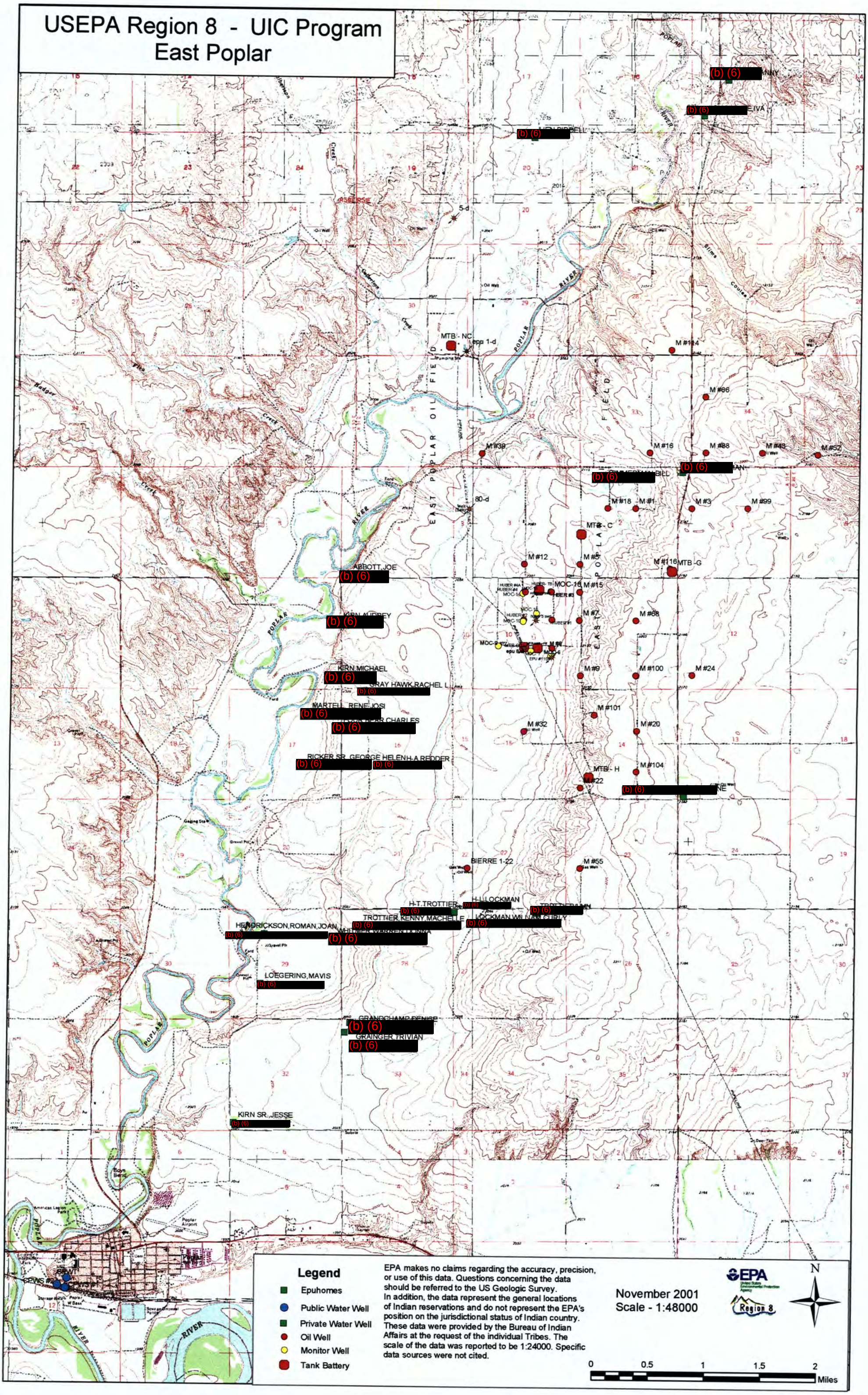
USEPA Region 8 - UIC Program
East Poplar



MAP I-367

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED AS A PART OF THE DEPARTMENT OF THE INTERIOR PROGRAM
FOR DEVELOPMENT OF THE MISSOURI RIVER BASIN

GEOLOGIC MAP OF THE POPLAR QUADRANGLE, ROOSEVELT RICHLAND AND MC CONE COUNTIES, MONTANA

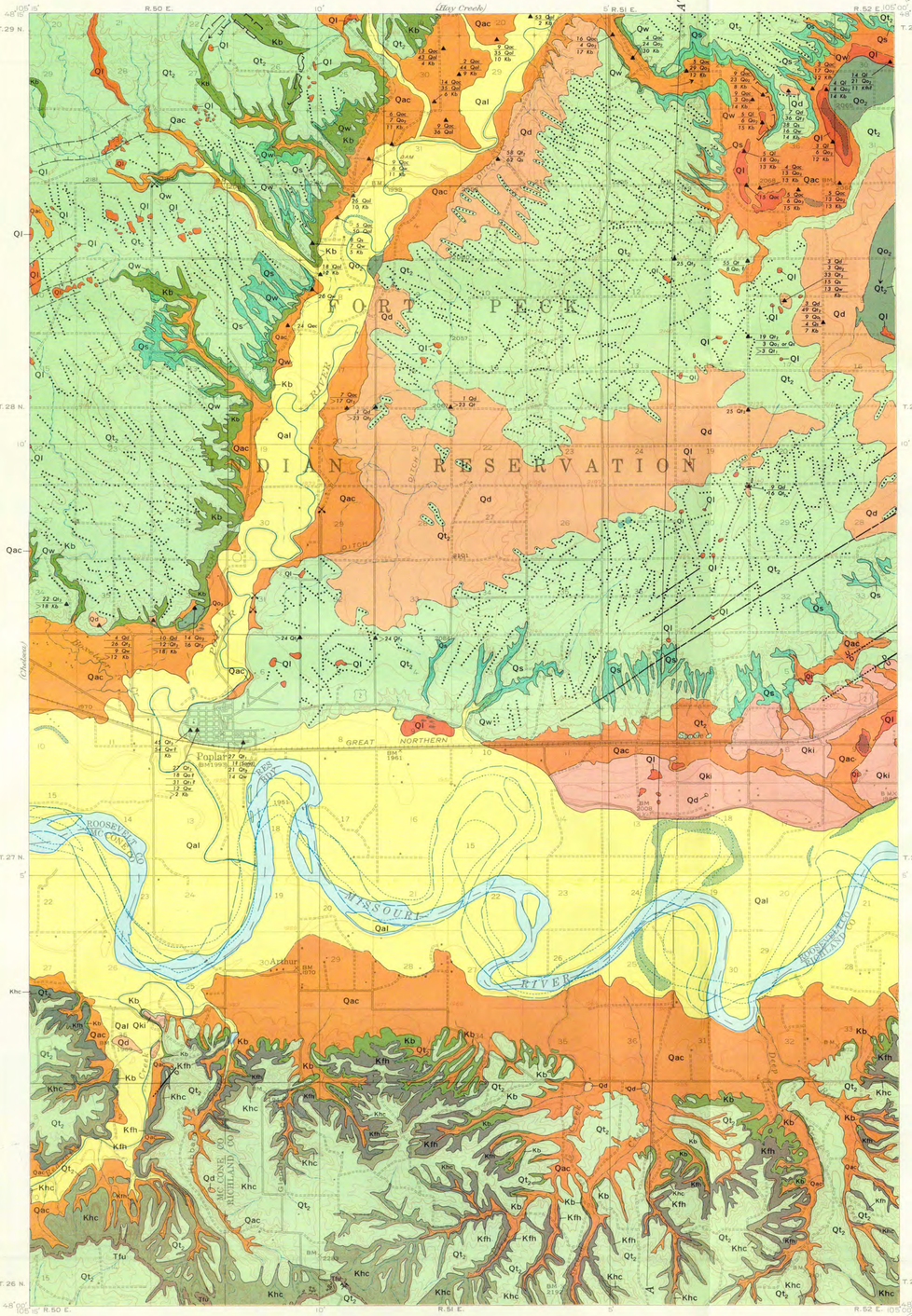
By
Roger B. Colton

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-367

101
Last in file
1

PUBLISHED BY THE U. S. GEOLOGICAL SURVEY
WASHINGTON, D.C.
1963

MAP I-367



Base modified from U.S. Geological Survey topographic quadrangle. Culture revised by Roger B. Colton from 1949 aerial photographs

APPROXIMATE MEAN DECLINATION, 1963

Geology by Roger B. Colton, and Conrad R. Appledorn, assisted by James McElroy and Leo Wanek, 1951

MONTANA
QUADRANGLE LOCATION

EXPLANATION

This is a master explanation for Miscellaneous Geologic Investigations Maps I - 361—371. Only map units present in this quadrangle are colored. An asterisk (*) precedes the explanation for symbols not present in this quadrangle

QUATERNARY

Recent

Qls — Landslide deposits
Areas of recent landsliding. Deposits are composed of the various formations affected by the landsliding

Qal — Alluvium
Fine- to coarse-grained flood-plain deposits of Missouri River and major tributaries. Mainly silt with local gravel lenses. Deposits average 50 feet in thickness but may be more than 130 feet thick under Missouri River flood plain

UNCONFORMITY

Pleistocene — Wisconsin Glaciation

Qki — Kintyre Formation
Buff to brown clay, silt, and sand; thickness up to 150 feet. Bedding planes folded and faulted

Qt₂ / Qt₁ — Till
Unstratified, compact, highly impervious, heterogeneous mixture of rock particles ranging in size from clay to boulders. Generally 15 feet thick; locally as much as 250 feet thick. Qt_1, older till and Qt_2, younger till

Qo₂ / Qo₁ — Outwash deposits
Sandy gravel and silt, as much as 60 feet thick, consisting mainly of rounded brown quartzite pebbles derived from the Flaxville Formation. A small percentage of limestone, dolomite, and granitic pebbles present. Some deposits formed as deltas in lakes. Qo_1, outwash deposits of early(?) Wisconsin age, and Qo_2, outwash deposits of late Wisconsin age

Qk₂ / Qk₁ — Kame deposits
Sand and gravel, rudely stratified and poorly sorted ice-contact deposits. Contain boulders as much as 2 feet in diameter. Maximum thickness, 100 feet. Qk_1, kame deposits of early(?) Wisconsin age, and Qk_2, kame deposits of late Wisconsin age.

Qe₂ / Qe₁ — Esker deposits
Long sinuous ridges of poorly sorted stratified ice-contact sand and gravel as much as 60 feet thick. Contain boulders as much as 2 feet in diameter. Qe_1, esker deposits of early(?) Wisconsin age, and Qe_2, esker deposits of late Wisconsin age

UNCONFORMITY

Qs — Sprole Silt[1]
Buff poorly bedded to massive silt deposits east and north of Poplar. Up to 100 feet thick

Qw — Wiota Gravels
Sand, silt, clay and gravel. Gravel similar to that found in the Flaxville and small percent glacially derived. Five to 55 feet thick and generally overlain by till. May include rocks of Pliocene age

Qac — Fan alluvium and colluvium
Slope-wash deposits derived from topographically higher deposits. The part derived from Flaxville Formation is largely gravel, that from Bearpaw Shale is almost entirely clay, that from the Hell Creek Formation and the Fox Hills Formation is chiefly silt and sand, and that from till is pebbly to gravelly clay. Generally tan to dark brown. Thickness of deposits highly variable, but observed maximum of 20 feet. May include rocks of Pliocene age

Qd — Dune sand
Well-sorted and stratified deposits of sand up to 20 feet thick. May include rocks of Pliocene age

Ql — Lake and pond deposits
Dark-gray clay and silty clay containing a few pebbles deposited in intermittent bodies of water by water, wind, and slope wash. As much as 16 feet thick. May include rocks of Pliocene age

TERTIARY

Miocene or Pliocene

Tf — Flaxville Formation
Quartzite sand and gravel, clay, sand and silt, marl, and volcanic ash. Locally cemented. Generally less than 50 feet thick but up to 160 feet thick in northern part of area. Includes younger rocks

UNCONFORMITY

Paleocene

Tfu — Fort Union Formation
Continental strata consisting of interbedded gray clay, buff silt, lignite, buff calcareous sandstone, brown carbonaceous clay, olive-gray sand, bentonitic gray clay, and silty limestone concretions. Well sorted and stratified. Marked lateral variation in lithology. Only lower 600 feet present in area

CRETACEOUS

Upper Cretaceous

Khc — Hell Creek Formation
Gray to tan shales, siltstones, sandstones, and carbonaceous shales about 230 feet thick. Lower 50 to 100 feet is predominantly medium-tan sand or sandstone. A few quartzite pebbles found in basal conglomeratic lenses

UNCONFORMITY

Montana Group

Kfh — Fox Hills Formation
Consists of upper sandstone 35 to 60 feet thick underlain by transitional marine shale 60 feet thick

Kb — Bearpaw Shale
Dark olive-gray marine shale approximately 1,100 feet thick. Only upper 300 feet exposed. Upper 100 feet includes a few brownish sandy shale beds. Thin bentonitic beds are present and bentonite is disseminated through some shale zones

Contact
Dashed where approximately located

Gradational contact

Fault
Dashed where approximately located; dotted where concealed. U, upthrown side; D, downthrown side

Lineation on aerial photograph
Surface trace of probable fault

*Strike and dip of beds

1890
1910
1949
Course of Missouri River

*Drift border and limit of mapped readvance
Dashed where approximately located. Tick marks on ice side

Traces of topographic breaks in slope on till surface inferred to reflect buried channel

Segments of melt-water channel
Arrow indicates direction of flow

Direction of flow of melt water in outwash channel
Indicates channel where no other symbol suggests presence of one

Ice-crack moraines
Long low ridges of till 10 to 15 feet high, 50 to 100 feet wide, and as much as 2 miles long

*Trend of crest of moraine
Includes washboard and other recessional moraines, lateral moraines, and end moraines

*Drumlin
Line shows orientation of long axis

*Scarp

Abandoned lignite mine

Gravel pit

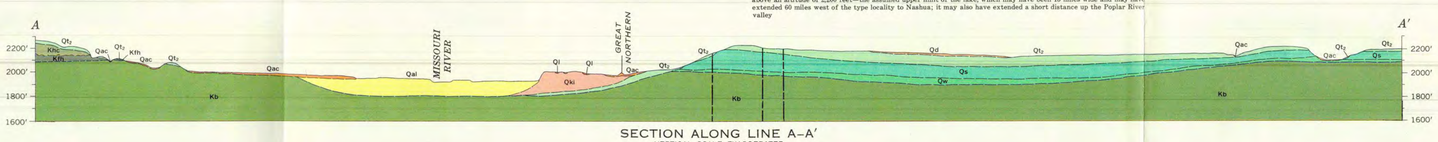
Abbreviated columnar section
Approximate thickness, in feet, and stratigraphic sequence of geologic units. Data based on natural and artificial exposures, and on test drilling. Apex of triangle shows location. >, more than

[1] The Sprole Silt is here named for an exposure 2 miles northwest of Sprole, a siding on the Great Northern Railroad (NW¼, SW¼, sec. 3, T. 27 N., R. 51 E.).

Measured and estimated thickness ranges from 60 to 100 feet, thinning to the west where it was not mapped locally. The silt is yellowish gray, brown, or reddish brown, clayey, plastic, thin bedded, and locally limonitic. It is locally much folded and faulted, probably by ice shove. The lower half is well stratified silt and clay, and contains pebbles; bedding is less pronounced in upper half. In some areas the silt has little structure and resembles loess.

No fossils were found in the formation, and its age was determined only on the basis of stratigraphic position: at the type locality it overlies at least 6 feet of Wiota Gravels and underlies 15 feet of till, both of Wisconsin age.

