# 3.0 Facility Description

This chapter provides a description of the former Kaiser Aluminum Specialty Products facility. Supplemental information relative to the "former operation area" of the facility is provided in the May 2002 DPA (Revised May 2003).

## 3.1 Site Location and Description

The former Kaiser Aluminum Specialty Products facility is located at 7311 East 41st Street in Tulsa, Oklahoma (Figure 3-1). It is situated in Tulsa County, Oklahoma, about 5 miles southeast of the downtown center of the City of Tulsa. The site initially occupied approximately 23 acres of land on both sides of 41st Street. Currently, a 3-acre parcel south of 41st Street contains an active aluminum extrusion and fabrication facility. North of East 41st Street are several parcels of land previously devoted to refining, processing, and waste disposal functions. This acreage is split by the Union Pacific Railroad right-of-way. An approximate 3.5-acre parcel south of the railroad (known as the former operational area) houses an active office building and several inactive industrial structures (Figure 2-1). An approximate 14.0-acre land area (known as the pond parcel) located north of the railroad contains a Retention Pond, former Freshwater Pond area, a former Reserve Pond area, and the Flux Building area.

The Retention Pond currently occupies 8 acres of the 14-acre land parcel north of the railroad. The water level in the Retention Pond varies, based on seasonal precipitation. The Retention Pond is surrounded by a well-maintained berm and there are no surface water discharges from the pond. The Retention Pond is permitted by the Oklahoma Water Resources Board. Occupying approximately 4 acres on the western portion of this parcel is the area of the former Freshwater Pond. The Freshwater Pond was closed in October and November 2002. Northeast of the Retention Pond is the area of the former Reserve Pond (approximately 1 acre). The Reserve Pond was backfilled in the late 1960s and is currently covered with grass.

Extensive site characterization activities have been conducted since 1994 within the 14.0-acre land area of the facility known as the pond parcel. These characterization activities have indicated the presence of residual radioactive material within a 10-acre portion of the pond parcel. The radioactive material identified within this portion of land is a thorium-bearing dross containing the isotopes Th-232, thorium-230 (Th-230), and thorium-228 (Th-228). The affected portion of the parcel contains the Retention Pond, and the former Reserve Pond area, and the Flux Building area.. The unaffected portion of the pond parcel contains a former Freshwater Pond area. This Decommissioning Plan (DP) was prepared to address the decommissioning of the pond parcel land area.

The pond parcel area considered for remediation is bounded by the south fence line, the former Fresh Water Pond eastern embankment on the west, Fulton Creek ditch on the north, the east fence line, and the northern and eastern edges of the Flux Building and paved area. A central feature of this area is the Retention Pond and associated embankments. Thorium-bearing dross was present on land adjacent to current Kaiser property along the east and south fence lines and represented the margins of the material. Kaiser has remediated this land by excavation and storing affected soil within the pond parcel. Affected soil generated during remediation of the adjacent land is considered as part of the on-site decommissioning.

The results of a site HSA are provided in Appendix A of the May 2002 DPA (Revised May 2003). As discussed in Section 3.1 of the May 2002 DPA (Revised May 2003), a limited amount of sanitary sewer lines, subsurface piping, and culverts exist at the facility. On-site sanitary sewer lines associated with rest rooms and employee shower facilities located within nonimpacted structures (Office, Maintenance, and Warehouse buildings) discharge to the main sanitary line traversing easterly along East 41st Street. A surface water storm drain and associated culvert are located near the northeastern corner of the North Extrusion Building. Subsurface piping associated with a storm drain and an air compressor cooling unit originates from the Warehouse Building and surface discharges at a location immediately north of the former operational area. Subsurface piping associated with drains originating from the Crusher Building surface discharge at locations immediately north of the building.

The pumping station structure identified near the retention pond was used to convey noncontact cooling water used in plant operations. Figure 3A-4 of the May 2002 DPA (Revised May 2003) shows a layout of the subsurface piping and the sanitary sewer for the Tulsa facility. As shown in that figure, several sections of storm drain/subsurface water piping and plant process piping (associated with the pumping station) were encountered and removed during the ALRP.

The site is located in the Northwest Oklahoma Cherokee Platform Physiographic Province which is a region with low relief. Originally, the site topography ranged from elevations above 710 feet above mean sea level (MSL) south of the tracks to below 690 feet at the Retention Pond and below 680 feet at the Reserve Pond. The current topography range of the site has not changed from the original calculations. This is illustrated in Figure 2-1, Site Plan.

## 3.2 Population Distribution

The Kaiser facility is located within the corporate limits of the City of Tulsa which is the second largest metropolitan area in the State of Oklahoma. In 1993, Tulsa had a population of 384,397. Population within the County of Tulsa was 526,410 in 1993.

In March 1996, demographic and population features were evaluated within an area defined by a square measuring 4 kilometers on each side (Area) with the facility at the center (R/S&A, March 20, 1996). This Area encompasses a radius of approximately 3 kilometers. Population information from the United States Census Bureau for the year 1990 was obtained for the applicable census tracts and block groups within the Area. In 1990, a total of 23,929 persons were living in residential structures within the Area. Additionally, approximately 3,473 business entities were in operation within the Area. Recently available Year 2000 census block data indicate that the population density for a 16-square-kilometer area surrounding the site is 0.00366 person per square meter.

Minority populations by compass vectors, a summary of projected populations in and around the site, and identification of poverty populations around the site are indicated in the tables below:

### 3.2.1 Number of Minorities by Race

| County | Direction from Tulsa County | Total Population | Black or African American | American Indian and Alaska Native | Asian | Native Hawaiian and Other Pacific Islander | Hispanic or Latino | Two or more races | Other |
|---|---|---|---|---|---|---|---|---|---|
| Creek | West | 67,367 | 1,724 | 6,120 | 179 | 17 | 1,283 | 3,479 | 423 |
| Okmulgee | South | 39,685 | 4,046 | 5,099 | 77 | 7 | 772 | 2,538 | 244 |
| Osage | West | 44,437 | 4,817 | 6,410 | 103 | 14 | 940 | 3,053 | 279 |
| Rodgers | East | 70,641 | 512 | 8,533 | 228 | 20 | 1,294 | 4,522 | 399 |
| Wagoner | East | 57,491 | 2,158 | 5,393 | 296 | 12 | 1,437 | 3,110 | 490 |
| Washington | North | 48,996 | 1,221 | 4,214 | 365 | 6 | 1,293 | 2,974 | 445 |

Source: U.S. Census Bureau, Census 2000 Redistricting (Public Law 94-171) Summary File, Matrices PL1 and PL2.

| County | Direction from Tulsa County | Current population (yr. 2000) | Projected population (yr. 2025) |
|---|---|---|---|
| Creek | West | 67,367 | 80,840 |
| Okmulgee | South | 39,685 | 47,622 |
| Osage | West | 44,437 | 53,359 |
| Rodgers | East | 70,641 | 84,709 |
| Tulsa | - | 563,299 | 645,928 |
| Wagoner | East | 57,491 | 68,989 |
| Washington | North | 48,996 | 58,795 |

Source: U.S. Census Bureau, Census 2000 Redistricting (Public Law 94-171) Summary File, Matrices PL1 and PL2.

| County | Direction from Tulsa County | Estimate of People of All Ages in Poverty (yr. 1998) (%) |
|---|---|---|
| National | - | 12.7 |
| Oklahoma | - | 16.1 |
| Creek | West | 13.7 |
| Okmulgee | South | 21.8 |
| Osage | West | 15.9 |
| Rodgers | East | 8.8 |
| Tulsa | - | 12.9 |
| Wagoner | East | 11.8 |
| Washington | North | 12.2 |

Estimates model 1998 income reported in the March 1999 Current Population Survey.

