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April 26, 2000

Mr. James Bearzi, Bureau Chief
NMED, Hazardous and Radioactive Materials Bureau
2044 Galisteo
Santa Fe, New Mexico 87505

**RE: 1999 Annual Groundwater Report
RCRA Part B Permit NMD 000333211-2**

Dear Mr. Bearzi:

Pursuant to the requirements of the above captioned permit, the Annual Groundwater Report for groundwater sampling performed in 1999 is enclosed. No unusual results were observed as a result of the 1999 sampling events.

If you require additional information or have any questions regarding this report, please contact me at (505) 722-0227.

Sincerely,

A handwritten signature in cursive script that reads "Dorinda Mancini".

Dorinda Mancini
Environmental Manager, Ciniza Refinery

cc: Dave Pavlich, Environmental Supt., Refining Operations, Giant Industries, Inc.
Matthew R. Davis, General Manager, Giant Refining Company
Sarah Allen, Corporate Counsel, Giant Industries, Inc.

GIANT

INDUSTRIES, INC.

ANNUAL GROUNDWATER REPORT

1999

GIANT REFINING CO.

CINIZA

MONITORING WELL IDENTIFICATION REPORT

Giant Refining Company - Ciniza Refinery

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	MW-1
WELL LOCATION (LONGITUDE)	108° 25' 36"
WELL LOCATION (LATITUDE)	35° 29' 08"
NEW MEXICO STATE PLANE	(X) 320,903.76 (Y) 1,636,112.13
AQUIFER NAME	Sonsela
AQUIFER CONFINED xx	UNCONFINED
WELL INSTALLATION DATE	10/14/81
DRILLING METHOD	Cable
INNER CASING DIAMETER	5.0"
BOREHOLE DIAMETER	10.0"
CASING MATERIAL	PVC
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6745.80
ELEV. BOTTOM OF WELL CASING	6745.80
ELEV. BOTTOM OF SCREENED INT.	6750.80
ELEVATION OF SCREENED INTERVAL	6760.80
SURVEYED ELEVATION OF CASING TOP	6878.52

MONITORING WELL IDENTIFICATION REPORT

Giant Refining Company - Ciniza Refinery

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	MW-2
WELL LOCATION (LONGITUDE)	108° 26' 00"
WELL LOCATION (LATITUDE)	35° 29' 43"
NEW MEXICO STATE PLANE	(X) 321,035.23 (Y) 1,636,184.06
AQUIFER NAME	Sonsela
AQUIFER CONFINED xx	UNCONFINED
WELL INSTALLATION DATE	10/15/81
DRILLING METHOD	Cable
INNER CASING DIAMETER	5.0"
BOREHOLE DIAMETER	10.0"
CASING MATERIAL	PVC
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6741.90
ELEV. BOTTOM OF WELL CASING	6741.90
ELEV. BOTTOM OF SCREENED INT.	6747.90
ELEVATION OF SCREENED INTERVAL	6847.90
SURVEYED ELEVATION OF CASING TOP	6880.84

MONITORING WELL IDENTIFICATION REPORT

Giant Refining Company - Ciniza Refinery

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	MW-4
WELL LOCATION (LONGITUDE)	108° 26' 54"
WELL LOCATION (LATITUDE)	35° 29' 30"
NEW MEXICO STATE PLANE	(X) 321,602.07 (Y) 1,635,066.25
AQUIFER NAME	Sonsela
AQUIFER CONFINED xx	UNCONFINED
WELL INSTALLATION DATE	10/16/81
DRILLING METHOD	Cable
INNER CASING DIAMETER	5.0"
BOREHOLE DIAMETER	10.0"
CASING MATERIAL	PVC
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6761.60
ELEV. BOTTOM OF WELL CASING	6761.60
ELEV. BOTTOM OF SCREENED INT.	6761.60
ELEVATION OF SCREENED INTERVAL	6781.60
SURVEYED ELEVATION OF CASING TOP	6882.54

MONITORING WELL IDENTIFICATION REPORT

Giant Refining Company - Ciniza Refinery

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	MW-5
WELL LOCATION (LONGITUDE)	108° 25' 57"
WELL LOCATION (LATITUDE)	35° 29' 43"
NEW MEXICO STATE PLANE	(X) 321,233.03 (Y) 1,636,212.58
AQUIFER NAME	Sonsela
AQUIFER CONFINED xx	UNCONFINED
WELL INSTALLATION DATE	7/21/86
DRILLING METHOD	HLWAG & AIRRT
INNER CASING DIAMETER	5.0"
BOREHOLE DIAMETER	10.0"
CASING MATERIAL	PVC
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6746.80
ELEV. BOTTOM OF WELL CASING	6753.30
ELEV. BOTTOM OF SCREENED INT.	6758.30
ELEVATION OF SCREENED INTERVAL	6768.80
SURVEYED ELEVATION OF CASING TOP	6883.32

