UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

National Center for Earthquake Research
345 Middlefield Road
Menlo Park, California 94025

WATER LEVEL MEASUREMENTS IN 52 SHALLOW
BOREHOLES IN THE SAN FRANCISCO BAY REGION

by

Edward F. Roth

Open-File Report 78-935

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OPEN FILE REPORT

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PLATE 1 SHEAR WAVE BOREHOLE SITE MAP

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SKETCH MAPS
Abstract

Water-level measurements have been read in 52 cased boreholes in the San Francisco bay region. These measurements are compared to water-table depths determined by P-wave velocity. A velocity in excess of 1200 m/s is taken as the depth of the upper surface of the water table. This method works best in saturated alluvium, and fails in dry rock because of P-wave velocities greater than 1200 m/s.
Water Level Measurements in 52 Shallow Bore Holes in the San Francisco Bay Region by Edward F. Roth

Introduction

This report discusses the results from two different methods of measuring water table depths in different geologic units surrounding San Francisco Bay. The first method used in measuring water table depth is by compressional (P-wave) velocity determination. The second method is by measuring with a steel tape the standing water level in the borehole. Through these measurements information is gained about the relative position of water level and water table in a group of cased boreholes. The water level measurements by these two methods have been made at 52 boreholes in the San Francisco Bay region. These holes were part of a group of 59 holes which were used originally for measurement of shear and compressional wave velocities and were drilled to 30 meters and cased (Gibbs et al., 1975, 1976, 1977).

In October, 1976 the author measured the water levels by steel tape and compared these measurements with the depths determined by the P-wave velocity method. This latter method is described in the section of this report entitled Water-Table Data Collection.

Geology and Hole Locations

The classification of the geologic units in which the holes were drilled is identified in Professional Paper 941-A, Borcherdt (Editor), 1975. The 52 holes have been grouped into three of these units: 1) Bay Muds, 2) Alluvium, 3) Bedrock (see Table A, this report, for site name and number).

Each hole has been surveyed by Brunton compass, hand level and tied to local fixed reference points. Sketch maps are prepared for access and
relocating purposes. Holes No. 1, 15, 18 and 22 were not surveyed in detail, but instead those portions of the identifying 7 1/2' quadrangles are substituted.

Field Procedures

Drilling. Rotary drilling was used to establish the 59 vertical holes for shear wave analysis over a three year period. The holes were drilled to a full 30 meters and flushed with clear water. Solid plastic casing was set and pea gravel was used to backfill around the casing. The holes are identified by number and name (see Table A) and are tabulated below by drilling number and completion dates:

<table>
<thead>
<tr>
<th>Holes by Number</th>
<th>Drilling Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>11-13-1974</td>
</tr>
<tr>
<td>13-35</td>
<td>5- 1-1975</td>
</tr>
<tr>
<td>36-59</td>
<td>1-12-1976</td>
</tr>
</tbody>
</table>

Several field procedures are routinely performed during the drilling operation. Geologic samples are taken by:

1. Shelby tube and "Pitcher" core barrel.

2. Standard penetration tests are made in soils and weathered bedrock.

3. Drill cuttings are continuously monitored by on site geologist.

4. When possible, a notation of water table contact is made, usually measured in upper levels of hand augered starter holes, e.g., site No. 41, Southern Pacific (rarely deeper than 4 meters when rotary drilling commences).

Water Level Measuring Techniques. Measurements to water level are made at each site by using two different tapes. At first a weighted cloth tape is used to identify the water surface by lowering it into the hole.
and listening for water contact. This provides a rough calibration measurement to determine the hole depth to which the chalked end of the steel tape should be lowered. The weighted and chalked steel tape, graduated into hundredths of a foot, is gradually lowered into the premeasured water zone and a precise reading is taken, using the casing lip at the ground surface as a reference point (see Figure 2). The same weight is used on the tape to insure identical volume displacement, and each hole is allowed to reach "equilibrium" from surface ripples, before attempting the final reading.

General Discussion

Water level measurements have been made in 52 widely dispersed, non-perforated, cased holes in the San Francisco region. All the holes are located in a region (see Plate 1, in pocket) approximately 2,000 square kilometers in area, and ranging in altitude from sea level to 810 meters. Webster's, D. A., 1973, Map 530-F in pocket is introduced as the base map for locating the 52 holes. The depth zones (A-D) on Webster's map of water table depth were determined from data obtained from more than one thousand shallow bore holes drilled in the San Francisco region to accommodate foundation engineering studies. Over 70% of the shear-wave sites were beyond these zones on Webster's map, and thus water table data were not compared. Water level depths determined by taping were not expected to be equal to water table depths determined by P-wave velocity method, for reasons discussed later in this report.

Bedrock and Alluvium

In interpreting P-wave velocity change as an indicator of water table depth, the geologic unit in which the velocity is measured is a very important consideration. It appears that a velocity in the range of 1350-1600 M/S is optimum for recognizing a water table horizon in saturated alluvium (see Table A). The same P-wave boundary denoting a water table in bedrock is more
200-foot steel tape, hand held.

Ground Level (G.L.) lip and edge of casing

Readings (1 and 2)
Ground Level (G.L.) minus Water Level (W.L.)
= Depth to Water
G.L. - W.L. = Depth to Water

Example: Hole No. 21
1. G.L. = 51.50 ft (uphole tape reading)
2. W.L. = 2.00 (downhole, chalk/W.L.)

49.50 ft, or 15.1 meters

Surface reading made on steel tape, graduated to hundredths of a foot. Reading taken only when tape is stabilized. Tape is read at uphole end, then rewound and read at chalk/water contact "line."

To reel

51.50 ft (G.L.)

residual chalk

2.0 ft (W.L.)

chalked zone: dissolves when in contact with water

Figure 1 Water Level Measuring Technique
### TABLE A
Measured water levels and water table determined from P-wave measurements with dates and locations.*

