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GROUNDWATER INVESTIGATION

DENNISTON CREEK VICINITY

SAN MATEO COUNTY, CALIFORNIA

- For Coastside County Water District
  Half Moon Bay, California

Lowney-Kaldveer Associates

Foundation / Soil / Geological Engineers

JOHN V. LOWNEY, C.E.
PETER KALDVEER, C.E.
ROBERT R. PRATER, C.E.
DONALD H. HILLEBRANDT, C.E.

145 ADDISON AVENUE, PALO ALTO, CALIFORNIA 94301

415/328-6920

April 4, 1974
349-2, PA 6644

Honorable Board of Directors
Coastside County Water District
766 Main Street
Half Moon Bay, California

Attention: Mr. Jack Canadas, Manager

RE: GROUNDWATER INVESTIGATION
DENNISTON CREEK VICINITY
SAN MATEO COUNTY, CALIFORNIA

Gentlemen:

In accordance with your request, we have performed a groundwater investigation for the above project. The accompanying report presents the results of our field investigation work, laboratory tests, and geological analyses. The basin hydrogeology and hydrology are discussed and recommendations for safe well yield and water resource management are presented.

We refer you to the text of the report for detailed recommendations. If you have any questions concerning our findings, please call.

Very truly yours,

LOWNEY/KALDVEER ASSOCIATES

John V. Lowney

JVL/MC:gs

Copies: Addressee (20)

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DENNISTON CREEK AREA GROUNDWATER INVESTIGATION
SAN MATEO COUNTY, CALIFORNIA

INTRODUCTION

In this report, we present the results of our groundwater investigation for the Denniston Creek and San Vicente areas located north of Half Moon Bay. The purpose of our study was to evaluate the potential for future subsurface water development within areas under the jurisdiction of the Coastside County Water District as a basis for management of the basin. The limits of our study are shown on the Boring Location Plan and Geologic Map, Figure 1, and approximately encompass the terrain bounded by the communities of El Granada on the south, Moss Beach on the north, the coast hills on the east, and the Pacific Ocean. In general, our study limits include the flatland discharge basins for San Vicente and Denniston Creeks from their emergence in the hills to discharge into the Pacific Ocean and Half Moon Bay, respectively.

We understand that it is desired to increase the existing plant capacity by means of additional wells and/or enlarged diversions of surface water from Denniston and San Vicente Creeks. At the present time, the District is extracting approximately 400 acre feet annually from Denniston Creek. This water is pumped to a water treatment plant situated on Denniston Creek and then transported by 12-inch line for distribution in the Half Moon Bay area.

Recognition is given to Jeremy C. Wire, Engineering Geologist, for assistance in preparing the hydrogeologic and hydrologic sections of the report.

SCOPE

The scope of our work consisted of the following:

1. Review of available hydrology and subsurface data including well logs, private and public reports, and technical data obtained from interviews with knowledgeable personnel of the U. S. Geological Survey, San Mateo County, the Coastside County Water District, Citizens Utility Water District, and others.

2. Limited field geologic mapping to supplement recent detailed mapping performed by the U. S. Geological Survey. Aerial photographs were reviewed by our engineering geologist, who also performed magnetometer traverses to locate a concealed fault east of Highway 1.

3. An extensive subsurface exploration program to define the subsurface materials, groundwater table, and bedrock depth.

4. A field pumping test to determine the aquifer transmissibility and recovery characteristics for well spacing determination, etc.

5. Preparation of a large scale geologic map for the basin, geologic cross-sections, and determination of present water quality from available chemical test data, as well as contour maps showing water table elevations and bedrock surface elevations. Analyses of hydrogeology, hydrologic inflow - outflow for the basin, and conclusions and recommendations for water resource management.

INVESTIGATION

A. Subsurface

A subsurface investigation was performed between January 25 and February 27, 1974, using truck-mounted rotary wash equipment. Eleven borings ranging from 35 to 140 feet in depth were drilled at the locations shown on Figure 1. All borings were backfilled with pea gravel; at least 20 feet of perforated P.V.C. pipe was installed at the surface of each boring for long-term monitoring of the water table elevations. Logs of the borings showing materials encountered, sampling intervals, and drilling rates are presented in Appendix A, as well as an explanatory key describing the soil classification system used. The results of laboratory classification tests are presented in Appendix B.

B. Pumping Test

Since limited data from specific-capacity tests and well logs were available for the study area, one aquifer or pumping test was made using the District's Denniston Creek Test Well No. 1 to determine aquifer properties, with particular respect to transmissibility. The coefficient of transmissibility (T) indicates the capacity of the aquifer system as a whole to transmit water and is equal to the coefficient of field permeability multiplied by the total saturated thickness of the aquifer.

As shown in Appendix A, which contains the pumping test results, measurements of drawdown and recovery were made in both the pumped well and in an observation well (Exploratory Boring 1) for a period slightly in excess of 48 hours. The analysis of the aquifer coefficients was made using a modification of the Theis non-equilibrium equation. When plotted on semi-logarithmic paper, the drawdown curve approaches a straight line when sufficient time has elapsed after pumping beings. Transmissibility (T) in gallons per day per foot is then determined from the relationship $T = \frac{264Q}{\Delta S}$,

where Q is the pumping rate in gallons per minute and ΔS is the change in drawdown in feet per log cycle in the straight line portion of the drawdown curve.

Reasonable agreement was obtained when computing the coefficient of transmissibility from both the drawdown and recovery data. A value of 13,600 gallons per day per foot was obtained based on the drawdown measurements, and a corresponding value of 16,500 gallons per day per foot was obtained using the recovery measurements. For purposes of evaluation of the groundwater hydrology and the groundwater basin inventory, an average of these two values, or a coefficient of transmissibility (T) of 15,000 gallons per day per foot, is used.

GEOLOGY

The general geology of the area with respect to structural features controlling groundwater movement is shown on the Geologic Map, Figure 1, and the Geologic Sections presented on Figures 3 through 6. The geologic setting has been largely affected by faulting. Approximately 150 feet of vertical uplift of the Seal Cove Fault has created a ridge of impermeable Tertiary Age Purisima Formation siltstone along the west margin of both the Denniston Creek and San Vicente Creek Basins. A parallel fault has been mapped by the U.S.G.S., and was detected and field located during the magnetometer traverses about 800 feet east of Highway 1 near the existing District wells. This fault does not appear to interfere with groundwater movement, based on the water table contouring and the aquifer pumping test.

Basement rocks for this region consist of relatively impermeable granite, which constitutes the highlands to the east and is overlain over most of the basin by Purisima siltstone. Several stages of marine terraces blanket the bedrock units; these terraces have been elevated several hundred feet by faulting, forming the aquifers for groundwater storage under study. In places, recent stream wash and basin alluvial deposits formed primarily by the creeks occur as a surficial mantle over the terraces.

The significant aquifer materials consist of unconsolidated silty sands, clayey sands, and coarse to fine sands separated over most areas by an intermediate sandy clay stratum up to 20 feet thick (see Figures 3 - 6). The deepest portion of the basin consists of silty sand and coarse to fine sand; this primary water bearing unit increases in thickness toward the east above Highway 1 to a maximum thickness of approximately 55 feet. A bedrock ridge, possibly caused by traverse faulting normal to the regional northwest fault trend, was found to exist north of the airport where the valley narrows. The bedrock surface in this latter area rises to Elev. 20. Bedrock surface contours from wells and the test borings, as shown on Figure 1, indicate that within the Denniston Creek Basin the basement surface through the basin center is relatively flat at approximately Elev. -30 sloping upward at the margin of the valley. Block tilting or warping has created a gentle bedrock gradient southward toward Half Moon Bay of 10 to 15 feet per mile through the center of the valley.

HYDROLOGY

Although groundwater is stored in the water bearing deposits of the basin, the ultimate availability is determined by recharge and discharge to the groundwater reservoir including the amount of rainfall, streamflow, and types and areas of natural discharge or artificial discharge through wells. Therefore, as a pre-requisite to constructing a hydrologic balance or inventory for the groundwater basin in order to estimate the available supply, we have attempted to obtain as much reliable data as possible on both surface and groundwater conditions for the area.

Surface Water

Average annual rainfall in the vicinity of the study area varies from approximately 20 inches in the lowland area near Princeton to nearly 45 inches in the higher portions of the watershed area of San Vicente and Denniston Creeks on Montara Mountain. Since rainfall is the ultimate source of recharge to the groundwater basin, a large amount of water is potentially available for yearly replenishment. Estimates made by the University of California, Agricultural Extension Service, indicate that the watershed of San Vicente Creek covers some 1209 acres, with elevations up to 2000 feet, collecting an average annual rainfall of 4095 acre feet. Similarly, the watershed of Denniston Creek to an elevation of 2000 feet covers some 2636 acres, collecting an average annual volume of rainfall amounting to some 9203 acre feet.

Periods of surface water runoff mainly occur in the period of October through March as a result of winter storms. At the present time, there are no historic stream gauge records for San Vicente Creek, and stream gauge readings are available for Denniston Creek only during the period March, 1968, to December, 1970. Excluding base flow which is sustained by springs and diversions made by the Coastside County Water District from the two creeks, we have estimated that 80 percent of the rainfall of the watershed area of the two creeks may be available as runoff. This condition is substantiated by rainfall/runoff relationships of gaged basins having a similar geologic and topographic setting in adjacent portions of the Coast Range.

