# Table 3-18
# Water Quality and Natural Attenuation Parameters in Groundwater

| Location ID | A-5 | | A-8 | DSW-4B | DSW-4C | | DSW-4D | DSW-6B | DSW-6C | DSW-7A | DSW-7B | DSW-7C | OFS-3B | OS-3E | OS-4A | OS-4B | OS-4C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date Collected** | **7/12/99** | **7/12/99** | **7/12/99** | **7/15/99** | **7/15/99** | **7/15/99** | **7/15/99** | **7/12/99** | **7/12/99** | **7/13/99** | **7/13/99** | **7/13/99** | **7/15/99** | **7/15/99** | **7/14/99** | **7/14/99** | **7/14/99** |
| **Field QC** | | **Dup.** | | | | **Dup.** | | | | | | | | | | | |
| **Metals (µg/L)** | | | | | | | | | | | | | | | | | |
| Manganese (total) | 20 | 20 | 5,500 | 270 | 380 | 360 | 160 | 120 | 170 | 1,200 | 80 | 150 | 170 | 510 | 340 | 100 | 120 |
| Manganese (dissolved) | 20 | 20 | 4,900 | 240 | 300 | 290 | 150 | 110 | 150 | 1,100 | 70 | 130 | 160 | 450 | 380 | 80 | 100 |
| **Miscellaneous Analytes (mg/L)** | | | | | | | | | | | | | | | | | |
| Chloride | 180 | 180 | 220 | 200 | 190 | 190 | 310 | 230 | 280 | 280 | 150 | 310 | 110 | 550 | 250 | 200 | 320 |
| Nitrate as N | 19 | 19 | 16 | 0.06 J | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 17 | 0.1 U | 0.1 |
| Nitrite as N | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 U | 0.1 |
| Sulfate | 270 | 270 | 510 | 1 U | 2 | 2 | 1 U | 0.5 | 1 U | 24 | 43 | 3 | 280 | 1 U | 210 | 86 | 0.5 |
| Total organic carbon | 18 | 17 | 140 | 36 | 32 | 32 | 4 | 18 | 4 | 9 | 10 | 5 J | 5 | 5 | 6 | 3 | 2 |
| **Field Data (mg/L)** | | | | | | | | | | | | | | | | | |
| Alkalinity (as $CaCO_3$) | 612 | -- | 769 | -- | 436 | -- | 163 | 368 | 210 | 598 | 330 | 303 | 267 | 144 | 432 | 183 | 158 |
| Conductivity (mS/cm) | 1,947 | -- | 2,510 | -- | 1,009 | -- | 990 | 1,243 | 1,087 | 1,917 | 975 | 1,236 | 1,181 | 1,700 | 1,787 | 968 | 1,009 |
| Dissolved oxygen—field meter | 0.82 | -- | 0.7 | -- | 0.72 | -- | 0.53 | 0.39 | 1.08 | 1.2 | 0.36 | 0.55 | 1.63 | 1.1 | 2.71 | 0.4 | 1.01 |
| Dissolved oxygen—test kit | 0.1 | -- | 0.3 | -- | 0.2 | -- | 0.3 | 0.9 | 0.4 | 0.15 | 1 | 0.15 | 0.15 | 0.25 | 3.5 | 0.2 | 0.3 |
| Hardness (as $CaCO_3$) | 366 | -- | 632 | -- | 227 | -- | 146 | 188 | 149 | 554 | 187 | 201 | 225 | 284 | 440 | 166 | 162 |
| Total iron | | -- | 1.1 | -- | 1.3 | -- | 0.7 | 0.95 | 0.85 | 0.9 | 2.1 | 0.85 | 1 | 0.8 | 7 | 0.9 | 0.6 |
| Oxygen reduction potential (mV) | 331 | -- | 381 | -- | 49.5 | -- | 5 | 94.3 | 202 | 149 | 59.8 | 102 | 53 | 67 | 139 | 2.9 | 72 |
| pH (std units) | 6.88 | -- | 6.91 | -- | 7.89 | -- | 8.46 | 7.93 | 8.09 | 7.03 | 8.07 | 7.96 | 8.12 | 7.82 | 7.12 | 8.3 | 8.33 |
| Temperature ($^oF$) | 72.9 | -- | 76.6 | -- | 71 | -- | 70.5 | 70.3 | 74 | 74.9 | 72.3 | 71.3 | 68.6 | 68.2 | 72.3 | 71 | 70.9 |
| Turbidity (visual)[1] | NA | -- | Rusty orange | -- | Clear | -- | Clear | Clear | NA | Clear | Rusty particles | Blackish, cloudy | Clear | Clear | Rust color | Black particles | Clear |

[1]Turbidity meter was broken and turbidity was assessed by visual observation.

Notes:
J - estimated
NA - not assessed
U - undetected

# Table 3-19
# NAPL Chemistry

| Analyte | Chemical Concentration (mg/kg) | | | |
|---|---|---|---|---|
| | ONS-1B | ONS-1B Field Duplicate | A-10 | DSW-6B |
| **TPH** | | | | |
| Diesel | 916,000 | 848,000 J | 439,000 J | 131,000 J |
| Lube Oil | ND | ND | ND | ND |
| **SVOCs** | | | | |
| 2,4-Dichlorophenol | ND | ND | 60 J | ND |
| Naphthalene | 120,000 | 130,000 | 39,000 | 32,000 J |
| 2-Methylnaphthalene | 26,000 | 30,000 | 14,000 | 9,100 J |
| Acenaphthylene | 400 J | 500 | 200 J | 200 J |
| Acenaphthene | 24,000 | 25,000 | 8,500 | 6,200 J |
| Dibenzofuran | 15,000 | 16,000 | 5,200 | 3,500 J |
| Fluorene | 16,000 | 18,000 | 5,900 | 3,900 J |
| Pentachlorophenol (PCP) | ND | ND | 1,800 | ND |
| Phenanthrene | 40,000 | 40,000 | 19,000 | 6,900 J |
| Anthracene | 5,600 | 7,300 | 4,100 | 2,500 J |
| Fluoranthene | 21,000 | 22,000 | 5,400 | 3,000 J |
| Pyrene | 16,000 | 18,000 | 5,000 | 2,700 J |
| Benzo(a)anthracene | 4,500 | 5,100 | 1,400 | 690 J |
| Chrysene | 4,600 | 5,000 | 1,600 | 770 J |
| bis(2-Ethylhexyl)phthalate | ND | ND | ND | ND |
| Benzo(b)fluoranthene | 2,500 | 3,000 | 500 J | 200 J |
| Benzo(k)fluoranthene | 2,300 | 2,300 | 550 | 300 J |
| Benzo(a)pyrene | 2,600 B | 2,900 B | 550 B | 200 J, B |
| Indeno(1,2,3-cd)pyrene | 930 | 1,100 | 200 J | 50 J |
| Dibenz(a,h)anthracene | 300 J | 400 J | 50 J | 20 J |
| Benzo(g,h,i)perylene | 820 | 970 | 100 J | 50 J |

