ANNUAL SUBSIDENCE MONITORING REPORT
EAST MOUNTAIN PROPERTY
1993

IW0062

IW0062

PACIFICORP
TECHNICAL SERVICES REPORT
RODGER C. FRY

CENTRAL ENGINEERING

ANNUAL SUBSIDENCE MONITORING REPORT
EAST MOUNTAIN PROPERTY
1993

MAY 31, 1994

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DIV. OF OIL, GAS & MINING

PACIFICORP

SUBSIDENCE MONITORING PROGRAM

ANNUAL REPORT FOR 1993

June 1994

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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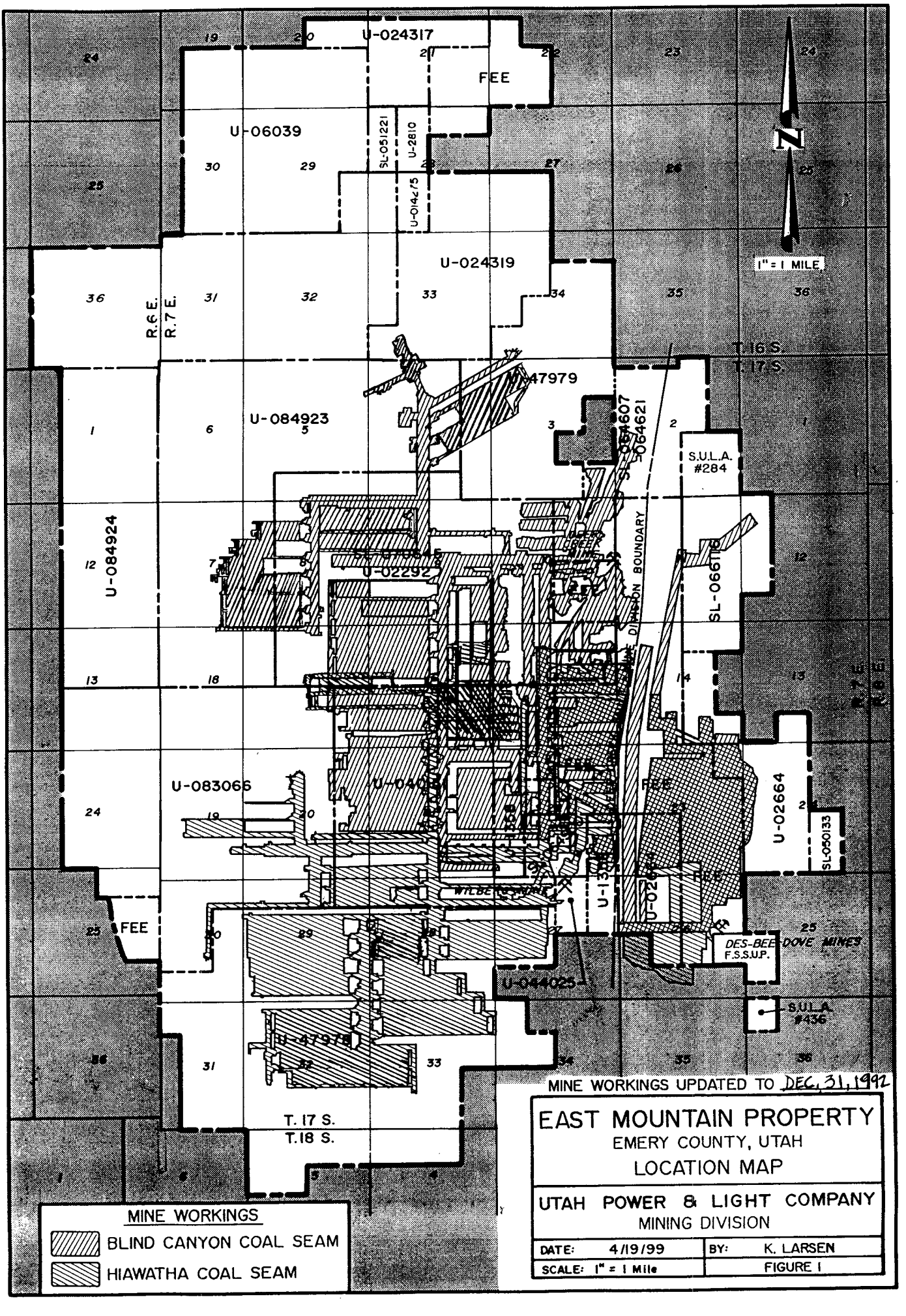
INTRODUCTION

PacifiCorp's 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/Cottonwood, Des-Bee-Dove and Trail Mountain Mines (see Figure 1). This, the twelfth such annual report submitted, covers the period between August 31, 1992 and August 31, 1993.

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. In 1991, the work was re-bid and a different company was awarded the job. 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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FEE
U-06039
SL-051221
U-2810
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U-024319
R.6 E.
R.7 E.
T.16 S.
T.17 S.
U-47979
U-084923
U-084924
U-02292
S.U.L.A. #284
SL-064607
SL-064621
SL-066116
U-083066
U-040
U-02664
SL-050133
U-13
U-02
FEE
DES-BEE DOVE MINE
F.S.S.U.P.
U-044025
S.U.L.A. #436
U-47978
T. 17 S.
T.18 S.
N
1" = 1 MILE
MINE WORKINGS
BLIND CANYON COAL SEAM
HIAWATHA COAL SEAM
MINE WORKINGS UPDATED TO DEC. 31, 1992
EAST MOUNTAIN PROPERTY
EMERY COUNTY, UTAH
LOCATION MAP
UTAH POWER & LIGHT COMPANY
MINING DIVISION
DATE: 4/19/99
BY: K. LARSEN
SCALE: 1" = 1 Mile
FIGURE 1

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 panelled 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 panelled 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.

In the spring of 1994, a comparison of change in subsidence over the past 3 years in the south end of East Mountain was made. In this study an error in the baseline elevations in the 1992 subsidence data was discovered. The contractor had added 1.5 feet to the elevation of the baseline data from 1986. Normally they would remove this 1.5 feet prior to sending the data to PacifiCorp but they failed to do this in this case. This exaggerated the amount of subsidence in some of the points on East Mountain by 1.5 feet for the data in the 1992 report. The profiles in this report that include 1992 data have been corrected.

Using the aerial photographs derived from a flight conducted on August 6, 1993, elevations were measured at 10,165 different points. These elevations were then compared with the baseline survey elevations measured

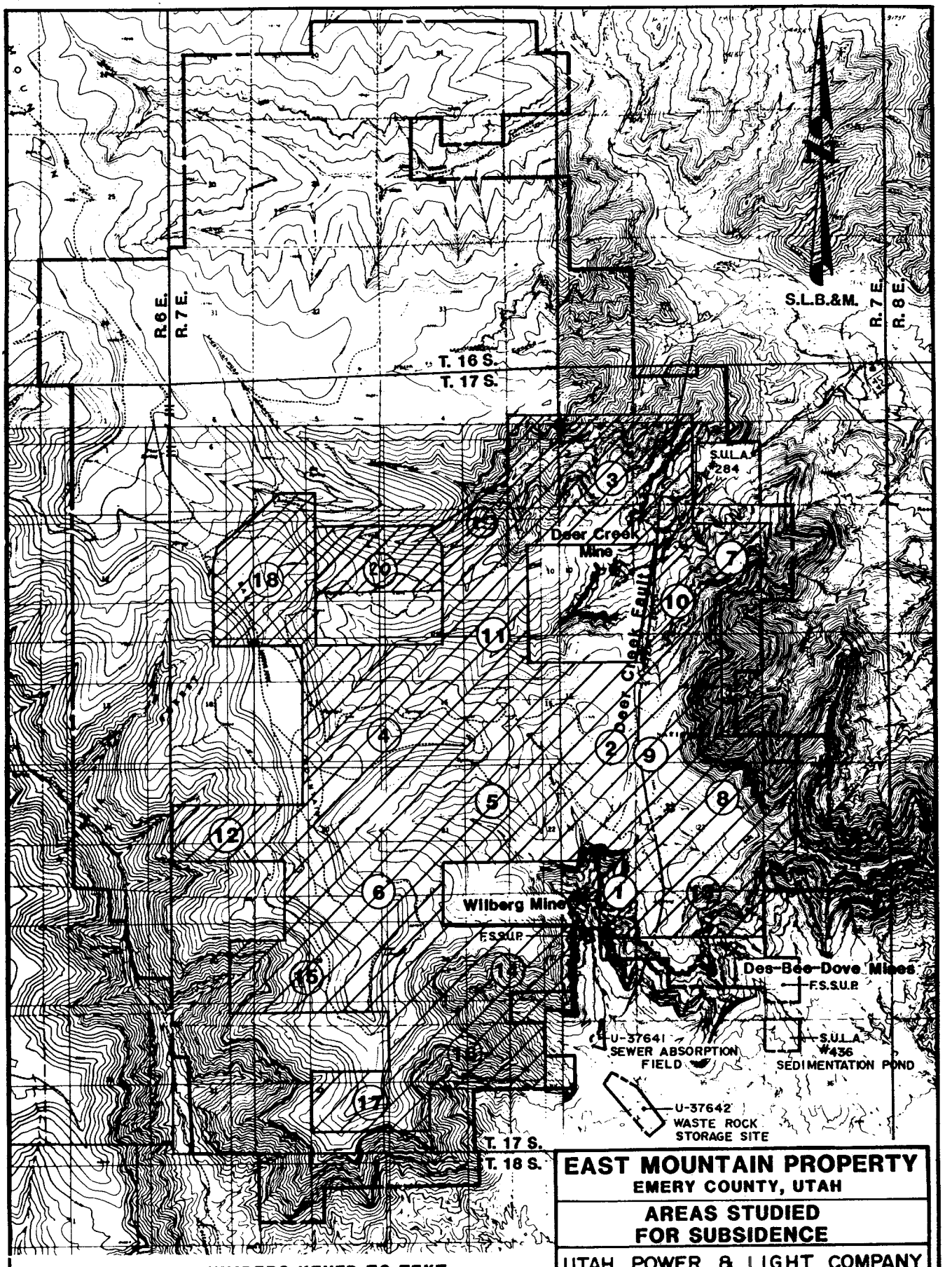
from the aerial photos collected in 1980, 1986, and 1987. The difference in elevation is the amount of subsidence that has occurred. Where the amount of subsidence measured at one point is significantly different than all surrounding points and by itself formed a one point anomaly, the point is considered bad and was eliminated from the analysis. These points comprised less than 0.2% of the total number of points collected. 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 1/2 inch disk in an ASCII file called SUB. DAT.

The photography completed on August 6, 1993 included a baseline survey of all of Trail Mountain including the Lease By Application area and all of East and Trail Mountains were photographed using color infrared film.

Prior to PacifiCorp's acquisition of the Trail Mountain Mine from ARCO Coal Co., they monitored subsidence using on the ground monumentation. Nowhere did the monitoring identify subsidence greater than a few tenths of feet. Since the acquisition of the property no mining has occurred. When mining does commence, we will read the elevations from that years photography.

Location

Figure 2 shows all areas above PacifiCorp's coal mines which have potential for mining-induced subsidence. A helicopter reconnaissance flight



NUMBERS KEYED TO TEXT

= AREAS STUDIED FOR SUBSIDENCE

= U.P.&L.CO. PERMIT BOUNDARY LINE

EAST MOUNTAIN PROPERTY

EMERY COUNTY, UTAH

AREAS STUDIED FOR SUBSIDENCE

UTAH POWER & LIGHT COMPANY

DEPARTMENT OF MINING & EXPLORATION

DATE: 2/11/86	BY: LJ GUM
SCALE: 1"= 1 Mile	FIGURE 2

during 1993 revealed no new areas of visible surface disturbance. Following the helicopter reconnaissance, fractures were discovered above the 7th Right Longwall Panel in the Cottonwood mine. These fractures are discussed in detail in the area 11 section of this report. 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 may show data for several years to better track the subsidence history of the area.

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.

Area 1

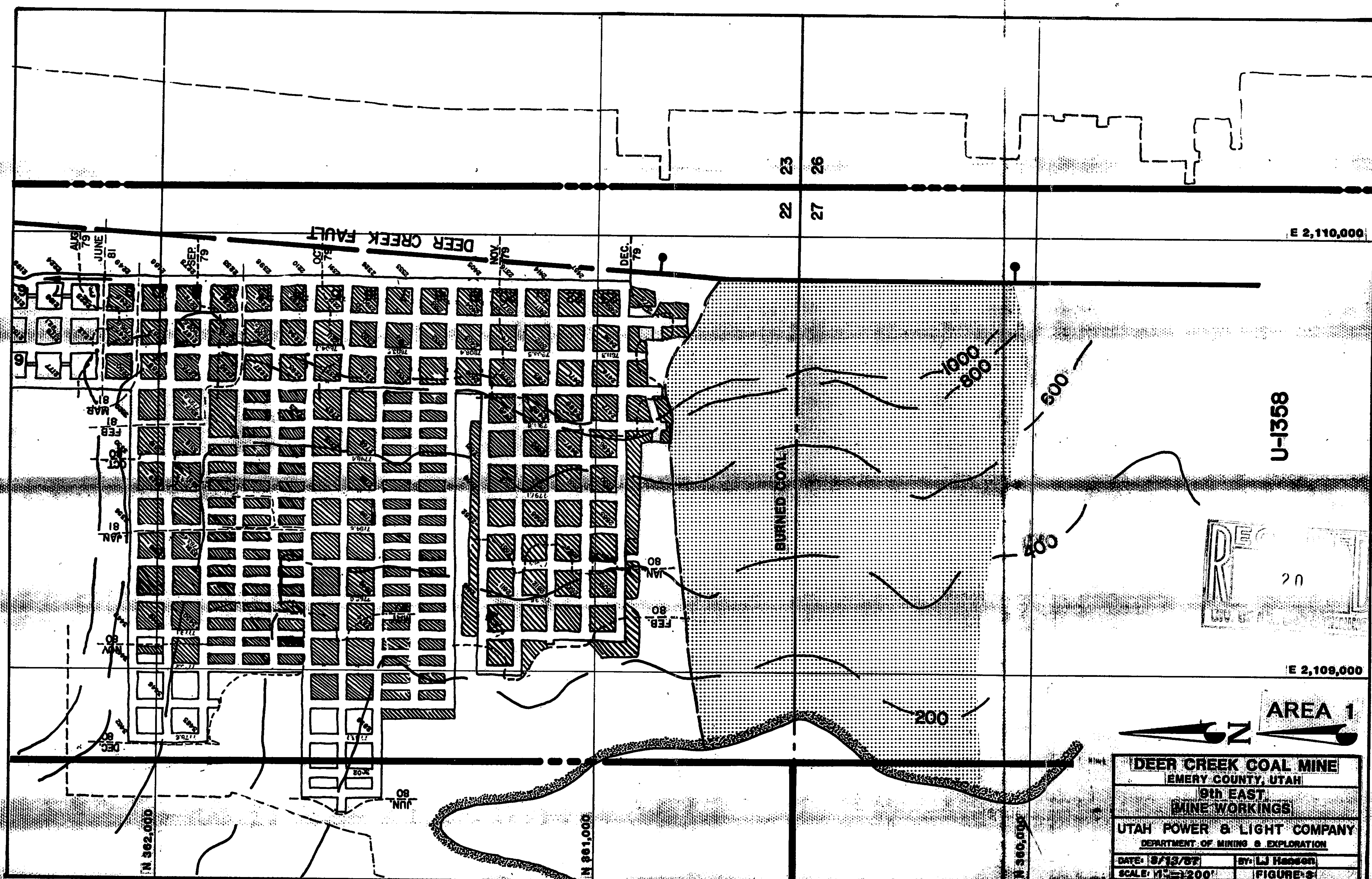
Deer Creek 9th East - Wilberg 1st Right

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.

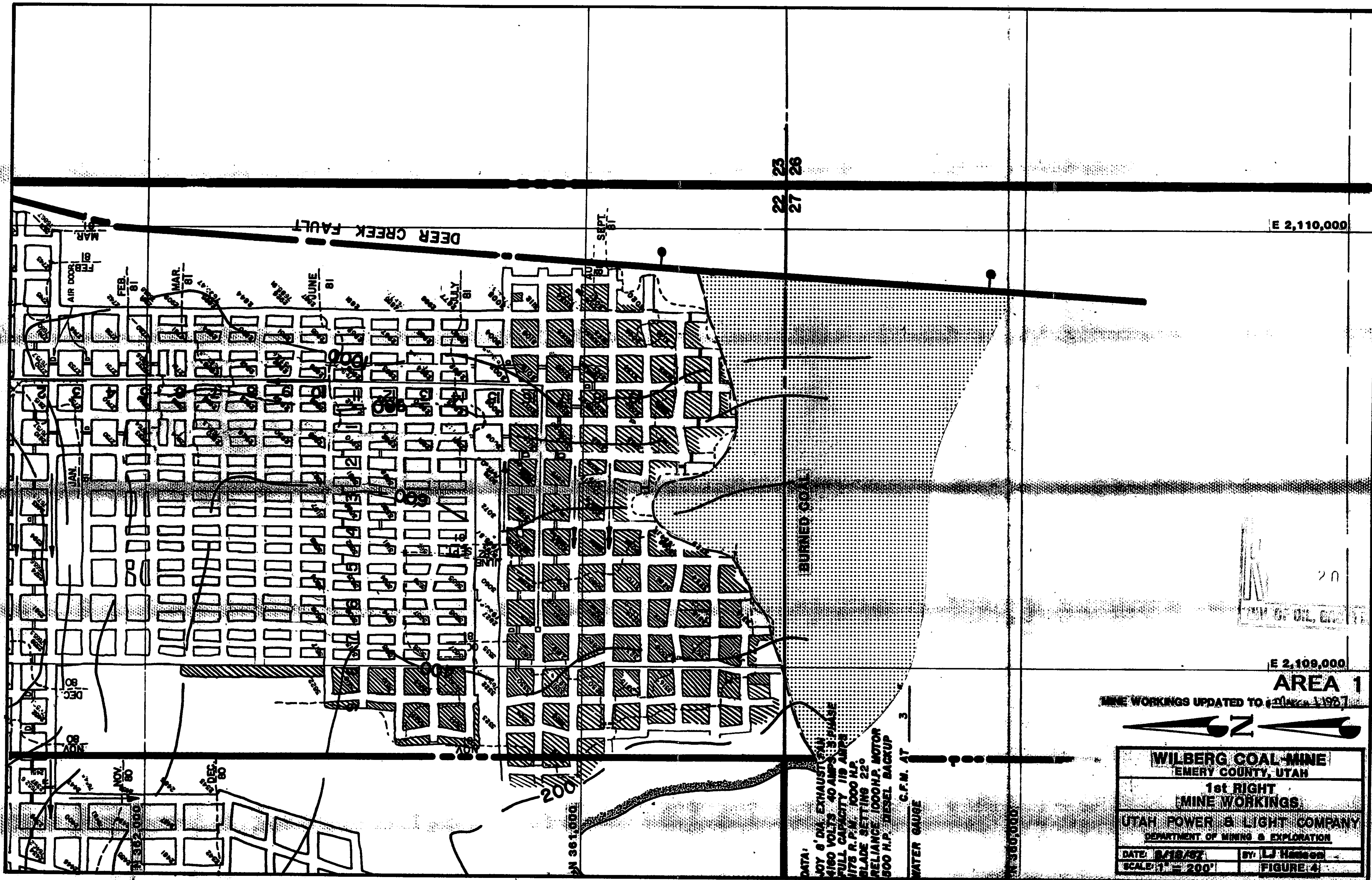
Figures 6 and 7 are north to south and west to east profiles showing the amount of subsidence in this area during the past eight years. The location of each line is shown on Figure 5. The area has seen little change since 1985 and appears to have totally stabilized. Maximum subsidence remains at about 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.