<table>
<thead>
<tr>
<th>Site No. and Name</th>
<th>Site Elevation (Meters)</th>
<th>Township * and Range</th>
<th>Depth to water level when logged</th>
<th>Depth to water table from break in P-wave velocity</th>
<th>Measured (taped) depth to water level, Oct. 1976</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAY MUD</td>
<td>58</td>
<td>Audubon School</td>
<td>0.6M</td>
<td>1.5M</td>
<td>20.0M, 1500 M/S</td>
<td>4.2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T4SR4W</td>
<td>5 May 76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Taped depth to bottom, Oct. 1976 16.4M</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>Bridgeway</td>
<td>0.6M</td>
<td>NR</td>
<td>11.0M, 1510 M/S</td>
<td>3.6M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T5SR4W</td>
<td>26 Mar 76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>KGEI</td>
<td>0.6M</td>
<td>1.5M</td>
<td>20.0M, 1470 M/S</td>
<td>1.7M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T4SR3W</td>
<td>13 Apr 76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALLUVIUM SITES</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Alviso</td>
<td>0.6M</td>
<td>1.3M(?)</td>
<td>2.5M, 1560 M/S</td>
<td>0.0M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T6SR1W</td>
<td>2 Jly 76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>Oliver Salt Works</td>
<td>0.6M</td>
<td>2.0M</td>
<td>8.0M, 1570 M/S</td>
<td>2.5M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T3SR2W</td>
<td>21 Aug 76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Cozzolino</td>
<td>70.3M</td>
<td>1.0M</td>
<td>2.0-2.5M</td>
<td>1.1M</td>
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<tr>
<td></td>
<td></td>
<td>T5SR5W</td>
<td>16 Aug 76</td>
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* Referred to Mt. Diablo Base & Meridian
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<th>Alluvial Sites No. &amp; Name (cont'd)</th>
<th>Site elevation (meters)</th>
<th>Township and Range</th>
<th>Depth to water level when logged</th>
<th>Depth to water table from break in P-wave velocity</th>
<th>Measured (taped) depth to water level, Oct. 1976</th>
<th>Remarks</th>
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<tr>
<td>24 Miller School</td>
<td>71.5M</td>
<td>T7SR1W</td>
<td>5.2M</td>
<td>20 Aug 75</td>
<td>9.2M</td>
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<tr>
<td>27 Mitchell Park</td>
<td>5.8M</td>
<td>T6SR2W</td>
<td>2.8M</td>
<td>25 Aug 75</td>
<td>2.6M, 1550 M/S</td>
<td>2.8M</td>
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<tr>
<td>31 Frenchman's Creek</td>
<td>42.7M</td>
<td>T5SR5W</td>
<td>8.5M</td>
<td>29 Aug 75</td>
<td>10.0M, 2260 M/S</td>
<td>9.2M</td>
</tr>
<tr>
<td>32 Half Moon Bay Terrace</td>
<td>15.2 M</td>
<td>T5SR3W</td>
<td>2.9M</td>
<td>3 Sept 75</td>
<td>5.0M, 1650 M/S</td>
<td>5.8M</td>
</tr>
<tr>
<td>54 Santa Clara Fairgrounds</td>
<td>44.2M</td>
<td>T7SR1E</td>
<td>5.0M</td>
<td>29 Apr 74</td>
<td>18.5M, 1690 M/S</td>
<td>4.3M</td>
</tr>
<tr>
<td>16 Lowry Road</td>
<td>3.1M</td>
<td>T4SR2W</td>
<td>3.0M</td>
<td>9 Jul 75</td>
<td>15.0M, 1980 M/S</td>
<td>N.R.</td>
</tr>
<tr>
<td>17 Hayward Sink</td>
<td>0.9M</td>
<td>T4SR1W</td>
<td>3.9M</td>
<td>28 Jul 75</td>
<td>15.0M, 1960 M/S</td>
<td>N.R.</td>
</tr>
<tr>
<td>Alluvium Sites No. &amp; Name (continued)</td>
<td>Site elevation (meters)</td>
<td>Township and Range</td>
<td>Depth to water level when logged</td>
<td>Depth to water table from break in P-wave velocity</td>
<td>Measured (taped) depth to water level, Oct. 76</td>
<td>Remarks</td>
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<tr>
<td>18 Parkway Towers</td>
<td>15.2M</td>
<td>T4SR1W</td>
<td>16.0M</td>
<td>1 Apr. 75</td>
<td>20.0-22.5M, 1630 M/S</td>
<td>N.R.</td>
</tr>
<tr>
<td>21 Montgomery School</td>
<td>33.6M</td>
<td>T7SR1W</td>
<td>10.5M</td>
<td>9 Apr. 75</td>
<td>17.5-20.0M, 1830 M/S</td>
<td>15.0M</td>
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<td>37 Windmill</td>
<td>6.1M</td>
<td>T2SR6W</td>
<td>N.R.</td>
<td>29 Mar 76</td>
<td>7.5M, 1610 M/S</td>
<td>3.2M</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Taped depth to bottom, Oct. 1976</td>
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<td>38 Chain of Lakes</td>
<td>24.4M</td>
<td>T2SR6W</td>
<td>N.R.</td>
<td>30 Mar 76</td>
<td>17.5M, 1260 M/S</td>
<td>14.5M</td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>Taped depth, 21.6M, Oct. 1976, several P-break, suspect gas in sediments</td>
</tr>
<tr>
<td>41 Southern Pacific</td>
<td>0.9M</td>
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<td>5.0M</td>
<td>1 Apr. 76</td>
<td>7.0M, 1700 M/S</td>
<td>2.0M</td>
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<td>43 Quintara</td>
<td>38.2M</td>
<td>T2SR6W</td>
<td>N.R.</td>
<td>8 Apr 76</td>
<td>10.0M, 1280 M/S</td>
<td>12.5M</td>
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<td></td>
<td></td>
<td></td>
<td>Taped depth to bottom, Oct. 1976</td>
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<tr>
<td>44 Hillview</td>
<td>76.4M</td>
<td>T3SR6W</td>
<td>7.0M</td>
<td>12 Apr 76</td>
<td>10.0M, 1210 M/S</td>
<td>5.1M</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Taped depth to bottom, Oct. 1976</td>
</tr>
<tr>
<td>Alluvium Sites No. &amp; Name (continued)</td>
<td>Site elevation (meters)</td>
<td>Township and Range</td>
<td>Depth to water level when logged</td>
<td>Depth to water table from break in P-wave velocity</td>
<td>Measured (taped) depth to water level Oct. 1976</td>
<td>Remarks</td>
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</tr>
<tr>
<td>45 Avalon</td>
<td>143.0M</td>
<td>T3SR6W</td>
<td>19.0M</td>
<td>13 Apr 76 20.0-22.5M 1690 M/S</td>
<td>13.8M</td>
<td>Taped depth to bottom, Oct. 1976 29.8M</td>
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<tr>
<td>48 Skyline</td>
<td>140.0M</td>
<td>T3SR6W</td>
<td>N.R.</td>
<td>21 Apr 76 4.0M 1210 M/S</td>
<td>3.8M</td>
<td>Taped depth to bottom, Oct. 1976 28.3M</td>
</tr>
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<td>56 Merritt Sand</td>
<td>8.2M</td>
<td>T1SR4W</td>
<td>N.R.</td>
<td>3 May 76 17.0M, 1830 M/S</td>
<td>0.5M</td>
<td>Taped depth to bottom, Oct. 1976 28.3M</td>
</tr>
<tr>
<td>59 Carmichael School</td>
<td>3.6M</td>
<td>T2SR5W</td>
<td>2.2M</td>
<td>6 May 76 11.0M, 1220 M/S</td>
<td>0.1M</td>
<td></td>
</tr>
<tr>
<td>15 Muir School</td>
<td>2.1M</td>
<td>T3SR2W</td>
<td>4.6M</td>
<td>25 Mar 75 22.5M, 1770 M/S</td>
<td>N.R.</td>
<td></td>
</tr>
<tr>
<td>55 Oak Avenue</td>
<td>59.5M</td>
<td>T7SR2W</td>
<td>Dry</td>
<td>10 Apr 76</td>
<td>950 M/S</td>
<td>Dry</td>
</tr>
<tr>
<td>14 Blackberry Farm</td>
<td>94.5M</td>
<td>T7SR2W</td>
<td>2.8M</td>
<td>11 Apr 75</td>
<td>7.5M, 1400 M/S</td>
<td>7.5M</td>
</tr>
<tr>
<td>No. &amp; Name</td>
<td>Site Elevation</td>
<td>Township and Range</td>
<td>Depth to water level when logged</td>
<td>Depth to water table from break in P-wave velocity</td>
<td>Measured (taped) depth to water level Oct. 1976</td>
<td>Remarks</td>
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<td>---------</td>
</tr>
<tr>
<td>Palo Alto Square</td>
<td>11.3M</td>
<td>T6SR3W</td>
<td>3.6M</td>
<td>10.0-12.5M</td>
<td>20.5M</td>
<td></td>
</tr>
<tr>
<td>North Peak</td>
<td>490.0M</td>
<td>T4SR6W</td>
<td>N.R.</td>
<td>9.0M,1260M/S</td>
<td>12.6M</td>
<td>Taped depth to bottom, Oct. 1976 25.5M</td>
</tr>
<tr>
<td>Sawyer Ridge</td>
<td>346.0M</td>
<td>T4SR5W</td>
<td>N.R.</td>
<td>10.0M,3350M/S</td>
<td>10.8M</td>
<td>Taped depth to bottom, Oct. 1976 21.6M</td>
</tr>
<tr>
<td>Mission Peak</td>
<td>500.0M</td>
<td>T5SR1E</td>
<td>8.0M</td>
<td>7.5M,1940M/S</td>
<td>8.2M</td>
<td>Taped depth to bottom, Oct. 1976 29.9M</td>
</tr>
<tr>
<td>Stevens Creek Quarry</td>
<td>182.0M</td>
<td>T7SR2W</td>
<td>4.6M</td>
<td>14 Apr 75</td>
<td>N.R.</td>
<td></td>
</tr>
<tr>
<td>Cal. State Hayward</td>
<td>134.0M</td>
<td>T3SR2W</td>
<td>15.0M</td>
<td>10.0M,1380M/S</td>
<td>19.0M</td>
<td>Taped depth to bottom, Oct. 1976 25.8M</td>
</tr>
<tr>
<td>No.</td>
<td>Bedrock Sites</td>
<td>Site Elevation</td>
<td>Township and Range</td>
<td>Depth to water level when logged</td>
<td>Depth to water table from break in P-wave velocity</td>
<td>Measured (taped) depth to water level Oct. 1976</td>
</tr>
<tr>
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<td>---------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>26</td>
<td>Corte Madera</td>
<td>241.0M</td>
<td>T3SR2W</td>
<td>5.2M</td>
<td>16 Apr 75; 2.5M, 1190M/S</td>
<td>4.9M</td>
</tr>
<tr>
<td>28</td>
<td>Foothill Park</td>
<td>427.0M</td>
<td>T7SR3W</td>
<td>N.R.</td>
<td>26 Aug 75; 15.0M, 2640M/S</td>
<td>16.9M</td>
</tr>
<tr>
<td>29</td>
<td>Sierra Morena</td>
<td>732.0M</td>
<td>T6SR4W</td>
<td>5.4M</td>
<td>25 Apr 75; 12.5-15.0M, 2100M/S</td>
<td>N.R.</td>
</tr>
<tr>
<td>30</td>
<td>Pulgas Tunnel</td>
<td>134.0M</td>
<td>T5SR4W</td>
<td>25.5M</td>
<td>21 Apr 75; 12.5M, 2470M/S</td>
<td>25.4M</td>
</tr>
<tr>
<td>33</td>
<td>Vista Grande</td>
<td>152.0M</td>
<td>T3SR5W</td>
<td>23.0M</td>
<td>30 Apr 75; 12.5M, 1610M/S</td>
<td>16.7M</td>
</tr>
<tr>
<td>34</td>
<td>Morrison Canyon</td>
<td>303.0M</td>
<td>T4SR1W</td>
<td>1.2M</td>
<td>2 Apr 75; 5.0M, 1740M/S</td>
<td>0.9M</td>
</tr>
<tr>
<td>35</td>
<td>Lake Merced Country Club</td>
<td>50.3M</td>
<td>T3SR6W</td>
<td>24.0M</td>
<td>28 Apr 75;</td>
<td>25.0M</td>
</tr>
</tbody>
</table>
<pre><code>                                                                                                                                       | Taped depth to bottom Oct. 1976 25.5 M          |
</code></pre>
<table>
<thead>
<tr>
<th>Bedrock Sites No. &amp; Name</th>
<th>Site Elevation</th>
<th>Township and Range</th>
<th>Depth to water level when logged</th>
<th>Depth to water table from break in P-wave velocity</th>
<th>Measured (taped) depth to water level Oct. 1976</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>39 Prayerbook Cross</td>
<td>91.5M</td>
<td>T2SR6W</td>
<td>N.R.</td>
<td>31 Mar 76</td>
<td>11.0M, 2650M/S</td>
<td>Taped depth to bottom, Oct. 1976 25.1M</td>
</tr>
<tr>
<td>40 Page Mill Basalt</td>
<td>180.OM</td>
<td>T6SR3W</td>
<td>14.OM</td>
<td>1 Apr 76</td>
<td>14.8M</td>
<td>Nearly Dry</td>
</tr>
<tr>
<td>46 Twin Peaks</td>
<td>251.OM</td>
<td>T2SR5W</td>
<td>2.5M</td>
<td>19 Apr 76</td>
<td>12.0-15.0M, 1020 M/S</td>
<td>Taped depth to bottom, Oct. 1976 29.8 M</td>
</tr>
<tr>
<td>47 San Bruno Mt.</td>
<td>244.OM</td>
<td>T3SR5W</td>
<td>7.0M</td>
<td>1 Apr 76</td>
<td>7.0-8.0M, 1290M/S</td>
<td>Taped depth to bottom, Oct. 1976 27.1M</td>
</tr>
<tr>
<td>49 Westmoor</td>
<td>143.OM</td>
<td>T3SR6W</td>
<td>13.6M</td>
<td>22 Apr 76</td>
<td>N.R.</td>
<td></td>
</tr>
<tr>
<td>51 Crest Road</td>
<td>171.OM</td>
<td>T5SR4W</td>
<td>10.5M</td>
<td>26 Apr 76</td>
<td>2.5M, 1090M/S</td>
<td>Taped depth to bottom, Oct. 1976 30.8 M</td>
</tr>
<tr>
<td>1 Purisima</td>
<td>76.0M</td>
<td>T5SR5W</td>
<td>12.5M</td>
<td>7 Aug 74</td>
<td>12.5M, 1780M/S</td>
<td>N.R.</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Bedrock Sites</strong> No. &amp; Name (continued)</td>
<td>Site Elevation</td>
<td>Township and Range</td>
<td>Depth to water level when logged</td>
<td>Depth to water table from break in P-wave velocity</td>
<td>Measured (taped) depth to water level, Oct. 1976</td>
<td>Remarks</td>
</tr>
<tr>
<td>3</td>
<td>Maryknoll</td>
<td>128.0M</td>
<td>T7SR2W</td>
<td>N.R.</td>
<td>25 Sept. 74</td>
<td>10.0M, 1890M/S</td>
</tr>
<tr>
<td>4</td>
<td>El Granada</td>
<td>353.0M</td>
<td>T5SR5W</td>
<td>N.R.</td>
<td>26 Nov 74</td>
<td>10.0M, 3850M/S</td>
</tr>
<tr>
<td>5</td>
<td>Black Mt.</td>
<td>810.0M</td>
<td>T7SR3W</td>
<td>N.R.</td>
<td>10 Oct 74</td>
<td>7.5M, 1880M/S</td>
</tr>
<tr>
<td>6</td>
<td>Digges Canyon</td>
<td>226.0M</td>
<td>T5SR5W</td>
<td>Dry</td>
<td>11 Oct 74</td>
<td>N.R.</td>
</tr>
<tr>
<td>7</td>
<td>Pise Lookout</td>
<td>560.0M</td>
<td>T5SR4W</td>
<td>N.R.</td>
<td>25 Nov 74</td>
<td>5.0M, 1790M/S</td>
</tr>
<tr>
<td>8</td>
<td>Pulgas Water Temple</td>
<td>108.0M</td>
<td>T5SR4W</td>
<td>N.R.</td>
<td>20 Nov 74</td>
<td>2.5M, 1650M/S</td>
</tr>
<tr>
<td>9</td>
<td>Spring Valley Ridge</td>
<td>350.0M</td>
<td>T4SR5W</td>
<td>N.R.</td>
<td>15 Nov 74</td>
<td>7.5M, 2360M/S</td>
</tr>
<tr>
<td>Bedrock Sites No. &amp; Name (continued)</td>
<td>Site Elevation</td>
<td>Township and Range</td>
<td>Depth to water level when logged</td>
<td>Depth to water table from break in P-wave velocity</td>
<td>Measured(taped) depth to water level, Oct. 1976</td>
<td>Remarks</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>----------------</td>
<td>--------------------</td>
<td>---------------------------------</td>
<td>---------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>10 Vista Point</td>
<td>268.0M</td>
<td>T5SR4W</td>
<td>N.R.</td>
<td>19 Nov 74</td>
<td>10.0M, 3300M/S</td>
<td>N.R. = not recovered</td>
</tr>
<tr>
<td>57 Merritt College</td>
<td>304.0M</td>
<td>T1SR3W</td>
<td>11.5M</td>
<td>4 May 76</td>
<td>15.0M, 1690M/S</td>
<td>Taped depth to bottom Oct. 1976 25.5M</td>
</tr>
<tr>
<td>52 College of San Mateo</td>
<td>172.0M</td>
<td>T4SR4W</td>
<td>16.0M</td>
<td>27 Apr 76</td>
<td>17.5M, 3160M/S</td>
<td>Taped depth to bottom, Oct. 1976 30.0M</td>
</tr>
<tr>
<td>53 Peninsula Country Club</td>
<td>46.0M</td>
<td>T4SR4W</td>
<td>6.5M</td>
<td>28 Apr 76</td>
<td>2.5M, 1670M/S</td>
<td>Taped depth to bottom, Oct. 1976 23.9M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
difficult to observe, because even dry rock may have a high P-wave velocity. At 20 bedrock sites, P-wave depths and taped water levels were compared (see Table B). The average velocity was 2085 M/S (6840 feet/second). The average P-wave velocity in saturated alluvium holes was 1545 M/S (5070 feet/second). (See Table C.)