Notes:
B - analyte also detected in associate blank
J - estimated
ND - not detected

# Table 3-20
# NAPL Density Measurements

| Well ID | Density (g/mL) at Various Temperatures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 10°C | 20°C | 30°C | 40°C | 50°C | 60°C | 70°C | 80°C | 90°C |
| A-10 | 1.0132 | 1.0044 | 0.9984 | 0.9916 | 0.9844 | 0.9768 | 0.9708 | 0.9616 | 0.9588 |
| | 1.0104 | 1.004 | 0.9968 | 0.9896 | 0.9828 | 0.9768 | 0.9676 | 0.9624 | 0.956 |
| | 1.01 | 1.0028 | 0.9956 | 0.9888 | 0.9824 | 0.9744 | 0.9688 | 0.9616 | 0.956 |
| A-10 (remeasurement) | 1.0096 | 1.0036 | 0.9952 | 0.9896 | 0.9816 | 0.9748 | 0.9676 | 0.96 | 0.9544 |
| | 1.0096 | 1.0028 | 0.9952 | 0.9892 | 0.9808 | 0.9744 | 0.9672 | 0.96 | 0.954 |
| | 1.0108 | 1.0036 | 0.996 | 0.99 | 0.9808 | 0.974 | 0.968 | 0.96 | 0.956 |
| A-10 field duplicate | 1.0592 | 1.052 | 1.046 | 1.0376 | 1.0288 | 1.0236 | 1.0156 | 1.0104 | 1.0032 |
| | 1.06 | 1.052 | 1.044 | 1.038 | 1.0304 | 1.0228 | 1.016 | 1.0088 | 1.0024 |
| | 1.062 | 1.0532 | 1.0468 | 1.038 | 1.0328 | 1.024 | 1.018 | 1.0116 | 1.0036 |
| A-10 (field duplicate remeasurement) | 1.0216 | 1.014 | 1.0064 | 0.9996 | 0.9916 | 0.9848 | 0.9788 | 0.9708 | 0.964 |
| | 1.018 | 1.0112 | 1.0024 | 0.9968 | 0.9884 | 0.9832 | 0.9752 | 0.9676 | 0.9608 |
| | 1.0196 | 1.012 | 1.0056 | 0.9992 | 0.9904 | 0.9832 | 0.9768 | 0.97 | 0.9624 |
| ONS-1B | 1.0608 | 1.054 | 1.0464 | 1.0388 | 1.0308 | 1.024 | 1.0176 | 1.0096 | 1.0036 |
| | 1.062 | 1.0556 | 1.0468 | 1.0396 | 1.0324 | 1.0244 | 1.0164 | 1.0096 | 1.0036 |
| | 1.0612 | 1.0536 | 1.0456 | 1.0388 | 1.0304 | 1.0236 | 1.0156 | 1.0096 | 1.0036 |
| ONS-1B field duplicate | 1.06 | 1.0536 | 1.0456 | 1.0376 | 1.0312 | 1.0228 | 1.0164 | 1.0096 | 1.0028 |
| | 1.0596 | 1.0524 | 1.0452 | 1.0376 | 1.03 | 1.0216 | 1.016 | 1.0096 | 1.002 |
| | 1.0608 | 1.0528 | 1.0452 | 1.0376 | 1.0296 | 1.0228 | 1.0148 | 1.008 | 1.0028 |
| DSW-6B | 1.0044 | 0.9976 | 0.9892 | 0.9812 | 0.9748 | 0.9684 | 0.9644 | 0.9564 | 0.9484 |
| | 1.0044 | 0.998 | 0.9896 | 0.982 | 0.9744 | 0.968 | 0.9632 | 0.9544 | 0.946 |
| | 1.004 | 0.9968 | 0.99 | 0.9824 | 0.9752 | 0.9684 | 0.9628 | 0.9524 | 0.9456 |

## Table 3-21
## NAPL Viscosity Measurements

| Well ID | Viscosity (cP) at Various Temperatures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 10°C | 20°C | 30°C | 40°C | 50°C | 60°C | 70°C | 80°C | 90°C |
| **A-10** | | | | | | | | | |
| 60 rpm | | 26.25 | 16.7 | 11.35 | 8.4 | 6.4 | 5 | 4.2 | 3.5 |
| | | 26.3 | 16.55 | 11.4 | 8.35 | 6.5 | 5.1 | 4.15 | 3.45 |
| | | 26.3 | 16.5 | 11.35 | 8.35 | 6.45 | 5.05 | 4.15 | 3.5 |
| 30 rpm | 46 | 26.5 | 16.6 | 11.8 | | | | | |
| | 46 | 26.4 | 16.6 | 11.7 | | | | | |
| | 46 | 26.4 | 16.7 | 11.9 | | | | | |
| 12 rpm | 45 | 28.25 | | | | | | | |
| | 45.25 | 28.25 | | | | | | | |
| | 45 | 28.5 | | | | | | | |
| **ONS-1B** | | | | | | | | | |
| 60 rpm | 21.25 | 13.5 | 9.2 | 6.85 | 5.35 | 4.2 | 3.4 | 2.95 | 2.55 |
| | 21.2 | 13.45 | 9.2 | 6.85 | 5.3 | 4.1 | 3.45 | 3 | 2.65 |
| | 21.3 | 13.5 | 9.2 | 6.9 | 5.35 | 4.2 | 3.5 | 2.95 | 2.65 |
| 30 rpm | 21.1 | 13.6 | | | | | | | |
| | 21.2 | 13.6 | | | | | | | |
| | 21.2 | 13.7 | | | | | | | |
| **ONS-1B Field Duplicate** | | | | | | | | | |
| 60 rpm | 21.2 | 13.4 | 9.2 | 6.75 | 5.3 | 4.15 | 3.4 | 2.95 | 2.6 |
| | 21.15 | 13.45 | 9.2 | 6.8 | 5.2 | 4.15 | 3.25 | 2.9 | 2.65 |
| | 21.15 | 13.5 | 9.15 | 6.8 | 5.3 | 4.1 | 3.45 | 2.9 | 2.65 |
| | 21.3 | 13.8 | | | | | | | |
| 30 rpm | 21.1 | 13.7 | | | | | | | |
| | 21.1 | 13.8 | | | | | | | |
| **A-10** | | | | | | | | | |
| 60 rpm | 43.05 | 24.9 | 15.7 | 10.95 | 7.95 | 6.05 | 4.95 | 4.05 | 3.4 |
| | 43 | 24.75 | 15.85 | 10.85 | 8 | 6.15 | 4.9 | 4 | 3.45 |
| | 43.05 | 24.7 | 15.85 | 10.9 | 7.95 | 6.05 | 4.9 | 4 | 3.4 |
| 30 rpm | 43.1 | 24.7 | 15.9 | 11.2 | | | | | |
| | 43.1 | 24.7 | 16 | 11.4 | | | | | |
| | 43.1 | 24.6 | 16 | 11.1 | | | | | |
| 12 rpm | 44.25 | | | | | | | | |
| | 44 | | | | | | | | |
| | 44 | | | | | | | | |