Groundwater: Occurrence and Movement

Measurements of water levels in observation wells situated in various portions of the basin made especially for this investigation indicate that at the present time (March, 1974) the basin is more or less brimfull with a water table gradient and configuration that approximates the land surface topography and elevation as shown on Figure 2, Water Level Contour Map. This map shows that there are two separate basins in the study area: the smaller basin in the vicinity of Moss Beach (herein designated as the San Vicente

Subarea) has a surface area of approximately 140 acres and is separated from the larger contiguous groundwater basin to the southeast by a low groundwater divide. The larger groundwater basin, which for purposes of reference is divided into the Denniston Creek and Airport Subareas delineated on Figure 2, covers approximately 879 acres.

With the possible exception of an area in the vicinity of Princeton near the Bay where thick clay sequences are present, groundwater in the overall area is believed to be mostly unconfined. It is, therefore, believed that the water table in the area will fluctuate primarily in response to changes in the amount of recharge by rainfall and streamflow; there are no historic well hydrographs in the immediate vicinity to substantiate this, however. With no data to indicate otherwise, the groundwater contours shown on Figure 2 are believed to represent not only the present configuration of the water table but also the historic steady state condition of minimal groundwater water development.

As shown on the groundwater contour map, Figure 2, the hydraulic gradient is generally to the south and southeast toward the Bay at some 50 to 70 feet per mile, extending from recharge areas concentrated along the northeast boundary of the basin to areas of effluent or discharging groundwater in a low lying marsh area west of Princeton. No groundwater is believed moving out of the consolidated rock of the ridge west of the Seal Cove Fault Zone, as the direction of flow is parallel to the fault zone. Although the presence of other surface and subsurface faults is suggested by geologic relationships, none of the faults appear to create a barrier to the water flow in either the Denniston Creek or the Airport Subareas.

Our review of existing water quality test records from wells within the basin indicates saline water encroachment has not occurred to date, although chlorides are higher than typically found in fresh water basins. Chloride concentrations range from approximately 60 to 110 parts per million; this may be the result of salt residue remaining from ancient times when the terraces were inundated by seawater.

Specific Yield, Transmissibility, and Storage Capacity

Physical parameters of the groundwater basin that will control the rate and amount of groundwater withdrawal possible under any future management plan are related to the specific yield, transmissibility, and storage capacity of the aquifer system. The derivation of the value for transmissibility was described previously under the explanation of the aquifer test program. Specific yield is defined as the ratio of (1) the volume of water which, after being saturated, will yield by gravity to (2) its own volume. Therefore, the amount of groundwater in storage (storage capacity) of the groundwater basin is equal to the total volume of saturated material multiplied by its specific yield.

For the purpose of computing storage capacity, the overall basin was divided into subareas, with emphasis on evaluating the Denniston Creek Subarea which is within the jurisdiction of the Coastside County Water District. These subareas were selected partly for convenience, but they also generally coincide with natural geologic and hydrologic boundaries. As determined from the logs of test wells, different types of subsurface water bearing materials were assigned various specific yield values as follows:

TABLE A - VALUES OF SPECIFIC YIELD FOR DENNISTON CREEK BASIN

Material	Percent
Gravel, medium and coarse grained sand	25
Fine sand	10
Clay	3
Bedrock (Purisima formation or granite)	0

Based on weighted averages of the percentages of various classifications of the material present in both shallow and deep wells, average specific yields were assigned to the subareas. The Denniston Creek Subarea has the highest average specific yield, approximately 13 percent; the Airport and San Vicente Subareas have average specific yields of approximately 11 percent. These relatively low values reflect the generally fine-grained nature of the deposits forming the aquifer system.

If the total saturated volume of the aquifer system to the top of bedrock as contoured on Figure 2 is considered, then approximate storage capacities for the various subareas are as follows, using the above specific yield values:

TABLE B - BASIN STORAGE CAPACITY

Subarea	Acre Feet
San Vicente	995
Denniston Creek	1800
Airport	4630
Total Storage Capacity	7425

If the storage computations are made on only the volume of the groundwater basin which is above sea level, however, the calculated storage capacity for the Denniston Creek and Airport Subareas would be reduced by approximately one-third because of the potential for sea water intrusion if groundwater levels decline below this elevation. Usable groundwater storage capacity under this criterion would be about 1200 acre feet for the Denniston Creek Subarea and approximately 3050 acre feet for the Airport Subarea.

HYDROLOGIC INVENTORY

General

Although from the performance of the existing wells and general knowledge of the area it would appear feasible to drill and complete several additional wells in the Denniston Creek area physically capable of yielding adequate quantities of water, the primary question to be answered by this investigation is: What will the practical sustained rate of groundwater pumping from the basin be? In other words, how much groundwater can be pumped year after year without serious decline of the water table resulting in mining or overdraft of the aquifer, causing water of inferior mineral quality to move into the basin, such as from a wedge of salt water intrusion, or reducing the surface flow of Denniston or San Vicente Creeks to the point where any water rights to such surface sources are impaired?

Accordingly, the purpose of collecting and evaluating the basic geologic and hydrologic data is to supply quantities to a hydrologic inventory or equation for the groundwater basin which states:

Inflow (streams, rainfall) - Outflow (streams, subsurface flow) = Consumptive use (pumping for water supply or irrigation, evaporation) $\pm$ Change in the amount of groundwater storage

All water that enters the basin during a certain time period must be accounted for, and will either be stored, evaporated, pumped out, or will leave as surface or subsurface flow.

Under present conditions, as will be demonstrated in Table C, the hydrologic system is probably in balance, there is a minimal amount of pumping, and the amount of groundwater in storage is generally unchanging from year to year. Once increased pumpage occurs, however, any pumping in excess of the long-term amount of natural recharge will remove groundwater from storage and could lead to undesirable overdraft. The perennial yield, or the amount of water which can be pumped year after

year cannot exceed the long-term natural recharge to or discharge from the groundwater reservoir. As shown in Table C, Hydrologic Balance, the amount of additional water which can be pumped without removing groundwater from storage is roughly equivalent to the discharge that can be salvaged. In this case, this potentially salvageable water is represented by effluent groundwater which sustains the high-water table around Princeton and by surface runoff which is rejected as recharge and evaporates or wastes to Half Moon Bay by way of Denniston Creek. The effluent groundwater near Princeton is now being evaporated or consumed by native grasses and other phreatophytes.

Normally, a base period is selected for the hydrologic balance which is representative of long-term average conditions. In this case, however, no long-term base period data for surface water inflow or outflow or for quantities of pumpage are available. Since we believe that the groundwater basin is probably in a steady state condition, this lack of long-term average data may not be a serious problem. As shown in the explanatory notes in Appendix C for the hydrologic inventory that follows, the basic data in some cases are fragmentary, come from several sources, and in some cases must be considered simply as knowledgeable estimates.

TABLE C - HYDROLOGIC INVENTORY

Estimated Items of Water Supply and Disposal

Denniston Creek and Airport Subareas

(Average Yearly Basis)

INFLOW	ACRE FEET * *
Streamflow	9600
Precipitation on Valley Floor	1050
Subsurface Inflow from San Vicente Subarea	350
Subsurface Inflow from Consolidated Rock on Margin of Basin	0
Total	11,000

OUTFLOW	
Stream flow to Half Moon Bay	7300
Consumptive use by natural vegetation and phreatophytes	1250
Subsurface Outflow to Bay	1200
Pumpage for Irrigation	500
Surface water exported from basin by Coastside County Water District	400
Miscellaneous Pumpage (Domestic and Municipal)	350
Total	11,000

Change in Groundwater Storage = 0

* * See Appendix C for explanation of quantities shown.

CONCLUSIONS - AVAILABLE WATER SUPPLY

General

With particular respect to the Denniston Creek Subarea, which is under the direct management of the Coastside County Water District, we can draw several conclusions pertaining to the groundwater storage capacity of the basin, the amount of groundwater which should be available on a long-term average basis, and on alternative schemes of using surface and groundwater water supply sources as would be required in the present and future management program for the Denniston Creek Subarea and the basin as a whole.

Based on the data that we have developed, it appears that the storage capacity of Denniston Creek and San Vicente Subareas of the basin is limited, particularly if only the volume of storage above mean sea level is considered. For the Denniston Creek Subarea, the maximum calculated storage capacity is 1800 acre feet, and the minimum value to mean sea level is approximately 1200 acre feet. In other words, these volumes of groundwater establish an absolute upper limit of groundwater potentially available from the Subarea if no recharge were to occur. In addition to the limited storage capacity, the ability to transmit groundwater from the point of recharge to the point of withdrawal by a well field, as evidenced by the coefficient of transmissibility is also limited. Therefore, the basin is not as responsive to short-term changes in the available recharge as it might be, due to the fine-grained and slowly permeable nature of the aquifer. Similarly, after a period of dry years, groundwater withdrawn from storage by wells may take a long time to replace. The length of such a period is not known, since no historic well hydrographs indicating fluctuations of the water table over a period of time exist.

On the more positive side, as far as the threat of sea water intrusion is concerned, the slowly permeable nature of the aquifer system would not allow such a condition to develop rapidly. Much groundwater would have to be removed from storage with a subsequent considerable lowering of the hydraulic gradient before the wedge of saline water would move a significant distance onshore.