## 3.3 Current/Future Land Use

Figure 3-2 is a 1995 aerial photograph depicting current land uses within the area. Figure 3-3 provides a current zoning map of the facility and areas of interest. As shown, the facility actually lies within two separate zones--Industrial Moderate District (the area between the railroad and East 41st Street) and Industrial Light District (the area north of the railroad).

Zoning within the vicinity of the plant is not expected to change. Therefore, future use of the site is expected to be restricted to commercial or light industrial use.

An inventory of water wells located within a 1-mile radius of the Tulsa facility was conducted through the Oklahoma Water Resources Board (OWRB). The inventory revealed the presence of one off-site well within a 1 mile area of the site that was being used for other than water quality/soil remediation monitoring purposes. The subject well is located approximately 1 mile to the west/southwest of the Tulsa facility and its identified use was for irrigation.

## 3.4 Meteorology and Climatology

Meteorological and climatological data for the facility were obtained from the Oklahoma Climatological Survey and the National Climate Data Center. A general description of Tulsa's climate follows.

The City of Tulsa lies along the Arkansas River at an elevation of about 700 feet above sea level. The surrounding terrain is gently rolling.

Latitude 36°, Tulsa is far enough north to escape long periods of heat in summer, yet far enough south to miss extreme winter cold. The influence of warm moist air from the Gulf of Mexico is often noted, due to the high humidity, but the climate is essentially continental, characterized by rapid changes in temperature. Generally, winter months are mild. Temperatures occasionally fall below 0°F, but last for a very short time. Temperatures of 100°F or higher often are experienced from late July to early September, but usually are accompanied by low relative humidity and a good southerly breeze. The fall season is long with a great number of pleasant sunny days and cool nights.

Rainfall is ample for most agricultural pursuits and is distributed favorably throughout the year. Spring is the wettest season, having an abundance of rain in the form of showers and thunderstorms. The steady rains of fall are a contrast to the spring and summer showers and provide a good supply of moisture and good conditions for growth of winter grains and pastures. The greatest amounts of snow are received in January and early March. Snow usually is light and remains on the ground only for brief periods.

The average date of the last 32°F temperature occurrence is late March and the average date of the first 32°F occurrence is early November. The average growing season is 216 days.

The Tulsa area occasionally is subjected to large hail and violent windstorms that occur mostly during spring and early summer, although occurrences have been noted throughout the year. Prevailing surface winds are southerly during most of the year. Heavy fogs are infrequent. Sunshine is abundant.

### 3.4.1 Wind

The predominant wind direction is from the south. The prevailing monthly wind speed varies from 9 to 12 knots. The highest 1-minute sustained wind speed was 52 miles per hour (mph). This occurred in April 1982. The highest peak gust was 70 mph recorded in June 1992.

### 3.4.2 Temperature

Average annual temperature for the years 1948 through 1990 was 61°F. The daily average temperature varies from 83°F in July to 36°F in January. Monthly extremes vary from minus 8°F in December to 112°F in July.

### 3.4.3 Precipitation

Average annual precipitation is 38.9 inches of rainfall. The wettest year recorded during the period 1948 through 1990 was 69.9 inches of rainfall, while the driest year received 23.2 inches. May is the wettest month with an average of 5.6 inches of precipitation, while January is the driest month with an average of 1.6 inches of precipitation.

Storm events have an average duration of 9.2 hours. There is an average of 48 storm events per year. The average storm produces 0.744 inch of rainfall at an intensity of 0.11 inch per hour.

Annual snowfall averages 10 inches. Monthly snowfall exceeding 0.5 inch occurs in November, December, January, February, and March. Trace amounts (less than 0.5 inch and greater than 0.05 inch) occur in October and April. The remaining months typically are void of snowfall. Figure 3-4 depicts the monthly average snowfall for the years 1948 through 1990.

### 3.4.4 Relative Humidity

The average annual morning and afternoon relative humidities compiled from readings taken at 0600 hours and 1500 hours for the years 1948 through 1990 are 81 percent and 49 percent respectively. Monthly averages vary from 85 percent in May, June, and September to 46 percent in April, August, and October.

### 3.4.5 Evapotranspiration

Average monthly potential evapotranspiration varies from 3 millimeters (mm) in January to 188 mm in July. During the months of February through May, the soil is at its maximum water-holding capacity and precipitation exceeds evapotranspiration. Therefore, a water surplus occurs during these 4 months.

During the June through September time frame, potential evapotranspiration exceeds actual evapotranspiration. This is due to the soil moisture content being below its maximum storage capacity, thereby limiting the water uptake of the vegetation. The amount of moisture removed from the soil by the vegetation during this time frame is dependent upon the ratio of the actual soil moisture content to the potential soil moisture content. In other words, actual evapotranspiration equals potential evapotranspiration, multiplied by the ratio of actual soil moisture content to potential soil moisture content. This exceedance of potential evapotranspiration to actual evapotranspiration results in a water deficit during June through September.

## 3.5 National Ambient Air Quality Standards Category

The U.S. Environmental Protection Agency (USEPA) Office of Air Quality Planning and Standards (OAQPS) is responsible for the development of the National Ambient Air Quality Standards (NAAQS).

The NAAQS sets standards for six criteria pollutants: carbon monoxide, nitrogen dioxide, ozone, lead, particulate (both PM 2.5 and PM 10), and sulfur dioxide. The OAQPS has three classifications of areas as follows:

(1) Attainment Areas – Areas in which the concentrations of each of the six criteria pollutants do not exceed the standards established by the OAQPS.

(2) Nonattainment Areas – Areas in which the concentrations of each of the six criteria pollutants do exceed the standards established by the OAQPS.

(3) Maintenance Areas – Areas which have previously been designated by the OAQPS as Nonattainment, but which have improved and are currently considered Attainment.

No Nonattainment or Maintenance areas are located in the State of Oklahoma. The nearest Nonattainment area to the facility is located in Arcadia, Iron County, Missouri which is approximately 400 miles northeast of the facility.

## 3.6 Geology and Seismology

### 3.6.1 Geology

In general, the site is underlain by Quaternary Age alluvial soil deposits. A large portion of the rocks that outcrop in northeastern Oklahoma are Pennsylvanian in age. The Pennsylvanian System is divided into five major series. These series, in descending order, are as follows:

- Virgilian Series (youngest rocks)
- Missourian Series
- Desmoinesian Series
- Atokan Series
- Morrowan Series (oldest rocks)

Figure 3-5 illustrates the general west-to-east cross section for Tulsa County.