## Table 3-21 (Continued)
## NAPL Viscosity Measurements

| Well ID | Viscosity (cP) at Various Temperatures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 10°C | 20°C | 30°C | 40°C | 50°C | 60°C | 70°C | 80°C | 90°C |
| **DSW-6B** | | | | | | | | | |
| 60 rpm | 24.9 | 13.8 | 7.7 | 6.45 | 5.75 | 5.05 | 4.2 | 3.6 | 3.2 |
| | 24.85 | 13.05 | 7.65 | 6.35 | 5.8 | 5 | 4.15 | 3.55 | 3.15 |
| | 24.85 | 13.05 | 7.6 | 6.2 | 5.65 | 5 | 4.1 | 3.55 | 3.1 |
| 30 rpm | 24.7 | 14.6 | | | | | | | |
| | 24.7 | 14.6 | | | | | | | |
| | 24.6 | 14.4 | | | | | | | |

Notes:
Viscosities under 5 cP should be considered approximate as 5 cP is the practical lower limit of measurement for the equipment used. However, the reproducibility of the measurements indicates that these estimates are reasonable.
cP - centipoise

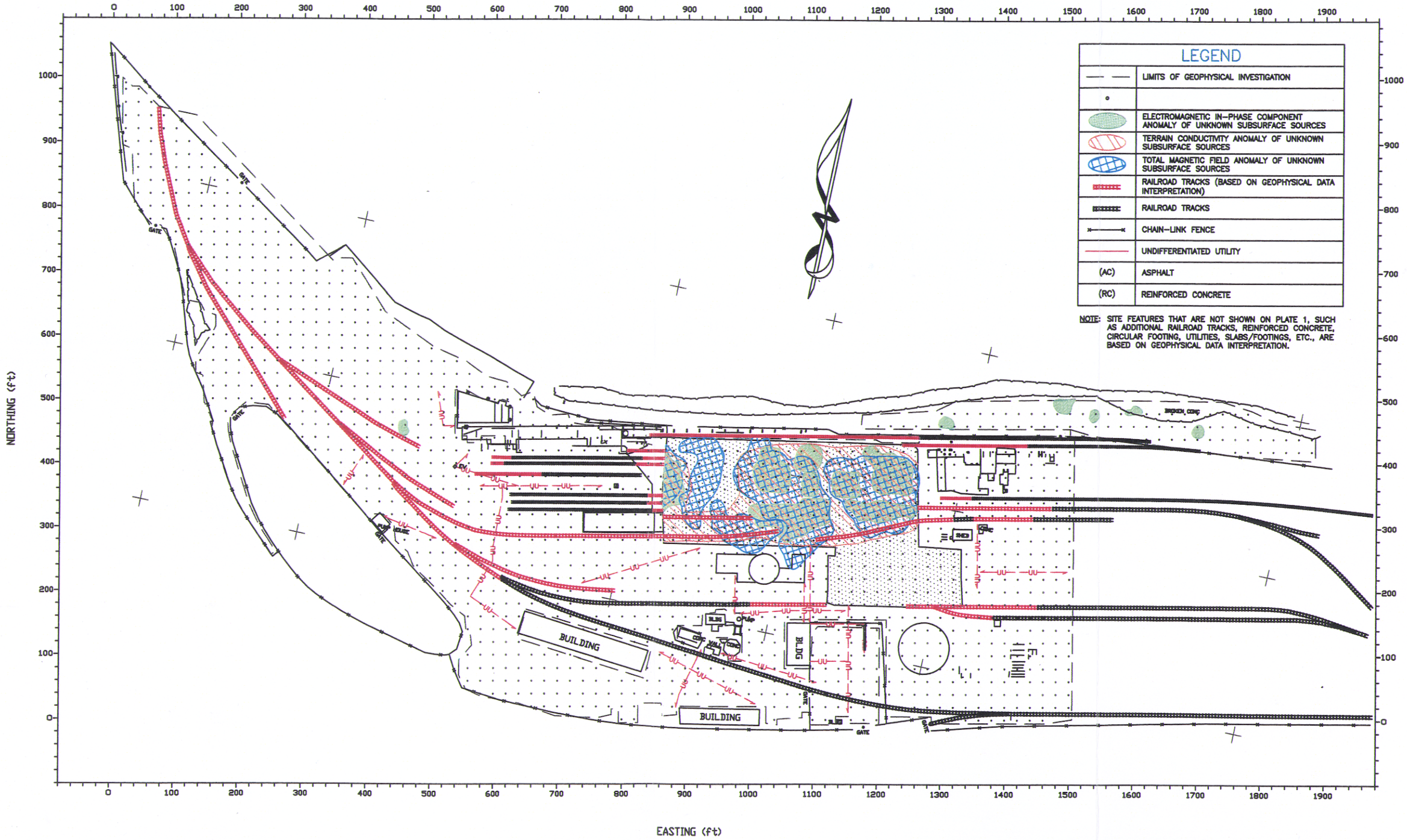
**Table 3-22**
**NAPL Simulated Distillation**

| Sample Volume Distilled (percent) | Temperature in °F (percent change) | | |
|---|---|---|---|
| | ONS-1B | A-10 | DSW-6B |
| Initial boiling point | 322 | 334 | 331 |
| 5 | 392 (22) | 401 (20) | 390 (18) |
| 10 | 403 (3) | 404 (0.7) | 403 (3.3) |
| 15 | 406 (0.7) | 407 (0.7) | 405 (0.4) |
| 20 | 408 (0.2) | 433 (6.4) | 407 (0.5) |
| 30 | 438 (7.3) | 475 (10) | 425 (4.4) |
| 40 | 480 (9) | 518 (9.1) | 447 (5.2) |
| 50 | 527 (9.7) | 562 (8.4) | 494 (10) |
| 60 | 588 (11.5) | 596 (5.5) | 531 (7.5) |
| 70 | 623 (5.9) | 635 (6.5) | 587 (10.5) |
| 80 | 675 (8.3) | 678 (6.6) | 629 (7.1) |
| 90 | 760 (12.6) | 766 (13) | 702 (12) |
| 95 | 839 (10.4) | 884 (15) | 800 (14) |
| Final boiling point | 1023 (21.9) | 1058 (20) | 1037 (30) |