Additional Well Development

Based on our evaluation of hydrologic and geologic subsurface conditions as well as the hydrologic inventory for the area, it is our opinion that an additional 400 acre feet per year could be withdrawn by properly spaced wells in the Denniston Creek and Airport Subarea, without significantly reducing the hydraulic gradient or removing

significant amounts of groundwater from storage. The most likely effect of such development would be to induce additional recharge from Denniston Creek and other surface sources, so that less annual surface water flow would waste to the Bay. As the groundwater basin adjusts to a new equilibrium condition, and this might take many years, some lowering of the water table in the area of effluent groundwater flow in the vicinity of Princeton would occur and this land could be more beneficially used.

If additional groundwater extractions as large as 800 acre feet per year are made, some lowering of the water table gradient to the range of 30 to 35 feet per mile should be expected. Additionally, substantial lowering of the water table in the effluent area near Princeton would result, inducing a change in vegetation types from the existing marsh grass types. Although we do not at this time foresee sea water encroachment as the result of withdrawals on the order of 800 acre feet per year maximum, since a positive seaward water table gradient would still be maintained, the long-term effects of such pumpage are difficult to predict and it may be necessary to reduce this 800 acre foot upper limit if combined pumpage and stream diversion lead to overdraft conditions. It is recommended, therefore, that new wells in excess of the 400 acre feet available surplus be installed in stages, with an evaluation period between stages to determine effects on the water table over several seasons.

Pumpage can be done on a seasonal basis with recharge during the wet season, provided regional surveillance of the water table indicates no long-term lowering effect. Thus, for instance, 8 wells pumping 60 to 75 gallons per minute for 6 months are feasible, as they would result in a net withdrawal of 400 acre feet per year. Proper well location and spacing would be important in this case. Figure 1 shows general locations for 8 additional wells.

In addition to the above new well development, the 500 acre feet of water currently withdrawn for farming, as shown in Table C, can be used for future District supplies if development replaces farming in the Denniston Creek basin.

Any plan to develop additional groundwater supplies over and above the 400 acre feet per year quantity should also consider conjunctive use of both surface and groundwater resources. In other words, the perennial yield and physical limitations of storage and transmissibility of the aquifer system may limit the flexibility of using the groundwater resource entirely. There is no imminent danger in over-development and removing groundwater from storage and exceeding the perennial yield for a period of several years, if it is realized that groundwater removed from storage eventually must be replaced to assure that undesirable conditions such as sea water intrusion do not occur. Groundwater reservoirs can be utilized similar to a surface water reservoir -- drawndown and replenished -- but the limitations must be realized in any management scheme. This is particularly true of the basin investigated where the transmissibility is low and the time to replace significant quantities of groundwater removed from storage may be great.

We have considered the use of the existing District test wells for recharge of surplus surface water to the groundwater basin. However, the low aquifer transmissibility makes this method unfeasible, in our opinion.

RECOMMENDATIONS

Based on the foregoing conclusions, we recommend that the District consider the following in a management plan to develop additional short-term and long-term water supplies for the Denniston Creek and San Vicente Subareas and adjacent portions of the groundwater basin.

1. As noted, an additional 400 acre feet per year (six to eight wells pumping 60 to 75 gallons per minute for six months per year) can be extracted from the Denniston Creek and Airport Subareas to meet immediate future needs without affecting the hydrologic balance or inviting sea water intrusion. These wells should be spaced out over the portion of the basin, where the aquifer is thickest, as shown on Figure 1. One of the District's three existing test wells on Denniston Creek should be pumped, also, as part of the additional groundwater extraction. Wells should be drilled to bedrock elevation as shown on the Bedrock Contour Map (Figure 1) and should be spaced a minimum distance of 400 feet to minimize interference. Additional wells, pumping up to a maximum total of 800 acre feet per year, are likely feasible, providing surveillance of coastal water quality and overall basin water table conditions is initiated. The water quality surveillance should consist of three or four perimeter monitoring wells along Half Moon Bay in which periodic chloride concentration determinations can be made.

2. Storage capacity of the San Vicente Subarea is small and no further development by wells is recommended in this area. This subarea is in a critical position, because subsurface recharge from San Vicente Creek passes through it into the Airport Subarea. Any significant reduction of the groundwater in storage in the San Vicente Subarea would reduce proportionately the underflow to the adjacent basin.

3. As part of a management program, in order to obtain the best conjunctive use of surface and groundwater, the possibility of further diversion of surface flows of San Vicente Creek and Denniston Creek should be evaluated. Since surface flow is and will continue to be rejected by the groundwater basin even under conditions of further well development, it may be possible to divert such flow upstream from the basin through one or more small dams

or infiltration galleries installed in the alluvial materials of the stream bed. Upstream diversions utilizing surplus stream runoff would not affect the construction of the proposed wells.

As a planning yardstick, surface water diverted from Denniston Creek may be substituted for groundwater pumpage on a 4:1 ratio, within the maximum constraints previously discussed. In other words, 4 acre feet of surface water can be taken for each acre foot of subsurface water to have an expected equivalent affect on the groundwater basin. This makes surface diversion highly efficient compared to subsurface withdrawal.

4. Long-term basic water resource data for the area are needed if the basin is to be managed to its full potential. The hydrologic balance presented with this report is only an attempt at providing an insight into the items of water supply and disposal. To accurately assess the effect of any basin operation scheme over a long or short term period, permanent stream gauges on San Vicente and Denniston Creeks should be established. Periodic seasonal measurements on groundwater levels in observation wells established in this investigation should be made, to monitor any changes in groundwater storage. Finally, as more basic data becomes available on elements of the hydrologic equation, a mathematical model of the basin should be constructed to provide a working tool in assessing the effects of various basin operation schemes on the behavior of the ground and surface water regimen.

* * * * * * *

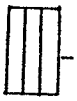
APPENDIX A - FIELD INVESTIGATION

The field investigation consisted of a surface reconnaissance for geologic mapping and well inventory purposes, and a subsurface exploration program using a truck-mounted rotary wash drill rig. Eleven exploratory borings were drilled within the Denniston Creek and San Vicente Creek basins between January 25th and February 27th, 1974. The locations of the exploratory borings, which extended to a maximum depth of 140.0 feet, are shown on the Boring Location Plan, Figure 1. The soils encountered in the borings were continuously logged in the field by our representative and described in accordance with the Unified Soil Classification System ASTMD-2487. The logs of the borings as well as the key for the classification of this soil are included as part of this appendix.

Representative soil samples were obtained from the exploratory borings at selected depths appropriate to the soil investigation. All samples were returned to our laboratory for classification and testing.

Standard penetration resistance blow counts were obtained by dropping a 140 pound hammer through a 30 inch free fall. The 2 inch O.D. split spoon sampler was driven 18 inches and the number of blows recorded per each 6 inch penetration or for any penetration less than 6 inches if high resistance was encountered. Undisturbed samples of the bedrock material were recovered in a thin wall Shelby tube using the pitcher barrel sampler. The type of sampler used to obtain the samples is symbolized below and is designated on the boring logs at the appropriate sample depths.

-Standard Split Spoon Sampler



-Pitcher Barrel Sampler

The upper 20 feet of all borings was cased with 2 inch diameter p.v.c. piezometer pipe, except Boring 1 in which 120 feet of casing was used. The piezometers were backfilled with pea gravel and left in place for future monitoring of groundwater levels and water quality.

Boring logs show our interpretation of the subsurface conditions on the dates and at the locations indicated; it is not warranted that they are representative of subsurface conditions at other locations and times. Also the stratification lines of the logs represent the approximate boundary between soil types and the transition may be gradual.

Boring elevations were taken from the County of San Mateo topographic base map having 10 feet contour intervals.

Field magnetometer traverses were performed across the fault located approximately 1,000 feet east of Highway 1.

Field pumping test was performed in the District's Well No. 1 located on Denniston Creek to determine the aquifer permeability and safe yield. Exploratory Boring 1 served as an observation well for this test. Details of the methods used and results have been presented in the report. Drawdown and recovery data from this test are presented in this appendix.

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS — MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVEL WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS — MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT IS LESS THAN 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS — LIQUID LIMIT IS GREATER THAN 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

DEFINITION OF TERMS

U.S. STANDARD SERIES SIEVE					CLEAR SQUARE SIEVE OPENINGS			
200	40	10	4	3/4"	3"	12"		
SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS	
	FINE	MEDIUM	COARSE	FINE	COARSE			

GRAIN SIZES

SANDS, GRAVELS AND NON-PLASTIC SILTS	BLOWS/FOOT†
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

RELATIVE DENSITY

CLAYS AND PLASTIC SILTS	STRENGTH‡	BLOWS/FOOT†
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32

CONSISTENCY

†Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1-3/8 inch I.D.) split spoon (ASTM D-1586).

‡Unconfined compressive strength in tons/sq. ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation.