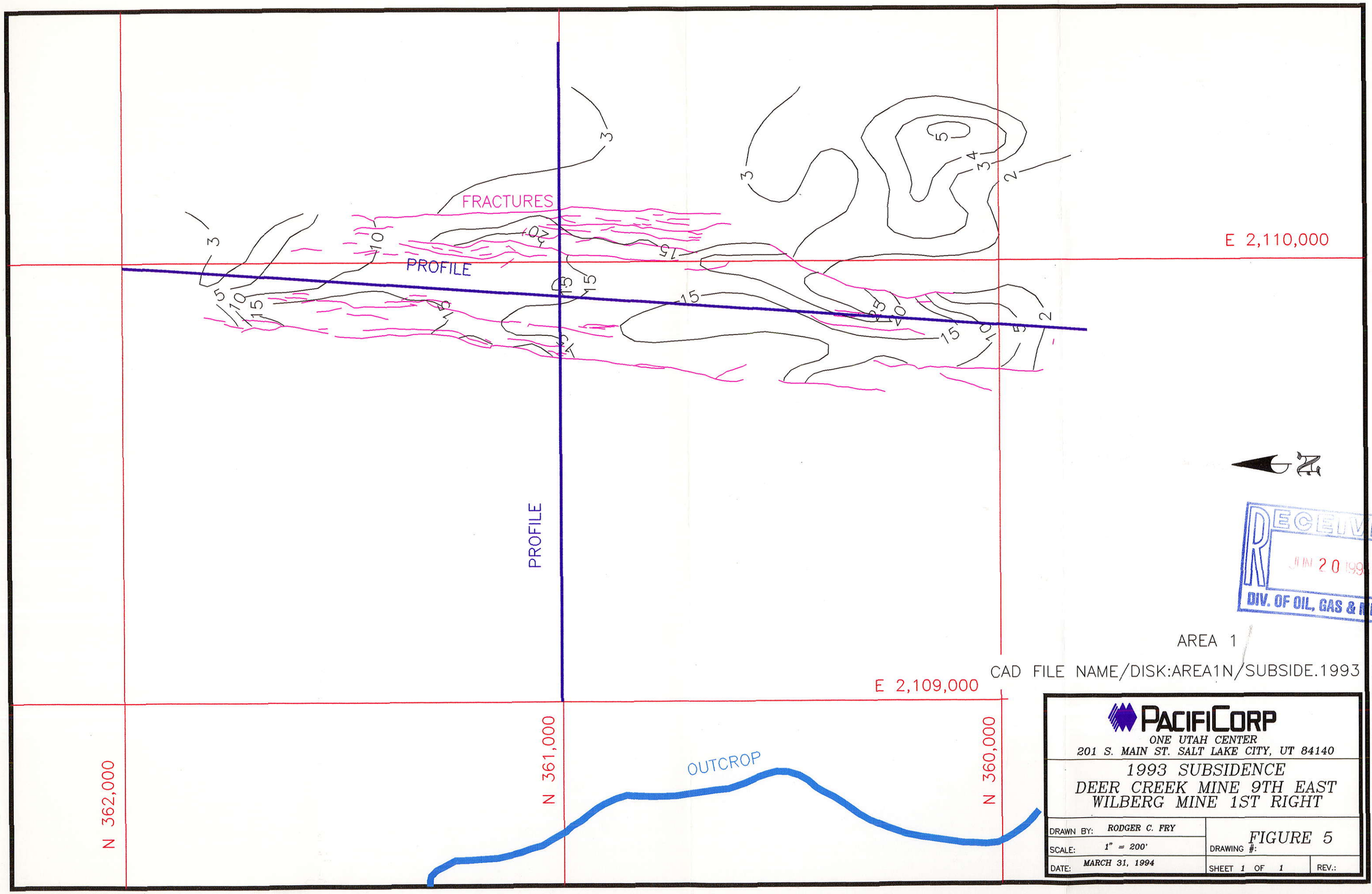
Calculation of the angle-of-draw is complicated because the workings are nearly surrounded by faults, burned coal, and other mine workings. Due to this complexity, angle-of-draw was not determined for Area 1.

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



DEER CREEK FAULT
23
26
22
27
E 2,110,000
E 2,109,000
BURNED COAL
1000
800
600
400
200
U-1358
AREA 1
N 362,000
N 361,000
N 360,000
DEER CREEK COAL MINE
EMERY COUNTY, UTAH
9th EAST
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE: 8/13/87
BY: LJ Hansen
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
22
23
26
27
AREA 1
MINE WORKINGS UPDATED TO
N
WILBERG COAL MINE
EMERY COUNTY, UTAH
1st RIGHT
MINE WORKINGS
UTAH POWER & LIGHT COMPANY
DEPARTMENT OF MINING & EXPLORATION
DATE:
BY: LJ Hansen
SCALE: 1" = 200'
FIGURE 4



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AREA 1

CAD FILE NAME/DISK:AREA1N/SUBSIDE.1993

PACIFICORP
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1993 SUBSIDENCE
DEER CREEK MINE 9TH EAST
WILBERG MINE 1ST RIGHT

DRAWN BY: RODGER C. FRY	DRAWING #: FIGURE 5	
SCALE: 1" = 200'		
DATE: MARCH 31, 1994	SHEET 1 OF 1	REV.:

FIGURE 6

AREA 1 SUBSIDENCE PROFILE

SOUTH-NORTH

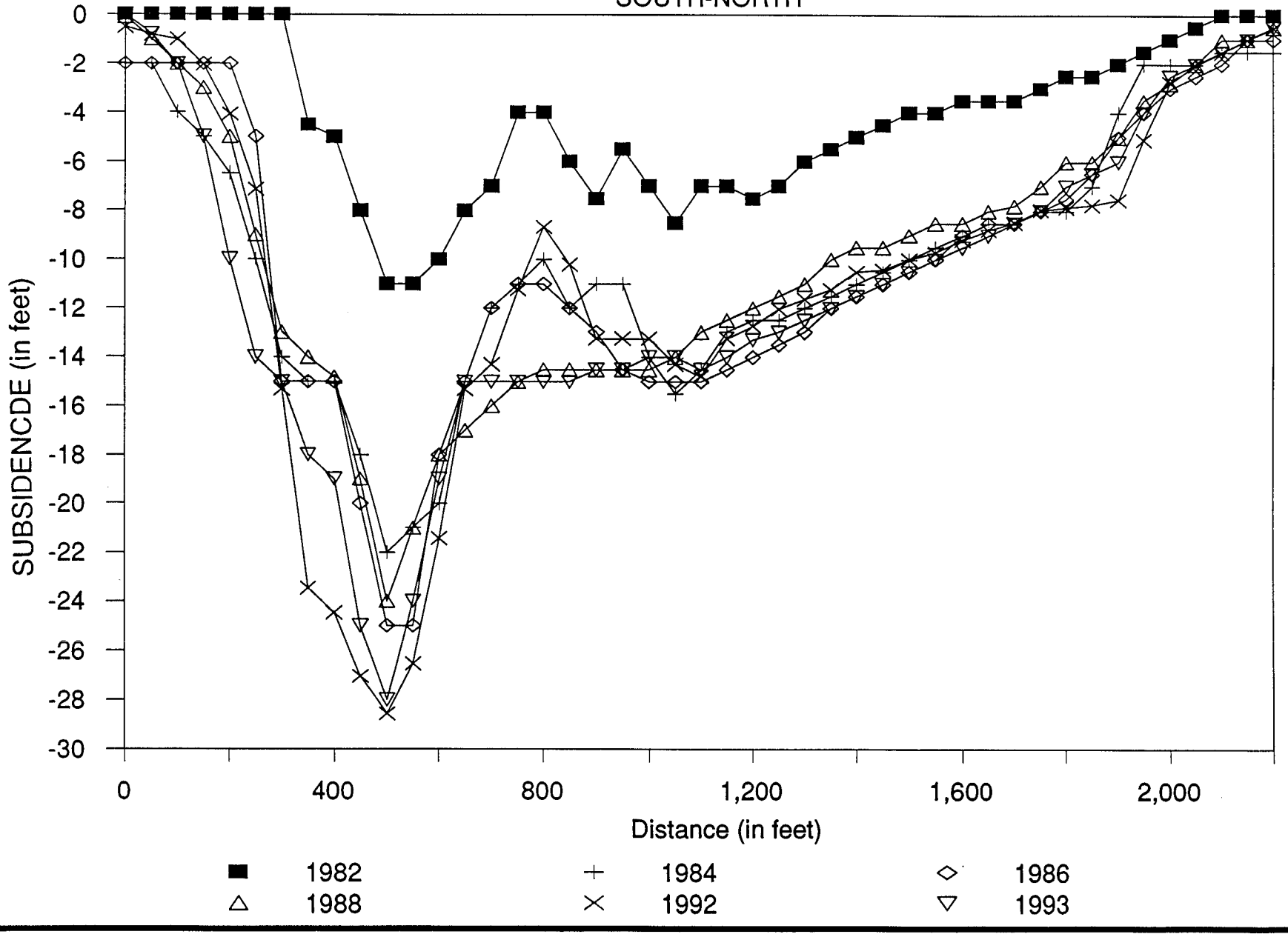
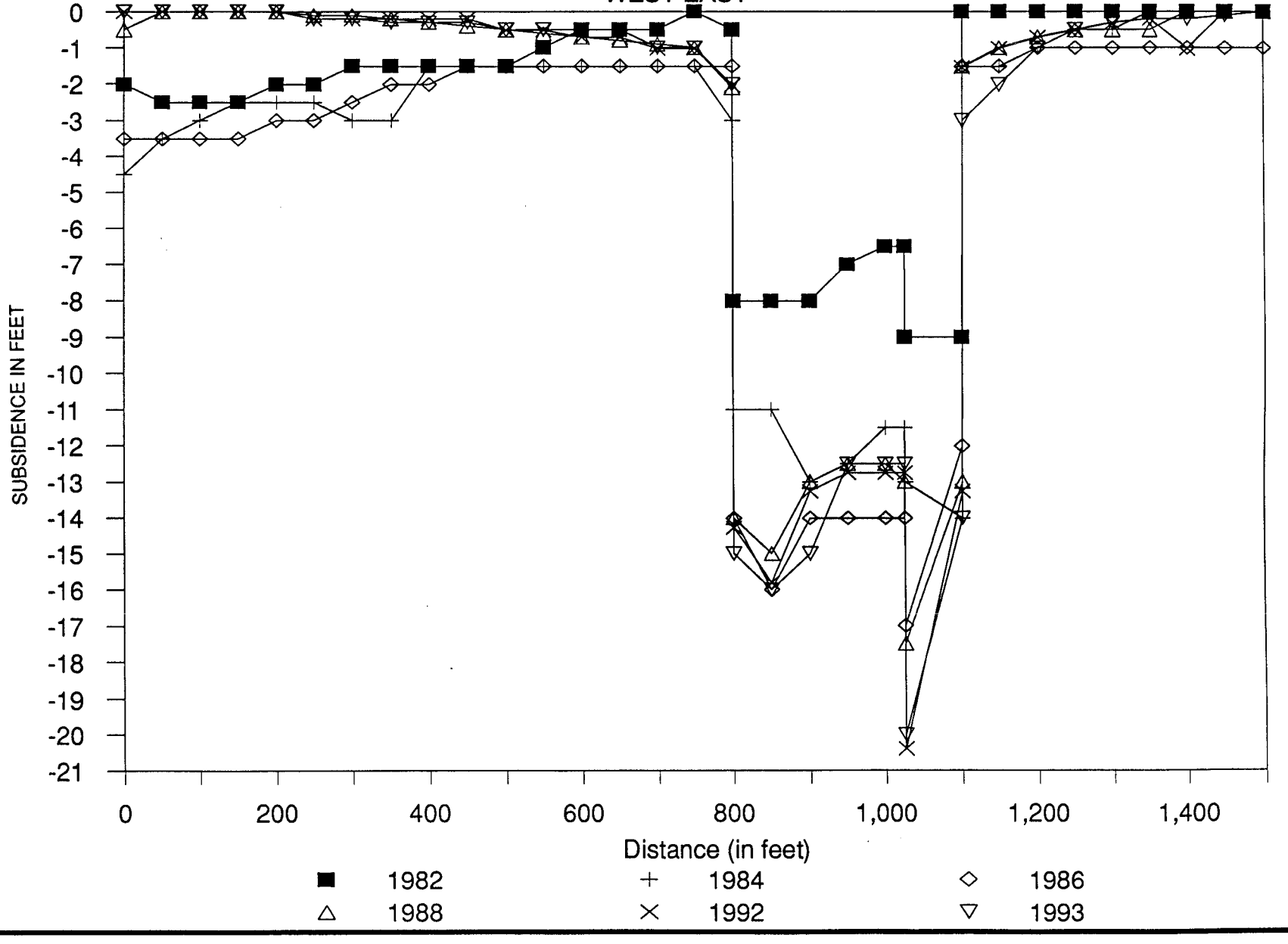


FIGURE 7

AREA 1 SUBSIDENCE PROFILE

WEST-EAST



Area 2

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

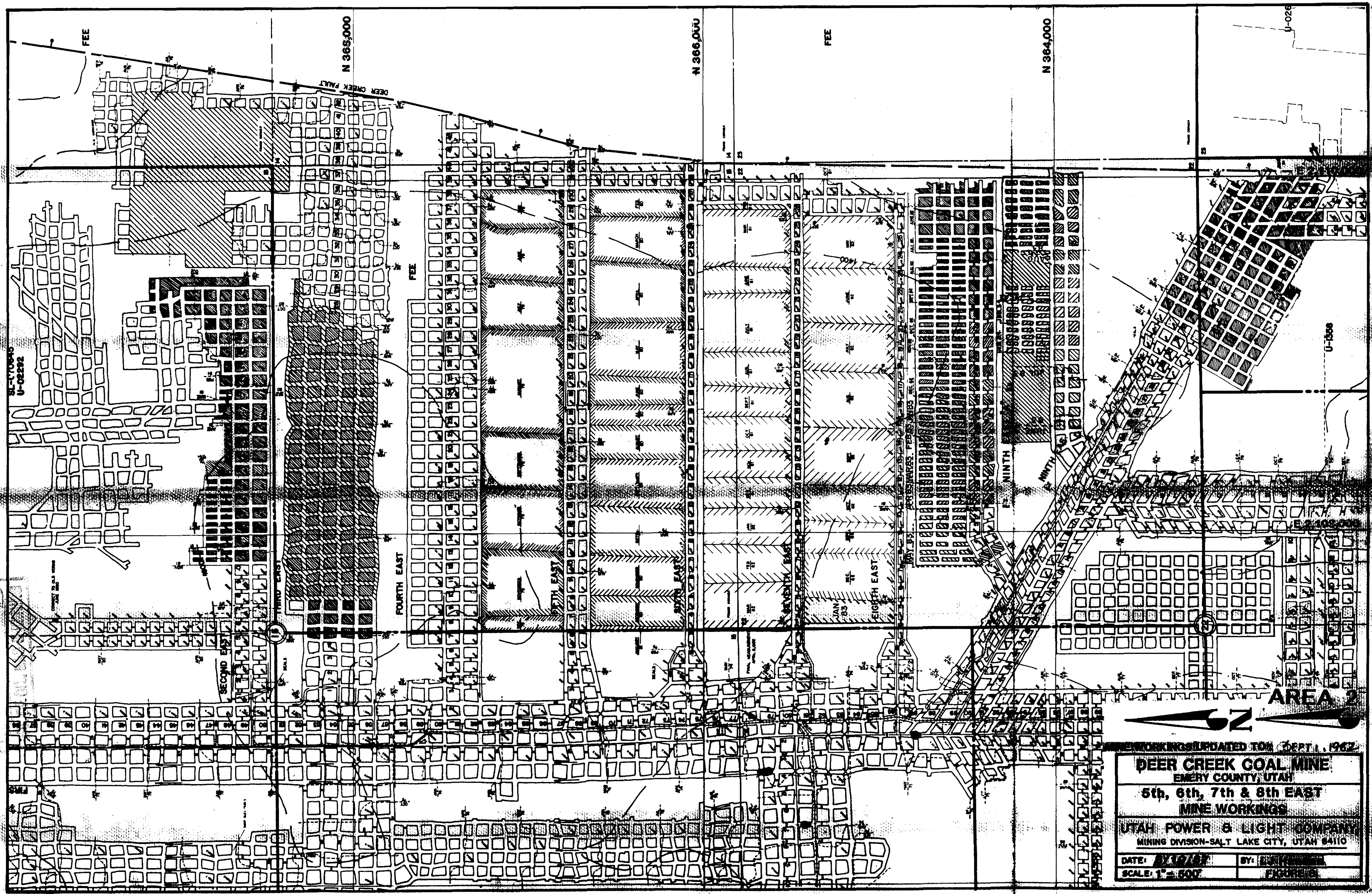
Wilberg 3rd through 13th Right Panels

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

Maximum subsidence in Area 2 has increased to 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 trough has deepened slightly in the last 3 years. 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, 1992).



