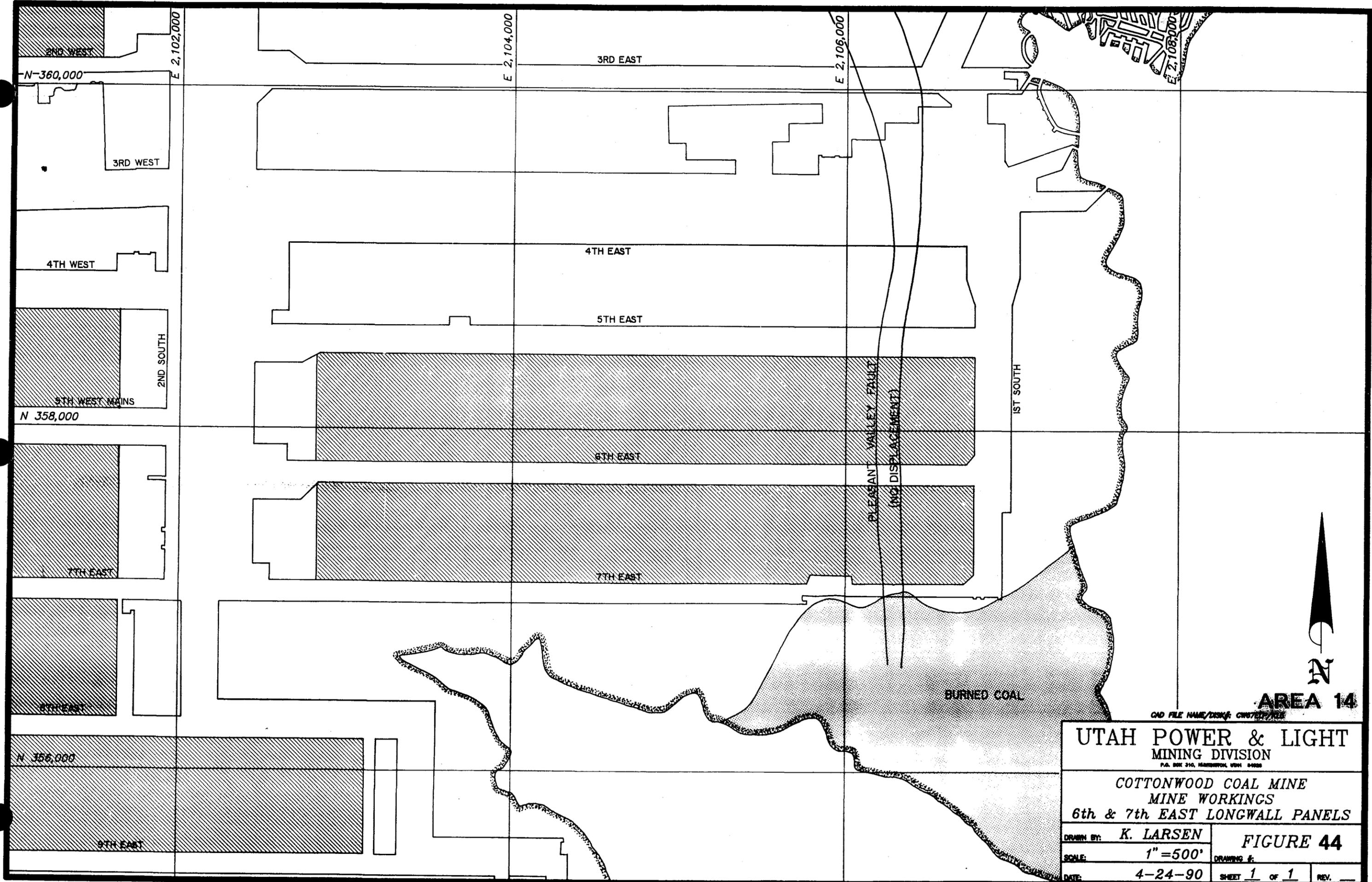


nest sites, 2) disruption of grazing and hunting land use, and 3) loss of wildlife habitat.

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.



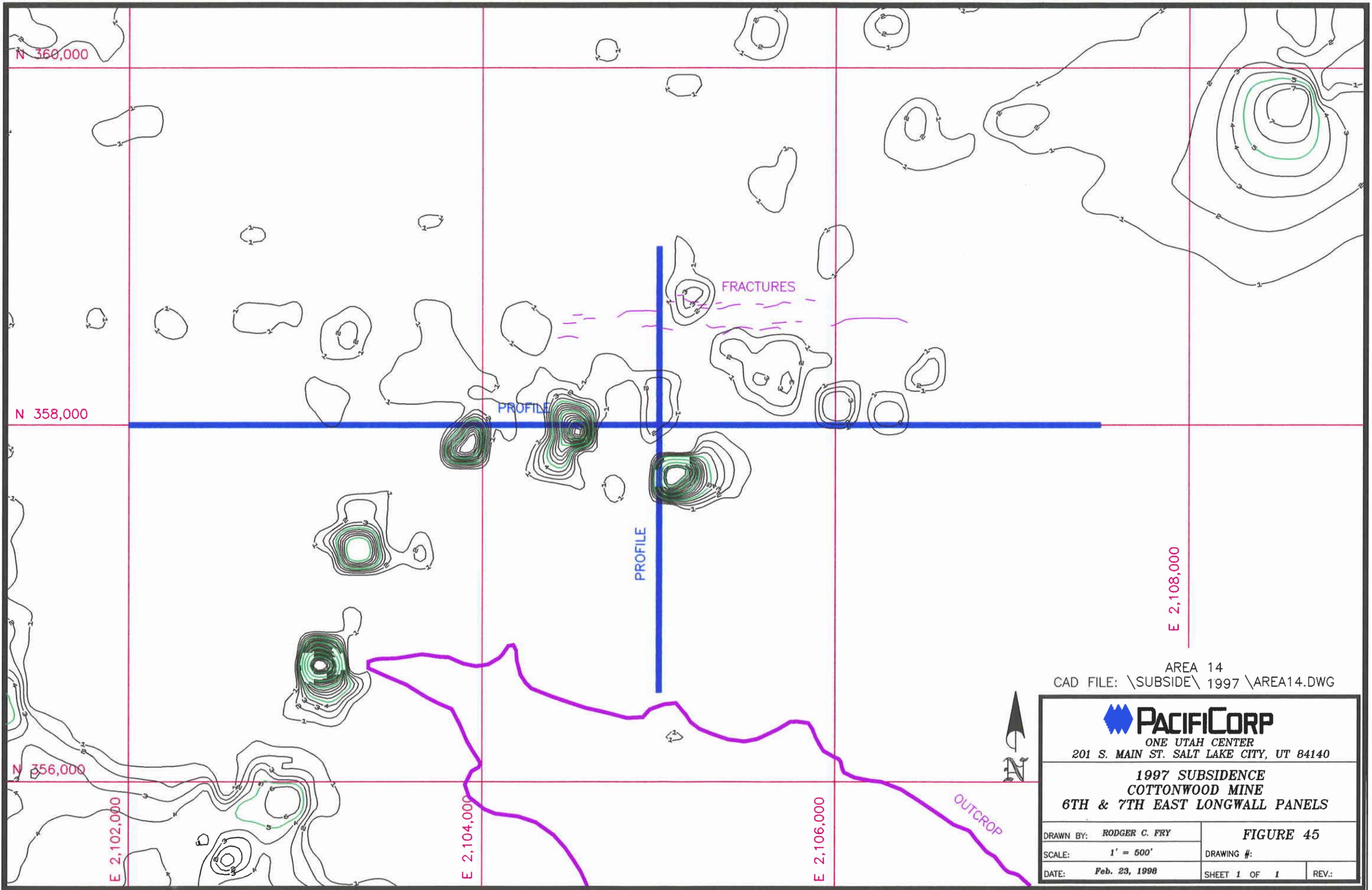
AREA 14

CAD FILE NAME/DISK: CWO707P/FILE

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

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

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



AREA 14
 CAD FILE: \SUBSIDE\ 1997 \AREA14.DWG



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

**1997 SUBSIDENCE
 COTTONWOOD MINE
 6TH & 7TH EAST LONGWALL PANELS**

DRAWN BY: **RODGER C. FRY**

FIGURE 45

SCALE: **1' = 500'**

DRAWING #:

DATE: **Feb. 23, 1998**

SHEET **1** OF **1** REV.:

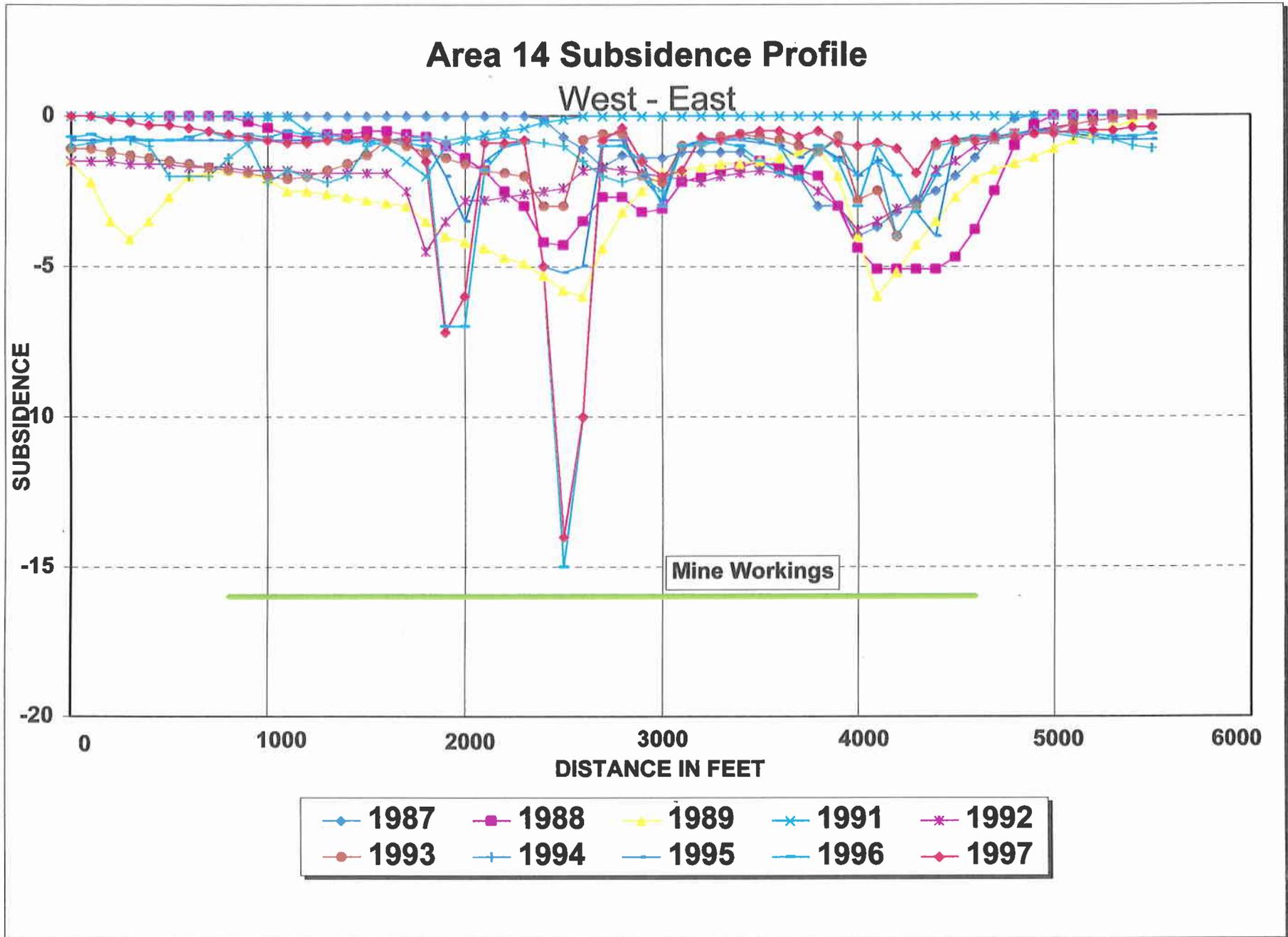
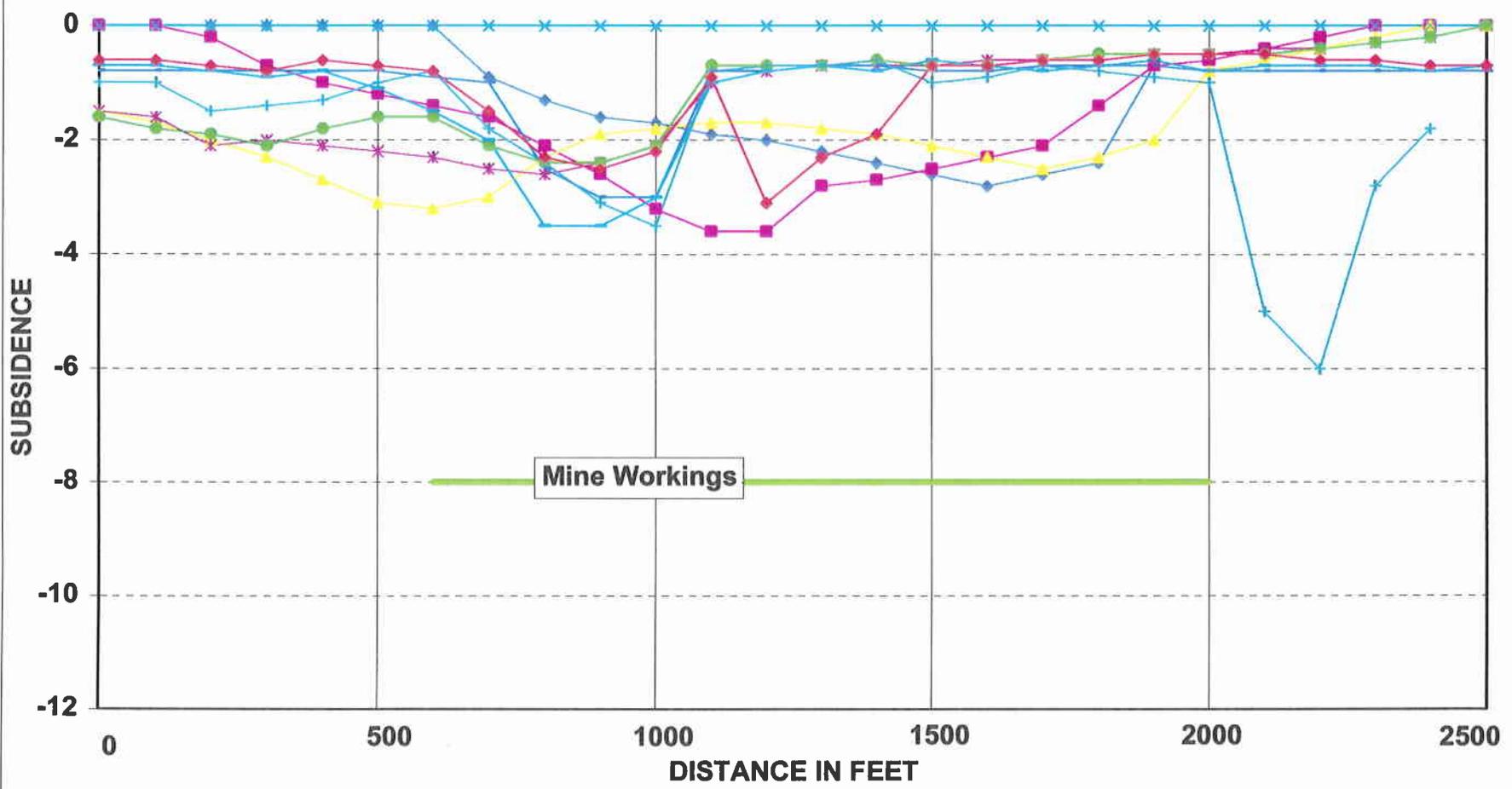


FIGURE 46

Area 14 Subsidence Profile North - South



- | | | | | |
|--------|--------|--------|--------|--------|
| ◆ 1987 | ■ 1988 | ▲ 1989 | × 1991 | * 1992 |
| ● 1993 | + 1994 | — 1995 | — 1996 | ◆ 1997 |

FIGURE 47

Area 15

Cottonwood 9th and 12th West Longwall Panels

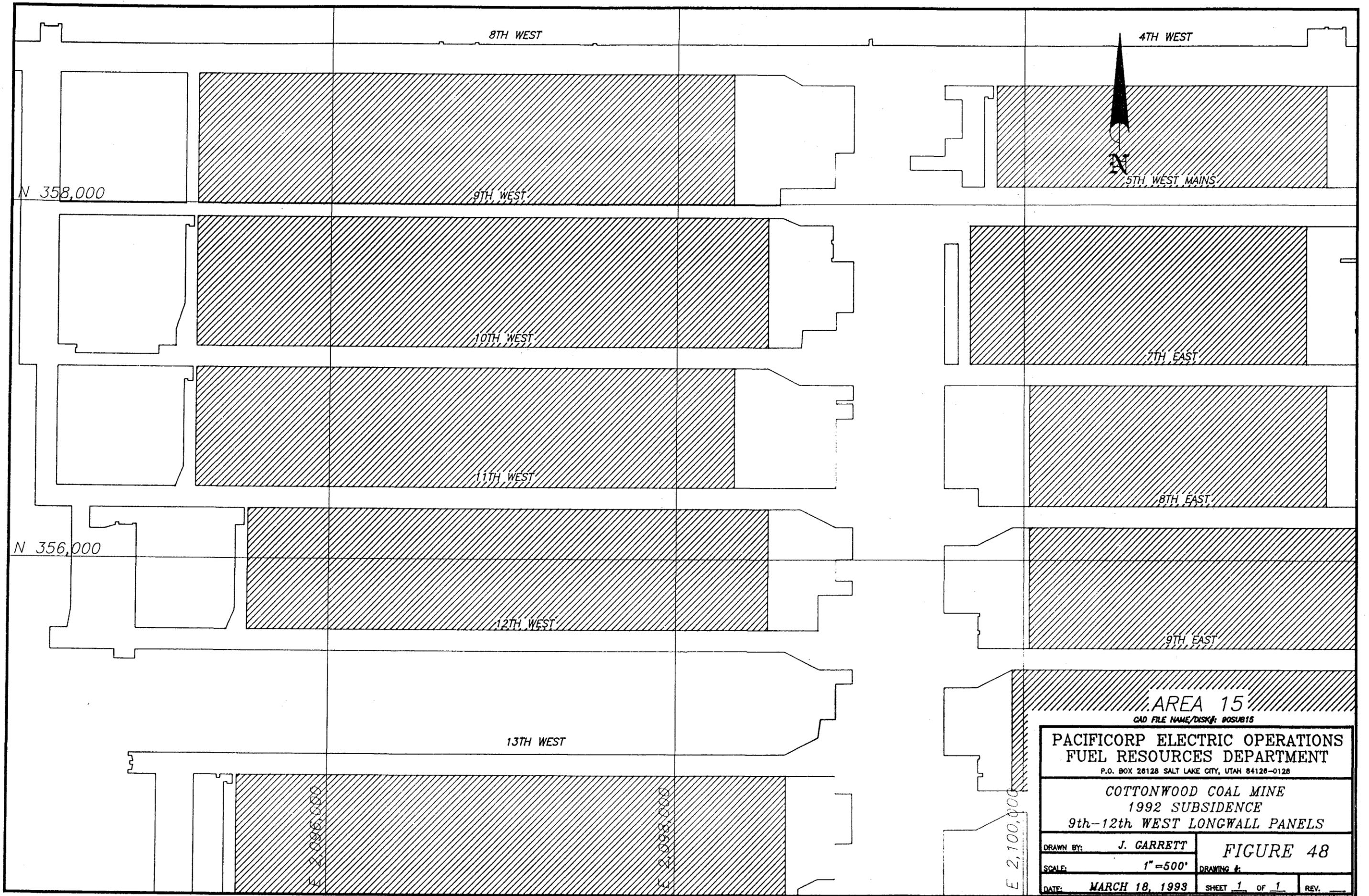
Subsidence in 9th and 10th West was first monitored and detected in 1988 when longwall extraction began there. The 9th through 12th West panels were all completed by fall of 1989 (Figure 48).

The surface above these panels is comprised mainly of steep to moderate slopes with a small flat area forming the top of East Mountain on the area's eastern edge. Overburden ranges from 800 feet to over 2000 feet.

Maximum measured subsidence in 1997 is slightly over five feet which is similar to that which was measured in 1995 above 11th West (Figures 49, 50, and 51). This area has experienced no additional subsidence in the past six years.

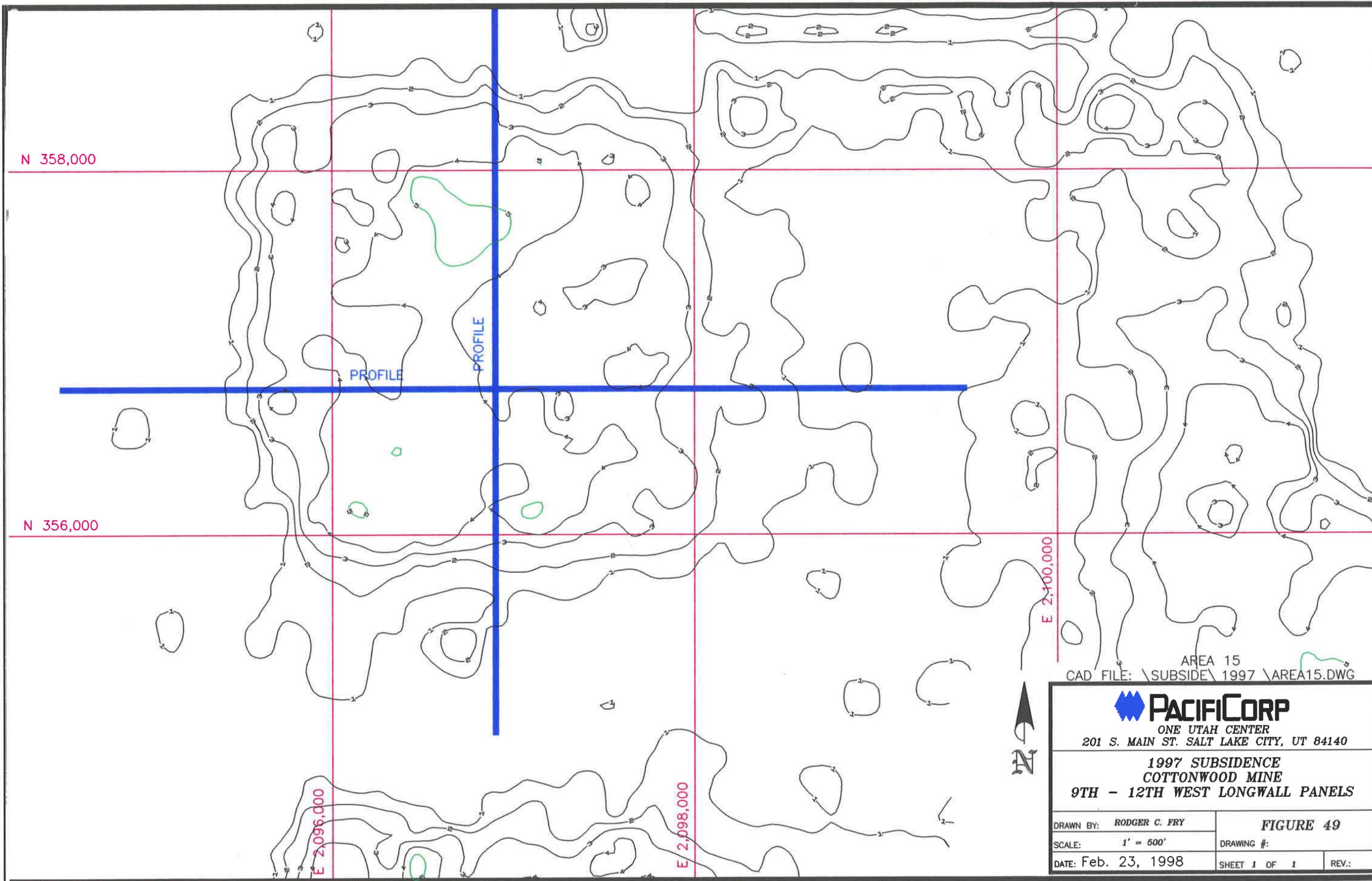
Calculated angle-of-draw is less than zero on the south and east and reaches 20 degrees on the west.

There are no known springs in the area.



AREA 15
 CAD FILE NAME/DISK#: 90SUB15

PACIFICORP ELECTRIC OPERATIONS FUEL RESOURCES DEPARTMENT	
P.O. BOX 28128 SALT LAKE CITY, UTAH 84128-0128	
COTTONWOOD COAL MINE 1992 SUBSIDENCE 9th-12th WEST LONGWALL PANELS	
DRAWN BY: J. GARRETT	FIGURE 48
SCALE: 1" = 500'	DRAWING #:
DATE: MARCH 18, 1993	SHEET 1 OF 1 REV. _____



AREA 15
 CAD FILE: \SUBSIDE\1997\AREA15.DWG



 ONE UTAH CENTER 201 S. MAIN ST. SALT LAKE CITY, UT 84140		
1997 SUBSIDENCE COTTONWOOD MINE 9TH - 12TH WEST LONGWALL PANELS		
DRAWN BY: RODGER C. FRY	FIGURE 49	
SCALE: 1' = 500'	DRAWING #:	
DATE: Feb. 23, 1998	SHEET 1 OF 1	REV.:

Area 15 Subsidence Profile North - South

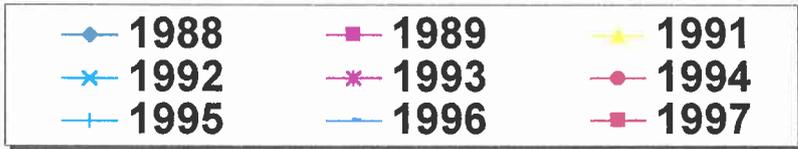
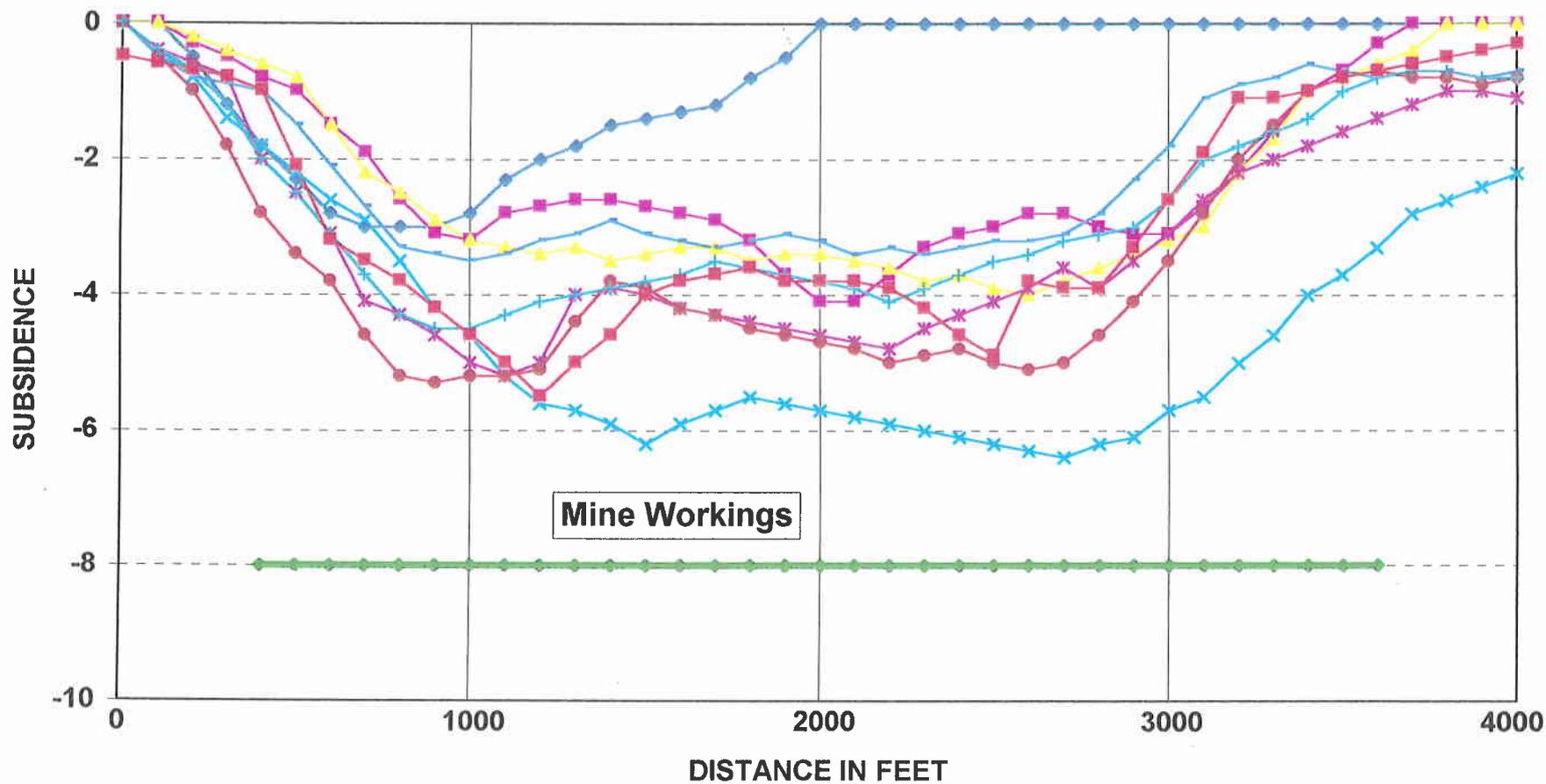


FIGURE 50

Area 15 Subsidence Profile West - East

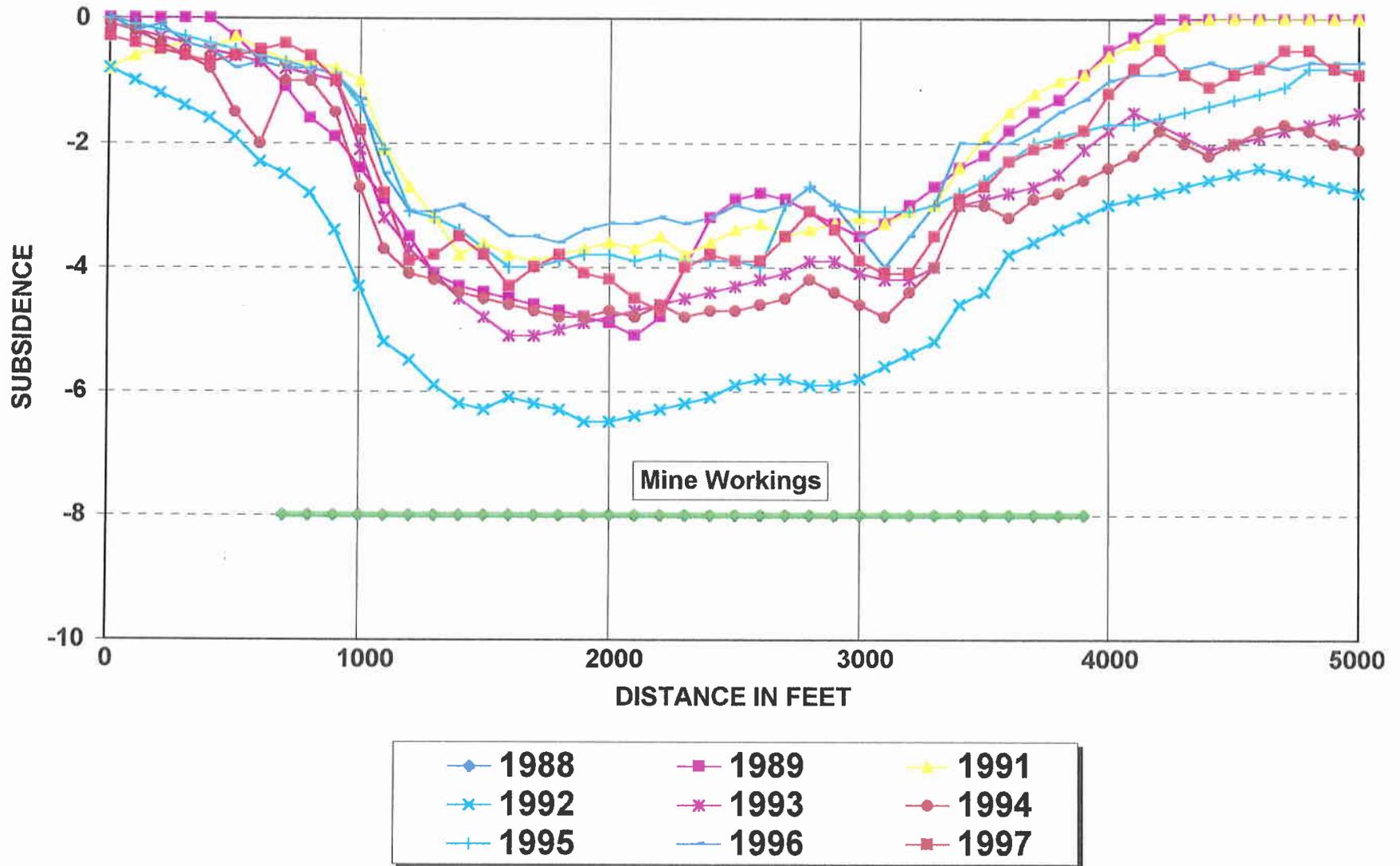


FIGURE 51

Area 16

Cottonwood 8th Through 11th East Longwall Panels

Mining in Area 16 began in the 8th East panel in June of 1989, and ended in the 8th East panel in May, 1992 (Figure 52).

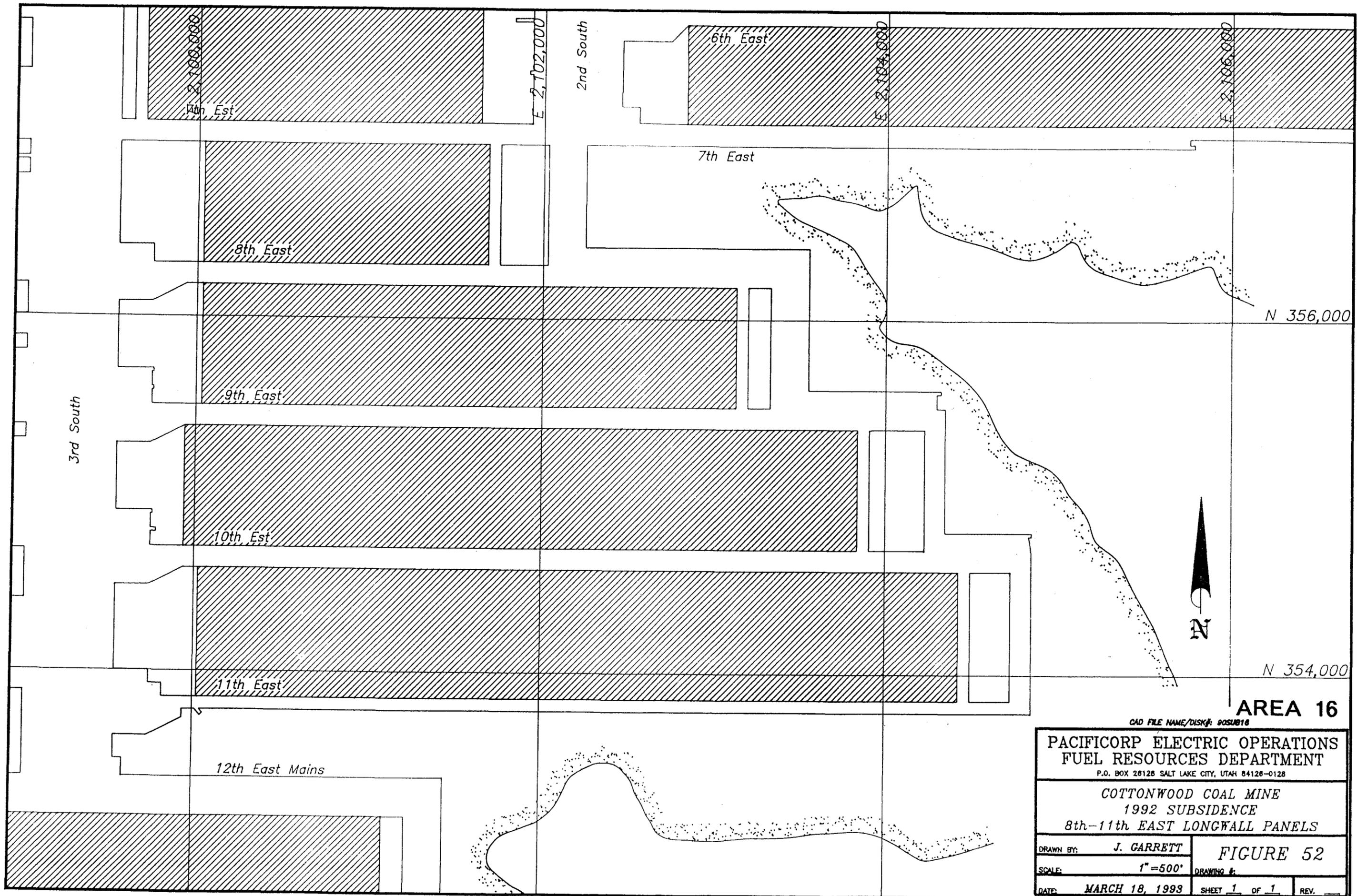
Topography in Area 16 is very similar to that of Area 14 with cliffs and very steep slopes covered by a few scattered pinon, juniper, mountain brush, and grasses. Overburden ranges from near 100 feet near outcrop to about 1800 feet.

As with Area 14 cliff spalling has occurred in places and the resulting talus has accumulated on the slopes below the cliffs. No surface cracks have been observed to date.

Maximum subsidence observed in 1997 is slightly less than the 1996 measurement that exceeded five (5) feet and occurs over the 11th East panel where the overburden is less than 600 feet (Figure 53, 54, and 55). Figure 53 shows several "bulls-eyes" in the area of the Castlegate cliff which are in very steep and rugged areas. The photogrammetric method is not reliable in these areas and it is not felt that the areas have subsided to the extent shown on figure 53. This is supported by the fact that subsidence survey targets placed along the cliff in 1986 have shown no movement in recent years (see appendix).

The angle-of-draw was not calculated because the steep slopes and other adjacent workings make accurate measurement difficult.

There are no known springs in the area. Strata on both the surface and in underground mine workings are typically very dry; therefore, mining is not expected to affect the hydrology.



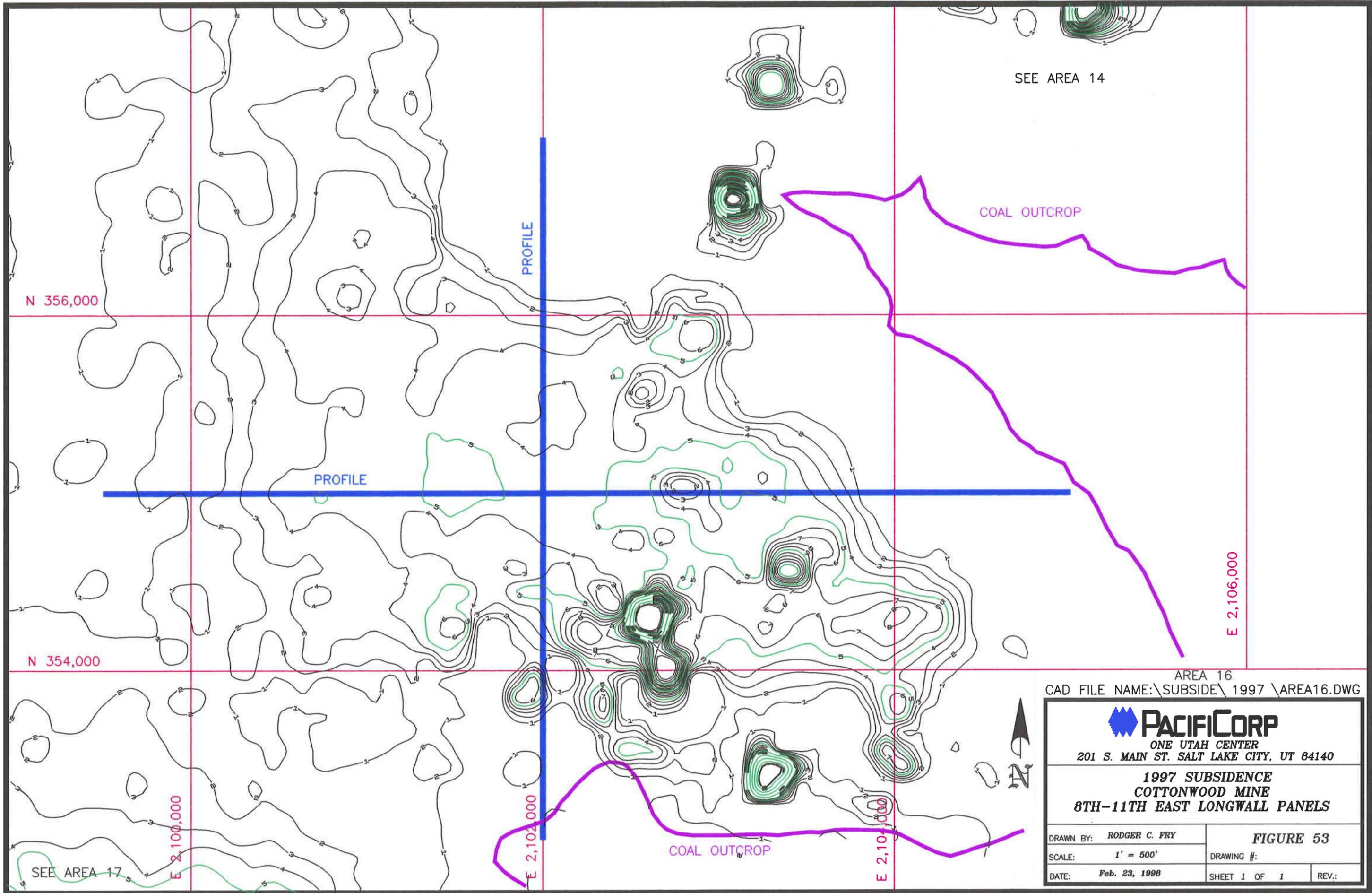
AREA 16

CAD FILE NAME/DISK#: 90SUB16

**PACIFICORP ELECTRIC OPERATIONS
FUEL RESOURCES DEPARTMENT**
P.O. BOX 28128 SALT LAKE CITY, UTAH 84128-0128

**COTTONWOOD COAL MINE
1992 SUBSIDENCE
8th-11th EAST LONGWALL PANELS**

<small>DRAWN BY:</small> J. GARRETT	FIGURE 52
<small>SCALE:</small> 1" = 500'	<small>DRAWING #:</small>
<small>DATE:</small> MARCH 18, 1993	<small>SHEET</small> 1 <small>OF</small> 1 <small>REV.</small>



SEE AREA 14

COAL OUTCROP

N 356,000

PROFILE

PROFILE

N 354,000

E 2,106,000

AREA 16

CAD FILE NAME: \SUBSIDE\ 1997 \AREA16.DWG

PACIFICORP

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

**1997 SUBSIDENCE
COTTONWOOD MINE
8TH-11TH EAST LONGWALL PANELS**

DRAWN BY: RODGER C. FRY

FIGURE 53

SCALE: 1' = 500'

DRAWING #:

DATE: Feb. 23, 1998

SHEET 1 OF 1

REV.:

SEE AREA 17

E 2,100,000

E 2,102,000

E 2,104,000

COAL OUTCROP

Area 16 Subsidence Profile North - South

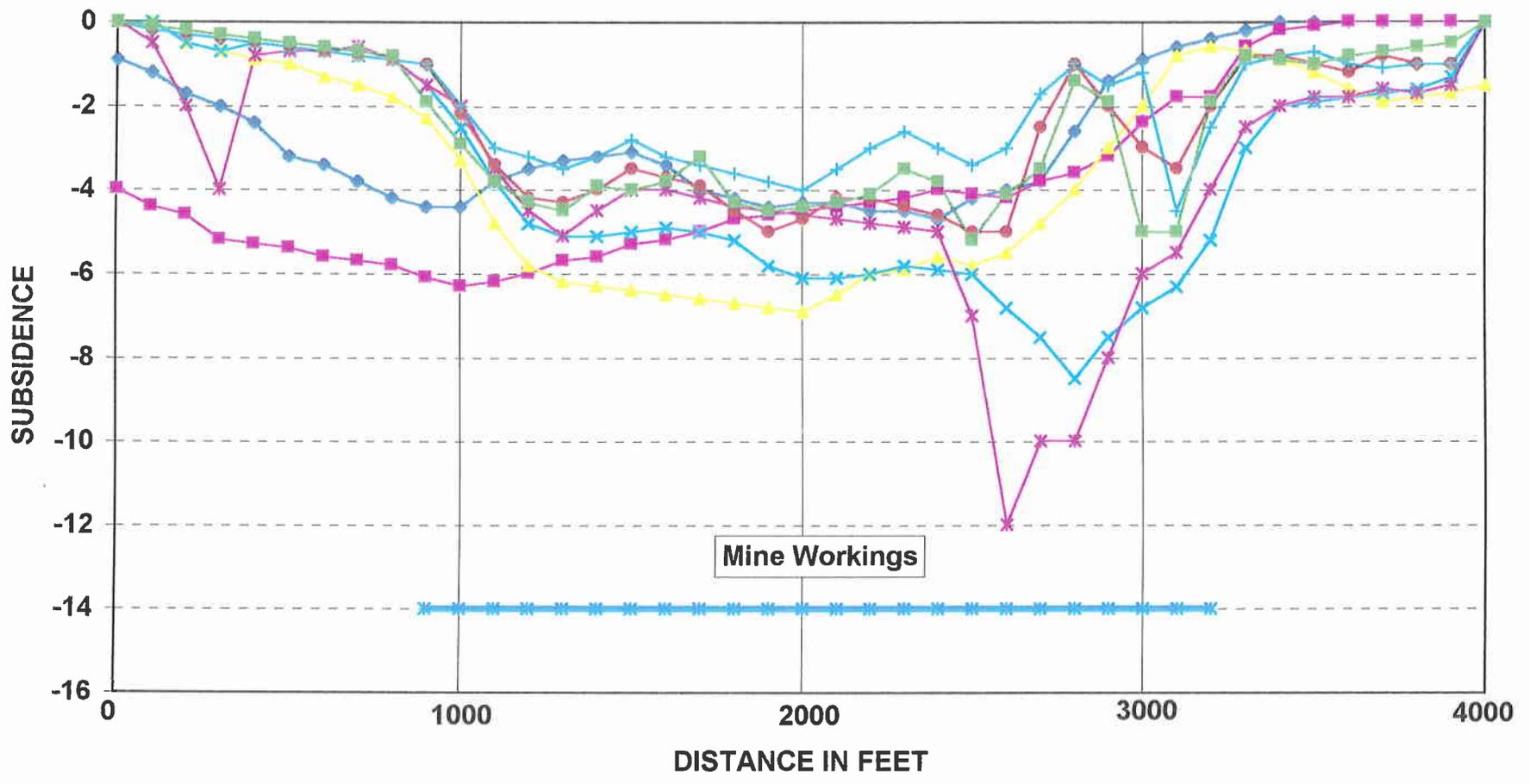


FIGURE 54

Area 16 Subsidence Profile West - East

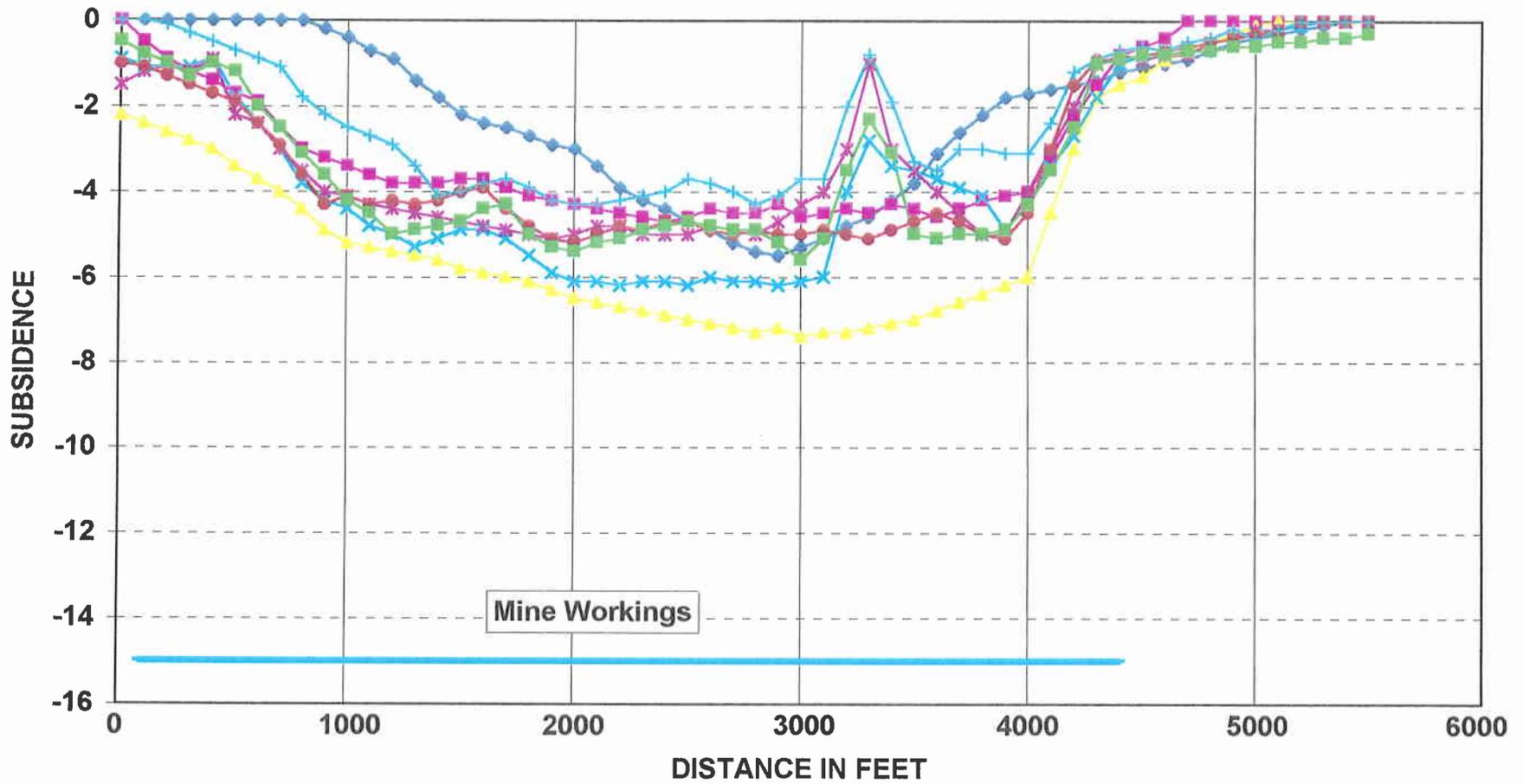


FIGURE 55

Area 17

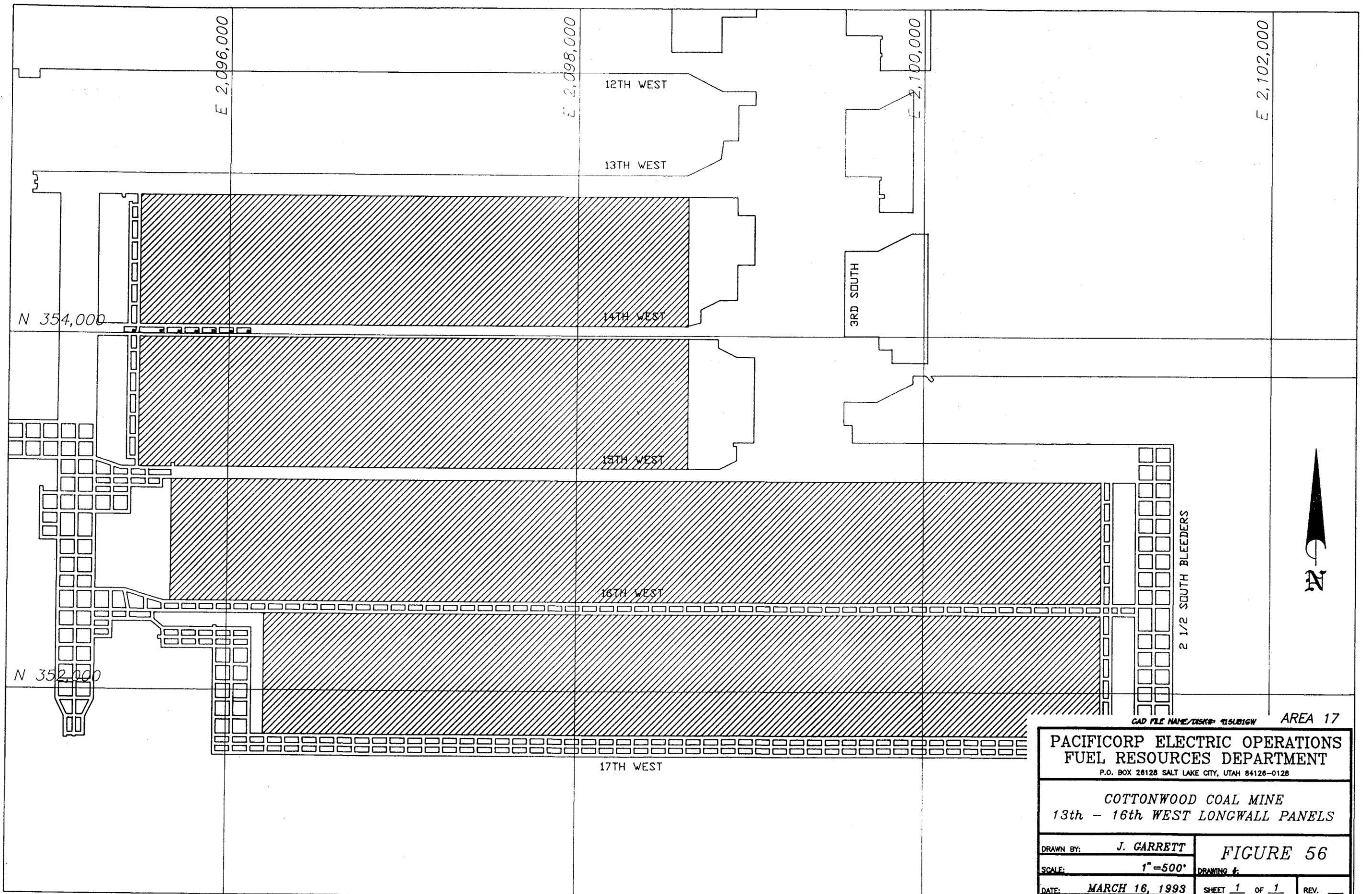
Cottonwood 13th Through 16th West Longwall Panels

Mining in the 16th West longwall panel began in October 1990 and the panel was completed in March 1991. Mining in the area was finished in March, 1992 with the completion of the 13th West longwall panel (figure 56). The topography over these longwall panels is characterized by steep slopes covered with conifer and aspen trees which extend up from the cliffs which surround the east, south and west sides of the panels. The panels are covered by overburden ranging from 800 feet at both the west and east end of the panels to over 1,800 feet in the center of the panels.

The measured subsidence exceeds seven (7) feet in an area above the 16th west panel. The subsidence zone follows a narrow east-west trending trough centered above the two longer panels and then extends north above the 14th and 13th west longwall panels (figures 57, 58, and 59). No surface fractures have been observed in the area above these longwall panels. Subsidence in this area has been stable for over six years.

On the south side of the subsidence zone, the angle of draw is less than 10 degrees.

No springs are located above this area and the strata is not saturated. Therefore, it is not likely that this subsidence will have any effect on the hydrology of the area.

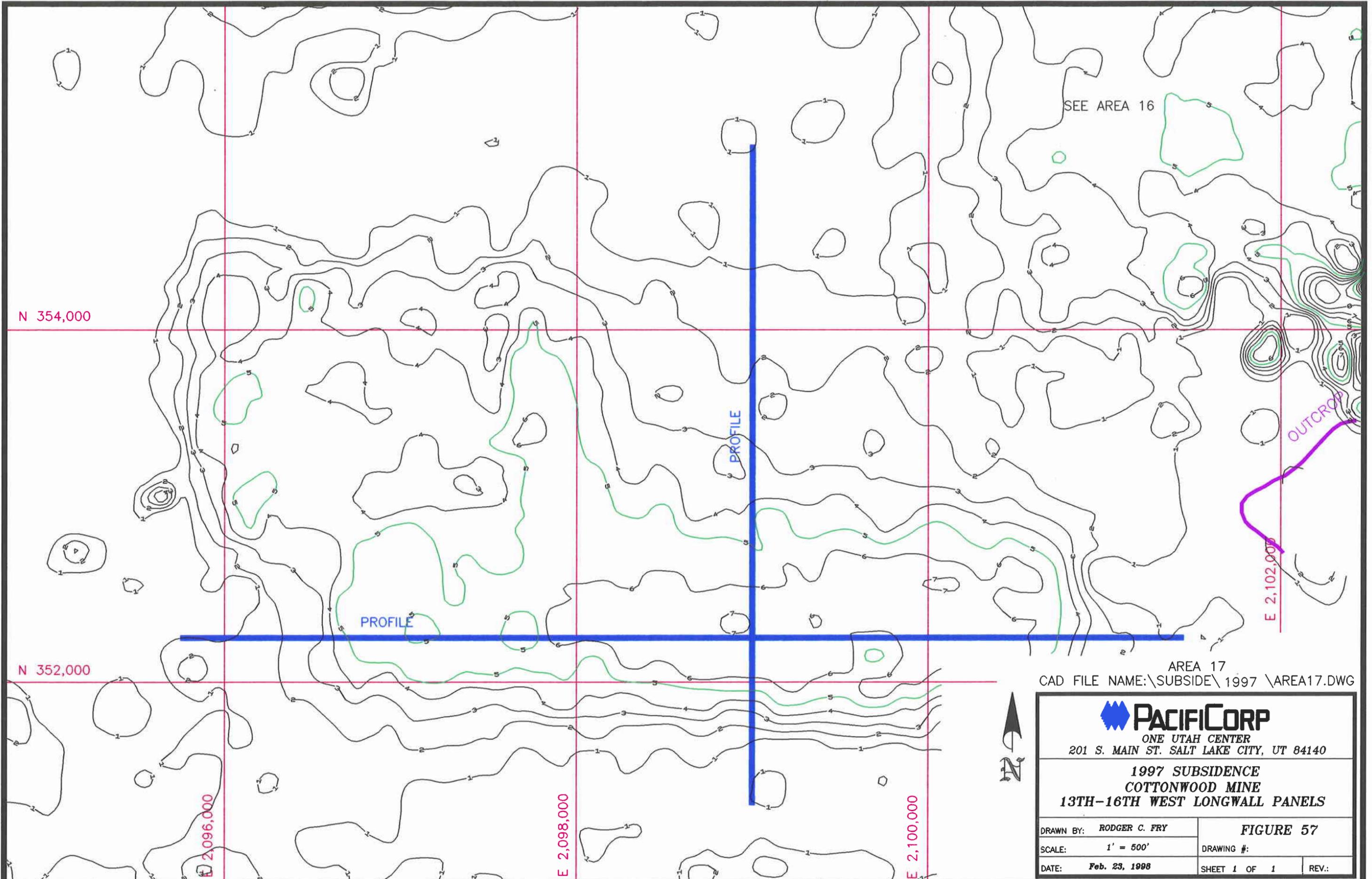


CAD FILE NAME/DISK# 915UB1GW AREA 17

PACIFICORP ELECTRIC OPERATIONS
 FUEL RESOURCES DEPARTMENT
 P.O. BOX 28128 SALT LAKE CITY, UTAH 84128-0128

COTTONWOOD COAL MINE
 13th - 16th WEST LONGWALL PANELS

DRAWN BY: J. GARRETT	FIGURE 56	
SCALE: 1"=500'	DRAWING #:	
DATE: MARCH 16, 1993	SHEET 1 OF 1	REV. _____



SEE AREA 16

N 354,000

N 352,000

E 2,096,000

E 2,098,000

E 2,100,000

E 2,102,000

PROFILE

PROFILE

OUTCROP

AREA 17

CAD FILE NAME:\SUBSIDE\1997\AREA17.DWG



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

1997 SUBSIDENCE
COTTONWOOD MINE
13TH-16TH WEST LONGWALL PANELS

DRAWN BY: RODGER C. FRY

FIGURE 57

SCALE: 1' = 500'

DRAWING #:

DATE: Feb. 23, 1998

SHEET 1 OF 1

REV.:

Area 17 Subsidence Profile West - East

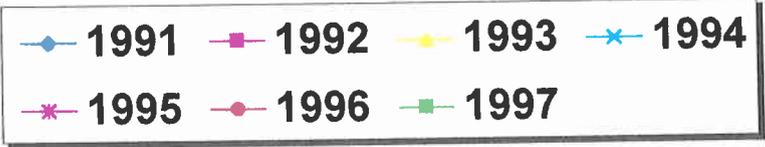
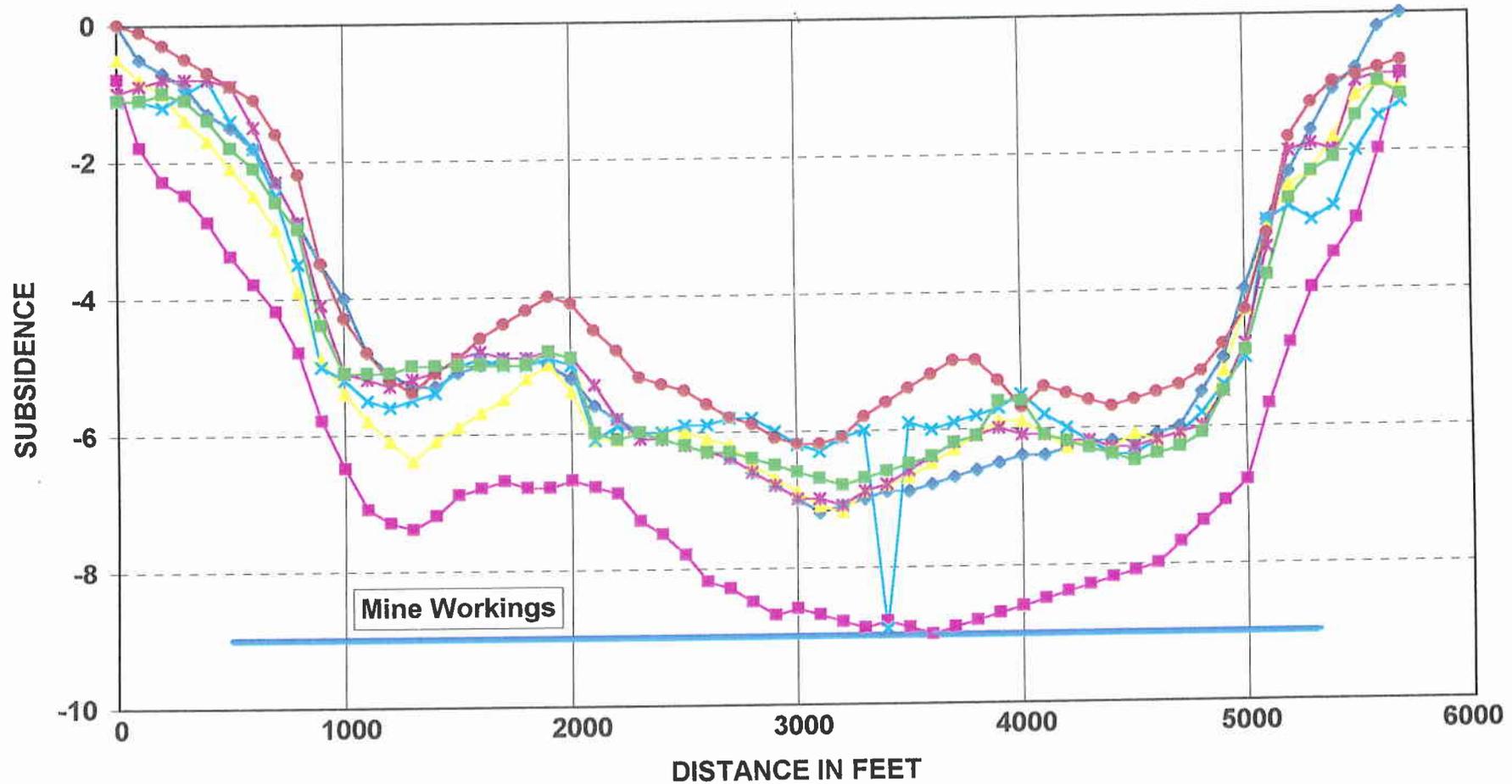


FIGURE 58

Area 17 Subsidence Profile

North - South

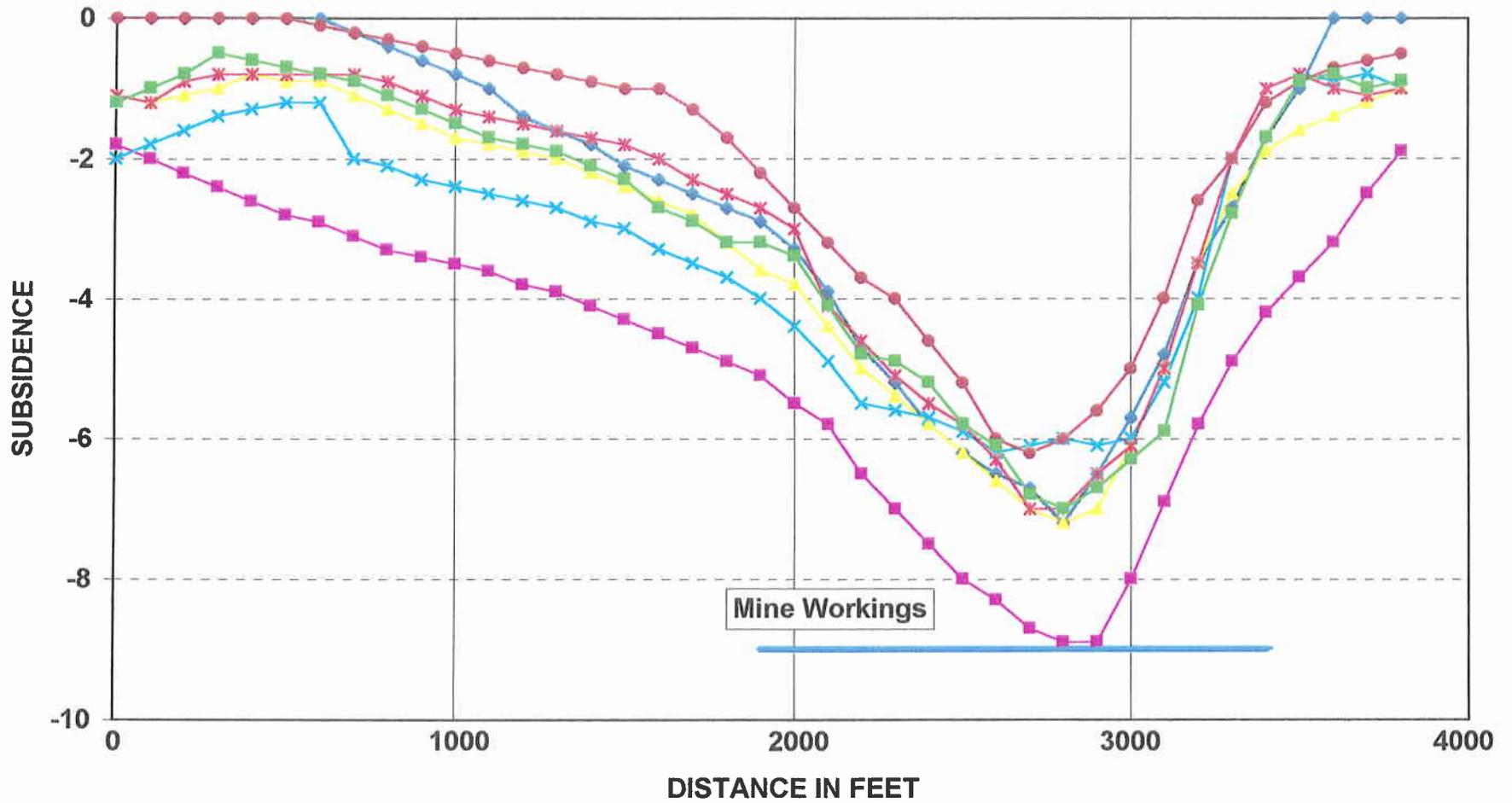


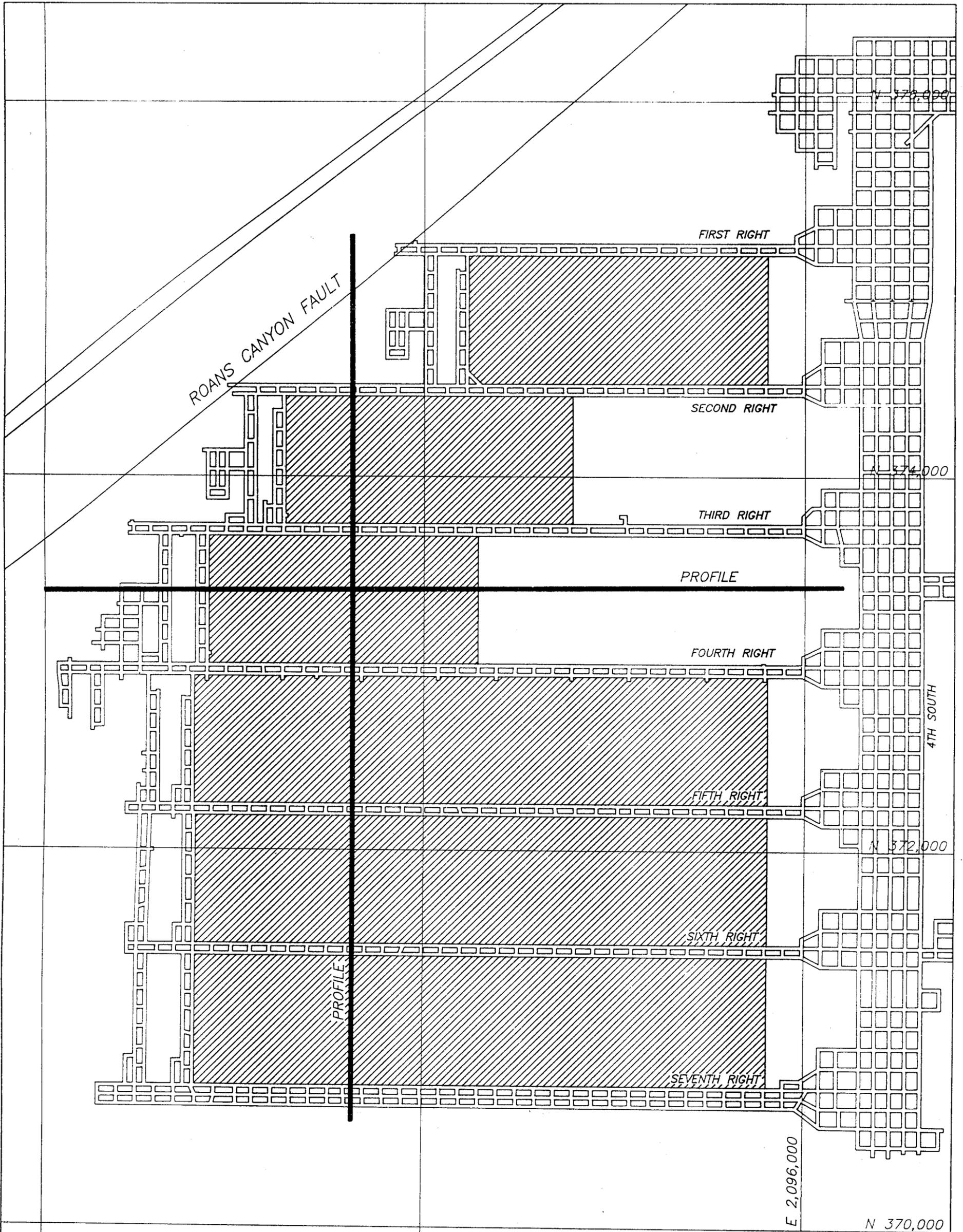
FIGURE 59

Area 18

Deer Creek Mine 2nd through 7th Right Longwall Panels

Longwall mining in this area was completed in May, 1992 with the extraction of six adjacent longwall panels (figure 60). The 3rd and 4th Right panels were terminated short of the entire panel due to geologic complications. The land surface in the area of these panels contains steep slopes covered by conifer and aspen trees, and sagebrush. The longwall panels have overburden ranging from 1,800 feet on the west end of the panels to 2,000 feet on the east side of the panels.

Subsidence in this area has reached a maximum of nearly eight (8) feet (Figures 61, 62, and 63) and has been stable since 1992. The subsidence zone is a broad trough running in a north - south direction. This area is overlain by several springs. Monitoring of these springs has shown no change in the quality or quantity of water discharged from them (see appendix and the 1997 Hydrologic Monitoring report).



E 2,092,000

E 2,094,000

E 2,096,000

N 370,000

AREA 18

CAD FILE NAME/DISK#: 91SUB7R

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

DEER CREEK MINE
 2nd-7th RIGHT LONGWALL PANELS

DRAWN BY: J. GARRETT
 SCALE: 1"=500'
 DATE: MARCH 16, 1993

FIGURE 60
 DRAWING #:
 SHEET 1 OF 1 REV.



N 376,000

N 374,000

N 372,000

N 370,000

E 2,096,000

E 2,092,000

E 2,094,000

ROANS CANYON
FAULT GRABEN

PROFILE

PROFILE

AREA 18
CAD FILE NAME:\SUBSIDE\1997\AREA18.DWG



PACIFICORP

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

1997 SUBSIDENCE
DEER CREEK MINE
2ND-7TH RIGHT LONGWALL PANELS

DRAWN BY: RODGER C. FRY

SCALE: 1' = 500'

DATE: Feb. 23, 1998

FIGURE 61

DRAWING #:

SHEET 1 OF 1

REV.:

Area 18 Subsidence Profile North - South

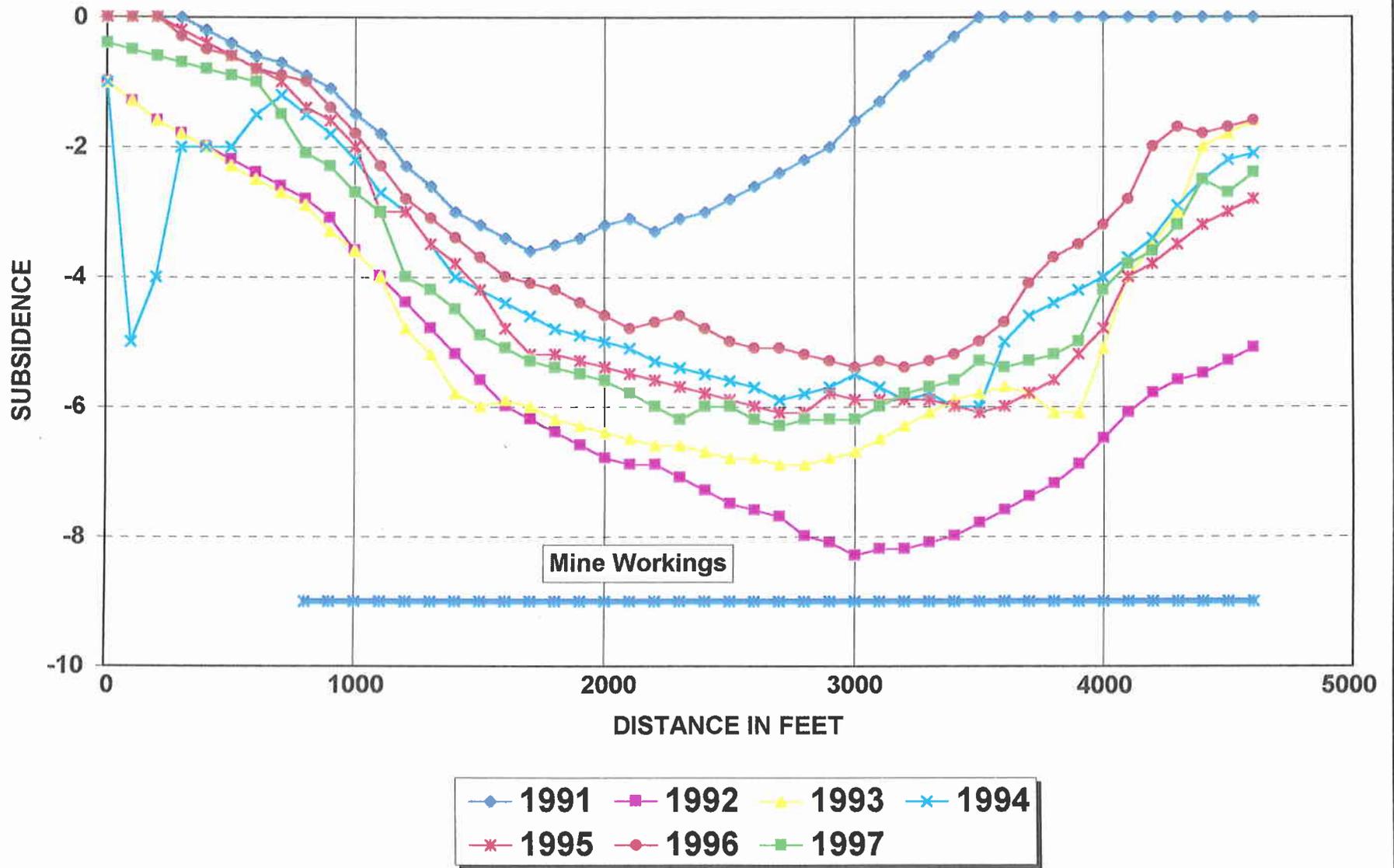


FIGURE 62

Area 18 Subsidence Profile West - East

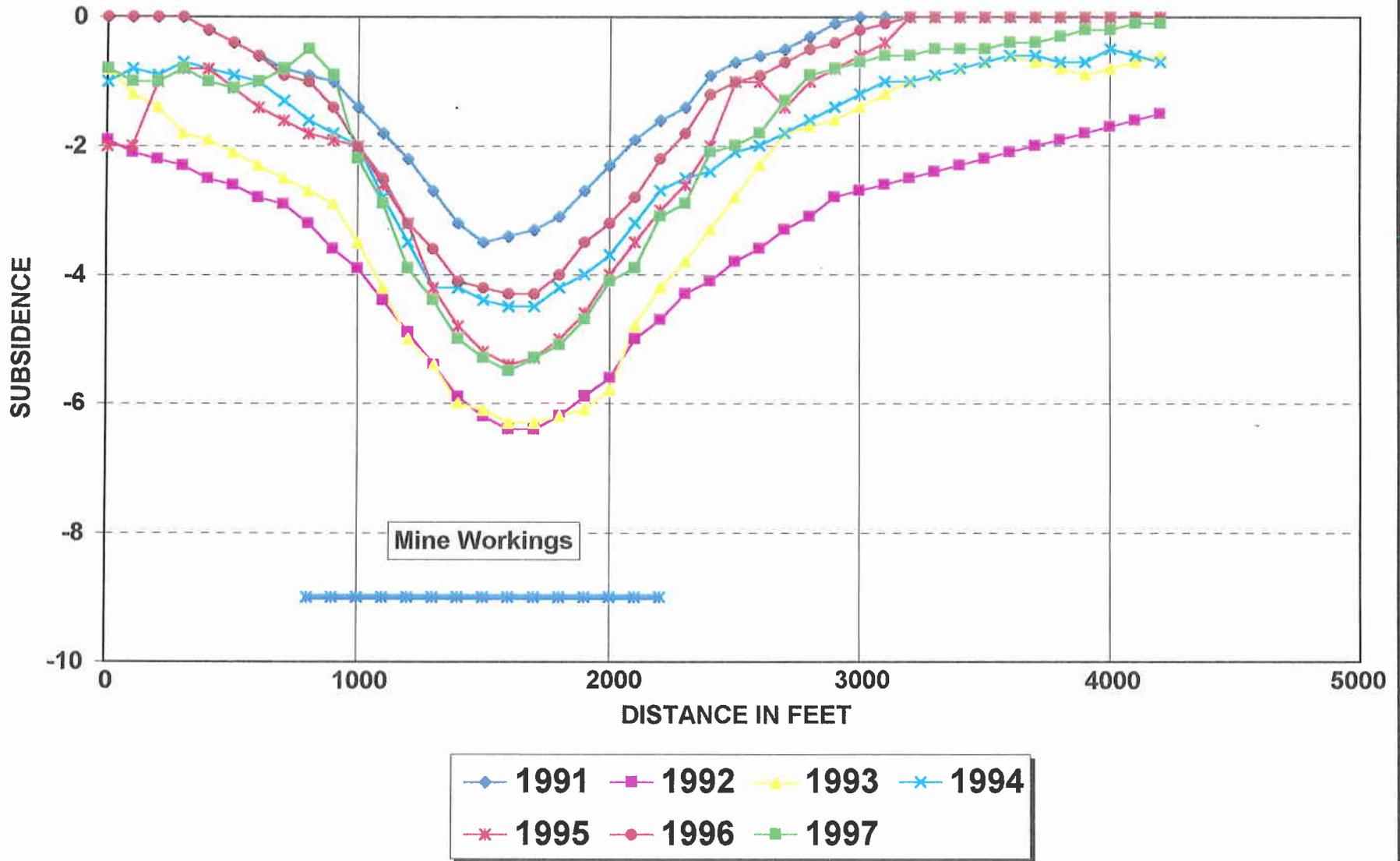


FIGURE 63

Area 19

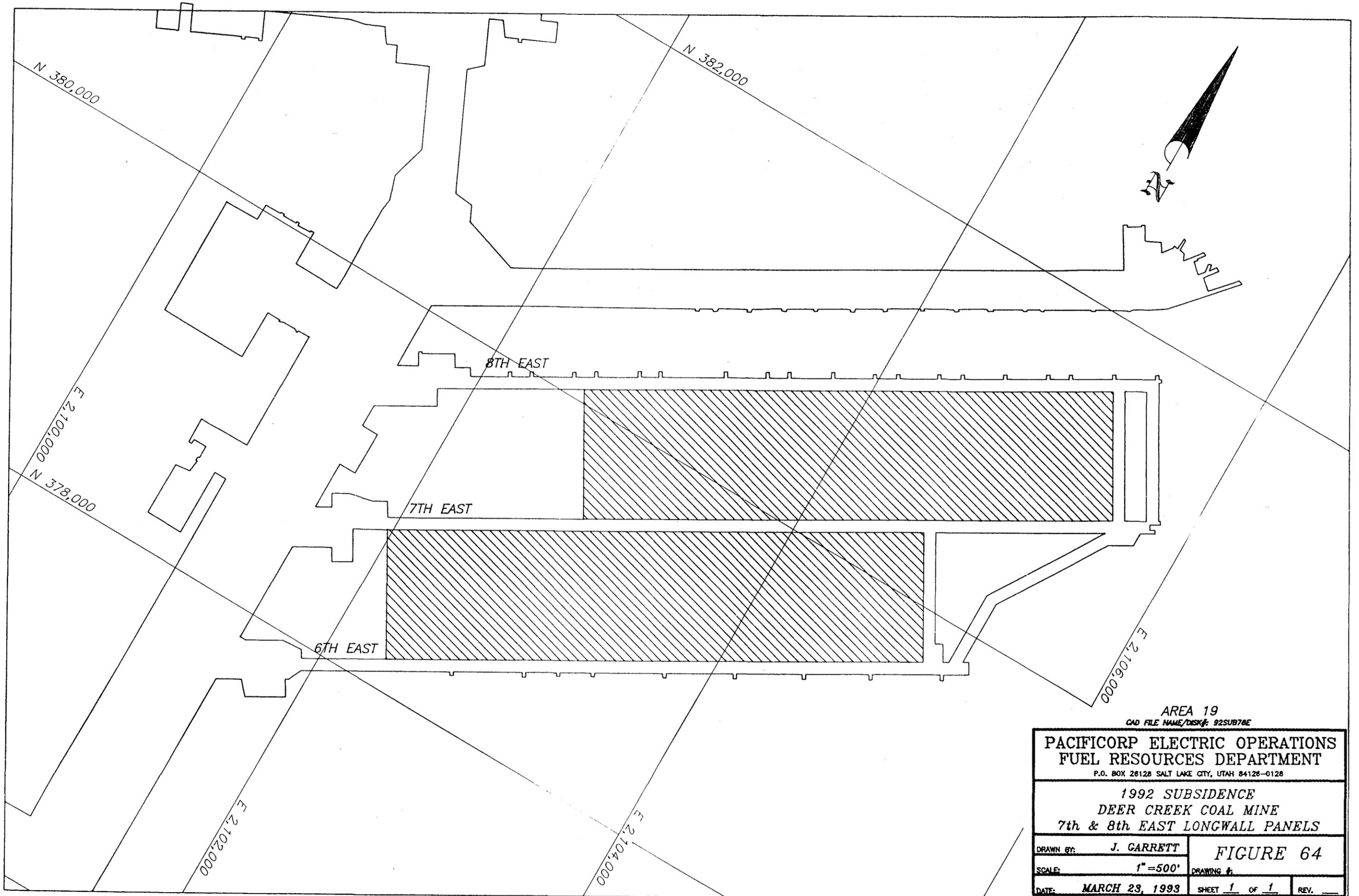
Deer Creek 7th and 8th East Longwall Panels off 3rd North

Mining in the 7th East Longwall Panel began in May, 1992 and by January 1993 mining was completed in the 8th East Longwall Panel (Figure 64).

The land surface above these two panels is very rugged. The longwall panels are located beneath a ridge located between the left and right forks of Meetinghouse Canyon. The area is covered by sagebrush on the south facing slopes and dense stands of spruce trees on the north facing slopes. The overburden in the area of these panels ranges from 400 feet on the north to over 1,800 feet on the south.

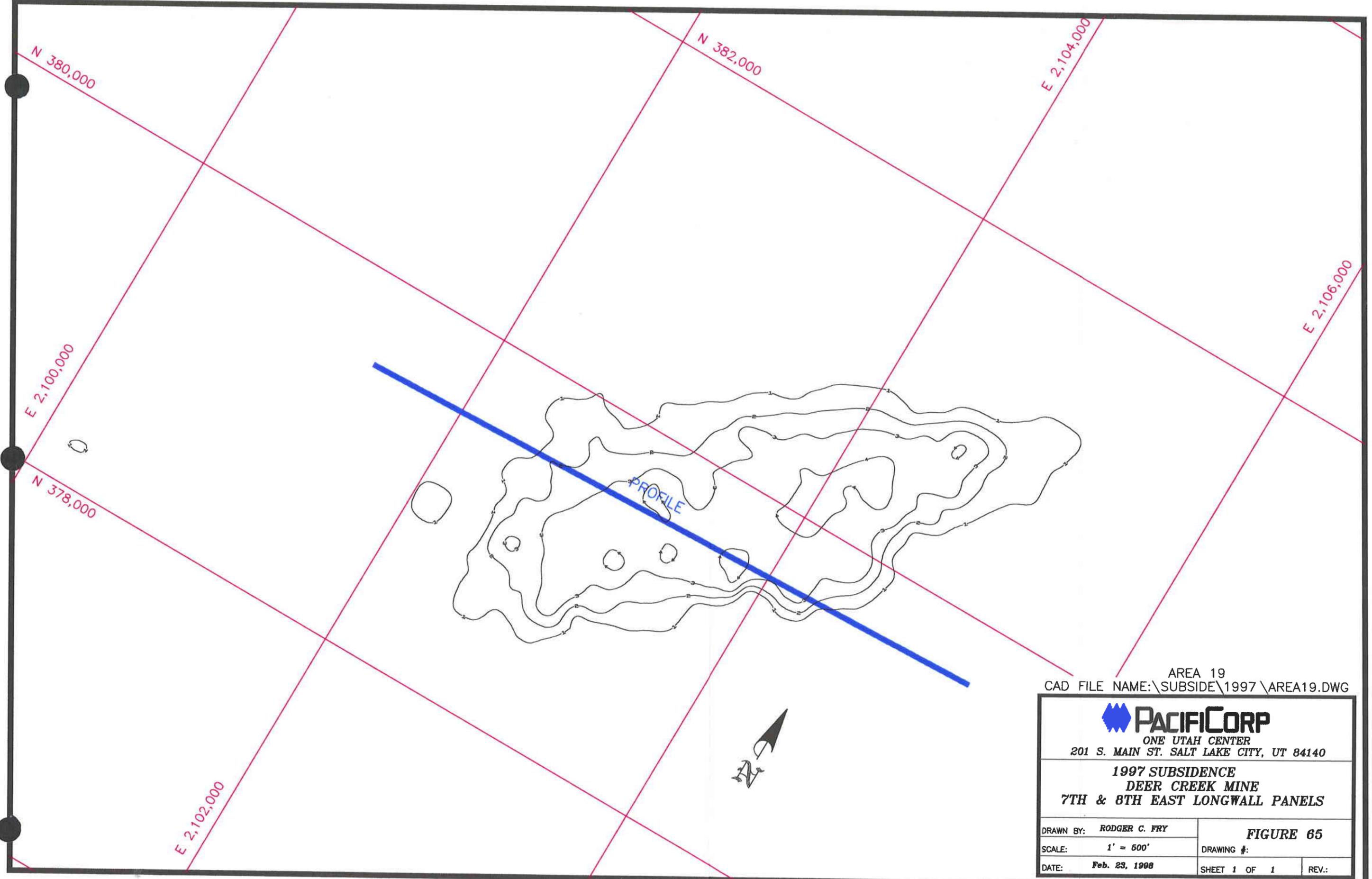
Subsidence in this area has increased from slightly over one foot in 1992 to over four feet in 1993 but has been stable between 1993 and 1997 (Figures 65 and 66).

This area is overlain by a few springs. Monitoring of these springs has shown no change in the quality or quantity of water discharged from them (see appendix and the 1997 Hydrologic Monitoring Report).



AREA 19
 CAD FILE NAME/DISK#: 92SUB78E

PACIFICORP ELECTRIC OPERATIONS FUEL RESOURCES DEPARTMENT <small>P.O. BOX 26128 SALT LAKE CITY, UTAH 84126-0128</small>	
1992 SUBSIDENCE DEER CREEK COAL MINE 7th & 8th EAST LONGWALL PANELS	
DRAWN BY: J. GARRETT	FIGURE 64
SCALE: 1" = 500'	DRAWING #:
DATE: MARCH 23, 1993	SHEET 1 OF 1 REV.



N 380,000

N 382,000

E 2,104,000

E 2,106,000

E 2,100,000

N 378,000

E 2,102,000

PROFILE

AREA 19
 CAD FILE NAME: \SUBSIDE\1997\AREA19.DWG



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

**1997 SUBSIDENCE
 DEER CREEK MINE
 7TH & 8TH EAST LONGWALL PANELS**

DRAWN BY: **RODGER C. FRY**

FIGURE 65

SCALE: **1' = 600'**

DRAWING #:

DATE: **Feb. 23, 1998**

SHEET 1 OF 1

REV.:

Area 19 Subsidence Profile West - East

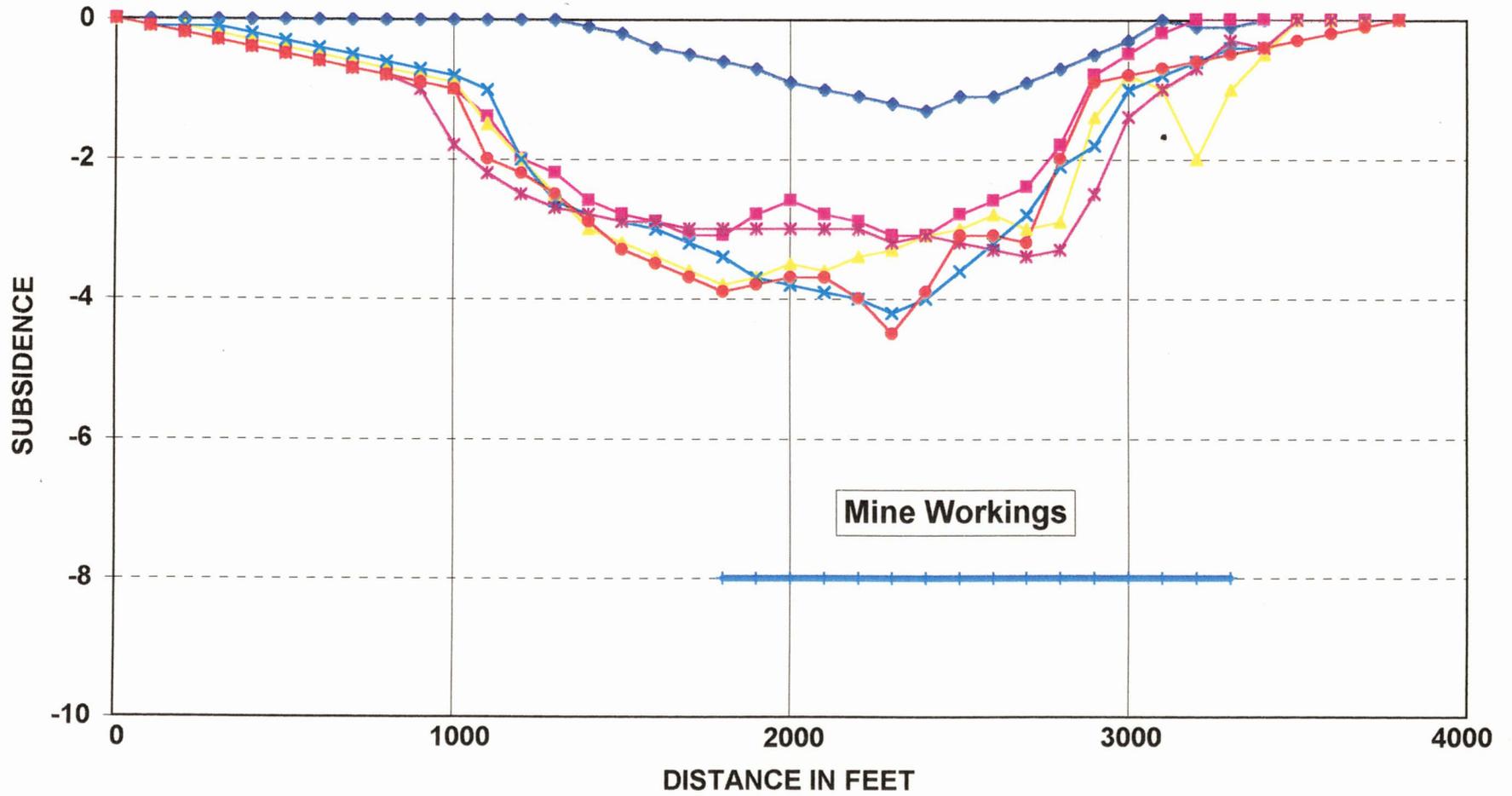


FIGURE 66

Area 20

Deer Creek 1st & 2nd Left Longwall Panels off 3 ½ South

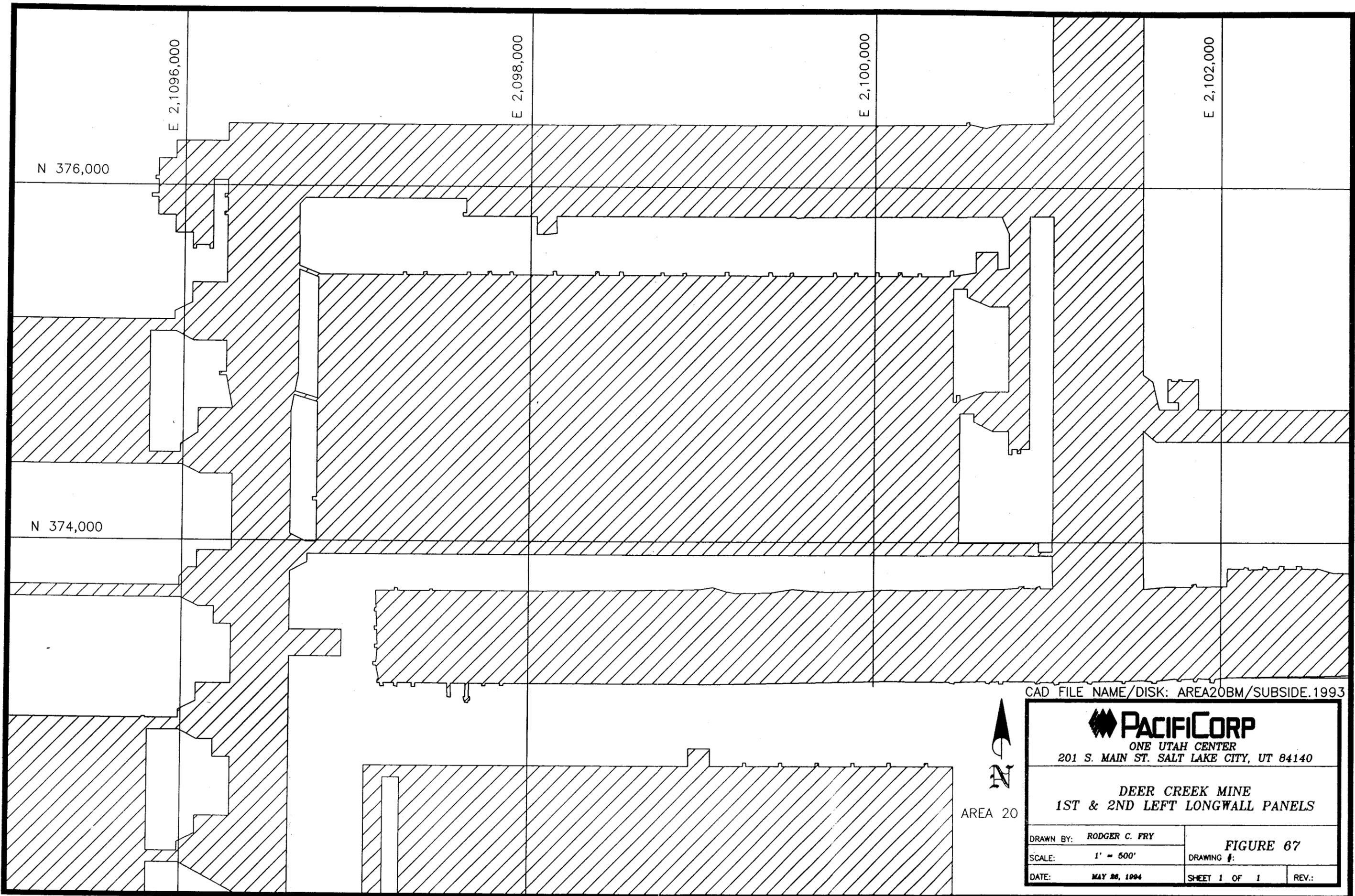
Mining in the 2nd Left Longwall Panel began in February 1993 and was completed in June 1993. Mining then started in the 1st Left Longwall Panel in July 1993 and was completed in November of 1993 (Figure 67).

These longwall panels are overlain by moderately steep slopes that are heavily covered with aspen and spruce trees. The overburden above these panels range from 1,400 feet at their east end to over 2,000 feet above their west end.

The monitoring detected a maximum of slightly over four (4) feet of subsidence in 1997 which is less than the maximum of slightly over six (6) feet of subsidence above the 2nd Left Longwall Panel measured in 1996. The 1996 reading showed an increase from the maximum of slightly over four feet that was measured in 1995 and a foot greater than that measured in 1994 which showed a maximum of five feet of subsidence (Figures 68 and 69).

It is believed that subsidence in this area is substantially complete. All of the subsidence detected falls within the bounds of the longwall area. Therefore; the angle of draw in this area is considered to be steeper than 10°.

These longwall panels are overlain by several springs. Monitoring of the springs revealed no impacts due to the subsidence.



CAD FILE NAME/DISK: AREA20BM/SUBSIDE.1993



AREA 20

 PACIFICORP ONE UTAH CENTER 201 S. MAIN ST. SALT LAKE CITY, UT 84140		
DEER CREEK MINE 1ST & 2ND LEFT LONGWALL PANELS		
DRAWN BY: RODGER C. FRY	FIGURE 67	
SCALE: 1" = 500'	DRAWING #:	
DATE: MAY 26, 1994	SHEET 1 OF 1	REV.:

N 376,000

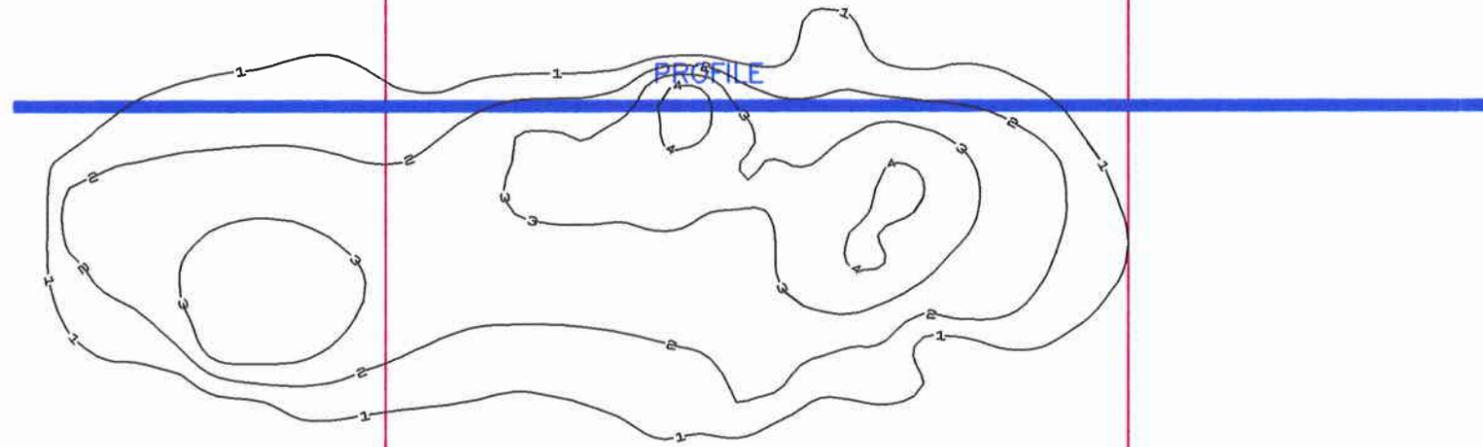
N 374,000

E 2,102,000

E 2,096,000

E 2,098,000

E 2,100,000



AREA 20
 CAD FILE NAME:\SUBSIDE\1997\AREA20.DWG

PACIFICORP

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

**1997 SUBSIDENCE
 DEER CREEK MINE
 1ST & 2ND LEFT LONGWALL PANELS**

DRAWN BY: **RODGER C. FRY**

FIGURE 68

SCALE: **1' = 500'**

DRAWING #:

DATE: **Feb. 23, 1998**

SHEET 1 OF 1

REV.:

Area 20 Subsidence Profile West - East

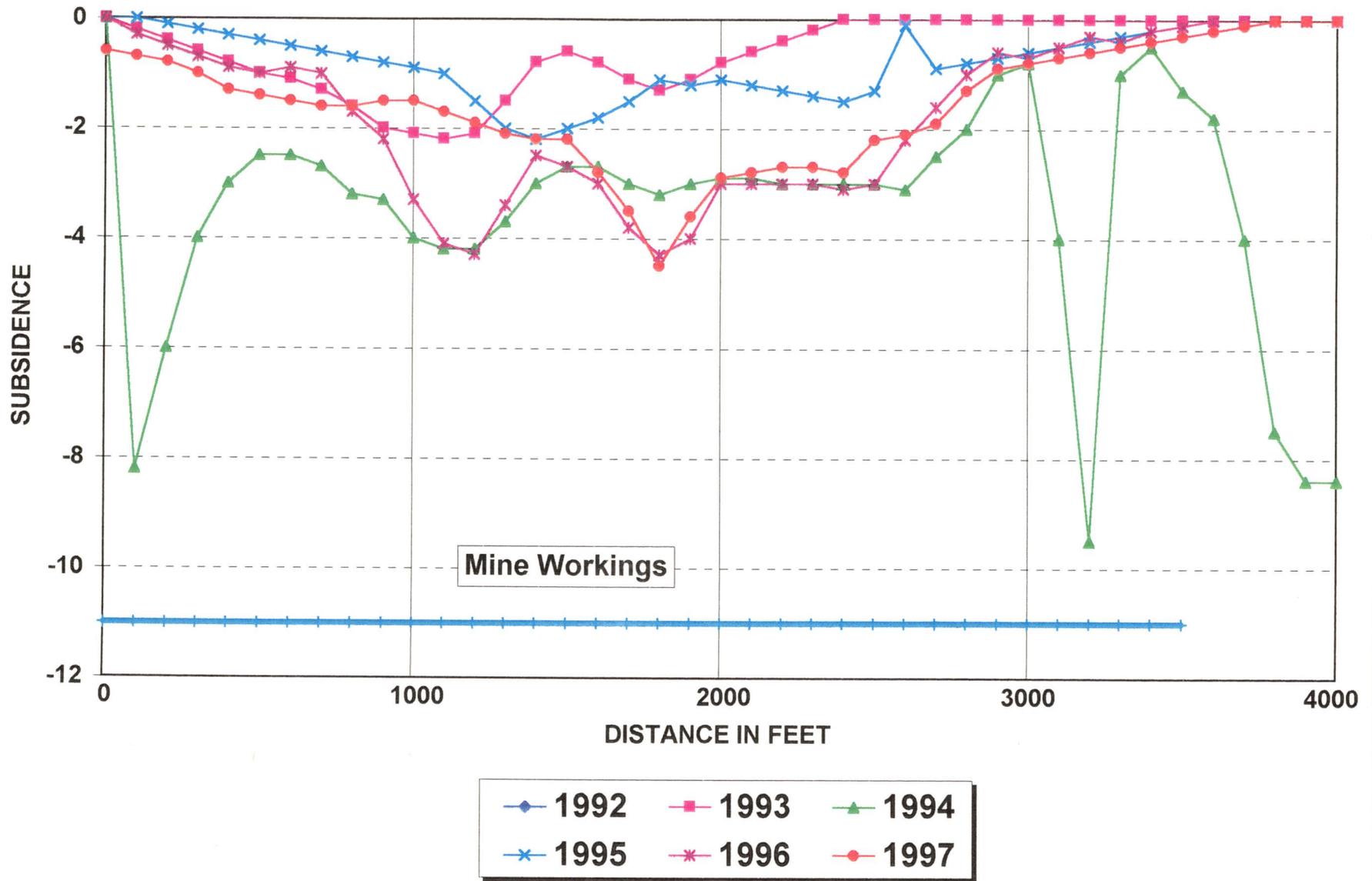


FIGURE 69

Area 21

Deer Creek Mine 2nd East Through 7th East Longwall Panels

Mining in the 2nd East Longwall panel began in November of 1993 and by the End of August 1995 longwall mining had removed all of the 2nd through 5th East Longwall Panels and the eastern 1,100 feet of the 6th East Longwall Panel (Figure 70). Mining in this area, including the remainder of the 6th East and all of the 7th East Longwall Panels, was completed in January 1996.

The topography in this area is fairly rugged. A ridge along the south side of Rilda Canyon is located through the center of the area. The slopes leading down from this ridge to Rilda Canyon on the north are heavily vegetated with conifer trees. Overburden in this area ranges from less than 200 feet in the north to greater than 1,800 feet beneath the ridge top.

Subsidence detected in 1994 had reached a maximum of over four (4) feet above the 2nd East Longwall Panel (Figures 71, 72 and 73). Subsidence over the 3rd East longwall panel was not detected because this panel is longer than the 2nd East panel and subsidence doesn't usually occur until two panel widths have been mined. In 1995, subsidence had progressed to where most of the areas underlain by the 2nd through 6th East Longwall Panels had subsided between 5 and 6 feet. In 1996, the maximum subsidence that was measured had not increased from that measured in 1995 but an increase in subsidence was noted on the north end of figure 72 and on the western end of figure 73. This is in the area of the 6th and 7th East Longwall Panels that were the last to be extracted. The 1997

monitoring indicated that subsidence has increased to slightly over seven (7) feet over the Second and Third East longwall panels in this area. In 1996, this area showed a maximum subsidence of six (6) feet. During the helicopter reconnaissance in 1995, several fractures were identified and several areas were noted where boulders had rolled from the Castlgate cliff. These are shown on figure 71. The area of subsidence is completely contained within the mining area; Therefore, the angle of draw is near verticle.

Several springs are located above these longwall panel. However, hydrologic monitoring has not detected any change to the spring flow that is attributable to mining (see 1997 Hydrologic Monitoring Report).



AREA 21
 CAD FILE:\SUBSIDE\1994\AREA21BM.DWG

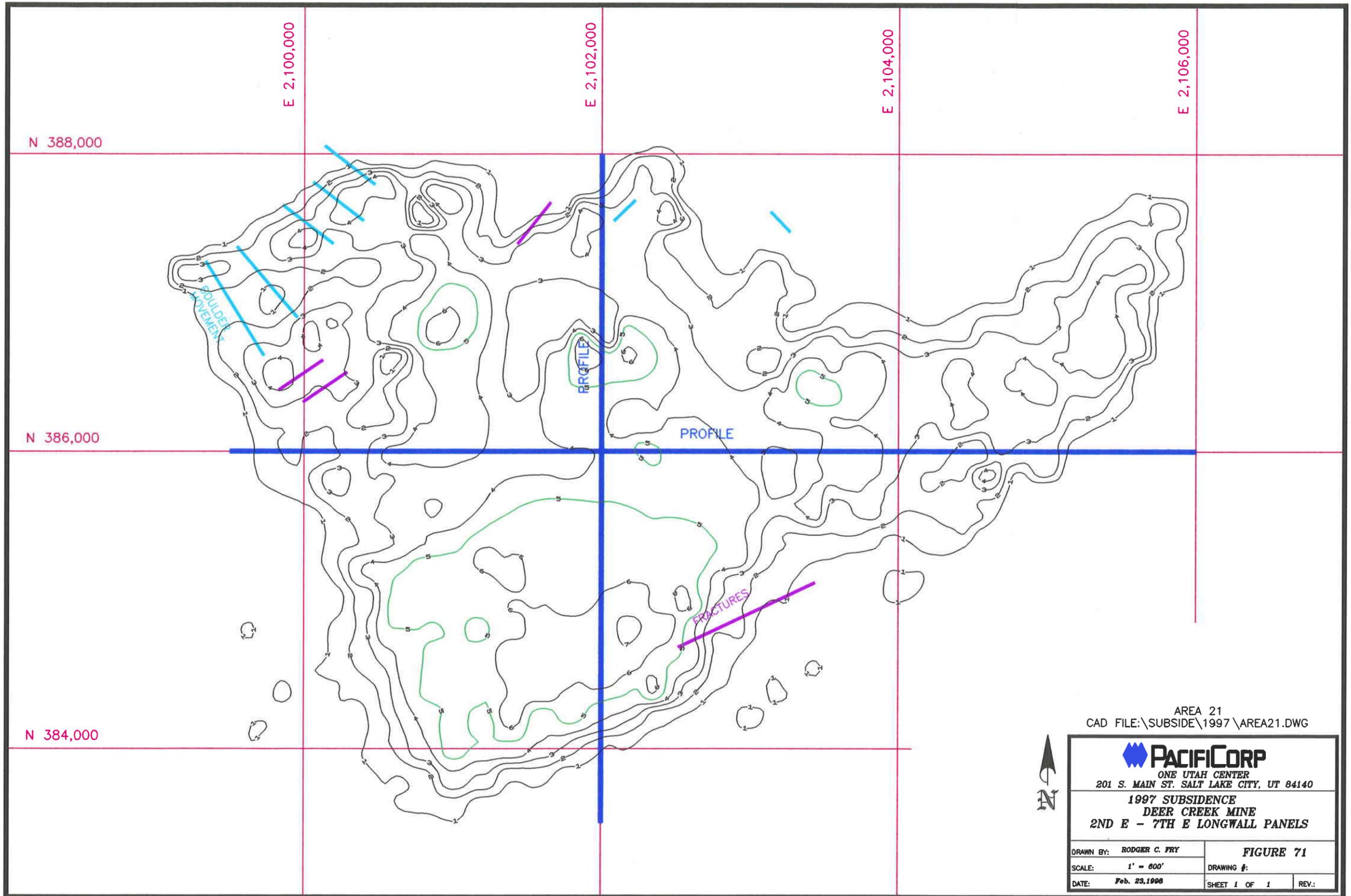


PACIFICORP

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

DEER CREEK MINE
 2ND E - 7TH E LONGWALL PANELS

DRAWN BY: RODGER C. FRY	FIGURE 70	
SCALE: 1" = 600'	DRAWING #:	
DATE: APRIL 7, 1995	SHEET 1 OF 1	REV.:



AREA 21
 CAD FILE:\SUBSIDE\1997\AREA21.DWG



 ONE UTAH CENTER 201 S. MAIN ST. SALT LAKE CITY, UT 84140	
1997 SUBSIDENCE DEER CREEK MINE 2ND E - 7TH E LONGWALL PANELS	
DRAWN BY: RODGER C. FRY	FIGURE 71
SCALE: 1' = 800'	DRAWING #:
DATE: Feb. 23, 1998	SHEET 1 OF 1 REV.:

Area 21 Subsidence Profile North - South

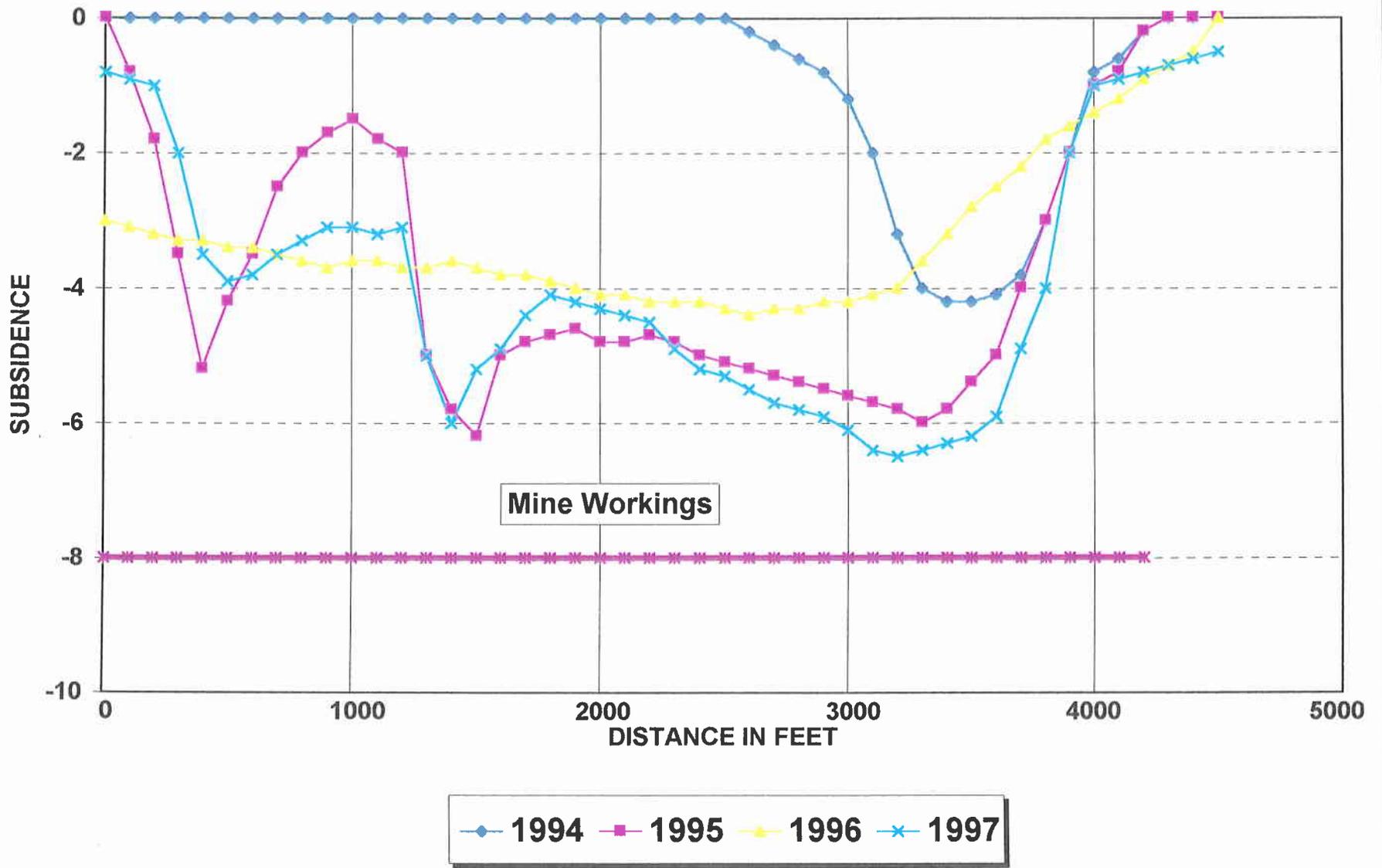


FIGURE 72

Area 21 Subsidence Profile West - East

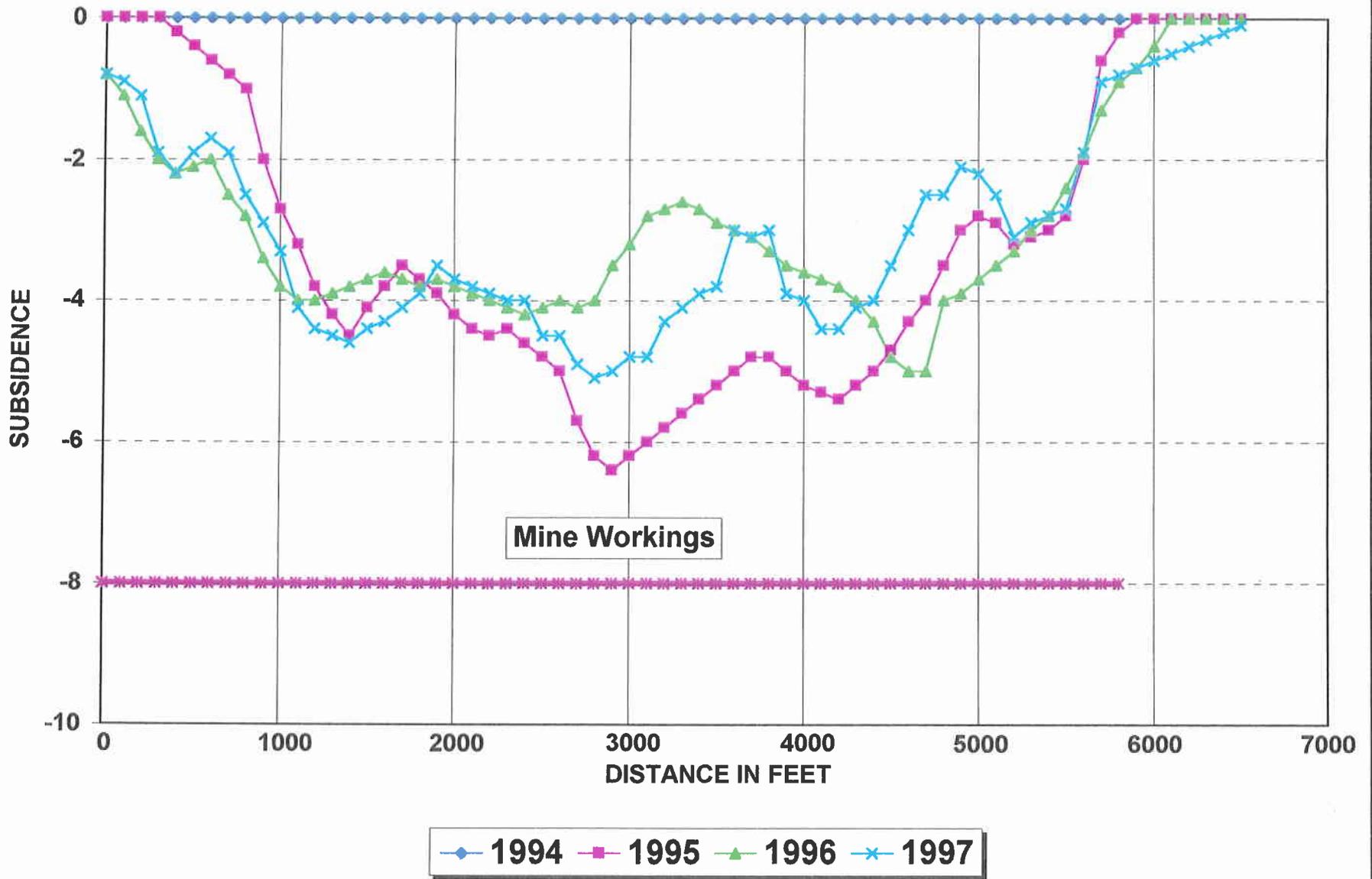


FIGURE 73

Area 22

Deer Creek Mine 2nd through 8th West Longwall Panels off 3rd North

Longwall Mining began in the 8th West Longwall Panel in February 1996 and the entire panel was mined by July 1996. Mining then moved to the 7th West Longwall Panel in July 1996 and this panel was completed in January 1997. Mining then started in the 6th west panel in January 1997 and this panel was completed in July 1997. Mining in the 5th west panel began in July 1997 and by August 31, 1997 the western 1,250 feet of the panel had been extracted. (see figure 74). Mining in this area will remain active for the next year. This area is located on the southern side of Rilda Canyon in an area where the terrain is very rugged. Several north-south side tributaries to Rilda Canyon are located in the area and form a series of canyons and steep ridges along the flanks of Rilda Canyon. Elevations range from 8,000 feet at the coal outcrop to 9,900 feet along the ridge tops. The area is heavily vegetated with spruce trees, aspen trees at the higher elevations and pinion-junipers at the lower elevations.

Several springs are located in the area and have been catalogued and are being monitored (see 1997 Annual Hydrologic Monitoring Report).

The subsidence monitoring showed an increase in subsidence in 1997 over that which was measured in 1996. Above the western end of the 7th west panel the subsidence has reached a maximum of eight (8) feet. And in a small area on the eastern end of the eighth west panel the subsidence has reached as much as ten (10) feet in a small area. The topography in this area is fairly rugged which limits the resolution of the photogrametric

monitoring (see figures 75, 76 and 77). It should be expected that as more panels to the south are mined the area of subsidence will broaden.

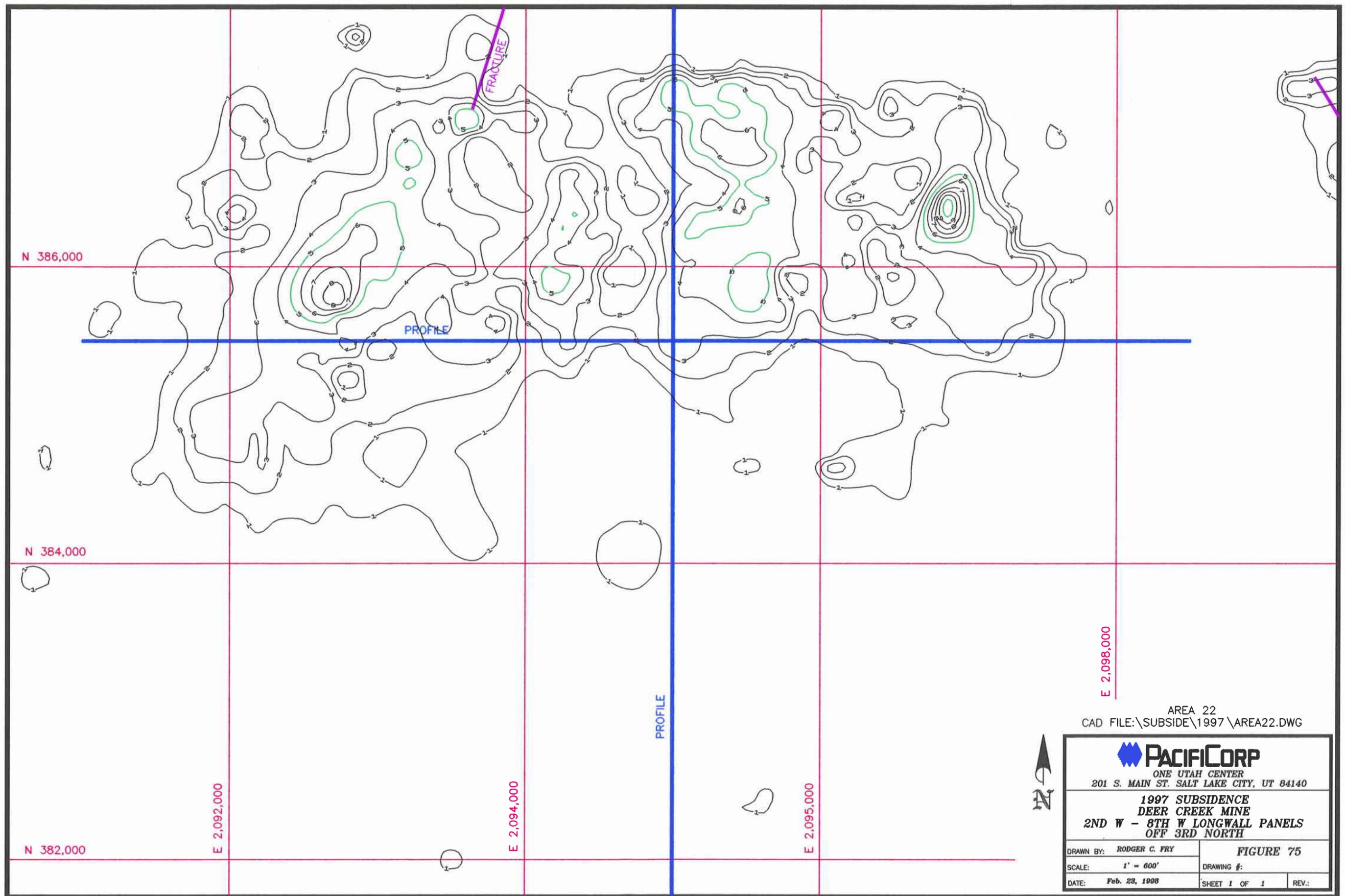
The subsidence that has occurred to date has had no effect on the springs or groundwater in the area (see 1997 Hydrologic Monitoring Report).



AREA 22
 CAD FILE: \SUBSIDE\1996\AREA22.DWG



 ONE UTAH CENTER 201 S. MAIN ST. SALT LAKE CITY, UT 84140	
MINE MAP DEER CREEK MINE 2ND W - 8TH W LONGWALL PANELS OFF 3RD NORTH	
DRAWN BY: RODGER C. FRY	FIGURE 74
SCALE: 1" = 600'	DRAWING #:
DATE: JANUARY 14, 1997	SHEET 1 OF 1 REV.:



AREA 22
 CAD FILE:\SUBSIDE\1997\AREA22.DWG



 ONE UTAH CENTER 201 S. MAIN ST. SALT LAKE CITY, UT 84140		
1997 SUBSIDENCE DEER CREEK MINE 2ND W - 8TH W LONGWALL PANELS OFF 3RD NORTH		
DRAWN BY: RODGER C. FRY	FIGURE 75	
SCALE: 1" = 600'	DRAWING #:	
DATE: Feb. 23, 1998	SHEET 1 OF 1	REV.:

Area 22 Subsidence Profile North - South

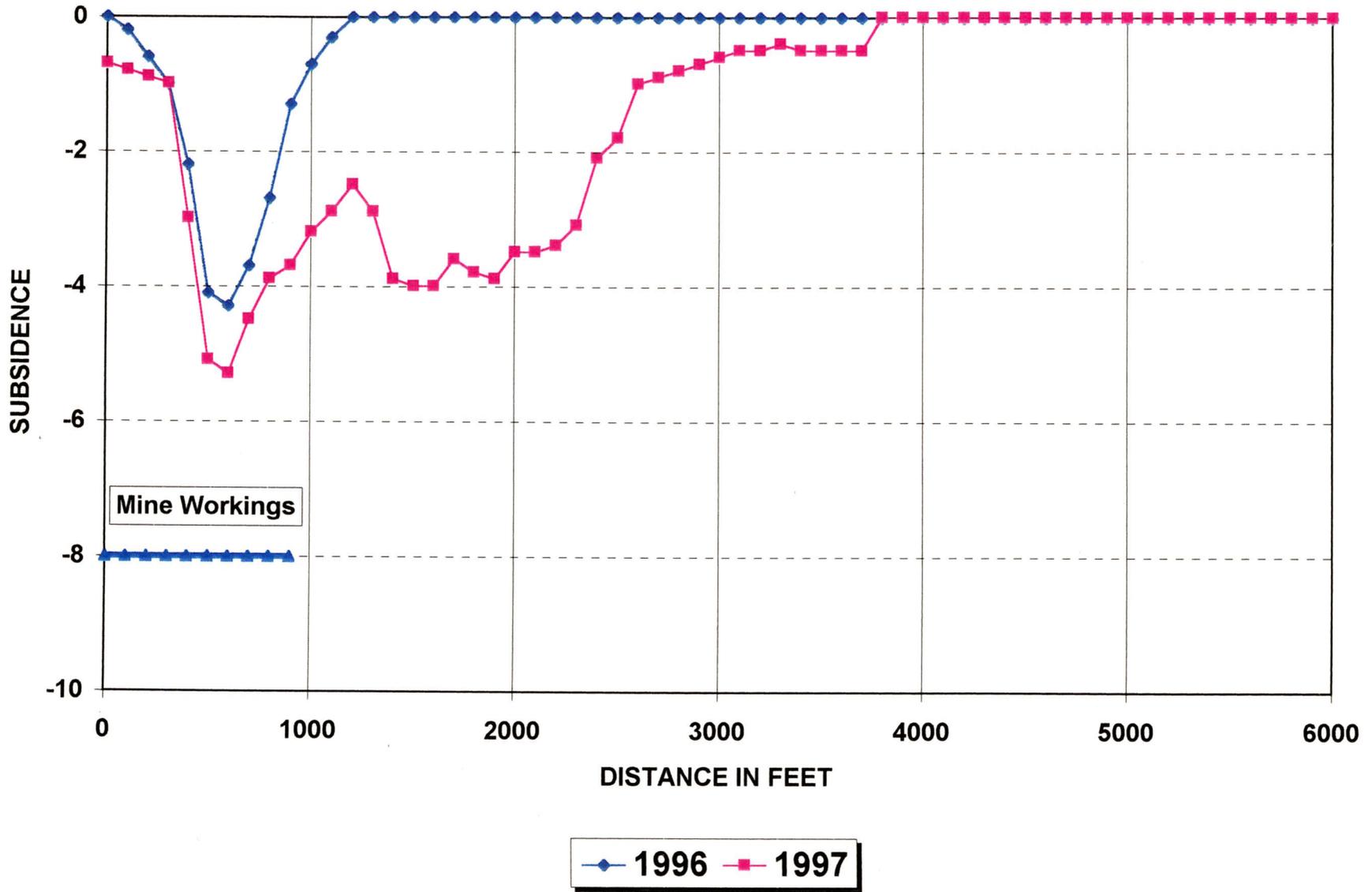


FIGURE 76

Area 22 Subsidence Profile West - East

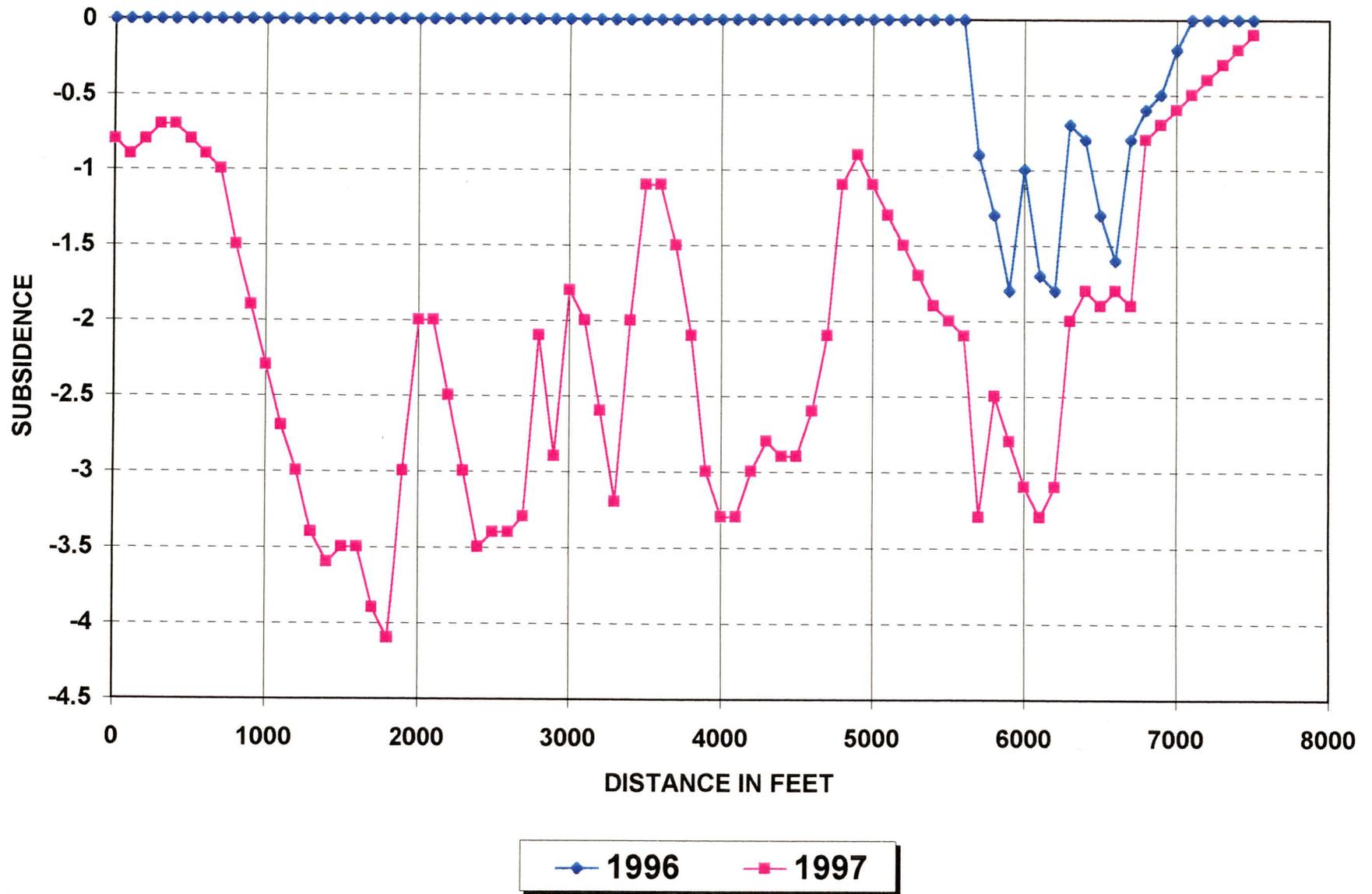


FIGURE 77

Area 23

Trail Mountain Mine 2nd through 5th East Longwall Panels off 5th Left

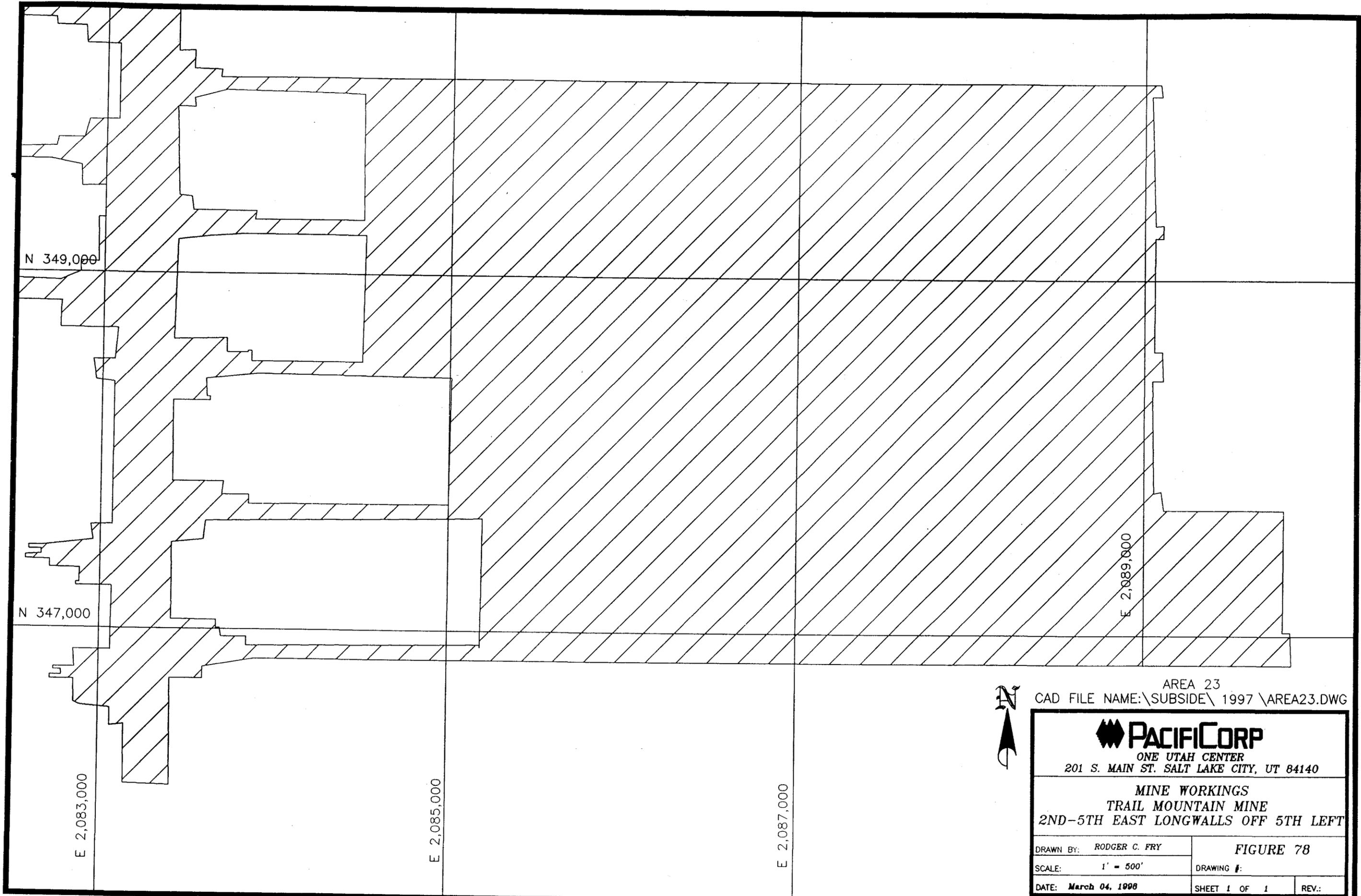
Mining in the 2nd East Longwall Panel began in October 1995 and mining continued until February 1996. In this panel only the eastern 2,600 feet was mined because the western 2,000 feet was not minable due to high ash content in the coal. Mining Began in the 3rd East Panel in February and was completed in June 1996. Mining began in the 4th East panel starting in June 1996 and was completed in October 1996. Mining then began in the 5th East panel which was completed in March 1997 (see figure 78). All of the longwall mining conducted to date has extracted an average thickness of 8 feet of coal. Mining in this area is now complete.

This area generally contains gentle south-facing slopes that project down to a steep escarpment along the south and east end of the area. Elevations in the area range from 8,750 feet to less than 6,700 feet along the coal outcrop in Straight Canyon. The land is sparsely vegetated with grasses and brush with some dense patches of ponderosa pine at the higher elevations and pinion-juniper trees in the steeper slopes above and below the escarpment.

The subsidence monitoring has detected up to eight (8) feet of subsidence that has occurred. This maximum subsidence is located over the east end of the 4th East longwall panels (see figures 79, 80 & 81). Most of the undermined area has subsided between five (5) and seven (7) feet. One point at the extreme east side of the 5th East panel shows

subsidence up to over 22 feet. This is in an area of steep terrain and may be reading inaccuracies or a large boulder may have moved causing the change in readings between 1996 and 1997. No angle of draw calculations have been made because subsidence in this area is not yet complete.

No surface fractures or visual evidence of subsidence has been observed. One spring is located in the area but as of yet has not been subsided. No change in spring discharge has been identified due to the mining activities (see 1997 Annual Hydrologic Monitoring Report).



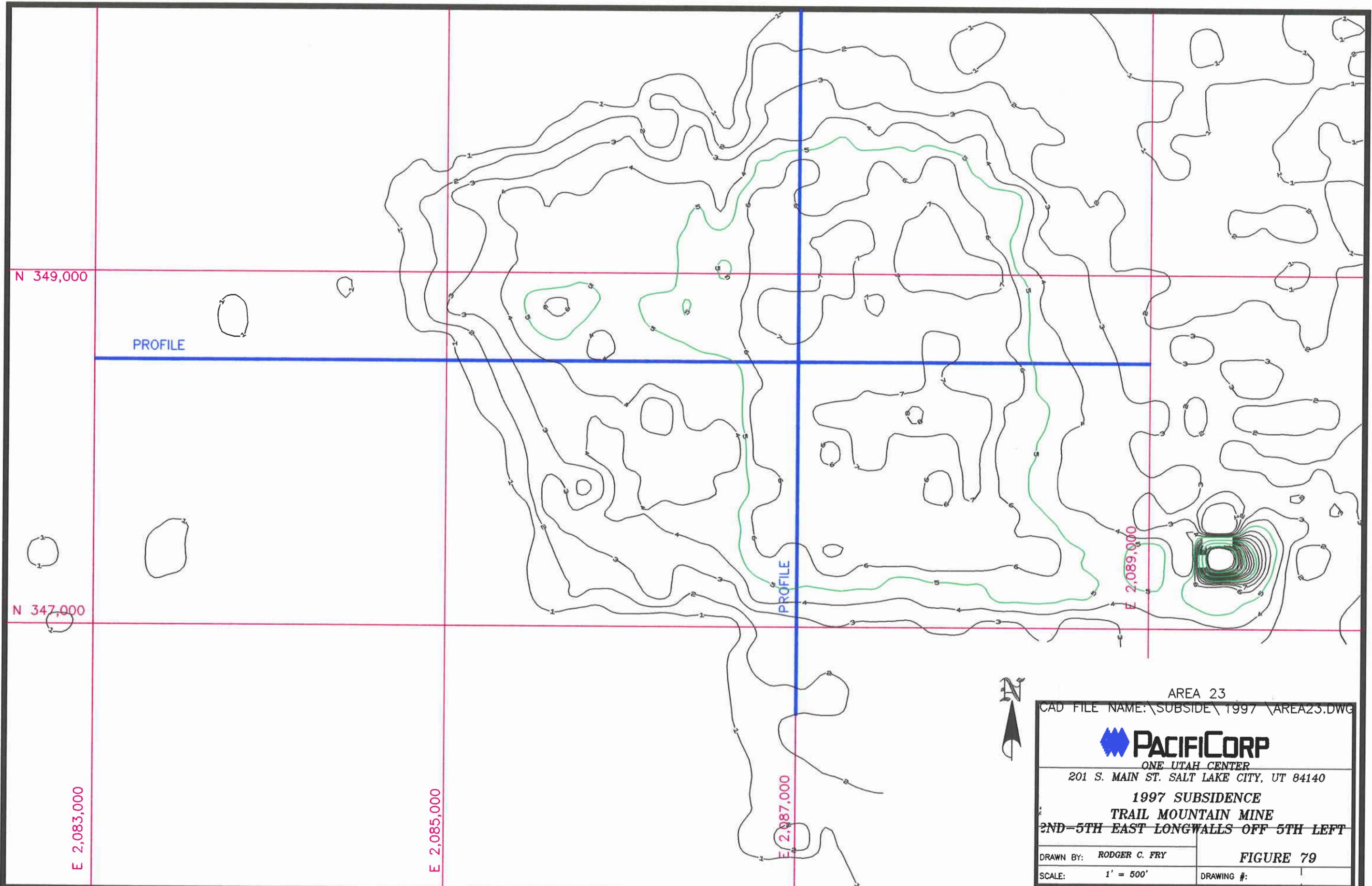
AREA 23
 CAD FILE NAME: \SUBSIDE\ 1997 \AREA23.DWG

PACIFICORP

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

MINE WORKINGS
 TRAIL MOUNTAIN MINE
 2ND-5TH EAST LONGWALLS OFF 5TH LEFT

DRAWN BY: RODGER C. FRY		FIGURE 78	
SCALE: 1" = 500'		DRAWING #:	
DATE: March 04, 1998	SHEET 1 OF 1	REV.:	



AREA 23

CAD FILE NAME: \SUBSIDE\1997\AREA23.DWG


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

1997 SUBSIDENCE
TRAIL MOUNTAIN MINE
2ND-5TH EAST LONGWALLS OFF 5TH LEFT

DRAWN BY: RODGER C. FRY	FIGURE 79
SCALE: 1' = 500'	DRAWING #:

DATE: Feb. 23, 1998 SHEET 1 OF 1 REV:

Area 23 Subsidence Profile North - South

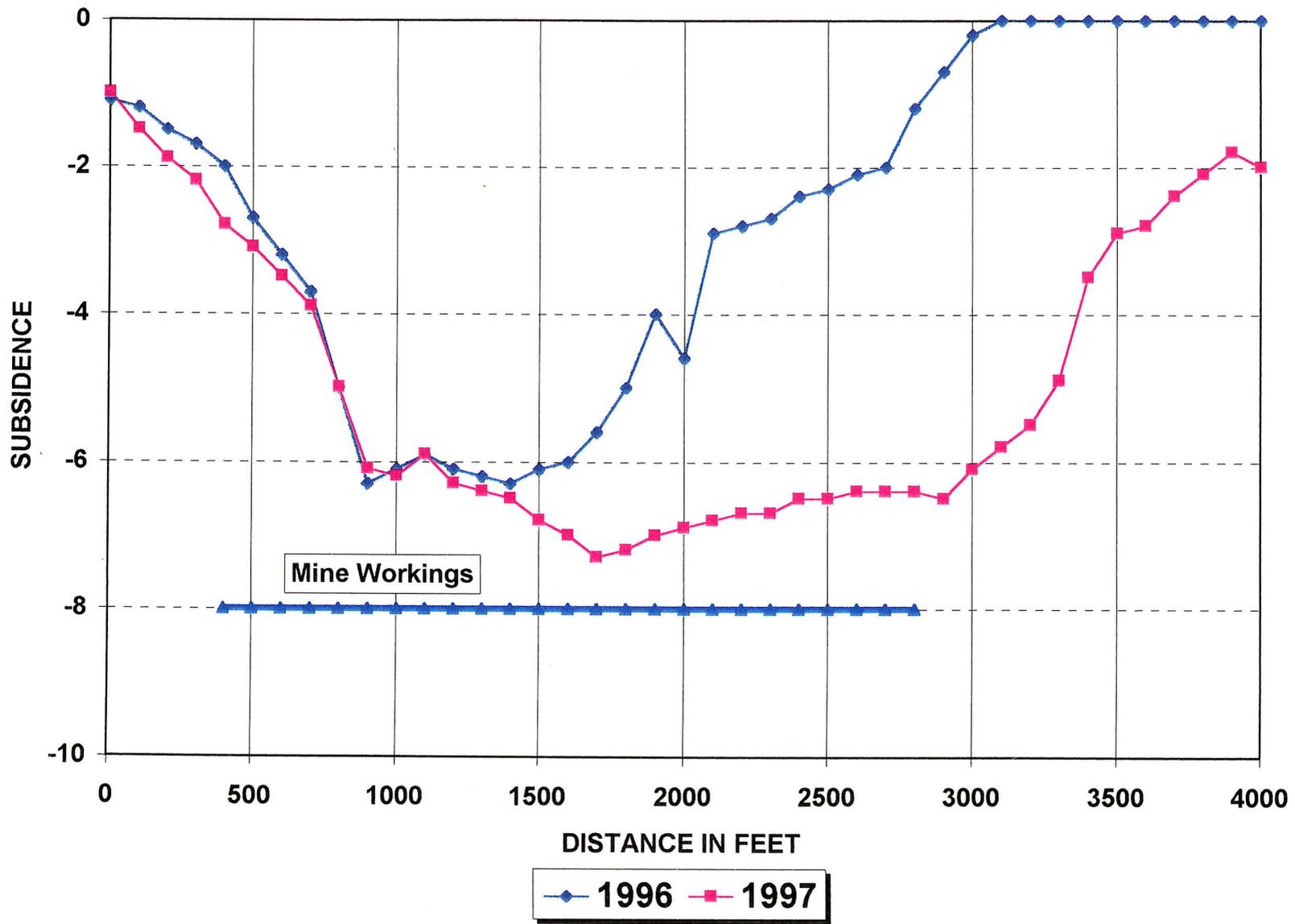
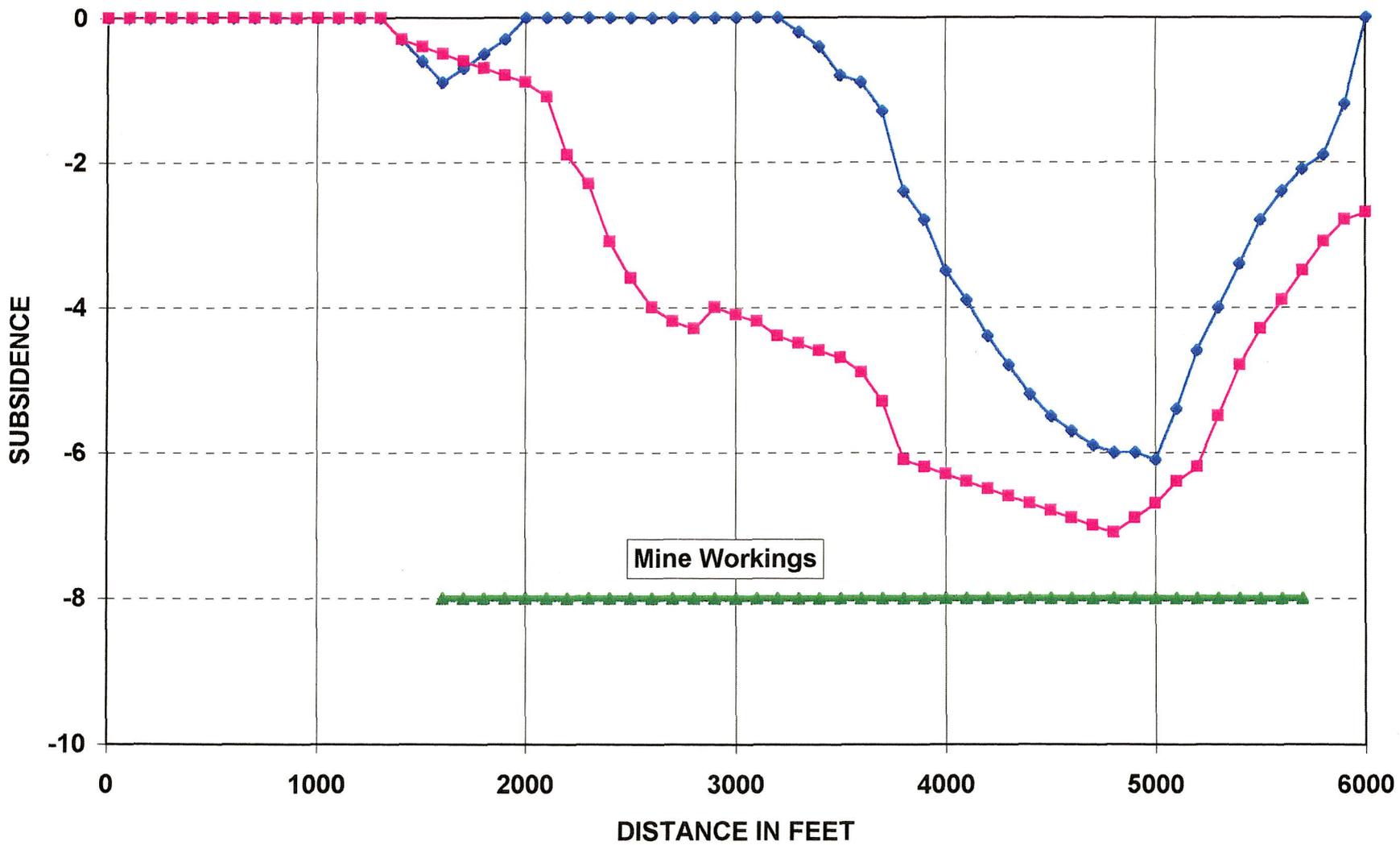


FIGURE 80

Area 23 Subsidence Profile West - East



◆ 1996 ■ 1997

FIGURE 81

AREA 24

TRAIL MOUNTAIN MINE 1ST-10TH RIGHT OFF 5TH LEFT

Mining in the 9th Right panel began in March 1997 and was completed at the end of August 1997. The mining was completed to an average mining height of nine (9) feet.

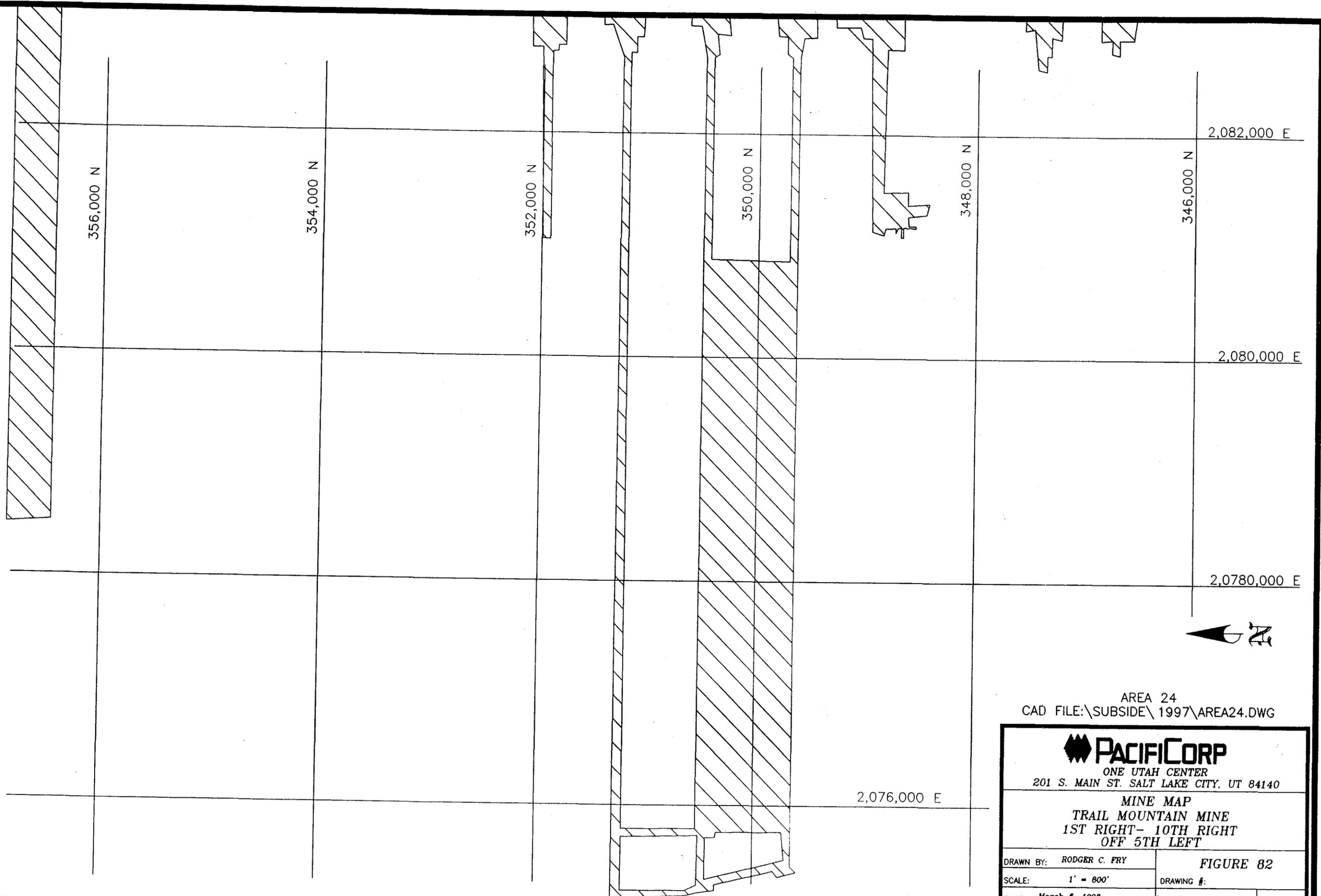
The topography within this mining area is quite variable. Elevations range from less than 7,000 feet in Straight Canyon on the southwest side of the area, where the topography is very rugged, to over 8,800 feet in the northeast portion of the area where the land is gently sloping to the south. The lower elevation areas are heavily vegetated with pinion and juniper trees interspersed with grasses. The higher elevations have stands of spruce and aspen trees separated by areas of sage brush and grasses.

The overburden above the coal seam in this area ranges from less than 1,400 feet in the southwest corner of the area to over 2,200 feet in the northeast corner of the area.

Mining began in the 9th right longwall panel off 5th left in March of 1997 and this panel was completed in late August 1997 (see figure 82). Because of this, at the close of this monitoring period, only one longwall panel had been extracted.

The subsidence monitoring showed that this area has only begun to subside. The maximum subsidence detected was just over two (2) feet (see figures 83, 84 and 85). Most of the area undermined has not begun to subside or has subsided less than one foot. As more panels are extracted, it is expected that the subsidence will increase to well over six feet.

The subsidence that has occurred has not had any effect on the current land use or on the hydrology of the area (see 1997 Annual Hydrologic Monitoring Report).



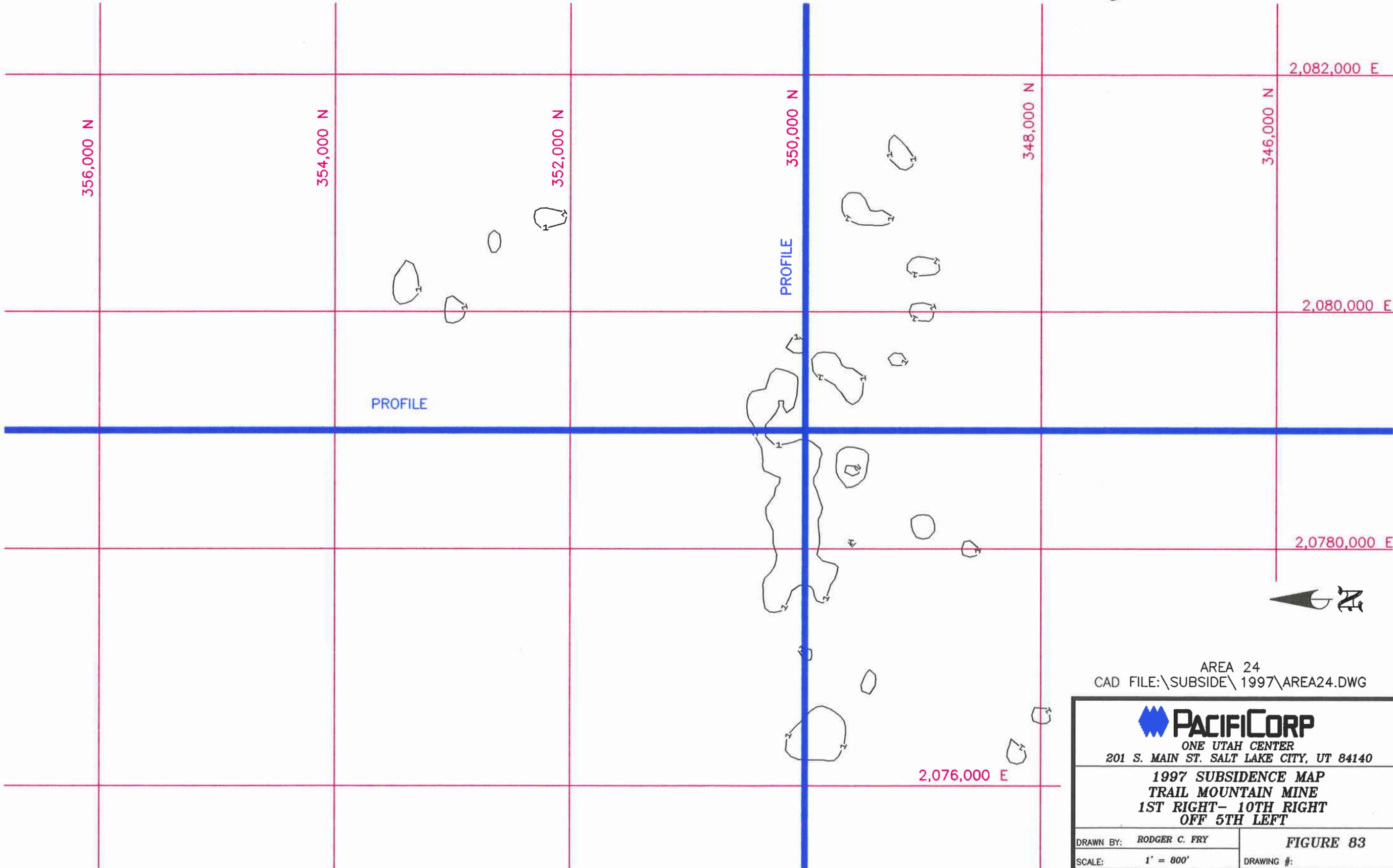
AREA 24
 CAD FILE:\SUBSIDE\1997\AREA24.DWG



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

MINE MAP
 TRAIL MOUNTAIN MINE
 1ST RIGHT- 10TH RIGHT
 OFF 5TH LEFT

DRAWN BY: RODGER C. FRY	FIGURE 82	
SCALE: 1" = 800'	DRAWING #:	
DATE: March 5, 1998	SHEET 1 OF 1	REV.:



AREA 24
 CAD FILE:\SUBSIDE\1997\AREA24.DWG



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

**1997 SUBSIDENCE MAP
 TRAIL MOUNTAIN MINE
 1ST RIGHT- 10TH RIGHT
 OFF 5TH LEFT**

DRAWN BY: RODGER C. FRY	FIGURE 83	
SCALE: 1' = 800'	DRAWING #:	
DATE: March 5, 1998	SHEET 1 OF 1	REV.:

Area 24 Subsidence Profile North - South

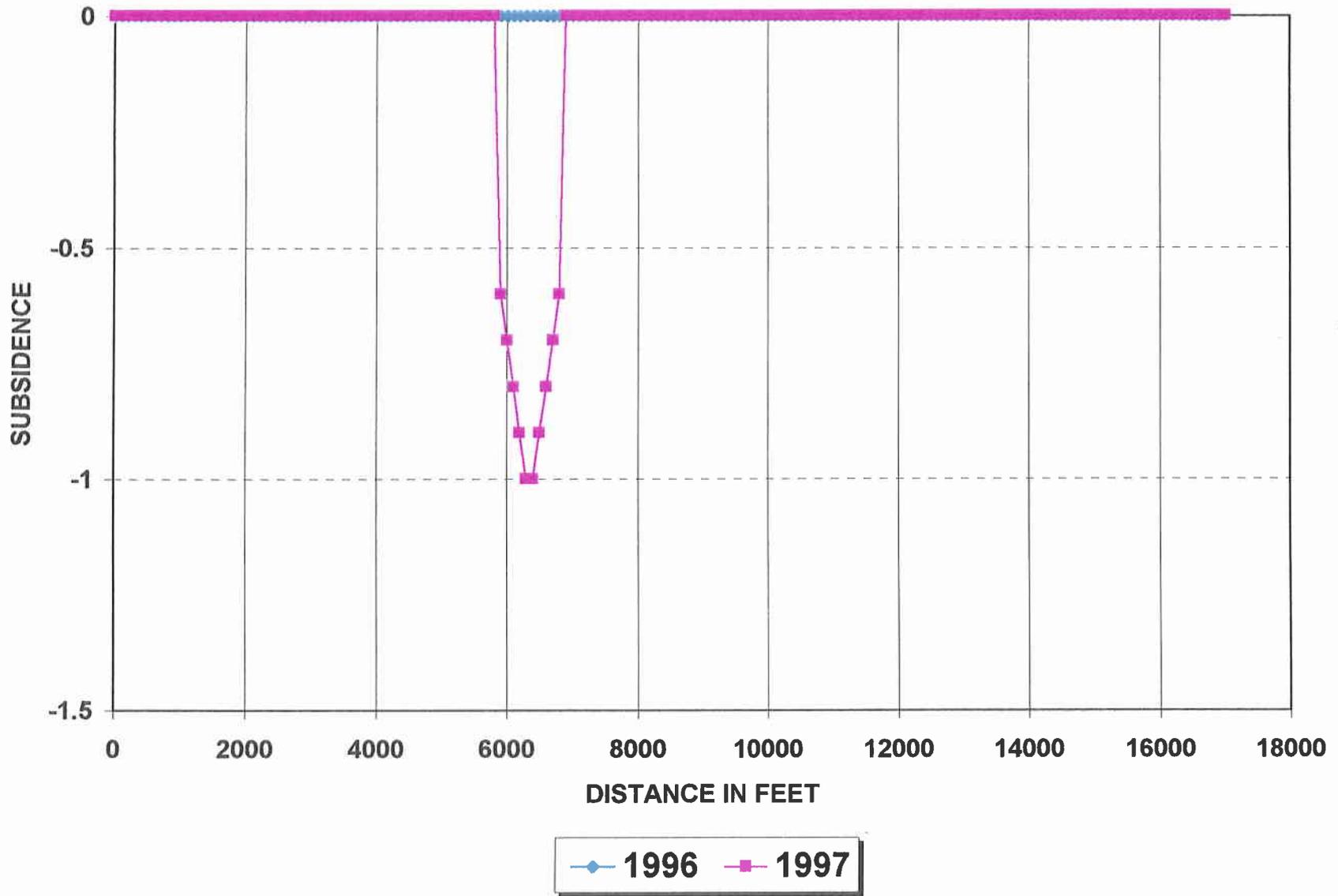
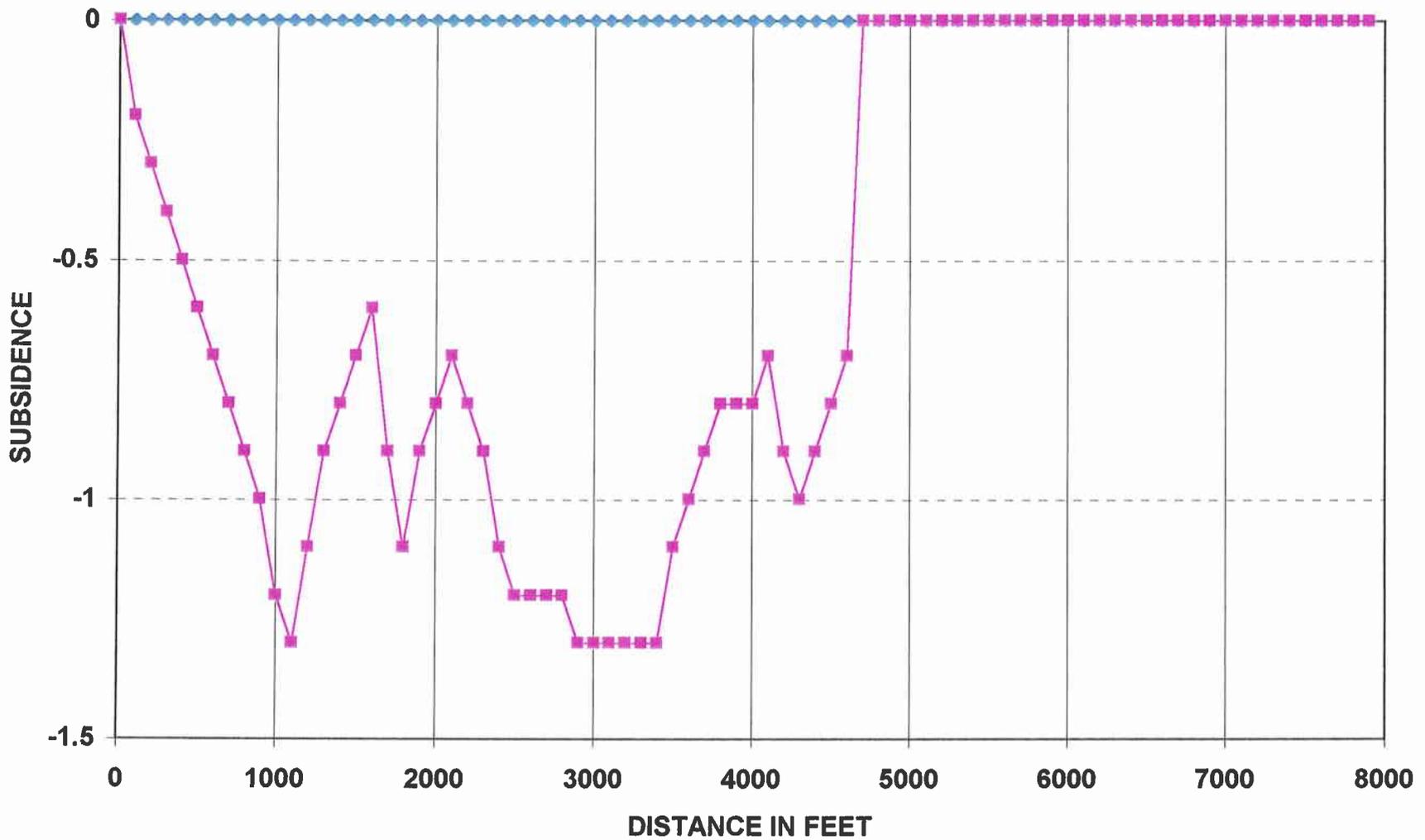


FIGURE 84

Area 24 Subsidence Profile West - East



◆ 1996 ■ 1997

FIGURE 85

Predicted Maximum Subsidence

A comparison between observed and predicted maximum subsidence for the various areas on PacifiCorp's property has been made using a method developed by the British National Coal Board (NCB). 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 $\pm 10\%$ in the majority of cases, assuming certain limiting conditions are met. The table below compares predicted maximum subsidence with observed subsidence for areas on East Mountain.

Area	Subsidence (feet)		
	Predicted Maximum	Observed	% of Predicted
1* DC 9E/W 1R	15.2	28.0	184
2 DC 5-8E/W, 3-13R	13.8	13.1	95
3 DC 1N Area 7.7	7.7	5.5	71
4 DC 2-17R	13.6	13.5	99
5 DC 2-5L	13.5	12.5	93
6 W 1-2W	5.0	4.5	90
7 Bee 2N off 8W	6.6	7.4	112
8 Bee/Des E&W Sections	6.8	4.8	104

Area	Subsidence (feet)		
	Predicted Maximum	Observed	% of Predicted
9 Little Dove 1N	4.3	3.5	81
10 Old American Fuel Mine	7.0	6.1	87
11 DC C&D N	13.7	13.2	96
12 W 2L	1.5	0.0	0
13 Des-Bee-Dove Southern Areas	2.0	1.8	90
14 Cottonwood 6-7E	7.6	4.7	62
15 Cottonwood 9-12W	7.2	5.0	69
16 Cottonwood 8-11E	7.4	4.5	61
17 Cottonwood 16-15 W	8.1	7.2	89
18 Deer Creek 2nd-7th R	7.7	7.2	94
19 Deer Creek 7th & 8th E	7.9	4.5	57
20 Deer Creek 1st & 2nd L	7.8	6.1	79
21 Deer Creek 2nd- 7th E	7.5	7.5	100
22 Deer Creek 2nd-8th W	7.5	8.1	108
23 Trail Mountain 2 nd -5 th E	7.8	8.1	104
24 Trail Mountain 1 st - 10 th Right	7.5	2.1	94

* This area does not fit the NCB prediction model.

In most areas subsidence is less than the maximum predicted by the NCB model. The observed subsidence shown here represents the actual maximum subsidence for the

particular geologic conditions -- probably the case in some areas since subsidence appears to have ceased in several areas where the NCB predicted maxima were not reached. In areas showing greater than expected subsidence, chain pillars or barriers between sections are probably crushing so that strata above the working caves as it would if a wider zone had been mined.

Mitigation of Surface Effects

Prior to mining in an area, we notify the land owner that mining will be in progress beneath his property. The land owners within our permit boundary are as follows:

Karl A. Seely, Inc.

LDS Church

US Forest Service

US Bureau of Land Management

Elk Springs Property Users Assn.

Kent Barton

We will continue to notify those owners prior to undermining their properties.

Over most areas where subsidence has been observed on East Mountain, present land use has not been affected in any way. Areas 2, 5, 6, 8, 9, 10, 12, 13, 15, 16, 17, 18, 19, 20 and 23 are good examples of subsidence without visible surface disturbance or adverse hydrologic effects. In such areas no mitigation is necessary.

In a few areas, such as Areas 1, 3, 4, 7, 10, 11, 14, 21 and 22, surface fractures have been detected. In order to protect livestock PacifiCorp has erected a fence around Area 1 where fractures are of sufficient magnitude to pose a threat to wandering cattle. The large fractures were reclaimed in 1997 and the area was reseeded. In Area 4, the small tension fractures that formed were reclaimed by filling in the fractures using a motor-grader and

reseeding the area. In Area 14, where cracks have also been observed, the U.S. Forest Service has determined that no fencing or other measures are needed unless "significant change" occurs in the area. This area has stabilized and the fractures have closed off.

In Areas 3, 7, 10, 11, 21 and 22 where only minor fracturing has occurred on remote ridges and/or where land use has not been affected, more damage would be done by gaining access to and repairing or fencing fractures than can be justified; therefore, mitigation is counterproductive in those areas and is not planned.

Summary

As of August 1997 PacifiCorp has identified twenty-four (24) areas of mining-induced subsidence on the East Mountain/Trail Mountain property. Terrain in the subsidence areas ranges from relatively flat mountain tops with thick overburden of up to 2,200 feet to steep slopes and cliffs with overburden of less than 200 feet. The most noticeable subsidence effects occur in the steep cliff areas and 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. The sandstones yield to stress by brittle deformation (fracturing).

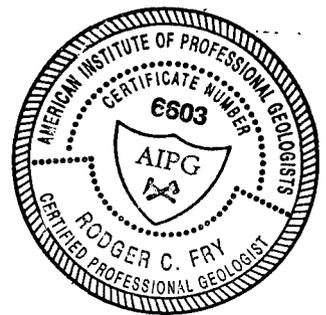
In areas where overburden is thicker and other, more clay-rich formations crop out, longwall and room-and-pillar mining methods have allowed the multiple seam mining of large quantities of coal without apparent impact on the environment because the overburden yields through plastic deformation. Areas such as the Beehive-Deseret east and west room-and-pillar sections (Areas 8 and 13) and the Deer Creek 4th through 8th East-Wilberg 3rd through 13th Right longwall panels (Area 2) have demonstrated that subsidence can occur over a broad area with no visible or hydrologic effects. In excess of eighty percent (80%) of the East Mountain property has conditions similar to those areas; therefore, 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.

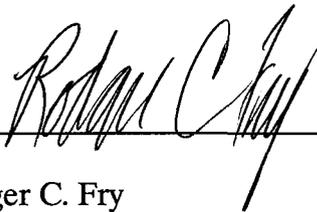
An effort was made again this year to predict maximum possible subsidence for the various areas where subsidence has been detected. The prediction was then compared with observed subsidence for each area. It appears that the actual subsidence occurring on East Mountain/Trail mountain is slightly less than that predicted by the NCB model.

Professional Certification of Subsidence Data

I, Rodger C. Fry being a Certified Professional Geologist, with significant experience in subsidence monitoring, certify that the subsidence data contained in this document was collected under my direction, and the attached subsidence materials were prepared by me using industry-accepted methods. I further certify that the interpretations contained herein are an accurate representation of the subsidence that has occurred.

Dated this 27 day of April, 1997.





Rodger C. Fry

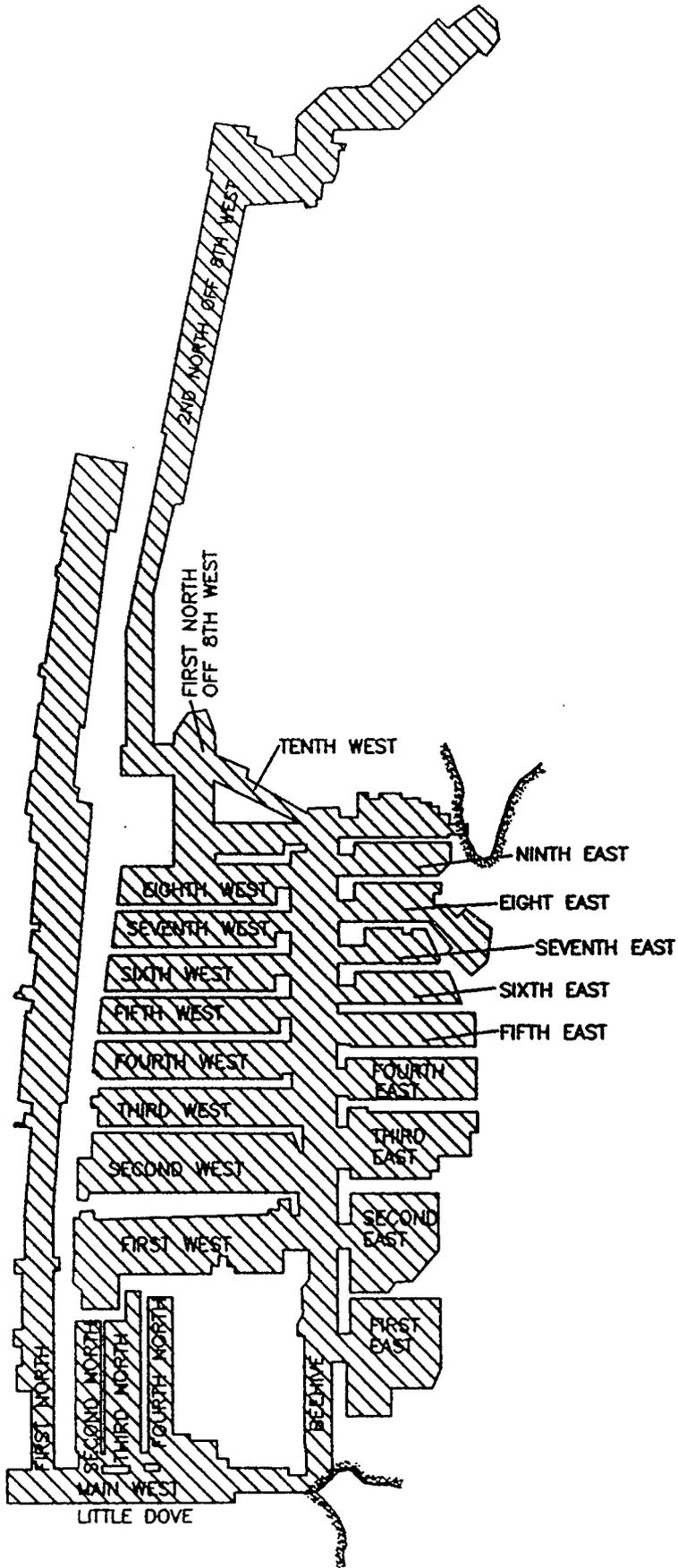
No. 6603

APPENDICES

SUBSIDENCE MAP

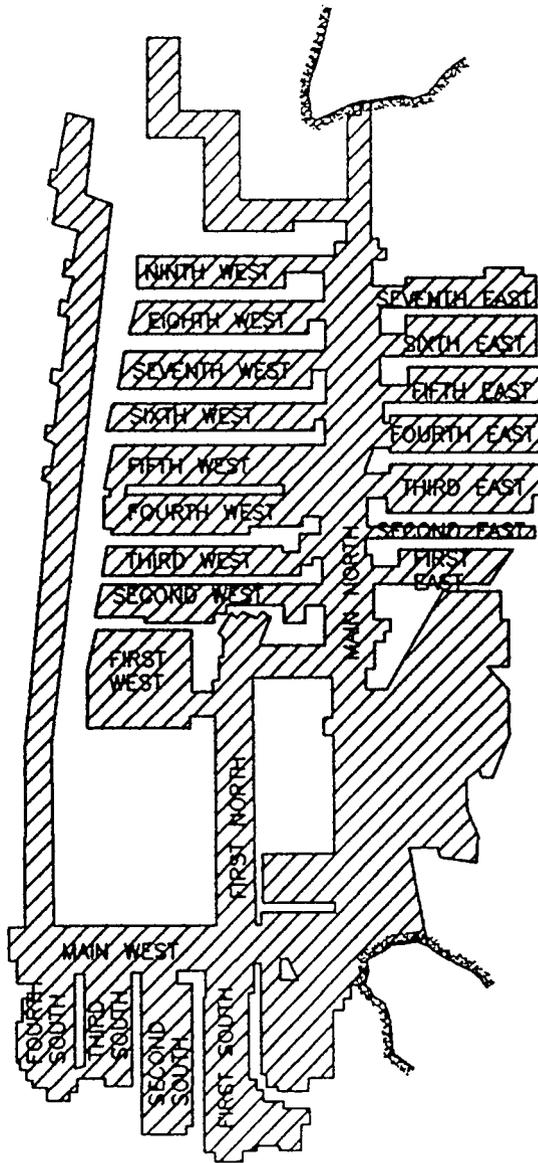
RAW DATA

Des-Bee-Dove Mines



BEEHIVE & LITTLE DOVE COAL MINES

SCALE: 1" = 2,000'



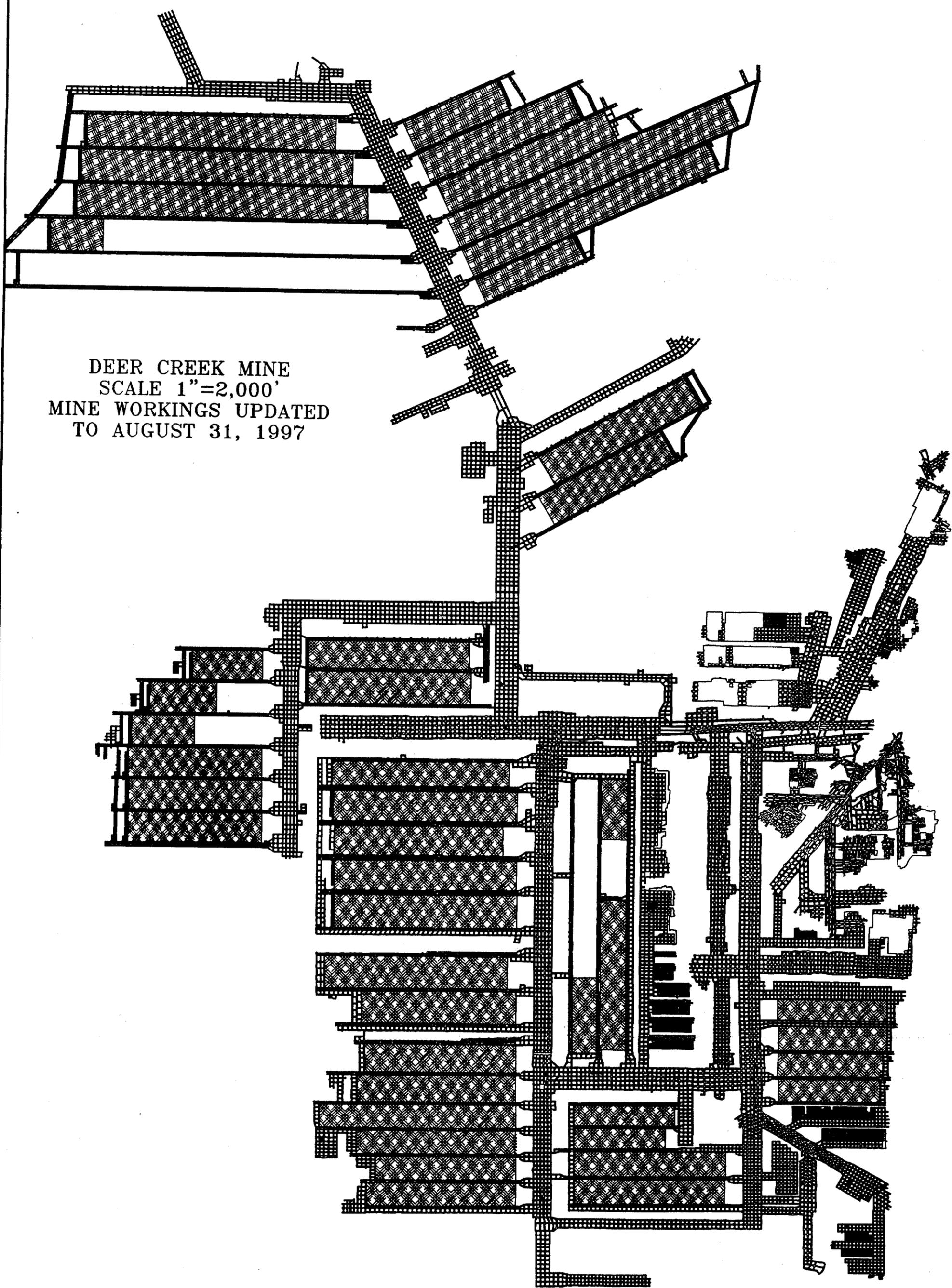
DESERET COAL MINE

SCALE: 1" = 2,000'

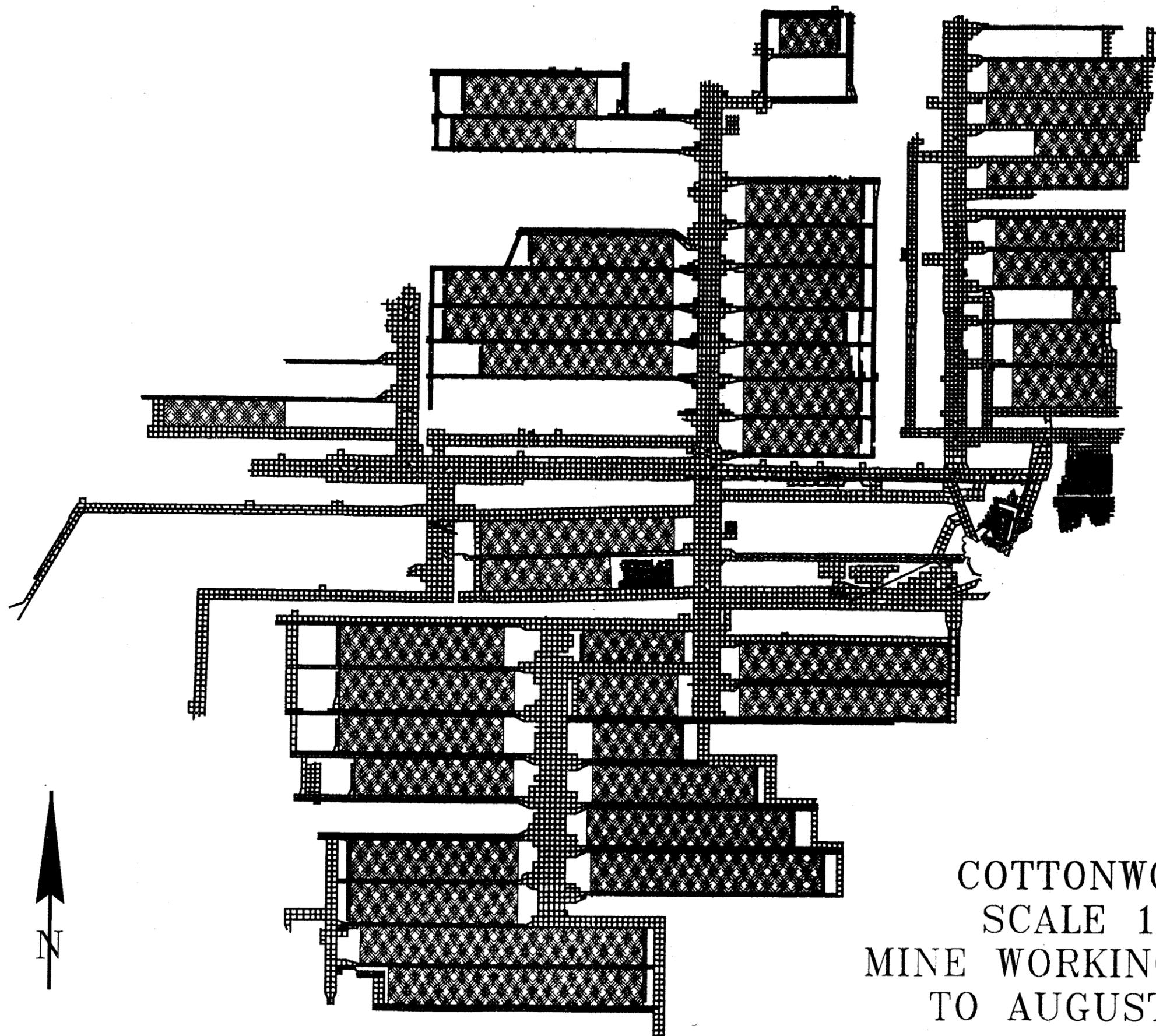


Deer Creek Mine

DEER CREEK MINE
SCALE 1"=2,000'
MINE WORKINGS UPDATED
TO AUGUST 31, 1997



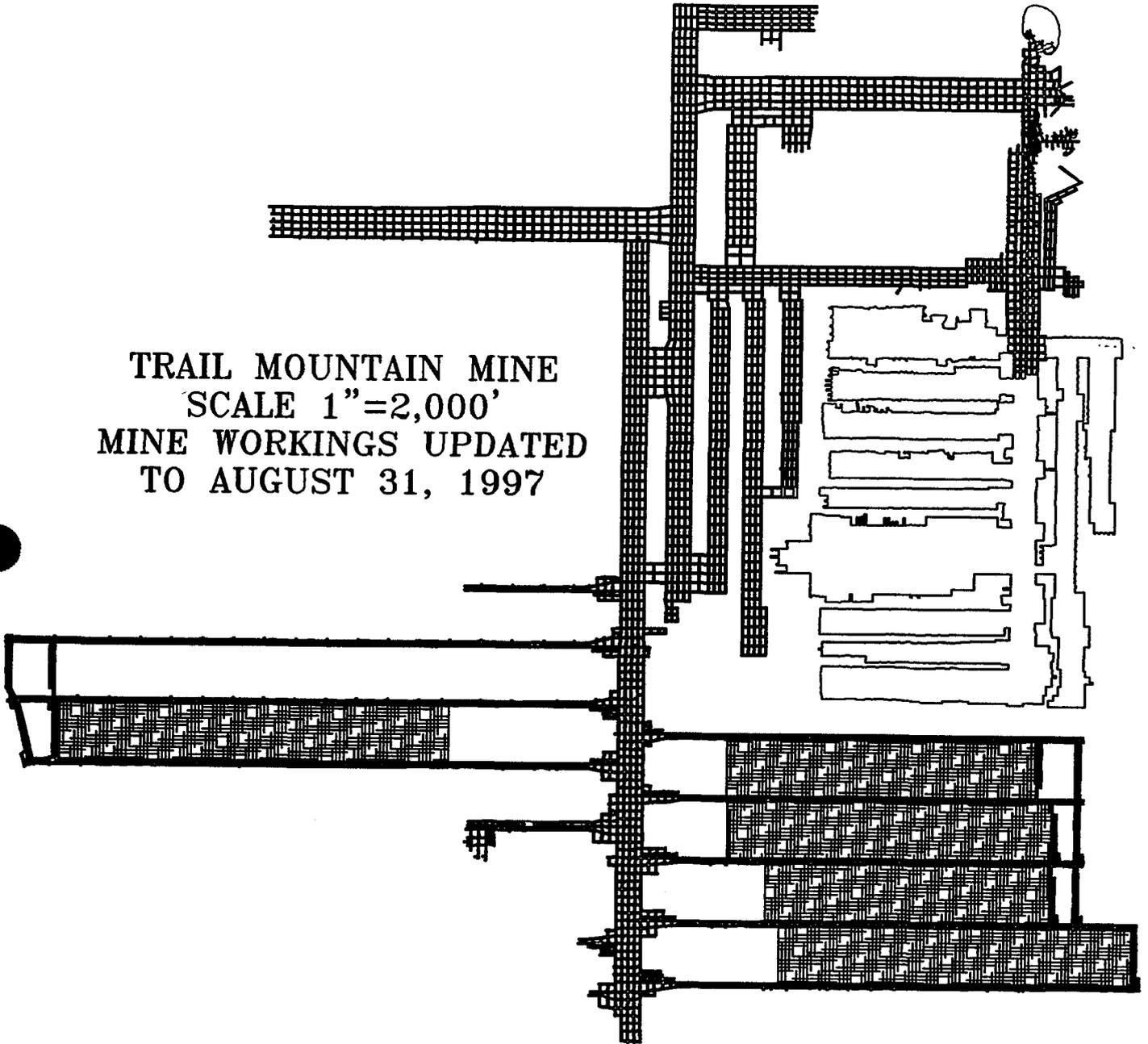
Wilberg/Cottonwood Mine



COTTONWOOD MINE
SCALE 1"=2,000'
MINE WORKINGS UPDATED
TO AUGUST 31, 1996

Trail Mountain Mine

TRAIL MOUNTAIN MINE
SCALE 1"=2,000'
MINE WORKINGS UPDATED
TO AUGUST 31, 1997



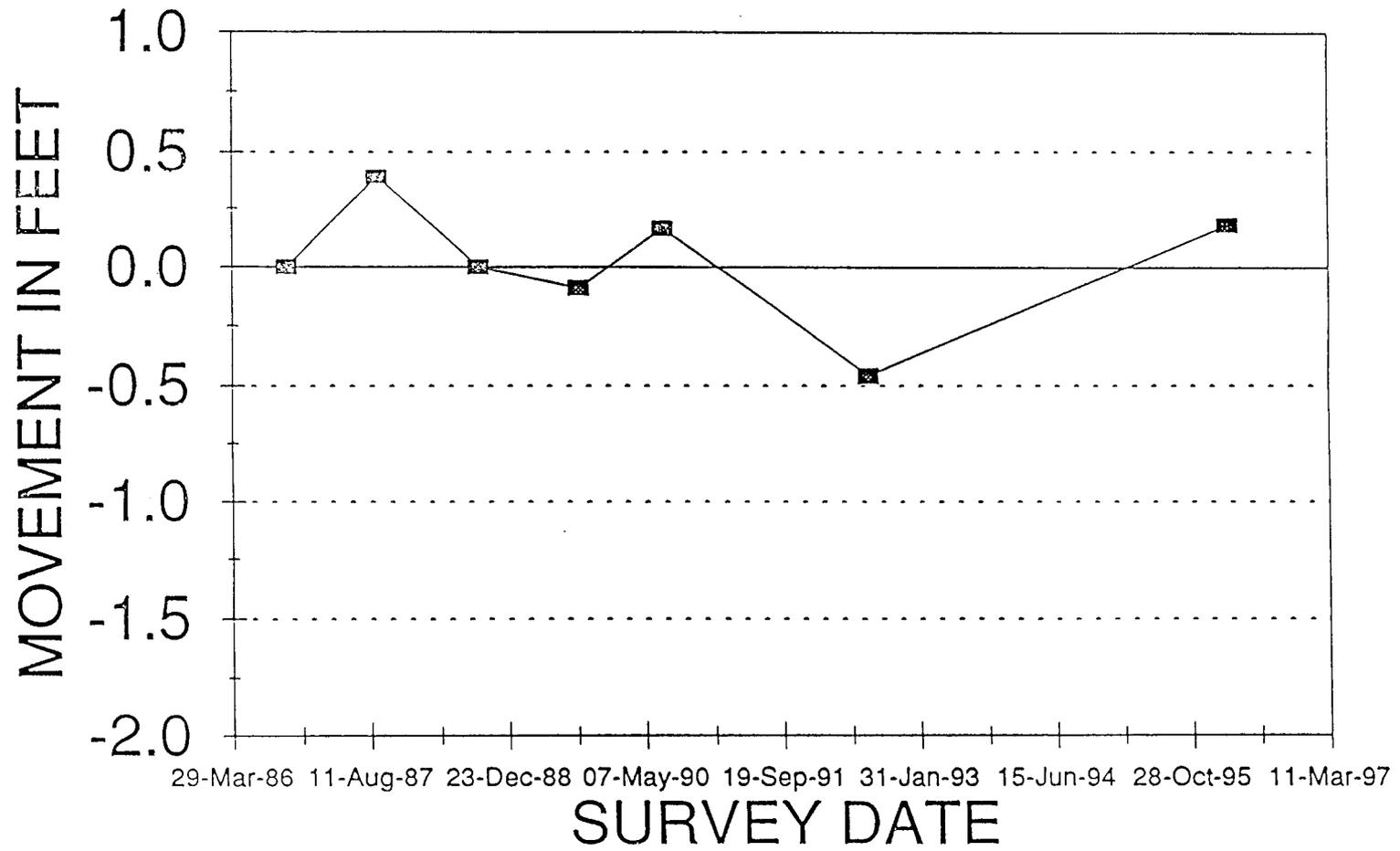
Spring Map with 5-Year Mine Plan

Showing Subsidence

Cliff Stability Survey Targets

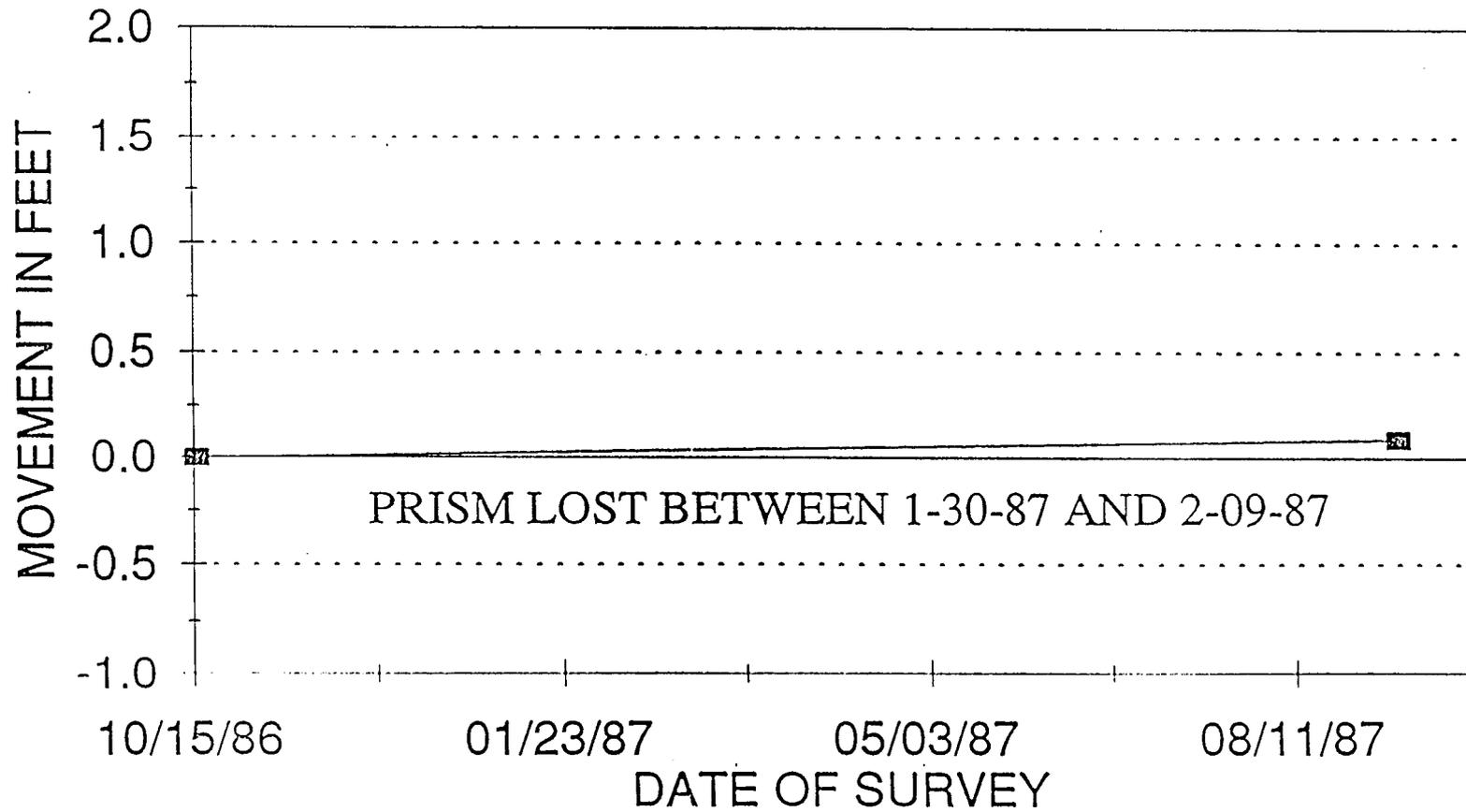
NEWBERRY CANYON

PR-1

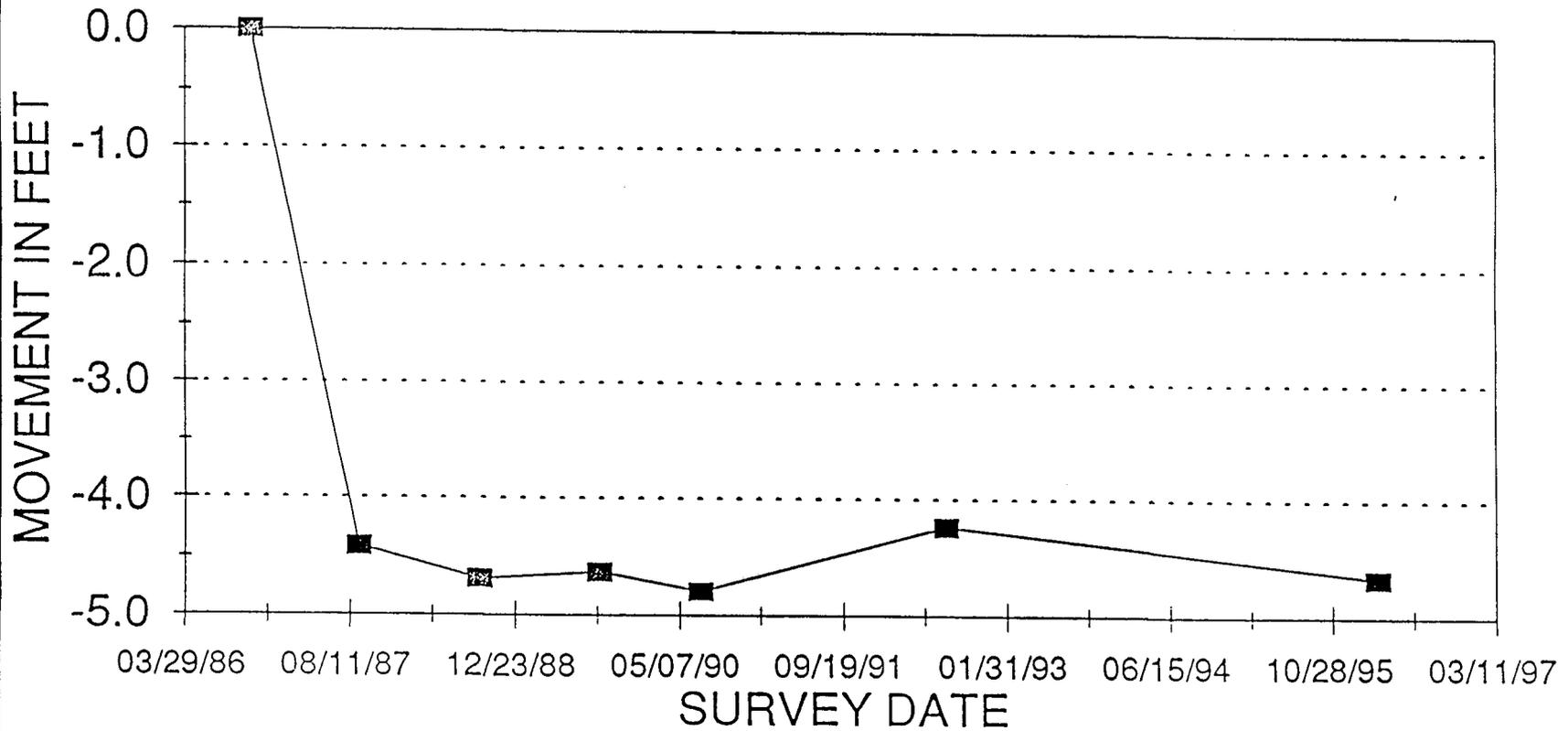


NEWBERRY CANYON

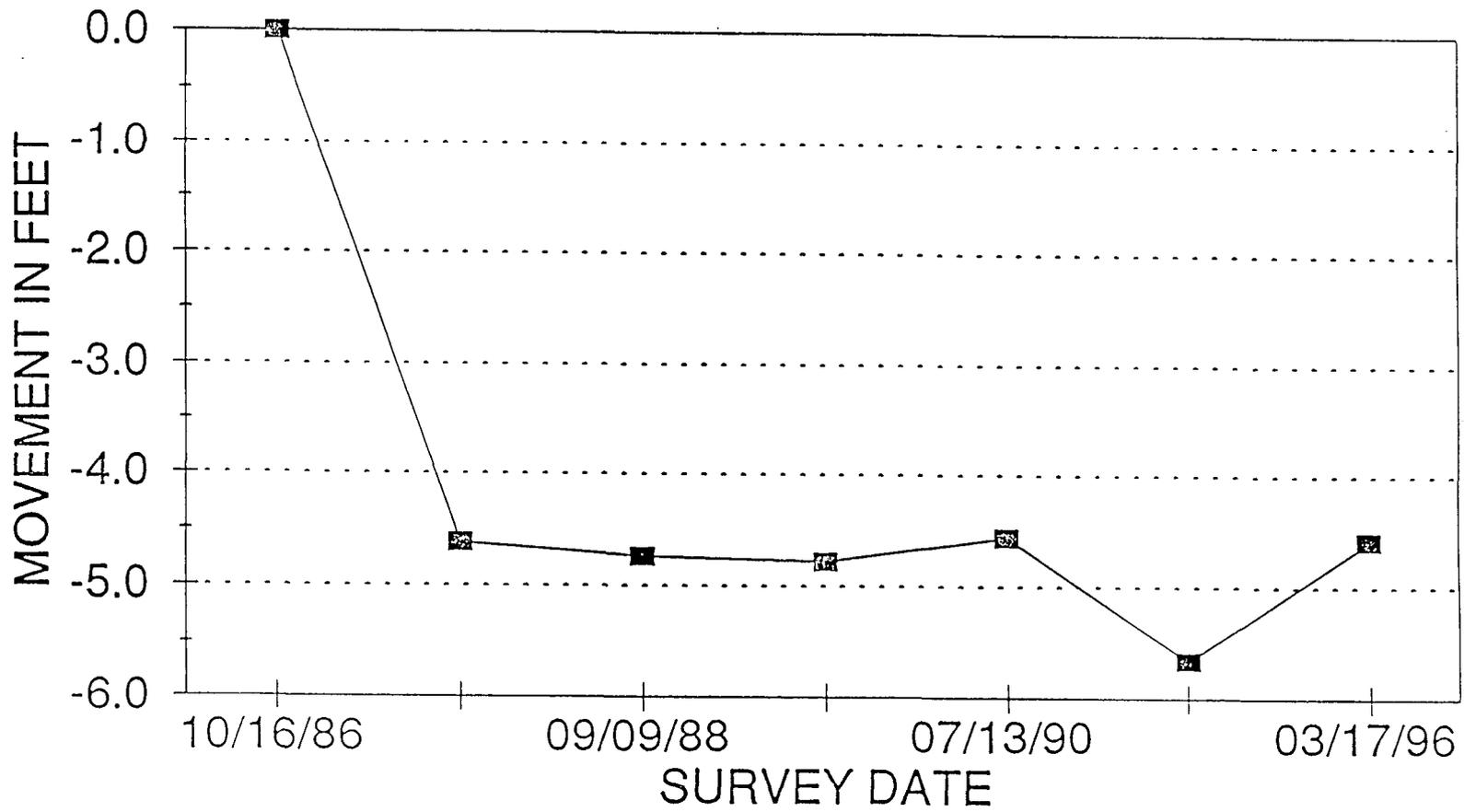
PR-2



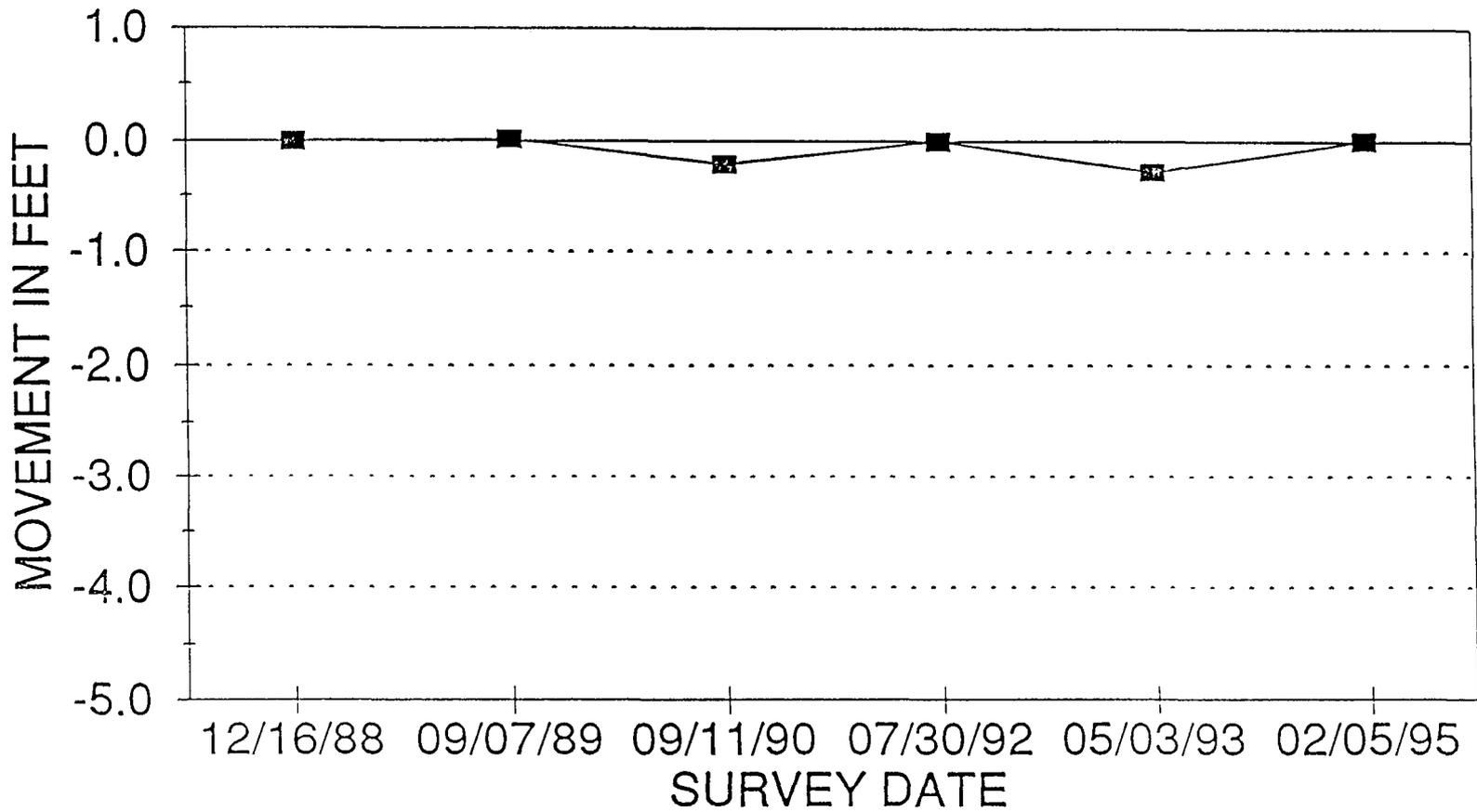
NEWBERRY CANYON PR-3



NEWBERRY CANYON PR-4

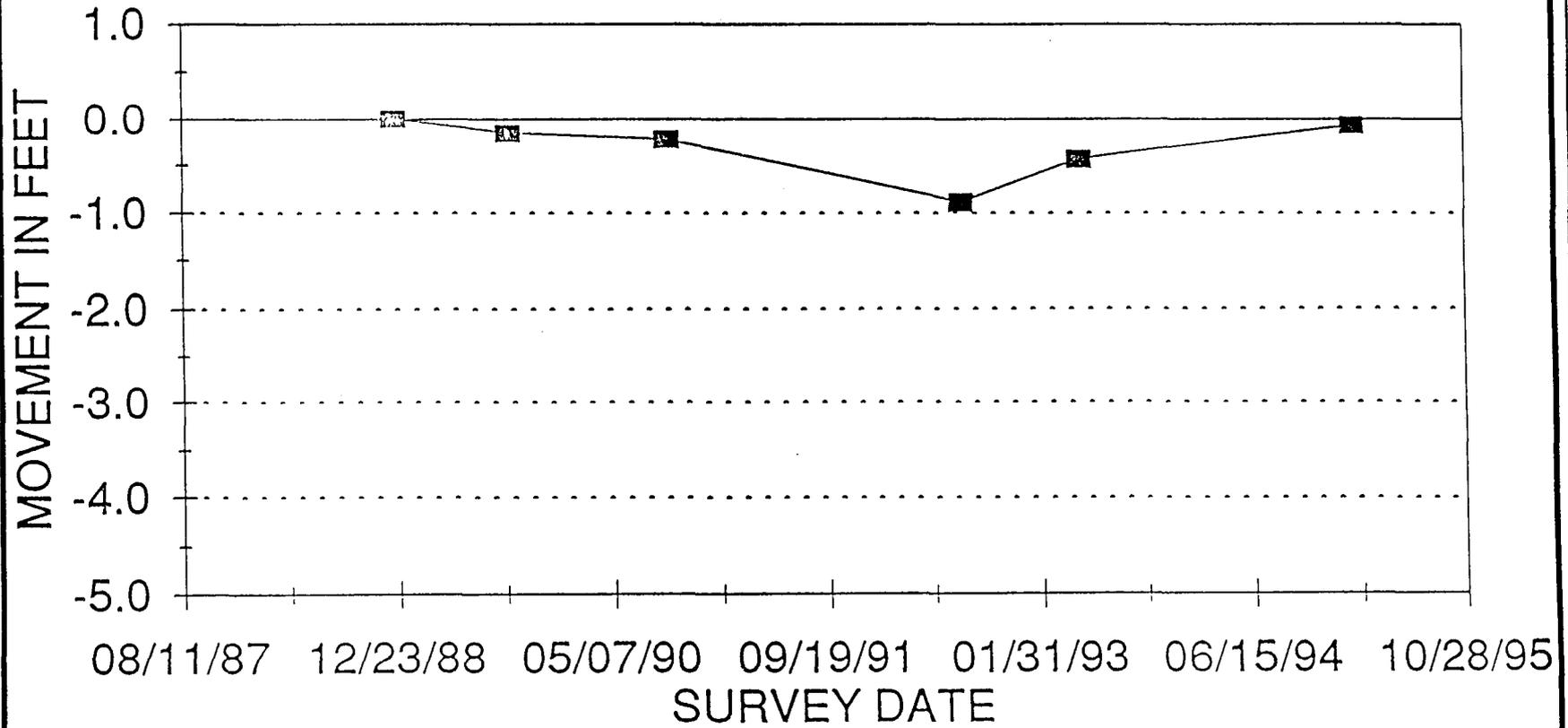


NEWBERRY CANYON PR-5

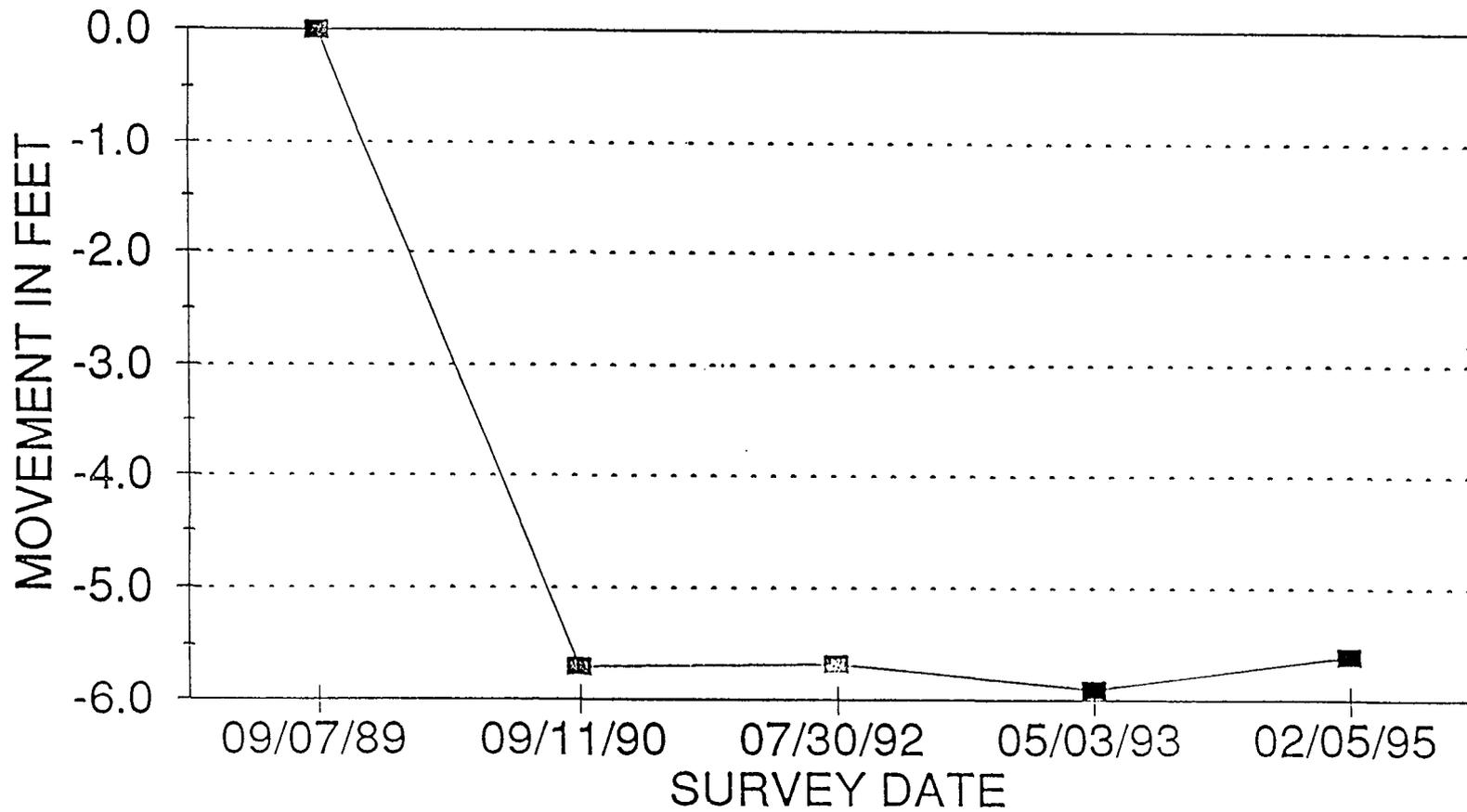


NEWBERRY CANYON

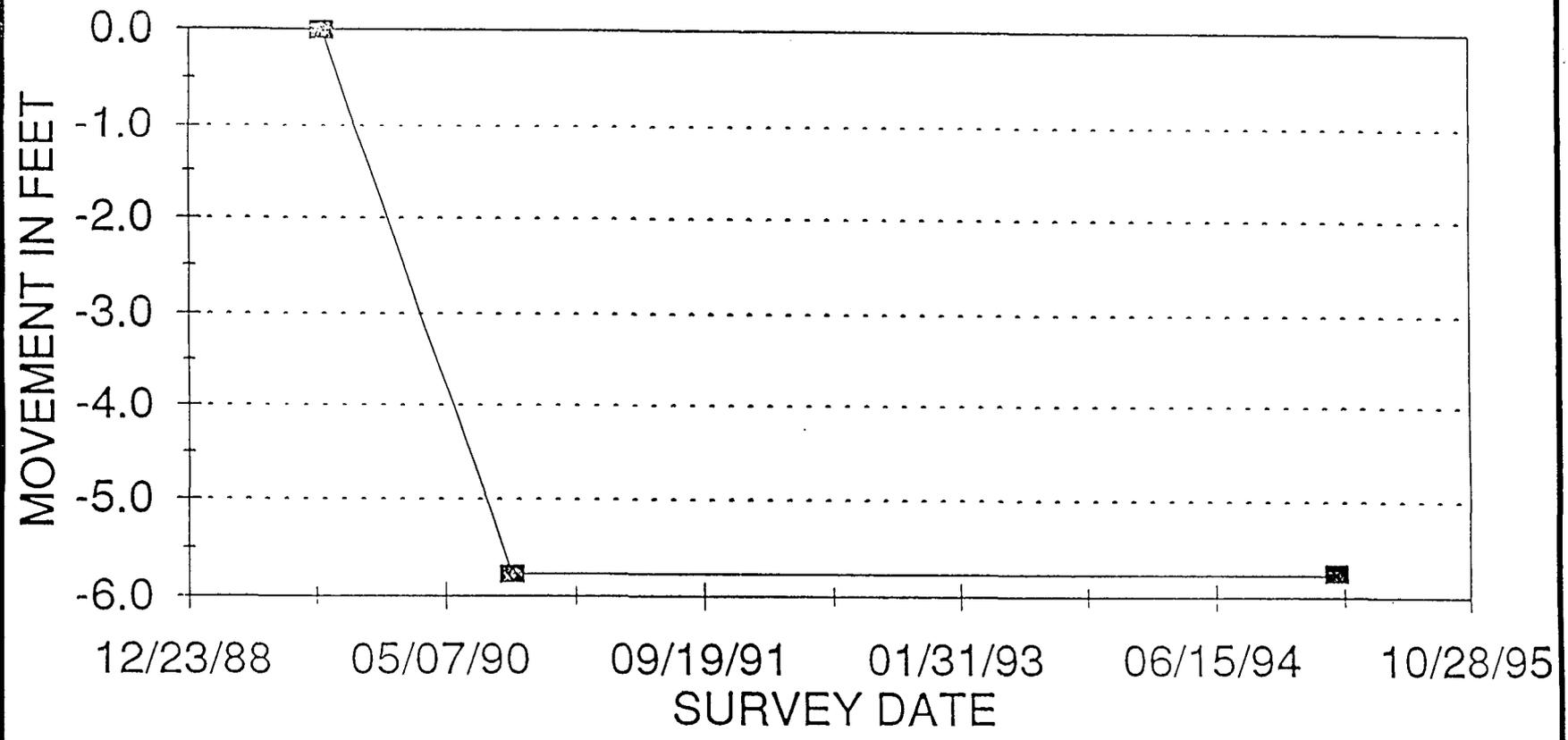
PR-6



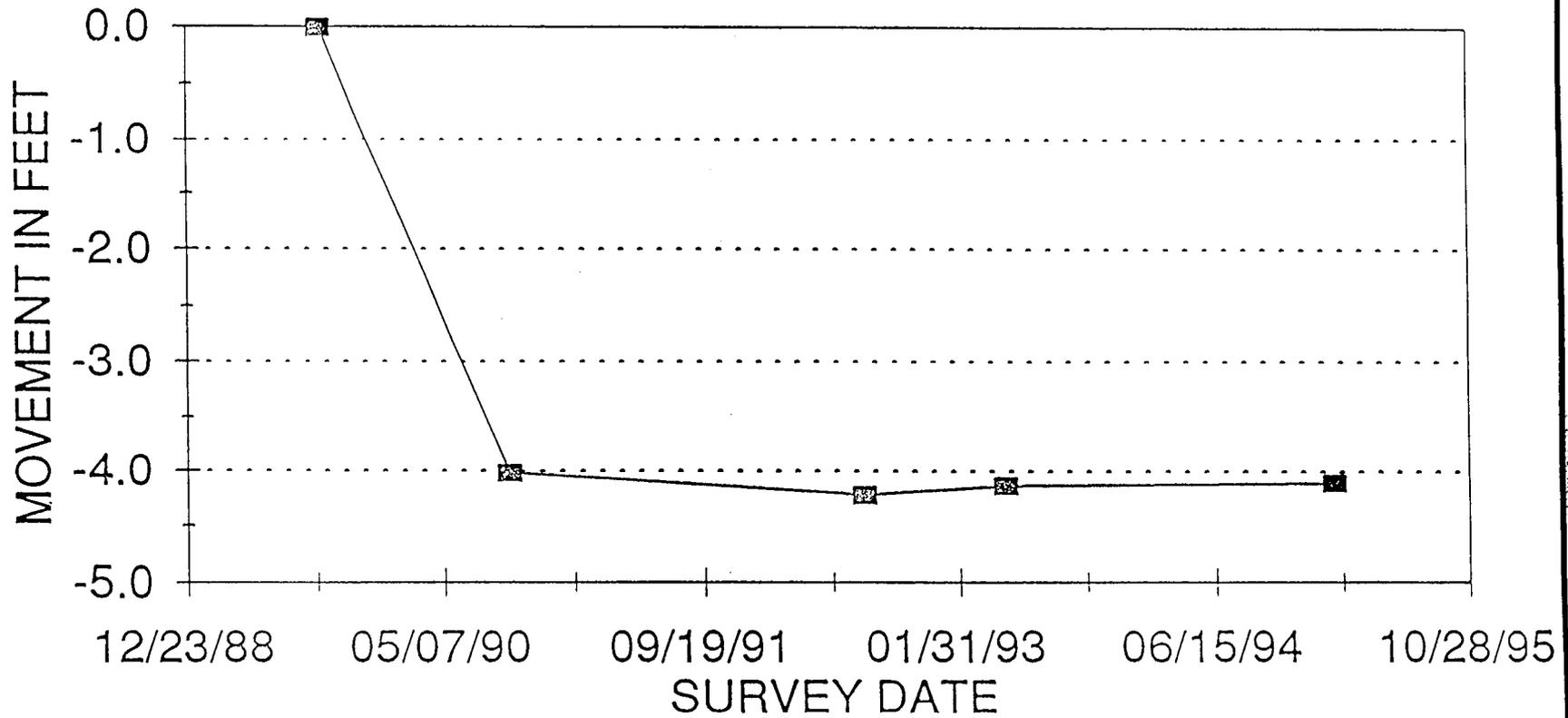
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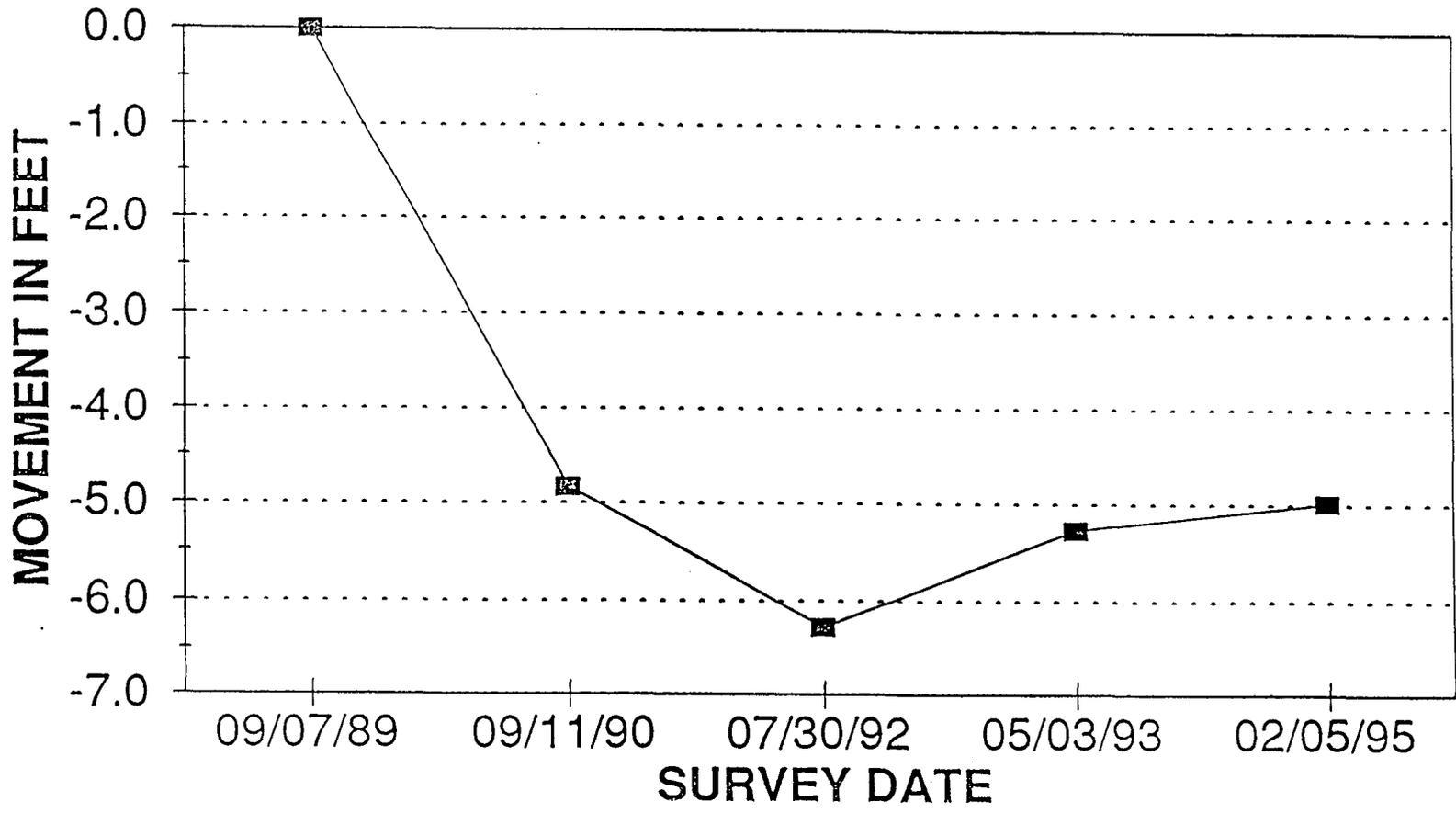
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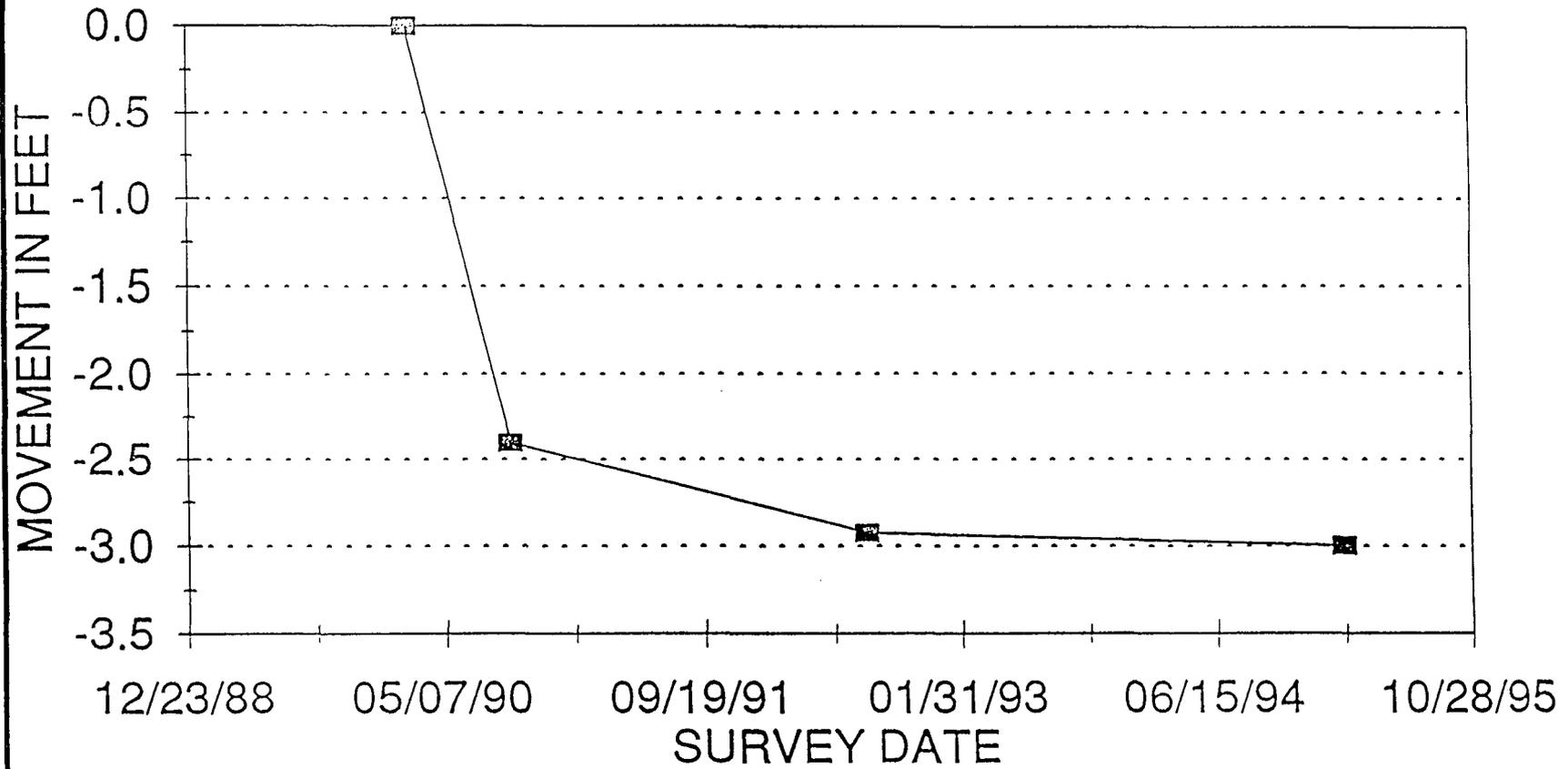
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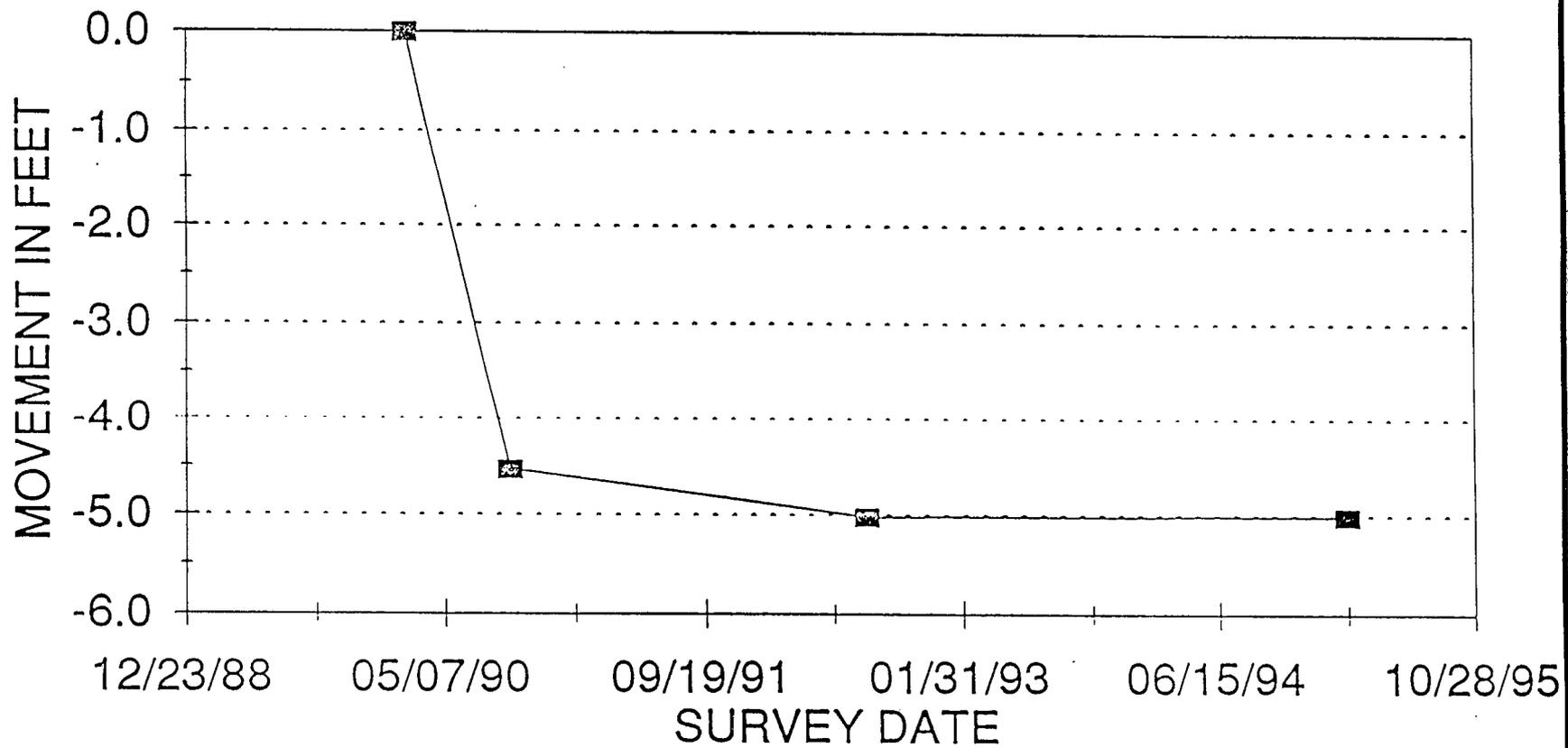
NEWBERRY CANYON PR-10