Lowney-Kaldveer Associates

Foundation / Soil / Geological Engineers

KEY TO EXPLORATORY BORING LOGS
Unified Soil Classification System (ASTM D-2487)

DENNISTON CREEK GROUNDWATER INVESTIGATIO
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	
349-2	March, 1974	Figure A-1

DRILL RIG Rotary Wash	SURFACE ELEVATION 50 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 10.5 feet	BORING DIAMETER 6 inches	DATE DRILLED 1/25/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SANDY CLAY		dark brown to black	firm	CL	1				*	
					2					
					3					
					4					
		gray-brown			5					
					6					
					7					
					8					
SILTY SAND, with lenses of red-brown silt, (decomposed granite sands)		yellow-brown	medium dense	SM	9					
					10		▽	3/18/74		
Percent Passing #200 Sieve = 58					11		16	23		
					12					
					13					
					14					
					15					
					16					
					17					
					18					
					19					
					20					

* Drilling rate faster than 1/4 min/ft from 0 to 35 feet

Lawney-Hultgren Associates

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	1

DRILL RIG	Rotary Wash	SURFACE ELEVATION	50 feet	LOGGED BY	R.D.R.
DEPTH TO GROUNDWATER	10.5 feet	BORING DIAMETER	6 inches	DATE DRILLED	1/25/74

DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SILTY SAND, (continued)		yellow-brown	medium dense	SM	21		27	14		
					22					
					23					
					24					
					25					
					26					
					27					
					28					
					29					
(grading clayey at 30.0 feet)		gray-brown	dense		30					
					31		30			
					32					
					33					
					34					
(less clay at 35.0 feet)		red-brown			35				.25	
					36				.25	
					37				.25	
					38				.25	
					39				.25	
SANDY CLAY		green-gray	very stiff	CL	40				.25	

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DENNISTON CREEK GROUNDWATER INVESTIGATI
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	1

DRILL RIG Rotary Wash	SURFACE ELEVATION 50 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 10.5 feet	BORING DIAMETER 6 inches	DATE DRILLED 1/25/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SANDY CLAY,(cont)		green-gray	very stiff	CL	41					
					42		18			
					43					
					44					
					45				.30	
					46				.50	
					47				.75	
					48				.50	
					49					
					50					
					51					
					52					
		blue-gray			53					
(with lenses of fine grained silty sand at 54.0 feet)					54		38/4"			
					55					
					56				.25	
					57				.25	
					58				.25	
					59				.25	
					60				.25	

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DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	1

DRILL RIG	Rotary Wash	SURFACE ELEVATION	50 feet	LOGGED BY	R.D.R.
DEPTH TO GROUNDWATER	10.5 feet	BORING DIAMETER	6 inches	DATE DRILLED	1/25/74

DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SANDY CLAY, (continued)		blue-gray	very stiff	CL	61				.25	
					62				.25	
SILTY SAND, fine, uniform		blue-gray	very dense	SP-SM	63				.25	
					64					
					65					
					66				.10	
					67				.10	
					68				.20	
					69				.20	
					70				.10	
					71				.10	
					72				.10	
					73				.10	
					74				.10	
Percent Passing #200 Sieve = 12					75		90			
					76				.10	
					77				.10	
					78				.10	
					79				.10	
SANDY SILTSTONE, with shells, fine uniform sand (Purisima Formation)		dark gray	low hardness		80				1.0	
									1.0	

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DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	1

DRILL RIG	Rotary Wash	SURFACE ELEVATION	50 feet	LOGGED BY	R.D.R.
DEPTH TO GROUNDWATER	10.5 feet	BORING DIAMETER	6 inches	DATE DRILLED	1/25/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
SANDY SILTSTONE, (cont)		dark gray	low hardness		81				2.0	
					82				2.0	
					83				2.0	
					84				2.0	
					85		64/6"		2.0	
					86				2.0	
					87				2.0	
					88				2.5	
					89				2.0	
					90				2.0	
					91				1.5	
					92				1.5	
					93				1.5	
					94				1.5	
					95					
Percent Passing #200 Sieve=47 Dry Density = 114 pcf					96			18		
					97					
					98				1.5	
					99				1.5	
					101				1.5	
									1.5	

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DENNISTON CREEK GROUNDWATER INVESTIGATIC
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	1

DRILL RIG	Rotary Wash	SURFACE ELEVATION	50 feet	LOGGED BY	R.D.R.
DEPTH TO GROUNDWATER	10.5 feet	BORING DIAMETER	6 inches	DATE DRILLED	1/25/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate 1 min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SANDY SILTSTONE, (cont)		dark gray	low hardness		101				1.5	
					102				1.5	
					103				1.5	
					104				1.5	
					105				2.5	
					106				2.5	
					107				1.0	
					108				1.0	
					109				2.0	
					110				2.0	
					111					
					112					
					113					
					114					
					115				2.0	
					116				3.0	
					117					
					118				1.5	
					119				1.5	
					120				2.0	

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DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	1

DRILL RIG Rotary Wash	SURFACE ELEVATION 50 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 10.5 feet	BORING DIAMETER 6 inches	DATE DRILLED 1/25/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SANDY SILTSTONE, (continued)		dark gray	low hardness		121				2.0	
					122					
					123					
					124					
					125				1.25	
					126				1.25	
					127				1.25	
					128				1.25	
					129				3.0	
					130				2.5	
					131				2.0	
					132				2.0	
					133				2.0	
					134				2.0	
					135				2.0	
					136				2.0	
					137				2.0	
					138				2.0	
					139			15		
Bottom of Boring = 140.0 feet					140					

Note: 120 feet of 2 inch diameter PVC piezometer pipe placed in boring and pea gravel placed around the sides of pipe.

Dry Density = 117 pcf
Percent Passing #200 Sieve = 41

Sand content decreasing at 138.0 feet

Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

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DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	1

DRILL RIG Rotary Wash	SURFACE ELEVATION 39 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 2.5 feet	BORING DIAMETER 6 inches	DATE DRILLED 1/29/74 .

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SANDY SILT		dark brown-black	firm	ML	1				*	
					2		▽ 3/6/74			
					3					
					4					
					5					
SILTY SAND, fine grained		yellow-brown	medium dense	SM	6					
					7					
					8					
					9					
SAND, coarse grained with lense of red-brown silt, (decomposed granite sand)		yellow-brown	medium dense	SP	10					
					11		28			
					12					
					13					
					14					
					15					
					16					
CLAYEY SAND, coarse grained, with mica		brown	medium dense	SC	17					
					18					
					19					
					20					

* Drilling rate faster than 1/4 min./ft. from 0 to 32 feet

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DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	2

DRILL RIG Rotary Wash	SURFACE ELEVATION 39 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 2.5 feet	BORING DIAMETER 4 inches	DATE DRILLED 1/29/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
CLAYEY SAND (continued)		brown	medium dense	SC	21 22 23 24 25 26 27 28 29					
SILTY SAND, coarse grained, with mica, (decomposed granite sand) Percent Passing #200 Sieve = 13		orange-brown	very dense	SM-SP	30 31 32 33 34 35 36 37 38		78		1.5 1.5 1.0 1.0 1.0 1.0	
SILTY CLAY, with trace of sand and trace of organic material		blue-gray	very stiff	CL-CH	39 40				0.30 0.30	

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DENNISTON CREEK GROUNDWATER INVESTIGATIO
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	2

DRILL RIG Rotary Wash	SURFACE ELEVATION 37 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 2.5 feet	BORING DIAMETER 4 inches	DATE DRILLED 1/[illegible]/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH
SILTY CLAY, (continued)		blue-gray	very stiff	CL-CH	41		22	23	.30	
Percent Passing #200 Sieve = 69					42					
					43				1.0	
					44				.50	
					45				1.25	
SILTY SAND, fine grained		gray	very dense	SM	46				.75	
					47				.75	
					48				.75	
					49				.75	
					50				.75	
					51		99			
					52					
					53				0.5	
					54				0.5	
					55				0.3	
					56				0.4	
					57				0.6	
					58				0.6	
					59				0.5	
					60				0.5	

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DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	2

DRILL RIG Rotary Wash	SURFACE ELEVATION 39 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 2.5 feet	BORING DIAMETER 4 inches	DATE DRILLED 1/25/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH
SILTY SAND, fine grained		gray	very dense	SM	61					
					62					
					63				0.25	
					64				0.25	
					65				0.20	
					66				0.40	
					67				0.5	
					68				.75	
SANDY SILTSTONE, with shells, fine grained sand (Purisima Formation)		gray-black	low-hardness		69				1.0	
					70		84/6"		1.0	
					71					
					72				1.3	
					73				1.0	
					74				.7	
					75				1.2	
Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.					76				1.0	
					77				1.25	
					78		110/6"		.75	
Bottom of Boring = 78.5 feet					79					
					80					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	2

DRILL RIG	Rotary Wash	SURFACE ELEVATION	50 feet	LOGGED BY	E.R.B.
DEPTH TO GROUNDWATER	1.3 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/27/74

DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	% WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
CLAY		black-brown		CL	1		▽ 3/6/74 3/18/74			
SILTY SAND, coarse grained, (decomposed granite sand)		brown-orange	medium dense	SM	2 3 4					
(with clay pockets at 6.0 feet)		red-brown		(CL)	5 6 7 8 9		19			
					10 11 12 13 14		20			
(with clay pocket at 16.0 feet)		gray	dense	(CL)	15 16 17 18 19 20		42			

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	3

DRILL RIG	Rotary Wash	SURFACE ELEVATION	50 feet	LOGGED BY	E.R.B.
DEPTH TO GROUNDWATER	1.3 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/27/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
SILTY SAND, (continued)		gray	dense	SM	21		45			
					22					
					23					
					24					
			very dense		25					
					26		98			
					27					
					28					
					29					
					30					
					31		51			
					32					
					33					
					34					
		gray			35					
SANDY CLAY		blue-gray	very stiff	CL	36		32	17		
					37					
					38					
					39					
					40					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATIC
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	3