The silt was deposited in a lake formed when the ice advanced and blocked the Missouri River. It has not been found above an altitude of 2,200 feet—the assumed upper limit of the lake, which may have been 15 miles wide and may have extended 60 miles west of the type locality to Nashua; it may also have extended a short distance up the Poplar River valley



SECTION ALONG LINE A–A′
VERTICAL SCALE EXAGGERATED

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—62304

GEOLOGIC MAP OF THE POPLAR QUADRANGLE, ROOSEVELT, RICHLAND AND MC CONE COUNTIES, MONTANA

By
Roger B. Colton

SCALE 1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

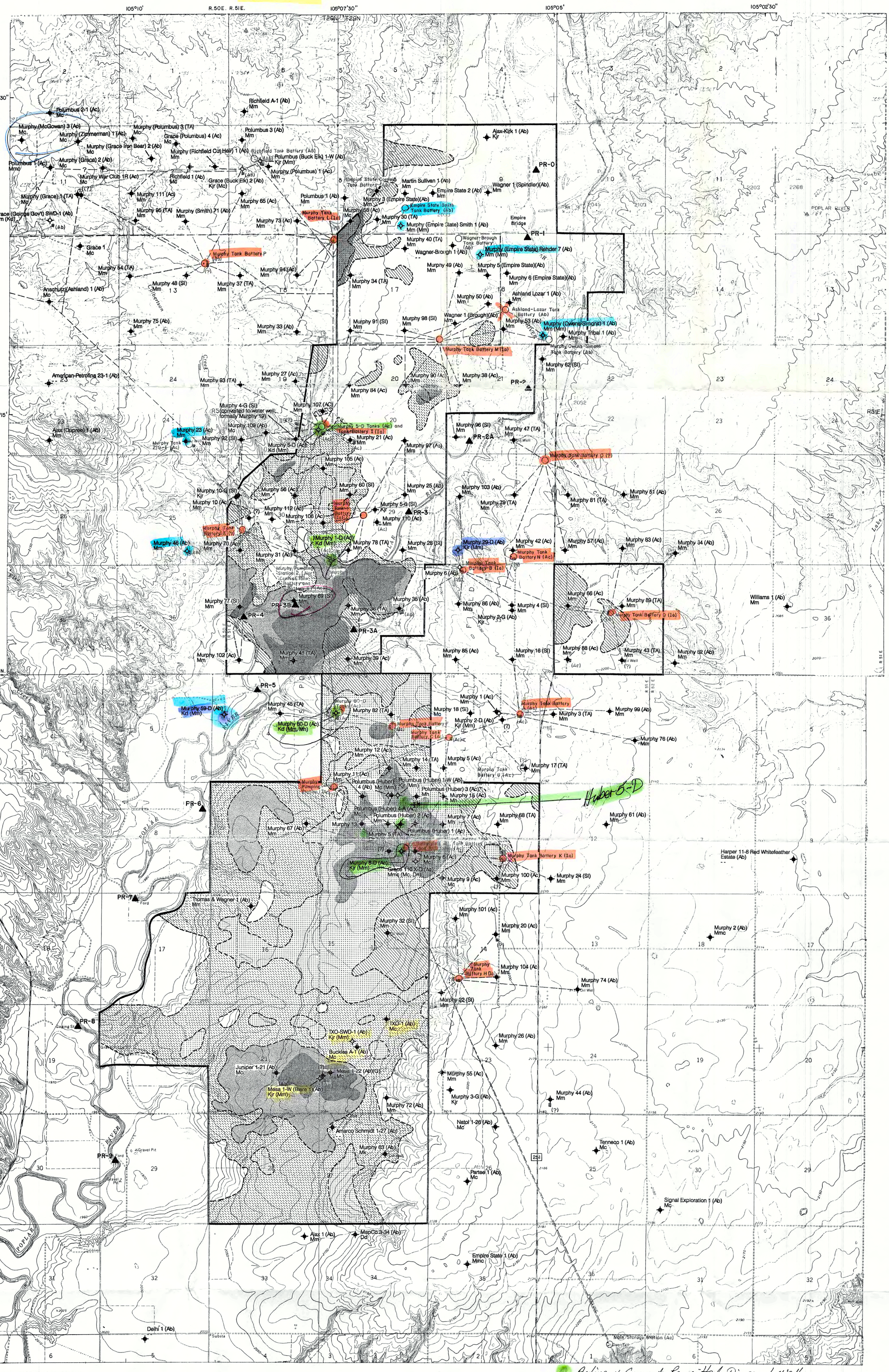
1963

For sale by U. S. Geological Survey, price 1.00

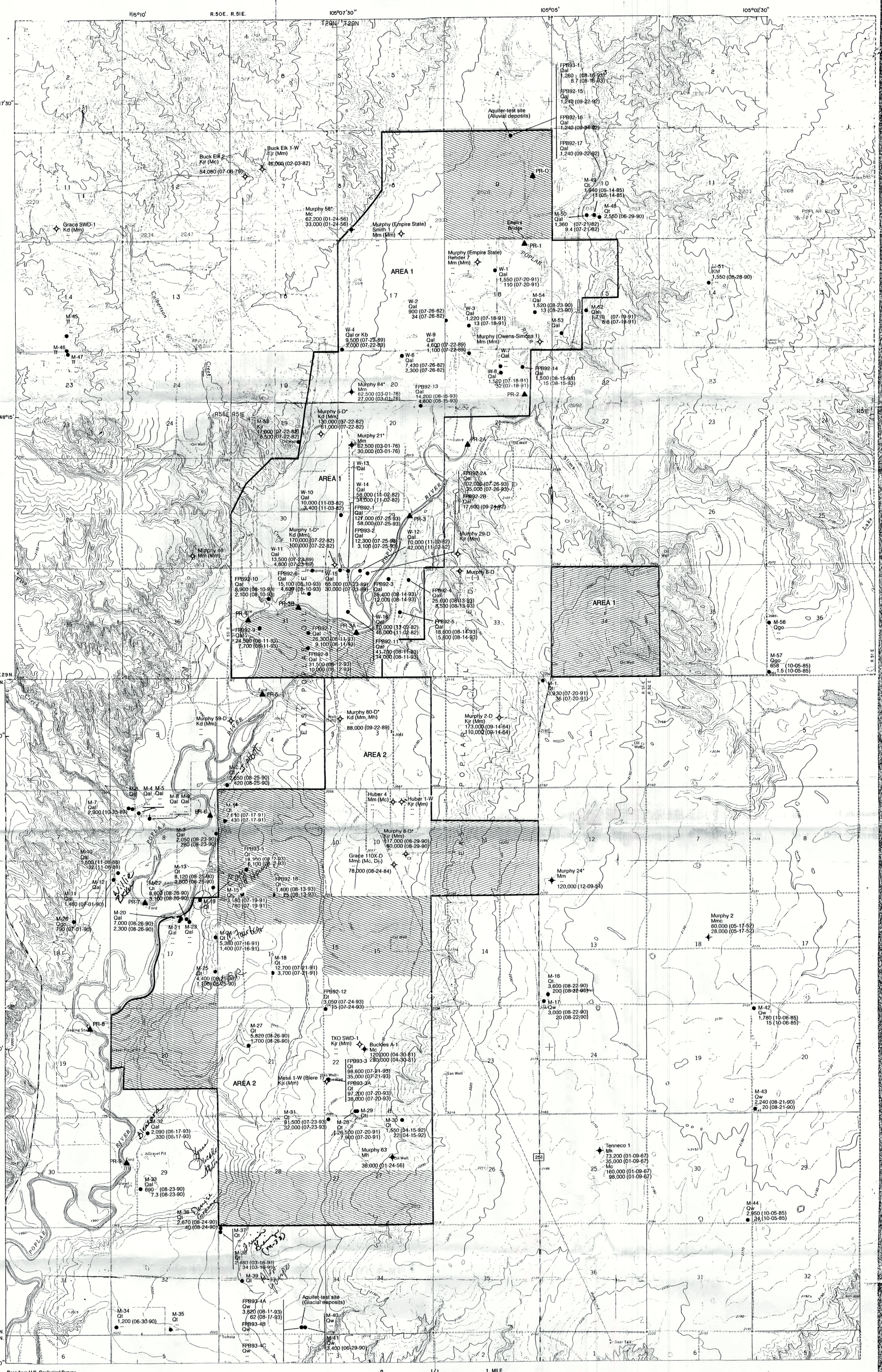
Thamke, J.N., and Craigg, S.D., 1997 Saline-water contamination in Quaternary deposits and the Poplar River, East Poplar oil field, northeastern Montana

107-4
Behind DOEA
(1)

EXHIBIT 51
Poupee v. Murphy
7-12-01


105°10'
R.50E. R.51E.
105°07'30"
105°05'
105°02'30"
48°17'30"
48°15'
48°12'30"
48°10'
48°07'30"
T.29N.
T.28N.
T.27N.
POPLAR RIVER
Empire Bridge
PR-0
PR-1
PR-2
PR-2A
PR-3
PR-3A
PR-3B
PR-4
PR-5
PR-6
PR-7
PR-8
PR-9
Huber 5-D
Murphy Tank Battery P
Murphy Tank Battery M (Ia)
Murphy Tank Battery O (?)
Murphy Tank Battery Q (Ia)
Murphy Tank Battery K (Ia)
Murphy Tank Battery H (Ia)
Murphy Tank Battery B (Ia)
Murphy Tank Battery N (Ac)
Murphy Tank Battery I (Ia)
Murphy Tank Battery E (?)
Murphy Tank Battery L (Ia)
Murphy 5-D Tanks (Ac) and Tank Battery I (Ia)
Murphy (Empire State) Rehder 7 (Ab)
Murphy (Owens-Simons) 1 (Ab)
Murphy (Empire State) Smith 1 (Ab)
Murphy 29-D (Ab)
Murphy 59-D (Ab)
Murphy 46 (Ab)
Murphy 23 (Ab)
Murphy (McGowan) 3 (Ac)
Murphy (Zimmerman) 1 (Ac)
Murphy (Grace Iron Bear) 2 (Ab)
Murphy (Grace) 2 (Ab)
Murphy (Grace) 1 (TA)
Murphy War Club 1R (Ac)
Murphy (Richfield Cut Heir) 1 (Ac)
Murphy (Columbus) 3 (TA)
Grace (Columbus) 4 (Ac)
Murphy (Columbus) 1 (Ac)
Murphy 111 (Ac)
Murphy 95 (TA)
Murphy (Smith) 71 (Ab)
Murphy 73 (Ac)
Murphy 65 (Ac)
Murphy 58 (Ac)
Murphy 30 (TA)
Murphy 40 (TA)
Murphy 49 (Ab)
Murphy 5 (Empire State)(Ab)
Murphy 6 (Empire State)(Ab)
Murphy 50 (Ab)
Murphy 53 (Ab)
Murphy 54 (TA)
Murphy 48 (SI)
Murphy 37 (TA)
Murphy 94 (Ac)
Murphy 34 (TA)
Murphy 75 (Ab)
Murphy 33 (Ab)
Murphy 91 (SI)
Murphy 98 (SI)
Murphy 62 (SI)
Murphy 38 (Ac)
Murphy 90 (Ac)
Murphy 84 (Ac)
Murphy 93 (TA)
Murphy 27 (Ac)
Murphy 107 (Ac)
Murphy 4-G (SI)
Murphy 109 (Ab)
Murphy 92 (SI)
Murphy 21 (Ac)
Murphy 97 (Ab)
Murphy 96 (SI)
Murphy 47 (TA)
Murphy 105 (Ac)
Murphy 60 (SI)
Murphy 25 (Ab)
Murphy 103 (Ab)
Murphy 79 (TA)
Murphy 51 (Ab)
Murphy 81 (TA)
Murphy 10-G (SI)
Murphy 10 (Ac)
Murphy 56 (Ac)
Murphy 112 (Ac)
Murphy 108 (Ac)
Murphy 5-G (SI)
Murphy 110 (Ac)
Murphy 1-D (Ac)
Murphy 78 (TA)
Murphy 28 (SI)
Murphy 42 (Ac)
Murphy 57 (Ac)
Murphy 83 (Ac)
Murphy 34 (Ab)
Murphy 31 (Ac)
Murphy 6 (Ab)
Murphy 66 (Ac)
Murphy 89 (TA)
Murphy 77 (SI)
Murphy 69 (SI)
Murphy 35 (Ab)
Murphy 36 (TA)
Murphy 86 (Ab)
Murphy 4 (SI)
Murphy 2-G (Ab)
Murphy 88 (Ac)
Murphy 43 (TA)
Murphy 52 (Ab)
Murphy 102 (Ac)
Murphy 41 (TA)
Murphy 39 (Ac)
Murphy 85 (Ac)
Murphy 16 (SI)
Murphy 45 (TA)
Murphy 82 (TA)
Murphy 18 (SI)
Murphy 1 (Ac)
Murphy 3 (TA)
Murphy 99 (Ab)
Murphy 76 (Ab)
Murphy 2-D (Ab)
Murphy 12 (Ac)
Murphy 14 (TA)
Murphy 5 (Ac)
Murphy 17 (TA)
Murphy 11 (Ac)
Murphy 15 (Ac)
Murphy 7 (Ac)
Murphy 68 (TA)
Murphy 61 (Ab)
Murphy 67 (Ab)
Murphy 13
Murphy 6 (Ac)
Murphy 9 (Ac)
Murphy 100 (Ac)
Murphy 24 (SI)
Murphy 101 (Ac)
Murphy 20 (Ac)
Murphy 2 (Ab)
Murphy 104 (Ac)
Murphy 74 (Ab)
Murphy 22 (SI)
Murphy 26 (Ab)
Murphy 55 (Ac)
Murphy 3-G (Ab)
Murphy 44 (Ab)
Murphy 72 (Ab)
Murphy 63 (Ab)
Murphy 32 (SI)
Murphy 8-D (Ac)
Murphy 5 (TA)
Murphy Pumping Station 2 (Ac)
Murphy Pumping Station 1 (Ac)
Murphy Tank Battery A (Ac)
Murphy Tank Battery C (Ac)
Murphy Tank Battery G (Ac)
Murphy Tank Battery D (Ac)
Murphy Tank Battery J (Ac)
Murphy Tank Battery F (Ac)
Murphy Tank Battery E (Ac)
Murphy Tank Battery B

Thamke, J.N., and others, 1996,
Hydrologic data for the East Poplar oil field,
Fort Peck Indian Reservation, northeastern Montana.



Base from U.S. Geological Survey Badger Creek, 1972; Geddart Lake, 1983; Long Creek East, 1983; and Poplar NE, 1972 quadrangles, 1:24,000

0 1/2 1 MILE
0 1/2 1 KILOMETER

CONTOUR INTERVALS 10 AND 20 FEET
SUPPLEMENTAL CONTOURS 5 AND 10 FEET

BOUNDARY OF ELECTROMAGNETIC GEOPHYSICAL SURVEY--Area 1 includes alluvial deposits along Poplar River. Area 2 includes glacial deposits

PR-9 ▲ STREAMFLOW-MEASUREMENT SITE AND NUMBER--Data for these sites are reported in tables 10, 11, and 12

WELL SITES--First line is the well name (described in text). Second line is the geologic unit in which the well is completed (for brine-injection wells, the unit in parentheses is the source of the brine). Third line is the specific conductance (in microsiemens per centimeter at 25 degrees Celsius) of water from the well and the date of measurement (for brine-injection wells, this is the specific conductance of the injected water). Fourth line is the chloride concentration (in milligrams per liter) of water from the well and the date of the sample (for brine-injection wells, this is the chloride concentration of the injected water). Symbol -- indicates no data

M-18
Qt
12,700 (07-21-91) ●
3,700 (07-21-91)
Existing privately owned well or Montana Bureau of Mines and Geology observation well

W-16
Qal
70,000 (11-02-82) ●
46,000 (11-02-82)
U.S. Geological Survey monitoring well (from Levings, 1984)

EXPLANATION

FPB93-3
Qt
98,600 (07-21-93) ●
35,000 (07-21-93)
U.S. Geological Survey monitoring well (installed during this investigation)

Murphy 58*
Mc
62,200 (01-24-56)
33,000 (01-24-56)
Oil well (asterisk indicates a well that was active as of 1994)

Murphy 1-D*
Kd (Mm)
170,000 (07-22-82)
100,000 (07-22-82)
Brine-injection well (asterisk indicates a well that was active as of 1994)

AREAS OF ELECTROMAGNETIC GEOPHYSICAL DATA COLLECTION

Indicates area in which 0.1-mile site spacing was used

Indicates area in which 0.2-mile site spacing was used

Indicates area in which measurements radiate from a selected oil well

ABBREVIATIONS FOR GEOLOGIC UNITS ARE AS FOLLOWS--

Qal - Alluvium (Quaternary)
Qt - Glacial till (Pleistocene)
Qgo - Glacial outwash (Pleistocene)
Qw - Wiota Gravel (Pleistocene)
Tf - Flaxville Formation (Pliocene and Miocene)
Khf - Hell Creek Formation and Fox Hills Sandstone (Upper Cretaceous)
Kb - Bearpaw Shale (Upper Cretaceous)
Kjr - Judith River Formation (Upper Cretaceous)
Kd - Dakota Sandstone (Lower Cretaceous)
Mh - Heath Formation (Upper Mississippian)
Mk - Kibbey Formation (Upper Mississippian)
Mm - Madison Group (Mississippian)
Mc - Charles Formation of Madison Group
Mmc - Mission Canyon Limestone of Madison Group
Dn - Nisku Formation (Upper Devonian)

MAP SHOWING LOCATION OF PRIVATELY OWNED WELLS, MONITORING WELLS, BRINE-INJECTION WELLS, SAMPLED OIL WELLS, SURFACE-WATER DATA-COLLECTION SITES, AND AREAS OF ELECTROMAGNETIC GEOPHYSICAL DATA COLLECTION FOR THE EAST POPLAR OIL FIELD, FORT PECK INDIAN RESERVATION, NORTHEASTERN MONTANA

By

Joanna N. Thamke, Steven D. Craigg, and Thomas M. Mendes

1996

EXHIBIT
1

BLEA[redacted]ARD SUBDIVISION No. 1

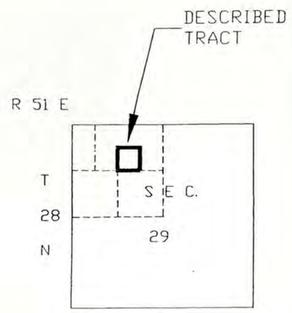
SW 1/4 N[redacted] NW 1/4 SECTION 29, T 28 N, R 51 E, PMM

[redacted]OOSEVELT COUNTY, MONTANA

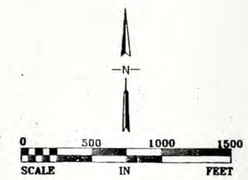
DATE: MAY 1998

(b) (6)

107-5
Behind Docs
①

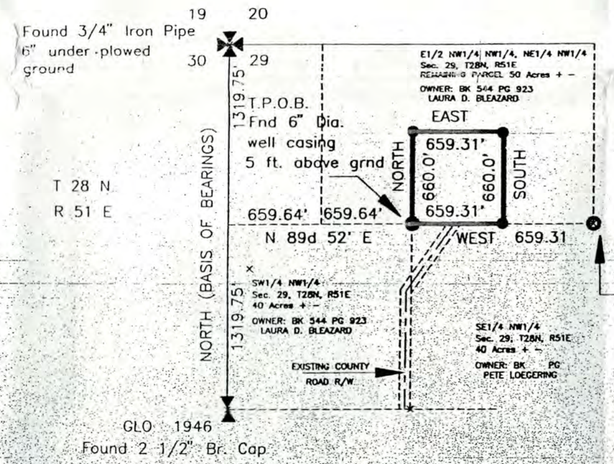


LOCATION MAP
1" = 2000'



FOR: LAURA D. BLEAZARD
P.O. BOX 1415
POPLAR, MONTANA 59255

BY: RODNEY A. BRUNER, ES
P.O. BOX 337
WOLF POINT, MONTANA 59201



PLAT MAP

LEGEND

- PROJECTED 1/4 SEC. CORNER
- MONUMENTED 1/4 SEC. CORNER
- PROJECTED SECTION CORNER
- MONUMENTED SEC. CORNER
- RERERENCE MONUMENT AS DESCRIBED
- SET 5/8" X 2' REBAR

CERTIFICATE OF LAND OWNER

"I (We) the undersigned property owner(s), do hereby certify that we have caused to be surveyed, subdivided and platted as shown on the plat hereto annexed, the following described land in Roosevelt County.

