135220

St. Louis Site Expert Geohydrologic Panel

AGENDA

October 5, 1995

Location:	Stouffer Renaissance St. Louis Hotel (Stouffer Concourse) Concourse B
7:30 a.m.	Continental Breakfast Concourse B
8 a.m.	Welcome David W. Miller, Chair
8:15 a.m.	Action Items From Last Meeting Dave Miller, SAIC
9:30 a.m.	Break
10 a.m.	Panel Discussion
Noon	Lunch Room Gatwick A
1 p.m.	Panel Discussion
3 p.m.	Public Comment
4 p.m.	Closing Remarks
4:30 p.m.	Adjourn

St. Louis Site Expert Geohydrologic Panel

KEY ISSUES

The St. Louis Site Expert Geohydrologic Panel, after reviewing pertinent site information regarding geology, hydrogeology, surface water hydrology and contaminant transport, will provide information and guidance to the St. Louis Site Remediation Task Force on the following issues[1]:

1) Is shallow groundwater contamination at the St. Louis Airport Site having, or expected to have, any environmentally significant impact on water or sediment quality in Coldwater Creek?

2) Is surface water runoff from the St. Louis Airport Site having, or expected to have, any environmentally significant impact on water or sediment quality in Coldwater Creek?

3) Is contamination present at the St. Louis Airport Site expected to have any environmental significant impact on the "deep" bedrock groundwater within the foreseeable future (*e.g.*, next 100 years)?

[1] From the "Statement of Work" section of the Technical Services Contract.

135220

St. Louis Site Expert Geohydrologic Panel

MEETING SIGN-IN

October 5, 1995

Name: J. K. GRANT

Affiliation: MALLINCKRODT CHEMICAL

Address: 16305 SWINGLEY RIDGE DR.

CHESTERFIELD, MO. 63017

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ____ NO ____

Name: WAYNE E. BLACK

Affiliation: ST. LOUIS COUNTY DEPT. OF HEALTH

Address: 111 S. MERAMEC

CLAYTON, MO 63105

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES X NO ____

Name: BRUCE N. DIEL

Affiliation: MIDWEST RESEARCH INSTITUTE

Address: 425 VOLKER BLVD

KANSAS CITY, MO 64110

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES X NO ____

Name: Mitchell C. Scherzinger

Affiliation: MDNR

Address: P.O. Box 176

Jefferson City, Mo 65102

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES X NO ___

Name: Jeff Braun

Affiliation: Bechtel

Address: ___

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ___ NO ✓

Name: KEN SKINNER

Affiliation: BECHTEL

Address: 151 LAFAYETTE DR

OAK RIDGE TN 37832

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ___ NO ✓

Name: GEORGE STEPHENS

Affiliation: SAIC

Address: ~~1708 GRENADA~~ 301 LAB RD

OAK RIDGE TN 37830

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ___ NO ___

Name: S. C. MEHROTRA

Affiliation: Bechtel National

Address: 151, Lafayette Drive
Oak Ridge, TN 37830

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ✓ NO ____

Name: Jason Darby

Affiliation: DOE FUSRAP

Address: ____

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ____ NO ✓

Name: Theresa Patterson

Affiliation: SAIC

Address: ____

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ____ NO ____

Name: Jan Titus

Affiliation: Lambert Airport

Address: ____

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ✓ NO ____

Name: Sally Price

Affiliation: St. Louis Site Remediation Task Force

Address:

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ______ NO ______

Name: Margaret Hermes

Affiliation: MO Coalition for the Environment

Address: 6107 Kingsbury
St Louis 63112

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ______ NO ______

Name: Kay Drey

Affiliation: MO Coalition for the Environment

Address: 515 West Point Ave
University City MO 63130

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ✓ NO ______

Name: Angel Martin, Jr.

Affiliation: USGS/WRD - Illinois District

Address: 102 E. Main St., 9th Floor
Urbana, IL 61801

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ______ NO ______

Name: Mimi Garstang

Affiliation: ______

Address: PO Box 250

Rolla, MO 65402

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ✓ NO ______

Name: ______

Affiliation: ______

Address: ______

______

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ______ NO ______

Name: ______

Affiliation: ______

Address: ______

______

Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ______ NO ______

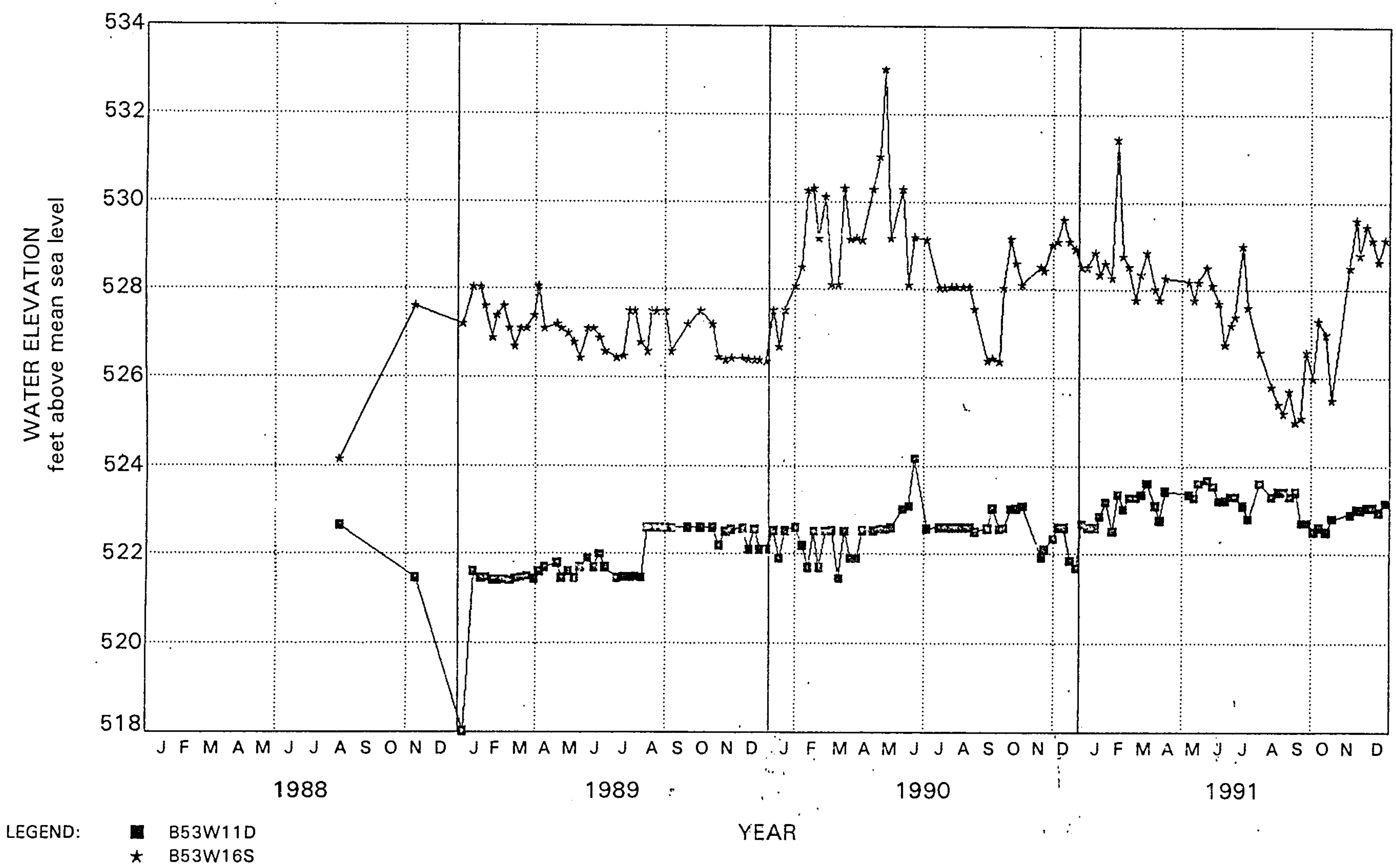
Name: ______

Affiliation: ______

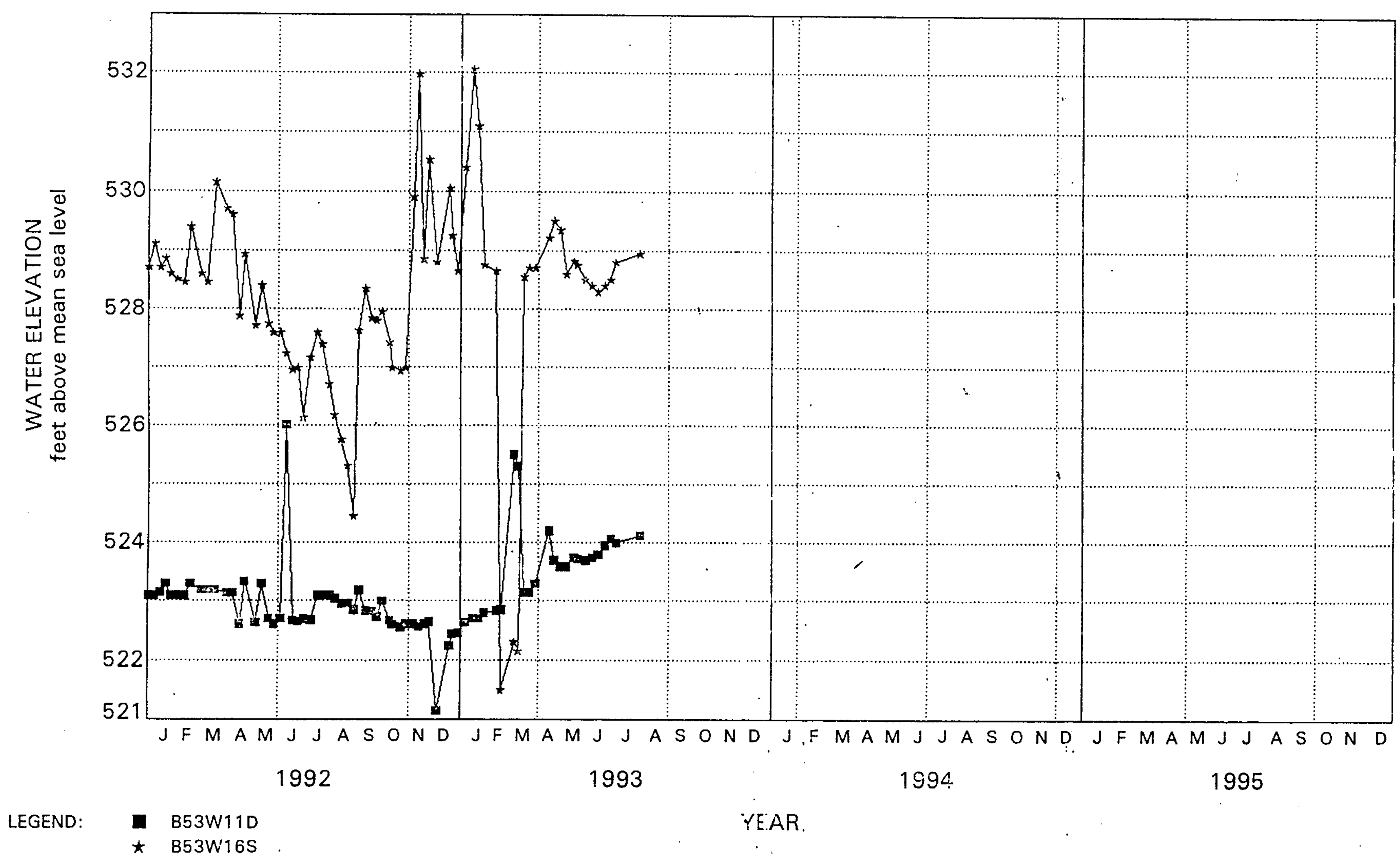
Address: ______

______

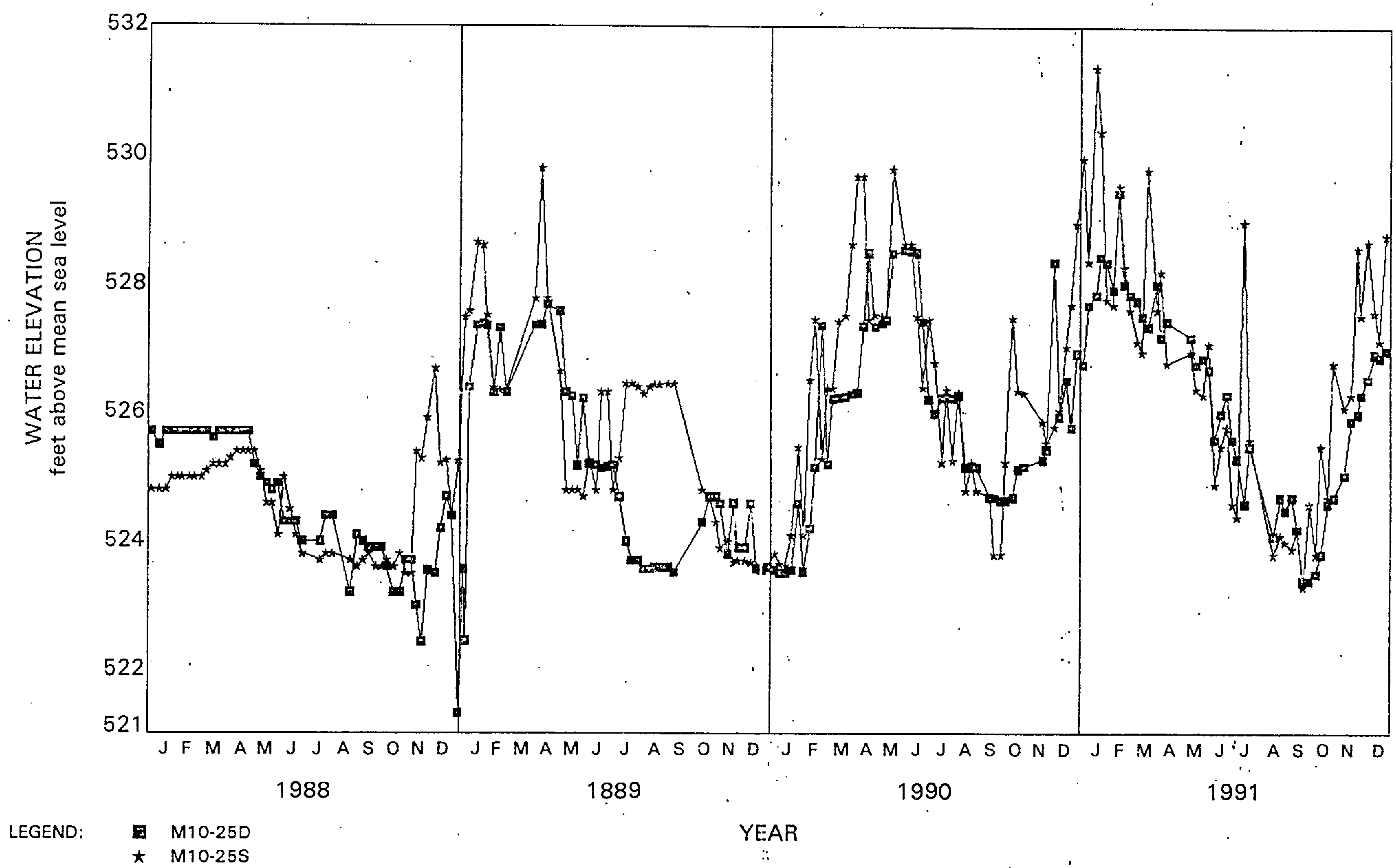
Do you wish to be added to the Task Force mailing list and receive information about future meetings? YES ______ NO ______

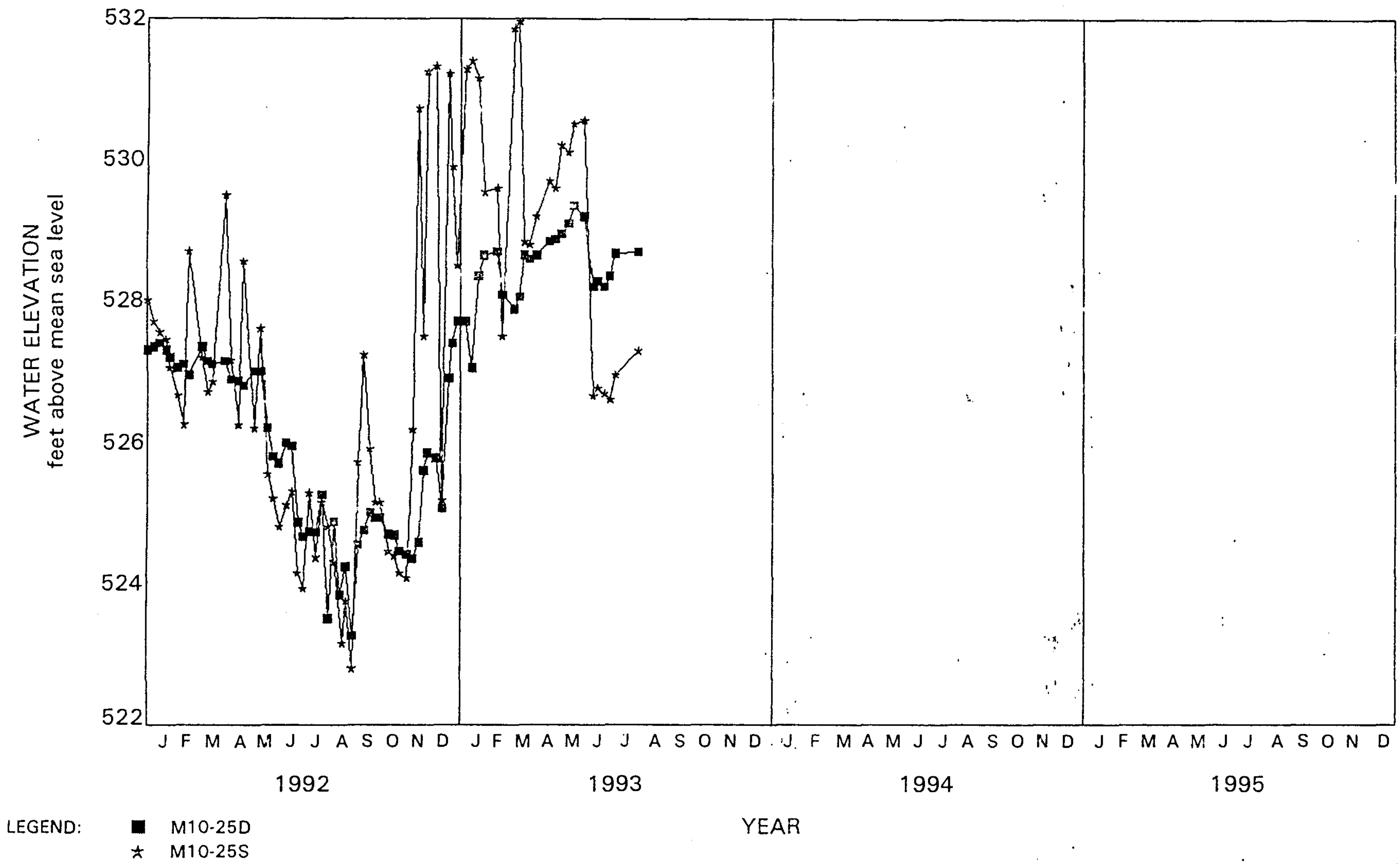


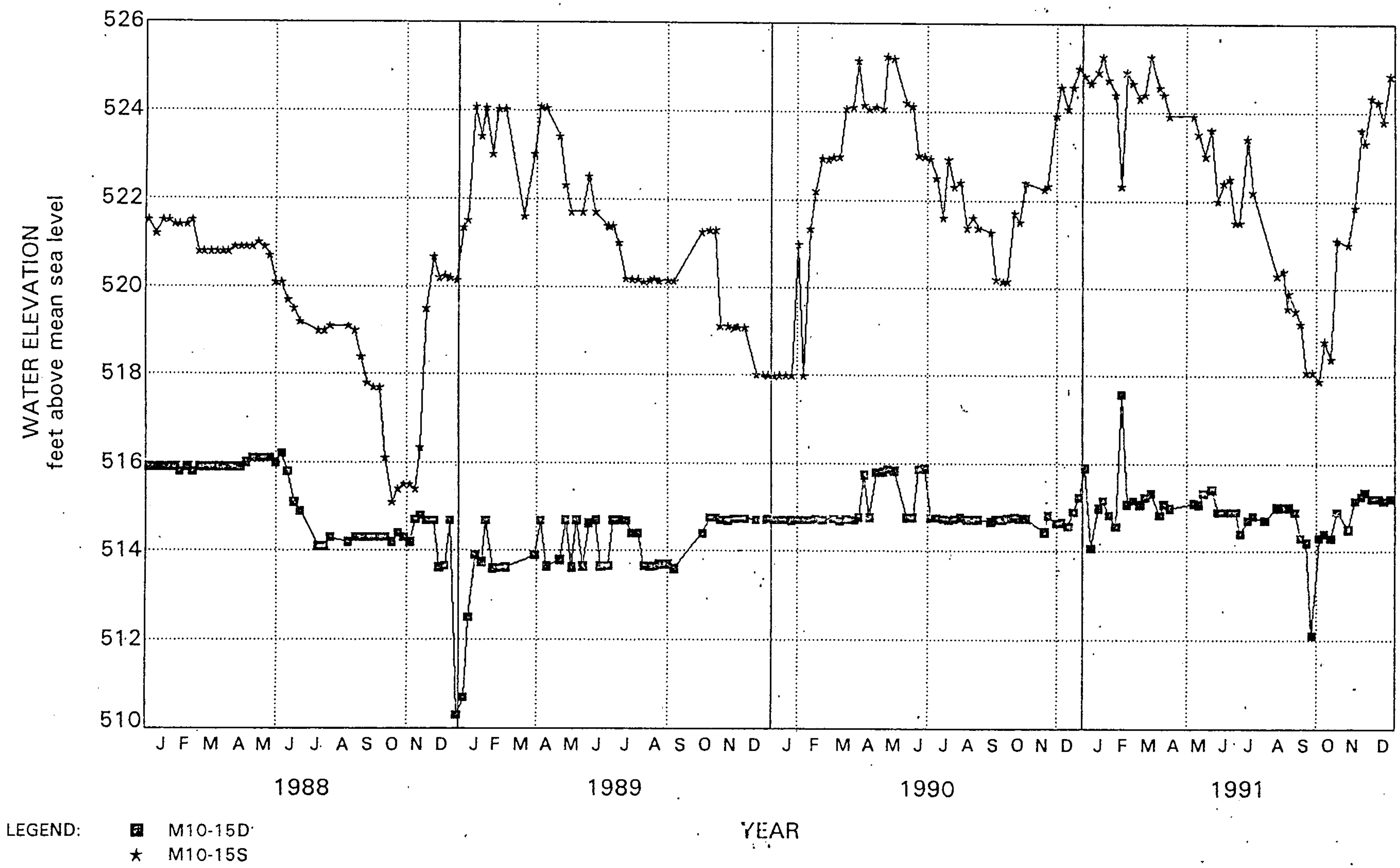
534
532
530
528
526
524
522
520
518
WATER ELEVATION
feet above mean sea level
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1988
1989
1990
1991
YEAR
LEGEND:
B53W11D
B53W16S



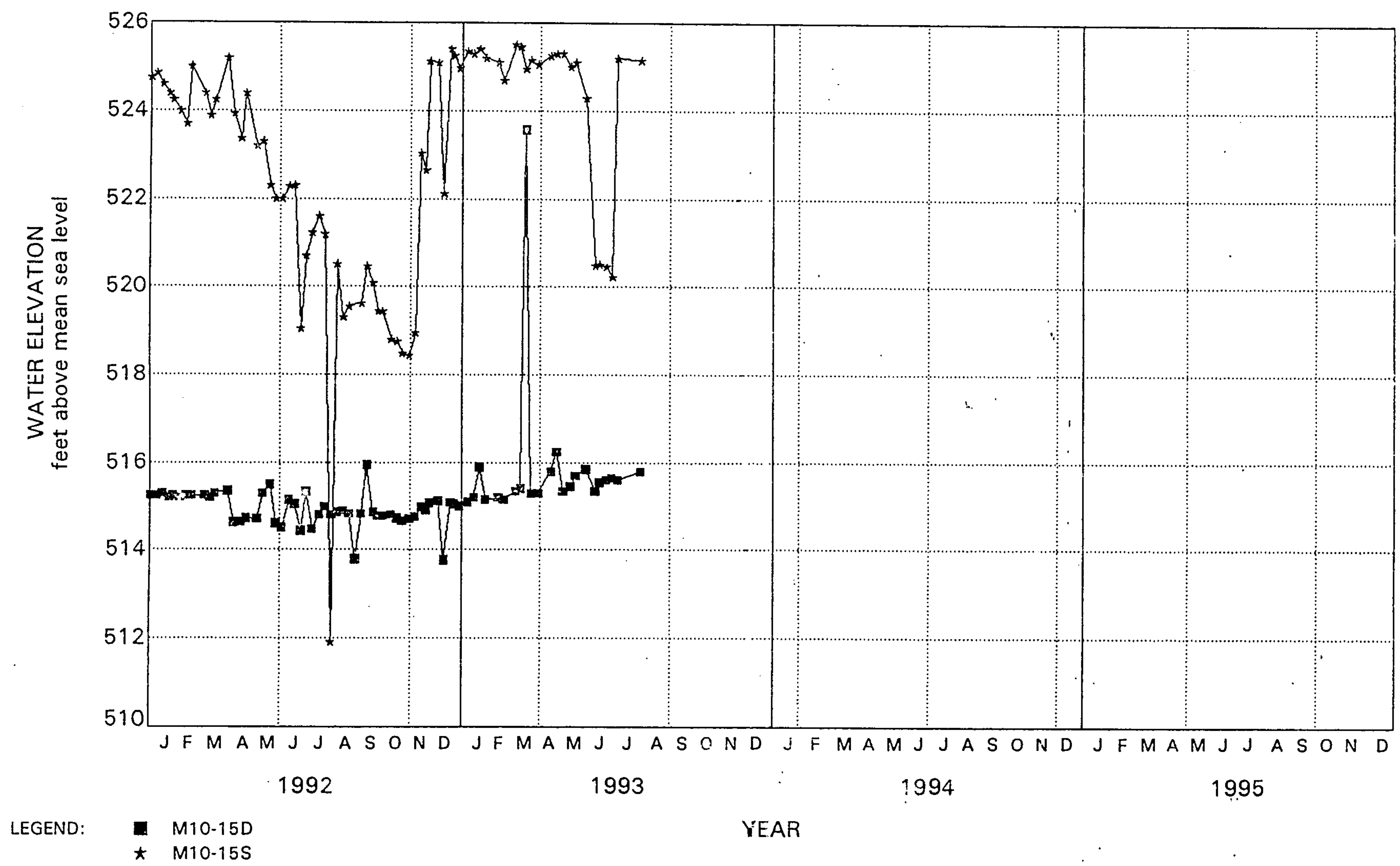
WATER ELEVATION
feet above mean sea level
532
530
528
526
524
522
521
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1992
1993
1994
1995
YEAR
LEGEND:
B53W11D
B53W16S

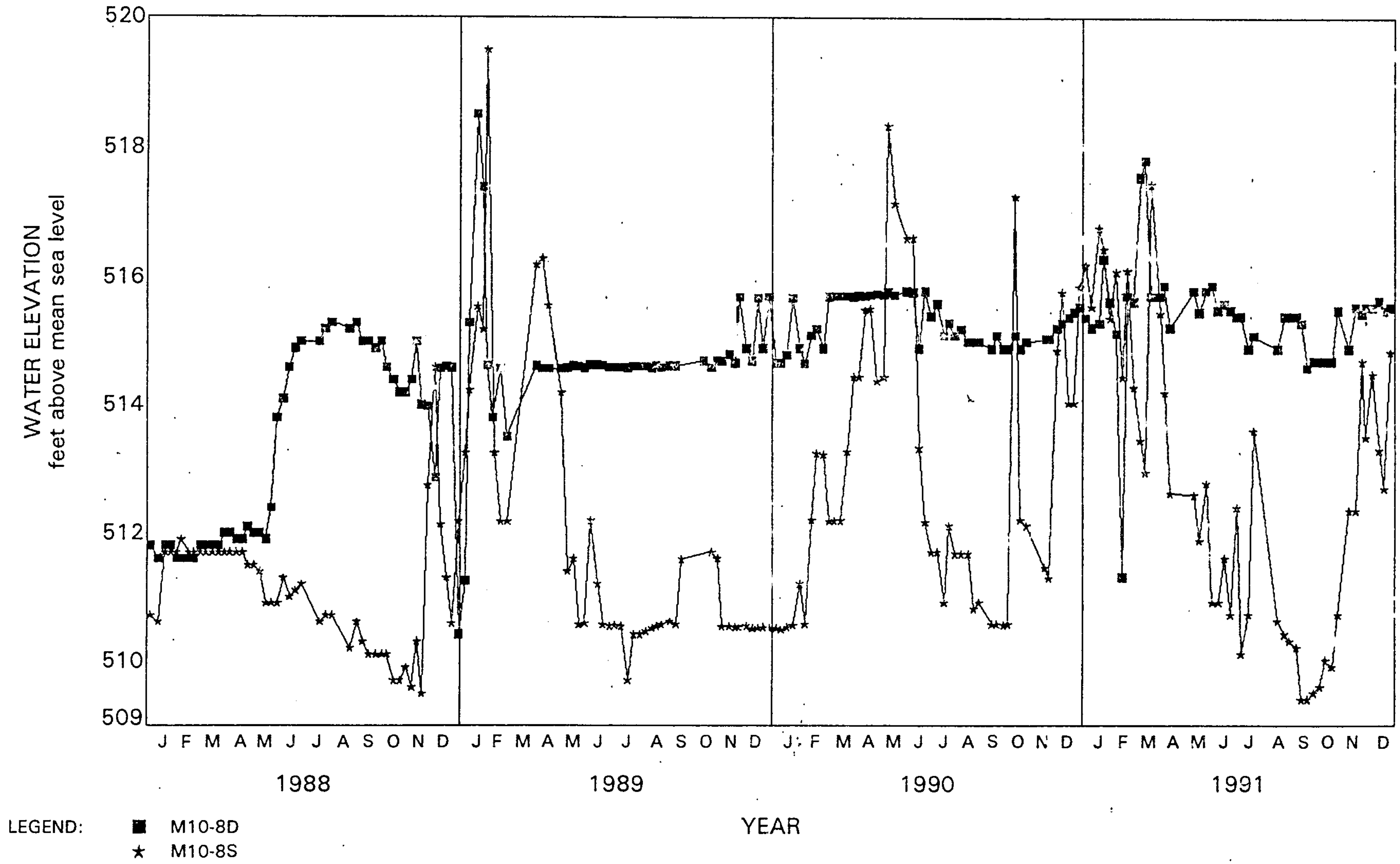

532
530
528
526
524
522
521
WATER ELEVATION
feet above mean sea level
J F M A M J J A S O N D
1988
1889
1990
1991
LEGEND:
M10-25D
M10-25S
YEAR


532
530
528
526
524
522
WATER ELEVATION
feet above mean sea level
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1992
1993
1994
1995
YEAR
LEGEND:
M10-25D
M10-25S

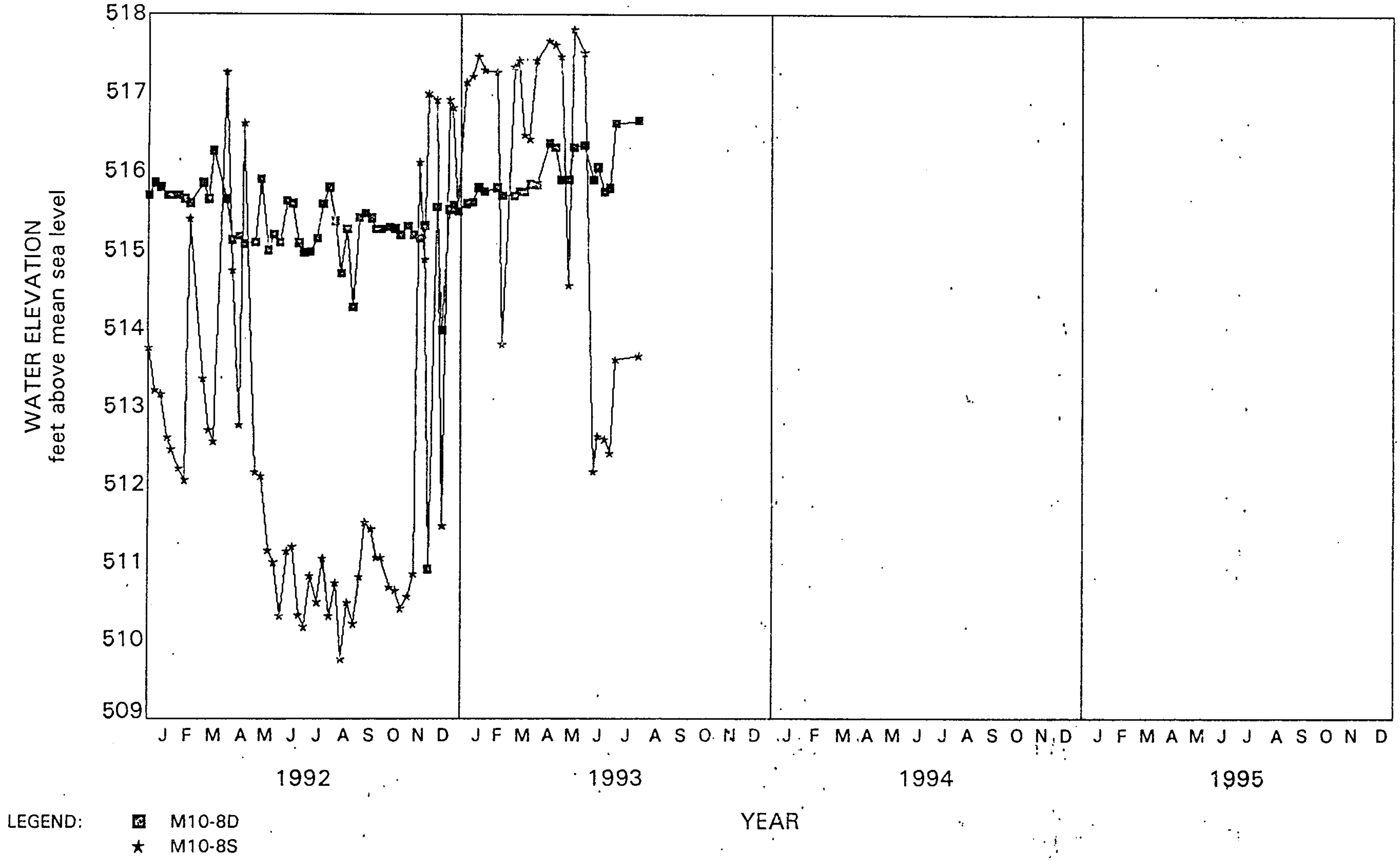


WATER ELEVATION
feet above mean sea level
526
524
522
520
518
516
514
512
510
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1988
1989
1990
1991
YEAR
LEGEND:
M10-15D
M10-15S

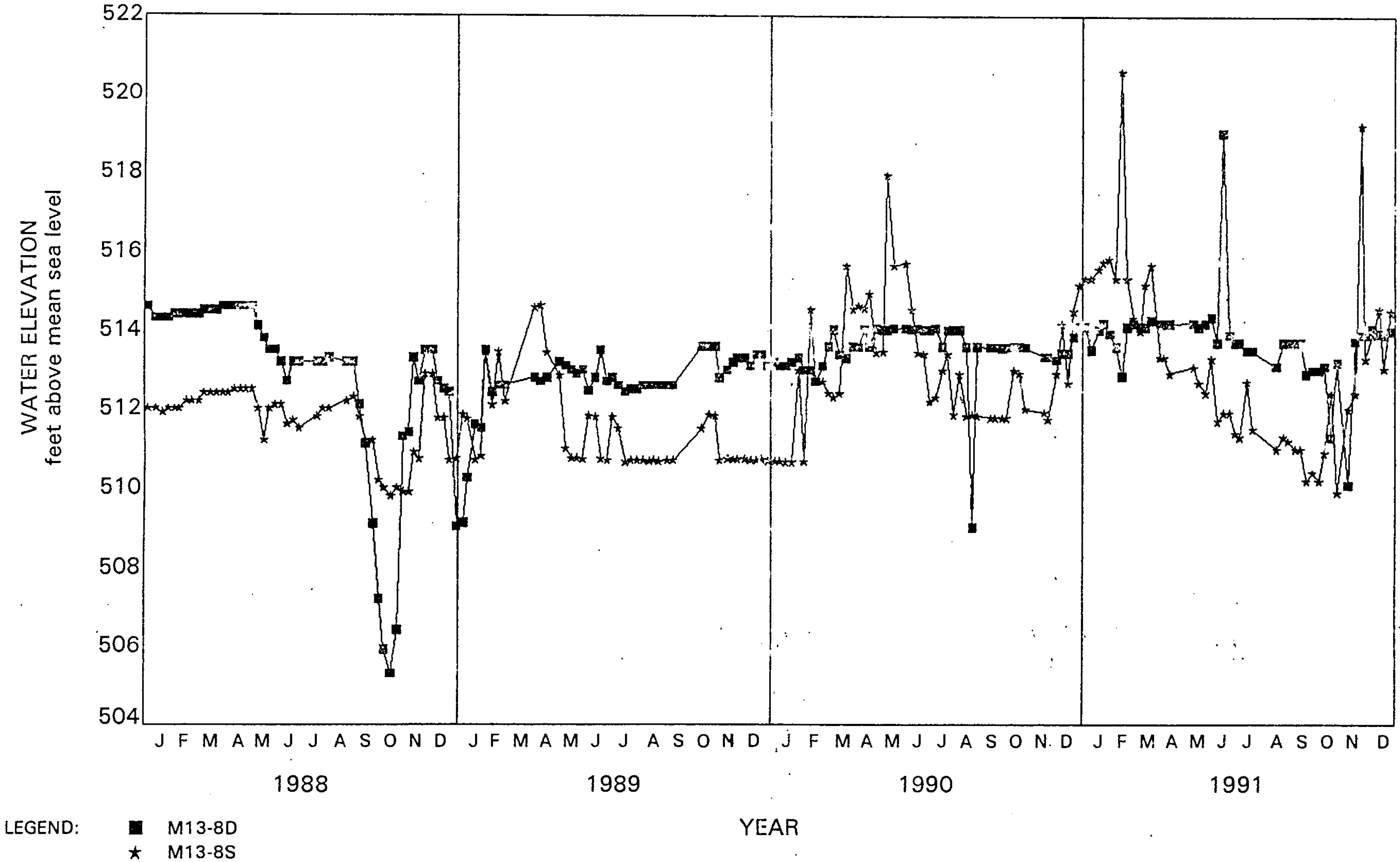

526
524
522
520
518
516
514
512
510
WATER ELEVATION
feet above mean sea level
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1992
1993
1994
1995
YEAR
LEGEND:
M10-15D
M10-15S

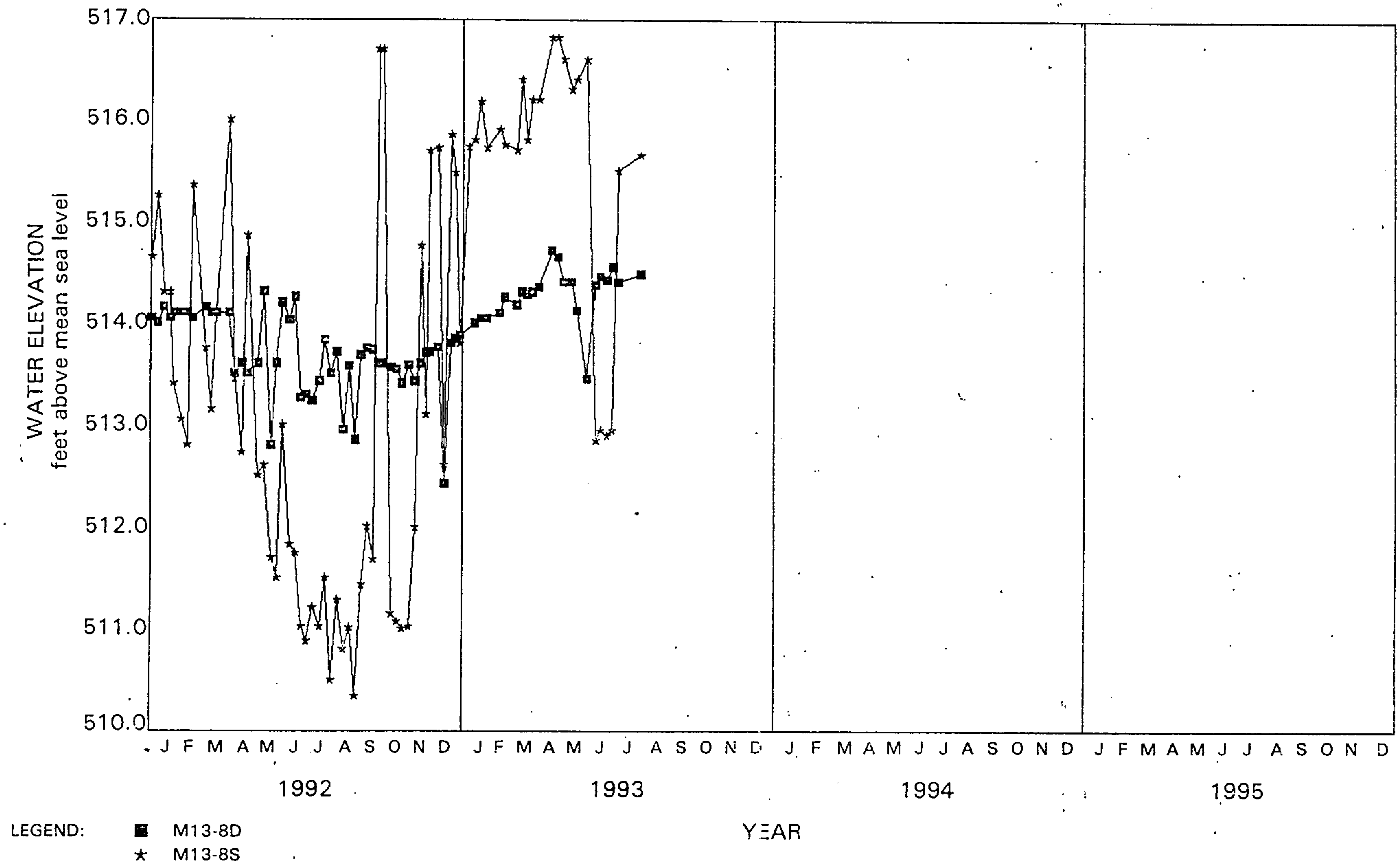


WATER ELEVATION
feet above mean sea level
520
518
516
514
512
510
509
J F M A M J J A S O N D
1988
1989
1990
1991
YEAR
LEGEND:
M10-8D
M10-8S

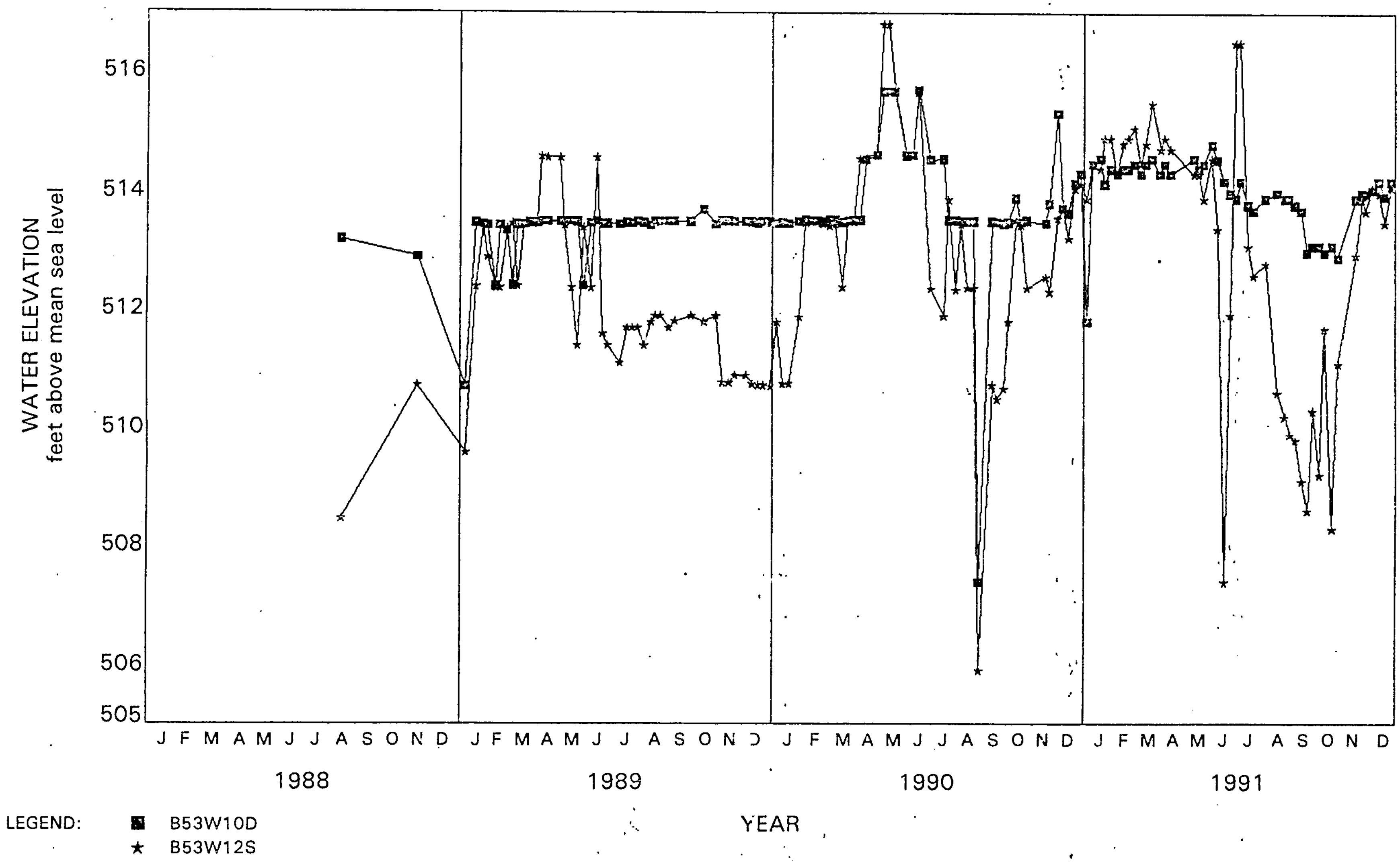


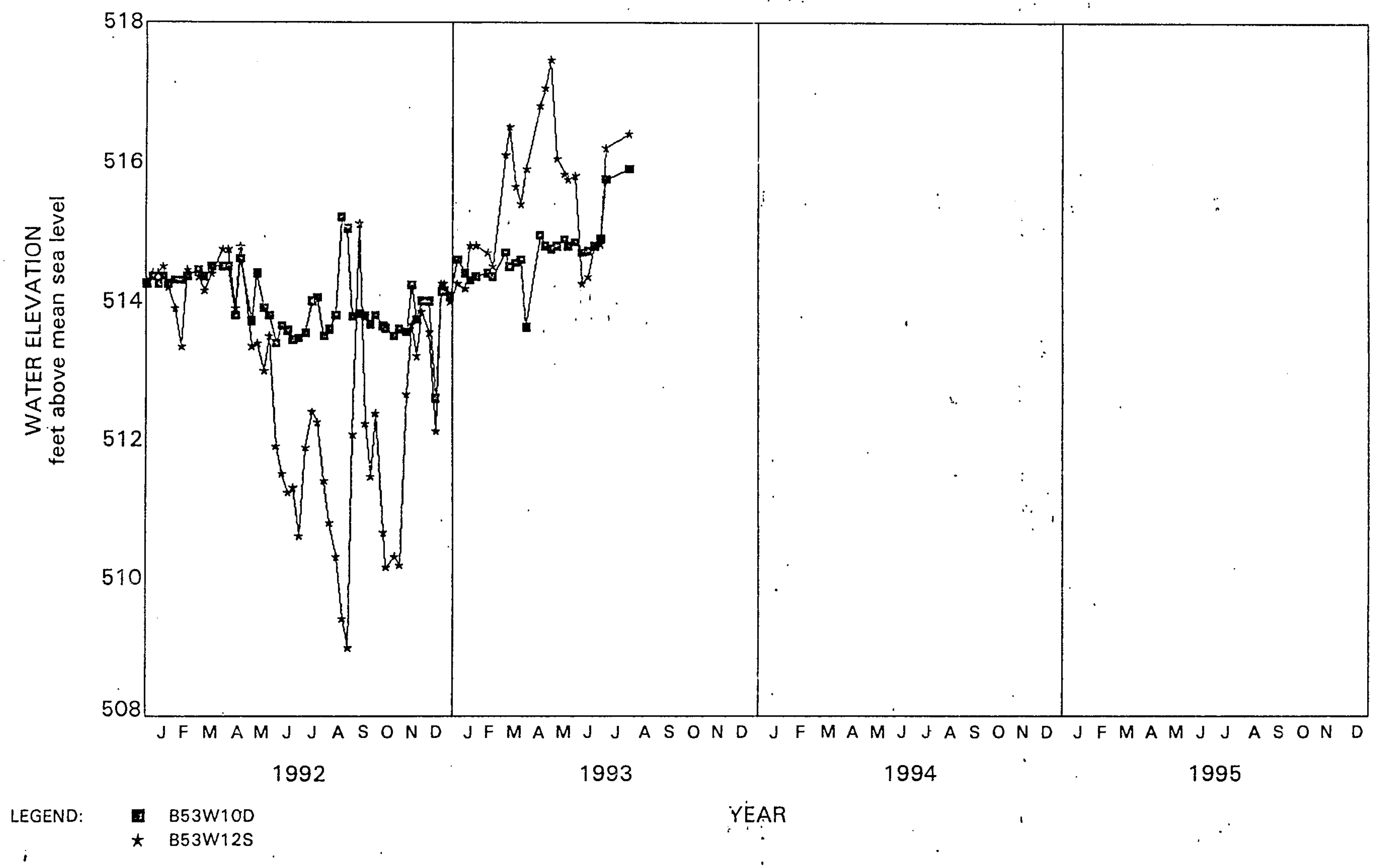
WATER ELEVATION
feet above mean sea level
518
517
516
515
514
513
512
511
510
509
J F M A M J J A S O N D
1992
1993
1994
1995
YEAR
LEGEND:
M10-8D
M10-8S

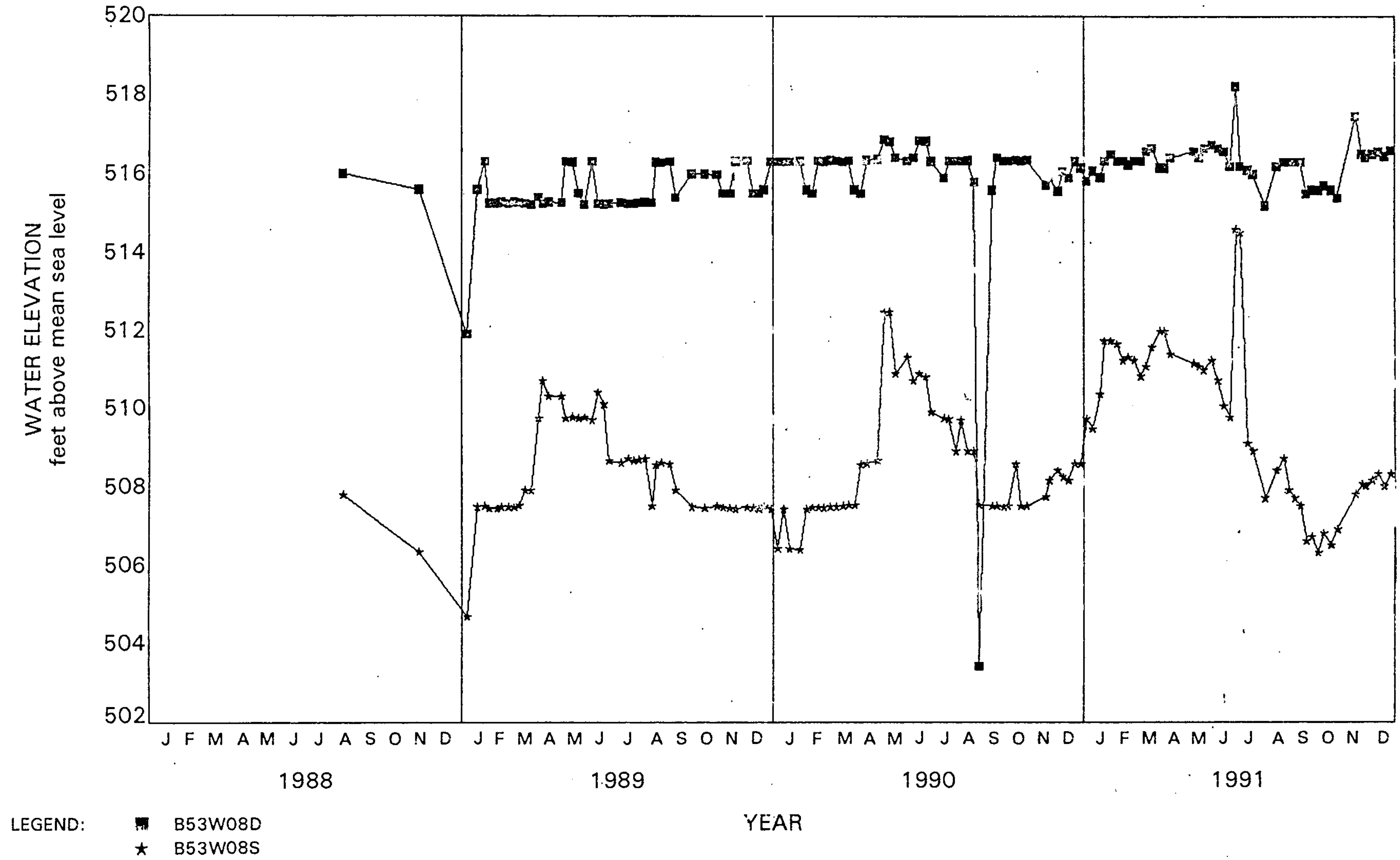

522
520
518
516
514
512
510
508
506
504
WATER ELEVATION
feet above mean sea level
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1988
1989
1990
1991
YEAR
LEGEND:
M13-8D
M13-8S



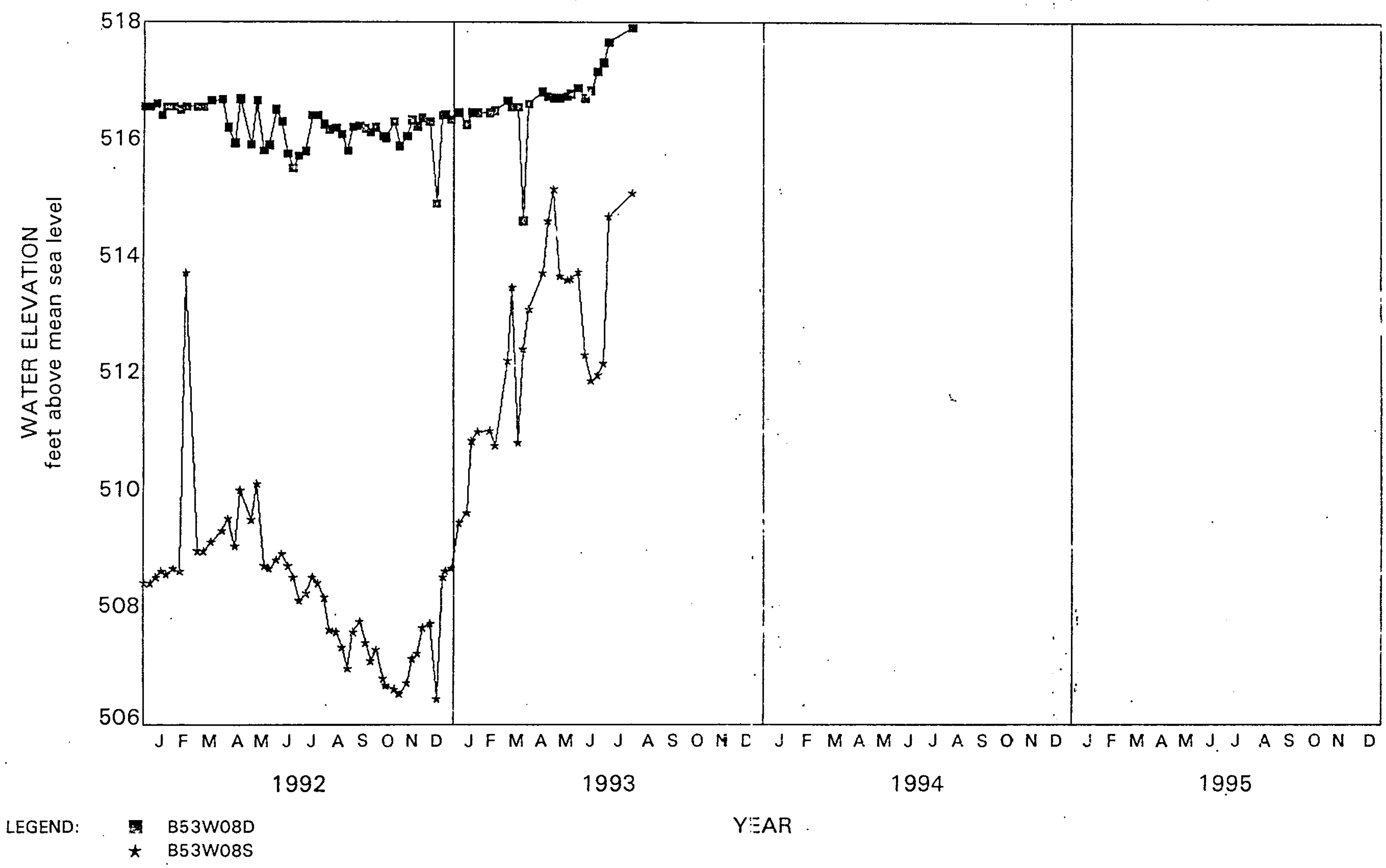
WATER ELEVATION
feet above mean sea level
517.0
516.0
515.0
514.0
513.0
512.0
511.0
510.0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1992
1993
1994
1995
YEAR
LEGEND:
M13-8D
M13-8S


WATER ELEVATION
feet above mean sea level
516
514
512
510
508
506
505
J F M A M J J A S O N D
1988
1989
1990
1991
YEAR
LEGEND:
B53W10D
B53W12S

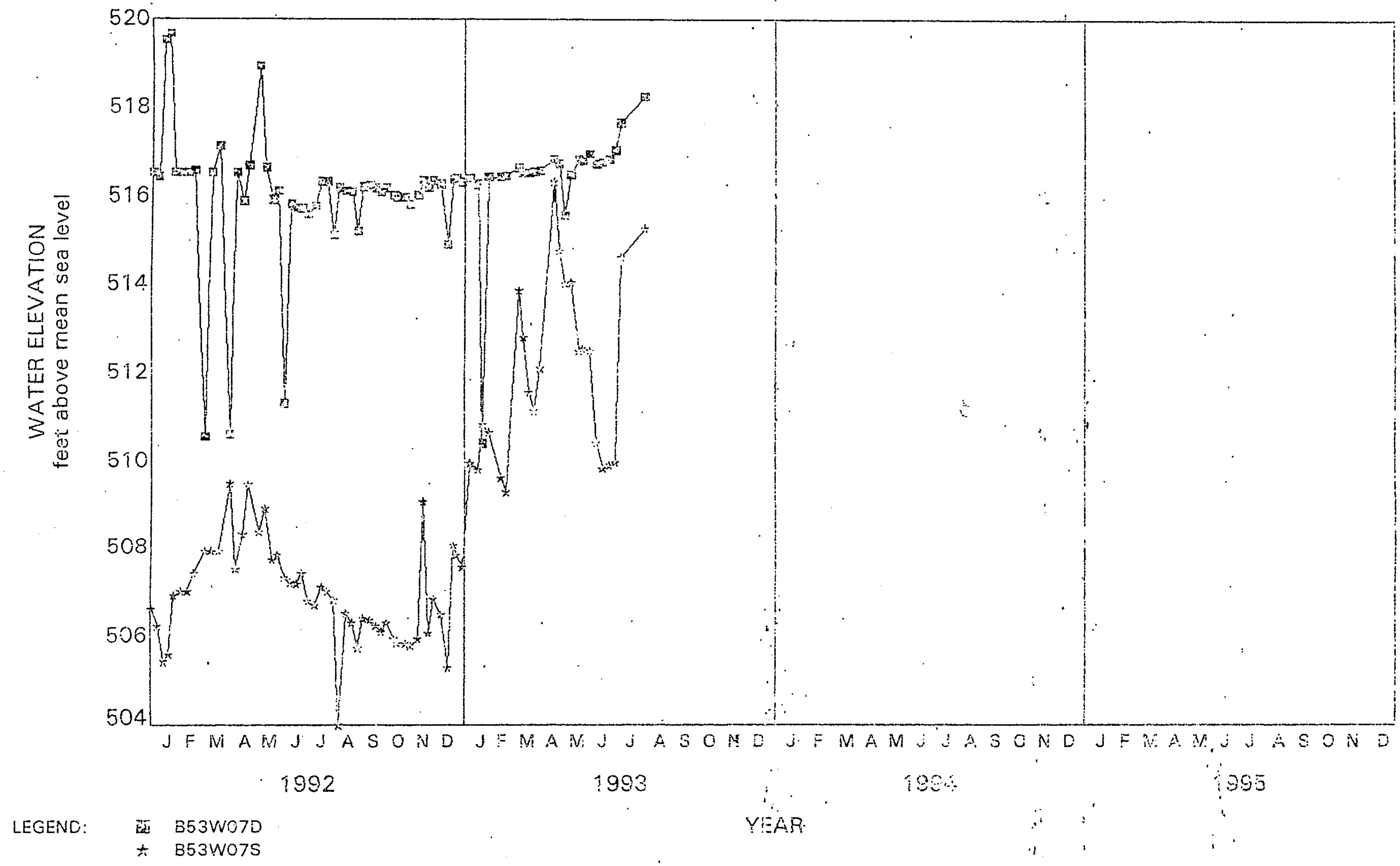

WATER ELEVATION
feet above mean sea level
518
516
514
512
510
508
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1992
1993
1994
1995
YEAR
LEGEND:
B53W10D
B53W12S



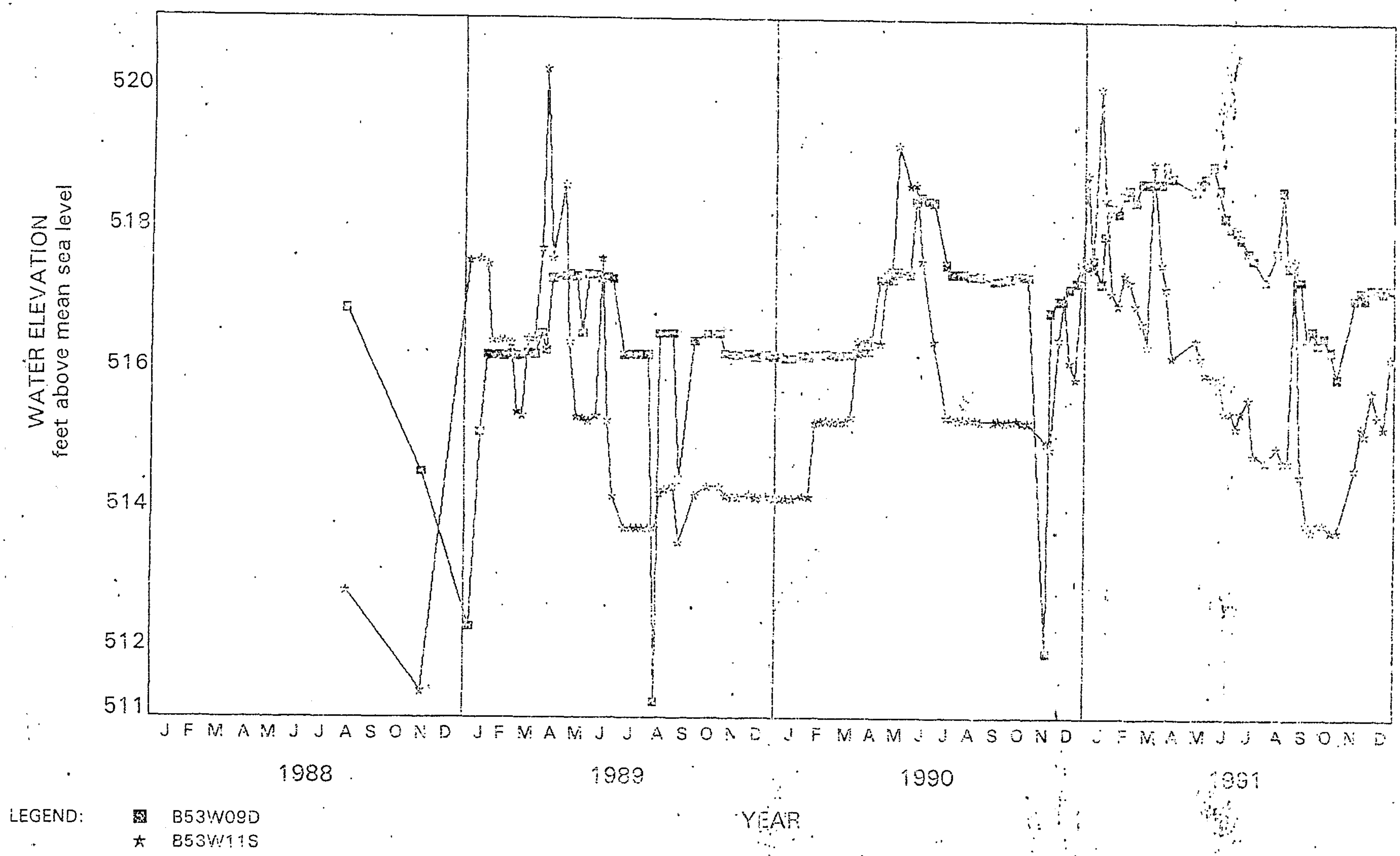
WATER ELEVATION
feet above mean sea level
520
518
516
514
512
510
508
506
504
502
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1988
1989
1990
1991
YEAR
LEGEND:
B53W08D
B53W08S

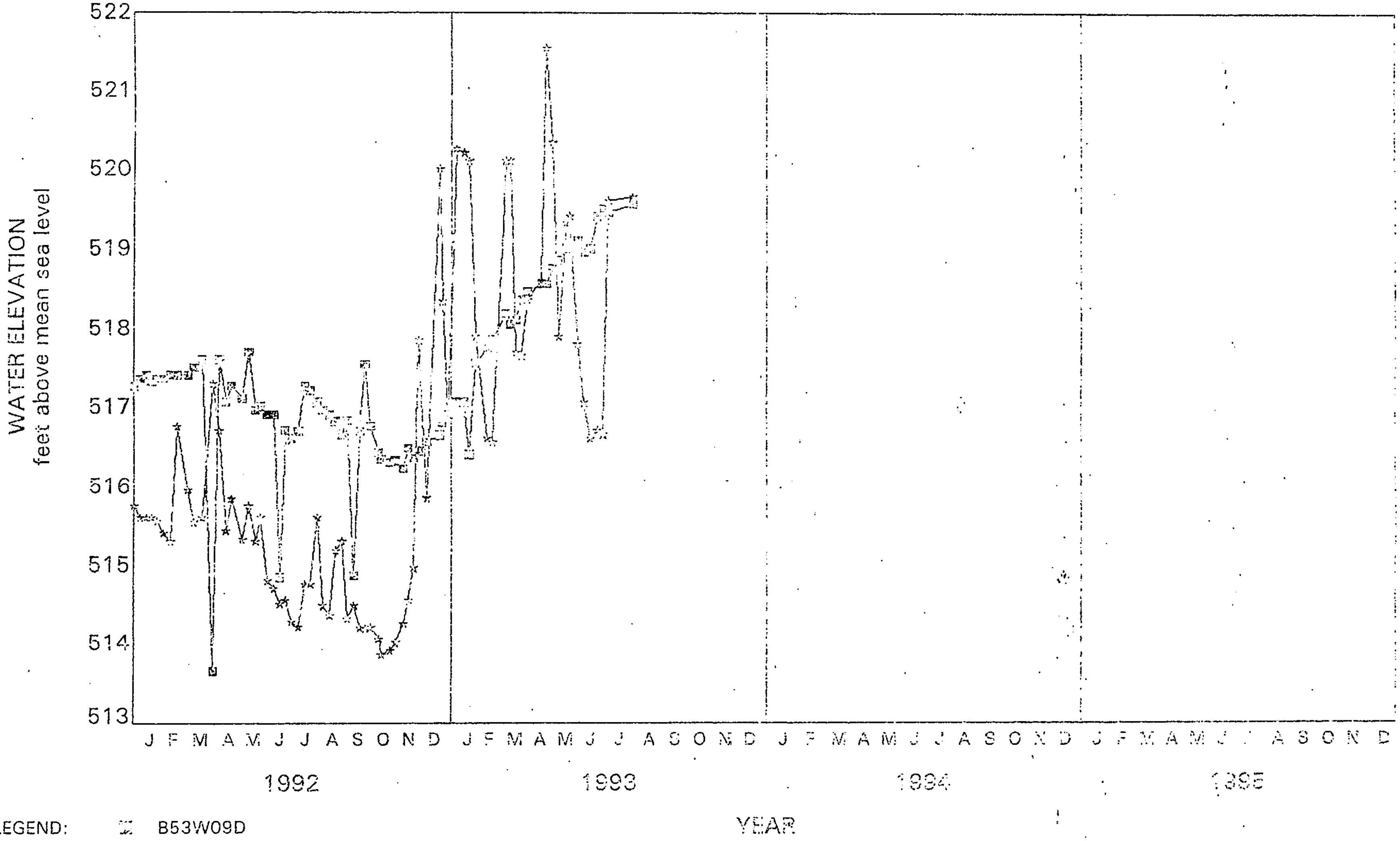


518
516
514
512
510
508
506
WATER ELEVATION
feet above mean sea level
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1992
1993
1994
1995
YEAR
LEGEND:
B53W08D
B53W08S



WATER ELEVATION
feet above mean sea level
520
518
516
514
512
510
508
506
504
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1992
1993
1994
1995
YEAR
LEGEND:
B53W07D
B53W07S


WATER ELEVATION
feet above mean sea level
520
518
516
514
512
511
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1988
1989
1990
1991
YEAR
LEGEND:
B53W09D
B53W11S



LEGEND: B53W09D
B53W11S

Table 3-46 Historic Sampling Data
Chemical Concentrations in Groundwater
Sampling Results at SLAPS

Location ID	Coordinates East	Coordinates North	Depth Interval (in feet)	Parameters	Results	Units
M10-8S	800	1010	n/a	ENDOSULFAN I	0.1	UG/L
M10-8S	800	1010	"	BORON	238.0	UG/L
M10-8S	800	1010	"	CALCIUM	82900	UG/L
M10-8S	800	1010	"	COPPER	322.0	UG/L
M10-8S	800	1010	"	MAGNESIUM	30100	UG/L
M10-8S	800	1010	"	MANGANESE	1050.0	UG/L
M10-8S	800	1010	"	SODIUM	23400	UG/L
M10-8D	800	1011	"	ENDOSULFAN I	0.1	UG/L
M10-8D	800	1011	"	TOLUENE	61.0	UG/L
M10-8D	800	1011	"	BIS(2-ETHYLHEXYL) PHTHALATE	170.0	UG/L
M10-8D	800	1011	"	BARIUM	358.0	UG/L
M10-8D	800	1011	"	CALCIUM	128000	UG/L
M10-8D	800	1011	"	IRON	105.0	UG/L
M10-8D	800	1011	"	MAGNESIUM	38700	UG/L
M10-8D	800	1011	"	MANGANESE	2730.0	UG/L
M10-8D	800	1011	"	SODIUM	53100	UG/L
M10-8D	800	1011	"	ZINC	26.2	UG/L
WELL-B	825	1110	"	1,2-DICHLOROETHENE (TOTAL)	77.0	UG/L
WELL-B	825	1110	"	TRICHLOROETHENE	110.0	UG/L
WELL-B	825	1110	"	ALUMINUM	643.0	UG/L
WELL-B	825	1110	"	BARIUM	255.0	UG/L
WELL-B	825	1110	"	BORON	268.0	UG/L
WELL-B	825	1110	"	CALCIUM	923000	UG/L
WELL-B	825	1110	"	COPPER	47.3	UG/L
WELL-B	825	1110	"	IRON	150.0	UG/L
WELL-B	825	1110	"	MAGNESIUM	302000	UG/L
WELL-B	825	1110	"	MANGANESE	1370.0	UG/L

= Compound was detected in the blank
= Results ranged from below the detection limit to the results shown
Note: Parameters for which results were below the sensitivity of the analytical method are not included

Chemical Concentrations in Groundwater
Sampling Results at SLAPS

Location ID	Coordinates East	Coordinates North	Depth Interval (in feet)	Parameters	Results	Units
M13.5-8.5D	864	1339	n/a	ZINC	333.0	UG/L
WELL-A	880	1240	"	TOLUENE	11.0	UG/L
WELL-A	880	1240	"	BIS(2-ETHYLHEXYL) PHTHALATE	23.0	UG/L
WELL-A	880	1240	"	ALUMINUM	300.0	UG/L
WELL-A	880	1240	"	BORON	503.0	UG/L
WELL-A	880	1240	"	CALCIUM	181000	UG/L
WELL-A	880	1240	"	CHROMIUM	20.1	UG/L
WELL-A	880	1240	"	IRON	155.0	UG/L
WELL-A	880	1240	"	MAGNESIUM	60100	UG/L
WELL-A	880	1240	"	MANGANESE	320.0	UG/L
WELL-A	880	1240	"	SELENIUM	333.0	UG/L
WELL-A	880	1240	"	SODIUM	49400	UG/L
WELL-A	880	1240	"	ZINC	37.2	UG/L
M11-9	900	1102	"	1,2-DICHLOROETHENE (TOTAL)	95.0	UG/L
M11-9	900	1102	"	TRICHLOROETHENE	130.0	UG/L
M11-9	900	1102	"	TOLUENE	170.0	UG/L
M11-9	900	1102	"	BIS(2-ETHYLHEXYL) PHTHALATE	170.0	UG/L
M11-9	900	1102	"	ALUMINUM	669.0	UG/L
M11-9	900	1102	"	BARIUM	272.0	UG/L
M11-9	900	1102	"	BORON	142.0	UG/L
M11-9	900	1102	"	CALCIUM	998000	UG/L
M11-9	900	1102	"	COPPER	50.3	UG/L
M11-9	900	1102	"	IRON	254.0	UG/L
M11-9	900	1102	"	MAGNESIUM	334000	UG/L
M11-9	900	1102	"	MANGANESE	4170.0	UG/L
M11-9	900	1102	"	SODIUM	180000	UG/L
M11-9	900	1102	"	ZINC	47.4	UG/L

: = Compound was detected in the blank
: = Results ranged from below the detection limit to the results shown
Note: Parameters for which results were below the sensitivity of the analytical method are not included

Chemical Concentrations in Groundwater
Sampling Results at SLAPS

Location ID	Coordinates East	Coordinates North	Depth Interval (in feet)	Parameters	Results	Units
M11-21	2096	1098	n/a	BORON	258.0	UG/L
M11-21	2096	1098	"	CALCIUM	309000	UG/L
M11-21	2096	1098	"	IRON	101.0	UG/L
M11-21	2096	1098	"	MAGNESIUM	70000	UG/L
M11-21	2096	1098	"	MANGANESE	59.0	UG/L
M11-21	2096	1098	"	SELENIUM	859.0	UG/L
M11-21	2096	1098	"	SODIUM	84400	UG/L
WELL-E	2220	1455	"	ALUMINUM	266.0	UG/L
WELL-E	2220	1455	"	BORON	204.0	UG/L
WELL-E	2220	1455	"	CALCIUM	555000	UG/L
WELL-E	2220	1455	"	IRON	160.0	UG/L
WELL-E	2220	1455	"	MAGNESIUM	60500	UG/L
WELL-E	2220	1455	"	SELENIUM	5560.0	UG/L
WELL-E	2220	1455	"	SODIUM	109000	UG/L
M10-25S	2500	1009	"	ENDOSULFAN I	0.1	UG/L
M10-25S	2500	1009	"	BIS(2-ETHYLHEXYL) PHTHALATE	36.0	UG/L
M10-25S	2500	1009	"	BARIUM	233.0	UG/L
M10-25S	2500	1009	"	CALCIUM	250000	UG/L
M10-25S	2500	1009	"	IRON	2420.0	UG/L
M10-25S	2500	1009	"	MAGNESIUM	64800	UG/L
M10-25S	2500	1009	"	MANGANESE	6850.0	UG/L
M10-25S	2500	1009	"	SODIUM	57000	UG/L
M10-25S	2500	1009	"	ZINC	34.1	UG/L
M10-25D	2508	1012	"	BIS(2-ETHYLHEXYL) PHTHALATE	430.0	UG/L
M10-25D	2508	1012	"	BARIUM	699.0	UG/L
M10-25D	2508	1012	"	BORON	106.0	UG/L
M10-25D	2508	1012	"	CALCIUM	69700	UG/L

= Compound was detected in the blank
= Results ranged from below the detection limit to the results shown
ote: Parameters for which results were below the sensitivity of the analytical method are not included

Table 3-50 Historic Sampling Data
Chemical Concentrations in Groundwater
Background Results at SLAPS

Location ID	Coordinates East	North	Depth Interval (in feet)	Parameters	Results	Units
BS3 W01D	1634	3198	n/a	BARIUM	540.0	UG/L
BS3 W01D	1634	3198	"	BIS(2-ETHYLHEXYL) PHTHALATE	2200.0	UG/L
BS3 W01D	1634	3198	"	CALCIUM	112000	UG/L
BS3 W01D	1634	3198	"	MAGNESIUM	42000	UG/L
BS3 W01D	1634	3198	"	MANGANESE	2100.0	UG/L
BS3 W01D	1634	3198	"	SODIUM	48000	UG/L
BS3 W01D	1634	3198	"	ZINC	13.8	UG/L
BS3 W01S	1648	3197	"	BARIUM	311.0	UG/L
BS3 W01S	1648	3197	"	CALCIUM	112000	UG/L
BS3 W01S	1648	3197	"	IRON	141.0	UG/L
BS3 W01S	[illegible]	3197	"	MAGNESIUM	47400	UG/L
BS3 W01S	1648	3197	"	MANGANESE	1150.0	UG/L
BS3 W01S	1648	3197	"	SODIUM	21500	UG/L
BS3 W01S	1648	3197	"	ZINC	31.3	UG/L

[illegible] = Compound was detected in the blank
= Results ranged from below the detection limit to the results shown
Note: Parameters for which results were below the sensitivity of the analytical method are not included

QUESTIONS/ACTIONS AND RESPONSES FROM
ST. LOUIS EXPERT PANEL MEETING
SEPTEMBER 15, 1995

1) Can you distinguish residues from areas contaminated by residues? (MILLER)

Response: Historical photographs and maps of the radionuclide distribution are provided. The discussion can focus on these items.

7) What is the difference between pits and dumps re: elevation, and what is the difference between pitchblende raffinate and raffinate? (i.e. difference between areas AM-7 and AM-10 on the St. Louis site?) (MILLER)

Response: See photographs for qualitative information on the pits and dumps. Pitchblende raffinates cannot be distinguished from raffinates based simply on the processes known to have been used to refine the uranium. Two likely possibilities exist. The first is that raffinate is simply a shortening of the term pitchblende raffinate. The other possibility is that the pitchblende raffinate is raffinate produced during the initial digestion of the pitchblende ore and the raffinate includes the raffinates produces during subsequent processing stages.

2) Need to include vegetation uptake/blowing leaves in pathway analysis. (ALEY)

Six samples were taken from the areas with the highest concentrations of radionuclides at the surface. The analytical results are provided.

3) Need to address bank storage during flooding. (ALEY)

Response provided

13) What is confidence in lab tests vs. slug tests and the consistency between the two types of tests? (ALEY)

20) Need to run good controlled aquifer tests; slug tests normally 1 to 2 orders of magnitude too low. (MILLER)

Response provided.

18) Re: calibration of model. Martin stated it would be good if we had calibrated to flux and not just head.

Response provided.

19) Martin questioned effective recharge of 0.3 inches per year; Mehrotra says numbers are soft. Since the sensitivity of the parameters is so important, the model should be bounded within the range of confidence. What is missing is the connection between the GW system and the creek. Seepage measurements/discharge measurements should be taken.

Response provided.

10) Provide write-up of Ken Skinner's recharge discussion. (MILLER)

Response: Provided.

4) Where were K-65s stored before Fernald? Is there a chance they were stored at SLAPS? (DREY)

The K-65s were stored at the Lake Ontario Storage Facility until their relocation to Fernald (and the Niagara Falls Storage Site). The available historical documentation for the St. Louis Site has been reviewed and does not shed any light on the question. However, the site has been thoroughly sampled for Ra-226 and the results have been provided to the panel.

5) Were any of the fills brought to SLAPS of low-permeability? (ALEY)

Response: The source of the fill could not be determined. A map of the fill texture was constructed based on the geologic log made during the drilling of each borehole. That map is provided. Also included are isopach maps of the estimated fill thickness.

6) Is a 500-year Floodplain map available? (DREY)

Response: It is possible that one will be available later today. It must be obtained from the Army Corps of Engineers in St. Louis.

8) Why are we seeing U and some Ra at the surface, but not thorium? (COX)

Response: The sampling data was reviewed to determine the reason for this apparent anomaly. Analysis was performed for all radionuclides of concern. The data shows very low levels of Th-230 on the central portion of the SLAPS. So low that they were plotted as near background in the color scheme. The reason for this anomaly is not obvious. Because of the separation processes used at Mallinckrodt, the radionuclides are not distributed evenly across the site, nor are they coincident with each other. In addition, fill was placed over portions of the site to reduce exposures at the surface. There is no good historical information on the source of the fill and it is likely that the entire site was not addressed. It is also likely that lower level material from the site was graded over the surface in the attempt to reduce exposures.

9) What is QA of data, potential for error (DIEL as related to Cox's question).

Response: The Remedial Investigation Addendum has been provided for review at this session. It includes the analytical error estimates.

10) Why is area to west of creek along McDonnell Boulevard so high for Th-230, also haul road area? (DREY)

11) Distribution of Th-230 looks suspicious in 0 - 0.5' range along haulroad - what goes off the map along this road. (COX)

Response: (to 10 and 11) McDonnell Boulevard, previously Brown Road, was used as a haul route. It is likely that the thorium contamination resulted from spillage from trucks. It is likely that the bulk of the material transported to the SLAPS from Mallinckrodt was the matrix of the pitchblende ores depleted of uranium and radium. Therefore, the contamination resulting from the depleted ores is marked with higher levels of thorium relative to uranium and radium.

12) What is sense of frequency of hits along the creek? (ALEY) (This is where Skinner said that maps have been put together, and Dan Wall described the figure).

Response: A slide will be provided (if a slide projector is available).

14) Depict the range of water table data and potentiometric map/contouring. (ALEY)

Provided during last meeting. Additional data available in Site Suitability Report.

15) Provide table to show well clusters and water level data (relationship between shallow/deep; screen interval vs. head. (MILLER)

Response: Provided - J. Braun

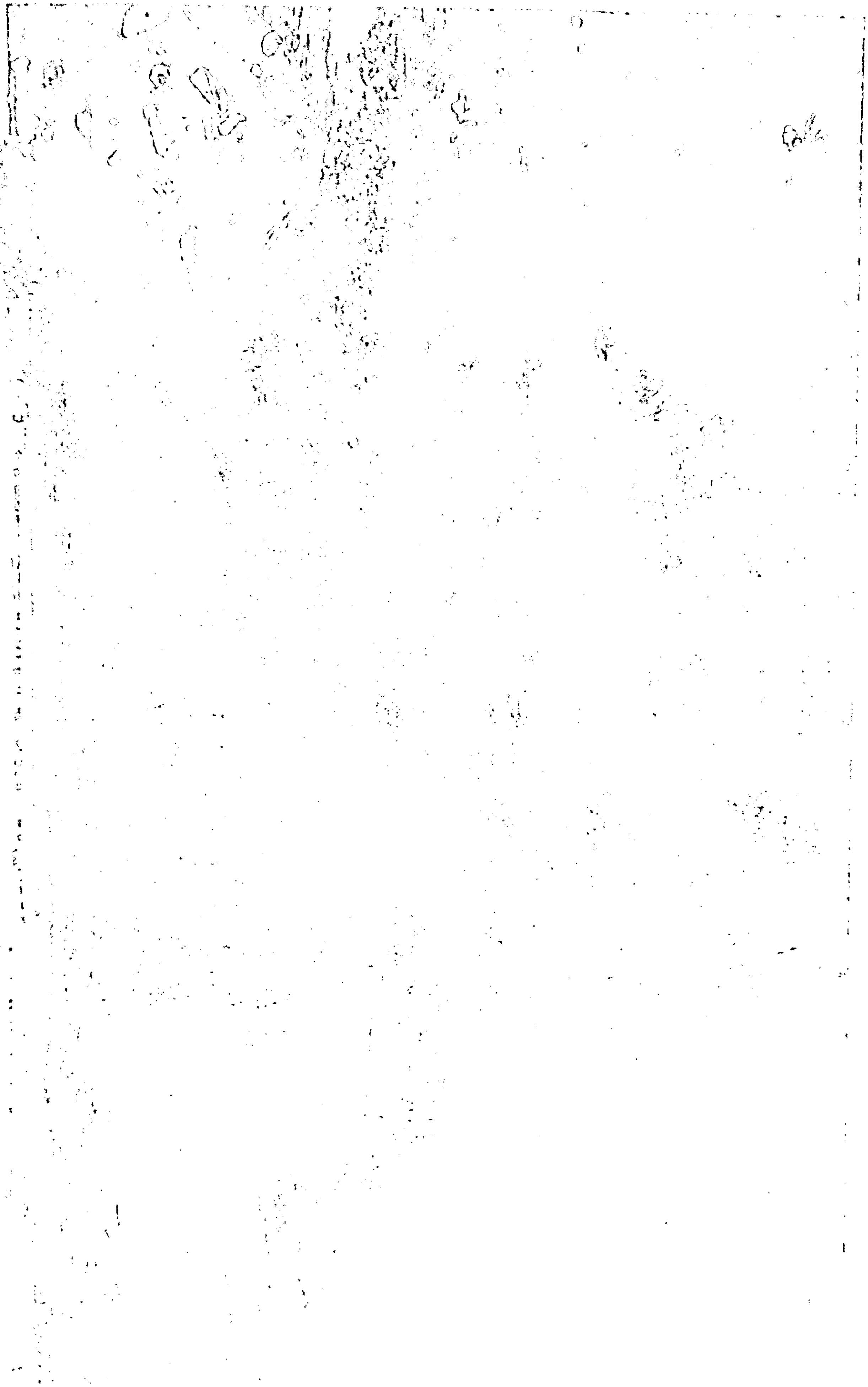
17) Tie in hydrographs with rainfall response. (ALEY)

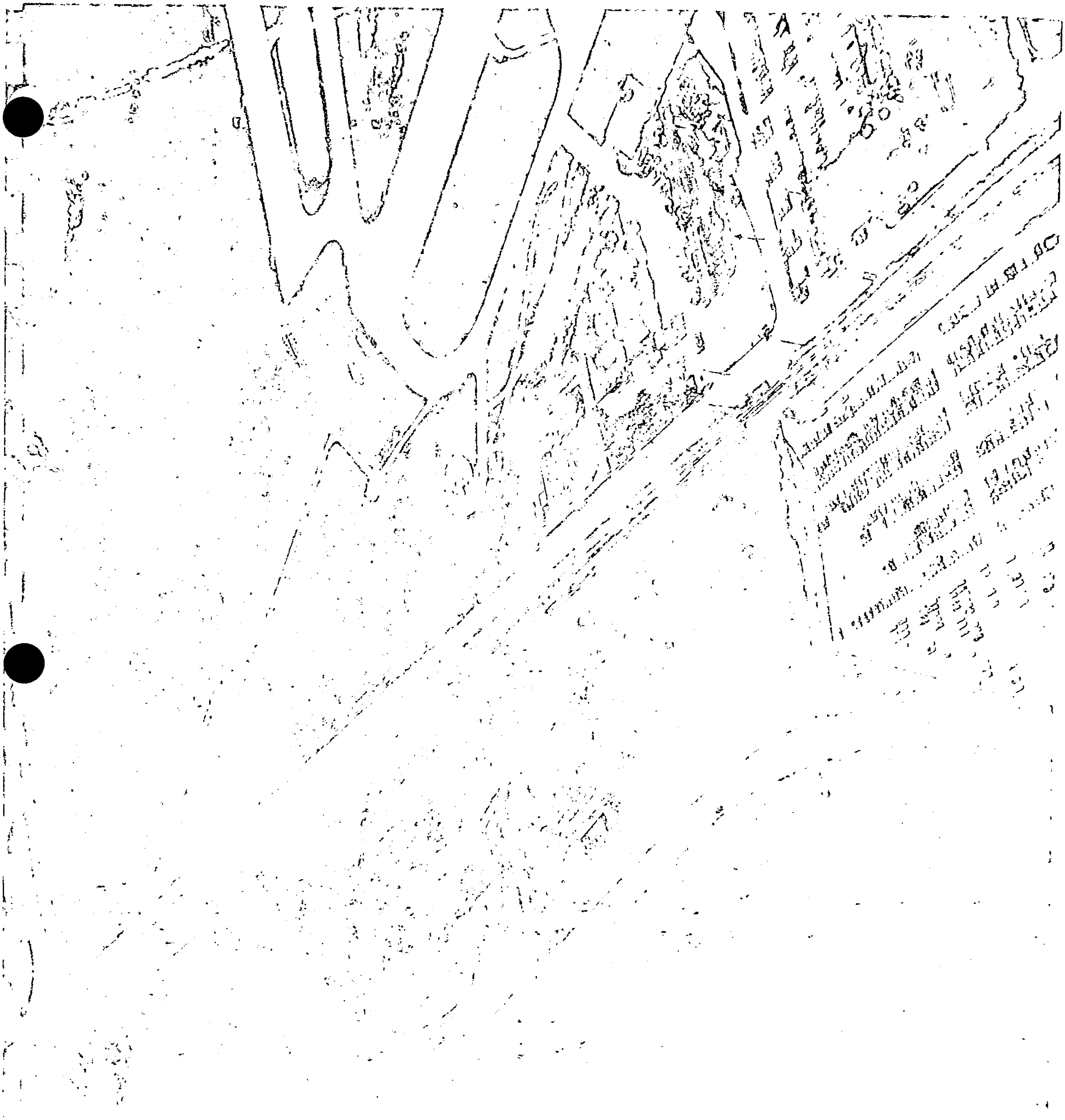
Response: The response of one shallow well was shown relative to precipitation at the site. Additional information will be provided regarding the response of the water table to flux from the vadose zone (both precipitation and evapotranspiration).

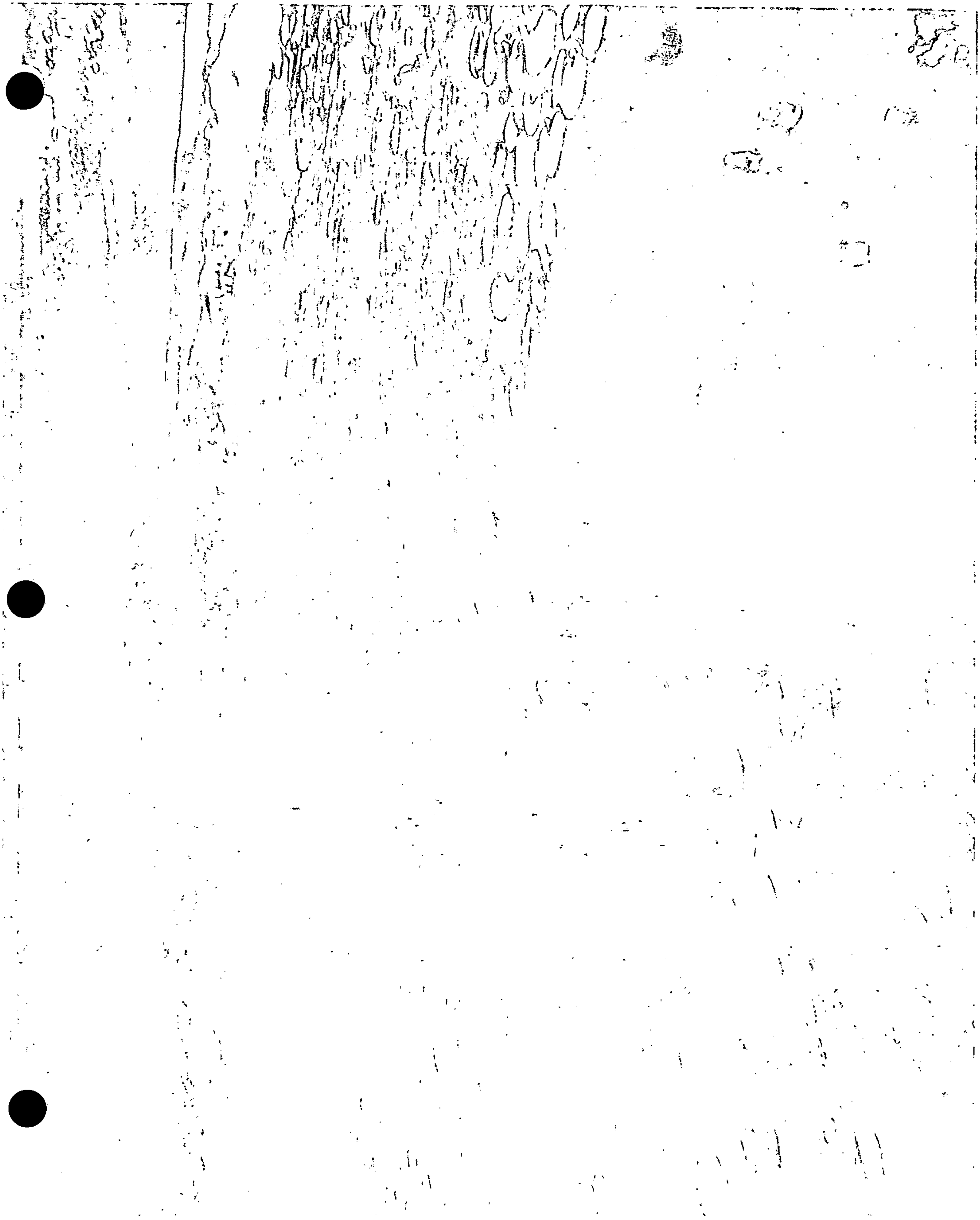
21) Dave Miller offers to provide panel with environmental monitoring data from past 6 years.

22) What is timing of the stormwater sampling events? (MARTIN)

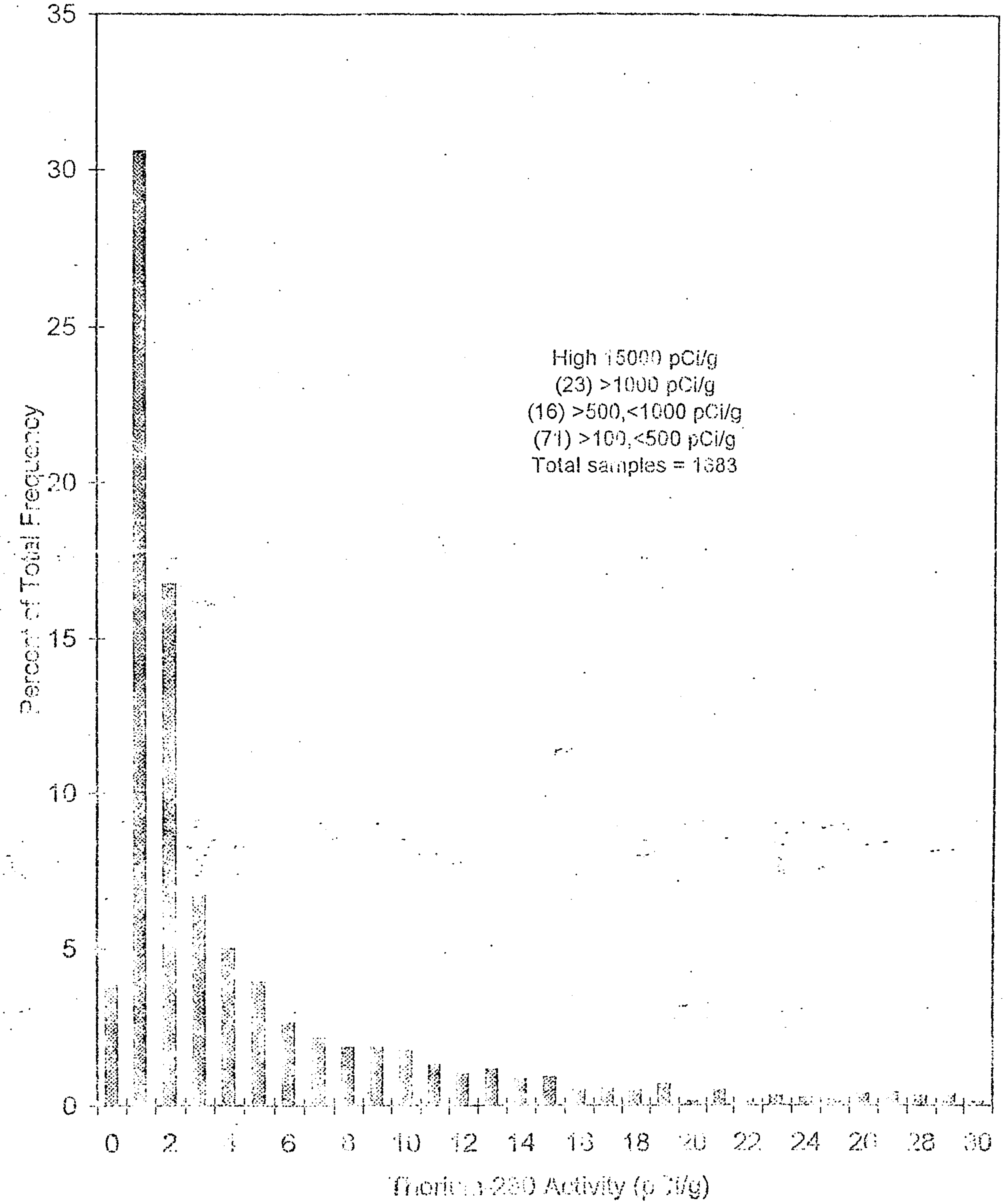
Response: Data has been provided and will be reviewed.



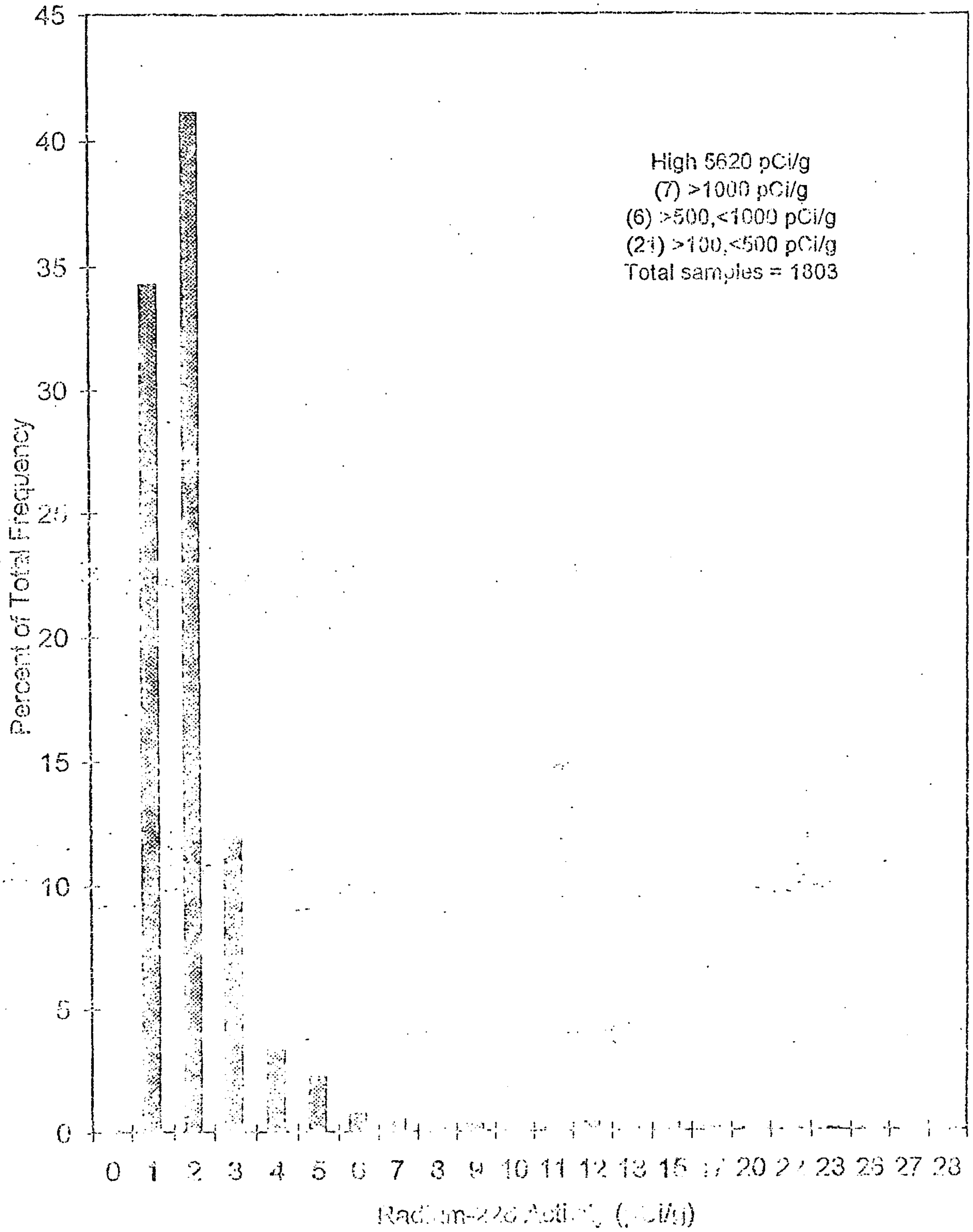




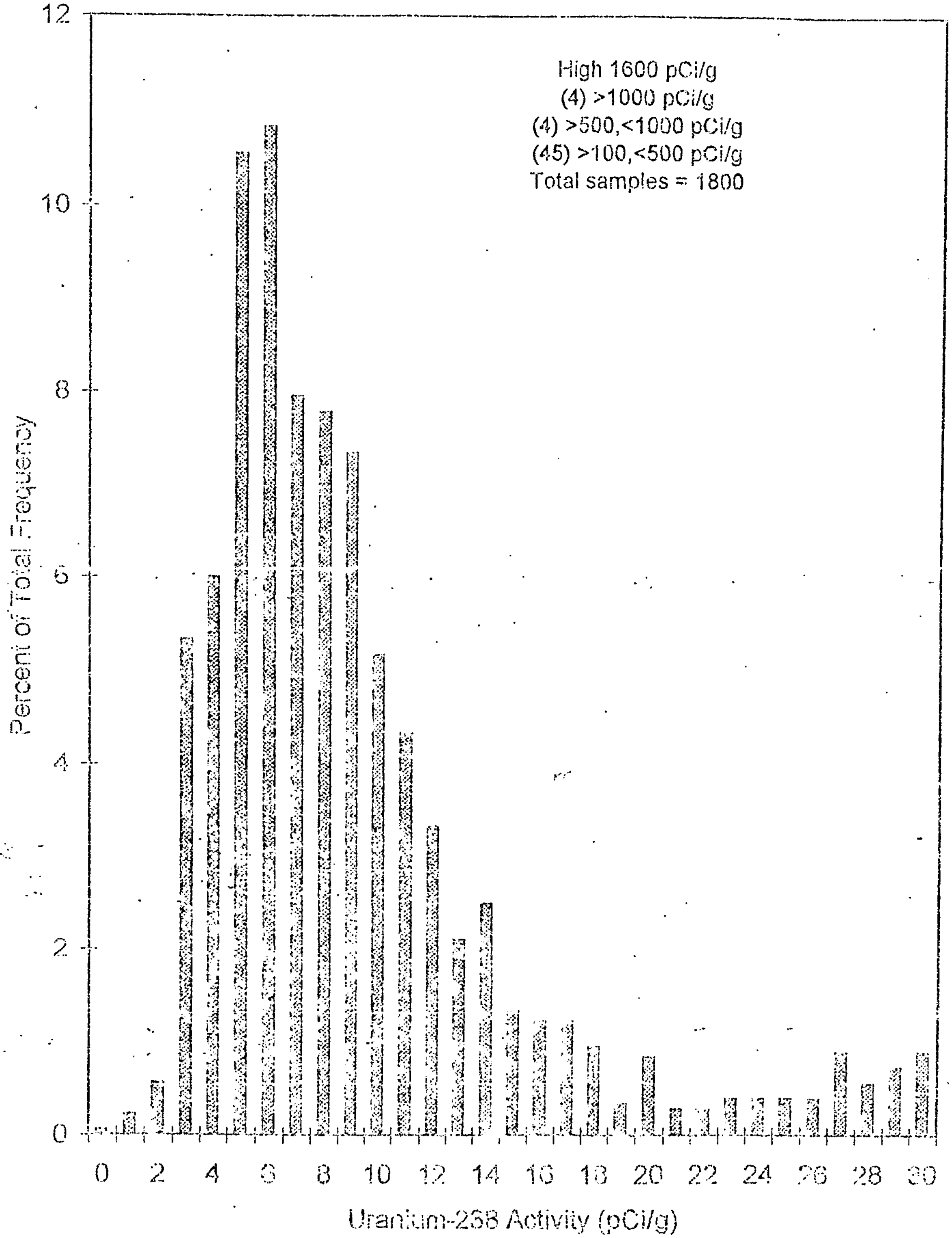
Thorium-230 Activity for Soil Samples from St. Louis, MO Site Frequency Distribution of Thorium-230 Activity

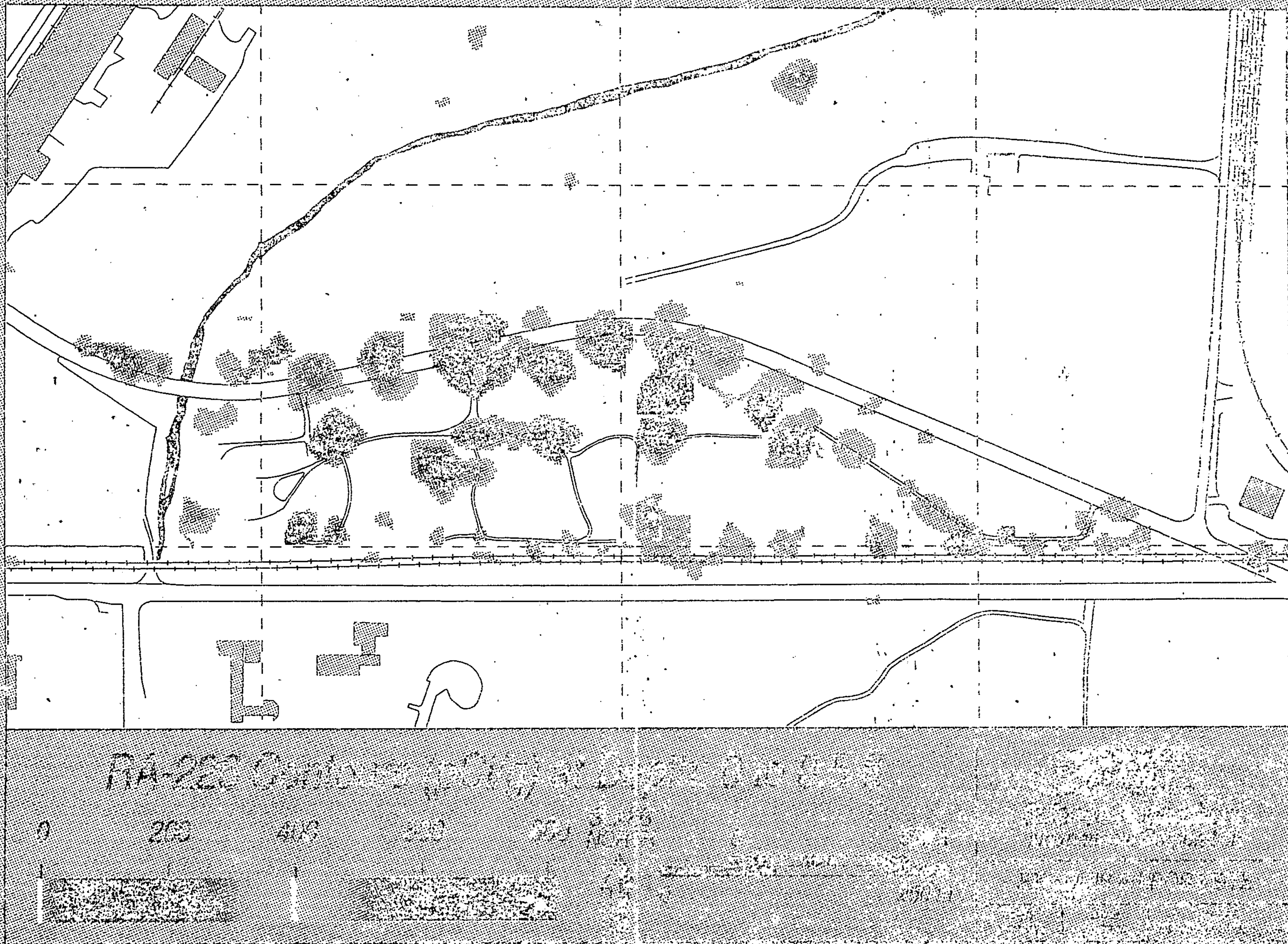


Radium-226 Activity for Soil Samples from St. Louis, MO Site Frequency Distribution of Radium-226 Activity

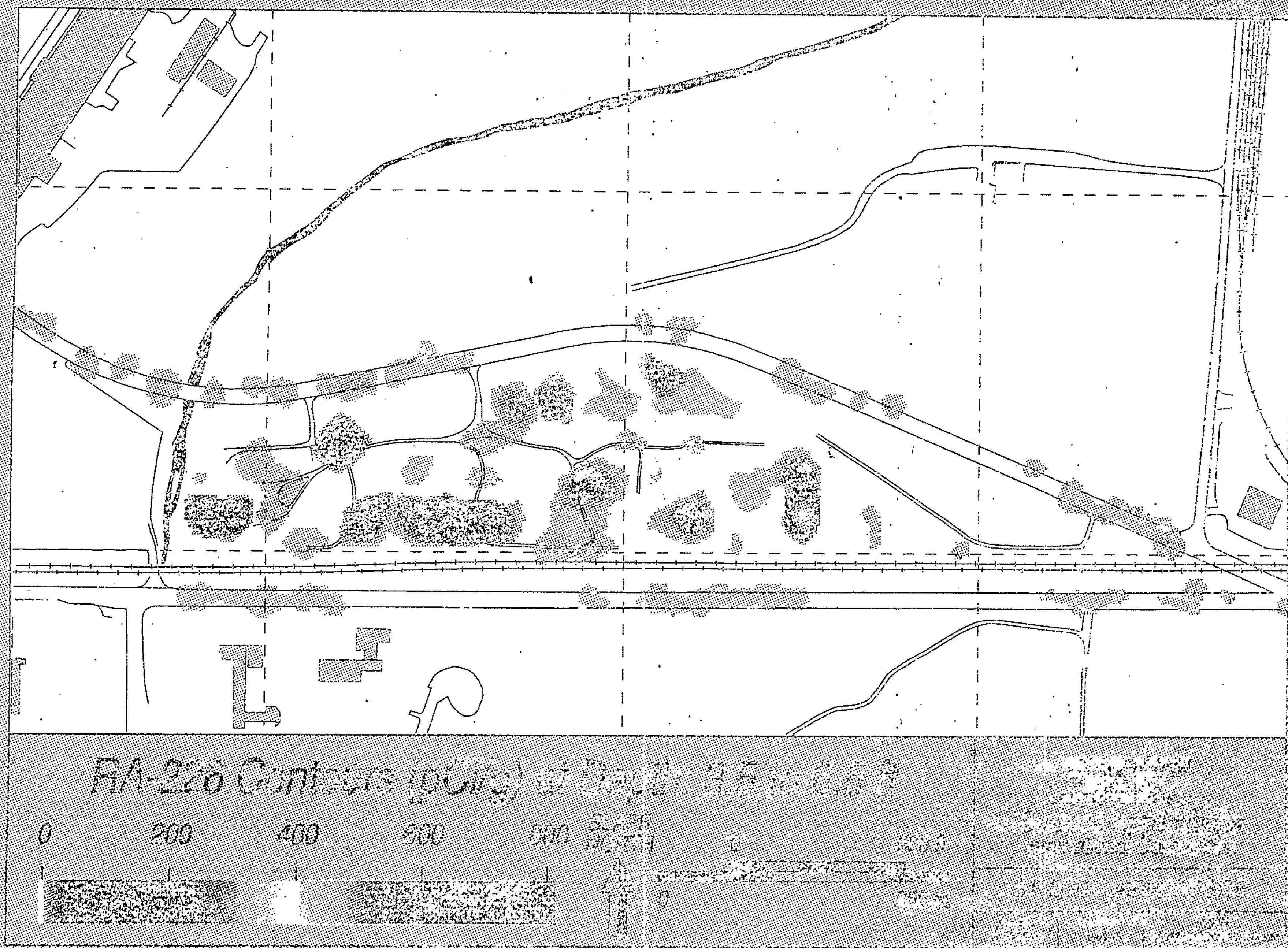


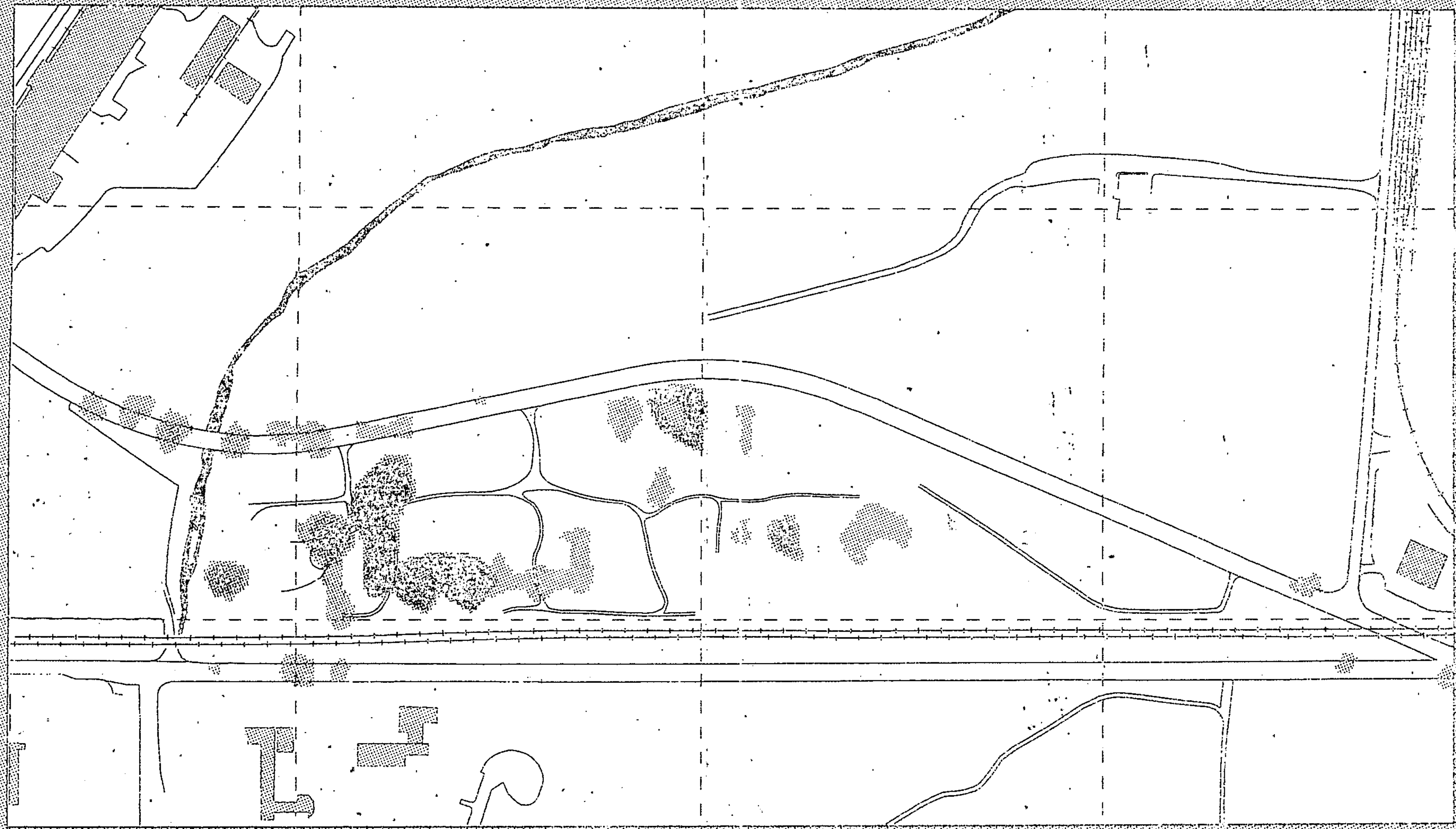
Uranium-238 Activity for Soil Samples from St. Louis, MO Site Frequency Distribution of Uranium-238 Activity



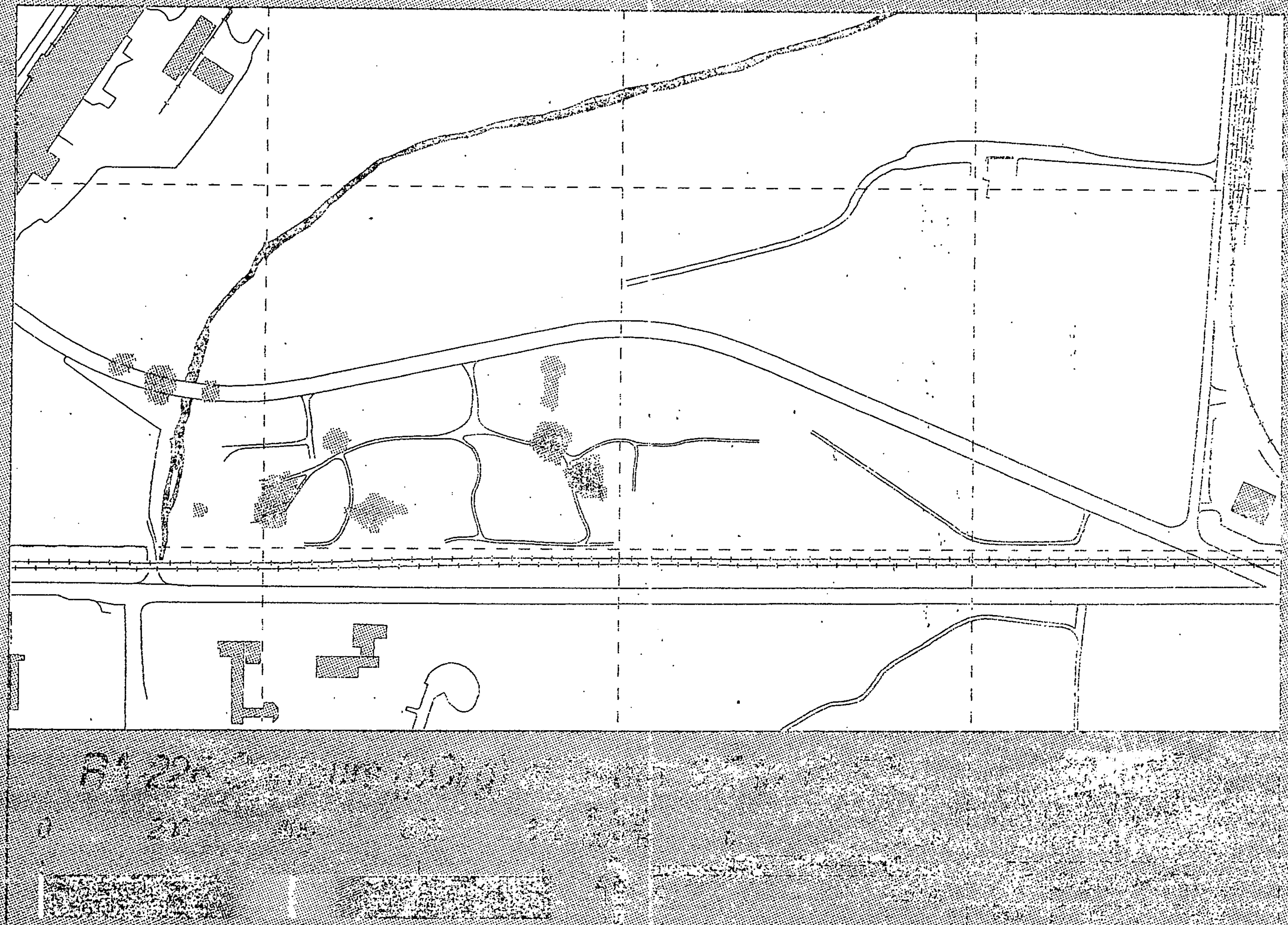

0
200
400

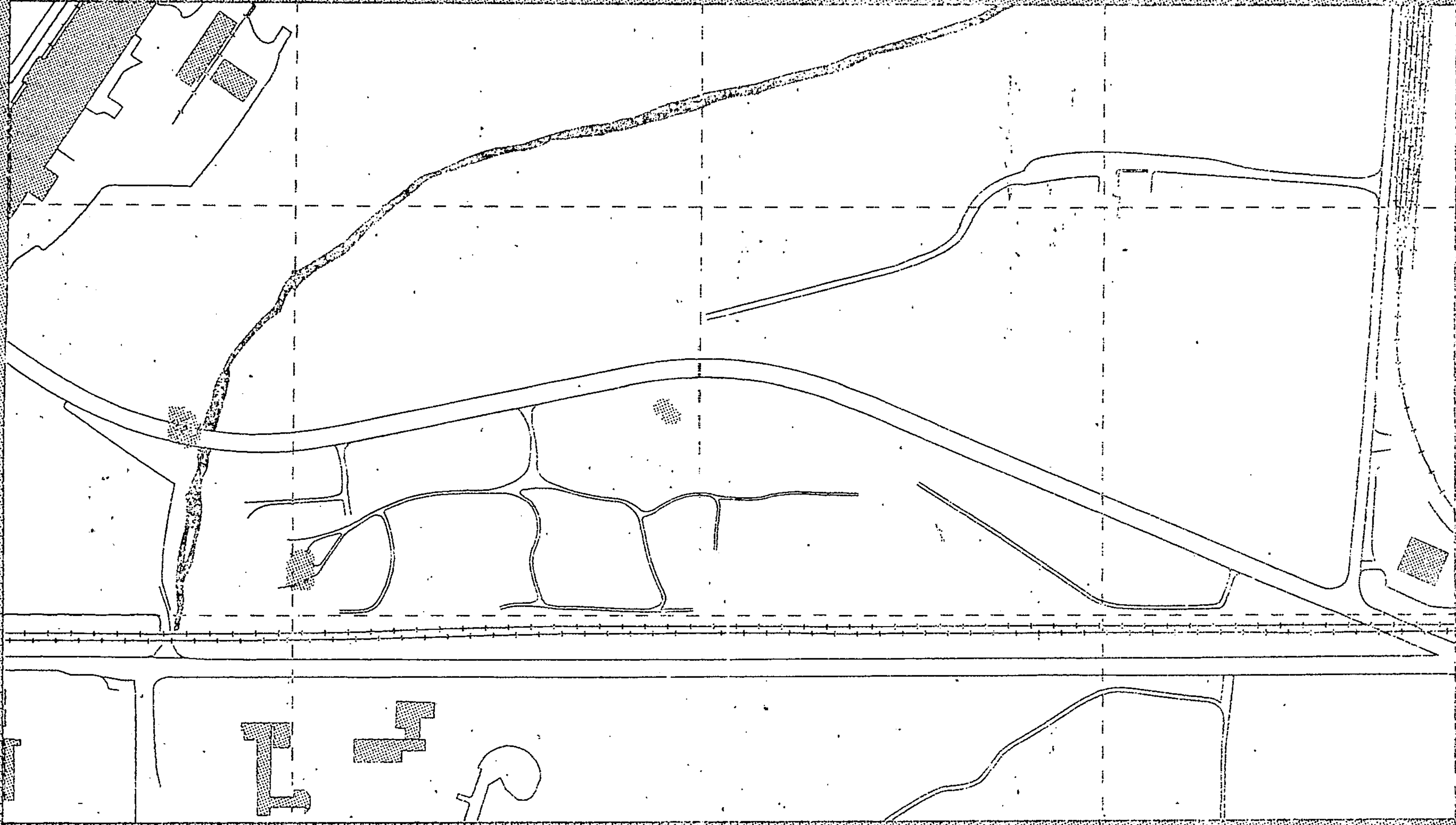

0
200
400


RA-226 Contours (pCi/g) at Depth
0
200
400



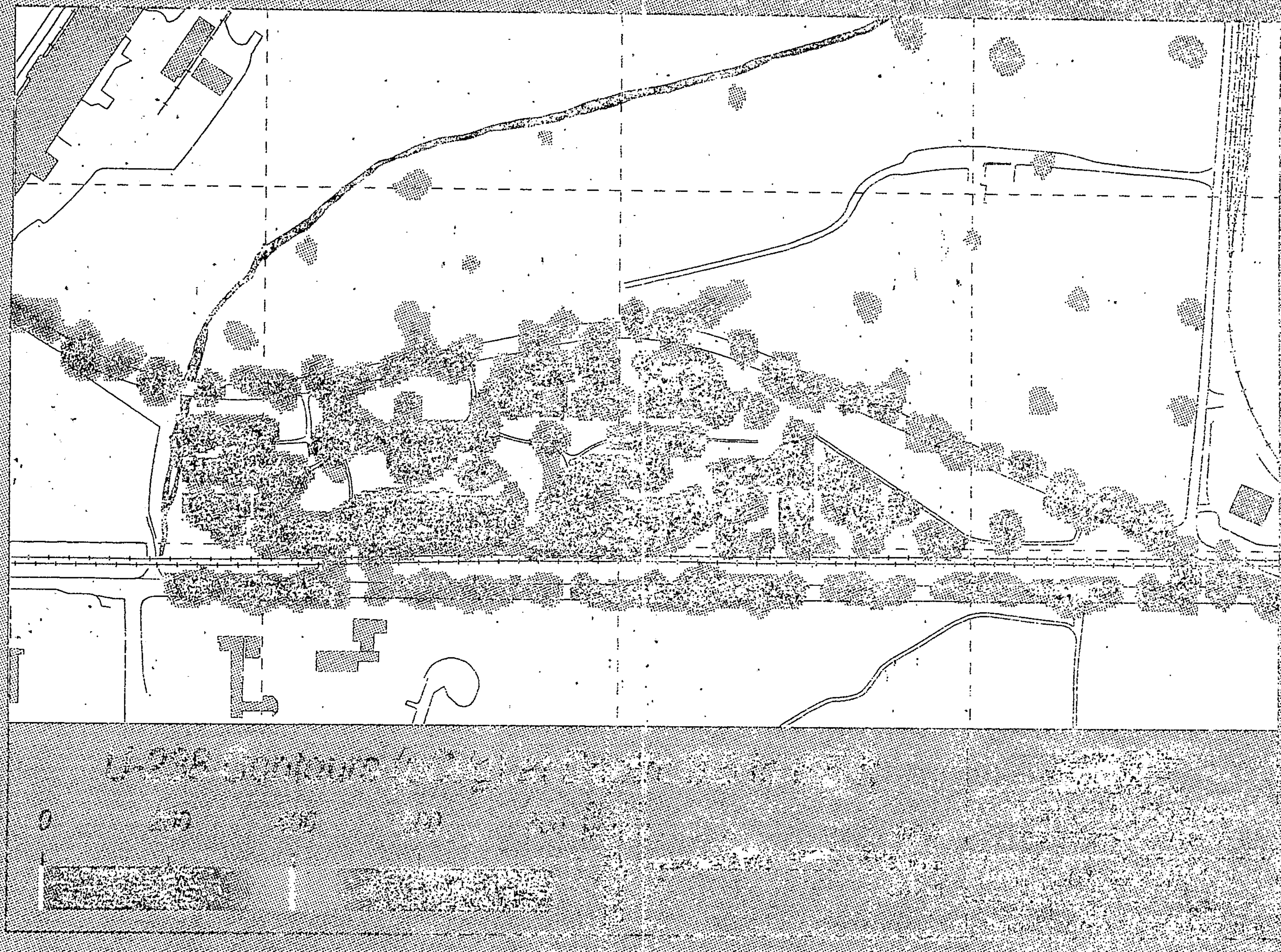
RA-[illegible] Contours [illegible]

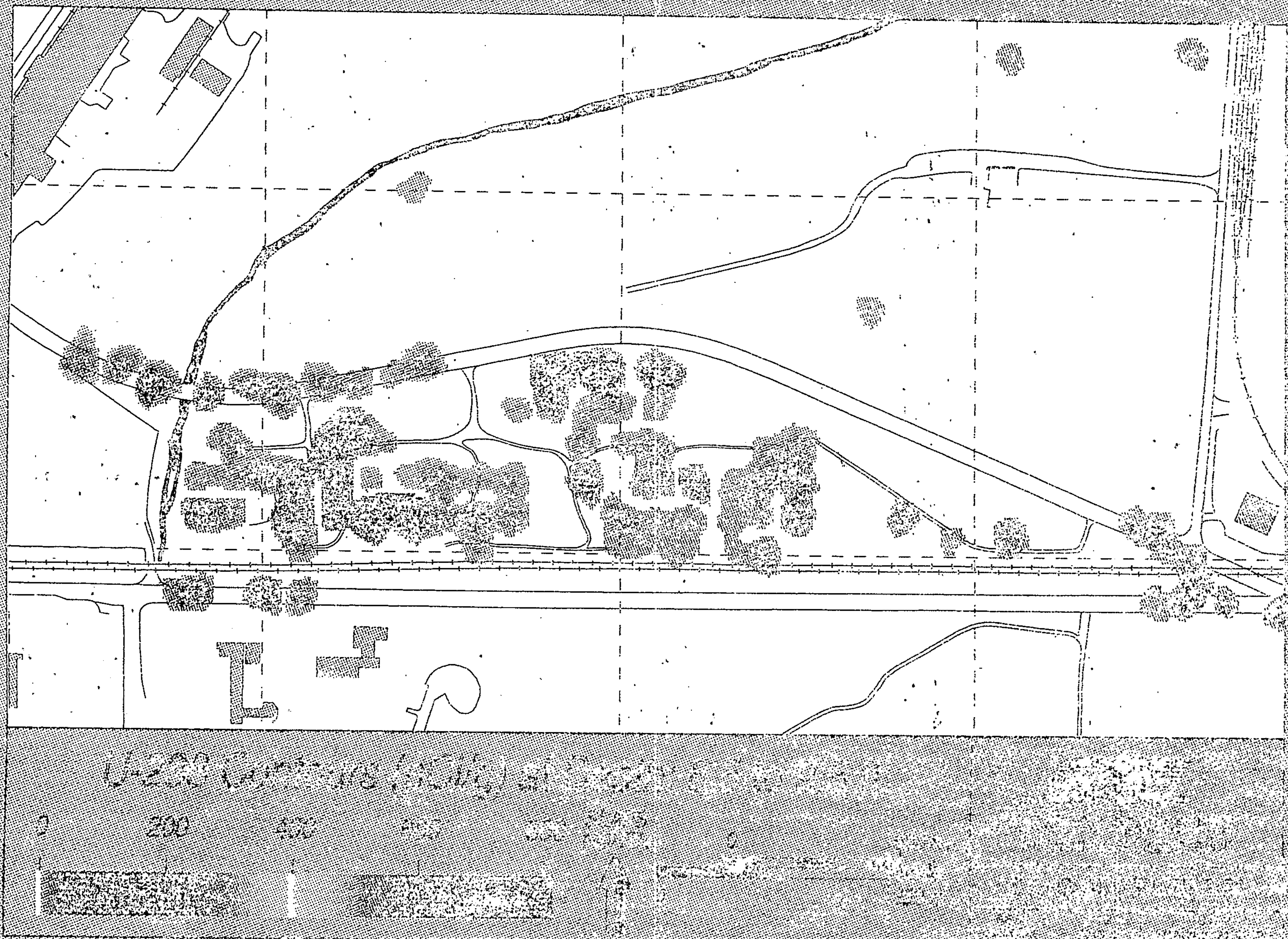


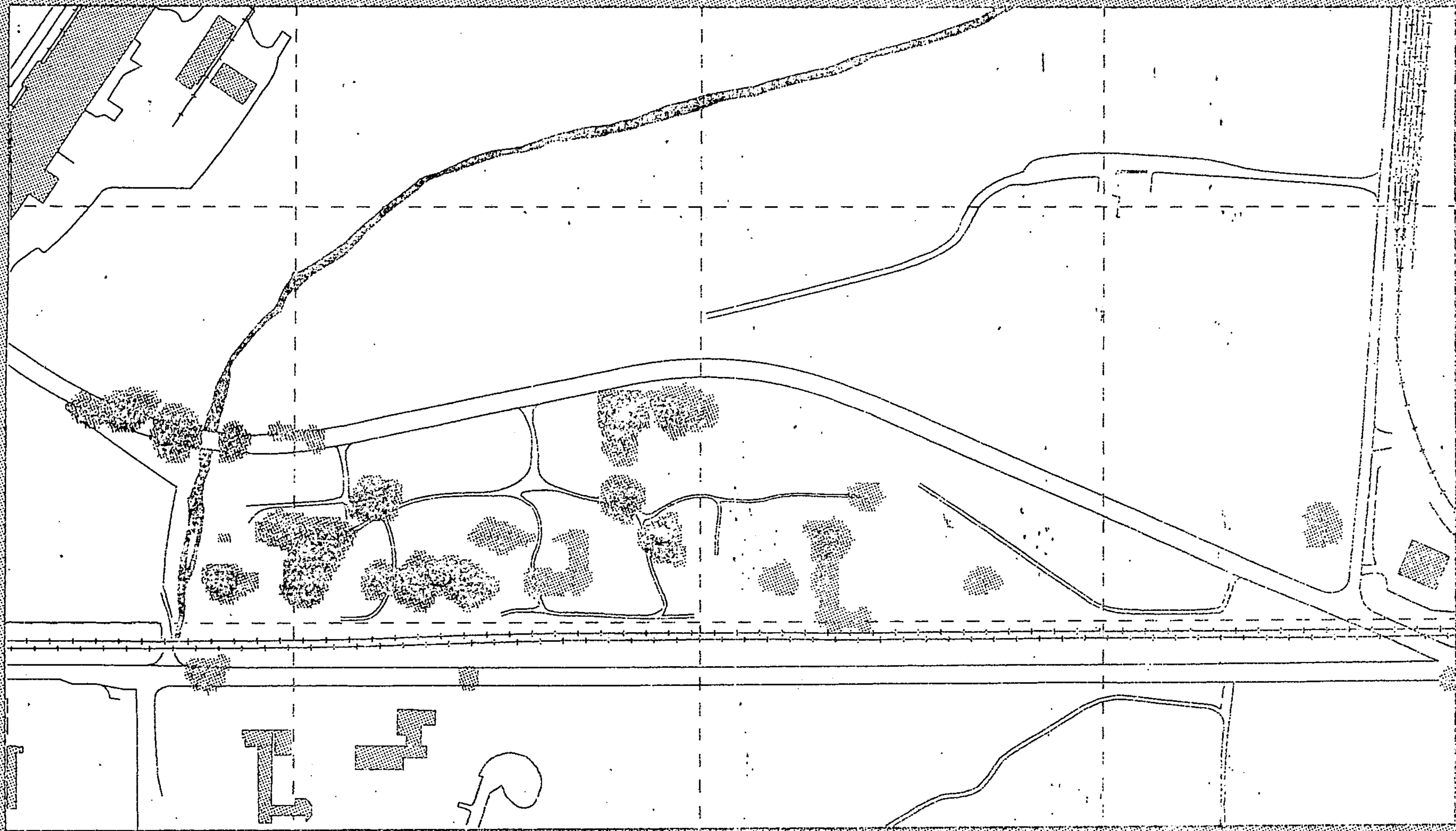


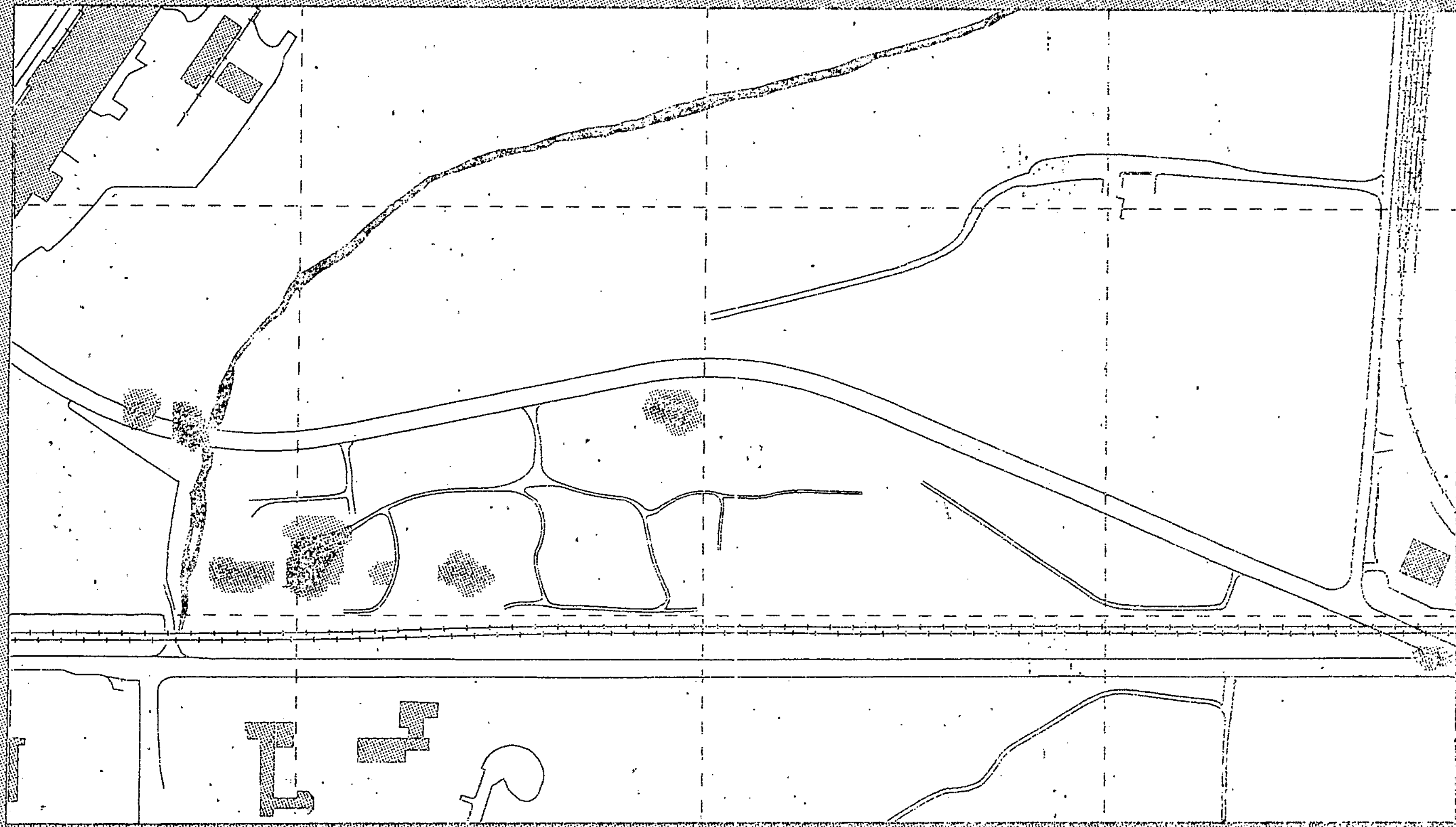
RA-226 Contours (pCi/g) at Depth


U-238 Contours
0
200



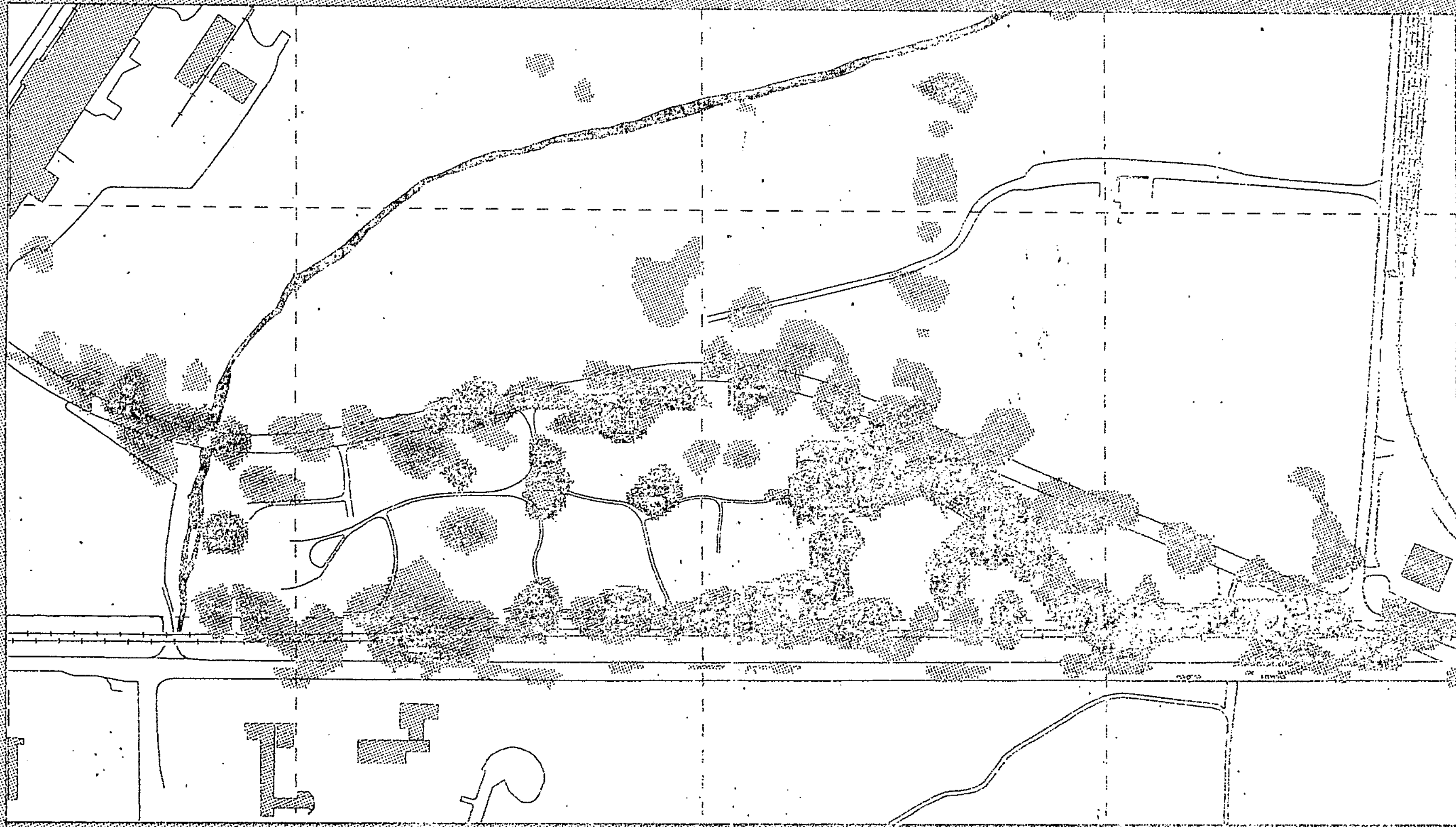

0
200
400



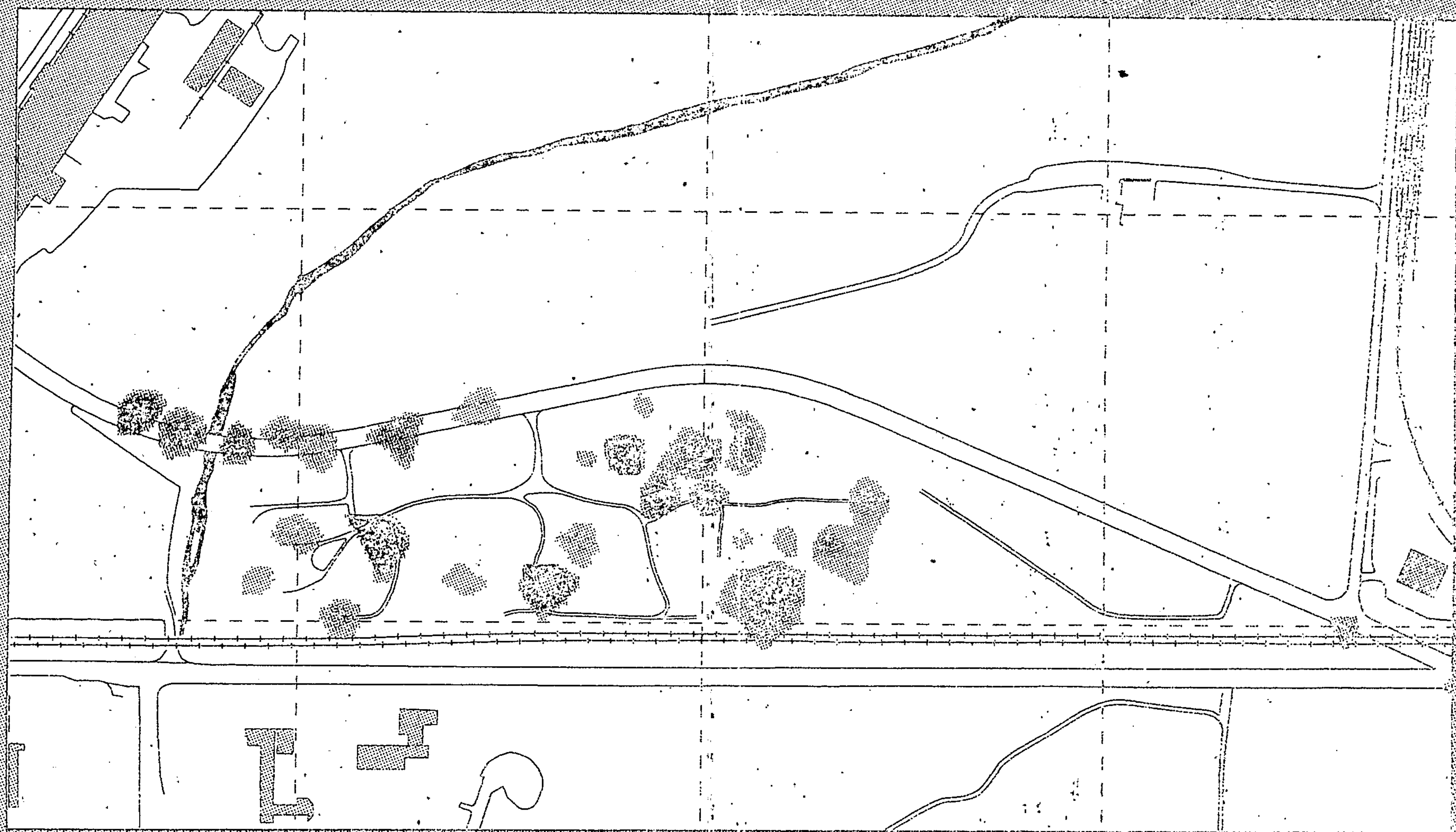


U-238 Contours (pCi/g) at

TH-250 Contours (

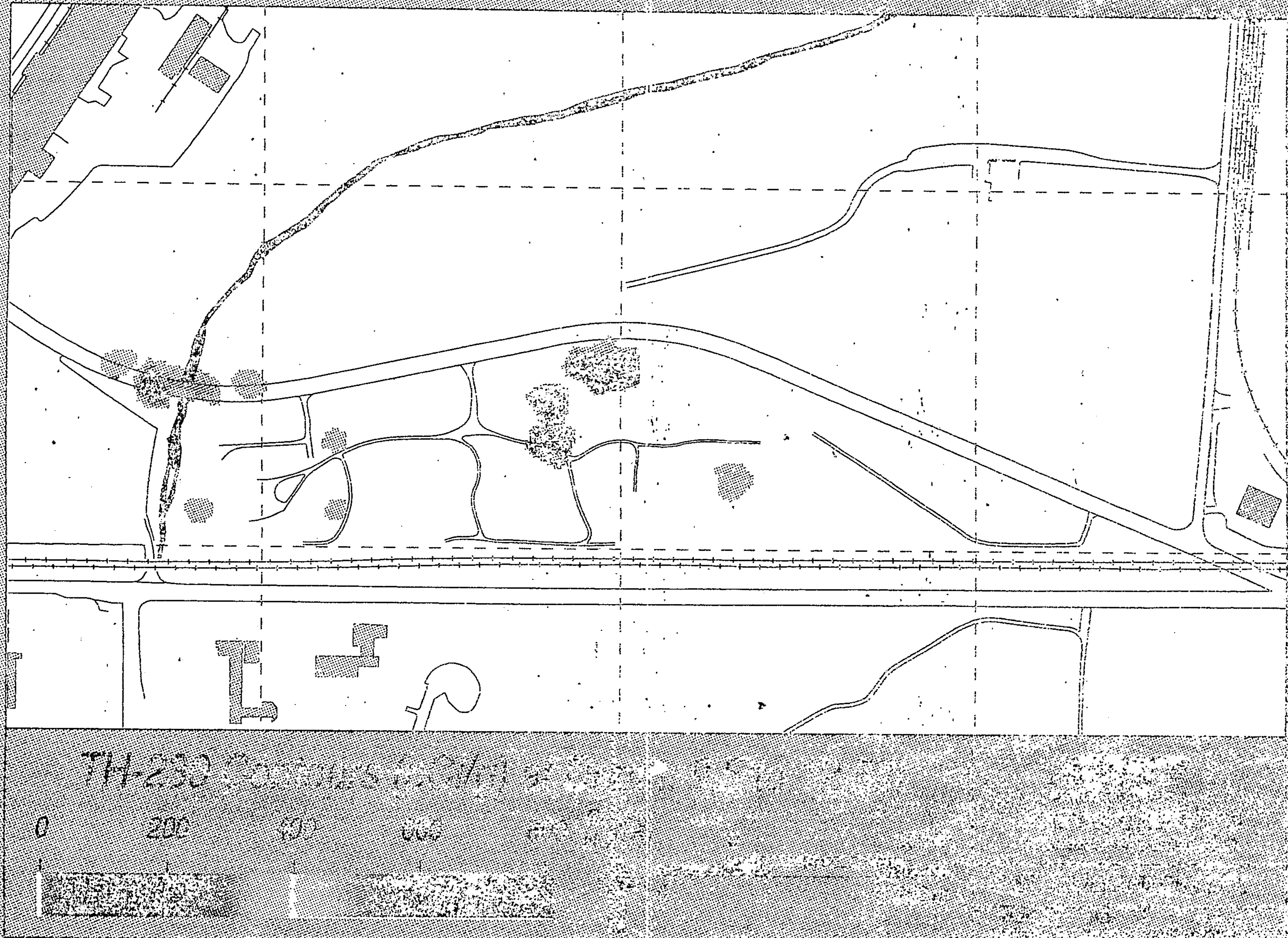


TH-230 Contour



Th-230 Contours

0 200 400


TH-230
0
200
400
600

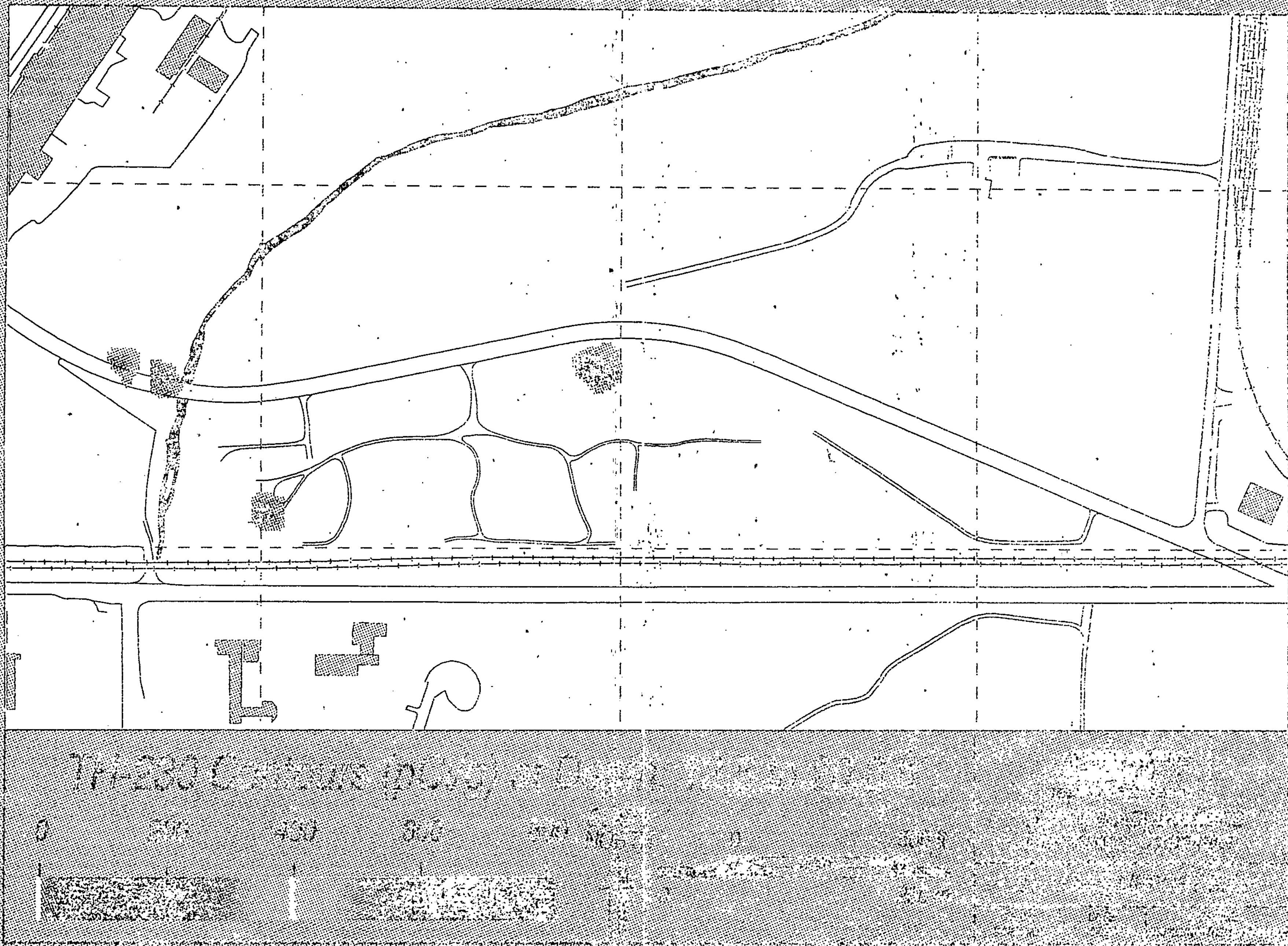


Table 8-42 Field Sampling Plan Sampling Data
Radionuclide Concentrations in Vegetation
Sampling at SLAPS

Location ID	Coordinates East	Coordinates North	Sample Interval (in feet)	Concentrations Uranium-238 (pCi/g ± 2σ)	Radium-226 (pCi/g ± 2σ)	Thorium-232 (pCi/g ± 2σ)	Thorium-230 (pCi/g ± 2σ)
A00131	752	2900	n/a	11.9 ± 0.0	4.0 ± 0.0	3.5 ± 0.0	0.4 ± 0.2
A00231	949	2900	n/a	11.3 ± 0.0	3.1 ± 0.1	0.4 ± 0.0	0.9 ± 0.3
A00331	1152	2901	n/a	10.5 ± 0.0	2.5 ± 0.0	3.0 ± 0.0	0.2 ± 0.2
A00431	1300	2901	n/a	6.4 ± 0.0	2.3 ± 0.0	2.1 ± 0.0	0.3 ± 0.2
A00531	4927	4073	n/a	6.1 ± 0.0	1.7 ± 0.0	2.0 ± 0.0	0.3 ± 0.2
A00631	4848	3951	n/a	8.1 ± 0.0	1.8 ± 0.0	2.7 ± 0.0	0.6 ± 0.3

* The radionuclide result exceeded the 5/15 pCi/gm guideline after background has been subtracted.

$ The sum of the ratios of the radionuclides exceeded the 5/15 pCi/gm guideline after background has been subtracted.

-a- Analysis not requested.

Item 3: Need to address bank storage during flooding

Radionuclide release from bank storage following a flooding event was estimated by first estimating the volume of bank storage assuming bank-full flow in Coldwater Creek. The bank-full flow was assumed to last for 12 hours, which is judged to be a typical length of time over which high stages can be sustained in Coldwater Creek based on past observations. Given the relatively small drainage area upstream of SLAPS (about 10 sq. mi.), high stages in Coldwater Creek sustained for longer periods should be rare events. The volume of bank storage would depend on how much of the creek water enters the bank when the water level in the creek is above the groundwater level within the bank and the fillable porosity available above the water table. The soil above the water table was assumed to be 90% saturated. Soil characteristic curves for Silt Loam G.E.3 given in van Genuchten (1980) were used to define the suction pressures and hydraulic conductivities in the soil above the water table. The physical properties (total porosity and saturated hydraulic conductivity) of Silt Loam G.E.3 are quite similar to those of soils above the water table. The head driving the creek water into the bank was estimated based on the surface and ground water levels and the suction pressure of the bank soil.

The maximum groundwater contamination occurs near the south-west corner of SLAPS, east of Coldwater Creek between Banshee Road and McDonnel Boulevard (Wells A, B, D, and M11-9 show elevated levels of total uranium). Assuming conservatively that the pore water above the water table has a total uranium concentration of 5000 pci/l within the bank storage, and assuming that the bank storage is contaminated with these high concentrations to a length of about 300 ft along the creek, a total loading of the order e-07 to e-04 Ci per bank-full event is estimated depending upon whether the slug-tested hydraulic conductivities or conductivities three orders of magnitude higher are used for this estimation. It is believed that use of hydraulic conductivites any higher than one order of magnitude is unreasonably conservative. (See response to Items 18 and 19.) Thus the bank storage contribution to radionuclide loading to Coldwater Creek is expected to be several orders of magnitude smaller than the potential contribution from groundwater discharge or from eroded sediments. The large discharges associated with high creek stages would further reduce the impact from bank-storage loadings.

Reference:

van Genuchten, M.Th. 1980. "A Closed-form Equation for Predicting the Hydraulic Conductivity of Unsaturated Soils," J. Soil Sci. Soc. Am., V. 44, pp.892-898.

Item 13: What is confidence in lab tests vs. slug tests and the consistency between the two types of tests?

Lab tests and slug tests were performed to provide information on the hydraulic conductivities of the various stratigraphic units of SLAPS. Whereas the lab tests provide information on the vertical hydraulic conductivities, the slug tests provide information primarily on the horizontal hydraulic conductivities. "Although streamlines in flow systems around slug-tested wells contain both vertical and horizontal portions, most of the head loss is dissipated in a horizontal direction." (Bouwer,1978). The hydraulic conductivities obtained from either test are applicable to small scales, and do not reflect scale effects. Since scale effects, primarily in the horizontal direction, can substantially increase the horizontal hydraulic conductivities (Rovey and Cherkauer, 1995), slug-test determined hydraulic conductivities should be modified as necessary via use of digital models to bring predicted groundwater flows close to reality. (Often "reality " is difficult to define. However, for SLAPS, estimated base flow in Coldwater Creek is a good measure of groundwater flow. See response to Items 18 and 19.)

In any stratigraphic unit of SLAPS, vertical hydraulic conductivities are found to be generally lower than the horizontal hydraulic conductivities. This is typical of sedimentary deposits. The groundwater flow is predominantly horizontal in any shallow groundwater system, and, therefore, horizontal hydraulic conductivities are of primary significance. However, the effectiveness of an aquiclude depends on its vertical conductivity. The lab-determined vertical hydraulic conductivity of Unit 3M of SLAPS, an aquiclude, is several orders of magnitude lower than that of the unit above. Still, because of limitations of lab data alluded to in the foregoing, pumping tests were performed to assure that Unit 3M was indeed acting as an aquiclude.(See response to Item 16.)

References:

Bouwer, Herman. 1978. Groundwater Hydrology. McGraw-Hill Book Company. p. 117.

Rovey II, Charles W., and Douglas S. Cherkauer. 1995. Scale Dependency of Hydraulic Conductivity Measurements. Ground Water, Vol. 33, No. 5, pp 769-780.

Recharge to SLAPS shallow Groundwater System

(In response to Items 18 & 19)

Recharge to SLAPS shallow groundwater system has been estimated through a steady-state quasi-three-dimensional groundwater model . The computer code MODFLOW was used for this purpose. Actual hydraulic conductivities obtained from slug tests were used, and recharge was used as a calibration parameter such that the modeled hydraulic heads were in good agreement with the observed ones. Observed heads on 12/3/92 were used for calibration targets. These heads are substantially higher than average heads, and using them as target heads would yield a higher estimate of recharge, which is conservative for use in contaminant flux estimations.

A recharge rate of 0.02 cfs/sq. mi. (about 0.3 inch per year) was estimated. The drainage area of the groundwater basin at SLAPS is about 10 sq. mi.. (the drainage area of the groundwater basin is assumed to be about the same as the area of the watershed.) The estimated recharge rate thus gives a baseflow of 0.2 cfs at SLAPS. Based on field observations, the actual dry-weather flow in the Coldwater Creek, which is the discharge boundary for the shallow groundwater system at SLAPS, is of the same order of magnitude. It can be conservatively assumed to be an order of magnitude higher (which would give a base flow of 2 cfs at SLAPS) , but certainly no higher.

If the hydraulic conductivities are raised an order of magnitude everywhere in the model, the calibrated recharge would also be raised an order of magnitude with the same level of agreement between the predicted and observed heads. As mentioned in the foregoing, any further increase in the hydraulic conductivities would not be justified based on the actual observations of the dry-weather flows in Coldwater Creek. Thus a maximum recharge of about 3 inches per year can be used to conservatively estimate contaminant fluxes from groundwater discharge. Leakage through the confining layer may slightly increase this value, but this increase is expected to be insignificant. Using a recharge of 3 inches per year would raise by an order of magnitude the fluxes previously estimated.

Blue Ribbon Panel Brief

Topic: Reservoir characteristics, reservoir performance and effectiveness of the 3M unit as an aquitard.

Data sources:
1) RI report for the St. Louis sites
2) RI Addendum
3) SLAPS site suitability study

Reservoir Characteristics

The site can be divided into four hydrostratigraphic units:

1) Bedrock; composed of fractured and weathered limestone having solution enhanced fracture and matrix porosity that decreases with depth. In the local area across the southeastern portion of the site an erosional remnant of extensively weathered Pennsylvanian shale is present. This unit has very poor hydrologic characteristics and is unsaturated in isolated lenses within the eroded remnant. This portion of the bedrock section is poorly interconnected with the limestone units.

2) Lower non-lithified sediments; comprised of Units 4 and 3B. Unit 4 is an erosional lag deposit composed of limestone and shale clasts in a clay matrix. Unit four is encountered in the remnant lows of the bedrock surface coinciding with the present coarse of Coldwater Creek. Unit 3B is a glacio-fluvial deposit composed of clastic sediment with a moderate to high clay content.

3) 3M aquiclude; the 3M Unit is a glacio-lacustrine deposit composed of nearly pure clay. The unit is unsaturated in areas where it has an appreciable thickness. Stratigraphically the unit is present across the northern and western portions of the site and pinches out onto the Pennsylvanian erosional remnant in the southeastern portion of the site.

4) Upper non-lithified sediment unit: comprised of the 3T and the lower portions of Unit 2. These units are gradational from clay rich glacio-lacustrine upward to glacio-fluvial deposits having a lower clay content and a higher coarse clastic fraction. This unit has low to very low permeability and moderate to high Kd values for the primary radioisotopes.

Distribution and Interconnections of the Hydrostratigraphic Units

Southeast of the site and in the southeast corner of the site, the 3M aquiclude is absent In this area the upper and lower non-lithified sediment units are in contact and are a single hydrologic unit. Recharge occurs to this combined unit on and along the airport property to the southeast of the site. In this area, vertical hydraulic gradients are downward, horizontal gradients are moderate to strong toward the northwest. Also in this area, the limestone portion of the bedrock is separated from the non-lithified units by the remnant Pennsylvanian shale unit. Interconnection is poor between the non-lithified sediments and bedrock in this portion of the site.

Reservoir Performance

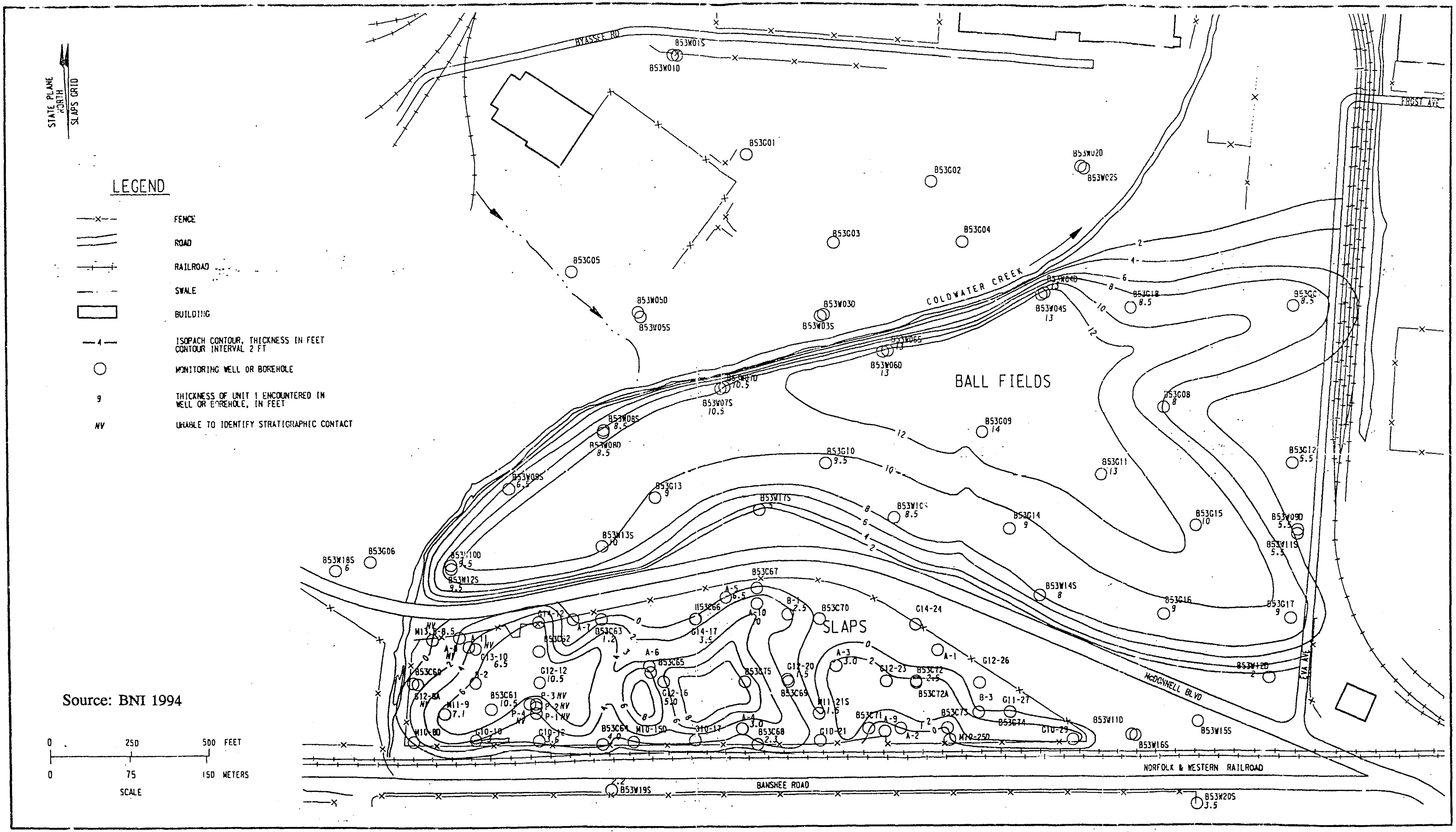
Reservoir performance and vertical interconnectedness between the deep and shallow hydrologic units across the 3M aquiclude was investigated during the December 1993 hydrologic investigations field program. The program is described and results are presented in detail in the addendum to the SLAPS Site Suitability Report.

A summary of the hydraulic conductivity data available for the site was presented at the first meeting of the Panel on September 14th. The data for horizontal permeability was collected from slug tests performed as part of the original RI work done onsite during the 1993 field investigations. Field tests have been performed on twenty-eight wells (all of the wells currently accessible at the site). In addition to the slug tests three controlled pumping tests were also performed during the 1993 investigations, specifically designed to determine the response in the shallow units as a result of pumping from the lower portion of the aquifer.

Extended pump tests were run or attempted at three locations: (1) M13.5-8.5 S and D, (2) B53W06S and D, and (3) M10-25S and D well pairs. The 3M Unit is present at the M13.5-8-5 and at the B53W06 locations and is absent at the M10-25 location. The 3M Unit is approximately 12 feet-thick in at least two locations.

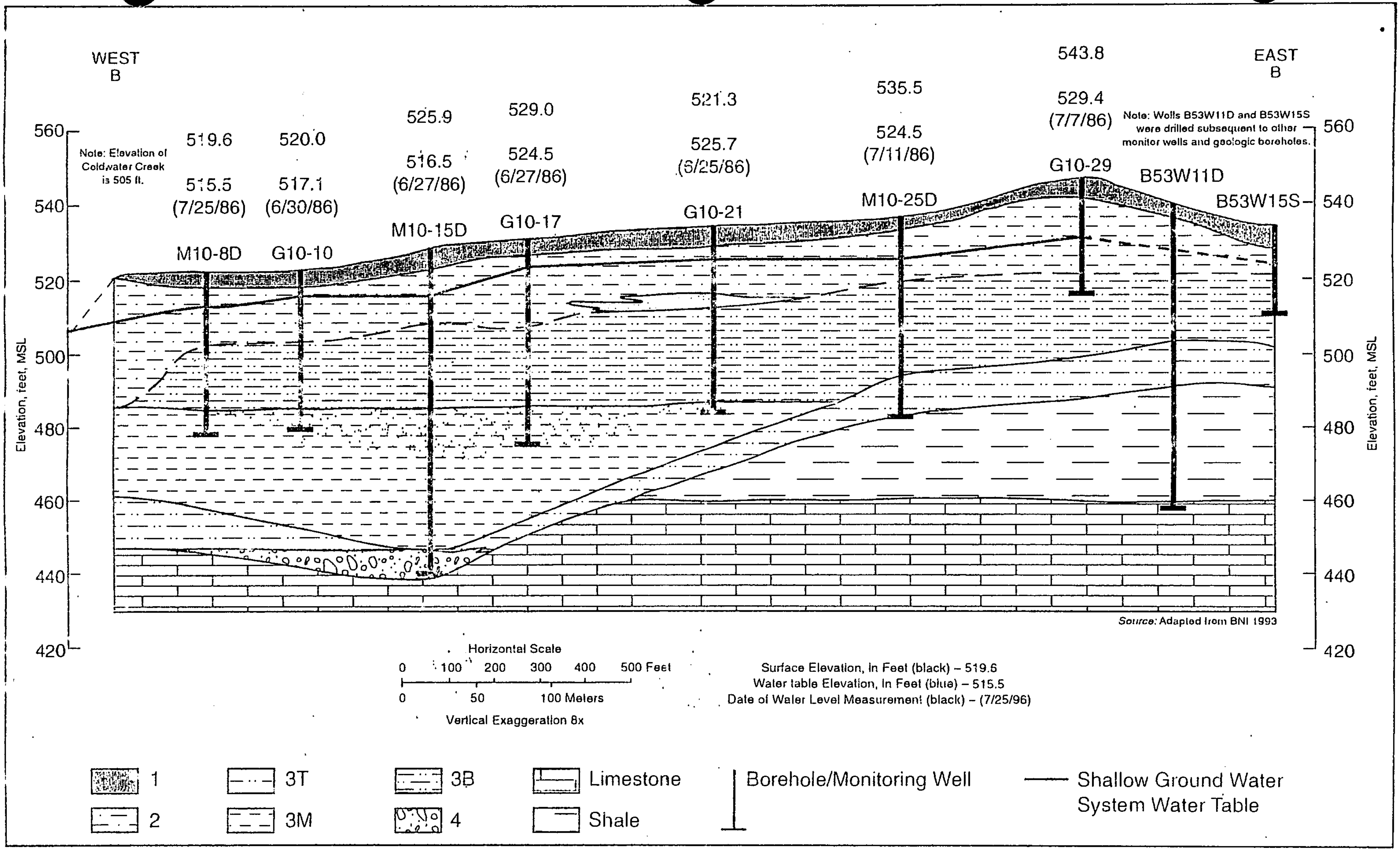
At location B53W06, a steady-state pump test was run for approximately 168 hours (7 days). The deep well 6D was pumped at a constant rate of approximately 1 gal/min for the period of the test. At this rate drawdown of the well was sustained at approximately 27 feet below static levels. Water levels in both B53W06 wells were continuously monitored with dedicated transducers. Water levels in offset well pairs B53W07 and B53W05 were monitored on a regular basis for the period of the test. No response was observed in the shallow well at the pumping location or in the shallow offset locations. Pressure responses to the pumping were observed in the offset deep well locations. Interpretation of the data collected is that there was no effect in the shallow formation under significant induced stress conditions for the period of the test indicating that vertical permeability is less than approximately 1.0×10^{-6} cm/sec across the 3M Unit. Refer to Section E 4.2 of the SLAPS Site Suitability Study, pp. E-10 through 3-11 for further description of the test and results.

At location M10-25 the 3M unit is absent. Results from the step test performed prior to the start of the planned sustained drawdown test indicated that the 3B Unit in the area had very low transmissivity and would sustain only minimal pumping rates. A sustained pump test was attempted with initial pumping rates at 0.05 gal/min. At his low rate the well went dry after 13 hours and flow could not be re-established. Water levels were monitored in the shallow off-set well, a response was observed in this well at ten hours into the test. The well had not stabilized by the time the pump failed and levels continued to drop during the recovery period of the pumped well. These data indicate that where the 3M Unit is absent the upper and lower portions of the aquifer are in communication. Refer to Section E 4.2 of the SLAPS Site Suitability Study, pp. E-1 through E-12 for further description of the test and results.



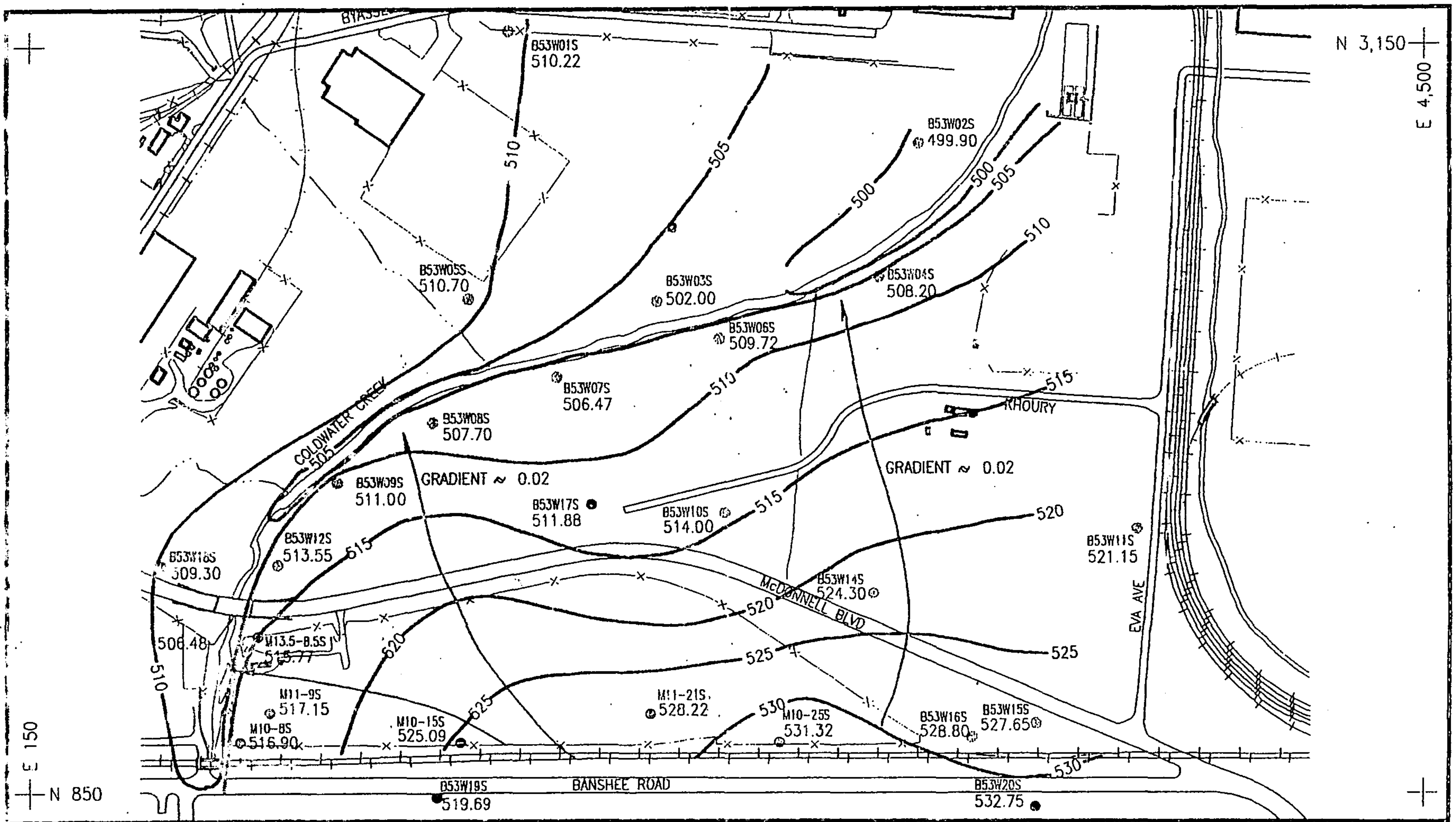
R02F038.DGN

Isopach Map of Fill



FUS St. Louis 09/95

Cross Section B – B. Water Table Positions of Shallow Ground Water System During Drilling of Monitoring Wells and Geologic Boreholes in June and July 1986, as Observed by the Drill Rig Geologist.



LEGEND:

- ⊕.......... 1986 SHALLOW MONITORING WELL BY BNI
- ⊕.... 1987–1988 SHALLOW MONITORING WELL BY BNI
- ⊕.......... 1992 SHALLOW MONITORING WELL BY BNI
- ——..POTENTIOMETRIC SURFACE (FT. ABOVE MSL)
- 515.55..............WATER LEVEL (FEET ABOVE MSL)
- ←——........ DIRECTION OF GROUNDWATER FLOW

NOTES:

1.) BASE MAP ANO SAMPLING INFORMATION PROVIOEO BY BECHTEL SEPT. 1995.

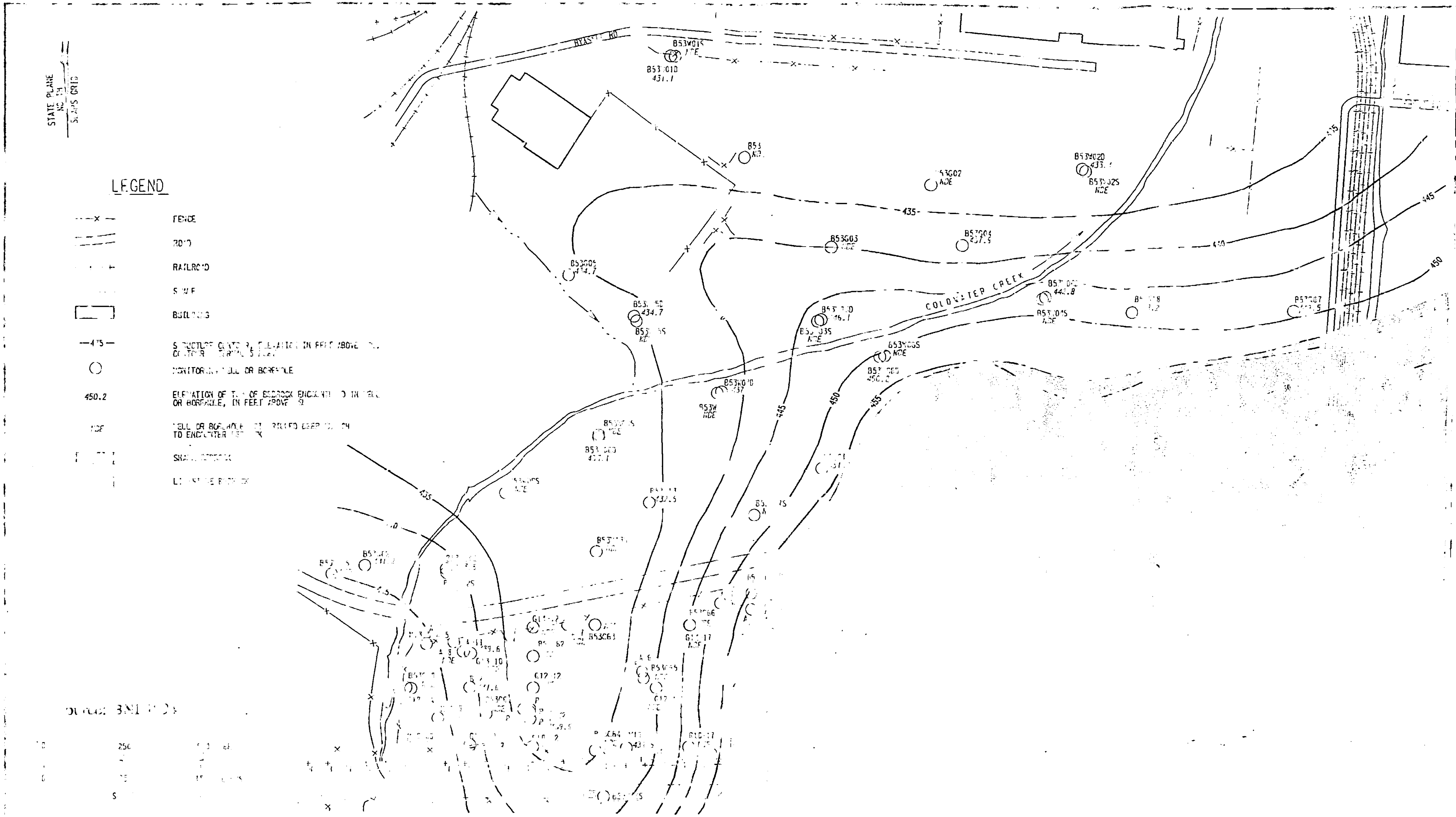
2.) ALL WELLS SHOWN ARE SHALLOW WELLS.

SAIC Science Applications International Corporation

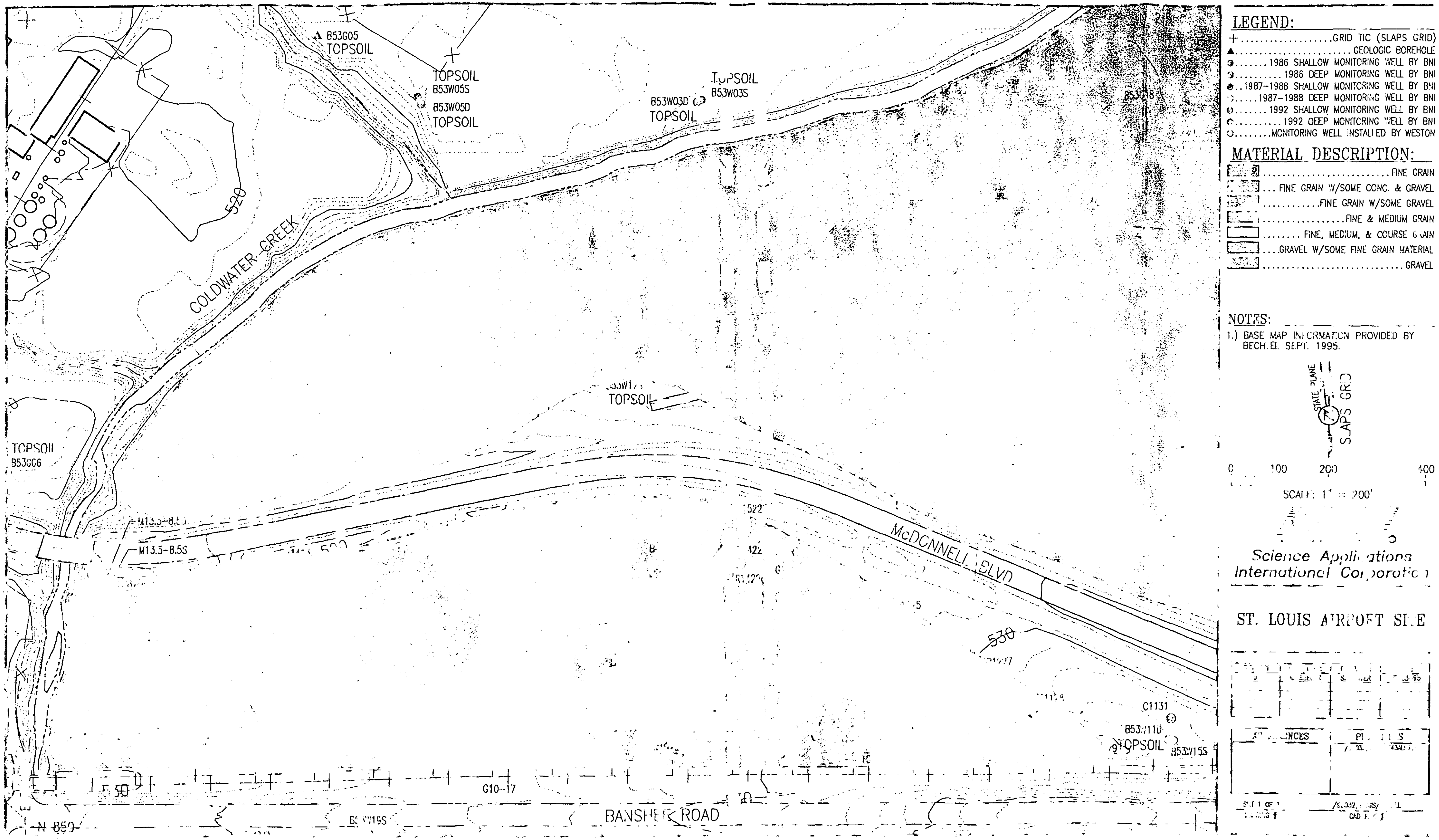
ST. LOUIS AIRPORT SITE

DRAWN BY:	REV. NO./DATE:	CAD FILE:
R. BEELER	REV. 0 / 08-11-95	/95032/DWGS/222UPOTS

POTENTIOMETRIC SURFACE OF THE UPPER GROUNDWATER SYSTEM



STATE PLANE
LEGEND
FENCE
RAILROAD
450.2
NDE
COLDWATER CREEK
435
445
450
455
B53G03
B53G04
B53G07



SLAPS FILL DESCRIPTION MAP

135220
SL-640

00-1771

Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for the St. Louis Site, Missouri

U.S. Department of Energy