UTAH POWER & LIGHT COMPANY
SUBSIDENCE MONITORING PROGRAM
ANNUAL REPORT FOR 1984

SUBMITTED MARCH 1985

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SUBSIDENCE MONITORING PROGRAM
ANNUAL REPORT FOR 1984

March 1985

Submitted to: United States Department of the Interior
Office of Surface Mining
Minerals Management Service
Utah Division of Oil, Gas and Mining

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APR 03 1985

DIVISION OF OIL
GAS & MINING

TABLE OF CONTENTS

Introduction	1
Deer Creek 9th East,	
Wilberg 1st Right	3
Deer Creek 5th through 8th East Longwall Panels,	
Wilberg 6th thru 12th Right Longwall Panels	5
Deer Creek 1st North	7
Deer Creek 2nd thru 5th Right Longwall Panels	8
Deer Creek 2nd thru 5th Left Longwall Panels	9
Wilberg 1st and 2nd West Longwall Panels	10
Beehive 8th West Off 2nd North	11
Beehive 4th West,	
Deseret 5th West	12
Little Dove 1st North,	
Old American Fuels Mine	13
Other Studied Areas	14
Predicted Maximum Subsidence	15
Mitigation of Surface Effects	17
Summary	18

APPENDICES

Des-Bee-Dove Mines

Deer Creek Mine

Wilberg Mine

Introduction

Utah Power & Light Company's (UP&L) East Mountain Subsidence Monitoring Study is an ongoing project designed to detect, observe and report the effects of mining induced subsidence above the Deer Creek, Wilberg and Des-Bee-Dove Mines (see Figure 1). This is the fourth such annual report submitted and covers the period between August 1983 and August 1984.

The initial report submitted in 1982 details the monitoring methods used in this study; therefore, they are not discussed here in depth. Briefly, UP&L uses aerial photogrammetric survey methods augmented by conventional monumented on-the-ground surveys and an annual helicopter reconnaissance flight to monitor subsidence. The Bureau of Mines will continue to survey for subsidence above areas of multiple seam longwall mining in the Deer Creek and Wilberg Mines through August 1985.

Location

Figure 2 shows all areas above UP&L's coal mines which have potential for mining induced subsidence and were studied in 1984 to detect subsidence. A helicopter reconnaissance flight on June 7, 1984 revealed no new areas of fractures or visible surface disturbance. Two new

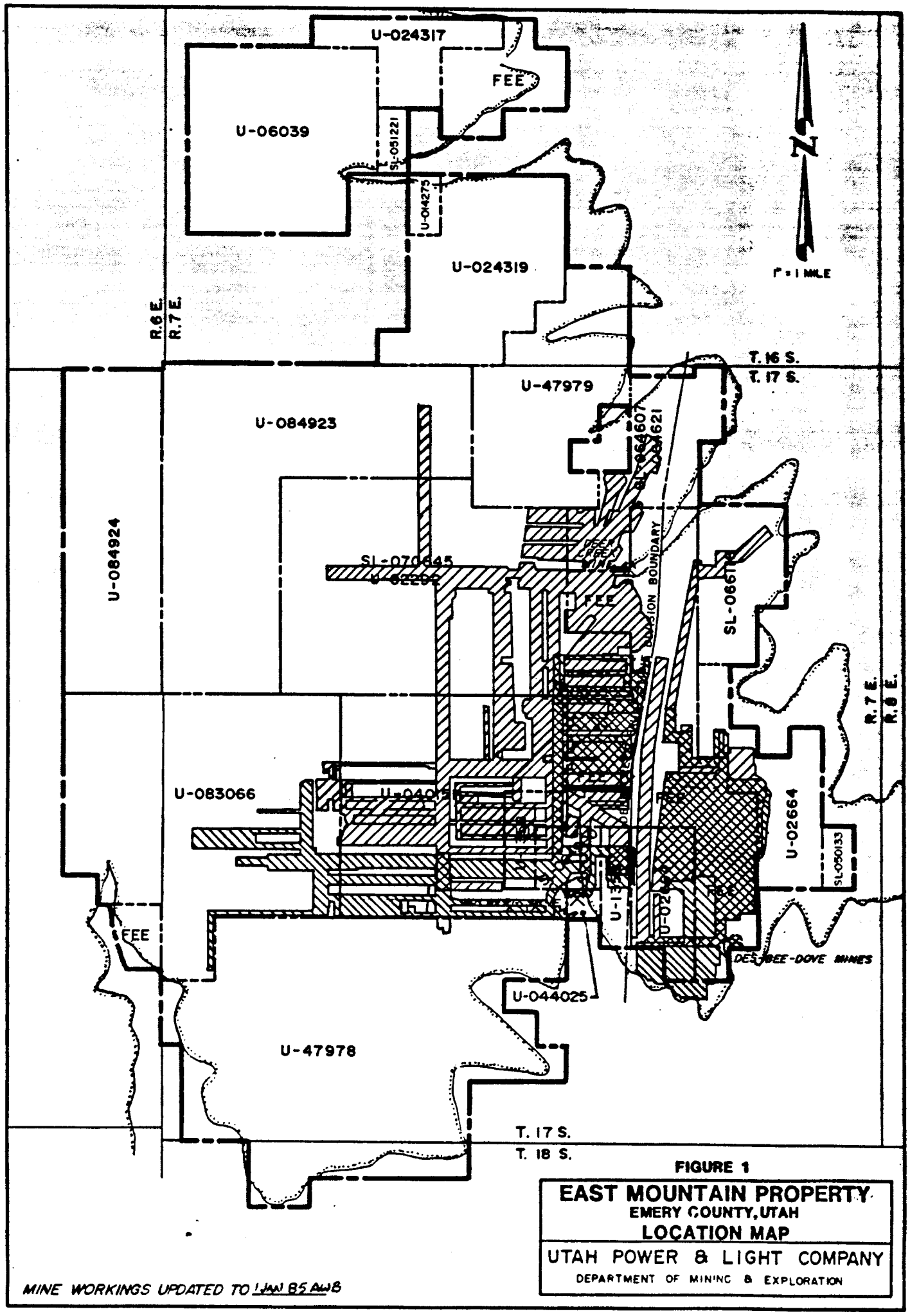
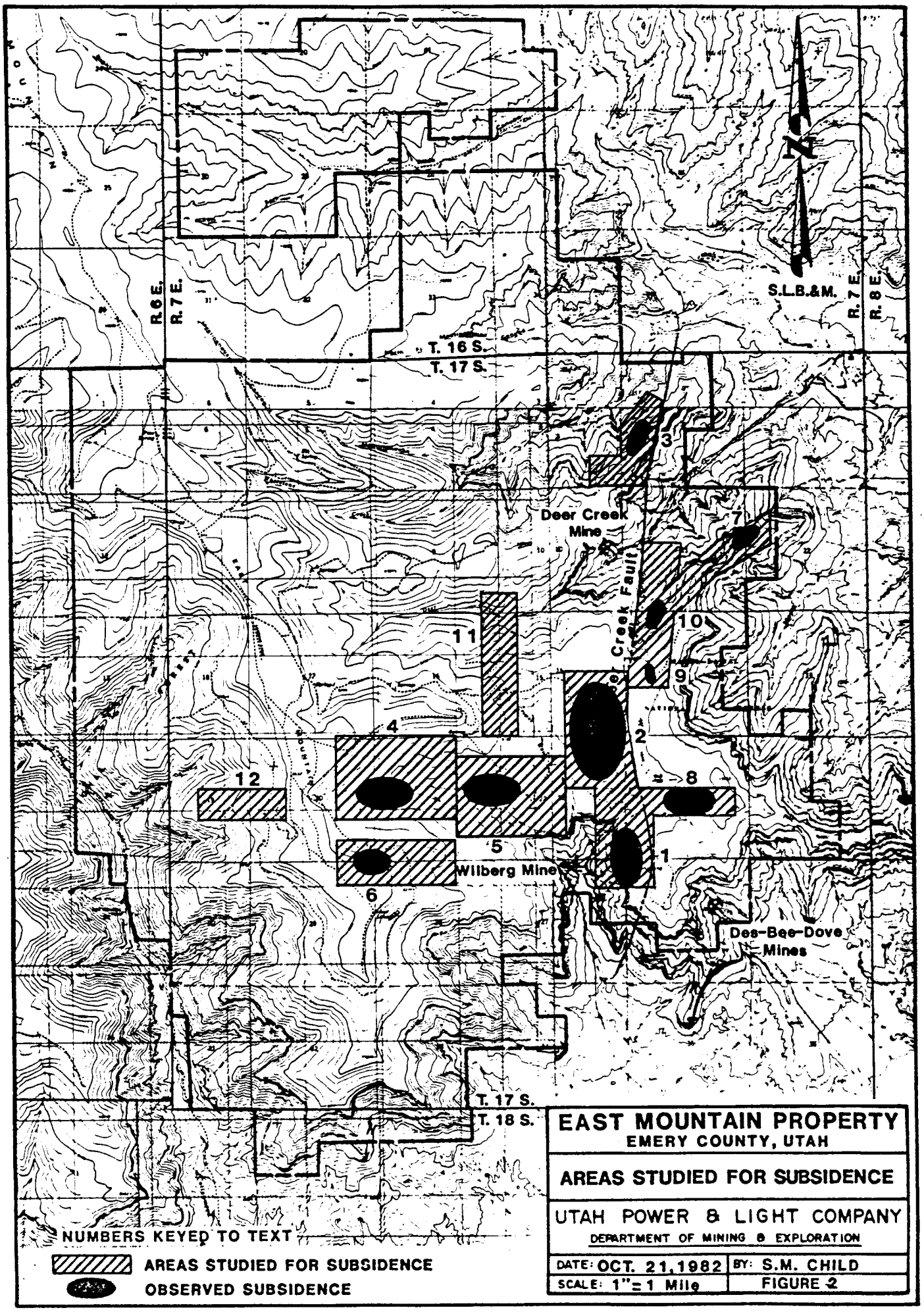


FIGURE 1

EAST MOUNTAIN PROPERTY
EMERY COUNTY, UTAH
LOCATION MAP

UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION

MINE WORKINGS UPDATED TO 1 JAN 85 AWB



EAST MOUNTAIN PROPERTY
EMERY COUNTY, UTAH

AREAS STUDIED FOR SUBSIDENCE

UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION

DATE: OCT. 21, 1982	BY: S.M. CHILD
SCALE: 1" = 1 Mile	FIGURE 2

areas of subsidence were detected in 1984 by photogrammetric methods; above the Deer Creek 2nd through 5th Left longwall panels, and above the Deer Creek 2nd through 5th Right longwall panels.

Each of the areas shown in Figure 2 are discussed in detail in the following paragraphs. Previous reports described the topographic and geologic setting of the subsidence areas, thus, mention of such will only be given when necessary in this report. If the reader has questions regarding this information, previous subsidence monitoring reports should be consulted.

As mentioned before, various methods have been employed in detecting and measuring subsidence. In the following, unless otherwise noted, measurements were made by aerial photogrammetry.

In some areas of subsidence the angle of draw has been calculated and reported herein. However, in other areas, the mine workings are surrounded by burned coal. The failure of the clinker beds in areas of burned coal promotes subsidence outside of the mined area making it nearly impossible to make a reliable angle of draw estimate. In other cases, the zone of subsidence covers a small area and is contained within the area of final mining. This suggests that the subsidence hasn't stabilized and a calculation of angle of draw would be meaningless.

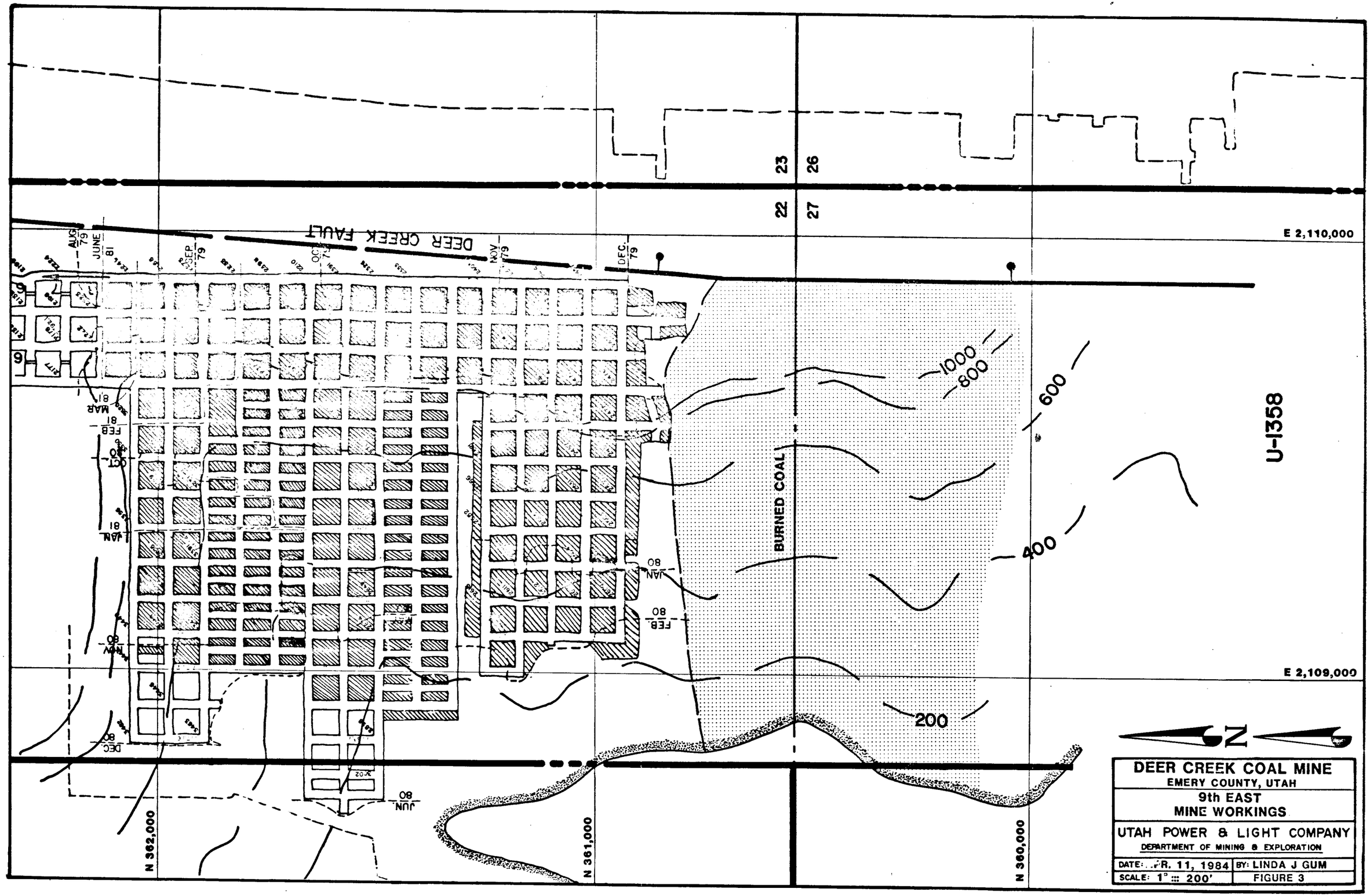
Area 1

Deer Creek 9th East - Wilberg 1st Right

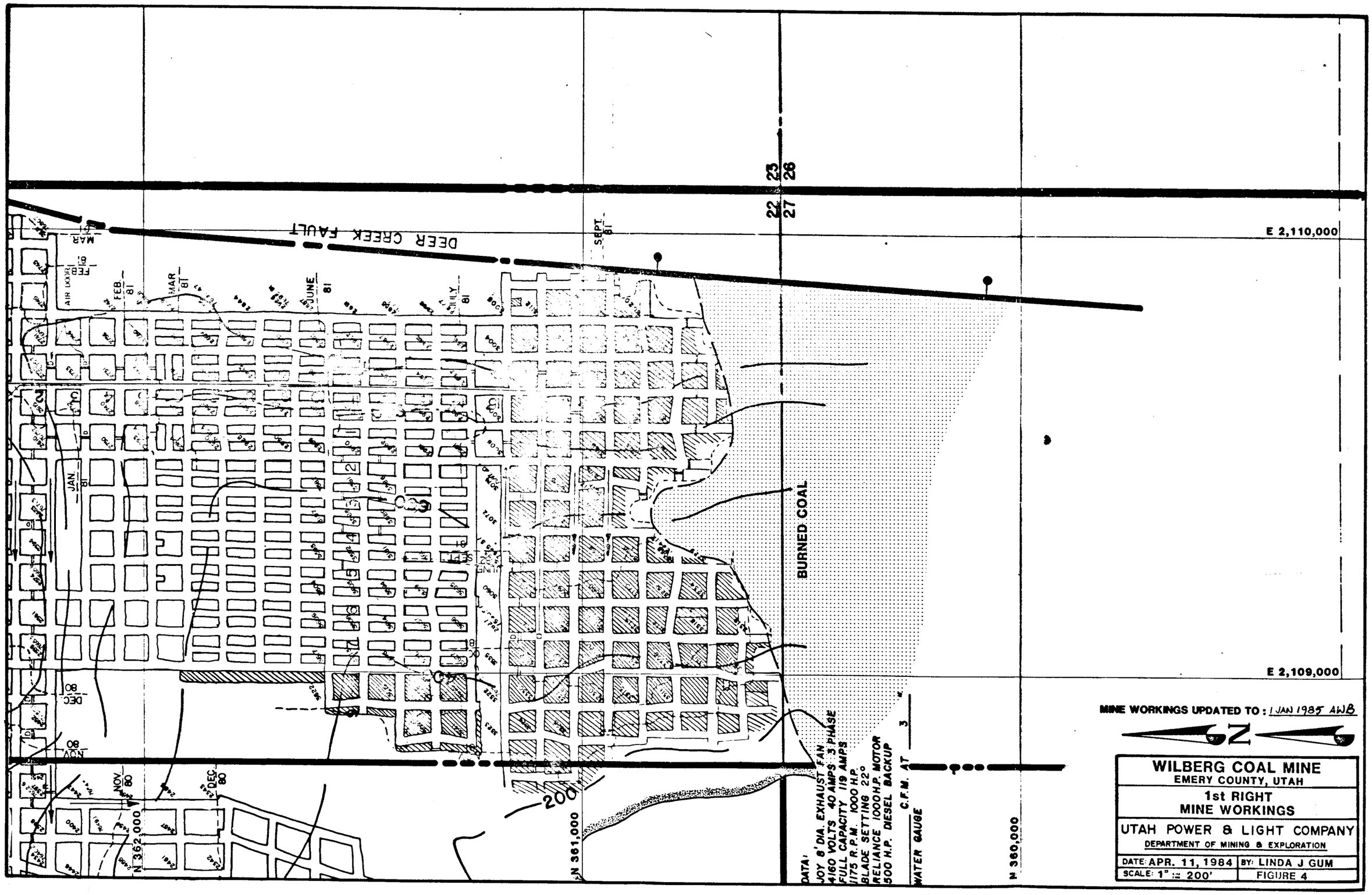
Subsidence in this area was first documented in the 1981 subsidence monitoring report submitted in December 1982. The relationship of the area of subsidence with the present Deer Creek and Wilberg Mine workings is shown in Figure 3, 4 and 5. The Deer Creek 9th East workings in this area have been abandoned since 1981 but pillar extraction in Wilberg 1st Right proceeded until June 1984.

Subsidence monitoring during 1984 showed a continuation of subsidence in and around the graben-like structure seen in this area. The maximum subsidence observed to date is 23 feet and occurs about 200 feet south of the southernmost mined-out area in 1st Right Wilberg over an area in which both the Hiawatha and Blind Canyon Seams are burned. This supports the theory that the clinker beds have been crushed allowing subsidence to occur well outside the area of mine workings.

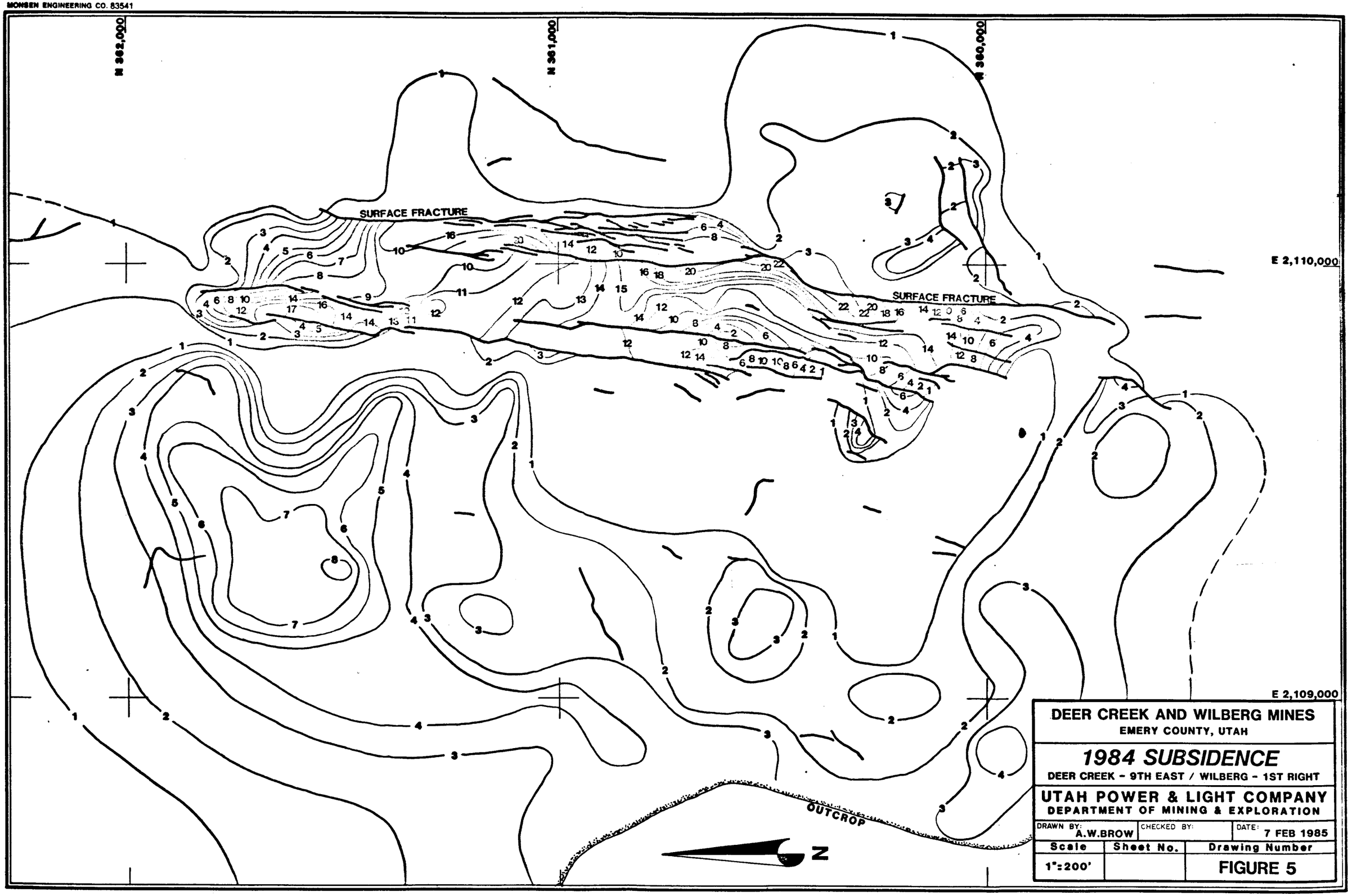
The angle of draw of subsidence in this area appears to be influenced by the Deer Creek Fault plane. On the east side of the mine workings the subsidence abruptly stops in an easterly direction about 200 feet east of the mine workings which coincides with the Deer Creek Fault trace.



DEER CREEK FAULT
BURNED COAL
E 2,110,000
E 2,109,000
N 362,000
N 361,000
N 360,000
1000
800
600
400
200
23
26
22
27
U-1358
N
DEER CREEK COAL MINE
EMERY COUNTY, UTAH
9th EAST
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: APR. 11, 1984
BY: LINDA J GUM
SCALE: 1" ::: 200'
FIGURE 3


DEER CREEK FAULT
BURNED COAL
E 2,110,000
E 2,109,000
N 362,000
N 361,000
N 360,000
200
22
23
26
27
MAR 81
FEB 81
JAN 81
DEC 80
NOV 80
SEPT 81
JULY 81
JUNE 81
AIR DOOR
DATA:
JOY 8' DIA. EXHAUST FAN
4160 VOLTS 40 AMPS 3 PHASE
FULL CAPACITY 119 AMPS
1175 R.P.M. 1000 H.P.
BLADE SETTING 22°
RELIANCE 1000 H.P. MOTOR
500 H.P. DIESEL BACKUP
C.F.M. AT 3 W.
WATER GAUGE
MINE WORKINGS UPDATED TO: 1 JAN 1985 AWB
N
WILBERG COAL MINE
EMERY COUNTY, UTAH
1st RIGHT
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: APR. 11, 1984
BY: LINDA J GUM
SCALE: 1" = 200'
FIGURE 4

MONSEN ENGINEERING CO. 83541



DEER CREEK AND WILBERG MINES
EMERY COUNTY, UTAH

1984 SUBSIDENCE

DEER CREEK - 9TH EAST / WILBERG - 1ST RIGHT

UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION

DRAWN BY: A.W.BROW	CHECKED BY:	DATE: 7 FEB 1985
Scale	Sheet No.	Drawing Number
1":200'		FIGURE 5

In this area the mine workings are covered with 1200 feet of overburden indicating a 9.5° angle of draw on subsidence.

No hydrologic impacts have been observed within this area of subsidence.