# Table 3-23
# NAPL Saturation

| Location ID | Depth (feet bgs) | Pore Fluid Saturation (percent Pv) | | Porosity (percent Vb) | | Description | |
|---|---|---|---|---|---|---|---|
| | | Water | Hydrocarbon | Effective Porosity | Air-Filled Porosity | Soil | NAPL |
| SB-099 | 13.4-14.7 | 83.8 | Less than 0.1 | 41.4 | 7.4 | Clay | Odor |
| SB-599 (field duplicate) | 27.5-29.5 | 60.2 | 13.0 | 44.2 | 13.3 | Sand | Sheen |
| SB-099 | 27.5-29.5 | 66.0 | 13.8 | 43.4 | 10.3 | Sand | Sheen |
| SB-099 | 31-33 | 28.0 | 77.0 | 38.5 | 5.5 | Sand | Mobile |
| SB-099 | 41-42.5 | 88.7 | 4.2 | 39.6 | 3.2 | Silt/Sand | Sheen |
| SB-086 | 33.6-35 | 81.3 | 2.1 | 35.6 | 6.1 | Sand | Visible |
| SB-086 | 36.3-38 | 69.7 | 9.2 | 37.8 | 8.9 | Sand | Visible |
| SB-028 | 31-33 | 93.2 | 3.7 | 44.4 | 1.8 | Sand | Sheen |
| SB-028 | 100.6-101.5 | 92.5 | 1.9 | 48.4 | 3.0 | Clay | Sheen |
| SB-028 | 48-49.7 | 63.5 | Less than 0.1 | 35.3 | 13.1 | Sand | Sheen |

Notes:
All samples were repacked and reformed prior to analysis.
Pv - pore volume
Vb - bulk volume of the sample




## LEGEND

| | |
|---|---|
| — — | LIMITS OF GEOPHYSICAL INVESTIGATION |
| ∘ | |
| | ELECTROMAGNETIC IN-PHASE COMPONENT ANOMALY OF UNKNOWN SUBSURFACE SOURCES |
| | TERRAIN CONDUCTIVITY ANOMALY OF UNKNOWN SUBSURFACE SOURCES |
| | TOTAL MAGNETIC FIELD ANOMALY OF UNKNOWN SUBSURFACE SOURCES |
| | RAILROAD TRACKS (BASED ON GEOPHYSICAL DATA INTERPRETATION) |
| | RAILROAD TRACKS |
| | CHAIN-LINK FENCE |
| | UNDIFFERENTIATED UTILITY |
| (AC) | ASPHALT |
| (RC) | REINFORCED CONCRETE |

NOTE: SITE FEATURES THAT ARE NOT SHOWN ON PLATE 1, SUCH AS ADDITIONAL RAILROAD TRACKS, REINFORCED CONCRETE, CIRCULAR FOOTING, UTILITIES, SLABS/FOOTINGS, ETC., ARE BASED ON GEOPHYSICAL DATA INTERPRETATION.

NORCA

GEOPHYSICAL SURVEY RESULTS MAP
FIELD INVESTIGATION REPORT

LOCATION: STOCKTON, CALIFORNIA

CLIENT: ARMY CORPS OF ENGINEERS

JOB #: 99-559.01

NORCAL GEOPHYSICAL CONSULTANTS INC.

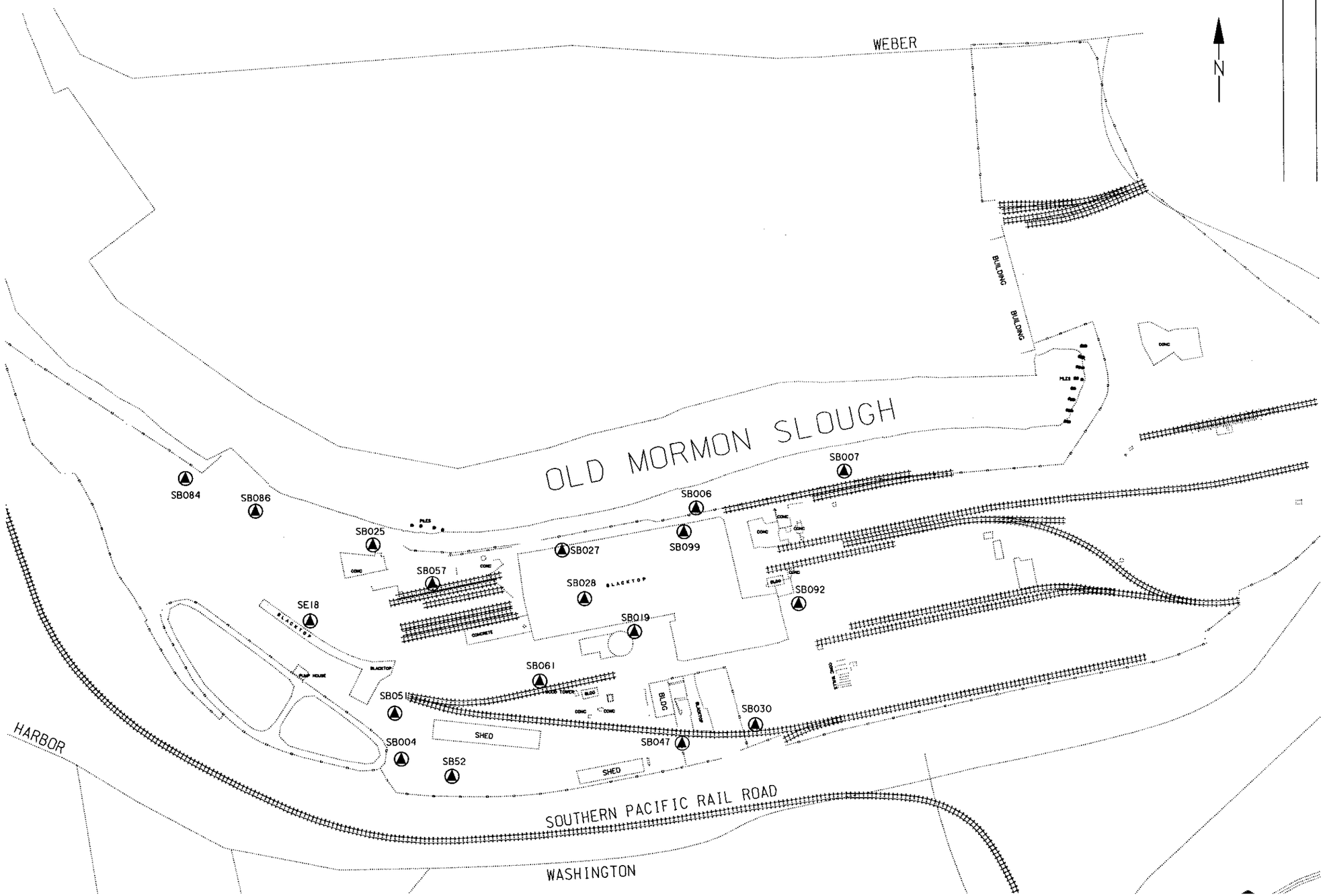
DATE: JUNE 1999

DRAWN BY: G.RANDALL

APPROVED BY: DJK

FIGURE 3-1

| REVISIONS | | | | |
|---|---|---|---|---|
| SYMBOL | ZONE | DESCRIPTION | DATE | BY |
| | | | | |




1" = 200'  0 100' 200'