Areal geology features a bedrock of mostly flatlying soft shales, interbedded with thin resistant beds of limestone and sandstone. The Kaiser Retention Pond parcel is located in an area overlying a buried stream valley filled with recently deposited sediments. Borehole data indicate that the pond parcel is situated over a series of stream-deposited clayey silty sands that directly overlie the Nowata Shale bedrock. In turn, the sand units are covered by silty to sandy clays which, together with clayey fill material, form the surface features of the site. The shale bedrock, which underlies much of the area, has been eroded along the original valley axis to average depths of 15 to 20 feet and locally to depths of 25 to 30 feet. Clay and silt sediments have some peat content, and localized thick organic peaty silt (Unit 4, A&M Engineering, July 1999) deposits are known from boreholes across the northern part of the Retention Pond.

The clay to silt sand unit (Unit 1) is a stream channel fill that ranges from 0 to 10 feet in thickness with the thickest areas under the east end of the retention pond. The silt to sandy clay unit (Unit 2) ranges from 5 to 15 feet in thickness with the thickest section under the Freshwater Pond. Along the axis of the stream valley, the top of the clayey sand layer is at a near-uniform elevation of 682 feet (ground elevation on the Retention Pond peninsula is approximately 696 feet) with changes in thickness due to fill in previously existing topography on the eroded shale. The silt clay unit directly overlies the sand and reaches an elevation of 692 feet. Fill (Unit 3) and dross (Unit 5) fill in low spots on this unit. Dross is present in deposits that range in thickness from inches to 10 plus feet. This dross material possesses a characteristic metallic gray color in sand to gravel particle sizes when found in sediments and was described as sludge by ARS (1995) when found in pond-bottom sediments.

Geologic and borehole log descriptions indicate that the dross, clay, and sand units possess little shear strength. The dross, when saturated with groundwater as exists under ponded water conditions, has little mechanical strength. The dross has been observed to run into drilled boreholes within or adjacent to the Retention Pond. Hammer blow counts for the soil surrounding and underlying the dross generally are low, in single digits, indicating minimal shear strength. Reasonable bearing strength is found in the shale bedrock and, to a lesser degree, in the clayey sands. Particle-size distributions for sand units indicate generally well-sorted sand with 5 to 20 percent fines and less than 10 percent gravel. For the clay units, more than 45 percent of the material passes the No. 200 sieve; the sand fraction composes another 40 to 45 percent of the sediment. Atterberg tests on the fines indicate a low- to medium-plasticity clay. More details on site geotechnical properties are presented in the Geotechnical Brief (Earth Sciences, 2000).

### 3.6.2 Regional Geologic Structures and Tectonics

The geologic and tectonic history of Oklahoma is basically characterized by marine sedimentation, which periodically was interrupted by episodes of uplift, gentle folding, and erosion, which was followed subsequently by renewed sedimentation.

Tulsa County is located in the eastcentral portion of the northeastern Oklahoma Cherokee Platform. The Oklahoma Cherokee Platform is bounded on the east by the Ozark Uplift, on the west by the Nemaha

Uplift, on the south by the Arbuckle Uplift, and on the southeast by the Arkoma Basin and extends north into Arkansas. These physiographic provinces were all created or influenced by Pennsylvanian tectonic activity.

The tectonic activity in this area is associated with the final uplift of the Ozark and Ouachita mountains. The remnants of this activity across Tulsa County are northeast- to southwest-trending folds, adjustment flexures, and some faults. A geologic map showing the location of these features in the vicinity of the site is provided as Figure 3-10. Normal and unclassified faults are located to the east of Tulsa.

Other than these few inactive structural features, the local structural geology of Tulsa County mainly consists of rock formations that gently dip or slope slightly north of west at a rate of 30 to 50 feet per mile.

### 3.6.3 Seismology

Very little seismic activity has occurred in and around Tulsa County. Historically, there have been five earthquakes in Tulsa County. These earthquakes were of very low intensity and were instrumentally recorded and not felt. These events occurred as follows:

- April 19, 1978 at 1420 hours, rural west Tulsa County
- August 3, 1983 at 0431 hours, rural southwest Tulsa County
- November 13, 1983 at 0527 hours, rural southwest Tulsa County
- November 29 1983 at 0349 hours, rural southcentral Tulsa County
- April 28, 1984 at 2255 hours, rural northcentral Tulsa County

There has never been a recorded earthquake within the corporate boundaries of the City of Tulsa.

## 3.7 Surface Water Hydrology

The Kaiser Tulsa facility lies within the intermittent stream portion of the Fulton Creek watershed. Fulton Creek flows north and east approximately 2 miles to Mingo Creek. The nearest location to the Tulsa facility for which stream discharge data are available is the U.S. Geological Survey gauging on Mingo Creek located approximately 8 miles downstream of the facility. Available flow data for this gauging station is summarized in the following table.

| Year | Annual mean streamflow, in $ft^3/s$ | Year | Annual mean streamflow, in $ft^3/s$ | Year | Annual mean streamflow, in $ft^3/s$ |
|---|---|---|---|---|---|
| **1988** | 78.6 | **1992** | 84.4 | **1995** | 100 |
| **1989** | 69.4 | **1993** | 91.5 | **1996** | 58.5 |
| **1990** | 84.2 | **1994** | 115 | **1997** | 80.1 |
| **1991** | 62.3 | | | | |

Fulton Creek and the Retention Pond dominate the site surface hydrology. The 274-acre Fulton Creek drainage basin upstream of the Retention Pond is located to the southwest, west, and northwest of the Kaiser facility. With increasing urbanization, the flow into the pond and creek has changed to receive surface runoff and storm water from an area largely taken over by light industrial and commercial development. Approximately 2 miles downstream, Fulton Creek connects to Mingo Creek, Bird Creek, and the Verdigris River which ultimately empty into the Arkansas River. Mingo Creek basin waters have been designated by the Oklahoma Water Resources Bureau (OWRB) for beneficial use as emergency water supply, fish and wildlife propagation, agriculture, industrial and municipal process and cooling waters, recreational, and aesthetics. According to the OWRB, there are no surface water withdrawals within 9 miles of the Tulsa facility. Some flood control is provided within one-half mile downstream from Kaiser's property; however, none of the ponds or structures on Kaiser property are designated as part of this system.

On-site features associated with the Fulton Creek drainage include the channeled headwaters of Fulton Creek along the western boundary of the former Freshwater Pond to the excavated ditch carrying Fulton Creek along the northern edge of Kaiser's pond parcel. At the east edge of the property line, a deteriorating concrete weir is used to control flow exiting the property. The weir is reported to pass water beneath the structure, making measurements of discharge quantities unreliable. In addition, three concrete weirs are present on Kaiser property along Fulton Creek and create small ponds. Discharge varies with season and local precipitation events.

The Retention Pond covers approximately 8 acres and is bounded on the north and east by embankments and higher ground elsewhere. The pond, permitted by the OWRB (Permit No. CW-72-131) as a nondischarging retention pond, formerly received both industrial process cooling water and solid dross wastes. Liquid wastewater (cooling water) from plant operations was carried to the Retention Pond through an underground pipe and a pumping station.