MONITORING WELL IDENTIFICATION REPORT

Giant Refining Company - Ciniza Refinery

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	OW-11
WELL LOCATION (LONGITUDE)	108° 25' 36"
WELL LOCATION (LATITUDE)	35° 29' 08"
NEW MEXICO STATE PLANE	(X) 323,167.68 (Y) 1,632,185.21
AQUIFER NAME	Sonsela?
AQUIFER CONFINED xx	UNCONFINED
WELL INSTALLATION DATE	12/30/80
DRILLING METHOD	Cable
INNER CASING DIAMETER	4.0"
BOREHOLE DIAMETER	8.0"
CASING MATERIAL	PVC
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6773.00
ELEV. BOTTOM OF WELL CASING	6773.00
ELEV. BOTTOM OF SCREENED INT.	6858.00
ELEVATION OF SCREENED INTERVAL	6880.00
SURVEYED ELEVATION OF CASING TOP	6923.89

MONITORING WELL IDENTIFICATION REPORT

Giant Refining Company - Ciniza Refinery

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	SMW-3
WELL LOCATION (LONGITUDE)	108° 25' 56"
WELL LOCATION (LATITUDE)	35° 29' 40"
NEW MEXICO STATE PLANE	(X) 321,397.90 (Y) 1,635,648.75
AQUIFER NAME	Unnamed *
AQUIFER CONFINED xx	UNCONFINED
WELL INSTALLATION DATE	10/1/85
DRILLING METHOD	HLWAG
INNER CASING DIAMETER	2.0"
BOREHOLE DIAMETER	6.5"
CASING MATERIAL	SS304
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6836.15
ELEV. BOTTOM OF WELL CASING	6838.65
ELEV. BOTTOM OF SCREENED INT.	6841.65
ELEVATION OF SCREENED INTERVAL	6861.65
SURVEYED ELEVATION OF CASING TOP	6884.56

MONITORING WELL IDENTIFICATION REPORT

Giant Refining Company - Ciniza Refinery

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	SMW-4
WELL LOCATION (LONGITUDE)	108° 26' 01"
WELL LOCATION (LATITUDE)	35° 29' 44"
NEW MEXICO STATE PLANE	(X) 321,397.90 (Y) 1,635,948.75
AQUIFER NAME	Unnamed *
AQUIFER CONFINED xx	UNCONFINED
WELL INSTALLATION DATE	9/25/85
DRILLING METHOD	HLWAG
INNER CASING DIAMETER	2.0"
BOREHOLE DIAMETER	6.5"
CASING MATERIAL	SS304
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6806.74
ELEV. BOTTOM OF WELL CASING	6807.84
ELEV. BOTTOM OF SCREENED INT.	6810.84
ELEVATION OF SCREENED INTERVAL	6830.84
SURVEYED ELEVATION OF CASING TOP	6880.08

MONITORING WELL IDENTIFICATION REPORT

Giant Refining Company - Ciniza Refinery

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	SMW-5
WELL LOCATION (LONGITUDE)	108° 26' 03"
WELL LOCATION (LATITUDE)	35° 29' 41"
NEW MEXICO STATE PLANE	(X) 320,778.61 (Y) 1,636,054.28
AQUIFER NAME	Unnamed *
AQUIFER CONFINED xx	UNCONFINED
WELL INSTALLATION DATE	9/25/85
DRILLING METHOD	HLWAG
INNER CASING DIAMETER	2.0"
BOREHOLE DIAMETER	6.5"
CASING MATERIAL	SS304
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6800.68
ELEV. BOTTOM OF WELL CASING	6801.78
ELEV. BOTTOM OF SCREENED INT.	6804.78
ELEVATION OF SCREENED INTERVAL	6824.78
SURVEYED ELEVATION OF CASING TOP	6878.02

Calculation Sheet for Semi-Annual Evaluation of Indicator Parameters

MW-1 Giant Refining - Ciniza (Down Gradient Well)

Parameter: pH

Background Indicator Values: $X_b = 8.51$ $S_b^2 = 0.015$
 $W_b = 0.00937$ $t_b = 2.947$

Current well sample values:	Sample	Value	$(\text{Value}-X_m)^2$
	1	8.74	0.0005
	2	8.71	0.0001
	3	8.69	0.0008
	4	8.73	0.0002

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 8.72$ Variance $S_m^2 = [\text{Sum of } (\text{Value}-X_m)^2] / 3 = 0.0005$

$t_m (\text{pH}) = 5.841$ $W_m = S_m^2 / n_m = 0.0001$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 2.13$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.98$ $|t^*| < t_c$: Statistically significant change not likely.

Parameter: Specific Conductivity

Background Indicator Values: $X_b = 984$ $S_b^2 = 1487$
 $W_b = 92.9375$ $t_b = 2.602$

Current well sample values:	Sample	Value	$(\text{Value}-X_m)^2$
	1	1139	76.5625
	2	1129	1.5625
	3	1127	10.5625
	4	1126	18.0625

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 1130$ Variance $S_m^2 = [\text{Sum of } (\text{Value}-X_m)^2] / 3 = 35.5833$

$t_m (\text{Specific Conduct.}) = 4.541$ $W_m = S_m^2 / n_m = 8.8958$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 14.49$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.77$ $t^* > t_c$: Statistically significant change possible.

Calculation Sheet for Semi-Annual Evaluation of Indicator Parameters

MW-1 Giant Refining - Ciniza (Down Gradient Well)

Parameter: pH

Background Indicator Values: $X_b = 8.51$ $S_b^2 = 0.015$
 $W_b = 0.00937$ $t_b = 2.947$

Current well sample values:	Sample	Value	$(\text{Value}-X_m)^2$
	1	8.50	0.0068
	2	8.56	0.0005
	3	8.62	0.0014
	4	8.65	0.0046

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 8.58$ Variance $S_m^2 = [\text{Sum of } (\text{Value}-X_m)^2] / 3 = 0.0044$
 $t_m (\text{pH}) = 5.841$ $W_m = S_m^2 / n_m = 0.0011$

$$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 0.71$$

$$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 3.25 \quad |t^*| < t_c : \text{Statistically significant change not likely.}$$

Parameter: Specific Conductivity

Background Indicator Values: $X_b = 984$ $S_b^2 = 1487$
 $W_b = 92.9375$ $t_b = 2.602$

Current well sample values:	Sample	Value	$(\text{Value}-X_m)^2$
	1	1170	25.0000
	2	1160	25.0000
	3	1166	1.0000
	4	1164	1.0000

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 1165$ Variance $S_m^2 = [\text{Sum of } (\text{Value}-X_m)^2] / 3 = 17.3333$
 $t_m (\text{Specific Conduct.}) = 4.541$ $W_m = S_m^2 / n_m = 4.3333$

$$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 18.35$$

$$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.69 \quad t^* > t_c : \text{Statistically significant change possible.}$$

Note: W_b, W_m = Special Weighting Factors; t_b, t_m = Standard T-Table Levels of Significance; t^* = the t-statistic; and t_c = the comparison t-statistic.
 Groundwater Report - Fall 99.xls MW-1

Calculation Sheet for Semi-Annual Evaluation of Indicator Parameters

MW-2 Giant Refining - Ciniza (Down Gradient Well)

Parameter: pH

Background Indicator Values: $X_b = 8.51$ $S_b^2 = 0.015$
 $W_b = 0.00937$ $t_b = 2.947$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	8.72	0.0002
	2	8.76	0.0006
	3	8.72	0.0002
	4	8.74	0.0000

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 8.74$ Variance $S_m^2 = [\text{Sum of (Value- X_m)²}] / 3 = 0.0004$
 $t_m (\text{pH}) = 5.841$ $W_m = S_m^2 / n_m = 0.0001$

$$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 2.31$$

$$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.98 \quad |t^*| < t_c : \text{Statistically significant change not likely.}$$

Parameter: Specific Conductivity

Background Indicator Values: $X_b = 984$ $S_b^2 = 1487$
 $W_b = 92.9375$ $t_b = 2.602$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	1163	289.0000
	2	1142	16.0000
	3	1141	25.0000
	4	1138	64.0000

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 1146$ Variance $S_m^2 = [\text{Sum of (Value- X_m)²}] / 3 = 131.3333$
 $t_m (\text{Specific Conduct.}) = 4.541$ $W_m = S_m^2 / n_m = 32.8333$

$$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 14.45$$

$$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 3.11 \quad t^* > t_c : \text{Statistically significant change possible.}$$

Calculation Sheet for Semi-Annual Evaluation of Indicator Parameters

MW-2 Giant Refining - Ciniza (Down Gradient Well)

Parameter: pH

Background Indicator Values: $X_b = 8.51$ $S_b^2 = 0.015$
 $W_b = 0.00937$ $t_b = 2.947$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	8.85	0.0000
	2	8.80	0.0023
	3	8.87	0.0005
	4	8.87	0.0005

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 8.85$ Variance $S_m^2 = [\text{Sum of (Value- X_m)²}] / 3 = 0.0011$
 $t_m (\text{pH}) = 5.841$ $W_m = S_m^2 / n_m = 0.0003$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 3.44$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 3.03$ $|t^*| > t_c$: Statistically significant change possible.

Parameter: Specific Conductivity

Background Indicator Values: $X_b = 984$ $S_b^2 = 1487$
 $W_b = 92.9375$ $t_b = 2.602$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	1190	52.5625
	2	1185	5.0625
	3	1180	7.5625
	4	1176	45.5625

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 1183$ Variance $S_m^2 = [\text{Sum of (Value- X_m)²}] / 3 = 36.9167$
 $t_m (\text{Specific Conduct.}) = 4.541$ $W_m = S_m^2 / n_m = 9.2292$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 19.66$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.78$ $t^* > t_c$: Statistically significant change possible.

Note: W_b, W_m = Special Weighting Factors; t_b, t_m = Standard T-Table Levels of Significance; t^* = the t-statistic; and t_c = the comparison t-statistic.
 Groundwater Report - Fall 99.xls MW-2

Calculation Sheet for Semi-Annual Evaluation of Indicator Parameters

MW-4 Giant Refining - Ciniza (Down Gradient Well)

Parameter: pH

Background Indicator Values: $X_b = 8.51$ $S_b^2 = 0.015$
 $W_b = 0.00937$ $t_b = 2.947$

Current well sample values:	Sample	Value	$(\text{Value}-X_m)^2$
	1	8.30	0.0006
	2	8.27	0.0000
	3	8.26	0.0002
	4	8.27	0.0000

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 8.28$ Variance $S_m^2 = [\text{Sum of } (\text{Value}-X_m)^2] / 3 = 0.0003$

$t_m (\text{pH}) = 5.841$

$W_m = S_m^2 / n_m = 0.0001$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = -2.42$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.97$ $|t^*| < t_c$: Statistically significant change not likely.

Parameter: Specific Conductivity

Background Indicator Values: $X_b = 984$ $S_b^2 = 1487$
 $W_b = 92.9375$ $t_b = 2.602$

Current well sample values:	Sample	Value	$(\text{Value}-X_m)^2$
	1	1172	42.2500
	2	1182	12.2500
	3	1180	2.2500
	4	1180	2.2500

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 1179$ Variance $S_m^2 = [\text{Sum of } (\text{Value}-X_m)^2] / 3 = 19.6667$

$t_m (\text{Specific Conduct.}) = 4.541$

$W_m = S_m^2 / n_m = 4.9167$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 19.66$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.70$ $t^* > t_c$: Statistically significant change possible.

Calculation Sheet for Semi-Annual Evaluation of Indicator Parameters

MW-4 Giant Refining - Ciniza (Down Gradient Well)

Parameter: pH

Background Indicator Values: $X_b = 8.51$ $S_b^2 = 0.015$
 $W_b = 0.00937$ $t_b = 2.947$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	8.48	0.0000
	2	8.48	0.0000
	3	8.48	0.0000
	4	8.48	0.0000

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 8.48$ Variance $S_m^2 = [\text{Sum of (Value-X}_m)^2] / 3 = 0.0000$

$t_m (\text{pH}) = 5.841$

$W_m = S_m^2 / n_m = 0.0000$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = -0.31$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.95$ $|t^*| < t_c$: Statistically significant change not likely.

Parameter: Specific Conductivity

Background Indicator Values: $X_b = 984$ $S_b^2 = 1487$
 $W_b = 92.9375$ $t_b = 2.602$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	1235	264.0625
	2	1211	60.0625
	3	1217	3.0625
	4	1212	45.5625

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 1219$ Variance $S_m^2 = [\text{Sum of (Value-X}_m)^2] / 3 = 124.2500$

$t_m (\text{Specific Conduct.}) = 4.541$

$W_m = S_m^2 / n_m = 31.0625$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 21.08$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 3.09$ $t^* > t_c$: Statistically significant change possible.

Calculation Sheet for Semi-Annual Evaluation of Indicator Parameters

MW-5 Giant Refining - Ciniza (Down Gradient Well)

Parameter: pH

Background Indicator Values: $X_b = 8.51$ $S_b^2 = 0.015$
 $W_b = 0.00937$ $t_b = 2.947$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	8.48	0.0023
	2	8.54	0.0002
	3	8.53	0.0000
	4	8.56	0.0011

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 8.53$ Variance $S_m^2 = [\text{Sum of (Value- X_m)²}] / 3 = 0.0012$
 $t_m (\text{pH}) = 5.841$ $W_m = S_m^2 / n_m = 0.0003$

$$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 0.18$$

$$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 3.03 \quad |t^*| < t_c : \text{Statistically significant change not likely.}$$

Parameter: Specific Conductivity

Background Indicator Values: $X_b = 984$ $S_b^2 = 1487$
 $W_b = 92.9375$ $t_b = 2.602$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	1157	52.5625
	2	1176	138.0625
	3	1162	5.0625
	4	1162	5.0625

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 1164$ Variance $S_m^2 = [\text{Sum of (Value- X_m)²}] / 3 = 66.9167$
 $t_m (\text{Specific Conduct.}) = 4.541$ $W_m = S_m^2 / n_m = 16.7292$

$$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 17.21$$

$$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.90 \quad t^* > t_c : \text{Statistically significant change possible.}$$

Calculation Sheet for Semi-Annual Evaluation of Indicator Parameters

MW-5 Giant Refining - Ciniza (Down Gradient Well)

Parameter: pH

Background Indicator Values: $X_b = 8.51$ $S_b^2 = 0.015$
 $W_b = 0.00937$ $t_b = 2.947$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	8.80	0.0020
	2	8.85	0.0000
	3	8.86	0.0002
	4	8.87	0.0006

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 8.85$ Variance $S_m^2 = [\text{Sum of (Value- X_m)²}] / 3 = 0.0010$

$t_m (\text{pH}) = 5.841$

$W_m = S_m^2 / n_m = 0.0002$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 3.42$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 3.02$ $|t^*| > t_c$: Statistically significant change possible.

Parameter: Specific Conductivity

Background Indicator Values: $X_b = 984$ $S_b^2 = 1487$
 $W_b = 92.9375$ $t_b = 2.602$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	1190	5.0625
	2	1188	0.0625
	3	1182	33.0625
	4	1191	10.5625

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 1188$ Variance $S_m^2 = [\text{Sum of (Value- X_m)²}] / 3 = 16.2500$

$t_m (\text{Specific Conduct.}) = 4.541$

$W_m = S_m^2 / n_m = 4.0625$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 20.69$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.68$ $t^* > t_c$: Statistically significant change possible.

Calculation Sheet for Semi-Annual Evaluation of Indicator Parameters

OW-11 Giant Refining - Ciniza (Down Gradient Well)

Parameter: pH

Background Indicator Values: $X_b = 8.51$ $S_b^2 = 0.015$
 $W_b = 0.00937$ $t_b = 2.947$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	7.80	0.0005
	2	7.80	0.0005
	3	7.84	0.0003
	4	7.85	0.0008

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 7.82$ Variance $S_m^2 = [\text{Sum of (Value-X}_m)^2] / 3 = 0.0007$
 $t_m (\text{pH}) = 5.841$ $W_m = S_m^2 / n_m = 0.0002$

$$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = -7.04$$

$$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 3.00 \quad |t^*| > t_c : \text{Statistically significant change possible.}$$

Parameter: Specific Conductivity

Background Indicator Values: $X_b = 984$ $S_b^2 = 1487$
 $W_b = 92.9375$ $t_b = 2.602$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	2640	6.2500
	2	2670	756.2500
	3	2620	506.2500
	4	2640	6.2500

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 2643$ Variance $S_m^2 = [\text{Sum of (Value-X}_m)^2] / 3 = 425.0000$
 $t_m (\text{Specific Conduct.}) = 4.541$ $W_m = S_m^2 / n_m = 106.2500$

$$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 117.51$$

$$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 3.64 \quad t^* > t_c : \text{Statistically significant change possible.}$$

Note: W_b, W_m = Special Weighting Factors; t_b, t_m = Standard T-Table Levels of Significance; t^* = the t-statistic; and t_c = the comparison t-statistic.
 Groundwater Report - Spring 99.xls OW-11

Calculation Sheet for Semi-Annual Evaluation of Indicator Parameters

OW-11 Giant Refining - Ciniza (Down Gradient Well)

Parameter: pH

Background Indicator Values: $X_b = 8.51$ $S_b^2 = 0.015$
 $W_b = 0.00937$ $t_b = 2.947$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	8.09	0.0009
	2	8.05	0.0001
	3	8.05	0.0001
	4	8.05	0.0001

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 8.06$ Variance $S_m^2 = [\text{Sum of (Value-X}_m)^2] / 3 = 0.0004$

$t_m (\text{pH}) = 5.841$ $W_m = S_m^2 / n_m = 0.0001$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = -4.62$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.98$ $|t^*| > t_c$: Statistically significant change possible.

Parameter: Specific Conductivity

Background Indicator Values: $X_b = 984$ $S_b^2 = 1487$
 $W_b = 92.9375$ $t_b = 2.602$

Current well sample values:	<u>Sample</u>	<u>Value</u>	<u>(Value-X_m)²</u>
	1	2760	100.0000
	2	2750	0.0000
	3	2750	0.0000
	4	2740	100.0000

Mean $X_m = (\text{Sum of Sample Values}) / 4 = 2750$ Variance $S_m^2 = [\text{Sum of (Value-X}_m)^2] / 3 = 66.6667$

$t_m (\text{Specific Conduct.}) = 4.541$ $W_m = S_m^2 / n_m = 16.6667$

$t^* = (X_m - X_b) / (W_m + W_b)^{1/2} = 168.69$

$t_c = [(W_b \times t_b) + (W_m \times t_m)] / (W_b + W_m) = 2.90$ $t^* > t_c$: Statistically significant change possible.

Note: W_b, W_m = Special Weighting Factors; t_b, t_m = Standard T-Table Levels of Significance; t^* = the t-statistic; and t_c = the comparison t-statistic.
 Groundwater Report - Fall 99.xls OW-11

Tolerance Interval

SMW-3 Giant Refining - Ciniza

pH

	Current Value	Historic Mean	Historic		
			Standard Deviation	Tolerance Interval	
Fall 98 sampling period	7.23	7.77	0.23	7.31 - 8.23	(Does exceed tolerance limit.)
Spring 99 sampling period	7.27	8.00	0.24	7.51 - 8.49	(Does exceed tolerance limit.)

Specific Conductivity

	Current Value	Historic Mean	Historic		
			Standard Deviation	Tolerance Interval	
Fall 98 sampling period	2928	3158	318	2522 - 3794	(Does not exceed tolerance limit.)
Spring 99 sampling period	2963	3150	314	2522 - 3778	(Does not exceed tolerance limit.)

Chromium

	Current Value	Historic Mean	Historic		
			Standard Deviation	Tolerance Interval	
Fall 98 sampling period	0.010	0.051	0.144	0.000 - 0.340	(Does not exceed tolerance limit.)
Spring 99 sampling period	0.005	0.049	0.142	0.000 - 0.333	(Does not exceed tolerance limit.)

Lead

	Current Value	Historic Mean	Historic		
			Standard Deviation	Tolerance Interval	
Fall 98 sampling period	0.003	0.022	0.075	0.000 - 0.172	(Does not exceed tolerance limit.)
Spring 99 sampling period	0.003	0.021	0.073	0.000 - 0.168	(Does not exceed tolerance limit.)

Tolerance Interval = (Mean ± 2 Standard Deviations)

Tolerance Interval

SMW-3 Giant Refining - Ciniza

pH

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	7.27	7.75	0.24	7.26 - 8.24	(Does not exceed tolerance limit.)
Fall 99 sampling period	7.15	8.00	0.27	7.47 - 8.53	(Does exceed tolerance limit.)

Specific Conductivity

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	2963	3150	314	2522 - 3778	(Does not exceed tolerance limit.)
Fall 99 sampling period	3018	3146	309	2528 - 3763	(Does not exceed tolerance limit.)

Chromium

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	0.005	0.049	0.142	0.000 - 0.333	(Does not exceed tolerance limit.)
Fall 99 sampling period	0.008	0.048	0.139	0.000 - 0.326	(Does not exceed tolerance limit.)

Lead

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	0.003	0.021	0.073	0.000 - 0.168	(Does not exceed tolerance limit.)
Fall 99 sampling period	0.003	0.021	0.072	0.000 - 0.165	(Does not exceed tolerance limit.)

Tolerance Interval = (Mean ± 2 Standard Deviations)

Tolerance Interval

SMW-4 Giant Refining - Ciniza

pH

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Fall 98 sampling period	7.91	8.33	0.20	7.92 - 8.74	(Does exceed tolerance limit.)
Spring 99 sampling period	8.41	8.33	0.20	7.93 - 8.73	(Does not exceed tolerance limit.)

Specific Conductivity

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Fall 98 sampling period	1213	1292	164	964 - 1620	(Does not exceed tolerance limit.)
Spring 99 sampling period	1278	1291	161	969 - 1614	(Does not exceed tolerance limit.)

Chromium

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 98 sampling period	0.005	0.010	0.013	0.000 - 0.037	(Does not exceed tolerance limit.)
Fall 98 sampling period	0.005	0.010	0.013	0.000 - 0.036	(Does not exceed tolerance limit.)

Lead

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 98 sampling period	0.003	0.007	0.020	0.000 - 0.047	(Does not exceed tolerance limit.)
Fall 98 sampling period	0.003	0.007	0.020	0.000 - 0.046	(Does not exceed tolerance limit.)

Tolerance Interval = (Mean ± 2 Standard Deviations)

Tolerance Interval

SMW-4 Giant Refining - Ciniza

pH

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	8.41	8.33	0.20	7.93 - 8.73	(Does not exceed tolerance limit.)
Fall 99 sampling period	8.25	8.33	0.20	7.93 - 8.73	(Does not exceed tolerance limit.)

Specific Conductivity

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	1278	1291	161	969 - 1614	(Does not exceed tolerance limit.)
Fall 99 sampling period	1279	1291	158	974 - 1608	(Does not exceed tolerance limit.)

Chromium

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	0.005	0.010	0.013	0.000 - 0.036	(Does not exceed tolerance limit.)
Fall 99 sampling period	0.005	0.010	0.013	0.000 - 0.035	(Does not exceed tolerance limit.)

Lead

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	0.003	0.007	0.020	0.000 - 0.046	(Does not exceed tolerance limit.)
Fall 99 sampling period	0.003	0.007	0.019	0.000 - 0.045	(Does not exceed tolerance limit.)

Tolerance Interval = (Mean ± 2 Standard Deviations)

Tolerance Interval

SMW-5 Giant Refining - Ciniza

pH

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Fall 98 sampling period	8.10	8.54	0.27	8.00 - 9.08	(Does not exceed tolerance limit.)
Spring 99 sampling period	8.53	8.54	0.27	8.01 - 9.08	(Does not exceed tolerance limit.)

Specific Conductivity

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Fall 98 sampling period	1136	1141	69	1003 - 1279	(Does not exceed tolerance limit.)
Spring 99 sampling period	1211	1143	69	1005 - 1281	(Does not exceed tolerance limit.)

Chromium

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Fall 98 sampling period	0.015	0.021	0.029	0.000 - 0.080	(Does not exceed tolerance limit.)
Spring 99 sampling period	0.005	0.021	0.029	0.000 - 0.079	(Does not exceed tolerance limit.)

Lead

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Fall 98 sampling period	0.003	0.012	0.045	0.000 - 0.102	(Does not exceed tolerance limit.)
Spring 99 sampling period	0.003	0.012	0.044	0.000 - 0.100	(Does not exceed tolerance limit.)

Tolerance Interval = (Mean ± 2 Standard Deviations)

Tolerance Interval

SMW-5 Giant Refining - Ciniza

pH

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	8.53	8.54	0.27	8.01 - 9.08	(Does not exceed tolerance limit.)
Fall 99 sampling period	8.51	8.54	0.26	8.02 - 9.07	(Does not exceed tolerance limit.)

Specific Conductivity

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	1211	1143	69	1005 - 1281	(Does not exceed tolerance limit.)
Fall 99 sampling period	1210	1145	69	1008 - 1283	(Does not exceed tolerance limit.)

Chromium

	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	0.005	0.021	0.029	0.000 - 0.079	(Does not exceed tolerance limit.)
Fall 99 sampling period	0.110	0.024	0.033	0.000 - 0.089	(Does exceed tolerance limit.)

Lead

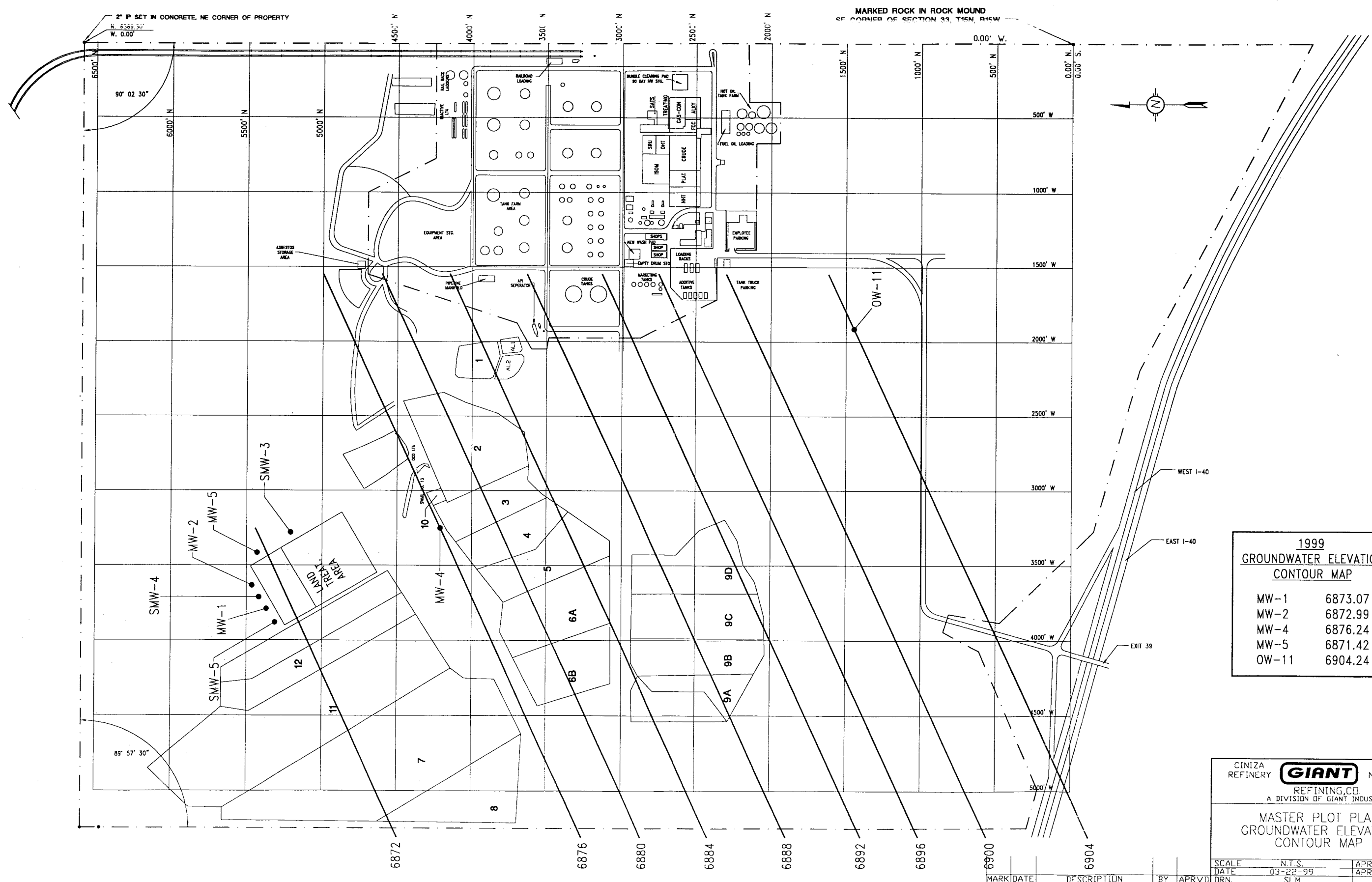
	Current Value	Historic Mean	Historic Standard Deviation	Tolerance Interval	
Spring 99 sampling period	0.003	0.012	0.044	0.000 - 0.100	(Does not exceed tolerance limit.)
Fall 99 sampling period	0.003	0.011	0.044	0.000 - 0.099	(Does not exceed tolerance limit.)

Tolerance Interval = (Mean ± 2 Standard Deviations)

GROUNDWATER ELEVATION MEASUREMENTS

Giant Refining Company - Ciniza

<u>Well No.</u>	<u>Date</u>	<u>Casing Elevation</u>	<u>Depth to Water</u>	<u>Groundwater Elevation</u>
MW-1	Spring 99	6878.52	5.65	6872.87
	Fall 99		5.45	6873.07
MW-2	Spring 99	6880.84	11.2	6869.64
	Fall 99		7.85	6872.99
MW-4	Spring 99	6882.54	6.4	6876.14
	Fall 99		6.3	6876.24
MW-5	Spring 99	6883.32	12.5	6870.82
	Fall 99		11.9	6871.42
OW-11	Spring 99	6923.89	19.4	6904.49
	Fall 99		19.65	6904.24
SMW-3	Spring 99	6884.56	30.5	6854.06
	Fall 99		30.1	6854.46
SMW-4	Spring 99	6880.08	30.1	6849.98
	Fall 99		30	6850.08
SMW-5	Spring 99	6878.02	30	6848.02
	Fall 99		30.5	6847.52



1999
GROUNDWATER ELEVATION
CONTOUR MAP

MW-1	6873.07
MW-2	6872.99
MW-4	6876.24
MW-5	6871.42
OW-11	6904.24

CINIZA REFINERY **GIANT** GALLUP NEW MEXICO
REFINING CO.
A DIVISION OF GIANT INDUSTRIES

MASTER PLOT PLAN
GROUNDWATER ELEVATION
CONTOUR MAP

SCALE	N.T.S.	APRV'D.
DATE	03-22-99	APRV'D.
DRN.	SLM	REV.
CHK'D.	IDWG NOGW ELEV. CTR. MAP	0

MARK	DATE	DESCRIPTION	BY	APRV'D.	REV.