FEE
N 365,000
N 366,000
FEE
N 364,000
DEER CREEK FAULT
U-02292
U-558
E 2,102,000
SECOND EAST
THIRD EAST
FOURTH EAST
FIFTH EAST
SIXTH EAST
SEVENTH EAST
EIGHTH EAST
NINTH EAST
AREA 2
N
MINE WORKINGS UPDATED TO: SEPT 1, 1982
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:
BY:
SCALE: 1" = 500'

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DEER CREEK FAULT

N 368,000

N 366,000

N 364,000

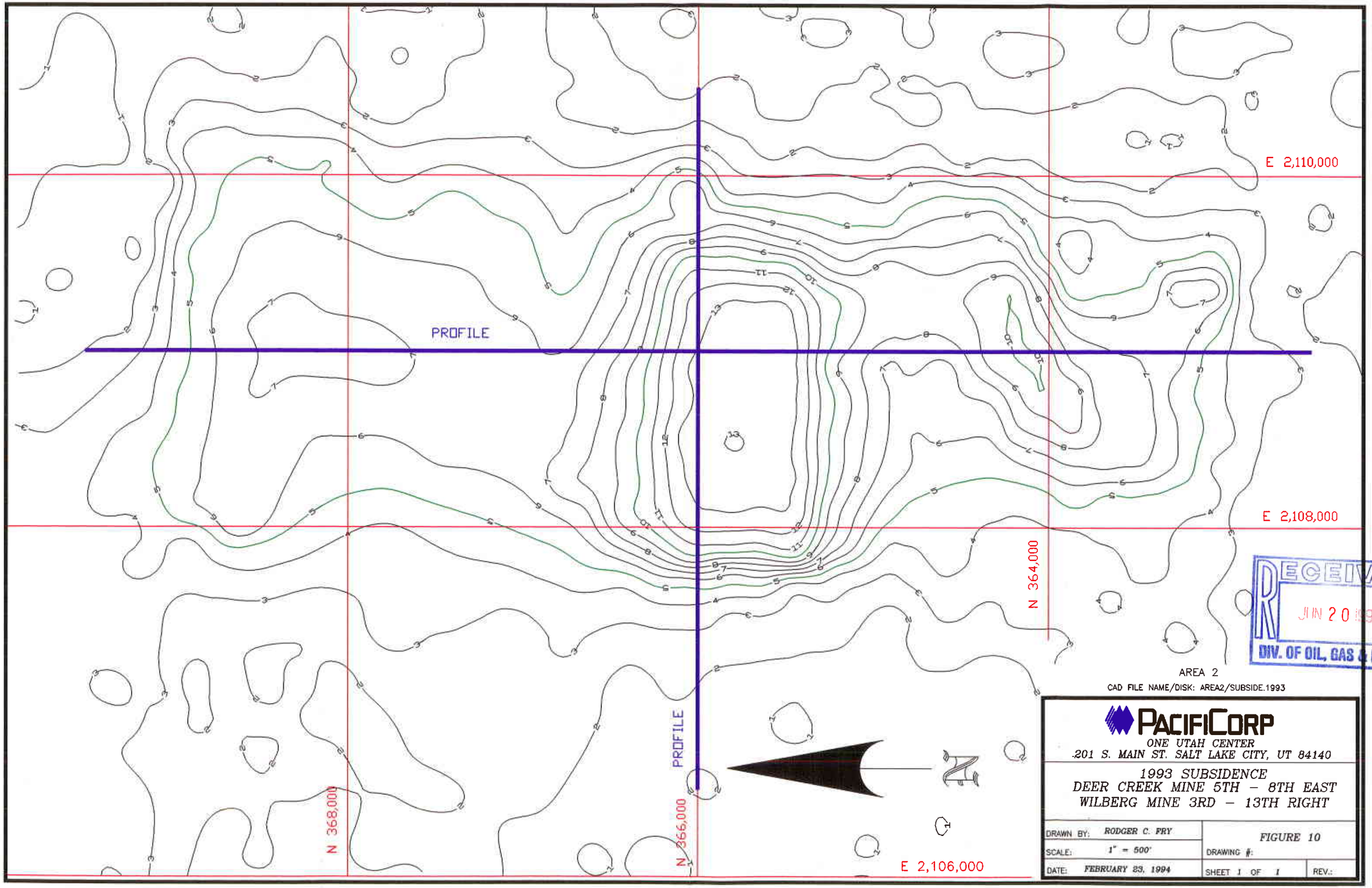
E 2,110,000

E 2,108,000

AREA 2

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

MINE WORKINGS UPDATED TO: AUGUST 31, 1988



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AREA 2

CAD FILE NAME/DISK: AREA2/SUBSIDE.1993

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1993 SUBSIDENCE
DEER CREEK MINE 5TH – 8TH EAST
WILBERG MINE 3RD – 13TH RIGHT

DRAWN BY:	RODGER C. FRY	FIGURE 10	
SCALE:	1" = 500'	DRAWING #:	
DATE:	FEBRUARY 23, 1994	SHEET 1 OF 1	REV.:

FIGURE 11

AREA 2 SUBSIDENCE PROFILE

NORTH-SOUTH

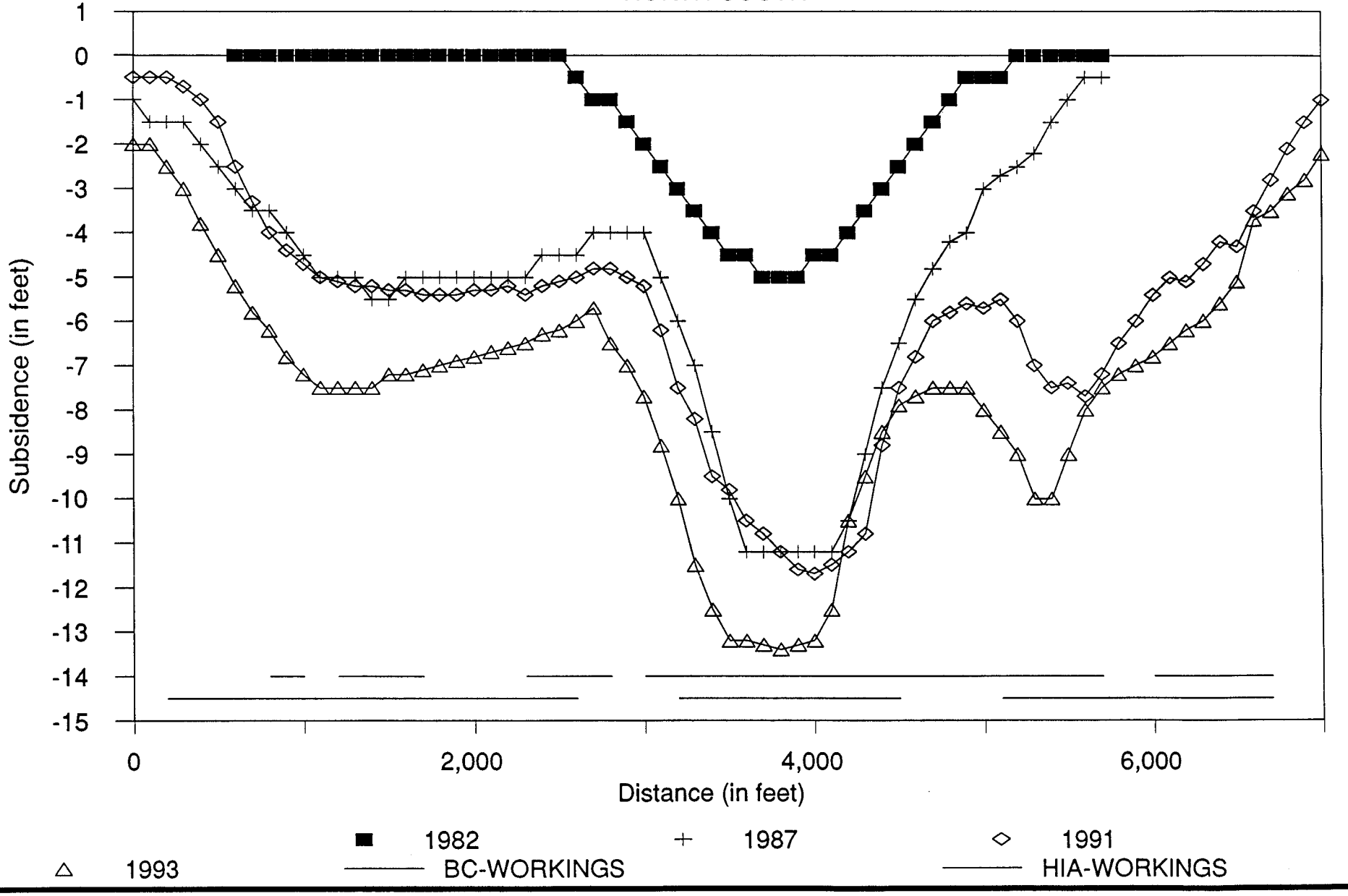
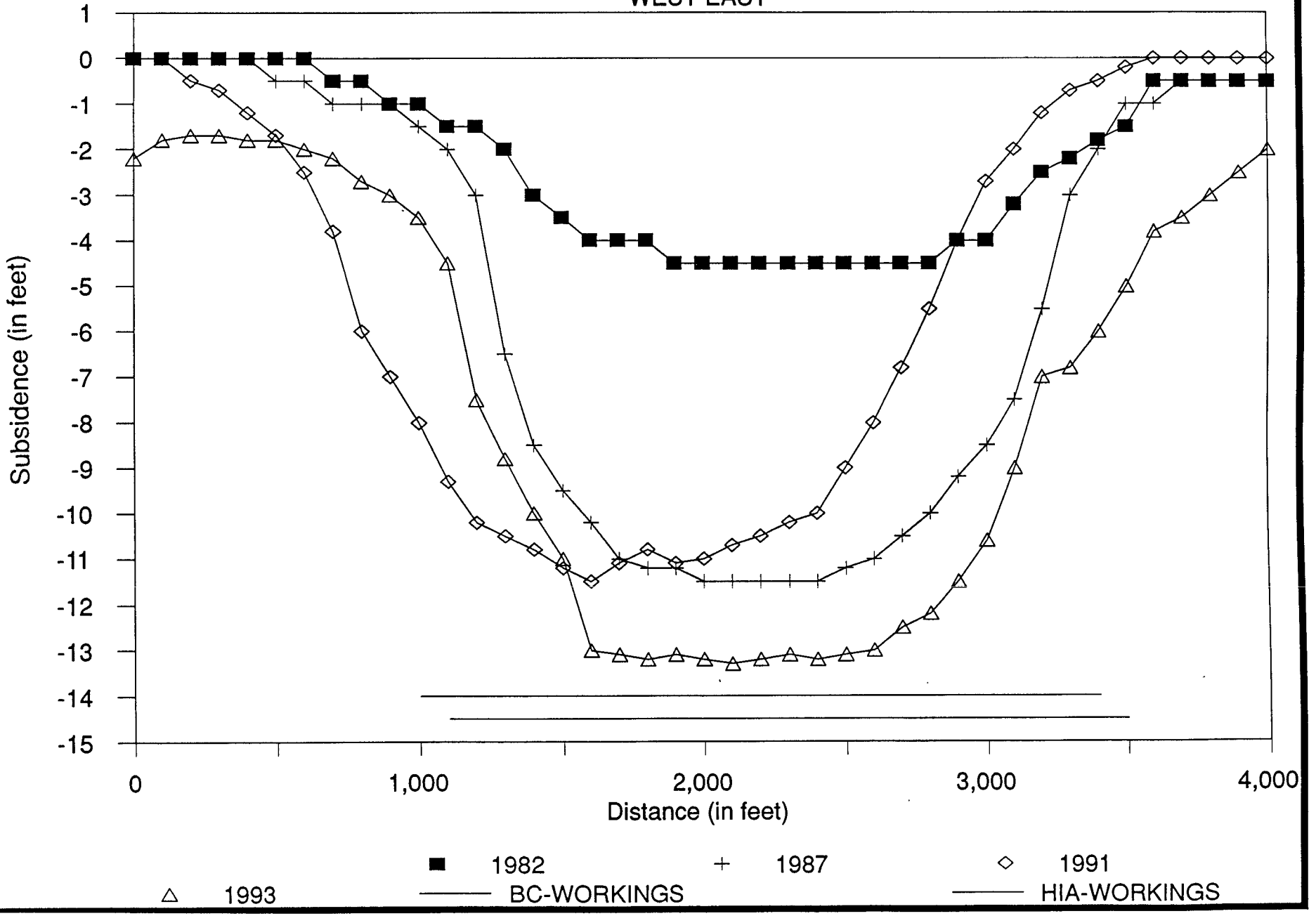


FIGURE 12

AREA 2 SUBSIDENCE PROFILE

WEST-EAST



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.

A Helicopter survey in 1993 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.

MONSEN ENGINEERING CO. 83541

N 380,000

N 378,000

N 376,000

E 2,106,000

E 2,108,000

E 2,110,000

E 2,112,000

1000

800

600

400

PARAMOUNT MINE

PROFILE

BURNED COAL

SL-064607
(064621)

THIRD LEFT

SECOND LEFT

FIRST NORTH

N

AREA 3

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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:	CHECKED BY:	DATE:
LJ Hansen		Mar. 19, 1984

Scale	Sheet No.	Drawing Number
1" = 500'		FIGURE 13

N 380,000

N 378,000

N 376,000

E 2,106,000

E 2,108,000

E 2,110,000

E 2,112,000

FAULT

OUTCROP

FAULT

PROFILE

N

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AREA 3
CAD FILE NAME/DISK:AREA3/SUBSIDE/1993

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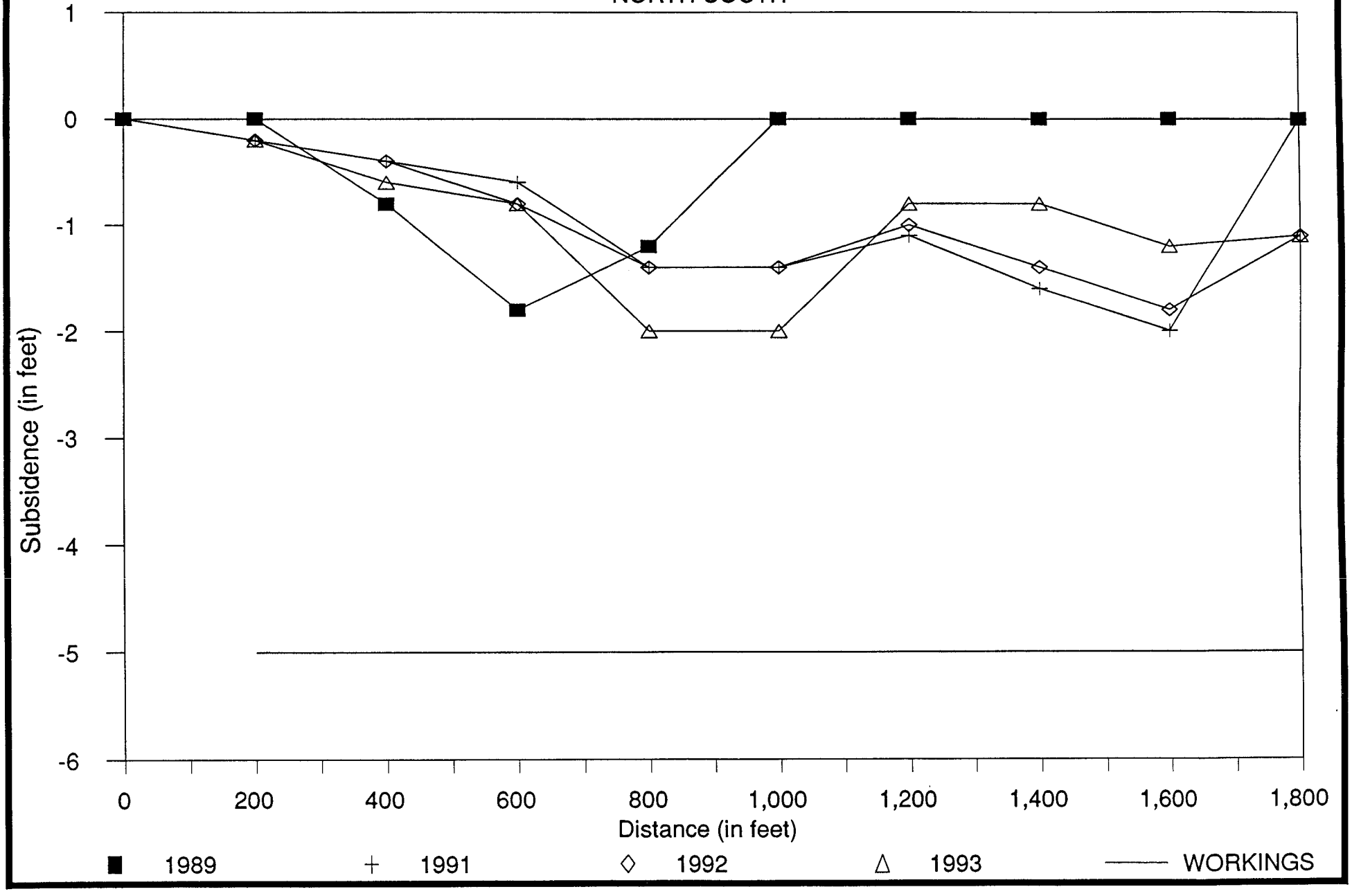
1993 SUBSIDENCE
DEER CREEK MINE
1ST NORTH AREA

DRAWN BY: RODGER C. FRY	FIGURE 13A	
SCALE: 1" = 500'	DRAWING #:	
DATE: APRIL 6, 1994	SHEET 1 OF 1	REV.:

FIGURE 14

AREA 3 SUBSIDENCE PROFILE

NORTH-SOUTH



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).