Area 2

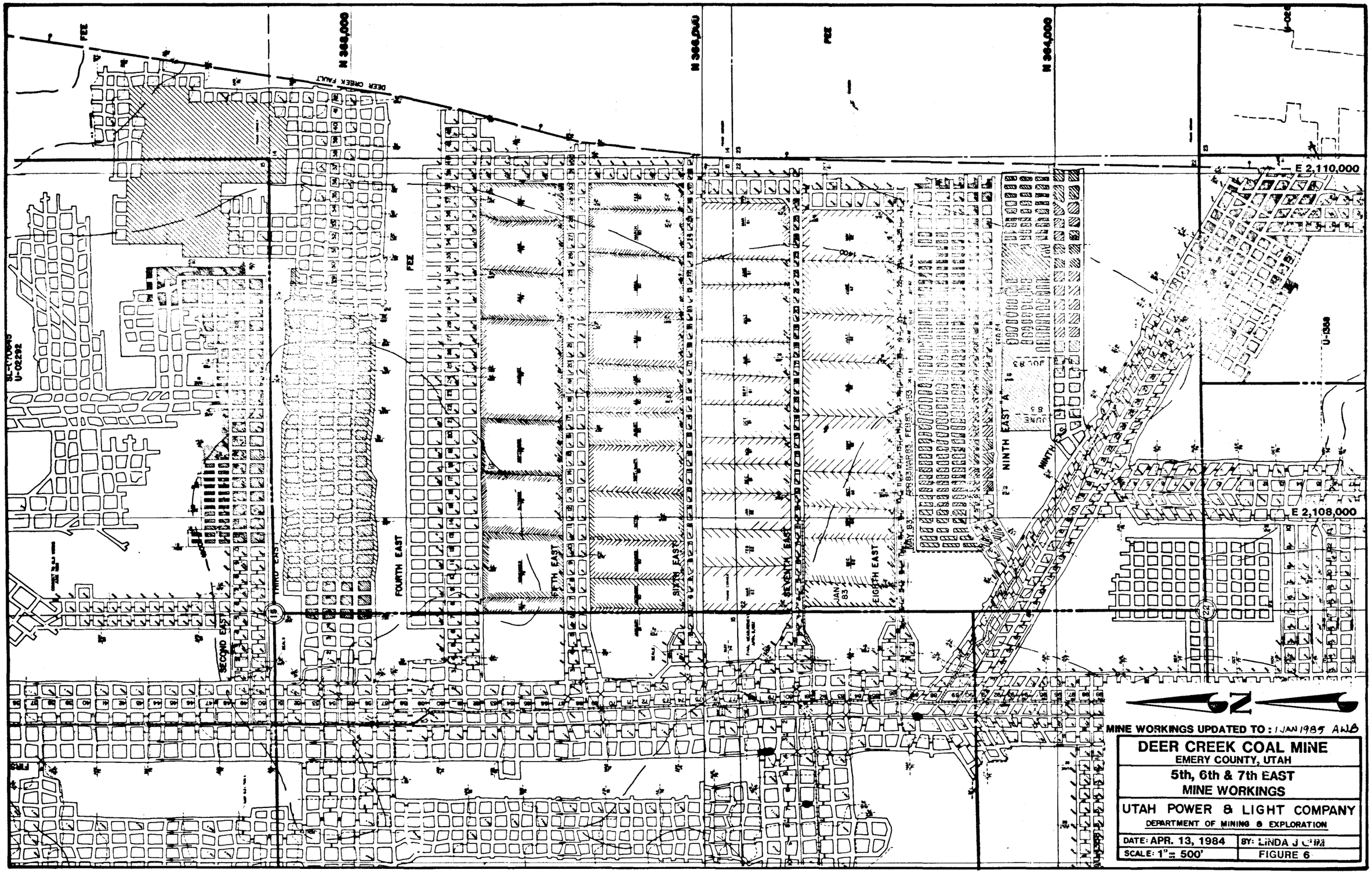
Deer Creek 5th, 6th and 7th and 8th East Longwall Panels

Wilberg 6th, 7th, 10th, 11th and 12th Right Longwall Panels

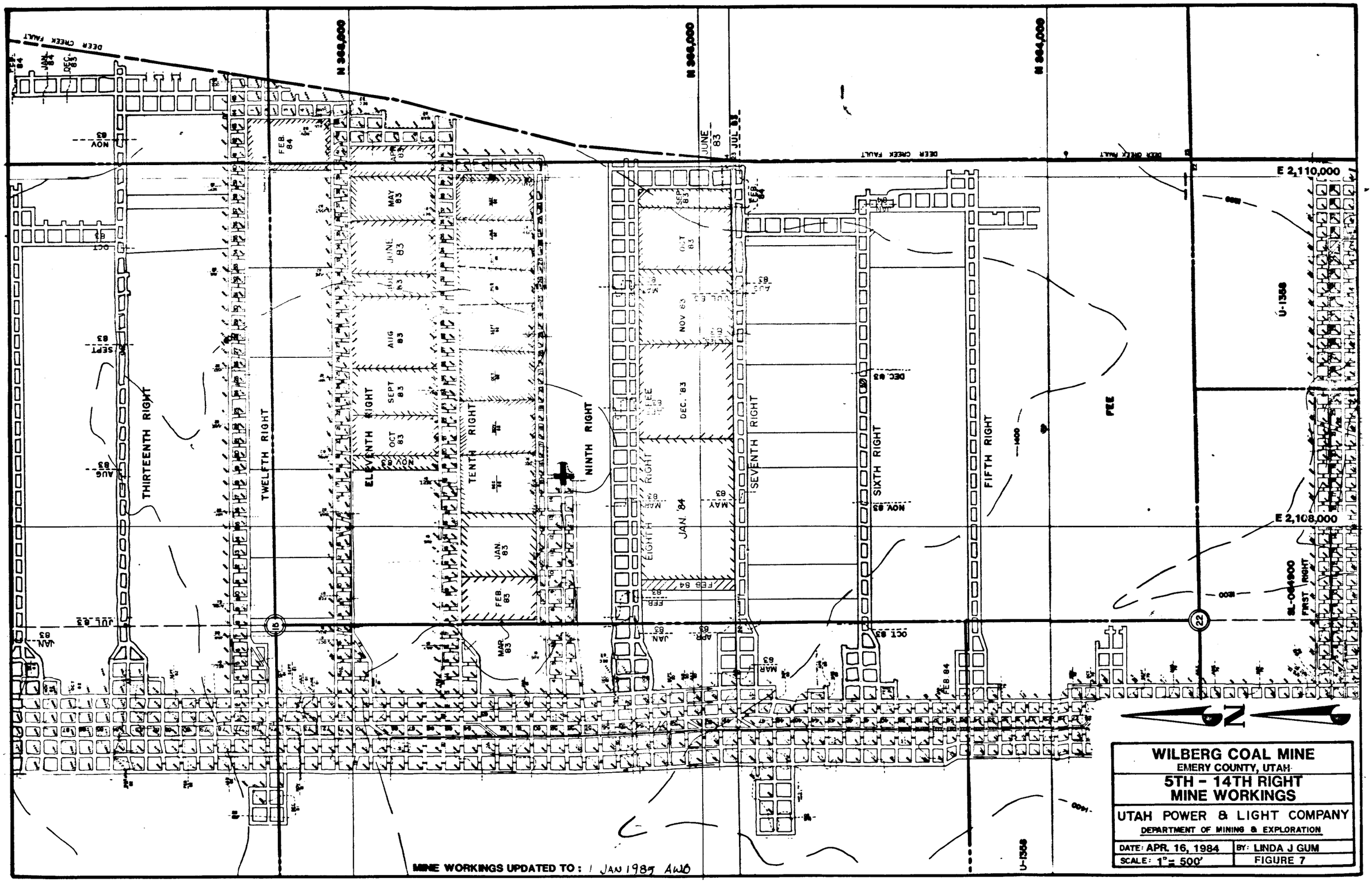
Mining in the Deer Creek Mine in this area had been completed by January 1983. During the period from August 31, 1983 to August 31, 1984, the 11th, 12th and 7th Right panels, and 750 feet of the 6th Right longwall panel were completed in the underlying seam (Figures 6 and 7).

In 1984 this area was surveyed by both photogrammetric methods and U. S. Bureau of Mines on-the-ground monumentation (Figures 8a and 8b). The two surveys were in close agreement; both showing a maximum subsidence of just over 11 feet centered over the Deer Creek 6th East and Wilberg 6th and 7th East longwall panels. The area of subsidence continues to elongate to the north and south but neither UP&L nor USBM personnel have detected any surface fissures or other visible disturbance.

An angle of draw has been calculated for different points surrounding this area. On the eastern side the angle is near vertical and continues to be influenced by the Deer Creek fault since subsidence stops abruptly at the fault on the southeast side. Further north on the eastern side subsidence has crossed the Deer Creek Fault but workings in the adjacent Little Dove Mine make any calculation of angle-of-draw there meaningless. On the western side angle-of-draw ranges from 6° to 18°.



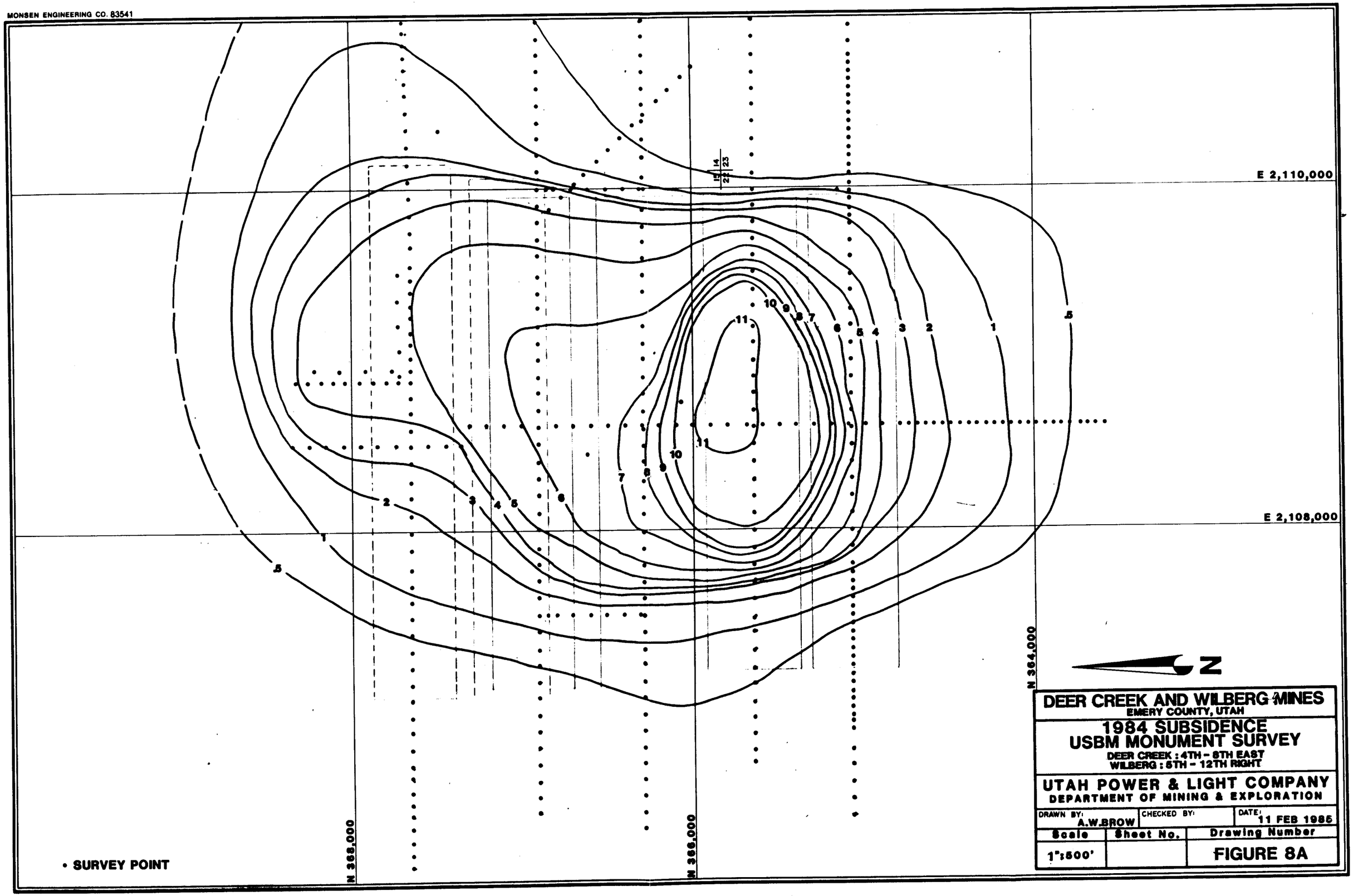
N 368,000
N 366,000
N 364,000
E 2,110,000
E 2,108,000
DEER CREEK FAULT
FEE
SECOND EAST
THIRD EAST
FOURTH EAST
FIFTH EAST
SIXTH EAST
SEVENTH EAST
EIGHTH EAST
NINTH EAST "A"
NINTH EAST
U-02292
U-1368
MINE WORKINGS UPDATED TO: 1 JAN 1985 AWB
DEER CREEK COAL MINE
EMERY COUNTY, UTAH
5th, 6th & 7th EAST
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: APR. 13, 1984
BY: LINDA J
SCALE: 1" = 500'
FIGURE 6



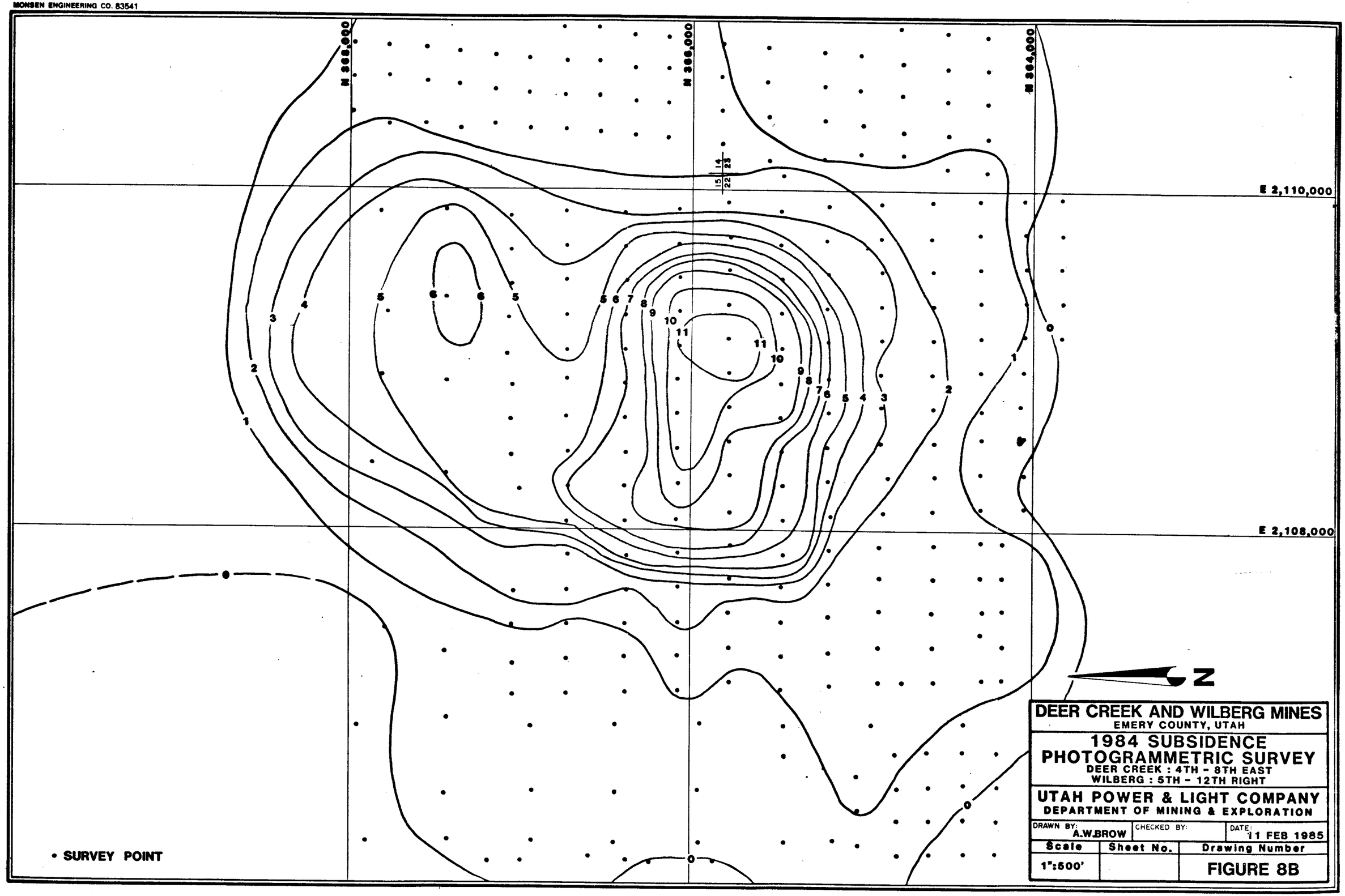
WILBERG COAL MINE
EMERY COUNTY, UTAH
5TH - 14TH RIGHT MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION

DATE: APR. 16, 1984	BY: LINDA J GUM
SCALE: 1" = 500'	FIGURE 7

MONSEN ENGINEERING CO. 83541



MONSEN ENGINEERING CO. 83541



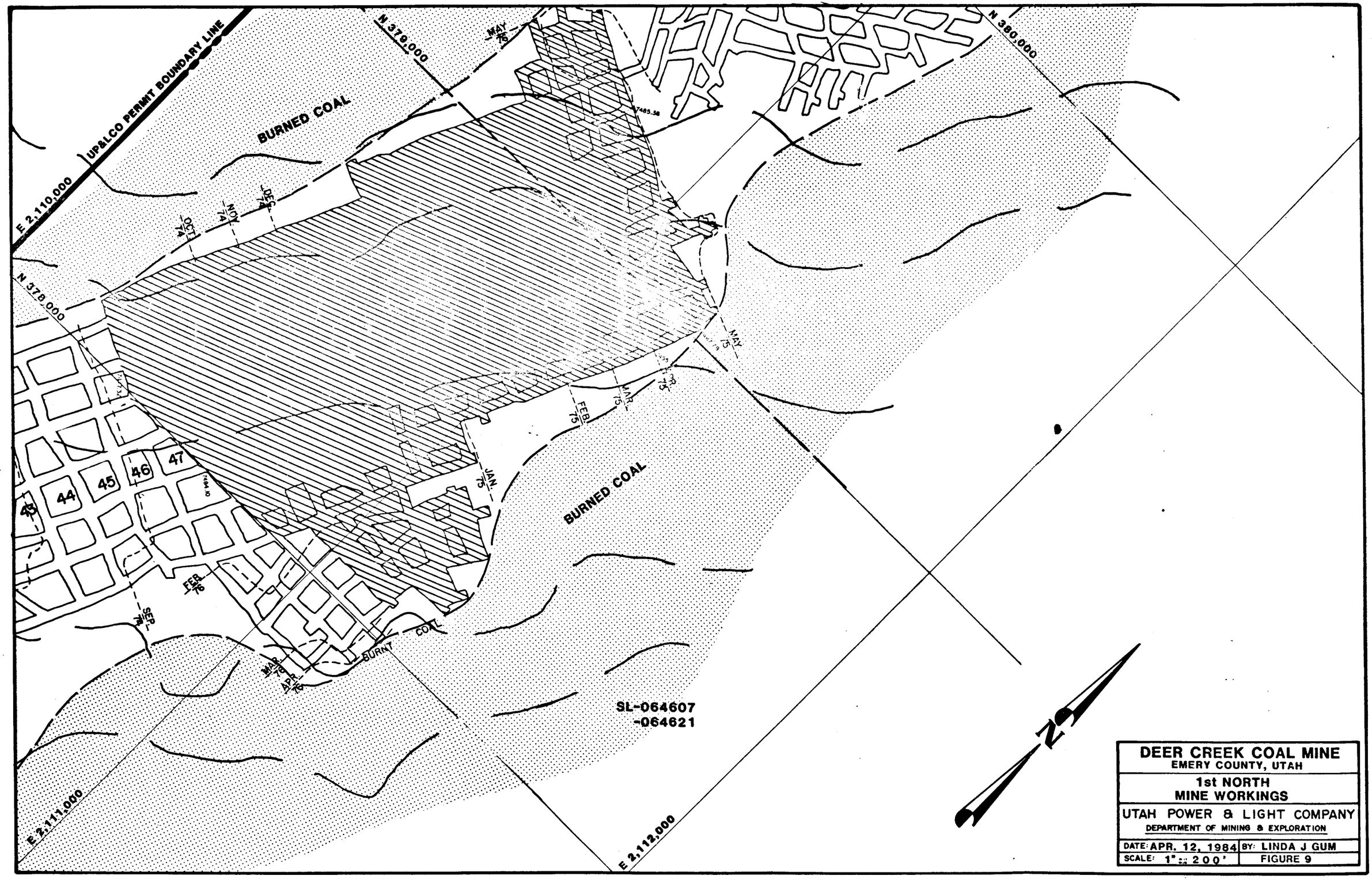
No springs have been identified over this subsidence area but two springs, one-fourth to one-third mile to the west show no affects from the subsidence (see Hydrologic Monitoring Report, February 1985).

Area 3

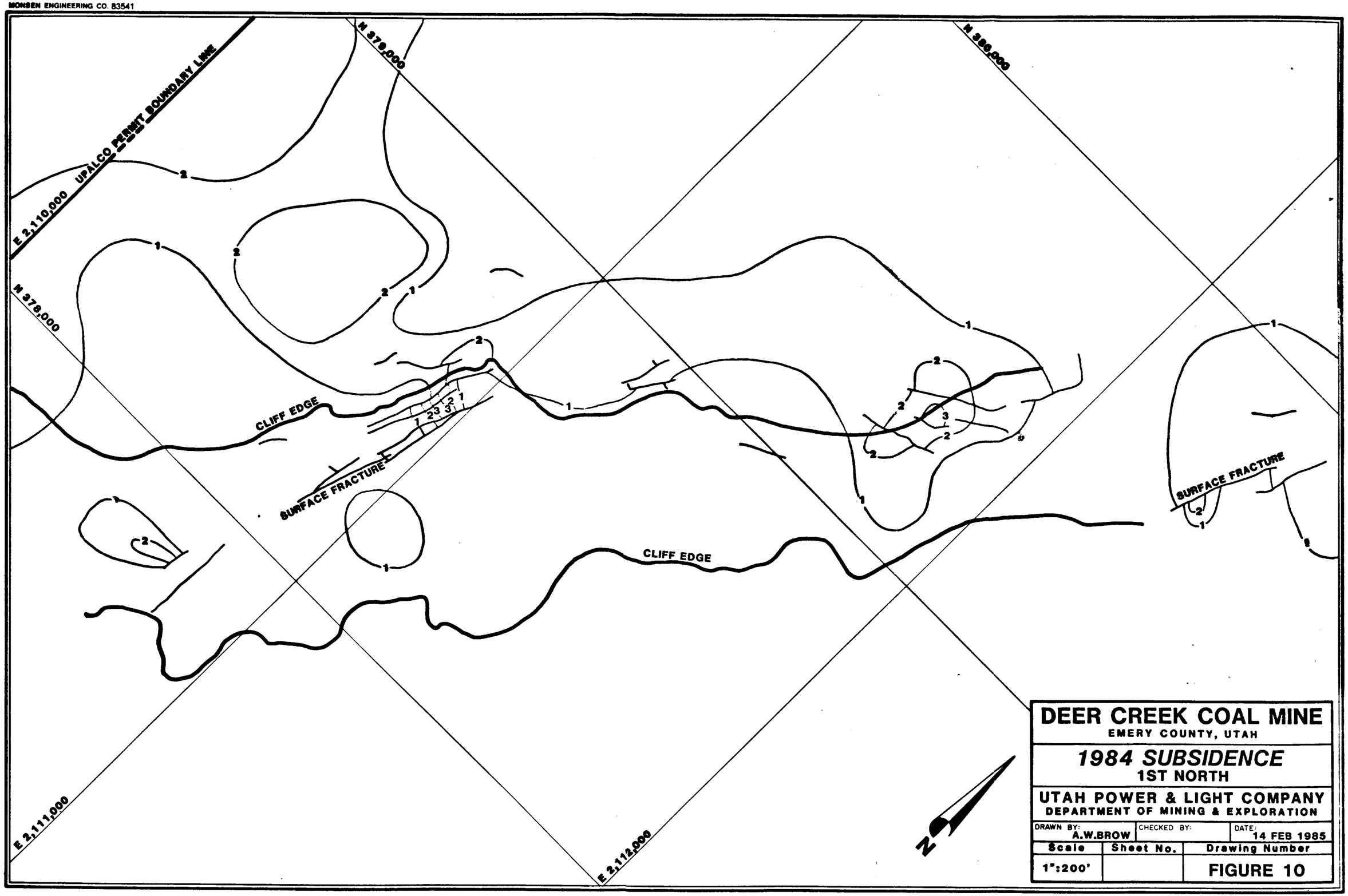
Deer Creek 1st North

The 1st North section of the Deer Creek Mine was abandoned and sealed in 1978 after having been completely mined out. During the period from August 1983 to August 1984 there was little change in the subsidence, indicating that the area has probably stabilized with a maximum down-drop of 3 feet centered above the abandoned mine workings (Figure 9 and 10). Another zone of subsidence occurs over an area of burned coal 500 feet northwest of the workings. No additional surface fracturing has been observed since the previous report. The strata in this area are dry because they lack adequate hydrologic recharge. Therefore, the subsidence will not effect the hydrology.

The mine workings are surrounded by burned coal making it difficult to accurately calculate an angle of draw.


UP&LCO PERMIT BOUNDARY LINE
BURNED COAL
N 379,000
N 380,000
N 378,000
E 2,110,000
E 2,111,000
E 2,112,000
OCT 74
NOV 74
DEC 74
MAY 75
JAN 75
FEB 75
MAR 75
APR 75
SEP 75
FEB 76
MAR 76
APR 76
BURNT COAL
43
44
45
46
47
SL-064607
-064621
DEER CREEK COAL MINE
EMERY COUNTY, UTAH
1st NORTH
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: APR. 12, 1984
BY: LINDA J GUM
SCALE: 1" = 200'
FIGURE 9

MONSEN ENGINEERING CO. 83541



Area 4

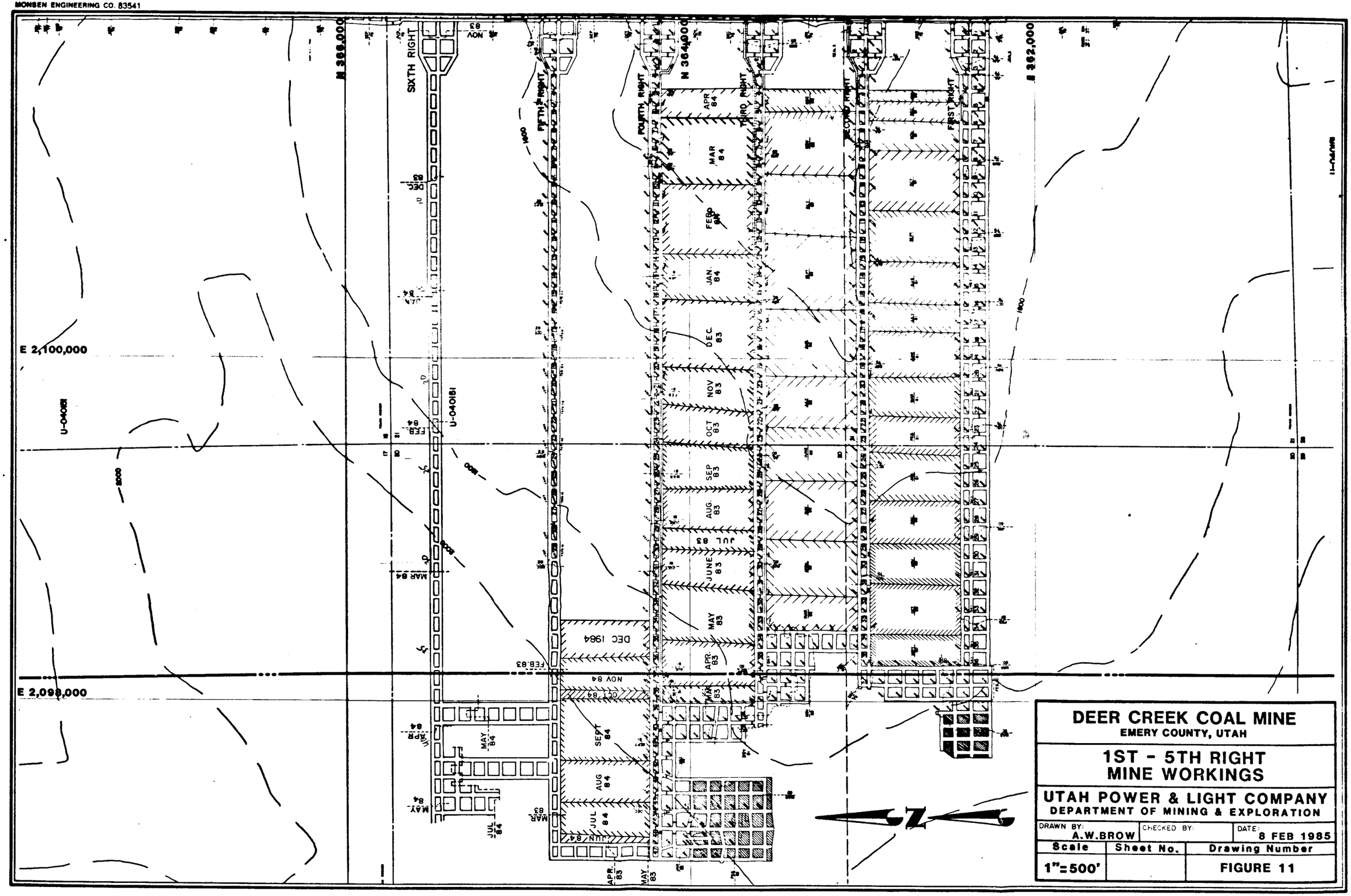
Deer Creek 2nd through 5th Right Longwall Panels

Subsidence in this area was detected for the first time in 1984 by photogrammetric methods. Longwall mining commenced in the 2nd Right longwall panel in 1980 and by the end of August 1984 the 2nd, 3rd, and 4th Right panels, and 500 feet of the 5th Right longwall panel had been completed (figure 11). The area is overlain by 1600 to 2000 feet of overburden; topography being mainly tree covered slopes.

The maximum subsidence noted to date is just over 5 feet, centered over the 3rd Right longwall panel. Up to 4 feet of subsidence also occurred over two room-and-pillar sections to the west which had been completely mined out and abandoned by mid-1982 (Figure 12). No fractures or other visible surface disturbance have been detected in this area. The calculated angle of draw ranges from near vertical to about 14° but more meaningful estimates will come after subsidence has stabilized.

Several springs are located on East Mountain above the Deer Creek 1st through 5th Right and 1st through 5th Left (see Area 5) mine workings. A graph included in the Deer Creek appendix compares the discharge of these springs with the annual precipitation on East Mountain. Fluctuations in spring flow appear to be related variations in precipitation; mining has caused no adverse hydrologic effects.