DRILL RIG	Rotary Wash	SURFACE ELEVATION	50 feet	LOGGED BY	E.R.B.
DEPTH TO GROUNDWATER	1.3 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/27/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SAND, coarse-medium grained, with clay lenses		blue-gray	very dense	SP-SM	41		66			
(clay lense at 43.5 to 44.5 feet)					42					
					43					
					44					
					45					
					46					
					47					
					48					
					49					
					50					
					51		52			
					52					
					53					
					54					
					55					
					56					
					57					
SILTY SAND, coarse - medium grained, with clay lenses		brown-orange	very dense	SM	58					
					59					
					60					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATIC
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	3

DRILL RIG Rotary Wash	SURFACE ELEVATION 50 feet	LOGGED BY E.R.B.
DEPTH TO GROUNDWATER 1.3 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/27/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SILTY SAND, (continued)		brown-orange	very dense		61		50/4"			
					62					
					63					
					64					
					65					
					66					
					67					
					68					
					69					
SAND, medium to fine grained, uniform		gray-brown	very dense	SP	70		50/4"			
					71					
					72					
					73					
					74					
					75					
					76					
SANDY SILTSTONE, fine grained sand, with shells (Purisima Formation)		gray-blue	low hardness		77					
					78					
					79					
					80		50/2"			

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATI
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	3

DRILL RIG	Rotary Wash	SURFACE ELEVATION	50 feet	LOGGED BY	E.R.B.
DEPTH TO GROUNDWATER	1.3 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/27/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SANDY SILTSTONE, (continued)		gray-blue	low hardness		81					
					82					
					83					
					84					
					85					
					86				1.15	
					87				1.20	
					88					
					89				1.20	
					90					
(with shells, cemented siltstone at 91.5 to 92.5 feet)					91			18		
					92					
Percent Passing #200 Sieve = 29 Dry Density = 112 pcf					93				45 sec/ft	
					94					
					95				1.05 sec/	
					96					
					97					
Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.					98					
					99					
Bottom of Boring = 100.0 feet					100					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGAT
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April 1974	3

DRILL RIG Rotary Wash	SURFACE ELEVATION 70 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 2.3 feet	BORING DIAMETER 4 inches	DATE DRILLED 1/30/7

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED
SANDY SILT		dark brown	stiff	ML	1					
					2		▽ 3/6/74			
					3					
					4		▽ 3/18/74			
CLAYEY SAND, with fine gravel		brown	loose	SC	5					
					6					
					7					
					8					
					9					
					10					
					11		9			
					12					
					13					
					14					
					15					
					16					
					17					
					18					
CLAYEY SAND, with gravel		brown	medium dense	SC	19					
					20					

DESCRIPTION AND CLASSIFICATION

Lawney-Haldeman Associates

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATI
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	4

DRILL RIG Rotary Wash	SURFACE ELEVATION 70 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 2.3 feet	BORING DIAMETER 6 inches	DATE DRILLED 1/30/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED
CLAYEY SAND, (continued)		brown	medium dense	SC	21		21			
					22					
					23					
					24					
					25					
					26					
					27					
					28					
					29					
clay content decreasing at 30 feet			dense		30					
					31		49			
					32					
					33					
					34					
					35					
					36					
					37					
					38					
					39					
					40					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGAT
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	4

DRILL RIG	Rotary Wash	SURFACE ELEVATION	70 feet	LOGGED BY	R.D.R.
DEPTH TO GROUNDWATER	2.3 feet	BORING DIAMETER	4 inches	DATE DRILLED	1/30/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
CLAYEY SAND, (continued)		brown	dense	SC	41		80			
					42					
					43					
					44					
					45					
					46					
					47					
					48					
					49					
SILTY SAND		blue-gray	very dense	SM	50					
					51					
					52					
					53					
					54					
					55					
					56					
					57					
					58					
					59					
					60					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATIC
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	4

DRILL RIG	Rotary Wash	SURFACE ELEVATION	70 feet	LOGGED BY	R.D.R.
DEPTH TO GROUNDWATER	2.3 feet	BORING DIAMETER	6 inches	DATE DRILLED	1/30/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED
SILTY SAND, (continued)		blue-gray	very dense	SM	61		71			
					62					
					63					
					64					
					65					
					66					
					67					
					68					
					69					
					70					
					71		76			
					72					
					73					
					74					
					75					
					76					
					77					
					78					
					79					
					80					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATIC
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	4

DRILL RIG	Rotary Wash	SURFACE ELEVATION	70 feet	LOGGED BY	R.D.R.
DEPTH TO GROUNDWATER	2.3 feet	BORING DIAMETER	6 inches	DATE DRILLED	1/30/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SILTY SAND, (continued) silt content decreasing with depth		red-brown	very dense	SM SP	81		64/6"			
					82					
					83					
					84					
					85					
					86					
					87					
					88					
					89					
		brown			90					
					91		94			
					92					
					93					
					94					
					95					
					96					
					97					
					98					
					99					
					100		82			

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATIC
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	4

DRILL RIG Rotary Wash	SURFACE ELEVATION 70 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 2.3 feet	BORING DIAMETER 6 inches	DATE DRILLED 1/30/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SILTY SAND, (continued)		brown	very dense	SM-SP	101					
					102					
					103					
					104					
CLAY STONE, with shells (Purisima Formation)		dark blue	low hardness		105					
					106					
					107					
					108					
					109					
					110					
Bottom of Boring = 110.3 feet					111					
					112					
					113					
					114					
					115					
					116					
					117					
					118					
					119					
					120					

Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	4

DRILL RIG Rotary Wash	SURFACE ELEVATION 64 feet	LOGGED BY E.R.B.
DEPTH TO GROUNDWATER 2 feet at time of drilling	BORING DIAMETER 6 inches	DATE DRILLED 2/21/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
CLAY		black	CL	CL	1			▽ 3/5/74 3/18/74		
					2		▽ at time of drilling			
SAND, coarse grained		brown	loose	SP	3					
					4					
					5					
					6		6			
ORGANIC SILT, with roots and wood fragments		black	soft	OL	7					
					8					
					9					
					10					
Dry Density = 63 pcf					11		2	89		
					12					
					13					
Sand lense at 14.5 feet					14					
					15					
SILTY CLAY, with gravel		brown-black	medium stiff	CL	16		7	27		
					17					
					18					
					19					
					20					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	5

DRILL RIG Rotary Wash	SURFACE ELEVATION 64 feet	LOGGED BY E.R.B.
DEPTH TO GROUNDWATER 2 feet at time of drilling	BORING DIAMETER 6 inches	DATE DRILLED 3/21/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SILTY SAND, fine grained		dark gray	medium dense	SM	21		24			
					22					
					23					
COARSE SAND, with gravel		blue-gray	dense	SP	24					
					25		46/5"			
					26					
					27					
					28					
					29					
					30					
					31		98			
					32					
					33					
					34					
GRANITE, decomposed, little fractured		black and with gray	mod. hard		35					
					36				4	
Bottom of Boring = 36.0 feet					37					
Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.					38					
					39					
					40					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	5

DRILL RIG	Rotary Wash	SURFACE ELEVATION	124 feet	LOGGED BY	E.R.B.
DEPTH TO GROUNDWATER	0.0 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/21/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
CLAYEY SILT		black	soft	ML	1			3/6/74		
CLAYEY SAND		brown	loose	SC	2			3/18/74		
					3					
SANDY CLAY		black	soft	SC	4					
					5	X				
					6					
		blue-gray			7					
					8					
COARSE SAND, with gravel, (decomposed granite sand)		gray-black	very dense	SP	9					
					10		40/6"			
					11					
					12					
					13					
					14					
Percent Passing #200 Sieve = 6		light brown			15		86/6"			
					16					
					17					
					18					
					19					
					20		96/6"		27	

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATIO
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	6

DRILL RIG Rotary Wash	SURFACE ELEVATION 124 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 0.0 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/21/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SANDY CLAY, coarse grained granite sand		blue-black	very stiff	CL	21					
					22					
					23					
					24					
					25					
					26					
					27					
					28					
					29					
					30		108/3" 18			
Percent Passing #200 Sieve = 39					31					
Grading harder					32					
decomposed bedrock at 35 feet					33					
					34					
					35					
Bottom of Boring = 35.0					36					
					37					
Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.					38					
					39					
					40					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	6

DRILL RIG	Rotary Wash	SURFACE ELEVATION	62 Feet	LOGGED BY	R.D.B
DEPTH TO GROUNDWATER	0.0 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/22/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
CLAY		black		CL	1			3/6/74 3/18/74		
CLAYEY SAND, coarse granite sand		brown-orange	loose	SC	2 3 4 5 6 7 8		9			
SILTY SAND, coarse, (decomposed granite sand)		brown	dense	SM	9 10 11 12 13 14		34			
			very dense		15 16 17 18 19 20		53			

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATI
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-1	April, 1974	7

DRILL RIG Rotary Wash	SURFACE ELEVATION 62 feet	LOGGED BY E.R.B.
DEPTH TO GROUNDWATER 0.0 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/22/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH
SILTY SAND, (continued)		brown	dense	SM	21		31			
CLAYEY SAND, coarse gravel		blue-gray	dense	SC	22 23 24 25 26		36			
SILTY SAND, medium grained, some clay fines		blue-gray	dense	SM	27 28 29 30 31		54			
SAND, coarse grained, with gravel		brown	very dense	SP	32 33 34 35		79			
grading fine at 35.0 feet, uniform		blue-gray			36 37 38 39					
Percent Passing #200 Sieve = 10				SP-SM	40					