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

MC CORMICK & BAXTER SUPERFUND SITE

ROTOSONIC BORING LOCATIONS

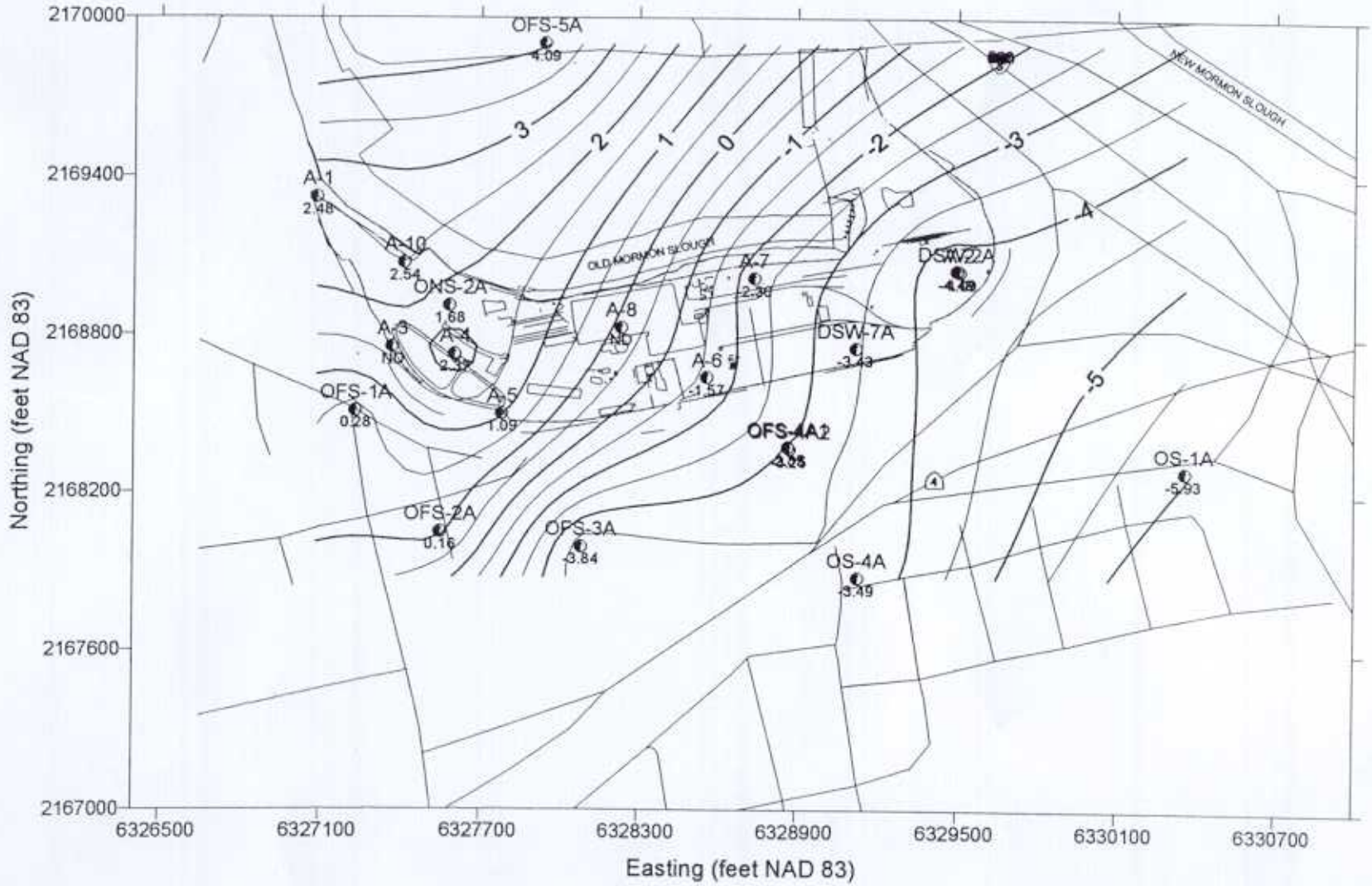
STOCKTON CALIFORNIA

| SIZE | INVITATION NO. | FILE NO. | DATE: | FIGURE |
|---|---|---|---|---|
| D | | | 99DEC22 | 3-2 |
| DSGN. SMITH | | CHK. LYNCH | SHEET | |

This project was designed by the Seattle District U.S. Army Corps of Engineers. The initials or signatures and registration designations of individuals appear within the specifications or on these project documents within the scope of their employment as required by ER 1110-1-8152, Professional Registration.

DATE AND TIME PLOTTED: 04-FEB-2000 17:24
DESIGN FILE: i:\htrw\mcbx\smith\mbrscs0y.dgn