Fetid waters were noted when making water level measurements in Hole No. 59, Carmichael School, and No. 41, Southern Pacific. These foul waters appear to have entered the upper levels of the cased holes, and may have originated in surrounding zones of water leaking from cracked or broken sewer lines. Both of these holes are located in the "South of Market" district of the city and county of San Francisco. Two additional holes (Nos. 44 and 45) were drilled into the same geologic unit, alluvium of the Merced formation. The water column heights rose in both of these holes between the time of P-wave logging and water-level measurement by taping. Whether or not these water column height increases are from artesian pressure is unknown. The water in Hole No. 44 was extremely brackish although its altitude is above any tidal influence.

Water Table Data Collection

Collectively, the three methods of obtaining water table information used in this report are:

1. Depths to water table measured during shear-wave logging. (See Table A.)


3. Direct water level taping by chalked steel tape to water level in non-perforated cased holes. (See Table A and Fig. 2, this report.)

Shown graphically (Fig. 2) are travel-time curves from a typical
Table B

Bedrock Sites: Average P-wave Velocity 2085 M/S

<table>
<thead>
<tr>
<th>Site</th>
<th>No</th>
<th>P-Wave Velocity</th>
<th>P-Wave</th>
<th>Taped Oct. 1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Peak</td>
<td>11</td>
<td>1260 M/S</td>
<td>5.0 M</td>
<td>12.6 M</td>
</tr>
<tr>
<td>Sawyer Ridge</td>
<td>12</td>
<td>3350</td>
<td>10.0</td>
<td>10.8</td>
</tr>
<tr>
<td>Mission Peak</td>
<td>20</td>
<td>1940</td>
<td>2.5</td>
<td>8.2</td>
</tr>
<tr>
<td>Cal State Hayward</td>
<td>23</td>
<td>1380</td>
<td>10.0</td>
<td>19.0</td>
</tr>
<tr>
<td>Corte Madera</td>
<td>26</td>
<td>1530</td>
<td>16.0</td>
<td>4.9</td>
</tr>
<tr>
<td>Foothill Park</td>
<td>28</td>
<td>2640</td>
<td>15.0</td>
<td>16.9</td>
</tr>
<tr>
<td>Pulgas Tunnel</td>
<td>30</td>
<td>2470</td>
<td>22.5</td>
<td>25.4</td>
</tr>
<tr>
<td>Vista Grande</td>
<td>33</td>
<td>1610</td>
<td>12.5</td>
<td>16.7</td>
</tr>
<tr>
<td>Morrison Canyon</td>
<td>34</td>
<td>1740</td>
<td>5.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Prayerbook Cross</td>
<td>39</td>
<td>2650</td>
<td>11.0</td>
<td>18.6</td>
</tr>
<tr>
<td>San Bruno Mt.</td>
<td>47</td>
<td>1290</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Mary Knoll</td>
<td>3</td>
<td>1780</td>
<td>10.0</td>
<td>9.7</td>
</tr>
<tr>
<td>El Granada</td>
<td>4</td>
<td>3850</td>
<td>10.0</td>
<td>10.2</td>
</tr>
<tr>
<td>Black Mt.</td>
<td>5</td>
<td>1880</td>
<td>7.5</td>
<td>12.2</td>
</tr>
<tr>
<td>Pise Lookout</td>
<td>7</td>
<td>1790</td>
<td>5.0</td>
<td>7.3</td>
</tr>
<tr>
<td>Pulgas Water Temple</td>
<td>8</td>
<td>1650</td>
<td>2.5</td>
<td>6.2</td>
</tr>
<tr>
<td>Spring Valley Ridge</td>
<td>9</td>
<td>2360</td>
<td>7.5</td>
<td>8.2</td>
</tr>
<tr>
<td>Merritt College</td>
<td>57</td>
<td>1690</td>
<td>15.0</td>
<td>9.6</td>
</tr>
<tr>
<td>College of San Mateo</td>
<td>52</td>
<td>3160</td>
<td>17.5</td>
<td>15.6</td>
</tr>
<tr>
<td>Peninsula Country Club</td>
<td>53</td>
<td>1670</td>
<td>2.5</td>
<td>5.9</td>
</tr>
</tbody>
</table>
Table C