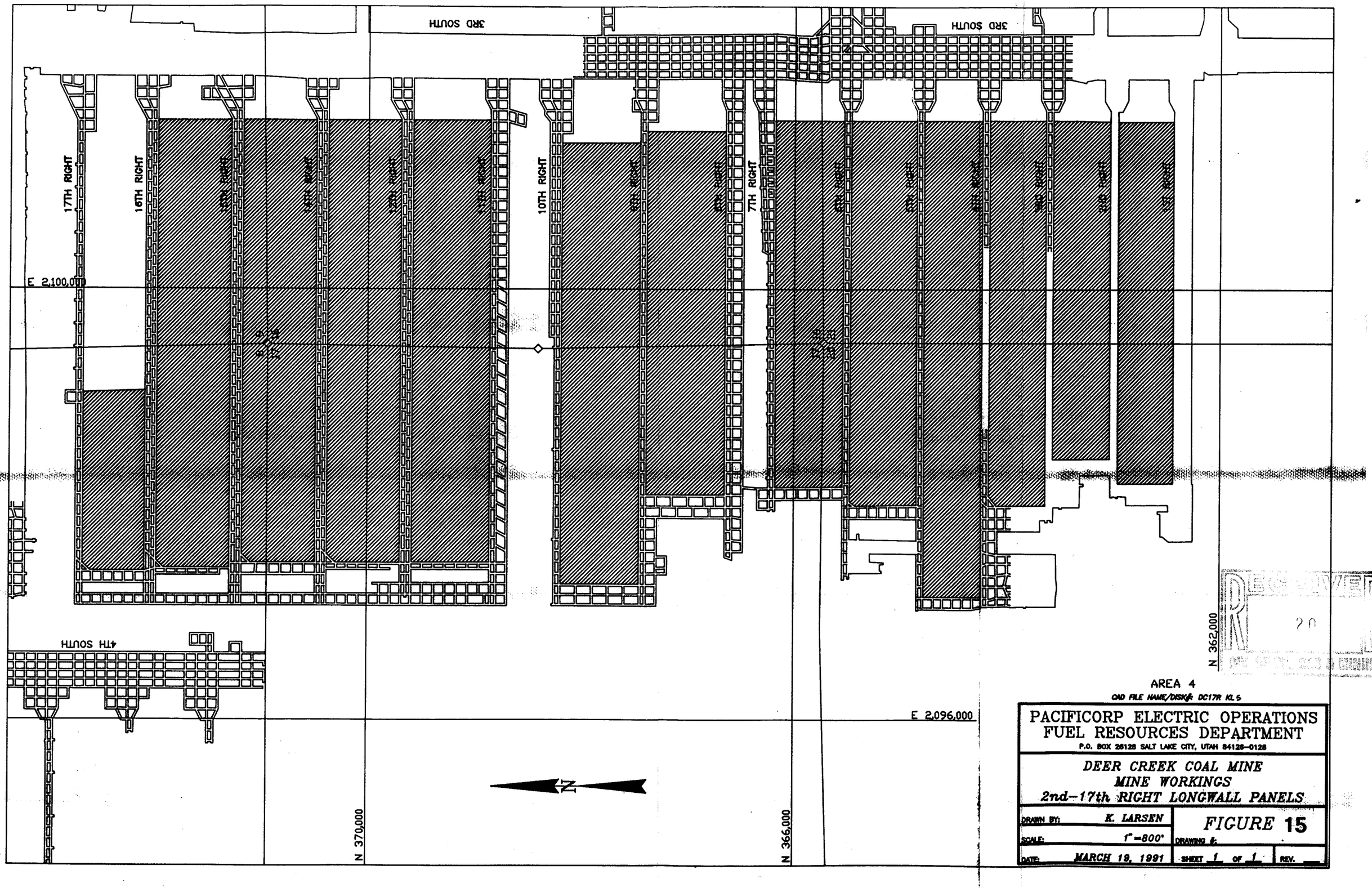
Maximum subsidence is just over seven (7) feet over the 5th Right longwall panel (Figure 16). The profiles, Figures 17 and 18 show some variability from year to year. This area is heavily vegetated and it is thought that this creates difficulties in obtaining consistent readings from year to year. The 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, 1992 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.

Figure 15



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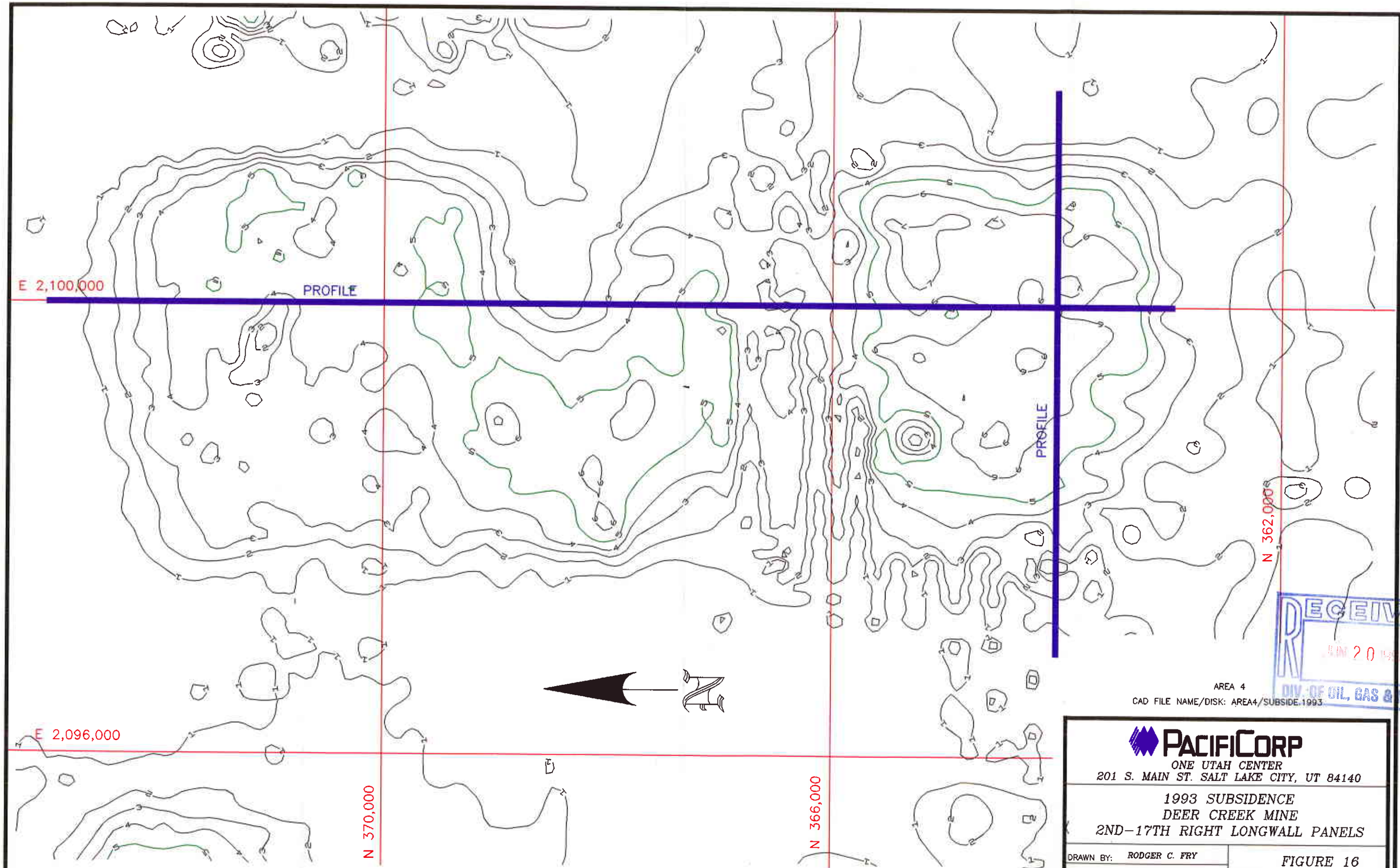
AREA 4

CAD FILE NAME/DISK#: DC17R KLS

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'	DRAWING #:
DATE: MARCH 19, 1991	SHEET 1 OF 1 REV.



AREA 4

CAD FILE NAME/DISK: AREA4/SUBSIDE.1993

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

1993 SUBSIDENCE
DEER CREEK MINE
2ND–17TH RIGHT LONGWALL PANELS

DRAWN BY: RODGER C. FRY		FIGURE 16
SCALE: 1" = 800'		DRAWING #:
DATE: FEBRUARY 24, 1994	SHEET 1 OF 1	REV.:

FIGURE 17

AREA 4 SUBSIDENCE PROFILE

NORTH-SOUTH

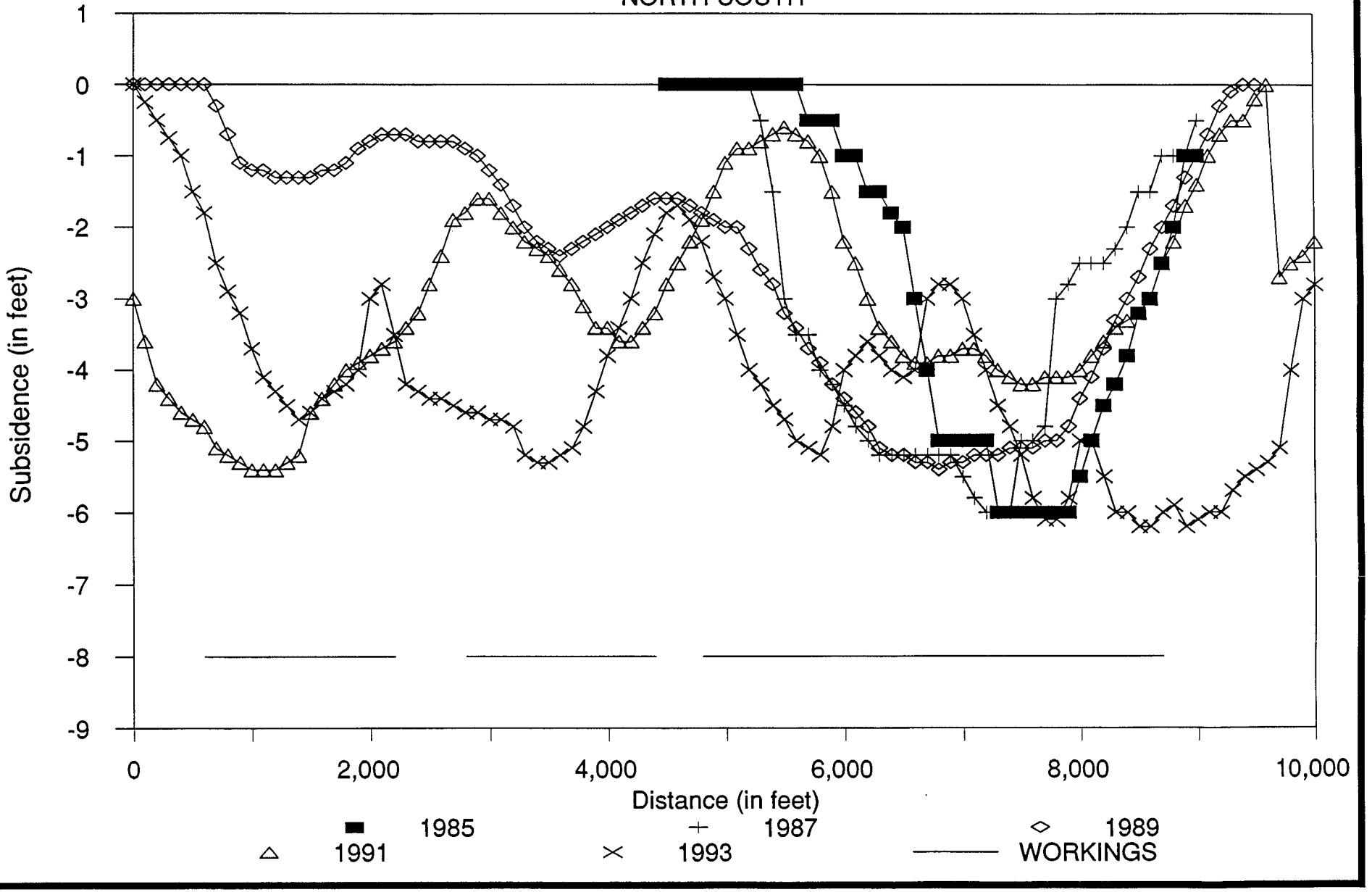
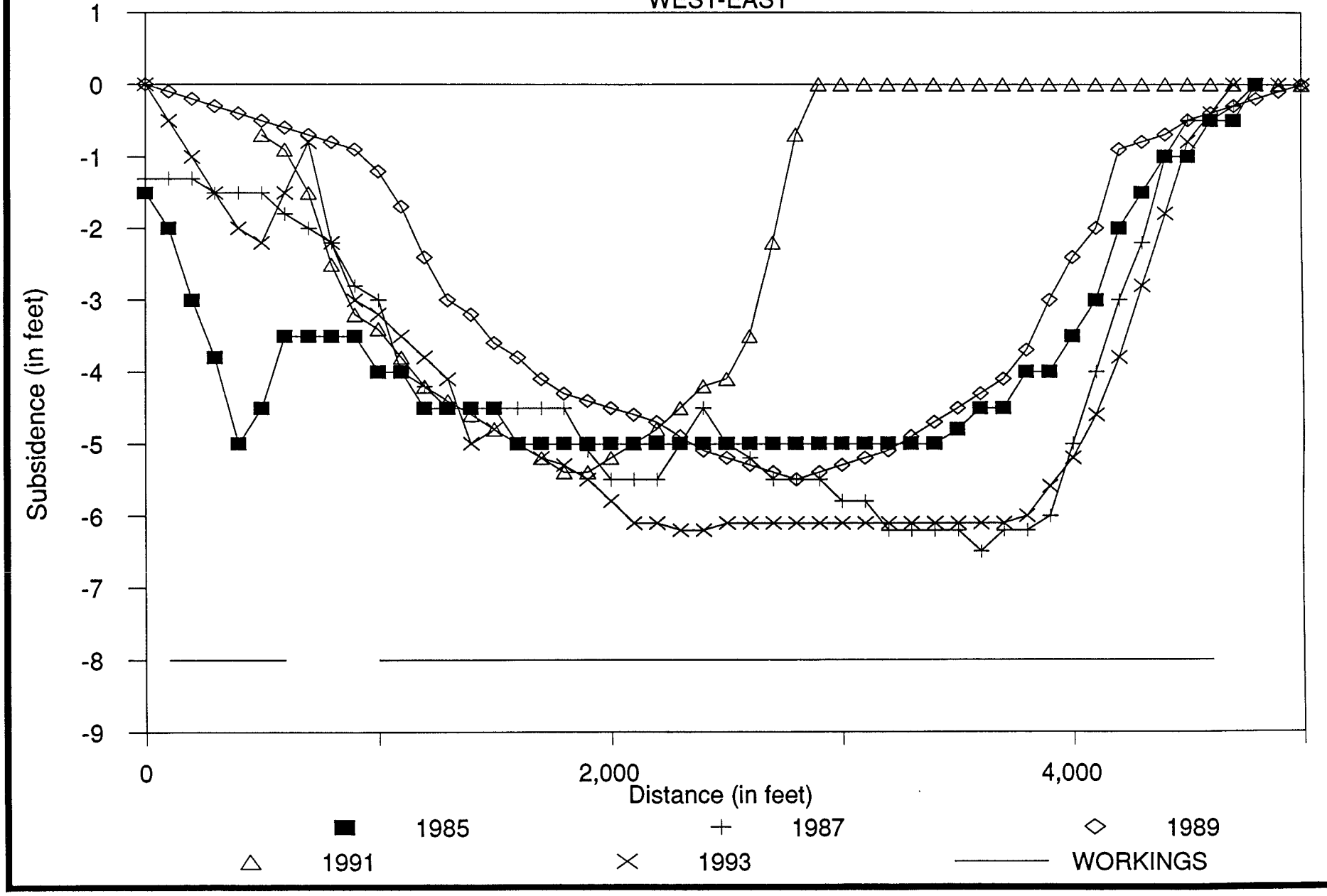


FIGURE 18

AREA 4 SUBSIDENCE PROFILE

WEST-EAST



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 began in January 1983, and by October 1985 all four panels had been completed (Figure 19).

Maximum subsidence over the panels is about seven (7) feet (Figure 20). The maximum subsidence shows an increase since 1991 over the center of the panels (Figures 21 and 22). 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.

MONSEN ENGINEERING CO. 83541

Deer Creek Coal Mine
EMERY COUNTY, UTAH

2ND - 5TH LEFT MINE WORKINGS

UTAH POWER & LIGHT COMPANY

DRAWN BY: John Garrett	CHECKED BY:	DATE: June 22, 1988
Scale: 1"=500'	Sheet No.	Drawing Number: Figure 10

AREA 5

SIXTH RIGHT · THIRD WEST · SEVENTH EAST · EIGHTH EAST · NINTH EAST · FIFTH RIGHT · FIFTH LEFT · FOURTH RIGHT · FOURTH LEFT · THIRD RIGHT · THIRD LEFT · SECOND LEFT · FIRST RIGHT · FIRST LEFT · FOURTH WEST · SOUTH · 2 1/2 SOUTH · FIRST SOUTH · NINTH SOUTH

N 362,000 · E 2,108,000 · SL-064900 · U-1358 · U-01015I

AUG 86 · SEPT 85 · OCT 85 · NOV 83 · DEC 83 · JAN 84 · FEB 84 · MAR 84 · APR 84 · MAY 84 · JUNE 84 · JUL 84 · AUG 84 · SEP 84 · OCT 84 · NOV 84 · DEC 84 · JAN 85 · FEB 85 · MAR 85 · APR 85 · MAY 85 · JUNE 85 · JULY 85 · JUL 83 · AUG 83 · SEP 83 · OCT 83 · NOV 83 · JAN 83 · FEB 83 · MAR 83 · APR 83 · MAY 83 · JUNE 83

1600 · 1400 · 1200 · 1000 · 800 · 600

SEE AREA 4

SEE AREA 3

N 364,000

PROFILE

PROFILE

N 362,000

E 2,102,000

2,104,000

2,106,000

2,108,000

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AREA 5
CAD FILE NAME/DISK: AREA5/SUBSIDE.1993

N

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201 S. MAIN ST. SALT LAKE CITY, UT 84140

1993 SUBSIDENCE
DEER CREEK MINE
2ND – 5TH LEFT LONGWALL PANELS

DRAWN BY:	RODGER C. FRY	DRAWING #:	FIGURE 20
SCALE:	1" = 500'		
DATE:	FEBRUARY 24, 1994	SHEET 1 OF 1	REV.:

FIGURE 21

AREA 5 SUBSIDENCE PROFILE

NORTH-SOUTH

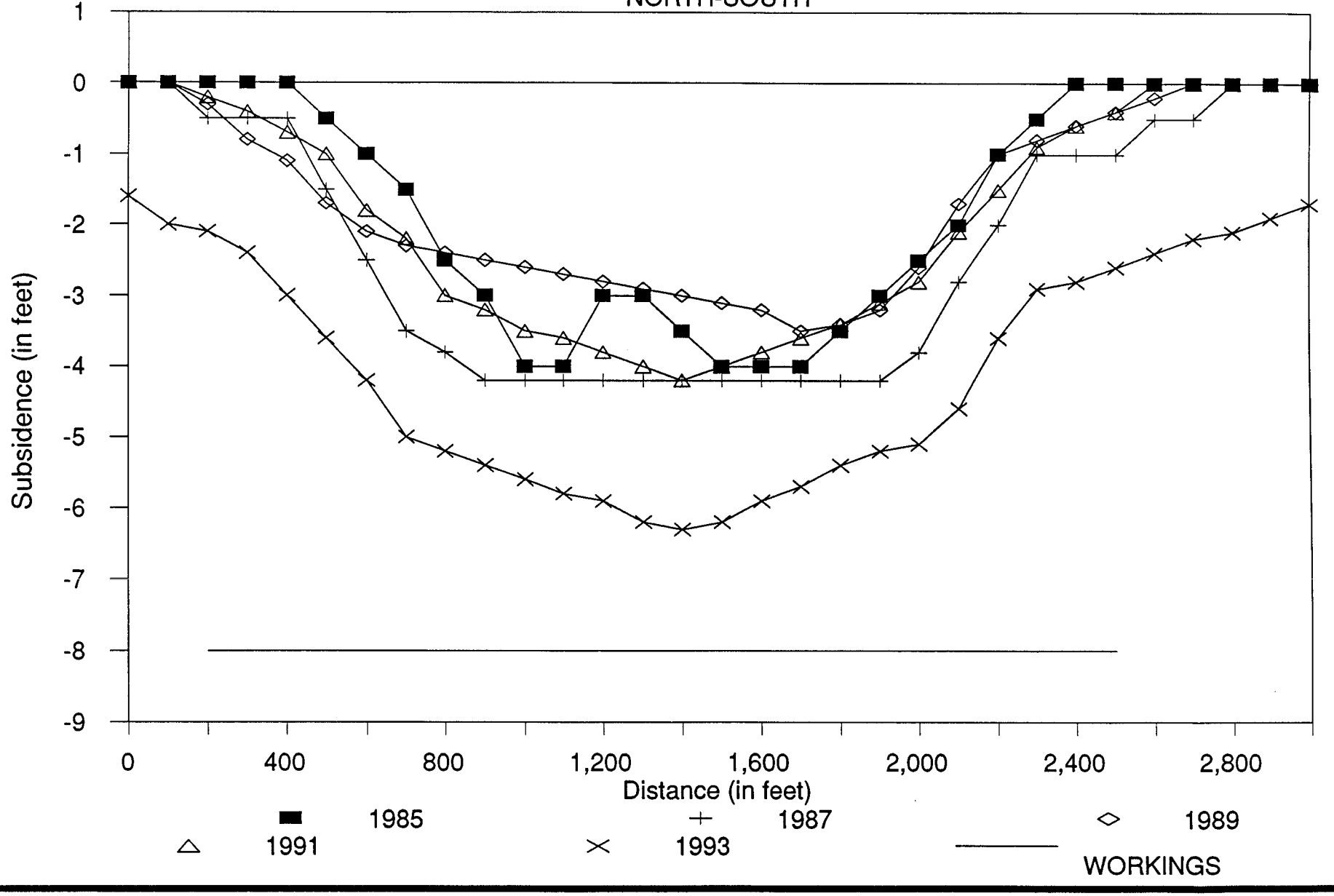
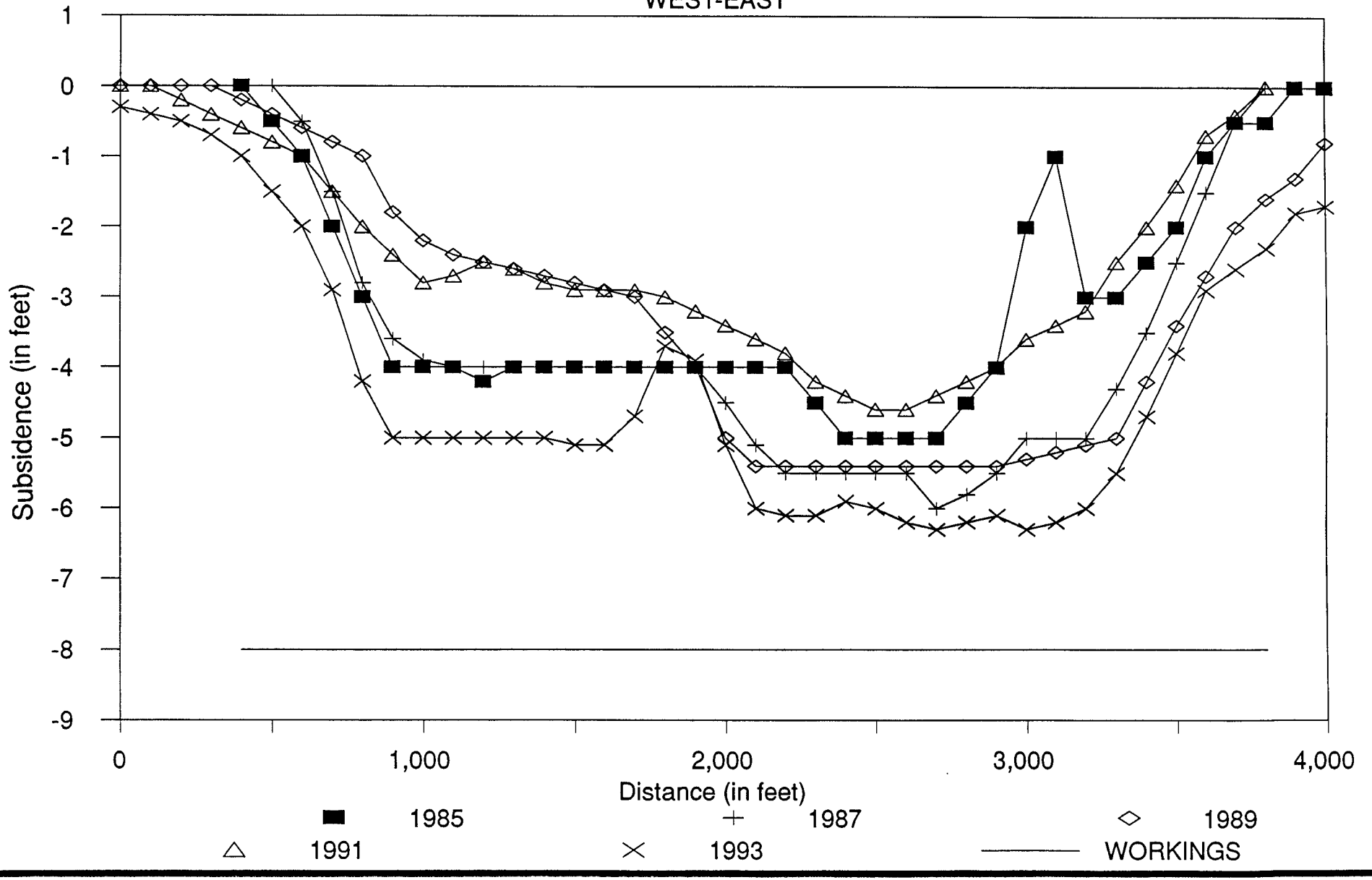


FIGURE 22

AREA 5 SUBSIDENCE PROFILE

WEST-EAST



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 five (5) feet over the Second West Longwall Panel. The subsidence in this area has been fairly stable with the exception of continued subsidence in the south which is due to the influence of mining in areas 14 and 15 (Figure 24). The subsidence profiles (Figures 25 and 26) show the change in subsidence since 1984.

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, 1992).

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FIRST LEFT

N 362,000

MAIN WEST

MAIN WEST

MAIN WEST

FIRST WEST

FIRST EAST

THIRD SOUTH

SECOND SOUTH

SECOND WEST

3RD EAST

N 360,000

SIXTH WEST

4TH EAST

SEVENTH WEST

THIRD WEST

8TH WEST

4TH WEST

E 2,102,000

5TH EAST

AREA 6

CAD FILE NAME/DISK#: DC88SUB KL5

5TH WEST MAINS

N

N 358,000

8TH WEST

E 2,095,000

E 2,098,000

366 SQ FT

E 2,100,000

UTAH POWER & LIGHT
MINING DIVISION

P.O. BOX 310, HELPER, UTAH 84526

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

DRAWN BY:	K. LARSEN	FIGURE 23	
SCALE:	1"=500'	DRAWING #:	
DATE:	4-11-90	SHEET 1 OF 1	REV. ___

N 362,000

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SEE AREA 15

SEE AREA 16

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AREA 6

CAD FILE NAME/DISK: AREA 6/SUBSIDE.1993

N

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

1993 SUBSIDENCE
COTTONWOOD MINE
1ST, 2ND, 4TH & 5TH LONGWALL PANELS

DRAWN BY:	RODGER C. FRY		FIGURE 24
SCALE:	1" = 500'	DRAWING #:	
DATE:	FEBRUARY 24, 1994	SHEET 1 OF 1	REV.:

FIGURE 25

AREA 6 SUBSIDENCE PROFILE

NORTH-SOUTH

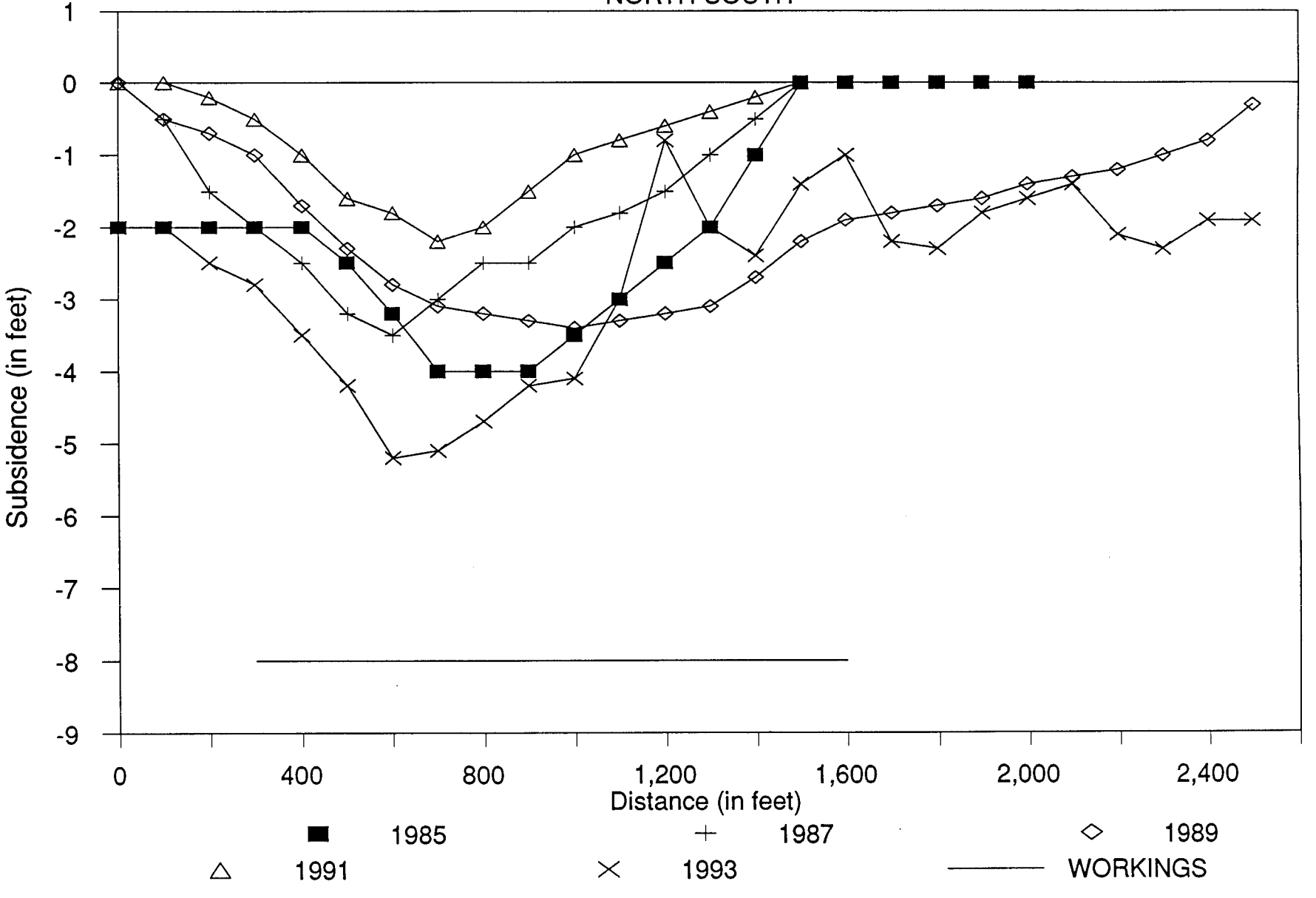
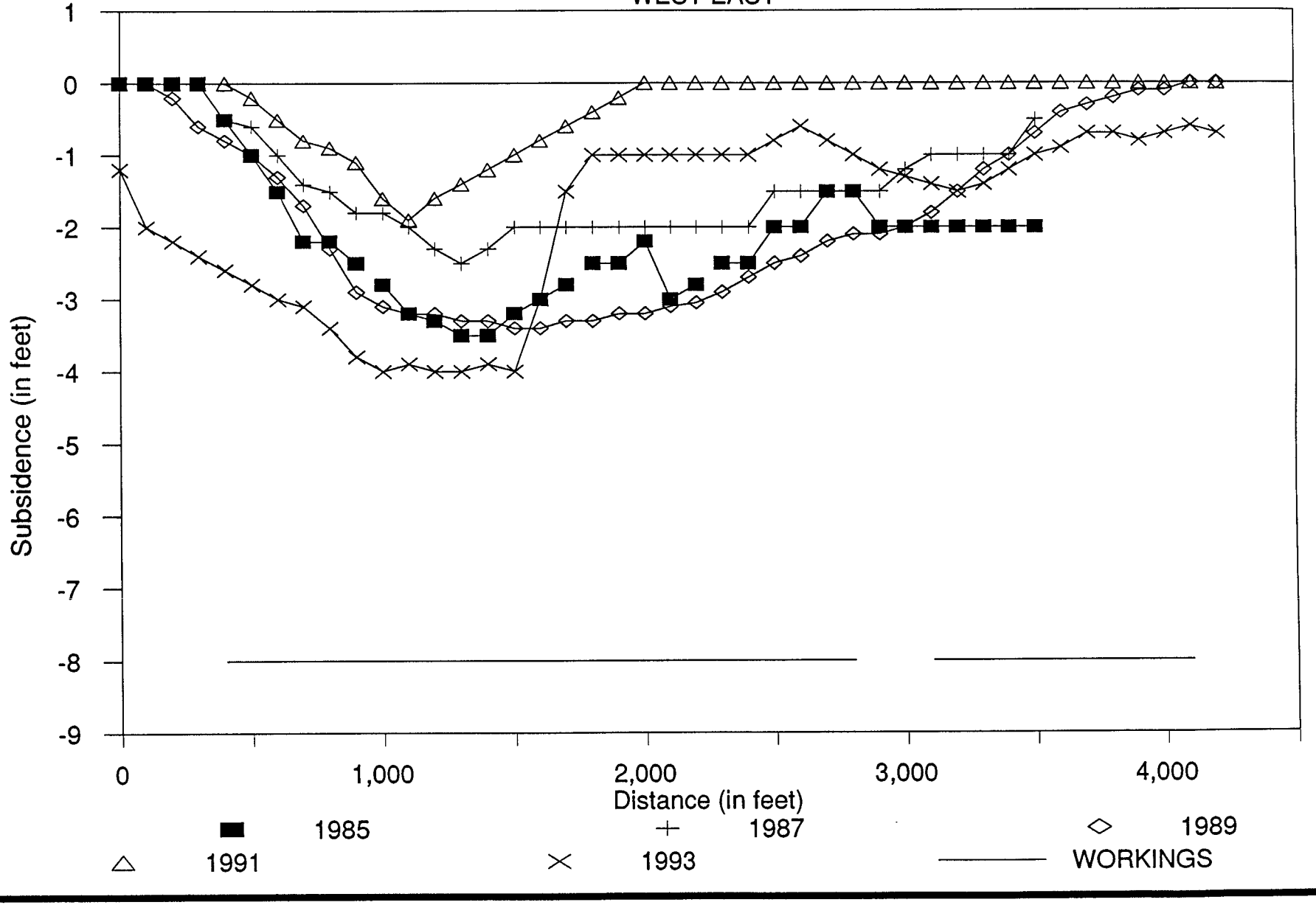


FIGURE 26

AREA 6 SUBSIDENCE PROFILE

WEST-EAST



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 six (6) 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.

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.

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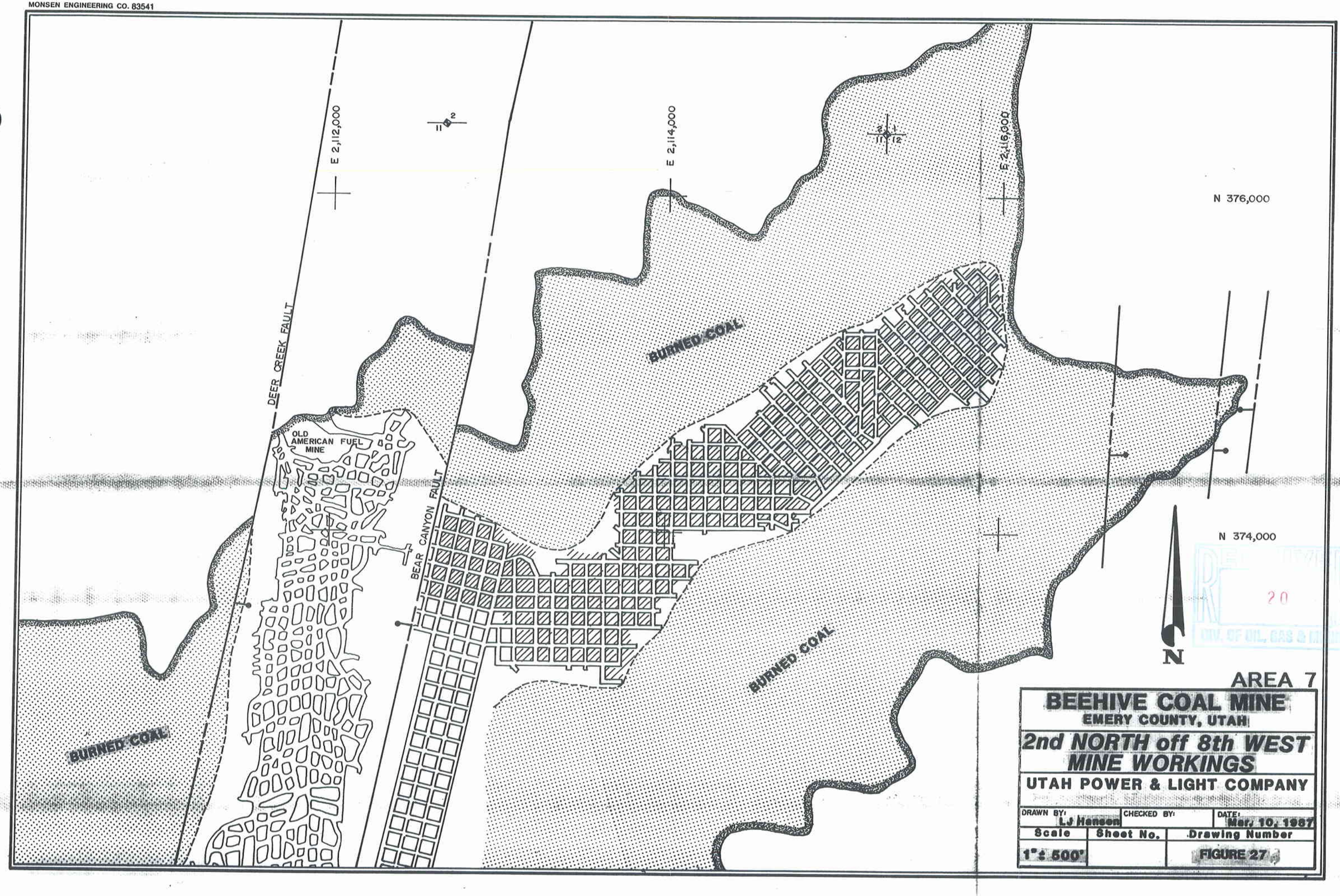