Surface runoff from Kaiser's former operational area south of the railroad is directed to the north, beneath the rail bed, through three culverts. In addition, surface runoff from the pond parcel is diverted either into the pond or off site through a ditch just north of the Flux Building and paved area. These structures convey water toward the pond area, toward a ditch along the north edge of the paved area around the Flux Building, or to an off-site area south of the Flux Building. Adjacent to the Flux Building, surface flow is collected in a ditch which enters a pipe at the east fence line. This pipe passes under the northwest corner of Specific Systems' property and enters a concrete-lined ditch, which connects with Fulton Creek, upstream of a weir at the northeast corner of Kaiser property.

The Reserve Pond was excavated and diked at the northeast corner of the site. It was put into service in 1964, operated to post-1967, and was backfilled circa 1972. This pond was approximately 1 acre in area and reported up to 15 feet deep.

Figure 3-8 is a topographic map of the site. Surface water typically leaves the facility moving north to Fulton Creek. From Fulton Creek, the flow proceeds east.

### 3.7.1 Flood Plan Data

A copy of the Federal Emergency Management Agency Flood Insurance Rate Map (FIRM) for Mingo Creek and its tributaries in the vicinity of the facility is provided in Figure 3-6. As shown on the FIRM, the facility is outside the 100-year and 500-year flood hazard boundaries. The FIRM for this area was last revised April 16, 1991 to reflect changes in the Base Flood Elevations resulting primarily from completion of major drainage improvement work on Mingo Creek (construction of storm water retention basins).

Figure 3-7 is a portion of a map prepared by the U.S. Army Corps of Engineers (COE) Tulsa District depicting the approximate boundary of areas which experienced significant flooding during the flood of record for Mingo Creek which occurred on May 27, 1984. The facility is not within the flood boundary shown in Figure 3-7. During this flood event, widespread and severe flooding occurred along Mingo Creek and Bird Creek from a flash flood event. As a result of this event, many properties (both residential and commercial) were acquired by the City of Tulsa along the Mingo Creek floodplain. These acquired properties and the existing Mingo Creek channel have been modified significantly since 1984 to prevent the reoccurrence of such flooding.

## 3.8 Groundwater Hydrology

The hydrogeologic setting was determined for Kaiser by A&M Engineering (July, 1999), based on data from 23 boreholes and piezometers drilled in and adjacent to the pond parcel. Piezometers and monitoring wells were installed to monitor groundwater in shallow fine-grained sediments, in deeper sandy units comprising the basal part of the buried valley fill, and in deep stratigraphic holes drilled into the Nowata Shale Unit. Groundwater elevation monitoring, hydraulic conductivity (slug) tests, and groundwater chemical analyses were performed. A series of hydraulic conductivity testing of subsurface unconsolidated materials was completed by A&M Engineering between April 1997 and May 1999. Slug tests were used to measure the hydraulic conductivity of the screened materials in the monitoring wells and piezometers installed at the site. An overview of the hydraulic conductivity tests is as follows:

- Unit 1 Materials (Sands) – Range of $2.12 \times 10^{-5}$ and $3.32 \times 10^{-3}$ cm/sec with an average of $1.11 \times 10^{-3}$ cm/sec.
- Units 2 and 3 Materials (Silty Clays) – Range of $10^{-6}$ and $10^{-8}$ cm/sec based on Unified Soil Classification System classifications.
- Unit 4 Materials (Peaty Clay) – Range of $10^{-3}$ and $10^{-6}$ cm/sec.
- Unit 5 Materials (Dross) - Range of $3.41 \times 10^{-4}$ and $3.06 \times 10^{-3}$ cm/sec with an average of $1.3 \times 10^{-3}$ cm/sec.
- Weathered Shale - Range of $1.6 \times 10^{-6}$ and $5.55 \times 10^{-4}$ cm/sec with an average of $2.11 \times 10^{-4}$ cm/sec.

The hydraulic conductivity of the Nowata shale bedrock underlying the site also was tested using inflatable packer tests. The hydraulic conductivity measured for this material ranged from $1.8 \times 10^{-4}$ cm/sec for shallow weathered and fractured bedrock to less than $10^{-7}$ cm/sec for deep competent bedrock. A hydrologic budget was estimated for surface and groundwater inflows and outflows of the site.

In general, groundwater flow is from west to the east, along the axis of the buried stream valley. Groundwater was found to lie fairly close (within 3 to 5 feet) to the ground surface but was recognized to vary considerably in response to short- and long-term precipitation patterns. Groundwater is suspected to occur both in shallow perched/mounded conditions and in deeper unconfined to semiconfined conditions. Groundwater elevations in piezometer pairs in deep and shallow aquifers/sediments generally differ at locations around the pond by 0.1 foot to 5 feet. Downward vertical groundwater flow through the upper fine-grained units into the lower sandy units was reported. There was little evidence of downward migration between near-surface sediments into the Nowata Shale. See Figures 3-8 and 3-9.

Water level data in wells and ponds were interpreted by A&M Engineering (July, 1999) to indicate that the former Freshwater Pond had a relatively insignificant impact on the groundwater table. This was attributed to the impermeability of the embankment dam and, to a lesser degree, to silting of the pond bottom and controlled outflow through a weir from the pond into Fulton Creek. Retention Pond and downstream groundwater elevations were observed to correlate closely during seasonal climate changes. Elevation changes of water in the Fulton Creek ditch were observed to correlate well with both Retention Pond levels and levels in deeper sand units, suggesting a link between them (A&M Engineering, 1998). However, infiltration through the Freshwater Pond into the subsurface was suspected of contributing to the locally high groundwater regime beneath the Retention Pond (Earth Sciences, August 2000).

### 3.8.1 Groundwater Flow Data

Groundwater levels were measured in monitoring wells during each monitoring event. The groundwater levels measured in the field were converted to groundwater elevations based upon surveyed measurement reference point elevations reported in feet above MSL. Three different groundwater-bearing units are monitored at the site: (1) shallow overburden/dross material, (2) deep overburden, and (3) shallow bedrock.

#### 3.8.1.1 Shallow Overburden/Dross Material

Monitoring wells screened in the shallow overburden/dross material are located to the east and northeast of the Retention Pond and consist of Wells MWS-4, MWS-5, MWS-6, and MWS-11. Groundwater elevations obtained during the December 2002 monitoring event were contoured as shown in Figure 3-8. The piezometric map indicates that shallow groundwater flows toward the north/northeast (toward Fulton Creek) away from the Retention Pond (Figure 3-8). The uppermost water-bearing zone occurs under unconfined conditions, with a direct relation to surface water, and is influenced by topography within the eastern portion of the site. The hydrologic flow data for past quarterly monitoring events are relatively consistent with the December 2002 data. Similarly, groundwater elevations are consistent with past monitoring events (April 1997, September 1998, and March 1999) as reported in the Hydrologic and Geologic Investigation report by A&M Engineering (July 1999).