Alluvium Sites: Average P-wave velocity 1545 M/S

<table>
<thead>
<tr>
<th>Site</th>
<th>No.</th>
<th>P-Wave Velocity</th>
<th>P-Wave Depths</th>
<th>Taped Oct. 1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitchell Park</td>
<td>27</td>
<td>1530 M/S</td>
<td>2.6 M</td>
<td>2.8 M</td>
</tr>
<tr>
<td>Frenchmans Cr.</td>
<td>31</td>
<td>2260</td>
<td>10.0</td>
<td>9.2</td>
</tr>
<tr>
<td>Half Moon Bay Terrace</td>
<td>32</td>
<td>1650</td>
<td>5.0</td>
<td>5.8</td>
</tr>
<tr>
<td>Sta. Clara Fairgrounds</td>
<td>54</td>
<td>1690</td>
<td>18.5</td>
<td>4.3</td>
</tr>
<tr>
<td>Montgomery School</td>
<td>21</td>
<td>1830</td>
<td>17.5</td>
<td>15.0</td>
</tr>
<tr>
<td>Windmill</td>
<td>37</td>
<td>1610</td>
<td>7.5</td>
<td>3.2</td>
</tr>
<tr>
<td>Chain of Lakes</td>
<td>39</td>
<td>1260</td>
<td>17.5</td>
<td>14.5</td>
</tr>
<tr>
<td>Southern Pacific</td>
<td>41</td>
<td>1700</td>
<td>7.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Quintara</td>
<td>43</td>
<td>1280</td>
<td>10.0</td>
<td>12.5</td>
</tr>
<tr>
<td>Hillview</td>
<td>44</td>
<td>1210</td>
<td>10.0</td>
<td>5.1</td>
</tr>
<tr>
<td>Avalon</td>
<td>45</td>
<td>1690</td>
<td>20.0</td>
<td>13.8</td>
</tr>
<tr>
<td>Skyline</td>
<td>48</td>
<td>1210</td>
<td>4.0</td>
<td>3.8</td>
</tr>
<tr>
<td>Merritt Sand</td>
<td>56</td>
<td>1830</td>
<td>17.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Carmichael School</td>
<td>59</td>
<td>1220</td>
<td>11.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Blackberry Farm</td>
<td>14</td>
<td>1400</td>
<td>7.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Palo Alto Square</td>
<td>19</td>
<td>1410</td>
<td>10.0</td>
<td>20.5</td>
</tr>
<tr>
<td>Oliver Salt Works</td>
<td>25</td>
<td>1570</td>
<td>8.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Cozzolino</td>
<td>2</td>
<td>1500</td>
<td>2.0</td>
<td>1.1</td>
</tr>
</tbody>
</table>
coarse-grained alluvium site; Frenchman's Creek, No. 31. The approximate depth of the water table at this site (10 meters) is shown on both the travel-time curve and the corresponding geologic section. The P-waves were generated from two sources at the ground surface, a vertical hammer blow, or a blasting cap (Gibbs et al., 1976). These P-wave arrival times are plotted on travel-time curves and a velocity is determined from the inverse slope of a least squares fit to the data points. The depth to the water-table in alluvium and bay mud is taken as the shallowest depth at which a P-wave velocity greater than 1200 M/S occurs. This water-table depth selection method has been used throughout the report, and is compared with the taped depths referred to and tabulated in Table A.

Water Table Measurement Problems

Several problems are inherent in the process of collecting water table data. A few variables which can affect a water-table measurement are listed below.

1. It is not always known if the water table measurement is related to a confined or unconfined aquifer.
   a) Confined aquifer. Ground water in a confined aquifer is overlain by a confining bed isolating it from other aquifers. This ground water is under pressure which forces the well water to rise above the top of the aquifer. Problem: Probably an extra high (toward ground level) measurement.
   b) Unconfined aquifer. Unconfined ground water moves downslope toward area of lowest water-table elevations. Problem: Has water in casing reached equilibrium?

2. A column of water standing in nonperforated casing may be held in the casing by a plug caused by drilling mud settling to the bottom of the hole or by side wall shards knocked off during casing placement.
If this were to occur, a water level reading, no matter how precisely measured, could be incorrectly interpreted as one which relates to the water table. In reality, an observer would be measuring an isolated column of water, captured shortly after the hole flushing, and now temporarily contained by the nonperforated plastic casing.

3. Are cultural (man-made) stresses affecting the measured depth? Examples: A refuse dump nearby could create new hydraulic gradients. Have sewage lines been broken? Has urban/suburban development created new drainage patterns? Does nearby well-pumping over exceed the sustained yield of a ground water basin?

4. How much does the tide influence the water levels in bay mud holes?

5. Has the weather affected the reading?

6. How does the geologic unit in which the hole was drilled affect the water column's equilibrium rate?

7. Have recent rains (Winter 1978) recharged the water table and what are the new water level heights?

8. Are locally occurring artesian pressure systems causing water column height rises?

P-Wave Breaks vs. Taped Depths and Hole Equilibrium History

Comparisons of measured depth to water level by taping and P-wave velocity pick to water table are plotted in Figure 3. The ratios are shown by dividing the graph into eight regions. The ratio values are shown at the end of the line segments, and range from 1:1 (identical measurements, i.e., taped depth equal to P-wave pick) to \( \infty \). Example: 1975 plot, taped depth = 0, P-wave pick = 2 meters. Accompanying this data is another parameter, hole equilibrium history. Based upon the following facts, the data from thirteen holes were excluded from Fig. 3 and the standard deviation section; six holes could not be relocated, three holes were dry in October, 1976; one hole was
blocked due to cracked or broken casing. At two locations the P-wave velocity
data was uninterpretable. For additional individual hole data the reader is
referred to Table A.

By dates it appears that the younger the hole, the more widely scattered
the two compared depths. This is shown by the following standard deviation
(Sx) data.

\[ S_X = \sqrt{\frac{\sum_{i=1}^{N} (X_i - \bar{X})^2}{N}} \]

We have:

- \( X_i \) = taped measurement (meters) minus P-wave pick to water level.
- \( \bar{X} \) = mean of \( X_i \)'s
- \( N \) = number of points, by years.

**Standard Deviation Results:**

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>Sx</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>9</td>
<td>3.1</td>
</tr>
<tr>
<td>1975</td>
<td>20</td>
<td>4.8</td>
</tr>
<tr>
<td>1976</td>
<td>17</td>
<td>10.9</td>
</tr>
</tbody>
</table>

These results suggest that the P-wave estimates represent an equilibrium level
toward which the water levels in the holes are trending.

**Bay Mud Sites**

Three Bay Mud Sites were selected for shear wave studies out of a total
of 59 holes. These three holes are also classified as saturated, i.e., virtually
all interstitial spaces have been filled by liquid. A discussion of their water
table measurements follows:

The historic estuarine environment in which the three Bay Mud Sites
were drilled creates a natural depositional zone, rich enough in organic
material to form methane gas in the mud (see Whalen et al., 1976). Slow P
and S velocities were recorded at the three holes. P-wave values of 770 M/S
in the upper 10 to 20 meters, and S wave values of 108 M/S were recorded.

When sediments contain gas, the velocity of the P-wave is reduced so
that the P-wave method of picking a depth to water table cannot be used.

Hole No. 58 - Audubon

Initially, the P-wave velocity at this hole is 1070 M/S, and does not
attain a velocity denoting water table until it reaches a depth of 15 to 20
meters and a velocity of 1500 M/S. The water level was taped in October 1976
at 4.2 meters, which is 1.7 meters deeper than it was when logged for shear wave
velocities in December, 1975. Based on the probability that daily tide fluctua-
tions can affect the taped water column height, future measurements taken over at
least one, 24 hour, period should be made to resolve the extent of these changes.
At the Audubon hole there is an upper depositional zone of 10 to 15 meters of
oyster shells which may contribute to a more rapid water column equilibrium than
at either KGEI or Bridgeway Park.

Hole No. 50 - KGEI

Geographically located approximately 4 kms. southeast of Audubon, the
KGEI hole has a similar water level to Audubon, but the P-wave velocity does not
reach saturated velocity until a depth of 20 meters (see Fig. 4 for these
comparisons).

Hole No. 36 - Bridgeway Park

In comparison with the two previous Bay Mud Sites, Bridgeway Park shows
the most striking velocity contrast. The velocities (P-wave 427 M/S  S-wave
54 M/S) are lower in the upper 11 meters than all the other velocities measured
in this survey. The top two meters of this site are artificially filled,
which is not enough section to account for the low P & S velocities
observed. A probable cause for the low velocities from near surface to
eleven meters is the presence of gas (methane CH\textsubscript{4}, Brandt, 1960). It appears (see Fig. 4) that the P-wave velocity break to identify a water table contact should be closer to the surface and faster than was recorded. With gas present, one conclusion reached is that gas mixed with water in a saturated sediment, such as was found at Bridgeway Park, produces lower P & S wave velocities, than are measured in water-saturated, homogenous-sediments, which are free of gas.

**Water Level Changes**

In Figure 4, the water levels are shown graphically with a solid line representing the level at the time of S-wave measurement and the dashed line representing the level in October 1976. Those bottoms that could not be recovered, as a result of casing obstacles encountered during taping, are left as blank columns. The seismic velocity data at Site No. 42, Mar Vista, were uninterpretable, and were therefore excluded from Table A. For the record, the water level depth in this hole measured 12.9 meters in October, 1976.

**Conclusions**

Water level measurements have been made in 52 holes in the San Francisco Bay area, and their relations to the water-table have been studied. The data compiled from the different types of measurements represents new water-table data from three geologic units, 1) alluvium, 2) bedrock, 3) bay muds. The P-wave velocity data obtained from saturated alluvium sites most clearly describe a water boundary with a range of velocities from 1200 m/s to 1600(+) m/s. The P-wave velocity method of obtaining a depth to water-table will not work in most bed rock because the initial velocity of the rock in most cases exceeds 1200 m/s.

A unique pattern of low P and S wave velocities describe the character
WATER LEVELS

Observed at time of shear wave study
By taping, October 1976

Fig. 4 Velocities (P and S) and Water Level Depths
WATER LEVELS

Observed at time of shear wave study
By taping, October 1976

Fig. 4  Continued
WATER LEVELS

Observed at time of shear wave study
By taping, October 1976

Fig. 4 — Continued
WATER LEVELS

Observed at time of shear wave study
By taping, October 1976

Fig. 4  Continued
WATER LEVELS

Observed at time of shear wave study
By taping, October 1976

Fig. 4 — Continued
WATER LEVELS

Observed at time of shear wave study
By taping, October 1976

Fig. 4 —Continued
WATER LEVELS

Observed at time of shear wave study
By taping, October 1976

Fig. 4 — Continued
WATER LEVELS

Observed at time of shear wave study
By taping, October 1976

Fig. 4 --Continued
WATER LEVELS

Observed at time of shear wave study ———
By taping, October 1976 ———

Fig. 4 —Continued
WATER LEVELS

Observed at time of shear wave study
By taping, October 1976

Fig. 4 —Continued
of all three bay mud sites. Based on similar seismic signatures in estuarine localities (Whelan, 1976), a likely reason for the low velocities is the presence of methane gas.

Probable plans and suggestions for future water-table measurements are: When the hole is drilled, the water-table measurement should be recorded. Water levels at all holes under study should be repeated by taping in order to evaluate the significance of two years of drought followed by a wet winter in 1978. Water levels in the bay margins should be retaped during flooding and ebbing tides to see if the change in the altitude of the bay affects the water-table.

