 36



PLAN VIEW



BORE & JACK

SECTION B – B PRINCIPAL SPILLWAY BORE & JACK

NTS

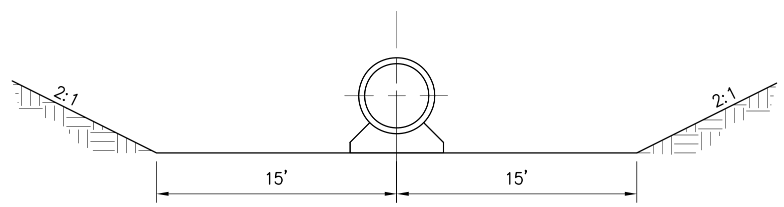
CARRIER PIPE SHALL BE MANUFACTURED SPECIFICALLY FOR TRENCHLESS INSTALLATION PROCEDURES. THIS SHALL INCLUDE THE CARRIER PIPE BEING MANUFACTURED/SUPPLIED SO THAT THE PIPE BELLS DO NOT TOUCH THE CASING PIPE.

THE CARRIER PIPE SHALL NOT BE ALLOWED TO FLOAT DURING THE GROUTING PROCESS. PIPE JACKS OR OTHER EQUIVALENT METHOD SHALL BE USED TO PREVENT FLOATING. FOR ADDITIONAL INFORMATION SEE SPEC 85.

NOTES:

1. THE FRONT SLOPE SHALL NOT BE MODIFIED. BLEND REHAB TOP OF DAM TO EXISTING FRONT SLOPE WITH SLOPE NO STEEPER THAN 3:1.
2. FRONT SLOPE PROTECTION WILL UTILIZE EXISTING RIPRAP. ANY RIPRAP THAT IS REMOVED SHALL BE REPLACED WITH NEW RIPRAP TO THE EXTENT APPROVED BY THE CONTRACTING OFFICER.

NOTE:
OTHER LENGTHS OF PIPE JOINTS AND INVERT ELEVATIONS MAY BE AUTHORIZED BY THE CONTRACTING OFFICER.

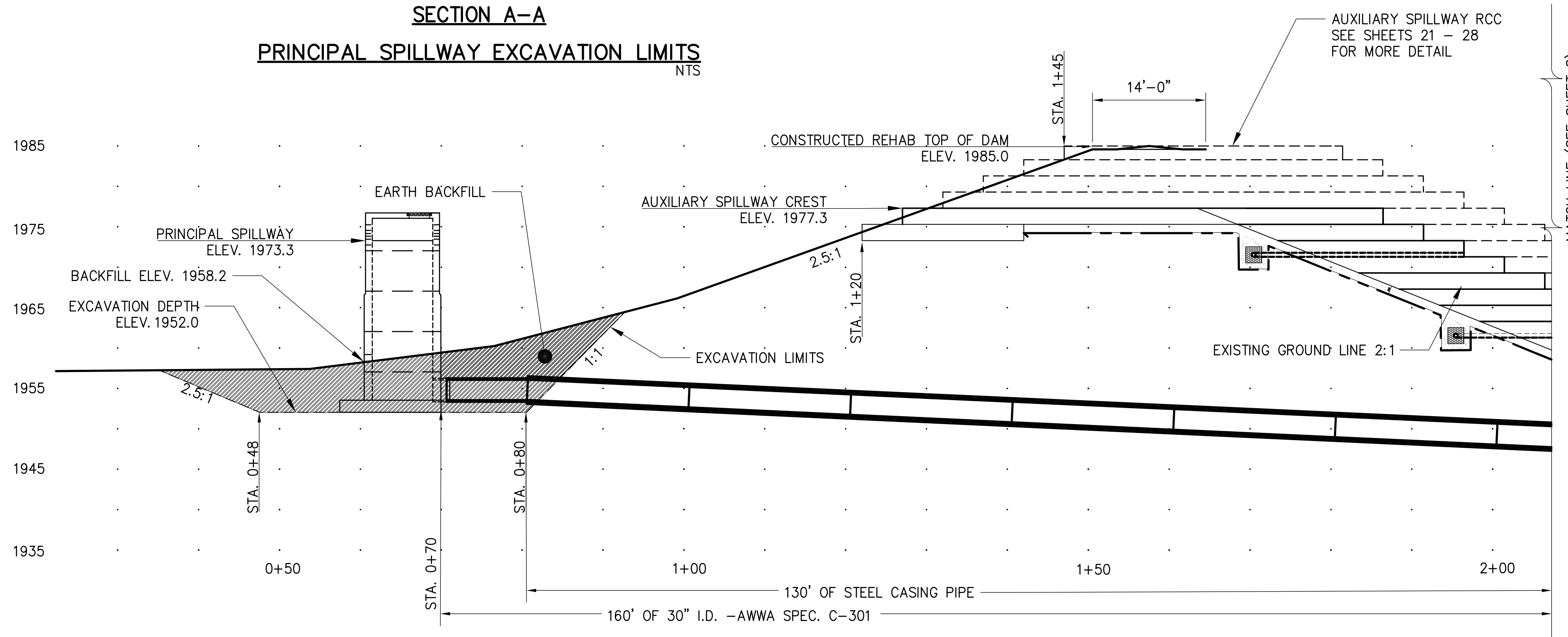


SECTION A–A

PRINCIPAL SPILLWAY EXCAVATION LIMITS

NTS

PIPE INVERT ELEVATIONS	
STATION	ELEVATION
0+70	1953.3
0+80	1953.3
1+00	1952.4
1+20	1951.6
1+40	1950.7
1+60	1949.8
1+80	1949.0
2+00	1948.1
2+10	1947.6
2+30	1947.6



PROFILE – REHAB PRINCIPAL SPILLWAY CENTERLINE

NOTES:
1. EARTH BACKFILL AND REGRADE EMBANKMENT FOR WAVE BERM RIPRAP REPLACEMENT.
2. EARTH BACKFILL TO ELEV. 1958.2, THEN TIE INTO EXISTING SLOPE OF EMBANKMENT.
3. EXISTING RIPRAP NOT SHOWN, SEE TYPICAL SECTION FOR EXISITNG WAVE BERM RIPRAP ON SHEET 5.

CHECK PRINT

10 0 10 20 30
SCALE IN FEET

Designed	V. Glasgow	01–18
Drawn	K. Dabney	01–18
Revised	K. Dabney	06–18
Approved	J. Chris Stoner	08–18

Date

REHAB PRINCIPAL SPILLWAY – PLAN & PROFILE
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

USDA United States Department of Agriculture
Natural Resources Conservation Service

E-File Location:
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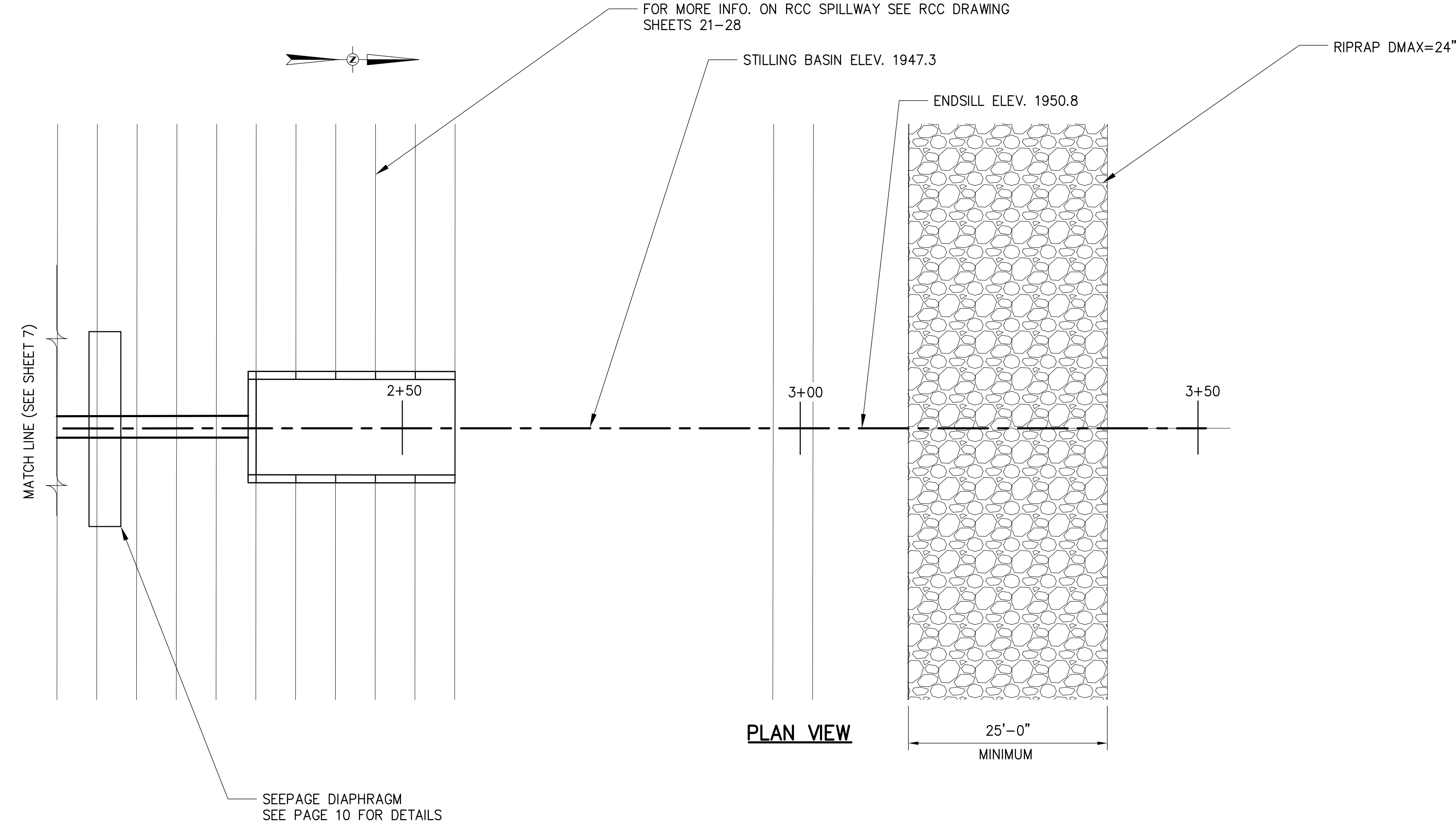
Drawing No.
OK–437

Sheet 07 of 36

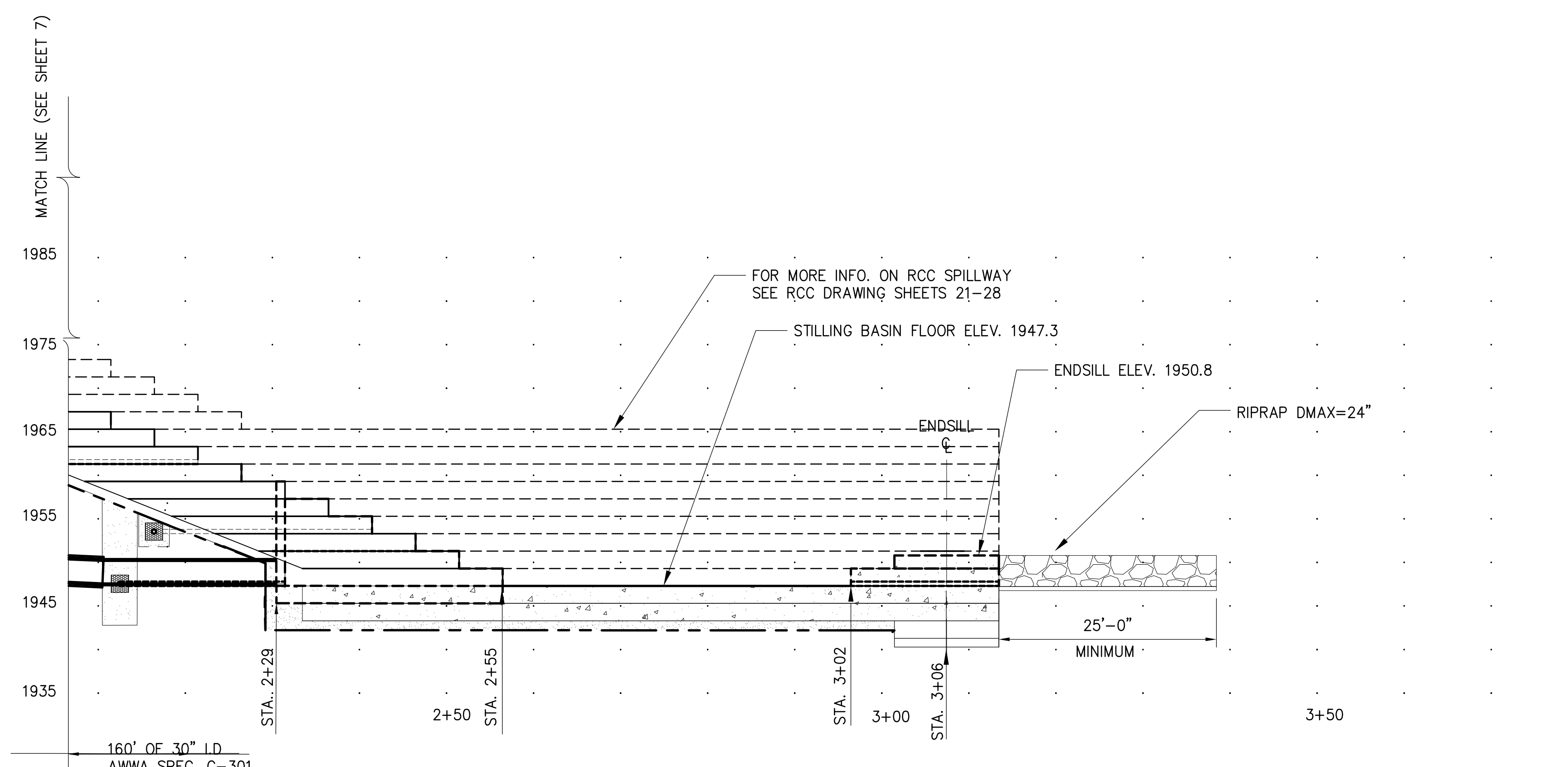


PLAN VIEW

D_{MAX} = 24"

RIPRAP GRADATION	
%	SIZE RANGE – LBS
MAX.	1280
90	445–1100
50	160–440
20	10–110
<5	SAND/DUST

NOTE:
1. EXCAVATION LIMITS TO BOTTOM OF PRINCIPAL SPILLWAY BEDDING OR AS APPROVED BY CONTRACTING OFFICER.
2. OTHER LENGTHS OF PIPE JOINTS AND INVERT ELEVATIONS MAY BE AUTHORIZED BY THE CONTRACTING OFFICER.
3. FINE FILTER SHALL CONFORM TO GRADATION FOR CONCRETE FINE AGGREGATE ASTM C-33.



SEE SHEET 23 FOR RCC DRAIN
SEE SHEET 10 FOR SEEPAGE DRAIN.

PROFILE – REHAB PRINCIPAL SPILLWAY CENTERLINE

CHECK PRINT

10 0 10 20 30
SCALE IN FEET

REHAB PRINCIPAL SPILLWAY – PLAN & PROFILE
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

		Date
Designed	V. Glasgow	01–18
Drawn	K. Dabney	01–18
Revised	K. Dabney	06–18
Approved	J. Chris Stoner	08–18

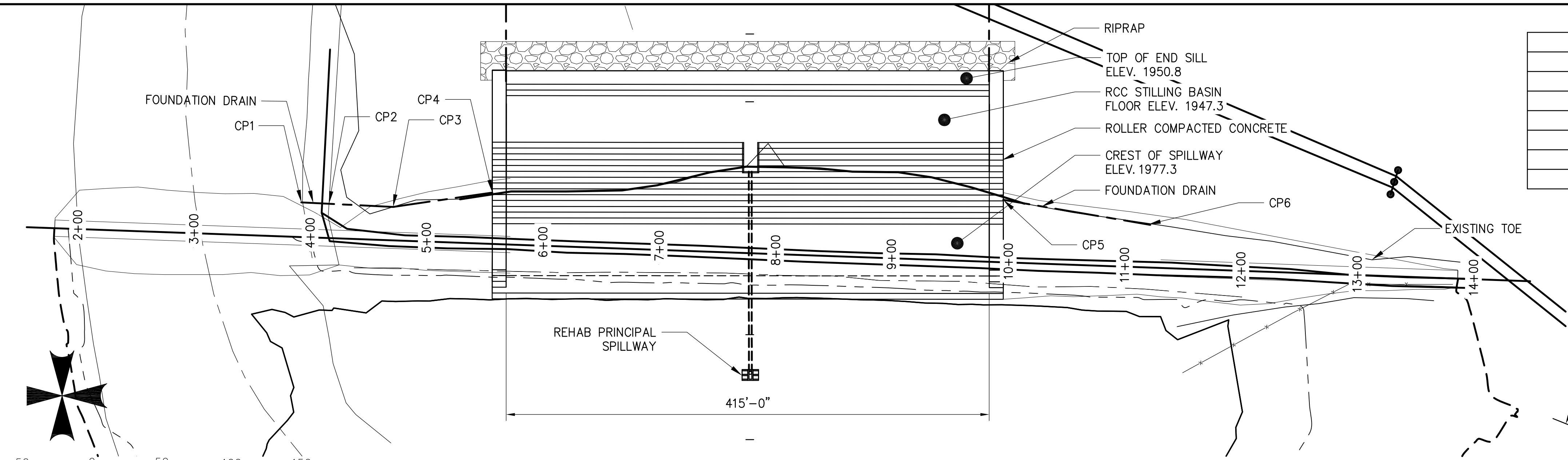
USDA United States Department of Agriculture
Natural Resources Conservation Service

E–File Location:
R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\ARS–Rehab PS Pipe

Drawing No.
OK–437

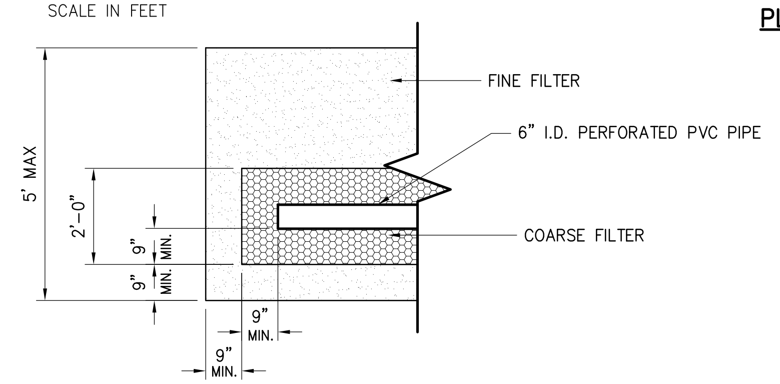
Sheet 08 of 36

FOUNDATION DRAIN CONTROL POINTS			
POINT	NORTHERN	EASTING	STATION
CP1	522848.063	1549467.588	℄3+92.0
CP2	522846.911	1549488.294	4+12.7
CP3	522848.917	1549568.788	4+93.2
CP4	522858.038	1549629.045	5+54.5
CP5	522851.391	1550071.960	9+96.7
CP6	522826.191	1550222.945	11+47.7

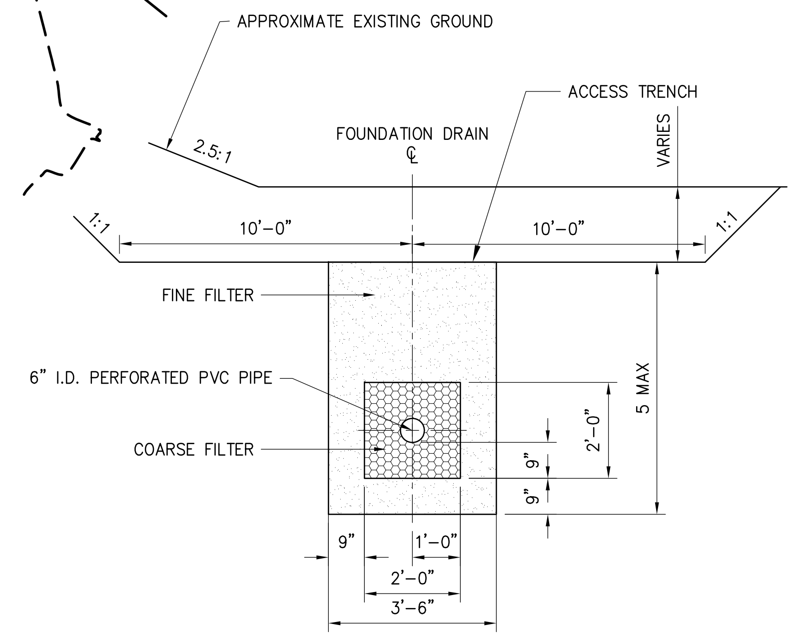


PLAN – FOUNDATION DRAIN

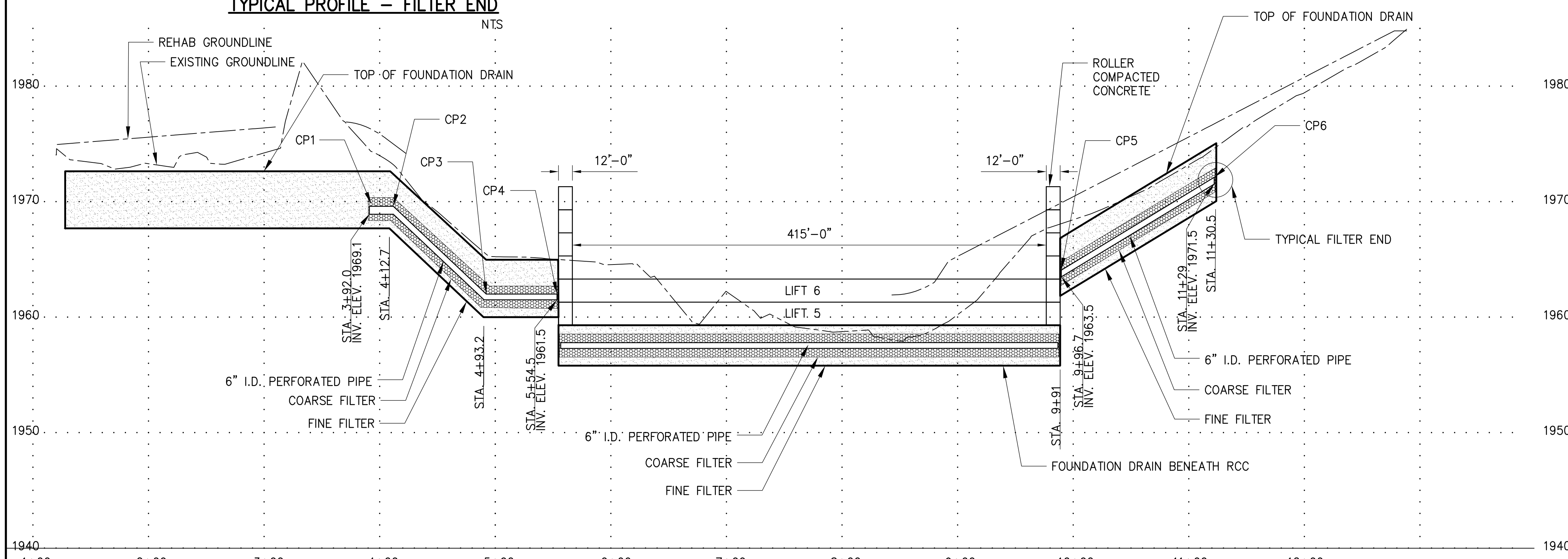
PVC NOTES:
(1) REVERSE GRADE SHALL NOT BE PERMITTED.
(2) PIPE SHALL BE 6: I.D. PVC PIPE.
(3) ENDS OF PERFORATED PIPES SHALL BE CLOSED WITH SLIP-ON TYPE CAP OR CAST IRON PLUG AND BE INSTALLED IN ACCORDANCE WITH THE MAUNFACTURERE'S RECOMMENDATIONS.



TYPICAL PROFILE – FILTER END
NTS



TYPICAL SECTION – FOUNDATION DRAIN
NTS



PROFILE – FOUNDATION DRAIN

GRADATION COARSE FILTER	
	PERCENTAGE PASSING
SIEVE SIZE	NORMAL LIMITS
2"	100
3/4"	68–100
1/2"	47–100
3/8"	35–87
#4	0–55
#10	0–15
#16	<5

* GRADATION FALLING WITHIN THESE LIMITS ARE ACCEPTABLE PROVIDED D_{15} (PARTICLE SIZE OF WHICH 15% OF TOTAL WEIGHT IS FINER) OF COARSE FILTER IS EQUAL TO OR SMALLER THAN 5 TIMES D_{85} OF FINER MATERIAL TO BE PLACED.
FINE FILTER SHALL CONFORM TO GRADATION FOR CONCRETE FINE AGGREGATE ASTM C-33.

NOTES:

(1) NO LESS THAN 2' OF EARTHFILL MUST COVER THE FOUNDATION DRAIN ALONG ITS ENTIRE LENGTH.
(2) ACCESS TRENCH SHALL BE USED AS NECESSARY TO MEET OSHA REQUIREMENTS.
(3) PLACE 1' OF COARSE FILTER AROUND END OF PERFORATED FOUNDATION DRAIN PIPE.

NOTES:
(1) SEPARATE THE CONCRETE BEDDING FROM THE DRAIN FILTER WITH AN IMPERMEABLE MEMBRANE.
(2) DO NOT PLACE COARSE FILTER WITHIN 12" OF PRINCIPAL SPILLWAY CONDUIT EXCEPT UNDER CONCRETE BEDDING.

CHECK PRINT

		Date
Designed	V. Glasgow	5-18
Drawn	K. Dabney	5-18
Revised	K. Dabney	08-18
Approved	J. Chris Stoner	08-18

FOUNDATION DRAIN
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
Natural Resources Conservation Service

E-File Location:
R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\ARS Woodward Final

Drawing No.
OK-437

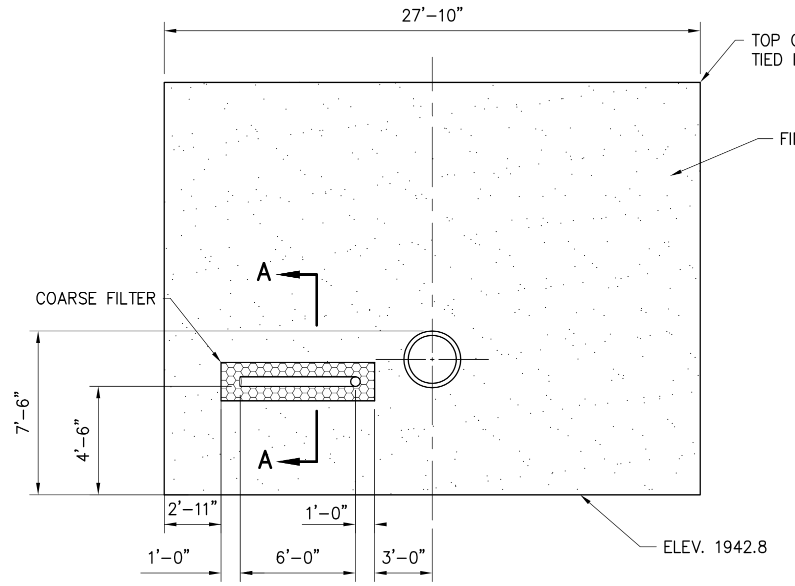
GRADATION COARSE FILTER	
SIEVE SIZE	PERCENTAGE PASSING NORMAL LIMITS
2"	100
3/4"	68–100
1/2"	47–100
3/8"	35–87
#4	0–55
#10	0–15
#16	<5

* GRADATION FALLING WITHIN THESE LIMITS ARE ACCEPTABLE PROVIDED D_{15} (PARTICLE SIZE OF WHICH 15% OF TOTAL WEIGHT IS FINER) OF COARSE FILTER IS EQUAL TO OR SMALLER THAN 5 TIMES D_{85} OF FINER MATERIAL TO BE PLACED.
FINE FILTER SHALL CONFORM TO GRADATION FOR CONCRETE FINE AGGREGATE ASTM C-33.

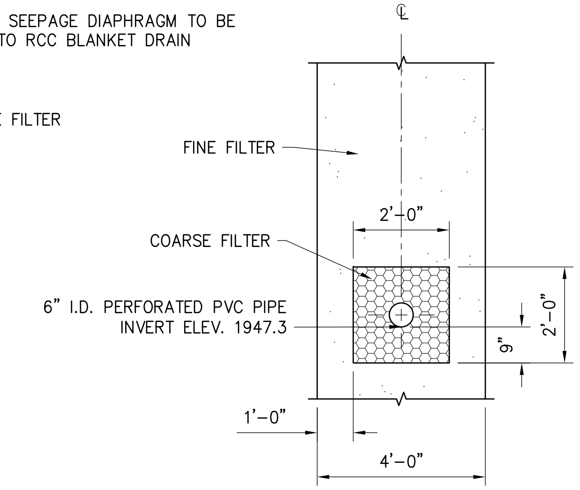
NOTES:

(1) NO LESS THAN 2' OF EARTHFILL MUST COVER THE FOUNDATION DRAIN ALONG ITS ENTIRE LENGTH.

(2) ACCESS TRENCH SHALL BE USED AS NECESSARY TO MEET OSHA REQUIREMENTS.



TYPICAL SECTION SEEPAGE DIAPHRAGM
NTS



SECTION A–A
(SECTION THROUGH COARSE FILTER)
NTS

PVC PIPE NOTES:

(1) REVERSE GRADE SHALL NOT BE PERMITTED.

(2) PIPE SHALL BE 6" I.D. PVC PIPE.

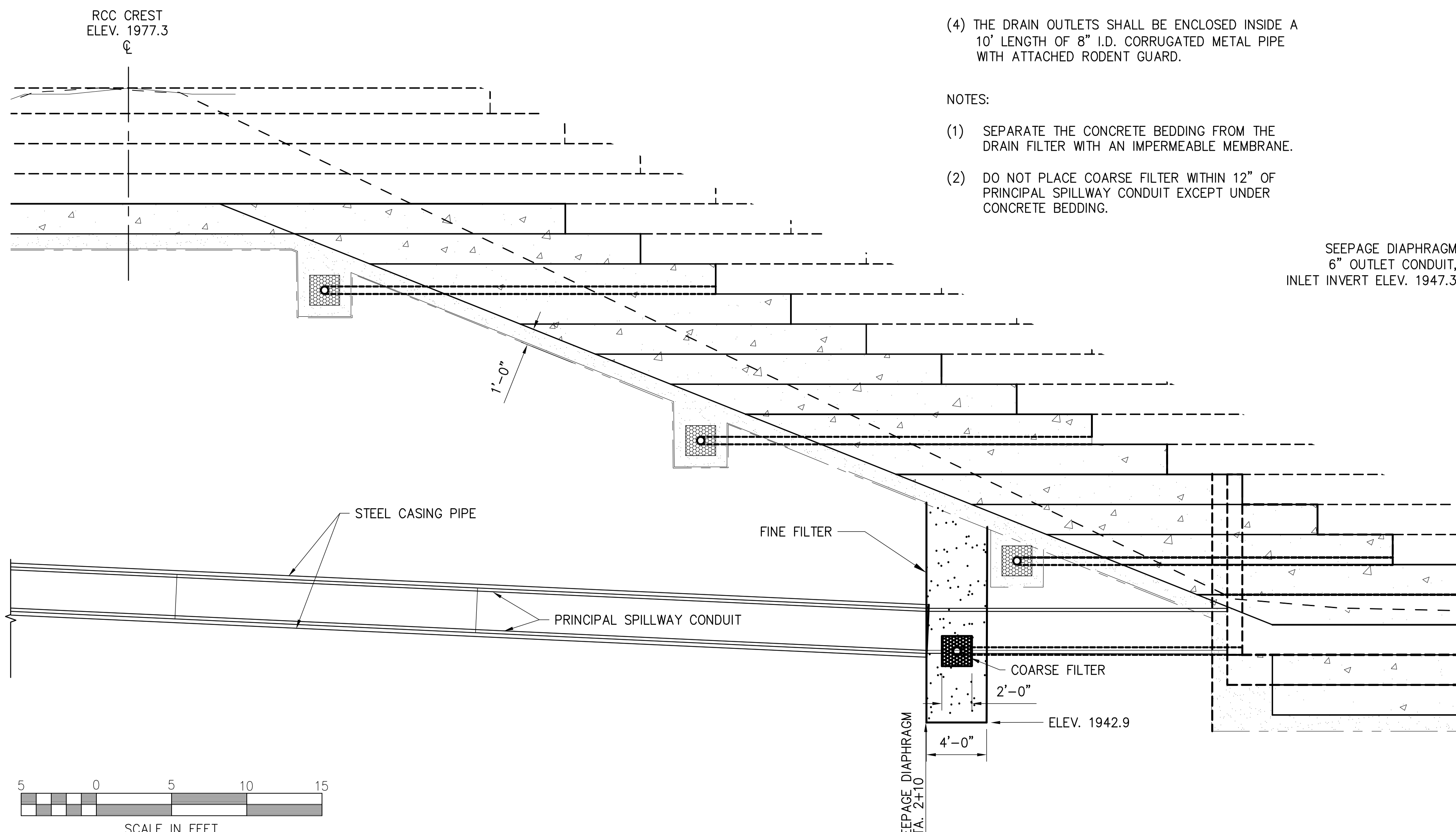
(3) ENDS OF PERFORATED PIPES SHALL BE CLOSED WITH SLIP-ON TYPE CAP OR CAST IRON PLUG AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

(4) THE DRAIN OUTLETS SHALL BE ENCLOSED INSIDE A 10' LENGTH OF 8" I.D. CORRUGATED METAL PIPE WITH ATTACHED RODENT GUARD.

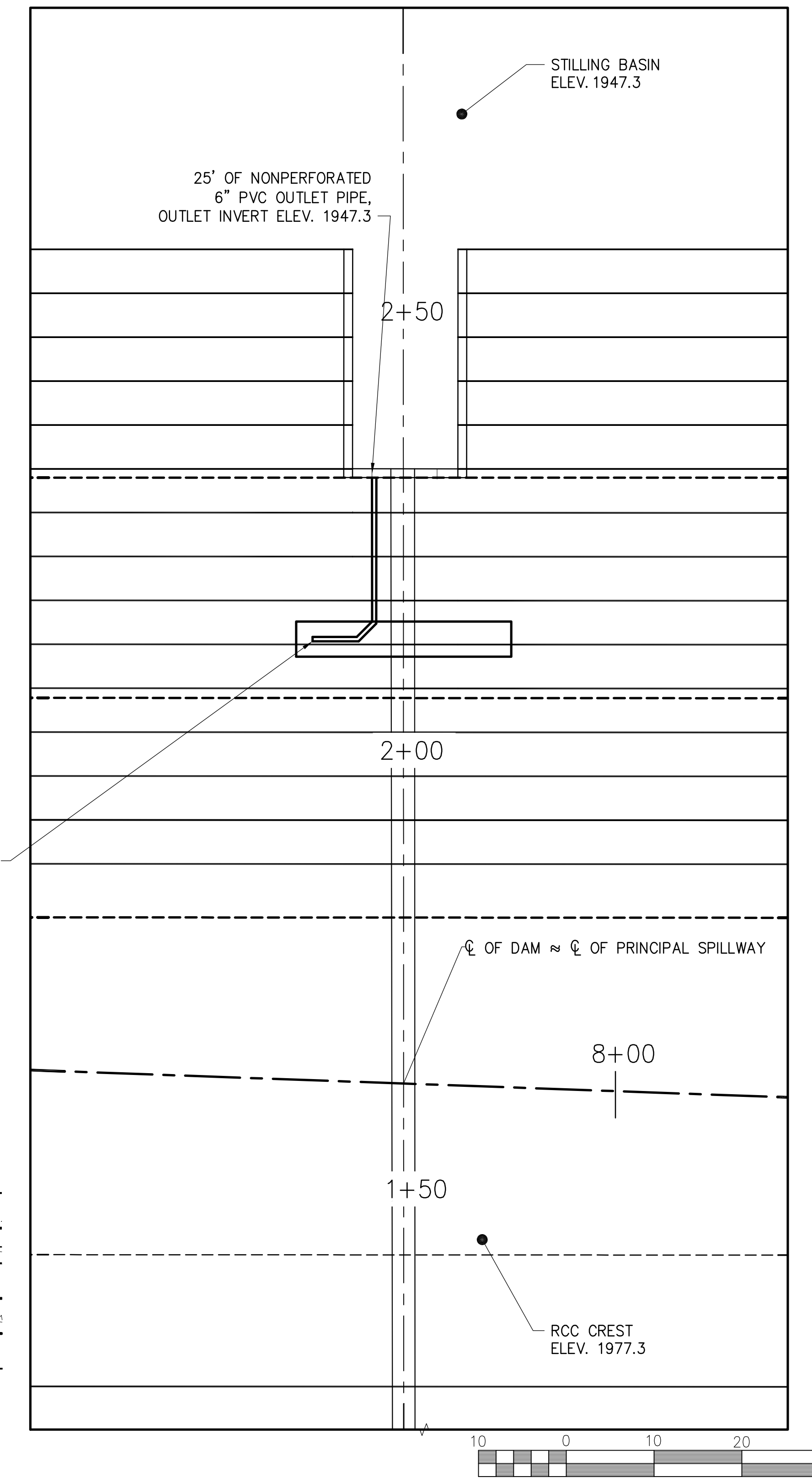
NOTES:

(1) SEPARATE THE CONCRETE BEDDING FROM THE DRAIN FILTER WITH AN IMPERMEABLE MEMBRANE.

(2) DO NOT PLACE COARSE FILTER WITHIN 12" OF PRINCIPAL SPILLWAY CONDUIT EXCEPT UNDER CONCRETE BEDDING.



PROFILE – SEEPAGE DIAPHRAGM
NTS



PLAN – SEEPAGE DIAPHRAGM

CHECK PRINT

		Date
Designed	V. Glasgow	04-18
Drawn	K. Dobney	04-18
Revised	K. Dobney	06-18
Approved	J. Chris Stoner	08-18

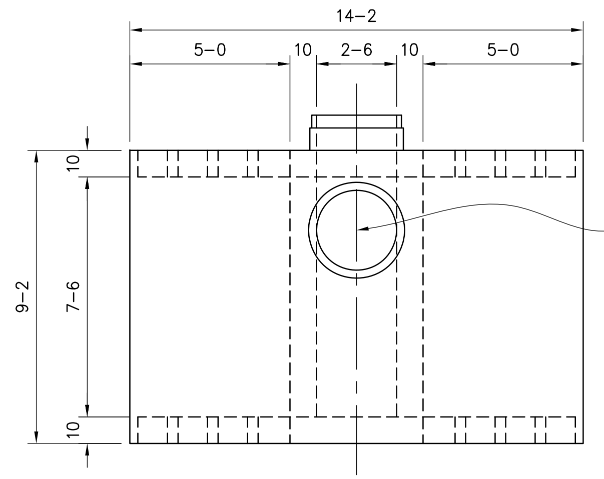
SEEPAGE DIAPHRAGM
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
Natural Resources Conservation Service

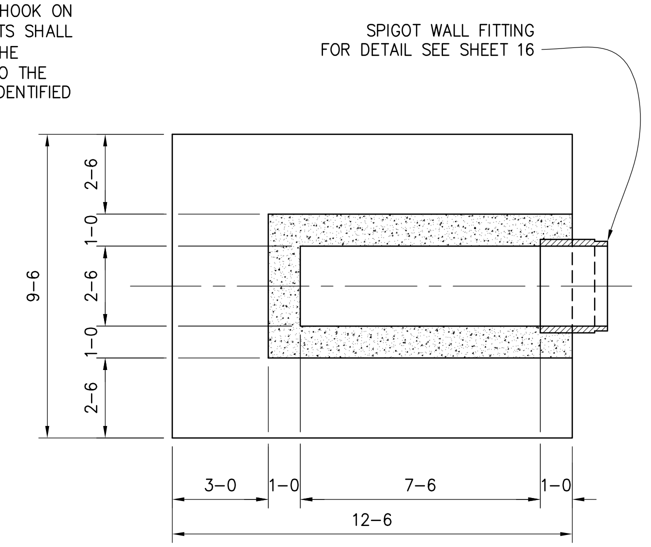
E-File Location:
R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\ARS Embankment_RCC Spillway

Drawing No.
OK-437

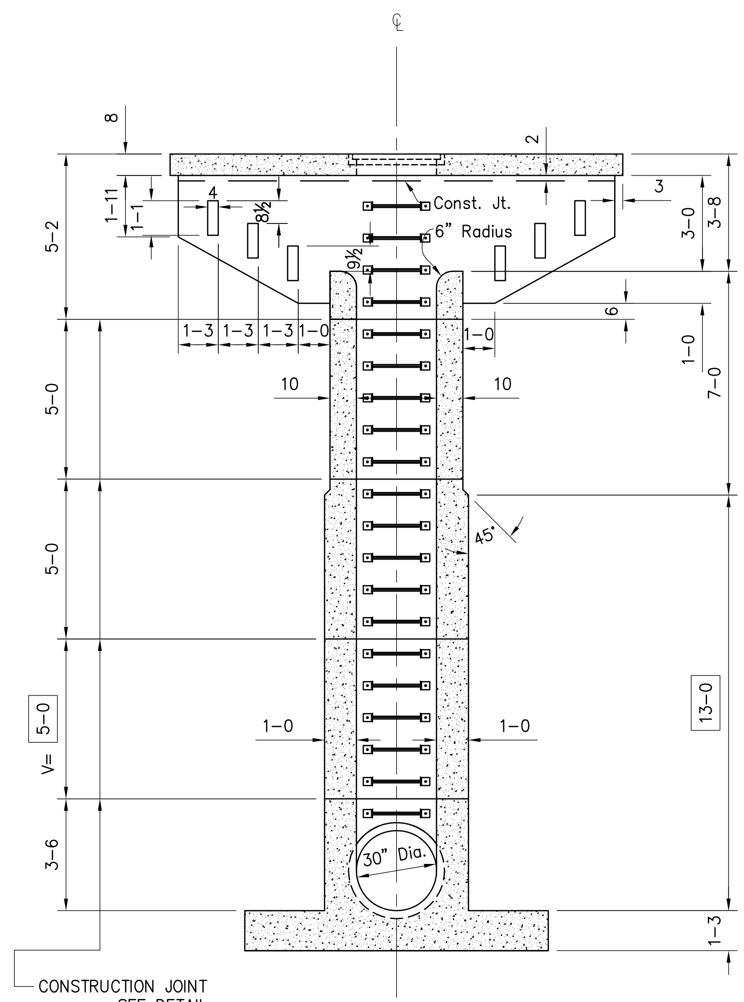
NOTE: EYE BOLTS SHALL BE ½" BOLT DIAMETER STAINLESS STEEL FABRICATED WITH A "J"HOOK ON THE EMBEDDED END. FOUR (4) EYE BOLTS SHALL BE EMBEDDED NOT LESS THAN 6" INTO THE CONCRETE. LOCATIONS ARE ADJACENT TO THE MANHOLE. FINAL LOCATIONS SHALL BE IDENTIFIED BY THE CONTRACTING OFFICER.



PLAN TOP

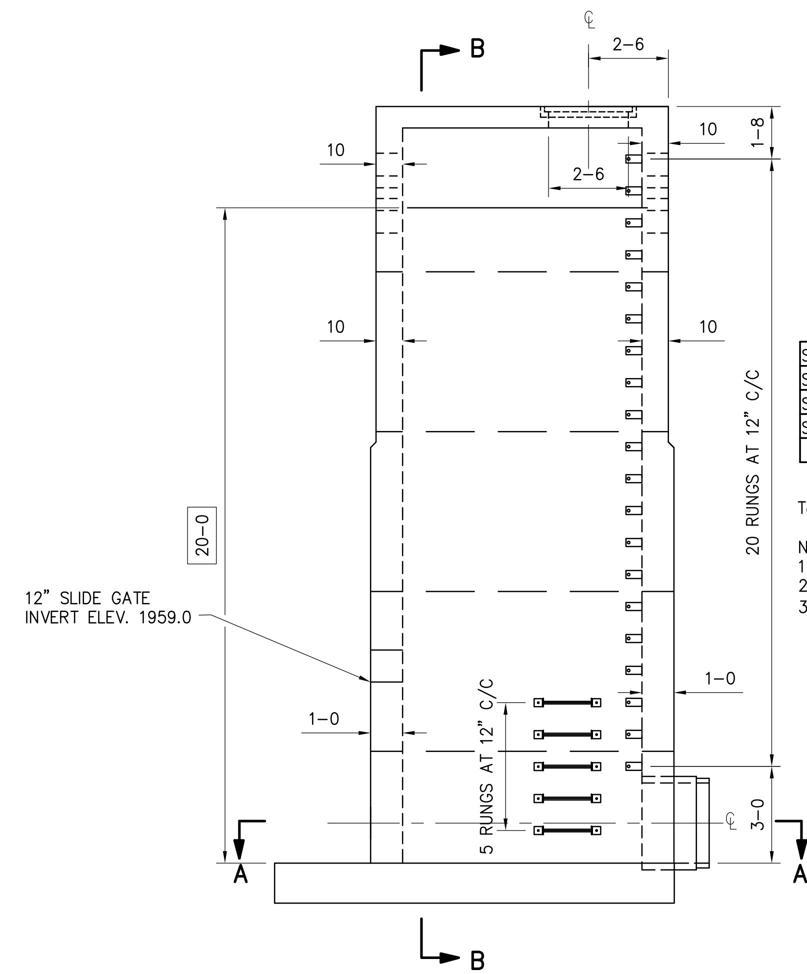


SECTION A–A



SECTION B–B

NOTE: VARIABLE 5'–0" SECTION NOT TO SCALE.



SIDEWALL ELEVATION

Mark	Size	Quan.	Length	Type	B	C	Total Length
B1	6	13	9–0	STR			117–0
B2	6	10	12–0	STR			120–0
B3	4	9	4–0	STR			36–0
B4	7	34	9–3	21	3–3	6–0	314–6
B5	6	10	12–0	STR			120–0
B6	6	13	9–0	STR			117–0
B7	6	2	3–9	STR			7–6
B8	5	6	7–0	21	1–0	6–0	42–0
B9	6	3	7–0	21	1–0	6–0	21–0
B10	5	16	7–0	21	1–0	6–0	112–0
B11	6	10	8–6	STR			85–0
B12	5	5	3–6	STR			17–6
B13	6	3	2–3	STR			6–9
B14	5	2	2–3	STR			4–6
B15	6	10	6–3	21	0–7	5–8	62–6
B16	6	18	8–9	21	3–1	5–8	157–6
R1	5	22	11–10	STR			260–4
R2	6	7	8–6	STR			59–6
R3	5	5	3–6	STR			17–6
R4	5	26	10–6	STR			273–0
R5	5	10	8–3	21	2–10½	5–4½	82–6
R6	5	14	8–3	STR			115–6
R7	5	10	3–6	STR			35–0
R8	5	20	3–8	STR			73–4
R9	4	36	8–0	21	2–9	5–3	288–0
R10	4	4	7–9	21	2–7	5–2	31–0
R11	5	8	2–9	STR			22–0

STEEL SCHEDULE

Mark	Size	Quan.	Length	Type	B	C	Total Length
T1	5	6	9–9	STR			58–6
T2	5	14	6–2	STR			86–4
T3	5	8	3–2	STR			25–4
T4	5	10	8–2	STR			81–8
T5	5	6	10–0	STR			60–0
T6	5	14	6–4	STR			88–8
T7	5	28	8–0	21	2–9	5–3	224–0
T8	5	2	3–2	STR			6–4
T9	5	4	8–2	STR			32–8
T10	5	2	6–6	STR			13–0
T11	5	2	5–6	STR			11–0
T12	5	2	8–2	STR			16–4
T13	5	2	10–8	STR			21–4
T14	5	2	13–4	STR			26–8
T15	5	4	4–0	STR			16–0
T16	5	4	3–8	STR			14–8
T17	5	4	3–0	STR			12–0
T18	5	4	2–3	STR			9–0
T19	5	4	6–2	23	2–1	4–1	24–8
T20	5	8	8–0	21	2–9	5–3	64–0
T21	5	2	6–6	STR			13–0
T22	5	2	5–10	STR			11–8
T23	5	2	8–4	STR			16–8
T24	5	2	10–10	STR			21–8
T25	5	2	13–4	STR			26–8
T26	5	4	6–1	21	1–9	4–4	24–4
T27	5	4	5–8	21	1–9	3–11	22–8
T28	5	4	5–0	21	1–9	3–3	20–0
T29	5	4	4–4	21	1–9	2–7	17–4
T30	5	4	4–1	21	1–9	2–4	16–4
T31	5	4	4–3	STR			17–0
T32	5	6	3–6	21	1–9	1–9	21–0
T33	5	2	1–7	21	0–10	1–9	5–2
T34	4	2	4–9	STR			9–6
T35	4	14	8–2	STR			114–4
T36	4	7	13–10	STR			96–10
T37	4	4	5–6	STR			22–0
T38	5	2	4–10	STR			9–8
T39	5	12	8–5	STR			101–0
T40	5	4	8–10	STR			35–4
T41	4	7	13–10	STR			96–10
T42	4	4	5–5	STR			21–8

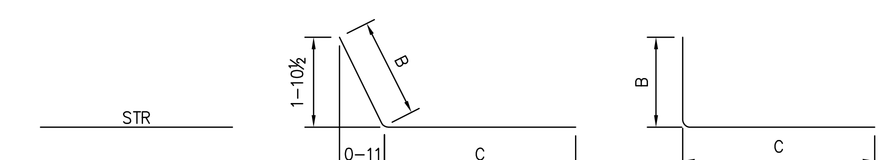
QUANTITIES

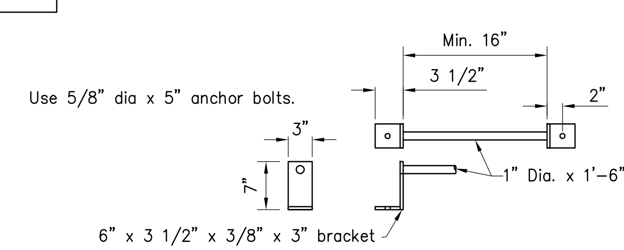
STEEL	# 4	716–2	LIN. FT.	478.4	POUNDS
STEEL	# 5	2326–10	LIN. FT.	2426.89	POUNDS
STEEL	# 6	873–9	LIN. FT.	1312.37	POUNDS
STEEL	# 7	314–6	LIN. FT.	642.84	POUNDS
	TOTAL			4860	POUNDS

Total Concrete = (23.30) + (0.89V) = _____ Cu. Yds.

Notes:
1. Bar dimensions are out to out of bar.
2. Radius of bends equals 3 bar diameters for sizes equal to or less than #7.
3. The 2" and 3" dimension from face of concrete to steel are clear distances.

BAR TYPES

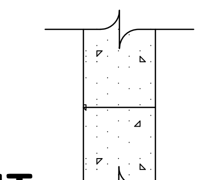




CHECK PRINT

LADDER RUNG DETAILS
N.T.S.

NOTES:
1. LADDER RUNGS SHALL BE WELDED ONTO BRACKETS.
2. THE ANCHOR BOLTS SHALL BE DRILLED AND EPOXIED INTO PLACE.
3. THE RUNGS SHALL BE CORRUGATED, KNURLED, DIMPLED, COATED WITH SKID–RESISTANT MATERIAL, OR OTHERWISE TREATED TO MINIMIZE SLIPPING.



CONSTRUCTION JOINT
N.T.S.

NOTE:
1. REINFORCING STEEL IS CONTINUOUS ACROSS THE JOINT.