A tract of land being the SW1/4 NE1/4 NW1/4 of Section 29, T28N, R51E, P.M.,M., Roosevelt County, Montana, more particularly described as follows:

Commencing at the West 1/4 Corner of the above described Section 29, T28N, R51E, P.M.,M., Roosevelt County, Montana; thence, on and along the section line between Sections 29 and 30, NORTH a distance of 1319.75 feet to the NW 1/16 Corner of Section 29, Thence; N 89d 52' E a distance of 1319.28 feet to the NW 1/16 corner. Said point being the True Point of Beginning, (T.P.O.B.)

Thence; NORTH a distance of 660.0 feet,
Thence; EAST a distance of 659.31 feet,
Thence; SOUTH a distance of 660.0 feet,
Thence; WEST a distance of 659.31 feet to the T.P.O.B.
Said described tract contains 10.00 acres, more or less.

Dated this 27 day of May, 1998

Laura D. Bleazard
OWNER:

OWNER:

STATE OF MONTANA)
COUNTY OF ROOSEVELT)

On this 27th day of May, 1998 before me a Notary Public in and for the State of Montana, personally appeared Laura D. Bleazard known to me to be the person who signed the forgoing Certificate and who acknowledged to me that they executed the same.

Notary Public in and for the State of Montana

Wolf Point
Residing at

March 15, 1999
My commission Expires

CERTIFICATE OF SURVEYOR

STATE OF MONTANA)
COUNTY OF ROOSEVELT)

This is to certify that Rodney A. Bruner, a Montana Registered Land Surveyor, Registration No. 3841 ES, being first duly sworn deposes and says that during the month of May 1998, a survey was conducted under his direct supervision of a tract of land being the SW1/4 NE1/4 NW1/4 Section 29, T28N, R51E, P.M.,M., Roosevelt County, Montana. Said tract of land is shown on the attached Plat of Bleazard Subdivision No. 1 and that said survey is true and complete as shown and the monuments found and set are of the character and occupy the position shown thereon.

Dated this 18th day of May, 1998

Rodney A. Bruner
Rodney A. Bruner, ES 3841

MONTANA RODNEY A. BRUNER 3841 ES REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR

CERTIFICATE OF COUNTY TREASURER

STATE OF MONTANA)
COUNTY OF ROOSEVELT)

I hereby certify that no real property taxes levied and assessed on the described land are delinquent.

Lori R Leyton
Treasure, Roosevelt County, Montana

CERTIFICATE OF APPROVAL

The County Commission of Roosevelt County, Montana does hereby certify that is has examined this subdivision plat and having found the same to conform to law, approves it, and hereby accepts the dedication to public use of any and all lands shown on this plat as being dedicated to such use, this 27th day of May, 1998.

Lee Matyjevsky
COMMISSIONER

Cheryl A. Hansen
CLERK and RECORDER

PLAT 336B #FILE 5397 INDEXED

350953

Cheryl A. Hansen

is filed for record in my office on the
1996, at _____ O'clock ____ M.
Page _____ of Certificate Of Survey.

County, Montana

FINAL PLAT
BLEAZARD SUBDIVISION No. 1
SW1/4 NE1/4 NW1/4 SECTION 29, T28N, R51E
ROOSEVELT COUNTY, MONTANA

SCALE 1" = 500'	DRAWN BY R A Bruner	DATE MAY 15, 1998
		AUTOCAD\COS\BLEAZFIN DWG. INDEX

EXHIBIT
22

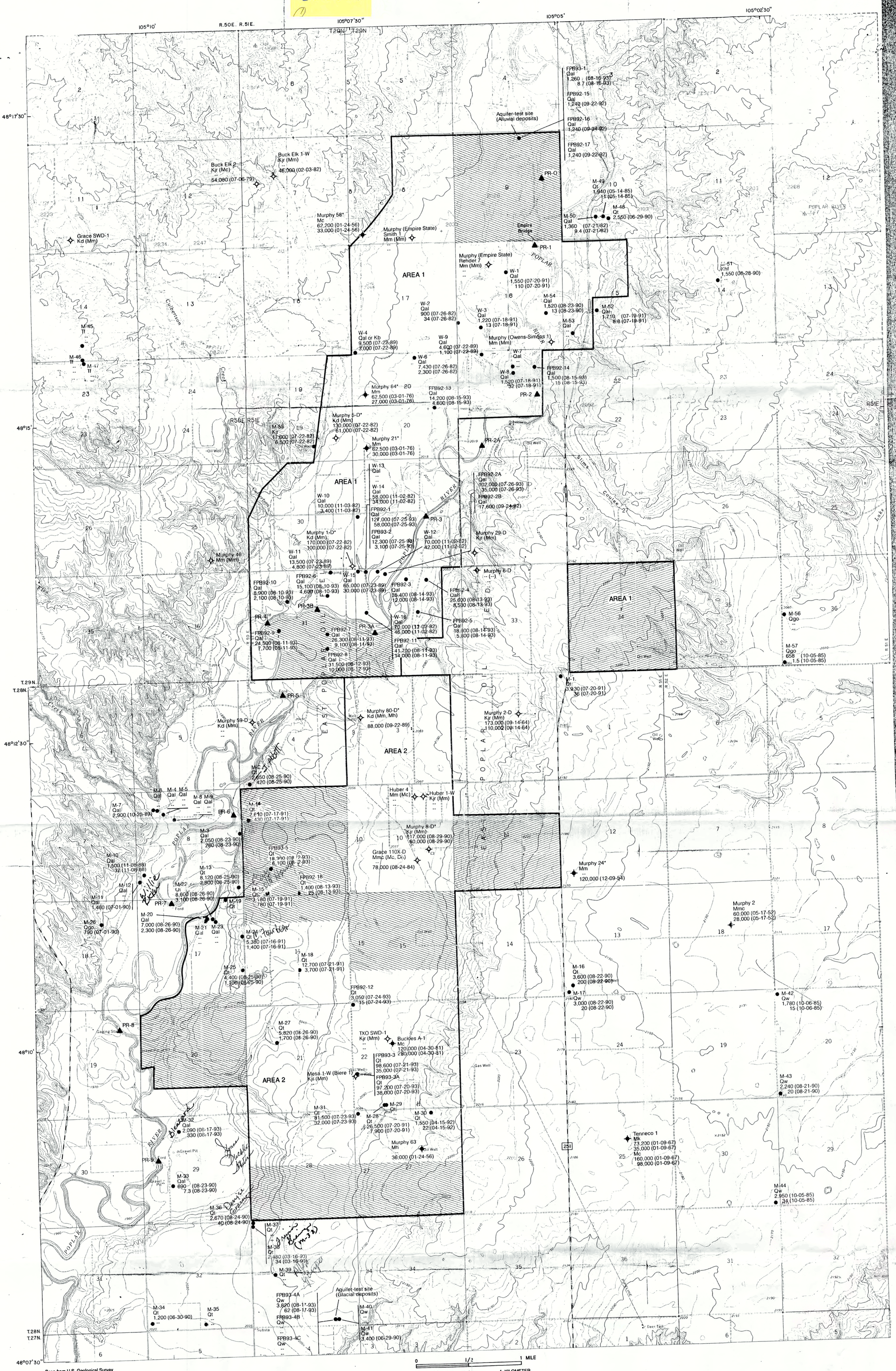
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

107-6
Bakeik Dora

Prepared in cooperation with the
FORT PECK TRIBES

OPEN-FILE REPORT 95-749
PLATE 1

Thamke, J.N., and others, 1996, Hydrologic data for the East Poplar oil field, Fort Peck Indian Reservation, northeastern Montana: U.S. Geological Survey Open-File Report 95-749, 1 sheet.



Base from U.S. Geological Survey Badger Creek, 1972; Geddart Lake, 1983; Long Creek East, 1983; and Poplar NE, 1972 quadrangles, 1:24,000

0 1/2 1 MILE
0 1/2 1 KILOMETER

CONTOUR INTERVALS 10 AND 20 FEET
SUPPLEMENTAL CONTOURS 5 AND 10 FEET

EXPLANATION

BOUNDARY OF ELECTROMAGNETIC GEOPHYSICAL SURVEY--Area 1 includes alluvial deposits along Poplar River. Area 2 includes glacial deposits

PR-9 ▲ STREAMFLOW-MEASUREMENT SITE AND NUMBER--Data for these sites are reported in tables 10, 11, and 12

WELL SITES--First line is the well name (described in text). Second line is the geologic unit in which the well is completed (for brine-injection wells, the unit in parentheses is the source of the brine). Third line is the specific conductance (in microsiemens per centimeter at 25 degrees Celsius) of water from the well and the date of measurement (for brine-injection wells, this is the specific conductance of the injected water). Fourth line is the chloride concentration (in milligrams per liter) of water from the well and the date of the sample (for brine-injection wells, this is the chloride concentration of the injected water). Symbol -- indicates no data

FPB93-3
Qt
98,600 (07-21-93) ●
35,000 (07-21-93)
U.S. Geological Survey monitoring well (installed during this investigation)

Murphy 58*
Mc
62,200 (01-24-56) ✦
33,000 (01-24-56)
Oil well (asterisk indicates a well that was active as of 1994)

Murphy 1-D*
Kd (Mm)
170,000 (07-22-82) ✪
100,000 (07-22-82)
Brine-injection well (asterisk indicates a well that was active as of 1994)

M-18
Qt
12,700 (07-21-91) ●
3,700 (07-21-91)
Existing privately owned well or Montana Bureau of Mines and Geology observation well

W-16
Qal
70,000 (11-02-82) ●
46,000 (11-02-82)
U.S. Geological Survey monitoring well (from Levings, 1984)

AREAS OF ELECTROMAGNETIC GEOPHYSICAL DATA COLLECTION

Indicates area in which 0.1-mile site spacing was used

Indicates area in which 0.2-mile site spacing was used

Indicates area in which measurements radiate from a selected oil well

ABBREVIATIONS FOR GEOLOGIC UNITS ARE AS FOLLOWS--

Qal - Alluvium (Quaternary)
Qt - Glacial till (Pleistocene)
Qgo - Glacial outwash (Pleistocene)
Qw - Wiota Gravel (Pleistocene)
Tf - Flaxville Formation (Pliocene and Miocene)
Khf - Hell Creek Formation and Fox Hills Sandstone (Upper Cretaceous)
Kb - Bearpaw Shale (Upper Cretaceous)
Kjr - Judith River Formation (Upper Cretaceous)
Kd - Dakota Sandstone (Lower Cretaceous)
Mh - Heath Formation (Upper Mississippian)
Mk - Kibbey Formation (Upper Mississippian)
Mm - Madison Group (Mississippian)
Mc - Charles Formation of Madison Group
Mmc - Mission Canyon Limestone of Madison Group
Dn - Nisku Formation (Upper Devonian)

MAP SHOWING LOCATION OF PRIVATELY OWNED WELLS, MONITORING WELLS, BRINE-INJECTION WELLS, SAMPLED OIL WELLS, SURFACE-WATER DATA-COLLECTION SITES, AND AREAS OF ELECTROMAGNETIC GEOPHYSICAL DATA COLLECTION FOR THE EAST POPLAR OIL FIELD, FORT PECK INDIAN RESERVATION, NORTHEASTERN MONTANA

By

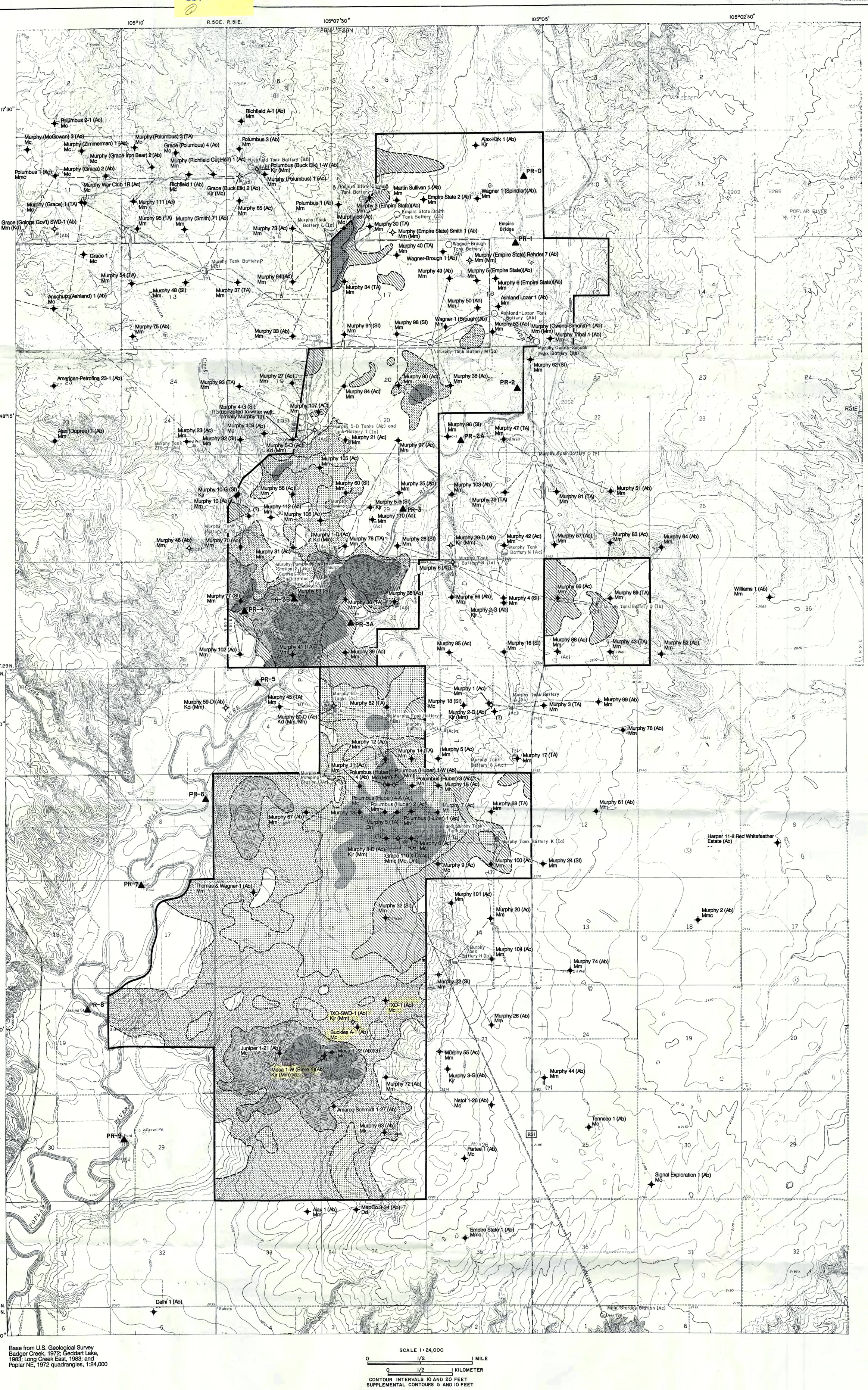
Joanna N. Thamke, Steven D. Craigg, and Thomas M. Mendes

1996

EXHIBIT 1

DRAWING

7/07-20
Behind Ltr 1
0



Base from U.S. Geological Survey Badger Creek, 1972; Geddart Lake, 1983; Long Creek East, 1983; and Poplar NE, 1972 quadrangles, 1:24,000

SCALE 1:24,000

0 1/2 1 MILE

0 1/2 1 KILOMETER

CONTOUR INTERVALS 10 AND 20 FEET
SUPPLEMENTAL CONTOURS 5 AND 10 FEET

TYPE 1 WATER (UNCONTAMINATED)--Based on water wells completed in Quaternary deposits that produce Type 1 water or subarea of low electromagnetic apparent conductivity

POSSIBLE TYPE 2 SALINE-WATER PLUME (MODERATELY CONTAMINATED)--Based on subarea of moderate electromagnetic apparent conductivity that does not contain water wells

POSSIBLE TYPE 3 SALINE-WATER PLUME (CONSIDERABLY CONTAMINATED)--Based on subarea of high electromagnetic apparent conductivity that does not contain water wells

CONFIRMED TYPE 2 SALINE-WATER PLUME (MODERATELY CONTAMINATED)--Based on subarea of moderate electromagnetic apparent conductivity that contains well(s) that produce Type 2 water

CONFIRMED TYPE 3 SALINE-WATER PLUME (CONSIDERABLY CONTAMINATED)--Based on subarea of high electromagnetic apparent conductivity that contains well(s) that produce Type 3 water

AREA OF SIGNIFICANTLY HIGH ELECTROMAGNETIC APPARENT CONDUCTIVITY--Probable specific sources of saline water may be located in or upgradient of these areas. These areas are delineated when electromagnetic apparent conductivities are ≥ 20 millimhos per meter than electromagnetic apparent conductivities used to delineate subarea 3 in figure 16.