#### 3.8.1.2 Deep Overburden

Wells currently used to monitor the aquifer occurring in the deep overburden are P-2, MWD-2, P-3, MWD-4, P-5, MWD-5, MWD-6, MWD-7, MWD-8, MWD-9, P-10, MWD-10, and MWD-11. Groundwater elevations obtained during the December 2002 monitoring event were used to create a potentiometric surface map as shown in Figure 3-9. As indicated in this figure, groundwater in this confined unit flows in an east/northeast direction following the axis of the bedrock valley identified during previous investigations (A&M Engineering, July 1999). Based on the December 2002 groundwater elevation for Monitoring Wells P-2 and MWD-8, the average horizontal hydraulic gradient across the site is 0.01 foot per foot with steeper gradients occurring in the west and south areas along the side of the bedrock valley. The hydrologic flow data for the deep overburden during past quarterly monitoring events are relatively consistent with the December 2002 data. These groundwater elevations also are consistent with past monitoring events (April 1997, September 1998, and March 1999) as reported in the A&M Engineering report (July 1999).

### 3.9 Natural Resources

There are no known natural resources located at or near the site. Water for industrial, agricultural, and potable uses in the area of the site is supplied by the municipality. There are no known industrial or agricultural users of surface water from the immediate area of the Kaiser facility.

### 3.10 Ecology/Endangered Species

Information to support this section was obtained from the U.S. Fish & Wildlife Services (USFWS), Oklahoma Wildlife Conservation (OWC), and the Oklahoma Biological Survey and National Heritage Inventory (OBS/NHI) sources. Information gathered leads to the conclusion that while the ecology, endangered species, and threatened species in the Tulsa area are diverse, there are no known species inhabiting or requiring the support of the area encompassed by the Kaiser Tulsa plant or adjacent industrial properties. This is supported by information in Attachment 3-1 which contains a finding by the COE that excavation and/or placement of fill associated with the unnamed tributary of Mingo Creek (Fulton Creek) will have no affect on federally listed endangered or threatened species or habitat critical for the survival of such species.

According to the OBS/NHI, the only known invertebrates, which are commercially or recreationally important in the Tulsa area, are the Fresh Water Mussels. The mussels are collected out of the Grand Lake, which is approximately 60 miles from the site, and Fort Gibson Lake, approximately 40 miles from the site. Neither of these areas will be impacted by the activities required in the DP.

According to the OBS/NHI, the only commercially important floral species in the Tulsa area is the pecan tree. However, the vast majority of the trees are located along the Arkansas River and there is no significant pecan production within 5 kilometers of the site. Activities to be conducted in the DP will not impact the area currently required for the pecan trees and will, therefore, not impact the environmental requirements of this biotic species.

Several animals are commercially and recreationally noted by the OBS/NHI, OWC, and the USFWS to exist within the Tulsa area. These are found in the wild but are not farmed within the immediate area for commercial purposes. None of the remediation activities planned for the Kaiser site are expected to impact the populations of these animals or their required habitat.

Commercially important animals that are within the Tulsa area as well as located on the site are Turtles (six species), Raccoons, Possums, Beavers, and Skunks. Other commercially important animals in the Tulsa area are; Coyote, Bobcats, Minks, Muskrat, and Gray Fox.

Recreationally important animals that are within the Tulsa area as well as located on site are Sunfish (four species), Ducks (four species), Geese (three species), and Morning Doves. Other recreationally important animals in the Tulsa area are; Bass (three species), Catfish (three species), Crappie (two species), Eastern Cotton Tail, Fox Squirrel, White Tailed Deer, Wild Turkey, Northern Bobwhite Quail, Ducks (nine species), Song Birds (30 species), and Hummingbirds.

3.10.1 Relative Abundance

Endangered species that are located within the Tulsa area are the American Burying Beetle and the Interior Least Tern. There are also threatened species of animals, the Bald Eagle and the Piping Plover, that are recorded to inhabit the Tulsa area. The activities, which are scheduled for the decommissioning of the facility, are not expected to impact the existence or the needs of the animals on this list.

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6. Earth Sciences, May 2002 , Revised May 2003, Decommissioning Plan Addendum, Tulsa Facility, Tulsa, Oklahoma, Kaiser Aluminum & Chemical Corporation, Baton Rouge, Louisiana.

7. Earth Sciences, January 2003, Semiannual Groundwater Quality Report, Retention Pond and Reserve Pond Area, First and Second Quarter 2002 Monitoring Events, Kaiser Aluminum Specialty Products Facility, Tulsa, Oklahoma.

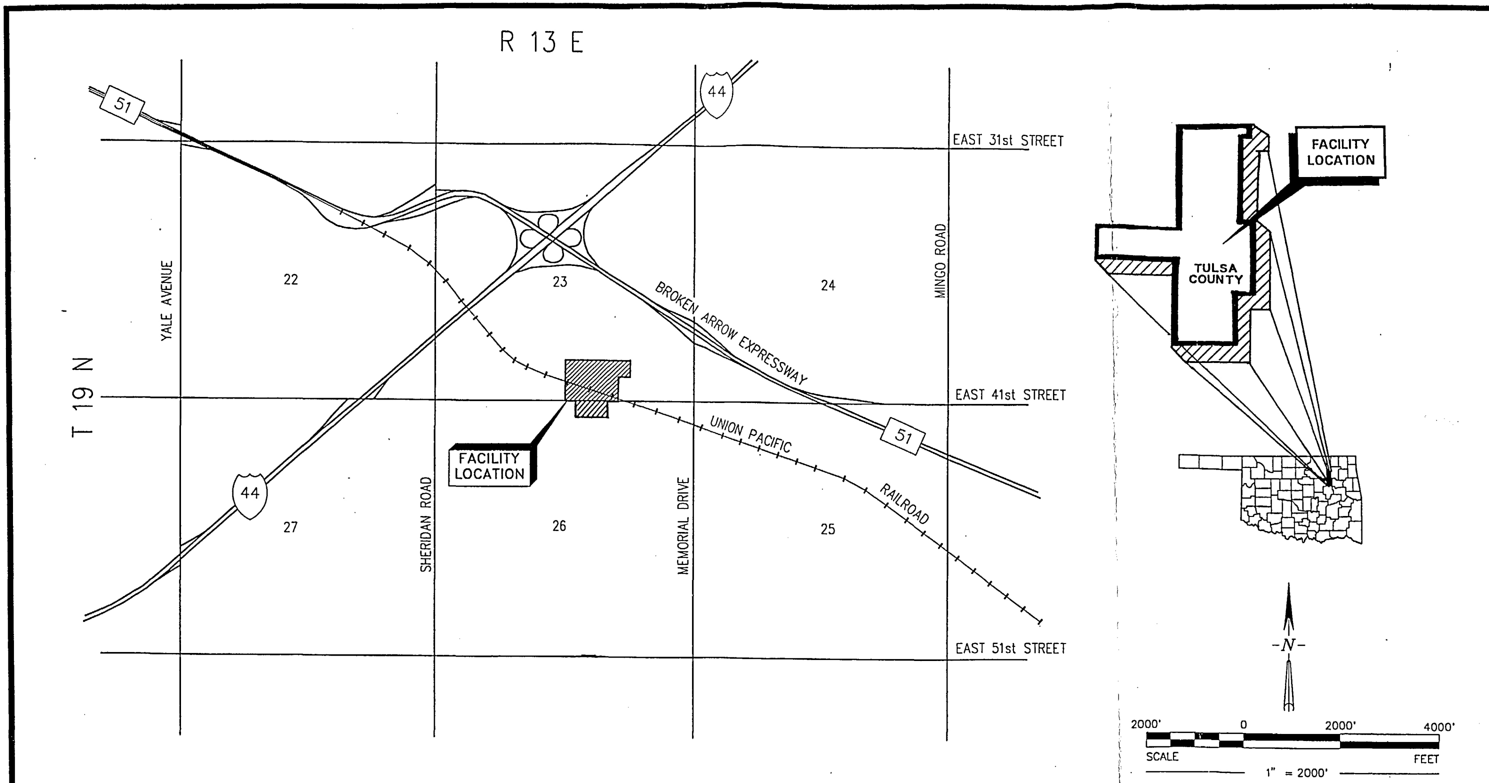
8. Earth Sciences, April 2003, Semiannual Groundwater Quality Report Retention Pond and Reserve Pond Area, Third and Fourth Quarter 2002 Monitoring Events, Kaiser Aluminum Specialty Products Facility, Tulsa, Oklahoma.