STANDARD BAFFLE RISER			
STANDARD DWG NO.		ES–3230–2020 E	
DATE	9–79	SHEET	1 OF 4
STANDARD COVERED RISER			
DESIGN CONSTANTS		f'_c = 4000 psi f_c = 1600 psi n = 8 f_s = 20,000 psi	
STANDARD DWG NO.		ES–3030–2520 E	
DATE	4–65	SHEET	1 OF 4

3 0 3 6 9
SCALE IN FEET

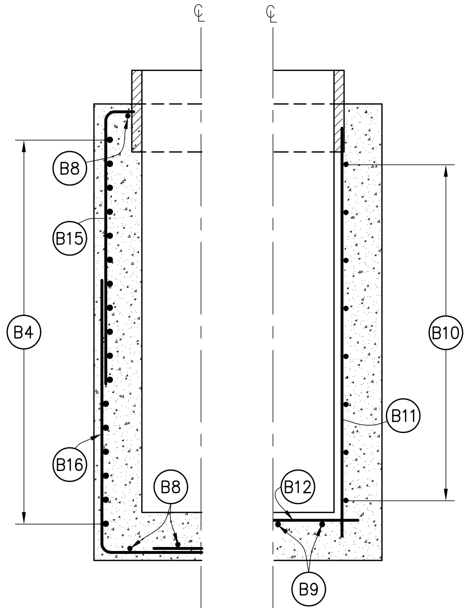
	Name	Date
Designed	V. Glasgow	10–17
Drawn	K. Dabney	10–17
Revised	K. Dabney	06–18
Approved	J. Chris Stoner	08–18

PRINCIPAL SPILLWAY INLET
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

USDA
United States Department of Agriculture
Natural Resources Conservation Service

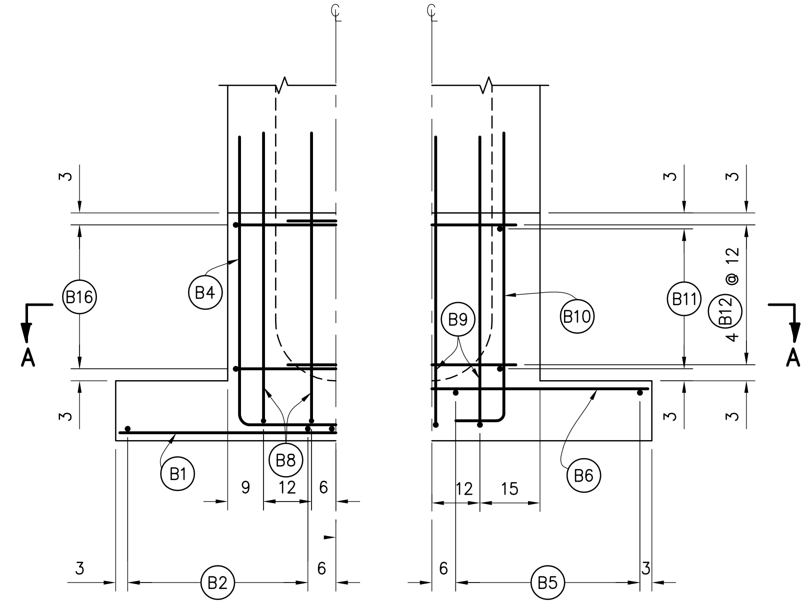
E–File Location:
R:\All Repairs\ARS Field Station Lake\Design–Rehab\Drawings\stdwgs\Tower\3230–2020R\3230–2020R_S1.dwg

Drawing No.
OK–437



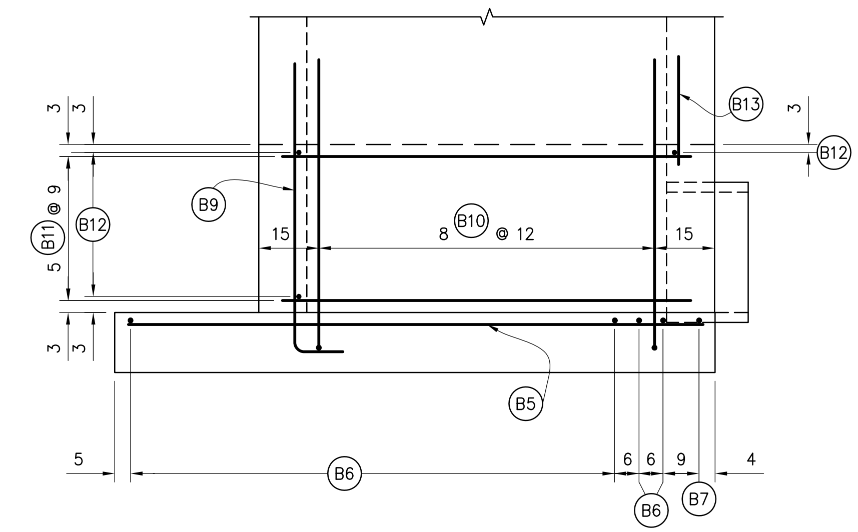
Outside Steel / Inside Steel

SECTION A–A



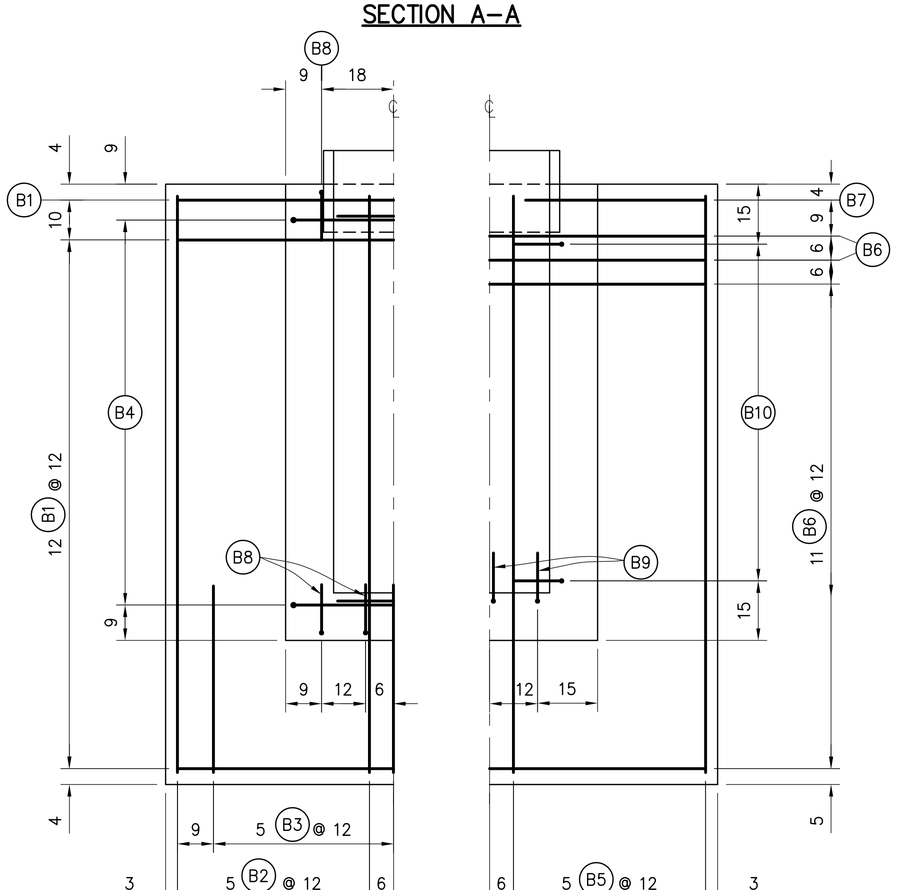
Steel 2" From Outside Face / Steel 2" From Inside Face

UPSTREAM ELEVATION



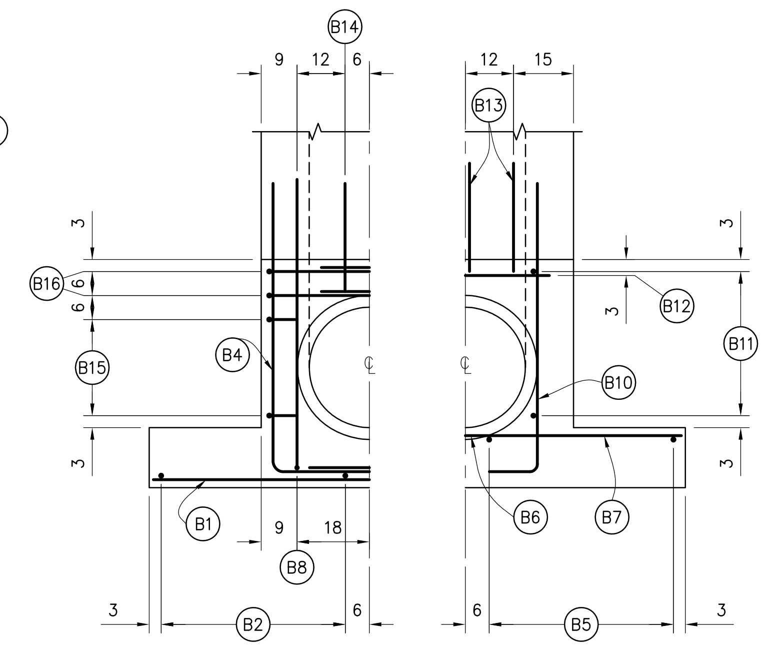
Steel 2" From Inside Face and 2" from Top of Footing

SIDEWALL ELEVATION



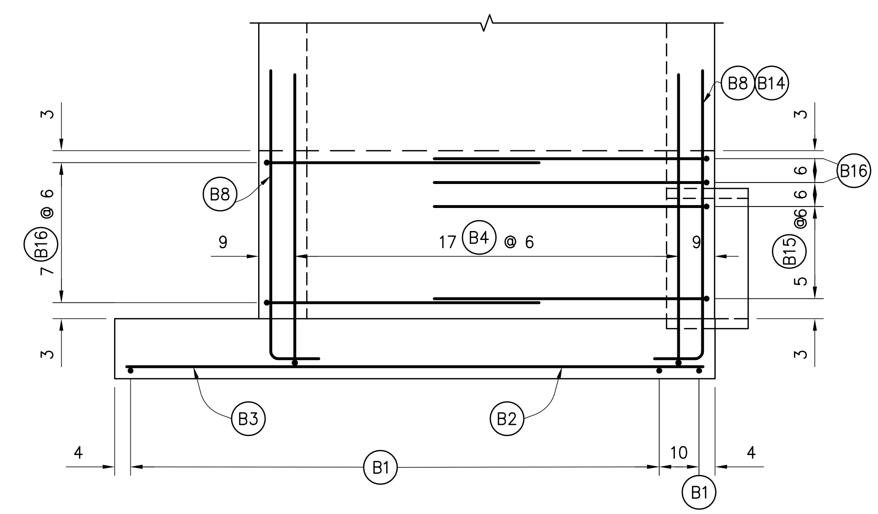
Steel 3" From Bottom of Footing / Steel 2" From Top of Footing

PLAN–FOOTING



Steel 2" From Outside Face / Steel 2" From Inside Face

DOWNSTREAM ELEVATION



Steel 2" From Outside Face and 3" from Bottom of Footing

SIDEWALL ELEVATION

STANDARD BAFFLE RISER		
STANDARD DWG NO.	ES–3230–2020 E	
DATE 9–79	SHEET 2 OF 4	
STANDARD COVERED RISER		
DESIGN CONSTANTS	f'_c = 4000 psi, n = 8	f_c = 1600 psi, f_s = 20,000 psi
STANDARD DWG NO.	ES–3030–2520 E	
DATE 7–65	SHEET 2 OF 4	

CHECK PRINT

2 0 2 4 6
SCALE IN FEET
UNLESS OTHERWISE SHOWN

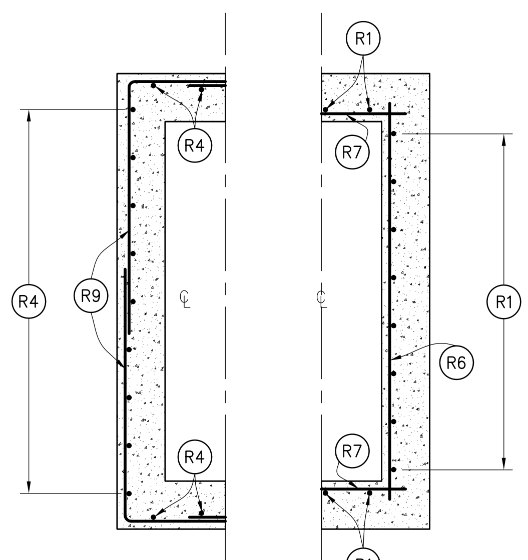
		Date
Designed	V. Glasgow	10–17
Drawn	K. Dobney	10–17
Revised	K.Dobney	06–18
Approved	J. Chris Stoner	08–18

STEEL PLACEMENT – PRINCIPAL SPILLWAY INLET
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

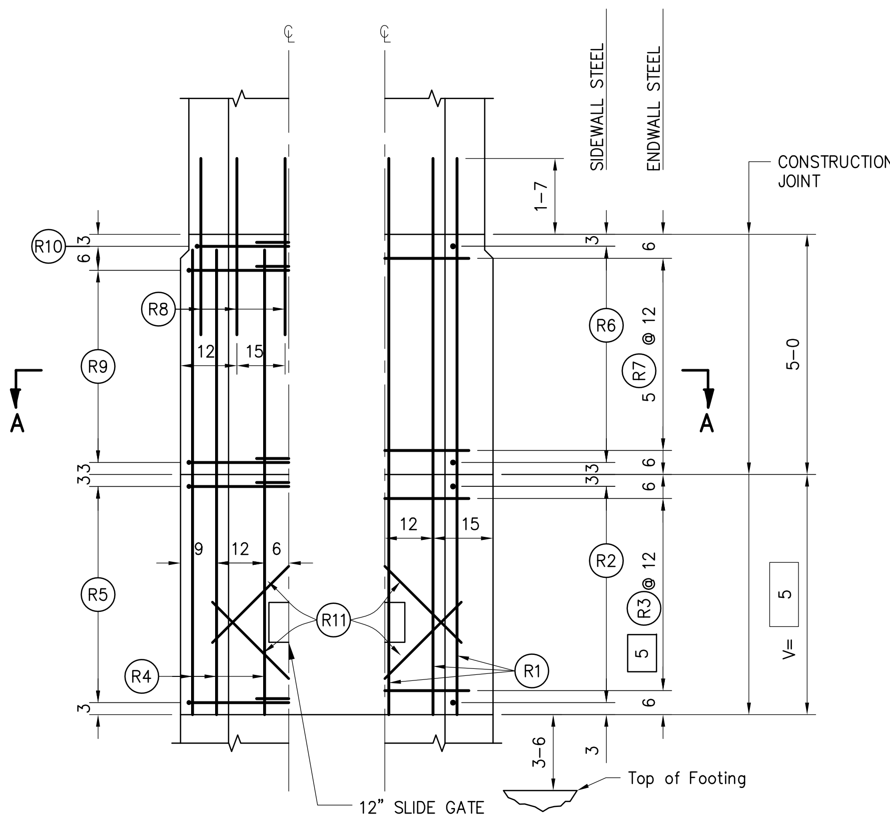
United States Department of Agriculture
Natural Resources Conservation Service

E–File Location:
R:\All Repairs\ARS Field Station Lake\Deisgn–Rehab\Drawings\stdwgs\Tower\3230–2020R\3230–2020R_S2.dwg

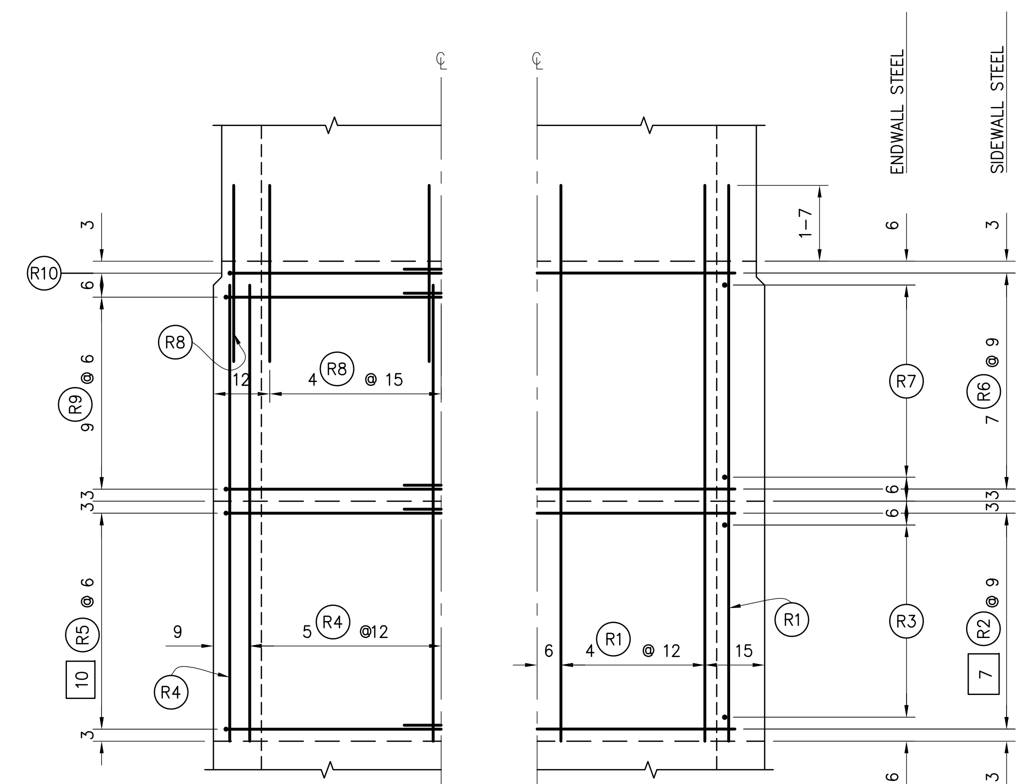
Drawing No. OK–437



SECTION A–A



ENDWALL ELEVATION



SIDEWALL ELEVATION

NOTE: THE FOLLOWING BARS SHALL BE CUT TO PROVIDE 2" MINIMUM CLEARANCE FOR THIMBLE AND SLIDE GATE INSTALLATION:

OUTSIDE FACE
1 – R1 BAR VERTICAL BAR
2 – R5 HORIZONTAL BARS
INSIDE FACE
1 – R3 VERTICAL BAR
1 – R1 HORIZONTAL BAR

STANDARD BAFFLE RISER	
STANDARD DWG NO.	ES–3230–2020 E
DATE 9–79	SHEET 3 OF 4
STANDARD COVERED RISER	
DESIGN CONSTANTS	f'_c = 4000 psi f_c = 1600 psi n = 8 f_s = 20,000 psi
STANDARD DWG NO.	ES–3030–2520 E
DATE 5–65	SHEET 3 OF 4

CHECK PRINT

2 0 2 4 6
SCALE IN FEET
UNLESS OTHERWISE SHOWN

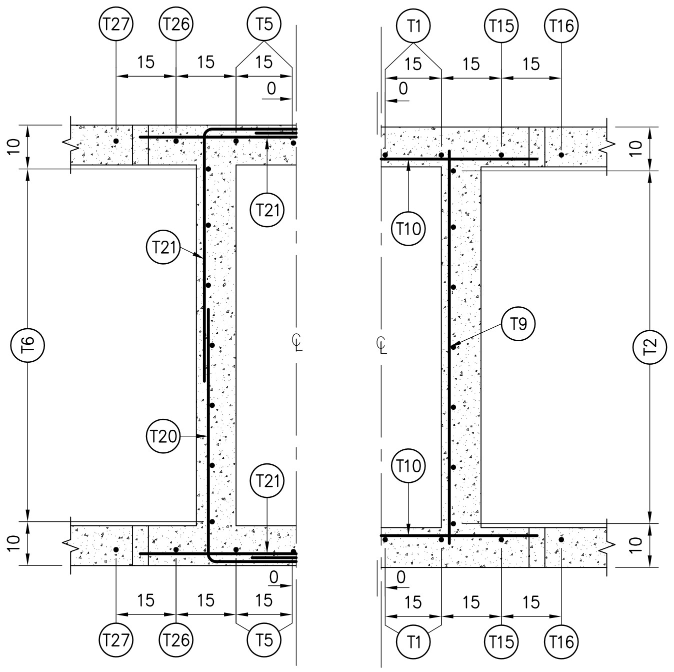
Designed	V. Glasgow	10–17
Drawn	K. Dabney	10–17
Revised	K. Dabney	06–18
Approved	J. Chris Stoner	08–18

STEEL PLACEMENT – PRINCIPAL SPILLWAY INLETS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

USDA United States Department of Agriculture
Natural Resources Conservation Service

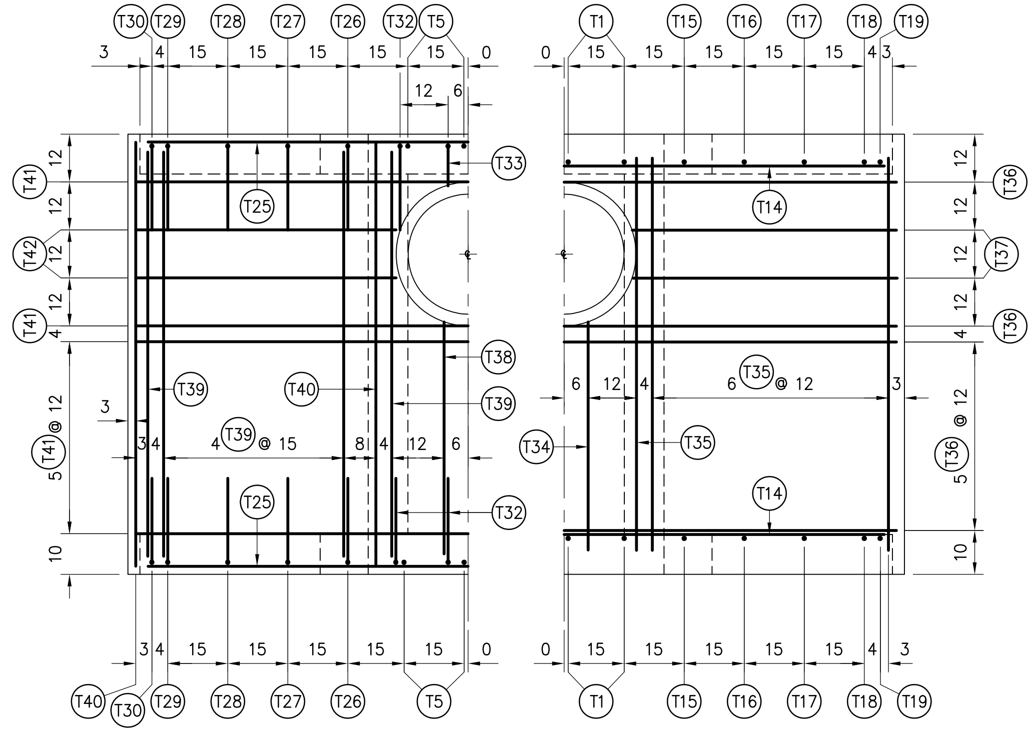
E–File Location:

Drawing No.
OK–437



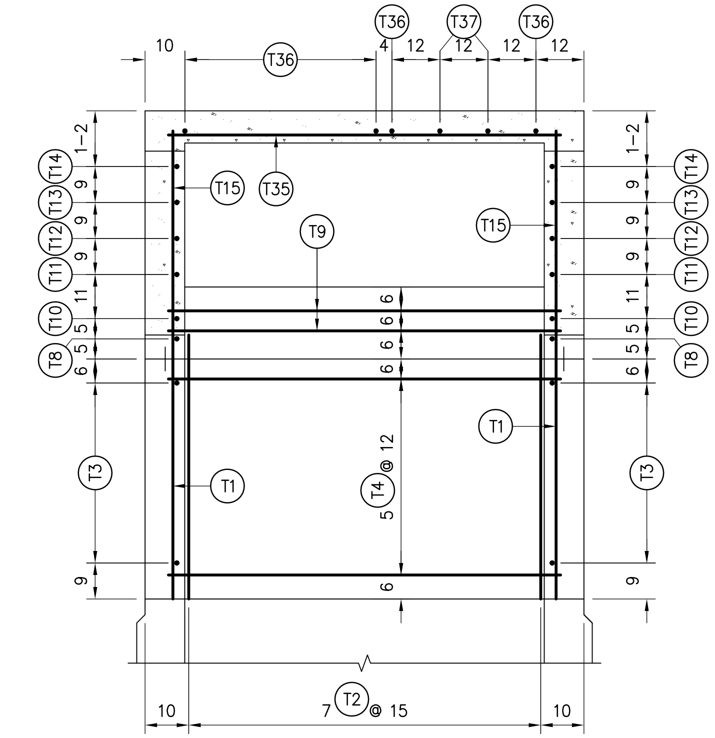
OUTSIDE FACE INSIDE FACE

SECTION A–A



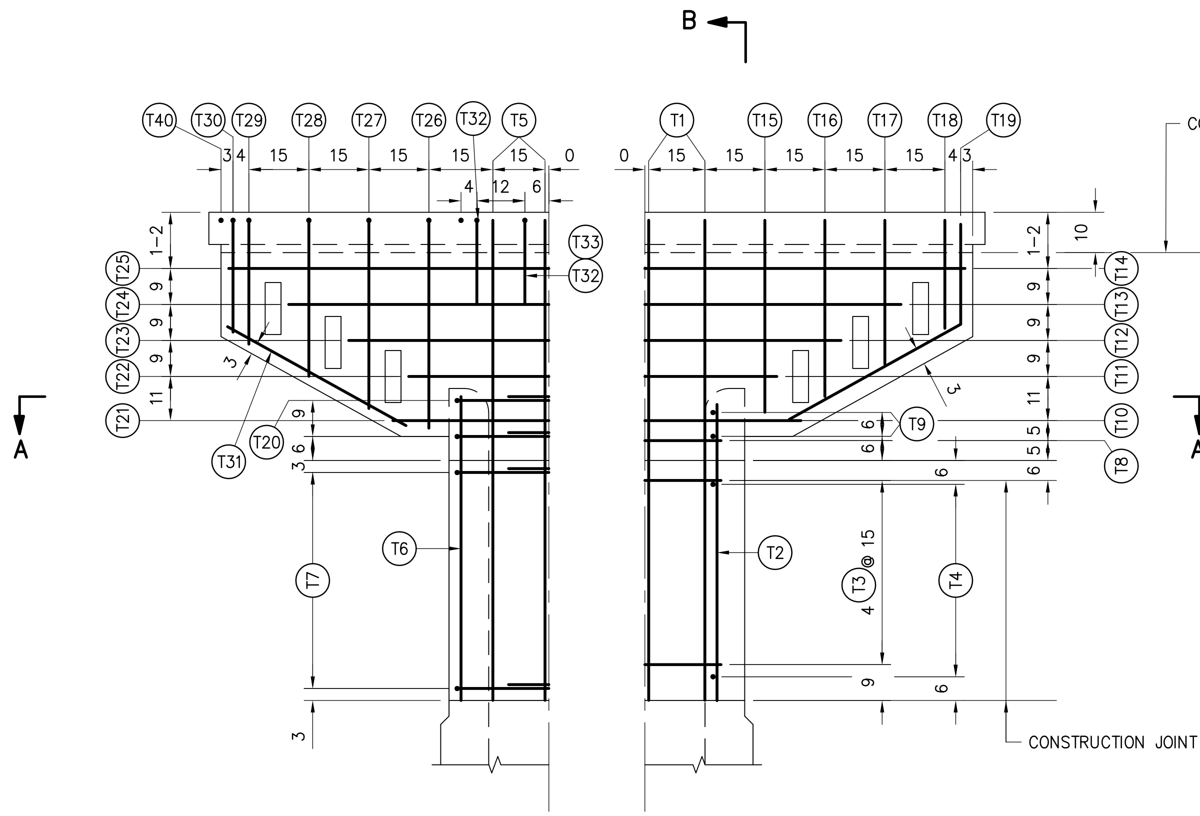
STEEL 2" FROM TOP STEEL 2" FROM BOTTOM

COVER SLAB PLAN



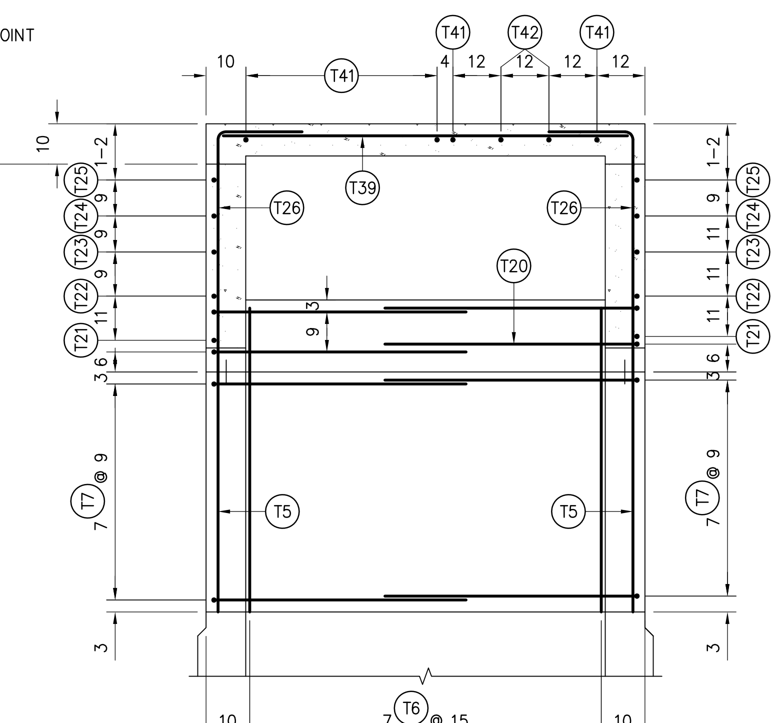
STEEL 2" FROM INSIDE FACE

SECTION B–B



STEEL 2" FROM OUTSIDE FACE STEEL 2" FROM INSIDE FACE

ENDWALL ELEVATION



STEEL 2" FROM OUTSIDE FACE

SECTION B–B

ADAPTED FROM	DATE 08–06
STANDARD BAFFLE RISER	
DESIGN CONSTANTS	f'_c = 4000 psi f_c = 1600 psi n = 8 f_s = 20,000 psi
STANDARD DWG NO.	ES–3230–2020 E
DATE 09–79	SHEET 4 OF 4

NOTES:
1. BAR DIMENSIONS ARE OUT TO OUT OF BAR.
2. RADIUS OF BENDS EQUALS 3 BAR DIAMETERS FOR SIZES < #7.
3. THE 2" AND 3" DISTANCES FROM SPECIFIED CONCRETE SURFACES ARE CLEAR DISTANCES.

CHECK PRINT

2 0 2 4 6

SCALE IN FEET
UNLESS OTHERWISE SHOWN

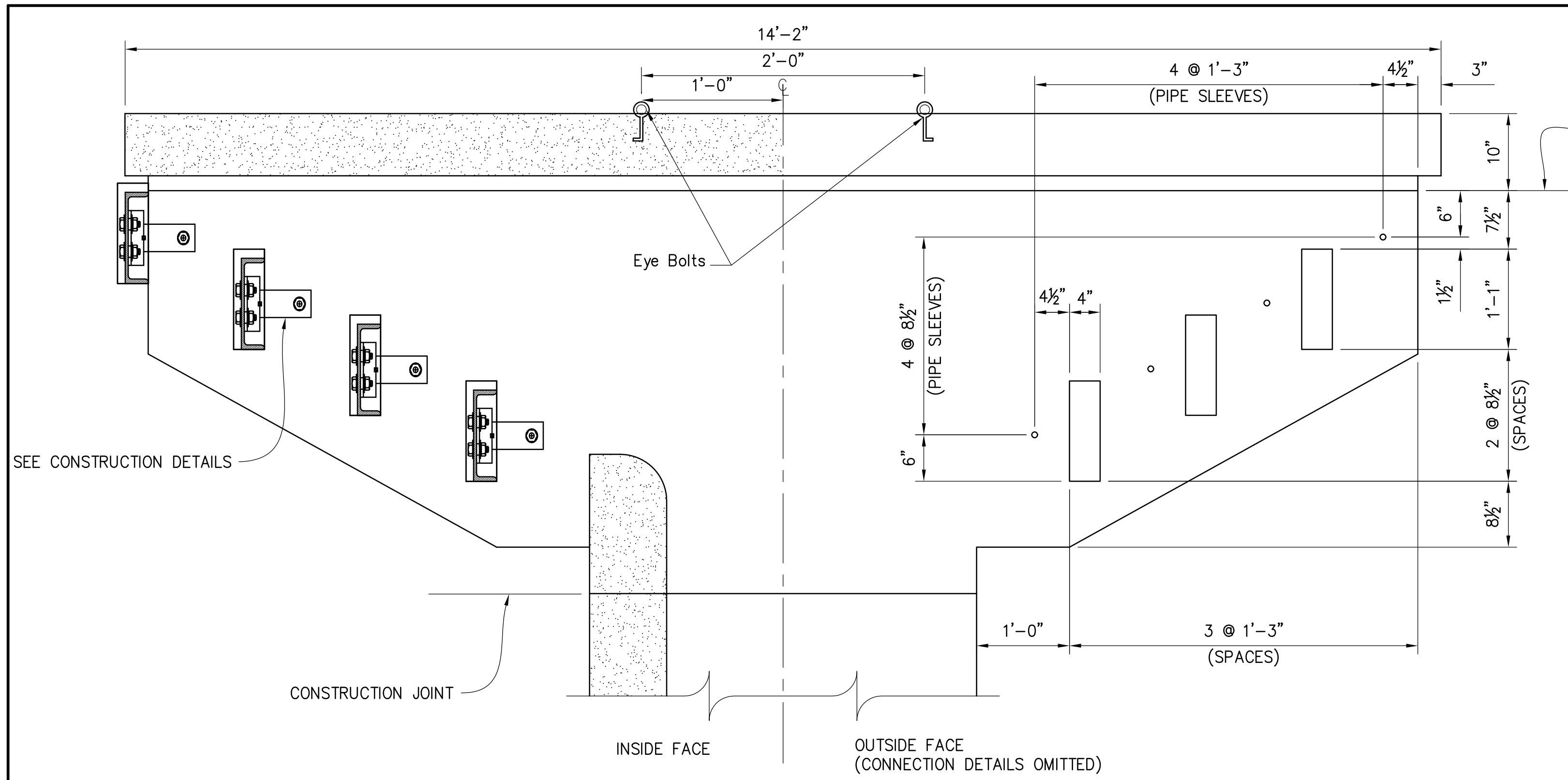
	Date
Designed V. Glasgow	10–17
Drawn K. Dobney	10–17
Revised K. Dobney	06–18
Approved J. Chris Stoner	08–18

STEEL PLACEMENT–PRINCIPAL SPILLWAY INLET
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

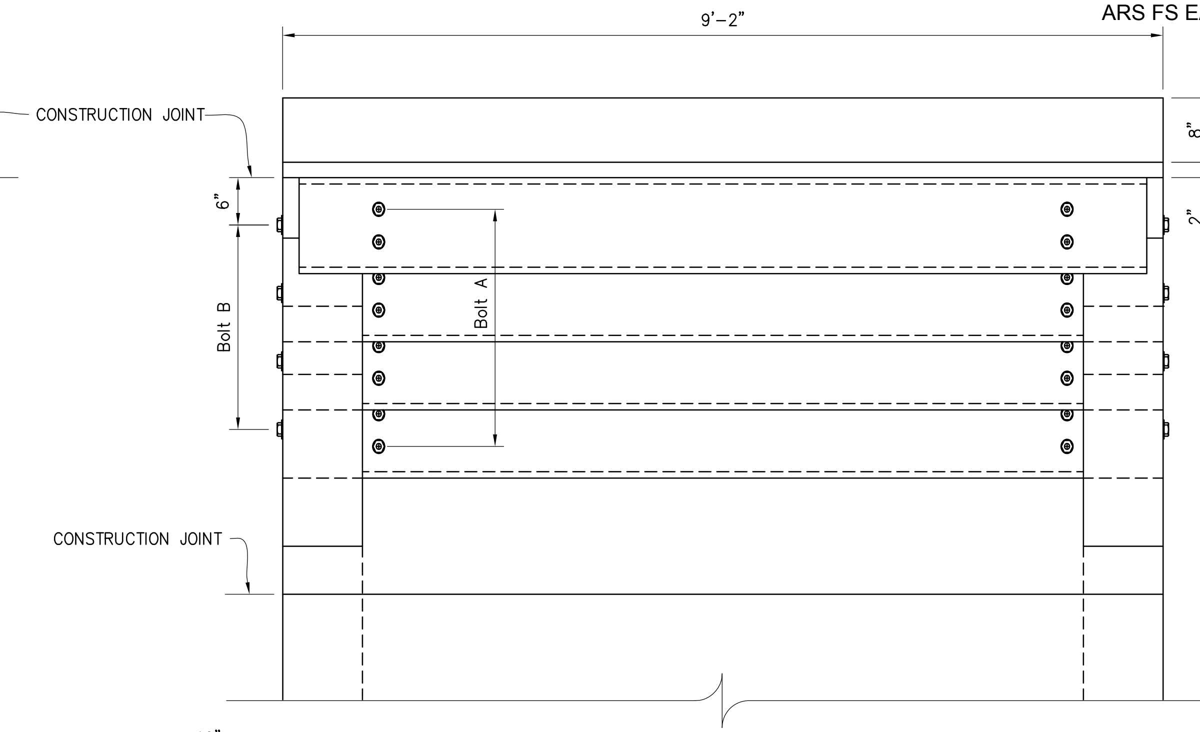
United States Department of Agriculture
Natural Resources Conservation Service

E–File Location:
R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\stdwgs\Tower\3230–2020R\3230–2020E_S4

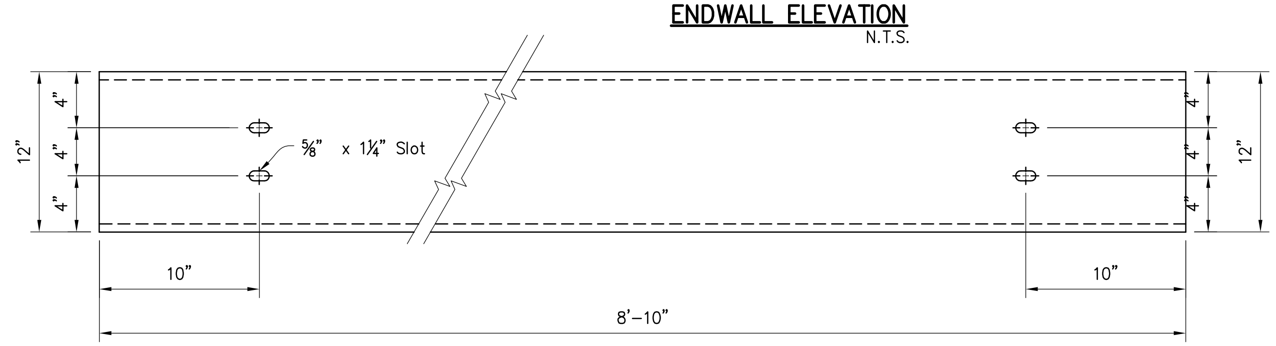
Drawing No.
OK–437



ENDWALL ELEVATION
N.T.S.



SIDEWALL ELEVATION
N.T.S.

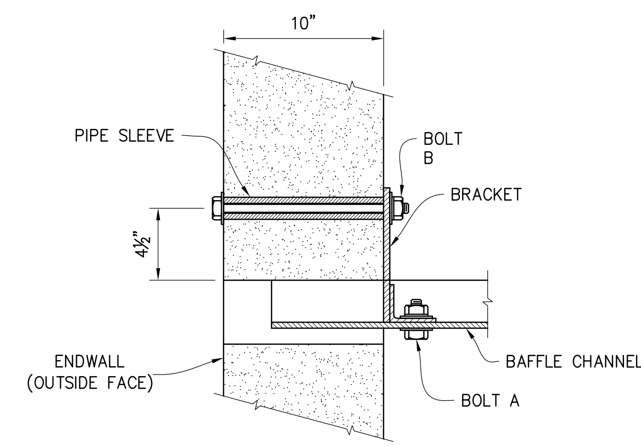


BAFFLE CHANNEL
N.T.S.

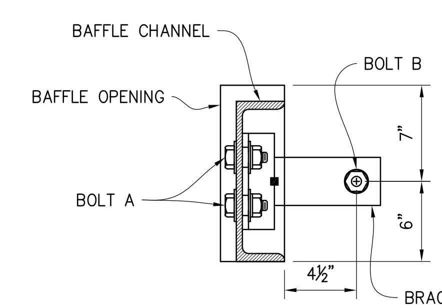
* BOLT WITH TWO FLAT WASHERS, ONE LOCK WASHER AND NUT.

NOTE: ALL PARTS OF TRASH RACK SHALL BE GALVANIZED AFTER FABRICATION.

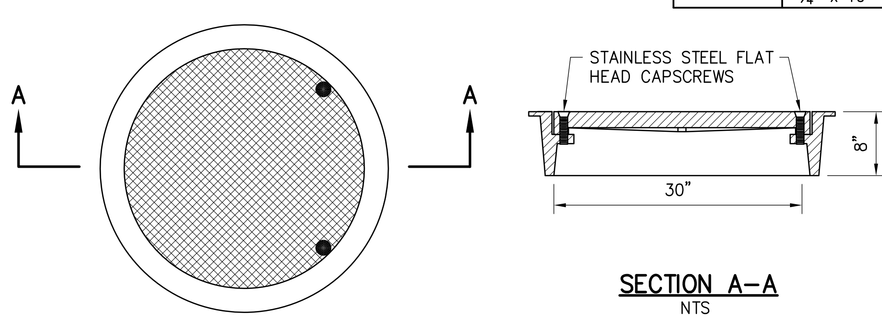
SCHEDULE OF QUANTITIES		
ITEM	SIZE	QUANTITY
CHANNEL	C12 x 25	8
BRACKET	SEE DETAIL	16
BOLT A	½" x 2"	32
BOLT B	⅝" x 12"	16
PIPE SLEEVE	¾" x 10"	16



SECTIONAL TOP VIEW
N.T.S.



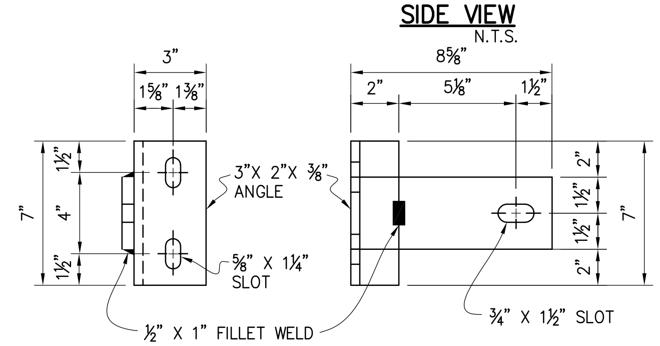
SIDE VIEW
N.T.S.



SECTION A–A
NTS

NOTE:
MANHOLE COVER SHALL HAVE TYPE E LOCKING DEVICE WITH STAINLESS STEEL CAP SCREWS AS APPROVED BY THE CONTRACTING OFFICER. (SEE CONSTRUCTION SPECIFICATION 81.)

MANHOLE COVER DETAILS
NTS



BRACKET
N.T.S.
(FABRICATE BRACKET FROM 3/8" STEEL PLATE AND ANGLE)

NOTE:
1. BLOCK OUTS SHALL BE USED FOR BAFFLE OPENINGS.

ADAPTED FROM	DATE 05-04
TRASHRACK – STANDARD BAFFLE RISER – 3230	
STANDARD DWG NO.	SNTC – 3
DATE 05-83	SHEET 1 OF 1

CHECK PRINT

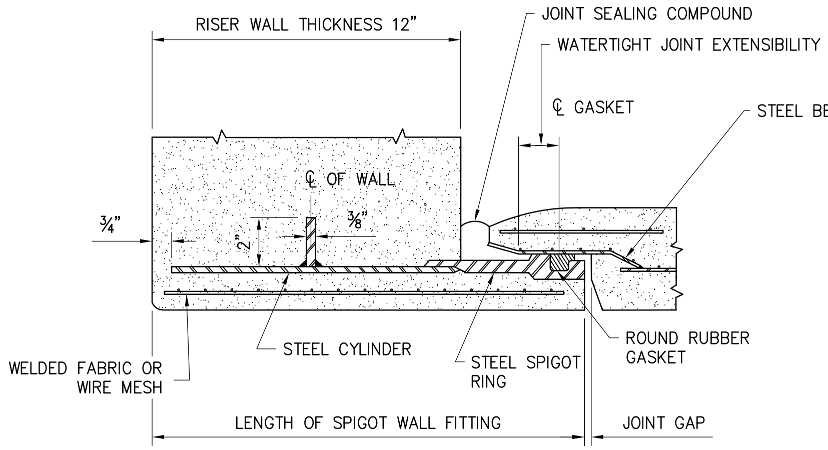
		Date
Designed	H. SAND	05-13
Drawn	A. LANE	05-13
Revised	K. DABNEY	03-17
Approved	J. CHRIS STONER	08-14

PRINCIPAL SPILLWAY INLET DETAILS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

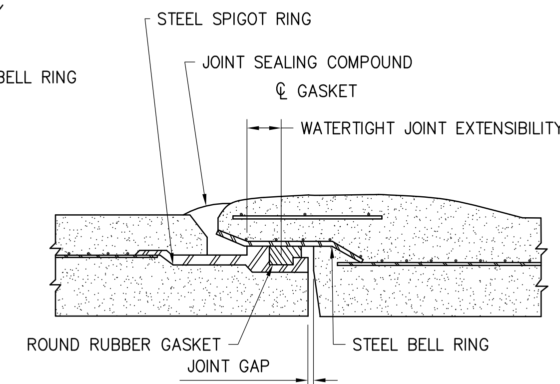
USDA United States Department of Agriculture
Natural Resources Conservation Service

E-File Location:
R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\Sldwgs\Tower\Trashrack30

Drawing No.
OK – 437



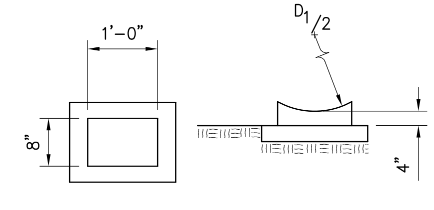
DETAIL A
NTS



DETAIL B
NTS

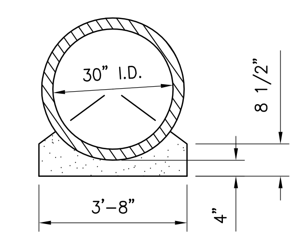
JOINT LENGTH EQUALS WATERTIGHT JOINT EXTENSIBILITY PLUS JOINT GAP.

THE PIPE SHALL BE DRAWN TOGETHER SO THAT THE MAXIMUM JOINT GAP DOES NOT EXCEED ⅜ INCH FOR PIPE LAID ON A STRAIGHT LINE. FOR CAMBERED PIPE OR PIPE LAID ON A CURVED LINE, THE JOINT GAP AT THE CLOSEST POINT SHALL NOT EXCEED ⅜ INCH.



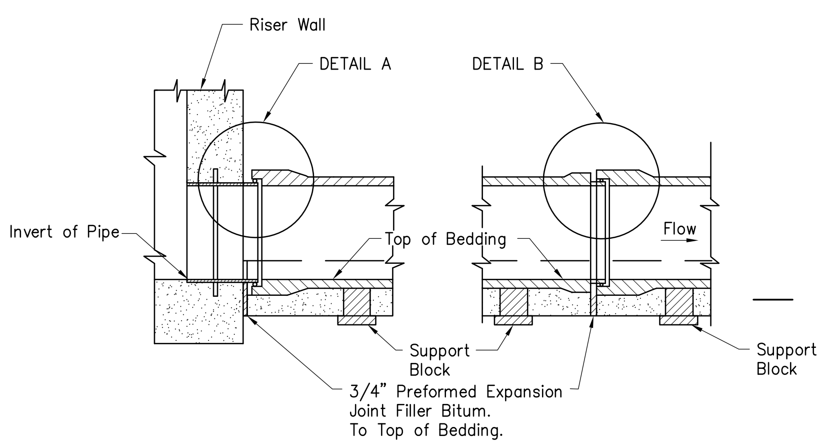
SUGGESTED SUPPORT BLOCKS
NTS

SUFFICIENT BLOCKS SHALL BE PROVIDED TO SUPPORT THE PIPE TO THE REQUIRED LINE & GRADE. THE CONTRACTOR SHALL DETERMINE THE NUMBER AND SIZE OF BLOCKS REQUIRED. WEDGES MAY BE USED AS AN ALTERNATIVE.



DETAIL OF BEDDING
NTS

TOTAL CONCRETE BEDDING = 5.3 CU. YDS.



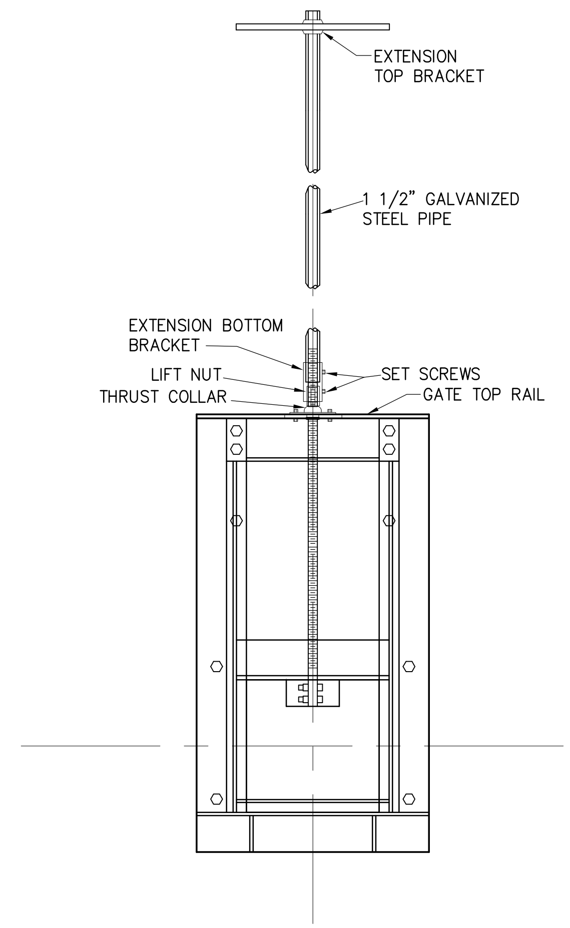
DETAIL OF SPIGOT WALL FITTING AND DETAIL OF PIPE JOINT
NTS

STRENGTH REQUIREMENTS		
INSIDE DIAMETER OF PIPE INCHES	INTERNAL LOAD HYDROSTATIC PRESSURE HEAD OF WATER FEET	EXTERNAL LOAD MINIMUM 3-EDGE BEARING STRENGTH IN POUNDS PER LINEAL FOOT OF PIPE APPLICABLE STANDARD SPECIFICATION AWWA C-301 LOAD TO PRODUCE 0.001 IN CRACK ONE FOOT LONG
30	37.7	7,500

THE OUTSIDE DIAMETER OF PIPE ASSUMED IN DESIGN IS 42.25 INCHES. WHERE THE PIPE FURNISHED HAS AN OUTSIDE DIAMETER GREATER THAN ASSUMED IN DESIGN, THE THREE-EDGE BEARING STRENGTH OF PIPE FURNISHED MUST NOT BE LESS THAN THE SPECIFIED THREE-EDGE BEARING STRENGTH MULTIPLIED BY THE RATIO OF THE OUTSIDE DIAMETER OF THE PIPE FURNISHED TO THE OUTSIDE OF DIAMETER ASSUMED IN DESIGN.

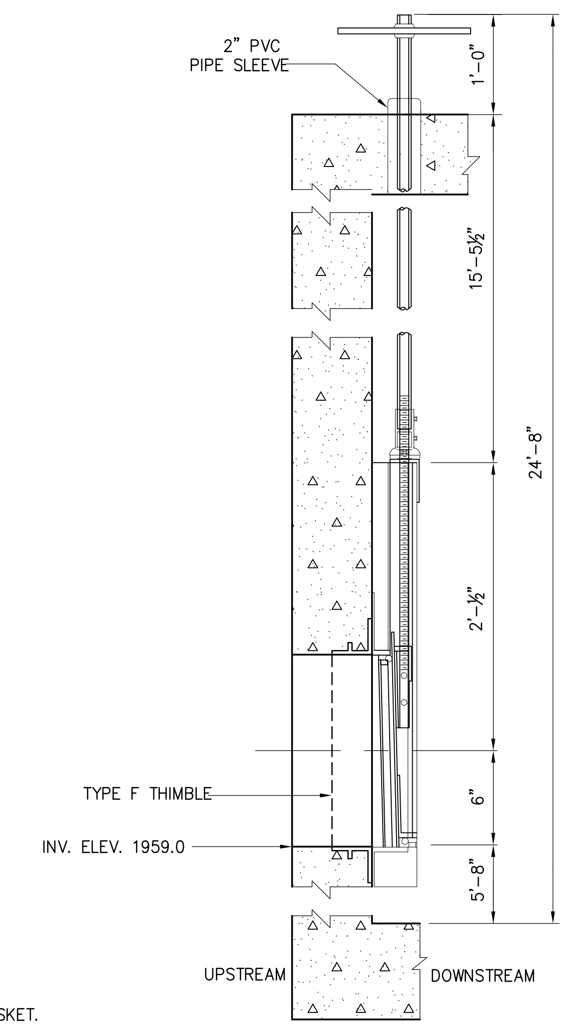
JOINT REQUIREMENTS			
LENGTH OF PIPE SECTION	MINIMUM JOINT LENGTH	MINIMUM JOINT LIMITING ANGLE	
FEET	INCHES	RADIANS	DEGREES
8	2.75	0.606	0.337
10	2.75	0.606	0.337
16	2.75	0.606	0.337
20	2.75	0.606	0.337

PRIOR TO DELIVERY OF PIPE, THE PIPE JOINT DETAIL PROPOSED FOR USE SHALL BE SUBMITTED TO THE CONTRACTING OFFICER FOR APPROVAL.



DETAILS OF SLIDE GATE
NTS

NOTES:
1. 12" I.D. FABRICATED ALUMINUM SLIDE GATE, SELF CONTAINED.
2. CLASS 30-20, TYPE MLS-2, FLANGE BACK, WITH THIMBLE AND RUBBER GASKET. THIMBLE–TYPE F, COMPATIBLE WITH ALUMINUM SLIDE GATE OR APPROVED EQUIVALENT.
3. ø 1 1/2" GALVANIZED STEEL PIPE NON-RISING STEM EXTENSION AND BRACKETS (TORQUE TUBE) ø18" HANDWHEEL, TYPE 1.
4. STAINLESS STEEL BOLTS AND NUTS.
5. GATE TO BE INSTALLED ACCORDING TO MANUFACTURERS INSTALLATION INSTRUCTIONS.
6. STEM GUIDES NOT SHOWN; TO BE INSTALLED PER MANUFACTURER'S INSTALLATION INSTRUCTIONS.