Acknowledgments

Gratitude for their comments in reviewing this report is extended to J. P. Akers, R. D. Borcherdt, J. F. Gibbs, W. B. Joyner, and R. E. Warrick.
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COZZOLINOS SITE NO. 2

Drive north on Hwy 280 to Half Moon Bay off ramp, Hwy 92. Continue on 92 over the ridge top, dropping down into an agricultural valley. Cozzolinos driveway is about 0.5 miles from Half Moon Bay nursery. Turn left in driveway, cross over wooden bridge, and take first right, (dirt road) circling around growing grounds. Climb up hill past an irrigation holding pond. Site is in depression above level of pond, and 2 - 300 ft. beyond. It is 0.5 miles from main road to site. See sketch below.

TO HALF MOON BAY

Wood Bridge

Half Moon Nursery

Cozzolino Residence

Pond

Distant Telephone Pole

Willow Tree in Creek Bank

Center Line of Road over Pipe Line

Note: Hole is plugged with old tri-cone bit.

Large Diameter Eucalyptus at base of grove.

~ 400 ft. from hole
GO SOUTH ON FOOTHILL EXPRESSWAY, TAKE LOYOLA OFF RAMP (LOS ALTOS). JOG ACROSS LOYOLA AND CONTINUE PARALLEL TO EXPRESSWAY ON GRANGER. TURN RIGHT OFF GRANGER INTO EVA, WHICH BECOMES ST. JOSEPH AVE. STAY ON ST. JOSEPH, UNDER HWY 280. CONTINUE THROUGH ST. JOSEPH SEMINARY GROUNDS, PAST TENNIS COURTS ON DIRT ROAD, PARALLEL TO ORCHARD. (ONE LOCKED GATE, PROCEED ABOUT 1500 FT. TAKE LEFT TURN (DIMLY MARKED), STILL ON DIRT ROAD IN ORCHARD. REFER TO OTHER MAP FOR EXACT HOLE LOCATION.

KEY TO LOCKED GATE:

ST. JOSEPH SEM.

GYM

TENNIS COURTS

LOCKED GATE

ORCHARD

HOLE

SEE OTHER MAP FOR DETAILS
Proceed southerly on HWY. 280 TO GRANT RD. TURN OFF, TURN SOUTH, OR RIGHT (TOWARD MONTE VISTA); TAKE FIRST RIGHT, AND CONTINUE TO FIRST ROAD TO LEFT, (TOWARD CEMETERY). DO NOT ENTER, BUT CONTINUE ABOUT 0.09 MILES (145 M) ON ORIGINAL ROAD TO FENCING LINE ON THE LEFT. RUNNING SOUTHWESTERNLY, (ALSO NEXT TO ROW OF PINES).

HOLE IS 53.5 METERS (SEE SKETCH) FROM 1ST RED AND WHITE STEEL FENCE POST. SKETCH MAP NOT TO SCALE. DATE OF SURVEY, 30 SEPT. 1975

Brunton Bearings:
1. Post No. 1B to HOLE = 323°T.
2. Post No. 1 to No. 1B = 238°T.
DRIVE NORTH ON HWY. 280 TO HALF MOON BAY TURN OFF (HWY. 92), CONTINUE ON 92 TO COAST HWY. 1, TURN RT. ON HWY. 1 AND PROCEED NORTH TO EL GRANADA, ABOUT 3.6 MILES. TURN RT. OFF HWY. 1 ON PLAZA ALHAMBRA, THEN LEFT TO ISABELLA. DRIVE 4 BLOCKS ON ISABELLA TO COLUMBUS; TURN LEFT ON COLUMBUS AND RT AGAIN ON CONTINUATION OF ISABELLA. TAKE A SHARP RT. AFTER LEAVING COLUMBUS ONTO EL GRANADA BLVD., AND CONTINUE, STEEPLY CLIMBING TO THE END OF EL GRANADA. THERE IS A CHAINED AND LOCKED GATE AT END OF PAVED ROAD. SEE SKETCH FOR DETAILS. KEY TO GATE WITH PAUL SMITH AT OLD DOLGER BLDG. IN PRINCETON, OPPOSITE THE SHORE BIRD RESTAURANT. TOTAL MILEAGE TO GATE FROM HWY. 1 AND PLAZA ALHAMBRA INTERSECTION IS 1.4 MILES.
Mr. 

Drive south on Junipero Serra Expressway or Hwy. 280 to Page Mill. Turn right off either one onto Page Mill and proceed uphill in Skyline direction, approximately 7.5 miles (from Hwy. 280) to Black Mt. Entrance gate at Page Mill intersection. It is 1.3 (+-.1) miles to site from this gate. See sketch below.

Black Mt. Site No. 5

Mindego Hill 7½’

SFO ➔ Hwy 280 ➔ San Jose

Foothills Park Rd ➔ Page Mill Rd ➔ Black Mt. Gate

Skyline Blvd.

Trail

305m 03'

Large Boulder

2600 ft. 090°

(Line of Sight)

Mirwa Beach

Rounded 402m

Spot Elevation (2675')

Hilltop

Oats 43

Black Mt. Ranch
DRIVE NORTH ON HWY. 280 TO HWY. 92. CONTINUE ON 92 TO COAST HIGHWAY 1, TAKE A RIGHT ON 1, DRIVE NORTH TO FRENCHMANS CREEK ROAD, (1.1 MILE), TURN RIGHT AND DRIVE ABOUT 0.9 MILE TO ROAD FORK, KEEP TO THE RIGHT, CONTINUING BEYOND ERICA NURSERY ABOUT 0.8 MILE TO LOCKED GATE, (F.A.A. MAINTAINED), WALK IN TO SITE, ABOUT 0.2 MILE, ON RIGHT SIDE OF ROAD BEYOND TREES, (FIRs) ON THE LEFT, ENTRANCE TO HOLE APPEAR AS A SLIGHT ROAD CUT OFF THE MAIN ROAD. SEE SKETCH BELOW.
PISE LOOKOUT
SITE NO. 7

WOODSIDE 7 1/2'

 DRIVE NORTH ON HWY. 280 TO HWY. 92, PROCEED TOWARD HALF MOON BAY ON 92 TO CREST OF RIDGE, (SKYLINE BLVD.) TURN LEFT ON SKYLINE AND DRIVE SOUTH ABOUT 3.2 MILES TO DIRT DRIVEWAY ON LEFT, (GATE ABOUT 20 FT. OFF ROAD), USUALLY UNLOCKED. THIS DRIVEWAY IS NORT 0.1 MILE FROM A CHRISTMAS TREE FARM ON OPPOSITE SIDE OF ROAD. SITE IS BEYOND A GROUP OF 3 LARGE FIR TREES, ON THE HILLTOP. SEE SKETCH BELOW.

* NOT TO BE CONFUSED WITH PISE LOOKOUT (BY MAP NAME), WHICH IS ON OPPOSITE SIDE OF SKYLINE BLVD.
PULGAS WATER TEMPLE SITE NO. 8

WOODSIDE 7½'

Drive on Woodside Road under Hwy. 280 to intersection of Woodside Road and Canada Road. Drive north on Canada about 5.0 miles to PULGAS WATER TEMPLE. Turn left into parking area keeping to the left, and through gate. (If locked, Gardener in general area has key). See sketch below.
**Spring Valley Ridge**

**Site No. 9**

*Montara Mt. 7 1/2*

*See No. 11 for key info.*

Same access route as to Site No. 11 (North Peak) with the following exceptions: (1) Site No. 9 is located at end of a dirt road along Sawyer Ridge at intersection to the right. At this intersection along a bearing of 300°, a dimly marked (2-track trail) is found. Proceed along this trail about 150 m. to the edge of a plowed firebreak. From the center of the trail and 2° to 6° to the left of a firebreak and 9.0 meters at the approximate center of the firebreak the hole is located. The top of steel plate covering the capped hole is 5" below rough ground surface. This will vary seasonally as firebreak is plowed.

Hole is in sect. 19, T4S, R5W.

Brunton bearings: 300° to Δ, from Δ trail, at clearing.

**Diagram:**
- Capped Hole
- Chaparral
- 9.0 meters to hole (from F.B. edge)
- Trail (300°)
- 150 m.
- Whiting Peak
- Pilarcitos Lake
- Dirt roads

North Point
VISTA POINT  SITE NO.10  WOODSIDE 7/2

DRIVE NORTH ON HWY. 280 = 1.7 MILES BEYOND EDGECWOOD RD.
TAKE THE VISTA (2ND ONE NORTH OF EDGECWOOD) OFF RAMP AND
GO 0.35 MILES TO S.E.W.D. LOCKED GATE* (LEFT SIDE). DRIVE THROUGH,
TO, AND BEYOND SMA SHACK. SEE SKETCH BELOW.

* ENTRY TO LOCKED GATE:

DATE OF SURVEY OCT. 8, 1975
E.F. ROTH

DATE OF SURVEY OCT. 8, 1975
E.F. ROTH
ACCESS ROUTE: Key opens gate at San Andreas Lake Dam. Proceed to Pilarcitos Lake Turnoff; at this junction take fork to right. Dropping in elevation to view of N.E. Finger of Pilarcitos Lake. Proceed to N.W., (after two fairly sharp 180° bends in road) along Spring Valley Ridge. Keep to left and continue along Whiting Ridge into Sect. 25, (see Montara 7½'), directly below the No. 25 of Sect. 25, 200 meters is the hole as depicted in sketch below.

The cased hole is capped and covered with a 25 x 25 cm. steel plate. Date of Survey: 1 Oct. 1975, E.F. Roth.

**Elevation View**

**Dirt Road Profile**

**Plan View**

**Brunton Bearings:** TP1 to "333°T."
SAWYER RIDGE  SITE NO. 12  MONTARA MT. 7 1/2'

The hole is located one (1.0) mile from turnoff from San Andreas Road. From 4 of Sawyer Ridge Rd. At 1.0 mile mark it is 13.5 meters to hole on a 215°T bearing. A two by two foot white sandstone boulder lies 12.5 meters from hole with a 015°T bearing back to hole. A small, 5 ft. diameter bush is located 4.0 meters north west of hole.