9. Roberts/Schornick & Associates, March 20, 1996, Local and Regional Environmental Data Report, Kaiser Aluminum Specialty Products, Tulsa, Oklahoma.

10. U.S. Census Bureau, 2000 Redistricting (Public Law) Summary File, Matrices PL1 and PL2.

11. U.S. Geological Survey, Gauging Data for Mingo Creek.

Figure 3-1

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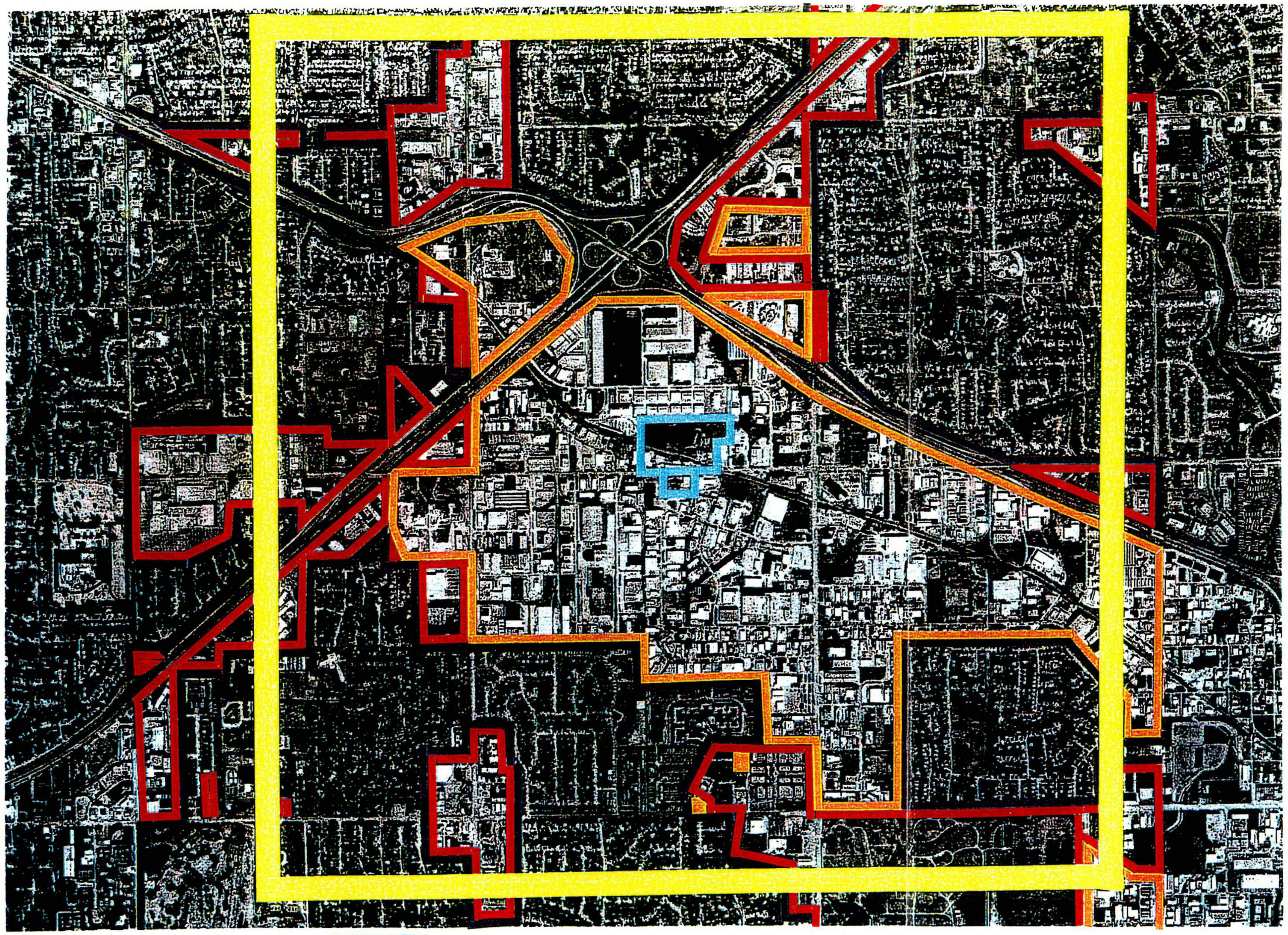
| Client: KAISER ALUMINUM EXTRUDED PRODUCTS | | Figure Title: FACILITY LOCATION MAP | |
| Location: 7311 EAST 41ST STREET TULSA, OKLAHOMA | | Document Title: LOCAL AND REGIONAL ENVIRONMENTAL DATA REPORT | |
| ROBERTS/SCHORNICK & ASSOCIATES, INC. Environmental Consultants 6314 South Yale, Suite 1100 Tulsa, Oklahoma 74135 (918) 496-0059 | DATE: 11/1/95 | PREPARED BY: KE | |
| | SCALE: 1" = 2000' | CHECKED BY: KE | |
| | | DRAFTED BY: GS | |
| | PROJECT NO: 9515901 F02 | FIGURE NO.: 1 | |

Figure 3-2



AERIAL DATA SERVICE, INC. ADS
10822 EAST NEWTON PLACE • TULSA, OKLAHOMA 74116 • 916-437-8453

**LEGEND:**

- RESIDENTIAL LAND USE
- INDUSTRIAL LAND USE
- COMMERCIAL LAND USE
- AREA BOUNDARY (ENCOMPASSES 2 KM RADIUS)
- FACILITY BOUNDARY