UPSTREAM ENDWALL
NTS

ADAPTED FROM	DATE 05–04
STANDARD CONDUIT DETAILS FOR REINFORCED CONCRETE PRESSURE PIPE PRINCIPAL SPILLWAY	
STANDARD DWG NO.	ES–5130–BE
DATE 02–76	SHEET 1 OF 1

CHECK PRINT

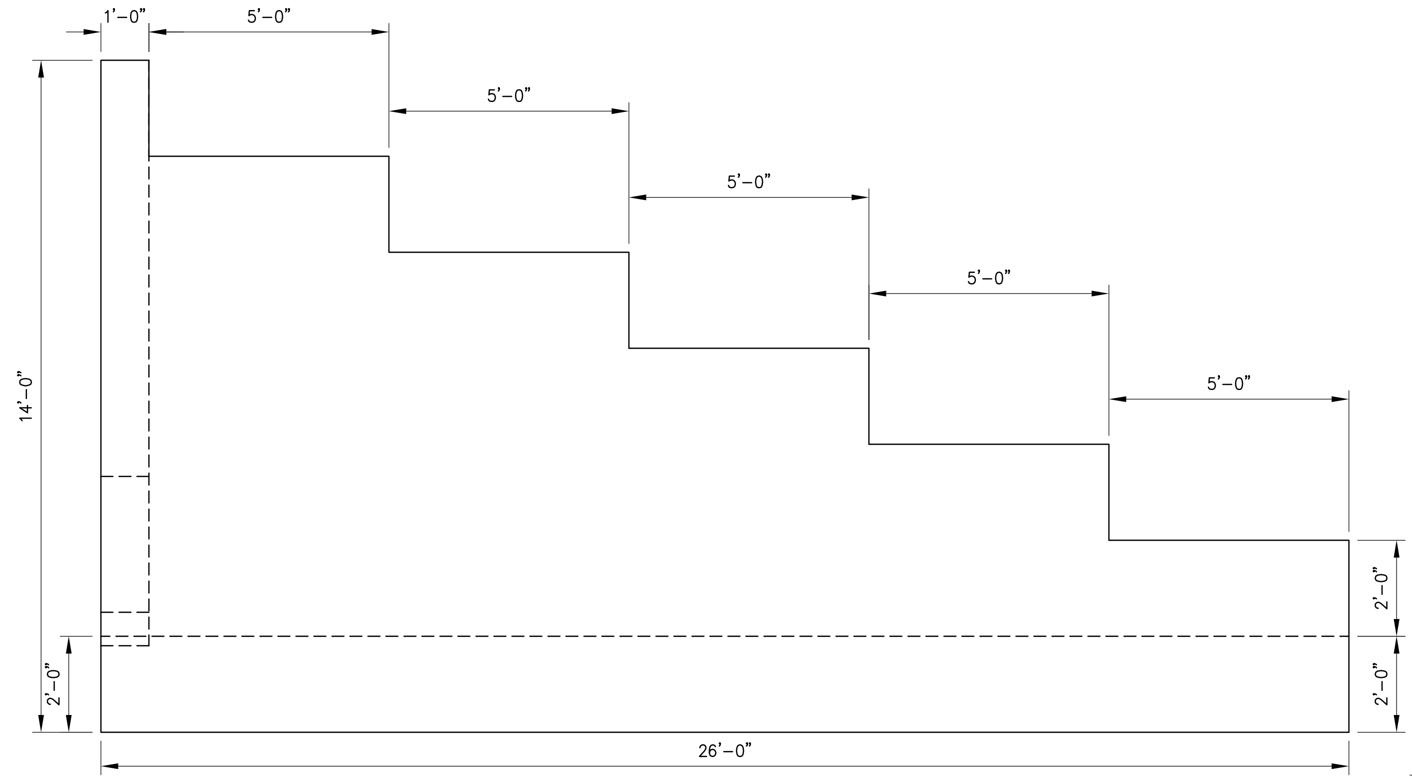
Designed	V. Glasgow	11–17
Drawn	K. Dobney	11–17
Revised	K. Dobney	06–18
Approved	J. Chris Stoner	08–18

CONDUIT AND SLIDE GATE DETAILS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

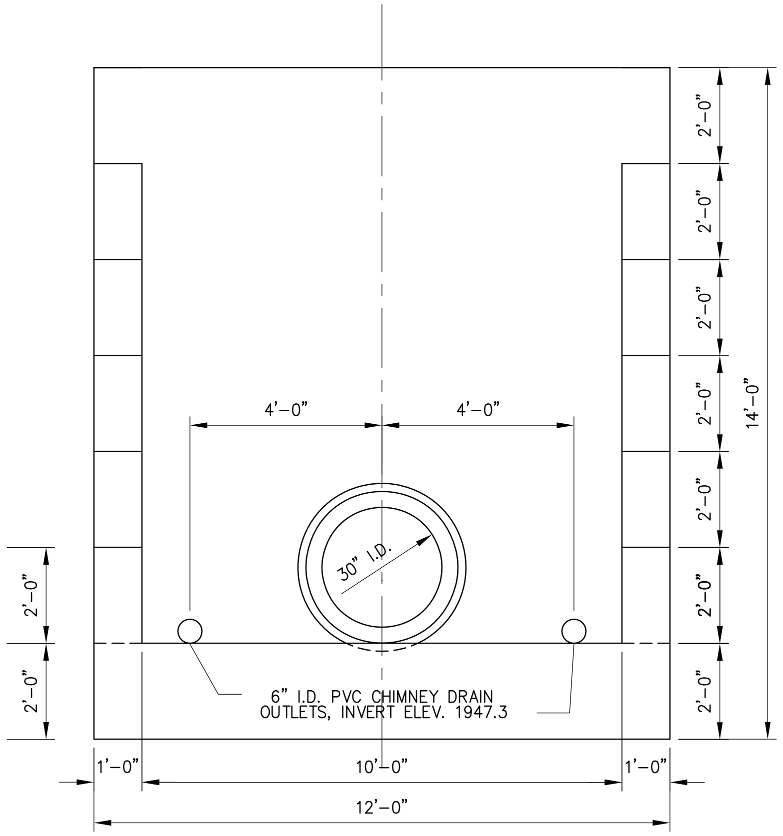
United States Department of Agriculture
Natural Resources Conservation Service

E-File Location:
R:\All Repairs\ARS Field Station Lake\Deisgn-Rehab\Drawings\stdwgs\ARS-Conduit & Slide Gate Details.dwg

Drawing No.
OK-437



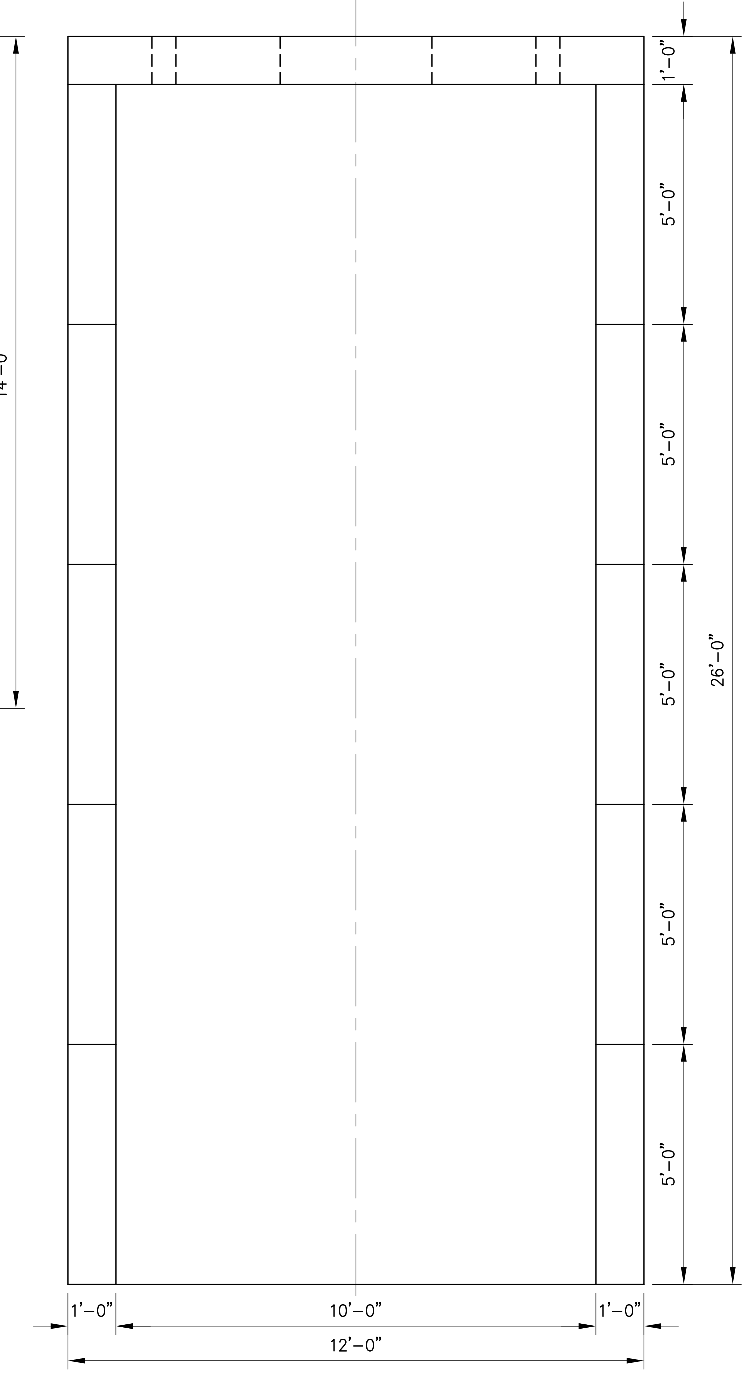
SIDEWALL ELEVATION



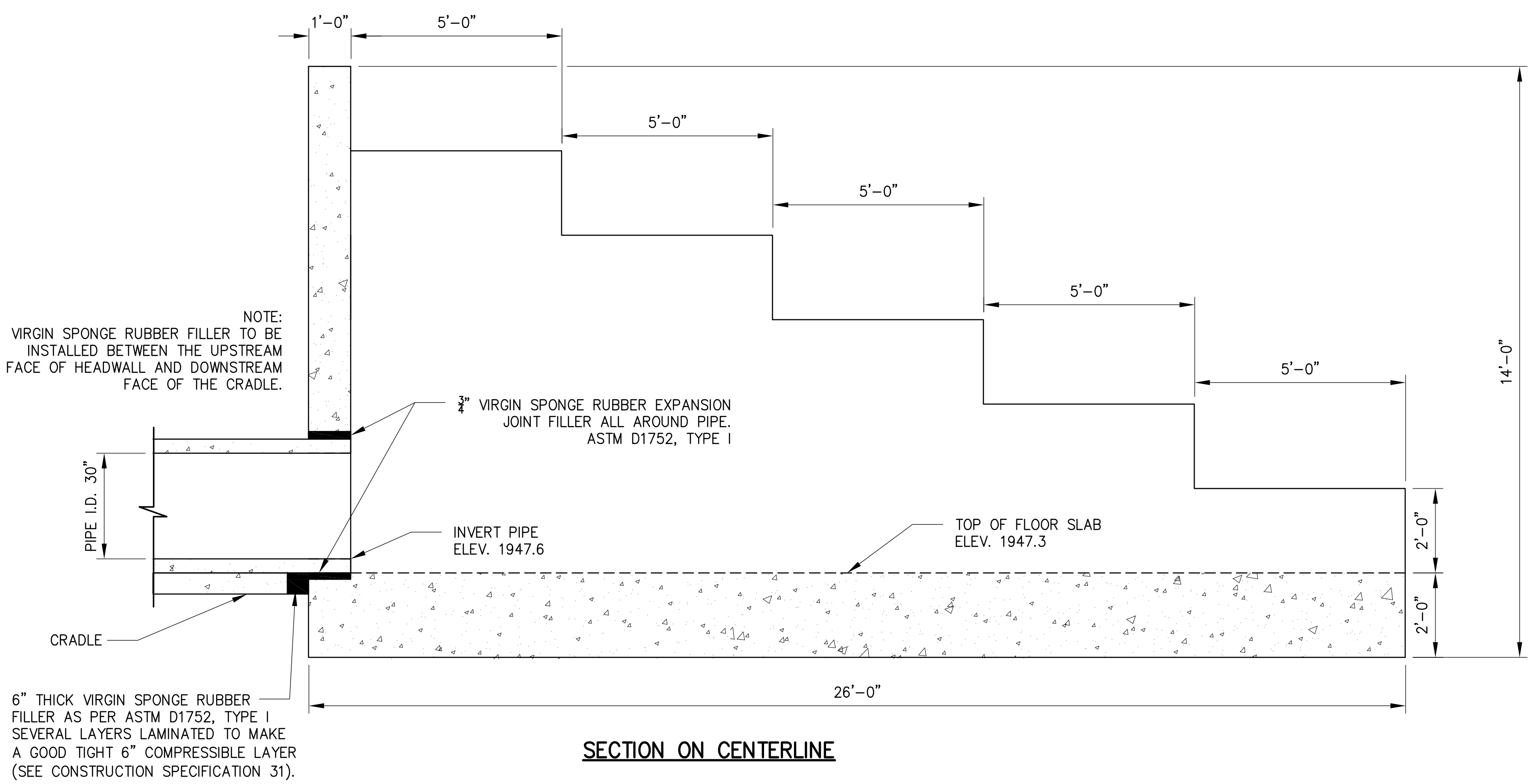
HEADWALL ELEVATION

NOTE:
CONCRETE FOR THE PRINCIPAL SPILLWAY OUTLET STRUCTURE SHALL EQUAL OR EXCEED CLASS 4000 (SEE CONSTRUCTION SPECIFICATION 31).

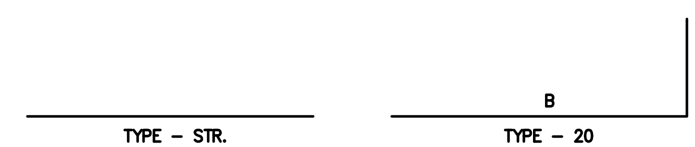
NOTE:
STEEL SHALL BE PLACED WITH A MINIMUM CLEAR CONCRETE COVER OVER REINFORCEMENT OF (2) INCHES, EXCEPT WHEN CONCRETE IS DEPOSITED ON OR AGAINST EARTH THE MINIMUM CLEAR COVER SHALL BE (3) INCHES.



TOP PLAN OF SLAB



SECTION ON CENTERLINE



BAR TYPES

CHECK PRINT

SCALE IN FEET

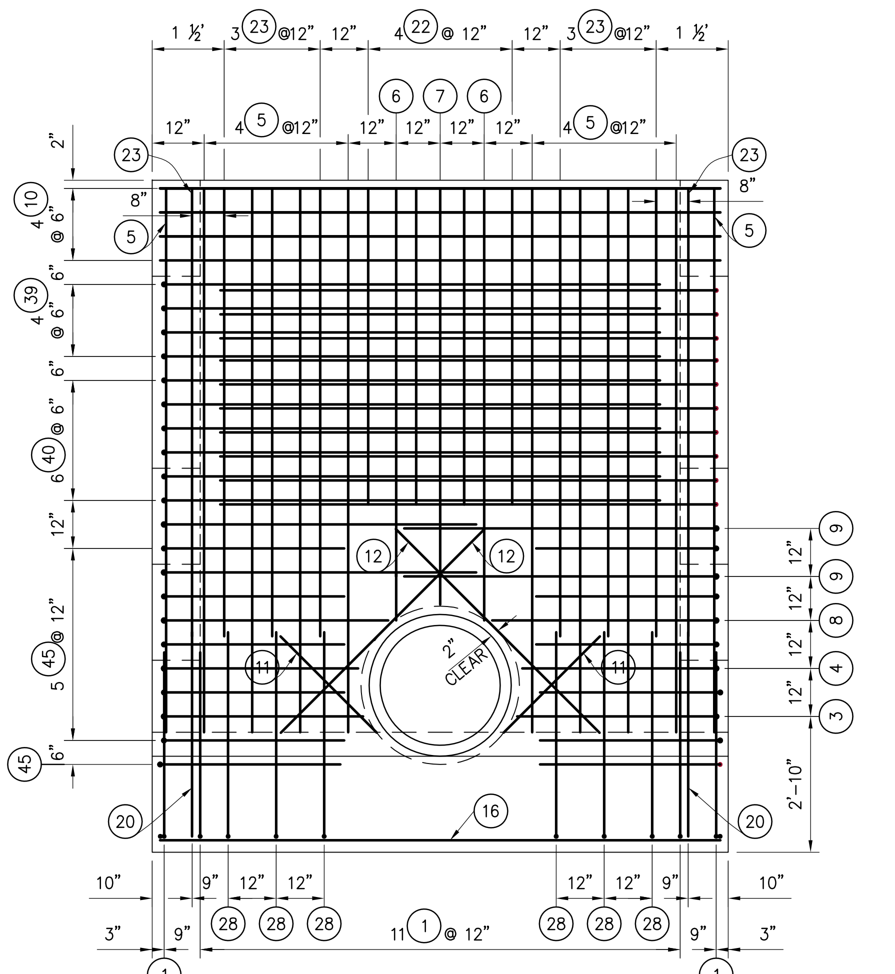
Designed	V. Glasgow	10–17
Drawn	K. Dobney	10–17
Revised	K. Dobney	11–17
Approved	J. Chris Stoner	08–18

PRINCIPAL SPILLWAY OUTLET STRUCTURE
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

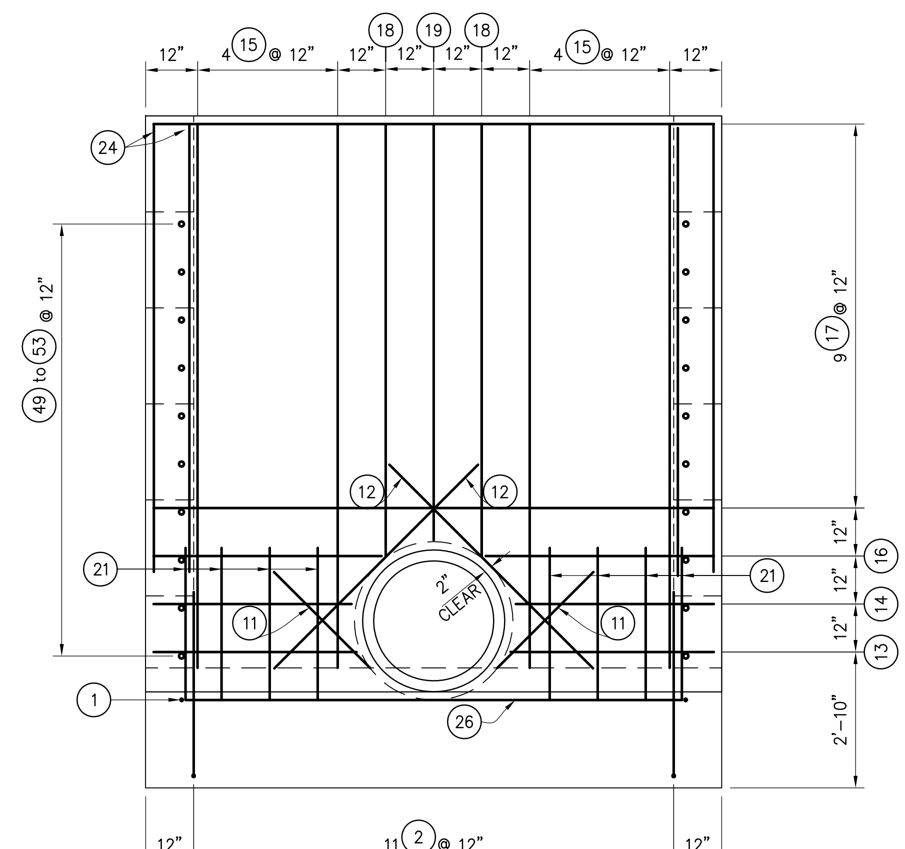
United States Department of Agriculture
Natural Resources Conservation Service

E–File Location:
R:\All Repairs\ARS Field Station Lake\Design–Rehab\Drawings\stdwgs\PS_Outlet\PS_Outlet_St.dwg

Drawing No.
OK–437



HEADWALL – OUTSIDE FACE



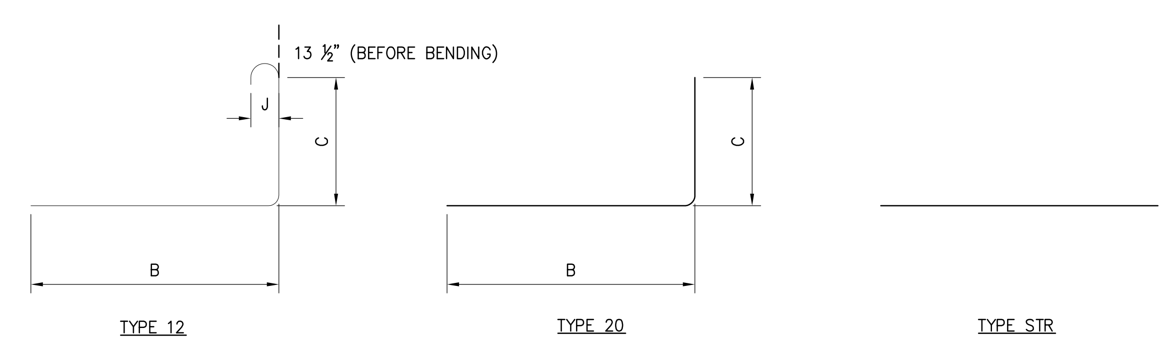
HEADWALL – INSIDE FACE

NOTES:

1. CUT BARS #1 & #2 AS NECESSARY TO CLEAR PIPE OPENING.
2. CONCRETE FOR THE PRINCIPAL SPILLWAY OUTLET STRUCTURE SHALL EQUAL OR EXCEED CLASS 4000.
3. STEEL SHALL BE PLACED WITH A MINIMUM CLEAR CONCRETE COVER OVER REINFORCEMENT OF 2 INCHES, EXCEPT WHEN CONCRETE IS DEPOSITED ON OR AGAINST EARTH THE MINIMUM CLEAR COVER SHALL BE 3 INCHES.

STEEL SCHEDULE

LOCATION	MARK	SIZE	QUAN.	LENGTH	TYPE	B	C	TOTAL LENGTH
HEADWALL	1	5	13	14–10	20	3–10	11–0	192–10
HEADWALL	2	6	11	4–7	20	0–9	3–10	197–1
HEADWALL	3	7	2	15–2¾	20	4–2¾	11–0	30–5½
HEADWALL	4	7	2	15–1½	20	4–1½	11–0	30–3
HEADWALL	5	5	10	11–4	STR			113–4
HEADWALL	6	5	2	9–0	STR			18–0
HEADWALL	7	5	1	8–8	STR			8–8
HEADWALL	8	7	2	20–5	20	4–9	15–8	40–10
HEADWALL	9	7	2	22–3	20	6–7	15–8	44–6
HEADWALL	10	7	4	11–8	STR			46–8
HEADWALL	11	5	4	2–10	STR			11–4
HEADWALL	12	5	4	6–0	STR			24–0
HEADWALL	13	5	2	4–2¾	STR			8–6
HEADWALL	14	5	2	4–1½	STR			8–4
HEADWALL	15	5	8	11–4	STR			90–8
HEADWALL	16	5	2	4–9	STR			9–6
HEADWALL	17	5	7	11–8	STR			81–8
HEADWALL	18	5	2	9–0	STR			18–0
HEADWALL	19	5	1	8–8	STR			8–8
HEADWALL	20	5	4	4–3	STR			17–0
HEADWALL	21	6	8	3–2	STR			25–4
HEADWALL	22	5	9	6–7	STR			59–3
HEADWALL	23	5	6	9–4	STR			56–0
HEADWALL	24	5	8	4–3	STR			34–0
BASE	25	6	33	25–6	STR			841–6
BASE	26	5	71	10–4	STR			733–8
BASE	27	5	37	26–2	STR			968–2
BASE	28	5	6	6–3	20	4–3	2–0	37–6
BASE	29	4	10	9–11	20	6–4	3–7	99–2
BASE	30	5	10	11–11	20	6–4	5–7	119–2
BASE	31	5	52	12–3	20	6–4	5–11	637–0
BASE	32	8	10	10–11	20	7–4	3–7	109–2
BASE	33	8	10	12–11	20	7–4	5–7	129–2
BASE	34	8	52	13–3	20	7–4	5–11	689–0
BASE	35	7	7	16–8	STR			116–8
SIDEWALL	36	6	21	7–4	STR			154–0
SIDEWALL	37	6	20	9–4	STR			186–8
SIDEWALL	38	6	20	11–4	STR			226–8
SIDEWALL	39	7	8	17–4½	12	10–4	5–11	139–0
SIDEWALL	40	7	12	17–8	20	10–4	7–4	212–0
SIDEWALL	41	4	4	5–7	STR			22–4
SIDEWALL	42	4	4	10–7	STR			42–4
SIDEWALL	43	4	4	15–7	STR			62–4
SIDEWALL	44	4	4	20–7	STR			82–4
SIDEWALL	45	7	12	11–1	20	7–4	3–9	133–0
SIDEWALL	46	5	50	4–10	STR			241–8
SIDEWALL	47	5	10	4–6	STR			45–0
SIDEWALL	48	5	10	2–8	STR			26–8
SIDEWALL	49	5	4	5–6	STR			22–0
SIDEWALL	50	5	4	10–6	STR			42–0
SIDEWALL	51	5	4	15–6	STR			62–0
SIDEWALL	52	5	4	20–6	STR			82–0
SIDEWALL	53	5	4	25–6	STR			102–0

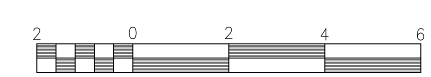


J = 7" FOR #39 BARS

A = 3 ½" FOR #39 BARS

BAR TYPES

NOT TO SCALE



SCALE IN FEET

Designed	VGG
Drawn	ARL
Revised	XXX
Approved	J. Chris Stoner

Date
01–18
01–18
XXX
XXX

PRINCIPAL SPILLWAY OUTLET – STEEL PLACEMENT

ARS FIELD STATION LAKE – REHABILITATION

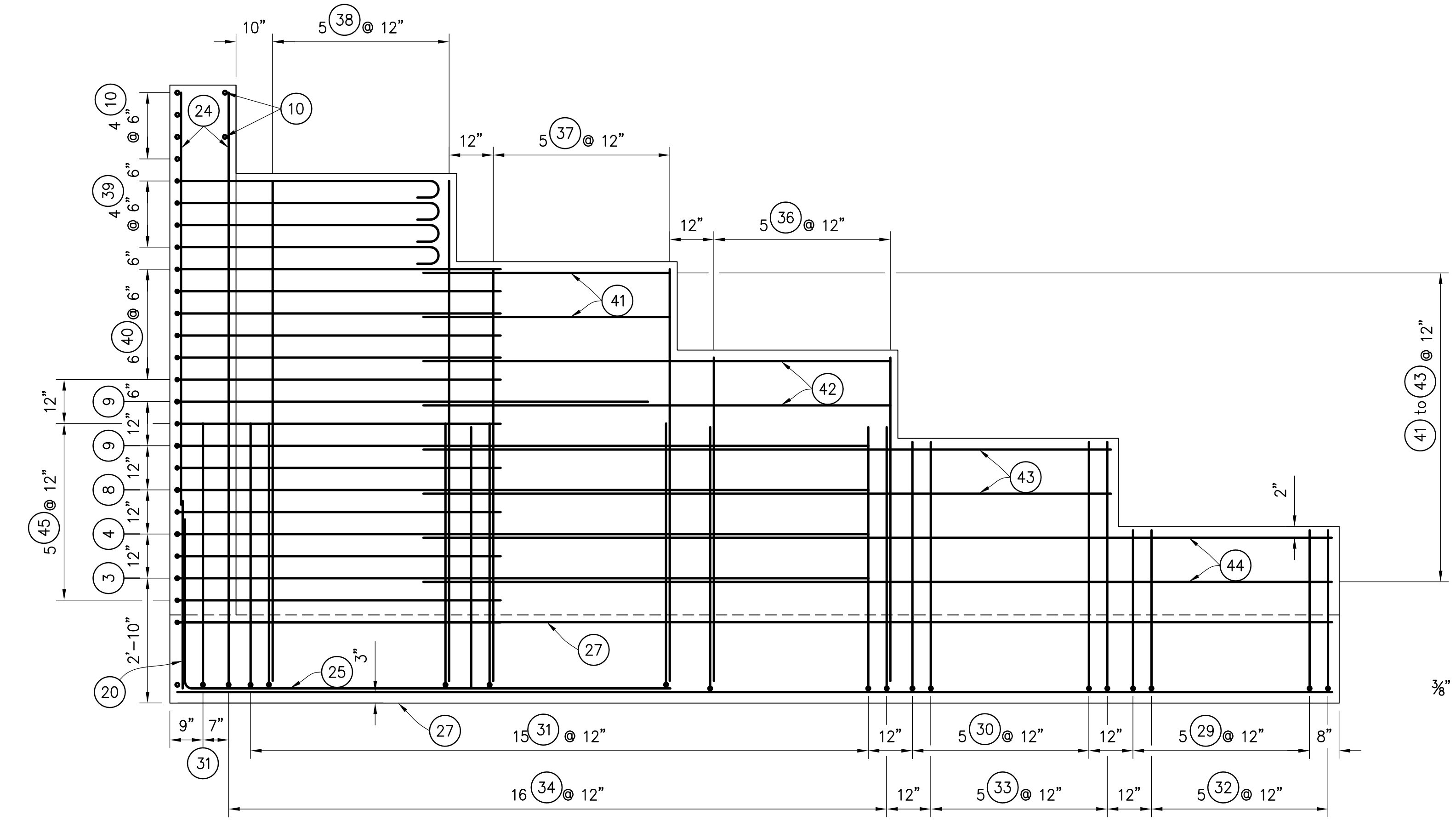
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture

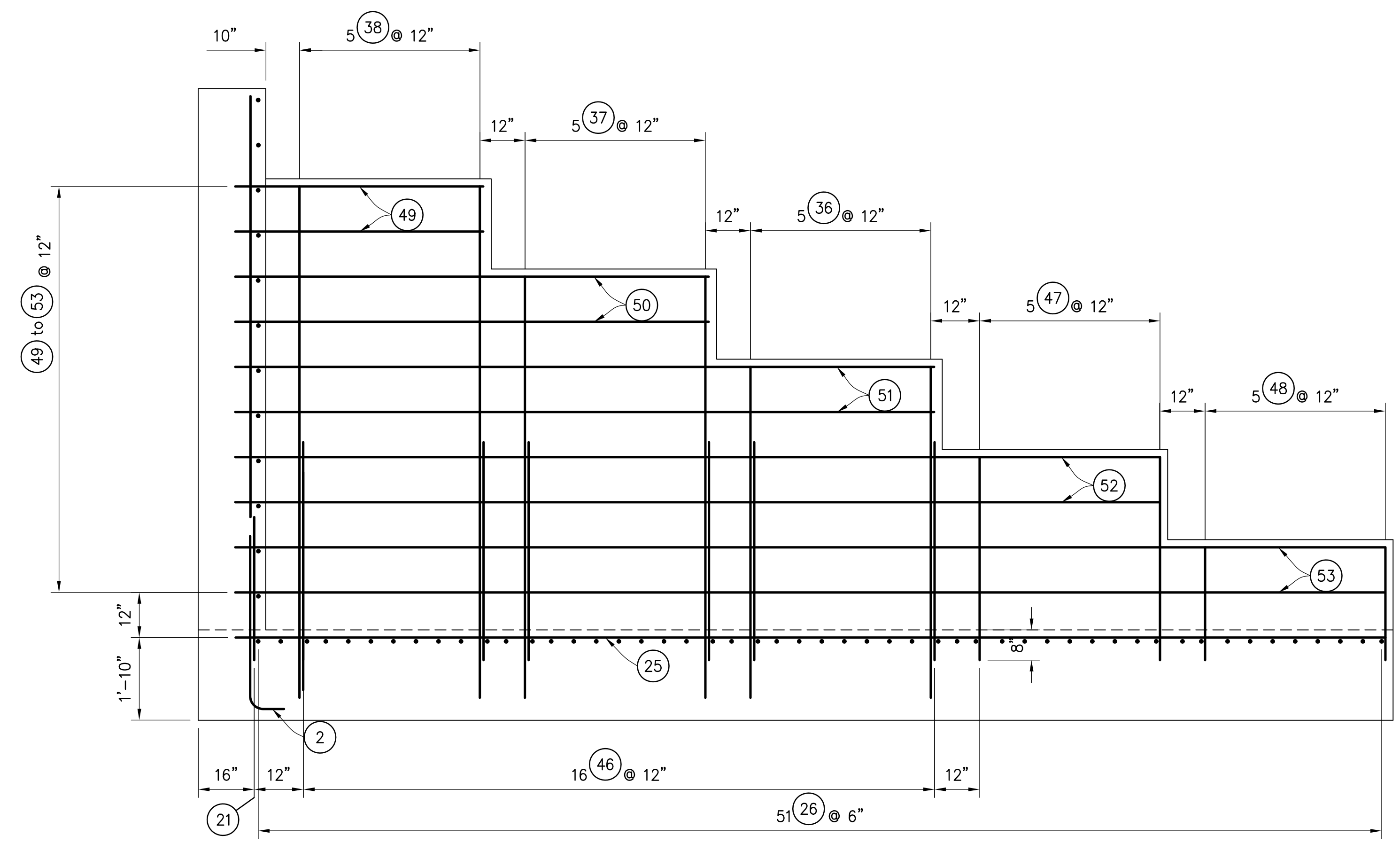
Natural Resources Conservation Service

E-File Location:
R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\dwgs\PS_Outlet\PS_Outlet_Steel Placement

Drawing No.
OK-437



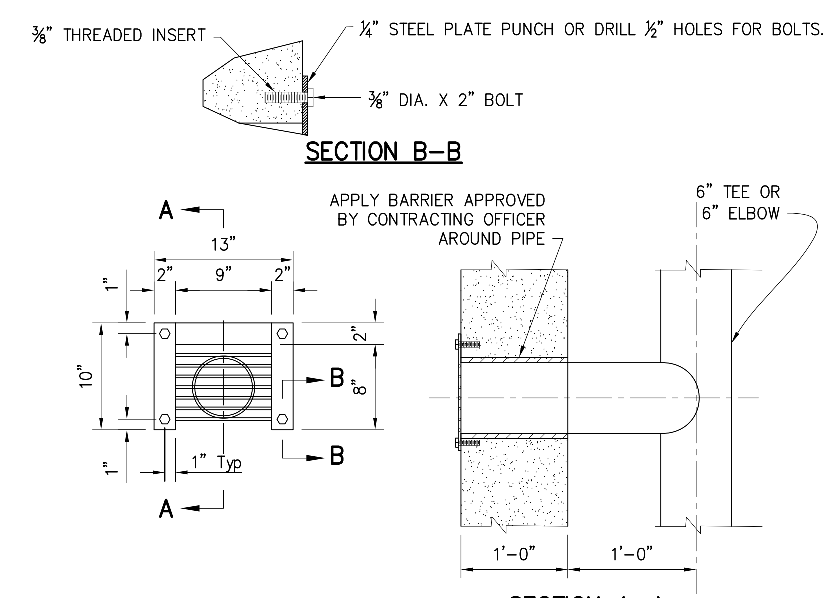
SIDEWALL ELEVATION – OUTSIDE FACE



SIDEWALL ELEVATION – INSIDE FACE

NOTES:

1. HOOK ON BAR #39 SHALL BE IN THE HORIZONTAL PLANE. IT IS SHOWN IN VERTICAL PLANE TO IDENTIFY THE HOOK LOCATION.
2. VERTICAL LEG ON BAR #34 IN OUTSIDE LAYER OF SIDEWALL WILL SPLICE WITH BAR #'S 36, 37, 38 AND 24. VERTICAL LEG ON BAR #31 WILL NOT SPLICE ANY BAR IN OUTSIDE LAYER OF SIDEWALL.



RODENT GUARD DETAILS

NTS

NOTE: RODENT GUARDS SHALL BE GALVANIZED AFTER FABRICATION.

SCALE IN FEET (2 0 2 4 6)

Designed	VGG	01-18
Drawn	ARL	01-18
Revised	XXX	XXX
Approved	J. Chris Stoner	XXX

PRINCIPAL SPILLWAY OUTLET – STEEL PLACEMENT

ARS FIELD STATION LAKE – REHABILITATION

WOODWARD COUNTY, OKLAHOMA

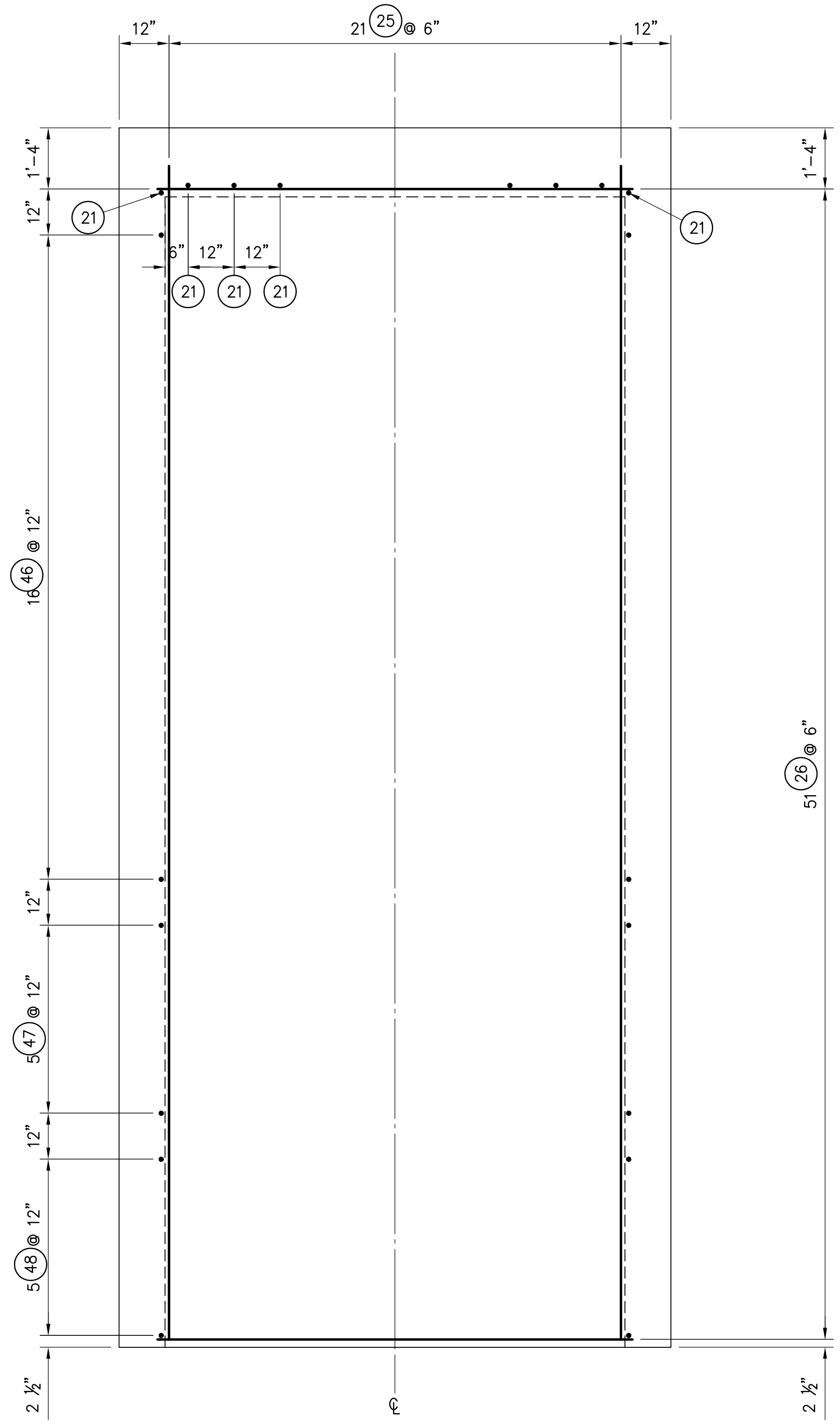
USDA United States Department of Agriculture

Natural Resources Conservation Service

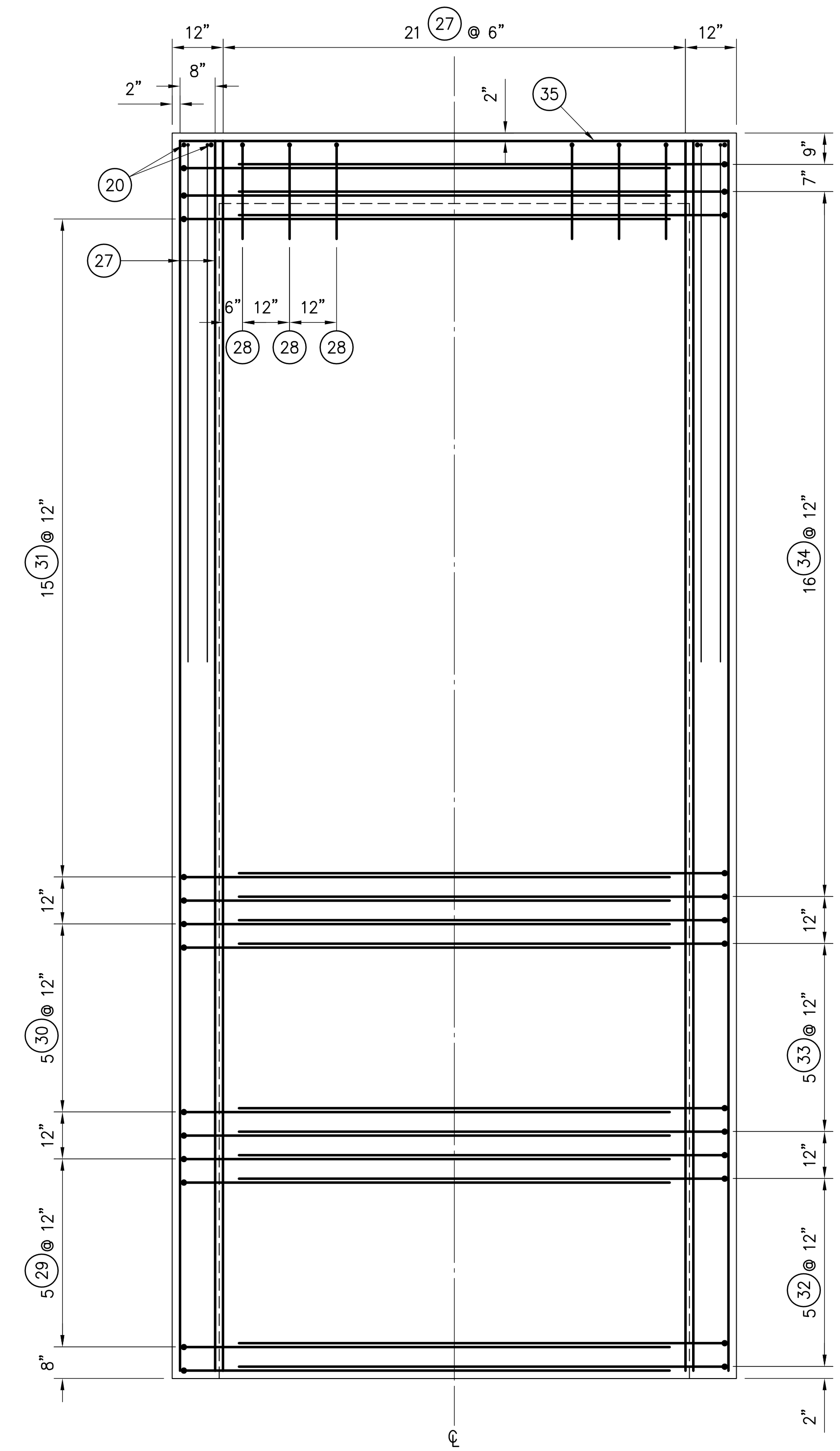
E-File Location: R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\dwgs\PS_Outlet\PS_Outlet_Steel Placement

Drawing No. OK-437

Sheet 19 of 36



FLOOR SLAB – TOP FACE



FLOOR SLAB – BOTTOM FACE

UNLESS OTHERWISE NOTED:

1. BARS MARKED NO. 29 SHALL ALTERNATE WITH BARS MARKED NO. 32 ON 6" CENTERS IN THE FLOOR SLAB–BOTTOM FACE.
2. BARS MARKED NO. 30 SHALL ALTERNATE WITH BARS MARKED NO. 33 ON 6" CENTERS IN FLOOR SLAB–BOTTOM FACE.
3. BARS MARKED NO. 31 SHALL ALTERNATE WITH BARS MARKED NO. 34 ON 6" CENTERS IN FLOOR SLAB–BOTTOM FACE.

2 0 2 4 6
SCALE IN FEET

Designed	VGG	01–18
Drawn	ARL	01–18
Revised	XXX	XXX
Approved	J. Chris Stoner	XXX

Date

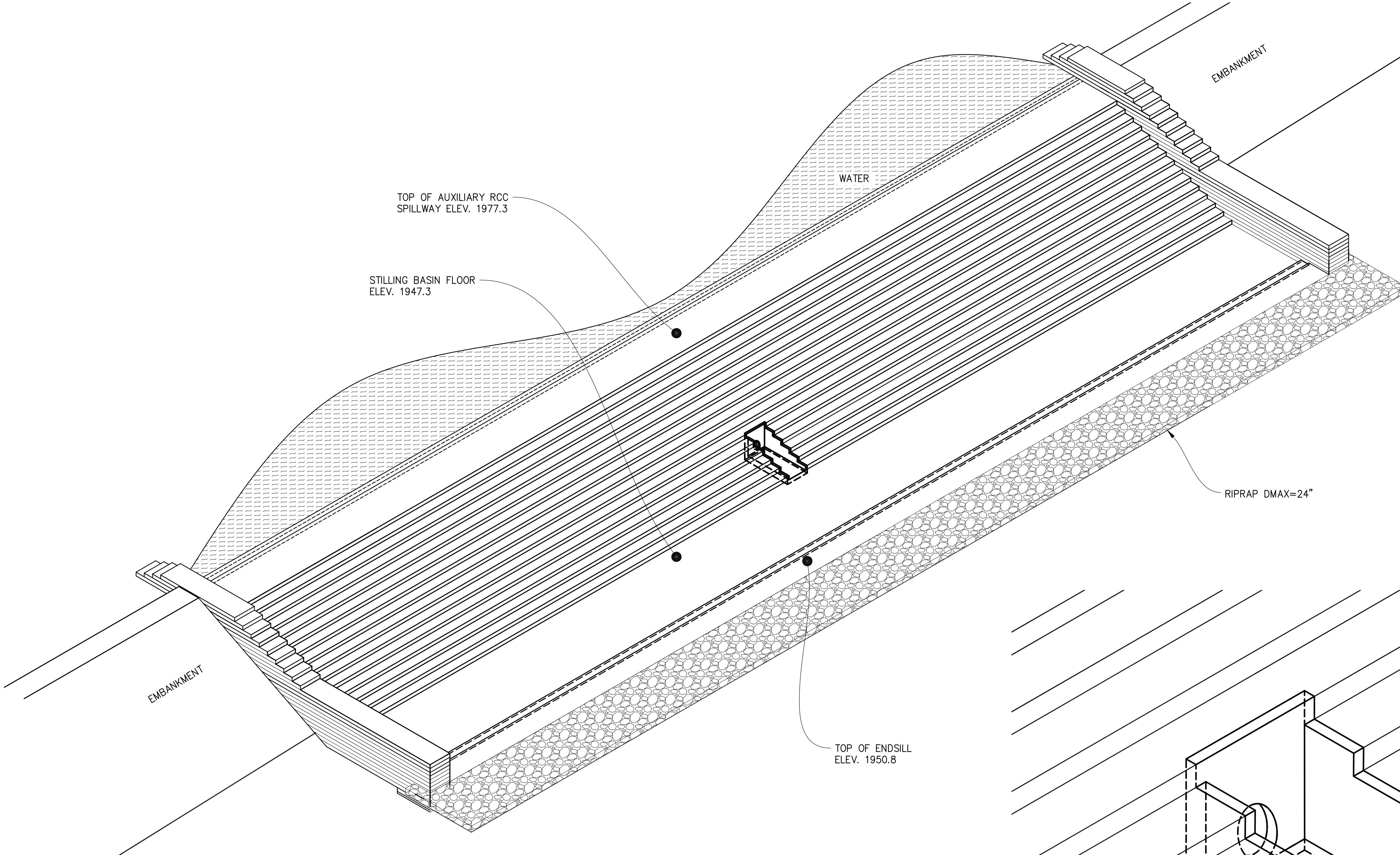
PRINCIPAL SPILLWAY OUTLET – STEEL PLACEMENT
ARS FIELD STATION LAKE – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

USDA United States Department of Agriculture
Natural Resources Conservation Service

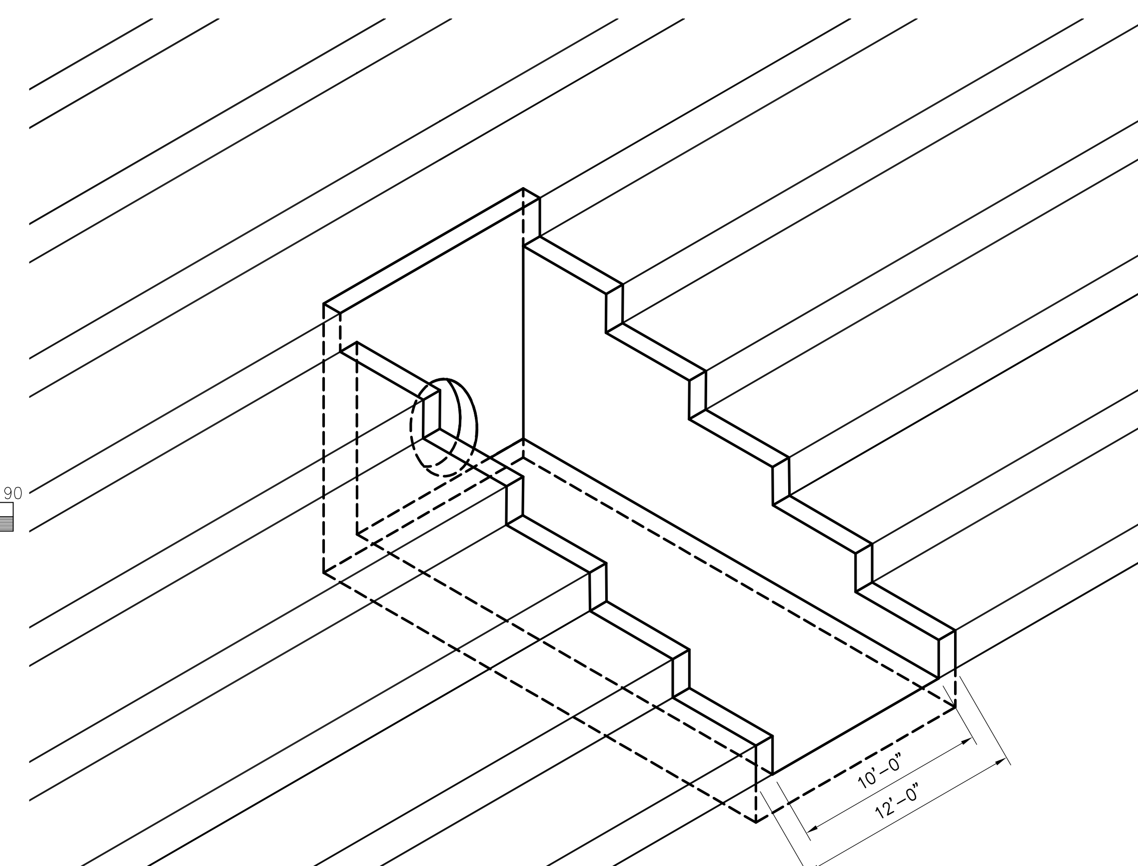
E–File Location:
R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\ctdwgs\PS_Outlet\PS_Outlet_Steel Placement

Drawing No.
OK–437

Sheet 20 of 36



ISOMETRIC VIEW



ISOMETRIC VIEW

CHECK PRINT

Designed	V. Glasgow	01-18
Drawn	K. Dobney	01-18
Revised	K. Dobney	06-18
Approved	J. Chris Stoner	08-18

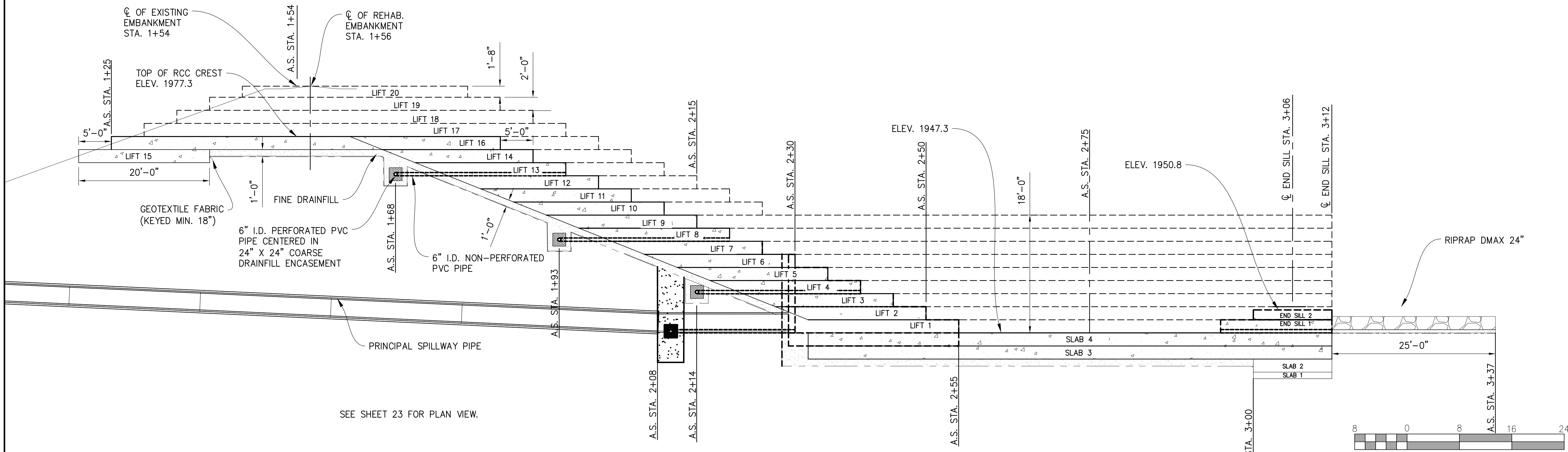
AUXILIARY SPILLWAY – RCC – DETAILS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
Natural Resources Conservation Service

E-File Location:
R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\ARS Embankment_RCC Spillway

Drawing No.
OK-437

Sheet 21 of 36

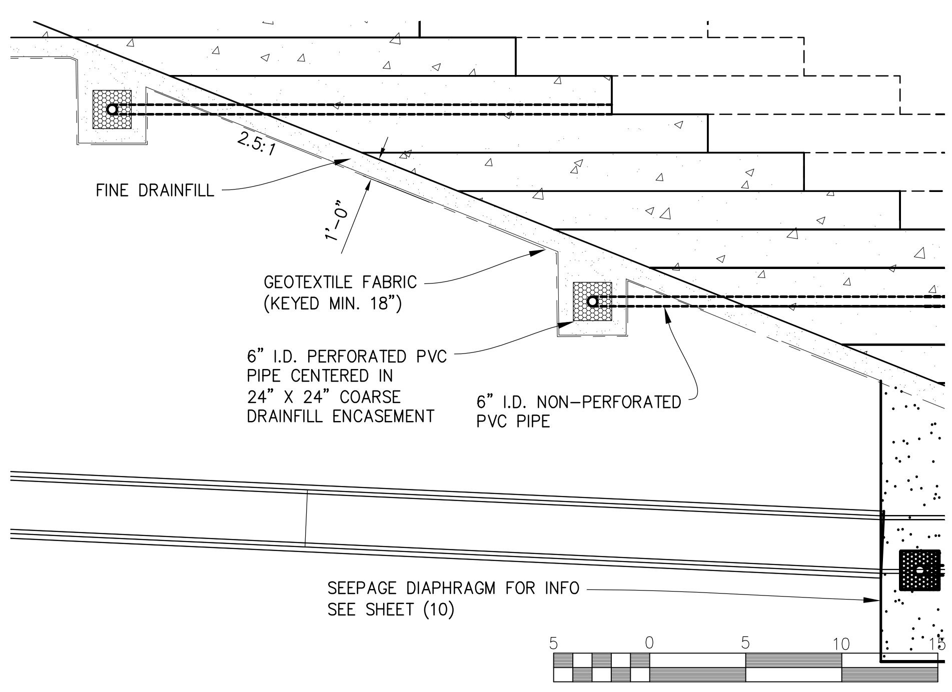


AUXILIARY SPILLWAY RCC PROFILE

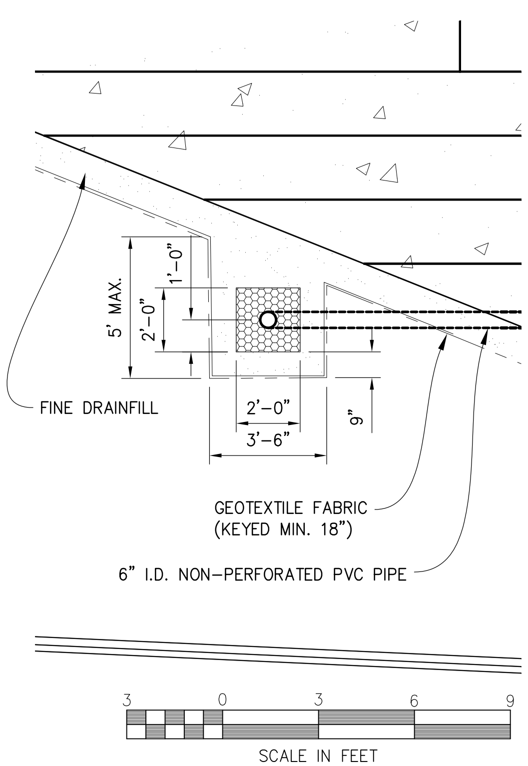
$D_{MAX} = 24"$

RIPRAP GRADATION	
%	SIZE RANGE – LBS
MAX.	1280
90	445–1100
50	160–440
20	10–110
<5	SAND/DUST

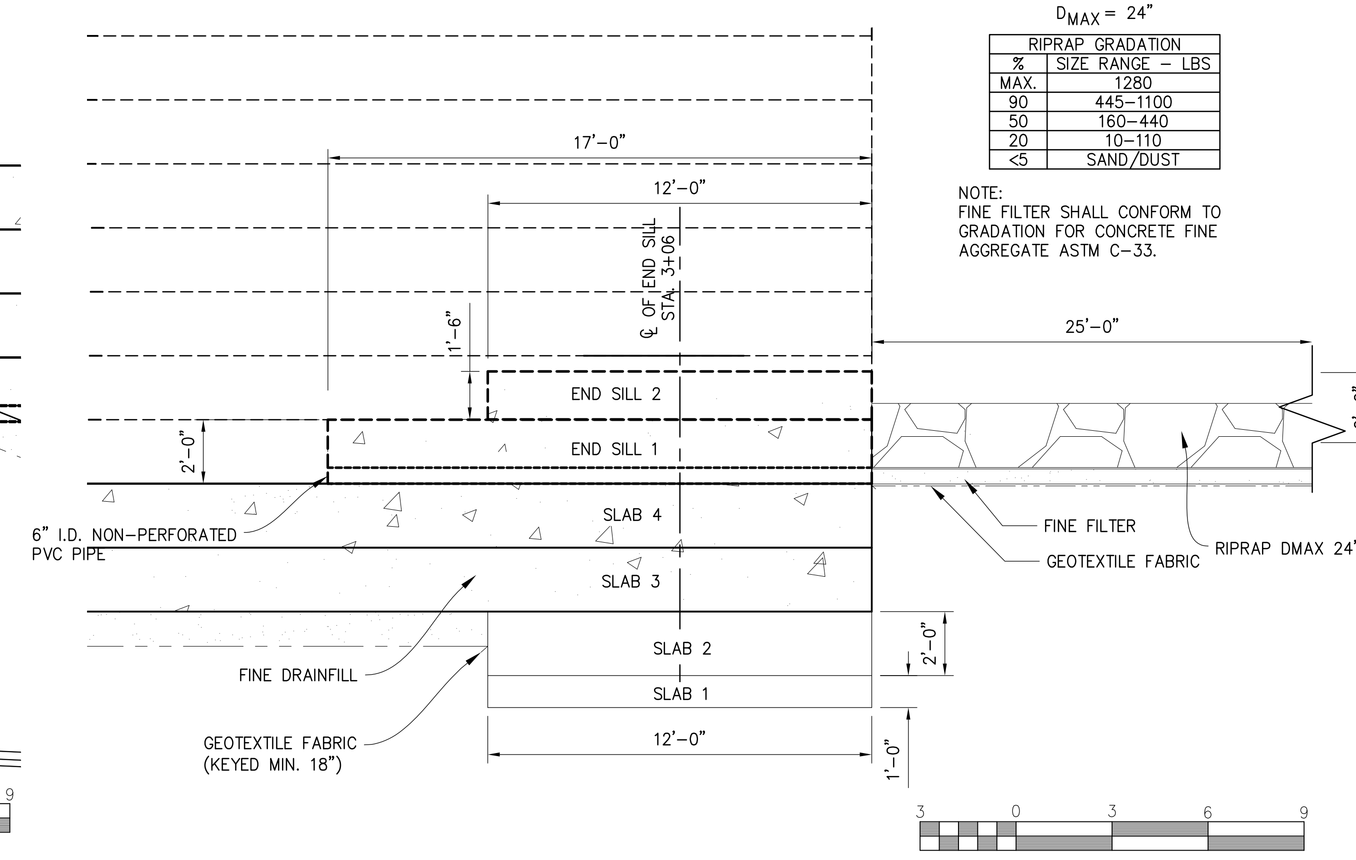
NOTE:
FINE FILTER SHALL CONFORM TO GRADATION FOR CONCRETE FINE AGGREGATE ASTM C-33.