MONSEN ENGINEERING CO. 83541



DEER CREEK COAL MINE

EMERY COUNTY, UTAH

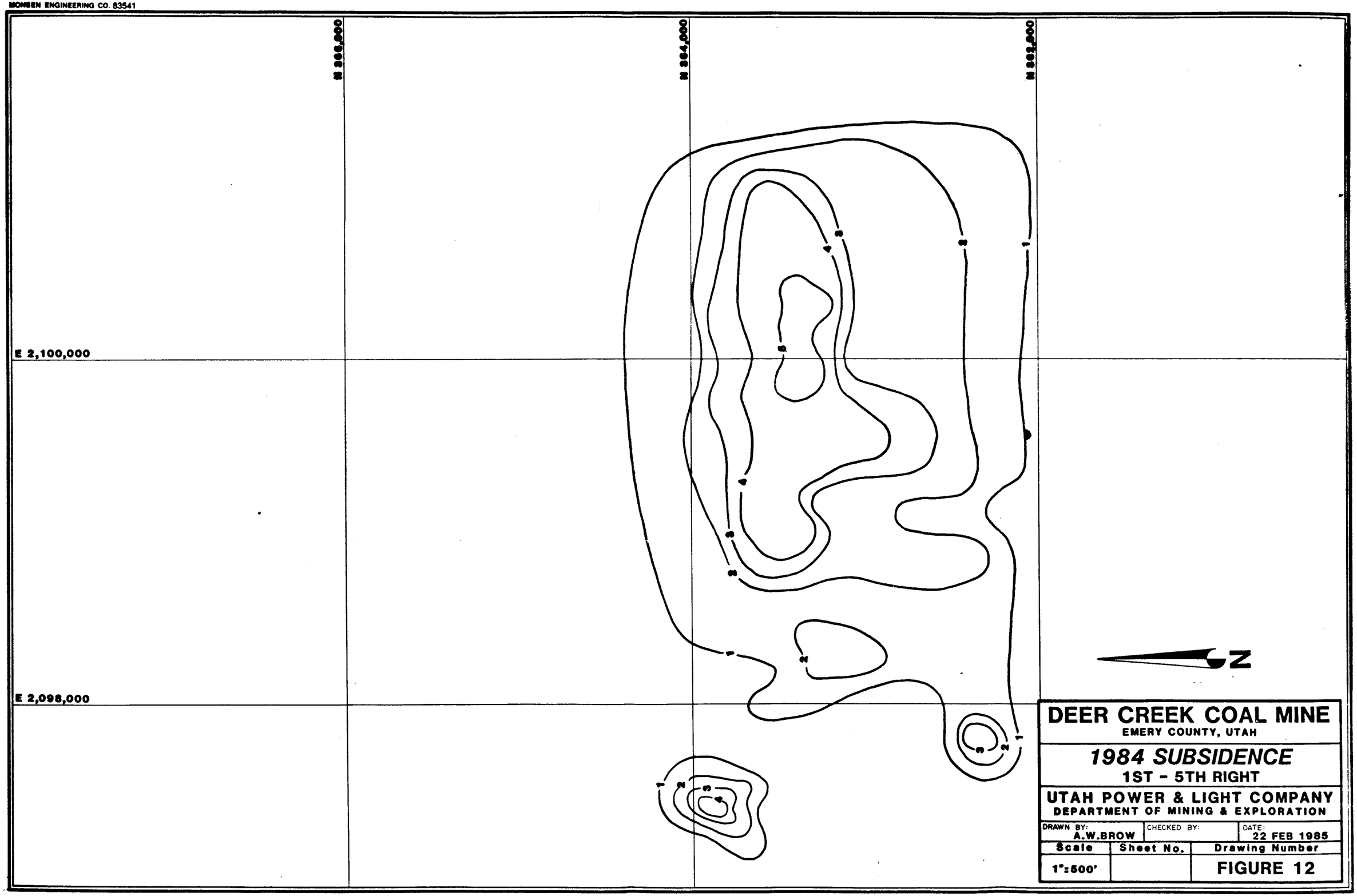
1ST - 5TH RIGHT MINE WORKINGS

UTAH POWER & LIGHT COMPANY

DEPARTMENT OF MINING & EXPLORATION

DRAWN BY:	CHECKED BY:	DATE:
A.W.BROW		8 FEB 1985
Scale	**Sheet No.**	**Drawing Number**
1"=500'		FIGURE 11

MONSEN ENGINEERING CO. 83541



DEER CREEK COAL MINE

EMERY COUNTY, UTAH

1984 SUBSIDENCE

1ST - 5TH RIGHT

UTAH POWER & LIGHT COMPANY

DEPARTMENT OF MINING & EXPLORATION

DRAWN BY:	CHECKED BY:	DATE:
A.W.BROW		22 FEB 1985
Scale	**Sheet No.**	**Drawing Number**
1":500'		FIGURE 12

Area 5

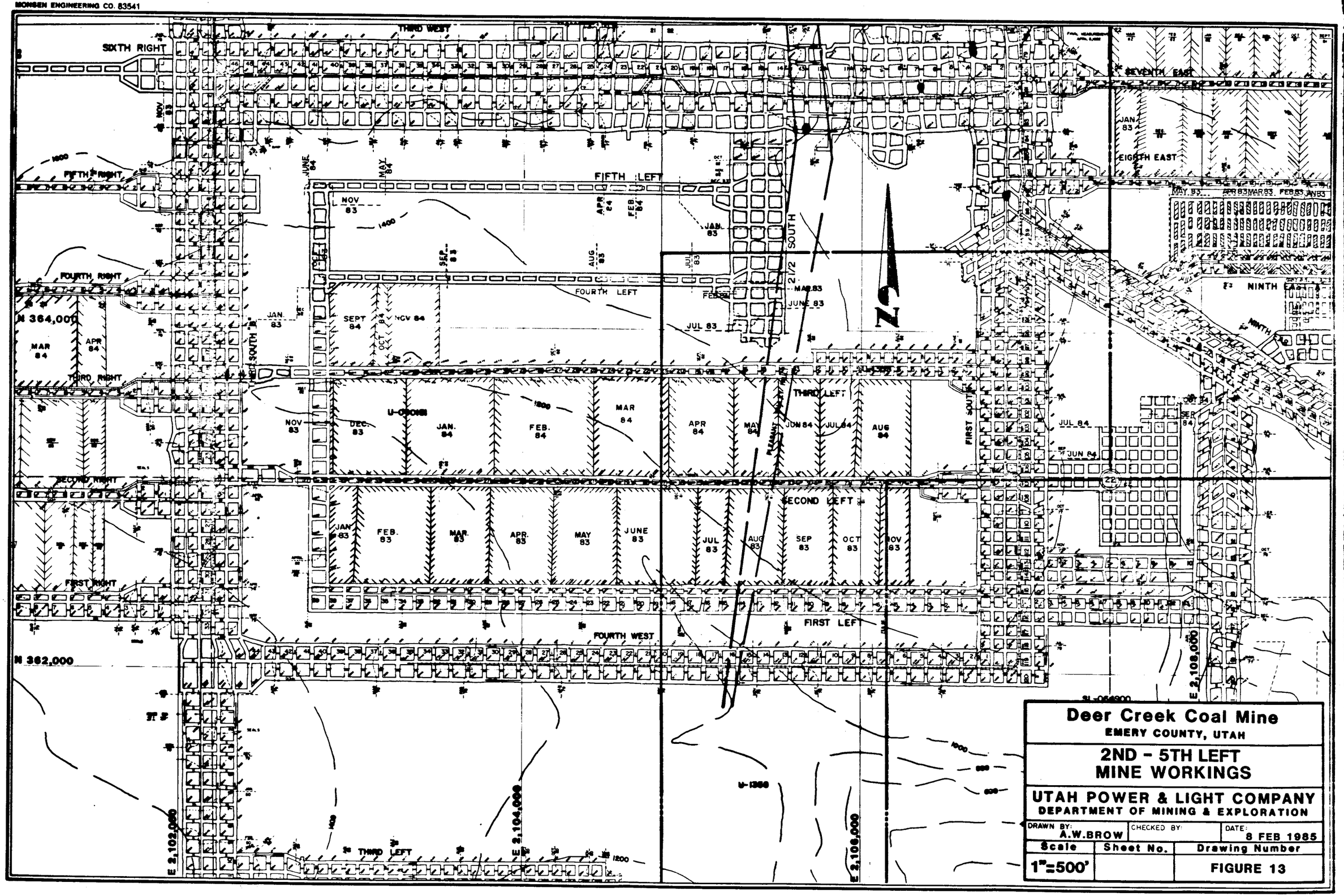
Deer Creek 2nd Through 5th Left Longwall Panels

Photogrammetric monitoring in 1984 revealed subsidence over this area for the first time. Mining of the 2nd Left panel began in January 1983; the 3rd Left panel was completed in August 1984 (Figure 13). Overburden in the area ranges from 1000 to 1450 feet. Sage brush and tree covered slopes dominate the topography.

Subsidence has reached a maximum of just over 4 feet to date; this occurs along the middle of the mined out area (Figure 14). The maximum angle of draw is approximately 8° but since the area should continue to subside for a time, this is not a reliable figure. No surface disturbance has been observed.

As mentioned in the previous section none of the springs located above these workings show any adverse effects due to mining (see graph of East Mountain springs in Deer Creek appendix).

MONSEN ENGINEERING CO. 83541



Deer Creek Coal Mine

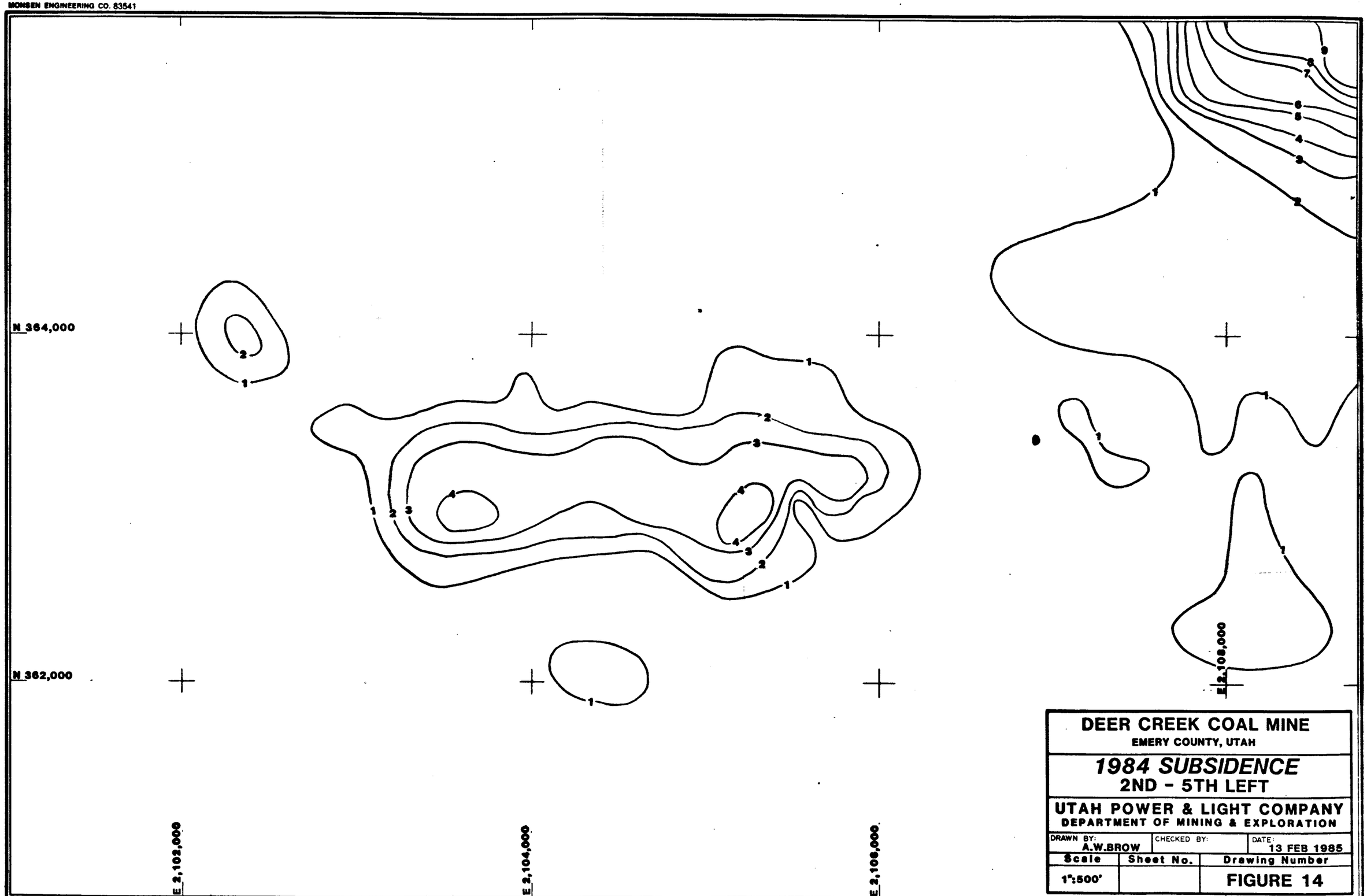
EMERY COUNTY, UTAH

2ND - 5TH LEFT MINE WORKINGS

UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION

DRAWN BY: A.W.BROW	CHECKED BY:	DATE: 8 FEB 1985
Scale	Sheet No.	Drawing Number
1"=500'		FIGURE 13

MONSEN ENGINEERING CO. 83541



DEER CREEK COAL MINE
EMERY COUNTY, UTAH

1984 SUBSIDENCE
2ND - 5TH LEFT

UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION

DRAWN BY: A.W.BROW	CHECKED BY:	DATE: 13 FEB 1985
Scale	Sheet No.	Drawing Number
1":500'		FIGURE 14

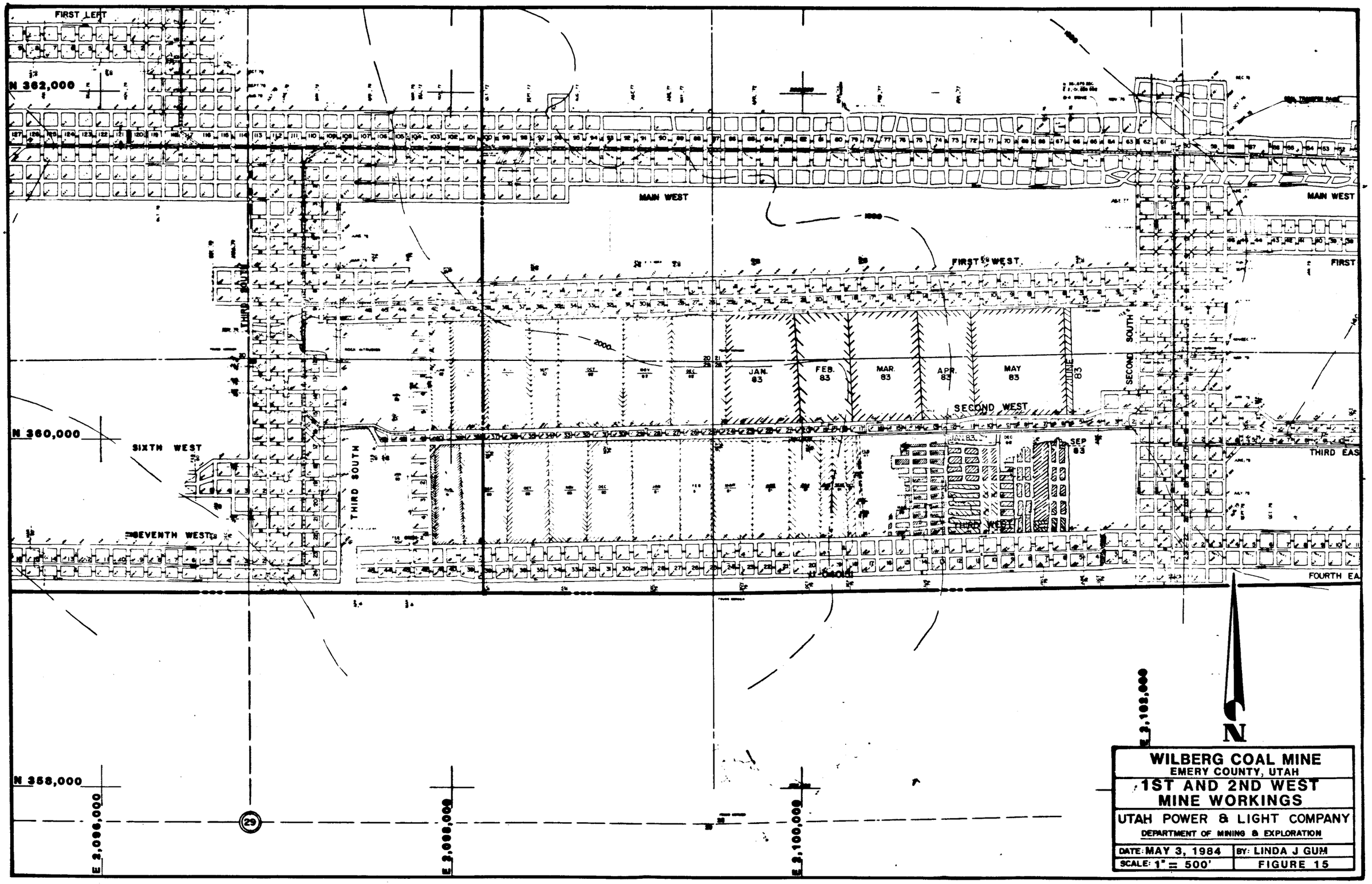
Area 6

Wilberg - 1st and 2nd West Longwall Panels

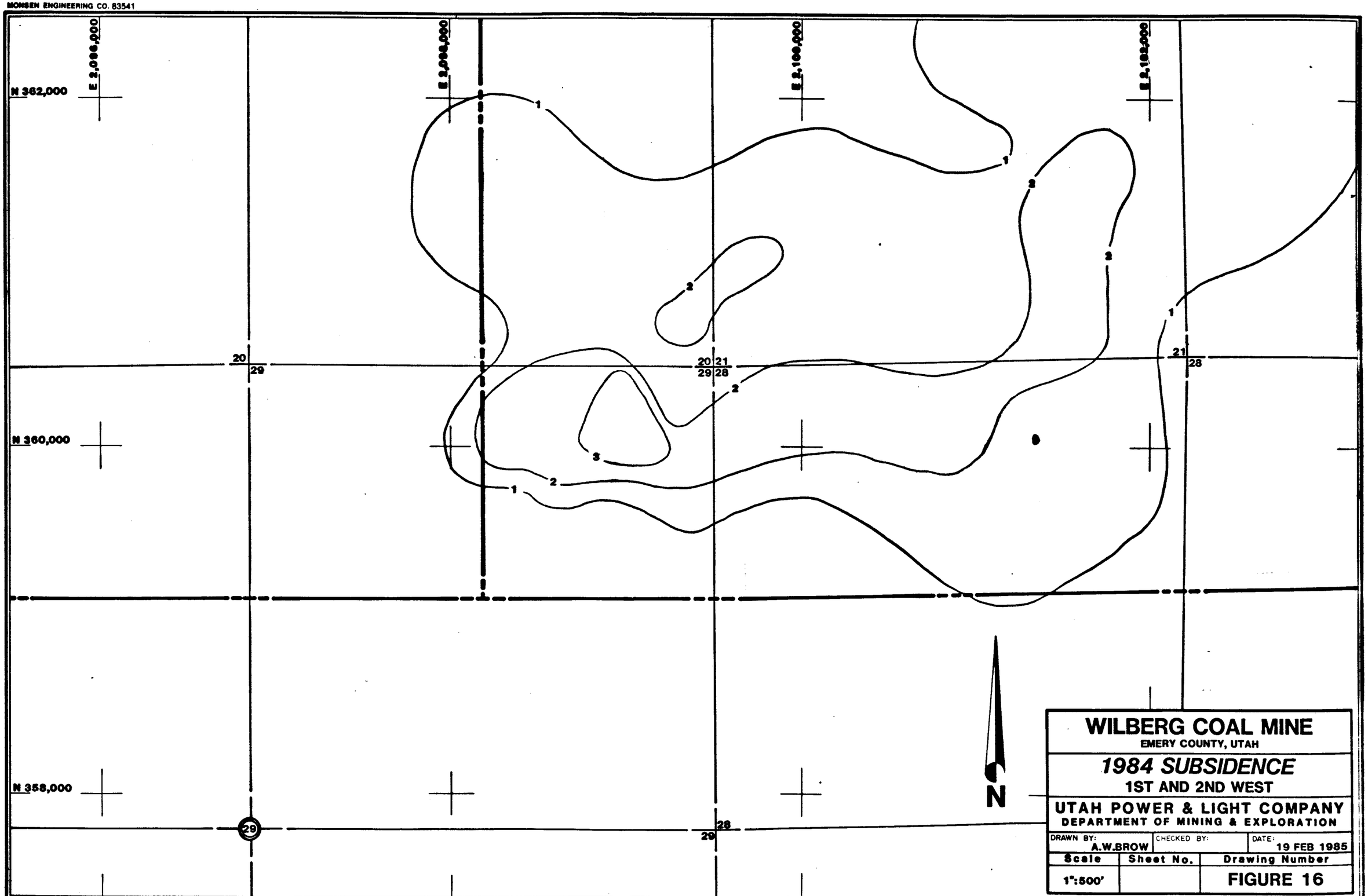
The Bureau of Mines monitoring of a system of surface monuments revealed subsidence over the Wilberg 1st and 2nd West longwall panels during 1983 (Figure 15). Mining in these two panels was completed by early June 1983 but subsidence continued in the 1984 monitoring period.

Maximum subsidence measured is now 3 feet (Figure 16). No surface fractures or other visible disturbance have been found. On the south side of the area the subsidence diminishes to less than 0.5 feet within 300 feet south of the longwall panels. With 2000 feet of overburden, this equates to an angle of draw of 8.5° but any calculated angle will be inaccurate until subsidence has stabilized in the area.

Four springs located just north of this area show no effect from the subsidence.


FIRST LEFT
N 362,000
MAIN WEST
MAIN WEST
FIRST WEST
FIRST
THIRD SOUTH
JAN. 83
FEB. 83
MAR. 83
APR. 83
MAY 83
JUNE 83
SECOND SOUTH
SECOND WEST
N 360,000
SIXTH WEST
THIRD SOUTH
SEP 83
THIRD EAS
SEVENTH WEST
THIRD WEST
FOURTH EA
N 358,000
E 2,096,000
E 2,098,000
E 2,100,000
E 2,102,000
N
WILBERG COAL MINE
EMERY COUNTY, UTAH
1ST AND 2ND WEST
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: MAY 3, 1984
BY: LINDA J GUM
SCALE: 1" = 500'
FIGURE 15

MONSEN ENGINEERING CO. 83541



Area 7

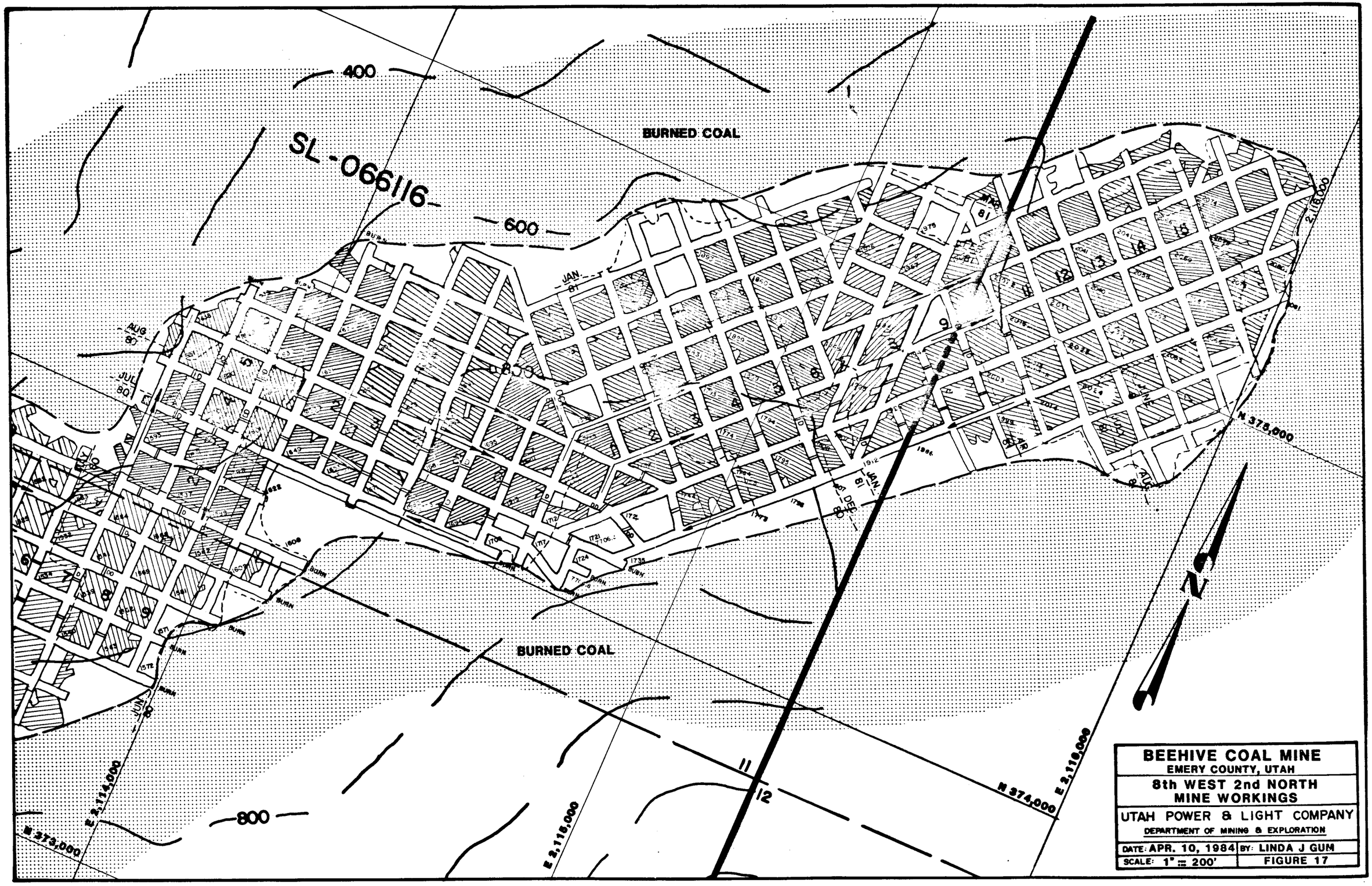
Beehive Mine 8th West Off 2nd North

Pillar extraction mining was terminated in December 1983 in this section of the Beehive Mine. The area is surrounded by burned coal (Figure 17).

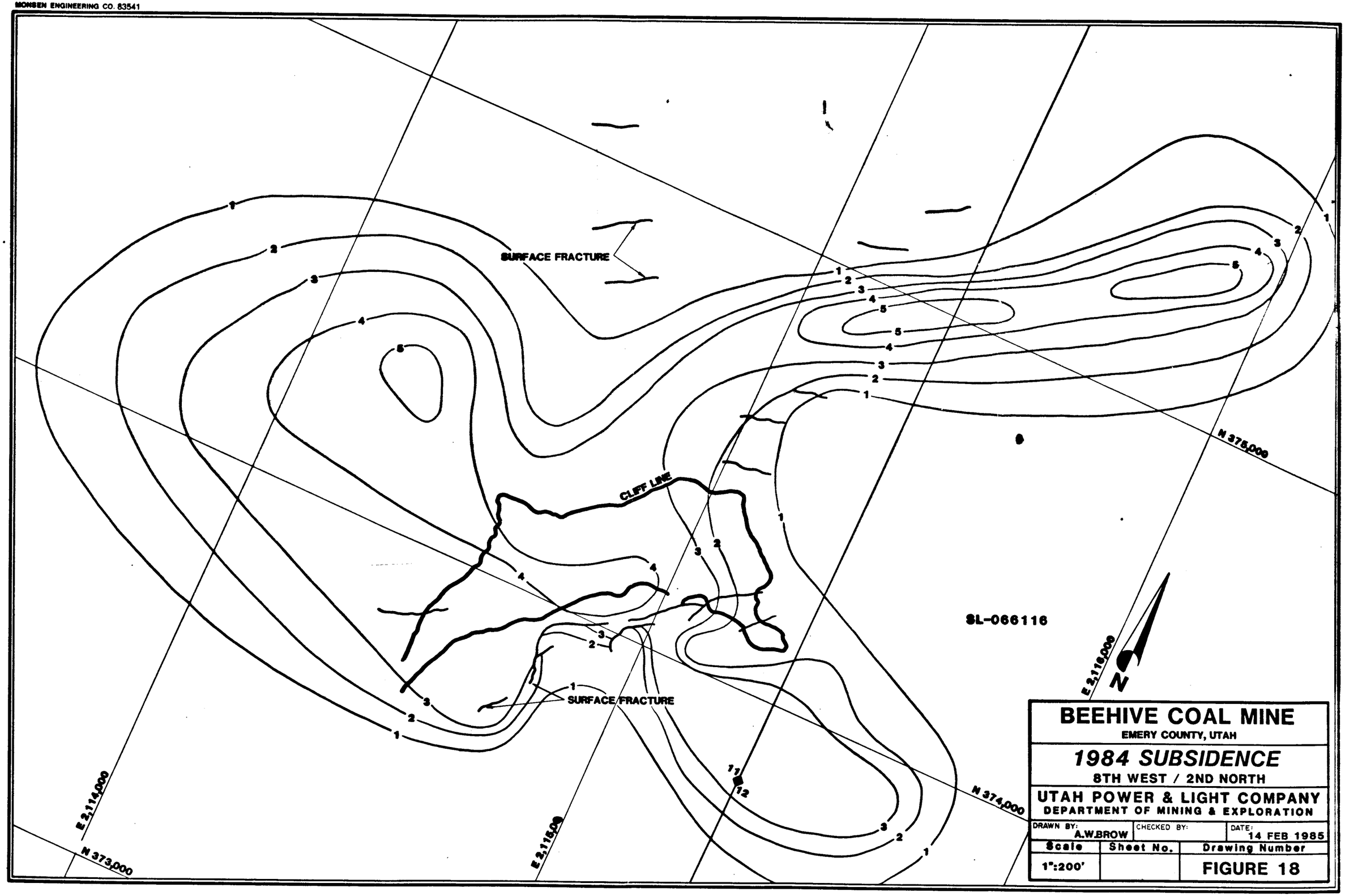
During the period from August 1983 to August 1984 very little additional subsidence was noted and the area appears to have stabilized. Maximum subsidence has not increased over the 5 feet that had occurred as of August 1983 (Figure 18).