N

C05

PHOTOGRAPH TAKEN NOVEMBER 15, 1992

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| Client: KAISER ALUMINUM EXTRUDED PRODUCTS | | Figure Title: LAND USE WITHIN THE AREA, 1995 | |
| Location: 7311 EAST 41ST STREET TULSA, OKLAHOMA | | Document Title: LOCAL AND REGIONAL ENVIRONMENTAL DATA REPORT | |
| ROBERTS/SCHORNICK & ASSOCIATES, INC. Environmental Consultants 5314 South Yale, Suite 1100 Tulsa, Oklahoma 74135 (918) 496-0059 | | DATE: 11/1/95 | PREPARED BY: KE |
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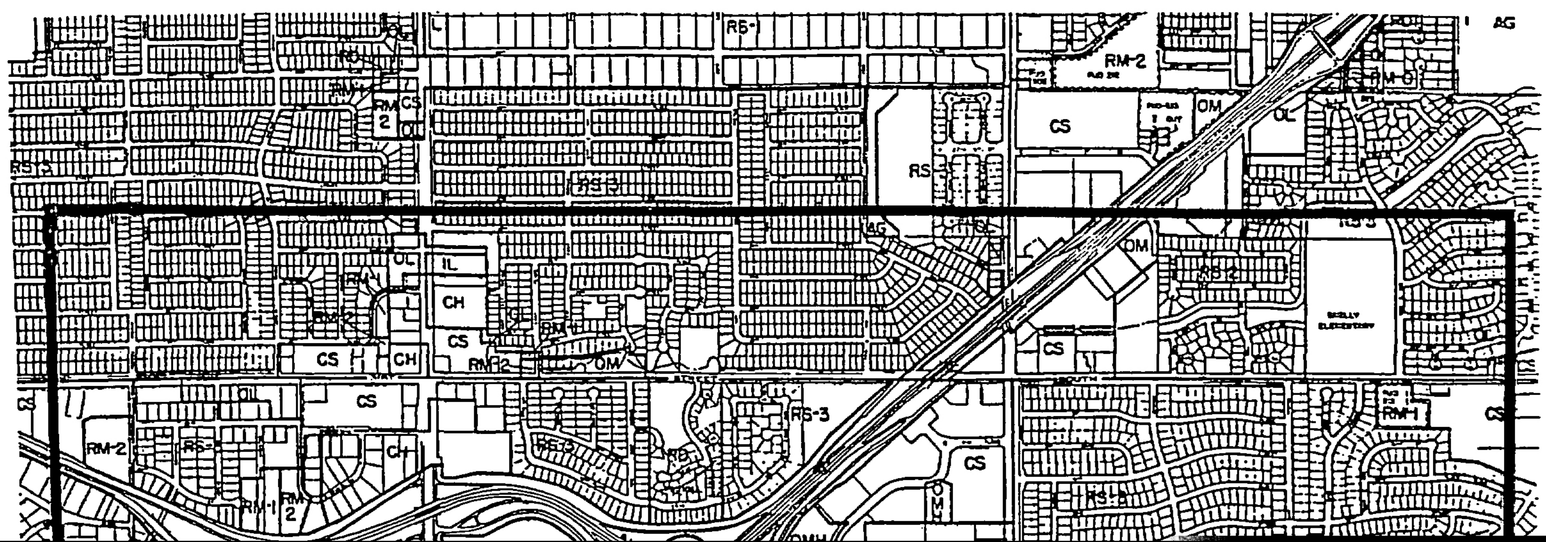
| | | PROJECT NO: 9515901 F02 | FIGURE NO.: 10 |

Figure 3-3



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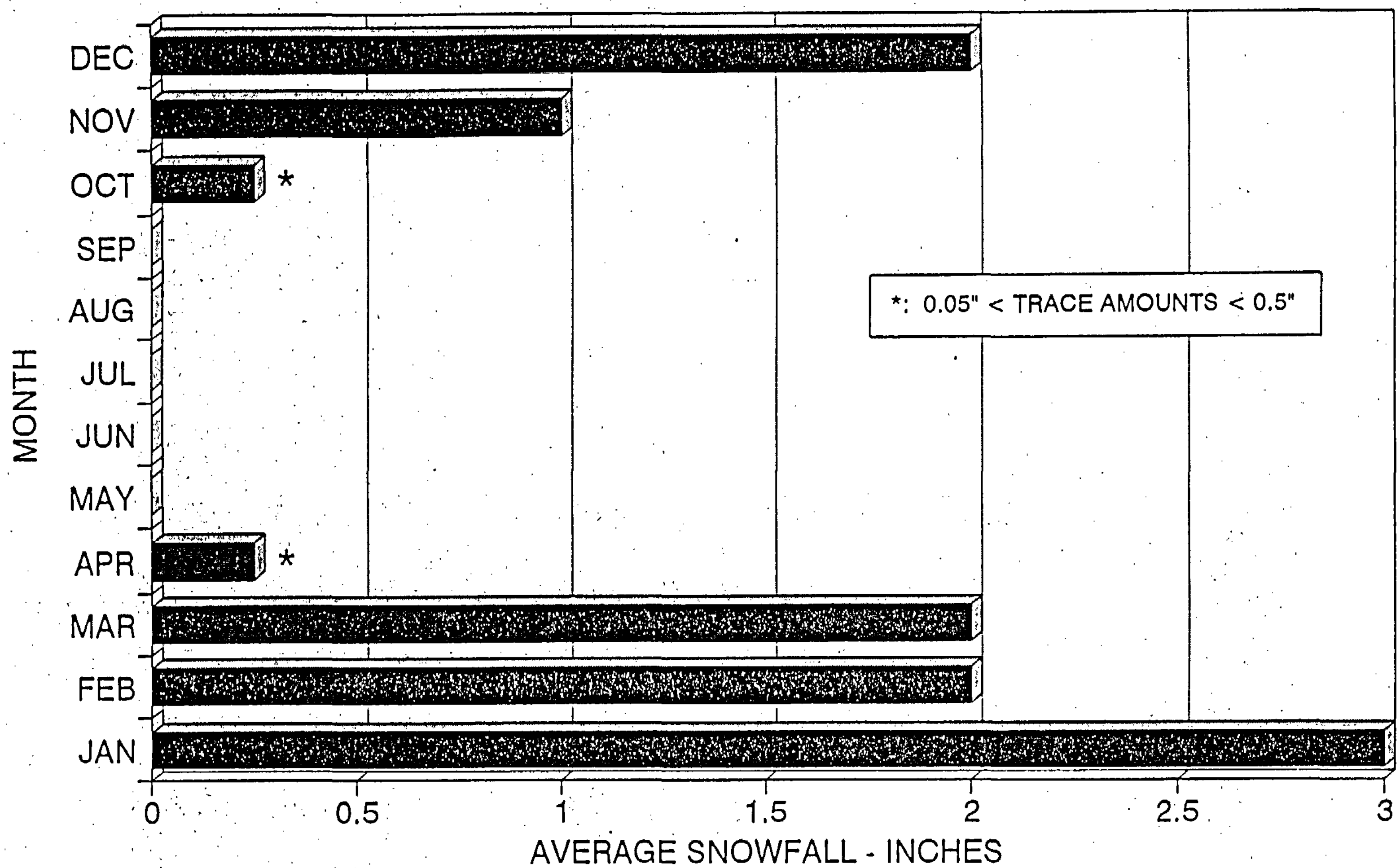
RS-3
RS-2
SKELLY ELEMENTARY