TYP. RCC DRAIN DETAIL



TYP. FONDATION DRAIN DETAIL



END SILL DETAIL

CHECK PRINT

	Date
Designed V. Glasgow	01-18
Drawn K. Dabney	01-18
Revised K. Dabney	06-18
Approved J. Chris Stoner	08-18

AUXILIARY SPILLWAY – RCC – PROFILE & DETAILS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

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Drawing No.
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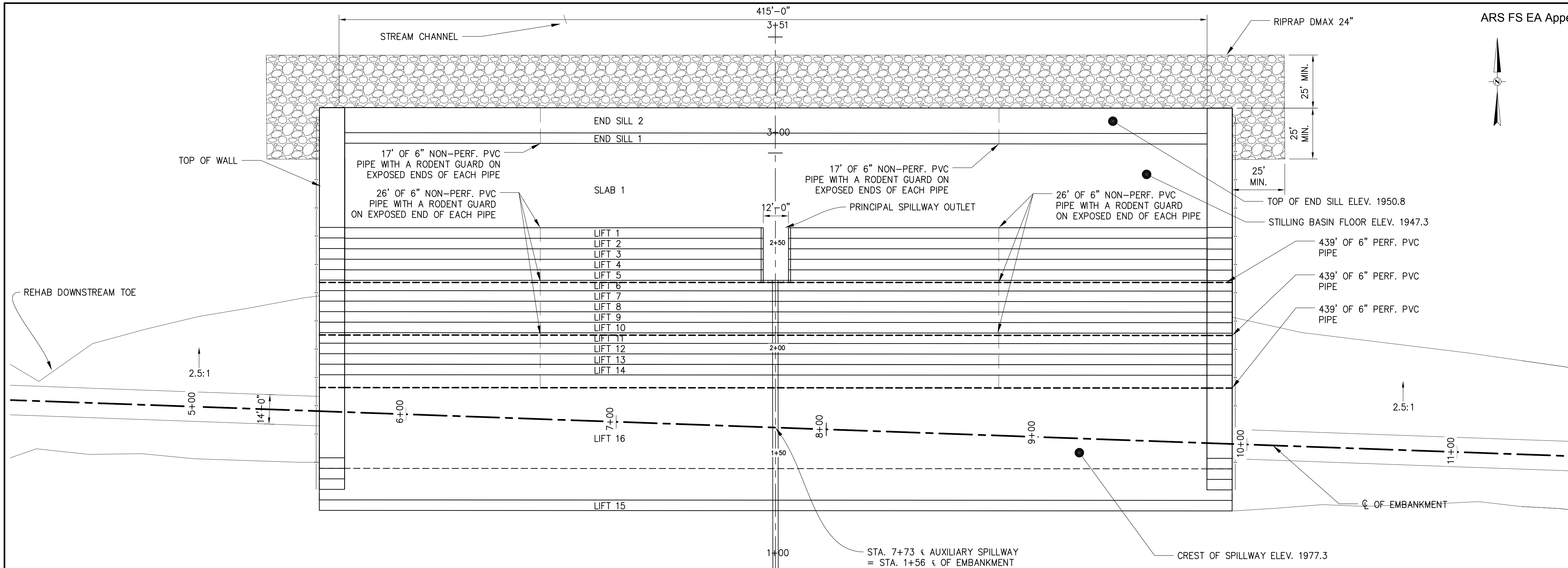
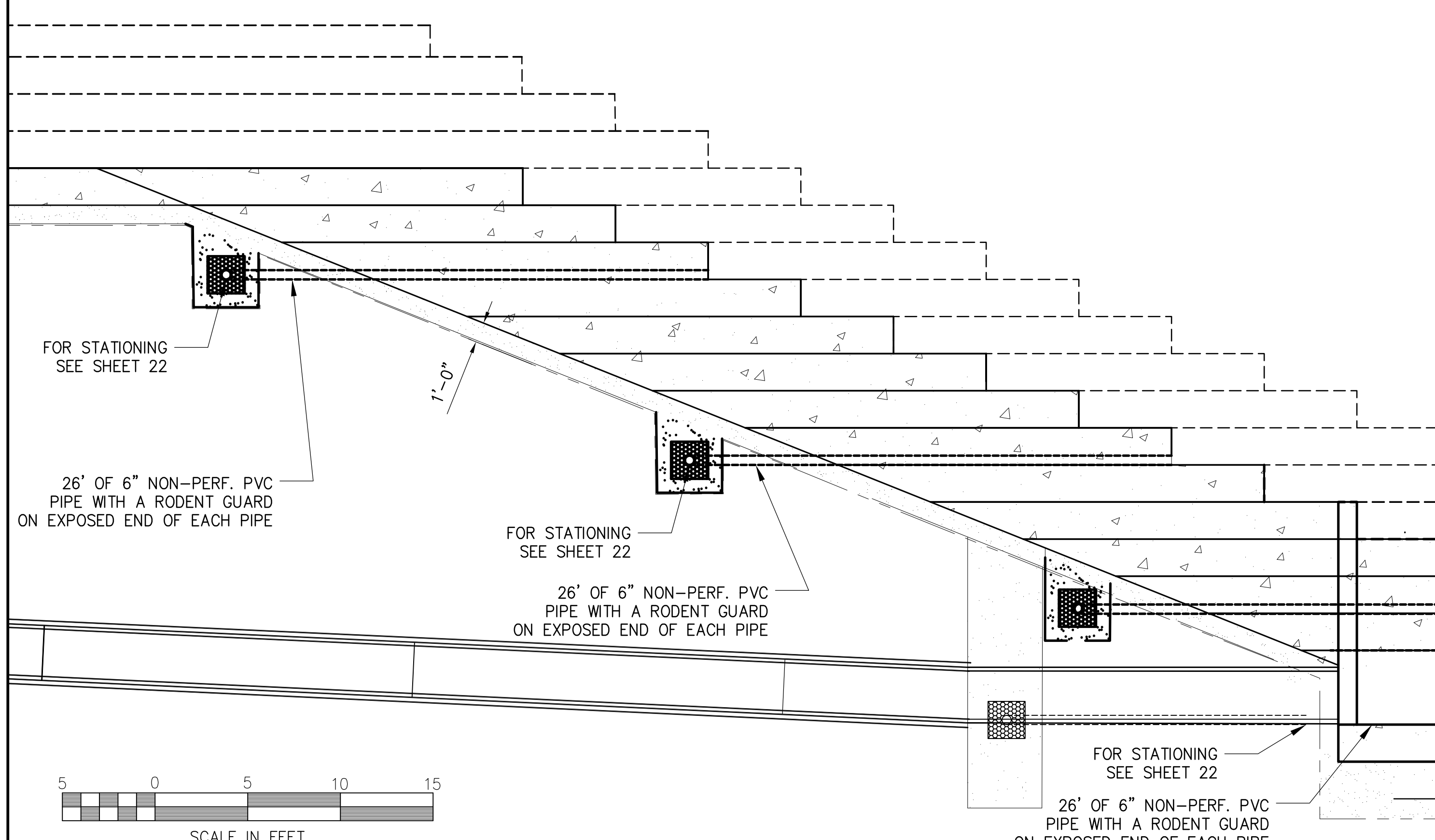
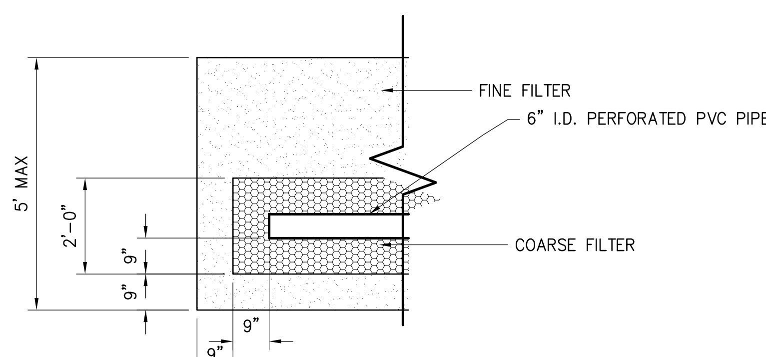
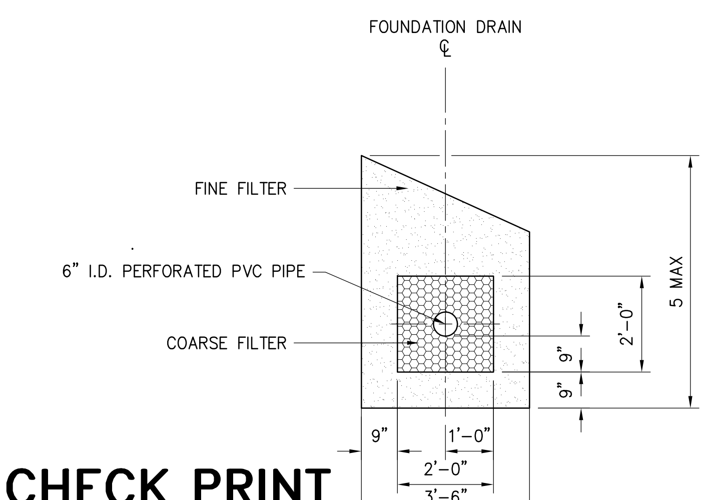


AUXILIARY SPILLWAY RCC PLAN





TYPICAL PROFILE – FILTER END
NTS



TYPICAL SECTION – RCC DRAIN
NTS

CHECK PRINT

	Date
Designed V. Glasgow	01-18
Drawn K. Dobney	01-18
Revised K. Dobney	06-18
Approved J. Chris Stoner	08-18

AUXILIARY SPILLWAY – RCC – PLAN
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

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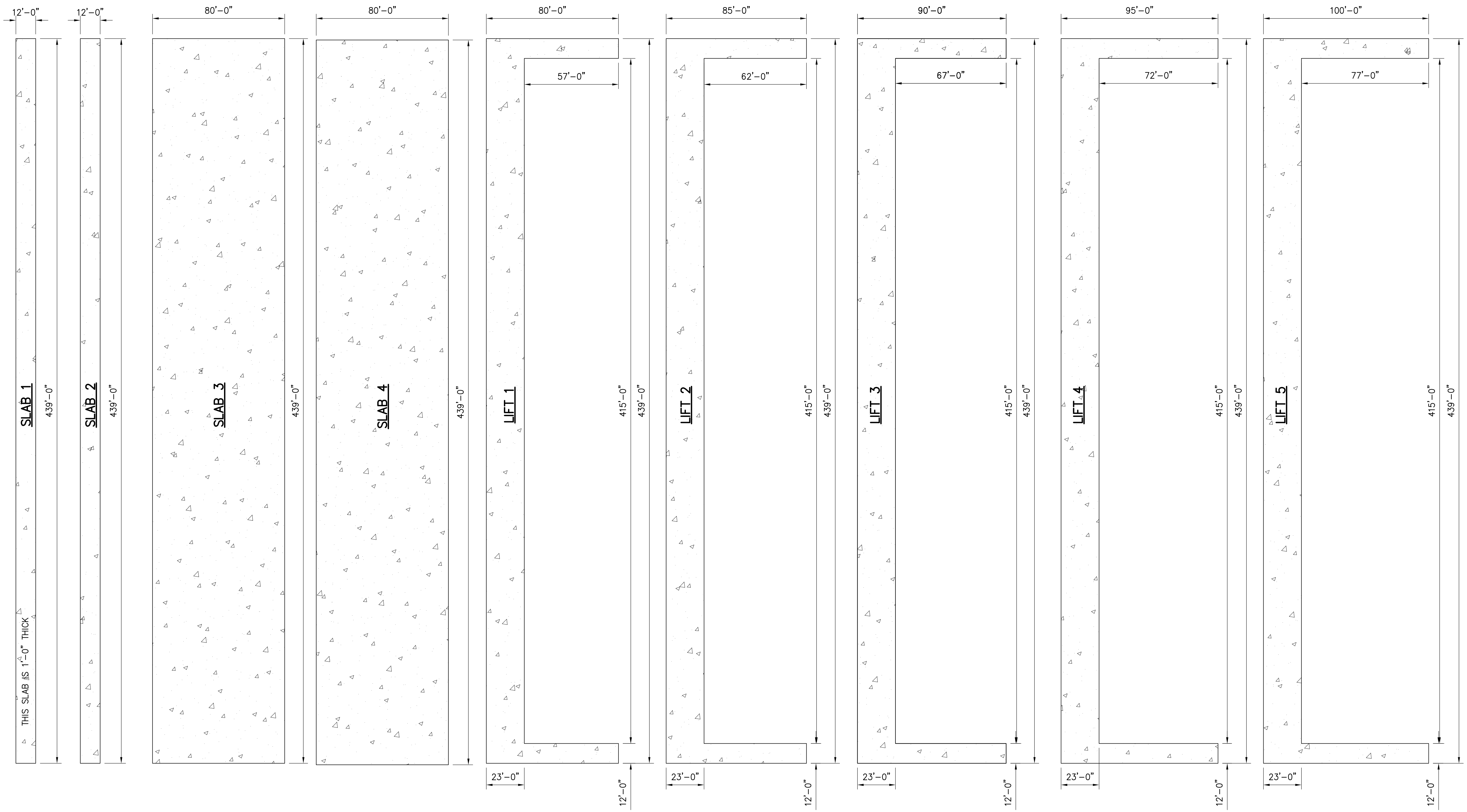

NOTE:
ALL SLABS & LIFTS ARE 2'-0" THICK
ROLLER COMPACTED CONCRETE U.N.O.

CHECK PRINT

30 0 30 60 90
SCALE IN FEET

Designed	V. Glasgow	01-18
Drawn	K. Dobney	01-18
Revised	K. Dobney	06-18
Approved	J. Chris Stoner	08-18

AUXILIARY SPILLWAY – RCC – LIFTS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
Natural Resources Conservation Service

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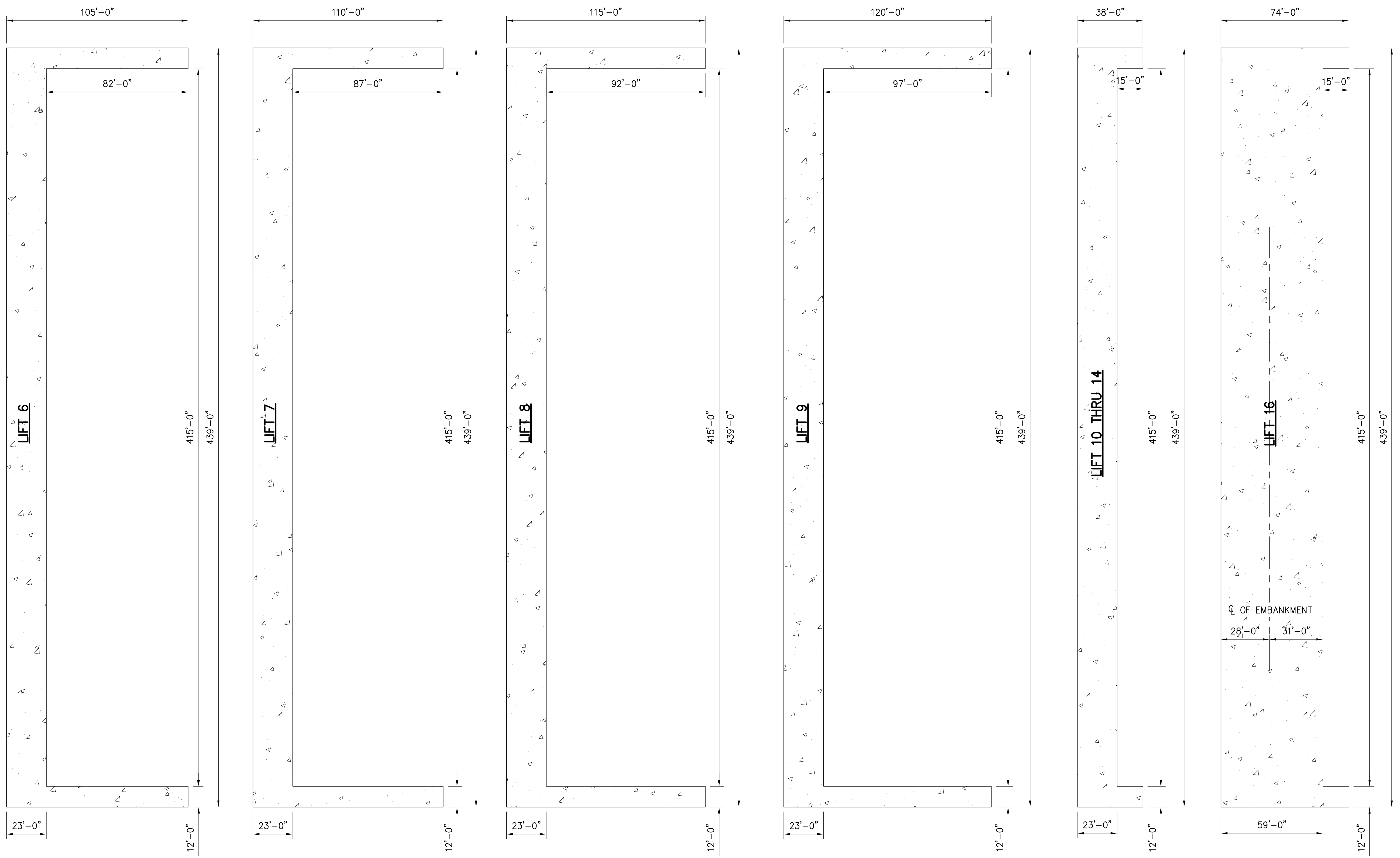
Drawing No.
OK-437



NOTE:
ALL SLABS & LIFTS ARE 2'-0" THICK ROLLER COMPACTED CONCRETE U.N.O.

CHECK PRINT

30 0 30 60 90
SCALE IN FEET

Designed	V. Glasgow	01-18
Drawn	K. Dobney	01-18
Revised	K. Dobney	06-18
Approved	J. Chris Stoner	08-18

AUXILIARY SPILLWAY - RCC - LIFTS
A.R.S. FIELD STATION LAKE DAM - REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
Natural Resources Conservation Service

E-File Location:
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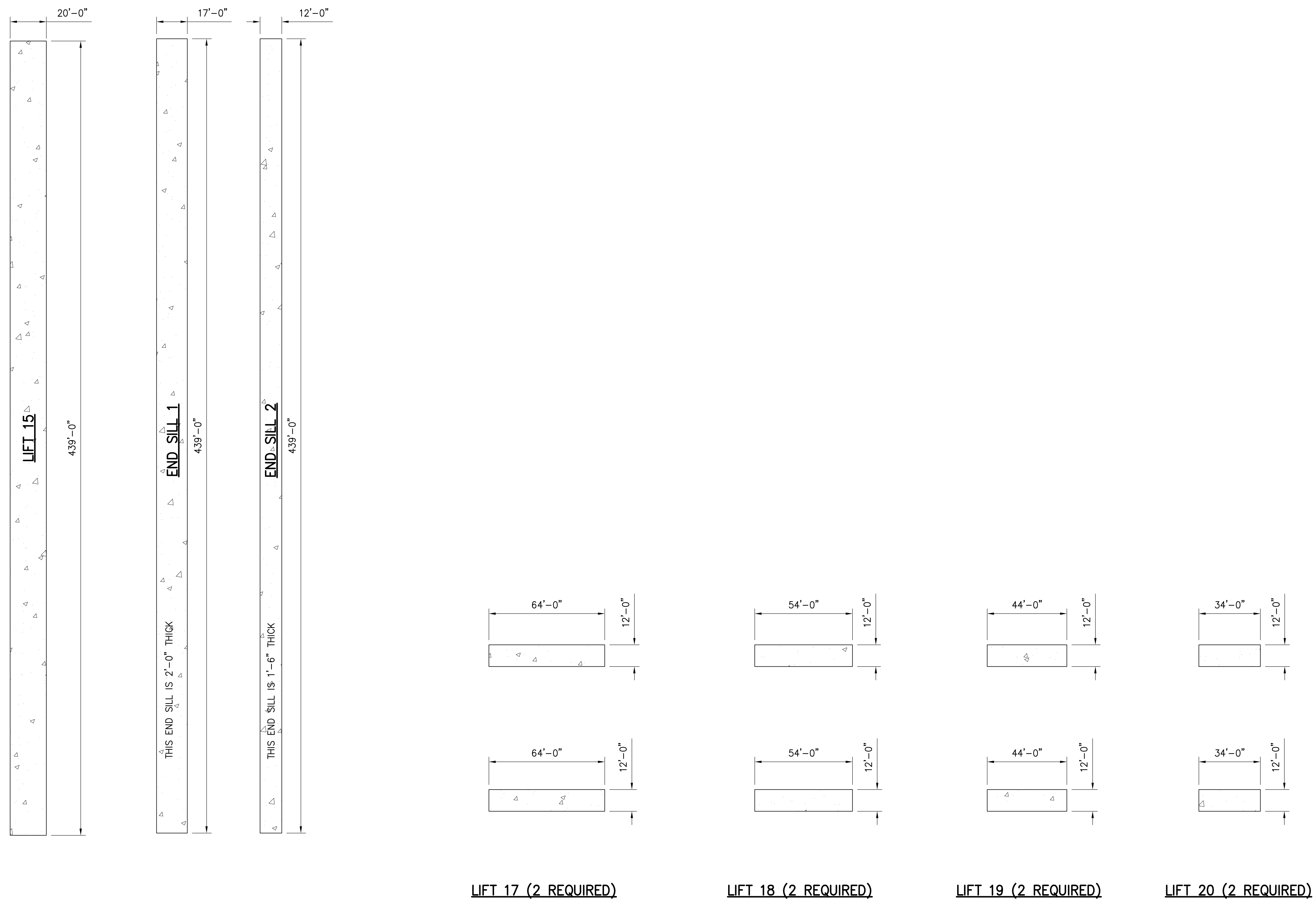
Drawing No.
OK-437



NOTE:
ALL SLABS & LIFTS ARE 2'-0" THICK
ROLLER COMPACTED CONCRETE U.N.O.

CHECK PRINT

30 0 30 60 90
SCALE IN FEET

Designed	V. Glasgow	01-18
Drawn	K. Dobney	01-18
Revised	K. Dobney	06-18
Approved	J. Chris Stoner	08-18

Date

AUXILIARY SPILLWAY – RCC – LIFTS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

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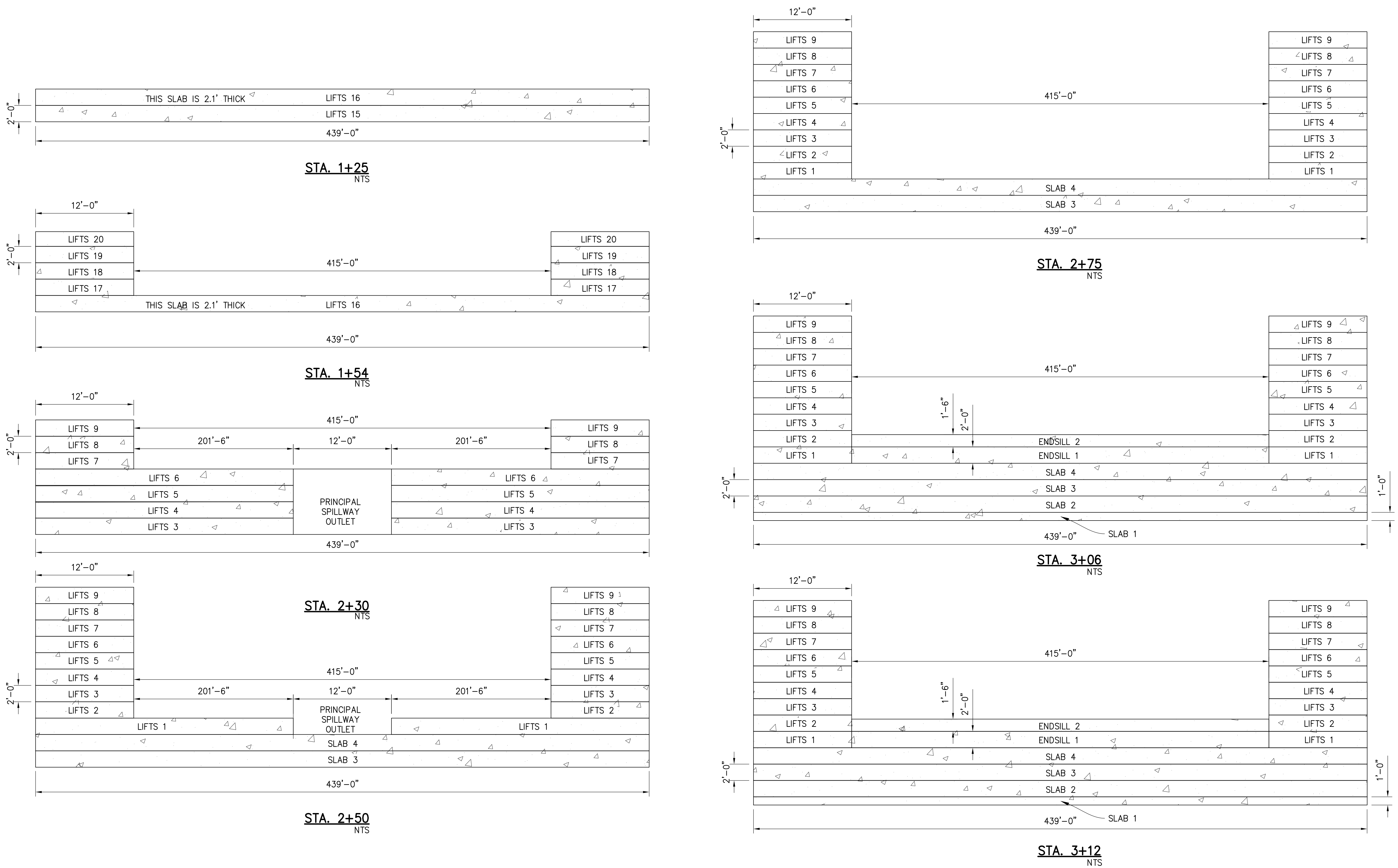
Drawing No.
OK-437

Sheet 26 of 36



CHECK PRINT

RCC – AUXILIARY SPILLWAY CROSS SECTIONS
NTS

Date		
Designed	V. Glasgow	01-18
Drawn	K. Dobney	01-18
Revised	K. Dobney	06-18
Approved	J. Chris Stoner	08-18

AUXILIARY SPILLWAY – RCC – SECTIONS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

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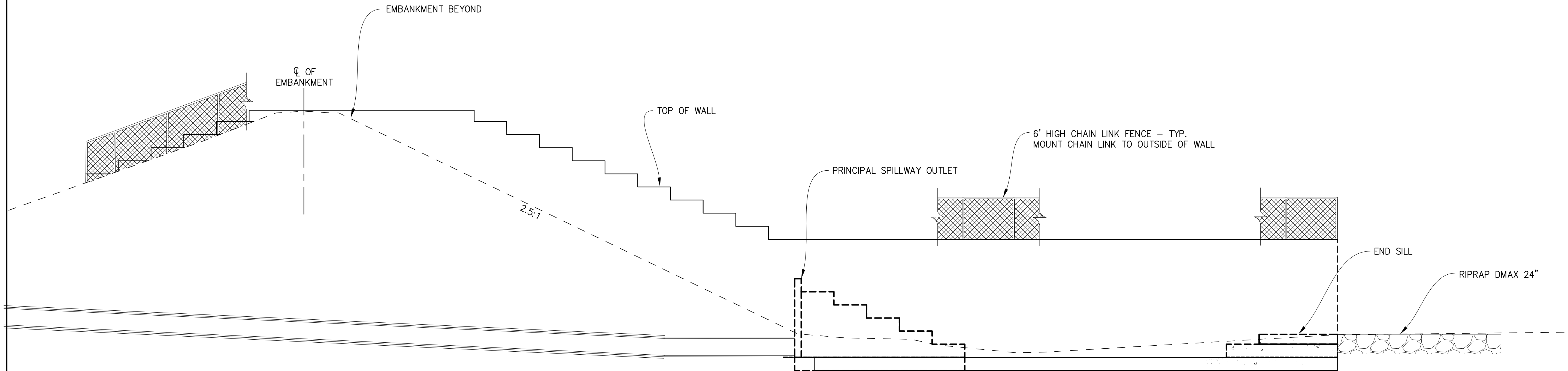
R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\ARS Embankment_RCC Spillway

Drawing No.
OK-437

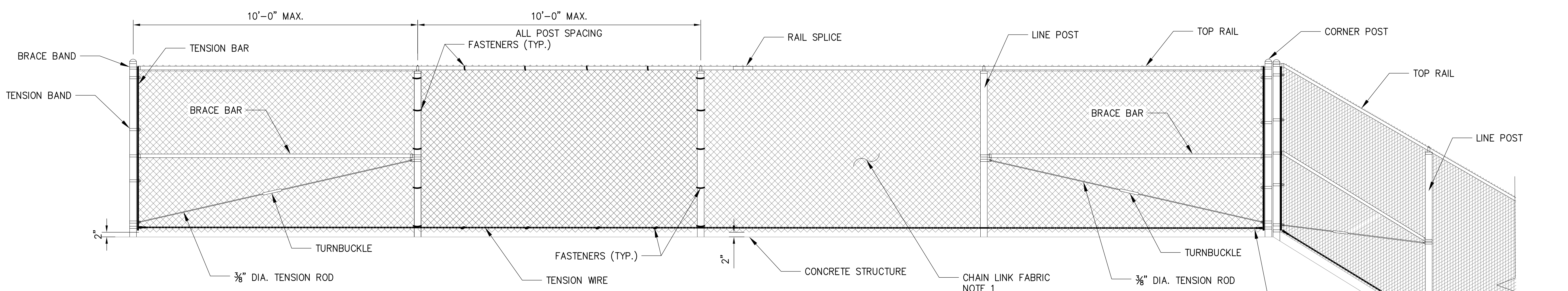
Sheet 27 of 36



EST. LENGTH OF FENCING 395'-0".

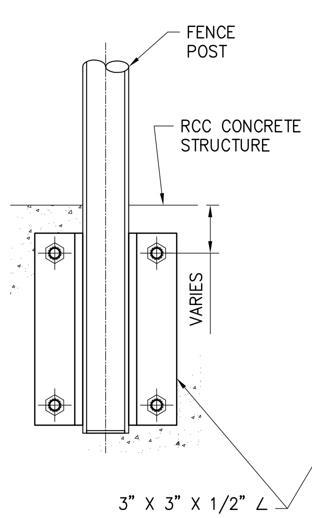
CHAIN LINK FENCE DETAIL

NOTE: CONTRACTOR MAY BUILD INDIVIDUAL FENCE PANELS.

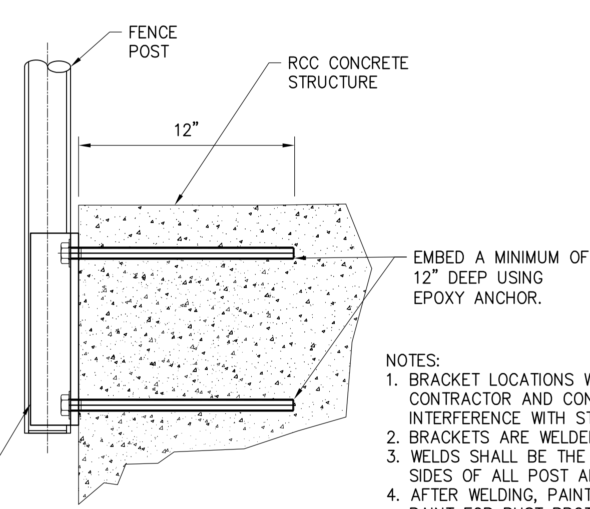


TYPICAL CHAIN LINK FENCE DETAIL

NOTE:
1. ATTACH FABRIC TO ALL FENCE AT 12" INTERVALS VERTICALLY AND AT 20" HORIZONTALLY.
2. CONTRACTOR MAY BUILD INDIVIDUAL FENCE PANELS.

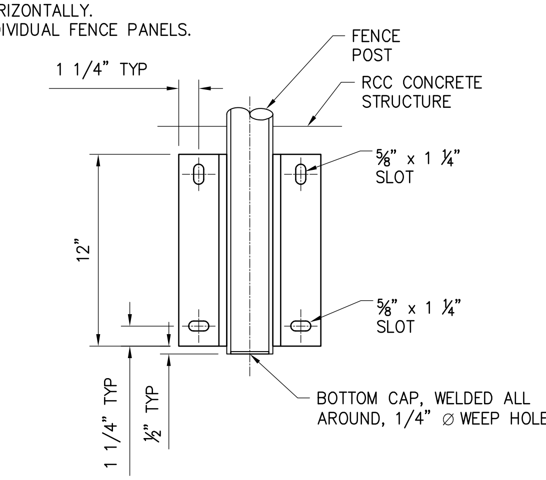


FRONT VIEW

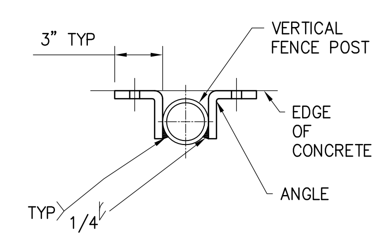


SIDE VIEW

NOTES:
1. BRACKET LOCATIONS WILL BE FIELD VERIFIED BY THE CONTRACTOR AND CONTRACTING OFFICER TO AVOID INTERFERENCE WITH STEEL REINFORCEMENT BARS.
2. BRACKETS ARE WELDED TO PIPE. SEE CALLOUT ON DETAIL.
3. WELDS SHALL BE THE FULL LENGTH OF ANGLE ON BOTH SIDES OF ALL POST ANGLE BRACKETS.
4. AFTER WELDING, PAINT WELDED AREA WITH GALVANIZE-TYPE PAINT FOR RUST PROTECTION.
5. NOTE: CONTRACTOR MAY BUILD INDIVIDUAL FENCE PANELS.



FRONT VIEW – ANGLE BRACKET



PLAN VIEW – ANGLE BRACKET

CHECK PRINT

Designed	V. Glasgow	01–18
Drawn	K. Dobney	01–18
Revised	K. Dobney	06–18
Approved	J. Chris Stoner	08–18

AUXILIARY SPILLWAY – RCC – FENCING & DETAILS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

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Drawing No.
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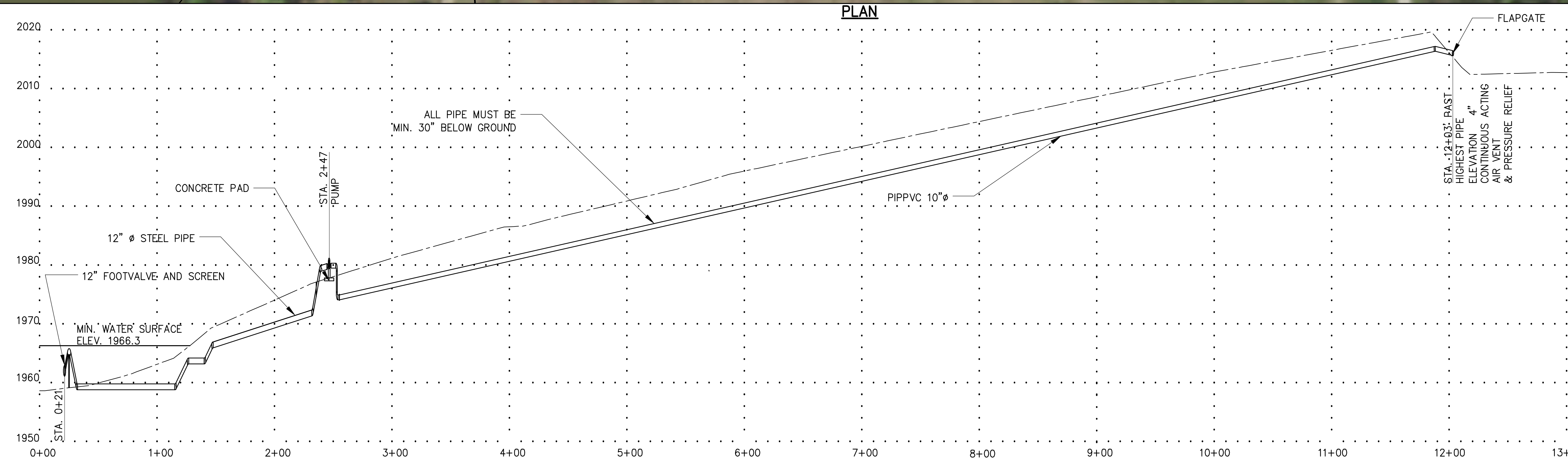
Sheet 28 of 36

PLAN



IRRIGATION PROFILE – REHAB IRRIGATION PIPE

NTS

CHECK PRINT

Designed	D. Livingston	06–18
Drawn	K. Dobney	09–18
Revised	A. Lane	09–18
Approved	J. Chris Stoner	04–18

REHAB. IRRIGATION PIPE
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

USDA United States Department of Agriculture
Natural Resources Conservation Service

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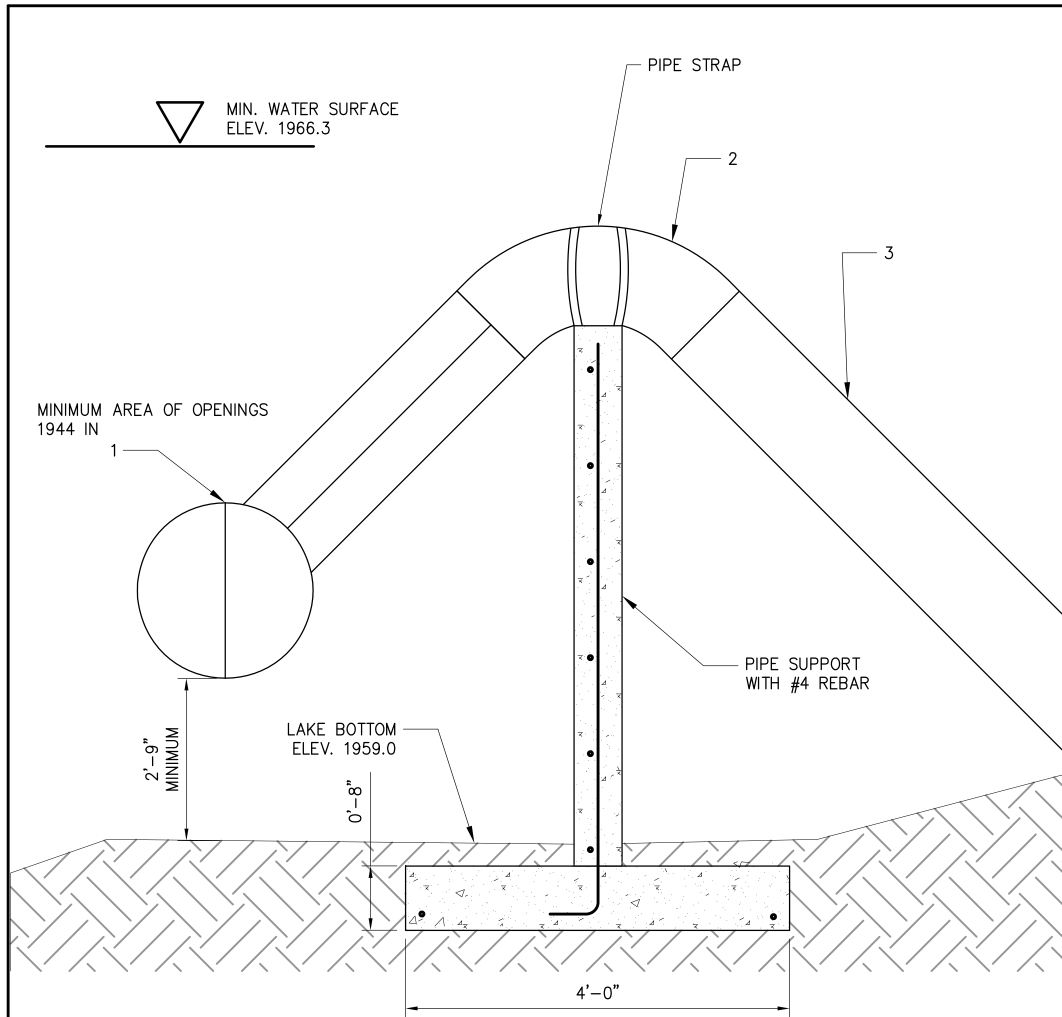
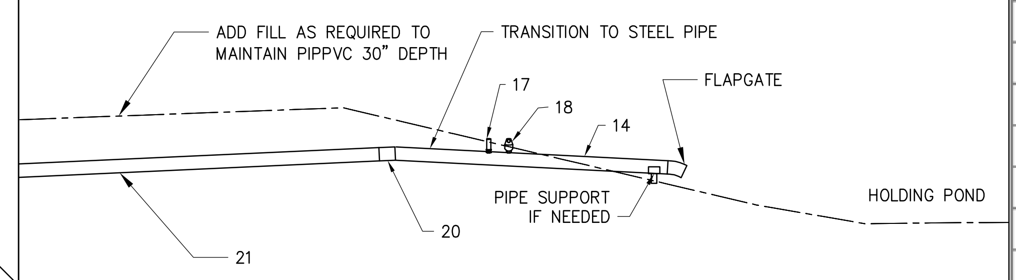
Drawing No. OK–437

Sheet 29 of 36



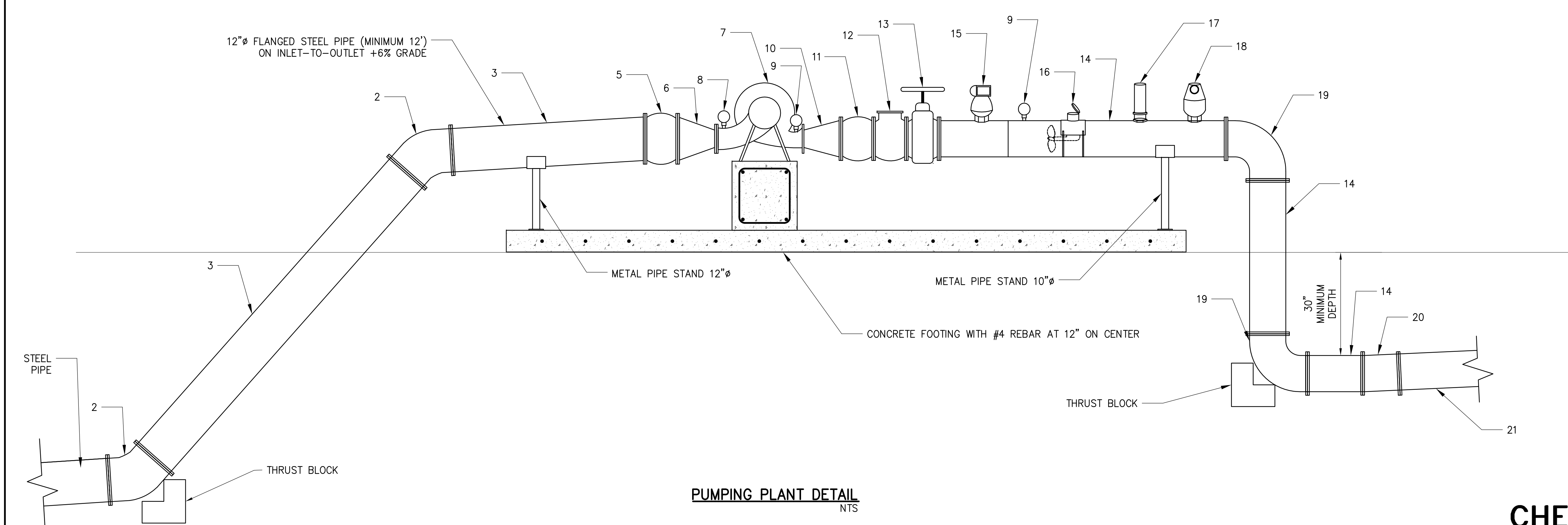
INTAKE DETAIL
NTS



DISCHARGE DETAIL
NTS

Bill of Materials

Item	Mark	Quanity	Unit
12" Foot Valve and Screen	1	1	Each
12" Long Radius 90° Bend	2	1	Each
12" Flanged Steel Pipe	3		Lin. Ft.
12" 45° Bend	4	2	Each
12" Expansion Joint	5	1	Each
12" to 6" Eccentric Reducer	6	1	Each
340 HSC American Marsh Pump	7	1	Each
30 in Hg Vacuum Gauge	8	1	Each
50 psi Pressure Gauge	9	2	Each
5" to 10" Concentric Reducer	10	1	Each
10" Expansion Joint	11	1	Each
10" Check Valve	12	1	Each
10" Gate Valve	13	1	Each
10" Flanged Steel Pipe	14		Lin. Ft.
4" Aluminum Air Vent	15	1	Each
10" Propeller Flowmeter	16	1	Each
4" Pressure Relief Valve (35 psi)	17	2	Each
4" Continuous Acting Air Vent	18	2	Each
10" Long Radius 90° Bend	19	2	Each
10" Weld-On Coupler	20	1	Each
10" PIP PVC SDR-81 50 psi	21		Lin. Ft.



PUMPING PLANT DETAIL
NTS

CHECK PRINT

Designed	D. Livingston	06-18
Drawn	K. Dobney	06-18
Revised	A. Lane	09-18
Approved	J. Chris Stoner	04-18

IRRIGATION PUMPING PLANT DETAILS
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
Natural Resources Conservation Service

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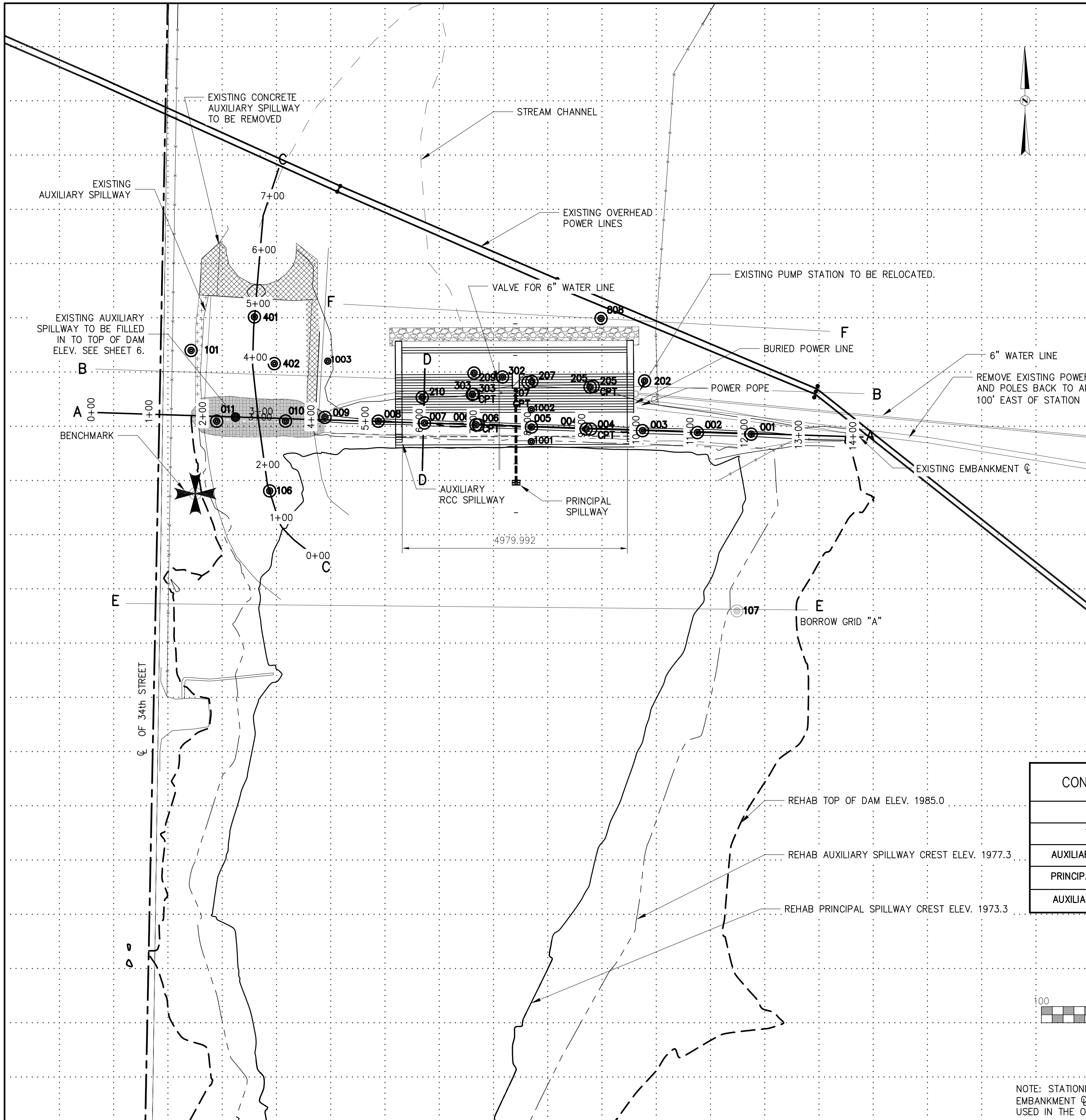
R:\XXXXXXX

Drawing No.
OK-437

Sheet 30 of 36



48 hours before you dig
CALL OKIE
1-800-522-6543

OKLAHOMA ONE - CALL SYSTEM

An effort has been made to locate and show approximate location of underground utilities lines. Buried utilities are not necessarily shown. It is the Contractor's responsibility to locate and preserve all utility services.

Contractor is responsible for contacting all utility companies prior to construction.