Survey date: Oct. 3, 1975

E.F. Roth
DRIVE SOUTH ON BAYSHORE, (HWY. 101) TO HWY. 237, (FIRST OVERHEAD SOUTH OF MOFFETT FIELD). TAKE HWY. 237 TOWARD MILPITAS ABOUT 3 MILES TO SANTA CLARA AVE. TURN LEFT ON SANTA CLARA, AFTER CROSSING SLough ROAD NAME CHANGES TO GOLD STREET; CONTINUE TO CATHERINE ST. AND TURN RIGHT TO JUNCTION OF STATE ST., PROCEED NORTHEASTERLY ON STATE ST. ABOUT 1/2 MILE, OR 3 BLOCKS. AT THIRD BLOCK, (PACIFIC AVE.) TURN LEFT ON DIRT ROAD SEE SKETCH BELOW FOR DETAILS.

CONTACT: GENE PELLEGRINI
PHONE: (408) 263-6880
BLACKBERRY FARM  SITE NO. 14  CUPERTINO 7 1/2'

Go south on Hwy 280 to Grant Rd. Turnoff, take South segment of Grant Rd. to Stevens Creek Rd., turn left and go about 3/4 mile. At the bottom of of a steep grade, take an oblique right and proceed parallel to Stevens Creek Rd. to Byrne Ave. Turn rt. and go 3/4 mile to San Fernando Ave., turn rt into Blackberry Farm main entrance; take sharp rt at ticket house and drop down into parking lot, past pools and picnic area.

Refer to sketch.

Note: It is 350° T, 4 2.9 M. from hole to fifth tree from maintenance shed.
LOWRY RD. SITE NO. 16

DRIVE EAST FROM MENLO PARK ON WILLOW ROAD, (BECOMES DUMBARTON BRIDGE) CROSSING BRIDGE THROUGH TOLL PLAZA ON DUMBARTON RD. TO JARVIS RD., TURN LEFT ON JARVIS AND CONTINUE EASTWARD ABOUT 2.5 MILES TO NEWARK BLVD., TURN LEFT ON NEWARK BLVD. AND PROCEED NORTH ABOUT 3.0 MILES, (CROSSING COYOTE HILLS SLough) TO LOWRY RD. (LOWRY PARALLELS SLough), TURN RT. ON LOWRY RD. AND GO ABOUT 0.45 MILES TO #5311, (LONE 2 STORY RANCH HOUSE) BARNs IN REAR. SEE SKETCH FOR DETAILS.
HAYWARD SINK  SITE NO. 17  

THE MOST DIRECT ROUTE TO SITE IS EAST ACROSS THE DUMBARTON BRIDGE TO NEWARK BLVD. VIA JARVIS ROAD. TURN LEFT ON NEWARK AT INTERSECTION WITH JARVIS, AND DRIVE NORTH ABOUT 5.0 MILES (THROUGH UNION CITY) ON HESPERIAN BLVD. THE ACCESS ROAD TO SITE IS 1.2 MILES NORTH OF MAIN INTERSECTION IN UNION CITY.

TURN LEFT ON DIRT ROAD, OPPOSITE A DRIVE IN THEATRE. PROCEED PAST A WHITE FARM HOUSE AND DRIVE OVER THE S.P.R.R. TRACKS TO GREEN HOUSE AND SHACK, (DUCK CLUB). SEE SKETCH FOR DETAILS.

* NOTE: HOLE WAS NOT RECOVERED, (JULY 1976). IT'S GENERAL LOCATION IN CENTER OF DIRT ROAD AS SHOWN IN FRONT OF SOME NATIVE SHRUBS.
Palo Alto Square  Site No. 19

Drive South on Hwy. 101, (Bayshore) or El Camino to Page Mill Rd. In South Palo Alto. Turn Rt. on Page Mill from El Camino Drive about 0.1 mile toward the hills and Hwy. 280. To a left turn holding lane. Turn left into Palo Alto Square, paralleling a Standard Oil Co. gas station. Drive about 3 – 400 ft to break in curbing, (driveway) turn Rt. in drive and park in large field.

Legend:
1. Curbing
2. Pepper tree
3. Light pole
4. Large Oak tree.
DRIVE EAST FROM MENLO PARK ACROSS DUMBARTON BRIDGE TO HWY. 17. TURN RIGHT ON #17 AND CONTINUE TO STEVENSON BLVD. TURN LEFT ON STEVENSON BLVD. AND DRIVE TO MISSION BLVD. (NE BASE OF HILLS). TURN RIGHT ON MISSION AND DRIVE SOUTH ABOUT 2.75 MILES TO MILL CREEK ROAD, (SECOND ROAD AFTER PASSING UNDER HWY. 680 ON MISSION BLVD.) TURN LEFT AND CLIMB ROAD ABOUT 4.5 MILES TO SITE ENTRANCE GATE. SEE SKETCH MAP.
MONTGOMERY SCHOOL SITE NO. 21.

Drive South on Hwy. 101, (Bayshore) to Lawrence Expressway, turn right, (South) and continue for about 2.5 miles to Homestead, turn left on Homestead for about 0.5 miles to Pepper Tree Lane, take a left to Peppertree Court, then left on Peppertree Ct. to curve in street, Site is near by. Note**: School has been converted to the: "Montgomery Adult Education Center."
TRAVEL SOUTHEASTERLY ON HWY. 101, (BAYSHORE) TO MATHILDA AVE IN SUNNYVALE. TURN OFF ON MATHILDA TO THE RIGHT, (SOUTH) AND DRIVE ABOUT 2.6 MILES TO MERGER OF MATHILDA WITH SARATOGA SUNNYVALE ROAD. DRIVE ABOUT 3.5 MILES TO BOLLINGER ROAD, TURN LEFT, CONTINUE ABOUT 7 BLOCKS TO MILLER AVE; TURN RIGHT AND PROCEED 7 BLOCKS TO RAINBOW AVE; TURN LEFT AND DRIVE TO ATHLETIC FIELD, BEHIND SCH. SITE IS JUST OFF RAINBOW IN AREA ADJOINING SHOTPUT PRACTICE AREA. SEE SKETCH BELOW.
Drive north on Hwy. 101 (Bayshore) to Hwy. #92, take 92, San Mateo Bridge route across bay. Just beyond Toll Plaza take a right on Eden Landing Road, then another right on Salt Way, (back toward bay) to its end. Salt works buildings are located there. See sketch below.

Processing plant.

Area for trucks.

Break in roofline.

Garage.

Salt pile.

Evaporating ponds.

Narrow gauge tracks to evaporating ponds.

Turning and parking area.
CORTÉ MADERA SITE NO. 26

DRIVE WEST FROM MENLO PARK ON ALPINE ROAD TO PORTOLA ROAD JUNCTION. CONTINUE ON ALPINE ROAD ABOUT 1.75 MILES TO ENTRANCE DRIVEWAY AND BRIDGE CROSSING CREEK ON THE RIGHT. FROM INTERSECTION OF ALPINE ROAD AND WILLOW BROOK IT IS 0.85 MILES TO THE DRIVEWAY ENTRANCE AND BRIDGE.
Mitchell Park  Site No. 27  Mountain View 7½'

Drive south on Bayshore Blvd. (Hwy. 101) to San Antonio off lane, approximately 4.0 miles south from Hwy. 101 and Willow Road in Menlo Park. Turn Rt. on San Antonio & Rt. again on Charleston Rd., about 0.5 miles. Continue on Charleston to Middlefield Rd., proceed through intersection, crossing Middlefield Rd., about 400 ft. to gate on right, marking entrance to Re-Cycle Center. Site is about 116 meters off edge of black top in vacant lot. See sketch below.

* Palo Alto Recycle ctr.
Foothills Park  Site No. 28

Drive south on Junipero Serra Expressway to Page Mill Rd. Turn rt. and stay on Page Mill, passing beneath Hwy. 280 and continuing up Page Mill to main entrance of Foothills Park. Mileage from Park entrance to access road and Page Mill is 1.5 miles. See sketch below.
DRIVE WESERTLY ON SANDHILL RD. FROM MENLO PARK, TO PORTOLA RD. OPPPOSITE SEARSVILLE LAKE ENTRANCE; TURN RIGHT AND CONTINUE ABOUT 0.18 MILES TO “Y” IN ROAD, KEEP TO THE LEFT AND GO ABOUT 0.58 MILES TO SHARP LEFT, (UPHILL CLIMB AND 180°). THIS IS LA HONDA RD. ON HWY. 84, CONTINUE TO THE TOP, (SKYLONDA) AND TURN RIGHT AT INTERSECTION OF HWY. 84 ON HWY. 35, SKYLINE BLVD. DRIVE NORTHWARD ON SKYLINE ABOUT 3.5 MILES TO SKEGGS POINT LOOKOUT. THE SITE IS ON OPPOSITE SIDE OF ROAD FROM SKEGGS PT. AND THE BLACK TOPPED ACCESS ROAD TO IT. IS 400 FT. BEYOND. SEE SKETCH BELOW.
PULGAS TUNNEL  SITE NO. 30

WOODSIDE 7 1/2

DRIVE UNDER HWY. 280 ON WOODSIDE ROAD TO INTERSECTION OF CAÑADA ROAD AND WOODSIDE. CONTINUE NORTHWESTERLY ON CAÑADA ABOUT 5.0 MILES TO ENTRANCE GATE ON RIGHT SIDE OF CAÑADA RD. (OPPOSITE PULGAS WATER TEMPLE). ENTER GATE AND DRIVE PARALLEL TO CAÑADA RD. TO A CURVE TO THE RIGHT, (0.15 MI.); PROCEED UP HILL ANOTHER 0.2 MILES TO TURNS OFF DIRT ROAD TO THE LEFT; CONTINUE UP A STEEP INCLINE 0.15 MILE TO A FLAT MEADOW ON THE LEFT. DIMLY MARKED CAR TRACKS LEAD TO THE SITE. KEEP A LOOKOUT FOR 2 SIGNS @ 30 FT. APART, MARKING P.G. T.E. GAS PIPE LINE CROSSING UNDERGROUND. HOLE IS NEARBY. SEE SKETCH BELOW.

P.G. T.E. RED & WHITE
(9.5 FT. HIGH)

PG T.E.
BLACK AND
YELLOW POST.