EXPLANATION

APPROXIMATE BOUNDARY OF SALINE-WATER PLUME AND BOUNDARY OF AREA OF SIGNIFICANTLY HIGH ELECTROMAGNETIC APPARENT CONDUCTIVITY

PIPELINE FOR TRANSPORTING OIL-FIELD FLUIDS--Queried where location uncertain

BOUNDARY OF ELECTROMAGNETIC GEOPHYSICAL SURVEY

PR-6 SURFACE-WATER DATA-COLLECTION SITE

WELL SITES--First line is the well name and site status (see abbreviations, below). Parentheses in well name designate lessee, owner, or previous operator. Second line is the geologic unit in which the well is completed (for brine-injection wells, the unit in parentheses is the source of the brine). Symbols: -- indicates no data; (?) indicates well name or status not known

Murphy 1-D (Ac) Kd (Mm) Brine-injection well

Murphy 21 (Ac) Mm Oil well

Ashland-Lozar Tank Battery (Ab) STORAGE-TANK FACILITY--Identified by site name if known. (?) indicates status not known

(Ab) BRINE-EVAPORATION PIT OR PIT FOR STORAGE OF OIL OR OTHER FLUIDS--Pits associated with brine-injection wells are evaporation pits. Pits associated with individual oil wells may be for temporary storage of produced crude oil and any associated brine, or fluids associated with any redrilling or general well maintenance. (?) indicates status not known

ABBREVIATIONS FOR SITE STATUS

Ac	Ac	Active
Ab	Ab	Abandoned
	Ia	Inactive
	SI	Shut In
	TA	Temporarily abandoned
	G	Denotes a gas well

ABBREVIATIONS FOR GEOLOGIC UNITS

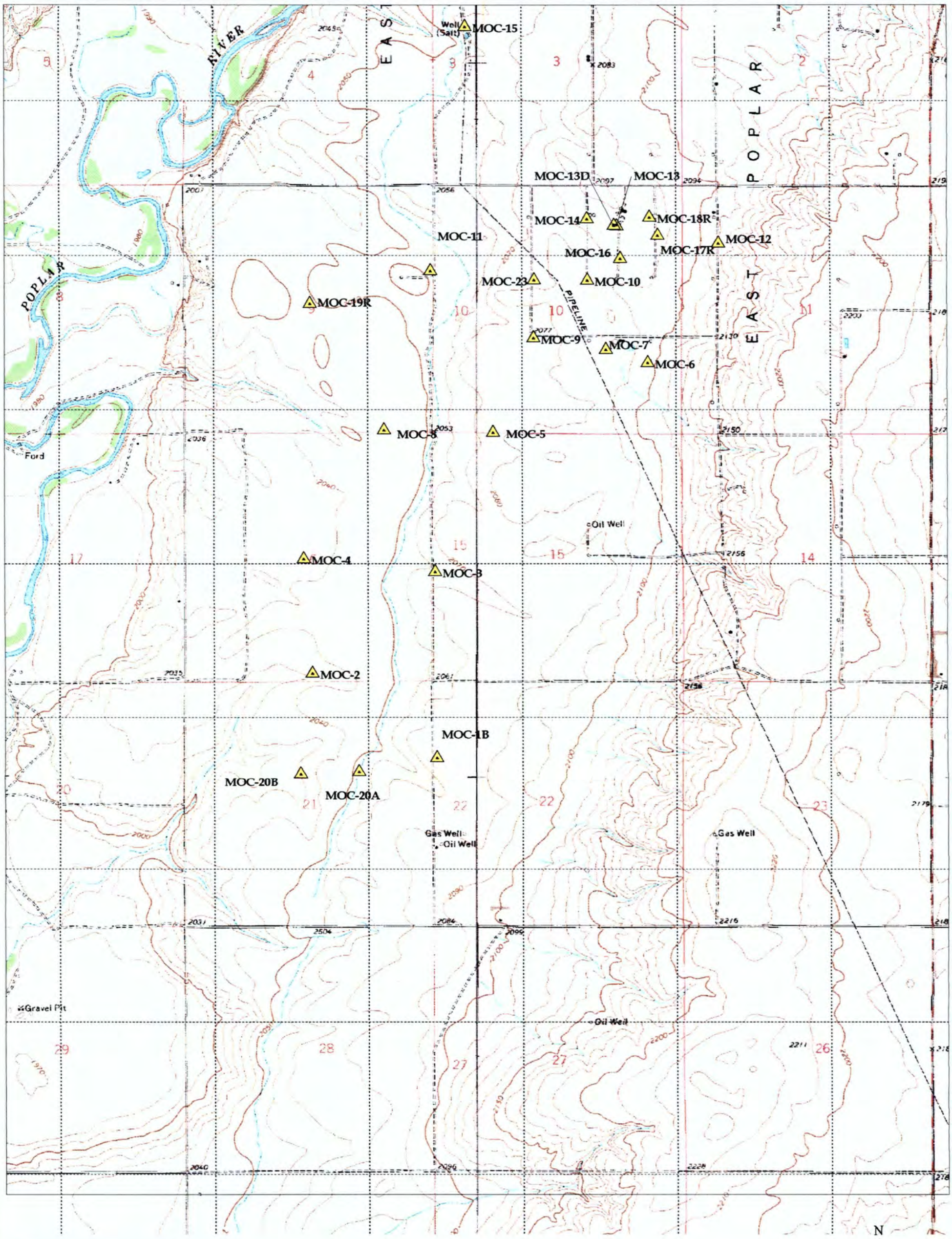
Kjr	Judith River Formation (Upper Cretaceous)
Kd	Dakota Sandstone (Lower Cretaceous)
Mh	Heath Formation (Upper Mississippian)
Mm	Madison Group (Mississippian)
Mc	Charles Formation of Madison Group
Mmc	Mission Canyon Limestone of Madison Group
Dn	Nisku Formation (Upper Devonian)
Dd	Duperow Formation (Upper Devonian)

MAP SHOWING LOCATION OF POSSIBLE AND CONFIRMED SALINE-WATER PLUMES, SURFACE-WATER DATA-COLLECTION SITES, KNOWN BRINE-INJECTION WELLS, OIL WELLS, PIPELINES, STORAGE-TANK FACILITIES, AND BRINE-EVAPORATION OR STORAGE PITS IN THE EAST POPLAR OIL FIELD STUDY AREA, NORTHEASTERN MONTANA

By

Joanna N. Thamke and Steven D. Craigg

1997



MOC Wells

MOC Wells

Murphy Oil Corporation Monitoring Wells
17 January 2002

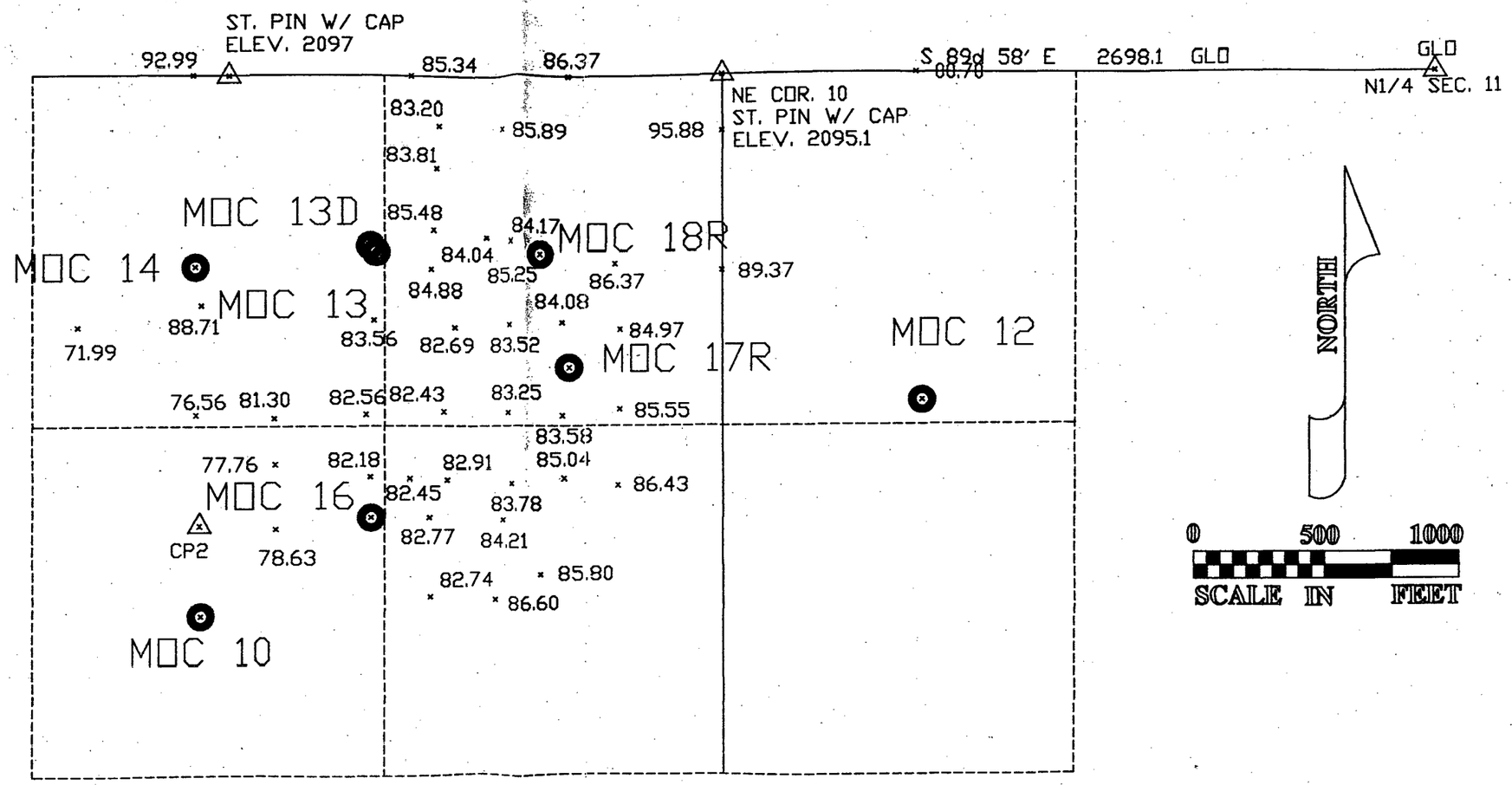
N
W E
S

1:24000

DS
7-110

Hydro Solutions Inc

MURPHY OIL COMPANY
NE1/4 SEC. 10, T28N, R51E,PMM
ROOSEVELT COUNT, MONTANA

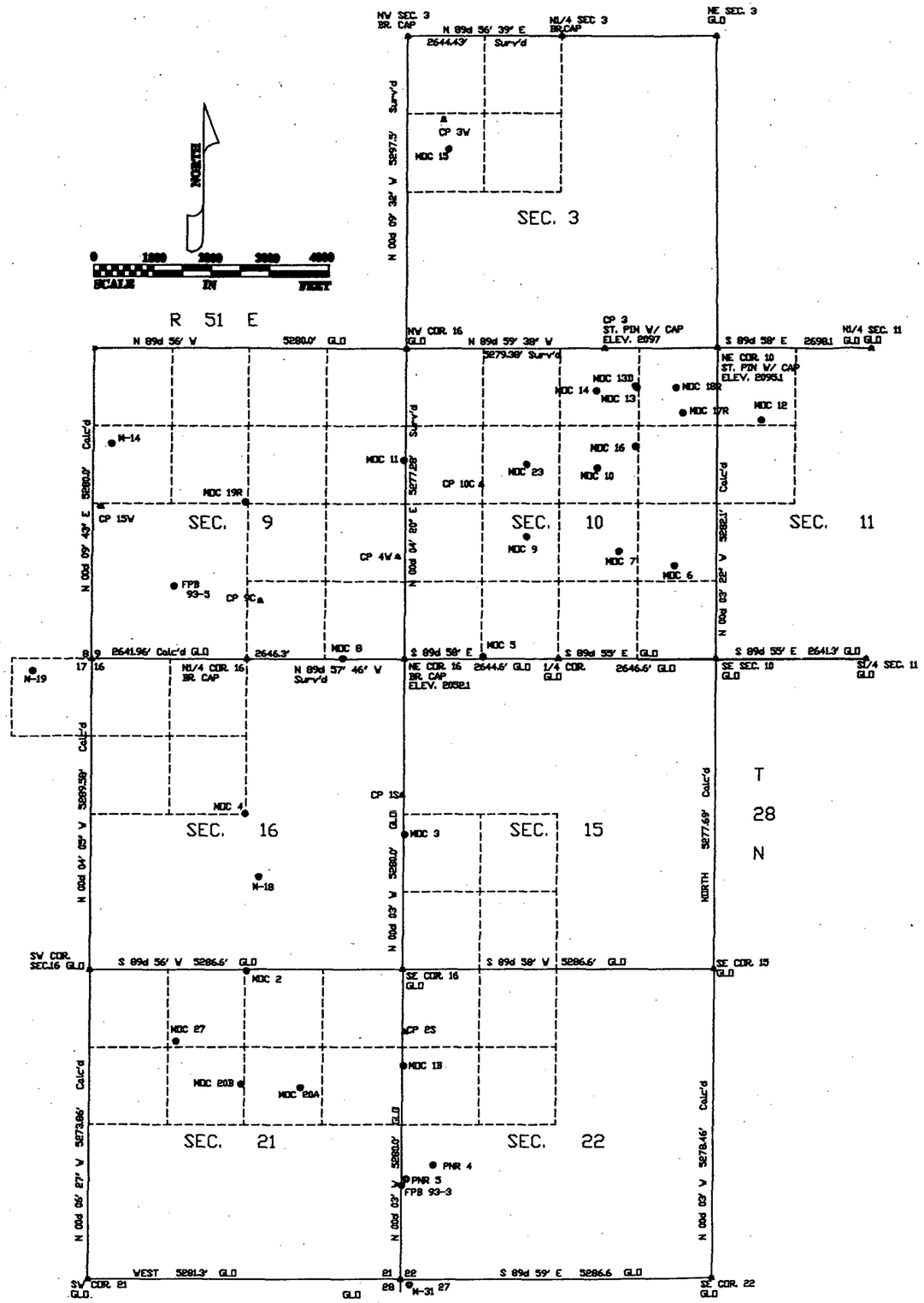


MURPHY OIL COMPANY
TOPOGRAPHIC SURVEY
NE 1/4 SEC. 10, T28N, R51E, PMM
ROOSEVELT COUNTY, MONTANA

ACAD/MOC 01-04-02	R.A. BRUNER, ES P.O. BOX 337 WOLF POINT, MT 59201

Received

MURPHY OIL COMPANY
WATER WELL LOCATIONS



WELL STATISTICS

WELL NO.	NORTHING COORDINATE	EASTING COORDINATE	ELEV. T.O.C.	ELEV. @ CONC.	ELEV. @ GRND	SEC.	DIST. F.N.L.	DIST. F.S.L.	DIST. F.E.L.	DIST. F.W.L.	DIA/TYPE CASING	M.D. TO CONC.
MOC 13	3088.4794	10027.3440	2078.67	2075.73	2075.40	22	1634.8			87.3	8" ST.	2.94
MOC 2	4702.0201	7373.0883	2038.68	2034.87	2034.54	21	18.2		2623.5		6" ST.	3.81
MOC 3	7020.6875	10021.3950	2065.07	2061.65	2061.32	15		2297.4		24.8	6" ST.	3.38
MOC 4	7373.8046	7341.6120	2042.94	2039.86	2039.53	16	2631.2			2632.8	6" ST.	3.08
MOC 5	10043.3950	11341.5661	2077.75	2075.44	2075.11	10		40.9		1347.5	6" ST.	2.31
MOC 6	11586.3747	14570.6871	2096.96	2094.23	2093.90	10		1587.4	712.9		6" ST.	2.73
MOC 7	11826.1957	13644.9226	2088.4	2085.13	2084.80	10		1825.9	1638.5		6" ST.	3.27
MOC 8	10014.5779	8971.8310	2047.68	2045.03	2044.70	9		10.6	1022.1		8" ST.	2.65
MOC 9	12077.9532	12090.2427	2077.92		2079.42	10		2073.9		2093.7	6" ST.	2.12
MOC 10	13244.0709	13275.8861	2085.11	2082.28	2081.95	10	2034.4		2006.1		6" ST.	2.83
MOC 11	13380.9355	9970.4375	2051.05	2049.03	2048.70	9	1899.7		27.8		8" ST.	2.02
MOC 12	14049.9497	16035.1757	2109.01		2107.36	11	1229.6			754.0		1.65
MOC 13	14614.4009	12929.1735	2090.76	2088.22	2087.89	10	664.6		1351.5		6" ST.	2.54
MOC 13D	14640.4823	13903.4130	2089.55	2088.51	2088.18	10	638.5		1375.2		6" ST.	1.04
MOC 14	14361.4218	13236.3352	2088.61	2086.76	2086.43	10	717.1		2024.4		6" ST.	1.85
MOC 15	18631.4550	10703.3358	2061.58		2059.68	3	1927.3			712.3		1.9
MOC 16	13614.7009	13909.7701	2084.13	2081.46	2081.21	10	1664.3		1371.9		6" ST.	2.67
MOC 17R	14180.8132	14694.0405	2086.87	2084.58	2084.35	10	1098.7		587.0		6" ST.	2.19
MOC 18R	14607.4563	14583.3203	2087.39	2085.47	2085.43	10	672.0		697.3		6" ST.	1.92
MOC 19R	12674.9390	7314.6294	2049.20	2046.74	2046.41	9	2608.7		2682.7		6" ST.	2.79
MOC 20A	2712.3424	8310.7589	2050.87	2049.12	2048.79	21	2009.0		1689.6		6" ST.	1.75
MOC 20B	2774.2295	7302.6097	2031.91	2029.33	2029.00	21	1943.9		2697.7	2587.0	6" ST.	2.58
MOC 23	13303.4269	12085.8964	2075.50	2073.20	2072.87	10	1974.2			2087.8	6" ST.	2.25
OTHER WELLS												
N-18	6294.7099	7584.4606	2045.01		2044.01	16		1574.2	2412.7			1.0
FPB 93-3	11248.0970	6089.8515	2028.29		2026.54	9		1242.3		1380.6	6" ST.	1.75
N-14	13668.0879	3019.2983	2044.4		2043.4	9	1618.3			303.2	6" ST.	1.0
N-19	9799.2007	3730.6343	1994.47		1993.32	17	206.4		975.3		6" ST.	1.15
N-27	3500.6646	6174.8647	2029.23		2027.83	21	1218.2			1460.6	6" ST.	1.4
FPB 93-3	1050.8369	10009.9951	2082.19		2080.74	22		1607.6		8.2	6" ST.	1.45
PNR 5	1161.1311	10081.7862	2084.42		2081.12	22		1717.9		80.1	6" ST.	2.25
PNR 4	1391.2189	10535.9172	2083.02		2079.82	22		1948.1		534.4	6" ST.	3.2
N-31	-646.9947	10153.3610	2085.76		2084.06	27	90.2			150.2	6" ST.	1.70