TEST HOLE NUMBERING SYSTEM	
Centerline of Dam	001–099
Borrow Area	101–199
Downstream Toe	201–299
Principal Spillway	301–399
Existing Auxiliary Spillway	401–499
Relief Wells	501–599
Downstream	801–899
Hand Auger	1001–1999
Trench or Pit	2001–2999
Outcrops	3001–3999

CONDITIONS EXISTING VS. REHAB

CONTROL	ORIGINAL	REHAB
TOP OF DAM	1985.0	1985.0
AUXILIARY SPILLWAY CREST	1973.6	1977.3
PRINCIPAL SPILLWAY CREST	1973.3	1973.3
AUXILIARY SPILLWAY WIDTH	200'	415'

CHECK PRINT

100 0 100 200 300
SCALE IN FEET

NOTE: STATIONING HAS BEEN CHANGED TO REFLECT REHAB EMBANKMENT ℄ STATIONS. THIS DIFFERS FROM WHAT WAS USED IN THE ORIGINAL GEOLOGIC INVESTIGATION FROM 2011.

LEGEND

SYMBOLS

UNCONSOLIDATED MATERIAL

gravel; sand; silt; clay
gravel, sandy; sand, gravelly; silt, gravelly; clay, gravelly
gravel, silty; sand, silty; silt, sandy; clay, sandy
gravel, clayey; sand, clayey; silt, clayey; clay, silty

CONSOLIDATED MATERIAL

sandstone Ss.; shale Sh.; siltstone Ms; limestone Ls.
claystone Cs

OTHER SYMBOLS

hole logged only; strike and dip
hole sampled; pit or trench
CPT; hand augered

ABBREVIATIONS

bld.	boulders (>12")	mas.	massive
calc.	calcareous	med.	medium
cav.	cavities	mod.	moderately
cmt.	cemented	n.r.	no recovery
cse.	coarse	per.	permeable
cbl.	cobbles (3"–12")	po.	poorly
c.t.	caved to	resid.	residual
ds.	dense	sl/.	slightly
d.s.	downstream	sft.	soft
fn.	fine	stf.	stiff
frm.	firm	s/.	some
frac.	fractured	t.b.	thin–bedded
frg.	fragments	tr.	trace
fri.	friable	uad	unable to auger deeper
int.	interbedded		
grn.	grain	u.s.	upstream
gyp.	gypsic/gypsum	v/.	very
hd.	hard	w/.	with
h.	highly	wea.	weathered
lam.	laminated	w.l.	(date) static water line
lse.	loose	W.L.	water level (date) during drilling

C	clay, clayey	O	organic
G	gravel, gravelly	P	poorly graded
M	silt, silty	S	sand, sandy
		W	well graded

UNIFIED SOIL CLASSIFICATION SYSTEMS SYMBOLS

GW	Well graded gravels; gravel–sand mixtures
GP	Poorly graded gravels
GM	Silty gravels; gravel–sand–silt mixtures
GC	Clayey gravels; gravel–sand–clay mixtures
SW	Well graded sands; sand–gravel mixtures
SP	Poorly graded sands
SM	Silty sand
SC	Clayey sands; sand–clay mixtures
ML	Silts with liquid limit (LL) of 50 or less
MH	Silts with LL above 50
CL	Clays with LL of 50 or less
CH	Clays with LL above 50
OL	Organic silts and clays with LL of 50 or less
OH	Organic silts and clays with LL above 50

The soil classification shown on this sheet are those made by the operations geologist. They do not in all cases agree with the classification made by the Soil Mechanics Laboratory.

Additional soil and foundation investigation data together with laboratory test data are available in NRCS field construction office for review by prospective bidders.

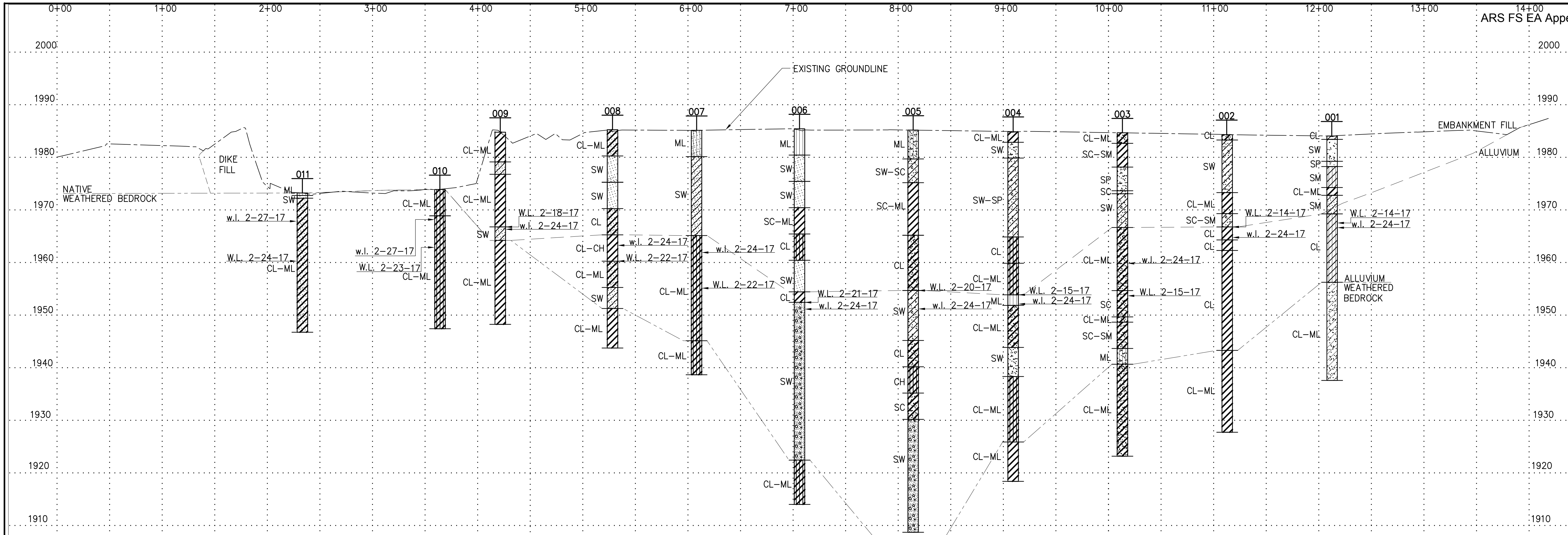
		Date
Designed	V. Glasgow	07–17
Drawn	K. Dabney	08–17
Revised	K. Dabney	09–18
Approved	J. Chris Stoner	09–18

PLAN FOR GEOLOGIC INVESTIGATION
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
Natural Resources Conservation Service

E–File Location:

Drawing No. OK–437



PROFILE A–A — CENTERLINE TOP OF EXISTING DAM

011
- tr.O
- S
- sft., sl/.S, blocky

010
- M, tr.O, wea. bedrock @ surface
- M

009
- tr.calc.nodules
- sl/.C
- C
- sl/.C
- blocky

008
- sl/.S, tr.O, tr.calc. nodules
- fn.
- h.cmt., calc.nodules
- sl/.S, hd.
- tr.O, sft.
- S
- sl/.C.
- hd. blocky

007
- S, tr.O, tr.calc. nodules
- fn., h.cmt, sl/.C
- M
- M, tight, hd., blocky

006
- M
- tr.calc.nodules
- strong calc.cmt.
- sl/.calc.cmt.,tr.calc. nodules
- sl/.M, hd., tr.calc. nodules
- fn.
- tr.O
- fn.S, tr.G
- M, blocky

005
- S, C
- v/.C, v/.calc., sl/.cmt.
- sl/.cmt.calc.nodules
- S
- C
- sl/.S, good C
- sl/.M, tight
- tr.fn.S
- tr.G, tr.C

004
- C
- S
- tr.pocketsC, tr.calc. nodules
- M
- M
- tr.calc.nodules
- tr.S
- S
- M
- blocky

003
- v/.S, tr.O, calc.
- fn.grn.,S pockets
- fn.lse.
- fn.tr.C, lse.
- fn.tr.S
- S, tr.calc.nodules, dilatant when wet
- S
- S
- S
- S, mod.dilatancy
- tr.fn.S

002
- O, S pockets, calc.
- sl/.C, tr.calc.nodules
- calc., tr.calc.nodules
- tr.fn.S
- tr.O
- tr.fn.S
- sl/.M tr.calc. nodules, sft.
- hd., lam.

001
- S,tr.O
- fn.S
- fn.S
- sl/.C, calc.nodules
- calc.
- sl/.C, calc.nodules
- sft.M, calc.nodules, tr.fn.S
- tr.fn.C, mod.dilatancy

NOTE: SEE SHEET 32 FOR LEGEND, ABBREVIATIONS, AND CLASSIFICATION SYMBOLS.

CHECK PRINT

Designed	V. Glasgow	08–17
Drawn	K. Dabney	08–17
Revised	K. Dabney	09–18
Approved	J. Chris Stoner	09–18

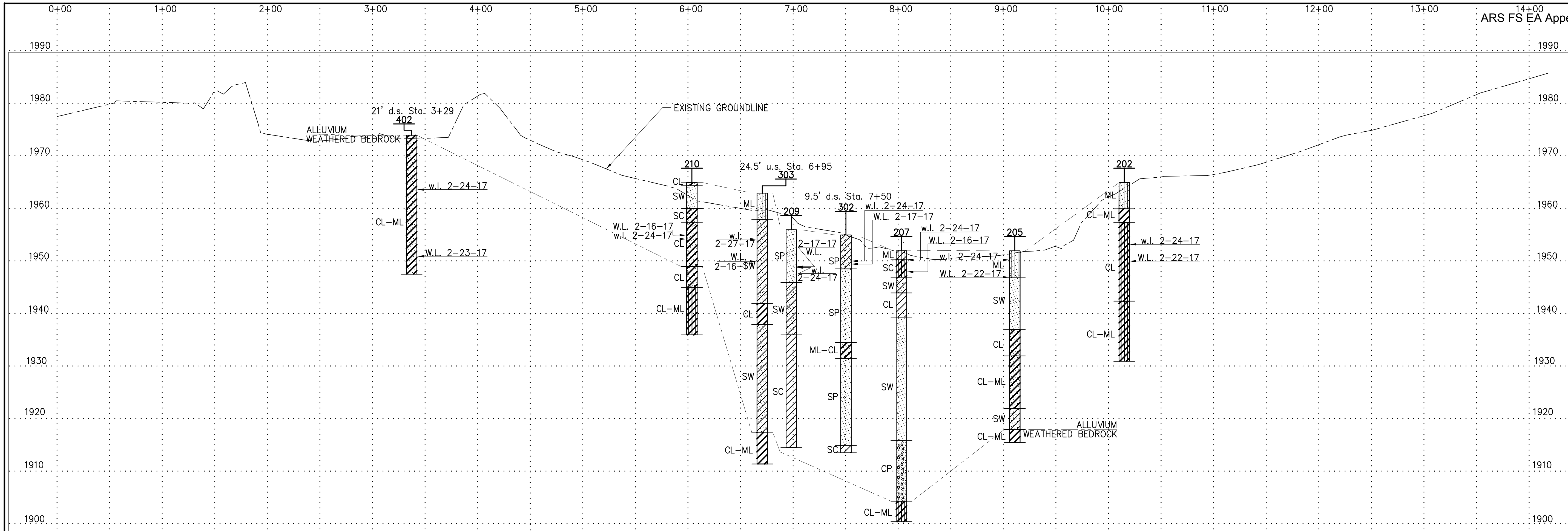
GEOLOGIC INVESTIGATION – TOP OF DAM PROFILE
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
Natural Resources Conservation Service

E–File Location: R:\All Repairs\ARS Field Station Lake\Design–Rehab\Drawings\ARS Woodward_GI Sheets.dwg

Drawing No. OK–437

ARS FS EA Appendix C



PROFILE B-B – DOWNSTREAM TOE
APPROXIMATELY 81' DOWNSTREAM FROM CENTERLINE OF DAM

303
- S
- heaving S, tr.O
- sl/.C
- C
- fn., tr.C pockets
- tr.calc.nodules
- blocky

302
- fn., sl/.C, tr.O
- tr.calc.nodules
- sl/.S
- tr.calc.nodules
- int.S&C layering, tr.G

402
- sl/.S, hd., blocky

210
- S
- S fn.
- int.fn.S&C seams
- sl/.S, tr.calc.nodules
- good const. S
- M, delatant

209
- heaving S, fn.
- cse., tr.S
- tr.calc.G seams

207
- tr.O, C
- M, tr.O
- sl/.C, tr.calc.nodules
- strong decay odor, tight, tr.O
- tr.calc.nodules
- heaving S, fn.
- G, tr.O, tr.calc.nodules
- blocky, sl/.M

205
- S, tr.G, tr.calc. nodules
- S fn.
- tr.S, sft.
- sft., tr.S pockets
- fn. sl/.C
- hd. blocky

202
- sl/.S
- C
- sft. , sl/.M, tr.calc. nodules
- sft., M, tr.calc. nodules

NOTE: SEE SHEET 32 FOR LEGEND, ABBREVIATIONS, AND CLASSIFICATION SYMBOLS.

CHECK PRINT

Designed V. Glasgow Date 08-17
Drawn K. Dabney 08-17
Revised K. Dabney 09-17
Approved J. Chris Stoner 09-18

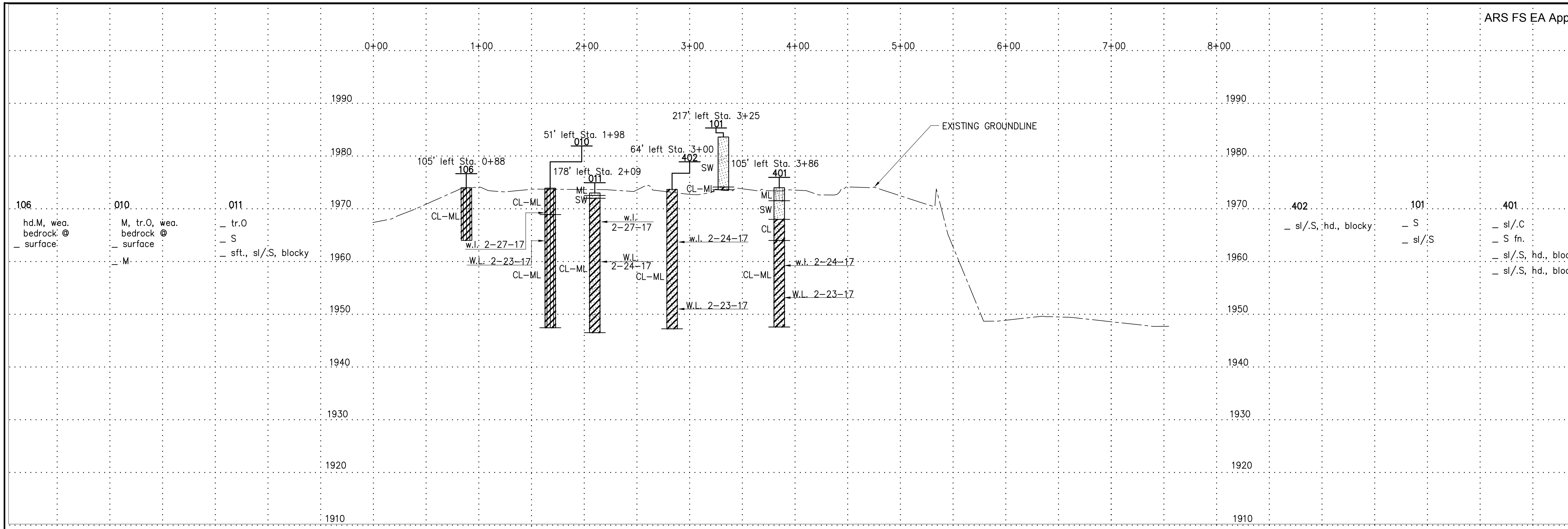
GEOLOGIC INVESTIGATON – DOWNSTREAM TOE PROFILES
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
USDA
Natural Resources Conservation Service

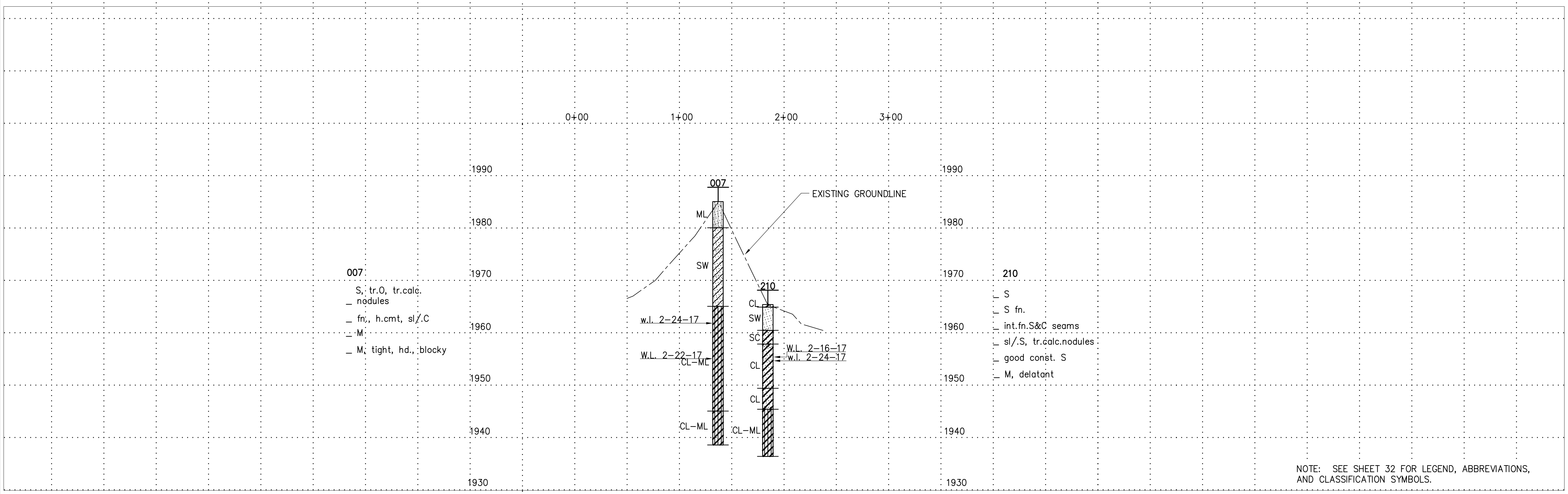
E-File Location:

Drawing No. OK-437

Sheet 33 of 36



PROFILE C–C – ℄ OF AUXILIARY SPILLWAY



PROFILE D–D – EXISTING PRINCIPAL SPILLWAY

NOTE: SEE SHEET 32 FOR LEGEND, ABBREVIATIONS, AND CLASSIFICATION SYMBOLS.

CHECK PRINT

		Date
Designed	V. Glasgow	08–17
Drawn	K. Dabney	08–17
Revised	K. Dabney	09–18
Approved	J. Chris Stoner	09–18

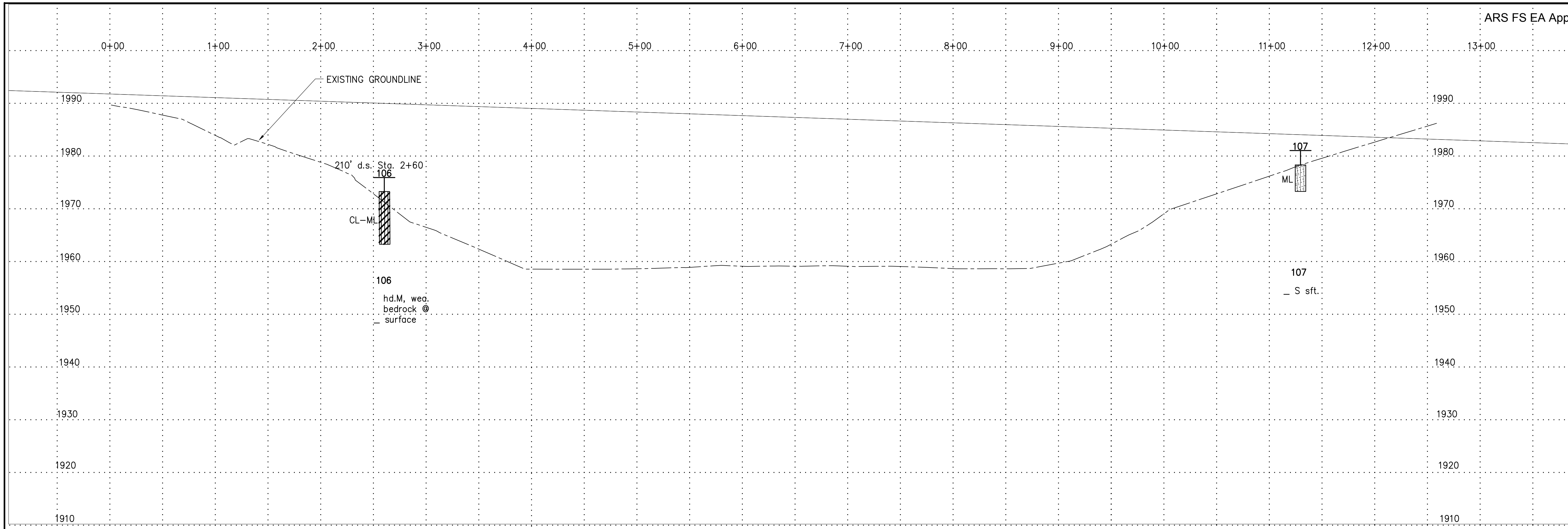
PROFILE – EXISTING ℄ AUXILIARY SPILLWAY & EMBANKMENT
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

USDA United States Department of Agriculture
Natural Resources Conservation Service

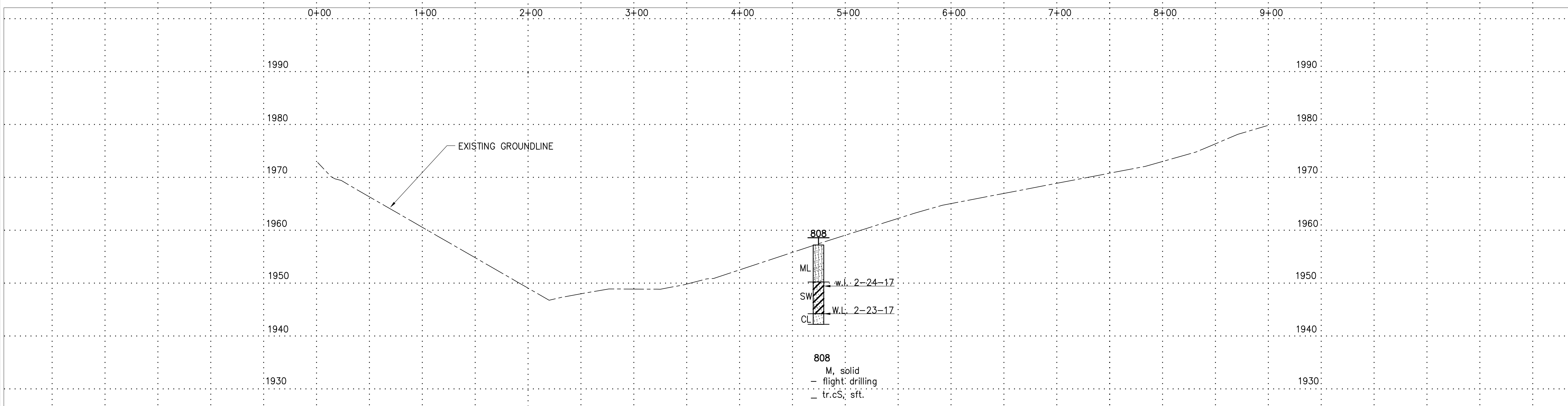
E-File Location:

Drawing No. OK–437

Sheet 34 of 36



PROFILE E–E – BORROW "A"



NOTE: SEE SHEET 32 FOR LEGEND, ABBREVIATIONS, AND CLASSIFICATION SYMBOLS.

PROFILE F–F – ALTERNATE BORROW

CHECK PRINT

		Date
Designed	V. Glasgow	08–17
Drawn	K. Dabney	08–17
Revised	K. Dabney	09–18
Approved	J. Chris Stoner	09–18

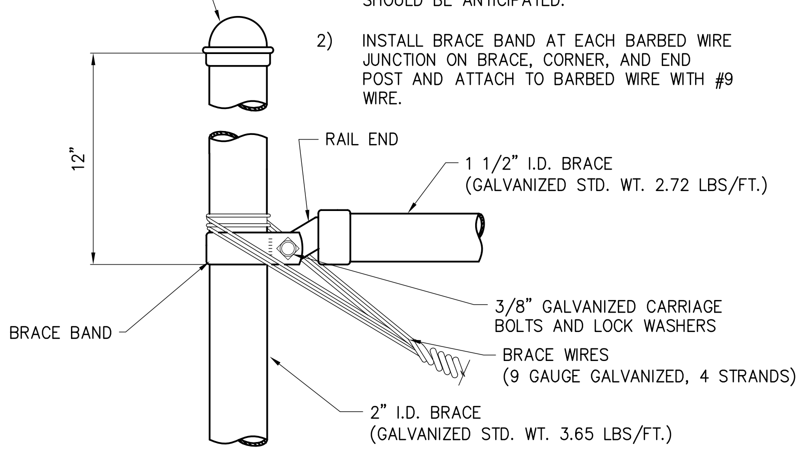
PROFILE – BORROW "A" & ALTERNATE BORROW AREA
A.R.S. FIELD STATION LAKE DAM – REHABILITATION
WOODWARD COUNTY, OKLAHOMA

USDA
United States Department of Agriculture
Natural Resources Conservation Service

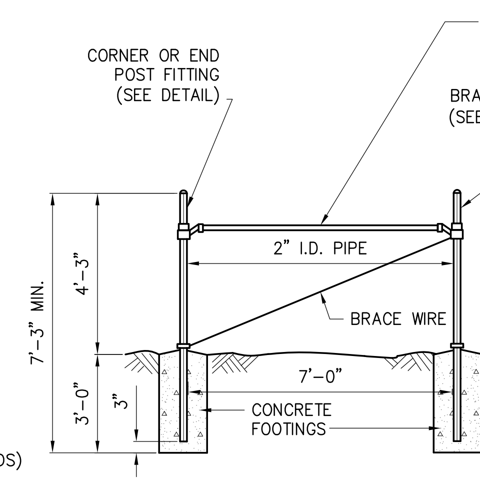
E–File Location:
R:\All Repair\ARS Field Station Lake\Design–Rehab Drawings\ARS Woodward_GI Sheets.dwg

Drawing No.
OK–437

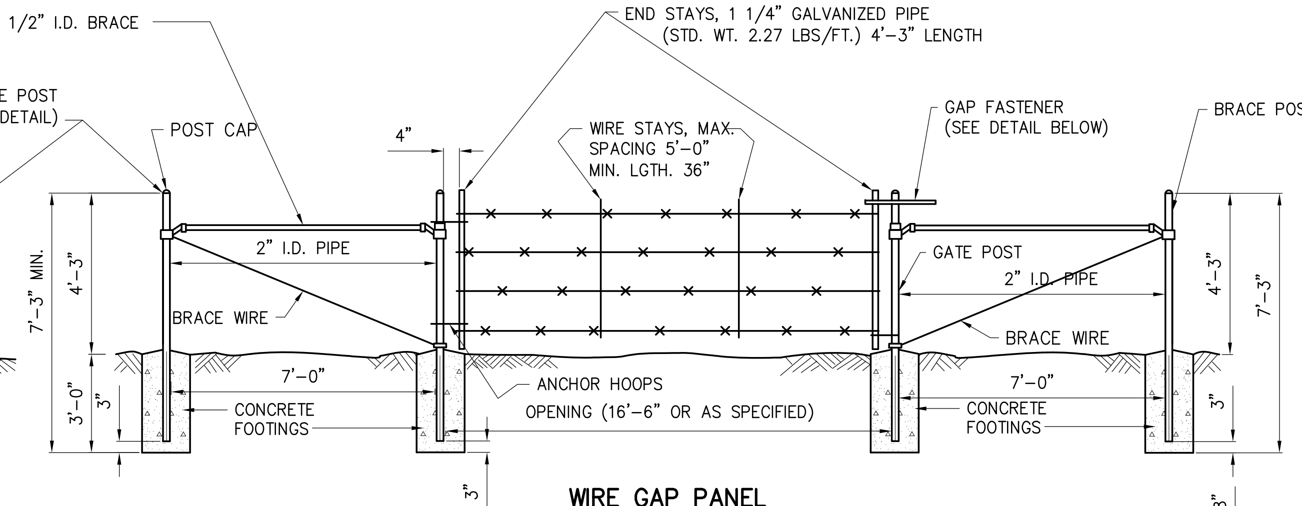
INSTALLATION NOTES:
1) IF EXTRA HIGH TENSILE STRENGTH WIRE IS USED FOR DIAGONAL BRACE WIRES, UNACCEPTABLE DESTRUCTION OF GALVANIZED COATING AND INSTALLATION DIFFICULTIES SHOULD BE ANTICIPATED.
2) INSTALL BRACE BAND AT EACH BARBED WIRE JUNCTION ON BRACE, CORNER, AND END POST AND ATTACH TO BARBED WIRE WITH #9 WIRE.



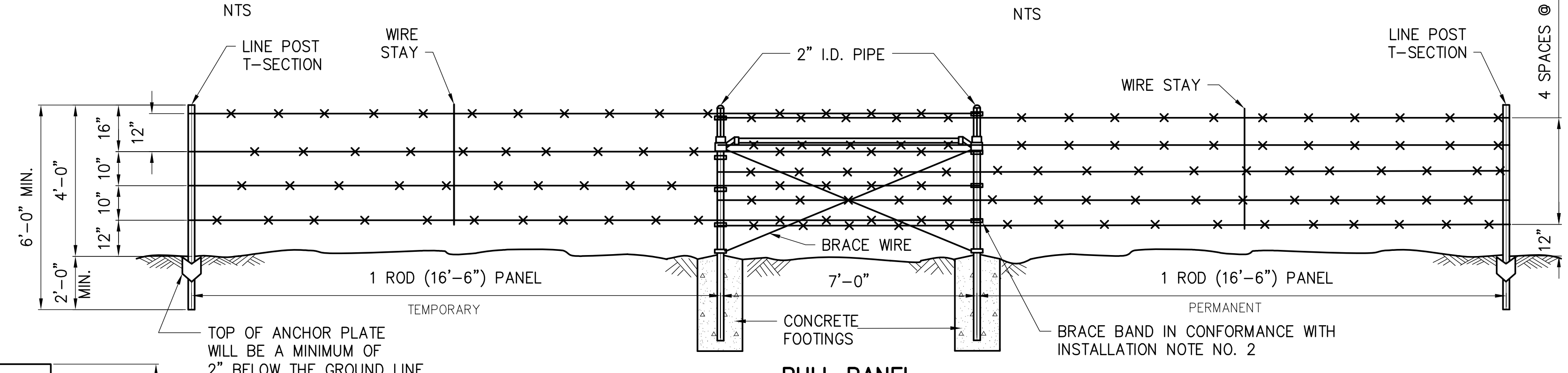
POST DETAIL
BRACE OR PULL POST (TOP TIE-OFF)
NTS



CORNER OR END PANEL
NTS



WIRE GAP PANEL
NTS



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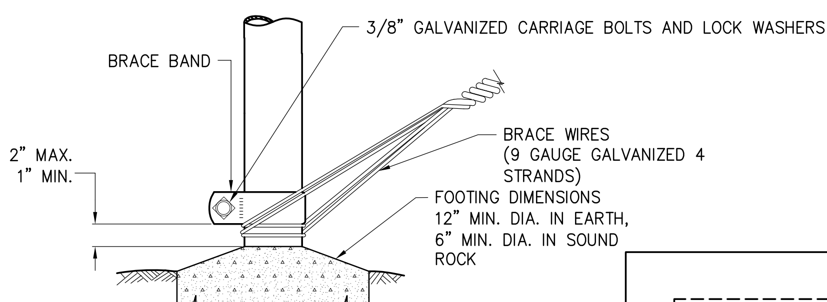
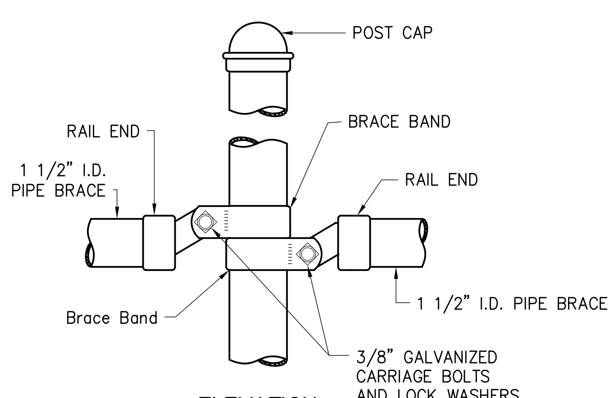
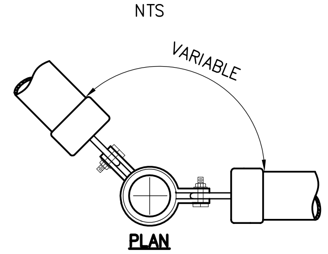
NTS



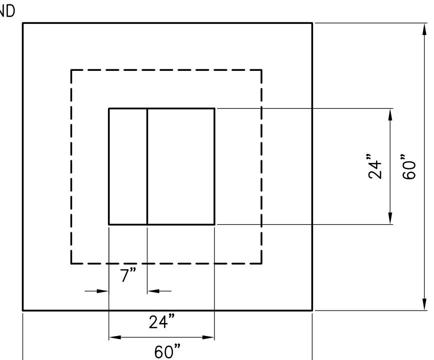
POST DETAIL
PULL POST (BOTTOM TIE-OFF)
NTS



ELEVATION
NTS

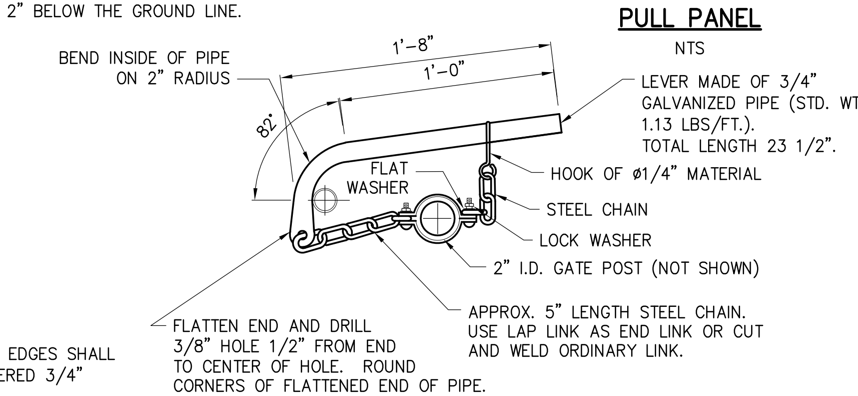


POST DETAIL
(CORNER POST)
NTS



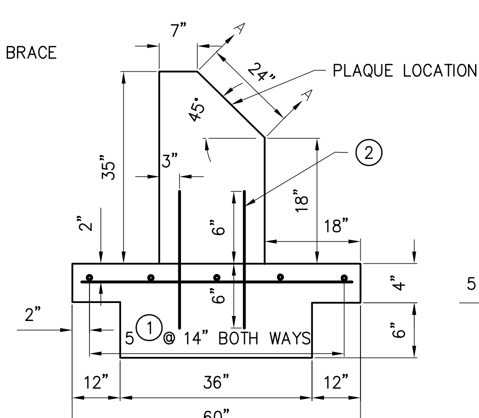
PLAN
NTS

NOTE: ALL EDGES SHALL BE CHAMFERED 3/4"

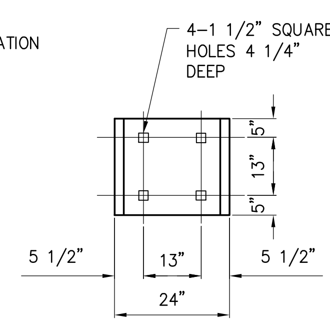


WIRE GAP FASTENER DETAIL
NTS

NOTE:
CHAIN USED MAY BE STRAIGHT LINK OR TWIST CHAIN; MATERIAL SIZE 1/8" TO 7/32", LINKS PER FOOT FROM 10 TO 18, WT. PER FOOT FROM 0.1 TO 0.5 LBS. WELDLESS WIRE-TWIST CHAIN WILL NOT BE PERMITTED.



LEFT ELEVATION
CONCRETE MONUMENT
NTS



HOLE LOCATIONS FOR
MOUNTING PLAQUE
NTS

NOTE:
LOCATION OF CONCRETE MONUMENT WILL BE MADE BY THE CONTRACTING OFFICER AT THE SITE.

CONCRETE MONUMENT

BAR NO.	QTY.	LENGTH	TOTAL LENGTH	SIZE	TYPE
1	10	4'-8"	46'-8"	3	STR.
2	4	1'-0"	4'-0"	4	STR.
TOTAL SIZE NO. 3 STEEL = 46'-8" = 17.5 LBS.					
TOTAL SIZE NO. 4 STEEL = 4'-0" = 2.7 LBS.					
TOTAL CLASS 4000 CONCRETE = 0.84 CU. YDS.					

NOTES:
1) CONCRETE FOOTINGS FOR FENCE POST WHICH REQUIRE ANCHORAGE SHALL BE A WORKABLE MIXTURE OF PORTLAND CEMENT, FINE AND COARSE AGGREGATE AND WATER. THE MIXTURE SHALL PRODUCE A CONCRETE WHICH CONTAINS NOT LESS THAN 6 BAGS OF CEMENT PER CUBIC YARD OF CONCRETE AND NOT MORE THAN 6 GALLONS OF WATER PER BAG OF CEMENT.
2) A COMMERCIAL-GRADE PACKAGED CONCRETE MIXTURE USED IN CONFORMANCE WITH MANUFACTURER'S RECOMMENDATIONS MAY BE USED WITH THE APPROVAL OF THE CONTRACTING OFFICER'S REPRESENTATIVE.
3) COST OF THE CONCRETE FOOTINGS SHALL BE SUBSIDIARY TO THE PIPE, REINFORCED CONCRETE.
4) NRCS TO FURNISH A SURVEY CAP TO BE INSTALLED IN THE SITE MONUMENT BY THE CONSTRUCTION CONTRACTOR AT THE TIME THE MONUMENT IS INSTALLED IN THE LOCATION AS DIRECTED BY THE CONTRACTING OFFICER.

CHECK PRINT

		Date
Designed	H. SAND	06-14
Drawn	A. LANE	06-14
Revised	K. DABNEY	03-17
Approved	J. CHRIS STONER	08-18

FENCE AND MONUMENT DETAILS
A.R.S. FIELD STATION LAKE DAM - REHABILITATION
WOODWARD COUNTY, OKLAHOMA

United States Department of Agriculture
Natural Resources Conservation Service

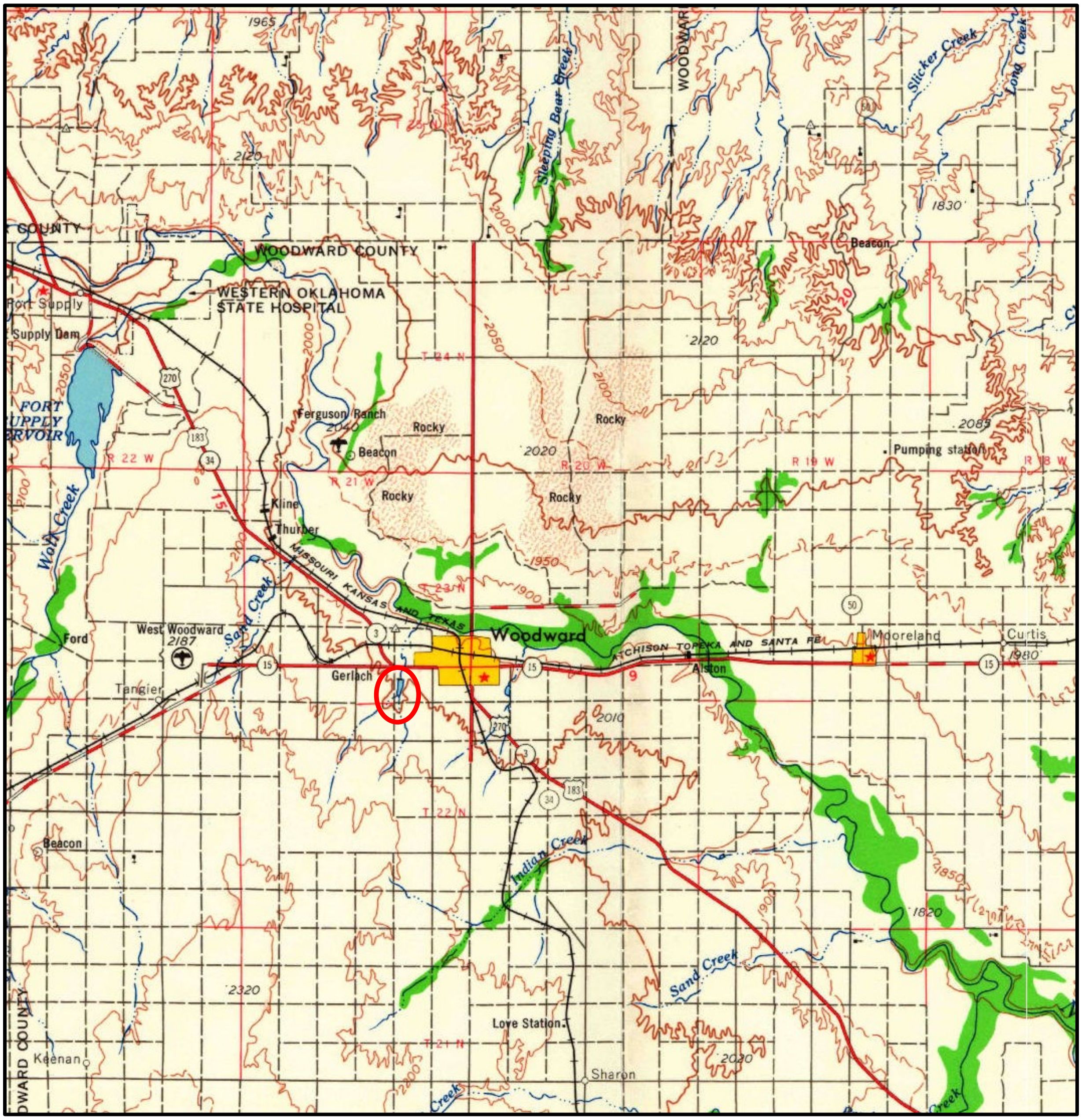
E-File Location:
R:\All Repairs\ARS Field Station Lake\Design Rehab\Drawings\Stdwgs\SWRE_mnt\fence

Drawing No.
OK - 437

Appendix B HISTORIC TOPOGRAPHIC MAP EXCERPTS

A CULTURAL RESOURCES ASSESSMENT FOR THE ARS FIELD STATION LAKE DAM REHABILITATION PROJECT, WOODWARD COUNTY, OKLAHOMA

Appendix B HISTORIC TOPOGRAPHIC MAP EXCERPTS

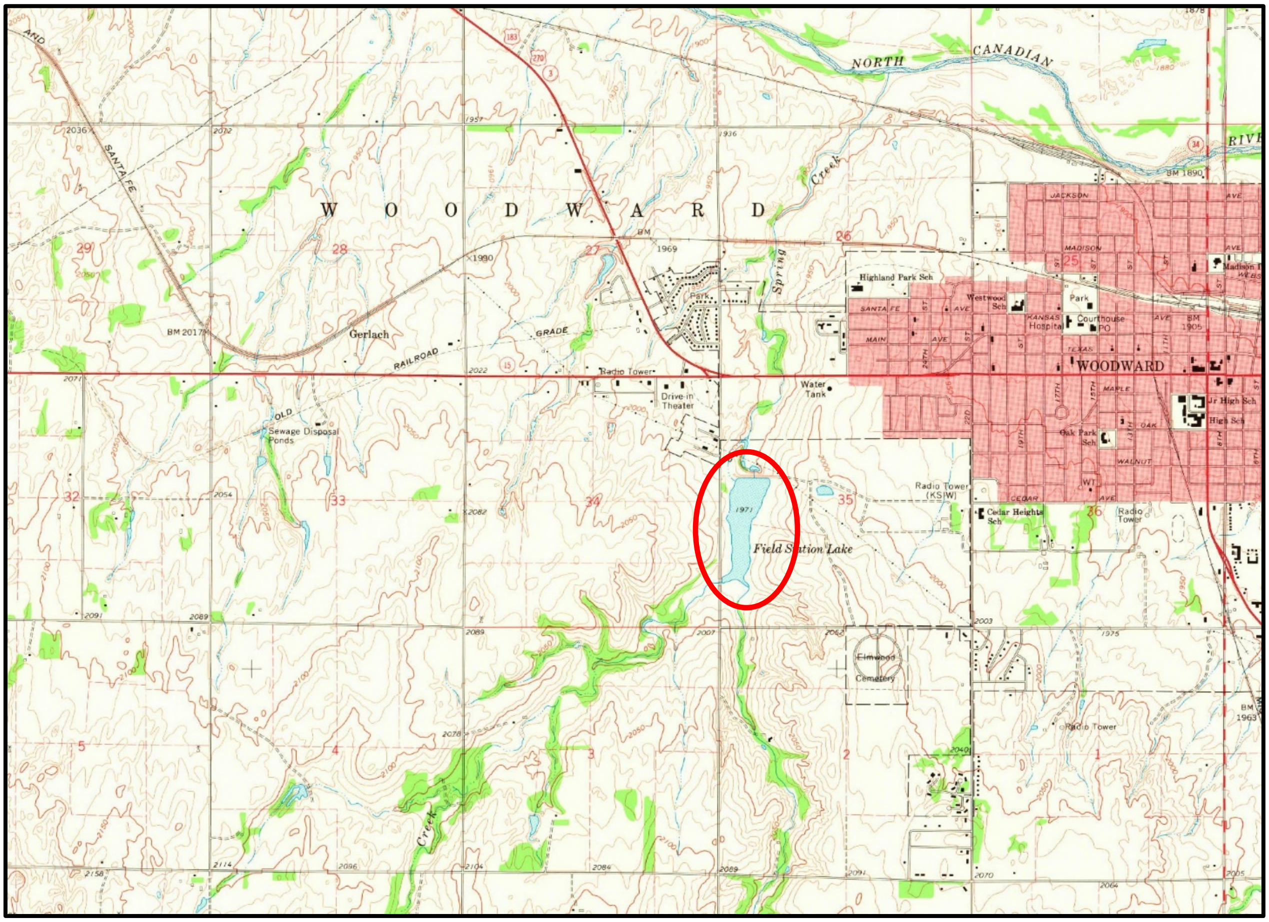


Not to Scale, North to Top of Page.

Appendix B1: Excerpt from the *Woodward, Oklahoma* USGS 1:250,000 Scale 1958 Topographic Map. Field Station Lake and Dam are noted to the west of Woodward and circled in red (http://historicalmaps.arcgis.com/usgs/, accessed September 2019).

A CULTURAL RESOURCES ASSESSMENT FOR THE ARS FIELD STATION LAKE DAM REHABILITATION PROJECT, WOODWARD COUNTY, OKLAHOMA

Appendix B HISTORIC TOPOGRAPHIC MAP EXCERPTS

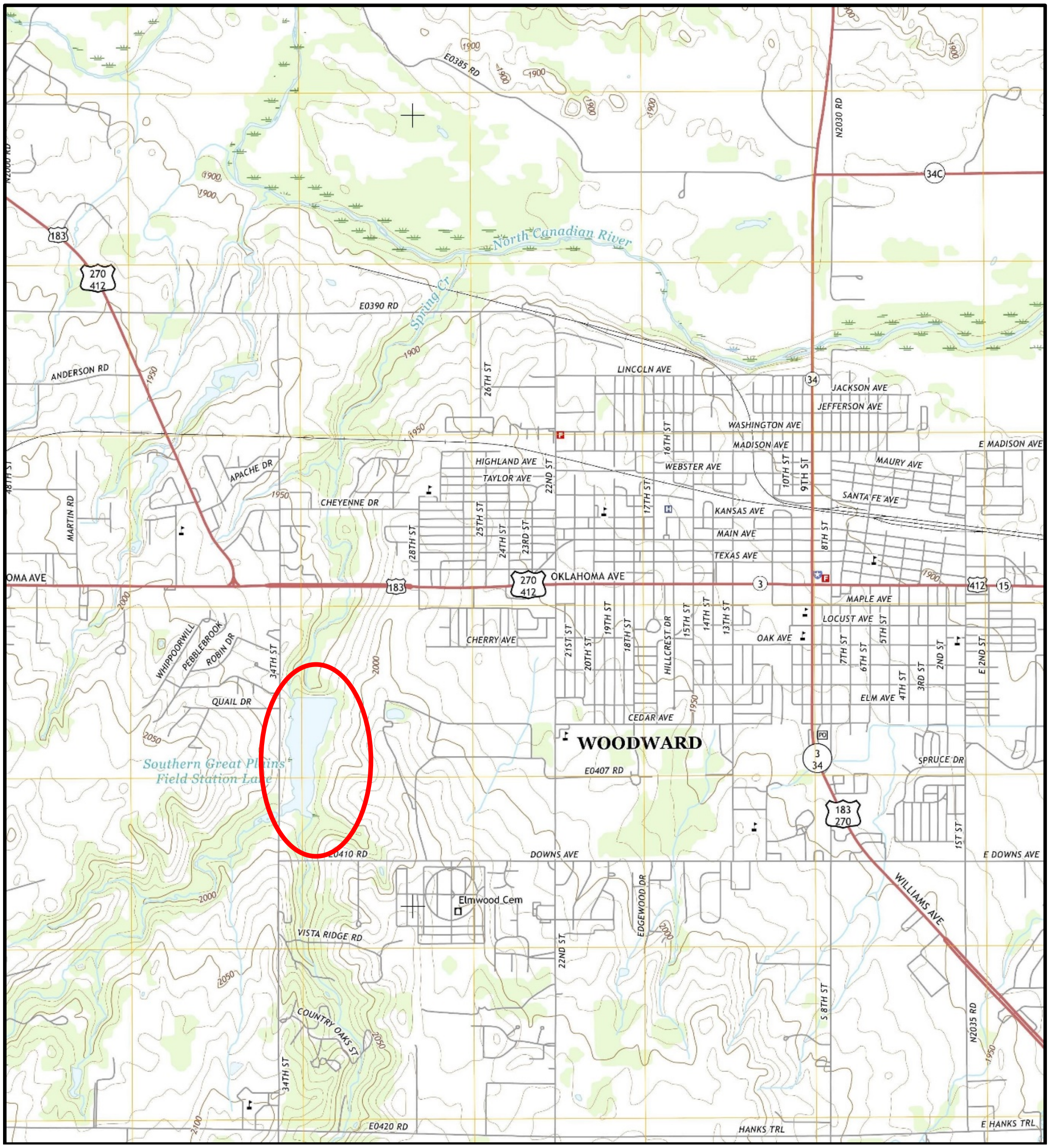


Not to Scale, North to Top of Page.

Appendix B2: Excerpt from the *Woodward, Oklahoma* USGS 1:24,000 Scale 1969 Topographic Map. Field Station Lake and Dam are noted to the west of Woodward and circled in red (http://historicalmaps.arcgis.com/usgs/, accessed September 2019).

A CULTURAL RESOURCES ASSESSMENT FOR THE ARS FIELD STATION LAKE DAM REHABILITATION PROJECT, WOODWARD COUNTY, OKLAHOMA

Appendix B HISTORIC TOPOGRAPHIC MAP EXCERPTS



Not to Scale, North to Top of Page.

Appendix B3: Excerpt from the *Woodward, Oklahoma* USGS 1:24,000 Scale 2016 Topographic Map. Field Station Lake and Dam are noted to the west of Woodward and circled in red. Note the Lake is now referenced as the Southern Great Plans Field Station Lake (http://historicalmaps.arcgis.com/usgs/, accessed September 2019).