Computer Aided Design & Drafting



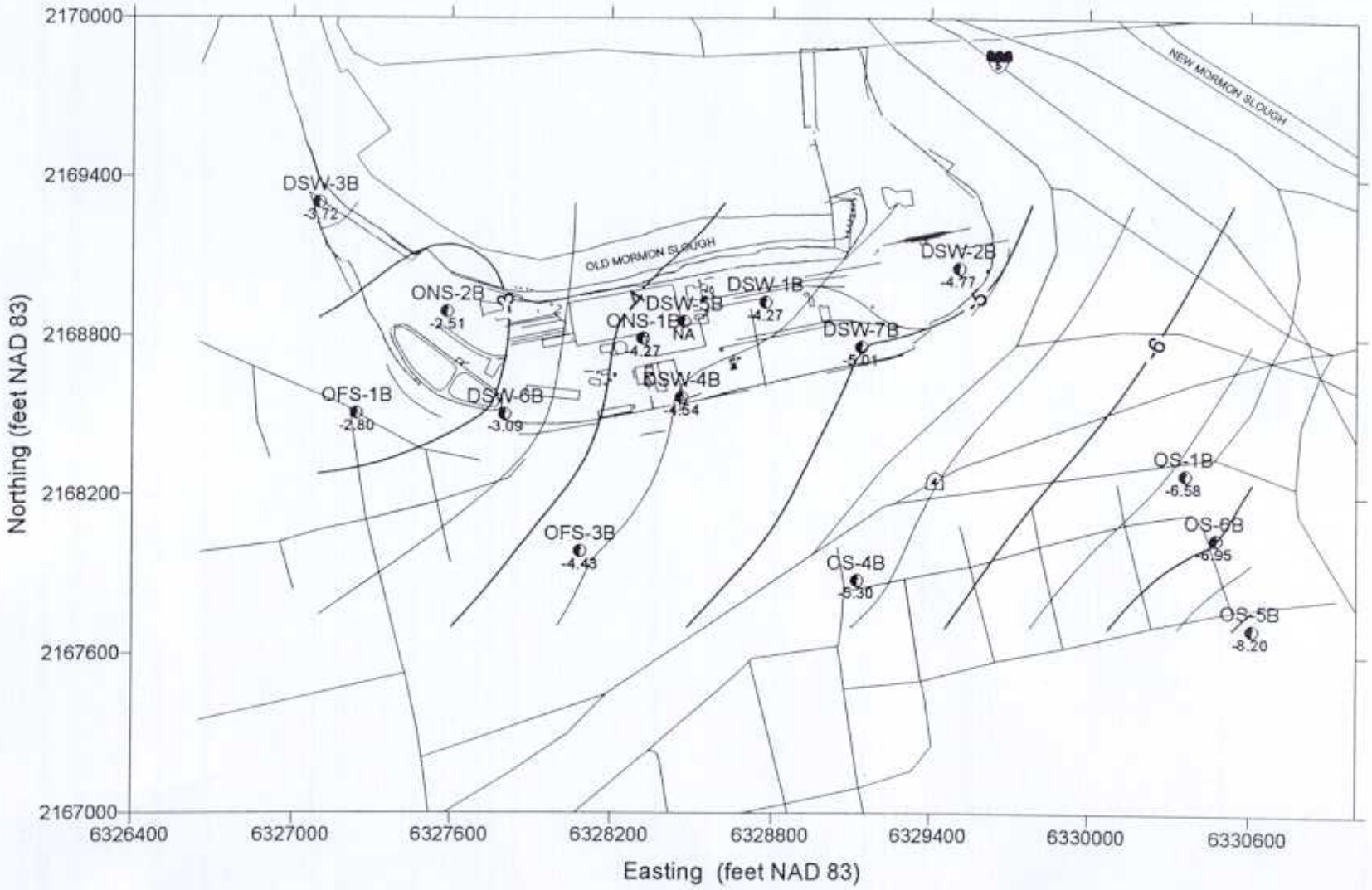

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

MC CORMICK & BAXTER SUPERFUND SITE
SITE INVESTIGATION

**FIGURE 3-3**

**APRIL 1999 A ZONE GROUNDWATER ELEVATIONS (FEET NVD 88)**

STOCKTON CALIFORNIA

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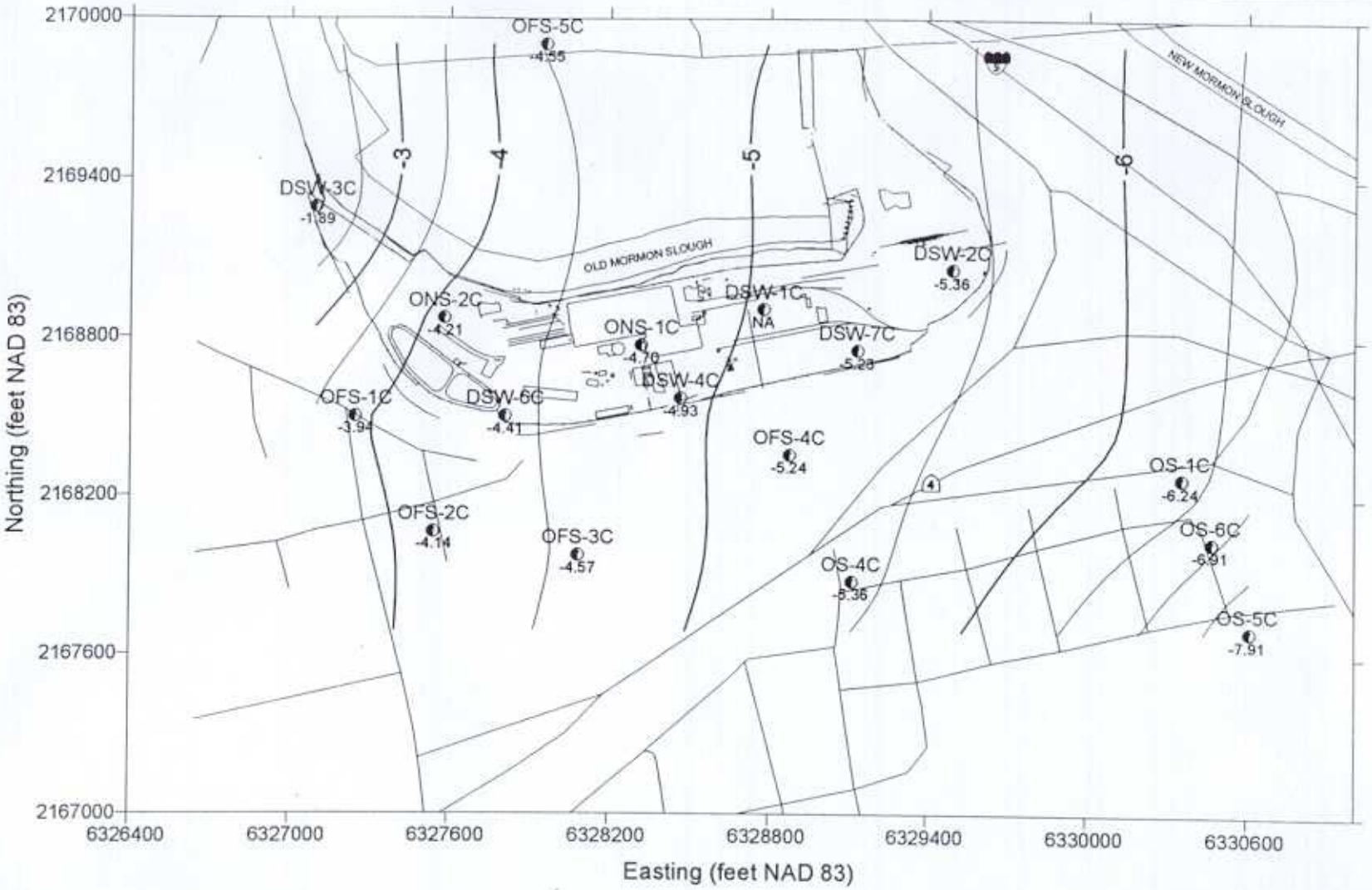
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