CONTROL POINT DATA

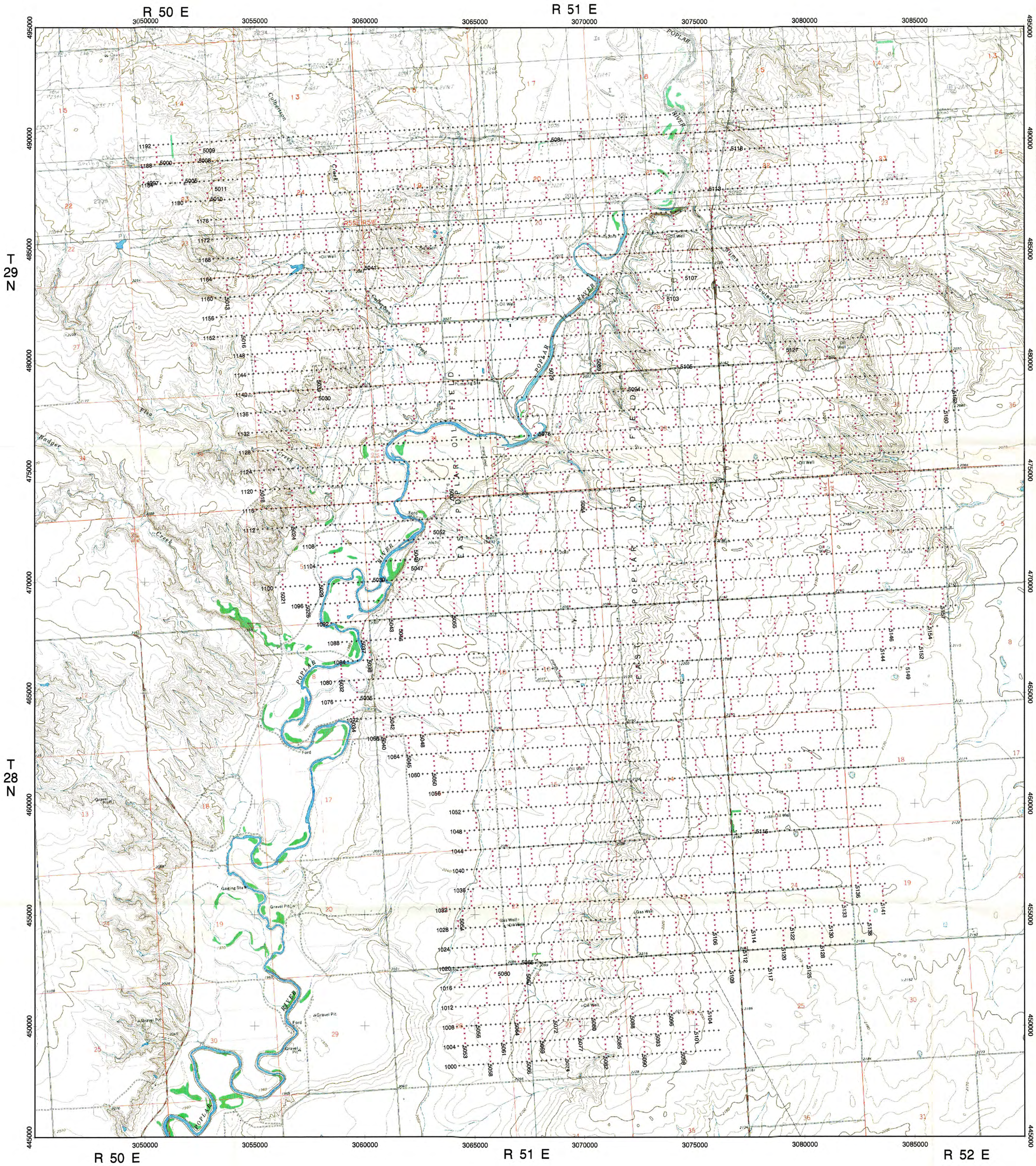
CONTROL POINT	NORTHING COORDINATE	EASTING COORDINATE	ELEV. TOP MON.	NOTE
NW COR 3	20578.0462	9985.9286	2035.27	BR. CAP
N1/4 COR 3	20580.6205	12630.3506	2063.73	BR. CAP
NE COR 10	15280.0000	15280.0000	2095.1	1/2" REBAR W/ CAP
SW COR 10 NE COR 16	10003.2847	9993.9646	2052.1	BR. CAP
N1/4 COR 16	10004.9985	7352.0006	2042.58	BR. CAP
CP 3V	15145.3632	10611.9300	2053.52	1X2 STAKE
CP 3	15278.5845	13384.1029	2097.0	1/2" REBAR W/ CAP
CP 10C	12961.7371	11292.4858	2076.13	1X2 STAKE
CP 4V	11740.6228	9879.9073	2057.05	1X2 STAKE
CP 9C	10992.3996	7574.8056	2050.41	1X2 STAKE
CP 1S	7682.7495	9964.8879	2071.92	1X2 STAKE
CP 2S	3658.9690	10038.2963	2076.35	1X2 STAKE

MURPHY OIL COMPANY
WATER WELL LOCATIONS
SECTIONS 3, 9, 10, 11, 15, 16, 21, 22
T28N, R51E, P.M.M.
ROOSEVELT COUNTY, MONTANA

ACAD/MOC
DATE: 12-27-01

R.A. BRUNER, ES
P.O. BOX 337
WOLF POINT, MT 59201

Received 1/5/02



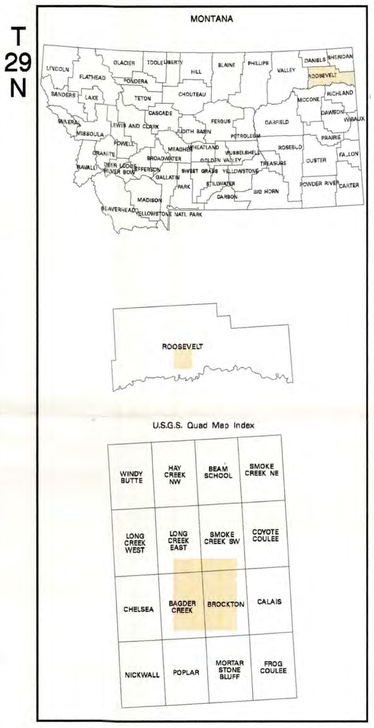
Western Geophysical WESTERN ATLAS

Murphy Exploration & Production Co.
East Poplar Unit 3D Survey
Post Plot Map

Roosevelt County, Montana

kww	Crew: 732	Date: January 06, 1996
Scale: 1:24000	Projection: Montana North Zone	
Contour Interval 10 Feet and 20 Feet		

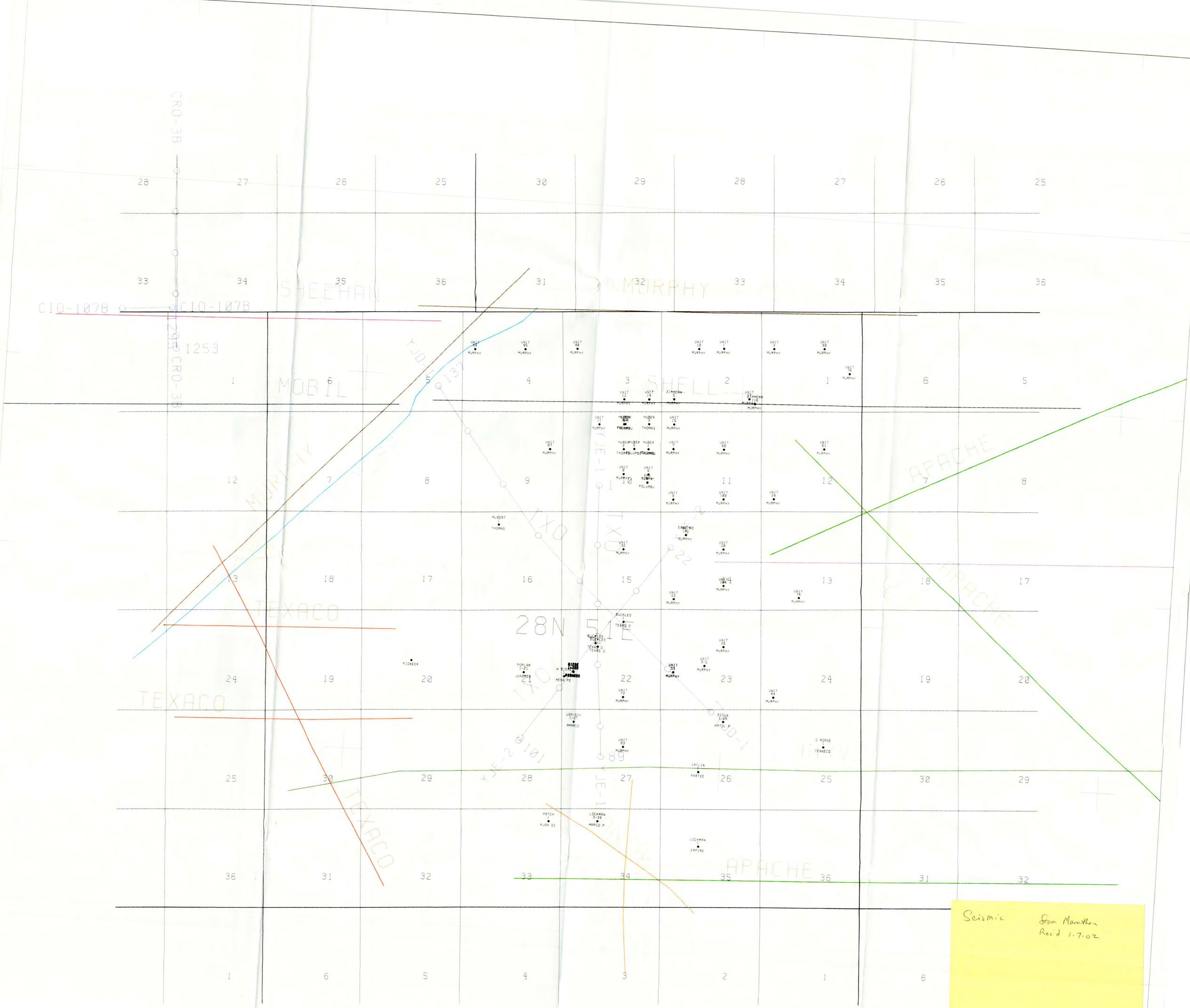
Copyright 1995
Premier Data Services
501 South Cherry Street, Suite 690
Denver, CO 80222
Phone: (303) 377-0033
Toll Free: (800) 210-9100



Seismic

Seismic from Murphy
Rec'd 1-15-02

7 112


CRO-3B
CIO-107B
CIO-107B
1253
CRO-3B
SHEEHAN
MURPHY
MOBIL
SHELL
APACHE
TEXACO
TEXACO
TEXACO
APACHE
28N 51E
YJE-1
YJE-2
YJE-1
YJE-2
YJE-1
YJE-1
YJE-1

1980-84 ①

7T Peck - Contaminator

Re attach to LTR
morbell X LT Side
Matalin on BK Side -

SCHLUMBERGER WELL SURVEYING CORPORATION
HOUSTON, TEXAS

SCHLUMBERGER

Temperature Log

COUNTY ROOSEVELT
FIELD or LOCATION POPLAR
WELL UNIT #61
COMPANY MURPHY CORPORATION

COMPANY MURPHY CORPORATION
WELL UNIT #61
FIELD POPLAR
LOCATION 12-28N-51E
COUNTY ROOSEVELT
STATE MONTANA

Location of Well

TEMP.

Elevation: D.F.: ____
K.B.: ____
or G.L.: ____

FILING No. ____

Date 7-25-55 Time Started 2230 Time Finished 2300
First Reading 1033
Last Reading 0
Footage Measured 1033
Max. Depth Reached 1034
Bottom Driller 1057
Hole Size 15"
Casing Size 10 3/4"
Depth Datum 1' ABOVE RT
Mud Data Nature ZERO Resistivity ____ @ ____ F
Fluid Level 116
Max. Temp. ____
Cementation Data Date 7-25 Time Started ____ Time Finished 1145
Circulation Data Date ____ Time Started ____ Time Finished ____
A. Cement Top Determination
1) Date Pressure Released 7/25/55 Time Released 1200
2) Amount Cement 700 REGULAR
3) Calculated Top --
4) Depth of Plug 1057
B. Location of Oil and Gas
1) Casing Shoe Driller ____
2) Date Drilling Stopped ____ Time Stopped ____
Truck No. 271B-MLSTN
Recorded By VALENTINE
Witnessed By DOMDEN

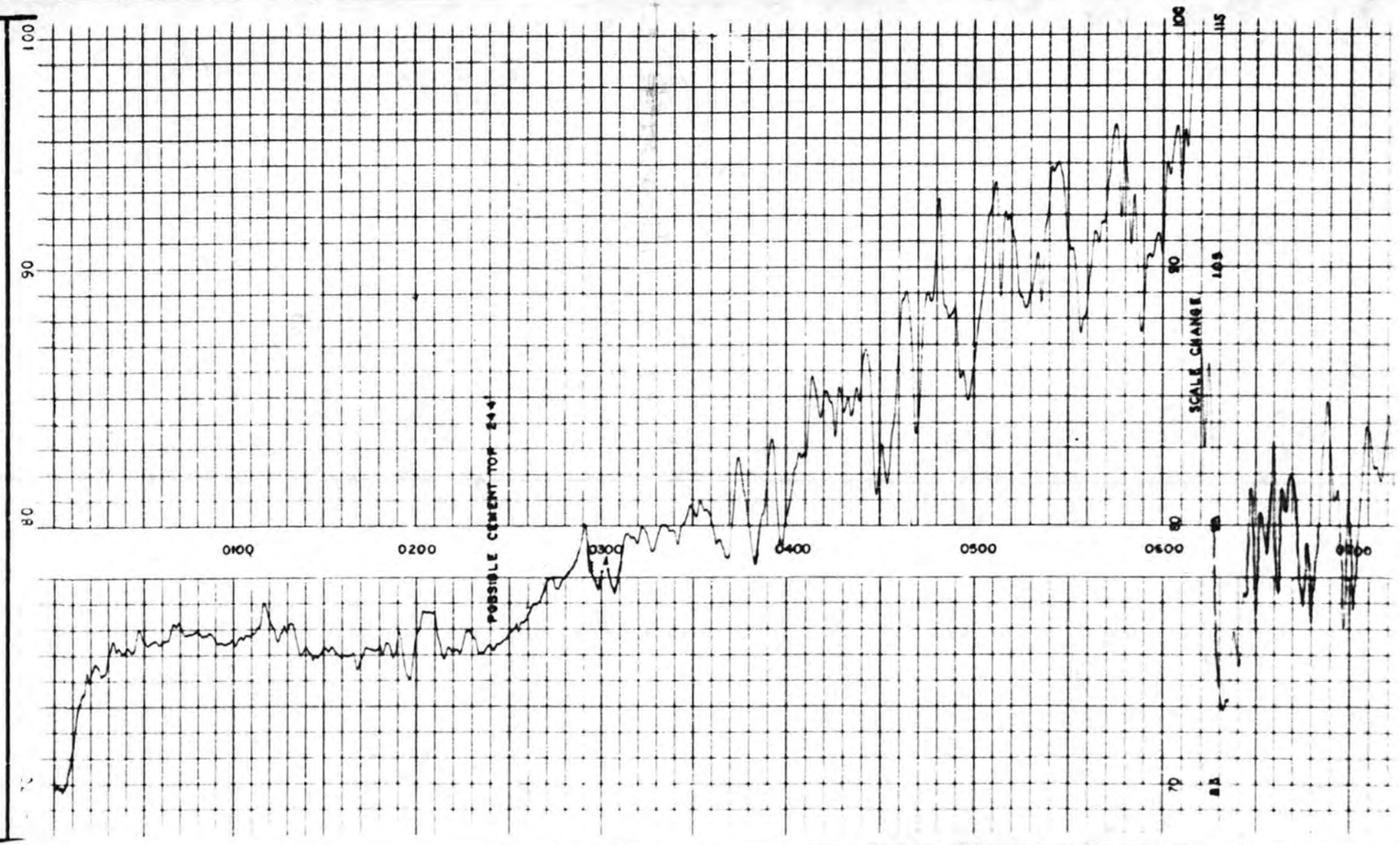
RECEIVED
JUL 27 1955
OIL AND GAS CONSERVATION COMMISSION OF THE STATE OF MONTANA

FOLD HERE

REMARKS

DEPTHS

L.R. 0 TEMPERATURE °F.