In general, the subsidence in this section is located directly over the abandoned workings except for an area to the south which has dropped up to three feet; probably due to crushing of clinker beds. In the northeastern portion of the area the subsidence is confined to a narrow belt well within the mined zone even though the workings are surrounded by burned coal. For these reasons it has not been possible to calculate a reliable angle of draw.

The strata here lack adequate recharge and are dry. Therefore, it is not expected that the subsidence will influence the hydrology of the area.


400
600
800
SL-066116
BURNED COAL
BURNED COAL
BURN
JAN 81
AUG 80
JUL 80
JUN 80
DEC 80
N 378,000
N 374,000
N 373,000
E 2,114,000
E 2,116,000
E 2,118,000
N
BEEHIVE COAL MINE
EMERY COUNTY, UTAH
8th WEST 2nd NORTH
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: APR. 10, 1984
BY: LINDA J GUM
SCALE: 1" = 200'
FIGURE 17

MONSEN ENGINEERING CO. 83541



BEEHIVE COAL MINE

EMERY COUNTY, UTAH

1984 SUBSIDENCE

8TH WEST / 2ND NORTH

UTAH POWER & LIGHT COMPANY

DEPARTMENT OF MINING & EXPLORATION

DRAWN BY:	CHECKED BY:	DATE:
A.W.BROW		14 FEB 1985
Scale	**Sheet No.**	**Drawing Number**
1":200'		FIGURE 18

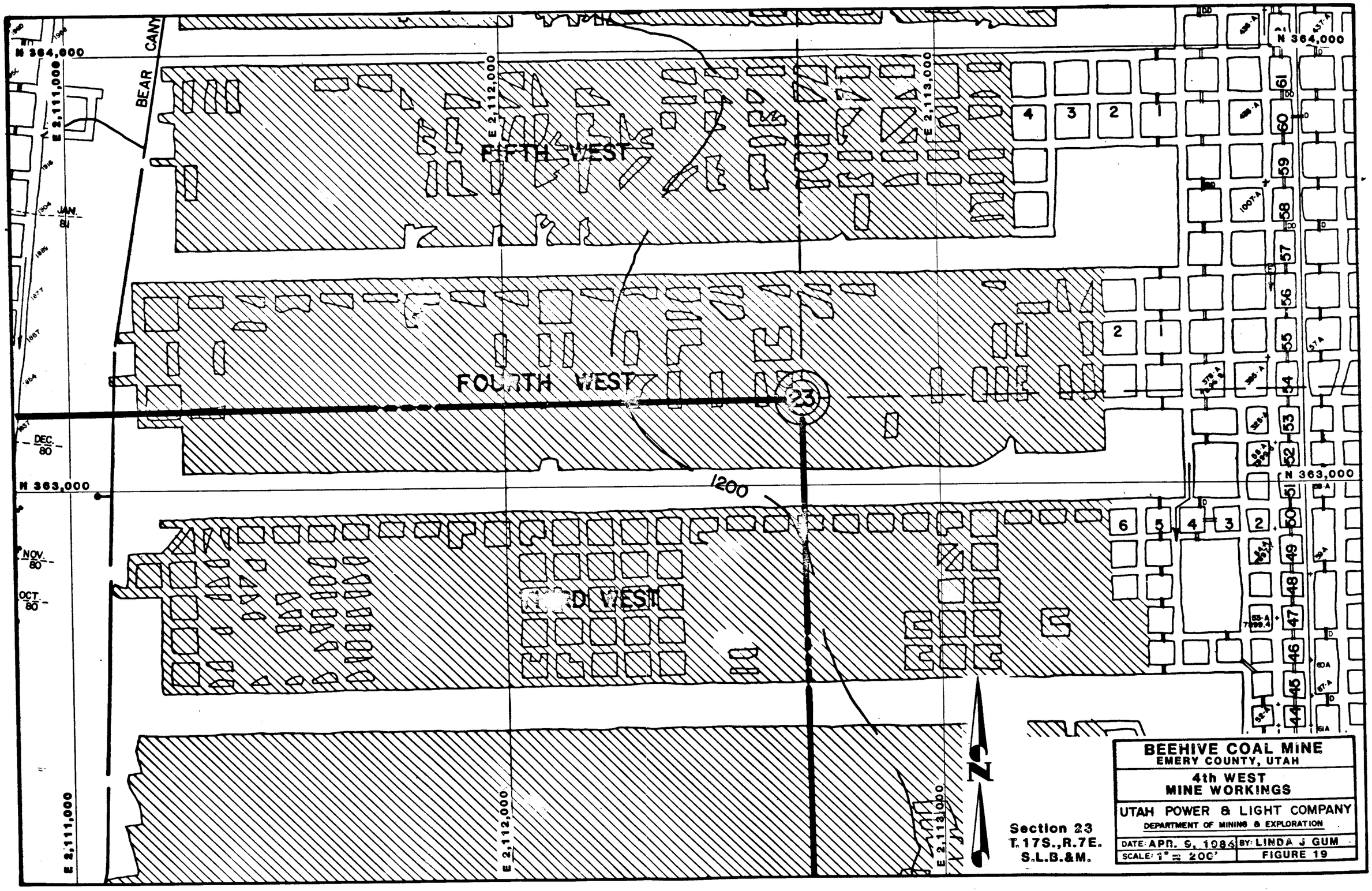
Area 8

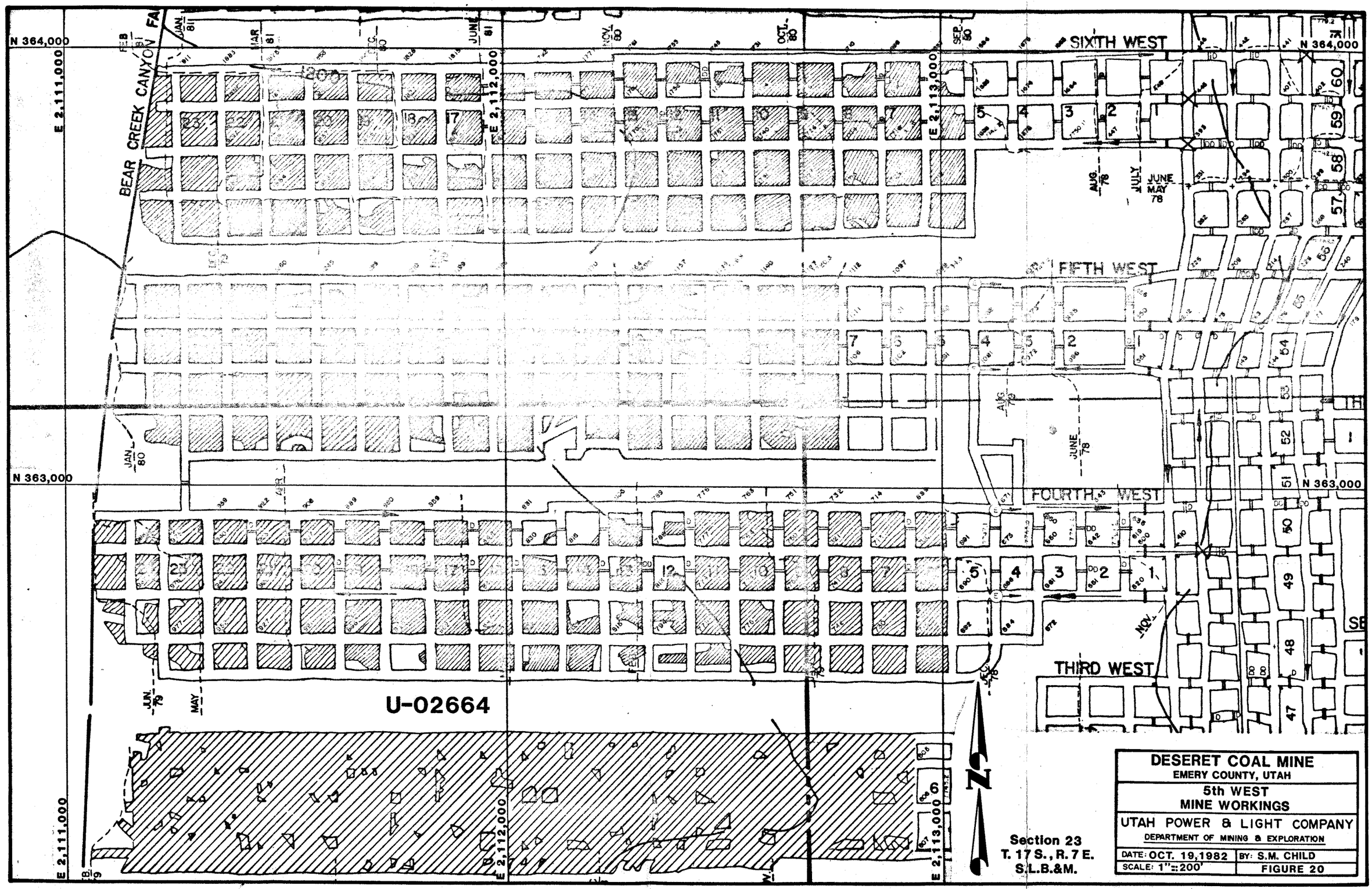
Beehive 4th West - Deseret 5th West

Mining in these sections of both the Beehive and Deseret Mines was completed before August of 1981. Up to 18 total feet of coal was mined from the two seams and pillars were extracted allowing the mine workings to collapse (Figures 19 and 20).

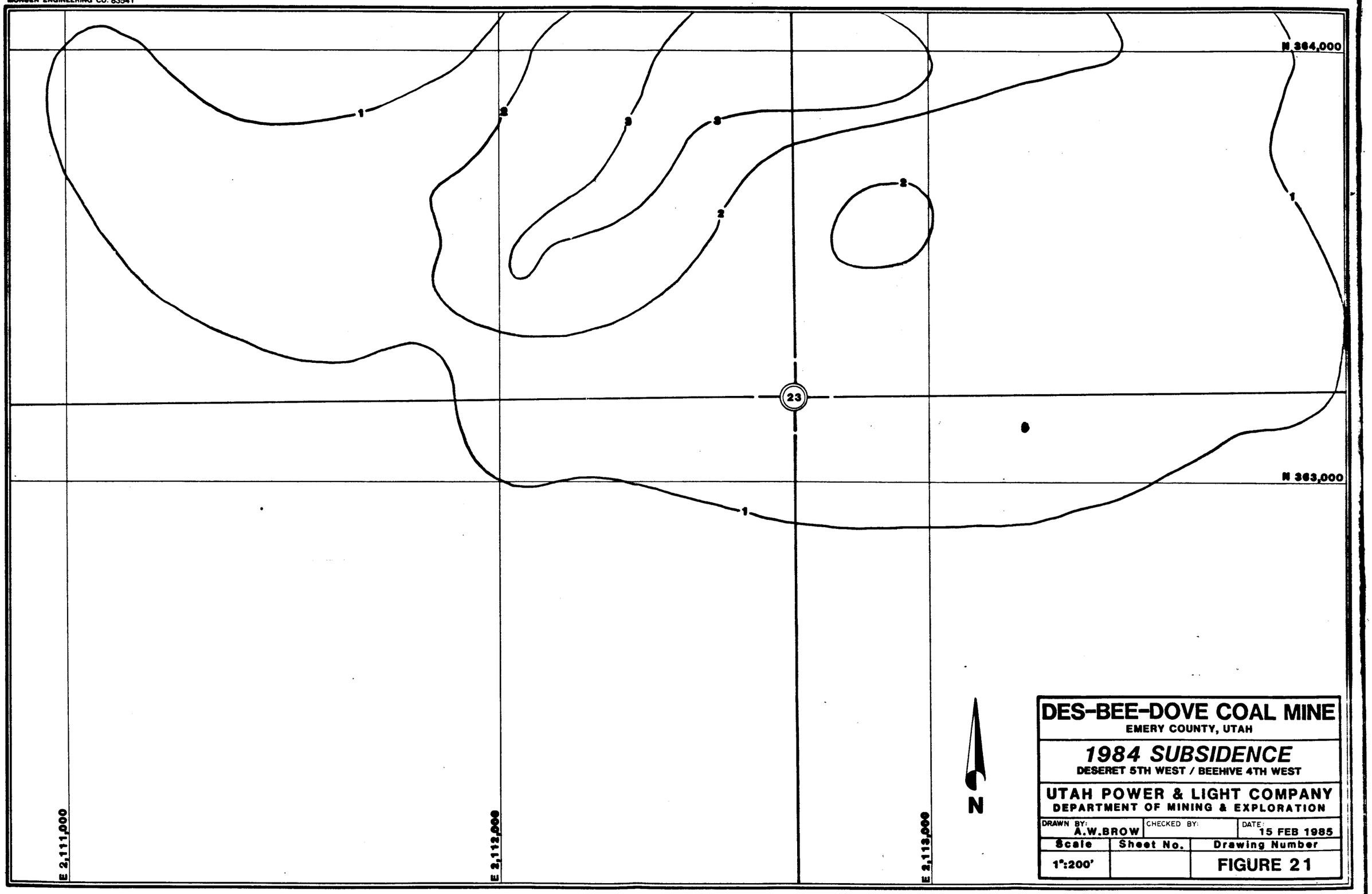
Subsidence increased over the monitoring period to a maximum of just over 3 feet (Figure 21). No surface fractures or other visible effects have ever been seen in the area. Because the subsidence is, for the most part, confined within the area of mined out workings, no accurate estimate of angle of draw is possible yet.

No springs are located in this area and it is believed that the subsidence has not affected the hydrology.


N 364,000
N 363,000
E 2,111,000
E 2,112,000
E 2,113,000
BEAR CANY
FIFTH WEST
FOURTH WEST
THIRD WEST
1200
JAN. 81
DEC. 80
NOV. 80
OCT. 80
N
BEEHIVE COAL MINE
EMERY COUNTY, UTAH
4th WEST
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: APR. 9, 1984
BY: LINDA J GUM
SCALE: 1" = 200'
FIGURE 19
Section 23
T.17S.,R.7E.
S.L.B.&M.


N 364,000
N 363,000
E 2,111,000
E 2,112,000
E 2,113,000
BEAR CREEK CANYON
SIXTH WEST
FIFTH WEST
FOURTH WEST
THIRD WEST
U-02664
N
Section 23
T. 17 S., R. 7 E.
S.L.B.&M.
DESERET COAL MINE
EMERY COUNTY, UTAH
5th WEST
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: OCT. 19, 1982
BY: S.M. CHILD
SCALE: 1" = 200'
FIGURE 20

MONSEN ENGINEERING CO. 83541



DES-BEE-DOVE COAL MINE

EMERY COUNTY, UTAH

1984 SUBSIDENCE

DESERET 5TH WEST / BEEHIVE 4TH WEST

UTAH POWER & LIGHT COMPANY

DEPARTMENT OF MINING & EXPLORATION

DRAWN BY: A.W.BROW	CHECKED BY:	DATE: 15 FEB 1985
Scale	Sheet No.	Drawing Number
1":200'		FIGURE 21

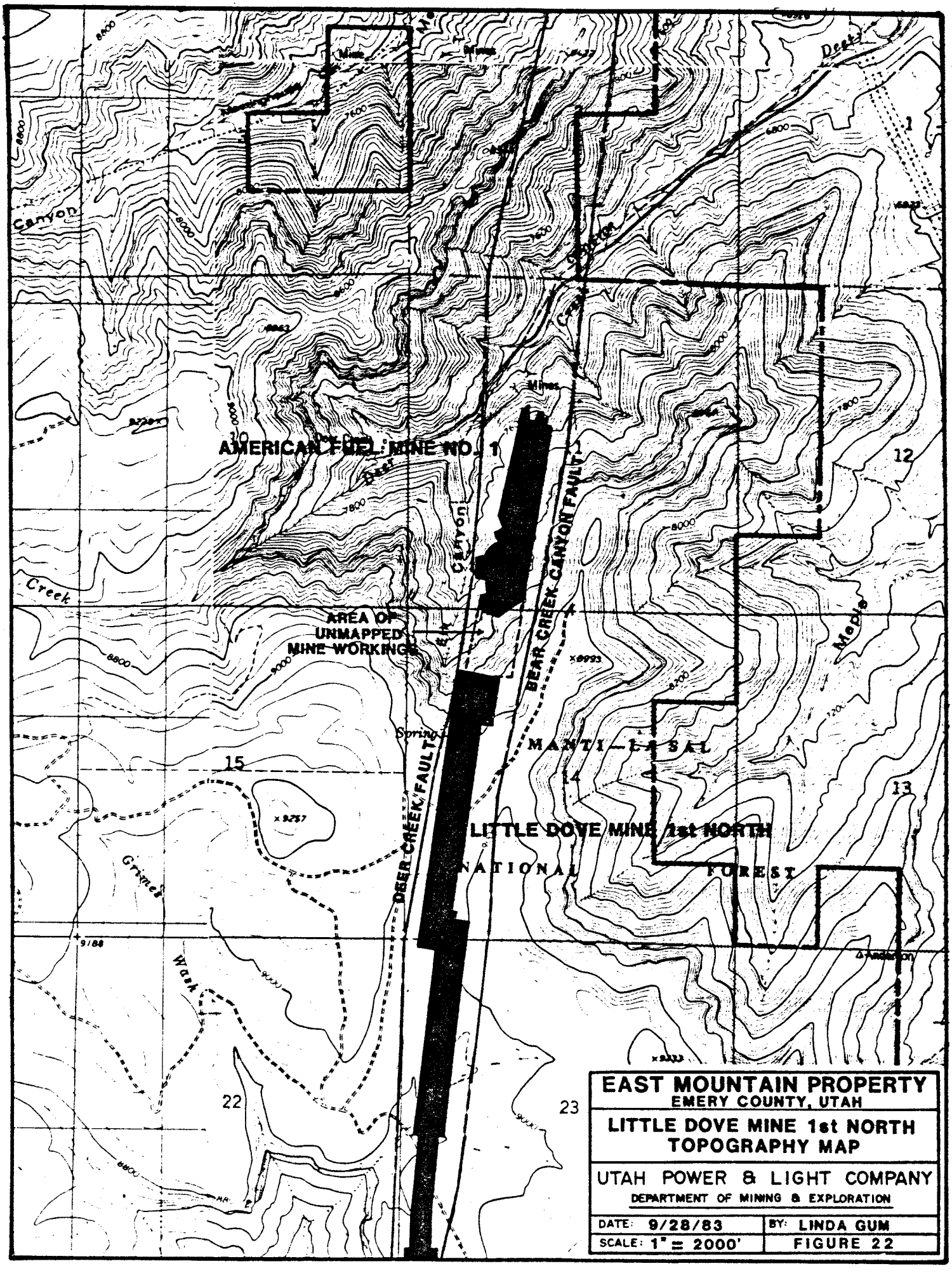
Areas 9 and 10

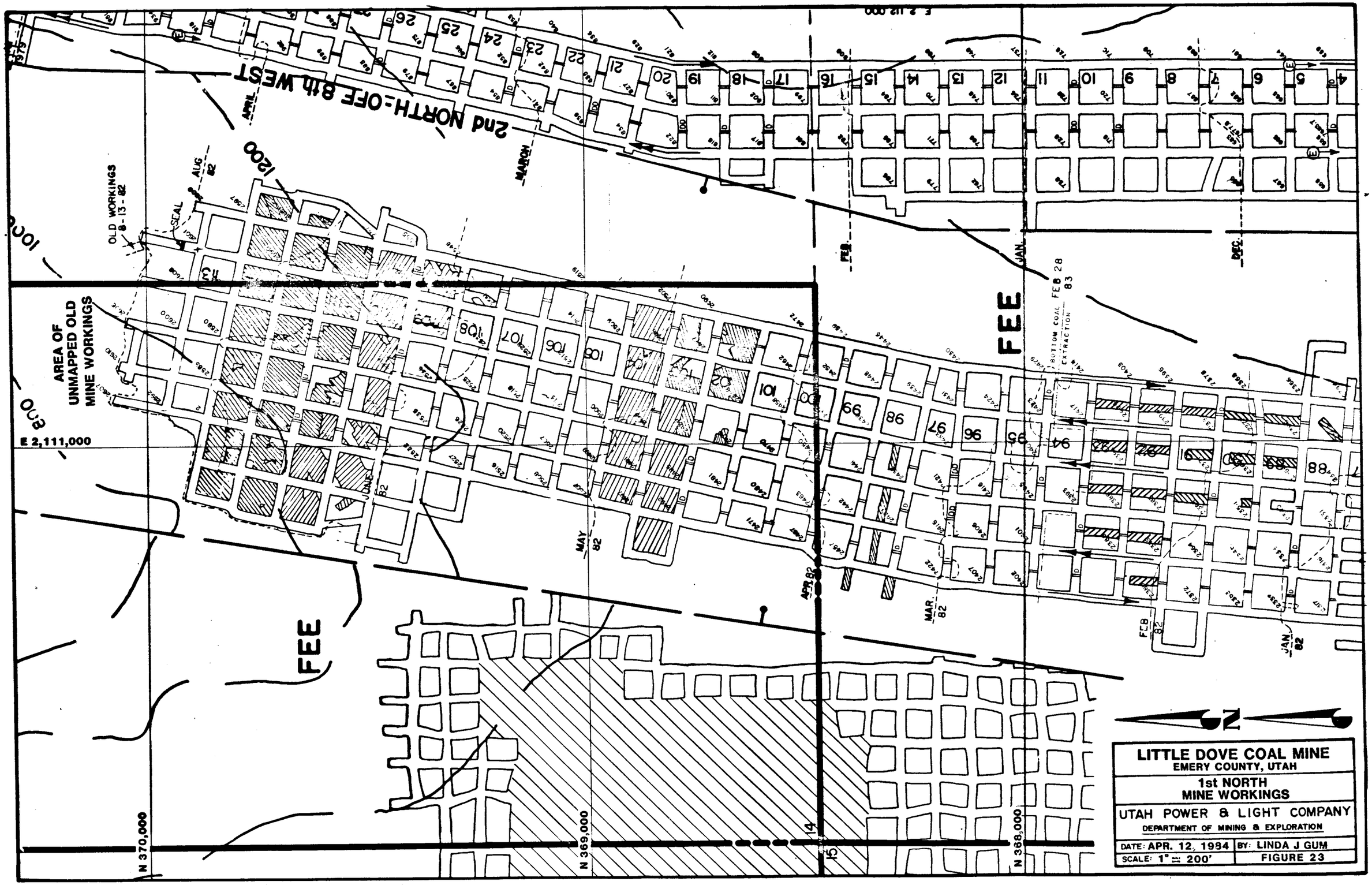
Little Dove 1st North - Old American Fuels Mine

The Little Dove Mine and old American Fuel Mine are both located in a graben formed by the Deer Creek and Bear Creek Canyon Faults (see Figure 22). In August of 1982 the 1st North section of the Little Dove Mine intersected the old American Fuel Mine workings about 1,000 feet south of where available maps had indicated that they extend. Mining conditions in that area of Little Dove revealed that strata were highly stressed. In some cases pillars were crushed before they could be extracted.

Maximum subsidence over the 1st North Little Dove workings remained at 2 feet in 1984 over an area of partial pillar extraction (compare Figures 23 and 24). The 3 feet of subsidence seen on Figure 24 actually occurs over the adjacent mined out workings of the Deer Creek and Wilberg Mines (Area 1).

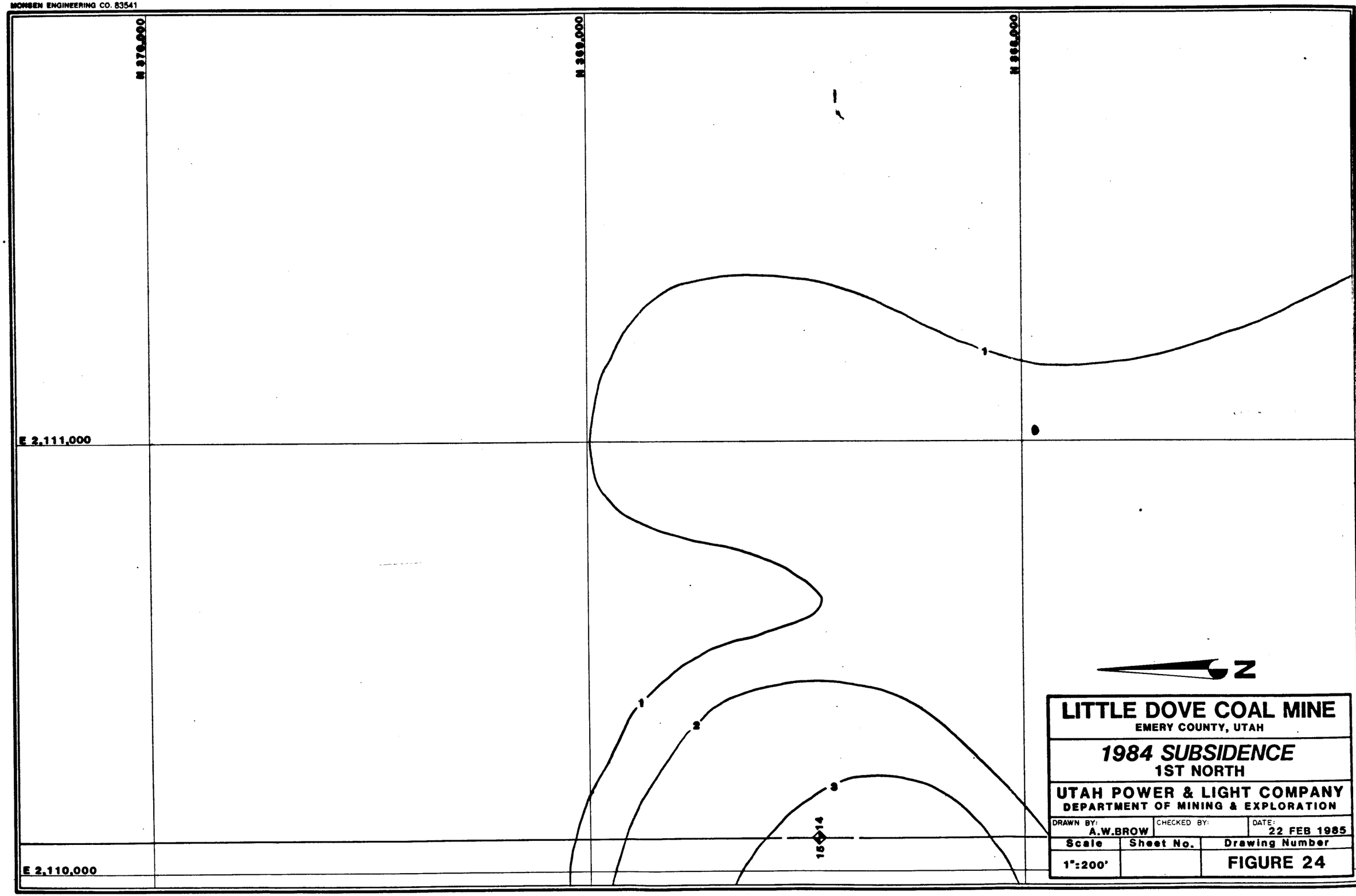
Over the old American Fuels Mine workings subsidence has occurred in an area where surface fractures were discovered in 1982 (Figures 25 and 26). These fractures trend in a northeast direction; the largest marks the surface trace of the Bear Creek Canyon Fault. Maximum subsidence over this section is still 4 feet, same as 1983, so the area appears to have stabilized. On the east side of the area of subsidence the angle of draw has been calculated to be 8° or less. The subsidence has not affected the hydrology of the area in any way.