GATE TO A = 0.15 MI.
A to B = 0.2 MI.
B to C = 0.15 MI.
C to Δ ≈ 50 METERS.
FRENCHMANS CREEK SITE NO. 31  △  HALF MOON BAY 7 ½

DRIVE NORTH ON HWY. 1, COAST HIGHWAY FROM HWY. 92, TO FRENCHMANS CREEK RD. CONTINUE UP "F.C. RD." TO LEFT FORK, (DIRT ROAD 0.9 MILES FROM HWY. 1), PROCEED LEFT ON THIS FORK ABOUT 0.1 MILE TO ANOTHER LEFT FORK, DROPPING DOWN INTO FIELD. THERE IS A CHAIN ACROSS THIS ROAD WITH LOCK, KEY AT ERICA NURSERY. SEE SKETCH FOR DETAILS.
HALF MOON BAY TERRACE SITE NO. 32 △ MONTARA MT.
DRIVE TO HWY. 1, COAST HWY. VIA HWY. 280 & 92. TURN RT. 7½'
on HWY. 1 AND PROCEED ABOUT 4.7 MILES TO HALF MOON BAY
AIRPORT TURNOFF: (CAUTION, TRICKY, SHORT WARNING AND HOLD
ING LANE). TURN LEFT AND RIGHT UPON ENTRY INTO AIRPORT, ROAD
PARALELLELS HWY. 1 TO THE NORTH. SEE SKETCH FOR DETAILS.
VISTA GRANDE  SITE NO. 33  SAN FRANCISCO, SOUTH 7½'
DALY CITY

AT THE INTERSECTION OF THIERS ST. AND FLORENCE, CONTINUE ON
THIERS WHICH TURNS INTO A DIRT RD. KEEPING TO THE RIGHT, GO TO A
POINT IN FRONT OF A LARGE RESERVOIR. A FLAT PROMONTORY PARKING
LOT FOR RIDING STABLES IS THE GENERAL AREA IN WHICH THE HOLE
IS LOCATED. ON THE BOTTOM OF THE STEEL LINK SURROUNDING THE RESER-
VOIR THERE IS A SHEET METAL BAND ENCIRCLING THE TANK. ETCHED IN THIS
BAND A SYMBOL △ WILL BE FOUND. FROM THIS MARK IN A SOUDHERLY
DIRECTION, 17.1 METER TO THE HOLE. 1.75 METERS BEYOND THE HOLE
A SMALL BOULDER WITH AN "X" MARKED ON ITS TOP IS FOUND, BEARING
007° T. TO THE HOLE FROM IT. SEE MAP BELOW FOR FURTHER DETAILS.
HOLE IS CAPPED AND COVERED WITH A 10"X10" STEEL PLATE.
Drive east from Menlo Park across the Dumbarton Bridge to Hwy #17; continue south on Hwy. 17 to Stevenson Blvd. Turn left (east on Stevenson and drive to Mission Blvd.). (End of Stevenson). Turn left on Mission and go 3/4 of a mile to Morrison Canyon Road. Take a right turn, and stay on Morrison Canyon Road. At Vargas Road, keep to the left. It is about 0.9 miles to hole from this intersection. Sketch maps below.
LAKE MERCEDE GOLF & COUNTRY CLUB, SITE NO. 35
Daly City, 2300 Junipero Serra Blvd.

Travelling north on Hwy. 280 in Daly City, get onto Junipero Serra Blvd. Stay on the west side of Hwy 280, and go two blocks beyond School St. Turn left off of Junipero Serra into Lake Merced Golf & Country Club. Keep to the right and proceed under entrance way. Continue on into parking lot to the right. (Through break in hedge). Leave parking lot on dirt road toward cement block building, parallel to #10 fairway. Start mileage check at west end of block building; it is 0.09 miles, (145 meters) to hole. This dirt road parallels a steel link fence. At 0.09 mile mark, measure 9.0 meters to hole. Capped and covered with steel plate.

Survey date: Oct. 20, 1975

E.F. Roth

Diagram of golf course layout and directions.
BRIDGEWAY PARK  SITE NO. 36  △  SAN MATEO  7½'

DRIVE NORTH ON HWY #101, (BAYSHORE FWY) TO MARINE WORLD TURN OFF, (RALSTON AVE.) IN BELMONT, CONTINUE ON RALSTON AVE. PAST MARINE WORLD ENTRANCE, CROSS SLough ON BRIDGE PARKWAY, TAKE 1ST RIGHT, (BOWSPIRIT DR.) TO LANYARD, DRIVE TO LEFT CURVE, (LANYARD BECOMES QUAY LANE HERE). SEE SKETCH BELOW FOR DETAILS.

NOTE. BEARING TO HOLE FROM SIDEWALK EDGE IS N.22E.
WINDMILL  SITE NO. 37  △  SAN FRANCISCO (No.) 7½

DRIVE NORTH ON HWY 280 TO PACIFICA, SKYLINE BLVD. OFF LANE, CONTINUE ON SKYLINE TO VICINITY OF LAKE MERCED, TAKE LEFT AND CONTINUE NORTH ON GREAT HIGHWAY TO NORTH EDGE OF GOLDEN GATE PARK, (FULTON STREET). TURN RIGHT ON FULTON AND RIGHT AGAIN, (ABOUT 100 FT. BACK INTO PARK) ON ACCESS ROAD. AREA IS ALL SANDY TERRAIN, USE CAUTION WHILE DRIVING. SEE SKETCH BELOW.
CHAIN OF LAKES  SITE NO. 38  ∆  SAN FRANCISCO (NO) 7½

DRIVE NORTH ON HWY. #280 TO VICINITY OF SAN ANDREAS LAKE, MERGE ONTO SKYLINE BLVD. AND DRIVE NORTH TO THE GREAT HIGHWAY, (ESPLANADE) IN SAN FRANCISCO. TAKE RIGHT TURN ONTO FULTON ST., GO TO 43rd AVE., TURN RIGHT, AND AGAIN TAKE A SHARP RIGHT THROUGH TREES TO SITE. SEE SKETCH BELOW.

* HOLE CASED TO 70 FT.
Prayerbook Cross  Site No. 39  △ San Francisco (no) 7½
Drive north on Hwy. #280 to Daly City; merge onto 19th Ave. and continue on 19th to Golden Gate Park, and into Park, taking a right at North part of Park on Kennedy Dr. (Main Dr.). Drive about 0.1 mile, and cross the drive to opposite side, entering driveway, (break in curb); proceed in a westerly direction to Hilltop, (Prayerbook Cross).
See sketch below.

Measurements
P.C. to △ = 8.85 m.
B to △ = 5.3 m.
P to △ = 9.2 m.
Drive southeasterly on JUNIPERO SERRA BLVD. FROM INTERSECTION AT ALPINE ROAD ABOUT 1.65 MILES TO ROAD ON RIGHT SIDE (PRIVATE) OF JUNIPERO SERRA; ROAD IS NEXT TO LAST HOUSE BEFORE LARGE FIELD; IT (ROAD) IS ABOUT 0.65 MILES FROM ROAD TO PAGE MILL RD. INTERSECTION. PROCEED UP ROAD TO LOCKED GATE (ELECTRONICALLY CONTROLLED), KEY WITH ED ROTH. IT IS ABOUT 0.645 MILES FROM GATE TO HOLE ON MODERATELY PAVED ROAD.

SEE SKETCH BELOW.

Bearings & Distances
1 to A = 13.2 Meters
2 (Post) to A = 196° T. 8'9.85 M.
3 to A = 11.7 M.

Note: 1 & 3 Measurements are from Road Edge.
Drive north on Hwy. #101, (Bayshore Fwy.) and merge off 101 at 6th Street, Hwy. 280 ramp continue on 280 to 3rd Street; turn left go one short block to Townsend Street, turn right on Townsend and continue to section of Street where R.R. tracks cross street obliquely into area of Kelly Street. Site is in large vacant lot near brick warehouse in direction of continuing track footage. See sketch below.
DRIVE NORTH ON HWY. 280 TO VICINITY OF SAN ANDREAS LAKE, TAKE PACIFIC SKYLINE BLVD. OFF RAMP AND CONTINUE NORTH ON SKYLINE TO JOHN DALY BLVD. STAY IN LEFT LANE AFTER CROSSING JOHN DALY, AND TURN LEFT ON OLYMPIC WAY (CUL DE SAC) IN FRONT OF MAR VISTA RIDING STABLE. CONTINUE ON OLYMPIC WAY (SOUTHERLY) TO DIRT ROAD. SEE SKETCH BELOW.
DRIVE NORTH ON HWY. 280 TO VICINITY OF SAN ANDREAS LAKE, MERGE ONTO SKYLINE BLVD. AND DRIVE NORTH ON SKYLINE TO GREAT HIGHWAY, (ESPLANADE) IN SAN FRANCISCO. IMMEDIATELY AFTER TRAFFIC LIGHT AT GREAT HIGHWAY & SLOAT BLVD., TURN RIGHT (STOP SIGN) THEN LEFT PARALLELING "G.H." UNTIL QUINTARA, (8 BLOCKS). TAKE RIGHT TURN ON QUINTARA AND DRIVE UP HILL TO 40TH AVE., (9 BLOCKS). SEE SKETCH
HILLVIEW COURT  WESTLAKE PALISADE  SAN FRANCISCO  
Daly City, CA.  SITE NO. 44  

SOUTH 7½'

DRIVE NORTH ON HWY. 280 TO THE PACIFICA, SKYLINE BLVD. OFF RAMP  
(VICINITY OF LAKE SAN ANDREAS). TAKE, OFF RAMP AND CONTINUE ON SKY-  
LINE BLVD. TO WESTRIDGE AVE. (ONE MAJOR INTERSECTION NORTH OF  
WESTMOOR AVE.). TAKE A LEFT ON WESTRIDGE AVE., THEN A RIGHT ON  
SKYLINE AVE. GO FOUR (4) BLOCKS TO HILLVIEW CT., LEFT TO END OF  
CUL DE SAC, THROUGH GATE, NOT LOCKED. SEE SKETCH FOR FURTHER DETAILS.