AREA 7

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

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N 376,000

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DEER CREEK FAULT

BEAR CANYON FAULT

PROFILE

OUTCROP

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AREA 7

CAD FILE NAME/DISK: AREA7/SUBSIDE.1993

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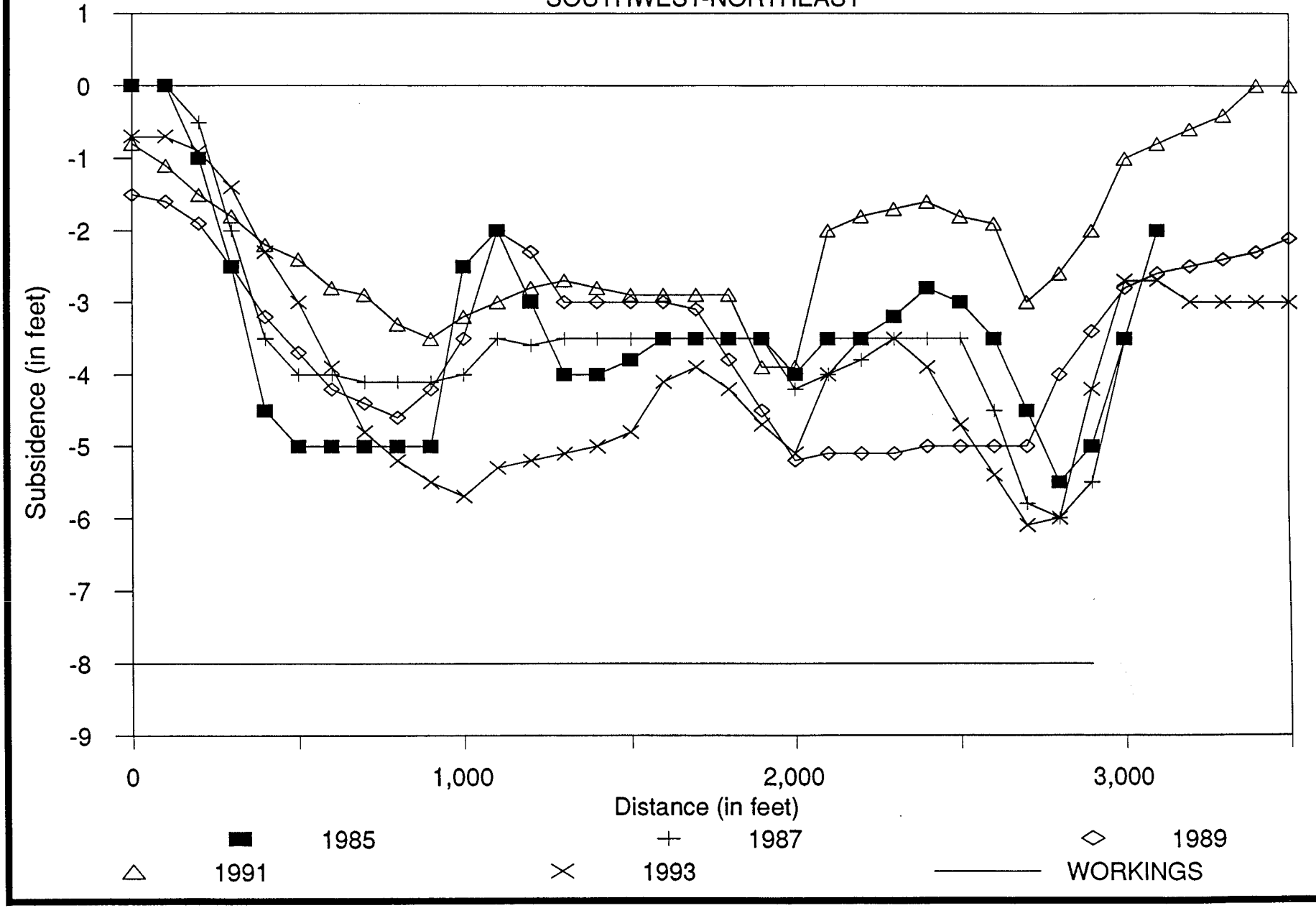
1993 SUBSIDENCE
BEEHIVE MINE
2ND NORTH OFF 8TH WEST

DRAWN BY:	RODGER C. FRY		FIGURE 28
SCALE:	1" = 500'	DRAWING #:	
DATE:	FEBRUARY 25, 1994	SHEET 1 OF 1	REV.:

FIGURE 29

AREA 7 SUBSIDENCE PROFILE

SOUTHWEST-NORTHEAST



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 over six (6) feet has occurred. On the eastern side subsidence has remained at two feet or less for the last four years. Where not influenced by other workings, the angle-of-draw reached a maximum of 31 degrees on the eastern edge of the area.

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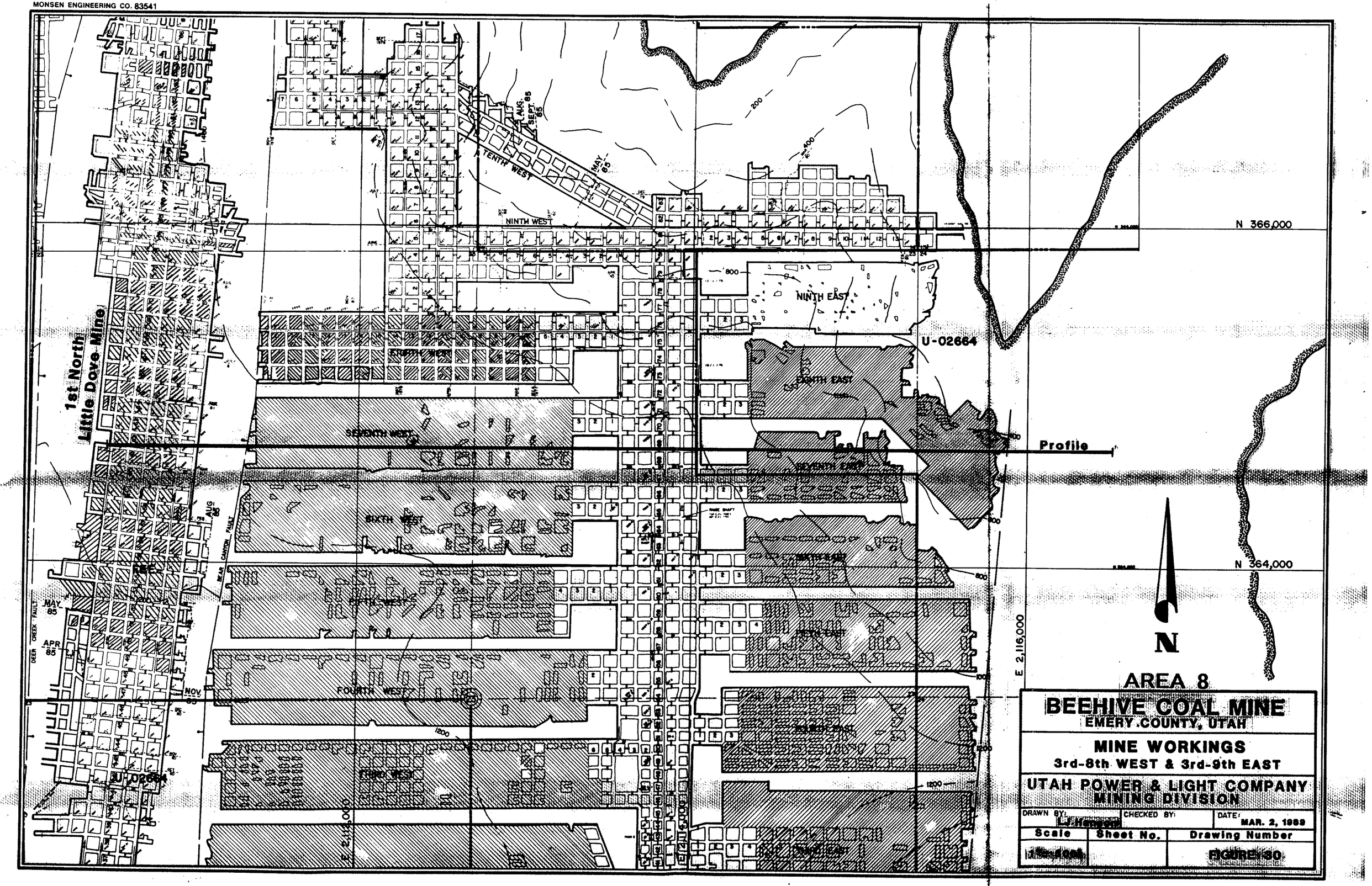

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NOV 83
OCT 83
AUG 83
JUNE 83
MAY 83
APR 83
MAR 83
FEB 83
JAN 83
DEC 82
FEB 83
MAY 83
APR 83
OCT 85
NOV 85
DEC 85

NINTH WEST
EIGHTH WEST
SEVENTH WEST
SIXTH WEST
FIFTH WEST
FOURTH WEST
THIRD WEST
SECOND EAST
FIRST EAST
SEVENTH EAST
SIXTH EAST
FIFTH EAST
FOURTH EAST
THIRD EAST

BEAR CREEK CANYON FAULT
DEER CREEK FAULT

U-02664
U-02664

Profile

N 366,000
N 364,000
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E 2,114,000
E 2,116,000

300
400

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AREA 8

DESERET COAL MINE
EMERY COUNTY, UTAH

MINE WORKINGS
3rd-9th WEST & 1st-5th EAST

UTAH POWER & LIGHT COMPANY
MINING DIVISION

DRAWN BY:	CHECKED BY:	DATE:
ED HANSEN		MAR. 2, 1989

Scale	Sheet No.	Drawing Number
		FIGURE 8-1

N 366,000

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PROFILE

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AREA 8

CAD FILE NAME/DISK: AREA8/SUBSIDE.1993

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ONE UTAH CENTER
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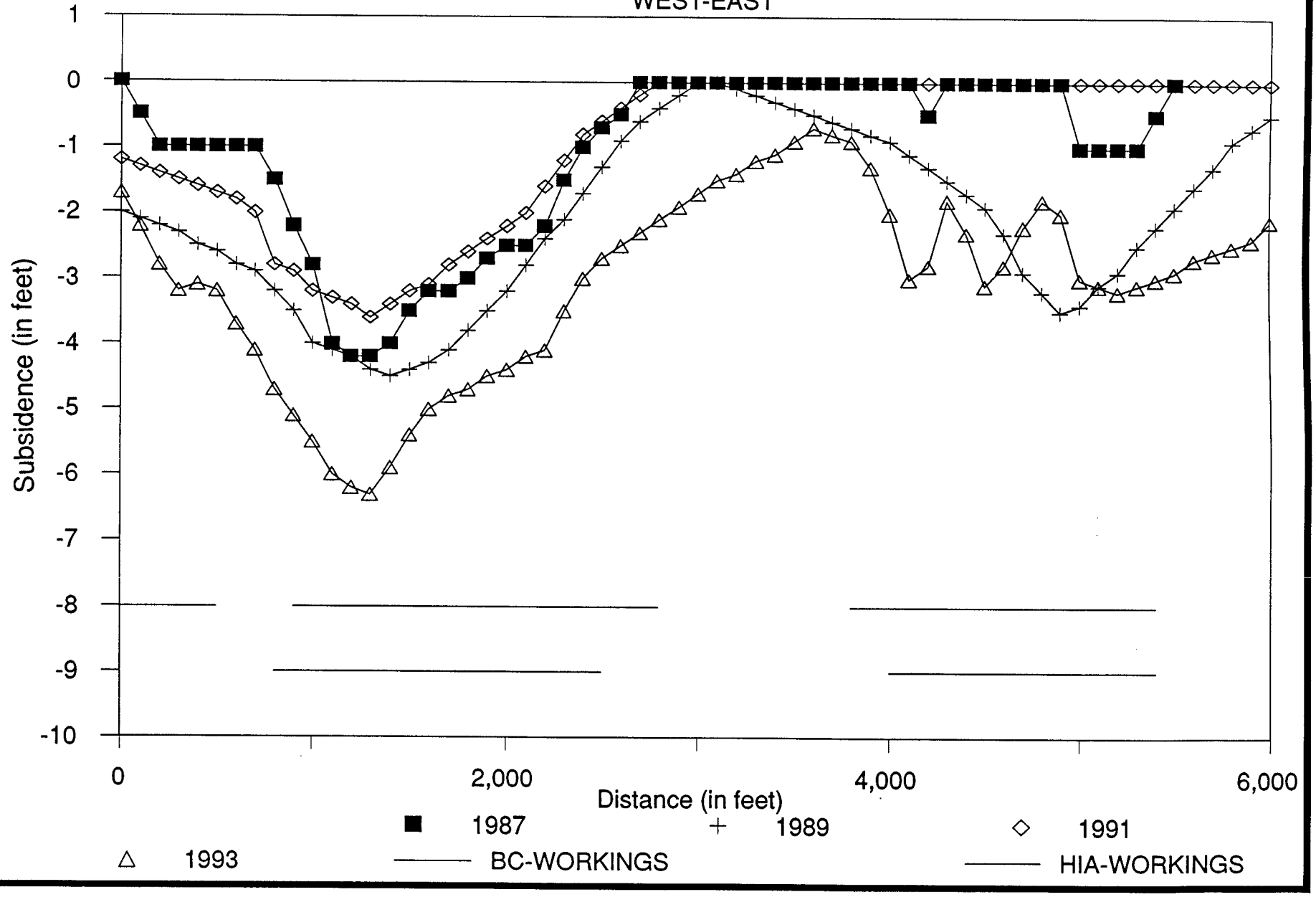
1993 SUBSIDENCE
DES-BEE-DOVE MINES
DESERET 3-9 WEST & 1-5 EAST
BEEHIVE 3-8 WEST & 3-9 EAST

DRAWN BY:	RODGER C. FRY	DRAWING #:	FIGURE 32
SCALE:	1" = 500'		
DATE:	FEBRUARY 25, 1994	SHEET 1 OF 1	REV.:

FIGURE 33

AREA 8 SUBSIDENCE PROFILE

WEST-EAST



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. 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 1/2 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 1994 mining in the 6th Right Panel had been completed.

Measurable subsidence to date has exceeded twelve (12) in the area of multiple seam mining above the 6th and 7th Right Longwall Panels in the Cottonwood mine (Figures 36, 37, and 38).

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 indicated that the fracturing has had no effect on the spring. The angle-of-draw measured ranges from less than zero to 28 degrees.

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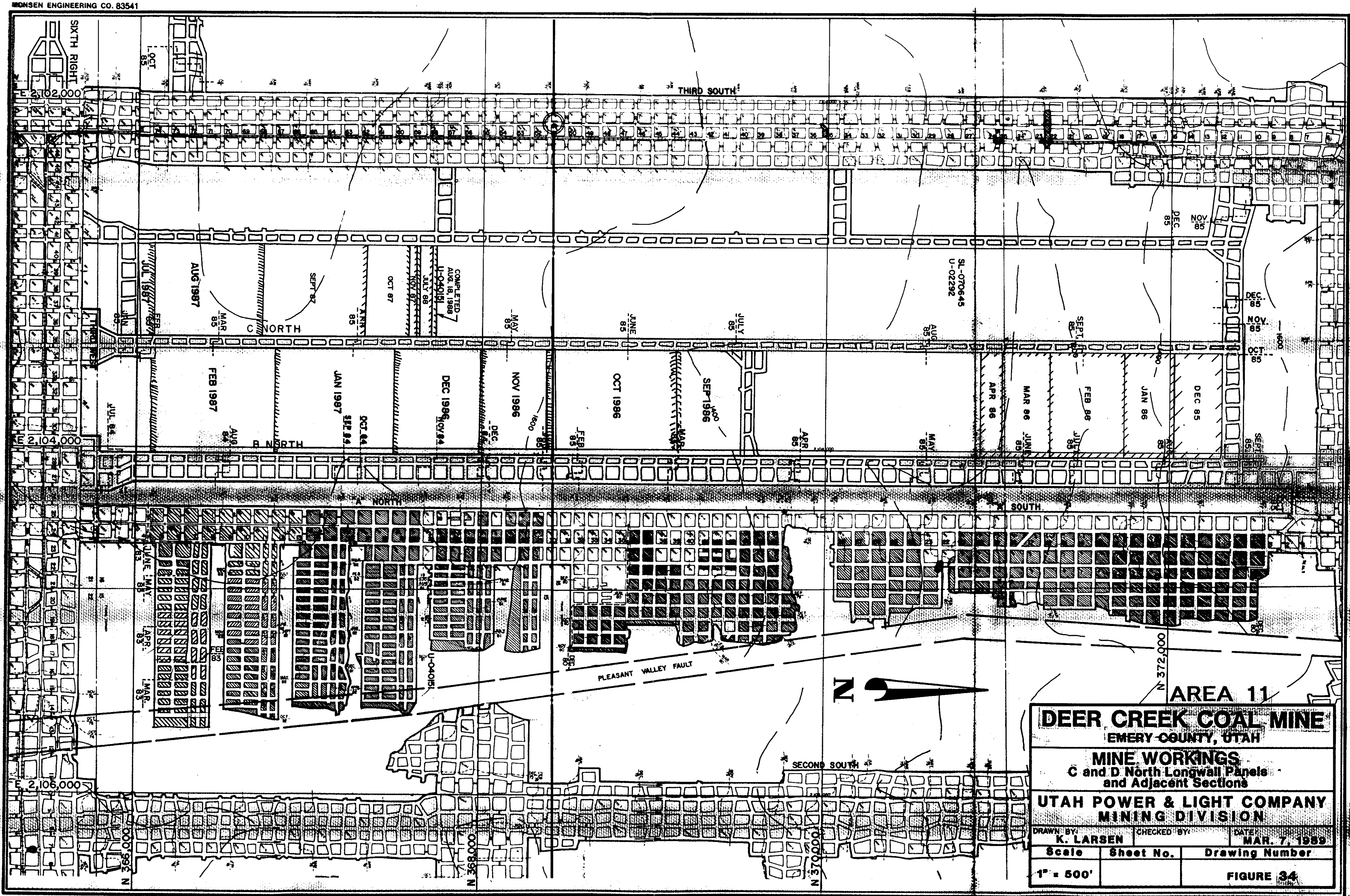