©Copy

PRAIRIE

Cement Bond Log

PRODUCTION DEPT.

#1

County

State

(SE NW)

LOCATION

PERMANENT DATUM

LOG MEASURED FROM

DRILLING MEASURED FROM

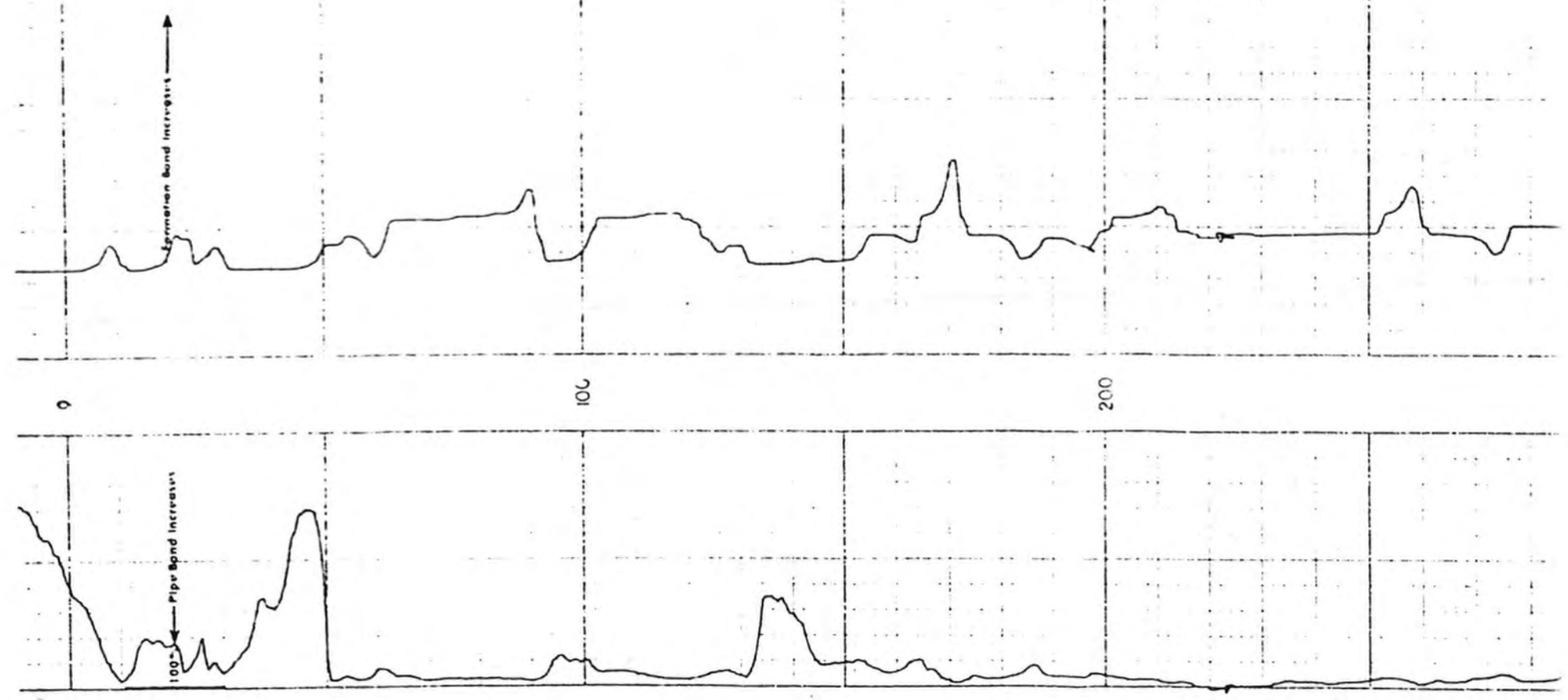
API # 085-21336

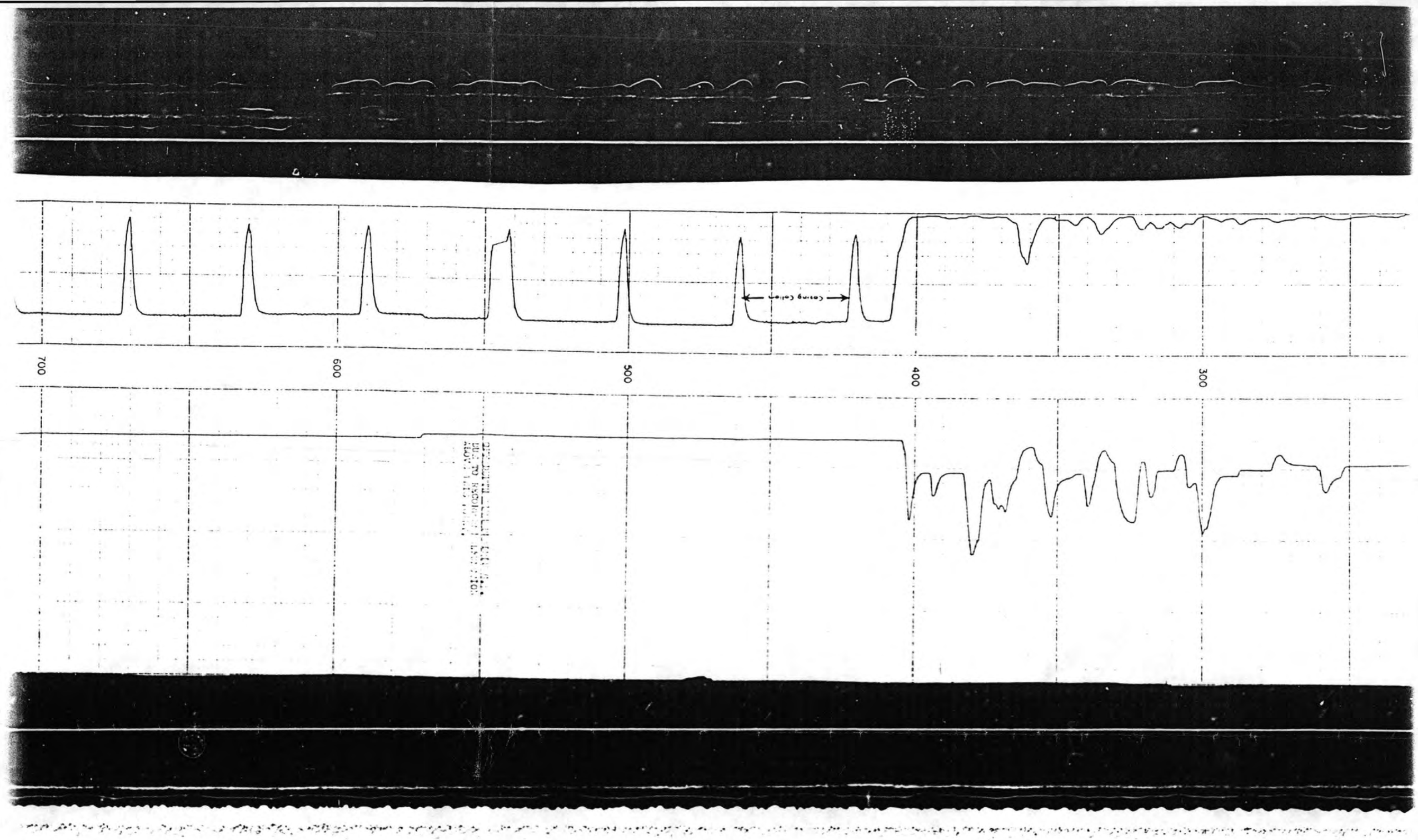
7 17

COLLAR LOCATION

OTHER SERVICES

Cement Bond




700
600
500
400
300

~~Apfl~~
1980 - 84
7-T Pet
Contamination

Replace in file
after LTR.
marked — RT Side
" Sundry Notices +
Report of Wells.

Casing Collars
FIRST READING
TOTAL DEPTH
907
910
900
800
700
600
500

SCHLUMBERGER WELL SURVEYING CORPORATION

HOUSTON, TEXAS

SCHLUMBERGER

Temperature Log

COUNTY ROOSEVELT
FIELD or LOCATION EAST POPLAR SEC.27-28N-51E
WELL E.P.U. #63
COMPANY MURPHY CORPORATION

COMPANY MURPHY CORPORATION
WELL E.P.U. #63
FIELD EAST POPLAR
LOCATION SEC.27-28N-51E C SW NE
COUNTY ROOSEVELT
STATE MONTANA

Location of Well

1955

TEMP (GR-N)

Elevation: D.F.:
K.B.: 2162
or G.L.: 2150

FILING No.

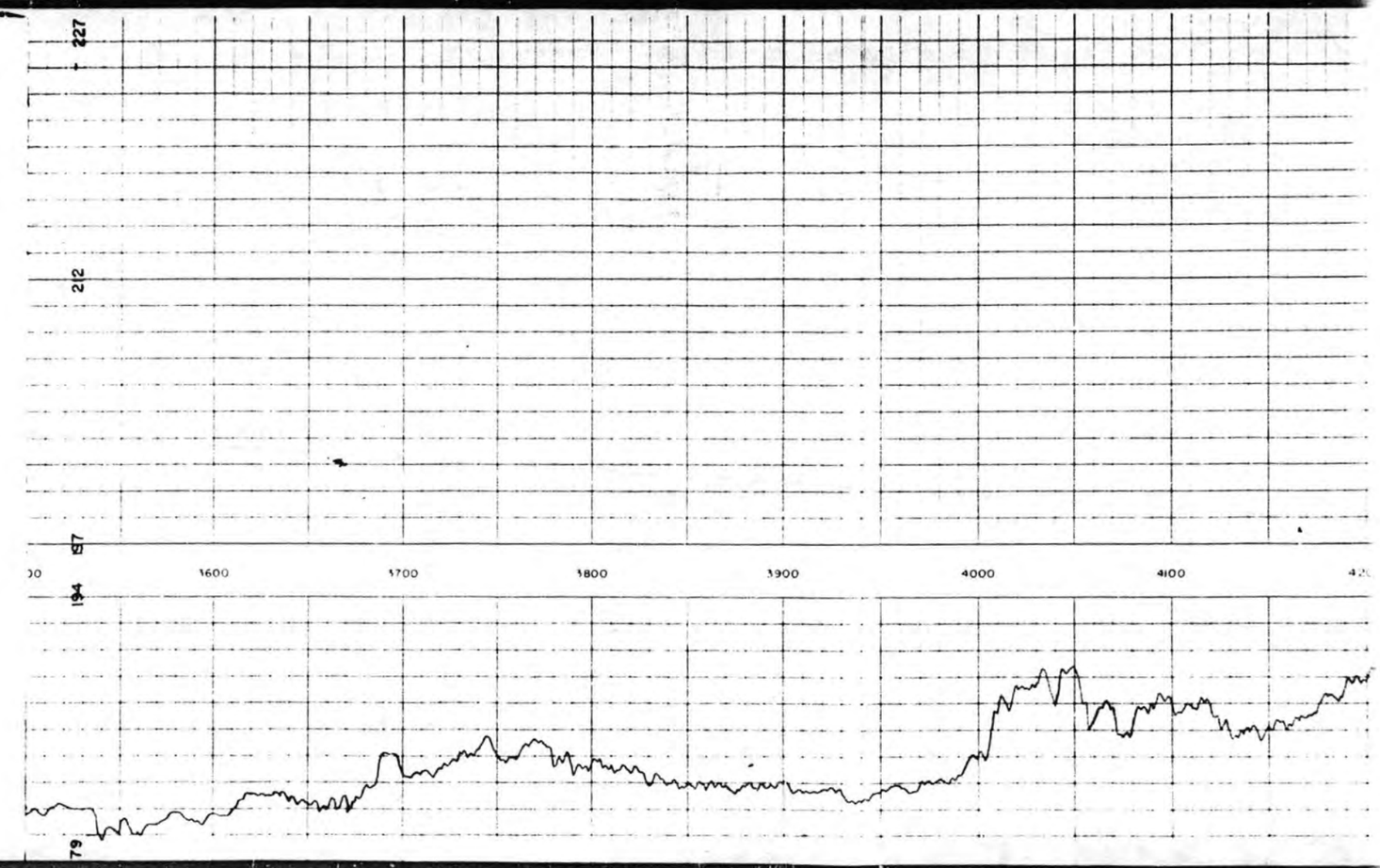
Date 12/9/55 Time Started 1400 Time Finished 1600
First Reading 3500
Last Reading 5913
Footage Measured 2413
Max. Depth Reached 5913
Bottom Driller 5913
Hole Size 8 3/4"
Casing Size 5½"
Depth Datum KB 12' ABOVE GL
Mud Data Nature * Resistivity @ F
Fluid Level SURFACE
Max. Temp. 242
Cementation Data Date Time Started Time Finished 2200
Circulation Data Date Time Started Time Finished
A-Cement Top Determination
1) Date Pressure Released IMMEDIATELY Time Released
2) Amount Cement 350 SACKS-SLOW SET
3) Calculated Top
4) Depth of Plug 5913
B-Location of Oil and Gas
1) Casing Shoe Driller
2) Date Drilling Stopped Time Stopped
Truck No. 1706-WLSTN
Recorded By RIETHMILLER
Witnessed By HELTON