SURVEY DATE       
MAR. 1976          
ED ROTH           

79
Drive north on Hwy. 280, taking the Pacifica, Skyline Blvd. off lane (Lake San Andreas vicinity). Continue on Skyline Blvd. to Westmoor Ave. intersection, Daly City. Turn left, go two blocks to Avalon Drive; turn left, go past church and stop at gate in steel link fence, (about 0.15 mile from Westmoor and Avalon Drive). See sketch map below for details.

Ed Roth has key to locked gate.

Date of Survey
March 1, 1976
By Ed Roth

Avalon Drive Site 45 Westlake Palisades △ San Francisco 7 1/4
Daly City, CA.
TWIN PEAKS  SITE NO. 46 △ SAN FRANCISCO (No.) 7½

Drive north on Hwy. 280 to 19th Ave. Golden Gate Bridge off lane (Daly City). Merge left and continue on 19th Ave. to Sloat Blvd. Turn right and in about 0.2 mile, Sloat becomes (oblique left) Portola Drive. Drive on Portola Drive to Twin Peaks Blvd., (about 1.35 miles). Turn left and stay on Twin Peaks Blvd. to first right; site is in "Quarry" at this junction. See sketch below.
DRIVE NORTH ON HWY. 101 (BAYSHORE) TO BRISBANE, COW PALACE OFF RAM TAKE THIS (OVERHEAD) TO 2ND SIGNAL LIGHT. THIS INTERSECTION IS ≈ 1.7 MILES FROM OVERHEAD, TURN LEFT (GUADALUPE PKWY.) AND CLIMB ABOUT 2.0 MILES TO MESA AREA WHERE FWY. INTERSECTS, (FAINTLY) WITH ROAD (NAMED RADIO RD.). TURN RIGHT, (NORTH) OVER CURBING AND CONTINUE ON RUTTED BLACK TOPPED ROAD, (BECOMES DIRT) THROUGH EUCALYPTUS GROVE ≈ 0.3 MILES, UPHILL TO SANDSTONE OUTCROP ON LEFT, SEE SKETCH BELOW FOR DETAILS.
SKYLINE BLVD.  WESTLAKE PALISADE  SAN FRANCISCO 50.91'
DALY CITY SITE NO. 48

DRIVE NORTH ON HWY. 280 TO PACIFICA, SKYLINE BLVD. OFF LANE.
CONTINUE ON SKYLINE BLVD. 0.25 MILE BEYOND WESTMOOR AVE.
DRIVE UP OVER ROLLED CURB 100 FT. SHORT OF A 6 TO 8 FT. HIGH
CYPRESS BUSH. THE HOLE IS 17.5 METERS SOUTH OF THIS BUSH; AND
IT IS 6.5 METERS FROM HOLE TO FENCE, AND 7.6 METERS TO CURB EDGE.

DATE OF SURVEY
FEB. 4, 1976

BY: ED ROTH
SKYLINE AT WESTMOOR AVE.  WESTLAKE PALISADE  SAN FRANCISCO
DASY CITY  SITE NO. 49  SOUTH  7½'

DRIVE NORTH ON HWY. 280, TAKING THE PACIFICA SKYLINE BLVD. OFF
LANE.  DRIVE TO INTERSECTION OF SKYLINE BLVD. AND WESTMOOR AVE.
HOLE IS IN LOW CHAPARRAL ON THE N.W. QUADRANT OF THIS LARGE INTER-
SECTION.  SEE SKETCH MAP BELOW FOR DETAILS.*

DATE OF SURVEY
FEB. 4, 1976
BY: ED ROTH,

HOLE IS 9.7 METERS TOWARD SKYLINE BLVD.
ON A LINE PERPENDICULAR TO REAR FENCE
LINE BEHIND THIRD HOUSE AND IN LINE WITH
PROPERTY FENCE LINE AT PINE TREE BETWEEN
THIRD AND FOURTH HOUSE

WESTMOOR AVE.

WESTMOOR BLVD.
Drive north on HWY #101, (Bayshore Fwy) to Ralston Ave., Marine world turn off. Proceed toward bay on Ralston, past marine world over canal on bridge Parkway about 0.325 miles to divided (?) road, turn left and continue for about 3/4 of a mile, to intersecting paved, (divided ?) road, turn left for ≤ 0.1 mile, and turn right on dirt road, KGEI Bldg. is visible at end of this road. See sketch below.

Note: Do not use electric blasting caps at this hole, too great a risk with strong R.F. signals. Dirt road at radio station very slippery when wet, don't use it!!
Drive north on Bayshore Fwy. (Broad) to Woodside Road (in Redwood City), take off ramp to Woodside; go about 2.75 miles to Alameda de las Pulgas. Turn right on the Alameda, go 0.5 miles to Massachusetts, turn left, (name changes to Woodside Drive), continue about 0.9 miles (winding route) to Ridgeway Road, turn right on Ridgeway and continue on Crest to its end, take right turn, tank is about 100 ft. on left side. See sketch below. Key needed.
DRIVE NORTH ON HWY. 280 TO HWY. 92, ARTHUR YOUNGER FREEWAY. TAKE OFF RAMP ON 92 AND GO ABOUT 3.0 MILES TO HILLSDALE BLVD. TAKE LEFT ON HILLSDALE TO CSM. TAKE FIRST RIGHT INTO CAMPUS AND FIRST RIGHT AGAIN (SHIPPING RECEIVING SIGN). CONTINUE ON ROAD, DOWN INCLINE PAST TENNIS COURTS, ABOVE TRACK, THROUGH GATE CURVING ABOVE AND AROUND BASEBALL DIAMOND TO OVER FLOW PARKING AREA. SEE SKETCH BELOW: E.F. ROTH, JUNE 1976.

NOTE: IT IS 2.7 METERS FROM #4 POLE TO HOLE. HOLE IS COVERED OVER WITH BRICKS.
PENINSULA COUNTRY CLUB  SITE NO. 53  △  SAN MATEO 7½'

DRIVE NORTH ON HWY. #101, (BAYSHORE) TO HWY. #92; TAKE #92 (HALFMOON BAY DIRECTION) ABOUT 1.50 MILES TO ALAMEDA DE LAS PULGAS. GO LEFT ON ALAMEDA, (S.E.) 0.25 MILES TO PENINSULA COUNTRY CLUB ENTRANCE, (MADERA DRIVE), ON RIGHT SIDE OF ALAMEDA. DRIVE INTO PARKING AREA. SEE SKETCH BELOW.

DISTANCES & BEARINGS
OAK TREE TO HOLE: 16.7 M., 322°T.
JUNIPER TO HOLE: 8.7 M.
Santa Clara County Fairgrounds

Site No. 54  344 Tully Rd., San Jose

Drive South from Menlo Park on Hwy. 101, (Bayshore Fwy.) to Tully Road, (in San Jose), turn right and go 1.9 miles to Monterey Road, turn left on Monterey and go 0.5 miles to Umbarger Road, turn left and continue on Umbarger ≈ 0.45 miles to Gate No. 2, (South End) Enter through Gate . . . . . . See Sketch Below.
DRIVE SOUTH FROM MENLO PARK TO LOS ALTOS ON FOOTHILL EXPRESSWAY. TURN LEFT OFF FOOTHILL INTO GRANT RD. AND 0.75 MILE NORTH TO OAK AVE. TURN RIGHT AND CONTINUE 0.4 MILE ON OAK AVE. SCHOOL IS ON LEFT SIDE OF ROAD.

SEE SKETCH FOR DETAILS.
Drive north on Hwy. 101, (Bayshore Fwy.), crossing to Oakland on Bay Bridge; after passing toll gate, keep to right and merge onto Hwy. 17, (Nimitz Fwy.), heading south to 14th Street. (About 1.25 miles) Take 14th Street easterly to Market St, turn left on Market, go one block to 15th St. Turn rt. and go one-half block to area of hole. See sketch below.
MERRITT COLLEGE  SITE NO. 57

DRIVE NORTH ON BAYSHORE FWY. (#101), CROSSING THE BAY ON THE I-80 - OAKLAND BAY BRIDGE; SHORTLY AFTER LEAVING TOLL PLAZA AREAGET ON HWY. 580 AND DRIVE TO 35TH AVE. TURN TO RIGHT AT OOF RAMP, THEN LEFT BACK OVER 580 TO REDWOOD AVE. TAKE REDWOOD UPHILL TO MERRITT COLLEGE ENTRANCE. SEE SKETCH MAPS BELOW.
SAN MATEO SITE NO. 58

A GULF AVE.

SCHOOL -S/TH A/O-

To HILLSDALE BLVD.

Drive north on HWY. #101 (Bayshore Pkwy) to Hillsdale Blvd.

Main entrance to Foster City. Turn right at Gull Ave. Park on left. Bayview School lot entrance is opposite east edge of park. Drive into school parking lot. See horseshoe logo opposite.

Drive south on Gull Ave. Turn right at Gull Ave. and drive 3 blocks to park on left. Bayview School lot entrance is opposite east edge of park. Drive into school parking lot. See horseshoe logo opposite.

Walk WALK PARKING AREA GULF AVE.

NOTE: From hole to hole, storm drain is 7.82 ft. on a 342.7 bearing.
CARMICHAEL SCHOOL  SITE NO. 59 △ SAN FRANCISCO (No) 7%1

DRIVE NORTH ON HWY. #101, (BAYSHORE FWY.) TO OFF RAMP OF HWY. 280 AND 6TH ST. (= 2 MILES BEYOND CANDLESTICK PARK TURNOFF). TAKE 6TH ST. AT THE END OF HWY. 280 AND PROCEED TO HARRISON. GO LEFT ON HARRISON TO 7TH STREET, TURN RT. ON 7TH, GO ONE (1) BLOCK TO FOLSOM, GO RT. TO SHERMAN AND RT. AGAIN ON SHERMAN. PRINCIPAL'S OFFICE IS MID-BLOCK ON SHERMAN BETWEEN FOLSOM & HARRISON. SEE SKETCH BELOW.

NOTE: AREA OF HOLE IS USED AS PARKING BY TEACHERS. AT LEAST OVERNIGHT NOTIFICATION TO CLEAR AREA.