AMERICAN FUEL MINE NO. 1
AREA OF UNMAPPED MINE WORKINGS
BEAR CREEK CANYON FAULT
DEER CREEK FAULT
LITTLE DOVE MINE 1st NORTH
MANTI-LA SAL
NATIONAL FOREST
Canyon
Creek
Grimes
Wash
Spring
Mines
Deer
Maple
Anderson
10
11
12
13
14
15
22
23
EAST MOUNTAIN PROPERTY
EMERY COUNTY, UTAH
LITTLE DOVE MINE 1st NORTH
TOPOGRAPHY MAP
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: 9/28/83
BY: LINDA GUM
SCALE: 1" = 2000'
FIGURE 22



2nd NORTH-OFF 8th WEST
AREA OF UNMAPPED OLD MINE WORKINGS
OLD WORKINGS 8-13-82
SEAL
AUG 82
APRIL
MARCH
FEB.
JAN.
DEC.
FEE
BOTTOM COAL EXTRACTION
FEB 28 83
E 2,111,000
E 2,112,000
N 370,000
N 369,000
N 368,000
JUNE 82
MAY 82
APR 82
MAR 82
FEB 82
JAN 82
N
LITTLE DOVE COAL MINE
EMERY COUNTY, UTAH
1st NORTH
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: APR. 12, 1984
BY: LINDA J GUM
SCALE: 1" = 200'
FIGURE 23

MONSEN ENGINEERING CO. 83541



LITTLE DOVE COAL MINE

EMERY COUNTY, UTAH

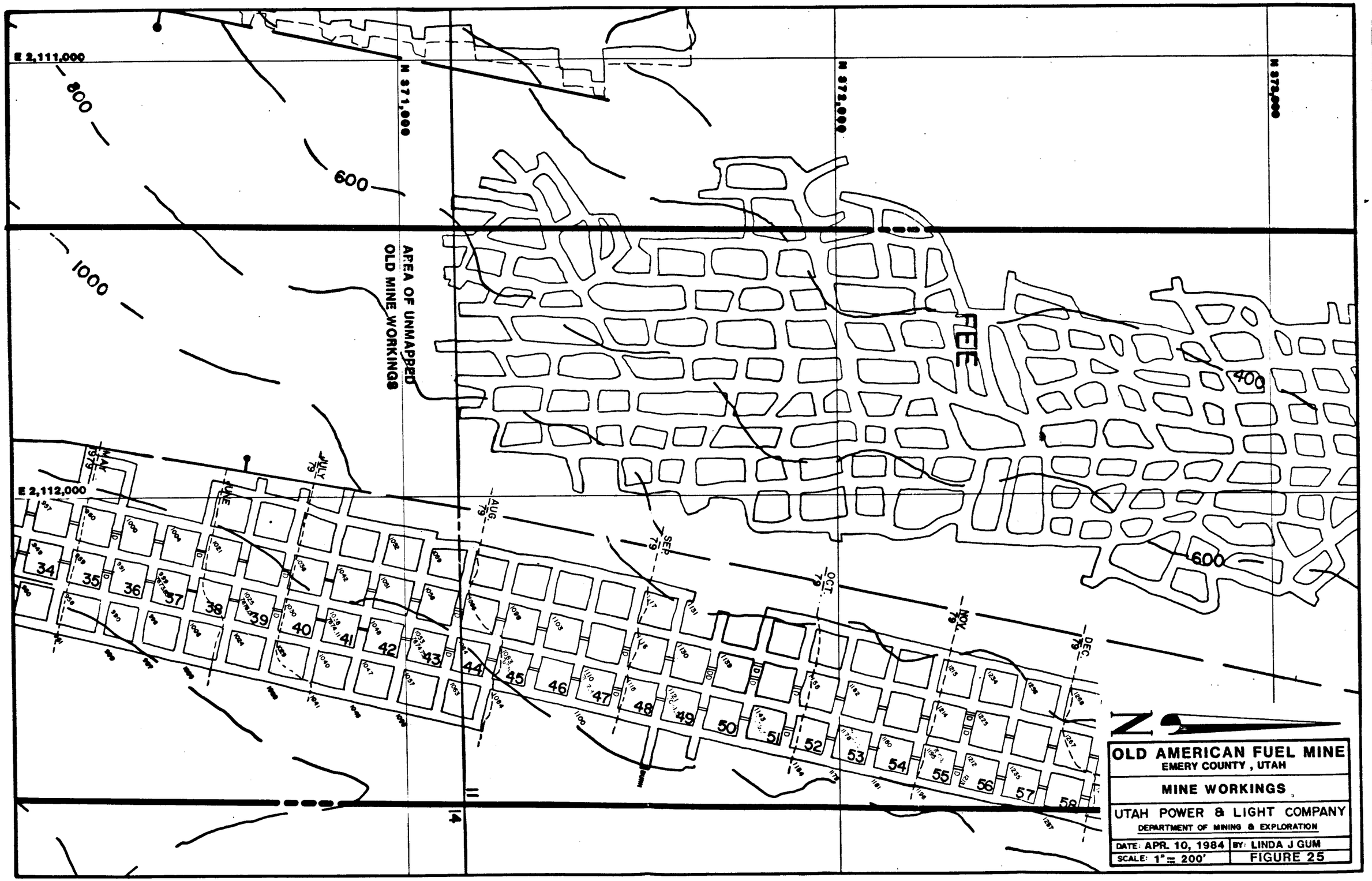
1984 SUBSIDENCE

1ST NORTH

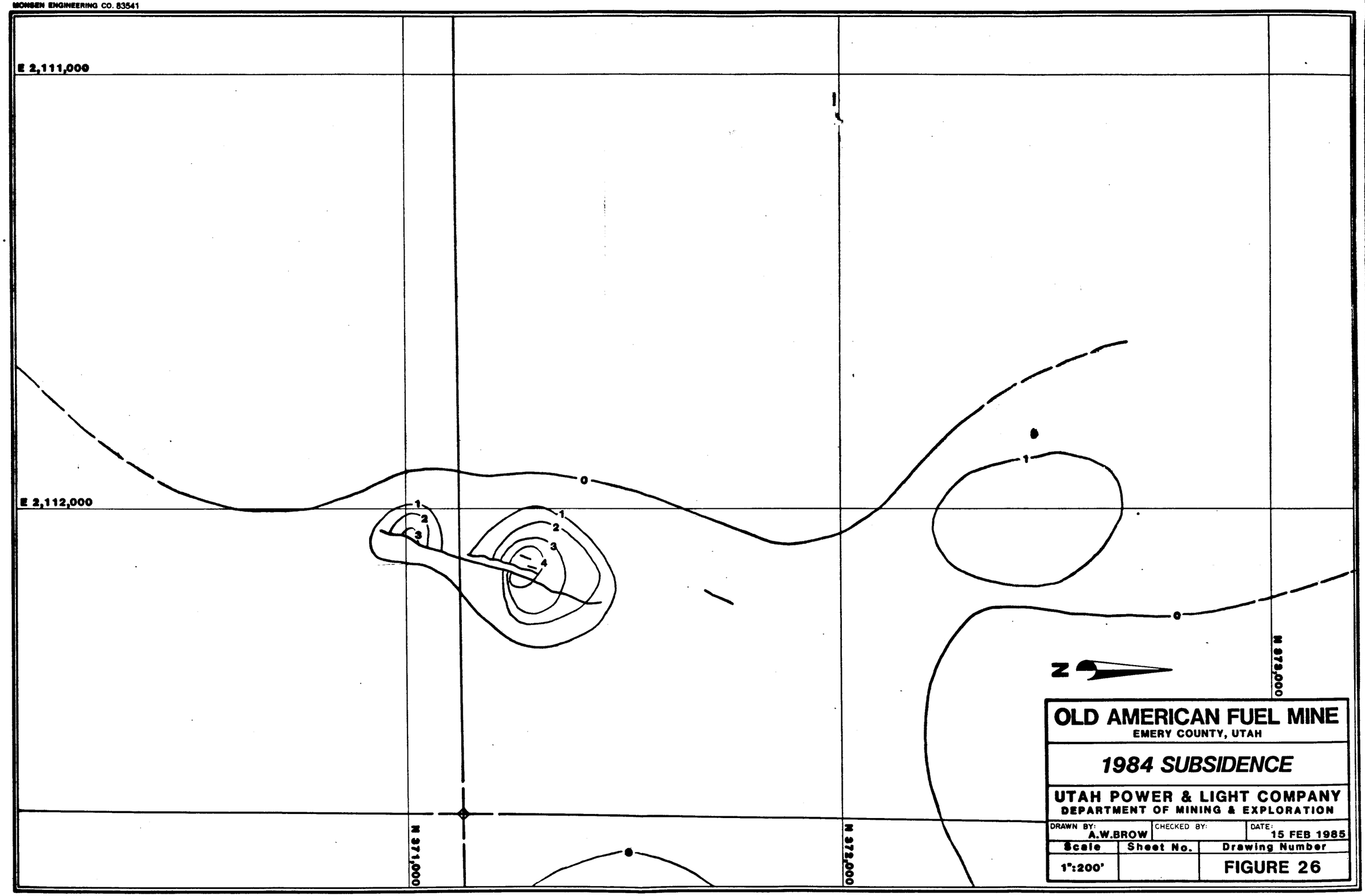
UTAH POWER & LIGHT COMPANY

DEPARTMENT OF MINING & EXPLORATION

DRAWN BY: A.W.BROW	CHECKED BY:	DATE: 22 FEB 1985
Scale	Sheet No.	Drawing Number
1":200'		FIGURE 24


E 2,111,000
E 2,112,000
N 371,000
N 372,000
N 373,000
800
600
1000
400
600
AREA OF UNMAPPED OLD MINE WORKINGS
FEE
MAY 79
JUNE
JULY 79
AUG. 79
SEPT. 79
OCT. 79
NOV. 79
DEC. 79
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
OLD AMERICAN FUEL MINE
EMERY COUNTY, UTAH
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: APR. 10, 1984
BY: LINDA J GUM
SCALE: 1" = 200'
FIGURE 25

MONSEN ENGINEERING CO. 83541



Other Studied Areas

No surface disturbance or subsidence was observed over any other areas studied for subsidence on East Mountain during the period from August 1983 to August 1984 (Areas 11, and 12; Figure 2). These areas will continue to be monitored as mining continues.

Predicted Maximum Subsidence

Using methods developed by the British National Coal Board (NCB) we have attempted to make a comparison between observed and predicted maximum subsidence for the various areas on UP&L's property. The NCB method utilizes graphs compiled from numerous field observations and takes into consideration the length and width of the mined-out area, thickness of coal extracted and depth of cover. The method is claimed to be correct to ± 10% in the majority of cases. The table below compares predicted maximum subsidence with observed subsidence for areas on East Mountain.

Area	Subsidence	
	Predicted Maximum	Observed
DC 9E/W 1R*	8.9'	23.4'
DC 5-8E/W 6-12R	14.2'	11.3'
DC 1N	6.0'	3.3'
DC 2-5R	7.6'	5.6'
DC 2-5L	8.3'	4.4'
W 1-2W	5.3'	3.4'
Bee 8W off 2N	7.1'	5.4'
Bee 4W/Des 5W	3.4'	3.4'
LD 1N	2.7'	2.0'
DC 4R Room*	0.4'	4.6'
DC 1R Room*	0.1'	3.5'

* These areas do not fit NCB prediction model.

A quick glance at the above table reveals three areas of anomalously high observed subsidence. These cases do not fit the certain limiting conditions that should exist in order for the NCB method to remain valid. The DC 9th East - Wilberg 1st Right area is surrounded by burned coal and bounded on the east by the Deer Creek Fault. As previously mentioned, crushing of clinker beds and

reactivation of the fault plane have added another complication to the subsidence in this area. The other two anomalies are small room-and-pillar sections off 1st and 4th Right, Deer Creek. In these sections the mined-out area is small compared to the overburden thickness, thus very little, if any, observed subsidence would be expected. Indeed, subsidence of the magnitude detected is very surprising since it has not been detected over other, similar sections.

Some of the remaining areas are approaching their predicted subsidence maxima. Where mining has been completed for several years subsidence is at or near its predicted value. In other sections, on-going mining is enlarging the mined-out area which will not only cause observed subsidence to increase, but also predicted maximum subsidence, by changing the parameters used in its determination.

Future comparisons of this type should help determine if the NCB model is valid for the East Mountain area.

Mitigation of Surface Effects

Over most areas where subsidence has occurred on East Mountain present land use has not been affected in any way. Areas 2, 4, 5, 6 and 8 are good examples of subsidence without visible surface disturbance or adverse hydrologic effects. In such areas no mitigation will be necessary.

In a few areas, such as areas 1, 3 and 7, fractures have been detected. In order to protect livestock UP&L has erected a fence around area 1 where fractures are of sufficient magnitude to pose a threat to wandering cattle. A reclamation plan is being formulated for this area by the U. S. Forest Service. UP&L's compliance with this plan would mitigate any damages there.

In areas 3 and 7, where only minor fracturing has occurred on remote ridges and the present land use has not been effected, more damage would be done by gaining access to and repairing fractures than can be justified, therefore, mitigation is counter-productive in these areas.

Summary

As of August 1984, UP&L has identified ten areas of mining induced subsidence on the East Mountain property. Terrain in the subsidence areas ranges from relatively flat mountain tops with thick overburden of up to 2,100 feet; to steep slopes and cliffs with overburden of less than 200 feet. The most noticeable subsidence occurs in these steep cliff areas where mining next to burned coal appears to have caused crushing of the clinker beds. Most of the fractures observed over mined areas have occurred under these conditions, especially where the Castlegate Sandstone (or similar lithologic unit) crops out or is near the surface. These sandstones yield to stresses by brittle deformation (fracturing). The remaining fractures which have been discovered are reactivated surface traces of the Bear Creek Canyon or Deer Creek faults.

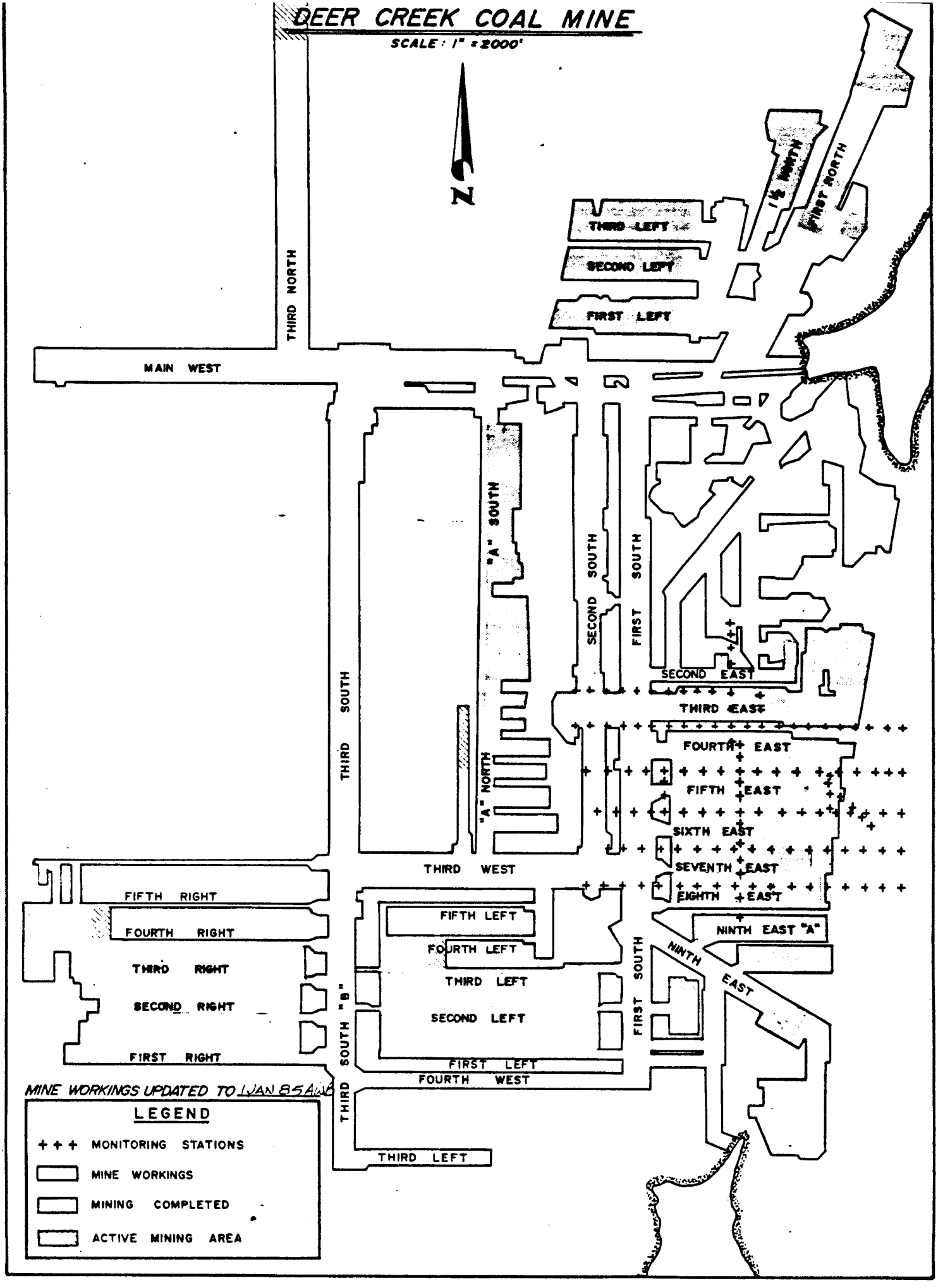
In areas where overburden is thicker and other, more clay-rich formations crop out, longwall and room-and-pillar mining methods have allowed the multiple seam mining of large quantities of coal without apparent impact on the environment because the overburden behaves somewhat plastically. Such areas as the Beehive 4th West - Deseret 5th West sections and the Deer Creek 4th through 8th East - Wilberg 5th and 12th Right longwall panels have demonstrated that subsidence can occur over a broad area with no visua-

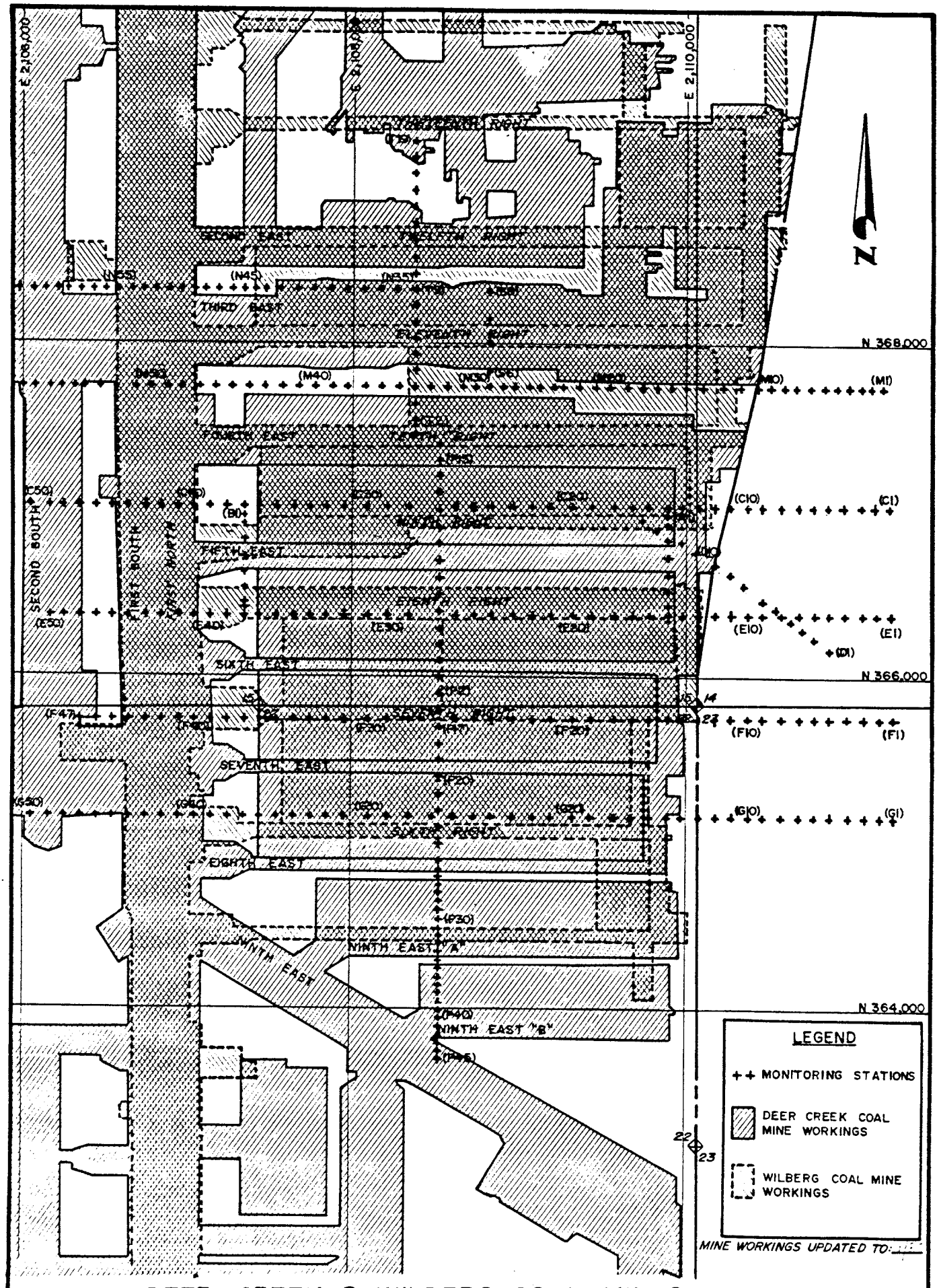
or hydrologic effects. In excess of 80% of the East Mountain property has conditions similar to these areas. It is, therefore, felt that the mining methods being utilized are well suited to the geologic conditions, allowing subsidence to occur without impacting the hydrology or present land use of the area.

An effort was made this year to predict maximum possible subsidence for the various areas where subsidence has been detected. This prediction was then compared with observed subsidence for each area. We hope to be able to use this type of comparison in the future to help determine if the NCB model is valid for East Mountain mining conditions.

APPENDIX

DEER CREEK MINE


DEER CREEK COAL MINE
SCALE: 1" = 2000'
N
THIRD NORTH
MAIN WEST
THIRD LEFT
SECOND LEFT
FIRST LEFT
1½ NORTH
FIRST NORTH
"A" SOUTH
SECOND SOUTH
FIRST SOUTH
SECOND EAST
THIRD EAST
FOURTH EAST
FIFTH EAST
SIXTH EAST
SEVENTH EAST
EIGHTH EAST
NINTH EAST "A"
NINTH EAST
THIRD SOUTH
"A" NORTH
THIRD WEST
FIFTH RIGHT
FOURTH RIGHT
THIRD RIGHT
SECOND RIGHT
FIRST RIGHT
FIFTH LEFT
FOURTH LEFT
THIRD LEFT
SECOND LEFT
FIRST LEFT
FOURTH WEST
THIRD SOUTH "B"
THIRD LEFT
MINE WORKINGS UPDATED TO 1 JAN 85 AWB
LEGEND
+ + + MONITORING STATIONS
MINE WORKINGS
MINING COMPLETED
ACTIVE MINING AREA



DEER CREEK & WILBERG COAL MINES

SCALE: 1" = 800'

1984 DEER CREEK/WILBERG
SUBSIDENCE RESEARCH SUMMARY REPORT

Surveys of the Deer Creek/Wilberg subsidence monitoring network for 1984 began in June. Below are details concerning the monitoring of the subsidence network.

WILBERG

One traverse survey and eight level surveys were performed at the Wilberg subsidence monitoring network in 1984. The results obtained from these surveys indicate that subsidence continued on each of the monitoring lines. Below is a table of the maximum amount of subsidence that occurred over each monitoring line during 1984.

Station Name	W Subsidence (ft)
M29	3.9
N35	2.3
P6	4.2
S8	4.2
T8	3.2

As part of the surveying programs carried out in 1984, the S-point and Z-point strain rosettes were also monitored. The results obtained from these measurements indicate that the horizontal strains in the area of the rosettes are large enough by NCB standards to be considered damaging to surface structures. The largest magnitude of strain calculated was approximately 0.004 tension. Not all of the data collected in 1984 from the strain rosettes have been analyzed; it is anticipated that an even larger value for the maximum strains will be obtained over the midpoint of the 12th Right panel. Surveys indicated that BM8, a control station, was moving with respect to other control points in the network. It was determined that BM8 was subsiding due to mining in the Des-Pee-Dove mines. Therefore, since each

survey that tied into BM8 was also tied into other control points, adjustments were made on the survey data to eliminate the error induced by the movement of BM8. The fact that each survey performed in 1984 was tied into more than one control point enabled us to recover surveys that otherwise might have been lost.

DEER CREEK

Five level surveys were performed at the Deer Creek subsidnece monitoring network in 1984. The results obtained from these surveys indicate that each monitoring line continued to subside. Below is a table of the maximum amount of subsidence that occurred over each monitoring line during 1984.

Station Name	W Subsidence (ft)
A1	0.8
B6	0.3
C26	1.2
D13	0.8
E31	2.2
F26	6.0
G29	2.9
P19	6.2

The subsidence profiles for these lines are attached.

The angle-of-draw has been calculated for the fifth-, sixth-, seventh-, and eighth-east longwall panels of the Deer Creek Mine. The angle-of-draws for the east ends of panels 5E, 6E, 7E, and 8E are 16°, 18°, 35°, and 27°, respectively. The angle-of-draws for the west ends of panels 5E, 6E, 7E, and 8E are 16°, 31°, 33°, and 21°, respectively. Note that the angle-of-draw values average far less than the 35° average used by the National Coal Board.

It is apparent that the Deer Creek fault has an effect on the subsidence at the Deer Creek/Wilberg monitoring site. The fault passes through the

C-line approximately at monument C12; the E-line at monument E13; the F-line at monument F12; and the G-line at monument G13. The fault line at mine level is located approximately 75 to 100 ft east of the fault line at the surface (see attached map).

GENERAL

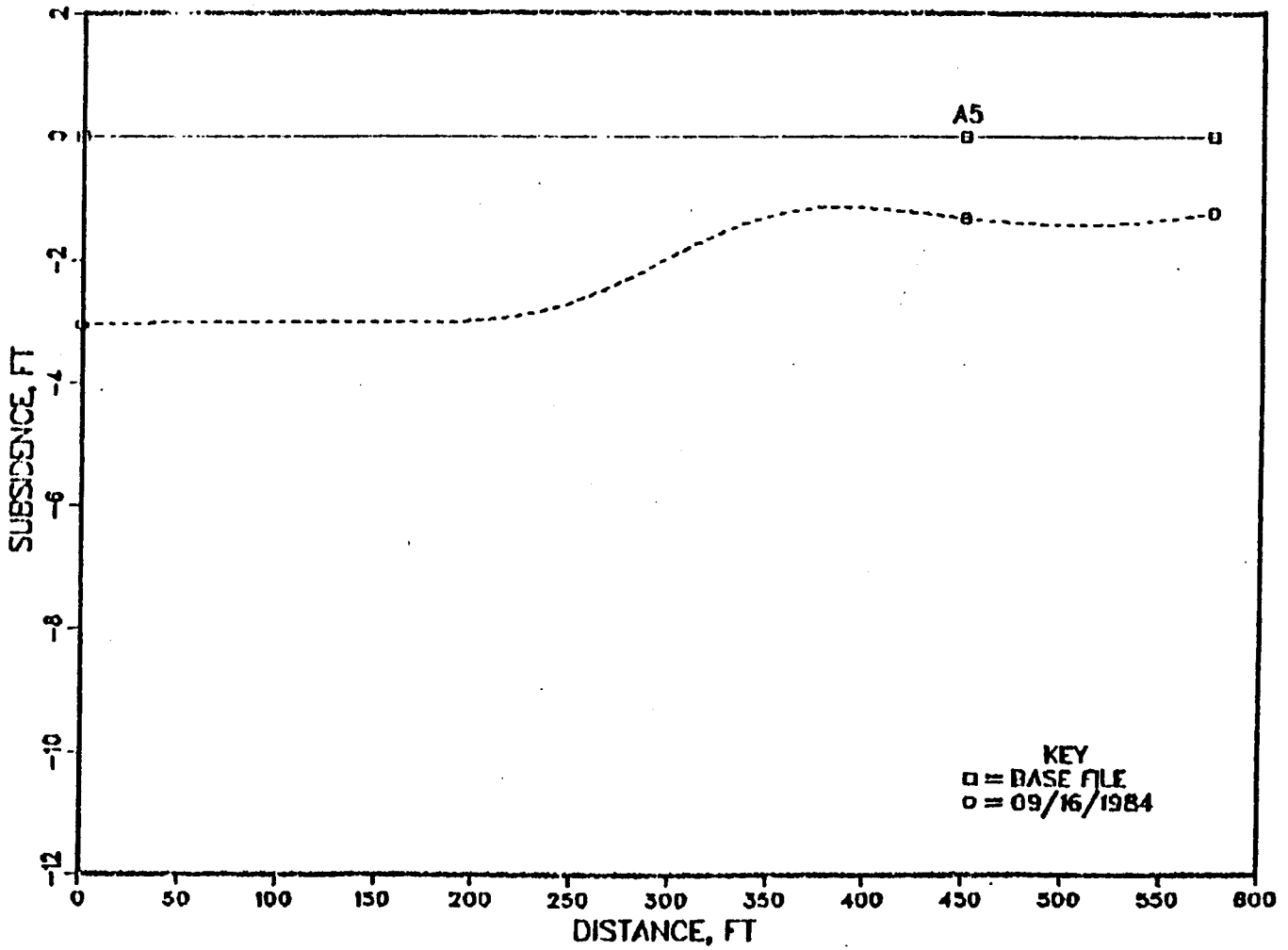
A report of investigations will be completed this summer and will contain an analysis of the data obtained from the Deer Creek monitoring site. Before this publication is completed, however, approximately four additional surveys will be performed over the entire monitoring network. These surveys will be performed this spring and summer when the site is accessible.