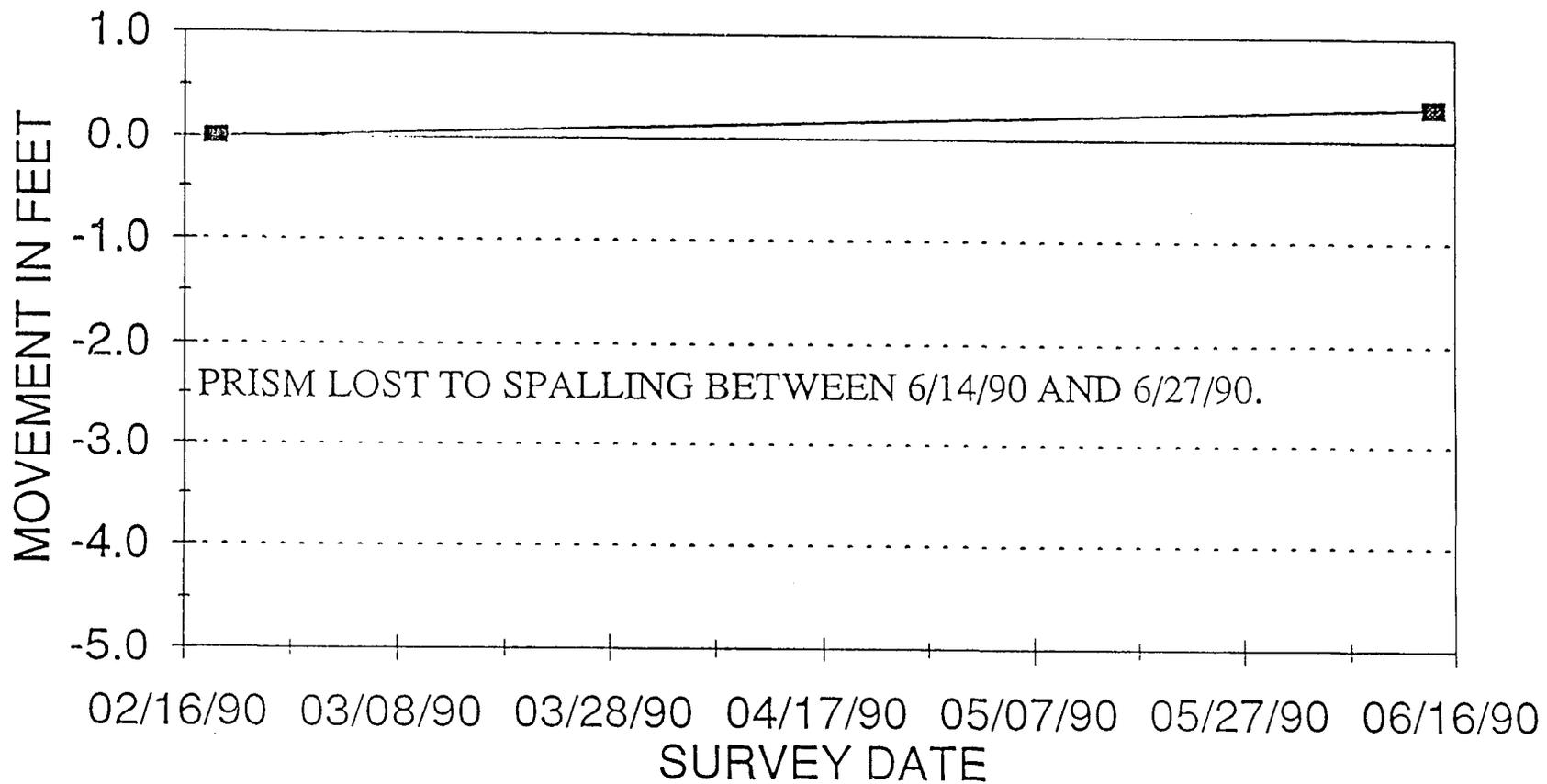
CORNCOB WASH PR-11



CORNCOB WASH PR-12

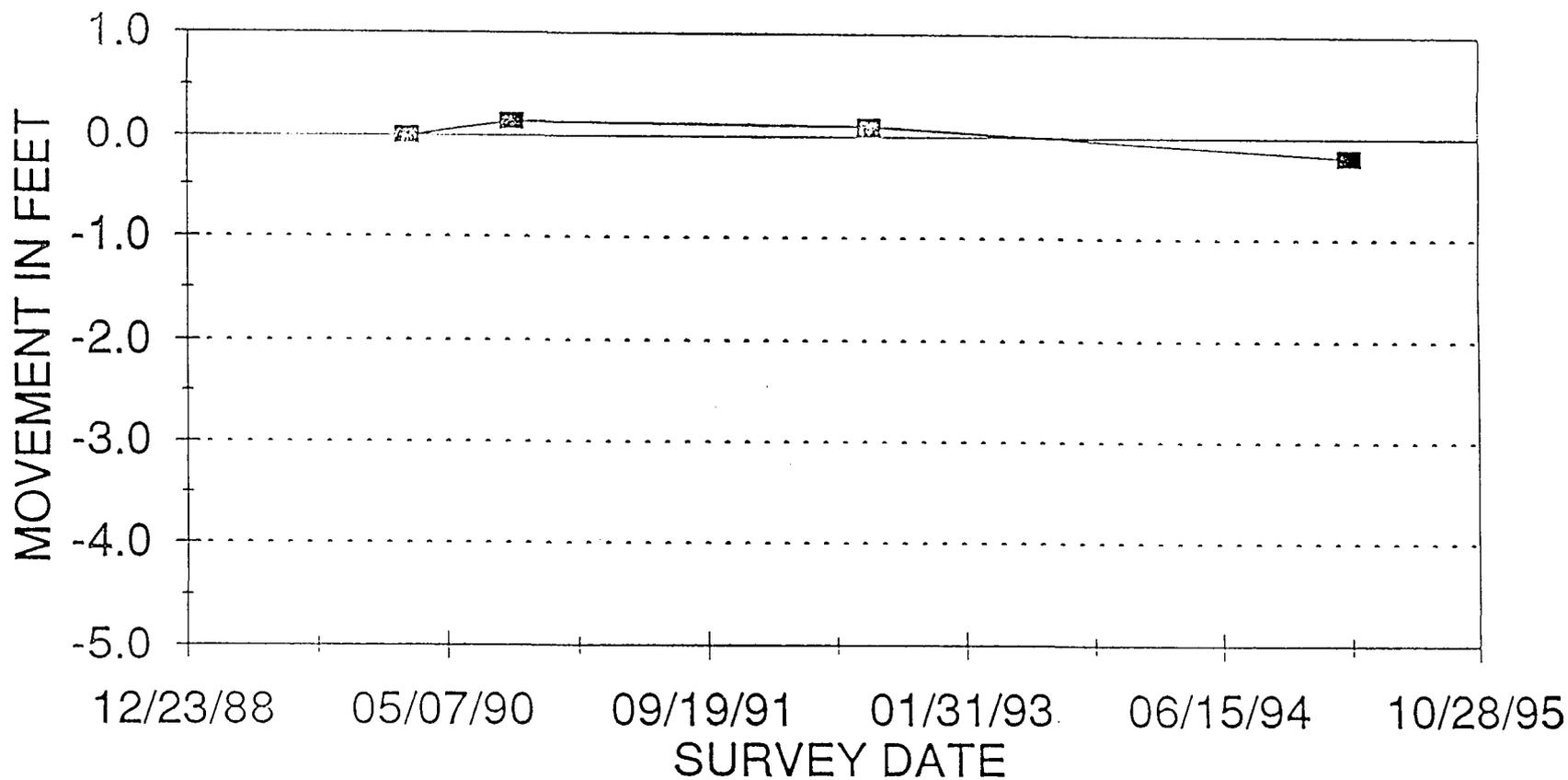


CORNCOB WASH PR-13

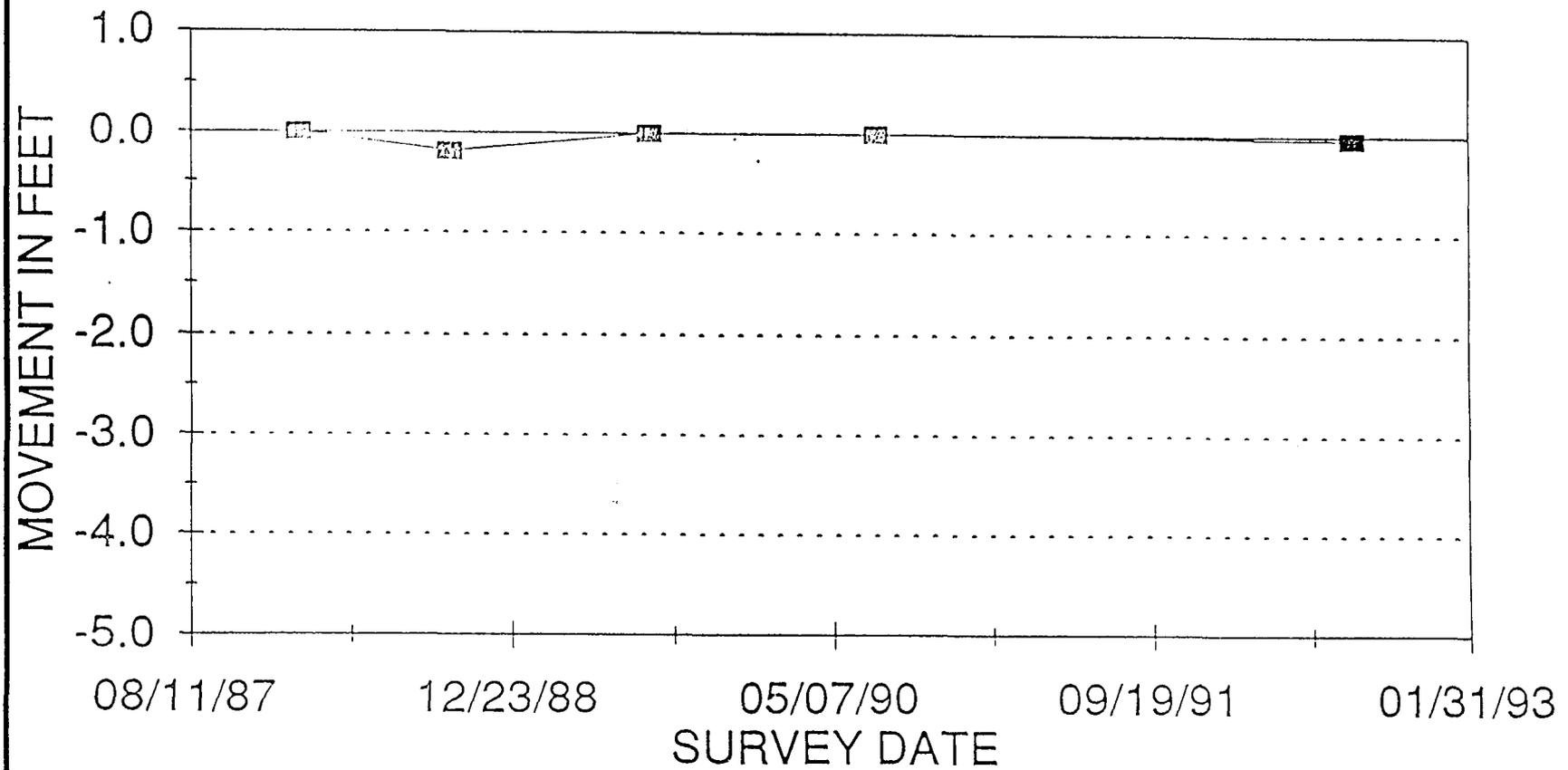


CORNCOB WASH

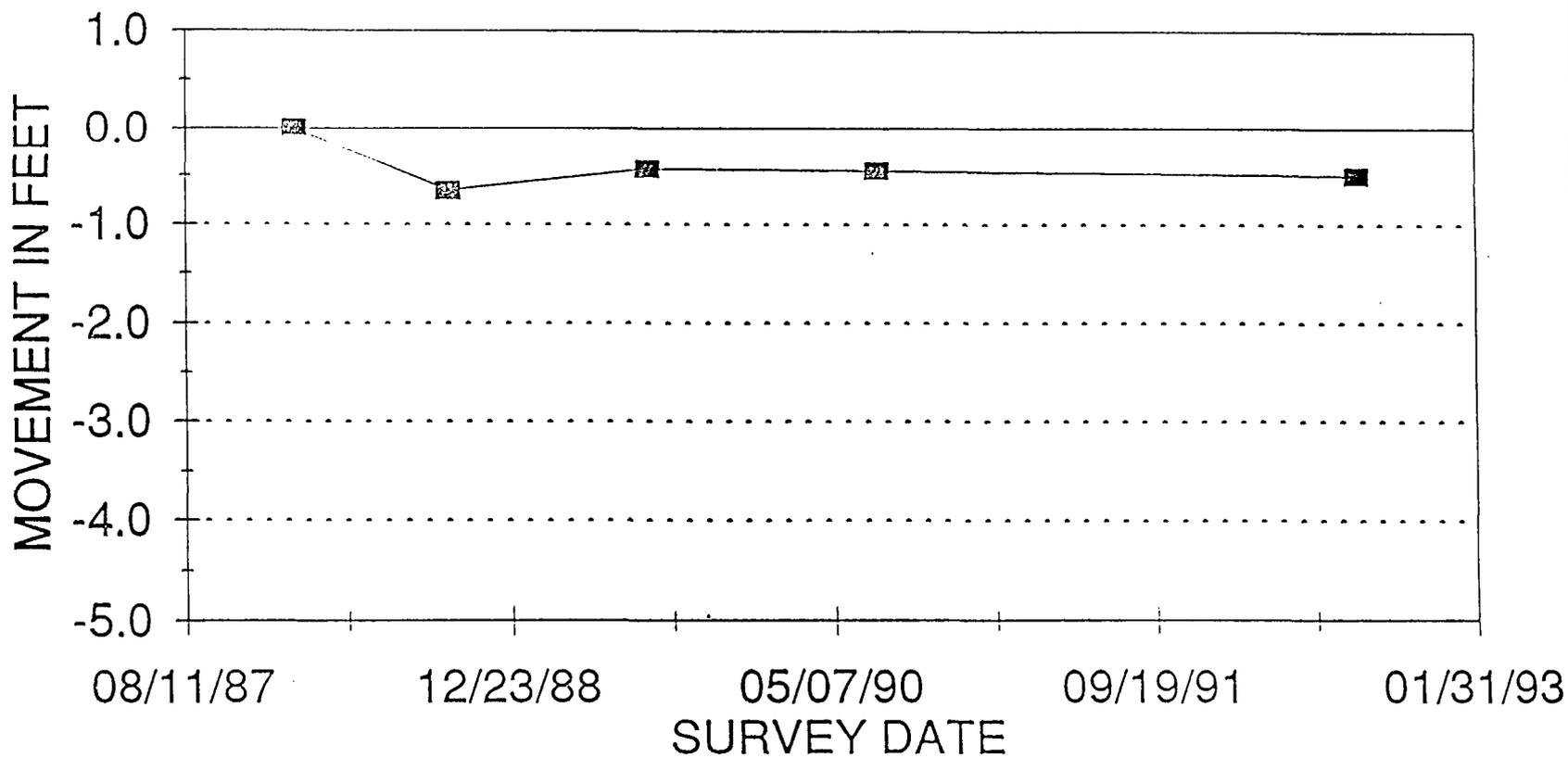
PR-14



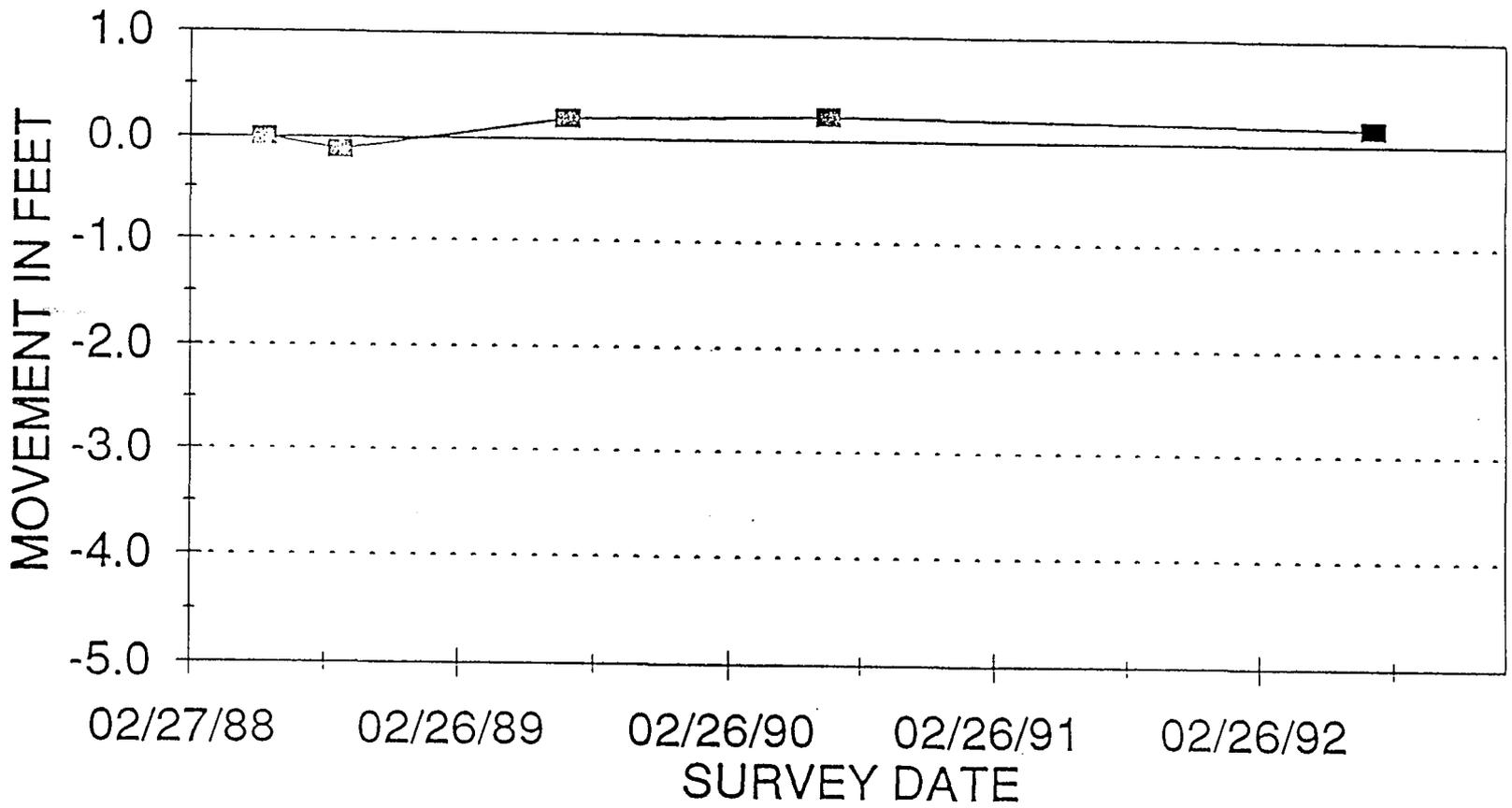
MILLER CANYON PR-1



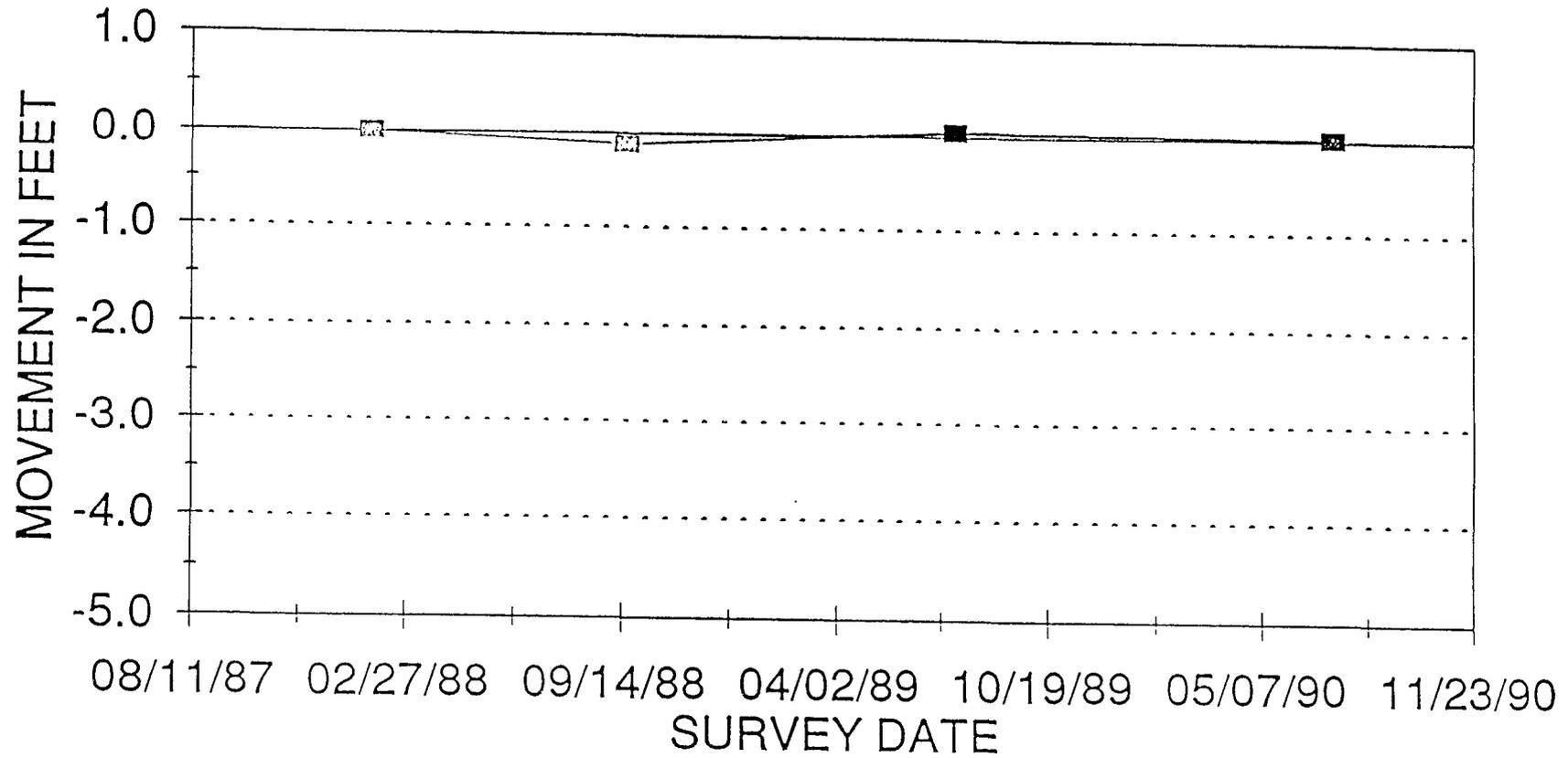
MILLER CANYON PR-2



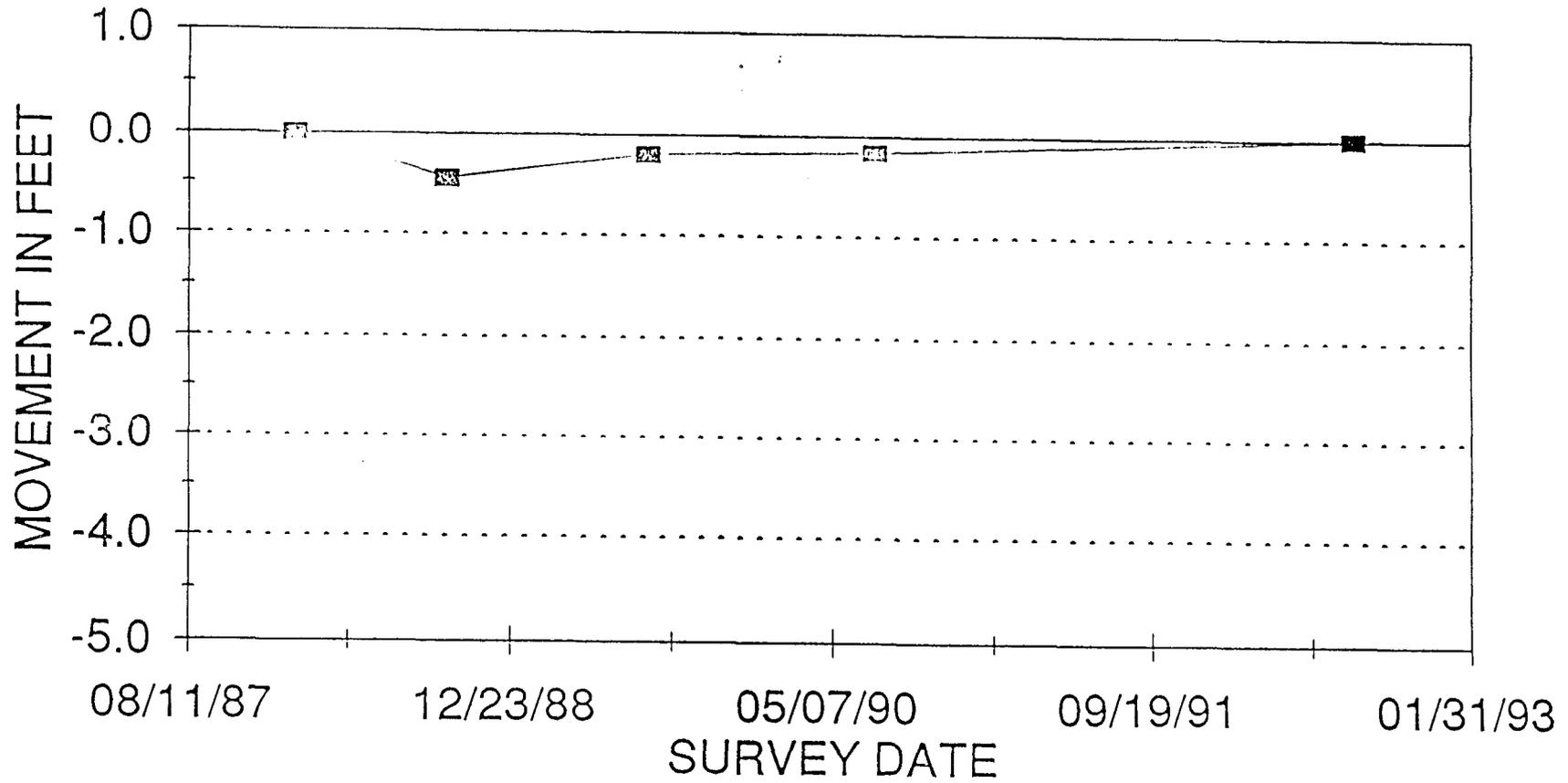
MILLER CANYON PR-3



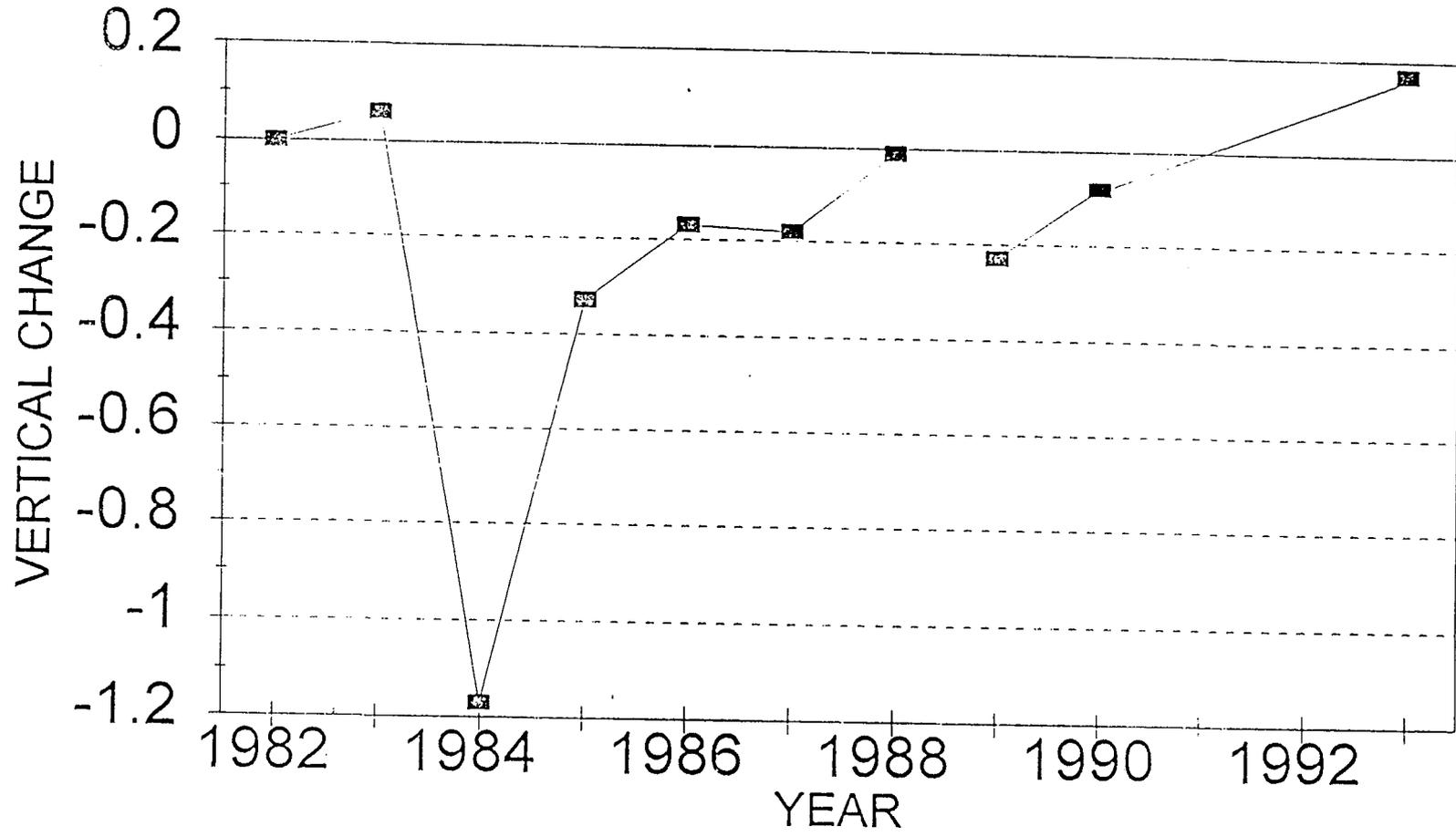
MILLER CANYON PR-4



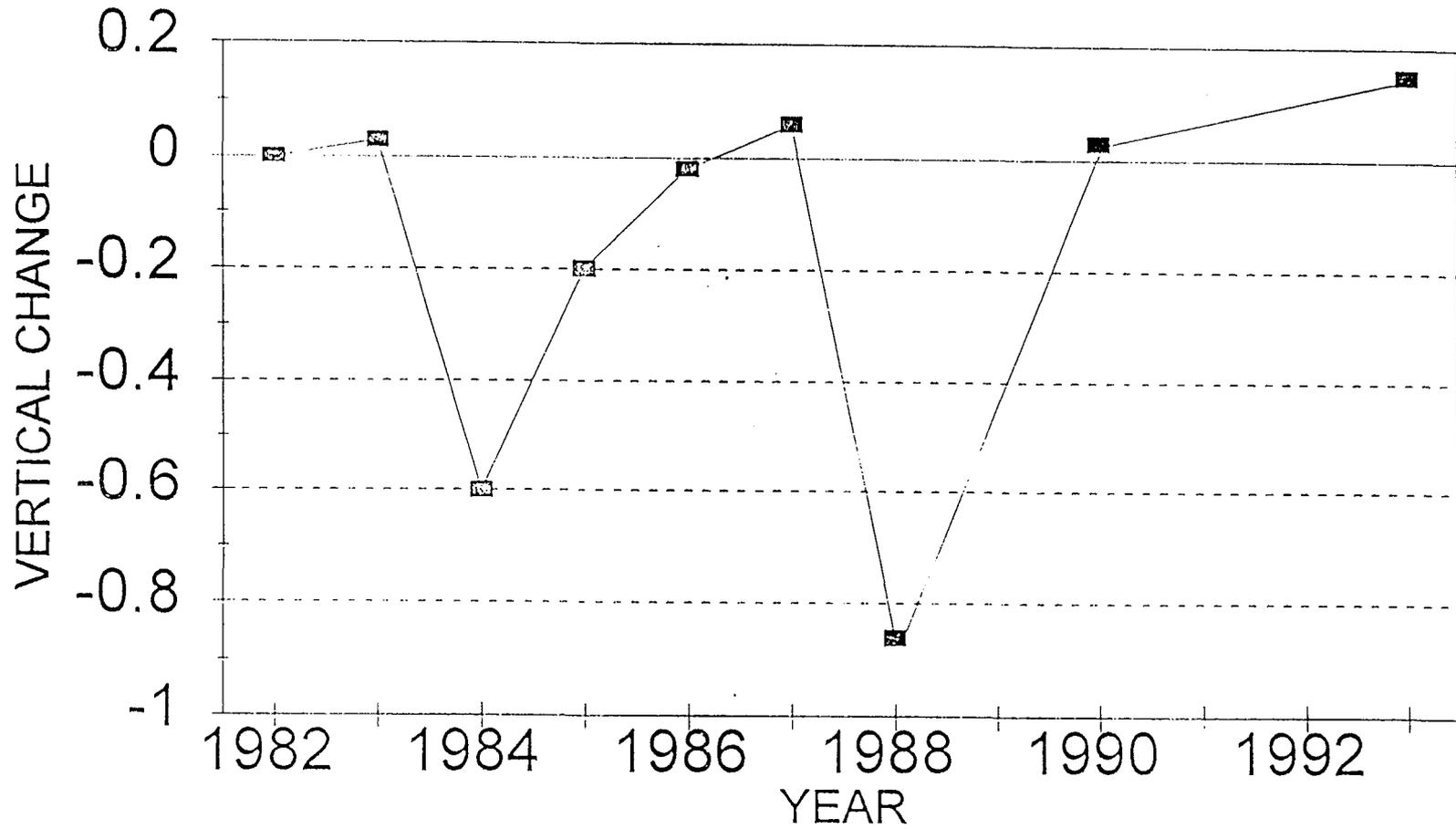
MILLER CANYON PR-5



GRIMES WASH PRISM 1

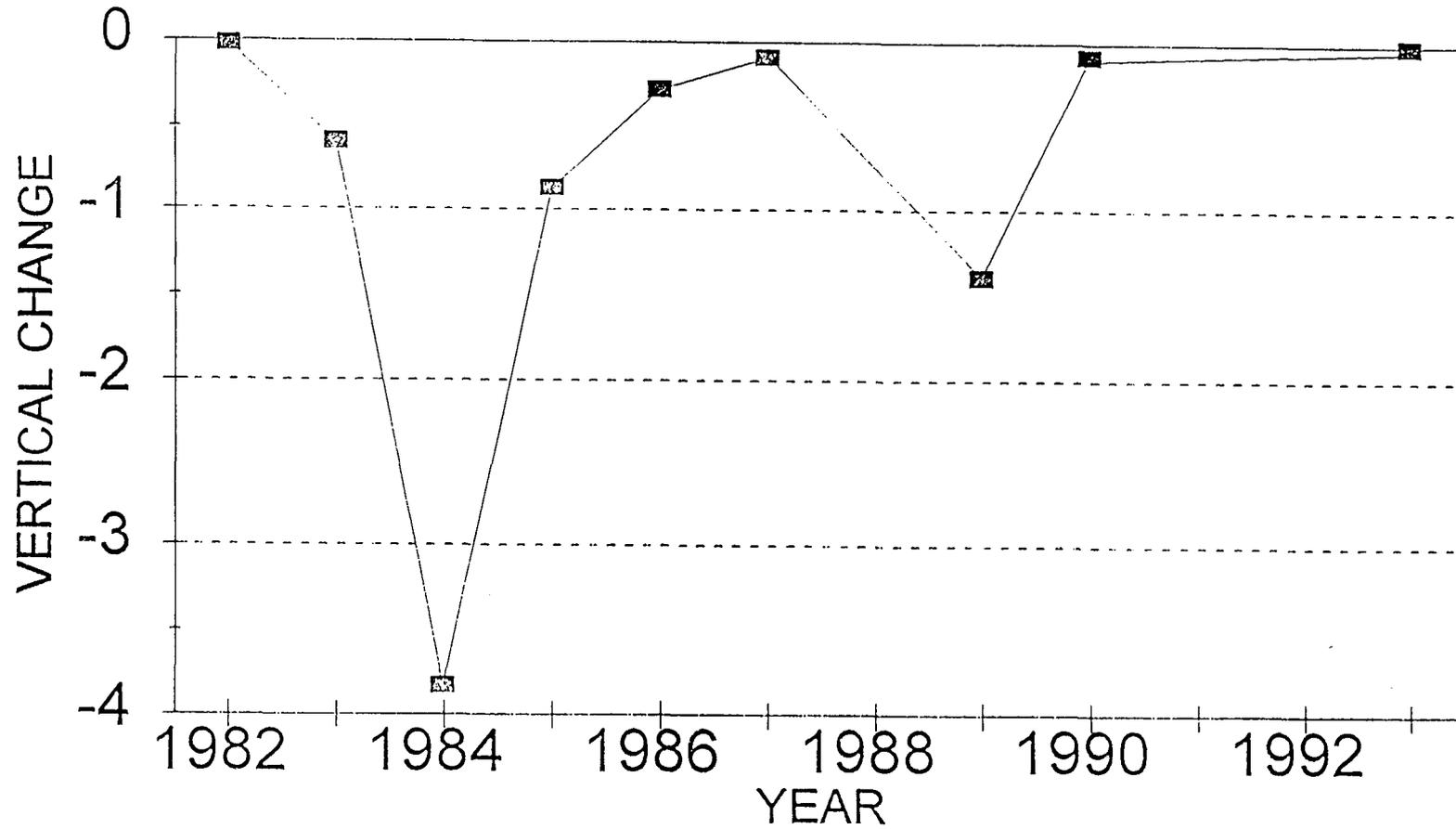


GRIMES WASH PRISM 2

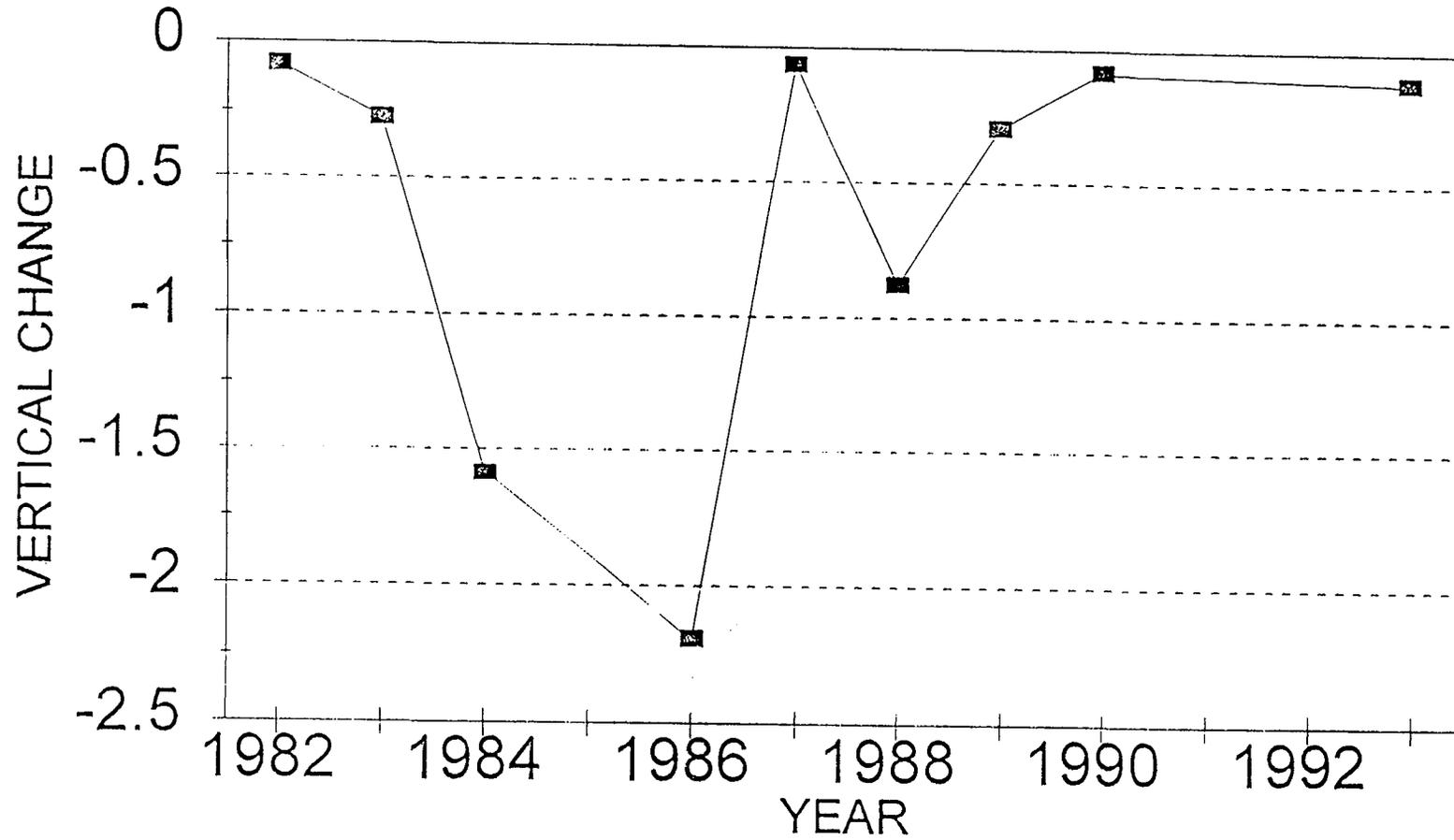


GRIMES WASH

PRISM 3



GRIMES WASH PRISM 4



NEWBERRY CANYON PRISMS ELEV. CHANGE

PR-1

BASE	10/16/86	8661.51	0.00
	09/09/87	8661.90	0.39
	09/09/88	8661.51	0.00
	09/09/89	8661.42	-0.09
	07/13/90	8661.68	0.17
	07/31/92	8661.05	-0.46
	03/17/96	8661.69	0.18

PR-2

BASE	16-Oct-86	8661.20	0.00
	09-Sep-87	8661.29	0.09

PRISM LOST DUE TO SPALLING BETWEEN 1-30-87 AND 2-09-87

PR-3

BASE	10/16/86	8884.18	0.00
	09/09/87	8879.77	-4.41
	09/09/88	8879.50	-4.68
	09/09/89	8879.55	-4.63
	07/13/90	8879.39	-4.79
	07/31/92	8879.95	-4.23
	03/17/96	8879.52	-4.66

PR-4

BASE	10/16/86	8679.50	0.00
	09/09/87	8674.88	-4.62
	09/09/88	8674.76	-4.74
	09/09/89	8674.72	-4.78
	07/13/90	8674.94	-4.57
	07/31/92	8673.84	-5.66
	03/17/96	8674.91	-4.59

PR-5

BASE	12/16/88	8682.62	0.00
	09/07/89	8682.63	0.01
	09/11/90	8682.41	-0.21
	07/30/92	8682.62	0.00
	05/03/93	8682.34	-0.28
	02/05/95	8682.63	0.01

PR-6
BASE

	12/16/88	8636.87	0.00
	09/07/89	8636.72	-0.15
	09/11/90	8636.65	-0.22
	07/30/92	8635.98	-0.89
	05/03/93	8636.44	-0.43
	02/05/95	8636.81	-0.06

PR-7

BASE	09/07/89	8649.78	0.00
	09/11/90	8644.08	-5.70

07/30/92	8644.11	-5.67
05/03/93	8643.88	-5.90
02/05/95	8644.18	-5.60

PR-8
BASE

09/10/89	8653.62	0.00
09/11/90	8647.85	-5.76
07/30/92	NO DATA COLLECTED	
05/03/93	NO DATA COLLECTED	
02/05/95	8647.88	-5.74

PR-9
BASE

09/07/89	8666.49	0.00
09/11/90	8662.47	-4.01
07/30/92	8662.27	-4.22
05/03/93	8662.36	-4.13
02/05/95	8662.38	-4.11

PR-10
BASE

09/07/89	8670.71	0.00
09/11/90	8665.87	-4.84
07/30/92	8664.43	-6.27
05/03/93	8665.43	-5.28
02/05/95	8665.72	-4.98

CORN COB WASH

PR-11
BASE

02/19/90	8708.98	0.00
09/11/90	8706.58	-2.40
07/30/92	8706.05	-2.93
02/19/95	8705.98	-3.00

PR-12
BASE

02/19/90	8698.60	0.00
09/11/90	8694.06	-4.53
07/30/92	8693.57	-5.02
02/19/95	8693.59	-5.01

PR-13
BASE

02/19/90	8654.05	0.00
06/14/90	8654.38	0.32

PRISM LOST TO SPALLING BETWEEN 6/14/90 AND 6/27/90

PR-14
BASE

02/19/90	8730.70	0.00
09/11/90	8730.84	0.14
07/30/92	8730.80	0.10
02/19/95	8730.51	-0.19

FLY CANYON PRISMS

PR-1
BASE

01/27/88	8536.54	0.00
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09/19/88	8536.35	-0.19
07/24/89	8536.54	-0.00
07/13/90	8536.54	-0.01
07/31/92	8536.51	-0.04

PR-2
BASE

01/27/88	8832.17	0.00
09/19/88	8831.52	-0.65
07/24/89	8831.74	-0.43
07/13/90	8831.72	-0.45
07/31/92	8831.68	-0.49

PR-3
BASE

06/08/88	8426.19	0.00
09/19/88	8426.07	-0.12
07/24/89	8426.39	0.20
07/13/90	8426.43	0.24
07/31/92	8426.35	0.16

PR-4
BASE

01/27/88	8781.43	0.00
09/19/88	8781.31	-0.12
07/24/89	8781.48	0.05
07/13/90	8781.45	0.02
07/31/92	NO DATA COLLECTED	

PR-5
BASE

01/27/88	8481.41	0.00
09/19/88	8480.95	-0.46
07/24/89	8481.21	-0.20
07/31/92	8481.41	0.00

GRIMES WASH PRISMS

LEASE U-1358	CHANGE FROM BASE ELEVATION			
YEAR	PR-1	PR-2	PR-3	PR-4
1982	0.00	0.00	-0.02	-0.08
1983	0.06	0.03	-0.59	-0.27
1984	-1.17	-0.60	-3.83	-1.59
1985	-0.33	-0.20	-0.87	
1986	-0.17	-0.02	-0.28	-2.19
1987	-0.18	0.06	-0.09	-0.06
1988	-0.01	-0.86		-0.88
1989	-0.23		-1.40	-0.29
1990	-0.08	0.03	-0.08	-0.08
1991	NO DATA COLLECTED			
1992	NO DATA COLLECTED			
1993	0.17	0.15	-0.01	-0.11
1994	NO DATA COLLECTED			
1995	NO DATA COLLECTED			