MC CORMICK & BAXTER SUPERFUND SITE
SITE INVESTIGATION

**FIGURE 3-4**

**APRIL 1999 B ZONE GROUNDWATER ELEVATIONS (FEET NVD 88)**

STOCKTON CALIFORNIA

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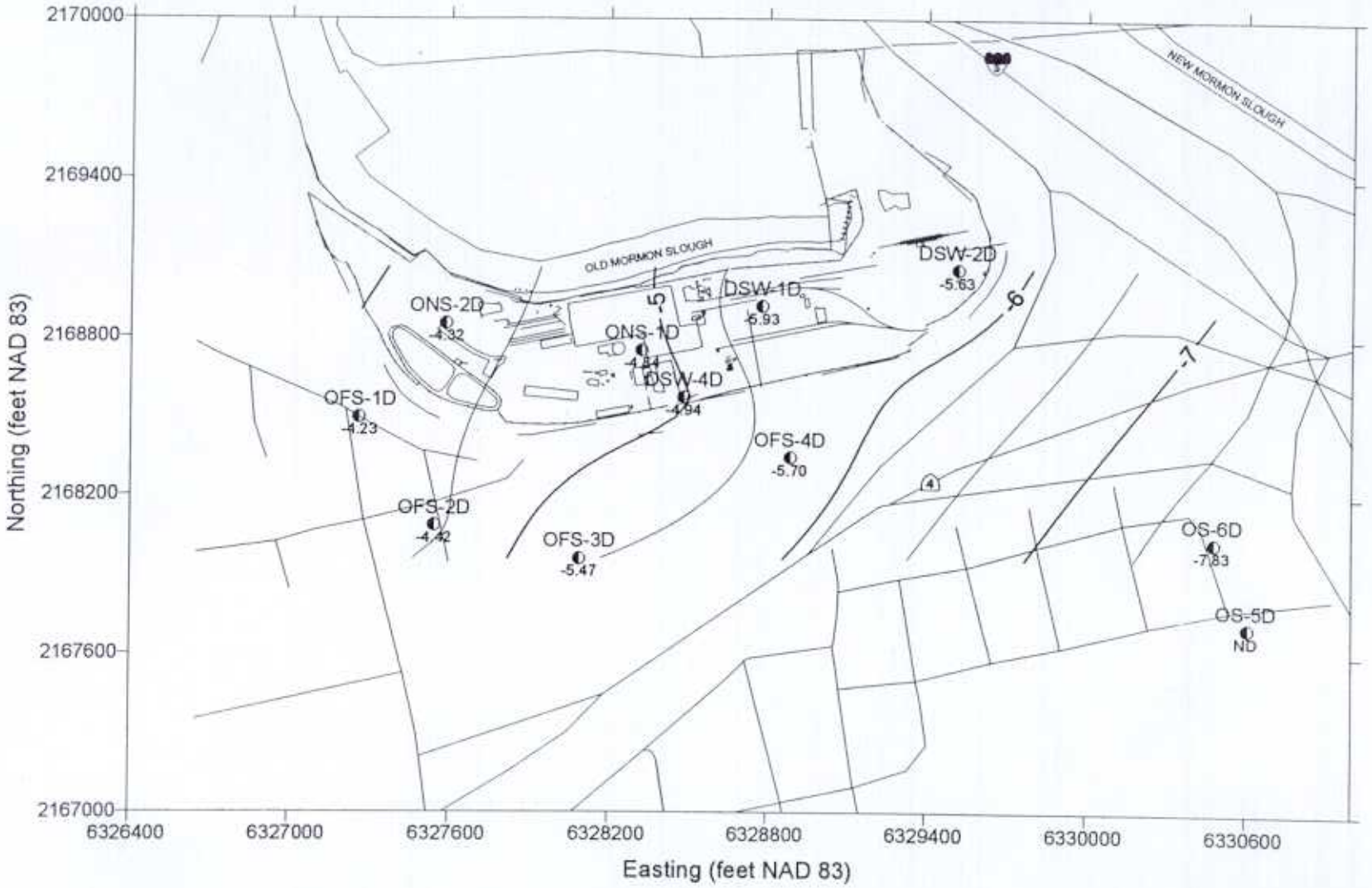
MC CORMICK & BAXTER SUPERFUND SITE
SITE INVESTIGATION