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DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	7

DRILL RIG Rotary Wash	SURFACE ELEVATION 62 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 0.0 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/22/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH (KSF)
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SAND, (Continued)		blue-gray	very dense	SP-SM	41		78			
					42					
					43					
					44					
					45					
					46		72			
					47					
					48					
					49					
SAND, fine grained		Blue	Very dense	SP	50					
					51		83			
					52					
					53					
					54					
					55					
					56					
					57					
					58					
					59					
					60		90			

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	7

DRILL RIG Rotary Wash	SURFACE ELEVATION 62 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 0.0 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/22/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH
SAND, (continued)		blue	very dense	SP	61		90			
SANDY SILTSTONE, with shells, deeply weathered (Purisima Formation)		gray-blue	low hardness		62					
					63				0.5	
					64				2.15	
					65				1.55	
Percent Passing #200 Sieve = 45 Dry Density = 123 pcf					66			13		
Bottom of Boring = 66.0 feet					67					
					68					
					69					
					70					
					71					
					72					
Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.					73					
					74					
					75					
					76					
					77					
					78					
					79					
					80					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATIC
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	7

DRILL RIG Rotary Wash	SURFACE ELEVATION 55 feet	LOGGED BY E.R.B.
DEPTH TO GROUNDWATER 1.5 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/25/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
CLAY		black		CL	1		▽ 3/6/74			
					2					
CLAYEY SAND, coarse with lenses of sandy clay and clean sand		orange-brown	medium dense	SC	3					
					4					
					5					
					6		13			
					7					
					8					
					9					
					10					
					11		19			
					12					
					13					
					14					
					15					
SAND, coarse grained		red-brown	medium dense	SP	16		13			
					17					
					18					
					19					
					20					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	8

DRILL RIG	Rotary Wash	SURFACE ELEVATION	55 feet	LOGGED BY	E.R.B.
DEPTH TO GROUNDWATER	1.5 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/25/74

DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH
SAND, (continued)		red-brown	medium dense	SP	21		46			
					22					
					23					
					24					
grading silty at 25.0 feet				SP-SM	25					
					26		45			
					27					
SANDY CLAY, coarse grained sand lenses		blue-gray	very stiff	CL	28					
					29					
					30					
					31		60			
					32					
					33					
					34					
					35					
					36					
					37					
					38					
					39					
					40					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING

DRILL RIG	Rotary Wash	SURFACE ELEVATION	55 feet	LOGGED BY	R.D.R.
DEPTH TO GROUNDWATER	1.5 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/25/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate 1 min/ft	UNCONFINED COMPRESSIVE STRENGTH
SANDY CLAY, (continued)		blue-gray	hard	CL	41		89			
					42					
					43					
					44					
					45					
					46					
					47					
SAND, medium to fine grained		brown	very dense	SP-SM	48					
					49					
					50					
					51		92			
					52					
					53					
					54					
					55					
					56					
					57					
					58					
					59					
					60		96			

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATIO
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	8

DRILL RIG Rotary Wash	SURFACE ELEVATION 55 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 1.5 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/25/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SAND, (continued)		brown	very dense	SP-SM	61		96			
					62					
		blue-gray			63					
					64					
					65					
					66					
					67					
					68					
					69					
grading silty at 70.0 feet				(SM)	70					
					71		81			
					72				1.15	
					73				1.15	
					74					
					75					
SANDY SILTSTONE, weakly cemented, little fractured, a few shells (Purisima Formation)		gray-black	low hardness		76					
					77					
					78					
					79					
					80		56/4"		1.15	

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	8

DRILL RIG	Rotary Wash	SURFACE ELEVATION	55 feet	LOGGED BY	E.R.B.
DEPTH TO GROUNDWATER	1.5 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/25/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
SANDY SILTSTONE, (continued)		gray-black	low hardness		81					
					82					
					83					
					84					
					85					
					86				1.15	
					87					
					88					
					89					
					90					
					91		50/2"			
Bottom of Boring = 91.0 feet					92					
					93					
					94					
Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.					95					
					96					
					97					
					98					
					99					
					100					

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DENNISTON CREEK GROUNDWATER INVESTIGATIC
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	8

DRILL RIG Rotary Wash	SURFACE ELEVATION 36 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 1.5 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/25/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH
SANDY CLAY, coarse grained sand, grading to clayey sand		orange-brown	stiff	CL	1–9			▽ 3/6/74		
CLAYEY SAND, coarse grained		orange-brown	medium dense	SC	10–14		10			
			dense		15–20		13 37			

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DENNISTON CREEK GROUNDWATER INVESTIGATIO
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	9

DRILL RIG Rotary Wash	SURFACE ELEVATION 36 feet	LOGGED BY E.R.
DEPTH TO GROUNDWATER 1.5 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/2

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE					
CLAYEY SAND, (continued)		orange-brown	medium dense	SC	21		40		
					22				
					23				
					24				
SILTY SAND		orange-brown	very dense	SM	25				
					26		56		
					27				
					28				
					29				
SAND, coarse grained		gray	dense	SP	30				
					31		32		
					32				
					33				
					34				
silty sand lense at 35.0 feet					35				
grading fine grained below 35.0 feet					36		40		
					37				
					38				
					39				
					40				

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGA
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	9

DRILL RIG Rotary Wash	SURFACE ELEVATION 36 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 1.5 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/25/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH
SAND		gray	dense	SP	41					
					42					
					43					
					44					
		blue-gray	very dense		45					
					46		62			
					47					
					48					
					49					
					50					
					51					
					52					
					53					
					54					
					55					
					56		87			
					57					
					58					
					59					
					60					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	9

DRILL RIG	Rotary Wash	SURFACE ELEVATION	36 feet	LOGGED BY	R.D.R.
DEPTH TO GROUNDWATER	1.5 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/25/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
SAND, (continued)		blue-gray	very dense	SP	61					
					62					
					63					
					64					
					65					
SANDY SILTSTONE, with shells, fine grained sand (Purisima Formation)		dark gray	low hardness		66		50/6"		1.1	
					67				1.3	
					68				1.3	
					69				1.2	
					70					
					71					
					72				1.3	
					73					
					74				1.0	
					75					
					76				1.5	
					77					
					78				1.5	
					79					
					80		50/2"			
Bottom of Boring = 80.5 '										

Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Percent Passing #200 Sieve = 39

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATIC
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	9

DRILL RIG	Rotary Wash	SURFACE ELEVATION	27 feet	LOGGED BY	E.R.B.
DEPTH TO GROUNDWATER	3.5 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/22/

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft
SANDY CLAY, with coarse granitic sand		black	firm	CL	1			3/6/74	
					2				
		brown			3			▽ 3/18/74	
					4				
			stiff		5				
					6		14		
sand content increasing with depth					7				
					8				
					9				
					10				
					11		16		
					12				
					13				
					14				
					15				
SILTY SAND, minor amount of clay		brown	very dense	SM	16		52		
					17				
					18				
					19				
					20				

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATI
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	10

DRILL RIG	Rotary Wash	SURFACE ELEVATION	27 feet	LOGGED BY	E.R.B.
DEPTH TO GROUNDWATER	3.5 feet	BORING DIAMETER	6 inches	DATE DRILLED	2/23/7

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft
SILTY SAND, (continued)		brown	dense	SM	21		40		
					22				
					23				
					24				
					25				
no clay below 25.0 feet					26		90		
fine uniform sand		blue-gray	very dense	SM	27				
					28				
					29				
					30		98		
					31				
					32				
					33				
					34				
					35		59		
					36				
					37				
					38				
					39				
					40				

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGA
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	10

DRILL RIG Rotary Wash	SURFACE ELEVATION 27 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 3.5 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/23/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE
SILTY SAND, (continued)		blue-gray	very dense	SM	41		92			
					42					
					43					
					44					
					45		98			
					46					
					47					
					48					
					49					
					50		96			
					51					
					52					
					53					
					54					
					55					
					56					
					57					
SILTY SANDSTONE, with shells (Purisima Formation)		blue-black	low hardness		58					
					59				1/3	
					60		53/1"			

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATI(
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	10

DRILL RIG Rotary Wash	SURFACE ELEVATION 27 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER 3.5 feet	BORING DIAMETER 6 inches	DATE DRILLED 2/22/74

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH
SILTY SANDSTONE, (continued) Dry Density = 113 pcf		blue-black	low hardness		61 62 63			15		
Bottom of Boring = 63.0 feet					64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80					

Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	10

DRILL RIG	Rotary Wash	SURFACE ELEVATION	145 feet	LOGGED BY	R.D.R.
DEPTH TO GROUNDWATER	Not established	BORING DIAMETER	6 inches	DATE DRILLED	2/21/7

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft
SANDY SILT, with organic material		black	soft	ML	1–9		3		
SILTY SAND, coarse grained granitic sand with trace of clay		orange-brown	medium dense	SM	10–14		18		
			dense		15–18		34		
			loose		19–20				

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGA
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	11

DRILL RIG	Rotary Wash	SURFACE ELEVATION	145 feet	LOGGED BY	R.D.R.
DEPTH TO GROUNDWATER	Not established	BORING DIAMETER	6 inches	DATE DRILLED	2/21/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED COMPRESSIVE STRENGTH
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SILTY SAND, (continued)		orange-brown	medium dense	SM	21		6			
					22					
					23					
SAND, coarse grained		blue grey	medium dense	SP	24					
					25					
grading finer with depth					26		14			
					27					
					28					
					29					
CLAYEY SAND		blue	medium dense	SC	30					
					31		23			
					32					
					33					
					34					
					35					
					36		29			
					37					
					38					
					39					
					40					