Appendix C HISTORIC AERIALS

ARS Field Station Lake Dam

Field Station Lake

Woodward, OK 73801

Inquiry Number: 5730696.5

July 27, 2019

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

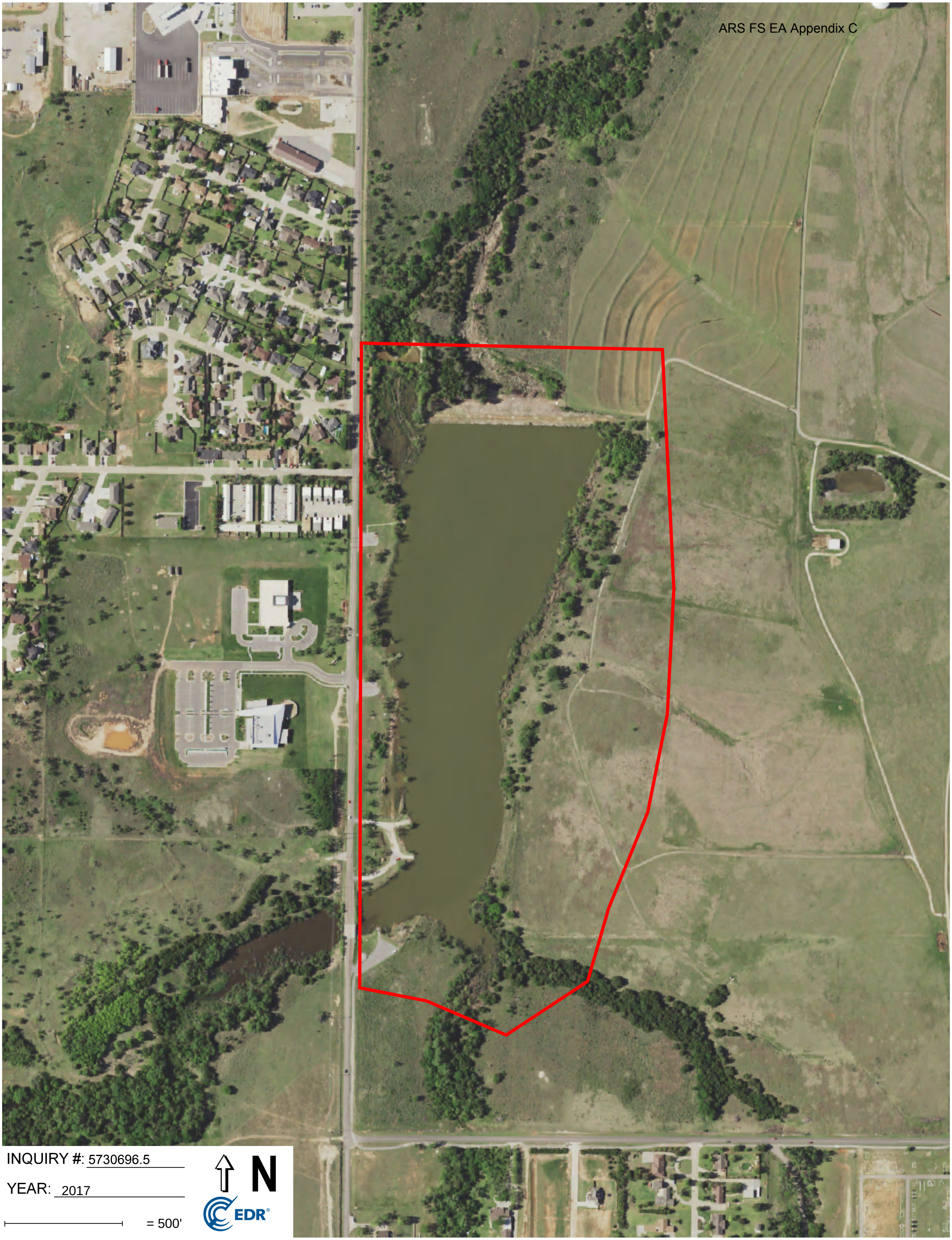
Site Name:	**Client Name:**
ARS Field Station Lake Dam	Stantec
Field Station Lake	1905 Aldrich Street Ste 300
Woodward, OK 73801	Austin, TX 78723
EDR Inquiry # 5730696.5	Contact: Erica Koopman-Glass

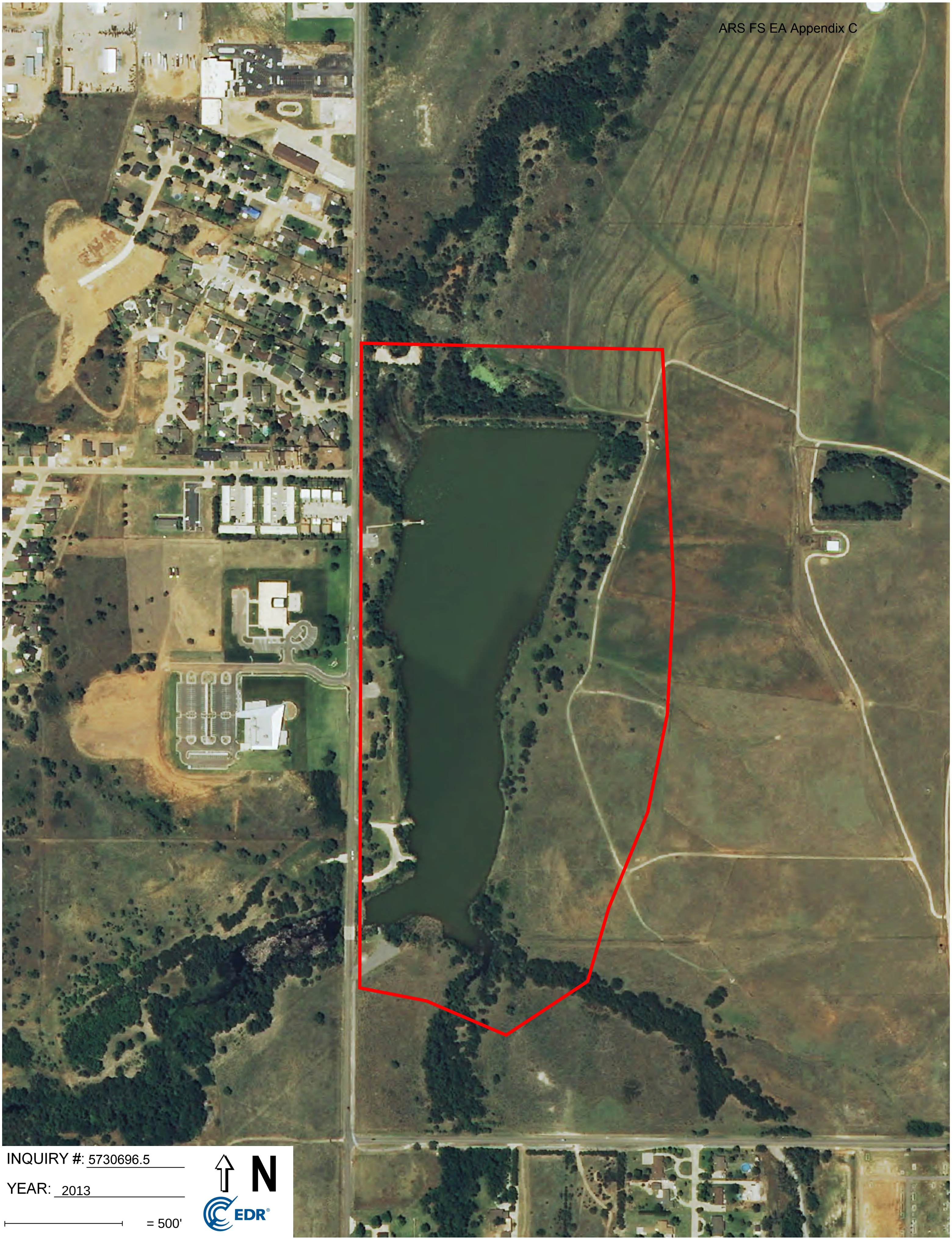
Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	Scale	Details	Source
2017	1"=500'	Flight Year: 2017	USDA/NAIP
2013	1"=500'	Flight Year: 2013	USDA/NAIP
2010	1"=500'	Flight Year: 2010	USDA/NAIP
2006	1"=500'	Flight Year: 2006	USDA/NAIP
1995	1"=500'	Acquisition Date: February 21, 1995	USGS/DOQQ
1983	1"=500'	Flight Date: November 12, 1983	USDA
1972	1"=500'	Flight Date: August 19, 1972	USGS
1968	1"=500'	Flight Date: February 11, 1968	USGS
1954	1"=500'	Flight Date: March 27, 1954	USGS

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.


INQUIRY #: 5730696.5
YEAR: 2017
= 500'
N
EDR



INQUIRY #: 5730696.5

YEAR: 2013

= 500'

N

EDR

ARS FS EA Appendix C

INQUIRY #: 5730696.5

YEAR: 2010

= 500'

N

EDR

INQUIRY #: 5730696.5

YEAR: 2006

= 500'

N

EDR


INQUIRY #: 5730696.5
YEAR: 1995
= 500'
N
EDR
Subject boundary not shown because it exceeds image extent or image is not georeferenced.

INQUIRY #: 5730696.5

YEAR: 1983

= 500'

N

EDR


INQUIRY #: 5730696.5
YEAR: 1972
= 500'
N
EDR


ARS FS EA Appendix C
INQUIRY #: 5730696.5
YEAR: 1968
= 500'
N
EDR

ARS FS EA Appendix C

Phase I Architectural Survey of the Field Station Lake Dam, Woodward County, Oklahoma

December 18, 2019

Prepared for:

Ad Astra Collaborative, LLC
8900 Indian Creek Parkway, Suite 450
Overland Park, Kansas 66210

Prepared by:

Sandra DeChard, Architectural Historian

and

Ellen Brady, Cultural Resources Practice Leader

Stantec Consulting Services Inc.
1011 Boulder Spring Drive, Suite 225
Richmond, VA 23059
(804) 267-3474

PHASE I ARCHITECTURAL SURVEY OF THE FIELD STATION LAKE DAM, WOODWARD COUNTY, OKLAHOMA

This document entitled Phase I Architectural Survey of the Field Station Lake Dam, Woodward County, Oklahoma was prepared by Stantec Consulting Services Inc. ("Stantec") for the account of Ad Astra Collaborative, LLC (the "Client") and the U.S. Department of Agriculture, Natural Resources Conservation Service. Any reliance on this document by any other party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ______________________________
(signature)
Sandra DeChard, Architectural Historian

Reviewed by ______________________________
(signature)
Ellen Brady, Cultural Resources Practice Leader

Approved by ______________________________
(signature)
Jay Mazzoni, Senior Principal

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Executive Summary

In December of 2019, Stantec Consulting Services Inc. (Stantec) conducted a reconnaissance-level architectural survey for the proposed Agricultural Research Service (ARS) Field Station Lake Dam rehabilitation Project (Project) in Woodward County, Oklahoma. The Field Station Lake Dam is operated by and located on the property of the ARS Southern Plains Range Research Station (SPRRS). The dam was constructed c. 1938 to offer irrigation to SPRRS. The Field Station Lake is also utilized by the community of Woodward as a recreation site. The Project is bordered to the west by 34th Street, to the north by Oklahoma Avenue, to the south by Field Station Lake, and to the east by property operated by the ARS. The project area is accessible via 34th Street and service roads to the east off 22nd Street. The work was conducted on behalf of Ad Astra Collaborative, LLC.

The cultural resources investigations described herein were conducted in reference to the National Historic Preservation Act of 1966 (NHPA-PL89-665), as amended, the Archeological and Historic Preservation Act of 1974, Executive Order 11593, and relevant sections of 36 CFR 60 and 36 CFR 800. The investigations were also conducted with reference to United States Department of the Interior's (USDI), Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (USDI 1983) and the *Guidelines for the Preparation of Archaeological Reports* promulgated by the Oklahoma State Historic Preservation Office (OKSHPO).

The Field Station Lake Dam was surveyed as part of proposed rehabilitation improvements to the structure. The dam is part of the early to-mid-twentieth century development of irrigation of experimental crops after the devastation of the 1930s Dust Bowl and one of a few examples of the built history of irrigation dams in this area of Oklahoma during this time period. Additionally, the dam and spillway retain a high degree of integrity of setting, location, materials, workmanship, and design. Based on the fieldwork and subsequent research, the resource is recommended as eligible for listing on the NRHP under Criterion A for its role in the development of irrigation as it relates to the experimental station and as an integral part of the station's history and its efforts in promulgating grasses and other plants for improving grazing lands. Additionally, as the dam is integral to the Southern Great Plains Research Station it is also recommended that the structure is a contributing resource to the National Register of Historic Places (NRHP)-eligible United States Field Station Historic District.

Abbreviations

APE	Area of Potential Effects
ARS	Agricultural Research Service
NHPA	National Historic Preservation Act
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
OAS	Oklahoma Archaeological Survey
OKSHPO	Oklahoma State Historic Preservation Office
OWRB	Oklahoma Water Resources Board
PMP	Probable Maximum Precipitation
RCC	Roller Compacted Concrete
SHPO	State Historic Preservation Office
SPRRS	Southern Plains Range Research Station
Stantec	Stantec Consulting Services Inc.
USDA	United States Department of Agriculture
USDOI	United States Department of the Interior
USGS	United States Geological Survey

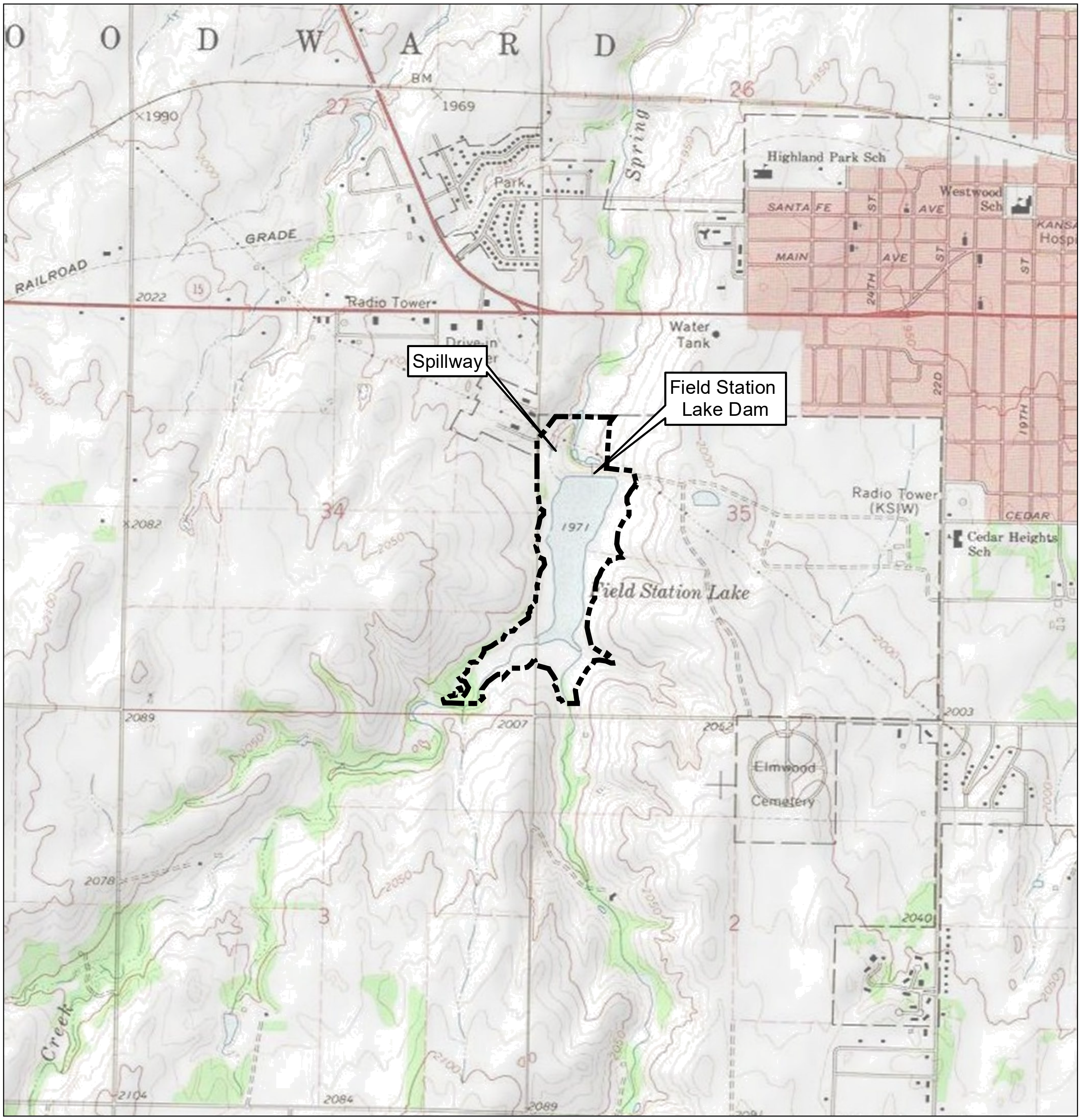
1.0 INTRODUCTION

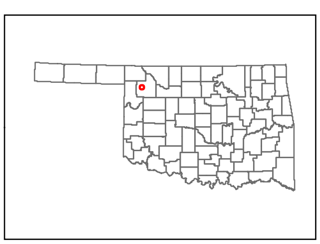
In December of 2019, Stantec Consulting Services Inc. (Stantec) conducted a reconnaissance-level architectural survey for the proposed Agricultural Research Service (ARS) Field Station Lake Dam rehabilitation Project (Project) in Woodward County, Oklahoma. The Field Station Lake Dam is operated by and located on the property of the ARS Southern Plains Range Research Station (SPRRS). The dam was constructed c. 1938 to offer irrigation to SPRRS. The Field Station Lake is also utilized by the community of Woodward as a recreation site. The Project is bordered to the west by 34th Street, to the north by Oklahoma Avenue, to the south by Field Station Lake, and to the east by property operated by the ARS. The project area is accessible via 34th Street and service roads to the east off 22nd Street. The work was conducted on behalf of Ad Astra Collaborative, LLC.

As part of the rehabilitation project, the Field Station Lake Dam, which is within the boundary of the NRHP-eligible Field Station Historic District, though not individually surveyed, was recorded at a reconnaissance level to evaluate the resource's potential for listing on the National Register of Historic Places (NRHP) as an individual resource as well as its potential as a contributing resource to the United States Field Station Historic District (Figures 1 and 2).

The cultural resources investigations described herein were conducted in reference to the National Historic Preservation Act of 1966 (NHPA-PL89-665), as amended, the Archeological and Historic Preservation Act of 1974, Executive Order 11593, and relevant sections of 36 CFR 60 and 36 CFR 800. The investigations were also conducted with reference to United States Department of the Interior's (USDI), Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (USDI 1983) and the *Guidelines for the Preparation of Archaeological Reports* promulgated by the Oklahoma State Historic Preservation Office (OKSHPO).

Jay Mazzoni, PE Senior Principal, served as Project Manager for the project. Senior Architectural Historian Sandra DeChard conducted the fieldwork on December 3 and 4, 2019. Ms. DeChard also prepared the architectural report and the resource inventory form. Graphics were prepared by GIS Analyst Elise Ljiko. Ellen M. Brady, Cultural Resources Practice Leader, provided quality control reviews. Copies of all field notes, maps, correspondence, and historical research materials are on file at Stantec's office in Richmond, Virginia.





Project Location

0 1,000 2,000
Feet
(At original document size of 8.5x11)
1:24,000

Stantec

Project Location
Woodward County, Oklahoma

Prepared by ECL on 2019-12-10
TR by TPS on 2019-12-10
IR by SLD on 2019-12-10

Client/Project
AdAstra Collaborative LLC
ARS Dam Rehabilitation - Oklahoma

175558215

Figure No.
1

Title
Project Location Map

Notes
1. Coordinate System: NAD 1983 StatePlane Oklahoma North FIPS 3501 Feet
2. Project limits digitized from drawings provided by USDA Natural Resource Conservation Service
3. Topographic map © USGS 7.5 Minute Series Topographic Map

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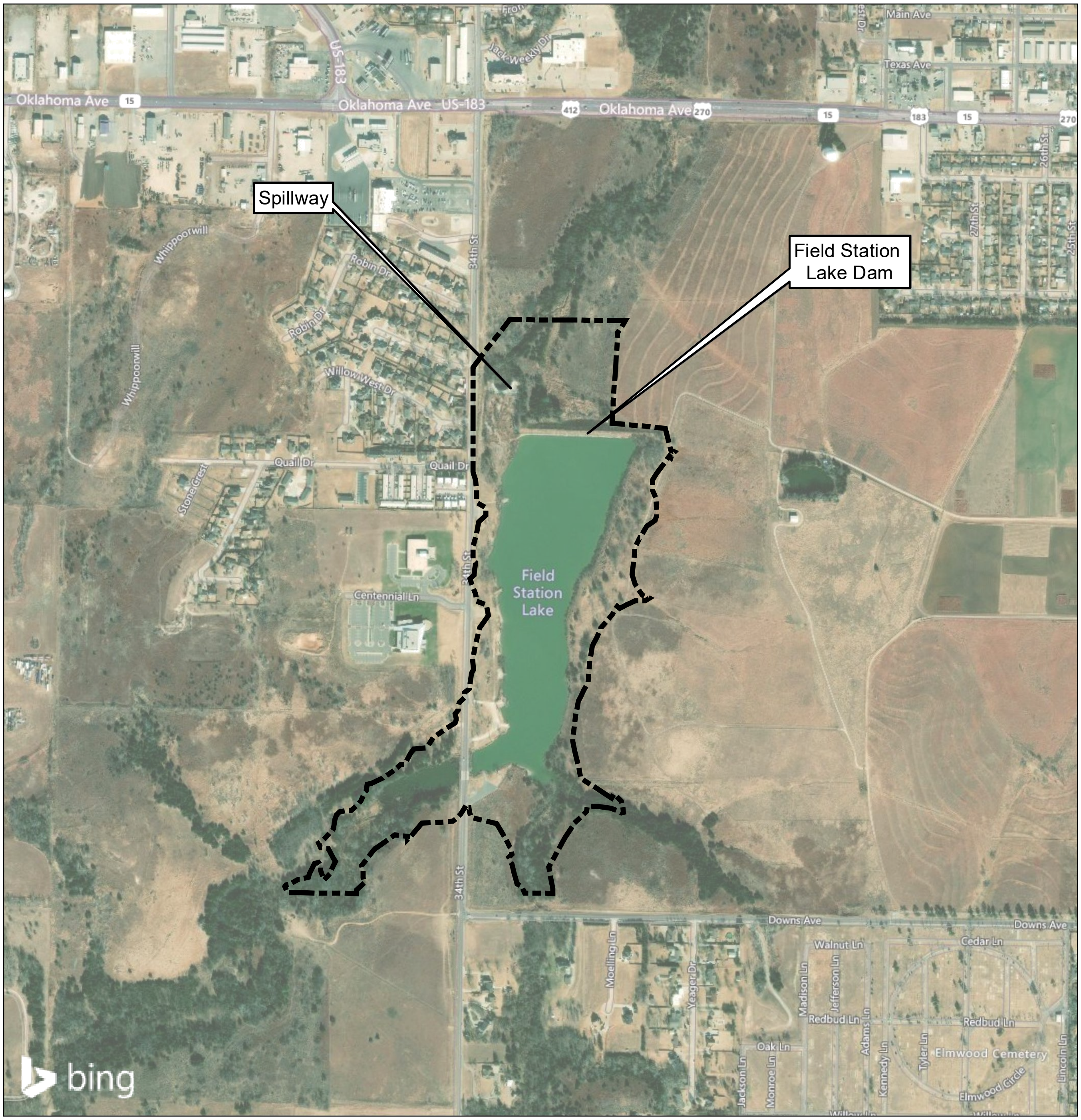

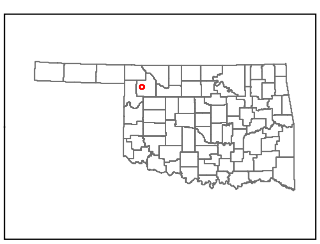

Project Location

0 500 1,000 Feet

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Stantec

Project Location
Woodward County, Oklahoma

Prepared by ECL on 2019-12-10
TR by TPS on 2019-12-10
IR by SLD on 2019-12-10

Client/Project
AdAstra Collaborative LLC
ARS Dam Rehabilitation - Oklahoma

175558215

Figure No.
2

Title
Project Vicinity Map

Notes

1. Coordinate System: NAD 1983 StatePlane Oklahoma North FIPS 3501 Feet
2. Project limits digitized from drawings provided by USDA Natural Resource Conservation Service
3. Orthoimagery © Bing Maps
4. Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation

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2.0 RESEARCH DESIGN

2.1 OBJECTIVES

The reconnaissance-level architectural survey was designed to document the Field Station Lake Dam within the United States Field Station Historic District. Stantec designed the survey to obtain sufficient information to make recommendations about the research potential of the dam based on the resource's potential eligibility for listing on the NRHP. A cultural resource is gauged to be significant if it meets at least one of four National Register criteria:

A. Associated with significant events in the broad patterns of national history.
B. Associated with the lives of persons significant in our past.
C. Representative of a type, period, or method of construction, or the work of a master.
D. Capable of yielding important information about the past.

Where individual structures do not meet these National Register criteria, but constitute a cohesive group of related buildings, a potential NRHP district may be considered. The resource, to be eligible, must also have a high degree of integrity. The seven aspects of integrity, which conveys the historical significance of the resource's original design, include location, setting, design, materials, workmanship, feeling and association. The resource should meet at least five of these aspects to be considered to have a high level of integrity.

2.2 PREVIOUS INVESTIGATIONS

The background research for the reconnaissance level architectural survey included review of OKSHPO historic resource surveys pertinent to the dam and the United States Field Station Historic District. Background research also focused on relevant sources of local historical information, any archive materials at the SPRRS, and available historical maps, which were examined to provide an historical context for the project area.

2.2.1 Previously Conducted Surveys

Architectural surveys of the project area and its immediate vicinity were few and included a report entitled *Final Survey Report: Architectural/Historic Reconnaissance Level Survey of Certain Portions of the City of Woodward* prepared by the Oklahoma Historic Preservation Survey, Department of History, Oklahoma State University in 1995/1996. The project documented several areas within the city of Woodward including the Woodward Downtown Historic District, Woodward Historic Residential District, Woodward Historic Agricultural and Warehouse District, the United States Field Station Historic District, Crystal Beach Historic District, and select individual historic properties recommended for further study.

3.0 PROJECT DESCRIPTION

The Field Station Lake Dam was originally classified as a low hazard structure; however, it has been reclassified as a high hazard due to the potential for damage to areas downstream of the dam, including loss of life, should the dam breach. The purpose of the current project is to reduce the risk of a dam breach and bring the dam up to current NRCS safety standards. The proposed rehabilitation project for the dam, as currently designed, will include the installation of a new reinforced concrete principal spillway conduit and a concrete baffle topped drop riser. The auxiliary spillway will be enforced with Roller Compacted Concrete (RCC) and have the capacity to safely pass the Probable Maximum Precipitation (PMP) storm event (Design Report 2018:1; Esenwein and Koopman-Glass 2019:2.2; Appendix A).

The Project proposes to construct a 415-foot wide RCC auxiliary spillway, which would be raised in elevation to the top of the dam. The existing auxiliary spillway features a concrete chute, which will no longer be used and will be filled in (Design Report 2018:1). The dam embankment is approximately 35 feet tall and is approximately 950 feet long. This structure is currently 12 feet wide at the crest and would be expanded to 14 feet in width to meet the OWRB standards (Design Report 2018:3; Esenwein and Koopman-Glass 2019:2.2). The embankment's front slope will be largely undisturbed; however, its centerline would be offset in the downstream direction by 2 feet to accommodate the expanded width and 6 inches of topsoil removed along with vegetation on the downstream embankment. The existing principal spillway will be rehabilitated and located within the proposed auxiliary spillway at an angle of 90 degrees from the embankment centerline. Additional design features will include a new foundation drain, which will incorporate two outlets into a stilling basin, and the relocation of the existing irrigation pump near the downstream section of the embankment to an area on the east side of the lake with new pipe installed connecting the current retention pond and the lake (Design Report 2018:3 and 6-8).

4.0 SURVEY METHODOLOGY

Prior to the reconnaissance-level architectural survey, the OAS and OKSHPO files were examined, and information was retrieved on sites, structures, or other cultural resources located within the architectural survey area, including previously recorded buildings within the NRHP- eligible Field Station Historic District. In addition, Stantec staff consulted with Dr. Stacey Gunter, Research Leader, USDA, SPRRS, for pertinent information regarding the Field Station Lake Dam and the Field Station Historic District. Background research also focused on relevant sources of local historical information and available historical maps, which were examined to provide a historical context. Research was also carried out at the Oklahoma History Center in Oklahoma City, the Woodward Public Library, the US Geological Survey, and the Plains Indian and Pioneer Museum. The architectural survey consisted of photographing the dam and spillway as well as photographing the extant buildings and examples of weather stations and experimental grass beds within which to evaluate the dam as a contributing resource to the United States Field Station Historic District.

5.0 SURVEY RESULTS

The existing circa 1938 dam is a rolled earth fill embankment dam. The dam's primary purpose is to supply irrigation water to the SPRRS and surrounding area. The existing dam is 950 feet long, 12 feet wide at the crest, and has a maximum height of 35 feet (Figure 3). Currently, the dam is overgrown with grasses and cattails.

The concrete spillway is also currently overgrown and there is a metal trash rack bolted to the top/center of the concrete spillway. The spillway is constructed in a horseshoe shape with board-formed poured concrete. Currently, a post-and-wire fence is located at the top of the spillway and acts as a safety device. An eight-inch diameter pipe in the center of the spillway wall is currently the only working outlet for the structure. Several areas of spalling concrete were noted (Esenwein and Koopman-Glass 2019:2.2; Schnabel Engineering 2016:3-4; Figures 4-8).

The downstream channel is also currently overgrown with trees and other vegetation. Erosion of soils is evident on the top of the eastern retaining wall as well as behind the wall (Figure 9). The lake, currently used for irrigation as well as recreational purposes, features grasses and other vegetation along its shores (Figure 10). Although the spillway is experiencing some issues such as erosion of soils and spalling and the dam is overgrown with vegetation, the dam and the spillway still retain a high degree of architectural integrity.

Figure 3. Field Station Lake Dam, View Looking East.

Figure 4. Spillway, View Looking West.

Figure 5. Spillway, View Looking Southeast.

Figure 6. Spillway, View Looking Northwest.

Figure 7. Poured Concrete Retaining Wall Adjacent to 34th Street, View Looking West.

Figure 8. Poured Concrete Retaining Wall, View Looking South.

Figure 9. Poured Concrete Retaining Wall, View Looking Southeast.

Figure 10. Field Station Lake, View Looking South.

6.0 BOUNDARIES OF HISTORIC DISTRICTS

The boundary of the United States Field Station Historic District includes parcels within T23N/R21W/S35 and T23N/R21W/S36. The district was surveyed in 1995/1996 and included mainly the core complex of buildings located off 18th Street and three buildings within the parcel on the west side of 22nd Street (Table 1; Figures 11-15). The architectural survey encompassed the area of the dam, which is currently within the boundary of the NRHP-eligible United States Field Station Historic District. No areas outside of the district were surveyed.

Table 1. List of Buildings Originally Surveyed as Part of the United States Field Station Historic District.

Building #	Designation	Date	Comments	Current Photograph
1	Residence #1	1930	Moved to Mooreland	N/A
2	Residence #2 (Director's House)	1914	Burned down	N/A
6	Administration Building	1950	Original building was destroyed by the 1947 tornado; current building was altered in 2006 with modern additions	
7	Laboratory and Greenhouse	1930-1937	Currently used for storage	
8	Barn	1914	Currently used as garage space and seed testing	

PHASE I ARCHITECTURAL SURVEY OF THE FIELD STATION LAKE DAM, WOODWARD COUNTY, OKLAHOMA

Boundaries of Historic Districts

Building #	Designation	Date	Comments	Current Photograph
9	Machine/Vehicle Shed	1932	Currently still functions as a machine/vehicle shed	
10	Machine/Vehicle Shed	1937	Currently still functions as a machine/vehicle shed	
11	Machine/Vehicle Shed	1919	Currently still functions as a machine/vehicle shed	
12	Germplasm Building	1948	Currently functions as a seed processing facility	
13	Metabolism Building	1940	Currently functions a storage building	

Boundaries of Historic Districts

Building #	Designation	Date	Comments	Current Photograph
14	Machine/Vehicle Shed	1948	Currently still functions as a machine/vehicle shed	
16	Garage	1930	Demolished in 2005	N/A
53/54	Headhouse and Greenhouses	2004	Currently functions in a limited capacity as greenhouses	

*Dates and building designations are consistent with those from the 1995/1996 architectural survey (Oklahoma State University 1996) and from the 2001 feasibility study (McCall & Associates 2001).

Other features associated with the Field Station Historic District, but not part of the survey, but within the historic district boundary include a retention pond (Figure 11), which provides water storage for irrigation, weather stations (Figure 12), and large areas of experimental grass plantings (Figures 13 and 14).

PHASE I ARCHITECTURAL SURVEY OF THE FIELD STATION LAKE DAM, WOODWARD COUNTY, OKLAHOMA

Boundaries of Historic Districts

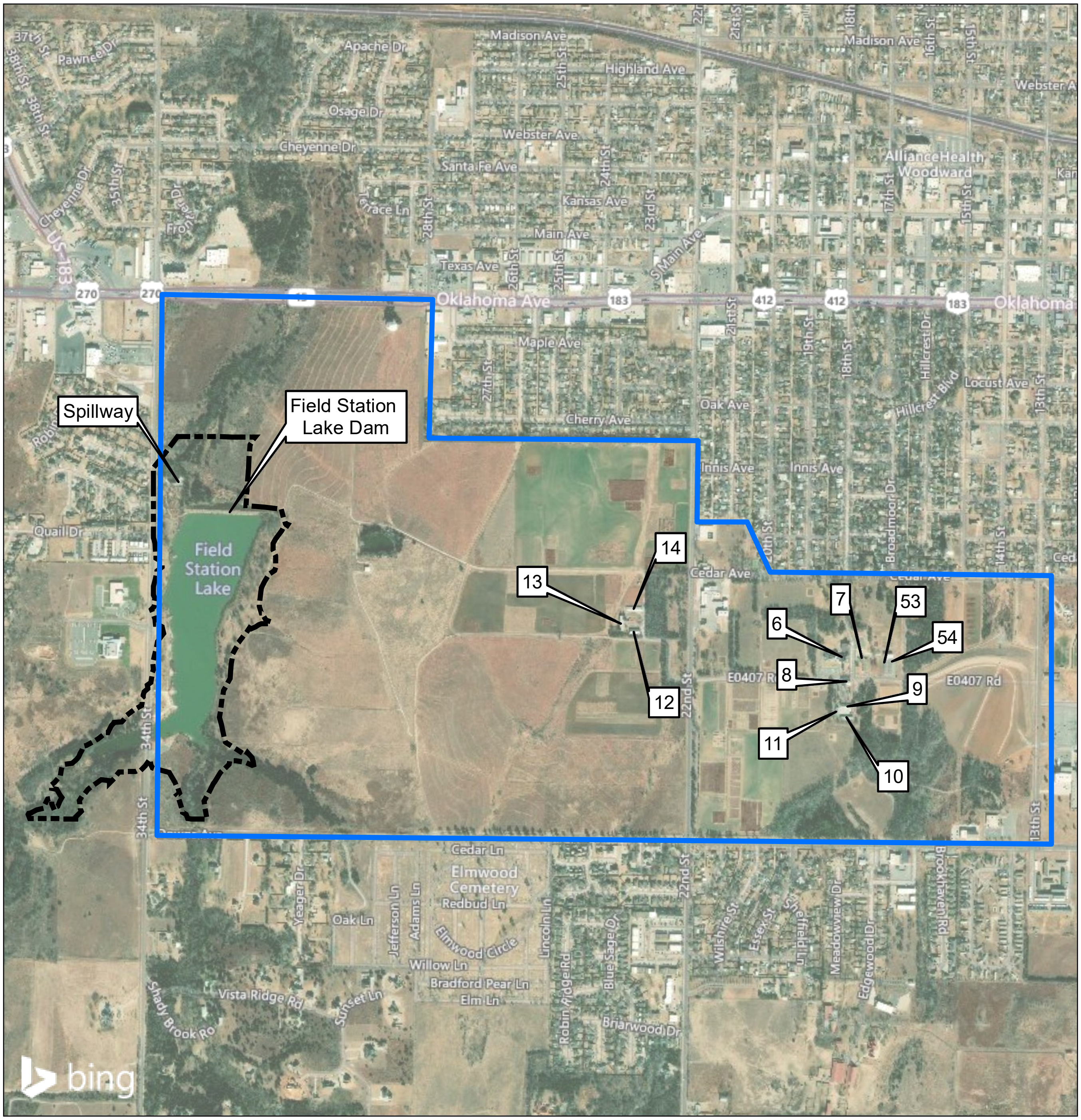
Figure 11. Retention Pond, View Looking East.

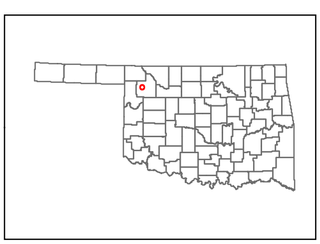
Figure 12. Example of a Weather Station (East of Building #53/54), View Looking Northeast.

Boundaries of Historic Districts

Figure 13. Example of Experimental Grass Plots, View Looking Southwest.

Figure 14. Example of Experimental Grass Plots, View Looking Northwest.





Project Location

Field Station Historic District

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(At original document size of 8.5x11)
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Stantec

Project Location
Woodward County, Oklahoma

Prepared by ECL on 2019-12-10
TR by TPS on 2019-12-10
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Figure No.
15

Title
United States Field Station Historic District

Notes
1. Coordinate System: NAD 1983 StatePlane Oklahoma North FIPS 3501 Feet
2. Project limits digitized from drawings provided by USDA Natural Resource Conservation Service
3. Historic resource data provided by Oklahoma State Preservation Office
4. Orthoimagery © Bing Maps
5. Microsoft product screen shot(s) reprinted with

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7.0 HISTORIC CONTEXT

7.1 AGRICULTURAL DEVELOPMENT IN THE GREAT PLAINS

Pioneers, during and after the Civil War, were encouraged to move westward to the Great Plains area by a series of farming incentives including the Homestead Act in 1862, the Kinkaid Act of 1904 and the Enlarged Homestead Act of 1909. These incentives resulted in a massive influx of people to this region, many inexperienced in farming. It was believed by land speculators, emigrants and a number of scientists that homesteading would make the land more conducive for farming as this influx would change the climate of the region, which would turn out to be false. The weather, which was alternated between wet years and dry, further perpetuated the myth and led to cultivating marginal areas, which were not able to be irrigated (History.com Editors 2009).

Economic pressures during the early decades of the twentieth century also lead to monoculture crops, particularly wheat, which was in demand during World War I in European countries. Native grasses were plowed under in order to plant the wheat as well as corn. When wheat prices plummeted during the Great Depression, farmers increased plowed acreages in order to break even; however, with the removal of the deep-rooted grasses accustomed to the area with the combination of an extended time of drought, the top soils eroded and blew away creating what became known as the Dust Bowl. The effects of poor farming methods and the long-term drought conditions resulted in approximately 35 million acres rendered useless and unable to be cultivated any longer. During the Black Sunday dust storm in 1935, as it was later known, approximately three million tons of topsoil were carried off the Great Plains by the winds, which started in the Panhandle of Oklahoma. As many as 440,000 people from Oklahoma migrated to California as a result of the loss of their farms and livelihood (History.com Editors 2009).

In order to help alleviate the plight of the Southern Great Plains farmers, President Franklin D. Roosevelt, in 1935, created the Soil Erosion Service, later called the Natural Resources Conservation Service, and the Prairie States Forestry Project. These New Deal programs encouraged the construction of windbreaks and helped put farmers to work. New farming techniques designed to inhibit soil erosion were also implemented (History.com Editors 2009). During this time, the Southern Great Plains Field Station was integral in these efforts by growing and researching experimental grasses to re-establish the farms and agricultural fields rendered useless due to the eroding soil (see below).

7.2 THE SOUTHERN GREAT PLAINS FIELD STATION

The United States Department of Agriculture (USDA) Southern Great Plains Field Station was established in 1913 in Woodward through the efforts of Senator Thomas P. Gore, who, at the time, was Chairman of the Senate Committee on Agriculture (James 1988:1; James 2019; Everett 2019). County Commissioners for Woodard arranged the purchase of a barren 160-acre lot to the southwest of the main core of the city. The reasoning for this desolate lot being chosen for the experimental farm, which was leased for 99 years by the Division of Dry Land Agriculture, was simple – "if crops grew here, they would grow anywhere" (James 1988:2).

The first superintendent of the Southern Great Plains Field Station was Ellery Chilcott and his wife, Winona, and Chilcott served in that capacity until 1939 (James 1988:2 and 4; United States Federal Census 1920; Oklahoma State University 1996:61). Together the couple went to work to create Oklahoma's "largest arboretum" (Oklahoma State University 1996:61). The caption for a photograph used in the August 19, 1954 edition of the Daily Oklahoman newspaper exclaimed "Woodward['s] most inviting spot is the Southern Great Plains Field Station, where hundreds of trees from all parts of the world have been planted" (Oklahoma Historical Society 2019; Figure 16). The facility boasted a large number of different types of grasses, shrubs, trees, and grains as well orchards and grape vines. The primary focus of study was methods of cultivation in order to reduce or prevent erosion from wind, rotation of crops, and breeding of various plants to withstand the dry, hot climate and for ease in mechanized harvesting. A year after the first planting, John B. Sieglinger came to head up the research of sorghum, one of the primary research crops, and broomcorn. In 1920, Lowell Locke, a horticulturist, also joined the research station as well as F. Joseph Bransom, Assistant Manager, and Everett Smith Jr., who was a farmer involved with the experimental station in Woodward (James 1988:5 and 7-9; United States Federal Census 1920 and 1930).

Figure 16. Photograph taken in 1954 of the Entry into the Southern Great Plains Field Station (Source: Oklahoma Publishing Company Photography Collection, Oklahoma Historical Society).

PHASE I ARCHITECTURAL SURVEY OF THE FIELD STATION LAKE DAM, WOODWARD COUNTY, OKLAHOMA

Historic Context

During the first years, several buildings were constructed at the research center and included a horse barn (present day Building #8), an equipment shed, three residences, including the Director's house, and an office building, which contained a laboratory, work room, dark room, and fire proof vault (James 1988:5). In 1921, the facility also added a dairy farm, now the site of the new high school. It was not until several years later; however, that buildings were erected to house the cattle as well as a dairy barn, milk house, herdsmen's cottage, and silos were constructed. Acreage during the late 1920s was also purchased for experimental grains and crop rotation experiments (James 1988:13 and 15).

The station faced closure during the Great Depression and again in 1934 as plans to close the station were put forward as part of the recovery efforts outlined by New Deal programs. Massive protests from farmers and ranchers as well as the chambers of commerce resulted in saving of the research station. Additionally, the research was expanded to include more extensive testing of trees and shrubs. The duties of this expansion fell to forest nurseryman Earnest W. Johnson, who had transferred to the Woodward field station from Fort Hays, Kansas. Johnson, along with Locke, established new greenhouses in 1935, and by 1936 the station was prominent in its testing of trees, roses, windbreaks, crops and vineyards as well as improvements in farming methods (James 1988:15-16).

The effects of the Great Depression and the erosion of the soil in the early 1930s left much of the Southern Plains desolate and dotted with abandoned farms. Lobbying efforts led to additional funds set aside for "grass breeding and re[-]grassing experiments" in the mid-1930s. New methods, not previously known to Southern Great Plains farmers, were developed by Agronomist David A. Savage, who relocated to Woodward from Hays, Kansas. The method he developed at the Woodward experimental station would be used to reclaim over five million acres of agricultural lands for grazing in the Southern Great Plains. The success of the experimental station led to an expansion of the facility with the purchase by the United States Government of a 480-acre parcel for the testing of various new grasses. As part of this expansion a dam was constructed beginning in 1938 to be used in irrigation efforts of the station and was completed in 1939 (James 1998:18-19). During the last years of the 1930s, not only did the facility expand, but additional staff were added including Maurice Peterson in 1939, whose role of grass breeder was integral in the development of drought resistant grasses and seed supplies. The success and national recognition of the development of grasses at the experimental station was further promulgated by Dr. Jack R. Harlan (1942-1951), as well as subsequent grass breeders extending into the 1970s (James 1988:19-20).

After the death of Ellery Chilcott as a result of a car accident, Lowell Locke was appointed acting Superintendent of the station until the arrival of agronomist Martin Bell. Bell spent seven years at the station at which time three additional residences had been constructed (James 1988:21). The expansion of the experimental station also required additional laborers as well as farmers to assist with the day to day maintenance and care of the grasses and other plants. Among those employed by the station at the beginning of the 1930s, many of German descent, included George Seeman, Lee Armstrong, All Buceinski, John, Paul, and William Rieth, William Gambrel, Allen Gorrell, Charles Chandler, John Brenner, and Harry Clemmer (United States Federal Census 1930).

Progress of various strains of grasses continued in the 1940s in conjunction with studies of beef cattle and their grazing habits. In 1948, Agronomist David Savage became Superintendent, although according to census records, he had worked at the experimental field station by 1940. Savage continued to serve as Superintendent until his death in 1954 (James 1988:18 and 22; United States Census Records 1940). Under his tenure, the new Administration building had been constructed after a tornado in 1947 damaged the original building. The number of employees also increased during this time with approximately 24 people listed as working at the experimental station in 1940.

Beginning in the 1940s through the later twentieth century, shifts occurred at the experimental station. The dairy station ceased experiments on grazing efforts in relation to quality of milk and continued until 1953 as a model farm. In that year, the dairy cows were sold, and the dairy farm closed. In addition, during the 1950s, most of the crop experiments were transitioned under the direction of Oklahoma State University, which continues to run experiments at the station. Research on cattle continued, with the ranch at Fort Supply becoming increasingly utilized. At the retirement of E. W. Johnson and Lowell Locke, the research on plants other than grasses was terminated (James 1988:25-27). In 1978, the name changed to the Southern Plains Range Research Station to reflect the facility's focus towards beef cattle, which the Woodward station still does research on today.

7.3 WOODWARD COUNTY IRRIGATION DAMS

Two dams were under construction during the closing years of the 1930s – Fort Supply Dam and the Field Station Lake Dam – to provide water for the experimental stations at both locations.

7.3.1 Fort Supply Dam

The Fort Supply Dam, located approximately 12 miles to the northwest of Woodward, began construction in 1937. The construction of the dam was one of the largest projects in the northwestern region of Oklahoma. It was such an event that observation towers were constructed so the public could view the building of the massive dam. The dam, when complete, was approximately 2 miles in length with a 1,900-foot spillway (Figure 17). Large numbers of men were employed during the dam's construction and grew from 100 to 500 by the end of 1938 (Woodward County Journal 1938; James 1984:168). Twelve men who were specifically noted as working on the Supply Dam were listed in the 1940 census and included laborers, carpenters, inspectors, guards, truck drivers, and operators (likely machinery operators) (United States Federal Census 1940).

Figure 17. Photograph taken by Gilbert Hill in 1954 of the Supply Dam (Source: Oklahoma Publishing Company Photography Collection, Oklahoma Historical Society; https://gateway.okhistory.org/ark:/67531/metadc322433/?q=Woodward).

7.3.2 Field Station Lake Dam

The Field Station Lake Dam, which is the focus of the current architectural survey, began construction at the end of 1938. While census records are not specific, 36 people are listed as employed in dam construction in 1940 and include laborers, pack hammer men, engineers, inspectors, foremen, truck drivers, and guards (United States Federal Census 1940). It is likely that crews overlapped with the building of the Fort Supply dam (see above). The dam was constructed for irrigating the grasses, in particular, at the experimental station as well as other grains and plantings. Siting for the dam was along Spring Creek to the northwest of the main experimental station complex and was designed to impound up to 50 acres of water (Figures 18 and 19). The dam, in the initial planning was intended to be approximately 40 feet in height and 1,000 feet in length (Woodward County Journal 1938). The dam still functions in its original capacity and along with a retention pond (see Table 1), supplies water to the experimental station for the grasses as well as provides recreational opportunities for the community of Woodward.

PHASE I ARCHITECTURAL SURVEY OF THE FIELD STATION LAKE DAM, WOODWARD COUNTY, OKLAHOMA

Historic Context

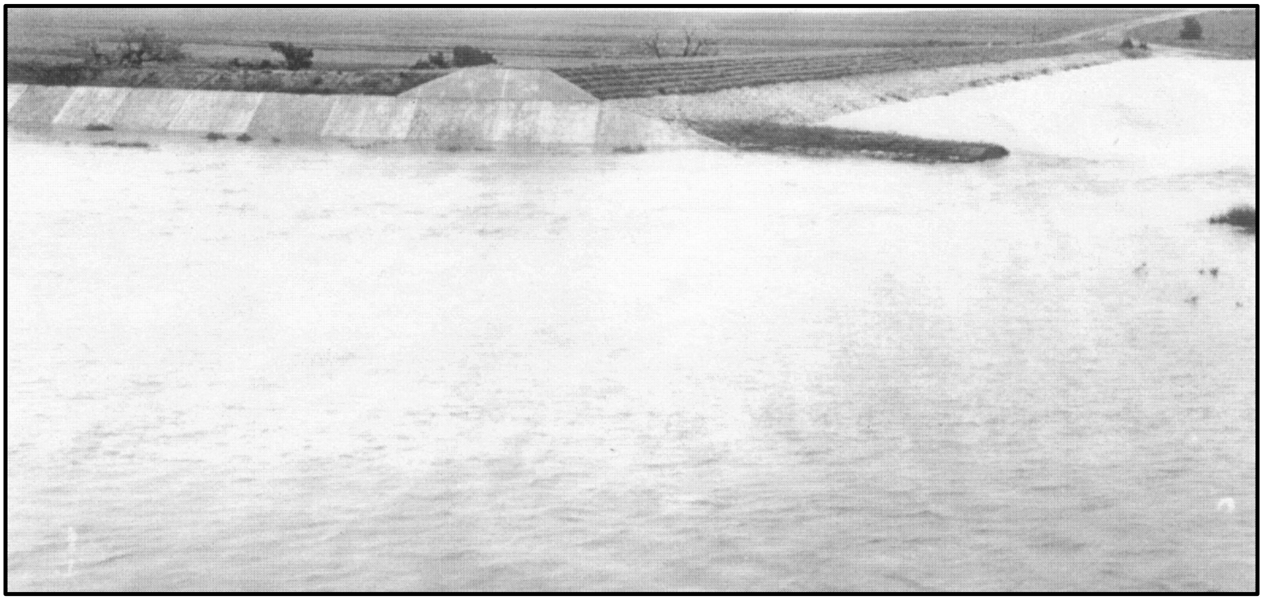

Figure 18. Photograph of Field Station Lake Dam (date unknown) (Source: Southern Great Plains Research Station Collection).

Figure 19. Photograph of Field Station Lake Dam (date unknown) (Source: Southern Great Plains Research Station Collection).

8.0 SUMMARY AND CONCLUSIONS

The Field Station Lake Dam was surveyed as part of proposed rehabilitation improvements to the structure. The dam is part of the early to-mid-twentieth century development of irrigation of experimental crops after the devastation of the 1930s Dust Bowl and one of a few examples of the built history of irrigation dams in this area of Oklahoma during this time period. Additionally, the dam and spillway retain a high degree of integrity of setting, location, materials, workmanship, and design. Based on the fieldwork and subsequent research, the resource is recommended as eligible for listing on the NRHP under Criterion A for its role in the development of irrigation as it relates to the experimental station and is an integral part of the station's history and its efforts in promulgating grasses and other plants for improving grazing lands. Additionally, as the dam is integral to the Southern Great Plains Research Station, it is also recommended that the structure is a contributing resource to the National Register of Historic Places (NRHP)-eligible Field Station Historic District.

Under Criterion A, a property can be eligible for listing on the NRHP if there is an association with a significant event or broad pattern in history at a local, state, or national level. The Field Station Lake Dam is an integral part of the history of the SPRRS and its efforts in the improvement of grasses and other plantings for the revitalization of farms and grazing lands after the devastating effects of erosion and the subsequent Dust Bowl effects of the 1930s. It is recommended therefore that the resource meets the criteria necessary for listing on the NRHP under Criterion A for its role in the re-establishment of viable grazing lands of the Southern Great Plains, particularly in this area of Oklahoma.

Under Criterion B, the resource can be considered eligible if it is associated with a person or persons of significance within the context of the community, state, or nation. The known persons associated with the resources do not appear to have been of transcendent importance within historic contexts on a local, state or national level. Therefore, it is recommended that the resource does not meet the criteria necessary for listing on the NRHP under Criterion B.

The resource does not appear to have significant architectural integrity for listing on the NRHP under Criterion C and is of a common type. In addition, the structure is utilitarian in design and does not embody distinctive characteristics of a type, period, or method of construction nor does the dam represent the work of a master. The resource, instead, is typical of construction of its time period. It is therefore recommended that the resource does not meet the criteria necessary for listing on the NRHP under Criterion C.

Criterion D, typically associated with archaeological sites, was not considered applicable to the architectural survey.

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PHASE I ARCHITECTURAL SURVEY OF THE FIELD STATION LAKE DAM, WOODWARD COUNTY, OKLAHOMA

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Unknown

1954 "Woodward most inviting spot is the Southern Great Plains Field station, where hundreds of trees from all parts of the world have been planted." [Photograph 2012.201.B1383.0259], photograph, August 19; (https://gateway.okhistory.org/ark:/67531/metadc760773/m1/1/?q; The Gateway to Oklahoma History, https://gateway.okhistory.org; crediting Oklahoma Historical Society. Accessed 19 November 2019.

Woodward County Journal

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Appendix A CONSTRUCTION DRAWINGS OF PROPOSED REHABILITATION

Reference Construction Drawings in Appendix A of the Cultural Resources Report

Appendix B HISTORIC AERIALS

Reference Historic Aerials in Appendix C of the Cultural Resources Report

Appendix C INVENTORY FORM

HISTORIC PRESERVATION RESOURCE IDENTIFICATION FORM

PLEASE TYPE ALL DATA IN UPPERCASE - FIELDS IN RED ARE REQUIRED

1. PROPERTY NAME: USDA SOUTHERN PLAINS RANGE RESEARCH STATION
2. RESOURCE NAME: FIELD STATION LAKE DAM
3. ADDRESS: 2000 18TH STREET
4. CITY: WOODWARD
5. VICINITY:
6. COUNTY NAME: WOODWARD
7. LOT:
8. BLOCK:
9. PLAT NAME:
10. SECTION: 35
11. TOWNSHIP: 23N
12. RANGE: 21W
13. LATITUDE (NORTH): (ENTER AS: "dd.ddddd")
14. LONGITUDE (WEST): (ENTER AS: "-dd.ddddd")
15. UTM ZONE: 14
16. NORTHINGS: 4031503
17. EASTINGS: 462025
18. RESOURCE TYPE: STRUCTURE
19. HISTORIC FUNCTION: IRRIGATION FACILITY
20. CURRENT FUNCTION: IRRIGATION FACILITY
21. AREA OF SIGNIFICANCE, PRIMARY: AGRICULTURE
22. AREA OF SIGNIFICANCE, SECONDARY: CONSERVATION
23. DESCRIPTION OF SIGNIFICANCE: RECOMMENDED ELIGIBLE UNDER CRITERION A AND AS A CONTRIBUTING RESOURCE TO THE NRHP ELIGIBLE (SEE CONT.)
24. DOCUMENTATION RESOURCE: SEE PHASE I ARCHITECTURE SURVEY REPORT
25. NAME OF PREPARER: SANDRA DECHARD
59. SURVEY PROJECT: YES
26. PROJECT NAME: FIELD STATION LAKE DAM
27. DATE OF PREPARATION: DECEMBER 9
28. PHOTOGRAPHS: YES
29. YEAR: 2019

30. ARCHITECT/BUILDER: ARS

31. YEAR BUILT: 1938

32. ORIGINAL SITE: YES

33. DATE MOVED: N/A

34. FROM WHERE: N/A

35. ACCESSIBLE: YES

36. ARCHITECTURAL STYLE: NO STYLE

37. OTHER ARCHITECTURAL STYLE:

38. FOUNDATION MATERIAL: EARTH

39. ROOF TYPE: N/A

40. ROOF MATERIAL: INAPPLICABLE

41. WALL MATERIAL, PRIMARY: EARTH

42. WALL MATERIAL, SECONDARY: CONCRETE

43. WINDOW TYPE: N/A

44. WINDOW MATERIAL: INAPPLICABLE

45. DOOR TYPE: N/A

46. DOOR MATERIAL: INAPPLICABLE

47. EXTERIOR FEATURES: BOARD-FORMED POURED CONCRETE WALLS

48. INTERIOR FEATURES: N/A

49. DECORATIVE DETAILS: NONE

50. CONDITION OF RESOURCE: FAIR (SOMEWHAT IN NEED OF MAINTENANCE)

51. DESCRIPTION OF RESOURCE:

THE DAM IS A ROLLED EARTHEN EMBANKMENT DAM CONSTRUCTED TO SUPPLY IRRIGATION WATER TO THE SPRRS AND SURROUNDING AREA (SEE CONT.)

52. COMMENTS:

THE DAM AND THE SPILLWAY STILL RETAIN A HIGH DEGREE OF ARCHITECTURAL INTREGRITY.