Unfortunately, a lack of funding will prohibit the Bureau from preparing a report concerning the subsidence resulting from the multiple seam mining in the Deer Creek/Wilberg Mine. All Bureau subsidence research in the western U.S. will end in September, 1985. However, reports on the results of the Deer Creek Mine monitoring program and the strain rosette experiment over the Wilberg Mine will be completed.

A listing of all level surveys performed on the Deer Creek and Wilberg monitoring networks in are attached.

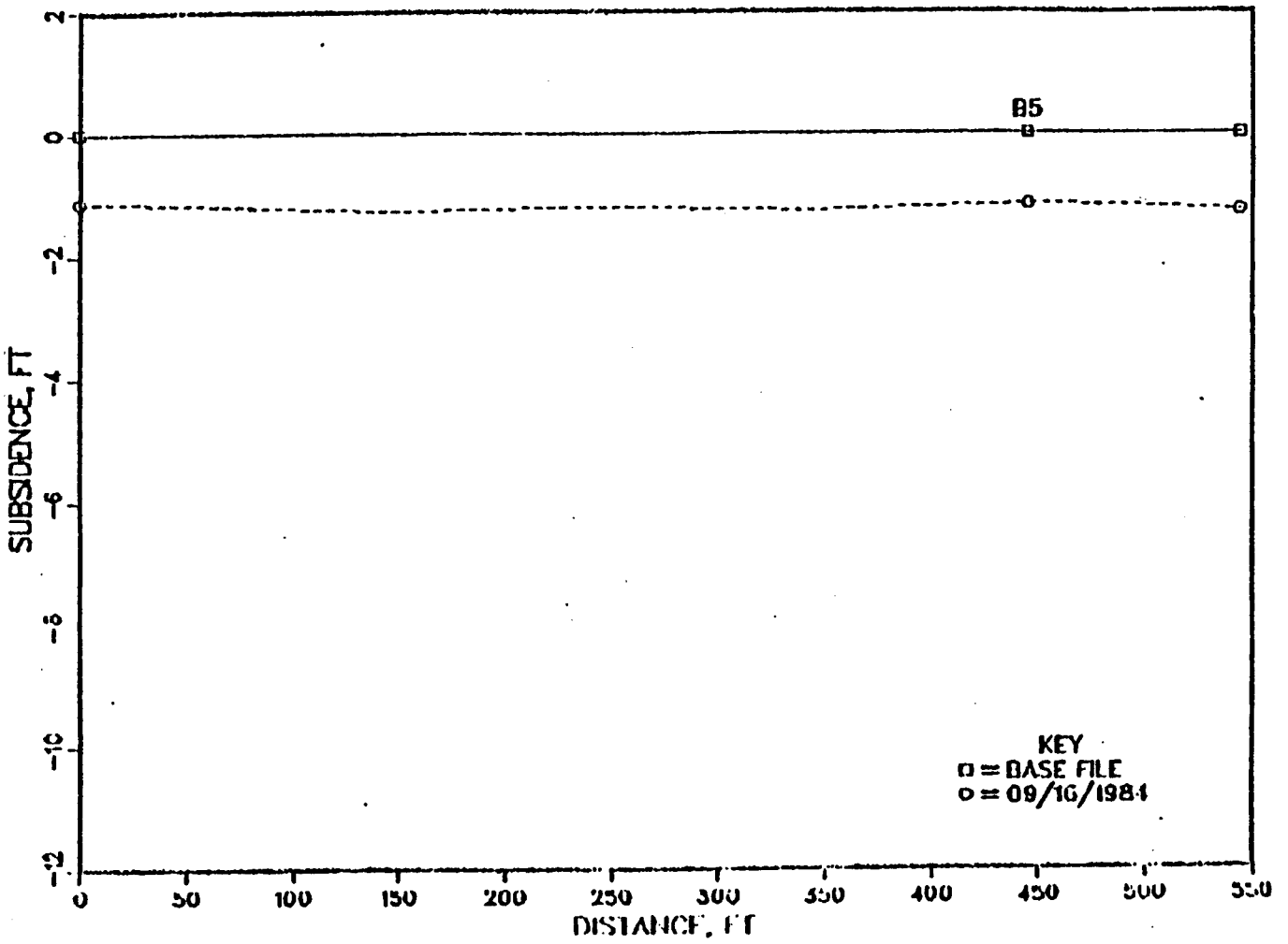
DEER CREEK MINE

A-LINE PROFILE



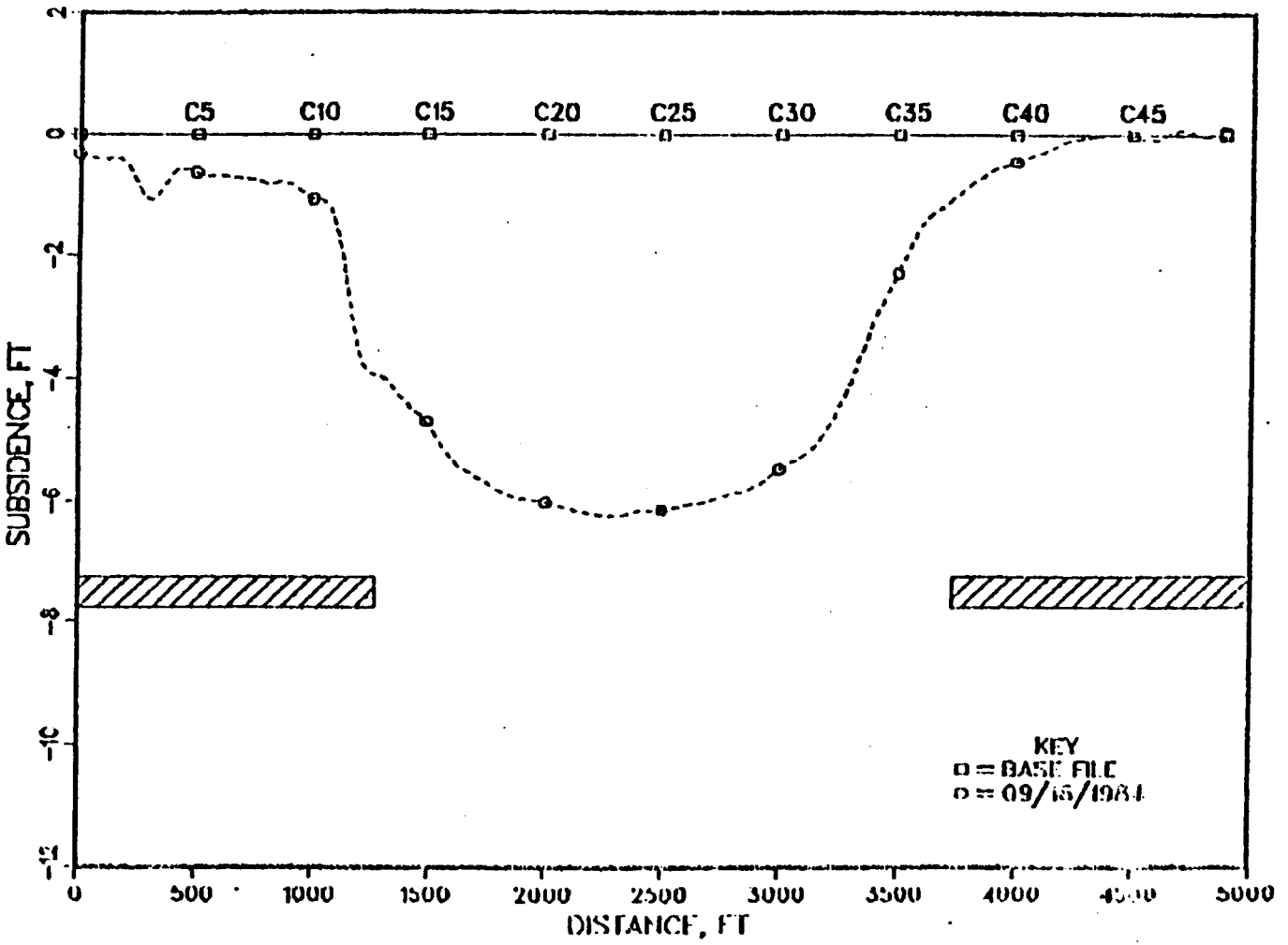
DEER CREEK MINE

B-LINE PROFILE



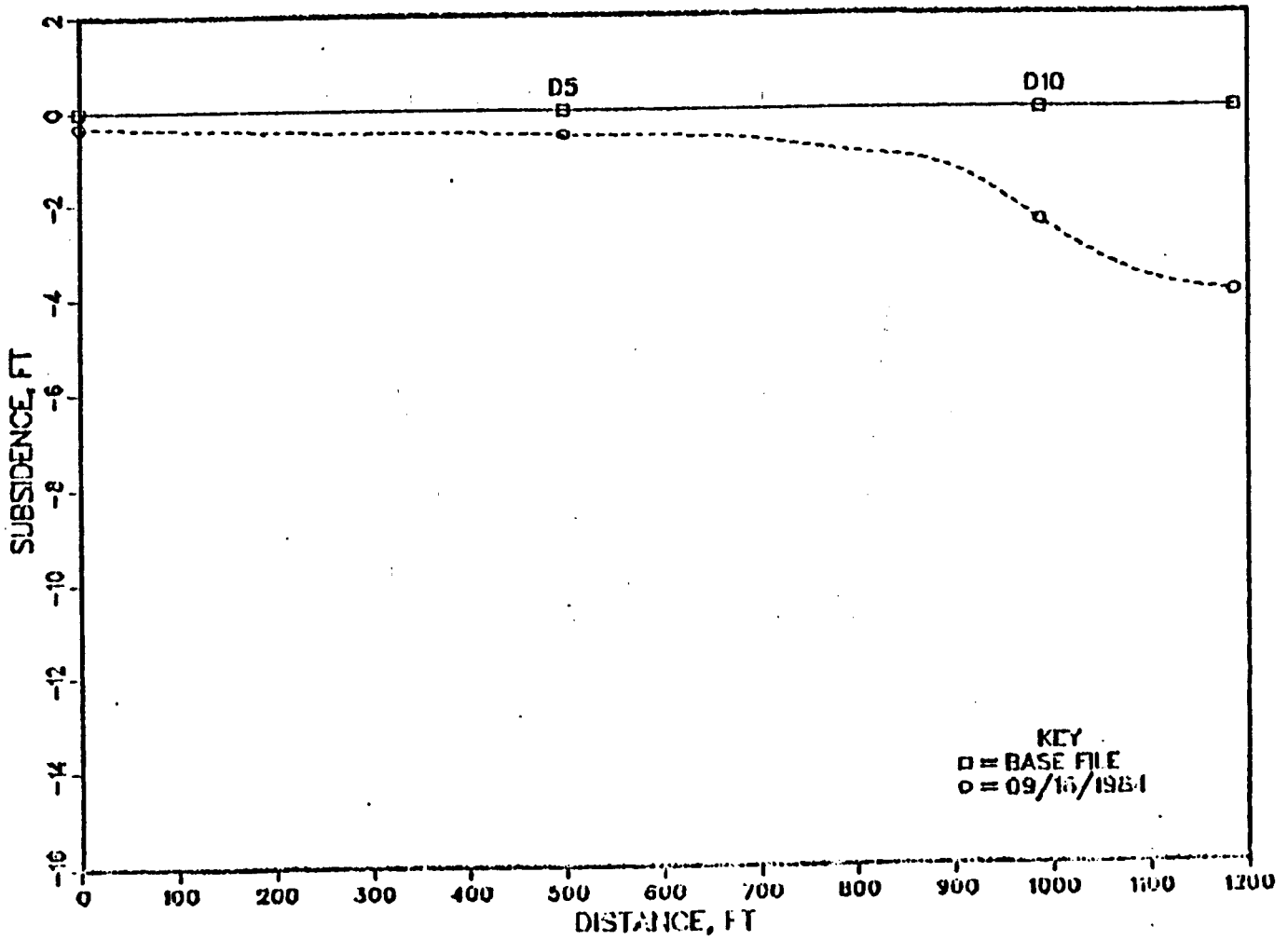
DEER CREEK MINE

C-LINE PROFILE



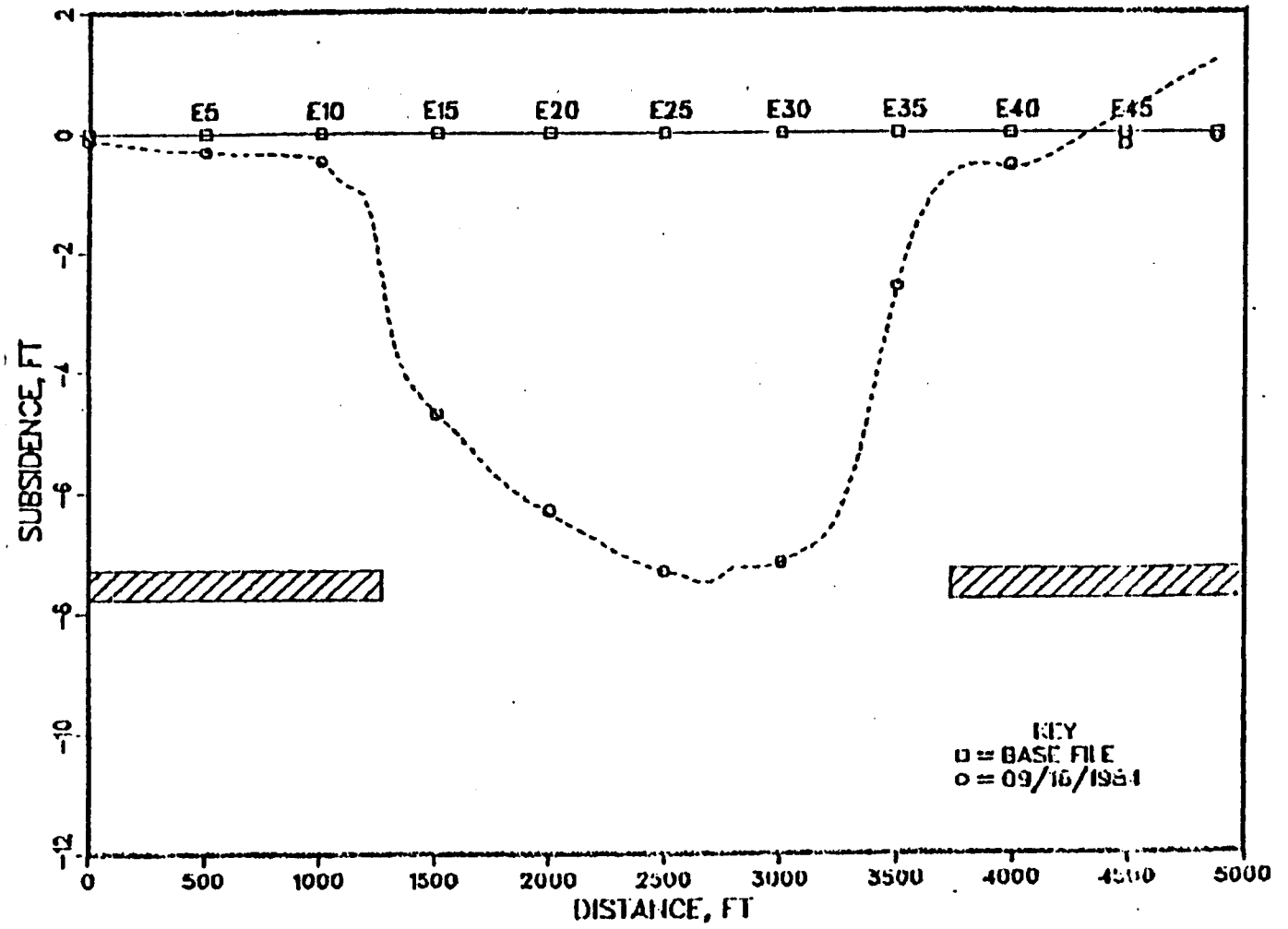
DEER CREEK MINE

D-LINE PROFILE



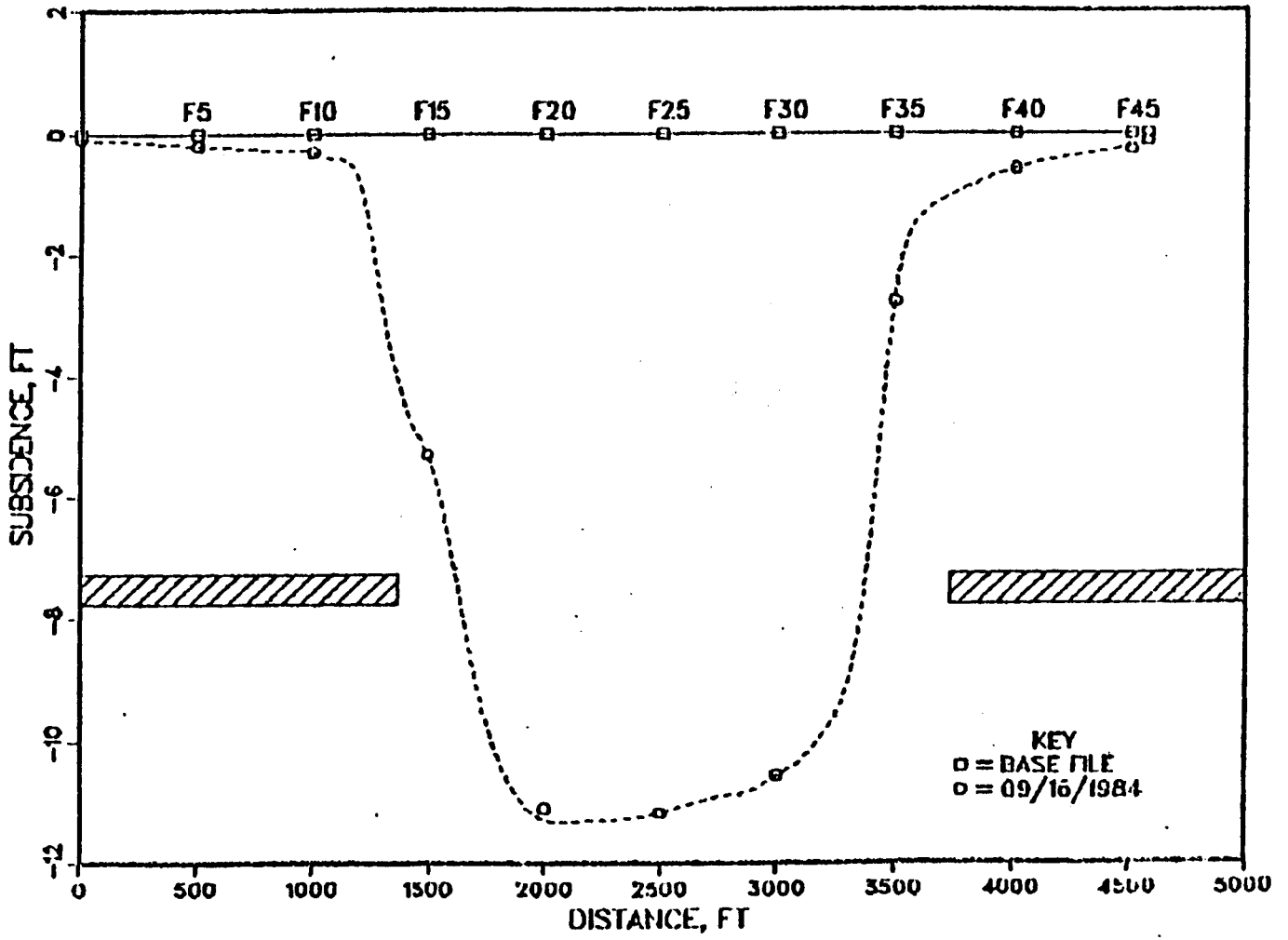
DEER CREEK MINE

E-LINE PROFILE



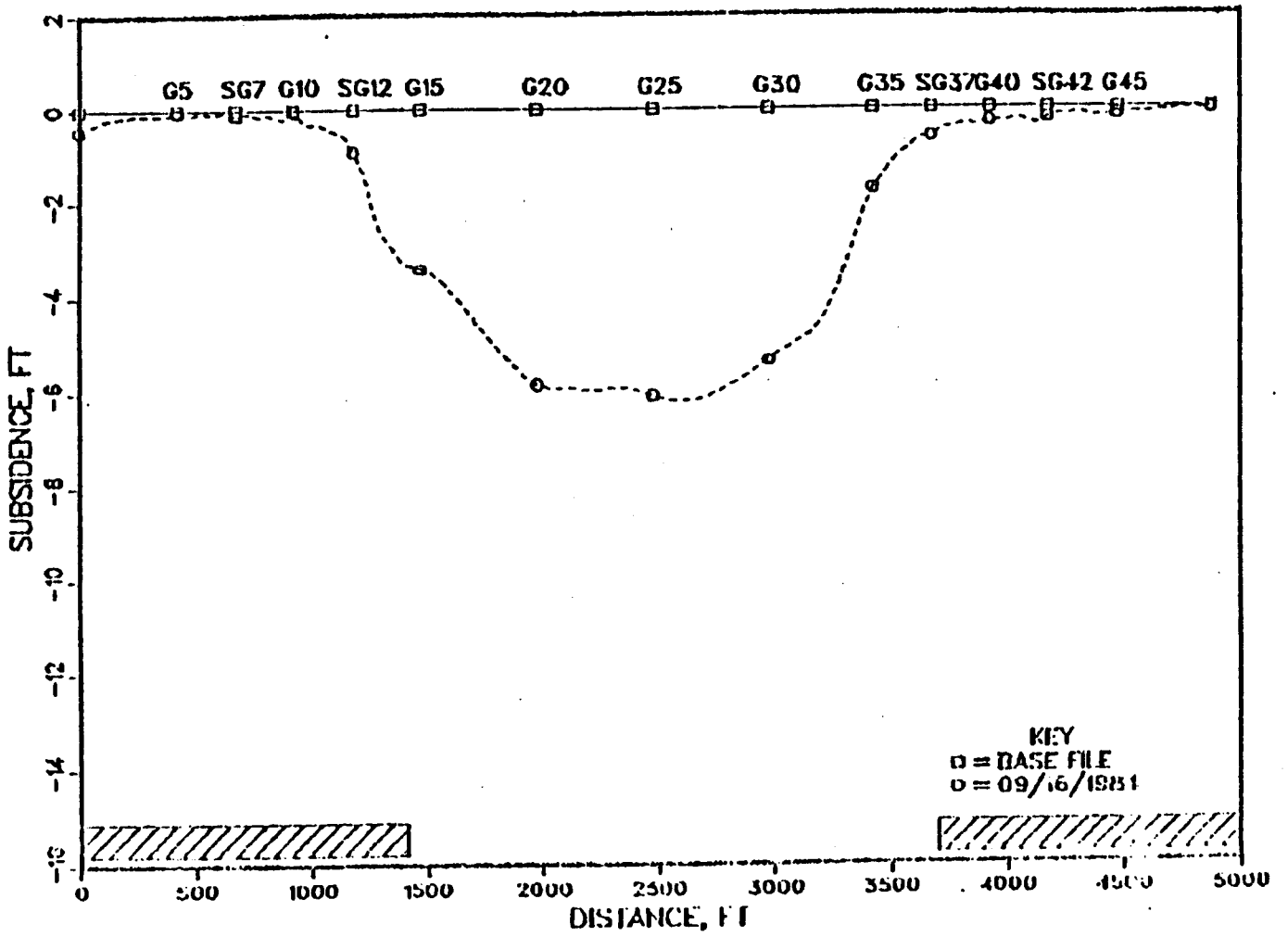
DEER CREEK MINE

F-LINE PROFILE



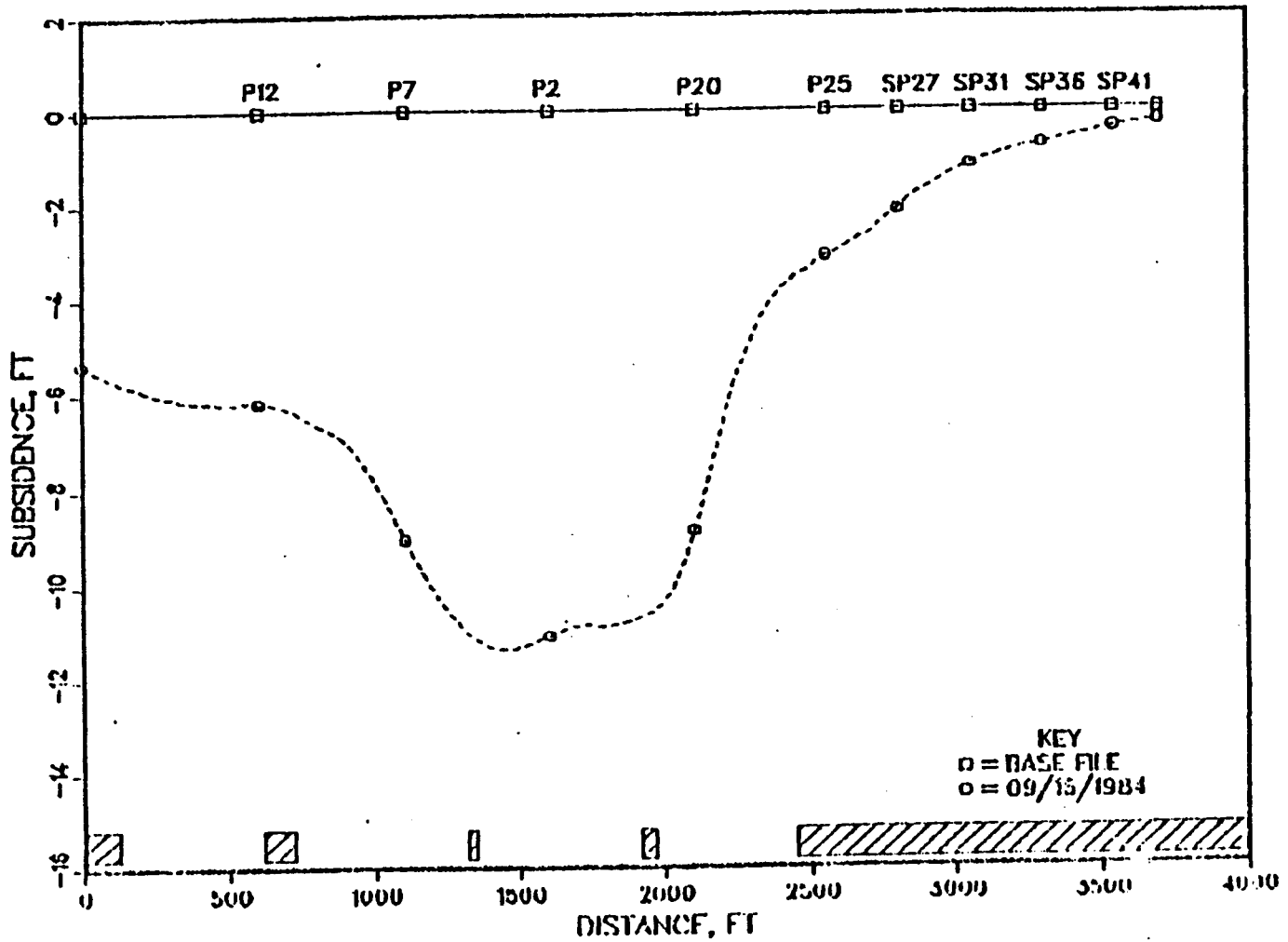
DEER CREEK MINE

G-LINE PROFILE



DEER CREEK MINE

P--LINE PROFILE



DEER CREEK SUBSIDENCE PROJECT LISTING OF ELEVATION

STATION NAME	BASE DATE BASE FILE	DIFFERENCES BY DATES : 06/21/1984 P/S : L	07/18/1984 P/S : L	07/31/1984 USBM : L	08/12/1984 P/S : L	09/16/1984 P/S : L
DC1	8994.68	. . . .	. . . .	. . . .	. . . .	. . . .
DC2	8955.53	. . . .	. . . .	. . . .	. . . .	. . . .
BM1	9025.91	0.00	0.00	0.00	0.00	0.10
BM2	9159.51	9.15	9.63	. . . .	9.98	10.53
BM3	9188.67	5.93	5.97	. . . .	5.92	6.10
BM4	9104.14	0.00	-0.10	. . . .	0.00	-0.05
BM5	9096.70	-0.08	-0.07	0.00	-0.08	0.00
BM6	8943.36	0.80	0.79	0.81	0.80	0.92
BM7	9106.90	-0.06	-0.15	. . . .	-0.05	-0.10
BM8	8980.15	0.23	0.23	. . . .	0.23	0.33
BM9	8961.81	-0.11	-0.17	. . . .	-0.15	-0.04
BM10	9067.32	3.96	4.01	4.05	4.02	4.13
NCP0	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
NCP1	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
NCP2	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
NCP3	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
NCP4	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
NCP5	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
NCP6	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
NCP7	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
NCP8	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
NCP9	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
C1	8998.65	0.24	0.24	0.22	0.24	0.34
C2	8988.15	0.31	0.33	0.29	0.32	0.43
C3	8978.20	0.40	0.41	0.37	0.40	0.51
C4	8971.85	. . . .	. . . .	. . . .	0.97	1.08
C5	8970.99	0.52	0.54	0.49	0.54	0.64
C6	8976.02	0.53	0.55	0.50	0.54	0.65
C7	8984.61	0.60	0.62	0.58	0.61	0.72
C8	8990.13	0.62	0.64	0.60	0.64	0.74
C9	8993.46	0.69	0.72	0.69	0.72	0.81
C10	8997.67	0.69	0.71	0.69	0.72	0.83
C11	9001.98	0.93	0.97	0.94	0.97	1.06
C12	9008.04	1.35	1.39	1.37	1.40	1.50
C13	9017.60	3.42	3.45	3.43	3.45	3.54
C14	9030.62	3.79	3.86	3.87	3.87	3.97
C15	9054.08	4.25	4.28	4.32	4.29	4.38
C16	9076.04	4.56	4.60	4.67	4.62	4.71
C17	9096.46	5.11	5.15	5.25	5.16	5.26
C18	9120.88	5.41	5.48	5.64	5.51	5.61