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EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	11

DRILL RIG Rotary Wash	SURFACE ELEVATION 145 feet	LOGGED BY R.D.R.
DEPTH TO GROUNDWATER Not established	BORING DIAMETER 6 inches	DATE DRILLED 2/21/74

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	Drilling Rate min/ft	UNCONFINED
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
CLAYEY SAND, (continued)		blue	Very dense	SC	41		50/6"			
					42					
GRANITE, highly weathered and decomposed		gray-blue	low hardness		43					
					44					
					45					
					46					
					47					
					48					
					49					
					50					
					51				2	
					52					
					53					
					54					
					55					
moderately weathered, little fractured					56				4	
					57					
					58					
					59					
					60					

Note: The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Bottom of Boring = 61.0'

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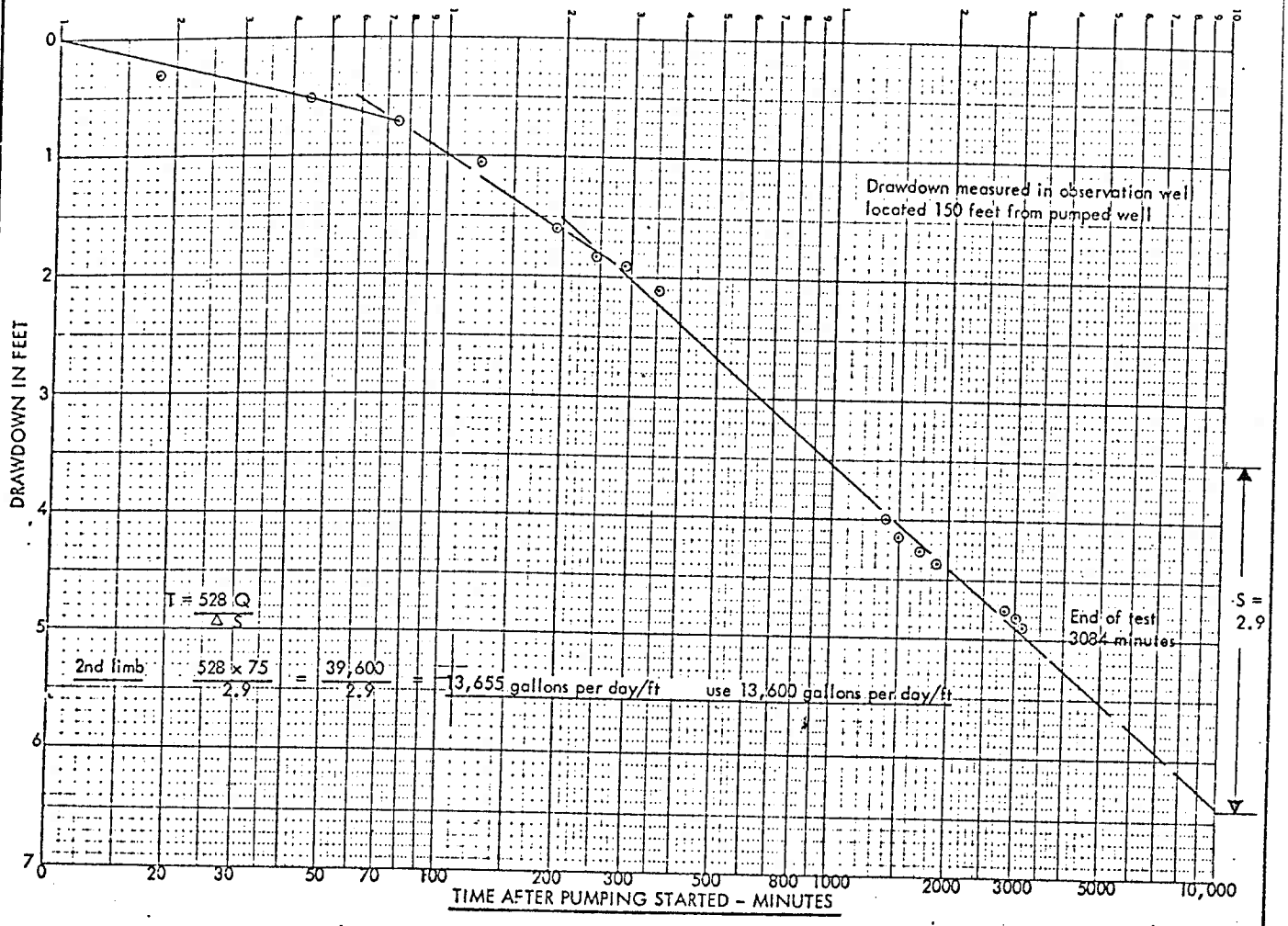
EXPLORATORY BORING LOG

DENNISTON CREEK GROUNDWATER INVESTIGATIC
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	BORING NO.
349-2	April, 1974	11



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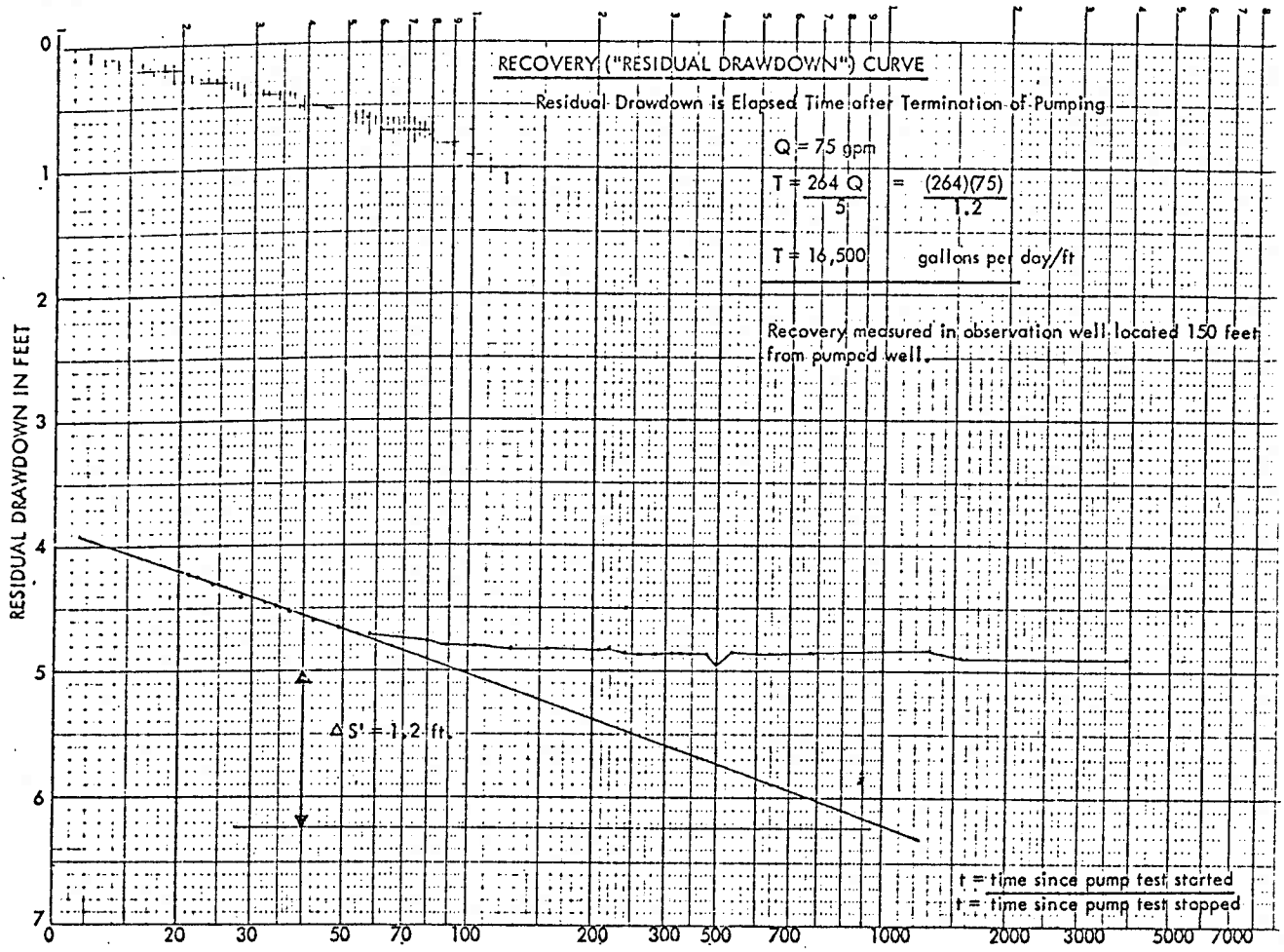
PUMPING TEST - (DRAWDOWN VS. TIME)

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
349-2	April, 1974	A-2



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PUMPING TEST - (RECOVERY VS. TIME)

DENNISTON CREEK GROUNDWATER INVESTIG.
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	FIGURE
349-2	April, 1974	A-3

APPENDIX B - LABORATORY TESTING

The laboratory testing program was directed towards a quantitative and qualitative evaluation of the physical and mechanical properties of the soils underlying the site.

Natural water content was determined on seven samples of the materials recovered from the borings. The water contents are recorded on the boring logs at the appropriate sample depths.

