

**STRONG-MOTION DATA FROM THE  
WHITTIER NARROWS AFTERSHOCK OF FEBRUARY 11, 1988**

**By**

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The ML=5.9 Whittier Narrows earthquake of October 1, 1987 triggered accelerographs at 52 stations in the Los Angeles region that are operated by the U.S. Geological Survey as a part of the National Strong-Motion Instrumentation Network (NSMIN). Strong-motion data and information about NSMIN stations that triggered during this main event have been presented in Etheredge and Porcella (1987). On February 11, 1988 at 1525 G.M.T. a significant set of strong-motion data was recorded at 19 of the main shock stations during an ML=5.0 (PAS) aftershock. The purpose of this companion report is to present NSMIN data recorded during the February 11 Whittier Narrows aftershock. The reader is referred to Etheredge and Porcella (1987) for a general overview of the NSMIN and for other Network information, including instrumentation layout of some of the more extensively instrumented structures in the greater Los Angeles region.

The February 11 aftershock was located at  $34.071^{\circ}$  N. lat. and  $118.048^{\circ}$  W. long., approx. 3 km northeast of the main shock epicenter. This event was reportedly responsible for additional damage to many structures in the Whittier-Alhambra area that were already damaged by the main shock.

Nineteen NSMIN stations owned by the U.S. Geological Survey, the Metropolitan Water District of Southern California, the Army Corps of Engineers and several private building owners recorded this aftershock at epicentral distances of 5 km (Whittier Narrows Dam) to 49 km (Jensen Filter Plant) (figures 1 and 2). These stations include 8 buildings, 9 dam/reservoir facilities, 1 VA hospital installation, and 1 ground site. Peak horizontal ground accelerations were in the range  $0.06 \text{ g}$  to  $0.25 \text{ g}$  at 4 stations within an epicentral distance of 11 km. At 13 to 23 km distances the peak recorded motions are significantly lower, generally in the range  $0.05 \text{ g}$  to  $0.15 \text{ g}$ , and beyond 23 km seldom exceed  $0.05 \text{ g}$  (see table 1). Copies of accelerograms from all NSMIN stations are presented in figure 3.

REFERENCE

Etheredge and Porcella, 1987, Strong-motion data from the October 1, 1987 Whittier Narrows earthquake, U.S. Geol. Surv., Open-File Report 87-616.

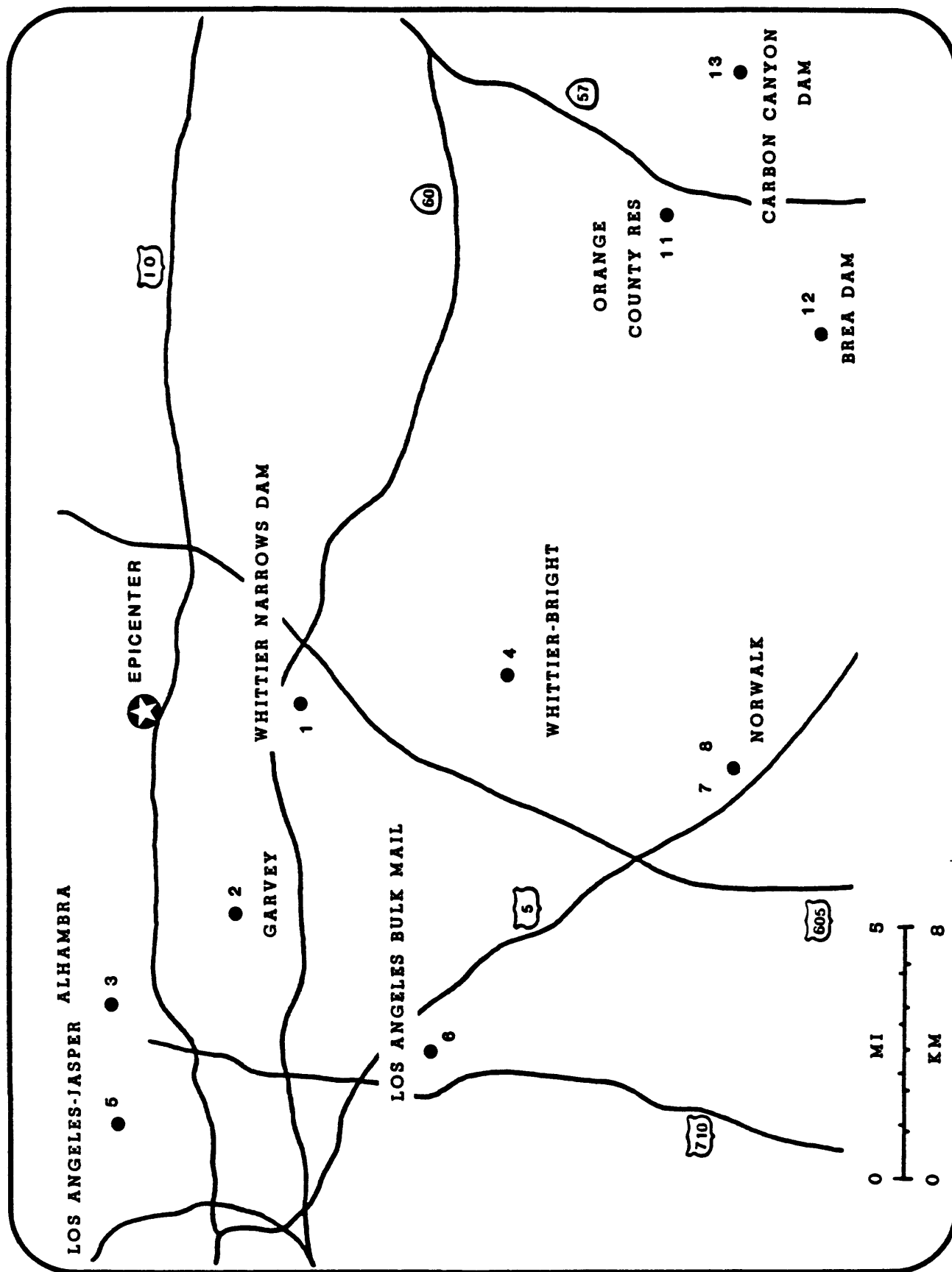


Figure 1. Close in map of USGS stations triggered during the Whittier Narrows aftershock.

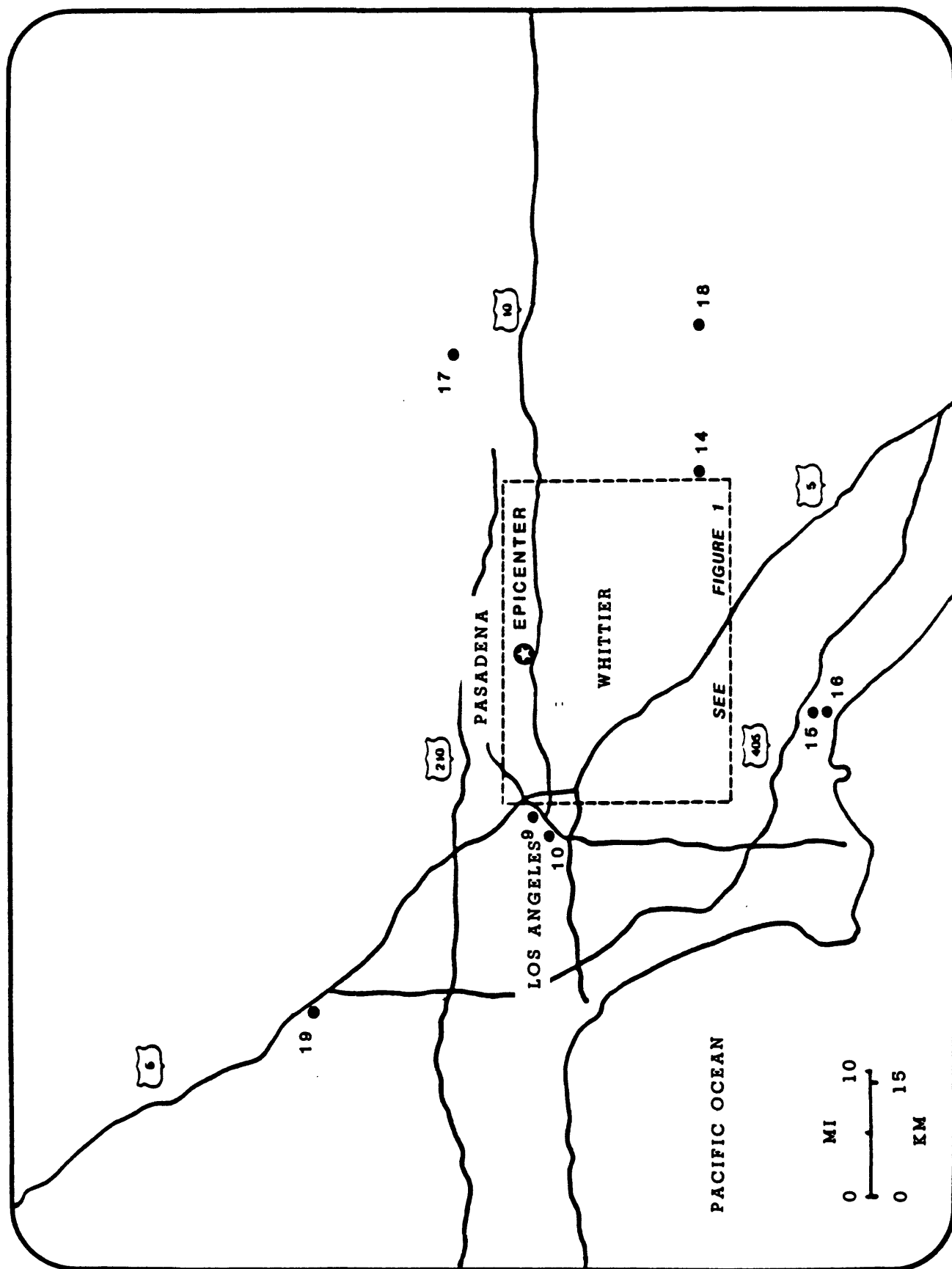


Figure 2. Regional map showing USGS stations triggered during the Whittier Narrows aftershock. Numbers on map may be referenced to table 1 index for station identification.

Table 1. STRONG-MOTION INFORMATION AND PEAK ACCELERATIONS FROM THE WHITTIER NARROWS  
AFTERSHOCK OF FEBRUARY 11, 1988

[Station owners are Army Corps of Engineers (ACOE); Bechtel Power Corporation (BECH); JCG Finance Corp. of America (JCG); Metropolitan Water District of Southern California (MWD); U.S Geological Survey (USGS); and the Veterans Administration (VA). Epicentral distance is measured from station to epicenter at lat. 34.071°N., long. 118.048°W. Direction of acceleration is for upward trace deflection on accelerogram; vertical component directions are all listed as up.]

Station Identification					Acceleration	
Map Index Number	USGS Number	Name (Owner)	Coordinates (Lat. °N, Long. °W)	Epicentral Distance (km)	Direction (degrees)	Maximum (g)
1	289	Whittier Narrows Dam (ACOE)	34.03 118.05	5		
		Crest			033 Up 303	0.16 0.12 0.10
		Upstream			152 Up 062	0.25 0.20 0.25
2	709	Garvey Reservoir Abutment Bldg. (MWD)	34.05 118.11	6	060 Up 330	0.22 0.11 0.15
3	482	Alhambra 900 S. Fremont (USGS)	34.09 118.15	10		
		Basement			090 Up 360	0.07 <0.05 0.06
		6th Floor			090 Up 360	0.06 <0.05 0.06
		12th Floor			090 Up 360	<0.05 0.05 <0.05
4	804	Whittier 7215 Bright Ave. (USGS)	33.977 118.036	11		
		Basement			180 Up 090	0.20 0.06 0.12
		5th Floor			180 Up 090	0.13 0.15 0.18
		10th Floor			180 Up 090	0.09 0.12 0.15

Table 1.--STRONG-MOTION INFORMATION AND PEAK ACCELERATIONS FROM THE WHITTIER NARROWS  
AFTERSHOCK OF FEBRUARY 11, 1988 (continued)

Station Identification					Acceleration	
Map Index Number	USGS Number	Name (Owner)	Coordinates (Lat. °N, Long. °W)	Epicentral Distance (km)	Direction (degrees)	Maximum (g)
5	5244	Los Angeles	34.081	13	130	0.06
		4407 Jasper Street	118.188		Up	<0.05
		(USGS)			040	0.07
6	5129	Los Angeles	33.99	14	010	0.14
		Bulk Mail Center	118.16		Up	0.08
		(USGS)			280	0.11
7	634	Norwalk	33.92	17		
		12400 Imperial Hiway	118.07			
		(USGS/BECH)				
		Basement			090	<0.05
					Up	<0.04
					360	<0.05
		4th Floor			090	<0.05
					Up	0.05
					360	0.08
		Roof			090	<0.05
					Up	0.06
					360	0.11
		North Ground Site	-- removed for repair.		---	---
		South Ground Site			090	0.05
					Up	<0.05
					360	0.07
8	5239	Norwalk	33.92	17		
		12440 Imperial Hiway	118.07			
		(USGS/BECH)				
		Structure Array 1:				
		Ch. 1- 7th Floor, Center			090	0.03
		Ch. 2- 5th Floor, Center			090	0.03
		Ch. 3- 2nd Floor, Center			090	0.05
		Ch. 4- 1st Floor, Center			090	0.08
		Ch. 5- Basement, East			360	0.08
		Ch. 6- 5th Floor, West-Center			360	0.11
		Ch. 7- Basement, Center			Up	0.05
		Ch. 8- Basement, Center			090	0.05
		Ch. 9- Basement, Center			360	0.08
		Ch. 10- 30 ft. Downhole, Bldg. Center			Up	0.04
		Ch. 11- 30 ft. Downhole, Bldg. Center			090	0.03
		Ch. 12- 30 ft. Downhole, Bldg. Center			360	0.05

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AFTERSHOCK OF FEBRUARY 11, 1988 (continued)

Station Identification					Acceleration	
Map Index Number	USGS Number	Name (Owner)	Coordinates (Lat. °N, Long. °W)	Epicentral Distance (km)	Direction (degrees)	Maximum (g)
Norwalk, 12440 Imperial Hiway (continued)						
Structure Array 2: (frequent hesitations of approx. 0.1 sec on this film, page 18)						
		Ch. 13- 7th Floor, East			360	0.13
		Ch. 14- 5th Floor, East			360	0.08
		Ch. 15- 2nd Floor, East			360	0.09
		Ch. 16- 1st Floor, East			360	0.09
		Ch. 17- 7th Floor, Center			360	0.15
		Ch. 18- 5th Floor, Center			360	INOP*
		Ch. 19- 2nd Floor, Center			360	0.10
		Ch. 20- 1st Floor, Center			360	0.11
		Ch. 21- 7th Floor, West			360	0.10
		Ch. 22- 5th Floor, West			360	0.06
		Ch. 23- 2nd Floor, West			360	0.08
		Ch. 24- 1st Floor, West			360	0.09
		Basement			090	0.05
					Up	0.04
					360	0.06
		North Ground Site			090	0.07
					Up	0.05
					360	0.10
		South Ground Site			090	0.05
					Up	0.07
					360	0.08
9	872	Los Angeles 1111 Sunset Blvd. (MWD)	34.07 118.25	19		
		Basement			348	<0.05
					Up	<0.05
					258	<0.05
		4th Floor			348	<0.05
					Up	<0.05
					258	<0.05
		Roof			348	<0.05
					Up	<0.05
					258	<0.05
10	5233	Los Angeles 1100 Wilshire (JCG/USGS)	34.052 118.263	20		
		Basement 3, NE			298	<0.05
					Up	<0.05
					208	<0.05

Table 1.--STRONG-MOTION INFORMATION AND PEAK ACCELERATIONS FROM THE WHITTIER NARROWS  
AFTERSHOCK OF FEBRUARY 11, 1988 (continued)

Station Identification					Acceleration	
Map Index Number	USGS Number	Name (Owner)	Coordinates (Lat. °N, Long. °W)	Epicentral Distance (km)	Direction (degrees)	Maximum (g)
10	5233	L.A., 1100 Wilshire (continued)				
		Basement 3, SE			298	<0.05
					Up	<0.05
					208	<0.05
		Basement 4, NW			298	<0.05
					Up	<0.05
					208	<0.05
		Structure Array:				
		Ch. 1- 12th Floor, North			298	<0.05
		Ch. 2- 12th Floor, North			208	<0.05
		Ch. 3- 12th Floor, South			208	<0.05
		Ch. 4- 13th Floor, North			298	<0.05
		Ch. 5- 13th Floor, North			208	<0.05
		Ch. 6- 13th Floor, South			208	<0.05
		Ch. 7- 32nd Floor, North			298	<0.05
		Ch. 8- 32nd Floor, North			208	<0.05
		Ch. 9- 32nd Floor, South			208	<0.05
		Ch. 10- Ground Floor, North			298	<0.05
		Ch. 11- Ground Floor, North			208	<0.05
		Ch. 12- Ground Floor, South			208	<0.05
11	697	Orange County Reservoir	33.935	22	096	<0.05
		Abutment	117.883		Up	<0.05
		(MWD)			006	<0.05
12	951	Brea Dam	33.889	23		
		(ACOE)	117.926			
		Crest			130	0.07
					Up	0.05
					040	0.18
		Left Abutment			130	0.05
					Up	0.04
					040	0.07
		Downstream			130	0.05
					Up	0.04
					040	0.09



Table 1.--STRONG-MOTION INFORMATION AND PEAK ACCELERATIONS FROM THE WHITTIER NARROWS  
AFTERSHOCK OF FEBRUARY 11, 1988 (continued)

Station Identification					Acceleration	
Map Index Number	USGS Number	Name (Owner)	Coordinates (Lat. °N, Long. °W)	Epicentral Distance (km)	Direction (degrees)	Maximum (g)
13	108	Carbon Canyon Dam (ACOE)	33.92 117.84	26		
		Crest			130 Up 040	0.05 <0.05 0.05
		Left Abutment			130 Up 040	Did not trigger
		Right Abutment			130 Up 040	Film jammed
14	698	Diemer Filter Plant (MWD)	33.91 117.82	28		
		Admin. Bldg. Basement			281 Up 191	<0.05 <0.05 <0.05
		Reservoir Roof			281 Up 191	<0.05 0.05 <0.05
15	132	Long Beach, CSULB Humanities Bldg. Basement (USGS)	33.78 118.11	33	076 Up 346	<0.05 <0.05 <0.05
16	5106	Long Beach VA Hospital (VA)	33.78 118.12	33		
		Basement			360 Up 270	<0.05 <0.05 <0.05
		6th Floor			360 Up 270	<0.05 <0.05 <0.05
		11th Floor			360 Up 270	0.06 <0.05 <0.05

Table 1.--STRONG-MOTION INFORMATION AND PEAK ACCELERATIONS FROM THE WHITTIER NARROWS  
AFTERSHOCK OF FEBRUARY 11, 1988 (continued)

Station Identification					Acceleration	
Map Index Number	USGS Number	Name (Owner)	Coordinates (Lat. °N, Long. °W)	Epicentral Distance (km)	Direction (degrees)	Maximum (g)
17	287	San Antonio Dam (ACOE)	34.166 117.680	35		
		Crest			090 Up 360	<0.05 <0.05 0.06
		Right Abutment			090 Up 360	Did not trigger
		Downstream			090 Up 360	Did not trigger
18	969	Prado Dam (ACOE)	33.89 117.64	43		
		Crest			090 Up 360	<0.05 <0.05 <0.05
		Left Abutment			090 Up 360	Did not trigger
		Downstream			090 Up 360	0.07 <0.05 0.08
19	655	Jensen Filter Plant (MWD)	34.309 118.499	49		
		Administration Bldg.			022 Up 292	<0.05 <0.05 <0.05
		Generator Room			022 Up 292	<0.05 <0.05 <0.05
		Reservoir Roof			022 Up 292	<0.05 <0.05 <0.05

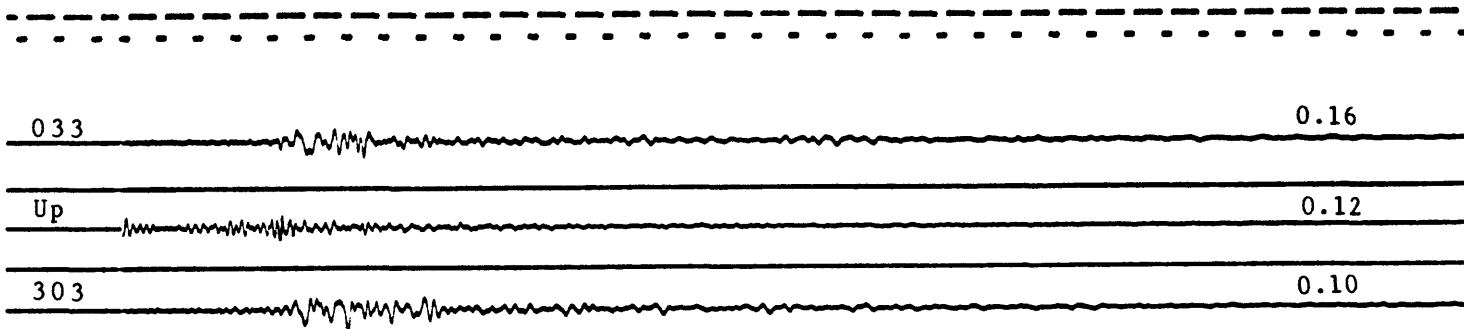
\*Channel 18 failed in the middle of the October 1 main shock.

Figure 3. Copies of accelerograms recorded at USGS-NSMIN stations during the Whittier Narrows aftershock.

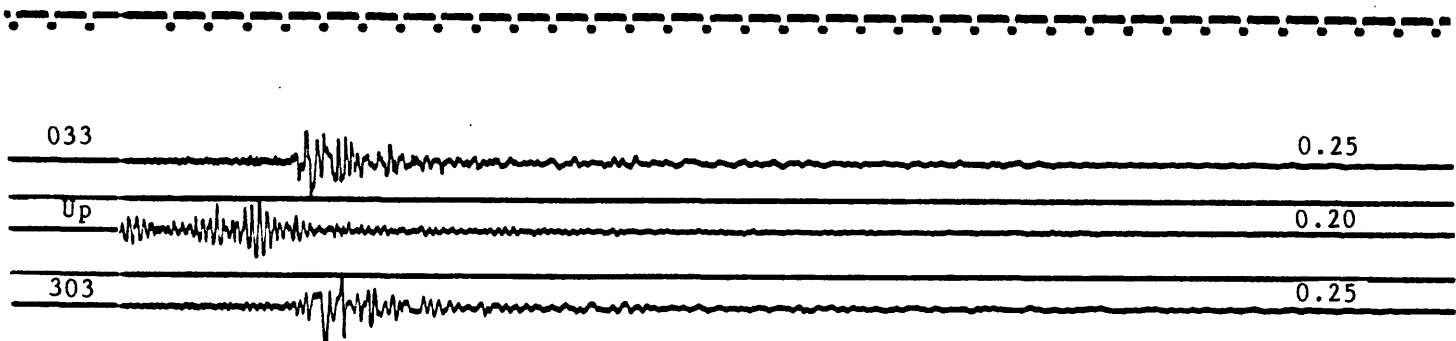
<u>Record</u>	<u>Page</u>
Whittier Narrows Dam - - - - -	11
Garvey Reservoir - - - - -	11
Alhambra - 900 S. Fremont Ave. - - - - -	12
Whittier - 7215 Bright Ave. - - - - -	13
L.A. - 4407 Jasper St. - - - - -	14
L.A. - Bulk Mail Center - - - - -	14
Norwalk - 12440 Imperial Highway - - - - -	16-18
Norwalk - 12400 Imperial Highway - - - - -	14-15
L.A. - 1111 Sunset Blvd. - - - - -	19
L.A. - 1100 Wilshire Blvd. - - - - -	20-21
Orange County Reservoir - - - - -	22
Brea Dam - - - - -	23
Carbon Canyon Dam - - - - -	25
Diemer Filter Plant - - - - -	22
Long Beach VA Hospital - - - - -	24
Long Beach - CSULB - - - - -	27
San Antonio Dam - - - - -	27
Prado Dam - - - - -	25
Jensen Filter Plant - - - - -	26

# WHITTIER NARROWS DAM

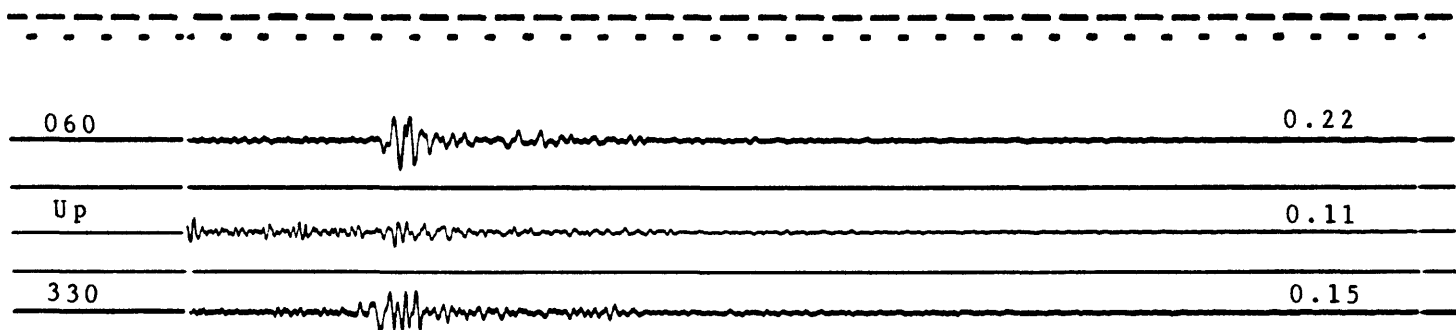
## Crest



## Upstream



# GARVEY RESERVOIR, ABUTMENT BLDG



One cm/sec

ALHAMBRA, 900 S. FREMONT

12th Floor



090

<0.05

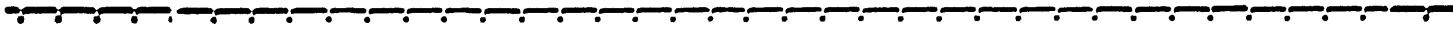
Up

0.05

360

<0.05

6th Floor



090

0.06

Up

<0.05

360

0.06

Basement

One cm/sec



090

0.07

Up

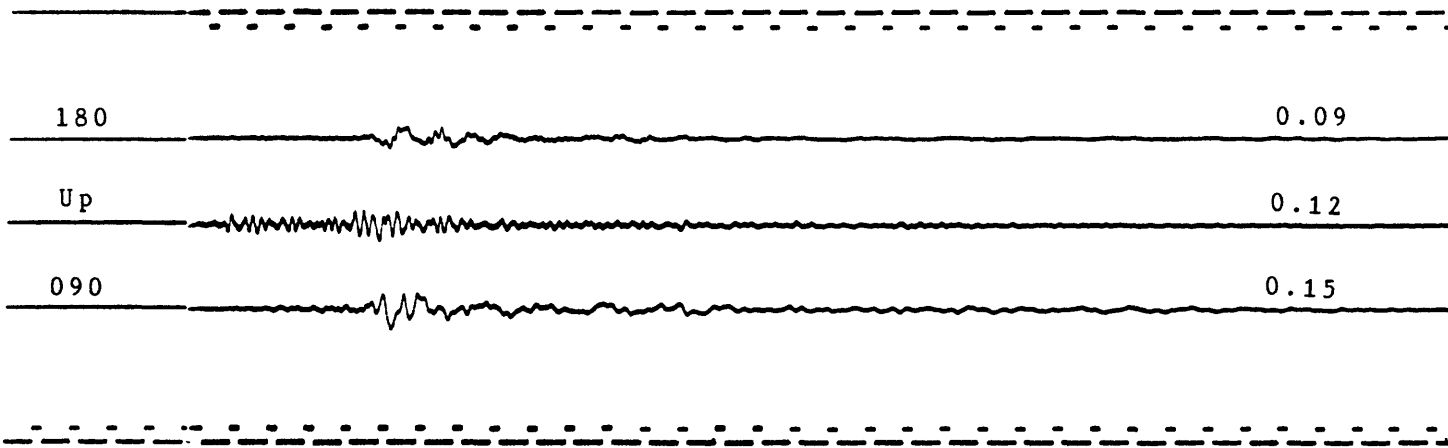
<0.05

360

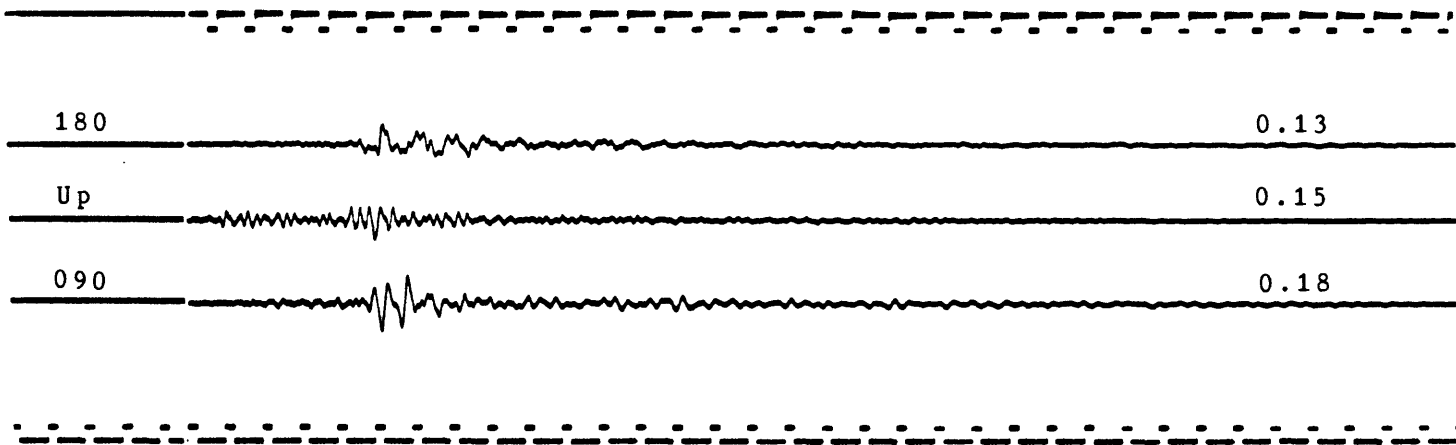
0.06

WHITTIER, 7215 BRIGHT AVE

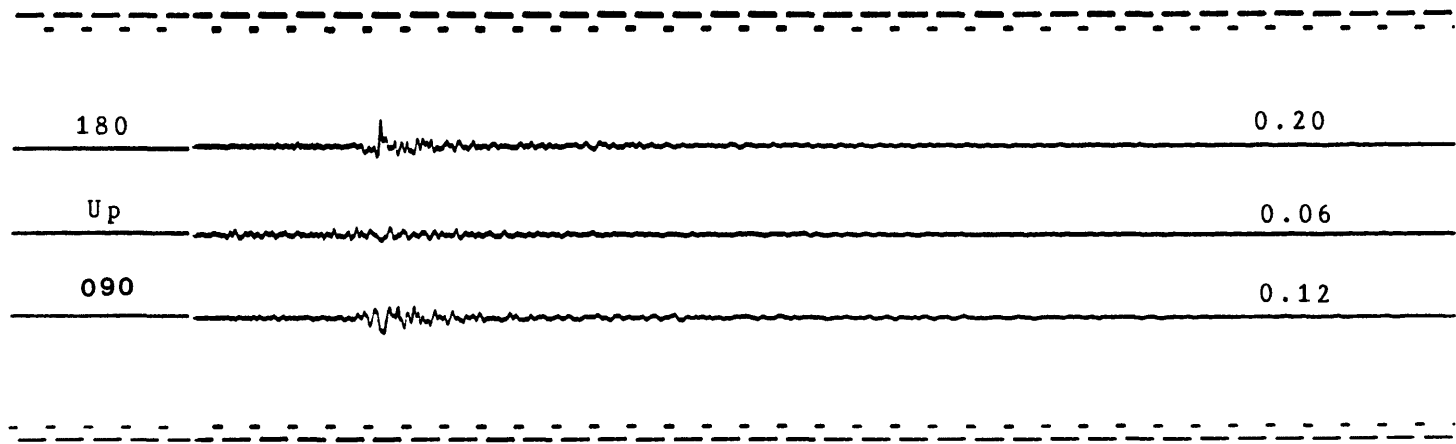
10th Floor



5th Floor

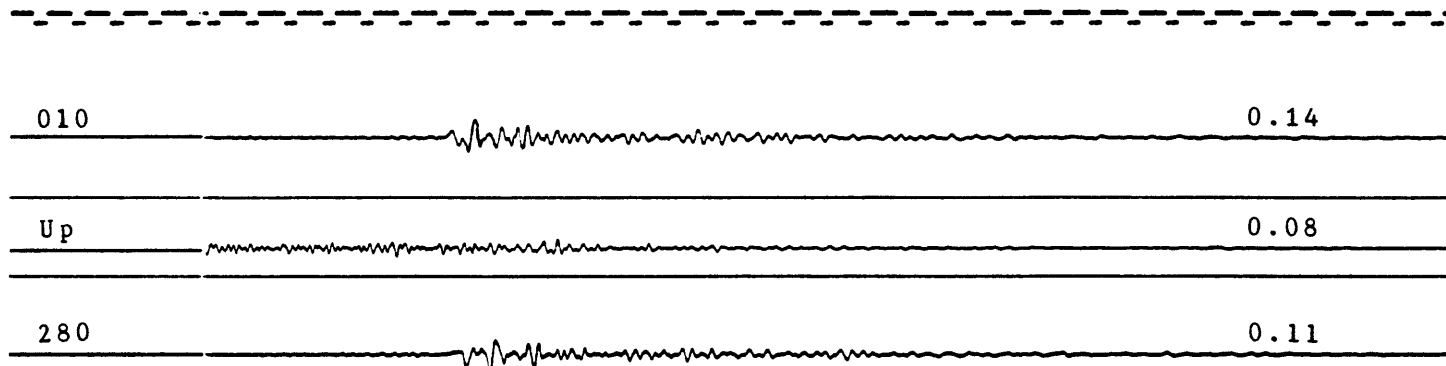


Basement

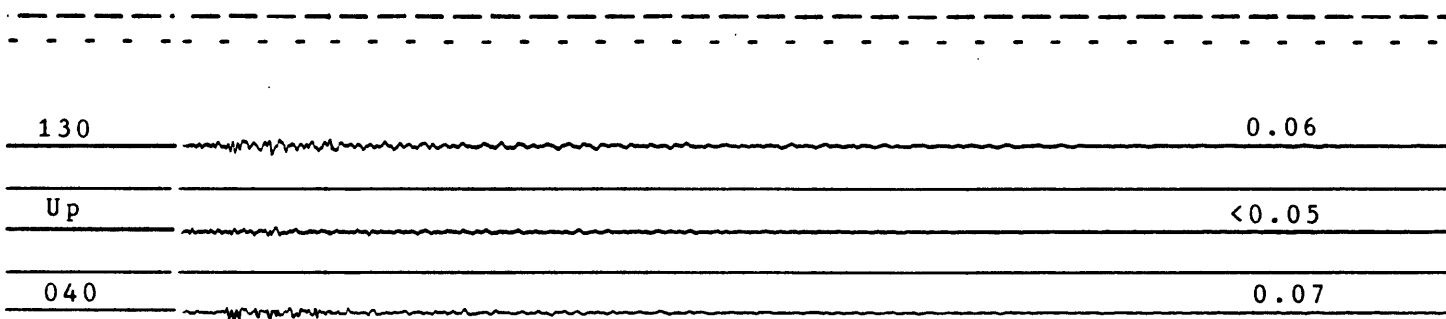


One cm/sec

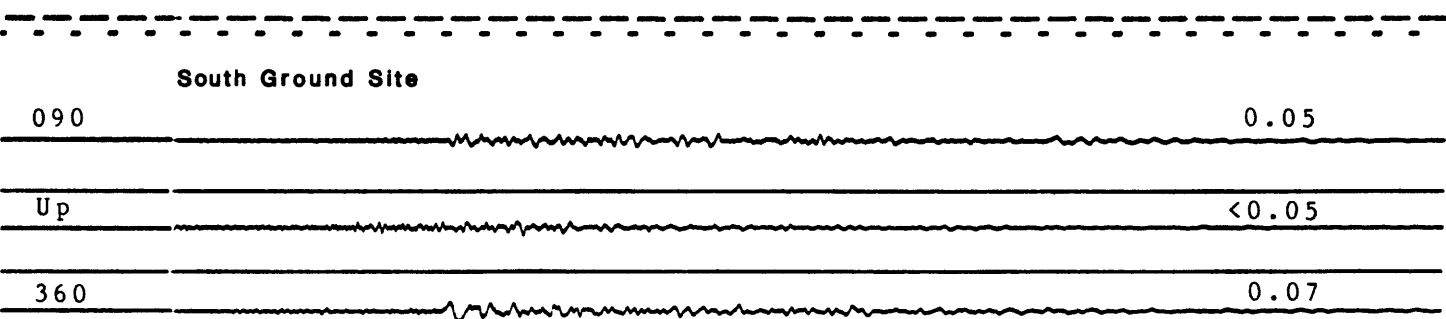
LOS ANGELES, BULK MAIL CENTER



LOS ANGELES, 4407 JASPER STREET



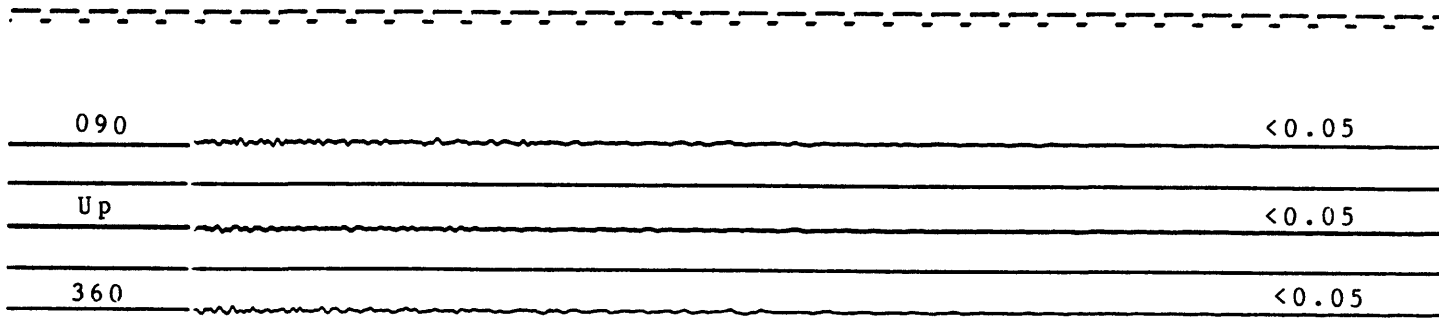
NORWALK, 12400 IMPERIAL HIWAY



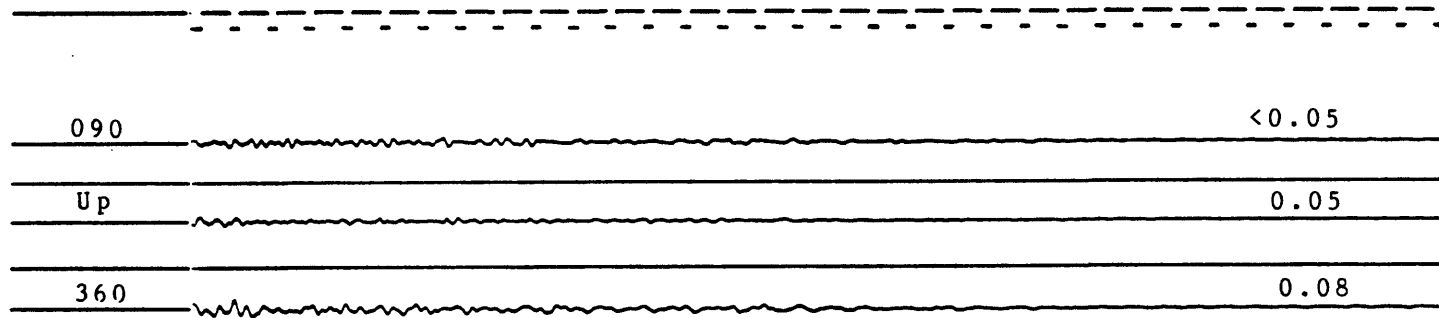
One cm/sec

# Norwalk, 12400 IMPERIAL HIWAY

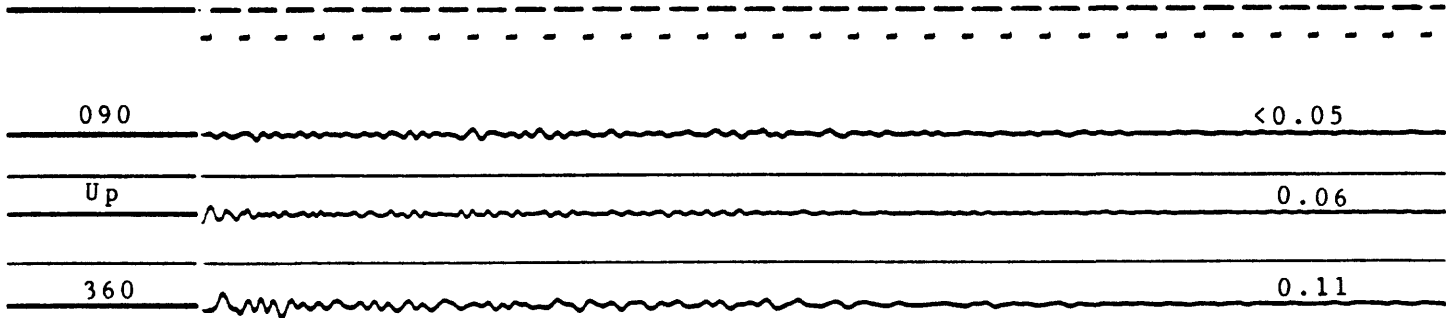
## Basement



## 4th Floor



## Roof

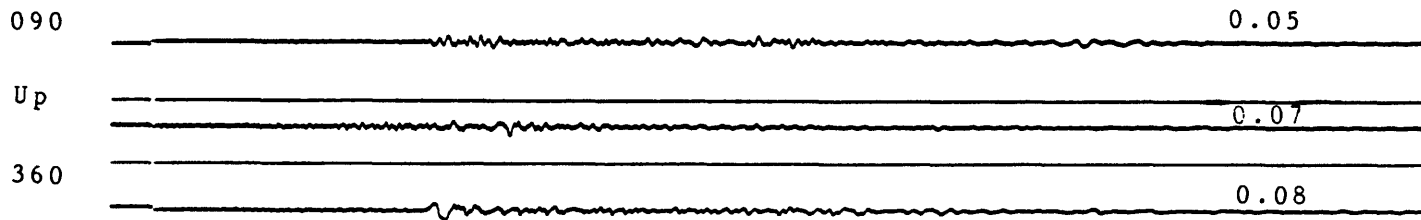


One cm/sec

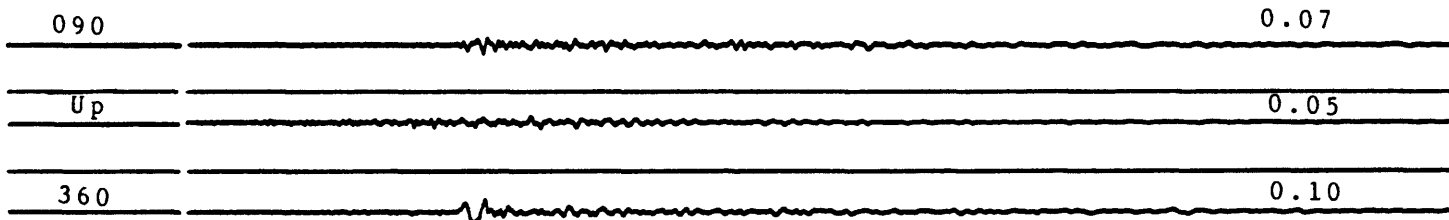


# NORWALK, 12440 IMPERIAL HIWAY

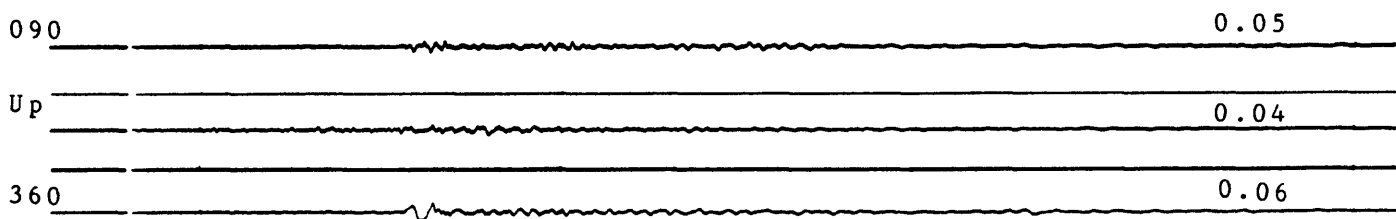
## South Ground Site



## North Ground Site



## Basement



One cm/sec

# NORWALK, 12440 IMPERIAL HIWAY

## Structure Array 1

Ch1	090	7th Floor, Center	0.03
2	090	5th Floor, Center	0.03
3	090	2nd Floor, Center	0.05
4	090	1st Floor, Center	0.08
5	360	Basement, East	0.08
6	360	5th Floor, West-Center	0.11
7	Up	Basement, Center	0.05
8	090	Basement, Center	0.05
9	360	Basement, Center	0.08
10	Up	30 ft Downhole, Bldg Center	0.04
11	090	30 ft Downhole, Bldg Center	0.03
12	360	30 ft Downhole, Bldg Center	0.05

One cm/sec

# NORWALK, 12440 IMPERIAL HIWAY

## Structure Array 2



Ch 13	360	7th Floor, East	0.13
14	360	5th Floor, East	0.08
15	360	2nd Floor, East	0.09
16	360	1st Floor, East	0.09
17	360	7th Floor, Center	0.15
18	360	5th Floor, Center	Inop
19	360	2nd Floor, Center	0.10
20	360	1st Floor, Center	0.11
21	360	7th Floor, West	0.10
22	360	5th Floor, West	0.06
23	360	2nd Floor, West	0.08
24	360	1st Floor, West	0.09



One cm/sec

LOS ANGELES, 1111 SUNSET BLVD.

Basement

348	<0.05
Up	<0.05
258	<0.05

4th Floor

348	<0.05
Up	<0.05
258	<0.05

Roof

348	<0.05
Up	<0.05
258	<0.05

One cm/sec

LOS ANGELES, 1100 WILSHIRE BLVD.

Basement 3, NE

298	<0.05
Up	<0.05
208	<0.05

Basement 3, SE

298	<0.05
Up	<0.05
208	<0.05

Basement 3, NW

298	<0.05
Up	<0.05
208	<0.05

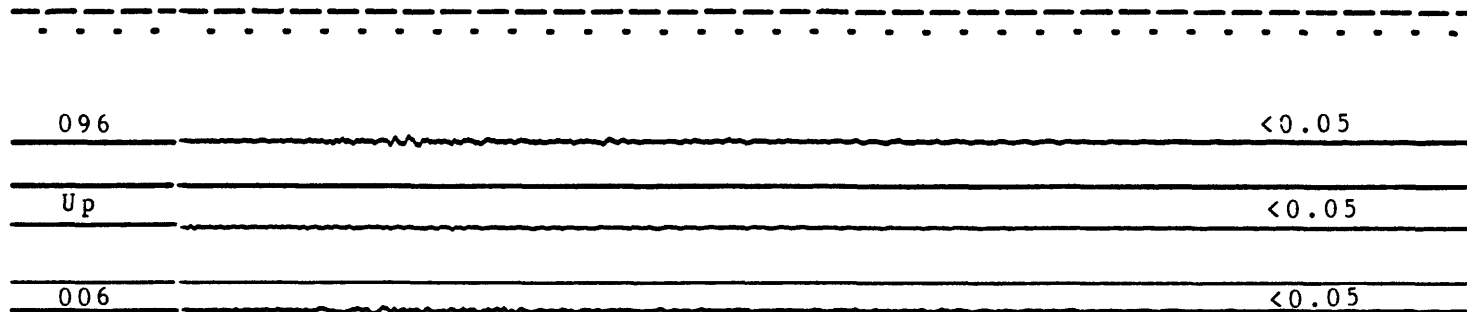
One cm/sec

# LOS ANGELES, 1100 WILSHIRE BLVD

## Structure Array

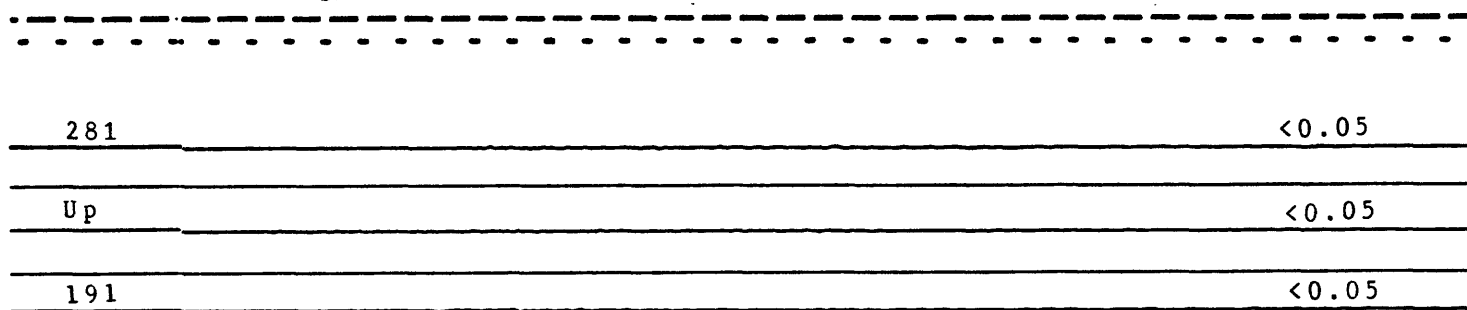
Ch 1	298	12th Floor, North	<0.05
2	208	12th Floor, North	<0.05
3	208	12th Floor, South	<0.05
4	298	13th Floor, North	<0.05
5	208	13th Floor North	<0.05
6	208	13th Floor, South	<0.05
7	298	32nd Floor, North	<0.05
8	208	32nd Floor, North	<0.05
9	208	32nd Floor, South	<0.05
10	298	Ground Floor, North	<0.05
11	208	Ground Floor, North	<0.05
12	208	Ground Floor, South	<0.05

# ORANGE COUNTY RESERVOIR, ABUTMENT

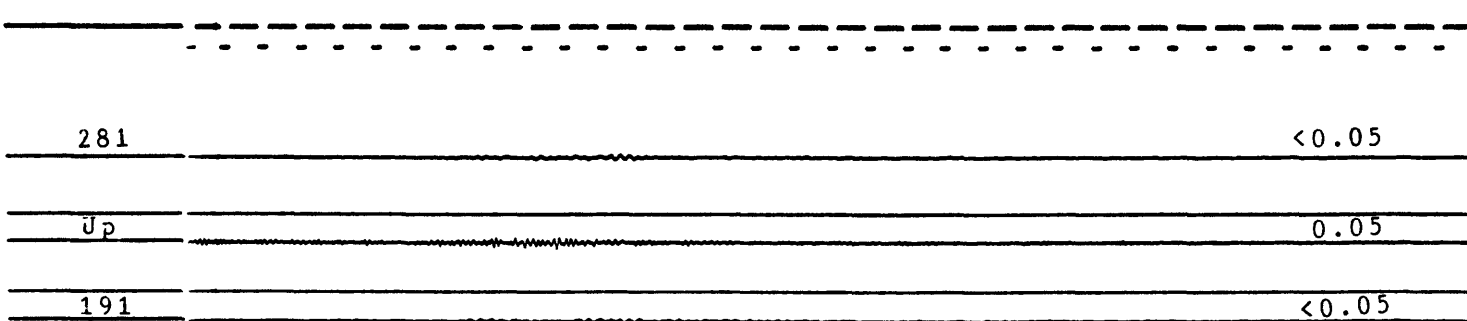


## DIEMER FILTER PLANT

Admin Bldg. Basement



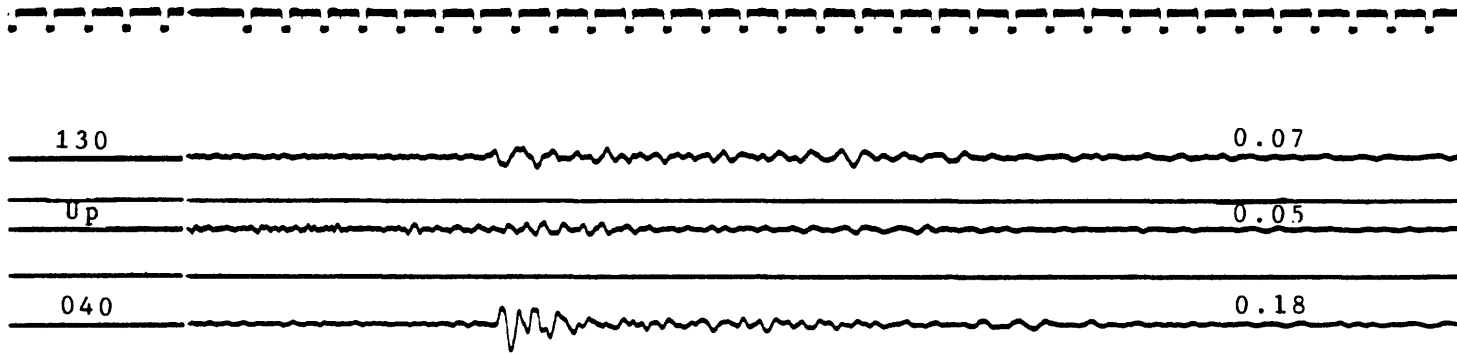
Reservoir Roof



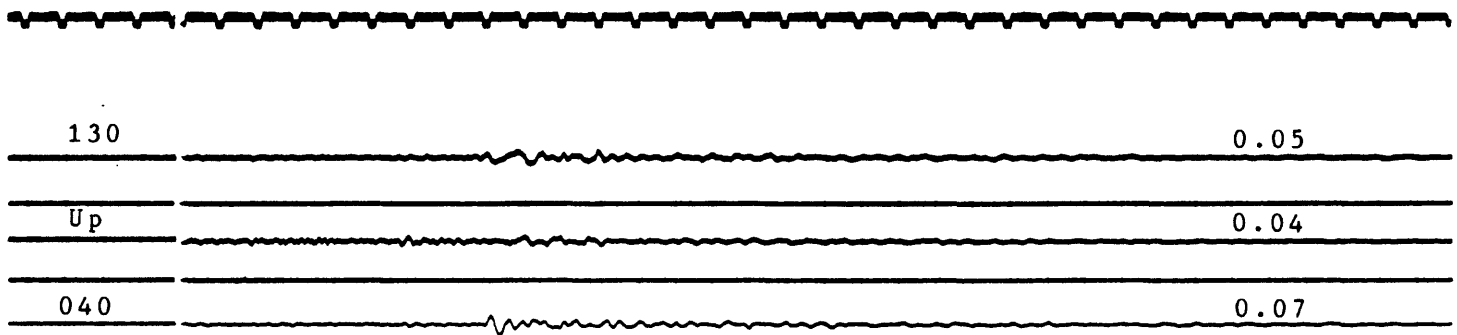
One cm/sec

# BREA DAM

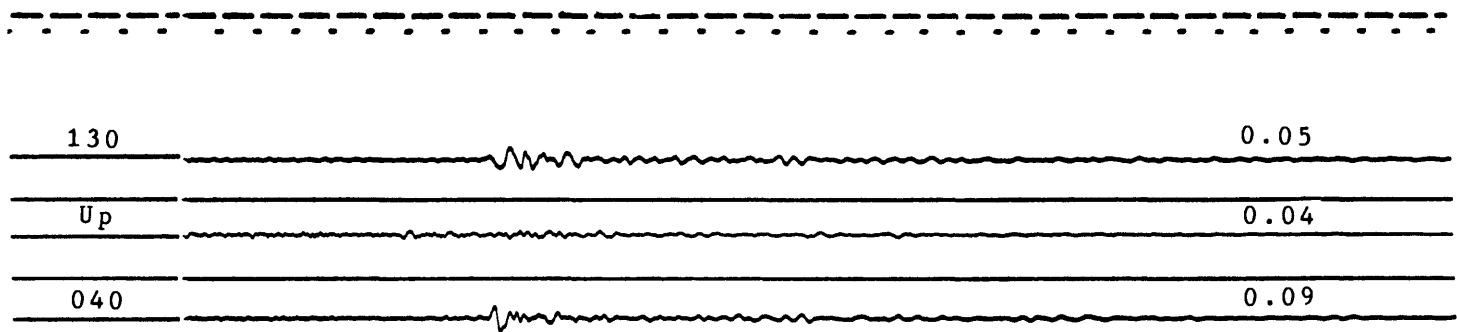
## Crest



## Left Abutment



## Downstream



One cm/sec



# LONG BEACH, VA HOSPITAL

## Basement

360 <0.05

Up <0.05

270 <0.05

## 6th Floor

360 <0.05

Up <0.05

270 <0.05

## 11th Floor

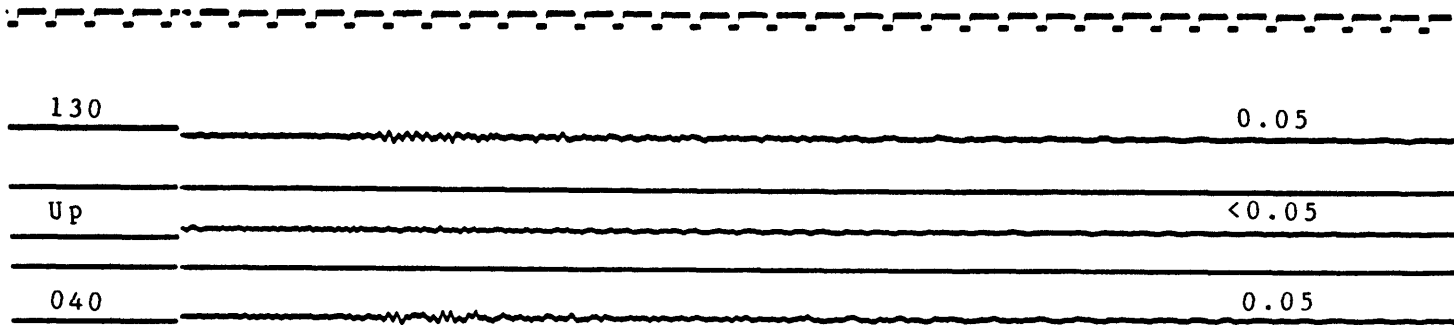
360 0.06

Up <0.05

270 <0.05

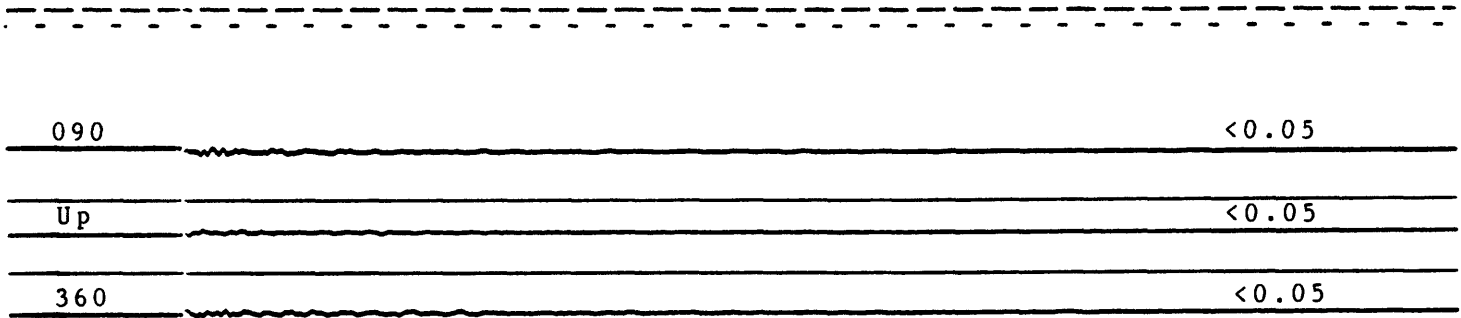
# CARBON CANYON DAM

Crest

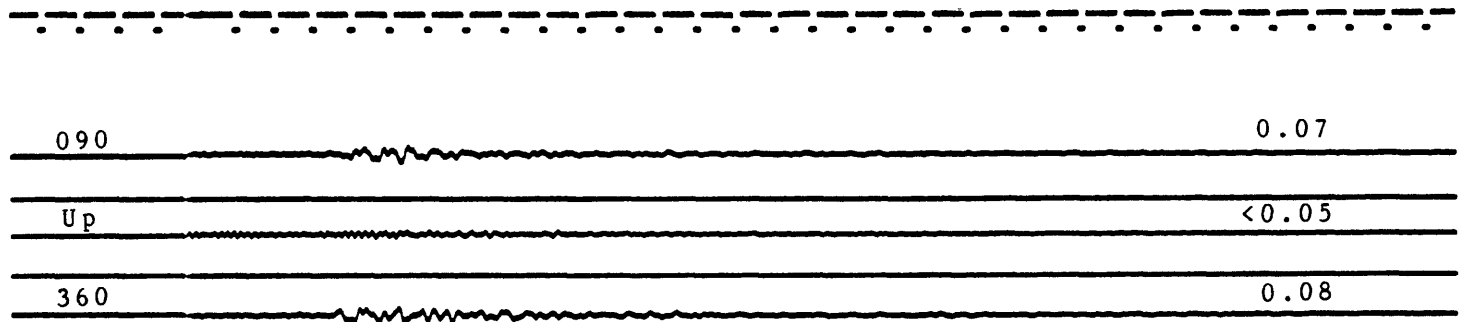


## PRADO DAM

Crest



Downstream



One cm/sec

## JENSEN FILTER PLANT

### Admin Bldg

022	<0.05
Up	<0.05
292	<0.05

### Generator Room

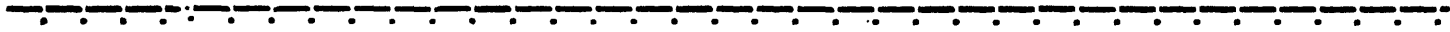
022	<0.05
Up	<0.05
292	<0.05

### Reservoir Roof

022	<0.05
Up	<0.05
292	<0.05

One cm/sec

# LONG BEACH , CSULB



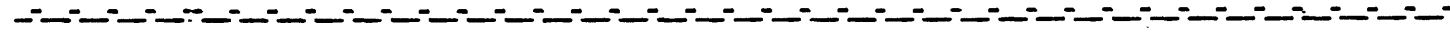
076		<0.05
Up		<0.05
346		<0.05

## SAN ANTONIO DAM

Crest



090		<0.05
Up		<0.05
360		0.06



One cm/sec