DEER CREEK SUBSIDENCE PROJECT LISTING OF ELEVATION

STATION NAME	BASE DATE BASE FILE	DIFFERENCES BY DATES : 06/21/1984 P/S : L	07/18/1984 P/S : L	07/31/1984 USBM : L	08/12/1984 P/S : L	09/16/1984 P/S : L
C19	9137.26	5.67	5.73	5.90	5.75	5.86
C20	9152.74	5.79	5.86	6.06	5.88	5.98
C21	9166.18	5.86	5.92	6.13	5.94	6.04
C22	9173.53	5.97	6.02	6.25	6.04	6.14
C23	9175.25	6.04	6.10	5.84	6.13	6.23
C24	9170.81	6.07	6.13	5.37	6.16	6.26
C25	9170.54	5.98	6.03	5.27	6.07	6.19
C26	9181.64	5.91	5.99	5.25	6.04	6.16
C27	9188.24	5.89	5.95	5.22	5.99	6.09
C28	9187.66	5.79	5.86	5.13	5.90	6.01
C29	9189.62	5.66	5.73	5.01	5.77	5.88
C30	9190.13	5.57	5.64	4.92	5.68	5.78
C31	9193.08	5.26	5.32	4.61	5.37	5.47
C32	9188.37	5.05	5.11	4.40	5.16	5.26
C33	9187.61	. . . .	. . . .	4.04	6.50	4.90
C34	9183.94	3.86	3.94	3.22	4.00	4.11
C35	9179.18	2.84	2.93	2.21	2.97	3.07
C36	9178.90	2.14	2.19	1.47	2.21	2.29
C37	9178.13	1.39	1.43	0.71	1.45	1.52
C38	9175.22	1.05	1.08	0.36	1.11	1.16
C39	9170.81	0.76	0.79	0.06	0.81	0.86
C40	9162.20	0.50	0.53	-0.20	0.56	0.61
C41	9148.84	0.38	0.40	-0.37	0.41	0.47
C42	9135.52	0.23	0.25	-0.54	0.27	0.34
C43	9125.00	0.02	0.06	-0.75	0.08	0.15
C44	9117.09	-0.03	-0.01	-0.84	-0.01	0.06
C45	9105.25	-0.08	-0.05	-0.90	-0.06	0.01
C46	9084.48	-0.10	-0.06	-0.94	-0.06	0.03
C47	9065.21	-0.00	0.03	-0.89	0.02	0.10
C48	9046.81	-0.17	-0.13	-1.09	-0.15	-0.07
C49	9028.02	-0.07	-0.03	-1.02	-0.06	0.03
C50	9004.20	-0.15	-0.11	-1.14	-0.15	-0.05
P16	9203.57	5.11	5.18	4.49	5.25	5.35
P15	9197.23	5.46	5.52	4.81	5.57	5.68
P14	9194.67	5.73	5.75	5.05	5.81	5.91
P13	9191.28	5.88	5.92	5.21	5.98	6.08
P12	9183.72	6.02	6.06	5.30	6.02	6.20
P11	9180.58	6.04	6.08	5.31	6.03	6.20
P10	9176.25	6.15	6.20	5.42	6.15	6.33
P9	9171.03	6.36	6.42	5.63	6.40	6.63

DEER CREEK SUBSIDENCE PROJECT LISTING OF ELEVATION

STATION NAME	BASE DATE BASE FILE	DIFFERENCES BY DATES : 06/21/1984 P/S : L	07/18/1984 P/S : L	07/31/1984 USBM : L	08/12/1984 P/S : L	09/16/1984 P/S : L
P8	9165.59	6.60	6.69	5.91	6.71	7.00
P7	9160.70	7.24	7.43	6.67	7.52	7.89
P6	9159.07	8.09	8.37	8.62	8.56	9.06
P5	9160.44	8.74	9.15	9.45	9.51	10.13
P4	9157.80	8.96	9.55	9.94	10.16	10.95
P3	9154.42	8.79	9.52	9.98	10.38	11.35
P2	9151.12	8.39	9.17	9.67	10.19	11.34
P1	9143.31	7.79	8.60	9.13	9.79	11.11
P17	9129.72	7.23	8.01	8.56	9.31	10.90
P18	9114.29	6.86	7.66	8.24	9.13	10.90
P19	9100.43	6.52	7.31	7.89	8.88	10.77
P20	9089.13	6.17	6.92	7.48	8.49	10.34
P21	9074.91	5.65	6.23	6.66	7.39	8.89
P22	9061.37	5.00	5.33	5.55	5.82	6.58
P23	9048.42	4.14	4.30	4.41	4.44	4.79
P24	9042.63	3.38	3.48	3.57	3.56	3.82
P25	9038.54	2.98	3.06	3.15	3.11	3.36
SP25	9039.18	2.76	2.83	2.92	2.88	3.12
P26	9036.75	2.68	2.75	2.83	2.80	3.04
SP26	9036.84	2.45	2.52	2.60	2.56	2.80
P27	9035.61	2.31	2.37	2.45	2.42	2.66
SP27	9033.56	2.04	2.11	2.19	2.15	2.38
P28	9027.03	1.82	1.89	1.97	1.93	2.14
SP28	9020.71	1.55	1.62	1.70	1.65	1.85
SP29	9014.04	1.44	1.50	1.58	1.52	1.70
SP30	9007.47	1.28	1.33	1.40	1.35	1.52
SP31	9000.30	1.14	1.18	1.24	1.20	1.36
SP32	8991.51	1.02	1.05	1.11	1.06	1.21
SP33	8979.06	0.93	0.95	1.01	0.97	1.10
SP34	8966.51	0.84	0.87	0.93	0.88	1.02
SP35	8954.85	0.74	0.75	0.80	0.76	0.89
SP36	8945.07	0.69	0.69	0.75	0.70	0.83
SP37	8937.55	0.66	0.66	0.70	0.66	0.77
SP38	8932.96	0.57	0.56	0.61	0.57	0.69
SP39	8929.45	0.51	0.50	0.55	0.50	0.61
SP40	8926.20	0.44	0.44	0.48	0.43	0.54
SP41	8923.56	0.41	0.39	0.44	0.38	0.49
SP42	8922.57	0.32	0.31	0.36	0.29	0.39
SP43	8922.02	0.28	0.26	0.32	0.25	0.35
SP44	8921.65	0.23	0.21	0.28	0.19	0.31

DEER CREEK SUBSIDENCE PROJECT LISTING OF ELEVATION

STATION NAME	BASE DATE BASE FILE	DIFFERENCES BY DATES : 06/21/1984 P/S : L	07/18/1984 P/S : L	07/31/1984 USBM : L	08/12/1984 P/S : L	09/16/1984 P/S : L
SP45	8921.35	0.20	0.17	0.23	0.16	0.26
D1	8960.18	0.21	0.22	. . . .	0.20	0.32
D2	8953.04	0.27	0.31	. . . .	0.28	0.39
D3	8949.27	0.31	0.36	. . . .	0.32	0.44
D4	8949.94	0.32	0.38	. . . .	0.36	0.48
D5	8957.29	0.36	0.40	0.37	0.38	0.49
D6	8967.44	0.41	0.45	. . . .	0.44	0.53
D7	8975.26	0.43	0.46	. . . .	0.45	0.56
D8	8983.90	0.51	0.55	. . . .	0.54	0.64
D9	8990.92	0.80	0.84	. . . .	0.84	0.94
D10	8999.20	1.14	1.16	. . . .	1.16	1.27
D11	9007.03	2.26	2.31	. . . .	2.30	2.41
D12	9016.69	3.40	3.45	. . . .	3.44	3.55
D13	9029.19	3.79	3.84	. . . .	3.84	3.94
A1	9015.87	2.89	2.94	. . . .	2.93	3.03
A2	9014.25	2.85	2.90	. . . .	2.89	3.00
A3	9009.87	2.83	2.88	. . . .	2.88	2.99
A4	9004.22	2.49	2.55	. . . .	2.55	2.67
A5	9001.00	1.10	1.15	. . . .	1.15	1.27
A6	8998.65	1.13	1.18	. . . .	1.17	1.30
A7	8993.71	1.15	1.20	. . . .	1.19	1.33
A8	8991.47	1.04	1.08	. . . .	1.08	1.20
B1	9173.78	1.01	1.04	. . . .	1.07	1.12
B2	9170.78	1.06	1.09	. . . .	1.11	1.16
B3	9158.29	1.16	1.19	. . . .	1.21	1.26
B4	9141.32	1.09	1.13	. . . .	1.16	1.20
B5	9124.50	1.14	1.19	. . . .	1.21	1.25
B6	9111.43	1.06	1.10	. . . .	1.12	1.16
B7	9095.66	1.18	1.21	1.35	1.22	1.26
E1	9008.16	0.03	0.02	0.04	0.02	0.13
E2	8997.85	0.07	0.06	0.06	0.06	0.16
E3	8987.42	0.08	0.09	0.11	0.10	0.21
E4	8977.75	0.14	0.14	0.15	0.14	0.26
E5	8968.10	0.19	0.19	0.19	0.19	0.30
E6	8959.71	0.17	0.18	0.17	0.18	0.30
E7	8954.73	0.21	0.22	0.20	0.22	0.33
E8	8957.98	0.20	0.23	0.22	0.23	0.34
E9	8959.92	0.22	0.24	0.23	0.24	0.35
E10	8960.97	0.25	0.26	0.25	0.26	0.37
E11	8967.90	0.33	0.35	0.35	0.35	0.47

DEER CREEK SUBSIDENCE PROJECT LISTING OF ELEVATION

STATION NAME	BASE DATE BASE FILE	DIFFERENCES BY DATES : 06/21/1984 P/S : L	07/18/1984 P/S : L	07/31/1984 USBM : L	08/12/1984 P/S : L	09/16/1984 P/S : L
E12	8983.37	0.74	0.76	0.77	0.75	0.87
E13	8993.84	1.21	1.24	1.25	1.23	1.35
E14	9007.06	3.23	3.27	3.31	3.27	3.42
E15	9029.96	4.07	4.12	4.19	4.13	4.29
E16	9055.05	4.44	4.52	4.62	4.53	4.69
E17	9076.10	4.79	4.85	4.97	4.86	5.03
E18	9094.27	5.18	5.27	5.42	5.29	5.47
E19	9104.22	5.48	5.56	5.72	5.59	5.77
E20	9105.05	5.72	5.82	5.98	5.87	6.08
E21	9118.34	5.94	6.05	6.24	6.09	6.31
E22	9129.72	6.13	6.27	6.47	6.31	6.55
E23	9140.18	6.32	6.45	6.67	6.50	6.77
E24	9147.95	6.49	6.64	6.87	6.70	6.99
E25	9154.02	6.63	6.79	7.01	6.86	7.18
E26	9157.11	6.69	6.85	7.08	6.94	7.29
E27	9159.69	6.76	6.94	7.18	7.03	7.41
E28	9161.39	6.80	6.97	7.20	7.07	7.48
E29	9159.70	6.52	6.69	6.45	6.80	7.24
E30	9155.41	6.53	6.68	6.91	6.79	7.24
E31	9148.90	6.38	6.54	6.76	6.64	7.14
E32	9141.48	6.19	6.34	6.55	6.44	6.96
E33	9134.71	5.93	6.07	6.26	6.16	6.67
E34	9125.08	5.22	5.35	5.52	5.41	5.88
E35	9116.50	3.91	4.01	4.15	4.01	4.30
E36	9112.04	2.42	2.49	2.60	2.42	2.56
E37	9105.12	1.50	1.55	1.65	1.46	1.58
E38	9090.76	1.04	1.08	1.17	1.01	1.11
E39	9075.68	0.75	0.80	0.85	0.69	0.82
E40	9065.14	0.60	0.65	0.69	0.55	0.68
E41	9051.25	0.45	0.51	0.53	0.41	0.55
E42	9040.70	0.44	0.50	0.50	0.40	0.52
E43	9034.43	0.26	0.31	0.31	0.22	0.34
E44	9031.28	0.27	0.31	0.31	0.22	0.35
E45	9025.88	0.16	0.22	0.21	0.13	0.27
E46	9006.92	0.11	0.17	0.13	0.07	0.21
E47	8988.15	0.05	0.12	0.06	0.03	0.17
E48	8971.80	0.02	0.10	0.02	-0.00	0.13
E49	8951.26	-0.01	0.06	-0.05	-0.05	0.08
E50	8942.68	-0.03	0.05	-0.06	-0.05	0.09
F1	9023.07	0.00	-0.01	0.02	-0.02	0.09

DEER CREEK SUBSIDENCE PROJECT LISTING OF ELEVATION

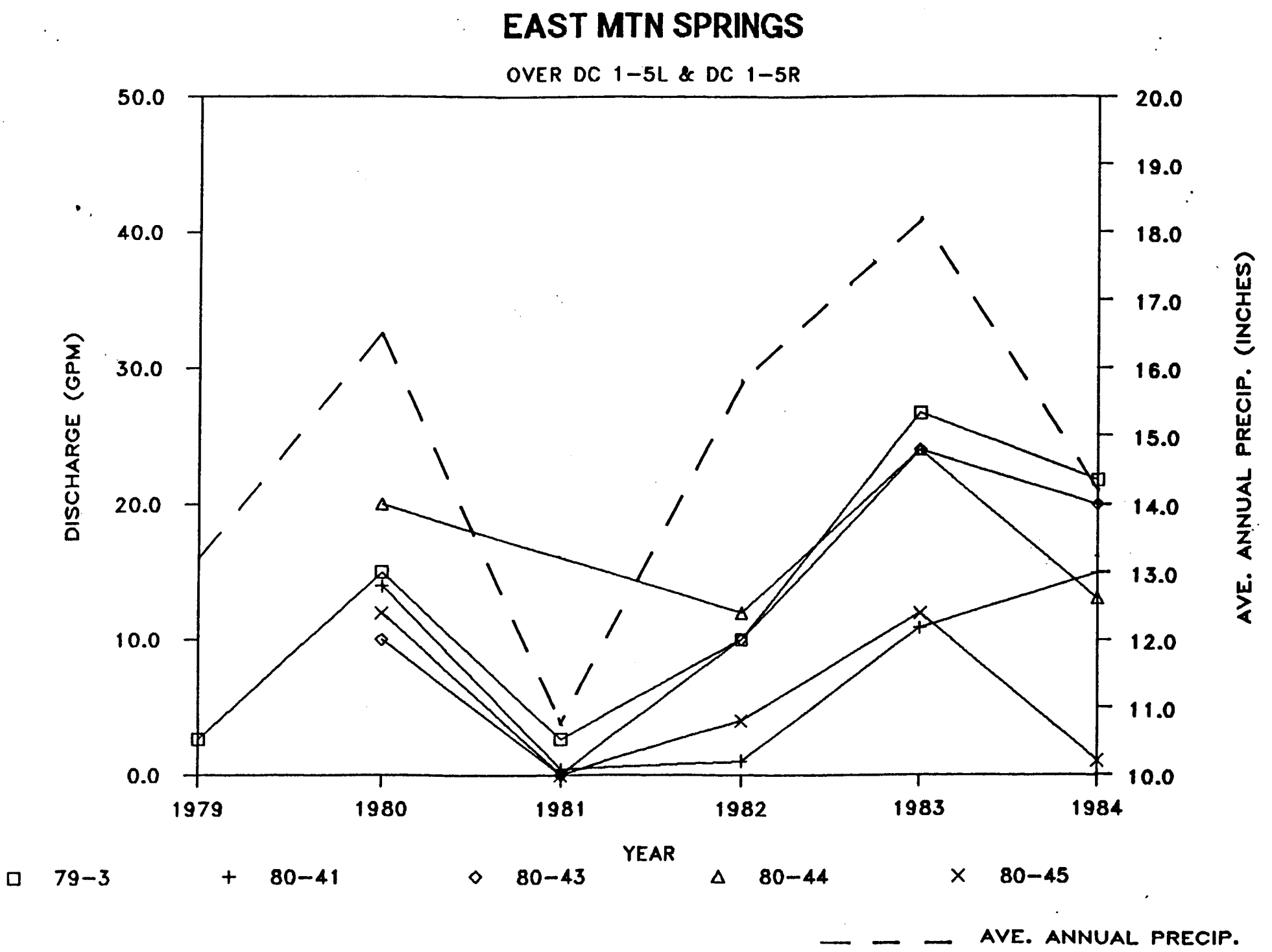
STATION NAME	BASE DATE BASE FILE	DIFFERENCES BY DATES : 06/21/1984 P/S : L	07/18/1984 P/S : L	07/31/1984 USBM : L	08/12/1984 P/S : L	09/16/1984 P/S : L
F2	9008.49	0.04	0.02	0.05	0.01	0.12
F3	8995.51	0.05	0.03	0.05	0.03	0.13
F4	8982.79	0.08	0.06	0.06	0.05	0.16
F5	8970.51	0.08	0.06	0.04	0.07	0.18
F6	8956.47	0.11	0.10	0.06	0.10	0.21
F7	8945.05	0.13	0.12	0.06	0.12	0.23
F8	8931.96	0.15	0.14	0.07	0.15	0.26
F9	8924.71	0.18	0.17	0.09	0.17	0.28
F10	8926.09	0.18	0.16	0.09	0.17	0.29
F11	8941.36	0.18	0.18	0.13	0.19	0.31
F12	8955.26	0.28	0.27	0.23	0.30	0.44
F13	8966.19	0.65	0.65	0.61	0.67	0.81
F14	8978.04	2.59	2.60	2.57	2.64	2.80
F15	9000.47	4.13	4.21	4.21	4.28	4.48
F16	9026.33	4.90	5.01	5.06	5.07	5.29
F17	9061.13	6.18	6.38	6.50	6.48	6.74
F18	9081.04	7.95	8.26	8.42	8.40	8.68
F19	9093.32	9.13	9.55	9.73	9.73	10.05
F20	9099.94	9.54	10.08	10.27	10.33	10.69
F21	9107.45	9.53	10.26	10.54	10.64	11.08
F22	9114.79	9.32	10.20	10.54	10.71	11.24
F23	9120.92	8.94	9.93	10.36	10.64	11.28
F24	9124.11	8.55	9.57	10.07	10.49	11.27
F25	9125.36	8.15	9.13	9.67	10.24	11.22
F26	9128.82	7.78	8.67	9.23	9.90	11.15
F27	9137.33	7.53	8.29	8.82	9.51	11.05
F28	9143.67	7.30	7.94	8.41	9.09	10.95
F29	9142.21	7.12	7.65	8.06	8.69	10.86
F30	9133.76	6.98	7.43	7.78	8.31	10.79
F31	9121.28	6.75	7.14	7.42	7.85	10.55
F32	9108.36	6.55	6.90	7.15	7.49	10.32
F33	9093.02	6.16	6.48	6.69	6.98	9.84
F34	9083.37	5.49	5.79	5.98	6.24	9.07
F35	9075.64	4.07	4.29	4.44	4.58	6.40
F36	9070.91	2.52	2.59	2.66	2.60	2.75
F37	9057.40	1.54	1.57	1.61	1.52	1.59
F38	9039.82	1.09	1.10	1.11	1.05	1.13
F39	9027.80	0.86	0.87	0.88	0.82	0.92
F40	9008.94	0.67	0.67	0.66	0.63	0.73
F41	8989.27	0.52	0.53	0.50	0.49	0.60

DEER CREEK SUBSIDENCE PROJECT LISTING OF ELEVATION

STATION NAME	BASE DATE BASE FILE	DIFFERENCES BY DATES : 06/21/1984 P/S : L	07/18/1984 P/S : L	07/31/1984 USBM : L	08/12/1984 P/S : L	09/16/1984 P/S : L
F42	8973.19	0.39	0.41	0.37	0.38	0.49
F43	8952.18	0.34	0.35	0.28	0.31	0.43
F44	8931.29	0.27	0.29	0.19	0.24	0.36
F45	8911.66	0.20	0.22	0.11	0.18	0.30
F46	8893.75	0.17	0.18	0.06	0.14	0.26
F47	8889.64	0.02	0.03	-0.10	-0.02	0.12
G1	9017.27	0.37	0.37	0.38	0.35	0.45
G2	9010.00	0.15	0.16	0.16	0.14	0.24
G3	8996.96	0.06	0.07	0.07	0.04	0.14
G4	8986.77	0.05	0.05	0.05	0.04	0.12
G5	8979.31	0.03	0.04	0.04	0.02	0.12
SG5	8974.82	-0.01	-0.01	-0.02	-0.03	0.06
G6	8968.83	0.04	0.04	0.03	0.02	0.11
SG6	8964.78	-0.02	-0.02	-0.03	-0.04	0.05
G7	8957.86	0.03	0.03	0.02	0.01	0.10
SG7	8951.87	-0.03	-0.03	-0.04	-0.04	0.05
G8	8940.86	0.06	0.05	0.04	0.04	0.13
SG8	8931.87	-0.00	-0.01	-0.02	-0.02	0.07
G9	8920.29	0.08	0.08	0.06	0.07	0.16
SG9	8911.38	0.02	0.02	-0.00	0.01	0.11
G10	8904.15	0.14	0.14	0.11	0.13	0.22
SG10	8900.79	-0.06	-0.04	-0.07	-0.06	0.05
G11	8897.67	0.21	0.22	0.19	0.22	0.33
SG11	8906.63	0.21	0.22	0.19	0.21	0.31
G12	8916.99	0.38	0.38	0.36	0.38	0.48
SG12	8929.77	0.41	0.42	0.41	0.43	0.54
G13	8939.73	0.80	0.80	0.80	0.81	0.92
SG13	8949.34	1.32	1.34	1.35	1.36	1.48
G14	8956.60	2.24	2.25	2.27	2.27	2.42
SG14	8970.00	2.60	2.62	2.66	2.66	2.81
G15	8986.45	2.96	2.97	3.01	3.01	3.16
G16	9020.60	3.16	3.18	3.22	3.23	3.40
G17	9049.24	3.45	3.49	3.55	3.52	3.70
G18	9068.76	3.97	4.03	4.11	4.07	4.26
G19	9080.04	4.55	4.62	4.72	4.68	4.89
G20	9086.97	5.07	5.18	5.29	5.26	5.48
G21	9090.12	5.36	5.52	5.66	5.63	5.86
G22	9085.88	5.38	5.57	5.71	5.69	5.93
G23	9082.52	5.32	5.54	5.69	5.69	5.95
G24	9079.10	5.22	5.46	5.63	5.65	5.95

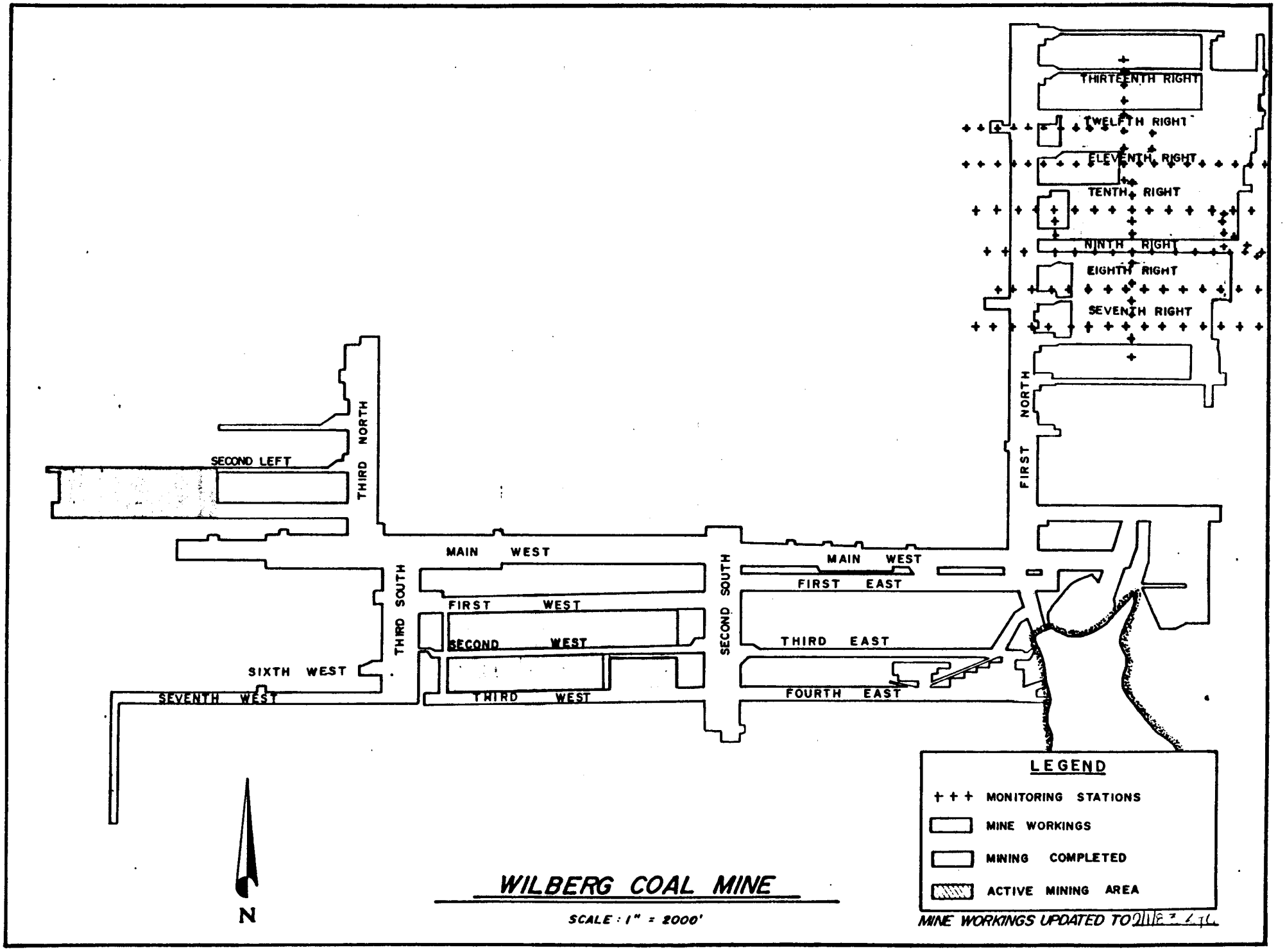
DEER CREEK SUBSIDENCE PROJECT LISTING OF ELEVATION

STATION NAME	BASE DATE BASE FILE	DIFFERENCES BY DATES : 06/21/1984 P/S : L	07/18/1984 P/S : L	07/31/1984 USBM : L	08/12/1984 P/S : L	09/16/1984 P/S : L
G25	9072.97	5.05	5.33	5.52	5.58	5.94
G26	9066.68	4.97	5.26	6.47	5.61	6.08
G27	9058.06	4.79	5.08	5.27	5.50	6.18
G28	9050.08	4.59	4.85	5.04	5.30	6.15
G29	9042.11	4.32	4.56	4.73	4.97	5.97
G30	9033.43	4.03	4.24	4.40	4.62	5.70
G31	9025.21	3.71	3.89	4.04	4.22	5.37
G32	9018.40	3.38	3.54	3.67	3.85	5.03
G33	9006.13	3.02	3.16	3.27	3.41	4.67
G34	8995.21	2.49	2.58	2.68	2.76	3.76
G35	8981.85	1.92	1.96	2.02	2.04	2.35
SG35	8974.89	1.57	1.59	1.64	1.63	1.72
G36	8964.21	1.32	1.31	1.34	1.32	1.38
SG36	8956.26	1.06	1.03	1.06	1.03	1.07
G37	8945.34	0.90	0.86	0.87	0.84	0.88
SG37	8937.39	0.67	0.65	0.66	0.65	0.69
G38	8930.39	0.65	0.59	0.59	0.58	0.61
SG38	8923.44	0.46	0.42	0.42	0.41	0.46
G39	8916.86	0.42	0.37	0.36	0.36	0.41
SG39	8913.78	0.36	0.30	0.28	0.29	0.34
G40	8908.02	0.35	0.31	0.30	0.31	0.37
SG40	8902.15	0.30	0.25	0.23	0.25	0.29
G41	8892.67	0.30	0.25	0.24	0.25	0.31
SG41	8886.58	0.26	0.21	0.18	0.20	0.26
G42	8877.43	0.27	0.22	0.20	0.22	0.28
SG42	8872.97	0.18	0.13	0.10	0.12	0.36
G43	8863.93	0.23	0.17	0.14	0.17	0.24
SG43	8861.41	0.13	0.07	0.03	0.07	0.14
G44	8858.04	0.13	0.08	0.03	0.07	0.14
SG44	8859.48	0.09	0.04	0.01	0.05	0.13
G45	8859.54	0.17	0.11	0.08	0.11	0.19
G46	8872.66	0.13	0.07	0.06	0.06	0.15
G47	8884.46	0.09	0.03	0.02	0.02	0.11
G48	8898.13	0.04	-0.01	-0.01	-0.01	0.08
G49	8913.06	0.01	-0.04	-0.04	-0.05	0.05
G50	8927.28	0.04	-0.05	-0.04	0.03	0.05


EAST MTN SPRINGS
OVER DC 1-5L & DC 1-5R
DISCHARGE (GPM)
50.0
40.0
30.0
20.0
10.0
0.0
AVE. ANNUAL PRECIP. (INCHES)
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
1979
1980
1981
1982
1983
1984
YEAR
79-3
80-41
80-43
80-44
80-45
AVE. ANNUAL PRECIP.