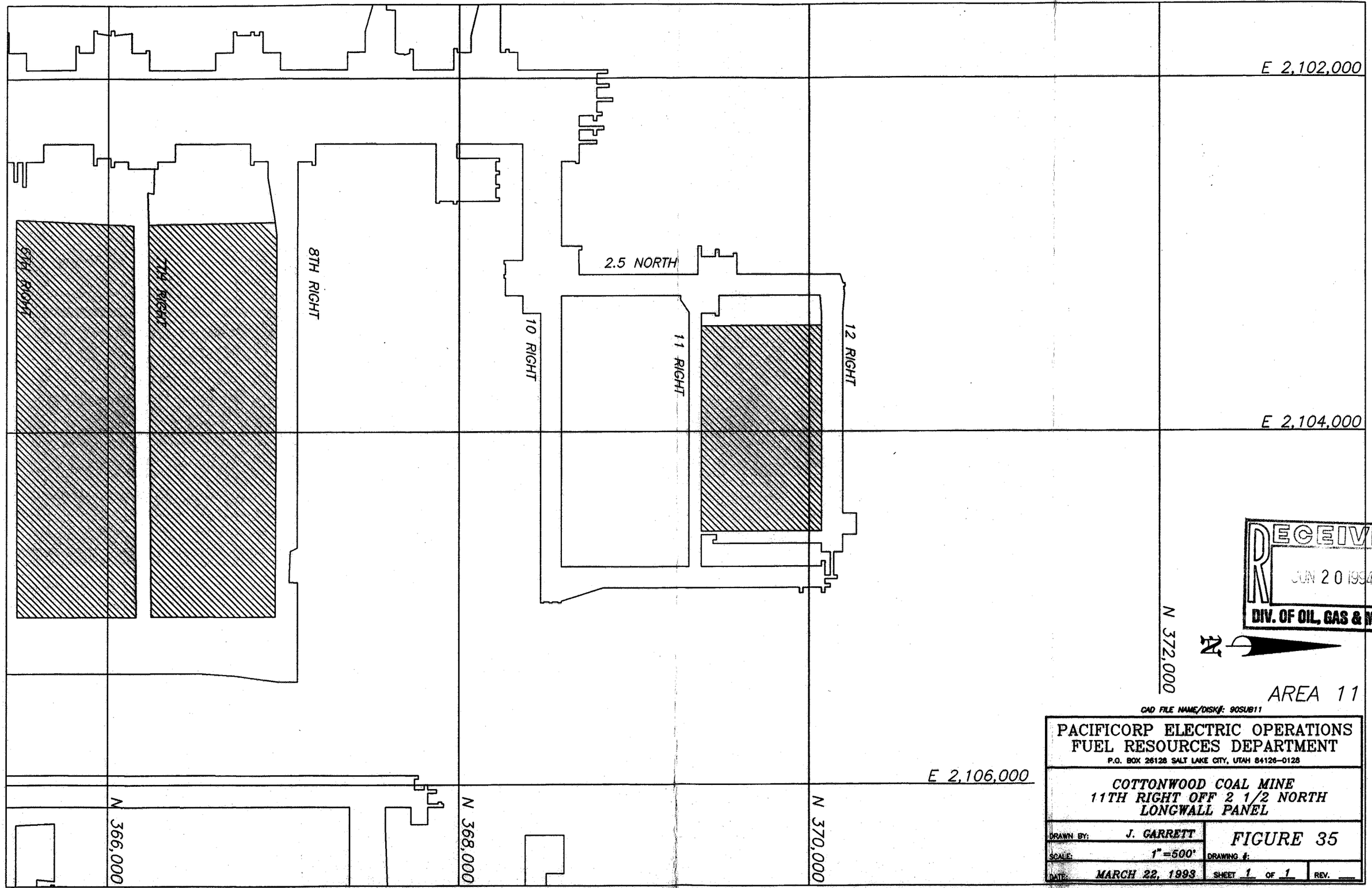

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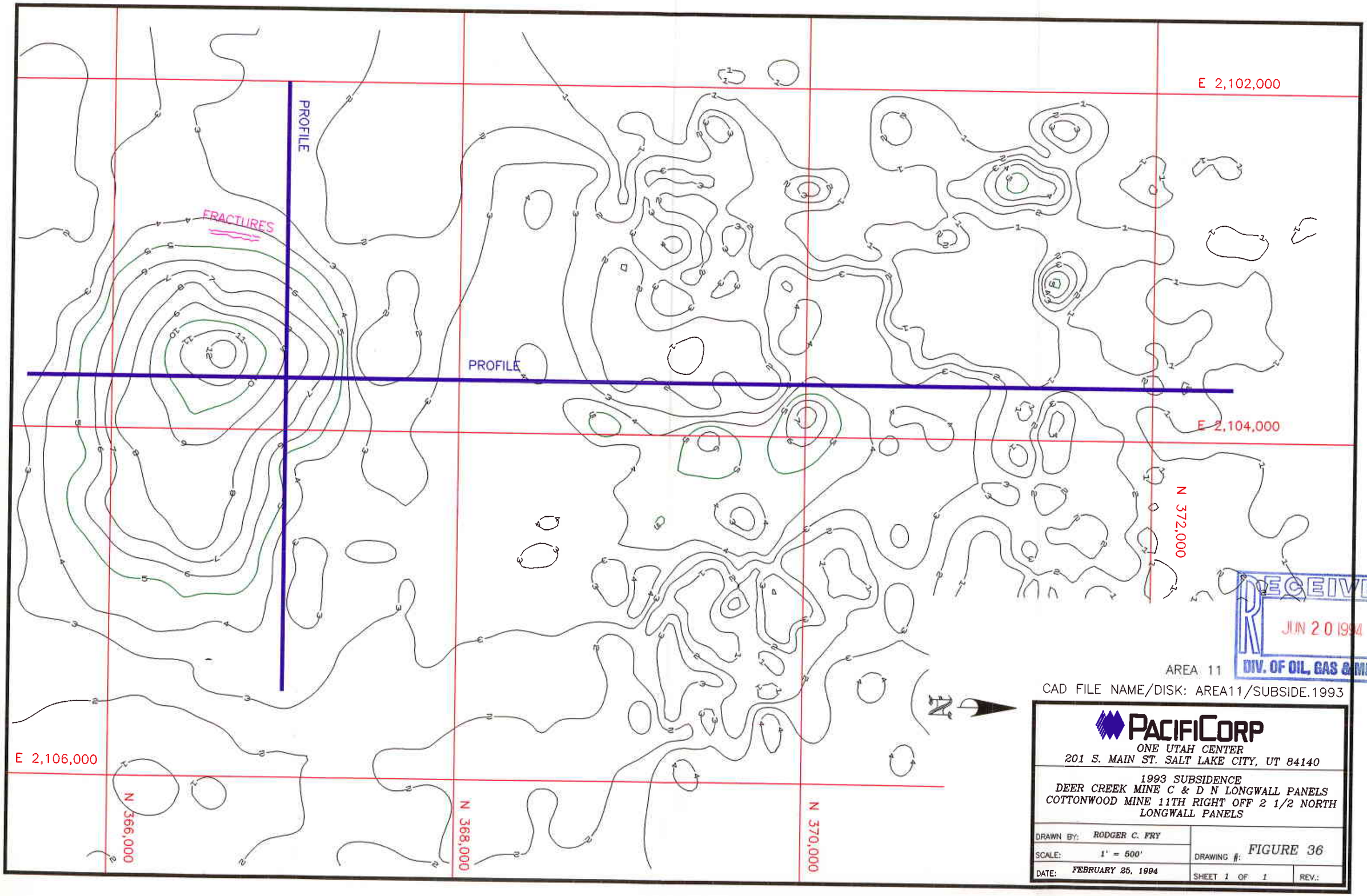
AREA 11

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

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



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

1993 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			
SCALE: 1" = 500'	DRAWING #: FIGURE 36		
DATE: FEBRUARY 25, 1994	SHEET 1 OF 1	REV.:	

FIGURE 37

AREA 11 SUBSIDENCE PROFILE

NORTH-SOUTH

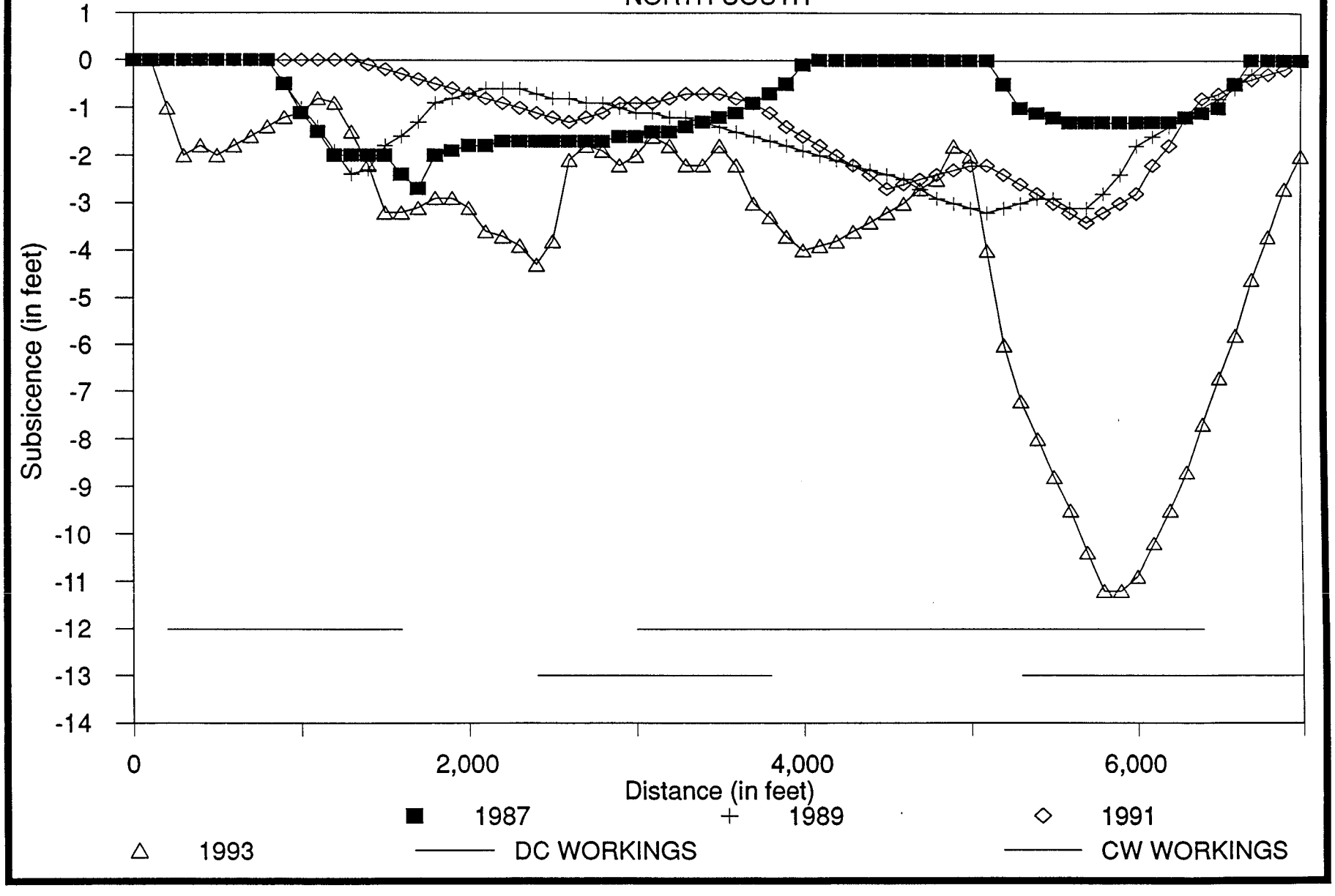
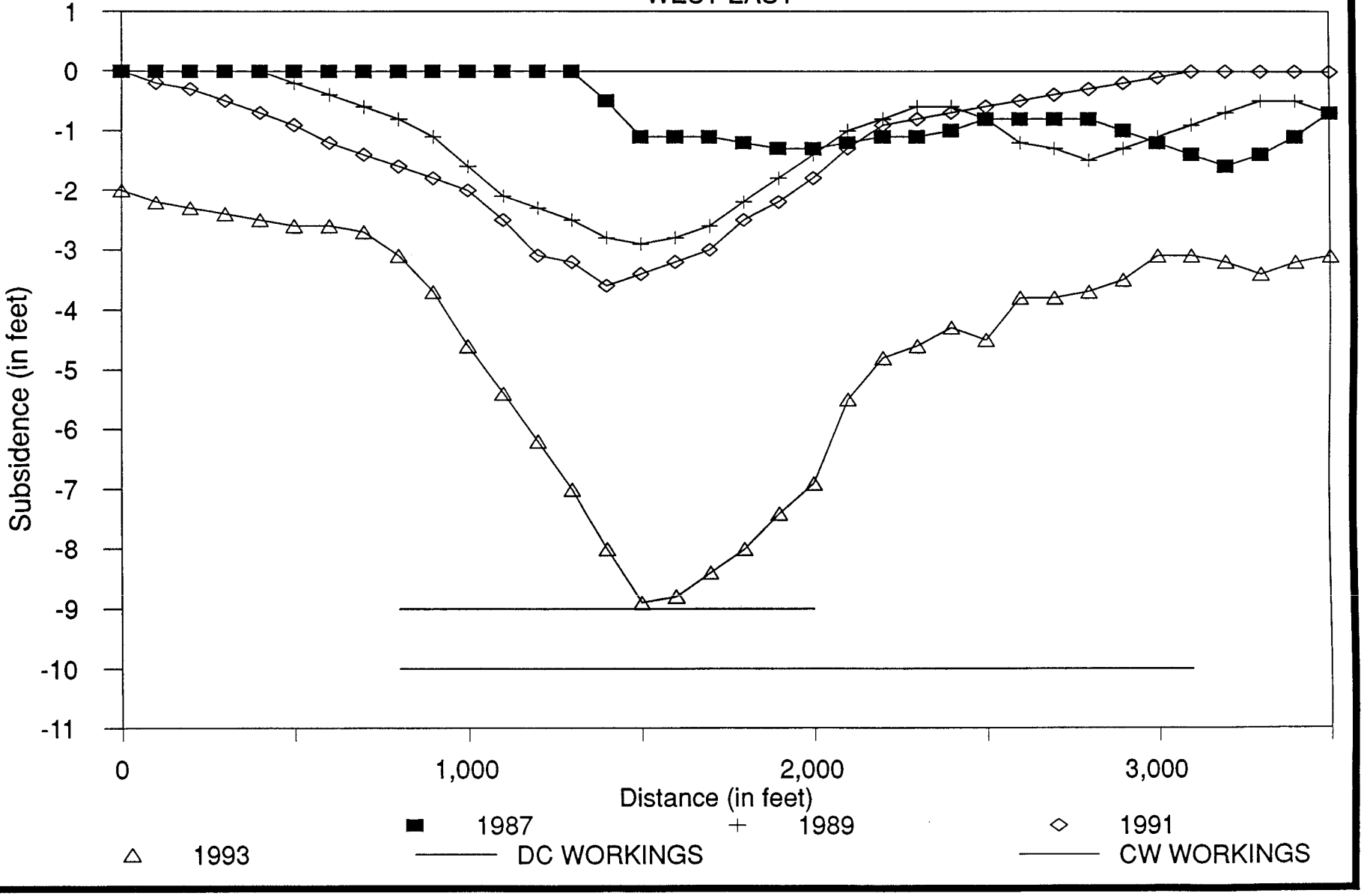


FIGURE 38

AREA 11 SUBSIDENCE PROFILE

WEST-EAST



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 1993 was about four (4) feet over some of the older working near the mine portals (Figures 41, 42, and 43).

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.

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THIRD EAST

SECOND WEST

FIRST WEST

SECOND EAST

FIRST EAST

FEE

U-02664

U-02664

22 23 / 27 26

23 / 26

23 24 / 26 25

DEER CREEK FAULT

FIRST NORTH

SECOND NORTH

THIRD NORTH

FOURTH NORTH

MAIN NORTH

MAIN WEST

Beehive Mine Portals

Little Dove Mine Portals

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AREA 13

Beehive & Little Dove Coal Mines
EMERY COUNTY, UTAH

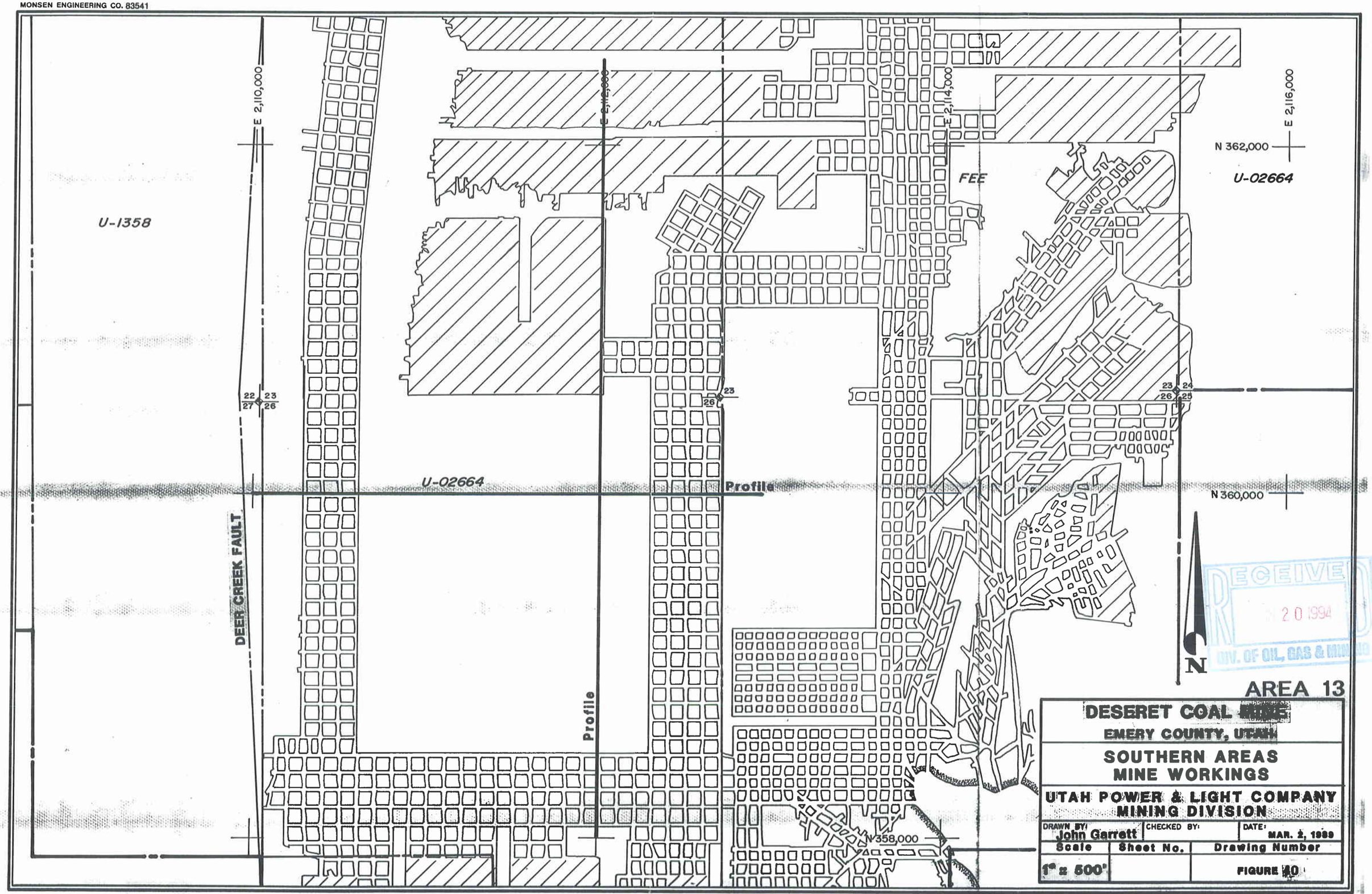
SOUTHERN AREAS MINE WORKINGS

UTAH POWER & LIGHT COMPANY
MINING DIVISION

DRAWN BY:	CHECKED BY:	DATE:
LJ Hansen		MAR. 6, 1989

Scale	Sheet No.	Drawing Number
1" = 500'		FIGURE 39

MONSEN ENGINEERING CO. 83541



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AREA 13

DESERET COAL MINE
EMERY COUNTY, UTAH

SOUTHERN AREAS MINE WORKINGS

UTAH POWER & LIGHT COMPANY MINING DIVISION

DRAWN BY:	CHECKED BY:	DATE:
John Garrett		MAR. 2, 1988

Scale	Sheet No.	Drawing Number
1" = 500'		FIGURE 10

SEE AREA 1

AREA OF COMPLEX SUBSIDENCE

PROFILE

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AREA 13

CAD FILE NAME/DRIVE: AREA13/SUBSIDE.1993

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201 S. MAIN ST. SALT LAKE CITY, UT 84140