FOLD HERE

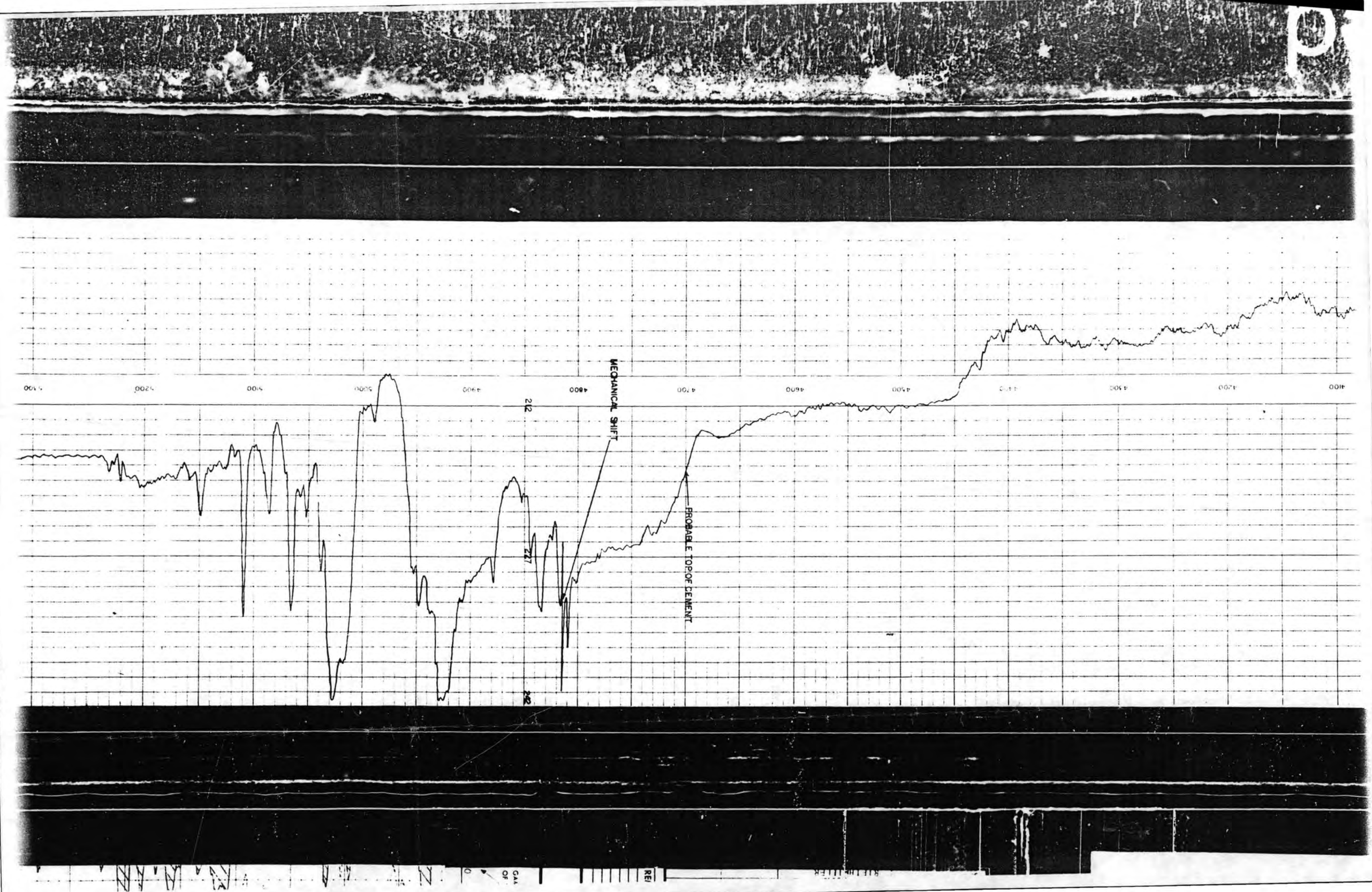
REMARKS * MUD TO SURFACE

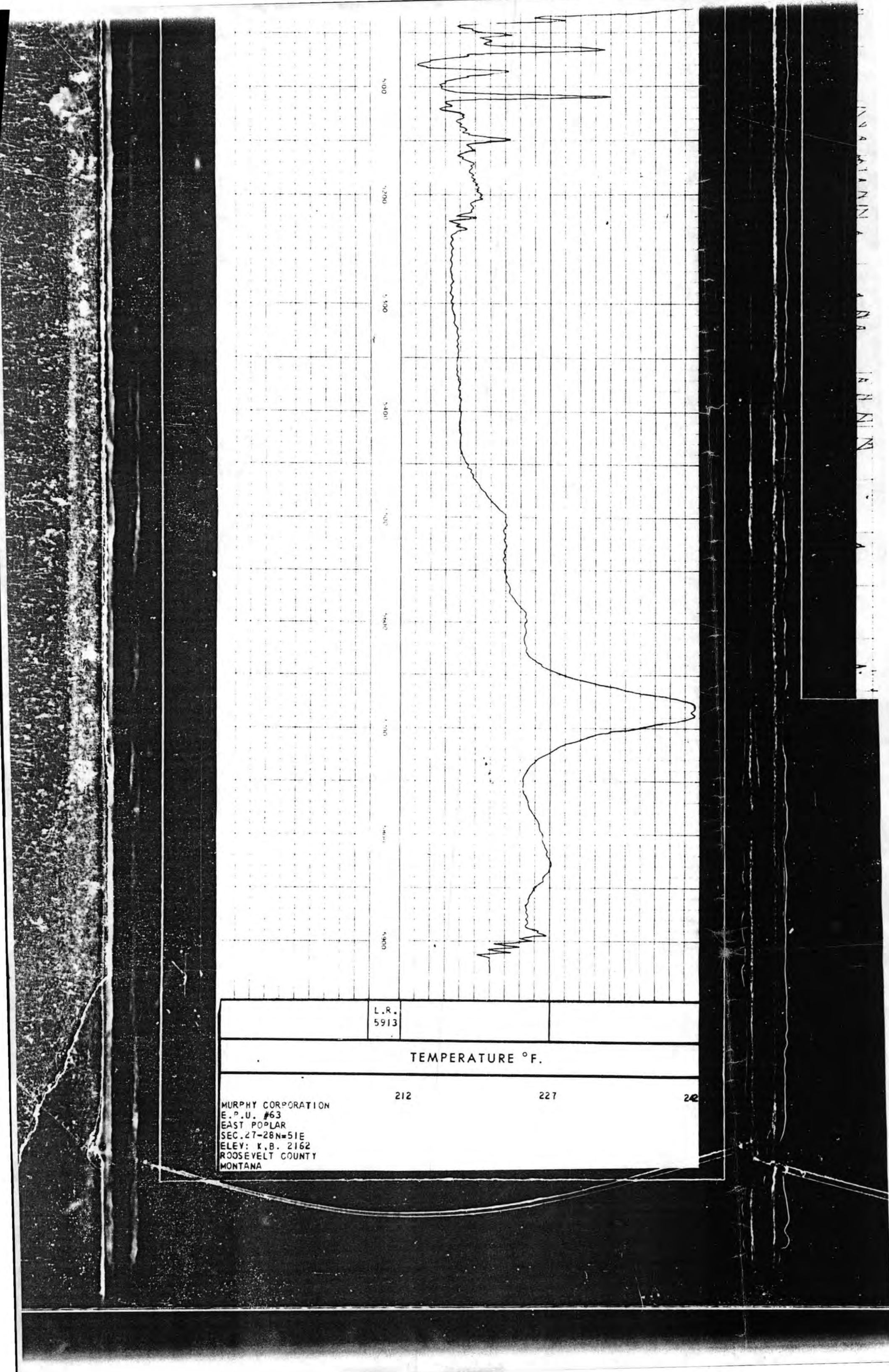
DEPTHS

F.R. TEMPERATURE °F.
3500



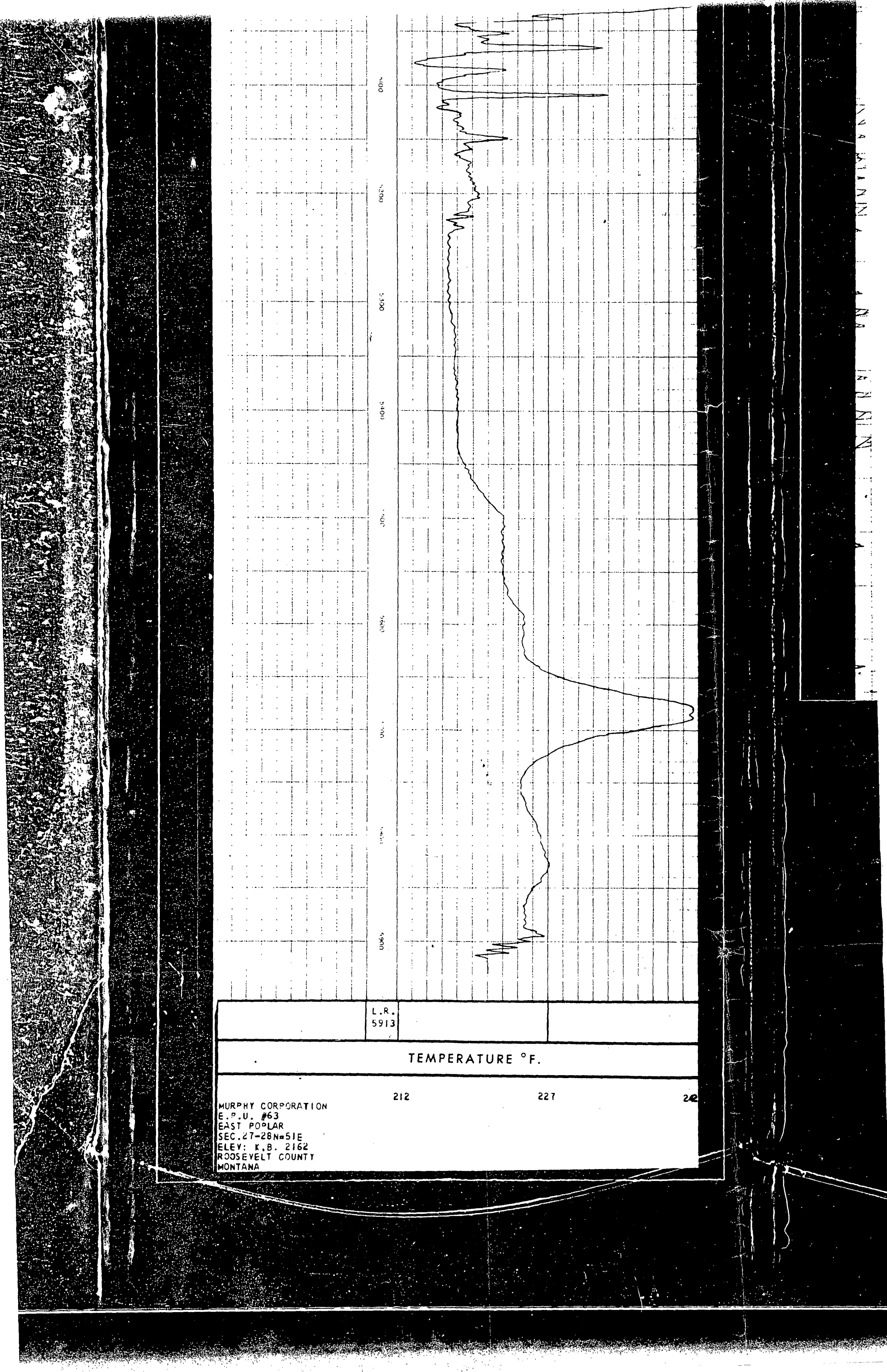
3 - Reproduction Prohibited

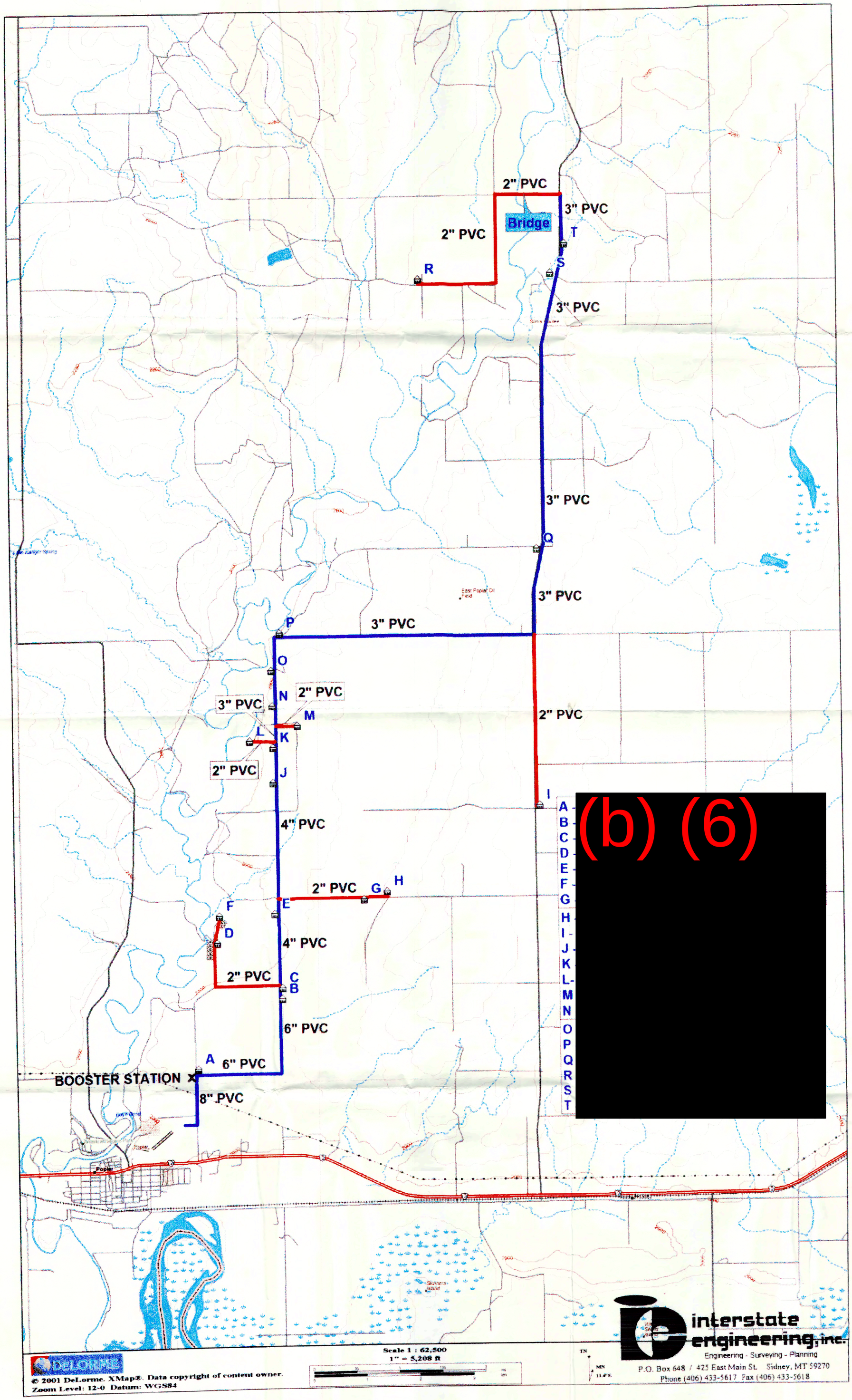

MECHANICAL SHIFT
PROBABLE TOP OF CEMENT
212
227
242


L.R.
5913
TEMPERATURE °F.
212
227
MURPHY CORPORATION
E.P.U. #63
EAST POPLAR
SEC.27-28N-51E
ELEV: K.B. 2162
ROOSEVELT COUNTY
MONTANA

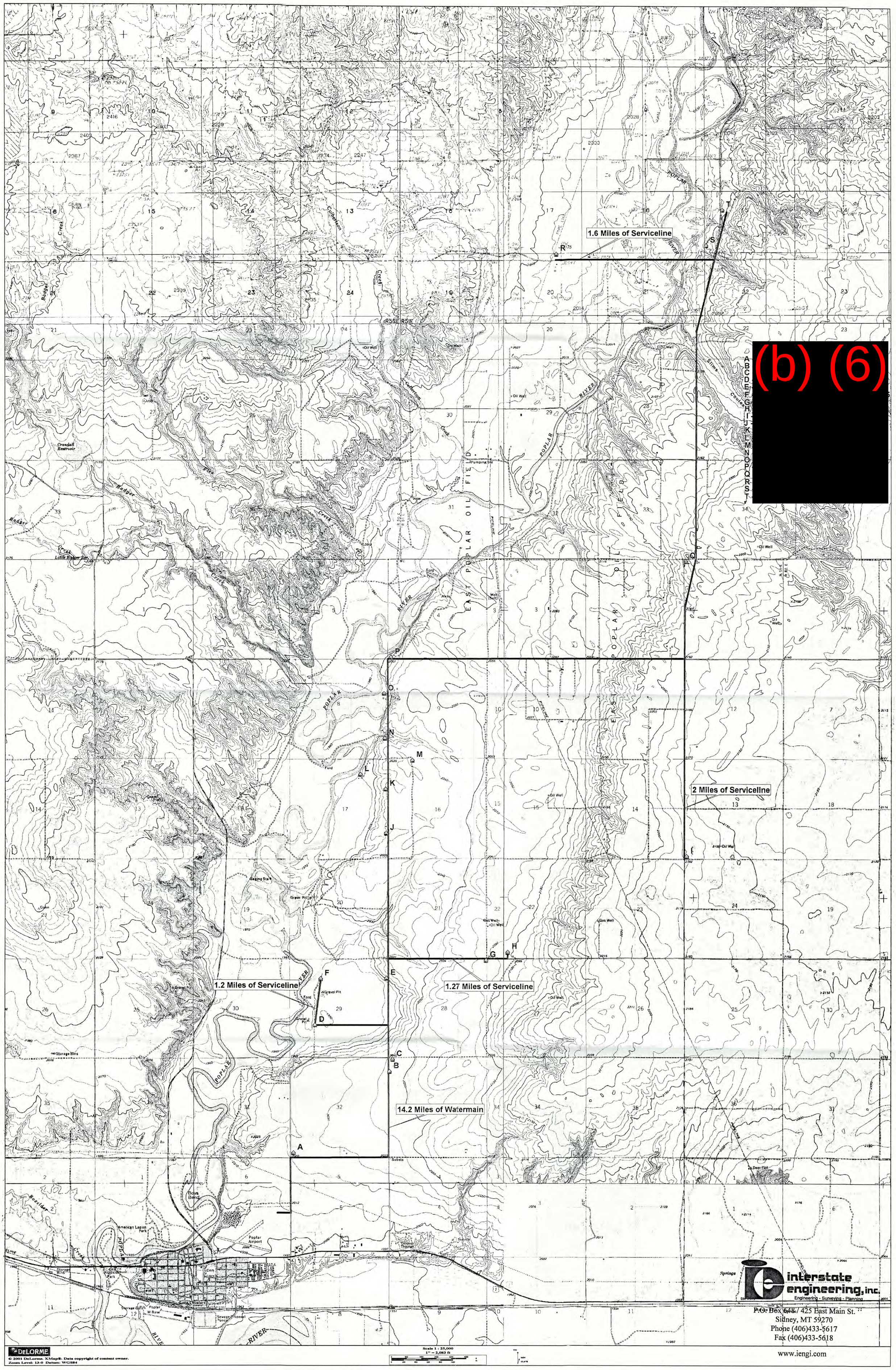
1980-84 (3)
Ft Pec Contamination

Insert on back
of last Ltr
in folder


L.R.
5913
TEMPERATURE °F.
212
227
MURPHY CORPORATION
E.P.U. #63
EAST POPLAR
SEC.27-28N-51E
ELEV: K.B. 2162
ROOSEVELT COUNTY
MONTANA