APPENDIX

WILBERG MINE


THIRTEENTH RIGHT
TWELFTH RIGHT
ELEVENTH RIGHT
TENTH RIGHT
NINTH RIGHT
EIGHTH RIGHT
SEVENTH RIGHT
FIRST NORTH
THIRD NORTH
SECOND LEFT
MAIN WEST
FIRST WEST
SECOND WEST
THIRD WEST
THIRD SOUTH
SIXTH WEST
SEVENTH WEST
SECOND SOUTH
MAIN WEST
FIRST EAST
THIRD EAST
FOURTH EAST
N
LEGEND
MONITORING STATIONS
MINE WORKINGS
MINING COMPLETED
ACTIVE MINING AREA
WILBERG COAL MINE
SCALE : 1" = 2000'
MINE WORKINGS UPDATED TO

WILBERO SUBSIDENCE PROJECT LISTING OF ELEVATION

STATION NAME	BASE DATE BASE FILE	DIFFERENCES BY DATES : 06/21/1984 P/S : L	07/18/1984 P/S : L	08/02/1984 USBM : L	08/15/1984 P/S : L	08/22/1984 USBM : L	09/11/1984 USBM : L	09/20/1984 P/S : L
A23	9294.86	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
A24	9280.90	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
A25	9242.48	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
A26	9191.45	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
A27	9138.56	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
A28	9083.71	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
M1	8970.56	0.61	0.66	0.39	0.67	. . . .	0.39	0.61
M2	8963.07	0.66	0.70	0.42	0.71	. . . .	0.42	0.66
M3	8956.49	0.70	0.75	0.46	0.76	. . . .	0.46	0.70
M4	8949.64	0.75	0.79	0.50	0.81	. . . .	0.51	0.76
M5	8943.68	0.84	0.88	0.59	0.90	. . . .	0.59	0.62
M6	8939.48	0.87	0.92	0.61	0.94	. . . .	0.63	0.89
M7	8936.48	0.95	1.00	0.69	1.02	. . . .	0.72	0.97
M8	8939.38	0.97	1.02	0.71	1.04	. . . .	0.74	1.00
M9	8945.41	0.91	0.99	0.70	1.04	. . . .	0.75	1.01
M10	8953.63	1.05	1.11	0.82	1.13	. . . .	0.85	1.11
M11	8962.77	1.10	1.15	0.89	1.19	. . . .	0.91	1.17
M12	8970.55	1.20	1.25	1.00	1.29	. . . .	1.01	1.26
M13	8977.47	1.38	1.44	1.19	1.47	. . . .	1.20	1.45
M14	8985.02	1.67	1.73	1.50	1.77	. . . .	1.50	1.75
M15	8994.98	2.57	2.66	2.43	2.70	. . . .	2.45	2.68
M16	9006.30	3.26	3.34	3.13	3.38	3.14	3.14	3.36
M17	9024.22	3.59	3.65	3.48	3.70	3.48	3.48	3.68
M18	9053.05	4.02	4.10	3.98	4.17	3.97	3.97	4.14
M19	9072.41	4.26	4.33	4.23	4.39	4.22	4.22	4.37
M20	9092.87	4.47	4.53	4.47	4.59	4.45	4.46	4.58
M21	9120.57	4.63	4.70	4.66	4.77	4.64	4.65	4.74
M22	9137.29	4.69	4.75	4.75	4.83	4.72	4.72	4.80
M23	9149.41	4.74	4.81	4.83	4.90	4.81	4.81	4.86
M24	9157.68	4.76	4.85	4.87	4.94	4.85	4.85	4.90
M25	9165.06	4.79	4.88	4.90	4.96	4.89	4.88	4.93
M26	9174.49	4.75	4.85	4.88	4.93	4.88	4.87	4.91
M27	9185.50	4.71	4.82	4.87	4.91	4.86	4.86	4.88
M28	9192.01	4.70	4.77	4.83	4.87	4.82	4.82	4.83
M29	9198.45	4.59	4.68	4.74	2.84	4.74	4.75	4.75
M30	9203.97	4.44	4.52	4.59	4.63	4.61	4.61	4.61
M31	9208.53	4.20	4.31	4.39	4.40	4.40	4.41	4.39
M32	9213.36	3.90	4.01	4.10	4.10	4.12	4.12	4.11
M33	9217.35	3.52	3.64	3.74	3.74	3.76	3.76	3.75
M34	9221.90	3.06	3.18	3.29	3.28	3.33	3.34	3.31

WILBERG SUBSIDENCE PROJECT LISTING OF ELEVATION

STATION NAME	BASE DATE BASE FILE	DIFFERENCES BY DATES : 06/21/1984 P/S : L	07/18/1984 P/S : L	08/02/1984 USBM : L	08/15/1984 P/S : L	08/22/1984 USBM : L	09/11/1984 USBM : L	09/20/1984 P/S : L
M35	9230.35	2.67	2.80	2.93	2.91	2.95	2.95	2.91
M36	9243.60	2.26	2.41	2.56	2.51	2.57	2.57	2.52
M37	9255.34	1.96	2.10	2.27	2.21	2.28	2.27	2.22
M38	9263.59	1.65	1.76	1.96	1.88	1.96	1.94	1.88
M39	9264.29	1.43	1.52	1.72	1.64	1.72	1.72	1.65
M40	9243.46	1.21	1.28	1.45	1.39	1.45	1.45	1.39
M41	9216.92	0.92	1.04	1.15	1.13	1.17	1.16	1.13
M42	9194.21	0.86	0.96	1.04	1.05	1.07	1.06	1.05
M43	9183.29	0.61	0.69	0.74	0.77	0.77	0.77	0.76
M44	9172.13	0.43	0.51	0.55	0.58	0.58	0.58	0.58
M45	9158.34	0.39	0.44	0.46	0.49	0.48	0.47	0.49
M46	9141.57	0.34	0.36	0.37	0.40	0.38	0.37	0.39
M47	9130.43	0.26	0.29	0.28	0.33	0.30	0.30	0.35
M48	9122.01	0.20	0.23	0.21	0.26	0.22	0.21	0.27
M49	9115.27	0.09	0.10	0.08	0.13	0.09	0.07	0.13
M50	9112.33	0.17	0.18	0.16	0.19	0.15	0.14	0.19
M51	9110.83	0.13	0.13	0.11	0.14	0.10	0.09	0.14
M52	9109.35	0.14	0.13	0.09	0.12	0.09	0.07	0.11
M53	9109.18	0.10	0.10	0.06	0.09	0.06	0.05	0.08
M54	9112.33	0.10	0.09	0.05	0.08	0.06	0.04	0.07
M55	9114.53	0.07	0.07	0.04	0.06	0.04	0.03	0.06
M56	9117.60	0.05	0.05	0.02	0.04	0.02	0.02	0.04
M57	9124.05	0.04	0.04	0.03	0.04	0.03	0.02	0.03
M58	9126.99	0.01	0.01	-0.00	0.01	0.00	0.00	0.00
M59	9129.59	0.01	0.02	0.00	0.01	0.01	0.01	0.01
M60	9131.82	-0.01	-0.01	-0.01	-0.00	0.00	-0.00	-0.01
M61	9132.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R1	9200.61	4.52	4.59	4.65	4.70	4.65	4.68	4.67
R2	9197.72	4.52	4.62	4.67	4.74	4.68	4.71	4.71
R3	9195.69	4.49	4.61	4.68	4.73	4.68	4.70	4.71
R4	9191.72	4.45	4.59	4.65	4.71	4.65	4.68	4.69
R5	9187.39	4.40	4.56	4.62	4.69	4.62	4.65	4.67
R6	9183.60	4.34	4.52	4.57	4.65	4.58	4.61	4.64
R7	9179.93	4.20	4.41	4.46	4.55	4.47	4.50	4.53
R8	9176.07	3.94	4.13	4.17	4.27	4.18	4.20	4.24
R9	9172.10	3.46	3.62	3.67	3.75	3.66	3.69	3.74
R10	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R11	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R12	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R13	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .

WILBERG SUBSIDENCE PROJECT LISTING OF ELEVATION

STATION NAME	BASE DATE BASE FILE	DIFFERENCES BY DATES : 06/21/1984 P/S : L	07/18/1984 P/S : L	08/02/1984 USBM : L	08/15/1984 P/S : L	08/22/1984 USBM : L	09/11/1984 USBM : L	09/20/1984 P/S : L
R14	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R15	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R16	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R17	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R18	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R19	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R20	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R21	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R22	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R23	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R24	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R25	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R26	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R27	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R28	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R29	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
R30	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
T1	9211.33	3.43	3.51	3.53	3.56	3.60	3.61	3.58
T2	9215.45	3.31	3.40	3.47	3.46	3.52	3.52	3.49
T3	9221.05	3.17	3.27	3.35	3.35	3.40	3.41	3.37
T4	9218.12	3.02	3.17	3.27	3.27	3.32	3.35	3.30
T5	9213.19	2.98	3.18	3.27	3.28	3.32	3.36	3.31
T6	9208.05	2.94	3.22	3.31	3.34	3.37	3.42	3.37
T7	9198.90	2.87	3.25	3.33	3.39	3.41	3.47	3.43
T8	9190.38	2.76	3.24	3.32	3.39	3.40	3.48	3.43
T9	9180.18	2.37	3.25	2.78	2.94	3.05	3.06	3.01
T10	9175.17	1.61	2.50	1.89	2.21	. . . .	2.30	2.26
T11	9166.34	1.14	2.10	1.25	1.54	. . . .	1.60	1.56
T12	9157.12	0.77	1.64	0.77	1.06	. . . .	1.09	1.06
T13	9149.99	0.53	1.38	0.51	0.79	. . . .	0.81	0.78
T14	9143.34	0.39	1.25	0.38	0.66	. . . .	0.70	0.67
T15	9142.84	0.29	1.14	0.26	0.53	. . . .	0.55	0.52
T16	9138.80	-0.13	0.72	-0.15	0.12	. . . .	0.13	0.12
T17	9138.63	0.02	0.88	-0.00	0.27	. . . .	0.29	0.26
T18	9135.71	0.15	1.01	0.13	0.40	. . . .	0.41	0.38
T19	9130.84	0.16	1.02	0.14	0.41	. . . .	0.42	0.40
T20	9125.77	1.15	2.03	1.16	1.44	. . . .	1.47	1.45
XT21	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
T22	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .

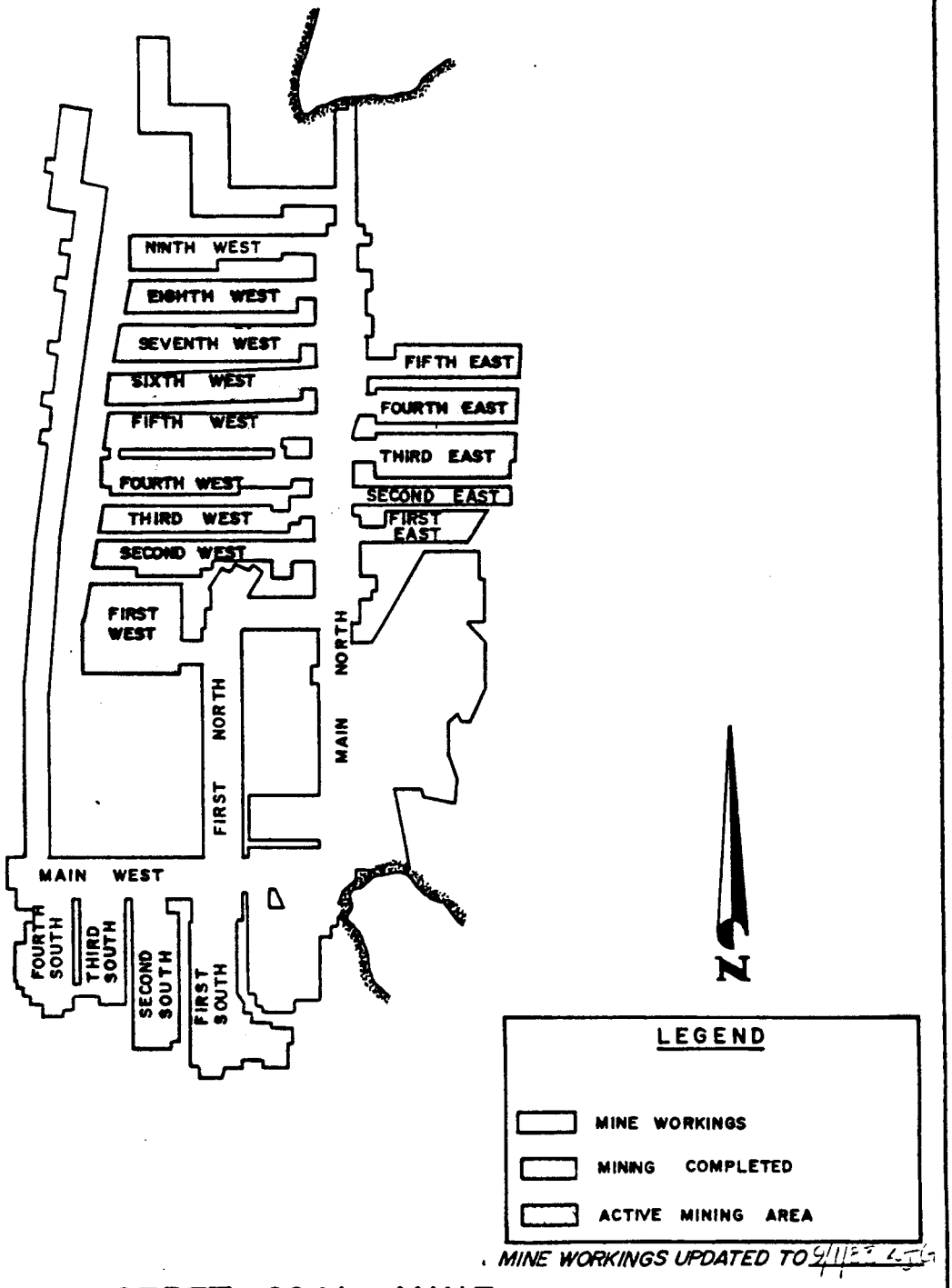
WILBERG SUBSIDENCE PROJECT LISTING OF ELEVATION

BASE DATE DIFFERENCES BY DATES :

STATION NAME	BASE FILE	06/21/1984 P/S : L	07/18/1984 P/S : L	08/02/1984 USBM : L	08/15/1984 P/S : L	08/22/1984 USBM : L	09/11/1984 USBM : L	09/20/1984 P/S : L
T24	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
T25	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
T26	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
T27	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
T28	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
T29	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
T30	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S1	9127.74	4.63	4.69	4.67	4.78	4.65	4.65	4.74
S2	9154.74	4.71	4.80	4.81	4.88	4.79	4.79	4.85
S3	9171.51	4.75	4.85	4.88	4.94	4.87	4.86	4.91
S4	9187.49	4.70	4.80	4.85	4.89	4.84	4.84	4.86
S5	9199.45	4.55	4.65	4.70	4.75	4.71	4.72	4.72
S6	9194.83	4.60	4.70	4.75	4.81	4.75	4.78	4.79
S7	9189.38	4.50	4.60	4.66	4.73	4.66	4.69	4.71
S8	9182.62	4.45	4.60	4.64	4.72	4.65	4.67	4.70
S9	9177.22	4.20	4.35	4.40	4.48	4.40	4.43	4.46
S10	9200.95	0.36	1.31	0.48	0.52	. . . .	0.67	0.55
S11	9192.35	0.24	1.15	0.30	0.32	. . . .	0.46	0.34
S12	9180.67	0.17	1.10	0.24	0.26	. . . .	0.33	0.27
S13	9174.60	0.06	0.97	0.14	0.14	. . . .	0.15	0.14
S14	9170.64	0.05	0.94	0.07	0.07	. . . .	. . . .	0.08
S15	9165.38	0.02	0.92	0.05	0.05	. . . .	-3.43	0.05
S16	9160.87	-0.00	0.90	0.01	0.00	. . . .	-1.47	0.01
S17	9154.68	-0.00	-0.01	0.02	0.01	. . . .	5.23	0.01
S18	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S19	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S20	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S21	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S22	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S23	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S24	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S25	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S26	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S27	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S28	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S29	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
S30	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
N35	9166.07	1.88	3.22	2.44	2.49	. . . .	2.64	2.54
N36	9189.83	1.52	2.89	2.12	2.18	. . . .	2.34	2.23
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.07	1.96

APPENDIX

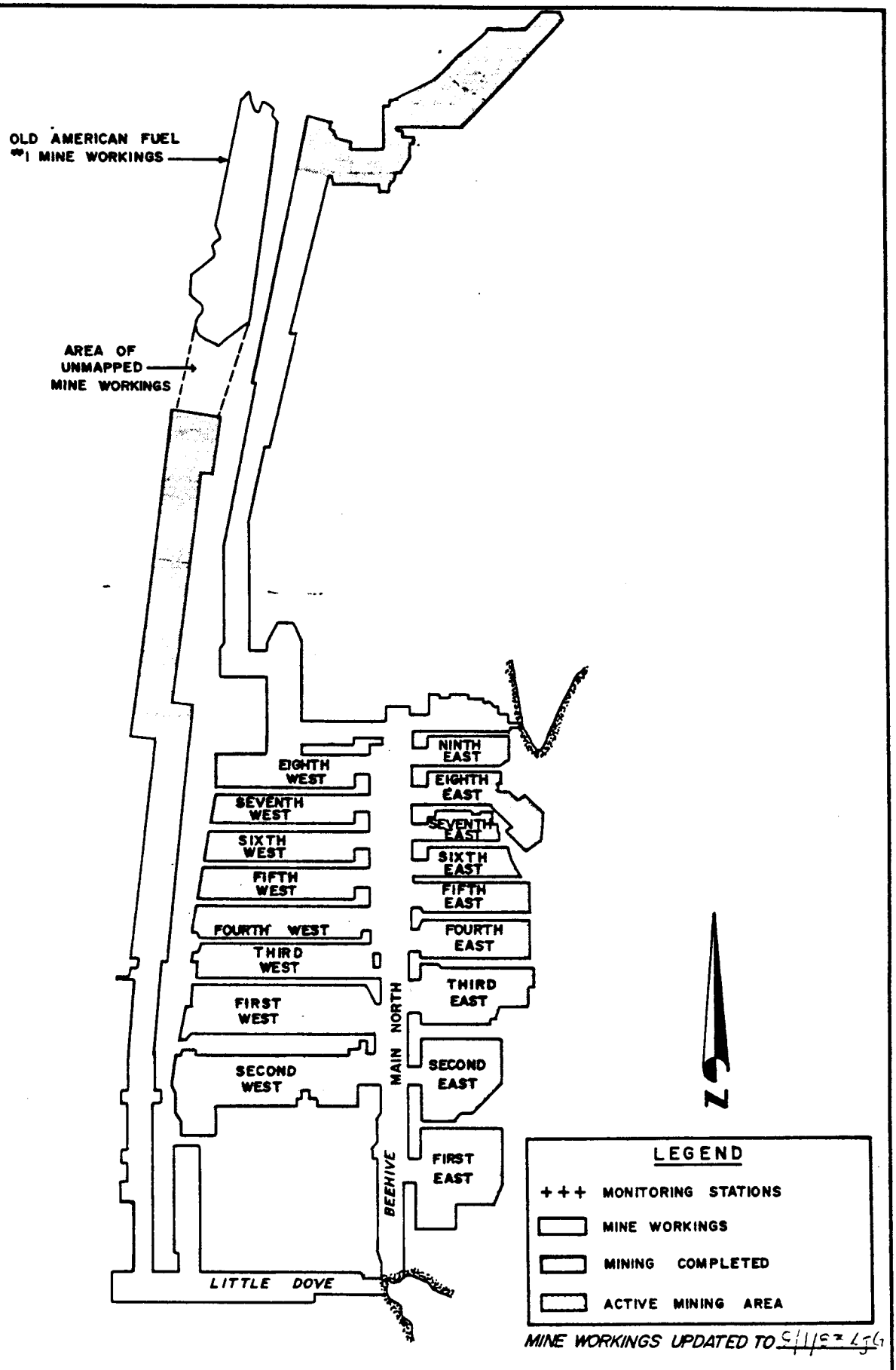
DES-BEE-DOVE MINE



MINE WORKINGS UPDATED TO 9/1/85

DESERET COAL MINE

SCALE: 1" = 2000'



BEEHIVE & LITTLE DOVE COAL MINES

SCALE: 1" = 2000

REPORT OF SUBSIDENCE STUDY

LOCATED ON EAST MOUNTAIN ABOVE THE

DES-BEE-DOVE
COAL MINES

From October 1980
to September 1984

By

Intermountain Aerial Surveys
A Div. of Engineering Enterprises, Inc.

Salt Lake City, Utah

SUBSIDENCE REPORT
DES-BEE-DOVE COAL MINES

September 28, 1984

I. Scope of Work

A. Establish Monuments on East Mountain above the "Des-Bee-Dove" Mine System as directed. Included sketch shows locations as related to mine workings. Computation sheets identify station location by State Plane Coordinate System (Utah Central Zone Modified C.A.F. = 1.0004350).

B. Monitor elevation changes on Monuments at yearly intervals.

II. Procedures

A. Elevations were established in 1980 by use of trigonometric leveling. Vertical angles were measured with a Wild T-2 theodolite. Accepted survey practices were utilized to insure reasonable accuracies.

B. Subsequent elevations were monitored by differential leveling. Third order technique and accuracies were observed.

C. Horizontal point determination was accomplished by employing third order techniques. Wild T-2 theodolites and AGA Model 78 Distance Measuring Equipment were used.

III. Control Datum

Control point "P-3" is used as the reference monument for this study. It is located on East Mountain, east of the monitoring line (see computation sheets). Its' stability has been tested by recalculating several control networks which have passed through the station throughout the last several years. To insure against the possibility of future subsidence it will be tied to control point "M-2 at systematic periods throughout the monitoring year by trigonometric leveling. M-2 is located near the portal of the Deseret Mine and is outside of the area of any suspected subsidence.

SUBSIDENCE STUDY
DES-BEE-DOVE COAL MINES

Station	VABM OCT 80	NOV 82	OCT 83	SEPT 84	Diff. OCT 80 SEPT 84
P-3	9239.89	9239.89	9239.89	9239.89	Fixed
BS-21	9223.5	9223.56	9223.60	9223.58	+0.1
BS-20	9210.2	9210.28	9210.32	9210.32	+0.1
BS-19	9201.9	9201.96	9202.02	9202.04	+0.1
BS-18	9188.7	9188.68	9188.71	9188.70	0
BS-17	9167.2	9167.08	9167.13	9167.12	-0.1
BS-16	9147.1	9146.66	9146.67	9146.66	-0.4
BS-15	9125.4	9124.66	9124.66	9124.64	-0.8
BS-14	9106.7	9105.81	9105.78	9105.78	-0.9
BS-13	9085.8	9084.70	9084.67	9084.66	-1.1
BS-12	9062.3	9061.11	9061.08	9061.05	-1.2
BS-11	9038.3	9037.05	9037.00	9036.97	-1.3
BS-10	9016.5	9015.27	9015.25	9015.21	-1.3
BS-9	8993.3	8992.03	8991.97	8991.96	-1.3
BS-8	8962.8	8961.64	8961.57	8961.54	-1.3

SUBSIDENCE STUDY

Station	VABM OCT 80	NOV 82	OCT 83	SEPT 84	Diff. OCT 80 SEPT 84
BS-7	8931.0	8929.98	8929.90	8929.88	-1.1
BS-6	8900.6	8899.71	8899.64	8899.62	-1.0
BS-5	8867.4	8867.39	8867.32	8867.32	-0.1
BS-4	8846.5	8846.51	8846.46	8846.46	-0.1
BS-3	8806.6	8806.71	8806.65	8806.66	+0.1
BS-2	8795.2	8795.29	8795.25	8795.27	+0.1
BS-1	8785.6	8785.54	8785.57	8785.59	0

SUBSIDENCE STUDY
DES-BEE-DOVE COAL MINES

Station	VABM OCT 80	NOV 82	OCT 83	SEPT 84	Diff. OCT 80 SEPT 84
BS-9					
#1 No.	8983.8	8982.36	8982.31	8982.28	-1.5
#2 No.	8973.9	8972.32	8972.24	8972.21	-1.7
#3 No.	8960.0	8958.32	8958.22	8958.21	-1.8
#4 No.	8946.8	8945.02	8944.87	8944.85	-2.0
BS-9					
#1 So.	8995.7	8994.61	8994.57	8994.56	-1.1
#2 So.	8992.6	8991.61	8991.60	8991.60	-1.0
#3 So.	8980.6	8979.75	8979.72	8979.72	-0.9
#4 So.	8958.3	8957.50	8957.50	8957.50	-0.8

SUBSIDENCE STUDY
DES-BEE-DOVE COAL MINES

Station	VABM OCT 80	NOV 82	OCT 83	SEPT 84	Diff. OCT 80 SEPT 84
BS-14					
#1 No.	9103.0	9102.05	9102.02	9102.02	-1.0
#2 No.	9098.8	9097.76	9097.72	9097.71	-1.1
#3 No.	9087.4	9086.22	9086.18	9086.16	-1.2
#4 No.	9076.8	9075.61	9075.56	9075.54	-1.3
BS-14					
#1 So.	9105.2	9104.35	9104.36	9104.36	-0.8
#2 So.	9095.0	9094.21	9094.21	9094.24	-0.8
#3 So.	9082.8	9082.05	9082.09	9082.10	-0.7
#4 So.	9079.4	9078.77	9078.81	9078.82	-0.6

SUBSIDENCE STUDY
DES-BEE-DOVE COAL MINES

Station	NOV 81	1982	1983	AUG 84
M-2A	+1963.05	+1963.33*	+1963.16**	+1963.15
P-3V.	+32.12	+32.08*	+32.10**	+32.08
P-3	+384.19	-	+383.92	-
S-6B	-744.33	-744.16	-743.83	-743.98
MT-1	-2296.78	-2296.75	-2296.94	-2296.47
HR-15	+3040.99	+3040.96	+3040.80	+3040.56
S-6B				
MT-1	+226.94	+223.41	+222.04	+216.34
MT-2	-192.61	-188.79	-187.56	-182.13
MT-3	+77.52	+77.34	+77.42	+77.18
MT-5	-2563.88 (1980)	-2563.64	-2564.06	-2564.22
409+00 R/W MKR.				

* Mean 4 Measurements
** Mean 2 Measurements

Station	NOV 81	OCT 82	SEPT 83	AUG 84
MT-1				
	+34.40	+34.62	+34.48	+34.21
MT-3				
S-6B				
	-727.22	-727.63	-727.38	+727.54
MT-7				
MT-5				
	+11.21	+11.43	+11.39	+11.33
MT-6				
	-106.07	-106.81	-	-106.70
MT-7				
	+60.41	-61.07	-	+61.24
MT-8				
	-77.55	-77.74	-	-77.62
MT-1				

	Diff./Elev.	
MT-2	1980-82 -	3.7
MT-2	1980-83 -	4.9
MT-2	1980-84 -	10.6