**FIGURE 3-5**

**APRIL 1999 C ZONE GROUNDWATER ELEVATIONS (FEET NVD 88)**

STOCKTON CALIFORNIA

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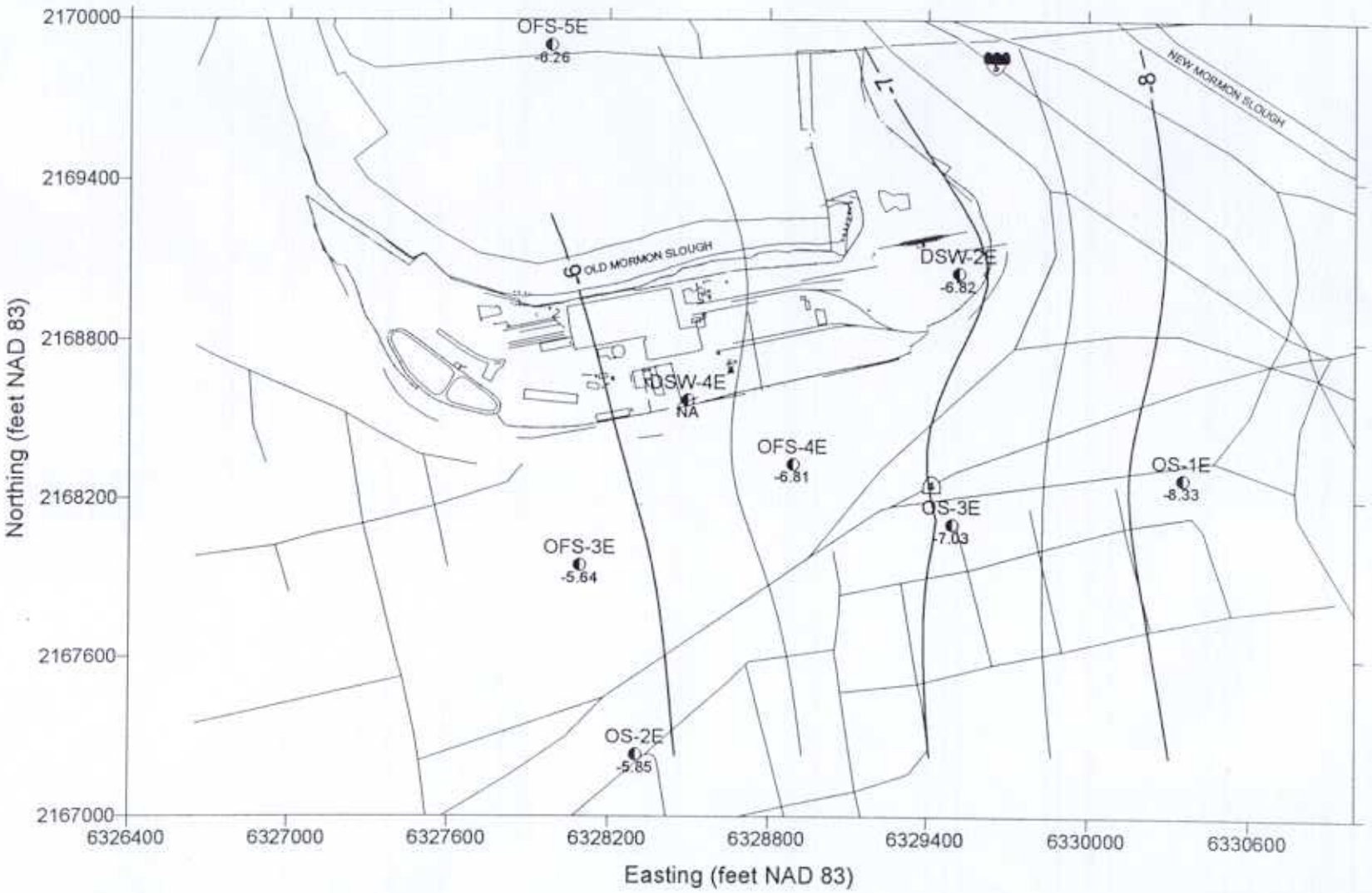
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

MC CORMICK & BAXTER SUPERFUND SITE
SITE INVESTIGATION

**FIGURE 3-6**

**APRIL 1999 D ZONE GROUNDWATER ELEVATIONS (FEET NVD 88)**

STOCKTON CALIFORNIA

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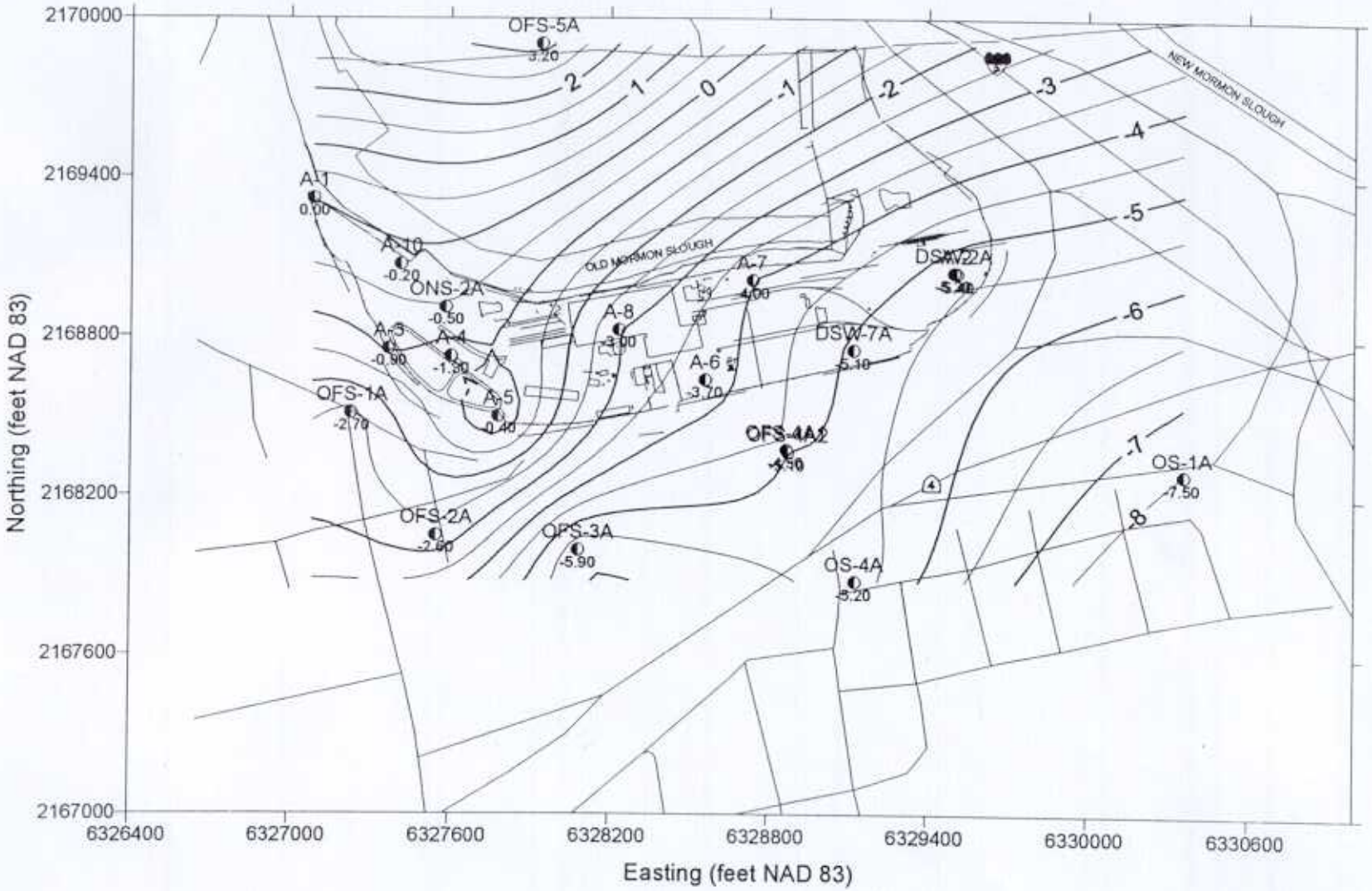
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

MC CORMICK & BAXTER SUPERFUND SITE
SITE INVESTIGATION

**FIGURE 3-7**

**APRIL 1999 E ZONE GROUNDWATER ELEVATIONS (FEET NVD 88)**

STOCKTON CALIFORNIA

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SEATTLE, WASHINGTON

MC CORMICK & BAXTER SUPERFUND SITE
SITE INVESTIGATION

**FIGURE 3-8**

**JULY 1999 A ZONE GROUNDWATER ELEVATIONS (FEET NVD 88)**

STOCKTON CALIFORNIA