1993 SUBSIDENCE
DES-BEE-DOVE MINES
SOUTHERN AREAS

DRAWN BY:	RODGER C. FRY	FIGURE 41	
SCALE:	1" = 500'	DRAWING #:	
DATE:	FEBRUARY 25,1994	SHEET 1 OF 1	REV.:

FIGURE 42

AREA 13 SUBSIDENCE PROFILE

NORTH-SOUTH

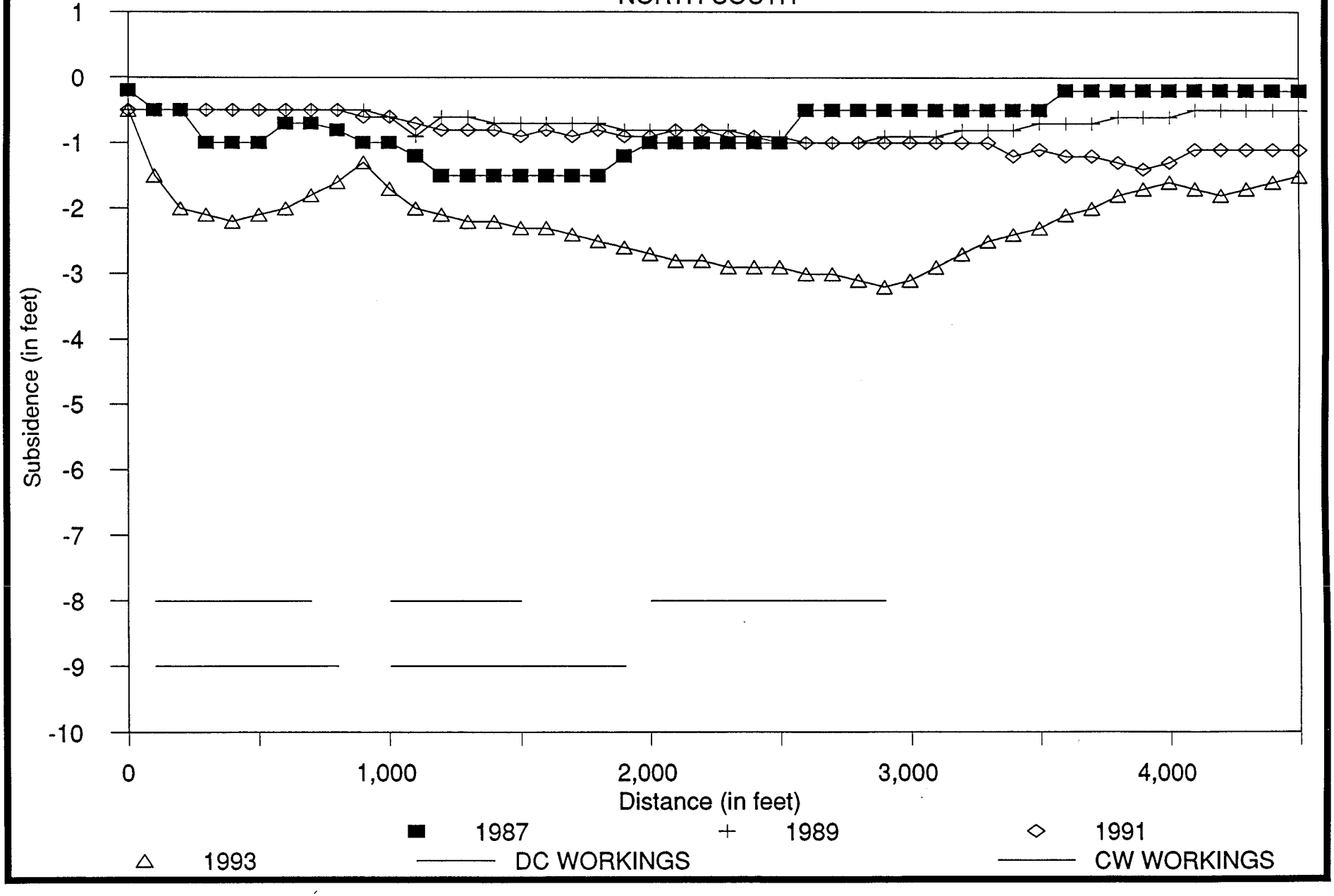
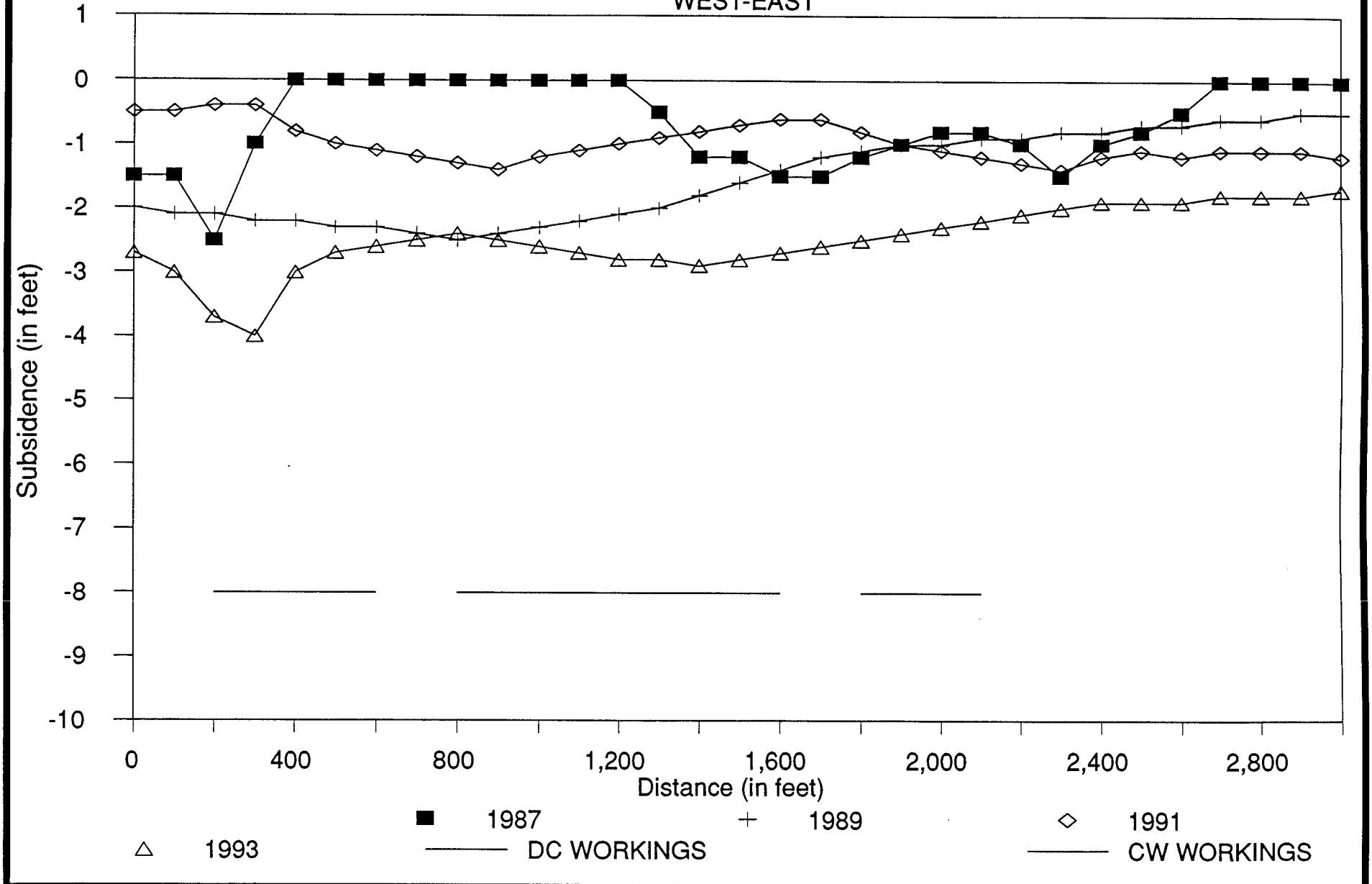


FIGURE 43

AREA 13 SUBSIDENCE PROFILE

WEST-EAST



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 1400 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 2000 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 nine (9) 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).

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.

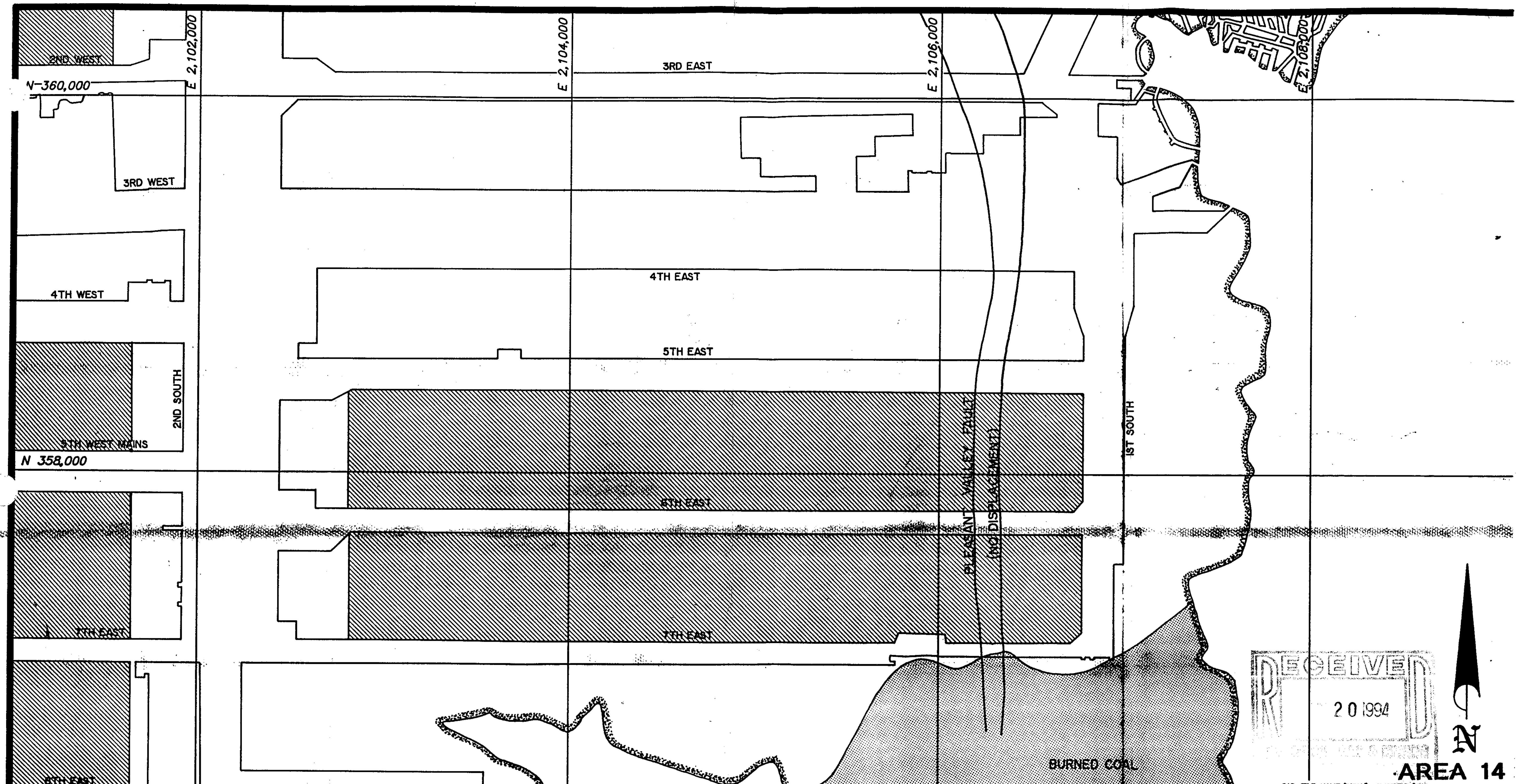
Wildlife in the area includes deer, elk, nesting golden eagles in spring and summer, wintering bald eagles, hares, rabbits, grouse, and other species. Grazing cattle can also be found along the ridge top in the summer months.

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 nest sites, 2) disruption of grazing and hunting land use, and 3) loss of wildlife habitat.

Prior to longwall mining in the area an eagle monitoring plan was developed and implemented. It went into effect in February 1986 and is an ongoing program. The purpose of the plan is to collect data whereby the impacts of subsidence and cliff spalling upon eagle nesting can be assessed. The

report entitled "Assessment of Mining Related Impacts in Newberry Canyon" submitted to the Utah Division of Oil, Gas and Mining discusses all mining related impacts in Area 14 and includes the eagle monitoring plan as an appendix.

PacifiCorp will continue to monitor subsidence to assess the significance of related impacts in this area.

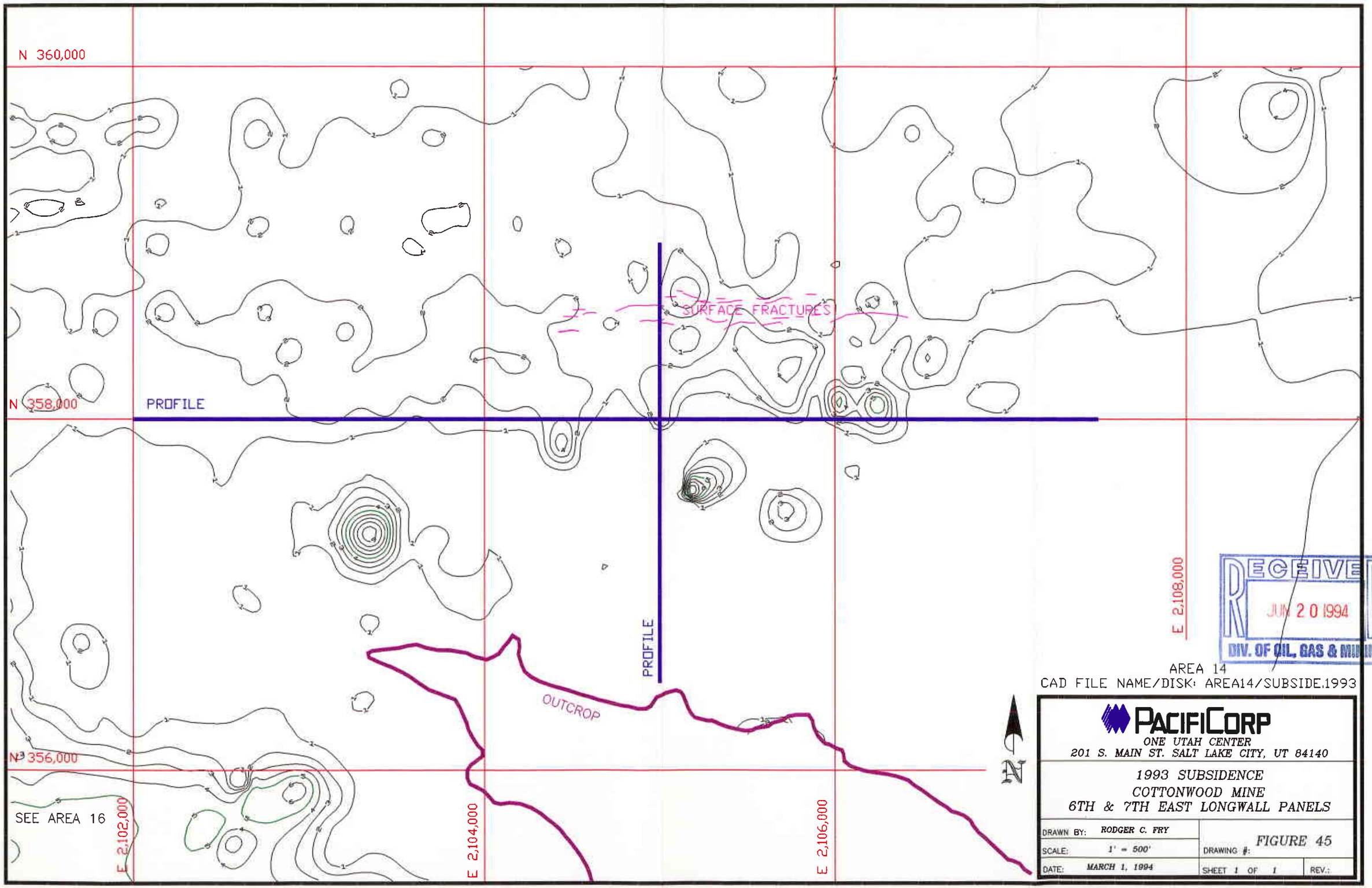


CAD FILE NAME/DISK#: CW67ELP/KLB

UTAH POWER & LIGHT
MINING DIVISION

COTTONWOOD COAL MINE
MINE WORKINGS
6th & 7th EAST LONGWALL PANELS

DRAWN BY: *K. LARSEN*	*FIGURE* **44**
SCALE: *1" =500'*	DRAWING #:
DATE: *4-24-90*	SHEET *1* OF *1* REV.



AREA 14

CAD FILE NAME/DISK: AREA14/SUBSIDE.1993

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201 S. MAIN ST. SALT LAKE CITY, UT 84140

1993 SUBSIDENCE
COTTONWOOD MINE
6TH & 7TH EAST LONGWALL PANELS

DRAWN BY: RODGER C. FRY		DRAWING #: FIGURE 45	
SCALE: 1" = 500'			
DATE: MARCH 1, 1994	SHEET 1 OF 1		REV.: