GETTLER-RYAN INC.

March 4, 1999

Mr. Amir K. Gholami
Alameda County Health Care Services
Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Subject: **Groundwater Velocity for Tosco 76 Branded Facility No. 6034, 4700 First Street, Livermore, California**

Mr. Gholami:

At the request of Tosco Marketing Company (Tosco), Gettler-Ryan Inc. (GR) has prepared this letter in response to your January 6, 1999, correspondence regarding the subject site. Eight groundwater monitoring wells are present at the site. In accordance with the Alameda County Health Care Services, Environmental Health Services correspondence dated December 19, 1996, monitoring wells MW-2 and MW-4 are monitored and sampled semi-annually. The remaining wells are monitored semi-annually and are not sampled. The groundwater elevations, potentiometric contours, and a summary of analytical results from the October 16, 1998 sampling event are presented on the enclosed Figures 1 and 2.

The estimated groundwater velocity has been calculated using the seepage velocity formula derived from Darcy's Law. The formula and calculations are enclosed with this letter. The boring log for well MW-2 (also enclosed) indicates silt (Unified Soil Classification Symbol ML) and well graded gravel with sand (GW) are the permeable soil types in the saturated interval of the well. Values for hydraulic conductivity (10^{-3} gpd/ft^2 and 10^{2} gpd/ft^2, respectively) and porosity (35%) for silt and well graded gravel with sand were selected from the ranges of published values[1]. Using these values and the hydraulic gradient measured on October 16, 1998, the seepage velocities calculated were 0.0014 ft/yr for silt and 139.7 ft/yr for well graded gravel with sand.

The seepage velocity for the gravel suggest dissolved hydrocarbons in MW-2 migrating in the gravel should have reached well MW-7. However, groundwater analytical results have consistently shown no detectable concentrations of dissolved hydrocarbons in MW-7 during 20 sampling events from 1991 to 1996. Dissolved hydrocarbons have been detected in MW-2 since 1989 but may be largely confined to the capillary fringe within the silt encountered between 12.5 to 17 feet bgs. Groundwater analytical results indicate the seepage velocity calculated for the silt accurately reflects groundwater flow conditions at the site where dissolved hydrocarbons have not migrated laterally or downgradient and are limited to the vicinity of MW-2.

As requested, groundwater samples from the next sampling event will be analyzed by EPA Method 8260 on a one-time basis to confirm the absence of fuel oxygenates other than MTBE.

---

[1] Driscoll, F. G., Groundwater and Wells, Johnson Division, St. Paul, Minnesota, 1986.

140096.02

6747 Sierra Court, Suite J • Dublin, California 94568 • (925) 551-7555

If you have any questions, please call us in our Dublin office at (925) 551-7555.

Sincerely,
Gettler-Ryan Inc.

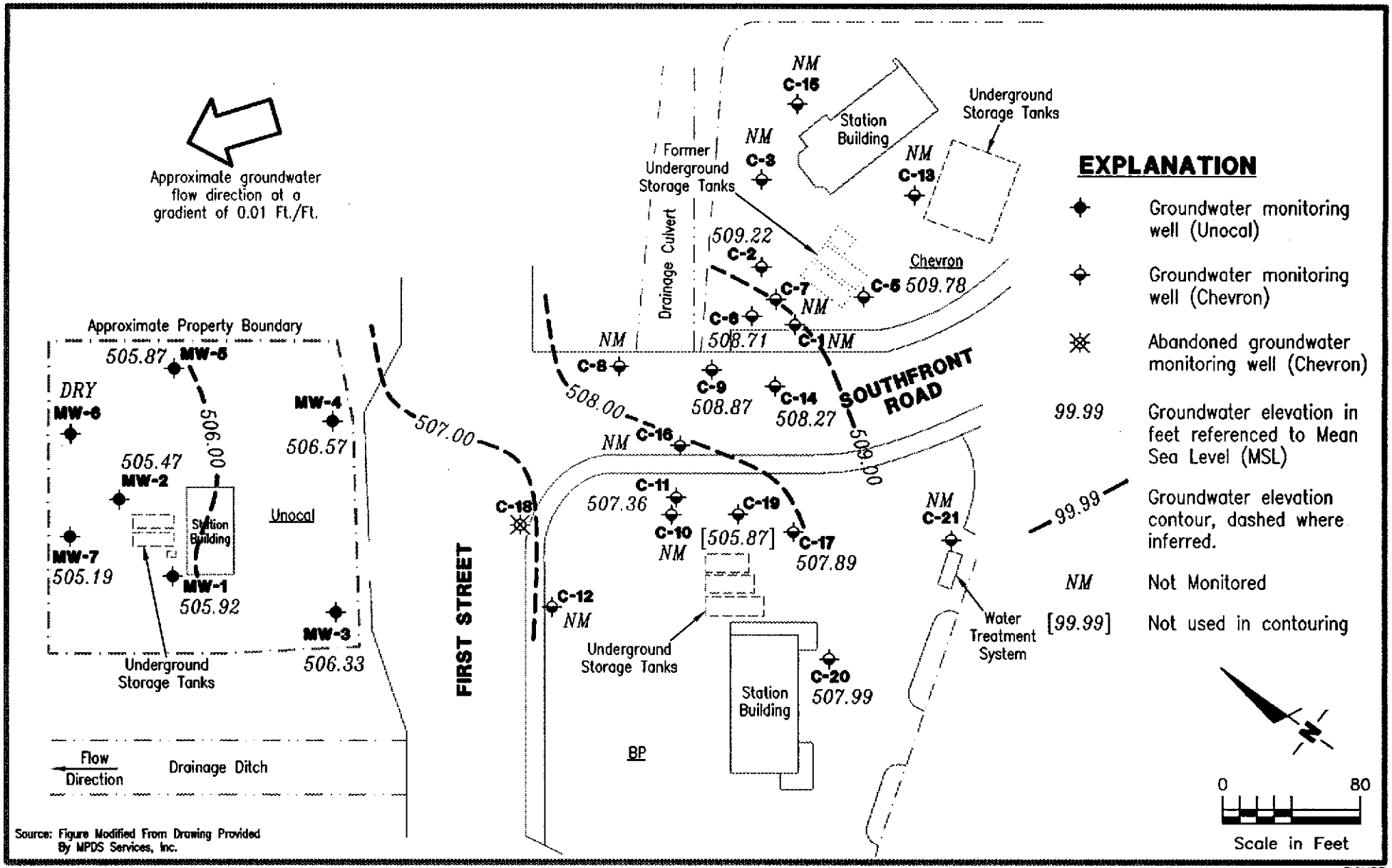
Douglas J. Lee
Project Manager

Joel G. Greger
Senior Engineering Geologist
C.E.G. EG 1633

REGISTERED GEOLOGIST
JOEL G. GREGER
No. EG 1633
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Enclosures: Figure 1 - Potentiometric Map
Figure 2 - Concentration Map
Groundwater Velocity Calculations
Boring Log - MW-2
Well Completion Diagram - MW-2

cc: Mr. David B. De Witt, Tosco Marketing Company



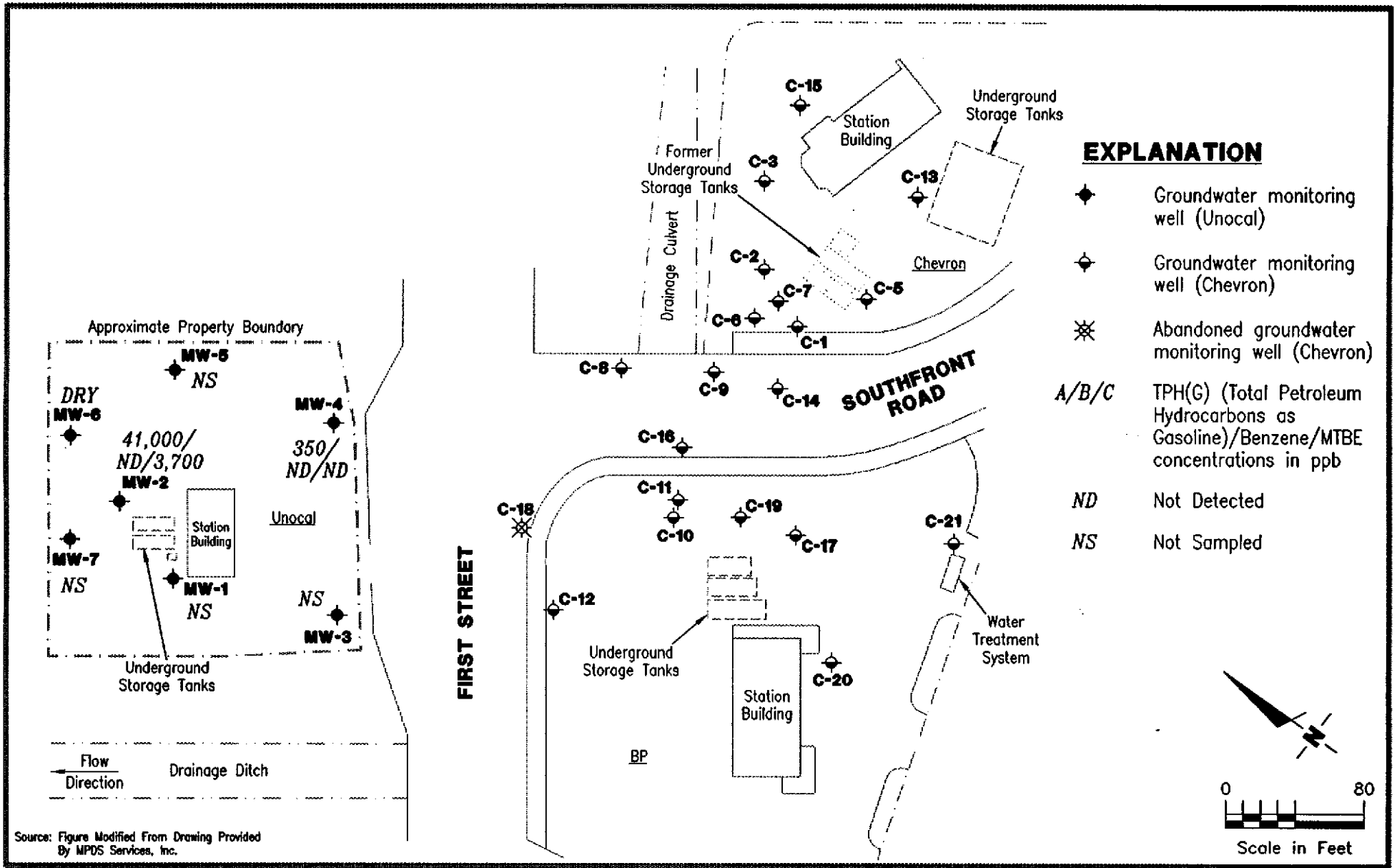
Source: Figure Modified From Drawing Provided By MPDS Services, Inc.

Gettler - Ryan Inc.
6747 Sierra Ct., Suite J (510) 551-7555
Dublin, CA 94568

POTENTIOMETRIC MAP
Tosco 76 Branded Facility No. 6034
4700 First Street
Livermore, California

FIGURE 1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
140096.02		October 7, 1998	



Gettler - Ryan Inc.
6747 Sierra Ct., Suite J (510) 551-7555
Dublin, CA 94568

CONCENTRATION MAP
Tosco 76 Branded Facility No. 6034
4700 First Street
Livermore, California

FIGURE
2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
140096.02		October 7, 1998	

GROUNDWATER VELOCITY CALCULATIONS
Tosco 76 Branded Facility No. 6034, 4700 First Street, Livermore, Ca.

$$V_s = \frac{K\,i}{n}$$

V_s = Seepage Velocity (ft/yr)
K = Hydraulic Conductivity (ft/yr)
i = Hydraulic Gradient (ft/ft)
n = Effective Porosity (Porosity)

Hydraulic Conductivity (Well Graded Gravel with Sand)[1] = 10^2gpd/ft^2
Hydraulic Conductivity (Silt)[1] = 10^{-3}gpd/ft^2
Porosity (Well Graded Gravel with Sand)[1] = 35%
Porosity (Silt)[1] = 35%
1 gpd/ft^2 = 0.134 ft/day Hydraulic Conductivity[2]

SILT:

$$10^{-3}\ \text{gpd/ft}^2 \times \frac{0.134\text{ft/day}}{1\ \text{gpd/ft}^2} \times \frac{365\ \text{days}}{1\ \text{yr}} = 0.0489\ \text{ft/yr}$$

$$\text{Seepage Velocity } V_s = \frac{(0.0489\ \text{ft/yr})(0.01\text{ft/ft})}{0.35} = 0.0014\ \text{ft/yr}$$

WELL GRADED GRAVEL WITH SAND:

$$10^{2}\ \text{gpd/ft}^2 \times \frac{0.134\text{ft/day}}{1\ \text{gpd/ft}^2} \times \frac{365\ \text{days}}{1\ \text{yr}} = 4891\ \text{ft/yr}$$

$$\text{Seepage Velocity } V_s = \frac{(489\ \text{ft/yr})(0.01\text{ft/ft})}{0.35} = 139.7\ \text{ft/yr}$$

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[2]Fetter, C. W., Applied Hydrogeology, Charles E. Merrill Publishing Co., Columbus, Ohio, 1980

140096.02

BORING LOG

Project No.	Boring & Casing Diameter	Logged By
KEI-P89-0801	9" 2"	D.L.
Project Name Unocal Livermore - First St.	**Well Head Elevation** N/A	**Date Drilled** 10-25-89
Boring No. MW2	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
		0		
			GW/ GM	A.C. Pavement Well graded gravel with silt and sand, medium dense, moist, olive brown: fill.
9/12/14		5		
			CH	Clay, high plasticity, 10-15% sand and gravel, gravel to 3/8" stiff, moist, black.
5/8/11		10		
			CL/ CH	Clay, moderate plasticity, stiff, moist, dark gray w/mod. cementation, blocky, dark greenish gray below 11 feet.
6/8/10			ML	Silt with clay, 10-15% fine sand from 12.5-13.5 feet, stiff, moist, dark greenish gray.
3/4/6		15		Grading stiff to very stiff Poor sample recovery at 16 feet.
10/22/32	▽		GW	Well graded gravel with sand, 5-10% fines, very dense, wet, dark gray.
40/50-5"		20		Well graded gravel with sand, lensed with well graded gravel

BORING LOG

Project No.	Boring & Casing Diameter	Logged By
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Project Name Unocal Livermore - First St.	**Well Head Elevation** N/A	**Date Drilled** 10-25-89
Boring No. MW2	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
			GW	with silt and sand, trace clay, very dense, wet, dark gray, discolored, some gravel is weathered.
8/11/20			CL/ CH	Clay, moderate plasticity, trace to 10% silt and sand, very stiff, cemented, slightly moist, light olive brown to pale olive, mottled, gravelly from 25.5' to 26', sandy below 26.75'.
8/11/18		25		
		30		
		35		
		40		TOTAL DEPTH 27'

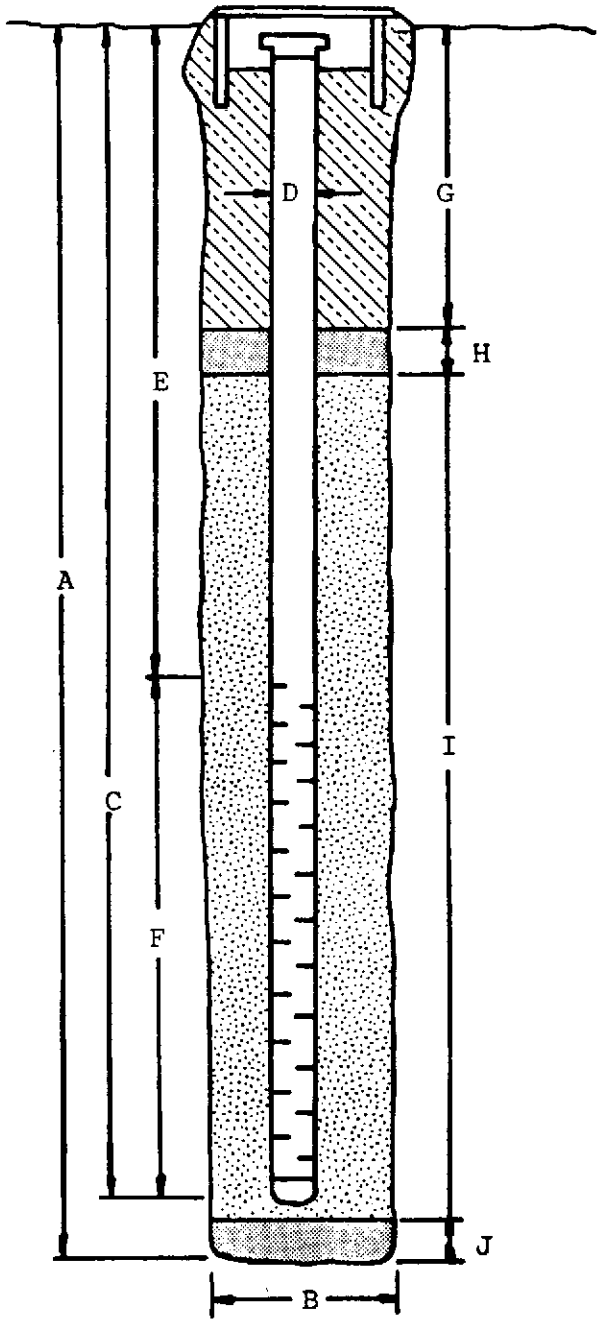
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Livermore - 4700 First St. BORING/WELL NO. MW2

PROJECT NUMBER: KEI-P89-0801

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 26'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 26'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 11'

F. Perforated Length: 15'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 7'

Seal Material: Concrete

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 17'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: 1'(Sampler hole)

Seal Material: Bentonite

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

TOSCO MARKETING COMPANY

FAX

TOSCO

ENVIRONMENTAL REMEDIATION
and COMPLIANCE
2000 Crow Canyon Place, Suite 400
San Ramon, CA 94583
fax (925) 277-2361

RESPONSE 9/28/99

[redacted]

TO: Mr. Amir Gholami

COMPANY: Alameda County HCS

FAX NO: 510-337-9335

DATE: 7-6-99 PAGES SENT: 9 (including cover)

FROM: Dave DeWitt

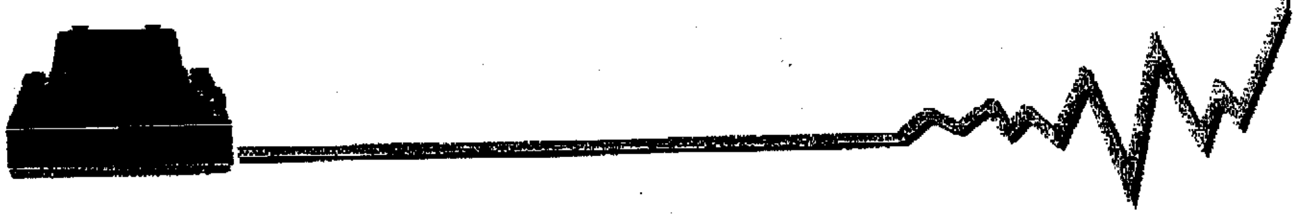
PHONE: 925-277-2384

COMMENTS:

Amir:

Please find attached a copy of report which calculates the groundwater velocity for the ~~[illegible]~~ site. Gettler-Ryan is our consultant for the site. Please call with questions

Dave DeWitt



GETTLER-RYAN INC.

256034SS X BP

3 4 5

March 4, 1999

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Alameda County Health Care Services
Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Subject: **Groundwater Velocity for Tosco 76 Branded Facility No. 6034, 4700 First Street, Livermore, California**

Mr. Gholami:

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[redacted] The formula and calculations are enclosed with this letter. The boring log for well MW-2 (also enclosed) indicates silt (Unified Soil Classification Symbol ML) and well graded gravel with sand (GW) are the permeable soil types in the saturated interval of the well. Values for hydraulic conductivity (10^{-3} gpd/ft^2 and 10^{2} gpd/ft^2, respectively) and porosity (35%) for silt and well graded gravel with sand were selected from the ranges of published values[1]. [redacted]

[redacted] However, groundwater analytical results have consistently shown no detectable concentrations of dissolved hydrocarbons in MW-7 during 20 sampling events from 1991 to 1996. Dissolved hydrocarbons have been detected in MW-2 since 1989 but may be largely confined to the capillary fringe within the silt encountered between 12.5 to 17 feet bgs. [redacted]

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140096.02

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Sincerely,
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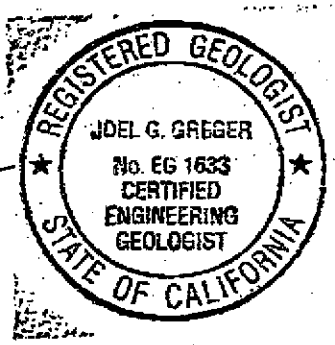
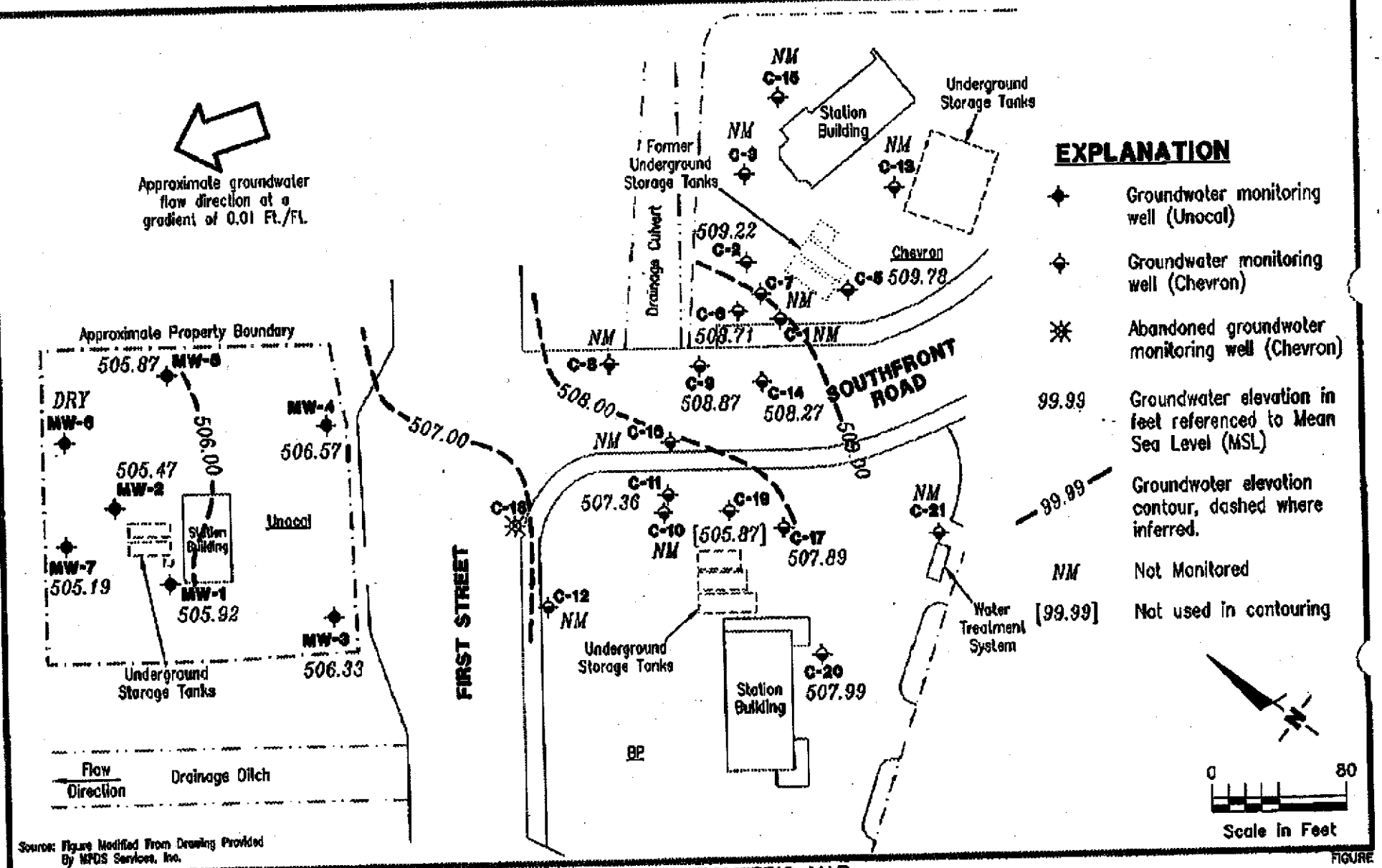
Douglas J. Lee
Project Manager



Joel G. Greger
Senior Engineering Geologist
C.E.G. EG 1633

Enclosures: Figure 1 - Potentiometric Map
Figure 2 - Concentration Map
Groundwater Velocity Calculations
Boring Log - MW-2
Well Completion Diagram - MW-2

cc: Mr. David B. De Witt, Tosco Marketing Company



Source: Figure Modified From Drawing Provided By NPDS Services, Inc.

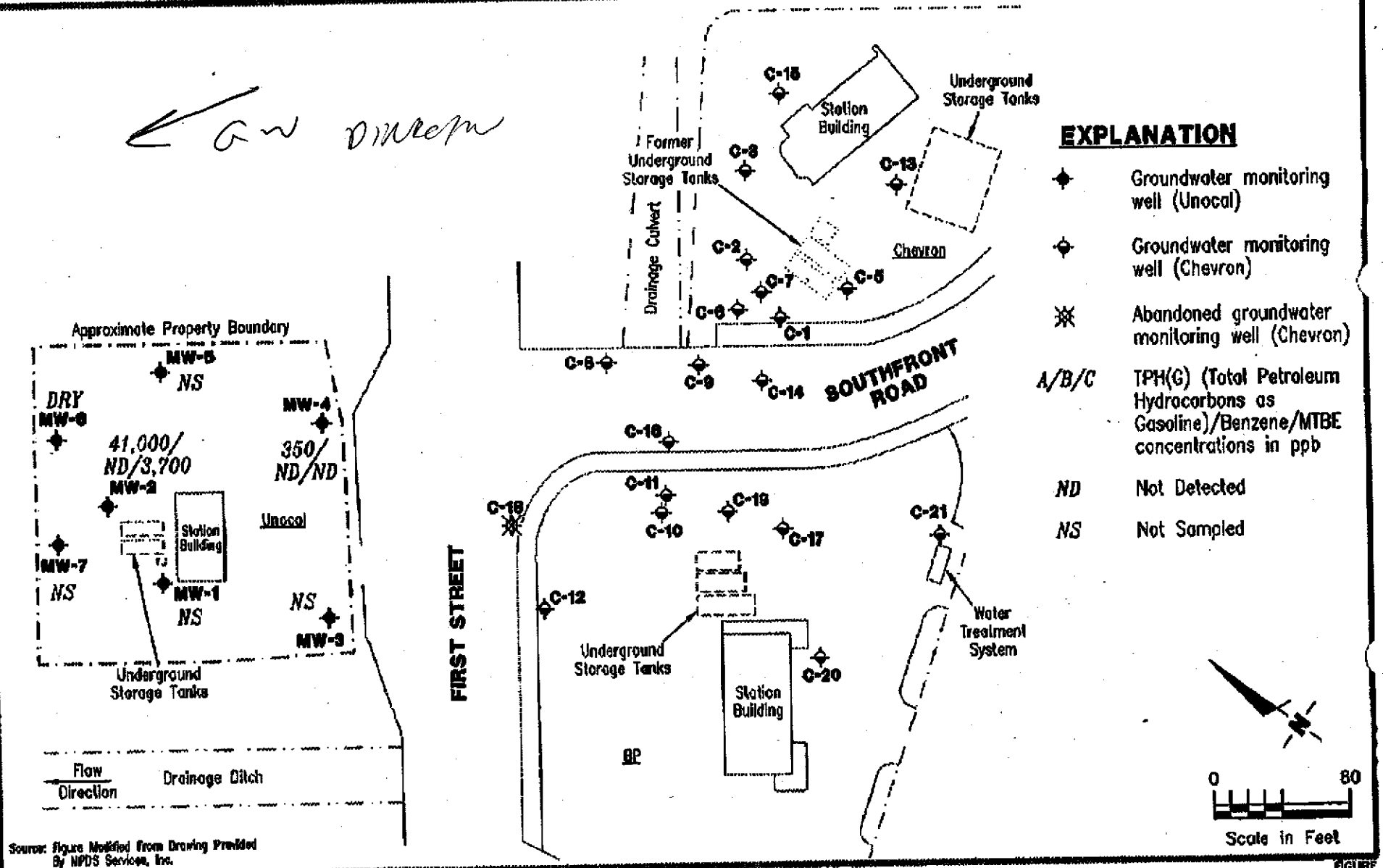
FIGURE 1

Gettler - Ryan Inc.

6747 Sierra Ct., Suite J
Dublin, CA 94568
(510) 551-7555

POTENTIOMETRIC MAP
Tosco 76 Branded Facility No. 6034
4700 First Street
Livermore, California

JOB NUMBER 140096.02
REVIEWED BY
DATE October 7, 1998
REVISED DATE



Source: Figure Modified from Drawing Provided By NPDS Services, Inc.

FIGURE 2

Gettler - Ryan Inc.

6747 Sierra Ct., Suite J
Dublin, CA 94568
(510) 551-7555

CONCENTRATION MAP
Tosco 76 Branded Facility No. 6034
4700 First Street
Livermore, California

JOB NUMBER 140096.02
REVIEWED BY
DATE October 7, 1998
REVISED DATE

GROUNDWATER VELOCITY CALCULATIONS
Tosco 76 Branded Facility No. 6034, 4700 First Street, Livermore, Ca.

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140096.02

BORING LOG

Project No. KEI-P89-0801	Boring & Casing Diameter 9" 2"	Logged By D.L.
Project Name Unocal Livermore - First St.	Well Head Elevation N/A	Date Drilled 10-25-89
Boring No. MW2	Drilling Method Hollow-stem Auger	Drilling Company EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
		0		A.C. Pavement
			GW/GM	Well graded gravel with silt and sand, medium dense, moist, olive brown: fill.
9/12/14		5		
			CH	Clay, high plasticity, 10-15% sand and gravel, gravel to 3/8" stiff, moist, black.
5/8/11		10	CL/CH	Clay, moderate plasticity, stiff, moist, dark gray w/mod. cementation, blocky, dark greenish gray below 11 feet.
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8/11/20			CL/ CH	Clay, moderate plasticity, trace to 10% silt and sand, very stiff, cemented, slightly moist, light olive brown to pale olive, mottled, gravelly from 25.5' to 26', sandy below 26.75'.
8/11/18		25		
		30		
		35		
		40		TOTAL DEPTH 27'

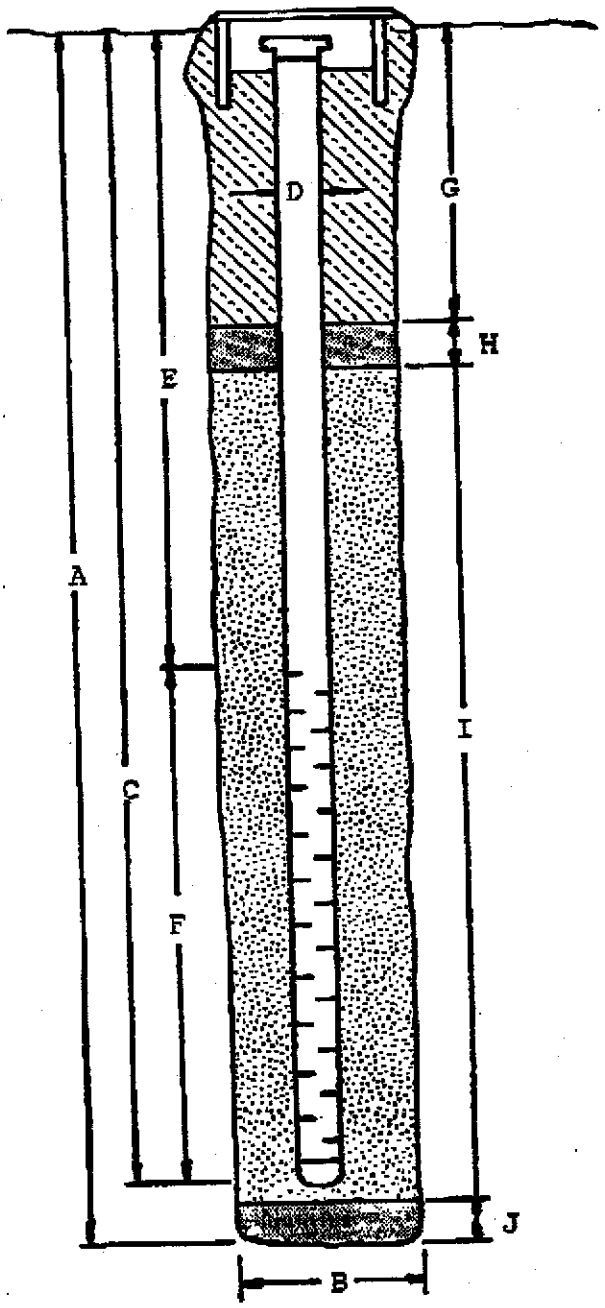
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Livermore - 4700 First St. BORING/WELL NO. MW2

PROJECT NUMBER: KEI-P89-0801

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 26'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 26'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375" ID = 2.067"

E. Depth to Perforations: 11'

F. Perforated Length: 15'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 7'

Seal Material: Concrete

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 17'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: 1'(Sampler hole)

Seal Material: Bentonite

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.

Gettler-Ryan Inc.
6747 Sierra Court, Suite J
Dublin, CA 94568-2611

FACSIMILE COVER SHEET

DATE: 3-5-99

TO: MR. AMIR K. GHOLAMI FAX:

COMPANY: ACHCSA/EHS

RE: TOSCO NO. 6034/4705 FIRST ST, LIVERMORE

FROM: DOUG LEE

PHONE: (925) 551-7555
FAX: (925) 551-7888

COMMENTS: GROUNDWATER VELOCITY LETTER.
SORRY ABOUT THE DELAY AND THANK YOU FOR YOUR PATIENCE. PLEASE CALL IF YOU HAVE ANY QUESTIONS

9 pages including cover

If there are any problems with this transmission, please call (925) 551-7555

X Hardcopy to follow BY MAIL

GETTLER-RYAN INC.

March 4, 1999

Mr. Amir K. Gholami
Alameda County Health Care Services
Environmental Health Services
1131 Harbor Bay Parkway, Suite 250
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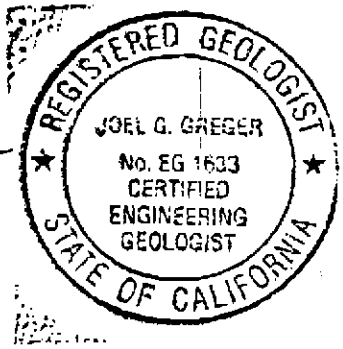

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Figure 2 - Concentration Map
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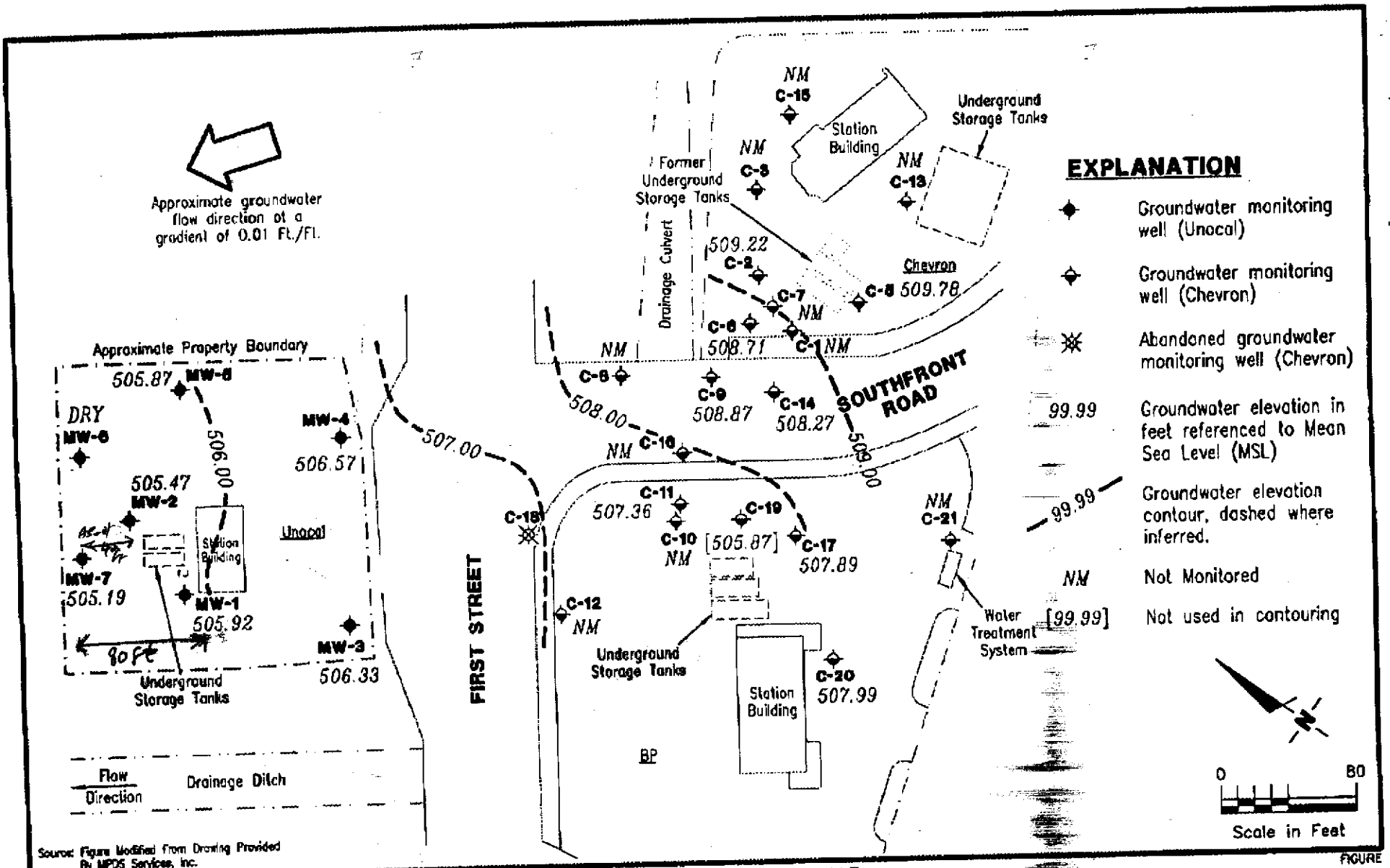
Well Completion Diagram - MW-2

cc: Mr. David B. De Witt, Tosco Marketing Company



Source: Figure Modified From Drawing Provided By MPDS Services, Inc.

FIGURE 1

Gettler - Ryan Inc.

6747 Sierra Ct., Suite J
Dublin, CA 94568
(510) 551-7555

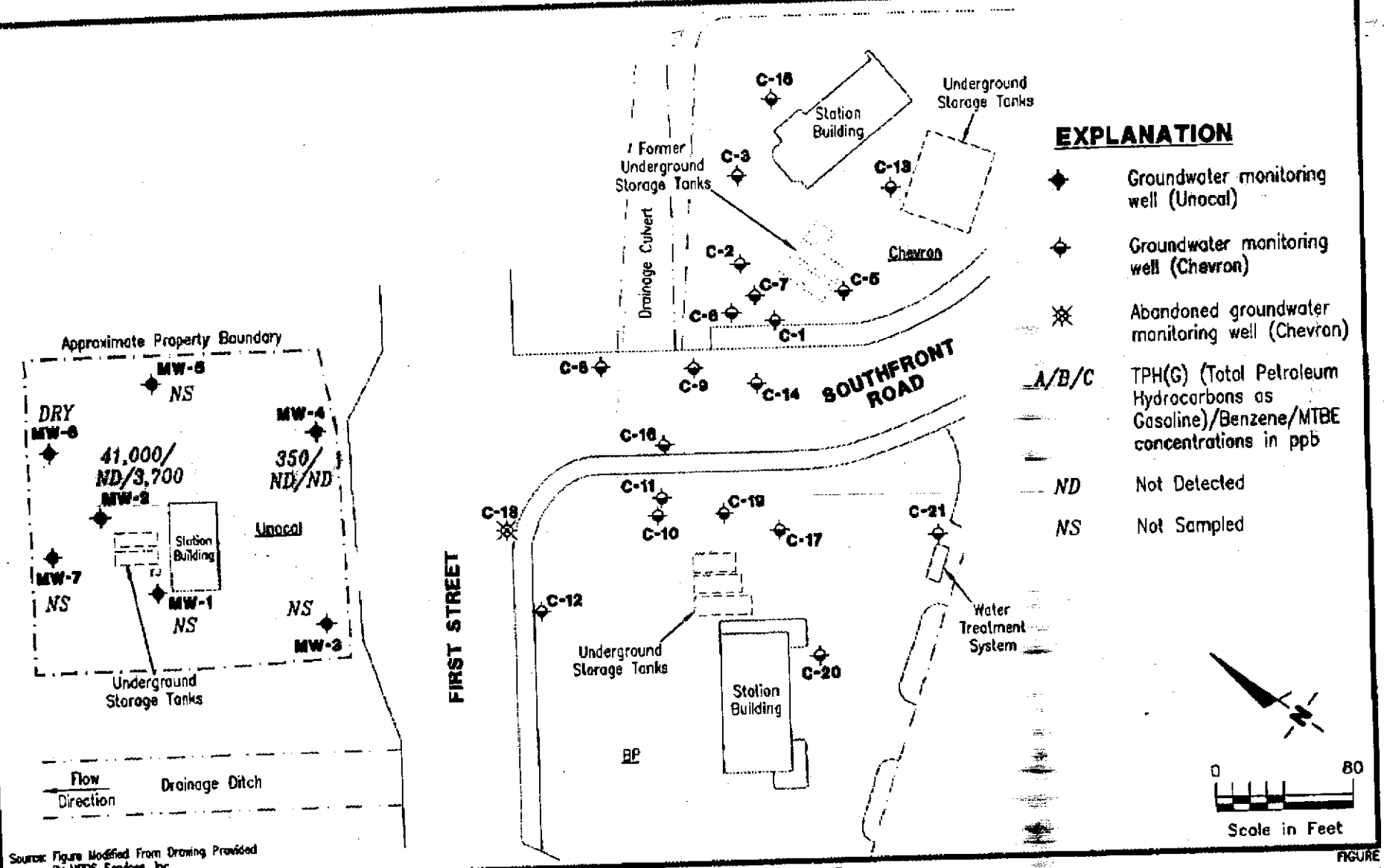
POTENTIOMETRIC MAP
Tosco 76 Branded Facility No. 6034
4700 First Street
Livermore, California

JOB NUMBER 140096.02

REVIEWED BY

DATE October 7, 1998

REVISED DATE



Source: Figure Modified From Drawing Provided By MPDS Services, Inc.

FIGURE 2

Gettler - Ryan Inc.

6747 Sierra Ct., Suite J
Dublin, CA 94568
(510) 551-7555

CONCENTRATION MAP
Tosco 76 Branded Facility No. 6034
4700 First Street
Livermore, California

JOB NUMBER 140096.02

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$$\text{Seepage Velocity } V_s = \frac{(0.0489\ \text{ft/yr})(0.01\text{ft/ft})}{0.35} = 0.0014\ \text{ft/yr}$$

WELL GRADED GRAVEL WITH SAND:

$$10^{2}\ \text{gpd/ft}^2 \times \frac{0.134\text{ft/day}}{1\ \text{gpd/ft}^2} \times \frac{365\ \text{days}}{1\ \text{yr}} = 4891\ \text{ft/yr}$$

$$\text{Seepage Velocity } V_s = \frac{(489\ \text{ft/yr})(0.01\text{ft/ft})}{0.35} = 139.7\ \text{ft/yr}$$

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[1]Driscoll, F. G., Groundwater and Wells, Johnson Division, St. Paul, Minnesota, 1986

[2]Fetter, C. W., Applied Hydrogeology, Charles E. Merrill Publishing Co., Columbus, Ohio, 1980

BORING LOG

Project No. KEI-P89-0801	Boring & Casing Diameter 9" 2"	Logged By D.L. DRB
Project Name Unocal Livermore - First St.	Well Head Elevation N/A	Date Drilled 10-25-89
Boring No. MW2	Drilling Method Hollow-stem Auger	Drilling Company EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
		0	GW/GM	A.C. Pavement Well graded gravel with silt and sand, medium dense, moist, olive brown: fill.
9/12/14		5	CH	Clay, high plasticity, 10-15% sand and gravel, gravel to 3/8" stiff, moist, black.
5/8/11		10	CL/CH	Clay, moderate plasticity, stiff, moist, dark gray w/mod. cementation, blocky, dark greenish gray below 11 feet.
6/8/10			ML	Silt with clay, 10-15% fine sand from 12.5-13.5 feet, stiff, moist, dark greenish gray.
3/4/6		15		Grading stiff to very stiff Poor sample recovery at 16 feet.
10/22/32	▽		GW	Well graded gravel with sand, 5-10% fines, very dense, wet, dark gray.
40/50-5"		20		Well graded gravel with sand, lensed with well graded gravel

BORING LOG

Project No. KEI-P89-0801	**Boring & Casing Diameter** 9" 2"	**Logged By** D.L.
Project Name Unocal Livermore - First St.	**Well Head Elevation** N/A	**Date Drilled** 10-25-89
Boring No. MW2	**Drilling Method** Hollow-stem Auger	**Drilling Company** EGI

Penetration blows/6"	G. W. level	Depth (ft) Samples	Stratigraphy USCS	Description
			GW	with silt and sand, trace clay, very dense, wet, dark gray, discolored, some gravel is weathered.
8/11/20			CL/ CH	Clay, moderate plasticity, trace to 10% silt and sand, very stiff, cemented, slightly moist, light olive brown to pale olive, mottled, gravelly from 25.5' to 26', sandy below 26.75'.
8/11/18		25		
		30		
		35		
		40		TOTAL DEPTH 27'

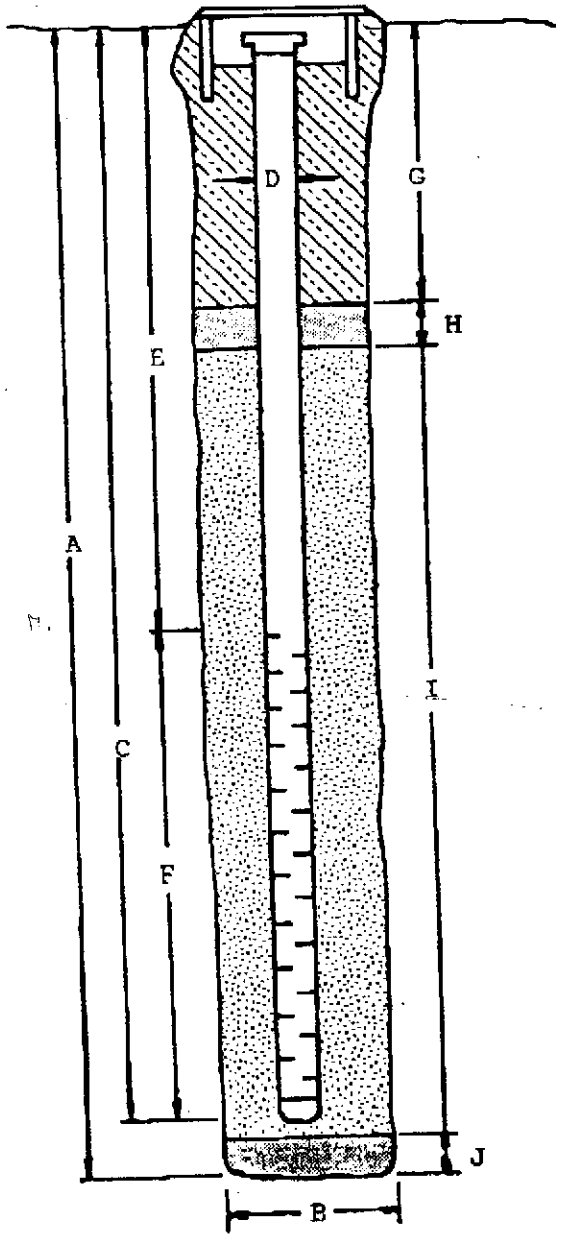
WELL COMPLETION DIAGRAM

PROJECT NAME: Unocal - Livermore - 4700 First St. BORING/WELL NO. MW2

PROJECT NUMBER: KEI-P89-0801

WELL PERMIT NO.:

Flush-mounted Well Cover



A. Total Depth: 26'

B. Boring Diameter*: 9"

Drilling Method: Hollow Stem Auger

C. Casing Length: 26'

Material: Schedule 40 PVC

D. Casing Diameter: OD = 2.375"
ID = 2.067"

E. Depth to Perforations: 11'

F. Perforated Length: 15'

Perforation Type: Machined Slot

Perforation Size: 0.020"

G. Surface Seal: 7'

Seal Material: Concrete

H. Seal: 2'

Seal Material: Bentonite

I. Gravel Pack: 17'

Pack Material: RMC Lonestar Sand

Size: #3

J. Bottom Seal: 1' (Sampler hole)

Seal Material: Bentonite

*Boring diameter can vary from 8-1/4" to 9" depending on bit wear.