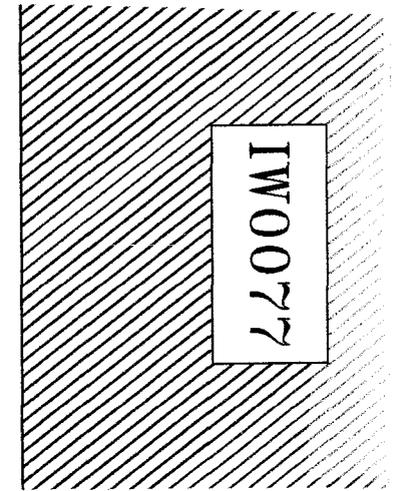


ANNUAL SUBSIDENCE MONITORING REPORT
EAST /TRAIL MOUNTAIN PROPERTIES
1997

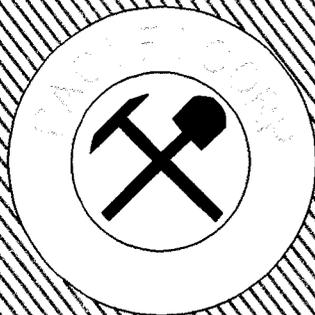


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TECHNICAL SERVICES REPORT
RODGER C. FRY

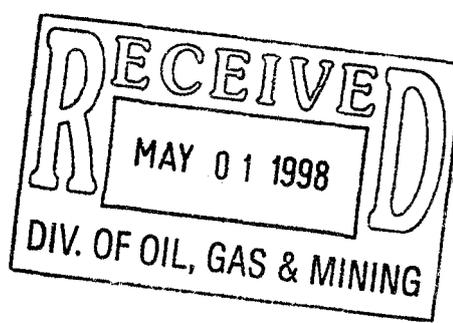
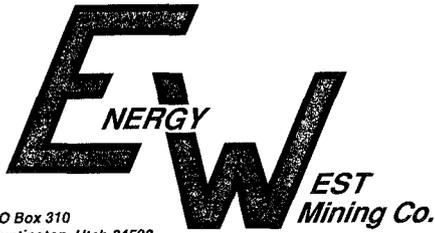
IW0077

CENTRAL ENGINEERING

ANNUAL SUBSIDENCE MONITORING REPORT
EAST/TRAIL MOUNTAIN PROPERTIES
1997



APRIL 30, 1998



Charles A. Semborski
Geology/Permitting Supervisor
(801) 687-4720
FAX (801) 687-2695

DATE: April 30, 1998
TO: Distribution
FROM: Charles A. Semborski
SUBJECT: Annual Subsidence Monitoring Report - East/Trail Mountain Properties 1997

Enclosed is a copy of the Annual Subsidence Monitoring Report - East/Trail Mountain Properties for 1997.

Distribution:

United States Forest Service:
Price Office - 2 copies (Carter Reed/Jeff DeFreest)

Bureau of Land Management:
Salt Lake Office - Jim Kohler
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cc: Carl Pollastro, with enclosure
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Trail Mountain Mine:
(435) 748-2140
Fax (435) 748-5125

PACIFICORP
SUBSIDENCE MONITORING PROGRAM
ANNUAL REPORT FOR 1997

April, 1998

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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APPENDICES

Subsidence Map

Raw Data

Des-Bee-Dove Mines

Deer Creek Mine

Wilberg/Cottonwood Mine

Trail Mountain Mine

Spring Map with 5-Year Mine Plan Showing Subsidence

Cliff Stability Survey Targets

INTRODUCTION

PacifiCorp's East Mountain/Trail 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/Cottonwood, Des-Bee-Dove and Trail Mountain Mines (see Figure 1). This, the sixteenth such annual report submitted, covers the period between August 31, 1996 and August 31, 1997.

The initial report submitted in 1982 details the monitoring methods used in the study; therefore, they are not discussed in depth here. Briefly, PacifiCorp uses aerial photogrammetric survey methods and annual helicopter reconnaissance flights to monitor subsidence. The aerial photogrammetry work is contracted to a mapping company. Contracts for the work are bid and awarded for a three year period. This is the third contractor that has been involved with the project. Between 1982 and 1987 the work was contracted through Intermountain Aerial Surveys. They established reading points on generally a 200 foot grid but adjusted the location of each point to be on easily reproducible locations. Between 1988 and 1990 the work was contracted to Maps Inc. Because of the type of equipment it was better for them to establish uniform grid points on 200 foot spacing. In 1991 the work was contracted to MapCon Mapping Consultants. The owners of this company were previously employed by Intermountain Aerial Surveys and felt that better results could be obtained by using the original grid established by Intermountain Aerial Surveys. Therefore, they reverted back to the original monitoring grid. A change in the method of reading the aerial photographs may result in some slight changes in

measured subsidence in some areas. Also, it is crucial that accurate paneled control be surveyed and recorded on the photographs to enable close subsidence readings. Between 1987 and 1990, some of the survey control in the more difficult to reach areas were not properly paneled and could not be identified on the photographs. It appears that this diminished the precision of the subsidence reading in some of the areas during those years.

Using the aerial photographs derived from a flight conducted on September 30, 1997, elevations were measured at 17,499 different points. These elevations were then compared with the baseline survey elevations measured from the aerial photos collected in 1980, 1986, 1987 and 1994. The difference in elevation is the amount of subsidence that has occurred.

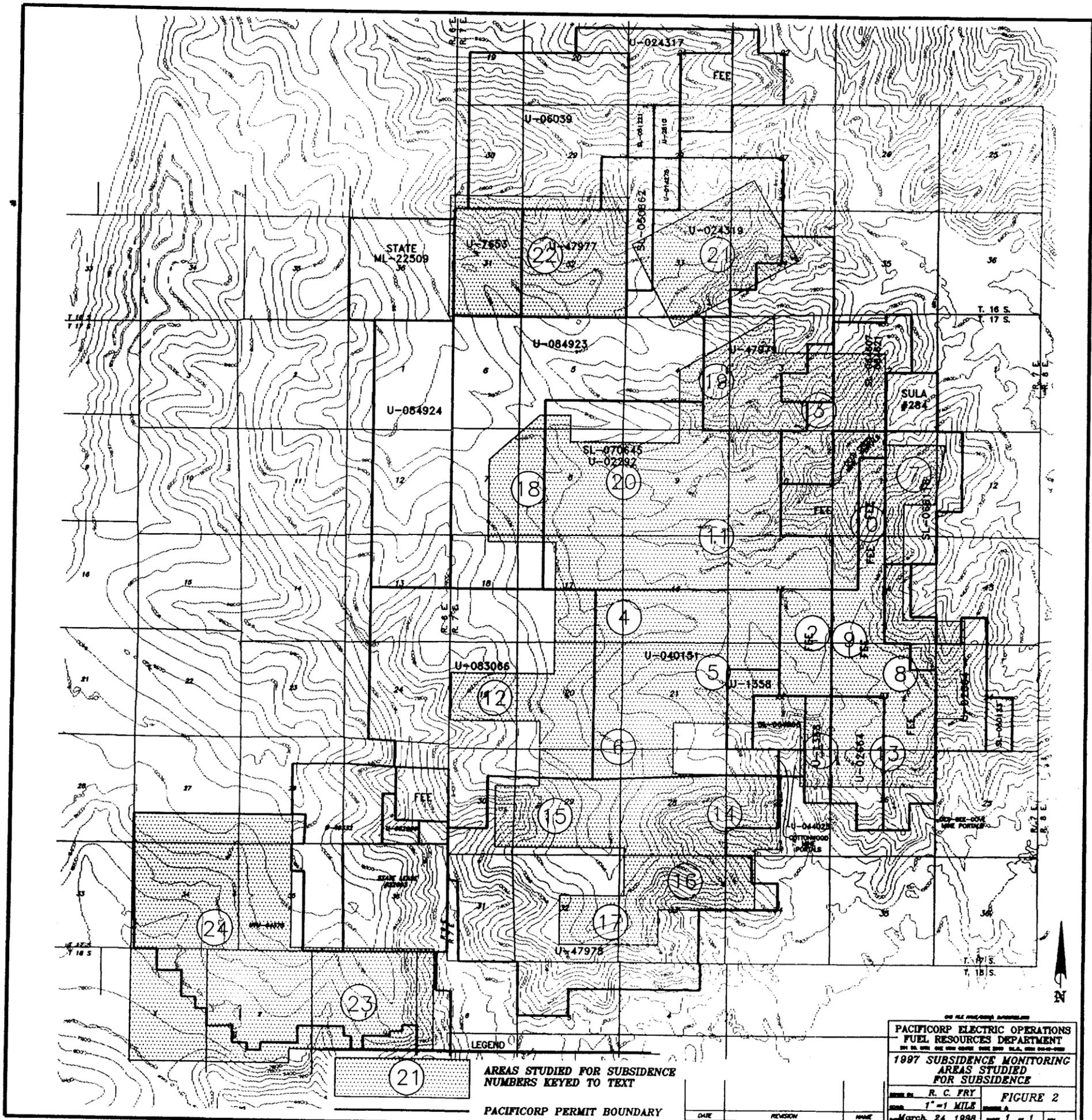
A map of all areas of subsidence is included in the appendix to this report. The raw data is included in the appendix of this report on a 3 ½ inch disk in an ASCII file called 97SUB.TXT. The photography completed on September 30, 1997 were black and white and included all of the areas where longwall or room and pillar extraction has been completed.

A helicopter reconnaissance flight May 19, 1997 revealed no new fracturing or visible signs of subsidence in any of the monitored areas. Prior to PacifiCorp's acquisition of the Trail Mountain Mine from ARCO Coal Co., they monitored subsidence using on the ground monumentation. Nowhere did that monitoring identify subsidence greater than a few tenths of feet. Substantial longwall mining has now occurred in the Trail Mountain Mine.

As a result, subsidence has been detected and is reported herein.

Location

Figure 2 shows all areas above PacifiCorp's coal mines which have potential for mining-induced subsidence. In 1997, twenty-four areas of subsidence were monitored and are reported herein. In areas where subsidence has been detected, data is shown in the form of contour maps and profiles. Both indicate elevation change from pre-mining elevations. The profile figures present data for all years monitored with the exception of the 1990 data. The computer data files from that year were damaged rendering them unreadable. At this time it is felt that enough data exists from the other years and the task of regenerating that data is not warranted. In many areas of subsidence the angle-of-draw has been calculated and reported; however, in the majority of cases the angle should not be considered the actual final angle-of-draw due to several factors. For example, the zone of subsidence to date may be small and contained within the underlying mined area, suggesting that the subsidence has not yet reached its maximum extent. Also, many mined sections are surrounded by other older workings which influence the calculation. In a few areas where the mined-out workings are surrounded by burned coal, the failure of clinker beds promotes subsidence outside the mined area resulting in an angle-of-draw greater than might be expected.



PACIFICORP ELECTRIC OPERATIONS
 FUEL RESOURCES DEPARTMENT
 1997 SUBSIDENCE MONITORING
 AREAS STUDIED
 FOR SUBSIDENCE

BY: R. C. FRY	FIGURE 2
SCALE: 1" = 1 MILE	DATE: March 24, 1998

LEGEND
 AREAS STUDIED FOR SUBSIDENCE
 NUMBERS KEYED TO TEXT
 PACIFICORP PERMIT BOUNDARY

Area 1

Deer Creek 9th East - Wilberg 1st Right

Subsidence in Area 1 was first documented in the 1981 Subsidence Monitoring Report submitted in 1982. The relationship of the subsidence to the underlying Deer Creek and Wilberg mine workings is shown in Figures 3, 4, and 5. Each map covers the same area, Figure 5 being a contour map of subsidence on the surface over the mine workings depicted in the other two figures. The most recent mining in this area occurred in the Wilberg 1st Right section in June 1984.

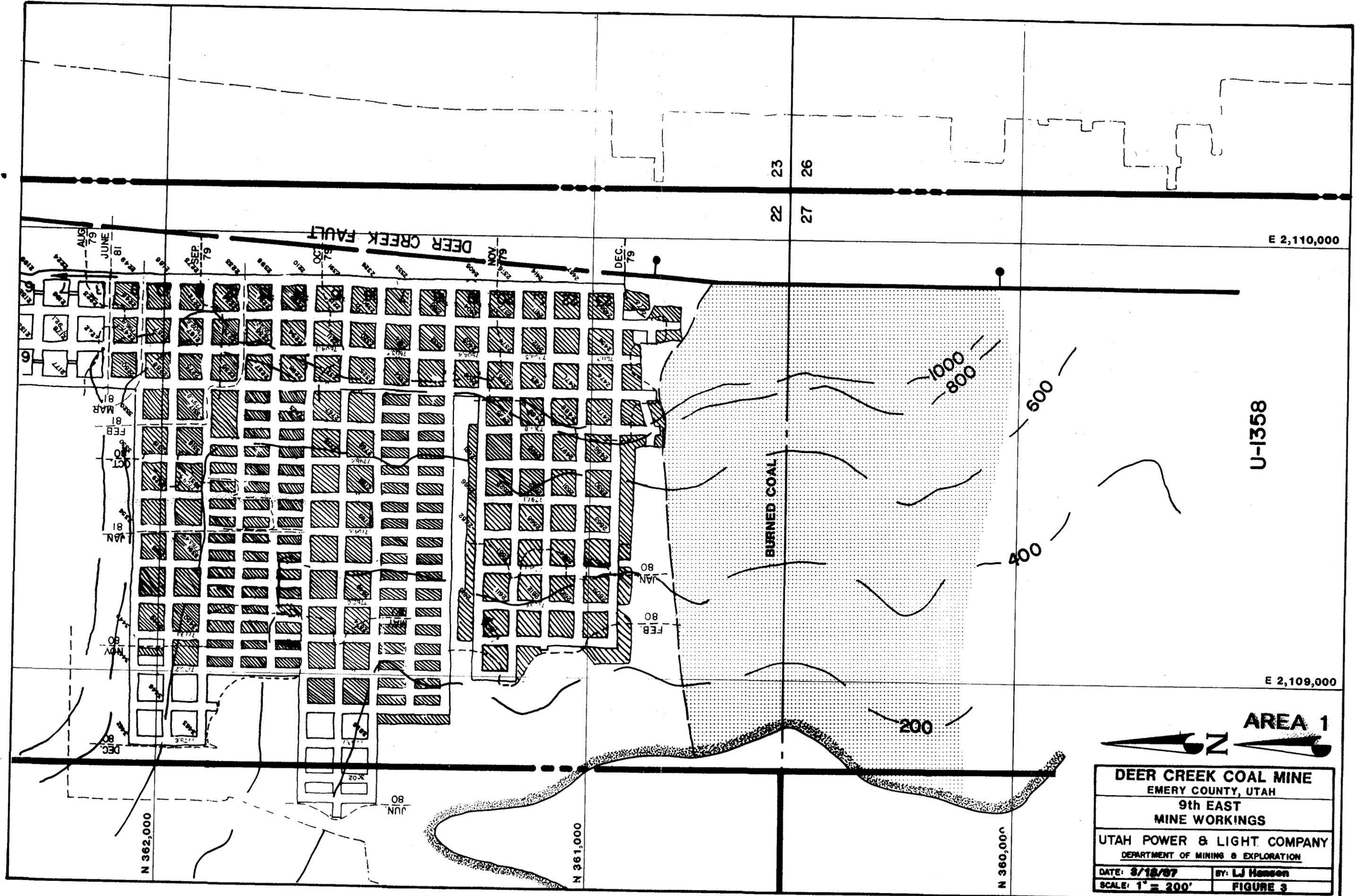
Figures 6 and 7 are north to south and west to east profiles showing the amount of subsidence in this area during the past fourteen years. The location of each line is shown on Figure 5. The area has seen little change since 1985 and appears to have totally stabilized. Maximum subsidence remains at about twenty-eight (28) feet. A detailed look from a helicopter revealed that the subsidence maximum is located on a steep slope, about 200 feet south of the southernmost mining, where a good-sized rotational slump has occurred. The workings here are also surrounded by burned coal. It is probable that the combination of steep slopes and crushing of clinker beds has allowed subsidence to occur well outside the area of mine workings. An inspection of the area from the ground indicates that many of the open fractures forming the graben-like structure have begun to heal and fill in with soil.

Calculation of the angle-of-draw is complicated because the workings are nearly surrounded by faults, burned coal, and other mine workings. Due to this complexity, angle-

of-draw was not determined for Area 1.

In the summer of 1997, some of the fractures in this area were reclaimed per the U. S. Forest Service recommendations. This reclamation consisted of knocking down the abrupt escarpments and filling in the fractures in accessible areas. The top soil was then evenly distributed and the area re-seeded. This reclamation was completed by September 1, 1997 and encompassed 1.5 acres.

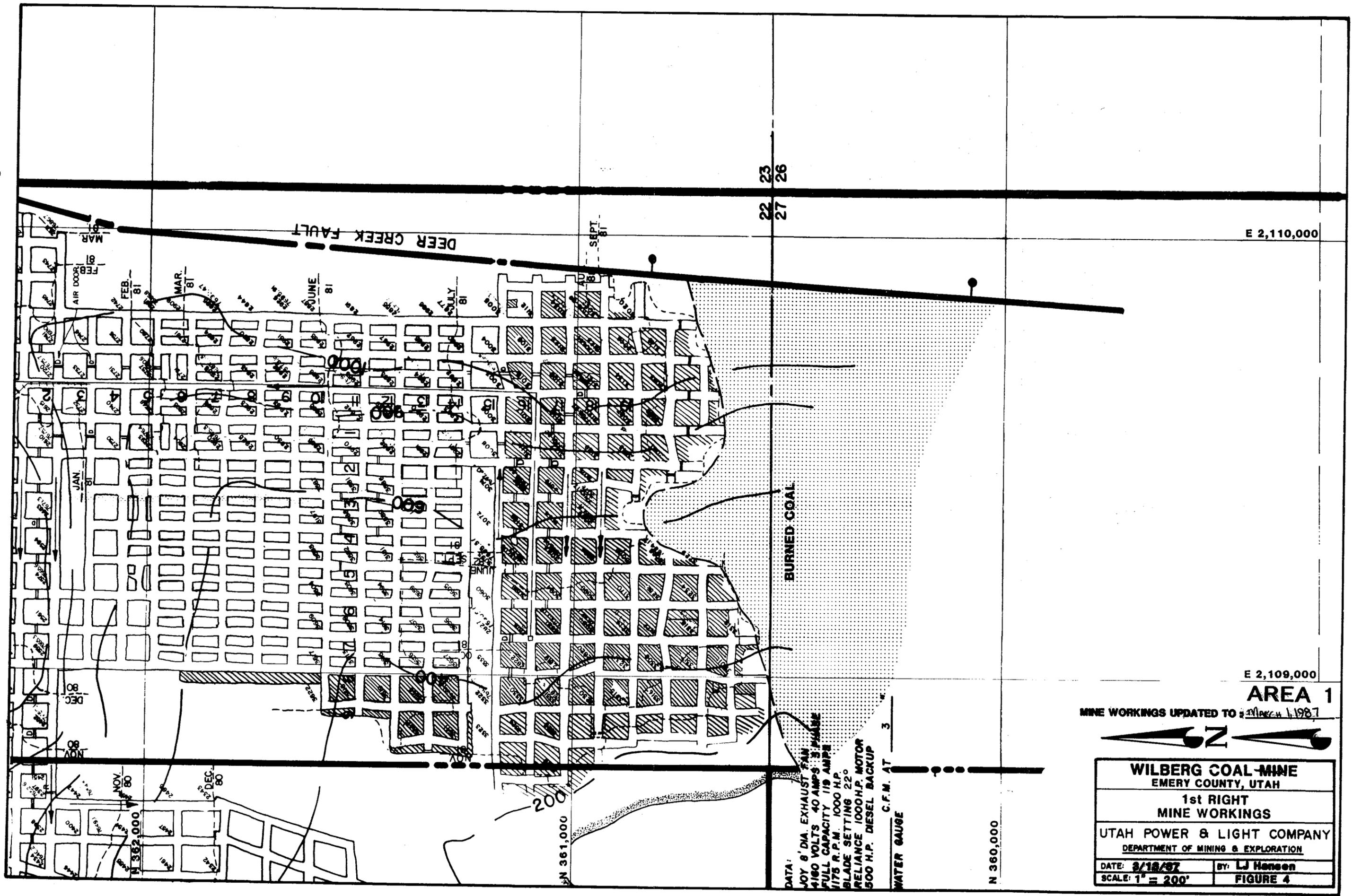
There are no springs, and no hydrologic impacts due to mining have been observed at this location.



U-1358

AREA 1

DEER CREEK COAL MINE	
EMERY COUNTY, UTAH	
9th EAST	
MINE WORKINGS	
UTAH POWER & LIGHT COMPANY	
DEPARTMENT OF MINING & EXPLORATION	
DATE: 8/18/87	BY: LJ Henson
SCALE: 1" = 200'	FIGURE 3



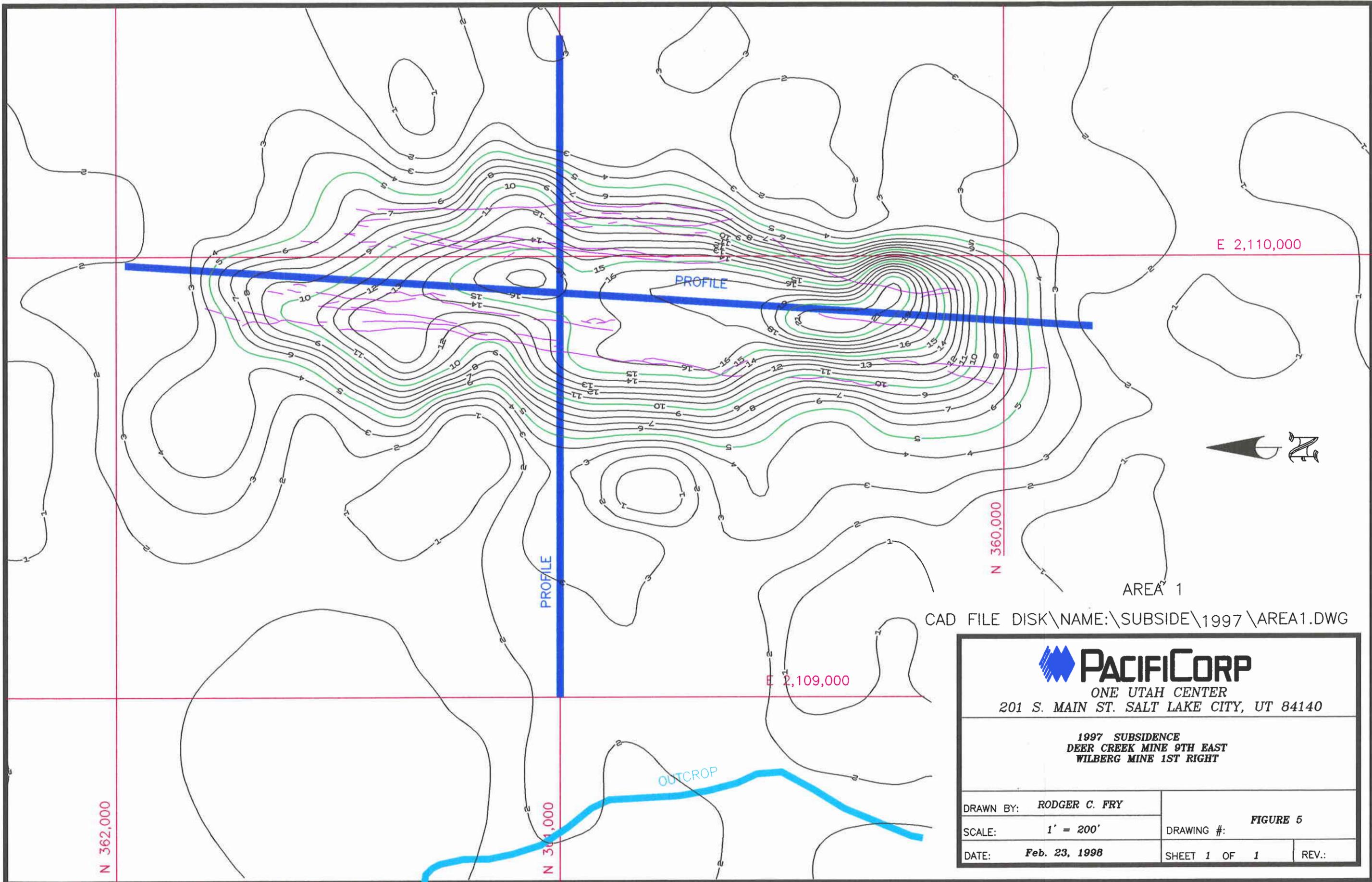
DATA:
 8' DIA. EXHAUST FAN
 4160 VOLTS 40 AMPS 3 PHASE
 FULL CAPACITY 119 AMPERE
 1175 R.P.M. 1000 H.P.
 BLADE SETTING 22°
 RELIANCE 1000 H.P. MOTOR
 500 H.P. DIESEL BACKUP

C.F.M. AT 3
 WATER GAUGE

E 2,109,000
AREA 1
 MINE WORKINGS UPDATED TO: *March 1, 1987*



WILBERG COAL MINE EMERY COUNTY, UTAH	
1st RIGHT MINE WORKINGS	
UTAH POWER & LIGHT COMPANY DEPARTMENT OF MINING & EXPLORATION	
DATE: 3/18/87	BY: LJ Hansen
SCALE: 1" = 200'	FIGURE 4



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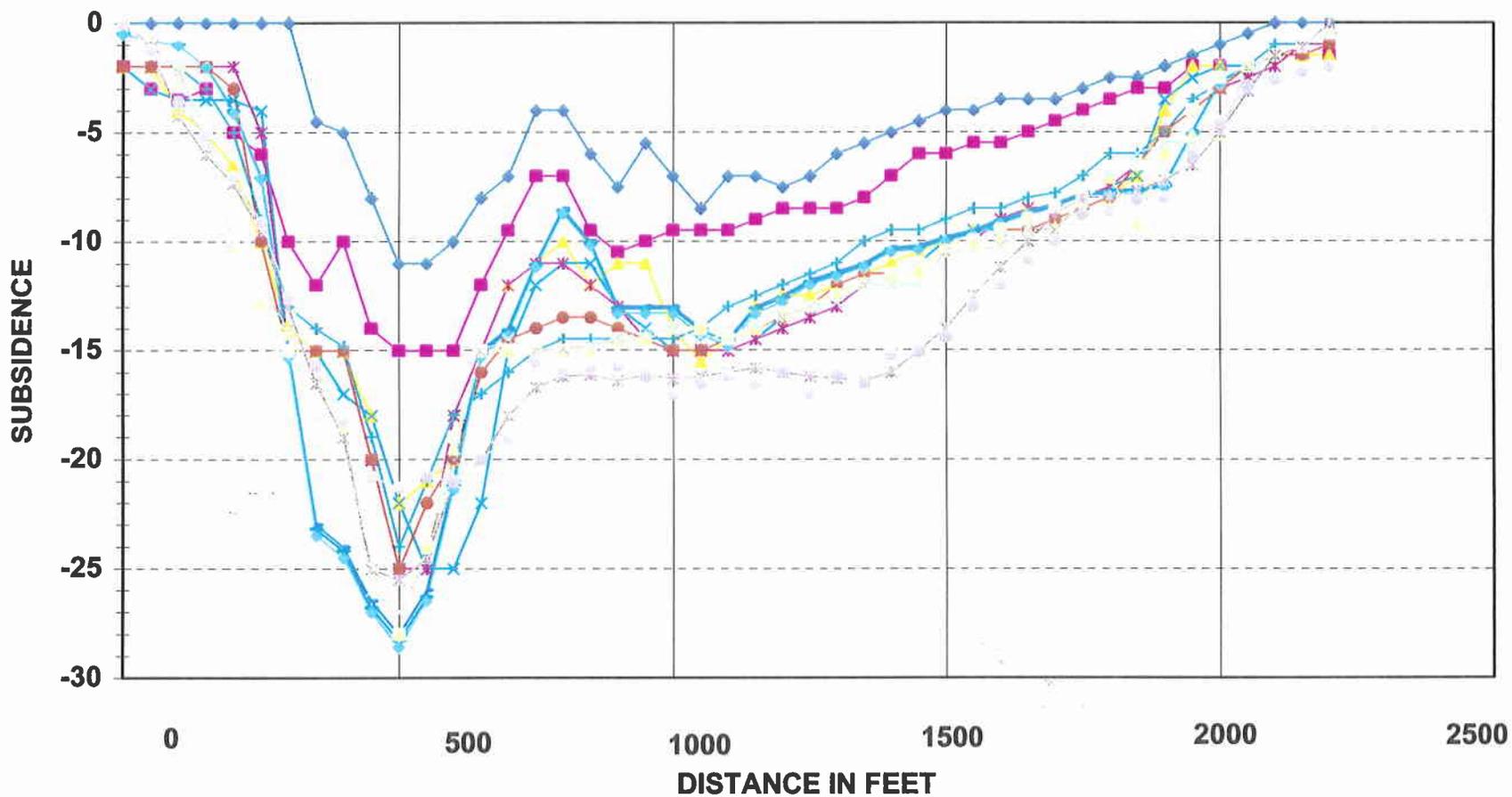


ONE UTAH CENTER
201 S. MAIN ST. SALT LAKE CITY, UT 84140

1997 SUBSIDENCE
DEER CREEK MINE 9TH EAST
WILBERG MINE 1ST RIGHT

DRAWN BY: RODGER C. FRY	DRAWING #: FIGURE 5	
SCALE: 1' = 200'	SHEET 1 OF 1	
DATE: Feb. 23, 1998	REV.:	

Area 1 Subsidence Profile South - North



- 1982
- 1983
- 1984
- 1985
- 1986
- 1987
- 1988
- 1989
- 1991
- 1992
- 1993
- 1994
- 1995
- 1996
- 1997

FIGURE 6

Area 1 Subsidence Profile West - East

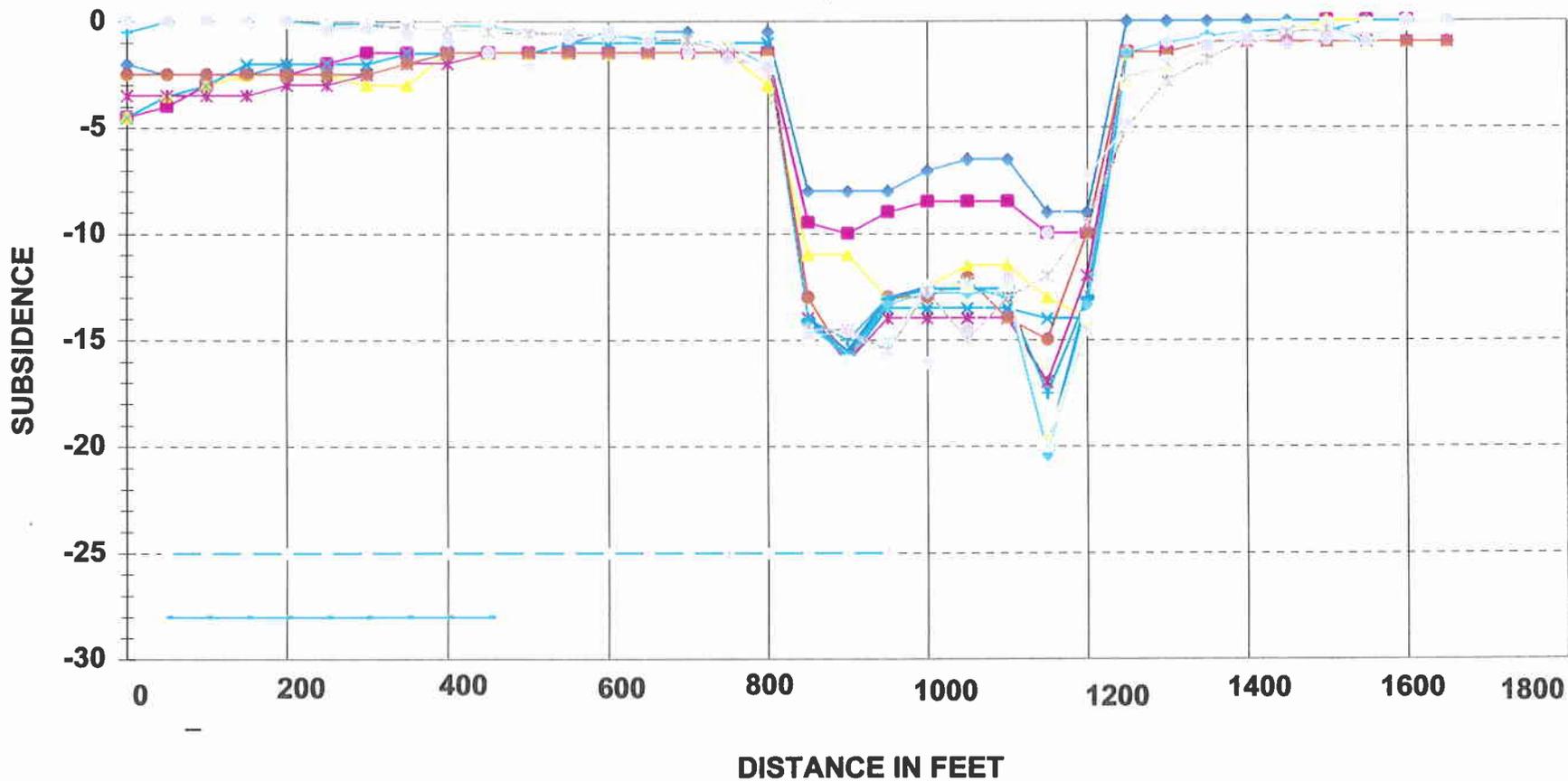


FIGURE 7

Area 2

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

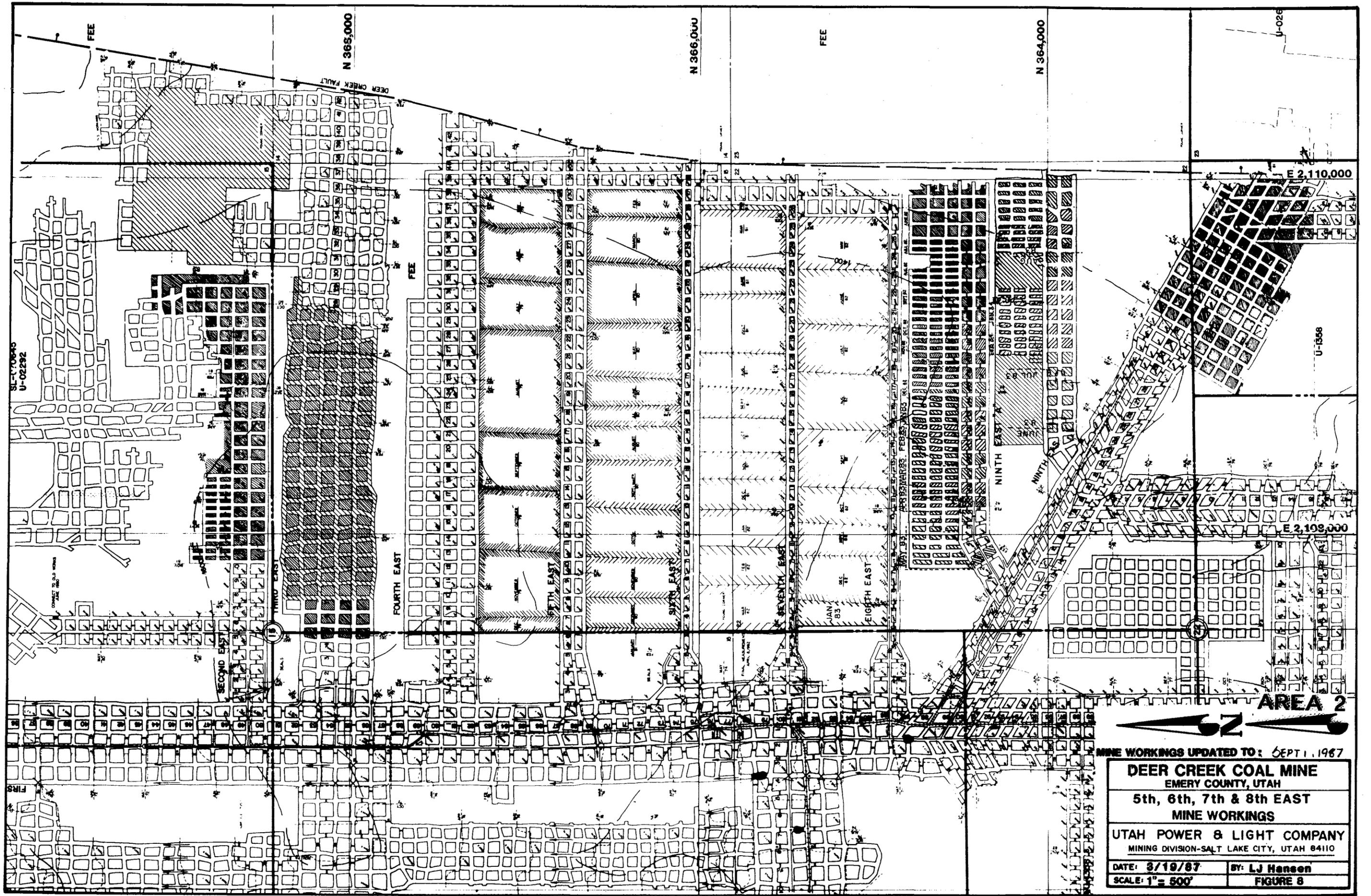
Wilberg 3rd through 13th Right Panels

Mining in the Deer Creek Mine in Area 2 was completed by February 1985 (Figure 8). Coal extraction in the underlying Wilberg Mine 3rd and 4th Right panels was completed between September 1987 and the end of January 1988 (Figure 9).

Maximum subsidence in Area 2 has stabilized at 13 feet in one area above the center of the multiple seam mining area (Figure 10). The subsidence profiles (Figures 11 and 12) indicate that the subsidence has been stable for the past 5 years or more. Neither PacifiCorp nor other contracted personnel have detected any surface fissures or other visible disturbance in the area.

Angle-of-draw has been calculated where possible. On the eastern side of Area 2 the angle is influenced by the Deer Creek Fault and the adjacent Little Dove Mine workings across the fault; thus, no angle was calculated. On other sides it ranges from less than zero to 11 degrees.

No springs have been identified over the subsidence area but two springs, one-fourth to one-third mile to the west, show no effects from mining (see Hydrologic Monitoring Report, 1997).

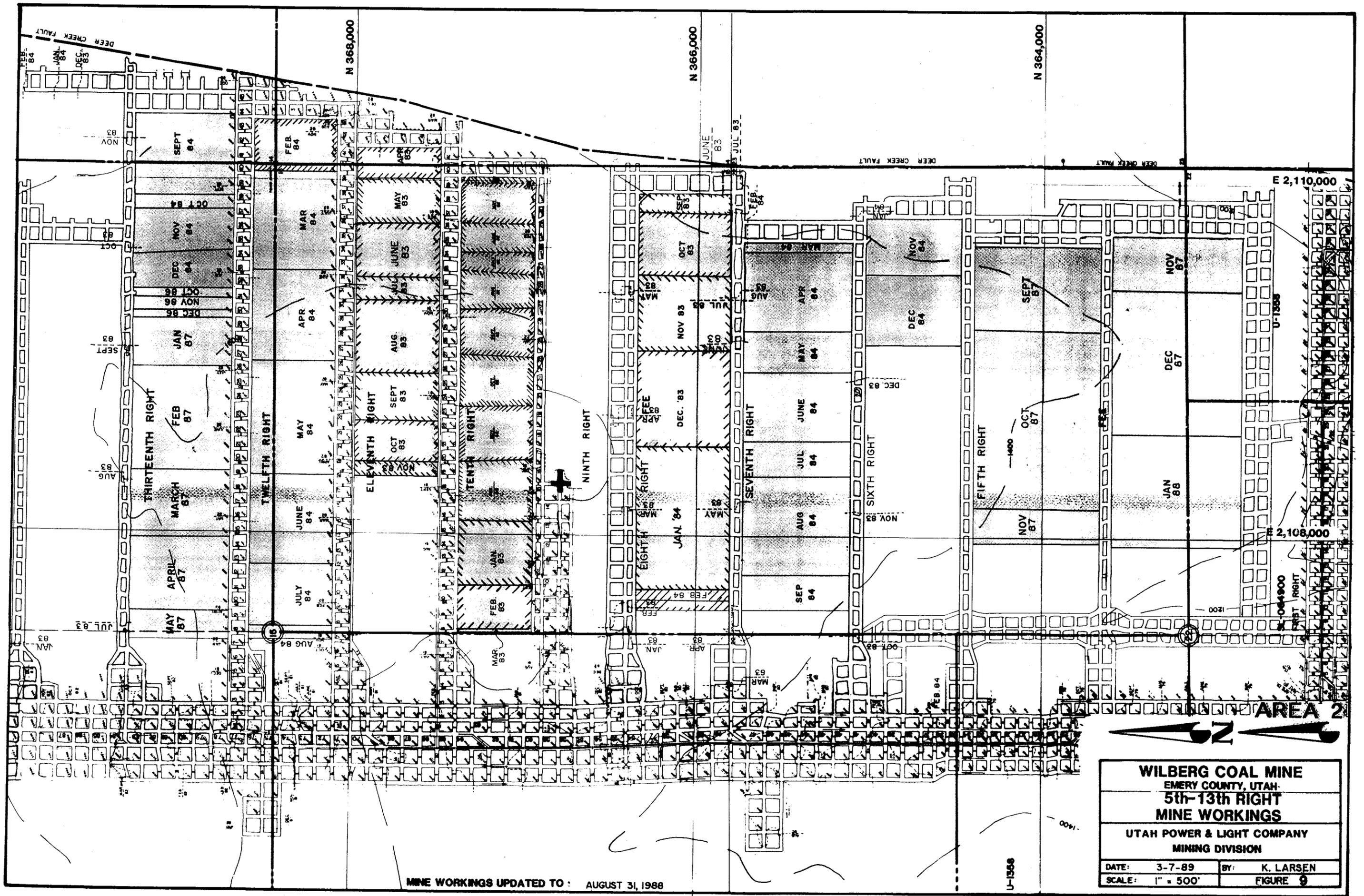


MINE WORKINGS UPDATED TO: SEPT. 1, 1987

DEER CREEK COAL MINE
 EMERY COUNTY, UTAH
 5th, 6th, 7th & 8th EAST
 MINE WORKINGS

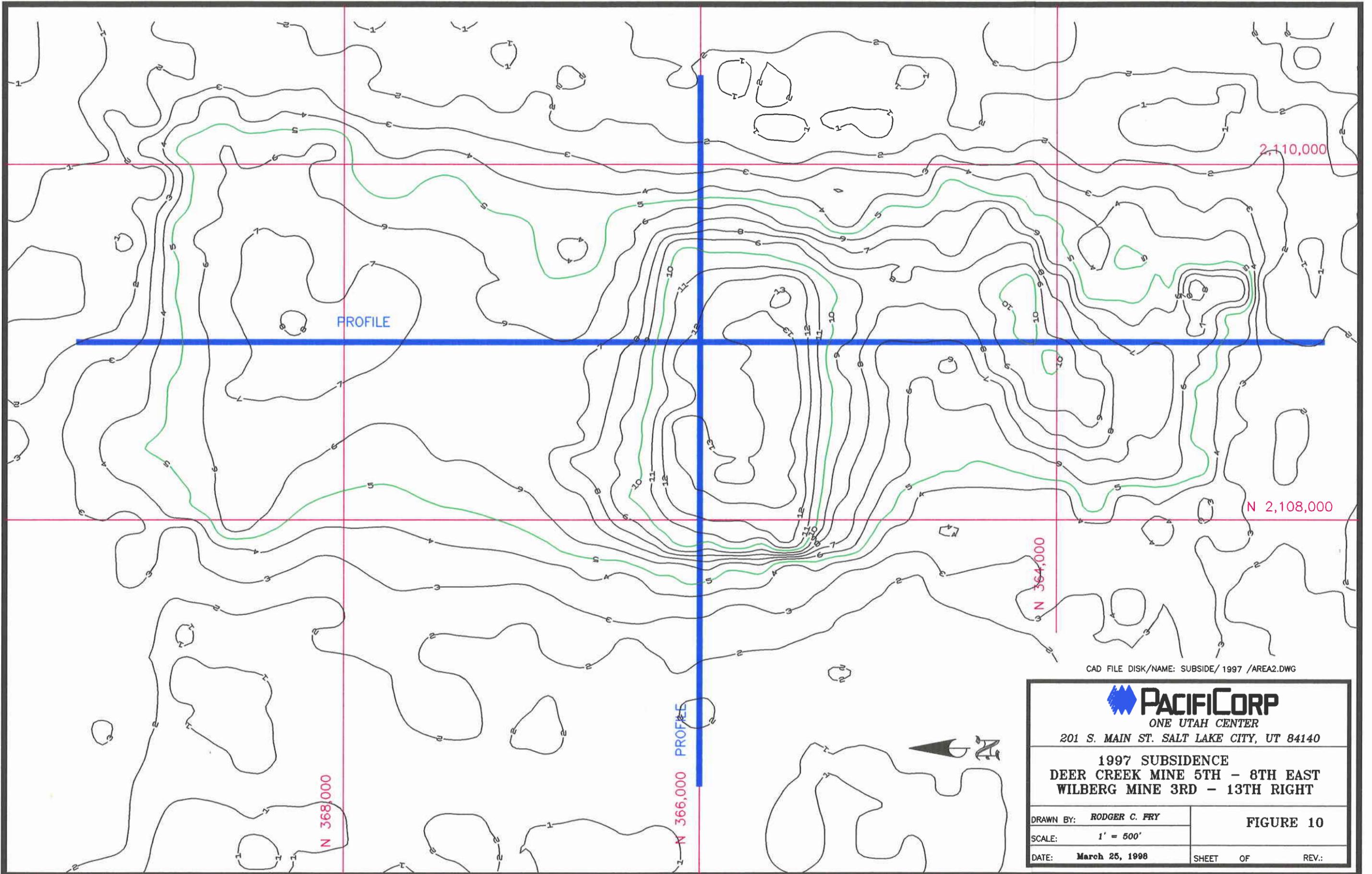
UTAH POWER & LIGHT COMPANY
 MINING DIVISION-SALT LAKE CITY, UTAH 84110

DATE: 3/19/87 BY: LJ Hansen
 SCALE: 1" = 500' FIGURE 8



MINE WORKINGS UPDATED TO : AUGUST 31, 1988

WILBERG COAL MINE	
EMERY COUNTY, UTAH	
5th-13th RIGHT	
MINE WORKINGS	
UTAH POWER & LIGHT COMPANY	
MINING DIVISION	
DATE: 3-7-89	BY: K. LARSEN
SCALE: 1" = 500'	FIGURE 9



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 PACIFICORP ONE UTAH CENTER 201 S. MAIN ST. SALT LAKE CITY, UT 84140	
1997 SUBSIDENCE DEER CREEK MINE 5TH - 8TH EAST WILBERG MINE 3RD - 13TH RIGHT	
DRAWN BY: RODGER C. FRY	FIGURE 10
SCALE: 1" = 500'	SHEET OF REV.:
DATE: March 25, 1998	

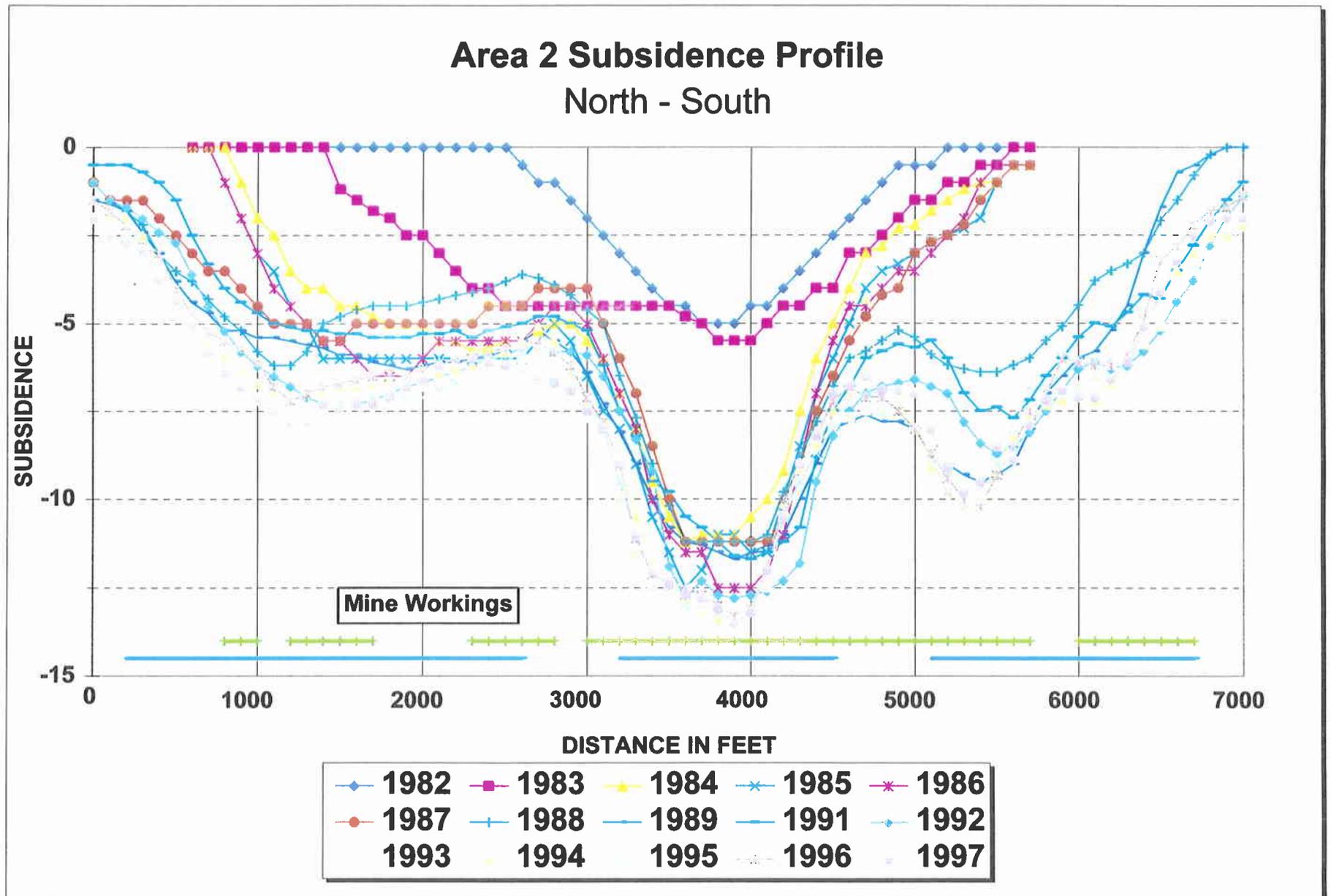


FIGURE 11

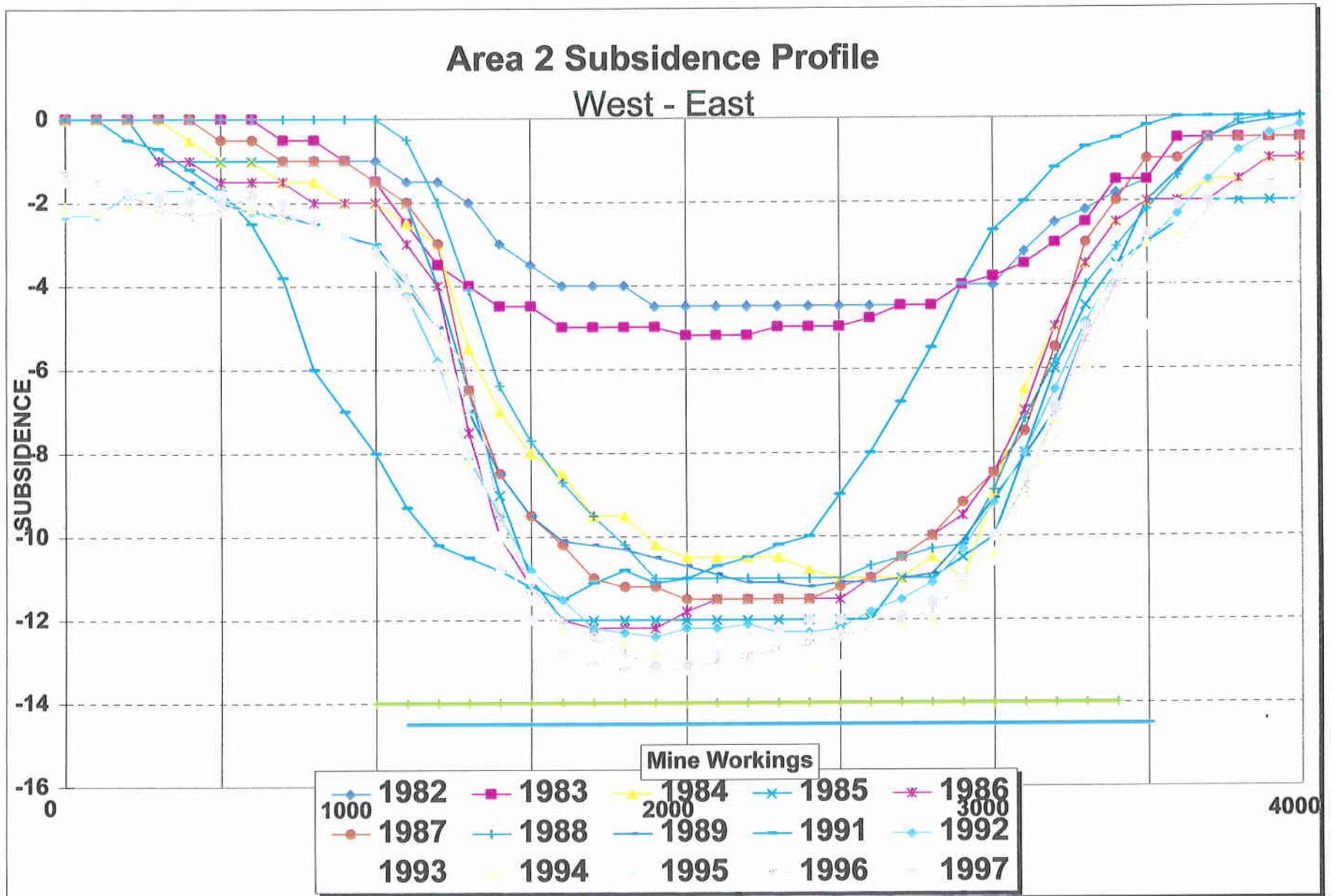


FIGURE 12

Area 3

Deer Creek 1st North Area

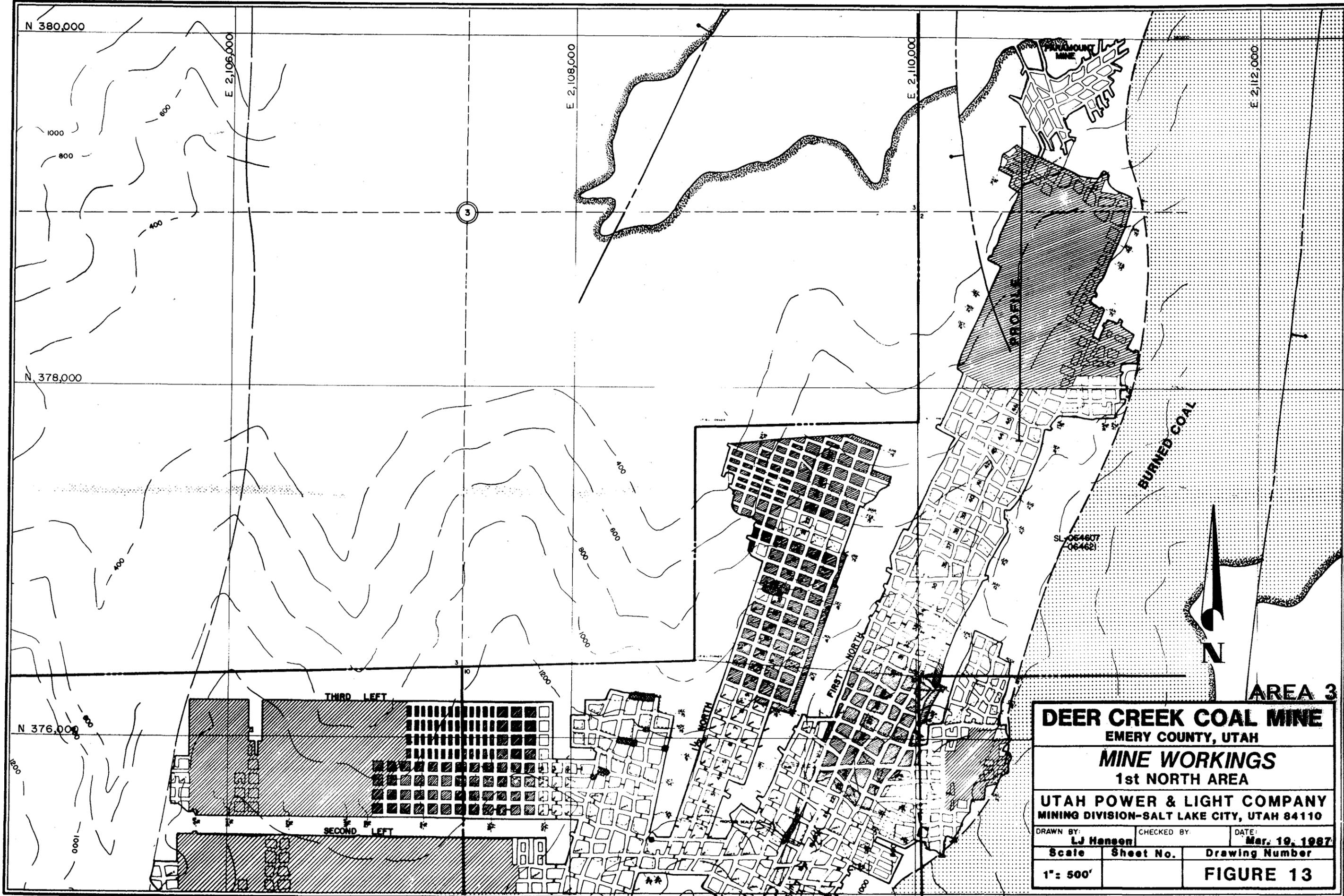
Most of the 1st North section of the Deer Creek Mine was abandoned and sealed in 1978 after being mined out. The southern portion is still open and may be used for access to a block of coal which lies to the west. Pillar extraction in the 3rd Left and 1-1/2 North sections was completed early in 1980 (Figure 13).

The subsidence above 1st North occurs on a narrow ridge capped by a highly fractured sandstone. The subsidence measured is depicted in Figure 13A. Figure 14 is a profile of total subsidence as it occurred along a line of points above the workings. The subsidence in area 3 has shown no significant change in the past 4 years.

A Helicopter survey in 1997 did not reveal any new surface cracks or new areas of cliff failure.

No angle-of-draw was determined due to the steep slopes, burned coal, and mode of subsidence.

The strata surrounding and above the 1st North workings are generally dry; therefore, mining has not adversely affected the groundwater.



DEER CREEK COAL MINE		
EMERY COUNTY, UTAH		
MINE WORKINGS		
1st NORTH AREA		
UTAH POWER & LIGHT COMPANY		
MINING DIVISION-SALT LAKE CITY, UTAH 84110		
DRAWN BY: LJ Hansen	CHECKED BY:	DATE: Mar. 10, 1987
Scale 1" = 500'	Sheet No.	Drawing Number FIGURE 13

N 380,000

E 2,106,000

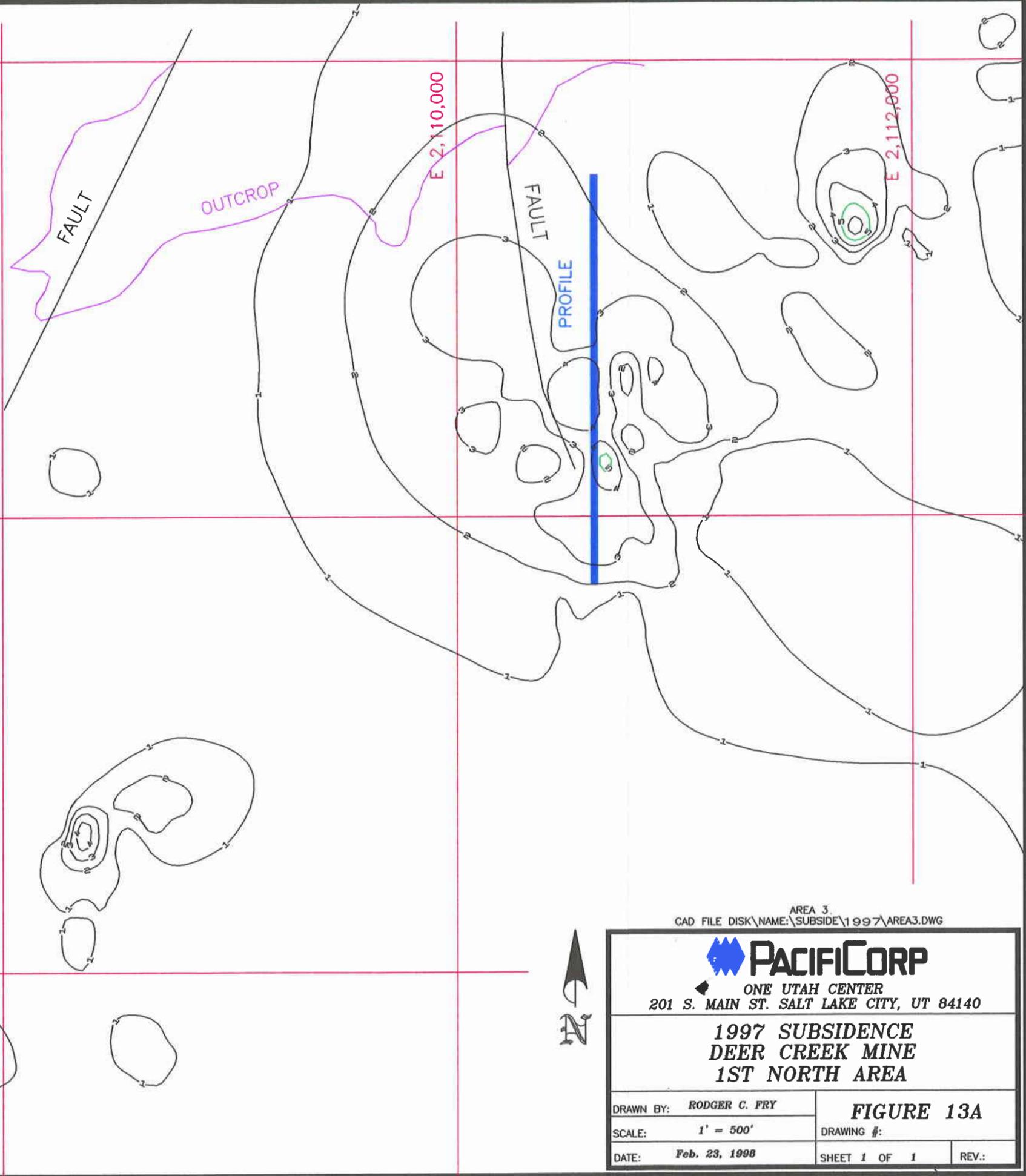
E 2,108,000

E 2,110,000

E 2,112,000

N 378,000

N 376,000



AREA 3.
CAD FILE DISK\NAME:\SUBSIDE\1997\AREA3.DWG



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**1997 SUBSIDENCE
DEER CREEK MINE
1ST NORTH AREA**

DRAWN BY: **RODGER C. FRY**

FIGURE 13A

SCALE: **1" = 500'**

DRAWING #:

DATE: **Feb. 23, 1998**

SHEET 1 OF 1

REV.:

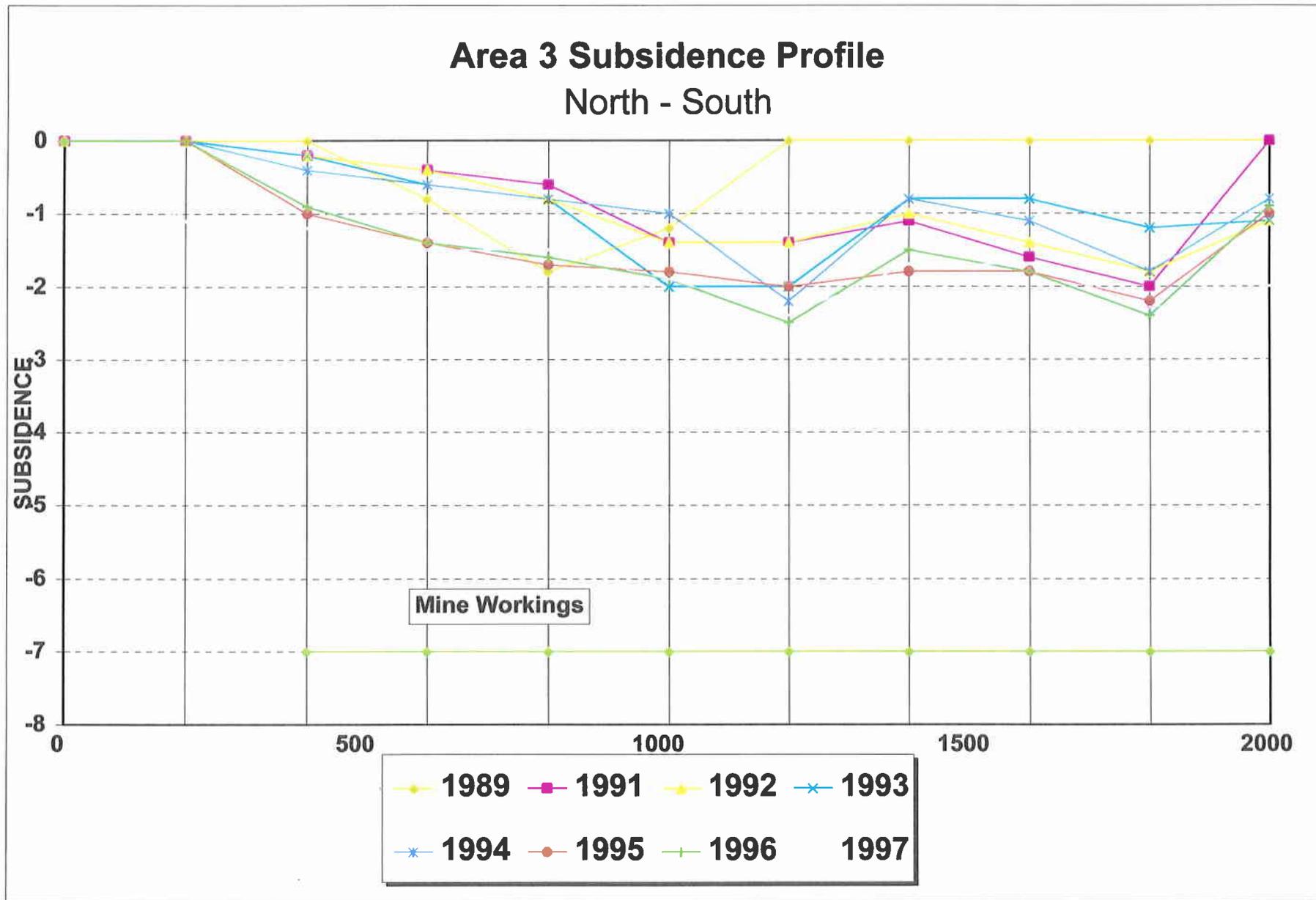


FIGURE 14

Area 4

Deer Creek 2nd through 17th Right Longwall Panels

Subsidence in Area 4 was detected for the first time in 1984 by photogrammetric methods. Longwall mining commenced in the 2nd Right longwall panels in 1980 and by the end of August 1991 the 2nd through 17th Right panels had been completed (Figure 15). In the Cottonwood mine, Longwall mining began in September of 1992 in the 9th Left Panel off 2nd north and the 8th Left Panel was terminated early because of unacceptable coal quality in February 1993. Mining resumed in this area in the 5th Left Longwall Panel in August of 1994 and continued through August of 1995 when mining was active in the 2nd Left Longwall Panel (Figure 15A).

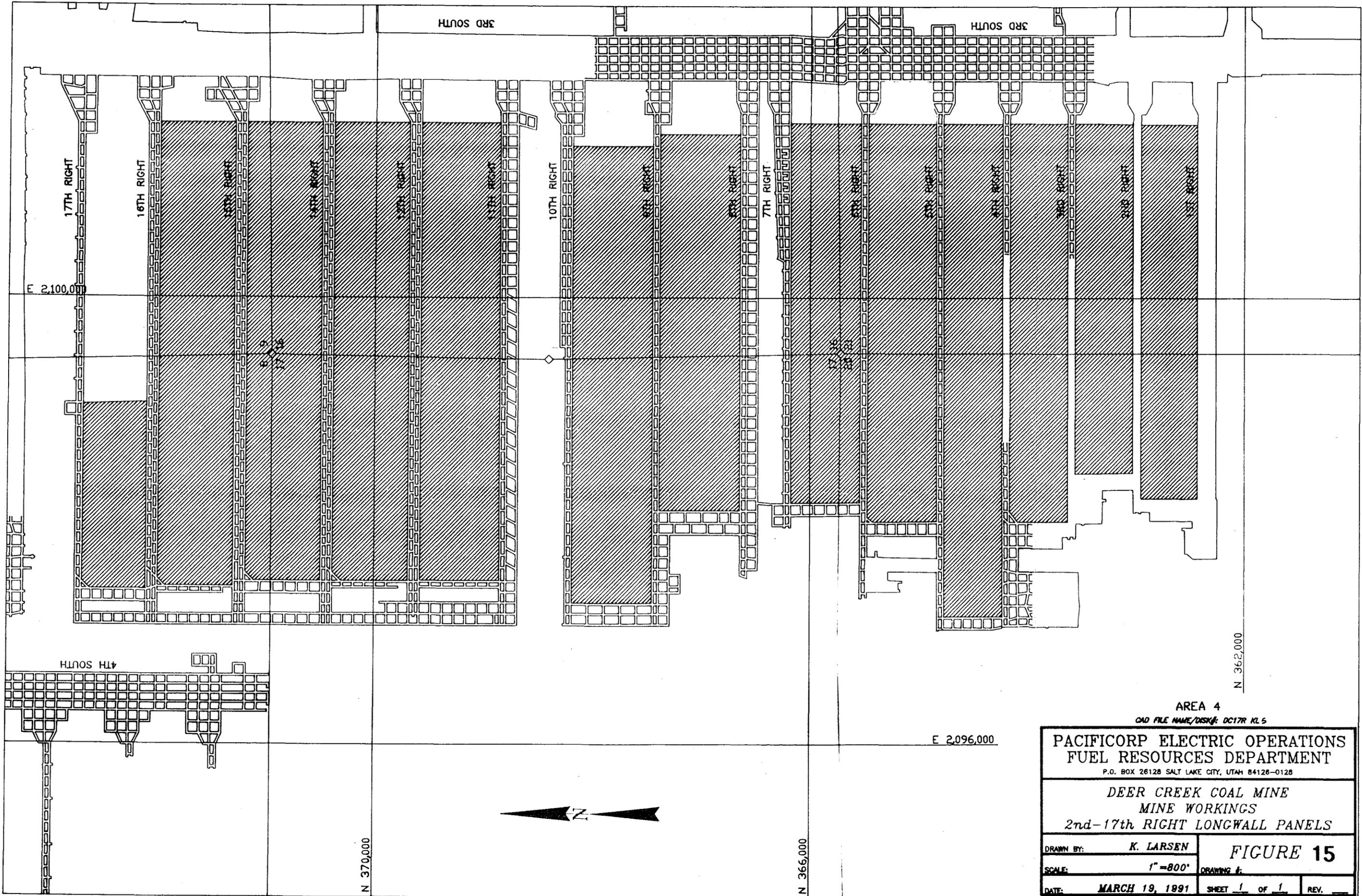
Maximum subsidence increased dramatically between 1994 and 1995 (8) feet to over thirteen (13) feet (Figure 16) due to the mining which occurred in the Hiawatha seam. The subsidence was virtually unchanged between 1995 and 1997 as shown in the profiles, Figures 17 and 18.

Surface fractures were identified in the field in late May of 1995. These fractures were located on Fee surface land and PacifiCorp filled in the fractures with a motor grader and reseeded the area. The location of the fractures are shown on figure 16. The revegetation in these areas is now established and no further fracturing has been identified.

The calculated angle-of-draw of the subsidence ranges from less than zero to 22 degrees. Several springs are located on East Mountain above these longwall panels and the 2nd through 5th Left panels located directly to the east (see Area 5). Fluctuations

in spring flow occur from year to year but seem to be related to variations in precipitation rather than mining. Flows are generally low in dry years and higher in wetter years (see Hydrologic Monitoring Report, 1997 and the Appendices to this report).

The left fork of the Grimes Wash drainage crosses the middle of the subsidence area. Stream monitoring has revealed no changes attributable to mining. This stream has been called **Perennial** by the US Forest Service, but our data indicates that it is ephemeral.



AREA 4
 CAD FILE NAME/DISK#: DC17R KL5

PACIFICORP ELECTRIC OPERATIONS
 FUEL RESOURCES DEPARTMENT
 P.O. BOX 26128 SALT LAKE CITY, UTAH 84126-0128

DEER CREEK COAL MINE
 MINE WORKINGS
 2nd-17th RIGHT LONGWALL PANELS

DRAWN BY:	K. LARSEN	FIGURE 15
SCALE:	1" = 800'	
DATE:	MARCH 19, 1991	DRAWING #: SHEET 1 OF 1 REV.

E 2,100,000

E 2,096,000

N 370,000

N 366,000

N 362,000

AREA 4
CAD FILE DISK\NAME:\SUBSIDE\1994\AREA4BM.DWG



ONE UTAH CENTER
201 S. MAIN ST. SALT LAKE CITY, UT 84140

COTTONWOOD COAL MINE
MINE WORKINGS
2ND-5TH LEFT & 8TH-9TH LEFT PANELS

DRAWN BY: RODGER C. FRY

FIGURE 15A

SCALE: 1" = 800'

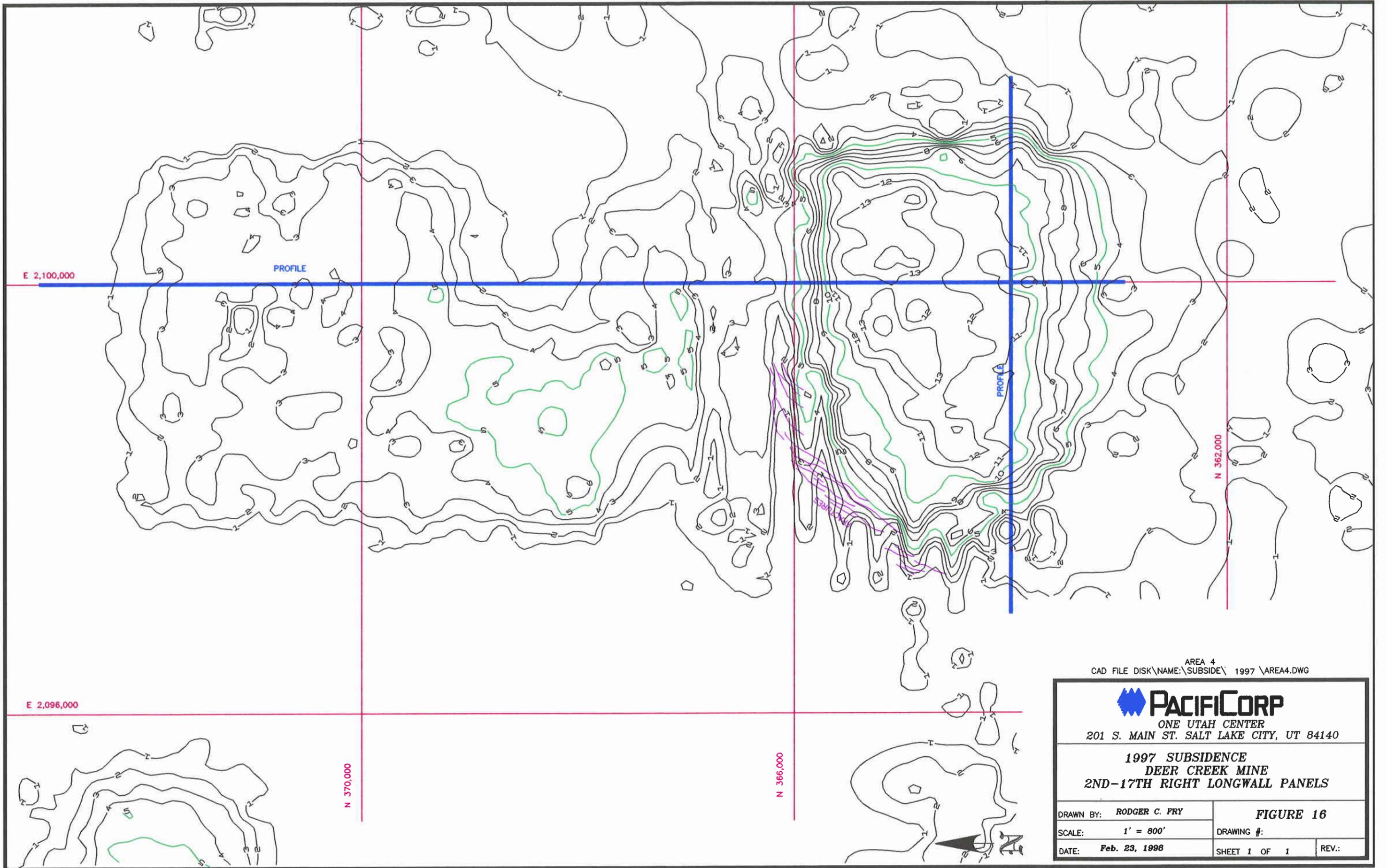
DRAWING #:

DATE: MARCH 31, 1995

SHEET 1 OF 1

REV.:





AREA 4
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ONE UTAH CENTER
 201 S. MAIN ST. SALT LAKE CITY, UT 84140

**1997 SUBSIDENCE
 DEER CREEK MINE
 2ND-17TH RIGHT LONGWALL PANELS**

DRAWN BY: **RODGER C. FRY**

FIGURE 16

SCALE: **1' = 800'**

DRAWING #:

DATE: **Feb. 23, 1998**

SHEET 1 OF 1

REV.:

Area 4 Subsidence Profile North - South

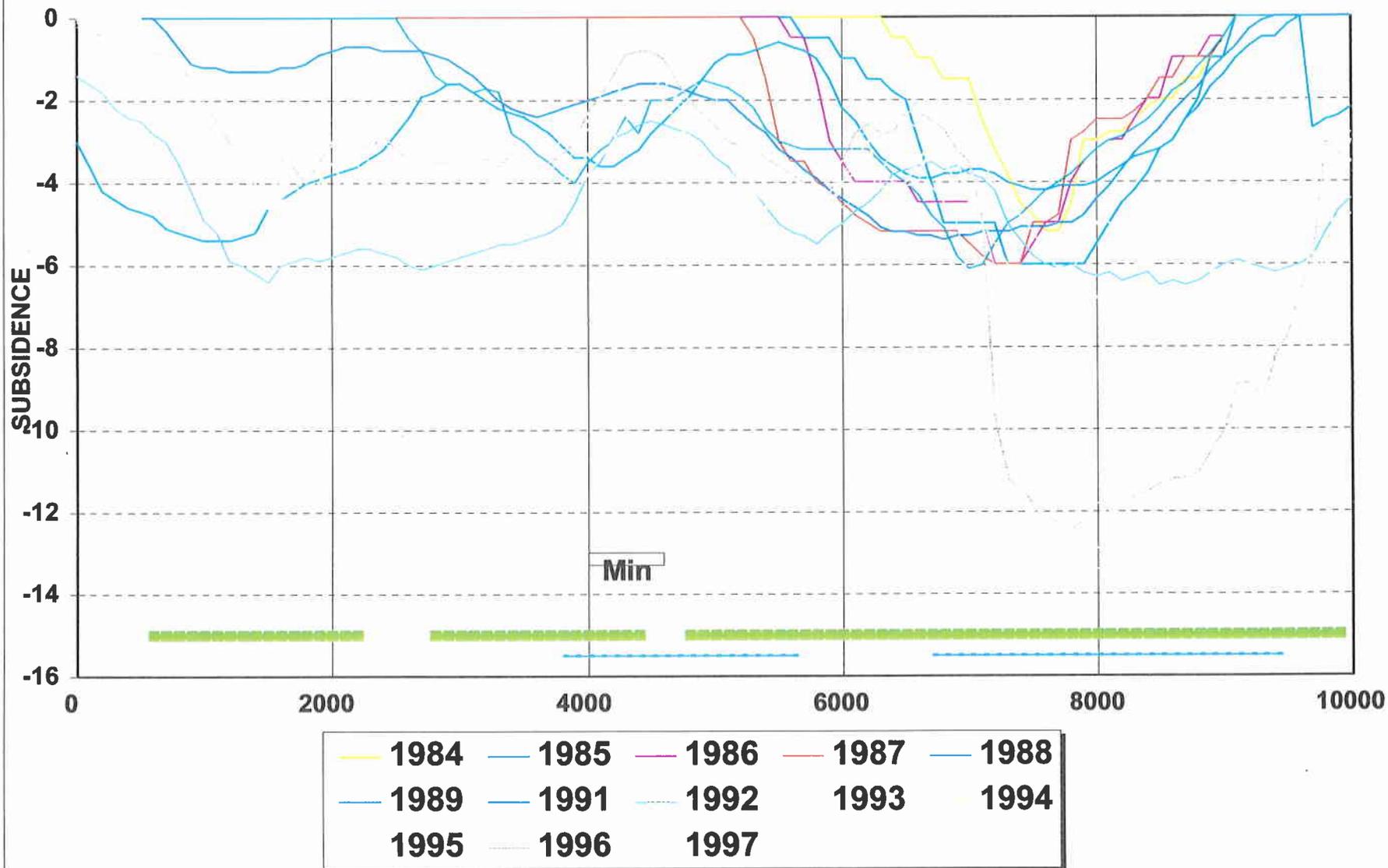


FIGURE 17

Area 4 Subsidence Profile West - East

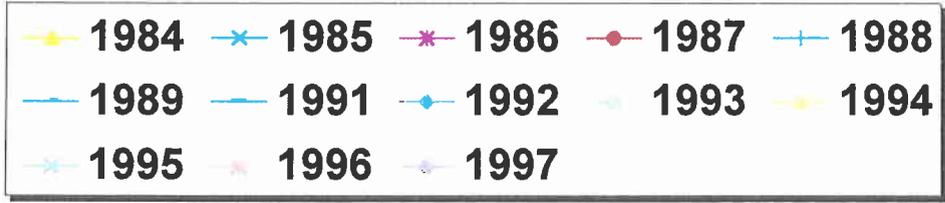
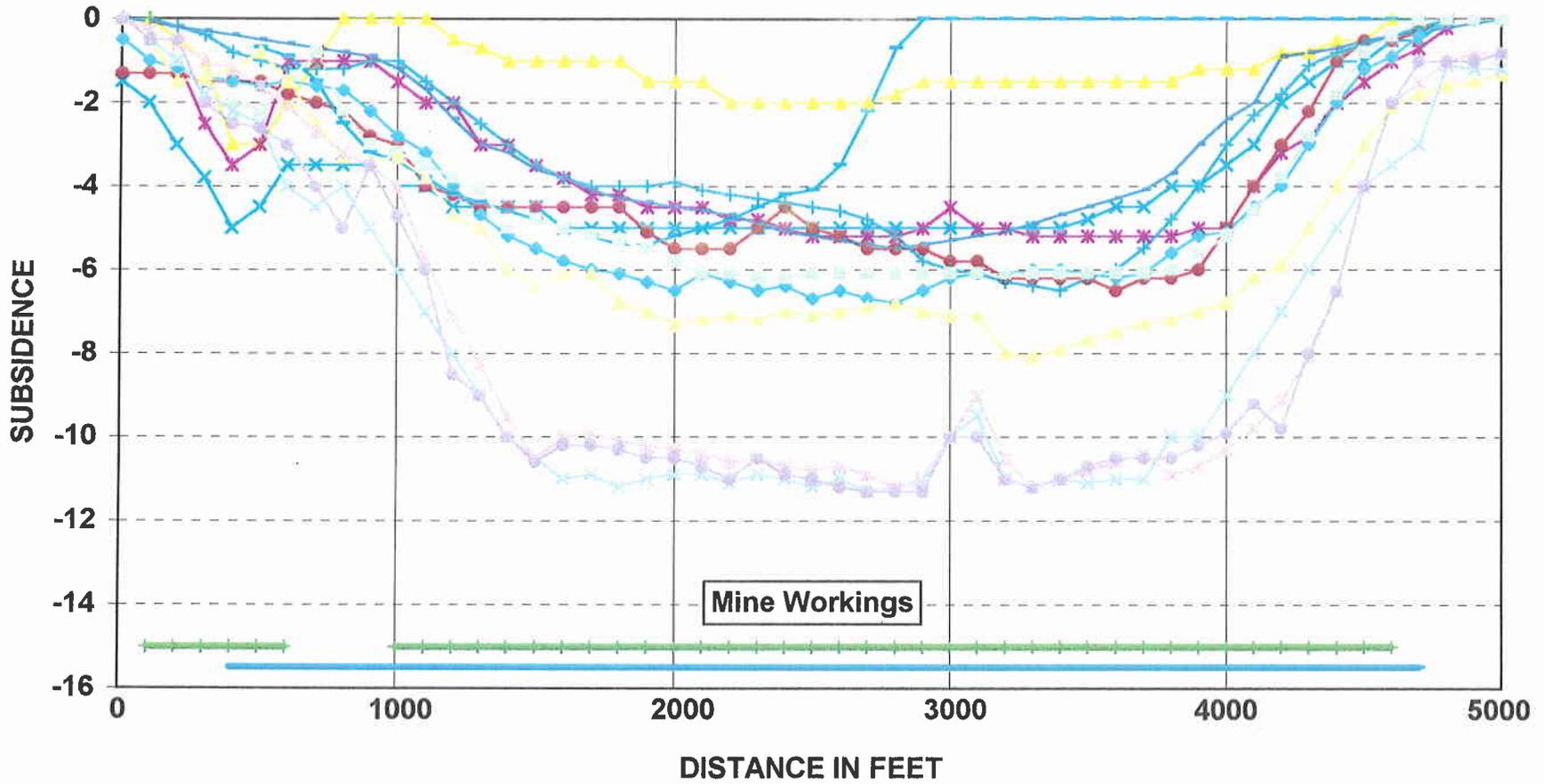


FIGURE 18

Area 5

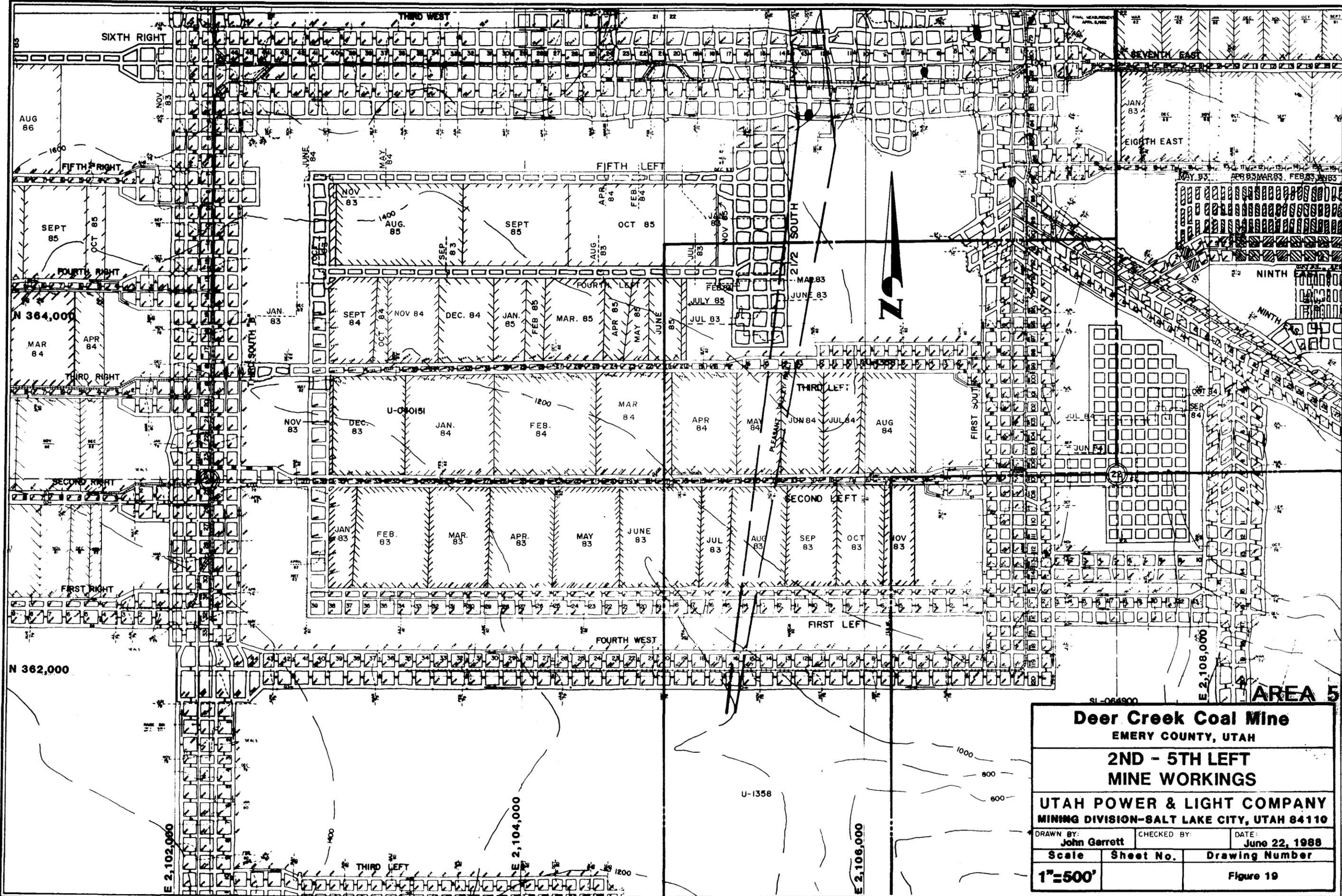
Deer Creek 2nd through 5th Left Longwall Panels

Photogrammetry revealed subsidence in Area 5 for the first time in 1984. Mining of the 2nd Left longwall panel in the Deer Creek Mine began in January 1983, and by October 1985 all four panels had been completed (Figure 19). In the Cottonwood Mine, longwall mining began in the 6th Right Longwall Panel in February 1993 and the last mining was completed in the 1st Right Longwall Panel in August 1994 completing all mining in this area (Figure 19A).

Maximum subsidence over the panels is slightly greater than thirteen (13) feet where both seams have been mined (Figure 20). The maximum subsidence showed a substantial increase between 1993 and 1994 but showed slight change between 1994 and 1997. It is important to point out that the subsidence measurements in 1997 between the 1,500 foot and 2,500 foot marks on the North-South profile show about 1 foot greater subsidence in 1997 than was measured in 1996. This could be due to measuring error or continuing subsidence. Future monitoring should identify which case exists. No surface disturbance has been identified over the panels.

As mentioned in the previous section, none of the springs located above the workings show any adverse effects due to mining.

Measured angle-of-draw is between zero and 13 degrees.



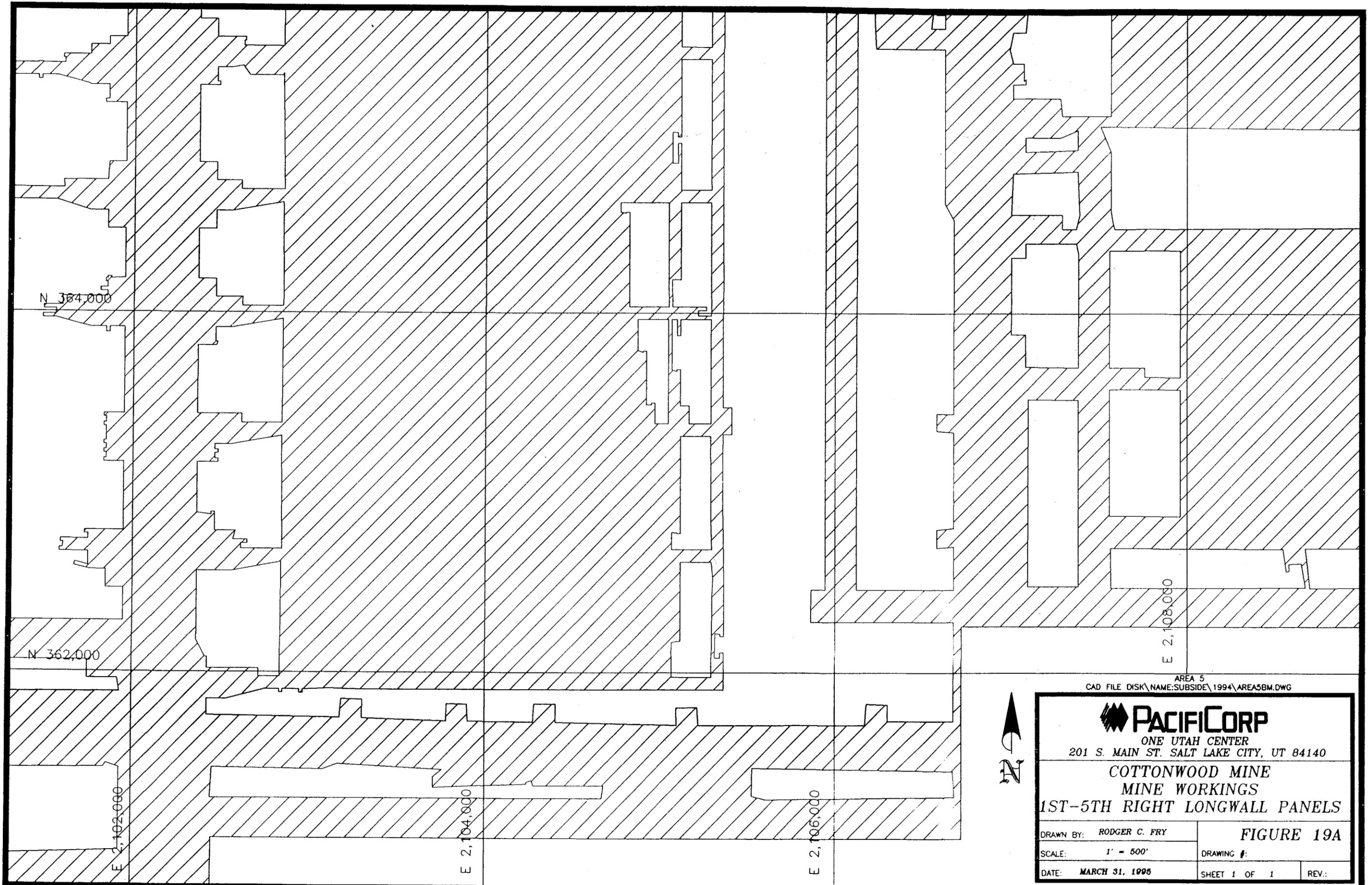
SL-064900

Deer Creek Coal Mine
EMERY COUNTY, UTAH

2ND - 5TH LEFT
MINE WORKINGS

UTAH POWER & LIGHT COMPANY
MINING DIVISION-SALT LAKE CITY, UTAH 84110

DRAWN BY: John Garrett	CHECKED BY:	DATE: June 22, 1988
Scale 1"=500'	Sheet No.	Drawing Number Figure 19



AREA 5
 CAD FILE DISK\NAME:SUBSIDE\1994\AREA5BM.DWG

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COTTONWOOD MINE
MINE WORKINGS
1ST-5TH RIGHT LONGWALL PANELS

DRAWN BY: **RODGER C. FRY**

FIGURE 19A

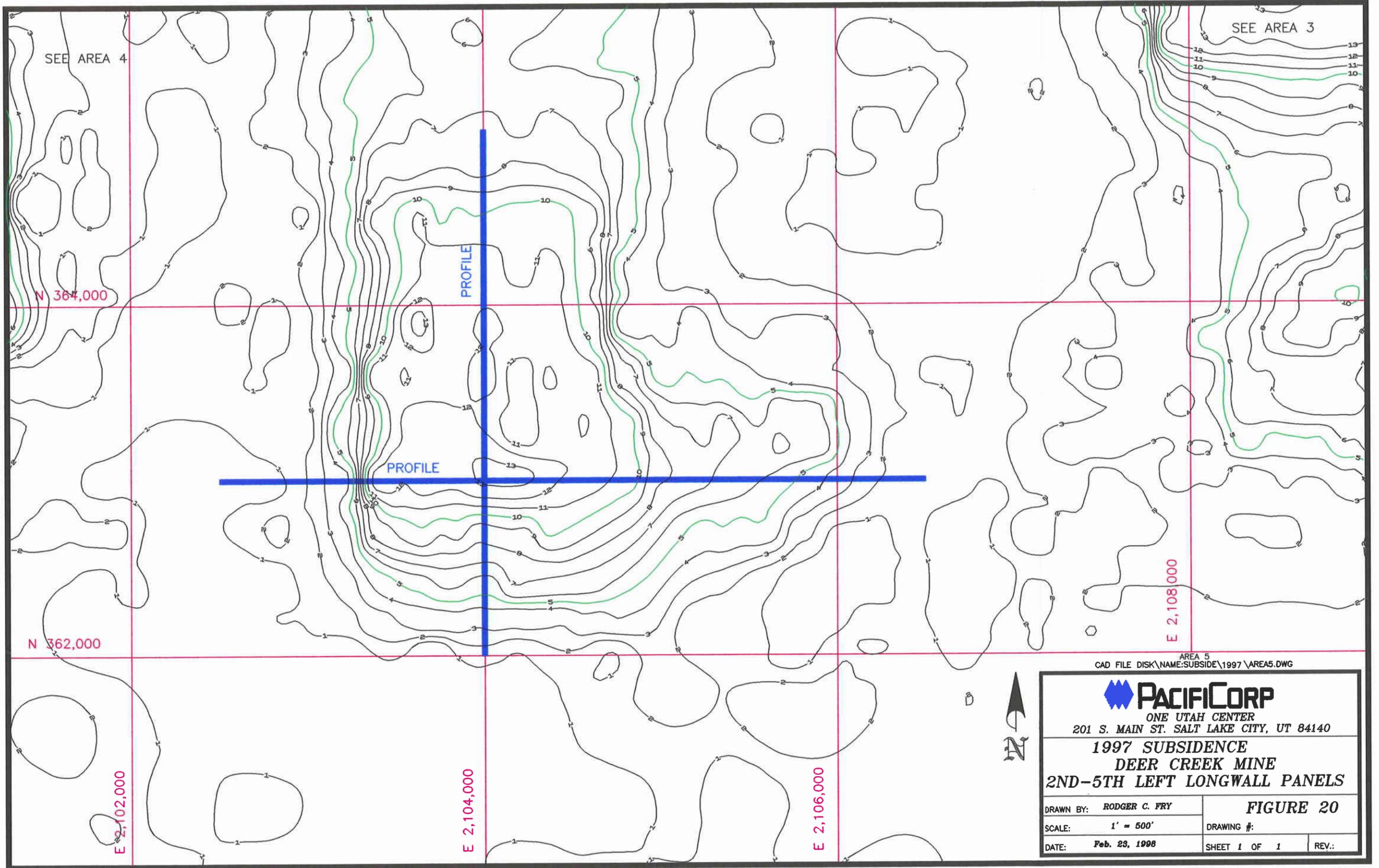
SCALE: **1" = 500'**

DRAWING #:

DATE: **MARCH 31, 1995**

SHEET 1 OF 1

REV.:



PACIFICORP

ONE UTAH CENTER
201 S. MAIN ST. SALT LAKE CITY, UT 84140

**1997 SUBSIDENCE
DEER CREEK MINE
2ND-5TH LEFT LONGWALL PANELS**

DRAWN BY: **RODGER C. FRY**
SCALE: **1' = 500'**
DATE: **Feb. 23, 1998**

FIGURE 20
DRAWING #:
SHEET 1 OF 1 REV.:

Area 5 Subsidence Profile North - South

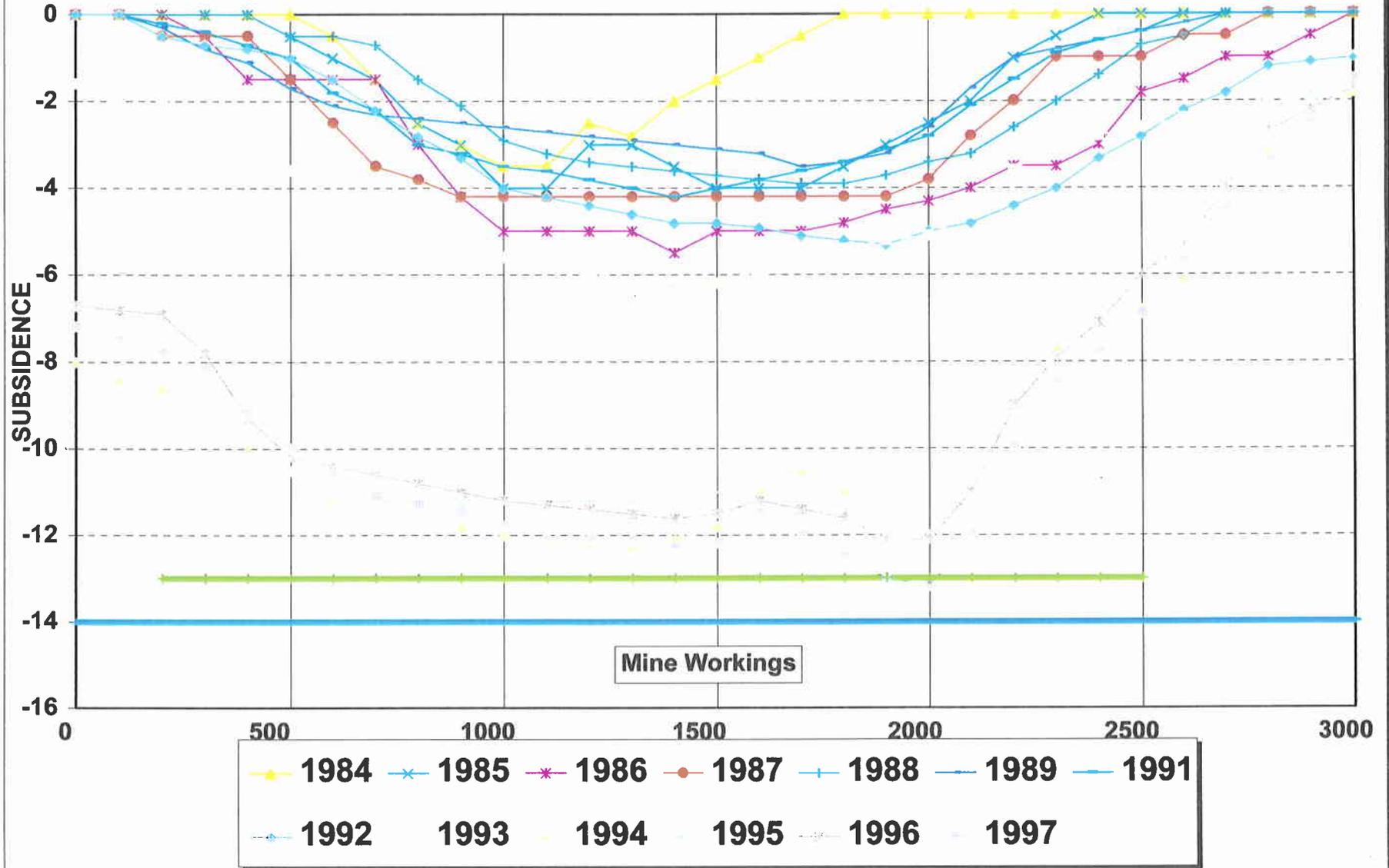


FIGURE 21

Area 5 Subsidence Profile West - East

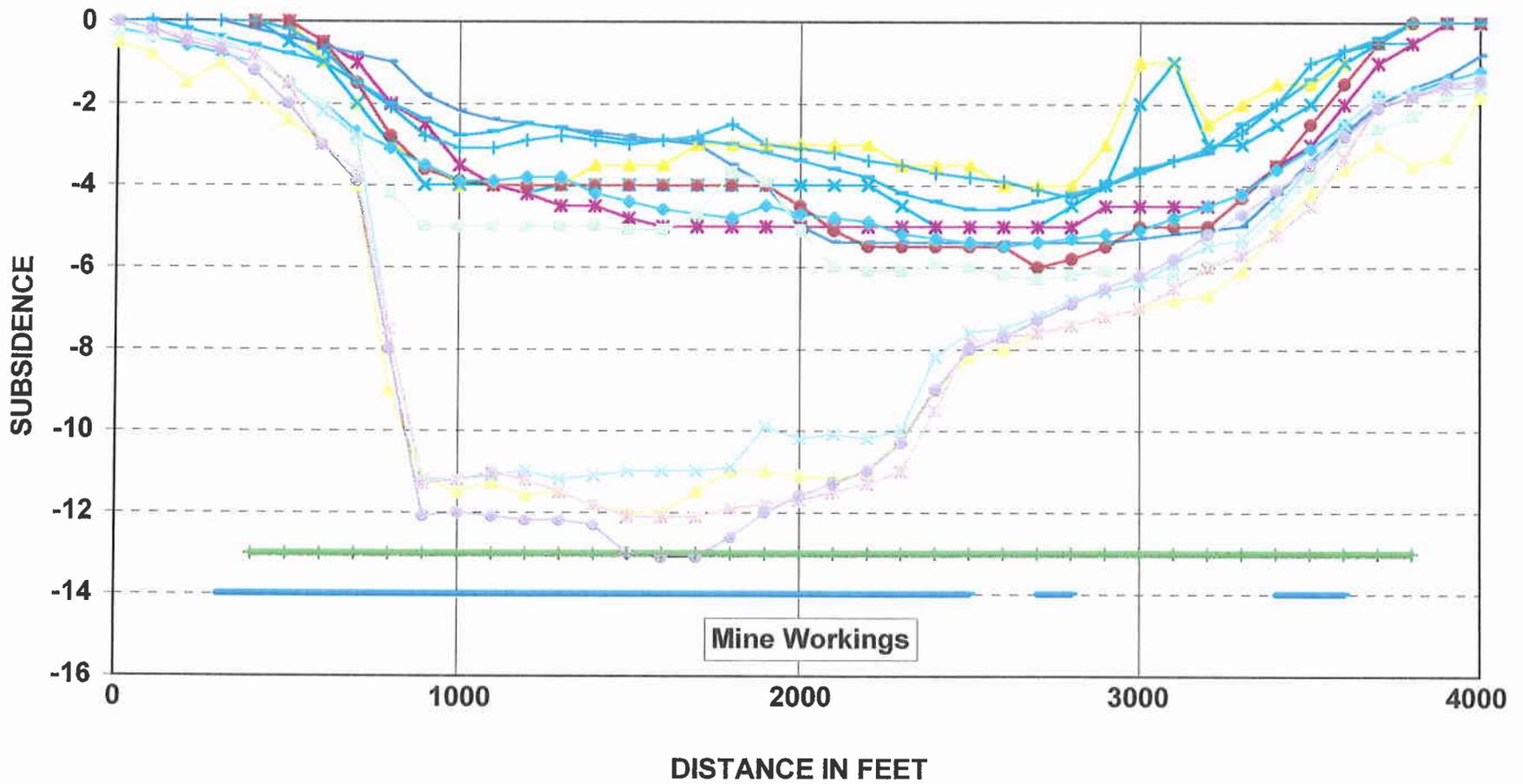


FIGURE 22

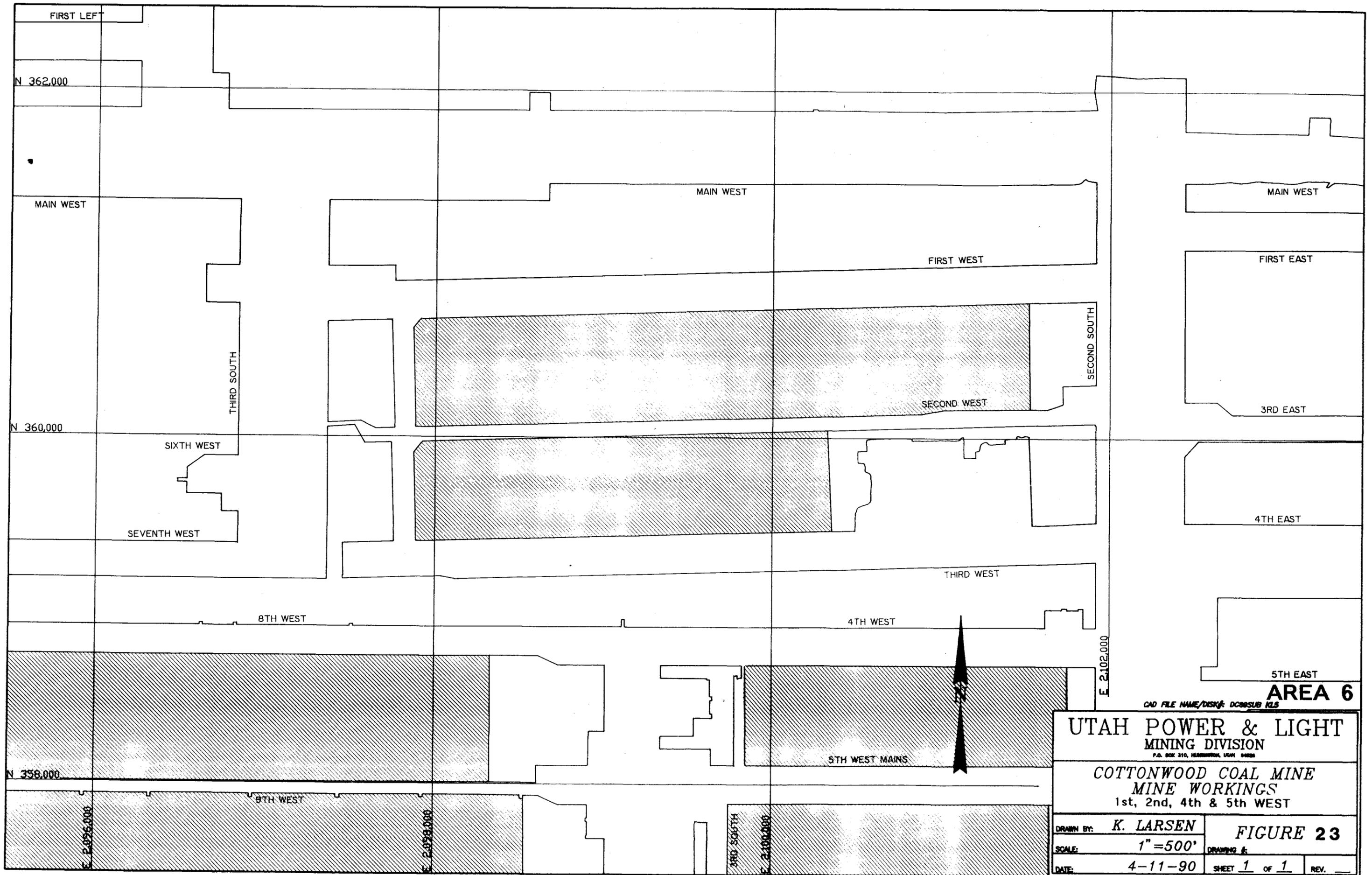
Area 6

Wilberg 1st and 2nd West Longwall Panels

Mining in the Wilberg 1st and 2nd West longwall panels was completed in June 1983 (Figure 23). This area of subsidence has now reached a maximum of between four and five feet over the Second West Longwall Panel (Figure 24). The subsidence in this area has been stable for the past four years. The subsidence profiles (Figures 25 and 26) show the change in subsidence since 1983.

Calculated angle-of-draw ranges from zero to 15 degrees where not influenced by other workings.

Four springs located just north of the area show no effect from the subsidence (see Hydrologic Monitoring Report, 1997).



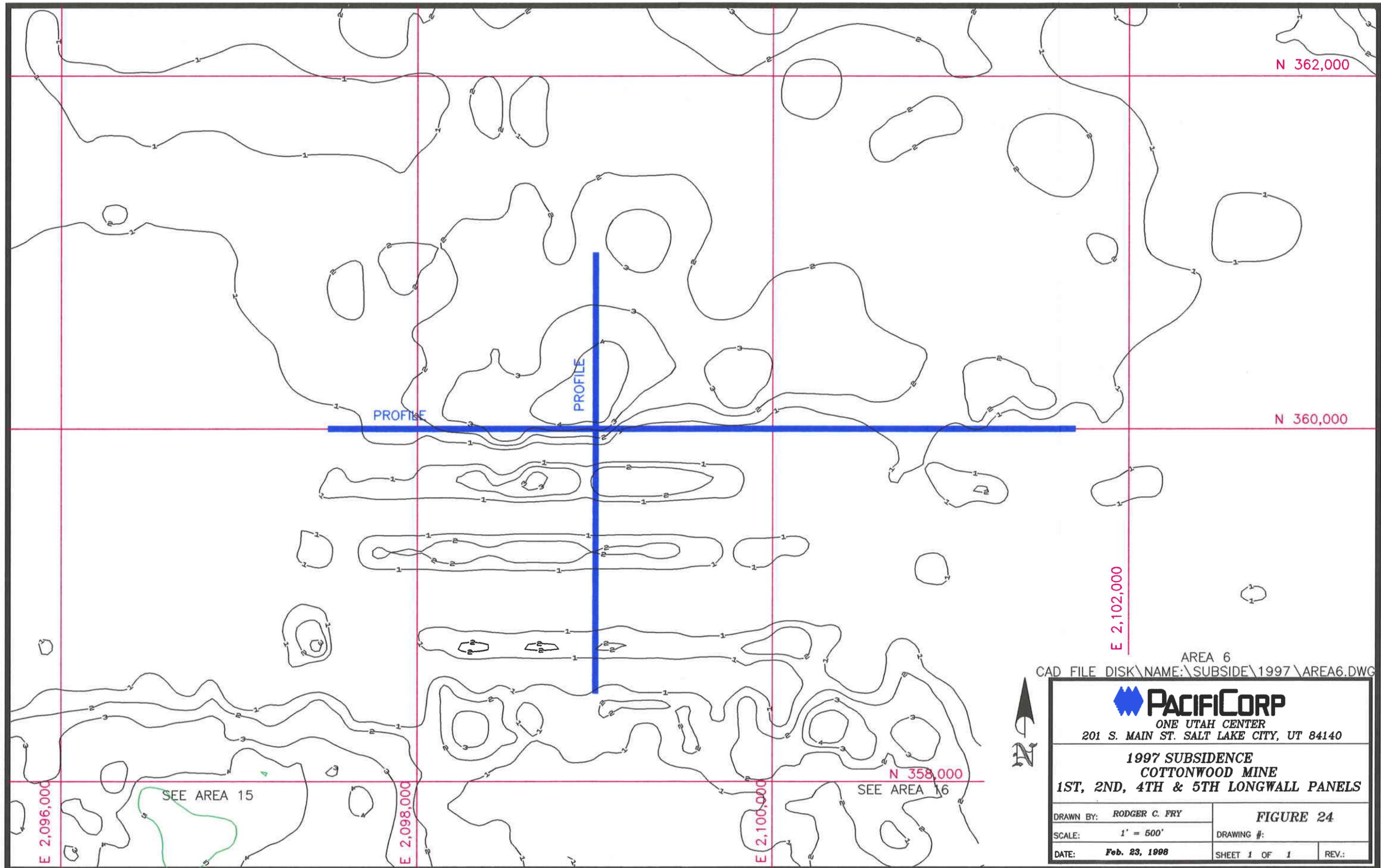
AREA 6

CAD FILE NAME/DISK: DC08SUB KLS

UTAH POWER & LIGHT
 MINING DIVISION
P.O. BOX 310, HARRISBURG, UTAH 84403

COTTONWOOD COAL MINE
 MINE WORKINGS
 1st, 2nd, 4th & 5th WEST

DRAWN BY:	K. LARSEN	FIGURE 23
SCALE:	1" = 500'	
DATE:	4-11-90	SHEET 1 of 1 REV. —



AREA 6
 CAD FILE DISK\NAME:\SUBSIDE\1997\AREA6.DWG

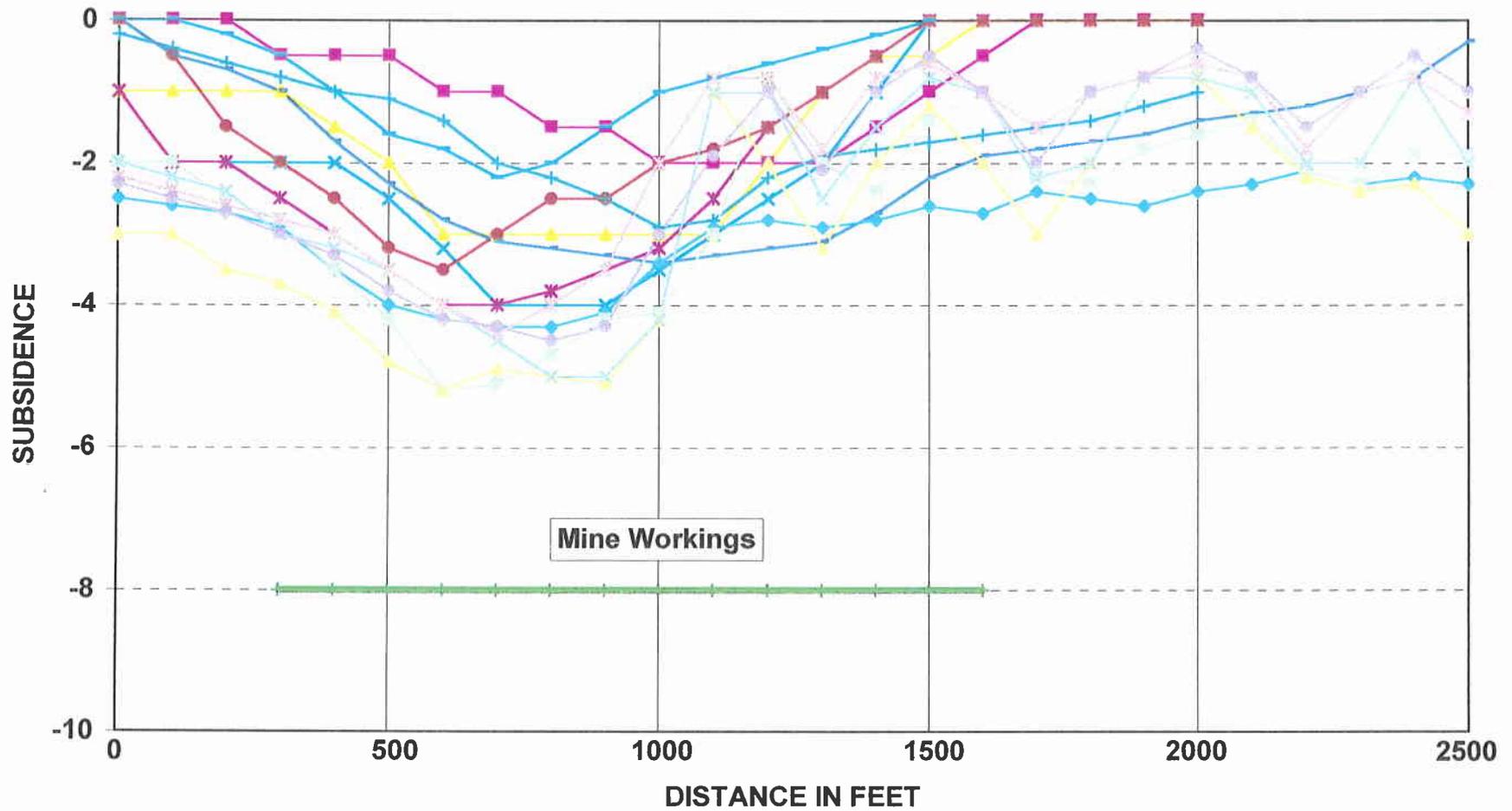


ONE UTAH CENTER
 201 S. MAIN ST. SALT LAKE CITY, UT 84140

**1997 SUBSIDENCE
 COTTONWOOD MINE
 1ST, 2ND, 4TH & 5TH LONGWALL PANELS**

DRAWN BY: RODGER C. FRY		FIGURE 24	
SCALE: 1' = 500'		DRAWING #:	
DATE: Feb. 23, 1998	SHEET 1 OF 1	REV.:	

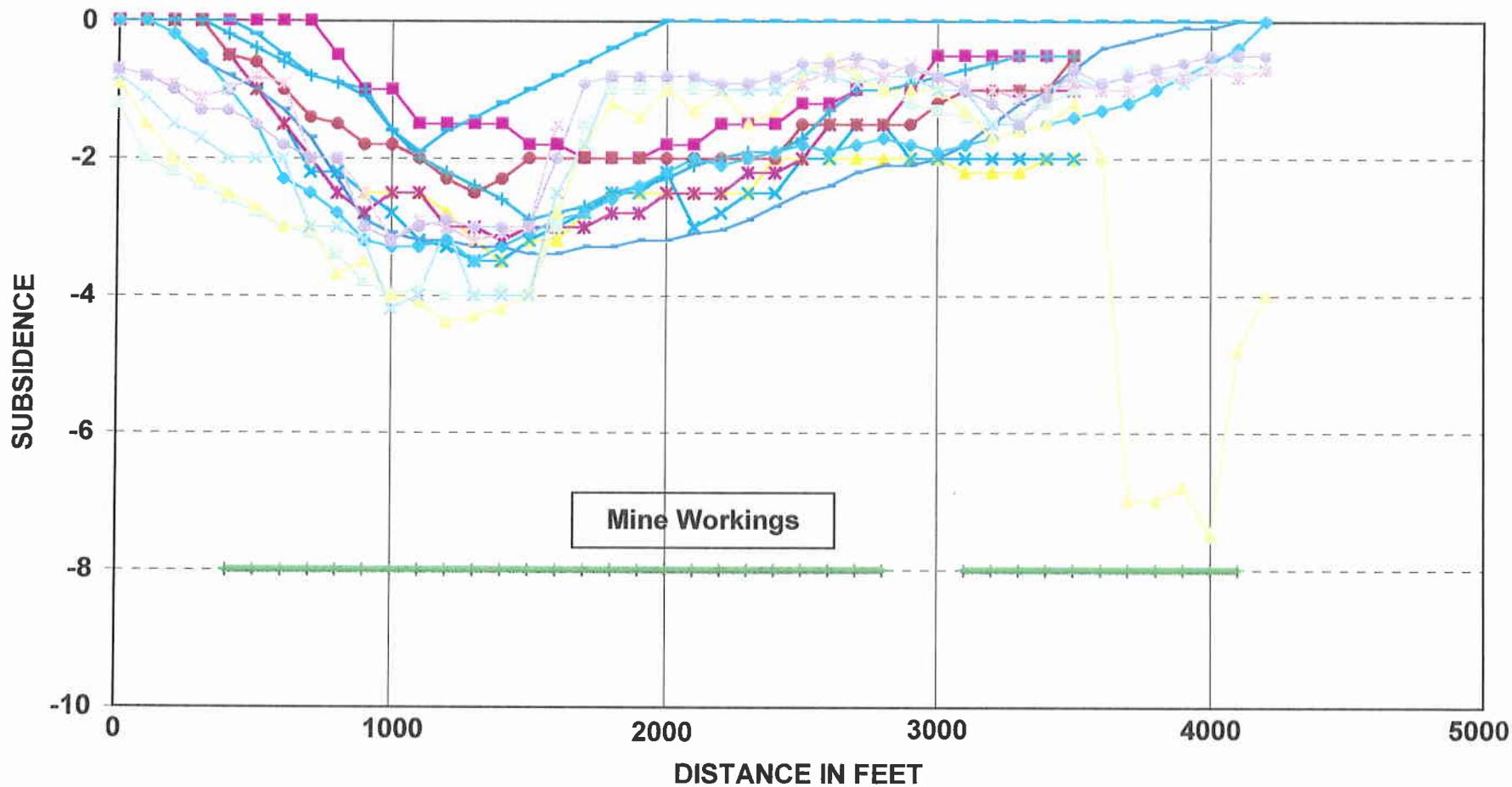
Area 6 Subsidence Profile North - South



■ 1983	▲ 1984	✕ 1985	✱ 1986	● 1987
+ 1988	— 1989	— 1991	◆ 1992	◇ 1993
▲ 1994	✱ 1995	✱ 1996	● 1997	

FIGURE 25

Area 6 Subsidence Profile West - East



■ 1983	▲ 1984	✕ 1985	✱ 1986	● 1987
✚ 1988	— 1989	— 1991	◆ 1992	◊ 1993
▲ 1994	✕ 1995	✱ 1996	● 1997	

FIGURE 26

Area 7

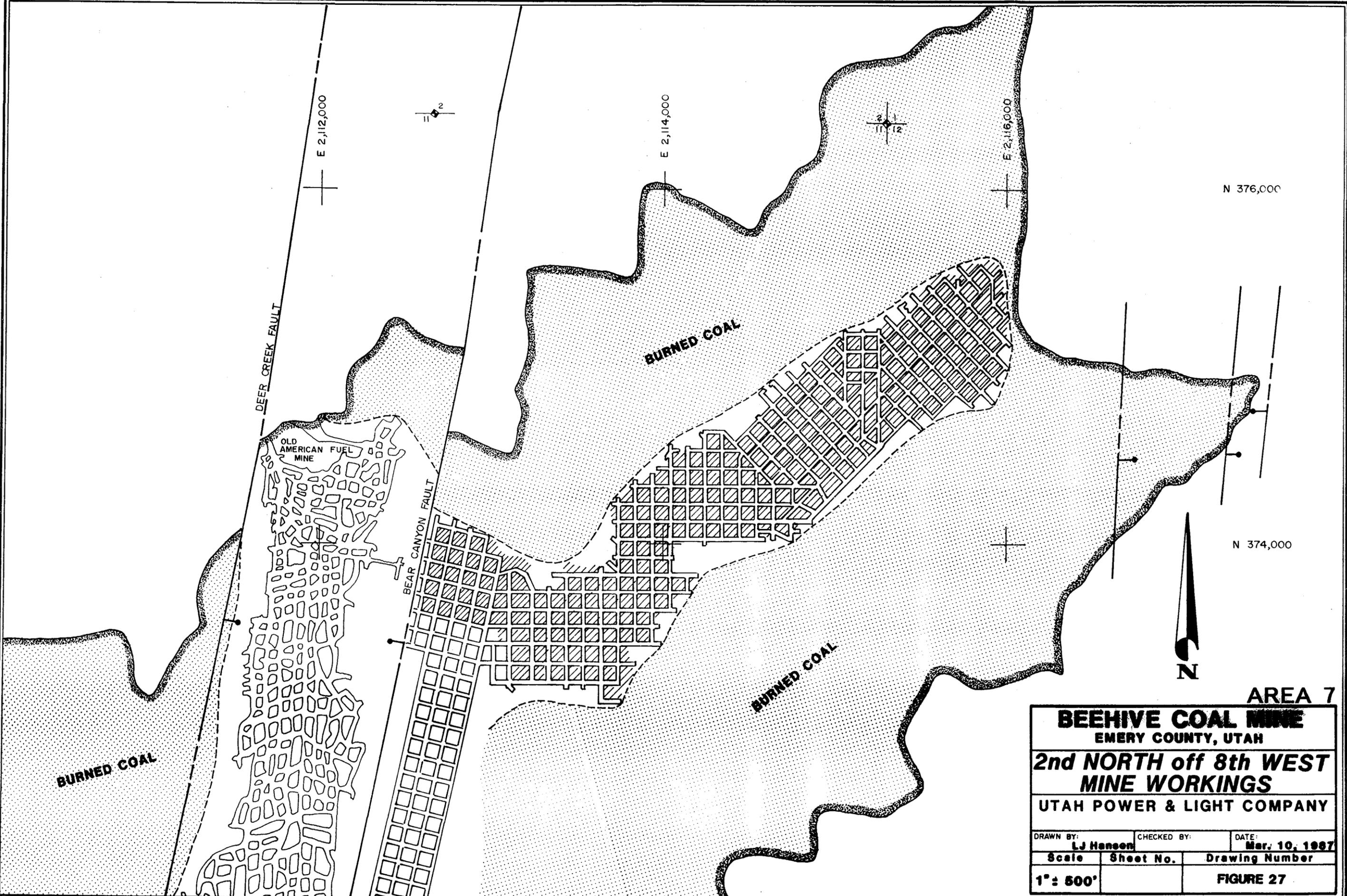
Beehive Mine 2nd North off 8th West

Pillar extraction mining in 2nd North was completed in 1983 and, as shown in Figures 27, 28, and 29, little additional subsidence has occurred over the workings since 1984. The workings are surrounded by burned coal.

Maximum subsidence is as much as seven (7) feet. In examining the area by helicopter and aerial photography, it is apparent that much of the elevation change measured was due to cliff failure and mass wasting on the steep slopes above the workings, where the rocks were highly fractured prior to mining. The profile, Figure 29, shows no measurable subsidence since 1991, this area is however, steep and rugged limiting the accuracy of the photogrammetric monitoring. Hence, the fluctuations in the reading are experienced from year to year.

It was not possible to get an accurate angle-of-draw because crushing of the surrounding clinker beds allowed subsidence to occur several thousand feet from the mine workings in some cases.

The subsidence has had no known influence on the hydrology in the area since they lack adequate recharge and are generally dry.



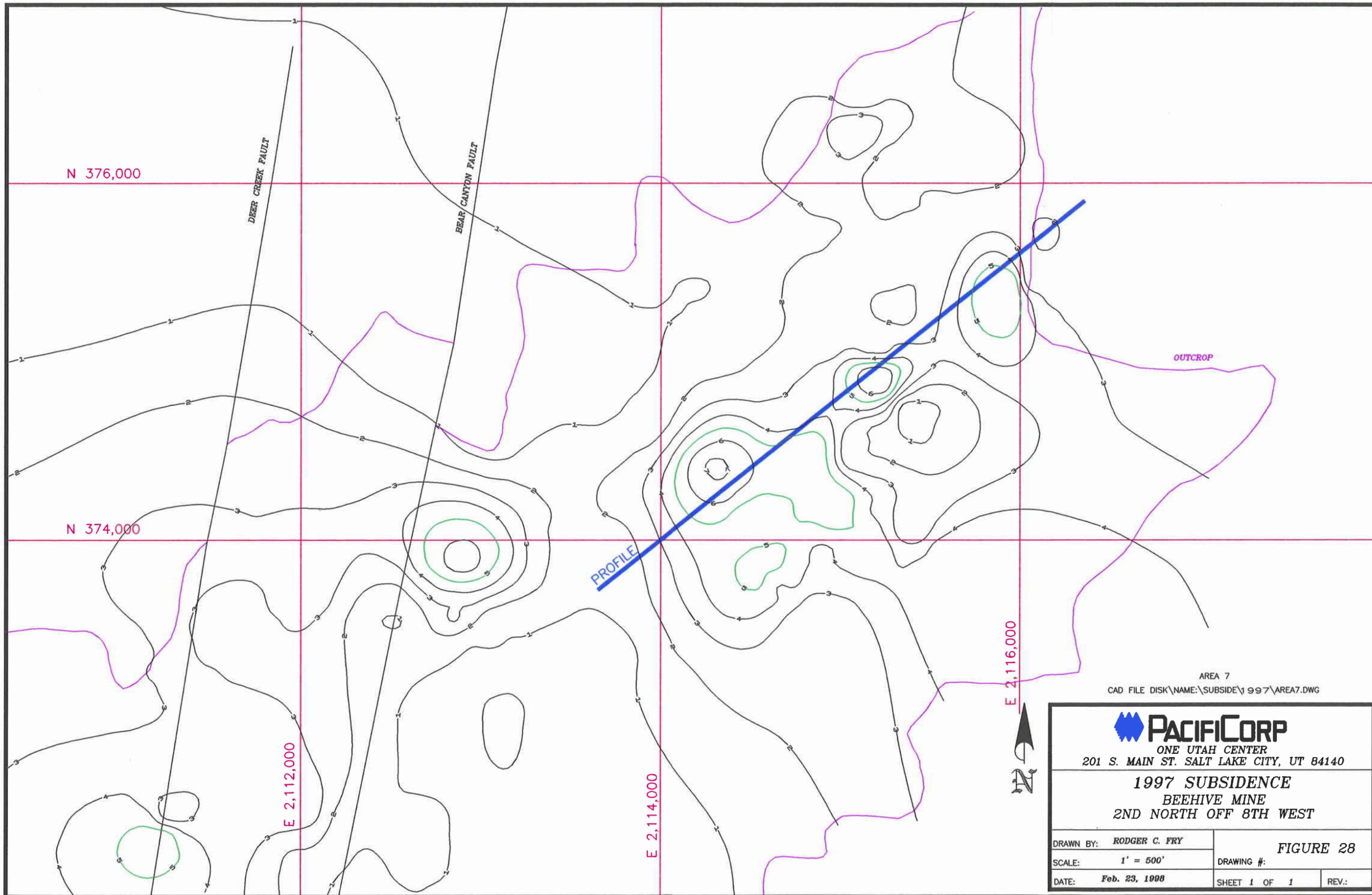
AREA 7

BEEHIVE COAL MINE
EMERY COUNTY, UTAH

2nd NORTH off 8th WEST
MINE WORKINGS

UTAH POWER & LIGHT COMPANY

DRAWN BY: LJ Hansen	CHECKED BY:	DATE: Mar. 10, 1987
Scale	Sheet No.	Drawing Number
1" = 500'		FIGURE 27



AREA 7
 CAD FILE DISK\NAME:\SUBSIDE\1997\AREA7.DWG

 PACIFICORP ONE UTAH CENTER 201 S. MAIN ST. SALT LAKE CITY, UT 84140		
1997 SUBSIDENCE BEEHIVE MINE 2ND NORTH OFF 8TH WEST		
DRAWN BY: RODGER C. FRY	FIGURE 28	
SCALE: 1' = 500'	DRAWING #:	
DATE: Feb. 23, 1998	SHEET 1 OF 1	REV.:

Area 7 Subsidence Profile Southwest - Northeast

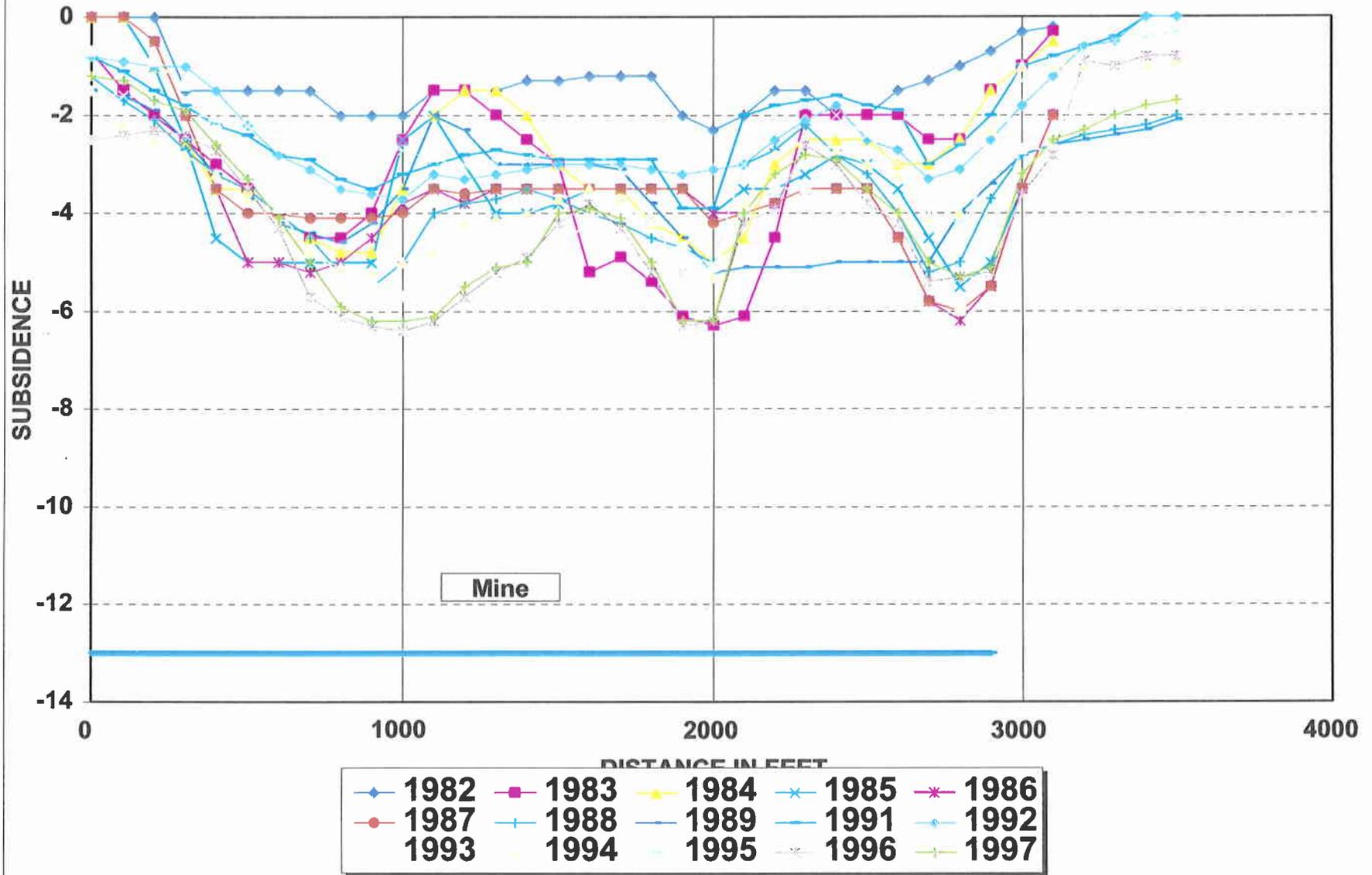


FIGURE 29

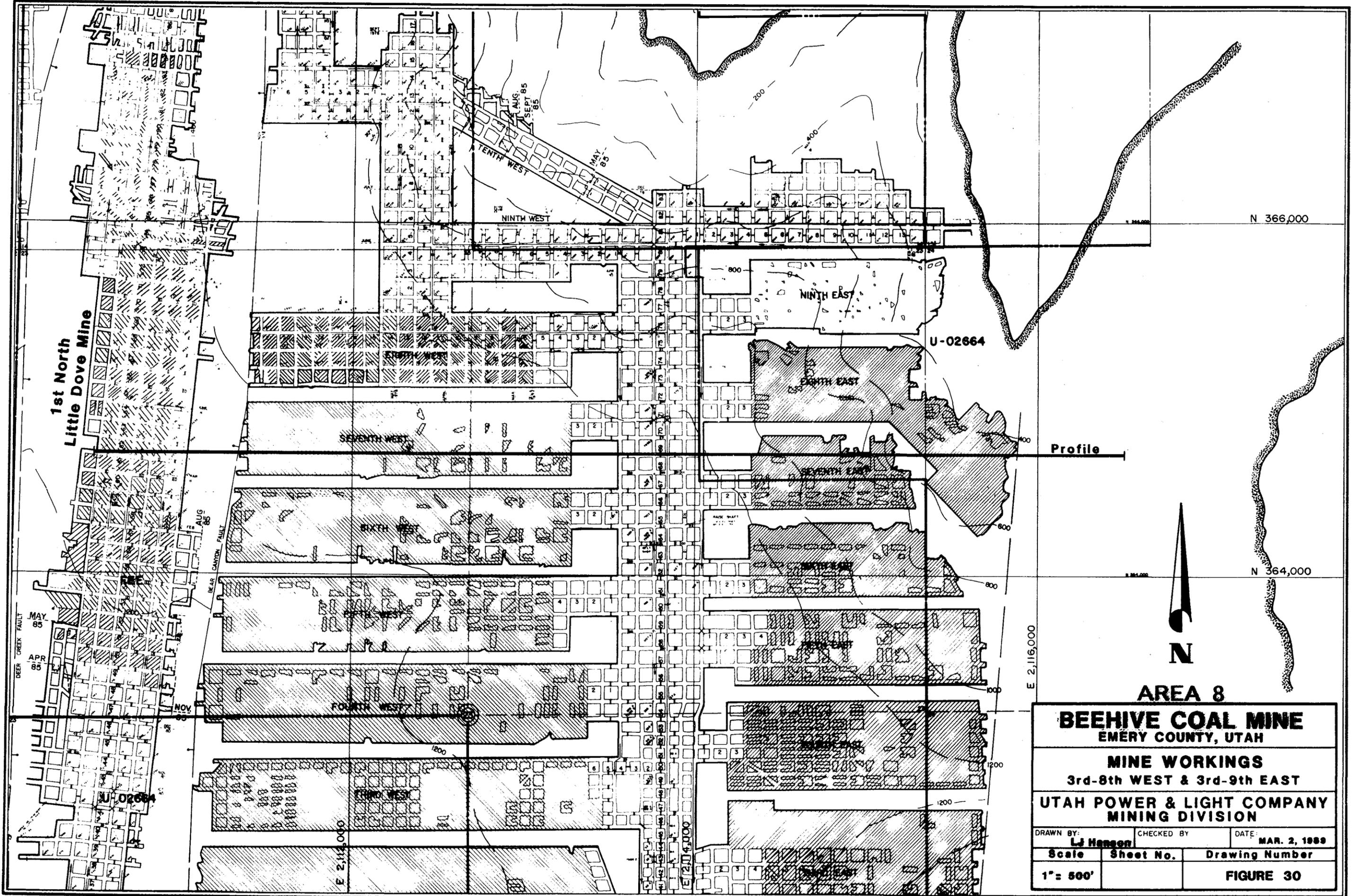
Area 8

Beehive 3rd Through 8th West and 3rd Through 9th East

Deseret 3rd Through 9th West and 1st Through 5th East

Some of the subsidence in Area 8 may have gone undetected because pillar extraction, and presumably subsidence, in part of the area was completed before the establishment of baseline survey data (Figures 30, 31, and 32). The west to east subsidence profile of the area depicted in Figure 33 indicates that subsidence up to slightly under seven (7) feet has occurred. The profile shows a fair amount of variability. This is due to the rugged terrain in the area. The profile indicates that no detectable change in subsidence has occurred in the past five years. Where not influenced by other workings, the angle-of-draw reached a maximum of 31 degrees on the eastern edge of the area.

The strata in this area is dry and the subsidence that has occurred has had no impact on the hydrology of the area.



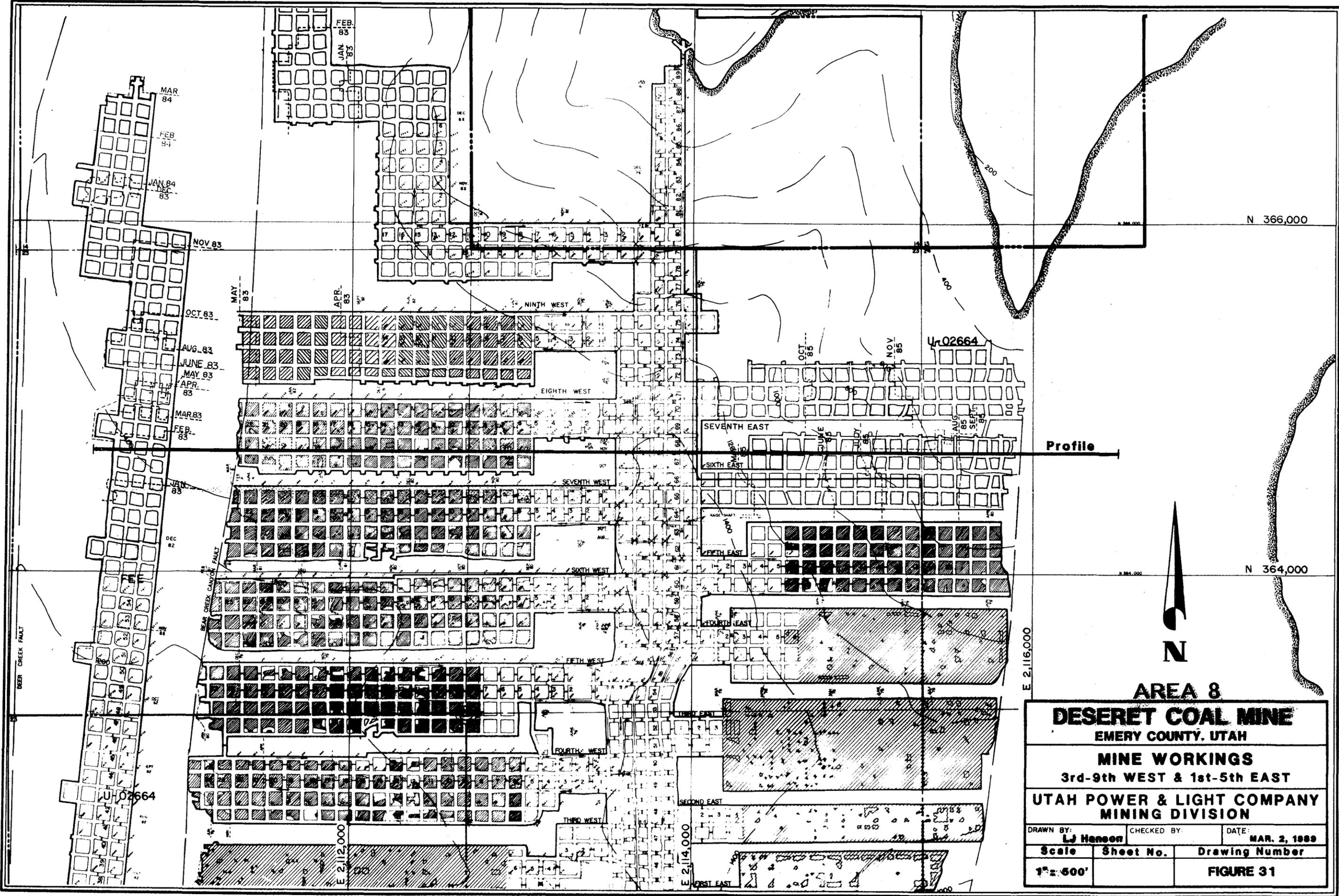
AREA 8

BEEHIVE COAL MINE
EMERY COUNTY, UTAH

MINE WORKINGS
3rd-8th WEST & 3rd-9th EAST

UTAH POWER & LIGHT COMPANY
MINING DIVISION

DRAWN BY: LJ Hansen	CHECKED BY:	DATE: MAR. 2, 1989
Scale 1" = 500'	Sheet No.	Drawing Number FIGURE 30



N 366,000

N 364,000

E 2,116,000

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E 2,122,000

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E 2,646,000

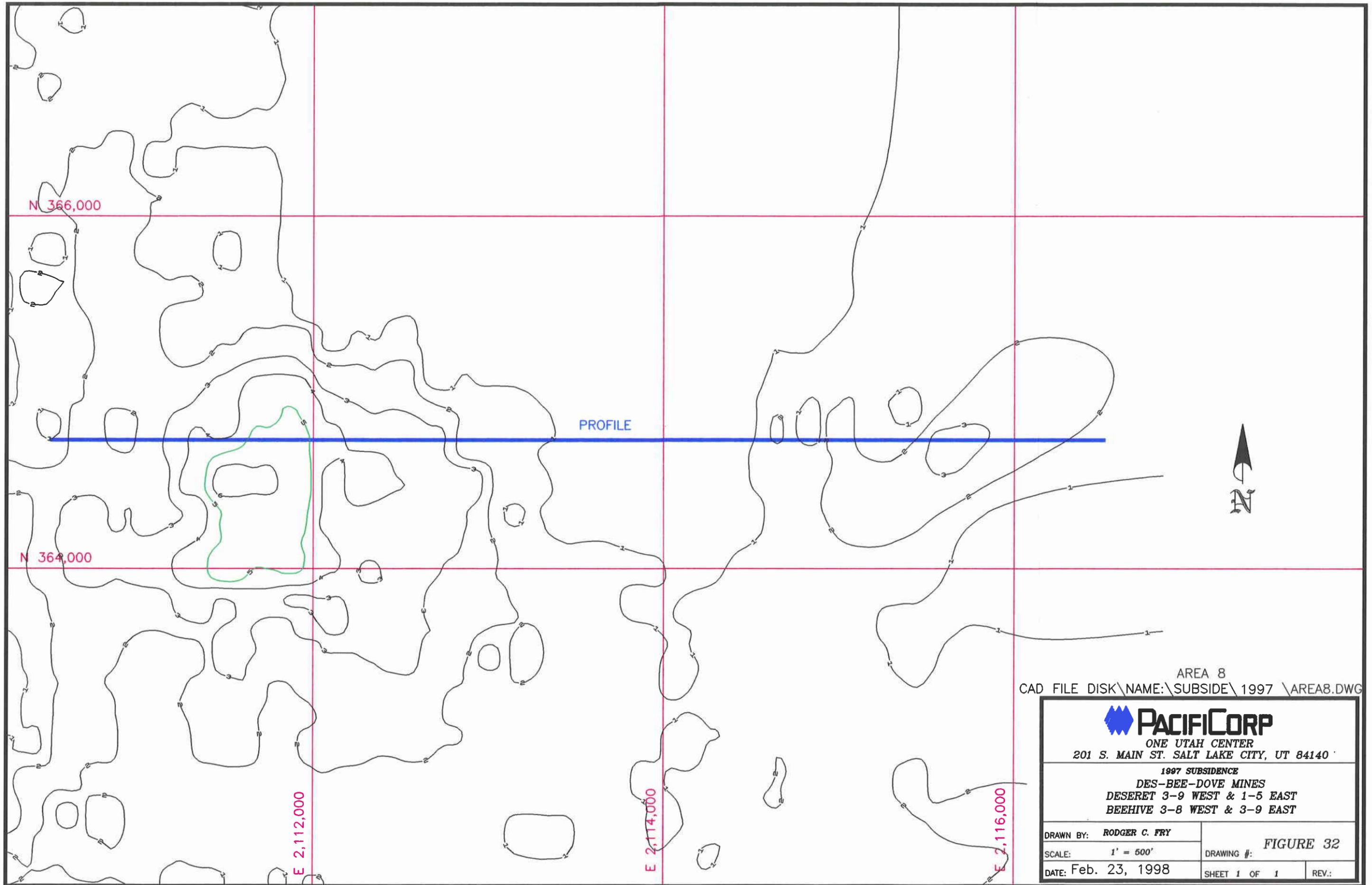
E 2,648,000

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E 2,652,000

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E 2,656,000



AREA 8
 CAD FILE DISK\NAME:\SUBSIDE\1997\AREA8.DWG

 PACIFICORP ONE UTAH CENTER 201 S. MAIN ST. SALT LAKE CITY, UT 84140	
1997 SUBSIDENCE DES-BEE-DOVE MINES DESERET 3-9 WEST & 1-5 EAST BEEHIVE 3-8 WEST & 3-9 EAST	
DRAWN BY: RODGER C. FRY	FIGURE 32
SCALE: 1' = 500'	DRAWING #:
DATE: Feb. 23, 1998	SHEET 1 OF 1 REV.:

Area 8 Subsidence Profile West - East

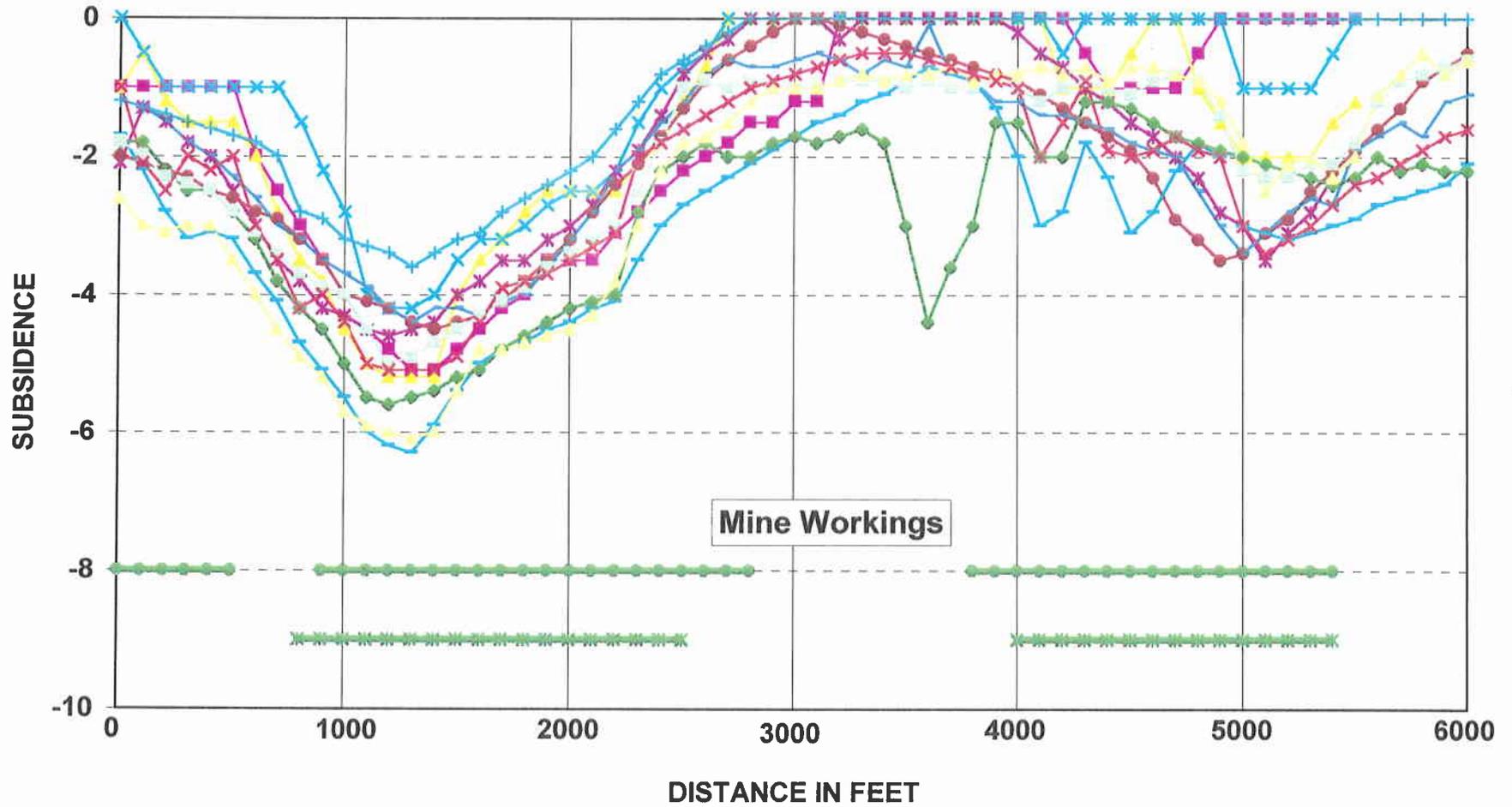


FIGURE 33

Areas 9 and 10

Little Dove 1st North and the old American Fuel Mine

The 1st North section of the Little Dove Mine and the American Fuel Mine workings are located in a graben formed by the Deer Creek and Bear Creek Canyon faults (see figures for Areas 7 and 8). In August 1982 the Little Dove workings, mining in a northerly direction, intersected the old workings of the American Fuel Mine about 1000 feet south of where available maps indicated 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. At that time pillar extraction mining was begun in 1st North and continued to the south with minor interruptions from 1982 through much of 1987.

To date the maximum observed subsidence over 1st North is about three to four feet, occurring over some of the most recently extracted pillars (see Subsidence Map in Appendix). No other notable subsidence has been detected over the remainder of 1st North.

Subsidence of over six (6) feet has been measured above the American Fuel Mine workings.

Any angle-of-draw calculation would be affected by both the surrounding mine workings and the faults on either side; therefore, no angle-of-draw was calculated for either the 1st North area of the Little Dove Mine or the old American Fuel Mine.

No fractures are known over the 1st North workings, but some cliff failure and fractures are probably present over the American Fuel Mine on the cliffs and steep slopes.

Mining has had no known effect on the hydrology of the areas.

Area 11

Deer Creek C and D North Longwall Panels

Cottonwood 11th Right Longwall Panel off 2 ½ North

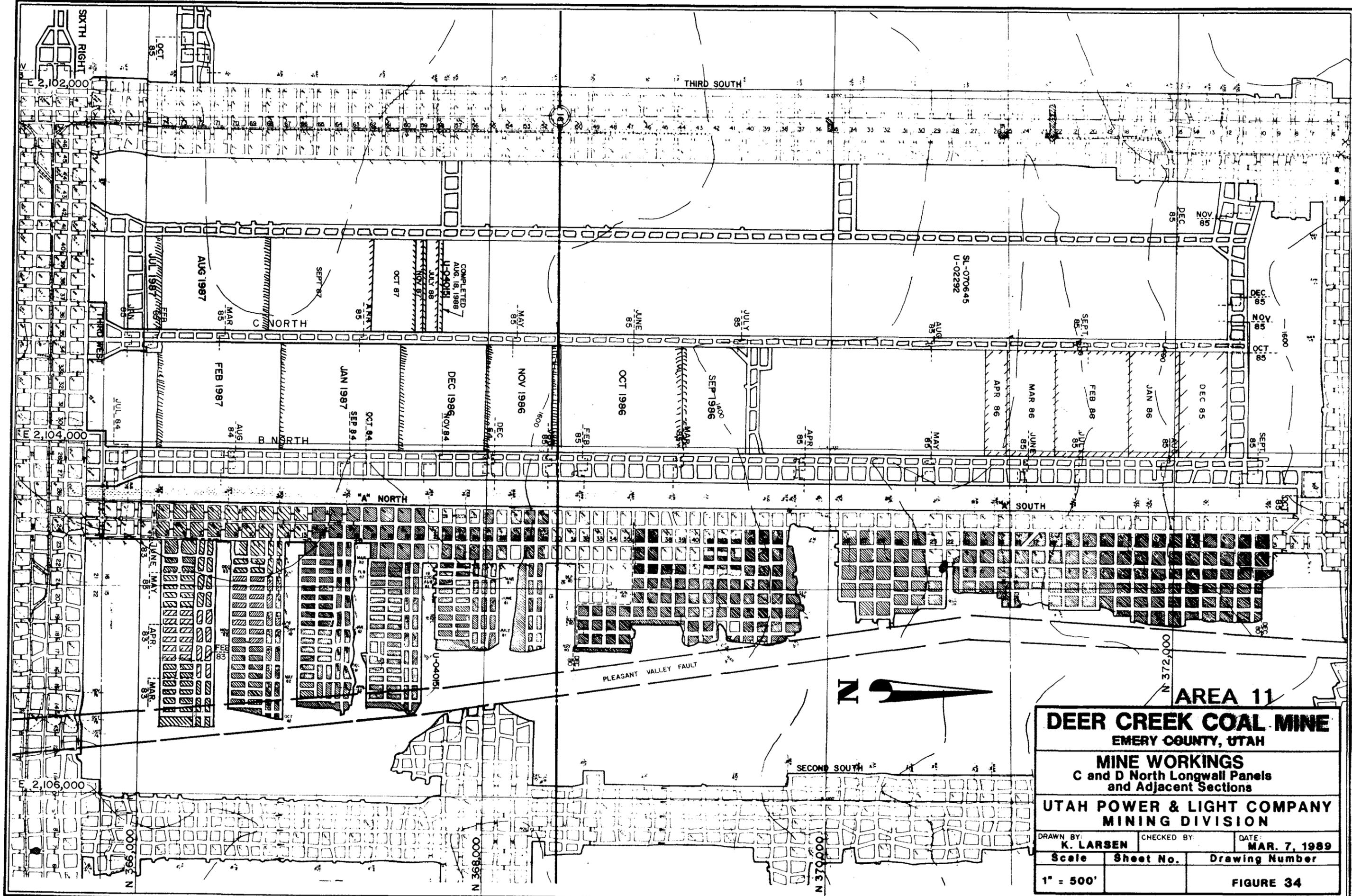
Cottonwood 6th & 7th Right Longwall Panel off of 2nd North

Longwall mining in the C North panel began in December 1984 and was terminated in April 1986 due to geologic complications. New setup entries were driven further south and mining resumed in September 1986; the panel was completed in March 1987. The D North longwall panel began production in July 1987, but after October 1987 production was limited due to poor coal quality. The panel was terminated in August 1988 at a length of 1750 feet. Pillar extraction mining in A North and A South was completed in June 1983 (Figure 34).

Mining in the 11th Right Panel in the Cottonwood Mine began In July of 1992 and was completed in September 1992 (Figure 35). The 10th Right Panel to the south was developed but couldn't be mined with longwall methods because of thin coal and poor coal quality. Mining began in the 7th Right Panel in February 1993 and by August 1993 mining in the 6th Right Panel had been completed.

Measurable subsidence to date has exceeded thirteen (13) feet in the area of multiple seam mining above the 6th and 7th Right Longwall Panels in the Cottonwood mine (Figures 36, 37, and 38). The maximum subsidence showed an increase between 1993 and 1994 but has been stable the past four years.

Fractures were discovered at the western end of coal extraction above the 7th Right Longwall Panel. The fractures were first discovered on June 17, 1993. Mining of the longwall panel was completed on May 12, 1993. An aerial reconnaissance of the area on May 18, 1993 revealed no surface fractures at that time. This places the occurrence of the fractures between May 18, 1993 and June 17, 1993. Burnt Tree Springs is located approximately 800 feet to the southeast of the fractures. Measurements of the spring discharge throughout the summer of 1993 through 1997 indicated that the fracturing has had no effect on the spring. The angle-of-draw measured ranges from less than zero to 28 degrees.



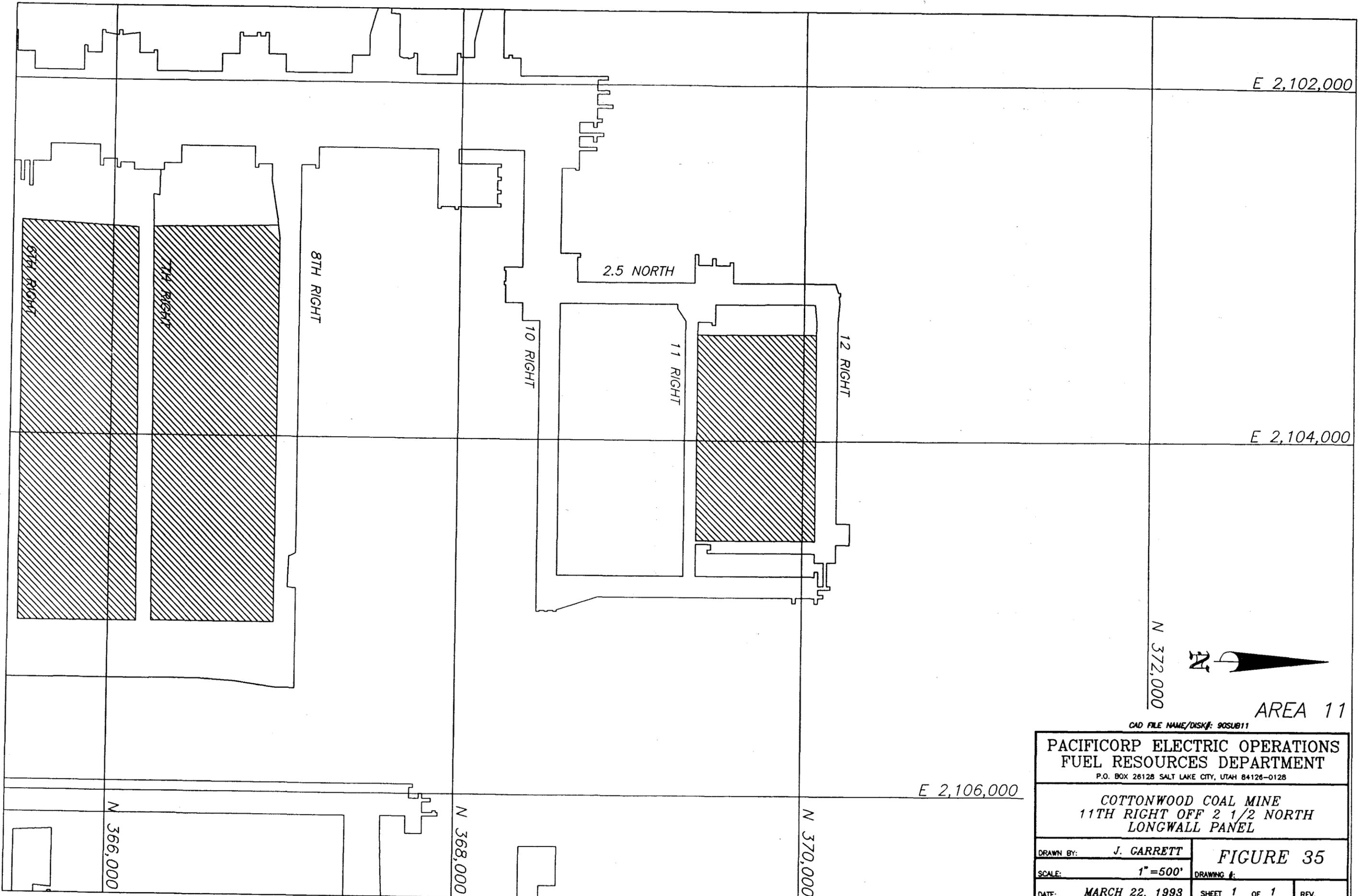
AREA 11

DEER CREEK COAL MINE
EMERY COUNTY, UTAH

MINE WORKINGS
C and D North Longwall Panels
and Adjacent Sections

UTAH POWER & LIGHT COMPANY
MINING DIVISION

DRAWN BY: K. LARSEN	CHECKED BY:	DATE: MAR. 7, 1989
Scale	Sheet No.	Drawing Number
1" = 500'		FIGURE 34



E 2,102,000

E 2,104,000

N 372,000



AREA 11

CAD FILE NAME/DISK#: 90SUB11

PACIFICORP ELECTRIC OPERATIONS
 FUEL RESOURCES DEPARTMENT
 P.O. BOX 26128 SALT LAKE CITY, UTAH 84126-0128

COTTONWOOD COAL MINE
 11TH RIGHT OFF 2 1/2 NORTH
 LONGWALL PANEL

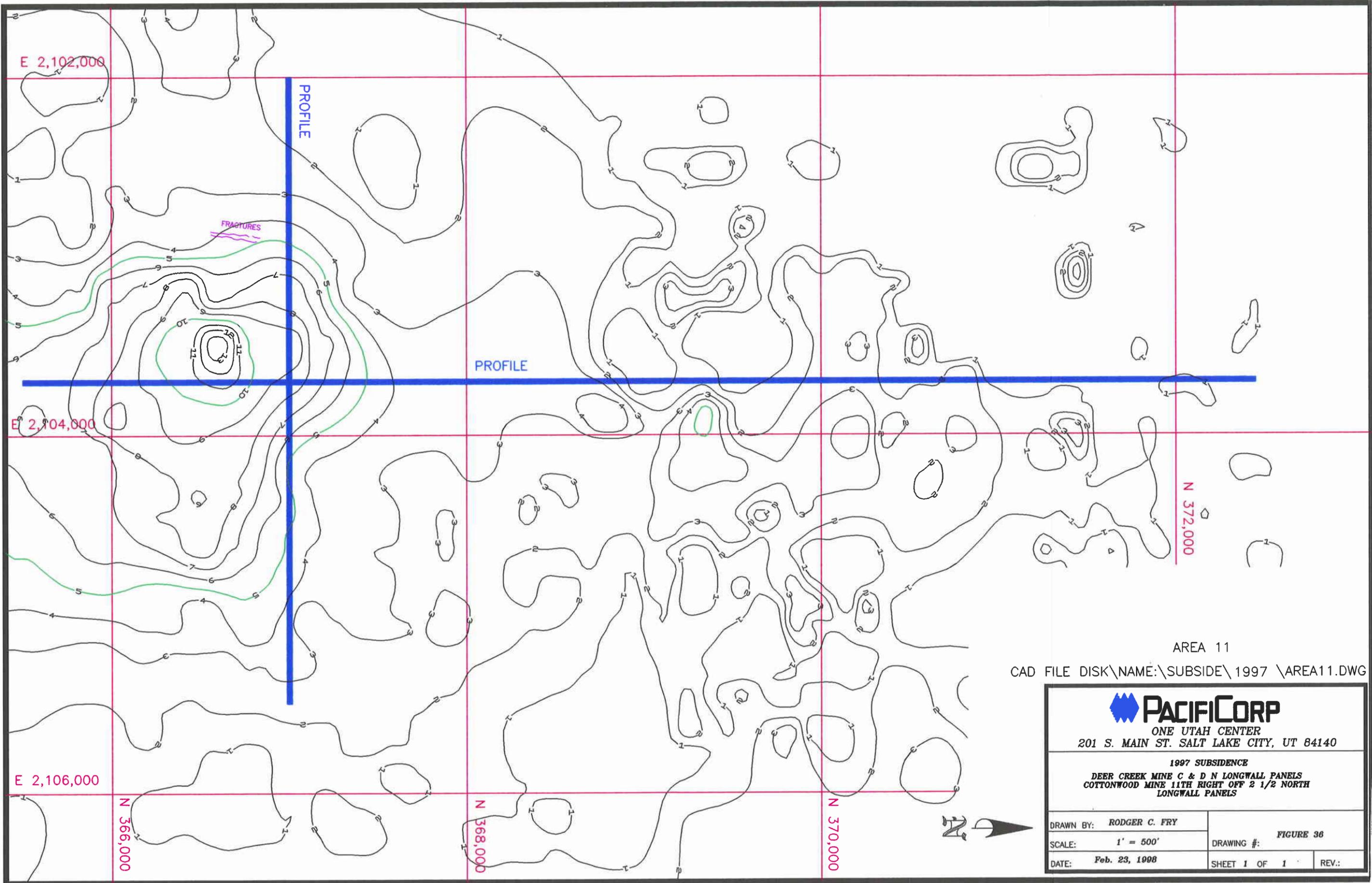
E 2,106,000

N 366,000

N 368,000

N 370,000

DRAWN BY: J. GARRETT	FIGURE 35	
SCALE: 1" = 500'	DRAWING #:	
DATE: MARCH 22, 1993	SHEET 1 OF 1	REV. _____



E 2,102,000

PROFILE

FRACTURES

PROFILE

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N 372,000

E 2,106,000

N 366,000

N 368,000

N 370,000

AREA 11

CAD FILE DISK\NAME:\SUBSIDE\1997 \AREA11.DWG



ONE UTAH CENTER
201 S. MAIN ST. SALT LAKE CITY, UT 84140

1997 SUBSIDENCE
DEER CREEK MINE C & D N LONGWALL PANELS
COTTONWOOD MINE 11TH RIGHT OFF 2 1/2 NORTH
LONGWALL PANELS

DRAWN BY: RODGER C. FRY	FIGURE 36	
SCALE: 1" = 500'	DRAWING #:	
DATE: Feb. 23, 1998	SHEET 1 OF 1	REV.:



Area 11 Subsidence Profile North - South

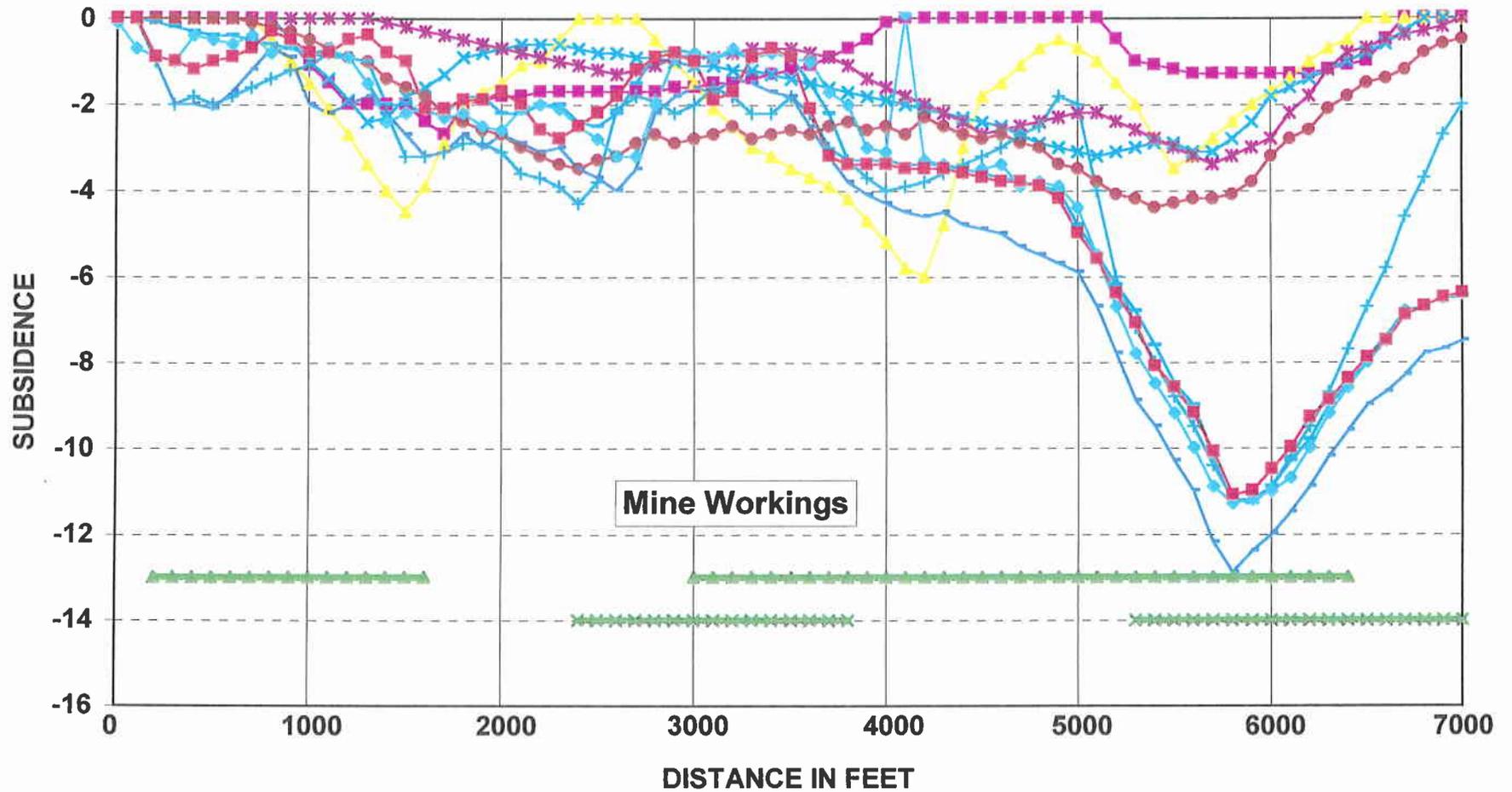


FIGURE 37

Area 11 Subsidence Profile West - East

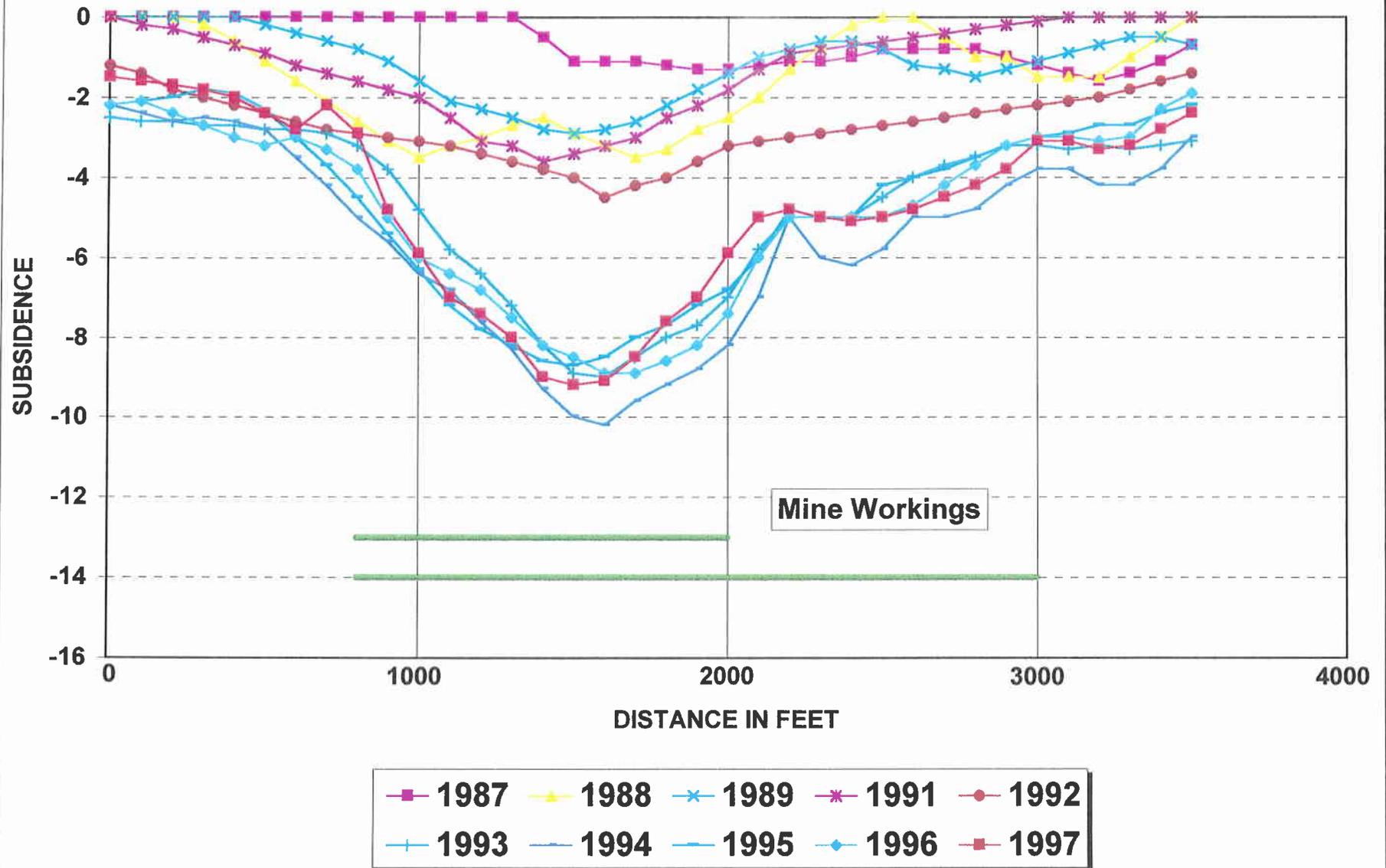


FIGURE 38

Area 12

Wilberg 2nd Left Longwall Panel

The 2nd Left longwall panel is located in the western portion of the Wilberg Mine (Figure 2). A block of coal measuring 2300 feet by 530 feet was extracted during 1981 and 1982. To date no measurable subsidence has occurred and no visible surface disturbance has been observed. Overburden ranges from 1500 to 1900 feet over the panel. It is somewhat surprising that no movement has been detected since subsidence has been observed in other instances where smaller blocks of coal were extracted and overburden was of similar thickness.

One spring is located approximately 800 feet northeast of the extracted workings on the surface. It has not been affected by mining.

Area 13

Des-Bee-Dove Southern Areas

Area 13, covering the southern portions of the Deseret, Beehive, and Little Dove Mines, was first monitored for subsidence in 1986. Some of the sections were mined before baseline survey data were established; therefore, subsidence measured over these sections will likely not represent what actually occurred. The 4th North section in the Little Dove Mine was completed in February 1987 (Figures 39 and 40).

Maximum subsidence over the area as of August 1997 was about three (3) feet over the second and third north sections of the Little Dove Mine (Figures 41, 42, and 43). No change in subsidence has occurred in the past three years.

The subsidence profiles, figures 42 and 43 show subsidence yearly since 1986. These profiles show that the readings in 1993 and 1994 are somewhat lower than in 1995, 1996, 1997 or in previous years. This is most likely a problem with the aerial triangulation because a comparison of the survey monuments in the area show no subsidence change in that time period.

No visible surface disturbance of any kind has been found.

There are no known springs over the workings, and mining is not expected to have any effect on the hydrology of the area.

U-1358

N 362,000
E 2,116,000
U-02664

N 360,000

AREA 13

Beehive & Little Dove Coal Mines
EMERY COUNTY, UTAH

SOUTHERN AREAS
MINE WORKINGS

UTAH POWER & LIGHT COMPANY
MINING DIVISION

DRAWN BY: LJ Hansen	CHECKED BY:	DATE: MAR. 6, 1989
Scale	Sheet No.	Drawing Number
1" = 500'		FIGURE 39

DEER CREEK FAULT

22 23
27 26

23 24
26 25

FIRST NORTH

SECOND NORTH

THIRD NORTH

FOURTH NORTH

MAIN WEST

MAIN NORTH

SECOND WEST

FIRST WEST

THIRD EAST

SECOND EAST

FIRST EAST

Beehive Mine Portals

Little Dove Mine Portals

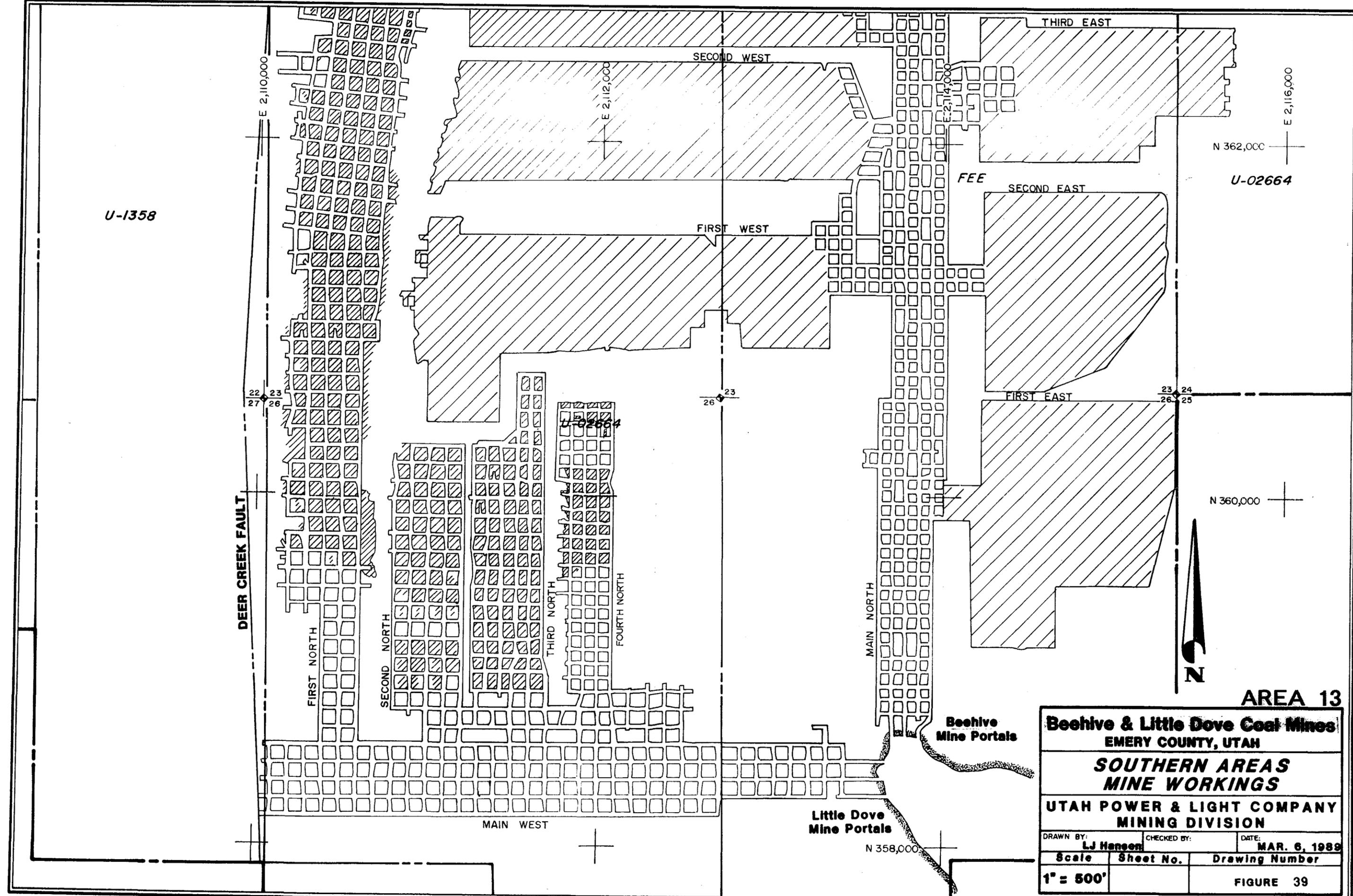
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U-1358

DEER CREEK FAULT

22 23
27 26

U-02664

Profile

Profile

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U-02664

N 360,000



AREA 13

DESERET COAL MINE

EMERY COUNTY, UTAH

**SOUTHERN AREAS
MINE WORKINGS**

**UTAH POWER & LIGHT COMPANY
MINING DIVISION**

DRAWN BY: **John Garrett** CHECKED BY: DATE: **MAR. 2, 1989**

Scale Sheet No. Drawing Number

1" = 500' **FIGURE 40**

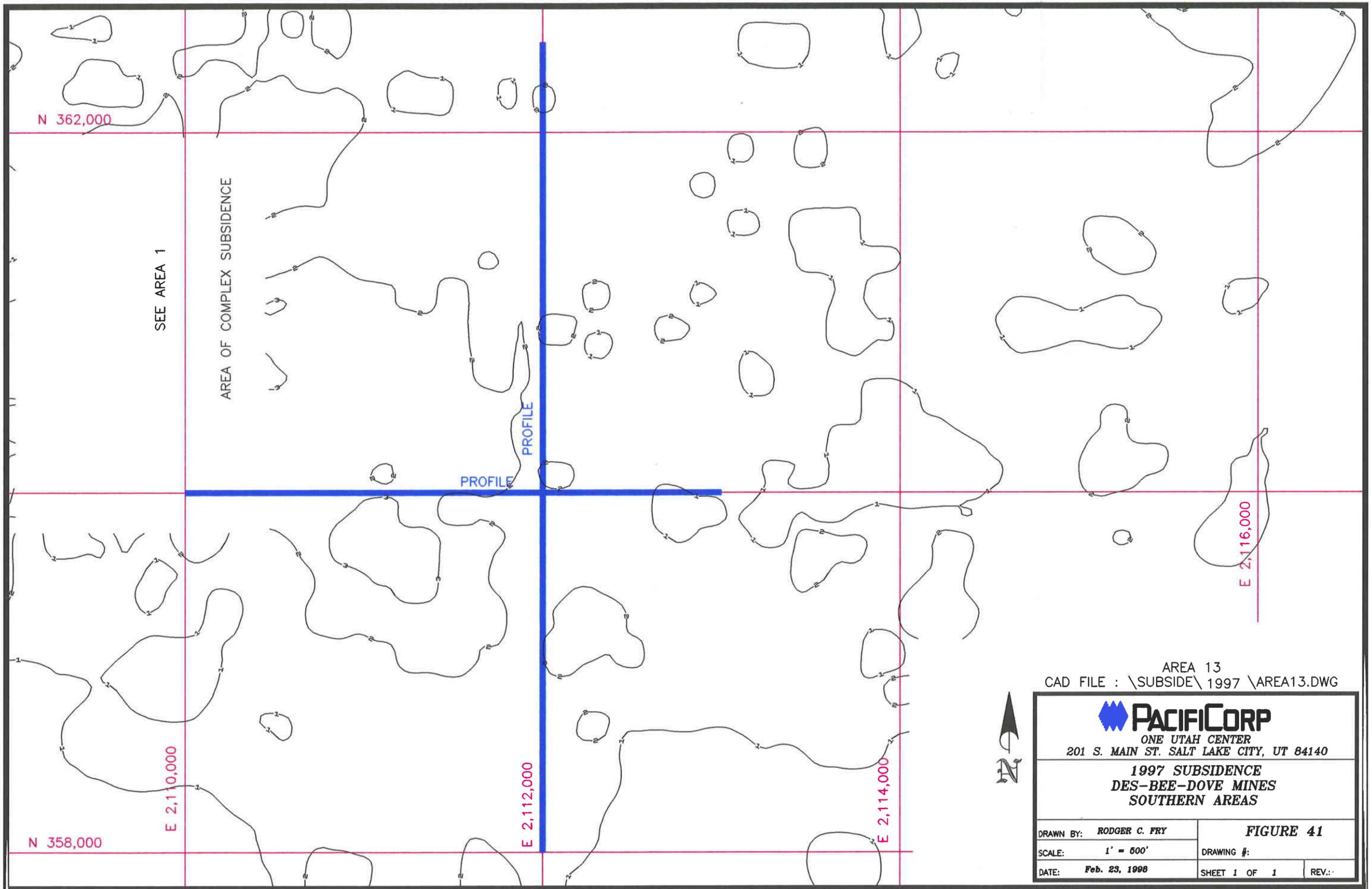
N 358,000

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AREA 13
 CAD FILE : \SUBSIDE\ 1997 \AREA13.DWG



PACIFICORP

ONE UTAH CENTER
 201 S. MAIN ST. SALT LAKE CITY, UT 84140

**1997 SUBSIDENCE
 DES-BEE-DOVE MINES
 SOUTHERN AREAS**

DRAWN BY: **RODGER C. FRY**

FIGURE 41

SCALE: **1' = 500'**

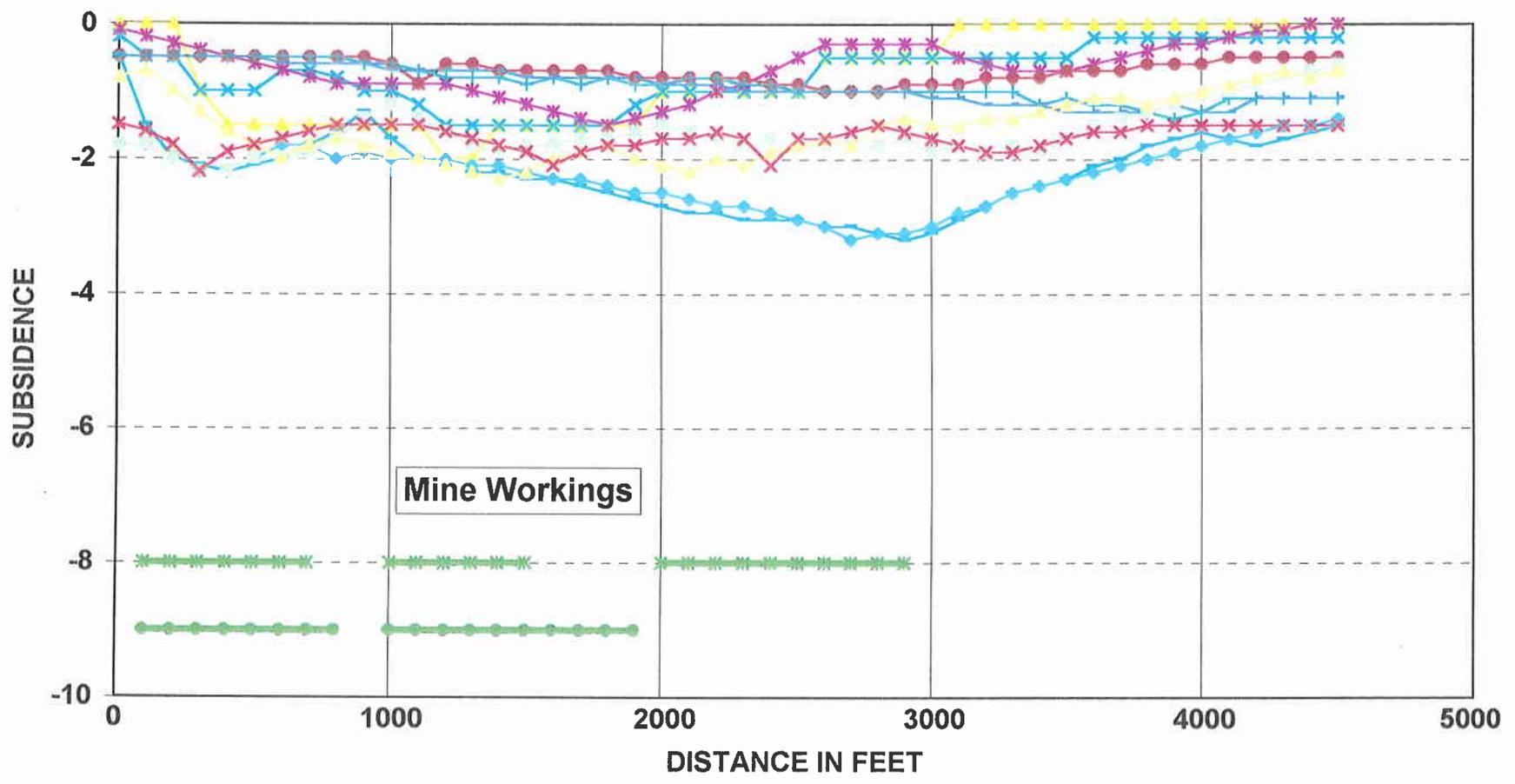
DRAWING #:

DATE: **Feb. 23, 1998**

SHEET 1 OF 1

REV.:

Area 13 Subsidence Profile North - South



- | | | | | | |
|------|------|------|------|------|------|
| 1986 | 1987 | 1988 | 1989 | 1991 | 1992 |
| 1993 | 1994 | 1995 | 1996 | 1997 | |

FIGURE 42

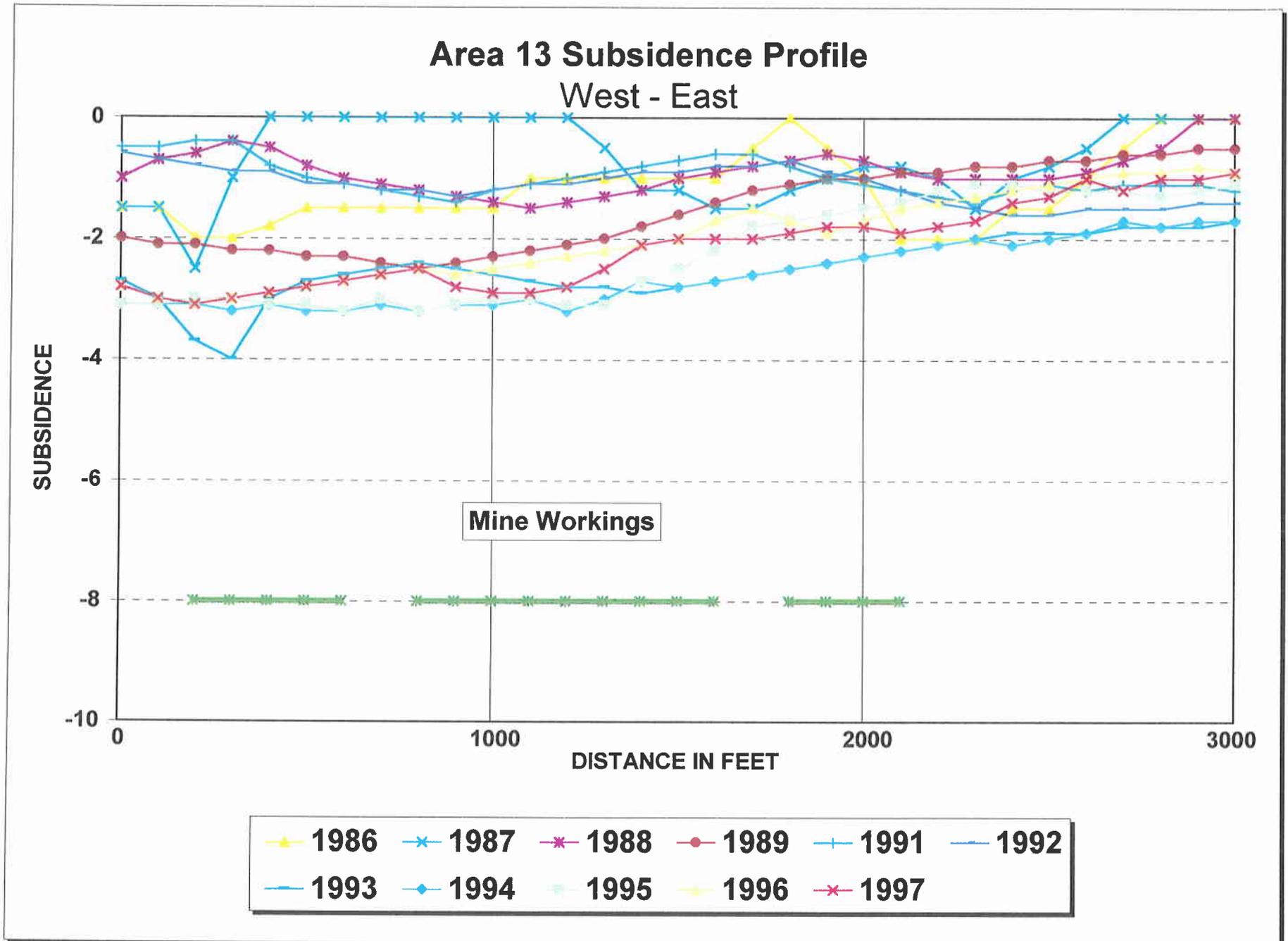


FIGURE 43

Area 14

Cottonwood 6th and 7th East Longwall Panels

Subsidence in Area 14 was first monitored and detected in 1987. Mining began in the 6th East panel in September 1986 and continued until the panel was completed in March 1987. Mining in the 7th East panel began in April 1987, and the panel was finished in September 1987 (Figure 44).

Topography consists of very steep south facing slopes and cliffs with slopes covered by a few scattered pinon, juniper, mountain brush, and grasses. Overburden ranges from near 1,400 feet to 200 feet.

The Castlegate Sandstone forms a 200-foot high escarpment along the north side of Newberry Canyon with numerous naturally occurring joints and fractures. Stress caused by removal of coal was transferred to the fractures resulting in brittle failure of the cliff face (spalling) in some places. Talus from the spalling has accumulated on the steep slopes below the cliffs on older natural talus slopes. The newer debris remains mostly above the coal outcrop level and reaches the canyon floor in only one location. Surface cracks have been observed and mapped along the ridge above the cliff. The cracks are discontinuous and extend for approximately 2,000 feet parallel to the northern edge of the 6th East longwall panel. A few cracks are also found directly on top of the Castlegate Sandstone escarpment. Maximum subsidence to date is over seven (7) feet above the western end of the 7th East Longwall Panel and five (5) feet over the eastern end of 6th East along the Pleasant Valley Fault (Figures 45, 46, and 47). Because this area has rugged and steep

terrain, it is the most difficult to achieve consistent results using the photogrammetric monitoring. As can be seen on the subsidence map (Figure 45) and the profiles (Figures 46 and 47) the subsidence appears to vary substantially from one location to another and change up and down in time. This is because the photogrammetric monitoring is difficult in this type of terrain. The "bulls-eyes" of subsidence shown in 1996 are still present in the 1997 data. The aerial reconnaissance on May 19, 1996 showed no visible indication of change in these areas. It should be expected that inaccuracies in the reading will occur in this area because of the rugged terrain. Several survey targets were established in this area on the Castlegate cliff and have been surveyed since their emplacement in 1986. This monitoring shows no changes in the last four years. The data from these monitoring sites are located in the appendix to this report.

The angle-of-draw was not calculated to the west, south and east because of the steep slopes, burned coal, and other workings surrounding the 6th and 7th East panels. The angle of draw on the north side of the 6th East Panel is 25 degrees.

There are no springs in the vicinity of Area 14. The strata are generally dry; thus, mining is expected to have no adverse impact on the hydrology.

Wildlife in the area includes deer, elk, nesting golden eagles in spring and summer, wintering bald eagles, hares, rabbits, grouse, and other species. Grazing cattle can also be found along the ridge top in the summer months.

The major impacts associated with subsidence and resulting cliff failure, surface cracking, and talus deposition in Area 14 are 1) possible loss of golden eagle nests and/or