Loose Ltrs
Place after
Lt mount well
Lt Corner
US Dept of Int
Mise Box


1.6 Miles of Serviceline
2 Miles of Serviceline
1.2 Miles of Serviceline
1.27 Miles of Serviceline
14.2 Miles of Watermain
(b) (6)
EAST POPLAR OIL FIELD
POPLAR RIVER
Culbertson Creek
Badger Creek
Crandall Reservoir
Little Badger Site
Oil Well
Gas Well
Gaging Sta
Gravel Pit
Ford
Storage Bins
Boys Bend
American Legion Park
Poplar Airport
Sewage Disposal Ponds
Poplar W Base
Grain Elevator
Cem
Boreider
Springs
Deer Tail
Pumping Sta
Pipeline
interstate engineering, inc.
Engineering - Surveying - Planning
P.O. Box 648 / 425 East Main St.
Sidney, MT 59270
Phone (406)433-5617
Fax (406)433-5618
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DeLORME
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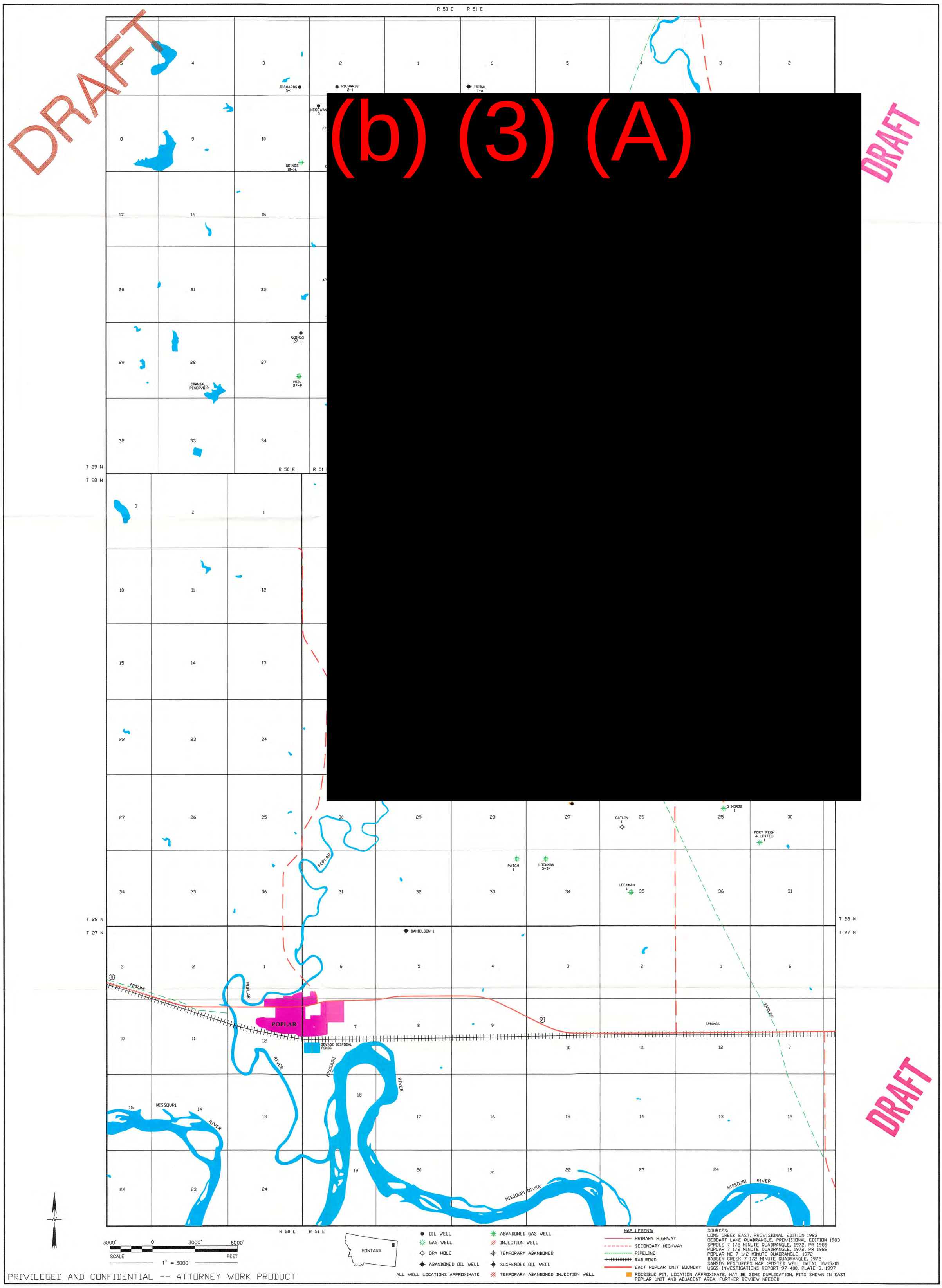
Zoom Level: 13-0 Datum: WGS84
Scale 1 : 25,000
1" = 2,083 ft

H:\2001\21222\CAD\2122201M01.DWG on Oct 02, 2002-12:21pm



(b) (3) (A)

DRAFT

DRAFT

DRAFT

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PROJECT NUMBER	2122201 M01
FIGURE NUMBER	
DESIGNED BY	BS
APPROVED BY	BS
DRAWN BY	LDJ
DATE	07/16/2002
SCALE	AS SHOWN

FIGURE TITLE: ***MAP SHOWING OIL/GAS/DISPOSAL WELLS IN THE EAST POPLAR UNIT.***

DOCUMENT TITLE:

CLIENT: SAMSON RESOURCES

LOCATION: EAST POPLAR UNIT
ROOSEVELT COUNTY, MONTANA

Atkins Benham
ENVIRONMENTAL DIVISION
3700 W. Robinson, Suite 200
Norman, Oklahoma 73072
(405) 321-3895
2488 E. 81st Street, Suite 610
Tulsa, Oklahoma 74137
(918) 496-0059
2225 E. Randol Mill Rd., Suite 315
Arlington, Texas 76011
(817) 640-6407
11200 Richmond Ave., Suite 300
Houston, Texas 77082
(281) 496-1073
www.atkinsbenham.com
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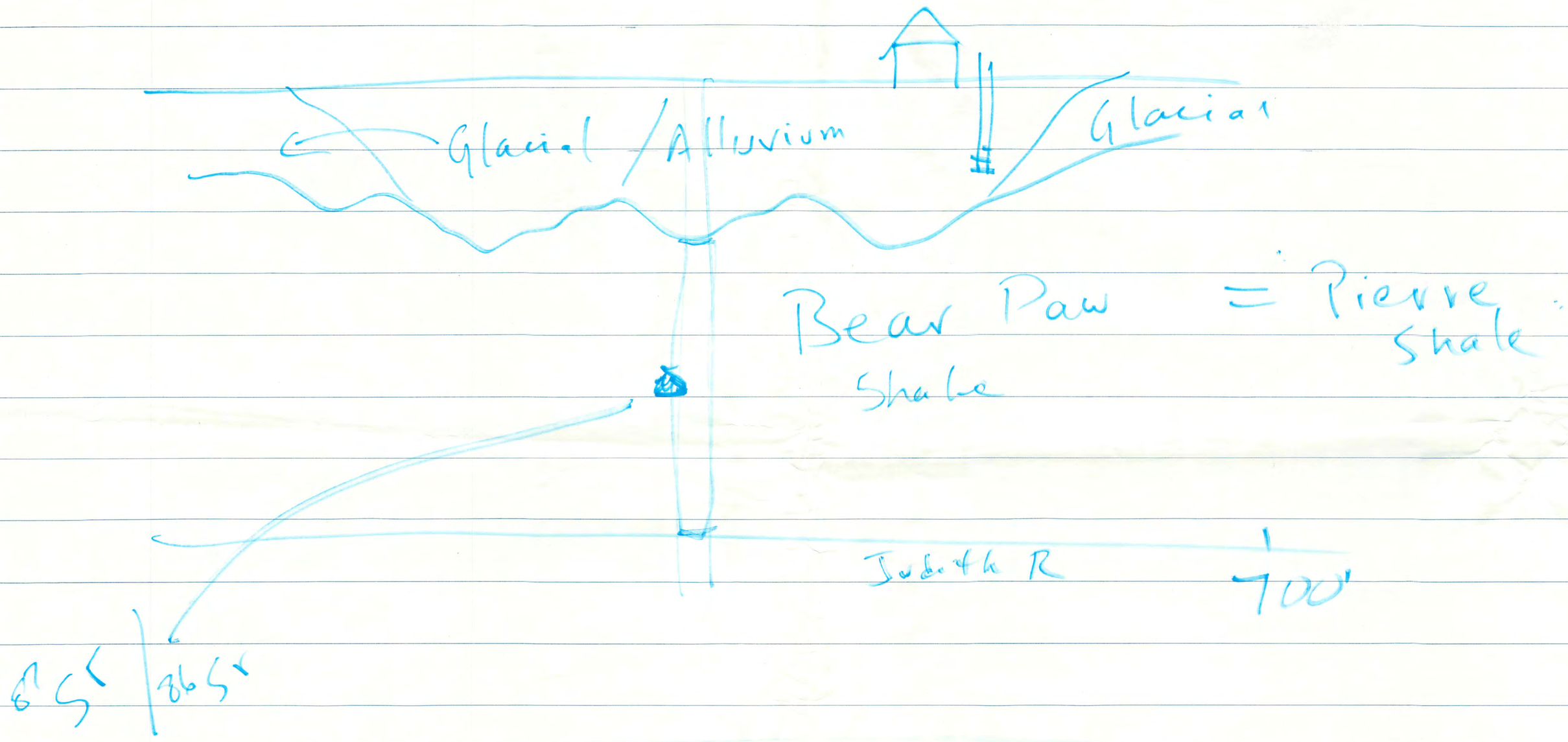
WS Atkins

NO.	DATE	DESCRIPTION OF REVISION OR ISSUE	BY	APP'D



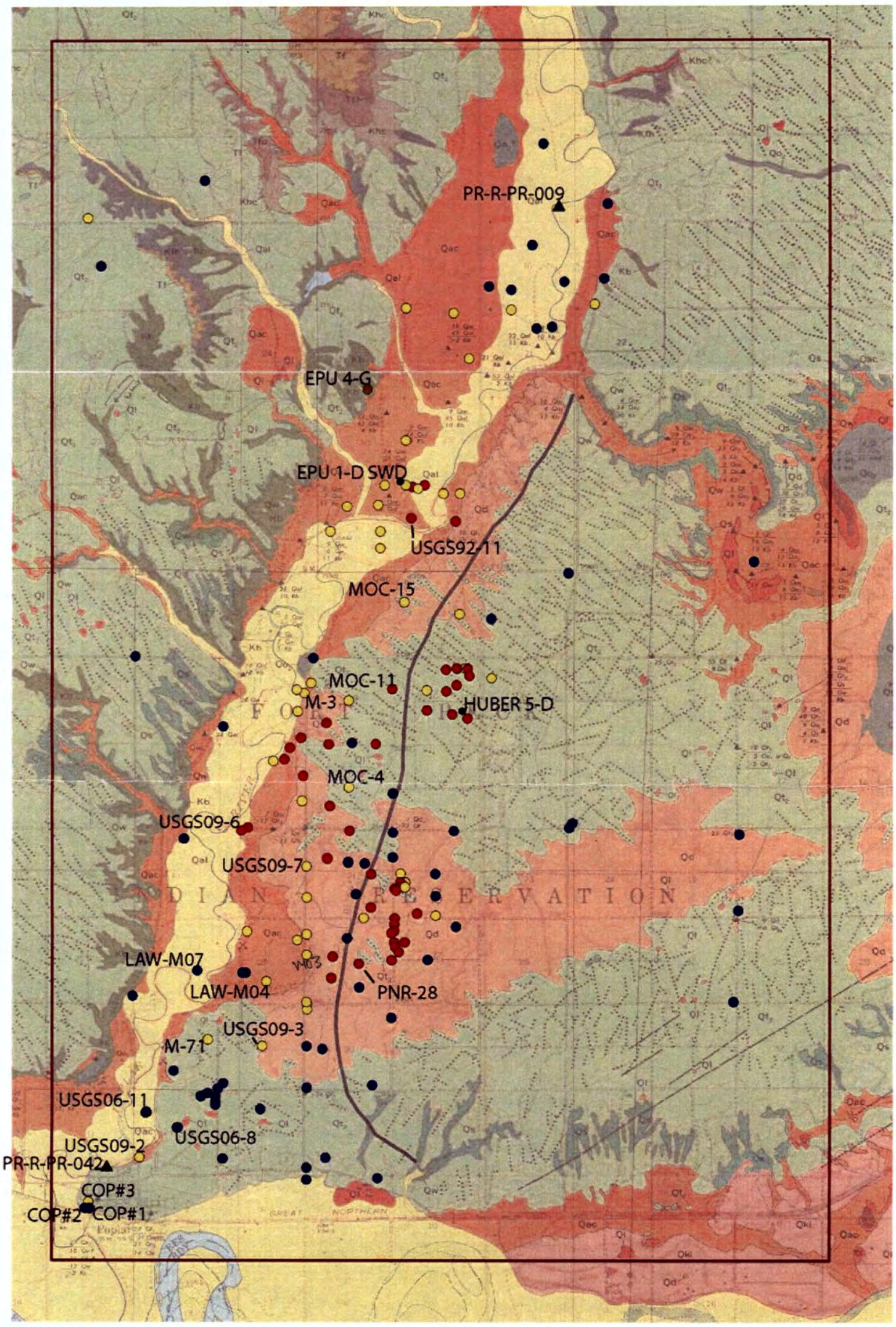
Dakota 3500'

Miss. ~~300-345~~ Ma
330-350

0.708 Charles . 6000'

Dev. 345-365 Ma

0.711 Nisku 7500'



EXPLANATION

LOW HYDRAULIC CONDUCTIVITY ZONE (S.S. Papadopulos & Associates, Inc., 2008)

▲ STREAMFLOW MEASUREMENT SITE AND NUMBER

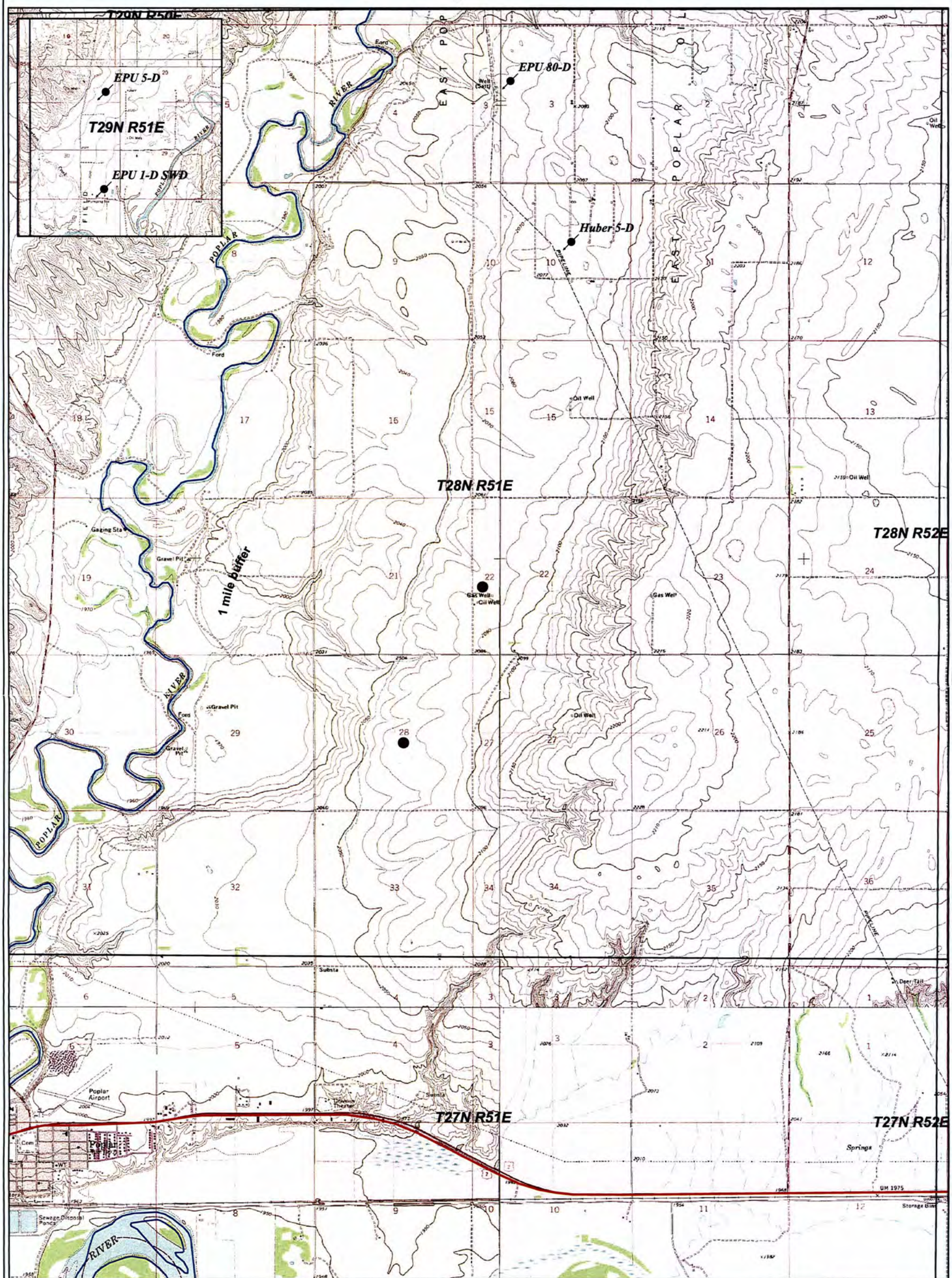
0 0.5 1 2 3 MILES
0 0.5 1 2 3 KILOMETERS

WELL AND NUMBER--Water type determined using concentration range in Thamke and Midtlyng (2003).

- Disposal well
- Water well completed in Judith River Formation
- Uncontaminated
- Moderately contaminated
- Extremely contaminated

Generalized location of low hydraulic conductivity zone, selected surface-water sites, and selected wells, East Poplar oil field area

East Poplar Oil Field



Legend

- Proposed Injection Wells
- Existing Injection Well
- Major Streams
- Townships & Ranges

N

1:35,178

0 3,000 6,000 9,000

Feet

Projection: UTM
Datum: NAD 1983
Zone: 13N
Units: Meters

Date: 2/6/2007
Magdaléna Dohnalová

NORWEST
Applied Hydrology

PIONEER
NATURAL RESOURCES