**Figure 3-4**




NATIONAL CLIMATIC DATA CENTER, 'INTERNATIONAL STATION METEOROLOGICAL CLIMATE SUMMARY', VERSION 2.1, JULY 2, 1992, NWS STATION #723560

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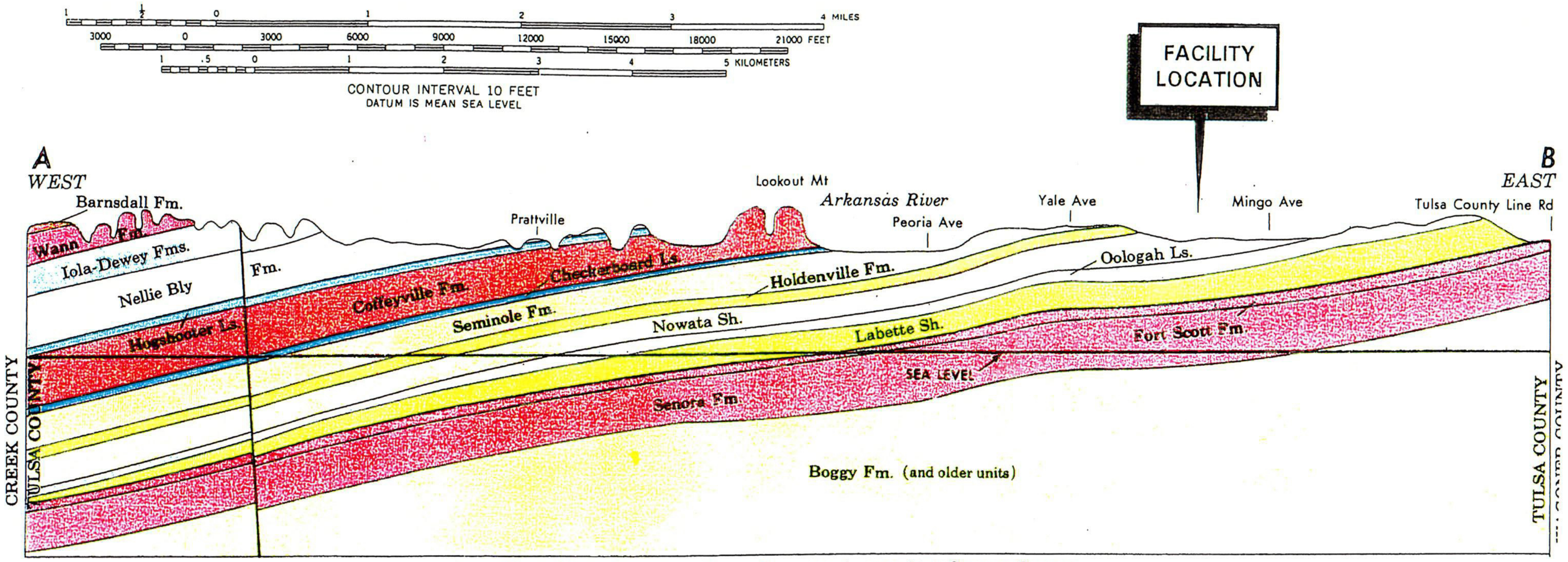
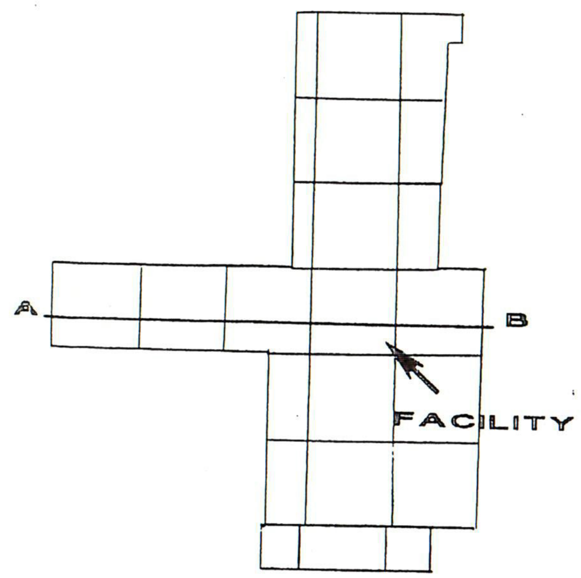
|---|---|---|---|
| Figure Title: AVERAGE SNOWFALL BY MONTH, TULSA, OKLAHOMA (1948-1990) | | Document Title: LOCAL AND REGIONAL ENVIRONMENTAL DATA REPORT | |
| ROBERTS/SCHORNICK & ASSOCIATES, INC. Environmental Consultants 5314 South Yale, Suite 1100 Tulsa, Oklahoma 74135 (918) 496-0059 | Client: KAISER ALUMINUM EXTRUDED PRODUCTS | DATE: 11/1/95 | PREPARED BY: CM |
| | | SCALE: NO SCALE | CHECKED BY: CM |
| | | | DRAFTED BY: GS |
| | Location: 7311 EAST 41ST STREET TULSA, OKLAHOMA | PROJECT NO: 9515901 F02 | FIGURE NO.: 17 |

**Figure 3-5**




WEST-EAST GEOLOGIC CROSS SECTION ALONG 31ST STREET SOUTH

SCALE: HORIZONTAL, 1 inch=3 miles
VERTICAL, 1 inch=1,000 feet




TULSA COUNTY

C06

SOURCE: TULSA'S PHYSICAL ENVIRONMENT, TULSA GEOLOGICAL SOCIETY, 1972

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|---|---|---|---|
| Client: KAISER ALUMINUM EXTRUDED PRODUCTS | | Figure Title: GENERALIZED WEST-EAST (A-B) CROSS-SECTION, TULSA COUNTY | |
| Location: 7311 EAST 41ST STREET TULSA, OKLAHOMA | | Document Title: LOCAL AND REGIONAL ENVIRONMENTAL DATA REPORT | |
| ROBERTS/SCHORNICK & ASSOCIATES, INC. Environmental Consultants 5314 South Yale, Suite 1100 Tulsa, Oklahoma 74135 (918) 496-0059 | | DATE: 11/1/95 | PREPARED BY: KE |
| | | | CHECKED BY: KE |
| | | SCALE: NO SCALE | DRAFTED BY: GS |
| | | PROJECT NO: 9515901 F02 | FIGURE NO.: 30 |

Figure 3-6

Federal Emergency Management Agency
Flood Insurance Rate Map

# THIS PAGE IS AN OVERSIZED DRAWING (MAP)

## THAT CAN BE VIEWED AT THE RECORD TITLED:

## DWG. NO. 40581 0065 F, REVISED: APRIL 16, 1991 "FLOOD INSURANCE RATE MAP, CITY OF TULSA, OKLAHOMA" WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: 40581 0065F

**NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.**