53. ATTACH LOCATION MAP

54. LISTED ON NATIONAL REGISTER: ELIGIBLE

55. NATIONAL REGISTER ENTRY: N/A

56. CONTINUATION

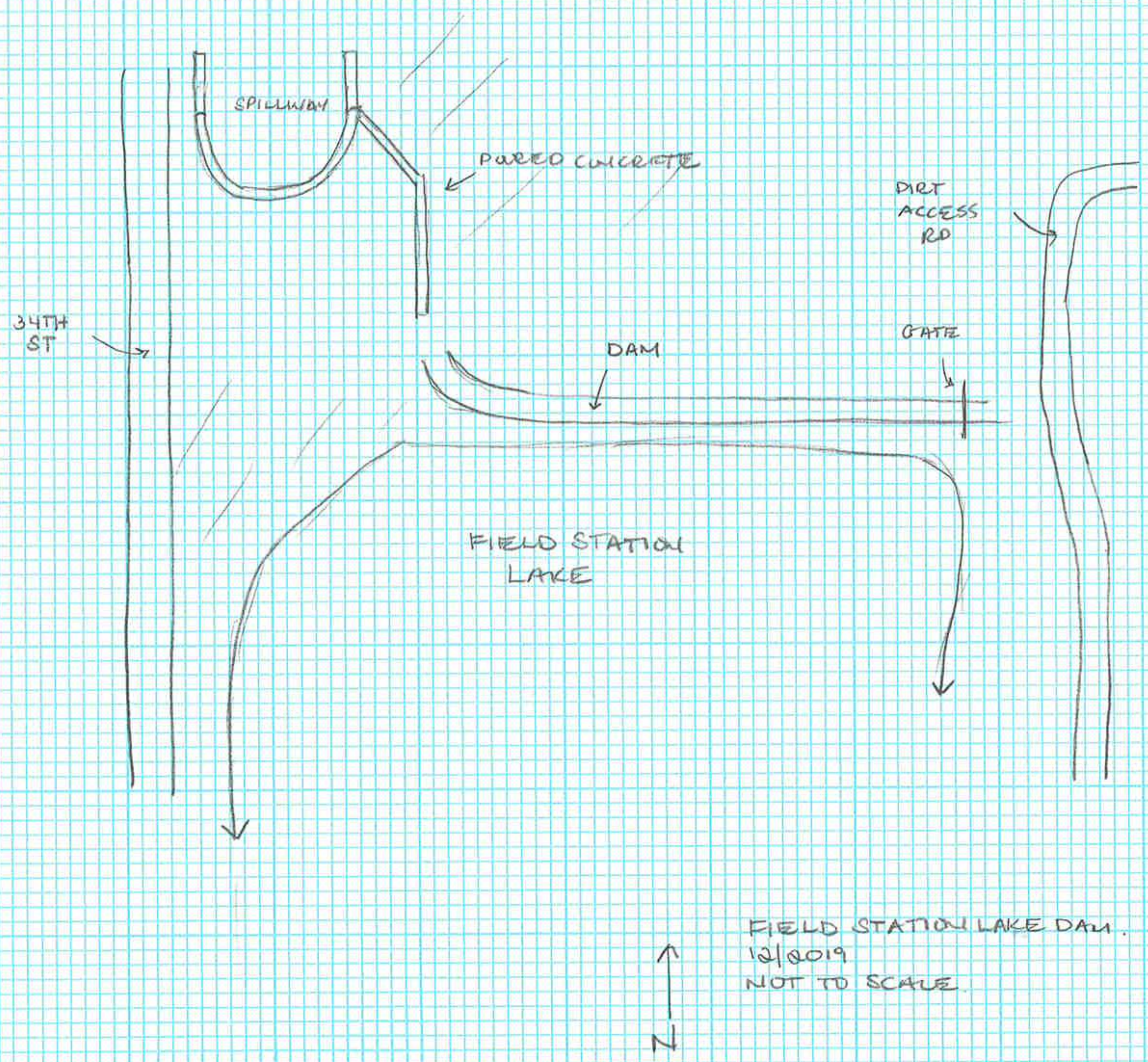
SIGNIFICANCE CONT.

FIELD STATION HISTORIC DISTRICT.

CONTINUATION SHEET, IF APPLICABLE

DESCRIPTION OF RESOURCE CONT.

THE DAM IS 950 FEET LONG, 12 FEET WIDE AT THE CREST, AND HAS A MAXIMUM HEIGHT OF 35 FEET. THE RESOURCE ALSO FEATURES A CONCRETE SPILLWAY WITH A METAL TRASH RACK BOLTED TO THE TOP/CENTER OF THE STRUCTURE.


SPILLWAY
POURED CONCRETE
DIRT ACCESS RD
34TH ST
GATE
DAM
FIELD STATION LAKE
FIELD STATION LAKE DAM
12/2019
NOT TO SCALE
N

APPENDIX D
HTRW Desktop Review Report

Hazardous, Toxic, and Radioactive Waste (HTRW) Desktop Review

Transaction Screen for the ARS Field Station Lake Dam

September 30, 2019

Prepared for:

Natural Resource Conservation Service (NRCS) and Agricultural Research Service (ARS)

Prepared by:

Robert Esenwein, CEP
Erica Koopman-Glass, EIT

This document entitled Hazardous, Toxic, and Radioactive Waste (HTRW) Desktop Review was prepared by Stantec Consulting Services Inc. (“Stantec”) for the account of Natural Resource Conservation Service (NRCS) and Agricultural Research Service (ARS) (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by ____
(signature)
Enter Name

Reviewed by ____
(signature)
Enter Name

Approved by ____
(signature)
Enter Name

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Executive Summary

The Field Station Lake Dam is operated by and located on the property of the Agricultural Research Service (ARS) Southern Plains Range Research Station (SPRRS) in Woodward, OK. The dam was constructed in 1938 to provide irrigation to SPRRS and currently also acts as a recreation site for the local community of Woodward (Schnabel Engineering, 2016). Stantec was chosen by Ad Astra Collaborative, LLC (also known as “Prime Consultant”) to conduct a high level Hazardous, Toxic, and Radioactive Waste (HTRW) desktop assessment to be included in the Environmental Assessment (EA) for the ARS Field Station Lake Dam Rehabilitation Project (Site) for the Natural Resource Conservation Service (NRCE) under an agreement with the ARS. Stantec conducted a transaction screen to determine any past, present, or possible HTRW contamination on the site. This effort included a database review, interview with the site representative/owner, and review of relevant documents about the Site. Environmental Data Resources, Inc. (EDR) provided a review of regulatory agency environmental databases and historic aerial maps of the Site.

Review of relevant documents and databases indicated that the Site is covered primarily by woody vegetation with northwesterly groundwater flow. The Site and surrounding area were largely undeveloped and was mainly comprised of grasslands (Stoner, 2018). Beginning in the 1980s, the surrounding site has increased residential and commercial development and roads that form around the lake. In 2008, NRCE recommended that the dam be assigned a High Hazard classification due to identification of four potential damage locations (PDLs) located downstream of the dam (Schnabel Engineering, 2016).

Possible contamination could be caused by the pedestrian access to the lake. The east side of the Lake can be accessed through the United States Department of Agriculture (USDA) property and is controlled with a gate across the gravel road that is closed during non-business hours. However, people can access the west side of the Lake from 34th Street. There are four parking areas/boat ramps off 34th Street that the public uses for recreation on the lake (Schnabel Engineering, 2016).

The database review indicated that there are two Leaking Underground Storage Tank (LUST) sites located ¼- ½ miles from the Site. The location nearest the dam was the site for an above ground diesel tank that was removed in 1990. The second location had five tanks and had a confirmed release in 1997. By 1998 all tanks on both sites were permanently out of use. These LUST sites are not expected to have any adverse impacts on the Site since the Site is located southeast of the tanks and the groundwater is presumed to flow northwesterly.

The interview with the owner specifies that there are no known HTRW contaminants on the Site.

This assessment has not identified any evidence of recognized environmental conditions (RECs) including controlled RECs (CRECs), historical RECs (HRECs), or *de minimis* conditions in connection with the Site. Based on the data reviewed and analysis preformed within this transaction screen, no hazardous substances including raw materials; finished products and formulations; hazardous wastes; hazardous constituents and pollutants including intermediates and byproducts were known to be historically present at the Site.

Abbreviations

Ad Astra Collaborative, LLC	Prime Consultant
ARS	Agricultural Research Service
ASTM	American Society for Testing and Materials
CREC	Controlled Recognized Environmental Condition
CPT	Cone Penetrating Testing
EA	Environmental Assessment
EDR	Environmental Data Resource, Inc.
FEMA	Federal Emergency Management Agency
Field Station Lake Dam Rehabilitation Project	Site
HREC	Historical Recognized Environmental Condition
HTRW	Hazardous, Toxic, and Radioactive Waste
LUST	Leaking Underground Storage Tank
MSL	Mean Sea Level
NRCE	Natural Resource Conservation Service
PDL	Potential Damage Location
REC	Recognized Environmental Condition
SPRRS	Southern Plains Range Research Station
USCS	United Soil Classification System
USDA	United States Department of Agriculture
USGS	United States Geological Survey

1.0 INTRODUCTION

1.1 PURPOSE

Stantec was retained as a subconsultant by Ad Astra Collaborative, LLC (also known as “Prime”) to conduct a high level Hazardous, Toxic, and Radioactive Waste (HTRW) desktop assessment as part of the Environmental Assessment (EA) for the Field Station Lake Dam Rehabilitation Project in Woodward, OK for the Natural Resource Conservation Service (NRCE) working under an agreement with the Agricultural Research Service (ARS). The dam and spillway is on the property of the ARS Southern Plains Range Research Station (SPRRS) (Site) and is operated by the ARS in Woodward, OK. Per Google Earth, Site coordinates are 36 degrees, 25 minutes, 28 seconds north; and 99 degrees, 25 minutes, and 25 seconds west. The dam was constructed in 1938 to provide irrigation water for fields located on the SPRRS. The reservoir is still the main source of irrigation for the SPRRS, but also serves as a recreation site for the local community of Woodward (Schnabel Engineering, 2016).

Stantec has conducted this transaction screen in accordance with the scope and limitations of the American Society of Testing and Materials (ASTM) Practice E1528-14 *Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process*. This effort includes a database search of properties within a circumscribed area that may be listed on various lists including landfills, local brownfields lists, emergency release reports, local contaminated sites lists, registered storage tanks and other local environmental record sources. The transaction screen included a review of a regulatory agency environmental database for the Property and surrounding area provided by Environmental Data Resources, Inc. (EDR), and a review of historical information for the Property. The transaction screen was created in order to determine the need for a Phase I Environmental Survey.

1.2 DATABASE REVIEW SUMMARY- RELEVANT INFORMATION REVIEWED

The following reports were reviewed while conducting this transaction screen:

EDR reports:

- EDR Summary Radius Map Report (**Appendix C**)
- EDR Aerial Photo Decade Package (1954-2017) (**Appendix D**)
- Certified Sanborn Map Report (fire insurance maps were not found for the Site) (**Appendix E**)

Reports regarding the Site were provided for Stantec’s review:

United States Department of Agriculture (USDA) Soil Mechanics Report for ARS Field Station Lake Dam, Woodward County (January 12, 2018)

USDA Soil Mechanics Supplemental Report, Seepage Analysis for ARS Field Station Lake Dam, Woodward County (October 17, 2017)

USDA Geologic Investigation Report Supplement Cone Penetrating Testing (CPT) for ARS Field Station Lake Dam, Woodward County, Oklahoma (March 7, 2019)

Investigative Study and Evaluation- Field Station Lake Dam OK 10416- Schnabel Engineering (June 30, 2016)

1.3 LIMITATIONS

Stantec has performed the services for this project in accordance with current standards of the American Society for Testing and Materials (ASTM) for transaction screen (ASTM standard E1528-14). No guarantees are either expressed or implied. Stantec is not responsible for errors or omissions in the information supplied by the commercial database company. Reasonably ascertainable information was reviewed for this project. Reasonably ascertainable information is publicly available and obtainable within reasonable time and cost constraints, and reasonably reviewable. The investigation was limited to a search for recognized environmental conditions (RECs). The term REC means the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include de minimis conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.

Opinions and judgments expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal opinions.

2.0 HISTORY OF SITE- OVERVIEW OF SITE

Field Station Lake Dam located at the ARS Southern Plains Field Station in Woodward County, OK, was first constructed in 1938 as a low hazard rolled earth fill embankment dam, with the primary purpose of supplying irrigation water to the surrounding area (Stoner, 2018). Primarily woody vegetation covers the Site and Site topographic elevation is about 1,972 feet above mean sea level (MSL) as indicated by the United States Geological Survey (USGS) topographic map (2006) (EDR, 2019).

Table 1: *Existing Dam Summary (Schnabel Engineering, 2016)*

	Elevation (ft)	Storage (ac-ft)
Pool at Time of inspection (Nov. 10, 2015)	1971.8	182
Principal Spillway Crest	1973.3	224
Auxiliary Spillway Crest	1973.6	232
Top of Dam	1985	803

The current structure is 950 feet long with a maximum height of 35 feet, see **Table 1** for a summary of the Existing Dam elevation and storage. The current top width of the structure is 12 feet with upstream and downstream slopes of the structure at 2.5H:1V and 2H:1V, respectively. The structure was originally designed and constructed as a low hazard rolled earthen embankment composed of a mix of CL, CL-ML, SC-SM, and SM soils, as classified according to the Unified Soil Classification System (USCS) (Stoner, 2018). The current embankment is constructed on alluvial materials overlying weathered bedrock. The alluvial materials are a heterogeneous mix of sands, silts, and clays (Stoner, 2017).

On December 1, 2008, NRCS recommended that the dam be assigned a High Hazard classification due to the identification of four potential damage locations (PDLs) located downstream of the dam (Schnabel Engineering, 2016). The structure has been upgraded to a significant or high hazard classification due to development downstream and around the pool area of the structure, changes in criteria, and to extend the life of the structure (Stoner, 2018). **Table 2** listed the proposed changes to the Field Station Lake Dam.

Table 2: *Proposed Dam Rehabilitation Summary (Schnabel Engineering, 2016)*

Drainage Area	14.4 sq. mi.
Embankment Length	950 ft
Maximum Embankment Height	35 ft
Principal Spillway Drop Box dimensions	2.5ft X 3.5ft
Principal Spillway Conduit	12-inch diameter
Auxiliary Spillway Weir Length	475 ft
Auxiliary Spillway Avg. Width	175 ft

2.1 EXISTING CONDITIONS- DAM

The dam can be accessed from both the east and west sides. The east side can be accessed through USDA property and is controlled with a gate across the gravel road that is closed during non-business hours. People can access the west side of the dam from 34th Street. There are four parking areas/boat ramps off 34th Street that the public uses for recreation on the lake (Schnabel Engineering, 2016). In 2014, the lake was drawn down to fill the smaller reservoir for USDA’s irrigation needs.

The overview Map, as seen in **Figure 1**, shows a power transmission line that passes within 200 feet from the northeast corner of the Site. The Site is within a 100-year flood zone, and a wetland may be located within a ¼ mile northeast of the Site. There is an existing waterline that is directly northeast of the Site that is to be abandoned in place and there is a main irrigation line that runs about 150 feet south of the northern edge of the dam (Stoner, 2018). There is a wet area downstream of the embankment that collect water from a reservoir blow-off valve. This area contained wetland plants during the 2016 inspection and might be considered a wetland. There are also other moist areas around the toe of the dam that may have formed due to foundation seepage (Schnabel Engineering, 2016). These wet areas might be the result of a slight increase in an already high-water table caused by the permanent pool (Stoner, 2017). There are two “caves” at the bottom of the right and left concrete spillway walls. There is a concrete structure with a metal trash rack bolted to the top in the center of the concrete spillway. The structure was most likely designed to prevent water from overtopping the concrete spillway during smaller storm events (EDR, 2019).

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW) DESKTOP REVIEW

History of Site- Overview of Site

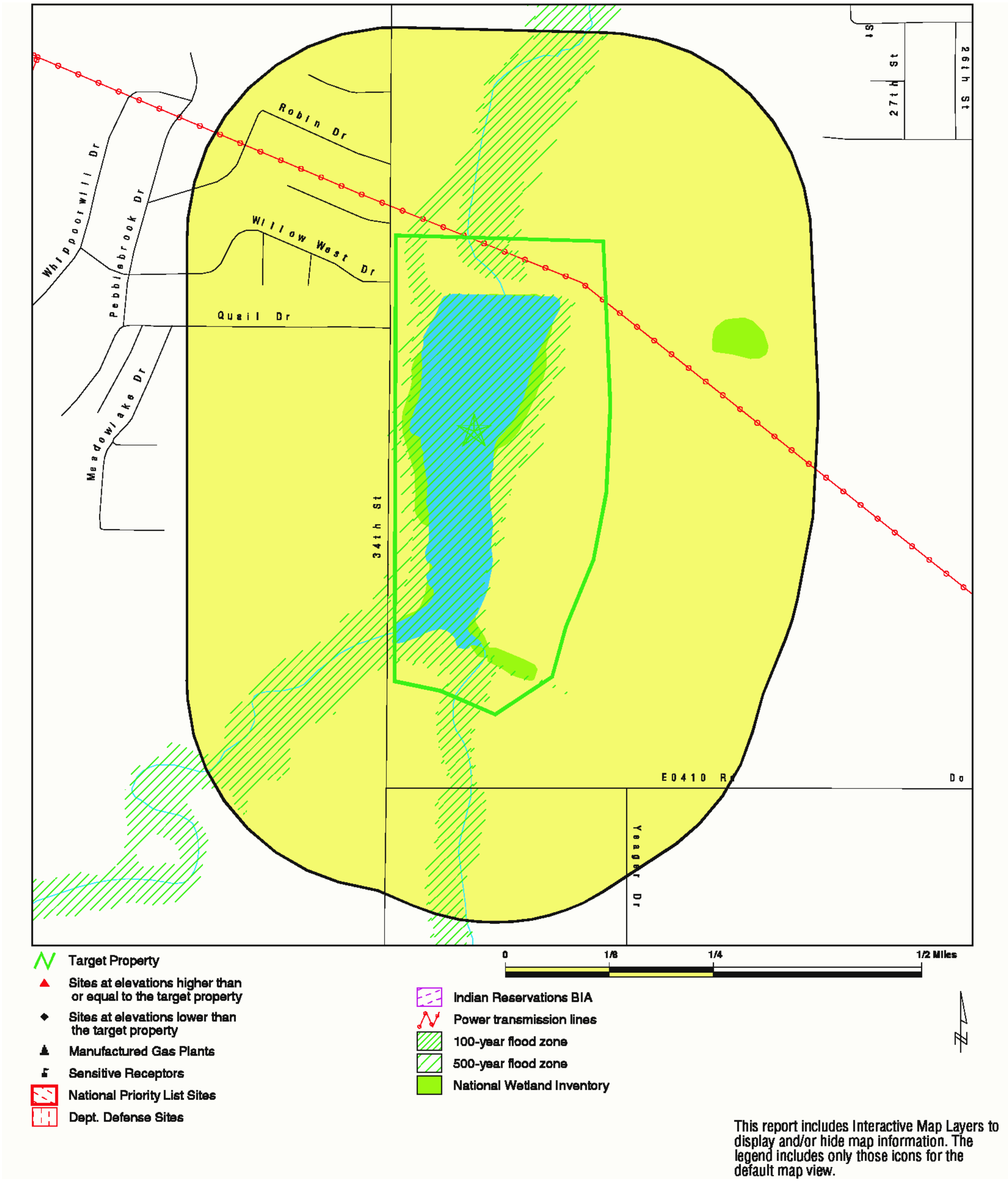

Figure 1: *Map illustrating an overview of the Site and surrounding features (EDR, 2019)*

2.2 EXISTING CONDITIONS- PHYSICAL SETTING- GEOLOGY

The most recent inspection of the dam and spillways took place during November 2015 and found that the Site is mainly comprised of grass, brush, and tree cover that was very dense on the embankment, auxiliary spillway, and downstream channel (Schnabel Engineering, 2016).

The structure was originally designed and constructed as a low hazard rolled earthen embankment composed of a mix of CL, CL-ML, SC-SM, and SM soils, as classified according to the USCS (Stoner, 2018). The existing embankment soils consist of coarse-grained SM (non-plastic to slightly plastic) and low plasticity SC-SM with fine-grained low plasticity CL-ML and low to medium plastic CL soils. The proposed embankment borrow material will come from near the existing auxiliary spillway area and tested (from drill holes 106, 107, and 402). These samples are representative of the borrow soils to be used for the new embankment fill material, each of the borrow soil samples are varied material (Stoner, 2018).

According to the USGS topographic map (2006), the Site topographic elevation is approximately 1972 feet above MSL, and regional topography slopes toward the northwest. Based on local topography and historical environmental reports provided to Stantec, as applicable, the assumed direction of shallow ground water flow is northwesterly. However, a subsurface investigation would be required to determine actual ground water flow direction (Stoner, 2018).

The database radius report by EDR of Milford, Connecticut was reviewed to obtain information regarding the dominant soil composition in the Site vicinity. The SSURGO Soil Map and the GEOCHECK Physical Setting Source Summary indicates the soil type for different areas in and around the Site (**Appendix C**) and **Table 3** summaries these soil types (EDR, 2019). The soils immediately East and West of the lake consist of silt loam/loam that have moderate to slow infiltration rates and are well drained. The soils North of the lake consist of loam/fine sandy loam that have high to moderate infiltration rates and are well drained/somewhat excessively drained. The soils South of the lake consist of fine sandy loam that have slow infiltration rates and are somewhat poorly drained.

Table 3: *Summary of the soil types in and surrounding the Site (EDR, 2019)*

Soil Map ID	Soil Component Name	Soil Surface Texture	Hydrologic Group	Soil Drainage Class	Hydric Status	Corrosion Potential
1	Water	Water	Not reported	Not reported	All hydric	Not reported
2	Carey	Silt loam	Class B- Moderate infiltration rates	Well drained	Not hydric	Moderate
3	Quinlan	Loam	Class C- Slow infiltration rates	Well drained	Unknown	Moderate
4	Hardeman	Loam	Class B- Moderate infiltration rates	Well drained	Not hydric	Low
5	Carey	Silt loam	Class B- Moderate infiltration rates	Well drained	Not hydric	Moderate
6	Dam	variable	Class D- Very slow infiltration rates	Not reported	Not hydric	Not reported
7	Hardeman	Loam	Class B- Moderate infiltration rates	Well drained	Not hydric	Low
8	Lincoln	Loamy fine sand	Class A- High infiltration rates	Somewhat excessively drained	Partially hydric	Low
9	Devol	Fine sandy loam	Class B- Moderate infiltration rates	Well drained	Partially hydric	Low
10	Waldeck	Fine sandy loam	Class C- Slow infiltration rates	Somewhat poorly drained	Partially hydric	Moderate
11	Woodward	Loam	Class B- Moderate infiltration rates	Well drained	Not hydric	Low

See the Physical Setting Source Map for the location of water wells in and surrounding the Site (EDR, 2019). There are no oil, gas or related wells within 1 (one) mile of the Site (EDR, 2019). Please refer to the Geocheck Physical Setting Source Summary of the EDR report presented in **Appendix C** for further information regarding the soil composition in the Site vicinity. According to EDR, the Site is located within a 100-year Federal Emergency Management Agency (FEMA) flood zone.

During the 2015 Site inspection, a wet area was observed at the toe of the embankment. This area has been identified in previous reports as being an historically wet area. This is indicative of seepage through the embankment; however, it appears the groundwater downstream of the dam is relatively shallow and there are beaver dams that impound water near the downstream toe (Schnabel Engineering, 2016).

2.3 PROPERTY HISTORY

Table 4 summarizes the Site's and adjoining properties history around the Site. In 1938, the Field Station Lake Dam was created to supply irrigation water to the surrounding area (Stoner, 2018). From 1954-1968

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW) DESKTOP REVIEW

History of Site- Overview of Site

the Site and surrounding area mainly comprised of grasslands with little development and two dirt dam access roads. Beginning in 1968, there were an increased number of dirt roads around the Site and the trees became more prominent. By 1983, roads are seen east of the lake and residential and commercial development forms northwest and southeast of the Site. In 2006, a dock is added to the northwest side of the lake. From 2006-2017, there is increased housing development to the west and northwest of the Site.

On December 1, 2008, NRCS recommended that the dam be assigned a High Hazard classification due to the identification of four potential damage locations (PDLs) located downstream of the dam (Schnabel Engineering, 2016).

Information regarding Site and vicinity historical uses was obtained from various publicly available and practically reviewable sources including:

- Aerial photographs (scale: 1” = 500’) dated 2017, 2013, 2010, 2006, 1995, 1983, 1972, 1968, and 1954;
- An environmental database report; and
- Interviews with Site representative(s) and regulatory agency official(s), as necessary.

No Sanborn Fire Insurance Maps (Sanborn Maps) were found for the Site

Table 4: *Summary of the Site and Adjoining Property History*

Year	Site and Adjoining Property History
1938	Creation of Field Station Lake Dam as a low hazard rolled earth fill embankment dam
1954-1968	The aerial photograph (aerial) beginning in 1954 depicted the Site as primarily void of improvements and comprised of grasslands with the exception of a small stand of trees north, southwest, and south of the lake. Two dirt roads were also apparent in the aerials. One runs parallel south of the lake and then connects to a road that cuts parallel west of the lake. The Site was otherwise unimproved and conditions remained generally consistent in subsequent aerial photographs reviewed through 1968.
1968-1972	Beginning with the 1968 aerial, small dirt roads around the lake start to appear. In 1972, the trees around the lake become more prominent.
1972-2006	In 1983, roads begin to form East of the lake that connect to other dirt roads. Also, a residential and commercial development forms northwest and southeast of the lake. In 2006, a dock is added to the northwest side of the lake.
2008	NRCS recommended dam to be classified as High Hazard
2006-2017	In 2010, a new road and structure is built west of the center of the lake. A parking lot and structure is built directly below the previously built structure by 2013 and there is more development west of the lake by 2017.

2.4 INTERVIEW WITH OWNER

The owner questionnaire answers were completed by Stacey Gunter, the Research Leader at the USDA ARS and who has been an employee at the Site for eleven years, on 7/24/2019. Stacey answered No to every question listed in the ASTM standard E1528-14. The responses provided by the interview is documented in **Appendix A.**

3.0 DATABASE REVIEW FINDINGS- ANALYSIS OF CONTAMINATION

The owner's interview, relevant reports, and EDR's database search report that identified properties listed on state and federal databases with the ASTM-required radii of the Site were used to determine potential HTRW contamination on the Site (**Appendix C**). Only two LUST Sites are located approximately 0.5 miles from the Site (EDR, 2019).

3.1 DATABASE REVIEW- CONTAMINATION TABLE

The review of available regulatory agency databases for the Site indicated the property on the following databases for the Oklahoma Corporation Commission Leaking Underground Storage Tank (LUST) List, the Oklahoma Corporation Commission Underground Storage Tank (UST) List, and the Oklahoma Corporation Commission Historical Underground Storage Tank (HIST UST) List, List II Version.

The database review, analysis of relevant reports, and owner interview indicate that there have been no HTRW identified on the Site. The only classified HTRW are two LUST Sites located ¼- ½ mile away from the Site. The first LUST Site is located on Jeter Service Company's property and consisted of a 10,000kg diesel single-walled steel tank. The tank was first installed in 1976 by L and L Backhoe Service and removed from the ground in 1990. **Table 5** and **6** provides a summary of the LUST findings for the Jeter Service Company's property.

Table 5: *Summary of the LUSTs found on the Jeter Service Company's property*

Tank Type	Number of Tanks	Substance	Date Installed	Closure Status	Tank Status
10000kg single-walled steel tank	1	Diesel	4/08/1976	06/26/1990	Tank Removed from Ground

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW) DESKTOP REVIEW

Database Review Findings- Analysis of Contamination

Table 6: *Summary of the information found about the Jeter Service Company property*

Site Facility Name(s) and/or Listed Address(es)	Jeter Service Company, 3600 Oklahoma Ave; NNW 0.359 mile of Site at 1895 ft.
EDR Map No(s).	A1
Database(s)	LUST, UST, HIST UST
Database Description(s)	**LUST** is a list of Leaking Underground Storage Tanks in Oklahoma. **UST** is a database for Active Underground Storage Tank Facilities in Oklahoma. **HIST UST** refers to the list of Historic Underground Storage Tanks in Oklahoma.
Database Review Summary	The listing was primarily administrative in nature. It indicated that the property had a 10,000 kg diesel single-walled steel tank. The tank was first installed in 1976 by L and L Backhoe Service and removed from the ground in 1990.

The second LUST is located on Leo Smith Oil Co.'s property and involved two steel single-walled 6,000kg gasoline tanks, one 500kg used oil tank, and one 12,000kg diesel tank. In 1997, there was a confirmed release from an active underground storage tank and by 1998 all the tanks were permanently out of use. **Table 7** and **8** provides a summary of the LUST findings for the Leo Smith Coil Co.'s property.

Table 7: *Summary of the LUSTs found on the Leo Smith Oil Co.'s property*

Tank Type	Number of Tanks	Substance	Date Installed	Closure Status	Tank Status
6000kg single-walled steel tank	2	Gasoline	4/22/1967	01/07/1998	Tank Closed in Place
500kg single-walled steel tank	1	Used Oil	4/22/1967	01/07/1998	Tank Closed in Place
12000kg single-walled steel tank	1	Diesel	04/21/1980	01/07/1998	Tank Closed in Place
6000kg single-walled steel tank	1	Diesel	04/22/1967	01/07/1998	Tank Closed in Place

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW) DESKTOP REVIEW

Database Review Findings- Analysis of Contamination

Table 8: *Summary of the information found about the Leo Smith Oil Co. property*

Site Facility Name(s) and/or Listed Address(es)	Leo Smith Oil Co., HWY 270 & Oklahoma A; NNW 0.391 mile of Site at 2063 ft
EDR Map No(s).	A2
Database(s)	LUST, UST, HIST UST
Database Description(s)	**LUST** is a list of Leaking Underground Storage Tanks in Oklahoma. **UST** is a database for Active Underground Storage Tank Facilities in Oklahoma. **HIST UST** refers to the list of Historic Underground Storage Tanks in Oklahoma.
Database Review Summary	In 1967, the Bank IV of Oklahoma installed three steel single-walled 6,000 kg gasoline closed in place tanks and one 500 kg gasoline tank and in 1980 they installed a 12,000 kg diesel tank. As of 1998, all the tanks were permanently out of use. In 1997, there was a confirmed release of an active underground storage tank by Leo Smith Oil Co. that closed in 1998.

No HTRW were identified from these reports regarding the Site:

USDA Soil Mechanics Report for ARS Field Station Lake Dam, Woodward County (January 12, 2018)

USDA Soil Mechanics Supplemental Report, Seepage Analysis for ARS Field Station Lake Dam, Woodward County (October 17, 2017)

USDA Geologic Investigation Report Supplement Cone Penetrating Testing (CPT) for ARS Field Station Lake Dam, Woodward County, Oklahoma (March 7, 2019)

Investigative Study and Evaluation- Field Station Lake Dam OK 10416- Schnabel Engineering (June 30, 2016)

3.2 SUMMARY OF POSSIBLE CONTAMINATION

Possible contamination could be caused by the pedestrian access to the lake. The east side of the Lake can be accessed through the United States Department of Agriculture (USDA) property and is controlled with a gate across the gravel road that is closed during non-business hours. However, people can access the west side of the Lake from 34th Street. There are four parking areas/boat ramps off 34th Street that the public uses for recreation on the lake (Schnabel Engineering, 2016).

The possible HTRW classifications can include RECs, historical RECS (HRECs), controlled RECs (CRECs) and de minimis conditions. RECs are the existence of any hazardous substances or petroleum products on the property due to a release to the environment or under conditions that pose a material threat of a future release to the environment. CRECs are defined as a REC from a past release of hazardous substances/petroleum products that has met the requirements of the applicable regulatory authority. HRECs are a past release of any hazardous substances/petroleum products that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authority. De minimis conditions are defined as a condition that does not present a threat to human health or the environment.

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW) DESKTOP REVIEW

Database Review Findings- Analysis of Contamination

This assessment has revealed no evidence of RECs (including CRECs) in connection with the Site. This assessment has revealed no evidence of HRECs in connection with the Site. This assessment has revealed no evidence of *de minimis* conditions in connection with the Site.
The two LUSTs located on adjoining properties within a ¼ to ½ mile from the Site have been either closed or removed in the 1990s and no further action letter was issued by the regulatory agency. These LUST Sites are not expected to have any adverse impacts on the Site since the Site is located southeast of the tanks and the groundwater is presumed to flow northwesterly (they are down gradient or cross gradient from the Site).

Based on the data reviewed and analysis preformed within this transaction screen, no hazardous substances including raw materials; finished products and formulations; hazardous wastes; hazardous constituents and pollutants including intermediates and byproducts were known to be historically present at the Site.

4.0 REFERENCES

EDR. “ARS Field Station Lake Dam EDR Summary Radius Map Report.” 26 July 2019.

McClintock, Clancy. “Geologic Investigation Report Supplement Cone Penetration Testing (CPT) ARS Field Station Lake Dam, Woodward County, OK.” *USDA,* 7 March 2019.

Schnabel Engineering. “Investigative Study/Evaluation of Field Station Dam for USDA Southern Plains Range Research Station, Woodard, OK.” *USDA*, 30 June 2016.

Stoner, Chris. “Soil Mechanics Report for ARS Field Station Lake Dam, Woodward County.” *USDA,* 12 Jan. 2018.

Stoner, Chris. “Soil Mechanics Supplemental Report, Seepage Analysis for ARS Field Station Lake Dam, Woodward County.” USDA, 17 Oct. 2017.

APPENDIX A

Owner Transaction Screen Questionnaire

Appendix A – OWNER TRANSACTION SCREEN QUESTIONNAIRE

Table 9: *Owner Responses to the Transaction Screen Questionnaire*

Number	Question	YES	NO	UNKNOWN
1a.	Is the *property* used for an industrial use?		X	
1b.	Is any *adjoining property* used for an industrial use?		X	
2a.	Did you observe evidence or do you have any prior knowledge that the *property* has been used for an industrial use in the past?		X	
2b.	Did you observe evidence or do you have any prior knowledge that any *adjoining property* has been used for an industrial use in the past?		X	
3a.	Is the *property* used as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility (if applicable, identify which)?		X	
3b.	Is any *adjoining property* used as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility (if applicable, identify which)?		X	
4a.	Did you observe evidence or do you have any prior knowledge that the *property* has been used as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility (if applicable, identify which)?		X	
4b.	Did you observe evidence or do you have any prior knowledge that any *adjoining property* has been used as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility (if applicable, identify which)?		X	
5a.	Are there currently any damaged or discarded automotive or industrial batteries, pesticides, paints, or other chemicals in individual containers of>5 gal (19 L) in volume or 50 gal		X	

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW) DESKTOP REVIEW– OWNER TRANSACTION SCREEN QUESTIONNAIRE

	(190L) in the aggregate, stored on or used at the *property* or at the facility?			
5b.	Did you observe evidence or do you have any prior knowledge that there have been previously any damaged or discarded automotive or industrial batteries, or pesticides, paints, or other chemicals in individual containers of >5 gal (19 L) in volume or 50 gal (190 L) in the aggregate, stored on or used at the *property* or at the facility?		X	
6a.	Are there currently any industrial *drums* (typically 55 gal (208 L)) or sacks of chemicals located on the *property* or at the facility?		X	
6b.	Did you observe evidence or do you have any prior knowledge that there have been previously any industrial *drums* (typically 55 gal (208 L)) or sacks of chemicals located on the *property* or at the facility?		X	
7a.	Did you observe evidence or do you have any prior knowledge that *fill dirt* has been brought onto the *property* that originated from a contaminated site?		X	
7b.	Did you observe evidence or do you have any prior knowledge that *fill dirt* has been brought onto the *property* that is of an unknown origin?		X	
8a.	Are there currently any *pits, ponds*, or *lagoons* located on the *property* in connection with waste treatment or waste disposal?		X	
8b.	Did you observe evidence or do you have any prior knowledge that there have been previously, any *pits, ponds*, or *lagoons* located on the *property* in connection with waste treatment or waste disposal?		X	
9a.	Is there currently any stained soil on the *property*?		X	
9b.	Did you observe evidence or do you have any prior knowledge that there has been previously, any stained soil on the *property*?		X	
10a.	Are there currently any registered or unregistered storage tanks (above or underground) located on the *property*?		X	
10b.	Did you observe evidence or do you have any prior knowledge that there have been previously, any registered or unregistered storage tanks (above or underground) located on the *property*?		X	

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW) DESKTOP REVIEW– OWNER TRANSACTION SCREEN QUESTIONNAIRE

11a.	Are there currently any vent pipes, fill pipes, or access ways indicating a fill pipe protruding from the ground on the *property* or adjacent to any structure located on the *property*?		X	
11b.	Did you observe evidence or do you have any prior knowledge that there have been previously, any vent pipes, fill pipes, or access ways indicating a fill pipe protruding from the ground on the *property* or adjacent to any structure located on the *property*?		X	
12a.	Is there currently evidence of leaks, spills or staining by substances other than water, or foul odors, associated with any flooring, drains, walls, ceilings, or exposed grounds on the *property*?		X	
12b.	Did you observe evidence or do you have any prior knowledge that there have been previously any leaks, spills, or staining by substances other than water, or foul odors, associated with any flooring drains, walls, ceilings or exposed grounds on the *property* ?		X	
13a.	If the *property* is served by a private well or non-public water system, is there evidence or do you have prior knowledge that contaminants have been identified in the well or system that exceed guidelines applicable to the water system?		X	
13b.	If the *property* is served by a private well or non-public water system, is there evidence or do you have prior knowledge that the well has been designated as contaminated by any government environmental/health agency?		X	
14.	Does the *owner* or *occupant* of the *property* have any knowledge of *environmental liens* or governmental notification relating to past or recurrent violations of environmental laws with respect to the *property* or any facility located on the *property*?		X	
15a.	Has the *owner* or *occupant* of the *property* been informed of the past existence of *hazardous substances* or *petroleum products* with respect to the *property* or any facility located on the *property*?		X	
15b.	Has the *owner* or *occupant* of the *property* been informed of the current existence of *hazardous substances* or *petroleum products* with respect to the *property* or any facility located on the *property*?		X	
15c.	Has the *owner* or *occupant* of the *property* been informed of the past existence of environmental violations with respect to the *property* or any facility located on the *property*?		X	

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW) DESKTOP REVIEW– OWNER TRANSACTION SCREEN QUESTIONNAIRE

15d.	Has the *owner* or *occupant* of the *property* been informed of the current existence of environmental violations with respect to the *property* or any facility located on the *property*?		X	
16.	Does the *owner* or *occupant* of the *property* have any knowledge of any *environmental site assessment* of the *property* or facility that indicated the presence of *hazardous substances* or *petroleum products* on, or contamination of, the *property* or recommended further assessment of the *property*?		X	
17.	Does the *owner* or *occupant* of the *property* know of any past, threatened, or pending lawsuits or administrative proceedings concerning a release or threatened release of any *hazardous substance* or *petroleum products* involving the *property* by any *owner* or *occupant* of the *property*?		X	
18a.	Does the *property* discharge *waste-water* (not including sanitary waste or storm water) onto or adjacent to the *property* and/or into a storm water system?		X	
18b.	Does the *property* discharge waste water (not including sanitary waste or storm water) onto or adjacent to the *property* and/or into a sanitary sewer system?		X	
19.	Did you observe evidence or do you have any prior knowledge that any *hazardous substances* or *petroleum products*, unidentified waste materials, tires, automotive or industrial batteries, or any other waste materials have been dumped above grade, buried and/or burned on the *property* ?		X	
20.	Is there a transformer, capacitor, or any hydraulic equipment for which there are any records indicating the presence of *PCBs*?		X	

APPENDIX B

Government Records/Historical Sources Inquiry

Appendix B– GOVERNMENT RECORDS/HISTORICAL SOURCES INQUIRY

Table 10: *Summary of Results from Government Records/Historical Sources Inquiry*

Title	***Approximate Minimum Search Distance, miles (kilometers)***	***Response***	
Federal NPL site list	*1.0 (1.6)*	Yes	No
Federal Delisted NPL site list	*0.5 (0.8)*	Yes	No
Federal CERCLIS list	*0.5 (0.8)*	Yes	No
Federal CERCLIS NFRAP site list	*0.5 (0.8)*	Yes	No
Federal RCRA CORRACTS facilities list	*1.0 (1.6)*	Yes	No
Federal RCRA non-CORRACTS TSD Facilities list	*0.5 (0.8)*	Yes	No
Federal RCRA generators list	*property and adjoining properties*	Yes	No
Federal institutional control/engineering control registries	*property only*	Yes	No
Federal ERNS list	*property only*	Yes	No
State and tribal lists of hazardous waste sites identified for investigation or remediation:			
State-and tribal-equivalent NPL	*1.0 (1.6)*	Yes	No
State-and tribal-equivalent CERCLIS	*0.5 (0.8)*	Yes	No
State-and tribal-landfill and/or solid waste disposal site lists	*0.5 (0.8)*	Yes	No
State-and tribal-leaking storage tank lists	*0.5 (0.8)*	Yes	No
State and tribal registered storage tank lists	*property and adjoining properties*	Yes	No
State and tribal institutional control/engineering control registries	*property only*	Yes	No
State and tribal voluntary cleanup sites	*0.5 (0.8)*	Yes	No
State and tribal Brownfield sites	*0.5 (0.8)*	Yes	No

Based upon a review of fire insurance maps, local street directories, or aerial photographs, all as specified in the guide (10.2.1), are any buildings or other improvements on the property or on an adjoining property identified as having been used for an industrial use or that could possibly lead to contamination of the property? No

APPENDIX C

Database Radius Report

ARS Field Station Lake Dam
Field Station Lake
Woodward, OK 73801

Inquiry Number: 5730696.2s
July 26, 2019

EDR Summary Radius Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

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GEOCHECK ADDENDUM

Physical Setting Source Addendum	**A-1**
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Physical Setting Source Records Searched	**PSGR-1**

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

FIELD STATION LAKE
WOODWARD, OK 73801

COORDINATES

Latitude (North):	36.4253340 - 36˚ 25' 31.20''
Longitude (West):	99.4235310 - 99˚ 25' 24.71''
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	462033.2
UTM Y (Meters):	4031007.5
Elevation:	1972 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property:	TP
Source:	U.S. Geological Survey

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20150430
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
FIELD STATION LAKE
WOODWARD, OK 73801

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1	JETER SERVICE COMPAN	3600 OKLAHOMA AVE	LUST, UST, HIST UST	Higher	1895, 0.359, NNW
A2	LEO SMITH OIL CO.	HWY 270 & OKLAHOMA A	LUST, UST, HIST UST	Higher	2063, 0.391, NNW

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.
LUST: A review of the LUST list, as provided by EDR, and dated 05/30/2019 has revealed that there are 2 LUST sites within approximately 0.5 miles of the target property.

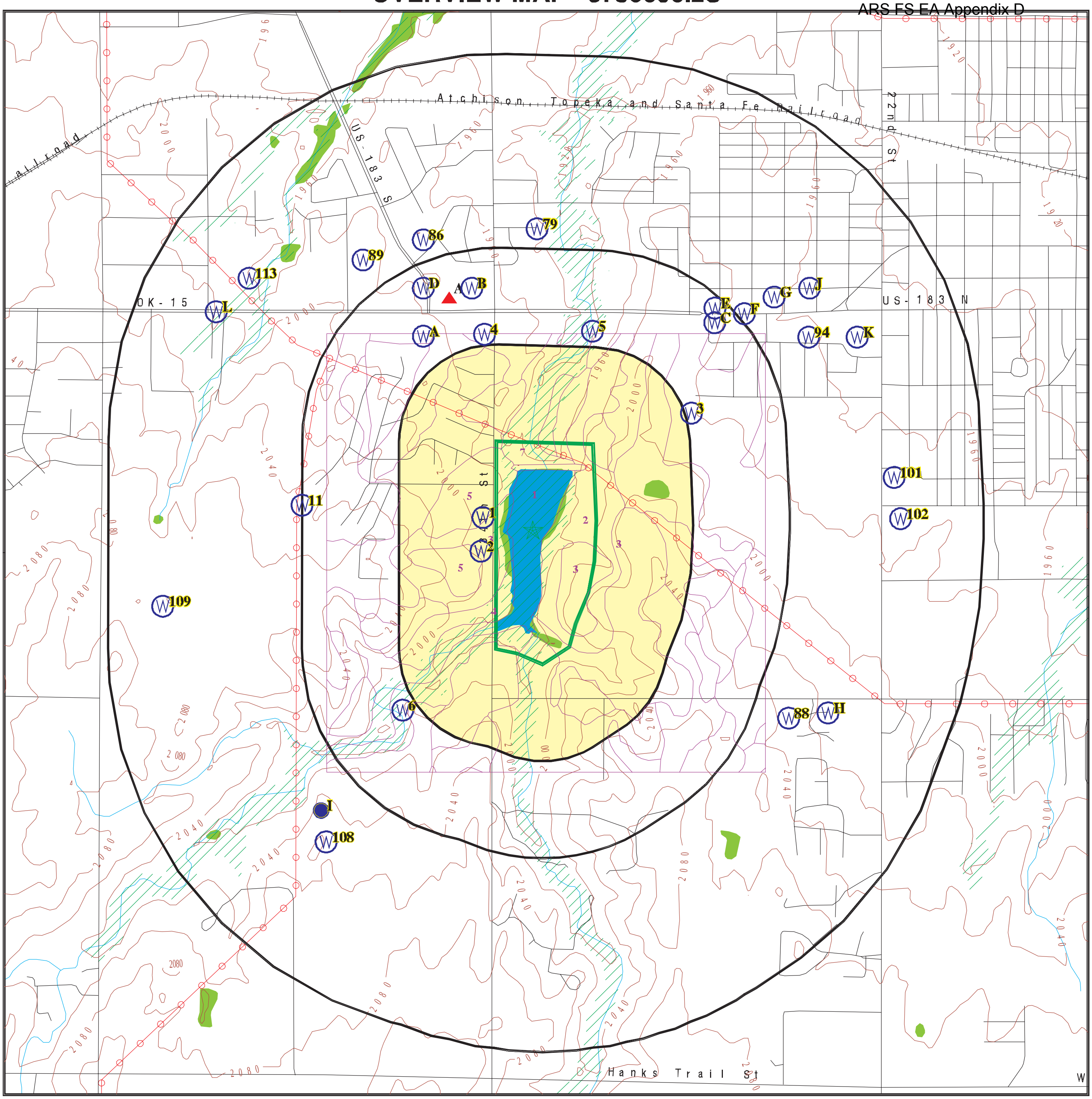
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
JETER SERVICE COMPAN STATUS: Closed Facility Id: 7703012 Close Date: 04/17/1996	***3600 OKLAHOMA AVE***	***NNW 1/4 - 1/2 (0.359 mi.)***	***A1***	***8***
LEO SMITH OIL CO. STATUS: Closed Facility Id: 7704859 Close Date: 06/11/1998	***HWY 270 & OKLAHOMA A***	***NNW 1/4 - 1/2 (0.391 mi.)***	***A2***	***8***

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

OVERVIEW MAP - 5730696.2S

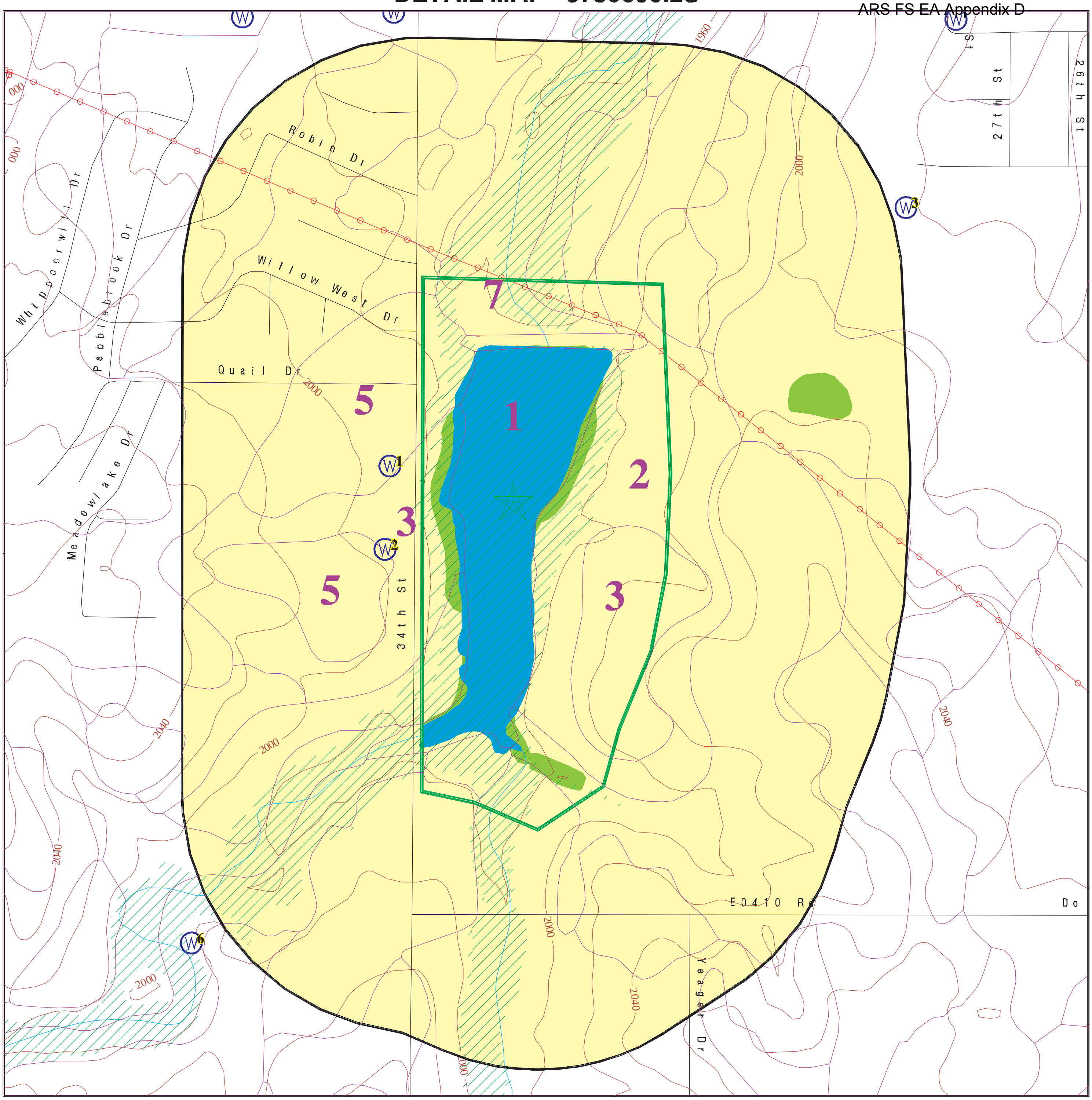


Target Property
Sites at elevations higher than or equal to the target property
Sites at elevations lower than the target property
Manufactured Gas Plants
National Priority List Sites
Dept. Defense Sites
Indian Reservations BIA
Power transmission lines
100-year flood zone
500-year flood zone
National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	ARS Field Station Lake Dam	CLIENT:	Stantec
ADDRESS:	Field Station Lake	CONTACT:	Erica Koopman-Glass
	Woodward OK 73801	INQUIRY #:	5730696.2s
LAT/LONG:	36.425334 / 99.423531	DATE:	July 26, 2019 1:10 pm

DETAIL MAP - 5730696.2S



Target Property
Sites at elevations higher than or equal to the target property
Sites at elevations lower than the target property
Manufactured Gas Plants
Sensitive Receptors
National Priority List Sites
Dept. Defense Sites

Indian Reservations BIA
Power transmission lines
100-year flood zone
500-year flood zone
National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: ARS Field Station Lake Dam ADDRESS: Field Station Lake Woodward OK 73801 LAT/LONG: 36.425334 / 99.423531	CLIENT: Stantec CONTACT: Erica Koopman-Glass INQUIRY #: 5730696.2s DATE: July 26, 2019 1:12 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	1.000		0	0	0	0	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LAST	0.500		0	0	0	NR	NR	0
LUST	0.500		0	0	2	NR	NR	2
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Lists of Registered Storage Tanks								
HIST UST	0.250		0	0	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
OK COMPLAINT	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
AIRS	TP		NR	NR	NR	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
TIER 2	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	TP		NR	NR	NR	NR	NR	0
RGA LF	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		0	0	0	2	0	0	2

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
A1 NNW 1/4-1/2 0.359 mi. 1895 ft.	**JETER SERVICE COMPANY 3600 OKLAHOMA AVE WOODWARD, OK 73802**	**LUST UST HIST UST**	**U001234391 N/A**

Relative: Higher

Click here for full text details

LUST
STATUS: Closed
Close Date: 04/17/1996
Facility Id: 7703012

UST
Tank Status: POU
Facility Id: 7703012

HIST UST
Tank Status: Permanently Out of Use
Facility Id: 7703012

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
A2 NNW 1/4-1/2 0.391 mi. 2063 ft.	**LEO SMITH OIL CO. HWY 270 & OKLAHOMA AVE WOODWARD, OK 73802**	**LUST UST HIST UST**	**U001234409 N/A**

Relative: Higher

Click here for full text details

LUST
STATUS: Closed
Close Date: 06/11/1998
Facility Id: 7704859

UST
Tank Status: POU
Facility Id: 7704859

HIST UST
Tank Status: Permanently Out of Use
Facility Id: 7704859

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date
OK	AIRS	Permitted AIRS Facility Listing	Department of Environmental Quality	05/14/2019	05/15/2019	06/18/2019
OK	AST	Aboveground Storage Tanks	Oklahoma Corporation Commission	12/07/2018	12/26/2018	01/07/2019
OK	BROWNFIELDS	Brownfield Sites	Department of Environmental Quality	09/07/2012	09/07/2012	10/10/2012
OK	BROWNFIELDS 2	Brownfields Public Record Listing	Department of Environmental Quality	02/14/2019	05/16/2019	05/29/2019
OK	DRYCLEANERS	Drycleaner Facilities	Department of Environmental Quality	03/25/2019	03/26/2019	05/29/2019
OK	Financial Assurance 1	Financial Assurance Information Listing	Department of Environmental Quality	07/25/2014	11/06/2014	01/13/2015
OK	Financial Assurance 2	Financial Assurance Information Listing	Department of Environmental Quality	12/10/2013	12/12/2013	01/24/2014
OK	HIST UST	Underground Storage Tank List, List II Version	Oklahoma Corporation Commission	03/21/2003	04/28/2003	05/27/2003
OK	INST CONTROL	Institutional Control Sites	Department of Environmental Quality	03/01/2018	05/17/2018	07/02/2018
OK	LAST	Leaking Aboveground Storage Tanks List	Oklahoma Corporation Commission	05/30/2019	06/13/2019	06/17/2019
OK	LUST	Leaking Underground Storage Tank List	Oklahoma Corporation Commission	05/30/2019	06/13/2019	06/17/2019
OK	OK COMPLAINT	Oklahoma Complaint System Database	Oklahoma Conservation Commission	06/30/2018	06/11/2019	06/17/2019
OK	RGA HWS	Recovered Government Archive State Hazardous Waste Facilitie	Department of Environmental Quality		07/01/2013	01/03/2014
OK	RGA LF	Recovered Government Archive Solid Waste Facilities List	Department of Environmental Quality		07/01/2013	01/20/2014
OK	RGA LUST	Recovered Government Archive Leaking Underground Storage Tan	Oklahoma Corporation Commission		07/01/2013	12/27/2013
OK	SHWS	Voluntary Cleanup & Superfund Site Status Report	Department of Environmental Quality	12/31/2009	05/28/2010	07/13/2010
OK	SWF/LF	Permitted Solid Waste Disposal & Processing Facilities	Department of Environmental Quality	01/29/2019	05/01/2019	06/26/2019
OK	SWRCY	Recycling Facilities	Department of Environmental Quality	12/21/2018	01/17/2019	03/06/2019
OK	TIER 2	Tier 2 Data Listing	Department of Environmental Quality	12/31/2017	09/28/2018	10/26/2018
OK	UIC	Underground Injection Wells Database Listing	Department of Environmental Quality	03/18/2019	04/17/2019	05/29/2019
OK	UST	Underground Storage Tank Listing	Oklahoma Corporation Commission	12/07/2018	12/26/2018	01/07/2019
OK	VCP	Voluntary Cleanup Site Inventory	Department of Environmental Quality	01/25/2019	02/13/2019	06/13/2019
US	2020 COR ACTION	2020 Corrective Action Program List	Environmental Protection Agency	09/30/2017	05/08/2018	07/20/2018
US	ABANDONED MINES	Abandoned Mines	Department of Interior	03/27/2019	03/28/2019	05/01/2019
US	BRS	Biennial Reporting System	EPA/NTIS	12/31/2015	02/22/2017	09/28/2017
US	COAL ASH DOE	Steam-Electric Plant Operation Data	Department of Energy	12/31/2005	08/07/2009	10/22/2009
US	COAL ASH EPA	Coal Combustion Residues Surface Impoundments List	Environmental Protection Agency	07/01/2014	09/10/2014	10/20/2014
US	CONSENT	Superfund (CERCLA) Consent Decrees	Department of Justice, Consent Decree Library	03/31/2019	04/23/2019	05/23/2019
US	CORRACTS	Corrective Action Report	EPA	03/25/2019	03/27/2019	04/17/2019
US	DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations	EPA, Region 9	01/12/2009	05/07/2009	09/21/2009
US	DOCKET HWC	Hazardous Waste Compliance Docket Listing	Environmental Protection Agency	05/31/2018	07/26/2018	10/05/2018
US	DOD	Department of Defense Sites	USGS	12/31/2005	11/10/2006	01/11/2007
US	DOT OPS	Incident and Accident Data	Department of Transporation, Office of Pipeli	12/03/2018	01/29/2019	03/21/2019
US	Delisted NPL	National Priority List Deletions	EPA	04/11/2019	04/18/2019	05/14/2019
US	ECHO	Enforcement & Compliance History Information	Environmental Protection Agency	04/07/2019	04/09/2019	05/23/2019
US	EDR Hist Auto	EDR Exclusive Historical Auto Stations	EDR, Inc.			
US	EDR Hist Cleaner	EDR Exclusive Historical Cleaners	EDR, Inc.			
US	EDR MGP	EDR Proprietary Manufactured Gas Plants	EDR, Inc.			
US	EPA WATCH LIST	EPA WATCH LIST	Environmental Protection Agency	08/30/2013	03/21/2014	06/17/2014
US	ERNS	Emergency Response Notification System	National Response Center, United States Coast	03/25/2019	03/26/2019	05/01/2019
US	FEDERAL FACILITY	Federal Facility Site Information listing	Environmental Protection Agency	04/03/2019	04/05/2019	05/14/2019
US	FEDLAND	Federal and Indian Lands	U.S. Geological Survey	12/31/2005	02/06/2006	01/11/2007
US	FEMA UST	Underground Storage Tank Listing	FEMA	05/15/2017	05/30/2017	10/13/2017
US	FINDS	Facility Index System/Facility Registry System	EPA	02/15/2019	03/05/2019	03/15/2019
US	FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fu	EPA/Office of Prevention, Pesticides and Toxi	04/09/2009	04/16/2009	05/11/2009
US	FTTS INSP	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fu	EPA	04/09/2009	04/16/2009	05/11/2009
US	FUDS	Formerly Used Defense Sites	U.S. Army Corps of Engineers	03/07/2019	04/03/2019	05/23/2019

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date
US	FUELS PROGRAM	EPA Fuels Program Registered Listing	EPA	02/19/2019	02/21/2019	04/01/2019
US	FUSRAP	Formerly Utilized Sites Remedial Action Program	Department of Energy	08/08/2017	09/11/2018	09/14/2018
US	HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing	Environmental Protection Agency	10/19/2006	03/01/2007	04/10/2007
US	HIST FTTS INSP	FIFRA/TSCA Tracking System Inspection & Enforcement Case Lis	Environmental Protection Agency	10/19/2006	03/01/2007	04/10/2007
US	HMIRS	Hazardous Materials Information Reporting System	U.S. Department of Transportation	03/25/2019	03/26/2019	05/14/2019
US	ICIS	Integrated Compliance Information System	Environmental Protection Agency	11/18/2016	11/23/2016	02/10/2017
US	IHS OPEN DUMPS	Open Dumps on Indian Land	Department of Health & Human Serivces, Indian	04/01/2014	08/06/2014	01/29/2015
US	INDIAN LUST R1	Leaking Underground Storage Tanks on Indian Land	EPA Region 1	10/13/2018	03/07/2019	05/01/2019
US	INDIAN LUST R10	Leaking Underground Storage Tanks on Indian Land	EPA Region 10	10/17/2018	03/07/2019	05/01/2019
US	INDIAN LUST R4	Leaking Underground Storage Tanks on Indian Land	EPA Region 4	09/24/2018	03/12/2019	05/01/2019
US	INDIAN LUST R5	Leaking Underground Storage Tanks on Indian Land	EPA, Region 5	10/12/2018	03/07/2019	05/01/2019
US	INDIAN LUST R6	Leaking Underground Storage Tanks on Indian Land	EPA Region 6	11/01/2018	03/07/2019	05/01/2019
US	INDIAN LUST R7	Leaking Underground Storage Tanks on Indian Land	EPA Region 7	02/19/2019	03/07/2019	05/01/2019
US	INDIAN LUST R8	Leaking Underground Storage Tanks on Indian Land	EPA Region 8	10/16/2018	03/07/2019	05/01/2019
US	INDIAN LUST R9	Leaking Underground Storage Tanks on Indian Land	Environmental Protection Agency	10/10/2018	03/08/2019	05/01/2019
US	INDIAN ODI	Report on the Status of Open Dumps on Indian Lands	Environmental Protection Agency	12/31/1998	12/03/2007	01/24/2008
US	INDIAN RESERV	Indian Reservations	USGS	12/31/2014	07/14/2015	01/10/2017
US	INDIAN UST R1	Underground Storage Tanks on Indian Land	EPA, Region 1	10/03/2018	03/07/2019	05/01/2019
US	INDIAN UST R10	Underground Storage Tanks on Indian Land	EPA Region 10	10/17/2018	03/07/2019	05/01/2019
US	INDIAN UST R4	Underground Storage Tanks on Indian Land	EPA Region 4	09/24/2018	03/12/2019	05/01/2019
US	INDIAN UST R5	Underground Storage Tanks on Indian Land	EPA Region 5	10/12/2018	03/07/2019	05/01/2019
US	INDIAN UST R6	Underground Storage Tanks on Indian Land	EPA Region 6	11/01/2018	03/07/2019	05/01/2019
US	INDIAN UST R7	Underground Storage Tanks on Indian Land	EPA Region 7	11/07/2018	03/07/2019	05/01/2019
US	INDIAN UST R8	Underground Storage Tanks on Indian Land	EPA Region 8	10/16/2018	03/07/2019	05/01/2019
US	INDIAN UST R9	Underground Storage Tanks on Indian Land	EPA Region 9	10/10/2018	03/08/2019	05/01/2019
US	INDIAN VCP R1	Voluntary Cleanup Priority Listing	EPA, Region 1	07/27/2015	09/29/2015	02/18/2016
US	INDIAN VCP R7	Voluntary Cleanup Priority Lisitng	EPA, Region 7	03/20/2008	04/22/2008	05/19/2008
US	LEAD SMELTER 1	Lead Smelter Sites	Environmental Protection Agency	04/11/2019	04/18/2019	05/14/2019
US	LEAD SMELTER 2	Lead Smelter Sites	American Journal of Public Health	04/05/2001	10/27/2010	12/02/2010
US	LIENS 2	CERCLA Lien Information	Environmental Protection Agency	04/11/2019	04/18/2019	05/23/2019
US	LUCIS	Land Use Control Information System	Department of the Navy	02/22/2019	03/07/2019	04/17/2019
US	MLTS	Material Licensing Tracking System	Nuclear Regulatory Commission	08/30/2016	09/08/2016	10/21/2016
US	NPL	National Priority List	EPA	04/11/2019	04/18/2019	05/14/2019
US	NPL LIENS	Federal Superfund Liens	EPA	10/15/1991	02/02/1994	03/30/1994
US	ODI	Open Dump Inventory	Environmental Protection Agency	06/30/1985	08/09/2004	09/17/2004
US	PADS	PCB Activity Database System	EPA	03/20/2019	04/10/2019	05/14/2019
US	PCB TRANSFORMER	PCB Transformer Registration Database	Environmental Protection Agency	05/24/2017	11/30/2017	12/15/2017
US	PRP	Potentially Responsible Parties	EPA	04/11/2019	04/18/2019	05/23/2019
US	Proposed NPL	Proposed National Priority List Sites	EPA	04/11/2019	04/18/2019	05/14/2019
US	RAATS	RCRA Administrative Action Tracking System	EPA	04/17/1995	07/03/1995	08/07/1995
US	RADINFO	Radiation Information Database	Environmental Protection Agency	04/02/2019	04/02/2019	05/14/2019
US	RCRA NonGen / NLR	RCRA - Non Generators / No Longer Regulated	Environmental Protection Agency	03/25/2019	03/27/2019	04/17/2019
US	RCRA-CESQG	RCRA - Conditionally Exempt Small Quantity Generators	Environmental Protection Agency	03/25/2019	03/27/2019	04/17/2019
US	RCRA-LQG	RCRA - Large Quantity Generators	Environmental Protection Agency	03/25/2019	03/27/2019	04/17/2019
US	RCRA-SQG	RCRA - Small Quantity Generators	Environmental Protection Agency	03/25/2019	03/27/2019	04/17/2019
US	RCRA-TSDF	RCRA - Treatment, Storage and Disposal	Environmental Protection Agency	03/25/2019	03/27/2019	04/17/2019
US	RMP	Risk Management Plans	Environmental Protection Agency	04/25/2019	05/02/2019	05/23/2019

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date
US	ROD	Records Of Decision	EPA	04/11/2019	04/18/2019	05/23/2019
US	SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing	Environmental Protection Agency	01/01/2017	02/03/2017	04/07/2017
US	SEMS	Superfund Enterprise Management System	EPA	04/11/2019	04/18/2019	05/23/2019
US	SEMS-ARCHIVE	Superfund Enterprise Management System Archive	EPA	04/11/2019	04/18/2019	05/23/2019
US	SSTS	Section 7 Tracking Systems	EPA	12/31/2009	12/10/2010	02/25/2011
US	TRIS	Toxic Chemical Release Inventory System	EPA	12/31/2016	01/10/2018	01/12/2018
US	TSCA	Toxic Substances Control Act	EPA	12/31/2016	06/21/2017	01/05/2018
US	UMTRA	Uranium Mill Tailings Sites	Department of Energy	06/23/2017	10/11/2017	11/03/2017
US	US AIRS (AFS)	Aerometric Information Retrieval System Facility Subsystem (	EPA	10/12/2016	10/26/2016	02/03/2017
US	US AIRS MINOR	Air Facility System Data	EPA	10/12/2016	10/26/2016	02/03/2017
US	US BROWNFIELDS	A Listing of Brownfields Sites	Environmental Protection Agency	12/17/2018	12/18/2018	01/11/2019
US	US CDL	Clandestine Drug Labs	Drug Enforcement Administration	02/24/2019	02/26/2019	04/17/2019
US	US ENG CONTROLS	Engineering Controls Sites List	Environmental Protection Agency	01/31/2019	02/04/2019	03/08/2019
US	US FIN ASSUR	Financial Assurance Information	Environmental Protection Agency	03/25/2019	03/26/2019	05/07/2019
US	US HIST CDL	National Clandestine Laboratory Register	Drug Enforcement Administration	02/24/2019	02/26/2019	04/17/2019
US	US INST CONTROL	Sites with Institutional Controls	Environmental Protection Agency	01/31/2019	02/04/2019	03/08/2019
US	US MINES	Mines Master Index File	Department of Labor, Mine Safety and Health A	11/27/2018	02/27/2019	04/01/2019
US	US MINES 2	Ferrous and Nonferrous Metal Mines Database Listing	USGS	12/05/2005	02/29/2008	04/18/2008
US	US MINES 3	Active Mines & Mineral Plants Database Listing	USGS	04/14/2011	06/08/2011	09/13/2011
US	UXO	Unexploded Ordnance Sites	Department of Defense	12/31/2017	01/17/2019	04/01/2019
CT	CT MANIFEST	Hazardous Waste Manifest Data	Department of Energy & Environmental Protecti	02/11/2019	02/12/2019	03/04/2019
NY	NY MANIFEST	Facility and Manifest Data	Department of Environmental Conservation	01/01/2019	05/01/2019	06/21/2019
WI	WI MANIFEST	Manifest Information	Department of Natural Resources	12/31/2017	06/15/2018	07/09/2018
US	AHA Hospitals	Sensitive Receptor: AHA Hospitals	American Hospital Association, Inc.			
US	Medical Centers	Sensitive Receptor: Medical Centers	Centers for Medicare & Medicaid Services			
US	Nursing Homes	Sensitive Receptor: Nursing Homes	National Institutes of Health			
US	Public Schools	Sensitive Receptor: Public Schools	National Center for Education Statistics			
US	Private Schools	Sensitive Receptor: Private Schools	National Center for Education Statistics			
OK	Daycare Centers	Sensitive Receptor: Day Care Centers	Department of Human Services			
US	Flood Zones	100-year and 500-year flood zones	Emergency Management Agency (FEMA)			
US	NWI	National Wetlands Inventory	U.S. Fish and Wildlife Service			
US	Topographic Map		U.S. Geological Survey			
US	Oil/Gas Pipelines		PennWell Corporation			
US	Electric Power Transmission Line Data		PennWell Corporation			

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

ARS FIELD STATION LAKE DAM
FIELD STATION LAKE
WOODWARD, OK 73801

TARGET PROPERTY COORDINATES

Latitude (North):	36.425334 - 36˚ 25’ 31.20’’
Longitude (West):	99.423531 - 99˚ 25’ 24.71’’
Universal Tranverse Mercator:	Zone 14
UTM X (Meters):	462033.2
UTM Y (Meters):	4031007.5
Elevation:	1972 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5925003 WOODWARD, OK
Version Date:	2012

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

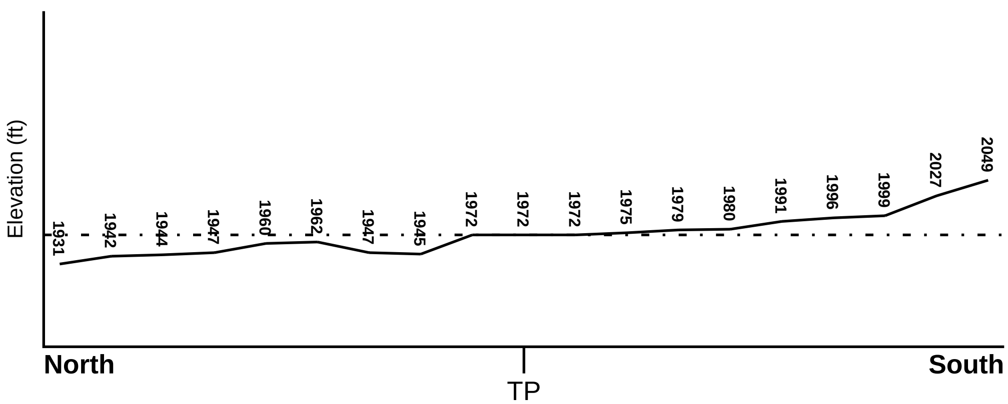
TOPOGRAPHIC INFORMATION

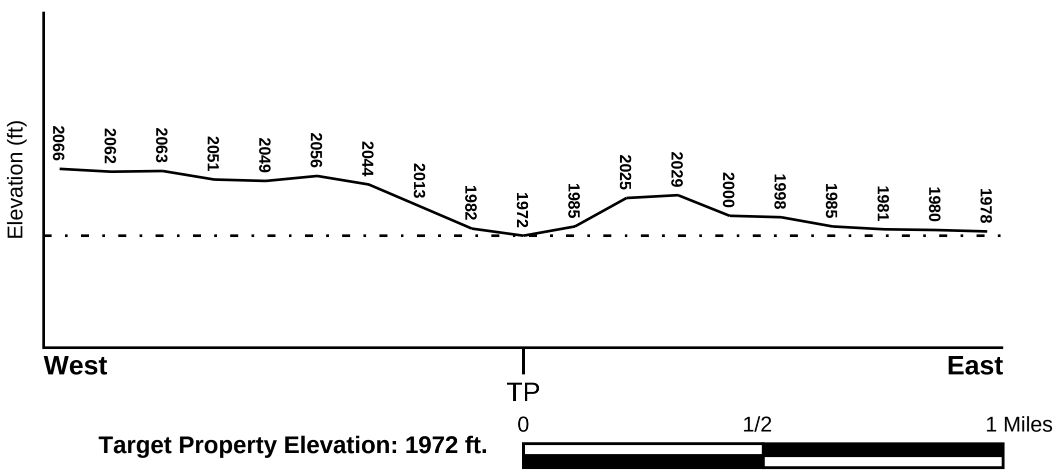
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General NNW

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 1972 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
40153C0375C	FEMA FIRM Flood data

Additional Panels in search area:	FEMA Source Type
Not Reported	

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
WOODWARD	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

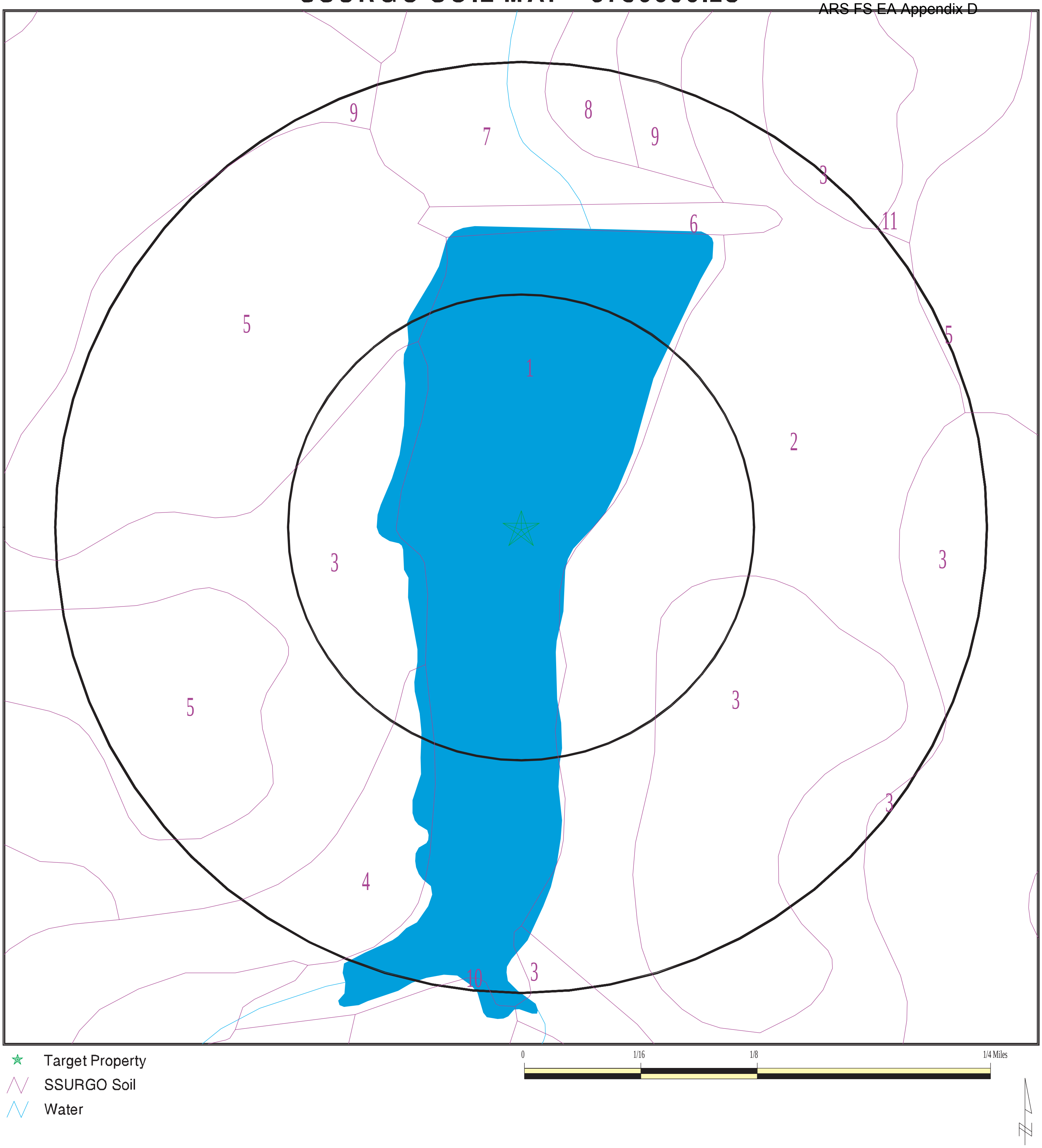
Era: Cenozoic
System: Quaternary
Series: Quaternary
Code: Q *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratifed Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 5730696.2s



SITE NAME:	ARS Field Station Lake Dam
ADDRESS:	Field Station Lake Woodward OK 73801
LAT/LONG:	36.425334 / 99.423531
CLIENT:	Stantec
CONTACT:	Erica Koopman-Glass
INQUIRY #:	5730696.2s
DATE:	July 26, 2019 1:13 pm

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Water

Soil Surface Texture: water

Hydrologic Group: Not reported

Soil Drainage Class:
Hydric Status: All hydric

Corrosion Potential - Uncoated Steel: Not Reported

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	79 inches	water	Not reported	Not reported	Max: Min:	Max: Min:

Soil Map ID: 2

Soil Component Name: Carey

Soil Surface Texture: silt loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	silt loam	Not reported	Not reported	Max: 14.114 Min: 1.4114	Max: Min:
2	7 inches	29 inches	silty clay loam	Not reported	Not reported	Max: 14.114 Min: 1.4114	Max: Min:
3	29 inches	44 inches	silt loam	Not reported	Not reported	Max: 14.114 Min: 1.4114	Max: Min:
4	44 inches	61 inches	bedrock	Not reported	Not reported	Max: 14.114 Min: 1.4114	Max: Min:

Soil Map ID: 3

Soil Component Name: Quinlan

Soil Surface Texture: loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	loam	Not reported	Not reported	Max: 4.233 Min: 1.4114	Max: Min:
2	7 inches	12 inches	loam	Not reported	Not reported	Max: 4.233 Min: 1.4114	Max: Min:

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
3	12 inches	64 inches	bedrock	Not reported	Not reported	Max: 4.233 Min: 1.4114	Max: Min:

Soil Map ID: 4

Soil Component Name: Hardeman

Soil Surface Texture: loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	9 inches	loam	Not reported	Not reported	Max: 42.33 Min: 14.114	Max: 8.4 Min: 7.4
2	9 inches	74 inches	fine sandy loam	Not reported	Not reported	Max: 42.33 Min: 14.114	Max: 8.4 Min: 7.4

Soil Map ID: 5

Soil Component Name: Carey

Soil Surface Texture: silt loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	11 inches	silt loam	Not reported	Not reported	Max: 14.114 Min: 1.4114	Max: Min:
2	11 inches	29 inches	silty clay loam	Not reported	Not reported	Max: 14.114 Min: 1.4114	Max: Min:
3	29 inches	44 inches	silt loam	Not reported	Not reported	Max: 14.114 Min: 1.4114	Max: Min:
4	44 inches	61 inches	bedrock	Not reported	Not reported	Max: 14.114 Min: 1.4114	Max: Min:

Soil Map ID: 6

Soil Component Name: Dam

Soil Surface Texture: variable

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class:
Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Not Reported

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	79 inches	variable	Not reported	Not reported	Max: 14.114 Min: 0.4233	Max: Min:

Soil Map ID: 7

Soil Component Name: Hardeman

Soil Surface Texture: loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	9 inches	loam	Not reported	Not reported	Max: 42.33 Min: 14.114	Max: 8.4 Min: 7.4
2	9 inches	74 inches	fine sandy loam	Not reported	Not reported	Max: 42.33 Min: 14.114	Max: 8.4 Min: 7.4

Soil Map ID: 8

Soil Component Name: Lincoln

Soil Surface Texture: loamy fine sand

Hydrologic Group: Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.

Soil Drainage Class: Somewhat excessively drained

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	loamy fine sand	Not reported	Not reported	Max: 141.14 Min: 42.33	Max: 8.4 Min: 7.9
2	16 inches	59 inches	sr to fine sand to clay loam	Not reported	Not reported	Max: 141.14 Min: 42.33	Max: 8.4 Min: 7.9

Soil Map ID: 9

Soil Component Name: Devol

Soil Surface Texture: fine sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	11 inches	fine sandy loam	Not reported	Not reported	Max: 42.33 Min: 14.114	Max: 8.4 Min: 6.6
2	11 inches	42 inches	loamy fine sand	Not reported	Not reported	Max: 42.33 Min: 14.114	Max: 8.4 Min: 6.6

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
3	42 inches	64 inches	loamy fine sand	Not reported	Not reported	Max: 42.33 Min: 14.114	Max: 8.4 Min: 6.6

Soil Map ID: 10

Soil Component Name: Waldeck

Soil Surface Texture: fine sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Somewhat poorly drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 92 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	11 inches	fine sandy loam	Not reported	Not reported	Max: 141.14 Min: 42.33	Max: 8.4 Min: 7.4
2	11 inches	46 inches	fine sandy loam	Not reported	Not reported	Max: 141.14 Min: 42.33	Max: 8.4 Min: 7.4
3	46 inches	72 inches	fine sand	Not reported	Not reported	Max: 141.14 Min: 42.33	Max: 8.4 Min: 7.4

Soil Map ID: 11

Soil Component Name: Woodward

Soil Surface Texture: loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	loam	Not reported	Not reported	Max: 4.233 Min: 1.4114	Max: Min:
2	9 inches	27 inches	loam	Not reported	Not reported	Max: 4.233 Min: 1.4114	Max: Min:
3	27 inches	40 inches	bedrock	Not reported	Not reported	Max: 4.233 Min: 1.4114	Max: Min:

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
6	USGS40000977851	1/2 - 1 Mile SW
I100	USGS40000977807	1/2 - 1 Mile SW
109	USGS40000977907	1/2 - 1 Mile WSW

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP

No PWS System Found

Note: PWS System location is not always the same as well location.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	OK6000000118587	1/8 - 1/4 Mile WNW
2	OK6000000139597	1/8 - 1/4 Mile WSW
3	OK6000000099348	1/2 - 1 Mile NE
4	OK6000000101876	1/2 - 1 Mile NNW
5	OK6000000101875	1/2 - 1 Mile NNE
A7	OK6000000073562	1/2 - 1 Mile NNW
A8	OK6000000073561	1/2 - 1 Mile NNW
A9	OK6000000076224	1/2 - 1 Mile NNW
A10	OK6000000073563	1/2 - 1 Mile NNW
11	OK6000000079338	1/2 - 1 Mile West
B12	OK6000000073217	1/2 - 1 Mile NNW
B13	OK6000000073215	1/2 - 1 Mile NNW
B14	OK6000000073559	1/2 - 1 Mile NNW
B15	OK6000000073557	1/2 - 1 Mile NNW
C16	OK6000000052336	1/2 - 1 Mile NE
C17	OK6000000052568	1/2 - 1 Mile NE
D18	OK6000000105743	1/2 - 1 Mile NNW
D19	OK6000000105746	1/2 - 1 Mile NNW
D20	OK6000000105747	1/2 - 1 Mile NNW
C21	OK6000000118329	1/2 - 1 Mile NE
C22	OK6000000118220	1/2 - 1 Mile NE
C23	OK6000000099352	1/2 - 1 Mile NE
C24	OK6000000118219	1/2 - 1 Mile NE
C25	OK6000000099351	1/2 - 1 Mile NE
C26	OK6000000118227	1/2 - 1 Mile NE
C27	OK6000000118011	1/2 - 1 Mile NE
C28	OK6000000118228	1/2 - 1 Mile NE
C29	OK6000000118013	1/2 - 1 Mile NE
C30	OK6000000118226	1/2 - 1 Mile NE
C31	OK6000000118221	1/2 - 1 Mile NE
C32	OK6000000118421	1/2 - 1 Mile NE
C33	OK6000000118417	1/2 - 1 Mile NE
C34	OK6000000118330	1/2 - 1 Mile NE
C35	OK6000000118225	1/2 - 1 Mile NE
C36	OK6000000118534	1/2 - 1 Mile NE
C37	OK6000000118710	1/2 - 1 Mile NE
C38	OK6000000118222	1/2 - 1 Mile NE
C39	OK6000000118418	1/2 - 1 Mile NE
C40	OK6000000118419	1/2 - 1 Mile NE
C41	OK6000000118420	1/2 - 1 Mile NE
C42	OK6000000118224	1/2 - 1 Mile NE
C43	OK6000000118422	1/2 - 1 Mile NE
C44	OK6000000118709	1/2 - 1 Mile NE
C45	OK6000000118012	1/2 - 1 Mile NE
C46	OK6000000118223	1/2 - 1 Mile NE
C47	OK6000000110385	1/2 - 1 Mile NE
C48	OK6000000118528	1/2 - 1 Mile NE
C49	OK6000000118339	1/2 - 1 Mile NE
C50	OK6000000118335	1/2 - 1 Mile NE
C51	OK6000000118337	1/2 - 1 Mile NE
C52	OK6000000118626	1/2 - 1 Mile NE
C53	OK6000000118428	1/2 - 1 Mile NE

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

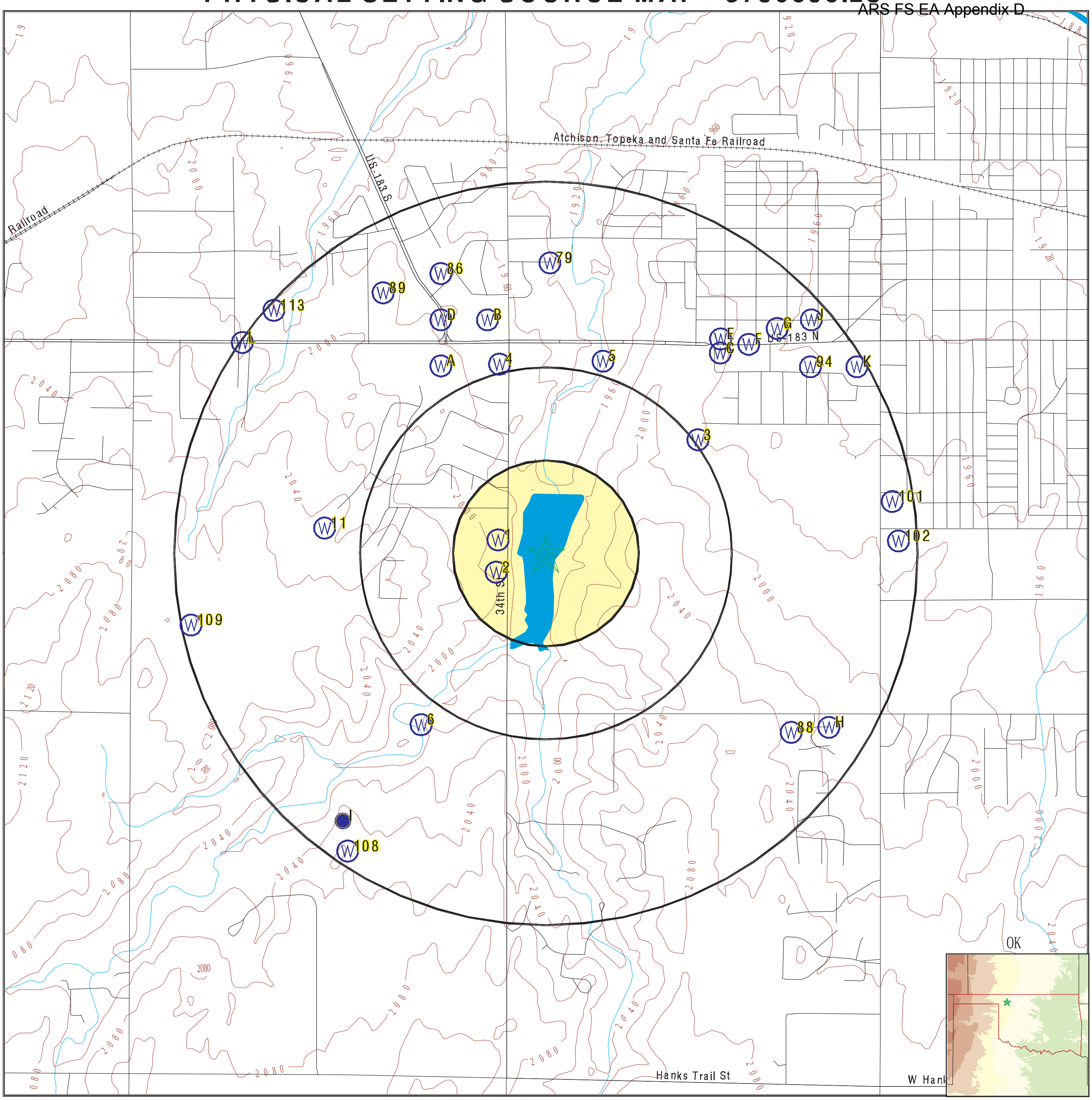
MAP ID	WELL ID	LOCATION FROM TP
C54	OK6000000118538	1/2 - 1 Mile NE
C55	OK6000000118426	1/2 - 1 Mile NE
C56	OK6000000118427	1/2 - 1 Mile NE
C57	OK6000000118624	1/2 - 1 Mile NE
C58	OK6000000118625	1/2 - 1 Mile NE
C59	OK6000000118540	1/2 - 1 Mile NE
C60	OK6000000118623	1/2 - 1 Mile NE
C61	OK6000000118338	1/2 - 1 Mile NE
C62	OK6000000118535	1/2 - 1 Mile NE
C63	OK6000000118536	1/2 - 1 Mile NE
C64	OK6000000118537	1/2 - 1 Mile NE
C65	OK6000000118533	1/2 - 1 Mile NE
C66	OK6000000099349	1/2 - 1 Mile NE
C67	OK6000000118532	1/2 - 1 Mile NE
C68	OK6000000118423	1/2 - 1 Mile NE
C69	OK6000000118425	1/2 - 1 Mile NE
C70	OK6000000107614	1/2 - 1 Mile NE
C71	OK6000000118424	1/2 - 1 Mile NE
E72	OK6000000118331	1/2 - 1 Mile NE
E73	OK6000000119546	1/2 - 1 Mile NE
F74	OK6000000118007	1/2 - 1 Mile NE
F75	OK6000000118333	1/2 - 1 Mile NE
F76	OK6000000118707	1/2 - 1 Mile NE
F77	OK6000000118004	1/2 - 1 Mile NE
F78	OK6000000118218	1/2 - 1 Mile NE
79	OK6000000133854	1/2 - 1 Mile North
F80	OK6000000118014	1/2 - 1 Mile NE
F81	OK6000000118217	1/2 - 1 Mile NE
F82	OK6000000118009	1/2 - 1 Mile NE
F83	OK6000000118008	1/2 - 1 Mile NE
F84	OK6000000118708	1/2 - 1 Mile NE
F85	OK6000000118010	1/2 - 1 Mile NE
86	OK6000000073216	1/2 - 1 Mile NNW
F87	OK6000000118334	1/2 - 1 Mile NE
88	OK6000000138377	1/2 - 1 Mile SE
89	OK6000000160214	1/2 - 1 Mile NNW
G90	OK6000000047419	1/2 - 1 Mile NE
G91	OK6000000047420	1/2 - 1 Mile NE
G92	OK6000000174184	1/2 - 1 Mile NE
G93	OK6000000162703	1/2 - 1 Mile NE
94	OK6000000103174	1/2 - 1 Mile NE
G95	OK6000000171068	1/2 - 1 Mile NE
G96	OK6000000161759	1/2 - 1 Mile NE
H97	OK6000000174994	1/2 - 1 Mile ESE
I98	OK6000000167063	1/2 - 1 Mile SW
H99	OK6000000127916	1/2 - 1 Mile ESE
101	OK6000000139511	1/2 - 1 Mile East
102	OK6000000156416	1/2 - 1 Mile East
J103	OK6000000050375	1/2 - 1 Mile NE
J104	OK6000000050374	1/2 - 1 Mile NE
J105	OK6000000050376	1/2 - 1 Mile NE
J106	OK6000000073212	1/2 - 1 Mile NE

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
J107	OK6000000050377	1/2 - 1 Mile NE
108	OK6000000161226	1/2 - 1 Mile SSW
K110	OK6000000049019	1/2 - 1 Mile ENE
K111	OK6000000049020	1/2 - 1 Mile ENE
K112	OK6000000049021	1/2 - 1 Mile ENE
113	OK6000000130356	1/2 - 1 Mile NW
L114	OK6000000170069	1/2 - 1 Mile NW
L115	OK6000000170070	1/2 - 1 Mile NW
L116	OK6000000170071	1/2 - 1 Mile NW

PHYSICAL SETTING SOURCE MAP - 5730696.2s



0 1/4 1/2 1 Miles

- County Boundary
- Major Roads
- Contour Lines
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons
- Groundwater Flow Direction
- GI Indeterminate Groundwater Flow at Location
- GV Groundwater Flow Varies at Location
- Oil, gas or related wells

SITE NAME: ARS Field Station Lake Dam	CLIENT: Stantec
ADDRESS: Field Station Lake	CONTACT: Erica Koopman-Glass
Woodward OK 73801	INQUIRY #: 5730696.2s
LAT/LONG: 36.425334 / 99.423531	DATE: July 26, 2019 1:13 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
1 **WNW** **1/8 - 1/4 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118587**
2 **WSW** **1/8 - 1/4 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000139597**
3 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000099348**
4 **NNW** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000101876**
5 **NNE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000101875**
6 **SW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**FED USGS**	**USGS40000977851**
A7 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000073562**
A8 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000073561**
A9 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000076224**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID / Direction / Distance / Elevation		Database	EDR ID Number
A10 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000073563**
11 **West** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000079338**
B12 **NNW** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000073217**
B13 **NNW** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000073215**
B14 **NNW** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000073559**
B15 **NNW** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000073557**
C16 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000052336**
C17 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000052568**
D18 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000105743**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
D19 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000105746**
D20 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000105747**
C21 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118329**
C22 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118220**
C23 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000099352**
C24 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118219**
C25 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000099351**
C26 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118227**
C27 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118011**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
C28 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118228**
C29 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118013**
C30 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118226**
C31 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118221**
C32 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118421**
C33 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118417**
C34 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118330**
C35 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118225**
C36 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118534**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
C37 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118710**
C38 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118222**
C39 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118418**
C40 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118419**
C41 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118420**
C42 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118224**
C43 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118422**
C44 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118709**
C45 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118012**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
C46 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118223**
C47 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000110385**
C48 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118528**
C49 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118339**
C50 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118335**
C51 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118337**
C52 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118626**
C53 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118428**
C54 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118538**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
C55 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118426**
C56 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118427**
C57 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118624**
C58 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118625**
C59 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118540**
C60 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118623**
C61 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118338**
C62 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118535**
C63 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118536**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
C64 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118537**
C65 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118533**
C66 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000099349**
C67 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118532**
C68 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118423**
C69 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118425**
C70 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000107614**
C71 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118424**
E72 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118331**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
E73 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000119546**
F74 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118007**
F75 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118333**
F76 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118707**
F77 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118004**
F78 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118218**
79 **North** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000133854**
F80 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118014**
F81 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118217**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID / Direction / Distance / Elevation		Database	EDR ID Number
F82 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118009**
F83 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000118008**
F84 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000118708**
F85 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000118010**
86 **NNW** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000073216**
F87 **NE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000118334**
88 **SE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000138377**
89 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000160214**
G90 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000047419**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID / Direction / Distance / Elevation		Database	EDR ID Number
G91 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000047420**
G92 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000174184**
G93 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000162703**
94 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000103174**
G95 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000171068**
G96 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000161759**
H97 **ESE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000174994**
I98 **SW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000167063**
H99 **ESE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000127916**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
I100 **SW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**FED USGS**	**USGS40000977807**
101 **East** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000139511**
102 **East** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000156416**
J103 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000050375**
J104 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000050374**
J105 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000050376**
J106 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000073212**
J107 **NE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OK WELLS**	**OK6000000050377**
108 **SSW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OK WELLS**	**OK6000000161226**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
109 **WSW** **1/2 - 1 Mile** **Higher**	[Click here for full text details]	**FED USGS**	**USGS40000977907**
K110 **ENE** **1/2 - 1 Mile** **Lower**	[Click here for full text details]	**OK WELLS**	**OK6000000049019**
K111 **ENE** **1/2 - 1 Mile** **Lower**	[Click here for full text details]	**OK WELLS**	**OK6000000049020**
K112 **ENE** **1/2 - 1 Mile** **Lower**	[Click here for full text details]	**OK WELLS**	**OK6000000049021**
113 **NW** **1/2 - 1 Mile** **Higher**	[Click here for full text details]	**OK WELLS**	**OK6000000130356**
L114 **NW** **1/2 - 1 Mile** **Higher**	[Click here for full text details]	**OK WELLS**	**OK6000000170069**
L115 **NW** **1/2 - 1 Mile** **Higher**	[Click here for full text details]	**OK WELLS**	**OK6000000170070**
L116 **NW** **1/2 - 1 Mile** **Higher**	[Click here for full text details]	**OK WELLS**	**OK6000000170071**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: OK Radon

Radon Test Results

Zipcode	Num Tests	# > 4 pCi/L	Maximum	Average
73801	32	3	11.9	2.096

Federal EPA Radon Zone for WOODWARD County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 73801

Number of sites tested: 9

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.833 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Reported Well Locations in Oklahoma
Source: Oklahoma Water Resources Board
Telephone: 405-530-8800

OTHER STATE DATABASE INFORMATION

Oil and Gas Well Listing
Source: Oklahoma Corporation Commission
Telephone: 405-521-3636
Oil and gas well locations in the state.

Oil and Gas Well Listing
Source: Osage Nation Environmental and Natural Resources
Telephone: 918-287-5333
Oil and gas well locations.

RADON

State Database: OK Radon
Source: Department of Environmental Quality
Telephone: 405-702-5100
Radon Information

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

STREET AND ADDRESS INFORMATION

APPENDIX D

Historical Aerials

ARS Field Station Lake Dam

Field Station Lake

Woodward, OK 73801

Inquiry Number: 5730696.5

July 27, 2019

The EDR Aerial Photo Decade Package

EDR®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

 07/27/19

Site Name:	Client Name:
ARS Field Station Lake Dam	Stantec
Field Station Lake	1905 Aldrich Street Ste 300
Woodward, OK 73801	Austin, TX 78723
EDR Inquiry # 5730696.5	Contact: Erica Koopman-Glass

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	Scale	Details	Source
2017	1"=500'	Flight Year: 2017	USDA/NAIP
2013	1"=500'	Flight Year: 2013	USDA/NAIP
2010	1"=500'	Flight Year: 2010	USDA/NAIP
2006	1"=500'	Flight Year: 2006	USDA/NAIP
1995	1"=500'	Acquisition Date: February 21, 1995	USGS/DOQQ
1983	1"=500'	Flight Date: November 12, 1983	USDA
1972	1"=500'	Flight Date: August 19, 1972	USGS
1968	1"=500'	Flight Date: February 11, 1968	USGS
1954	1"=500'	Flight Date: March 27, 1954	USGS

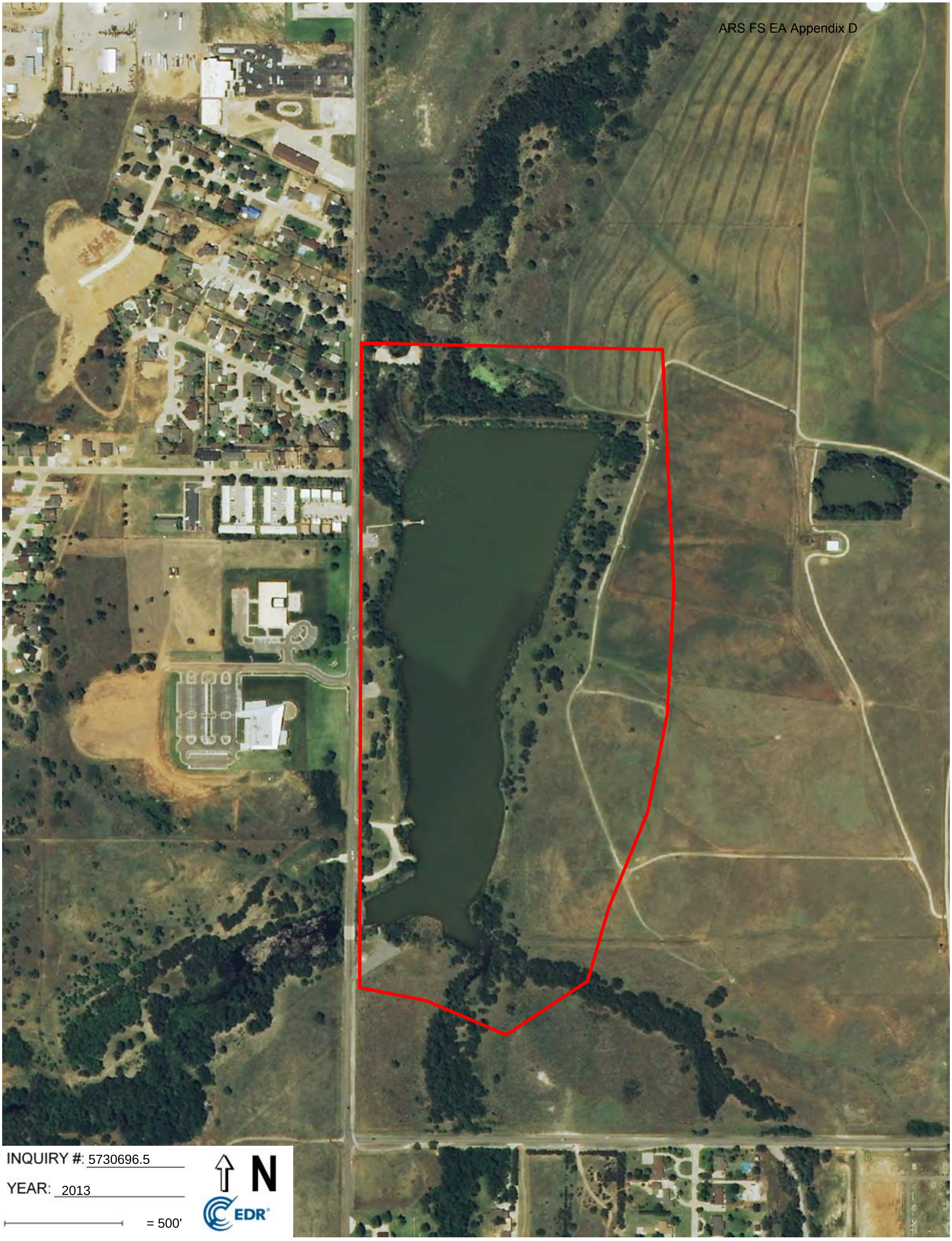
When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

INQUIRY #: 5730696.5

YEAR: 2017

= 500'

N



INQUIRY #: 5730696.5

YEAR: 2013

= 500'

N

EDR

INQUIRY #: 5730696.5

YEAR: 2010

= 500'

N

EDR


INQUIRY #: 5730696.5
YEAR: 2006
= 500'
N
EDR

INQUIRY #: 5730696.5

YEAR: 1995

= 500'

N

EDR

Subject boundary not shown because it exceeds image extent or image is not georeferenced.

INQUIRY #: 5730696.5

YEAR: 1983

= 500'

N

EDR


INQUIRY #: 5730696.5
YEAR: 1972
= 500'
N
EDR


INQUIRY #: 5730696.5
YEAR: 1968
= 500'
N
EDR

INQUIRY #: 5730696.5

YEAR: 1954

= 500'

N

EDR

Subject boundary not shown because it exceeds image extent or image is not georeferenced.

APPENDIX E

Sanborn Map Report

ARS Field Station Lake Dam

Field Station Lake

Woodward, OK 73801

Inquiry Number: 5730696.3

July 26, 2019

Certified Sanborn® Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

07/26/19

Site Name:	**Client Name:**
ARS Field Station Lake Dam	Stantec
Field Station Lake	1905 Aldrich Street Ste 300
Woodward, OK 73801	Austin, TX 78723
EDR Inquiry # 5730696.3	Contact: Erica Koopman-Glass

The Sanborn Library has been searched by EDR and maps covering the target property location as provided by Stantec were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification # F091-4AD6-988C

PO # 175558215

Project ARS Dam Rehabilitation -OK

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

Sanborn® Library search results

Certification #: F091-4AD6-988C

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✔ Library of Congress
- ✔ University Publications of America
- ✔ EDR Private Collection

The Sanborn Library LLC Since 1866™

Limited Permission To Make Copies

Stantec (the client) is permitted to make up to FIVE photocopies of this Sanborn Map transmittal and each fire insurance map accompanying this report solely for the limited use of its customer. No one other than the client is authorized to make copies. Upon request made directly to an EDR Account Executive, the client may be permitted to make a limited number of additional photocopies. This permission is conditioned upon compliance by the client, its customer and their agents with EDR's copyright policy; a copy of which is available upon request.

APPENDIX E
Summary of Stakeholder Input

Southern Plains SPRRS Range Research Station

Public Scoping

ARS Field Station EA

Contract No. 12SPEC18D0015, Order No. 12FPC219F0109

Notes from Stakeholder Meetings & Public Open House held on September 26, 2019. Answers provided by staff are in italics.

Stakeholder Meeting – 9AM | 7 participants

- Potential Impacts
    - Will the project affect local parks? *No.*
    - Was there a previous proposal to include a structure on south side to capture debris, keeping it from going in the lake?
        - *Taken care of via the 34th Street project.*
    - Concerned about debris going into the lake and up against the dam even with the 34th Street project.
        - Principal spillway will have a trash guard and RCC that will have to be maintained
    - Several homes on Cheyenne are in the floodplain – Will a dam breech impact them?
        - *Homes are already in the floodplain.*
        - Will dam rehab affect them? *No.*
    - How will the project affect water levels?
        - City works with the Department of Wildlife for fish stocking – During dam construction, will the water level be lowered? *Yes.*
        - Need to work with the City and Department of Wildlife to build habitat structures for the fish during rehab work.
- Project Benefits
    - Potential recreation
        - City always tries to enhance what it can, including Field Station Lake.
            - Lake is beautiful and suits residents very well – Don't want to lose it
            - *Dam rehab won't affect lake recreation or the trail along 34th Street.*
            - *Improved 34th Street will be a 3-lane road at the park.*
        - Any need for clearing on the west side?
            - Could enhance the park and benefit the community.
        - *City owns a trail easement on the southern and part of the eastern side of the lake but building the trail would also require building a bridge* over Spring Creek.
            - Could access be provided over the dam? *No – Would need to cross the spillway.*
            - Don't want citizens on dam property.

ADASTRA collaborative FREESE AND NICHOLS Stantec

- Will subcontractors from the area be used?
  - *An open bid process will be used.*
- Other Comments
  - What's the projected timeline to completion?
    - *Want to start in 2020 and complete in 1 year.*
  - Is the function of the spillway beyond just rising water?
  - Who's considering the amount budgeted for the project? *ARS.*
  - What's the timeframe between budget submittal and approval?
    - *To be determined.*
    - *Significant amount of time needed for contracting.*
  - Is this the first time any work has been done on the dam since its 1930s construction? *Yes.*
  - What's roller-compacted concrete?
    - *A dry mix of concrete that can be applied with earth-moving equipment.*
  - Has the lake silted much?
    - *Need to look at the data.*
    - *Have very few plan files on what/how the dam was built in 1930s.*
    - *No information on soils, etc.*
    - *Principal spillway has silted in significantly.*
  - Work will need a city floodplain permit – See STNFIP Coordinator and Dam Coordinator (David Smith)

Stakeholder Meeting – 1 PM | 4 participants

- Potential Impacts
  - Impacts to fish are a concern
    - Did huge shock of the lake in the past – Lots of nice fish there
  - Don't block 34th Street during construction
- Potential Benefits
  - Ability to lower the lake when necessary is good
    - When you lower it, will the water be pumped elsewhere? *Yes.*
  - Positive affect on downtown stream homes and businesses
- Other Comments
  - Have you decided which direction you want to go with the alternatives? *Alternative 4.*
    - Easy to maintain and operate?
    -

    - Will need to check for cracks and mow the embankment, but because the majority of the dam would be concrete, less maintenance is necessary
- Will the whole lake have to be drained for construction? *Yes.*
- Some community members call the lake "Experiment Lake"
    - People are unsure of what goes on at the field station
- What will the annual maintenance costs be?
    - Suggest costs be included with ARS' budget
- How many acres are at Fort Supply? *4,300.*
- What's the project schedule after January 2020?
    - *Depends on when ARS receives funding from Congress for the project.*
    - Could be finished with construction at the same time as 34th Street project
- Will contractors be local?
    - Contracting will be selected via open bid; also looking for lowest cost.
    - Construction contractors have to be listed in various Federal database
    - Subcontractors have been local in the past
    - Dam construction and RCC are very specialized

Public Open House – 4:30PM | 3 participants

- Participants opted to mail-in comments.