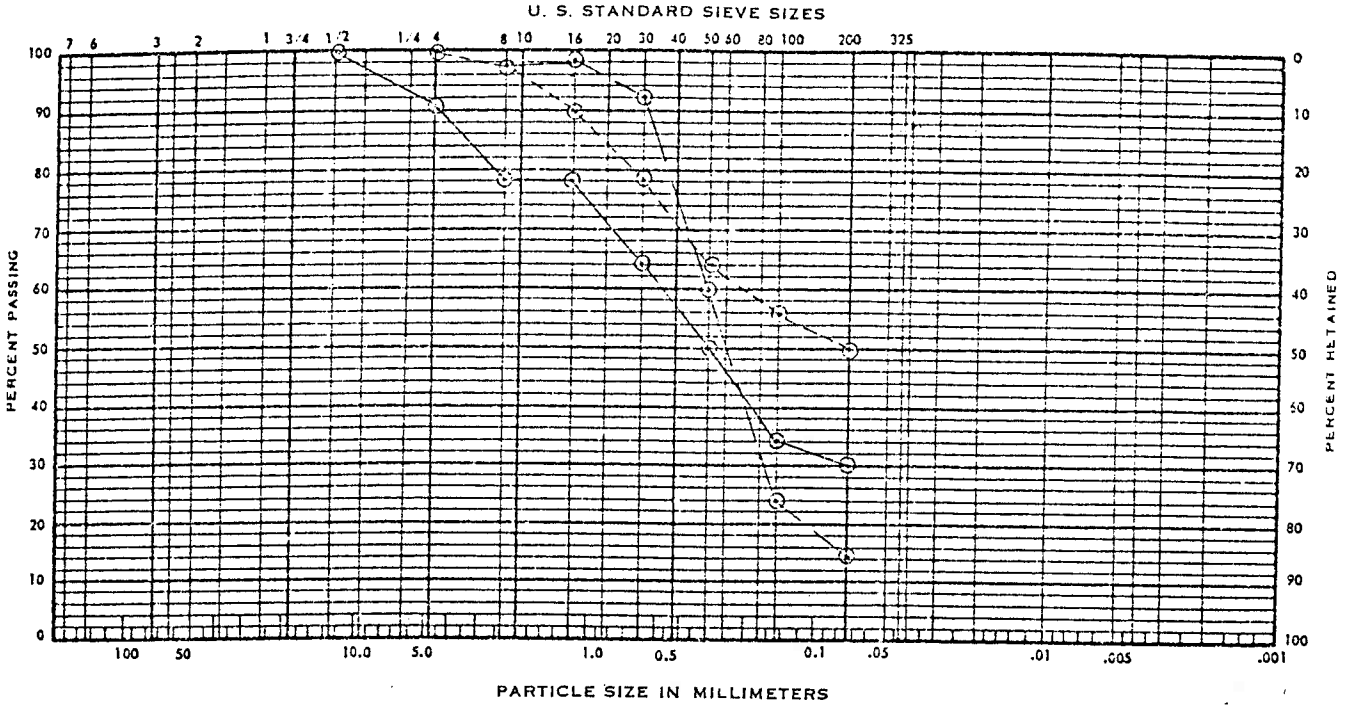
Dry density determinations were performed on 21 samples to measure the unit weight of the subsurface soils. Results of these tests are shown on the boring logs at the appropriate sample depths.

The percent soil fraction passing the No. 200 Sieve was determined on 10 samples of the subsurface soils to aid in the classification of the soils. Results of these tests are shown on the boring logs at the appropriate sample depths.

Gradation tests were performed on 6 samples of the subsurface soils. These tests were performed to assist in the classification and to determine grain size distribution of the soils. Results of these tests are presented on Figures B-1 and B-2.

UNIFIED SOIL CLASSIFICATION SYSTEM

(ASTM D 422-72)



COBBLES	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

KEY SYMBOL	BORING NO.	SAMPLE DEPTH (feet)	ELEV. (feet)	UNIFIED SOIL CLASSIFICATION SYMBOL	SAMPLE DESCRIPTION
———	1	20.5	---	SM	Brown Silty Sand with Gravel
- - - -	1	41.0	---	CL	Gray Sandy Clay
— —	1	63.0	---	SM	Blue-Gray Silty Sand

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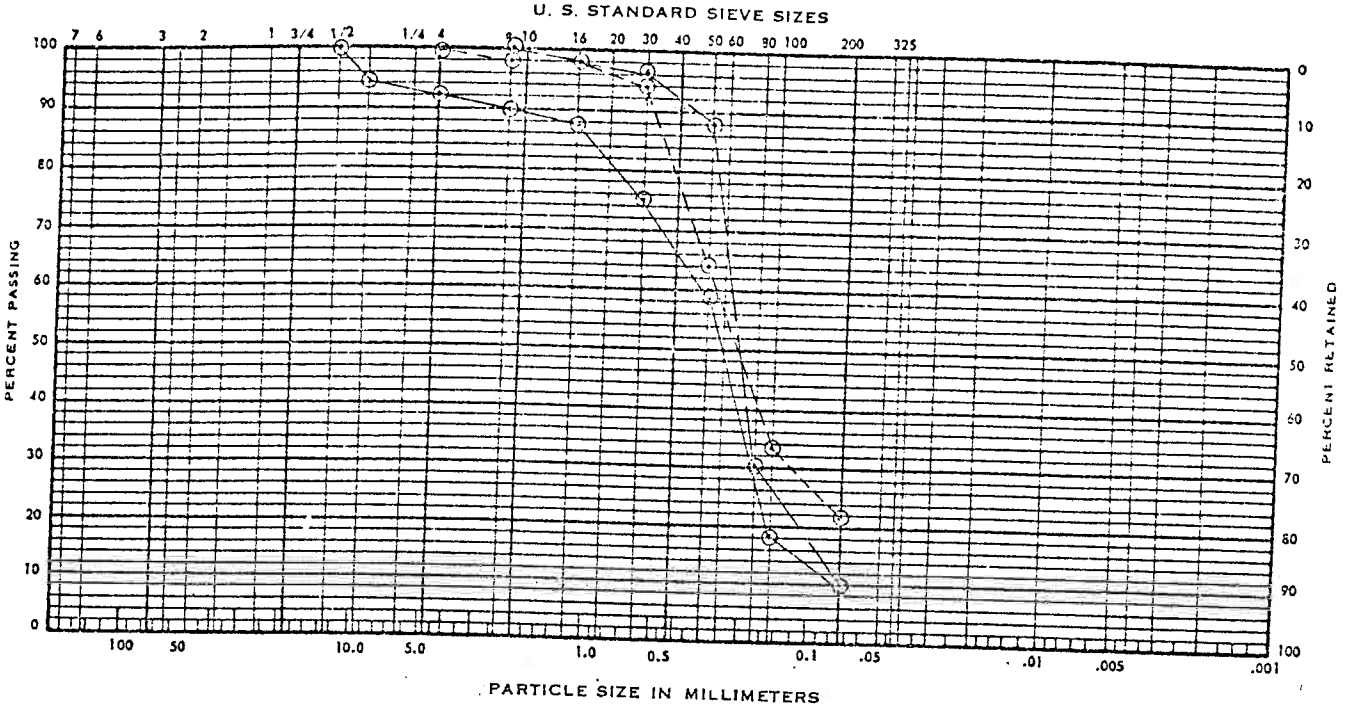
GRADATION TEST DATA

DENNISTON CREEK GROUNDWATER INVESTIGATIO
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	Figure
349-2	March, 1974	B-1

UNIFIED SOIL CLASSIFICATION SYSTEM

(ASTM D 422-72)



COBBLES	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

KEY SYMBOL	BORING NO.	SAMPLE DEPTH (feet)	ELEV. (feet)	UNIFIED SOIL CLASSIFICATION SYMBOL	SAMPLE DESCRIPTION
———	5	30.0	---	SP	Brown-Gray Sand with Gravel
- - - -	8	50.0	---	SM	Brown Silty Sand
— —	9	45.0	---	SP	Blue-Gray Sand

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GRADATION TEST DATA

DENNISTON CREEK GROUNDWATER INVESTIGATION
HALF MOON BAY, CALIFORNIA

PROJECT NO.	DATE	
349-2	March, 1974	Figure B-2

APPENDIX C

EXPLANATION OF HYDROLOGIC INVENTORY FACTORS

A brief explanation of how quantities of water used in the hydrologic inventory were estimated is as follows:

Items of Inflow

Streamflow, or runoff from the watershed areas was taken as 80 percent of the total watershed precipitation (12,000 acre feet) for Denniston Creek as estimated by the U.C. Agricultural Extension Service.

Precipitation, over the lowland area of the basin is calculated as the average annual precipitation of 20 inches over an area of 879 acres.

Subsurface Inflow, from consolidated rock is assumed to be negligible, since probably little transmittable water is stored in the granitic rocks or in the siltstone of the Purisima Formation.

Subsurface Inflow, from San Vicente Subarea is estimated from the relationship $Q = TIL$, where Q equals the quantity of subsurface flow, T is the coefficient of transmissibility, I is the hydraulic gradient, and L is the width through which the subsurface flow is occurring. The critical width is taken as 0.3 mile, other hydraulic properties as noted in preceding sections of this report.

Items of Outflow

Streamflow, to Half Moon Bay was considered to be that quantity remaining after 20 percent of inflow is recharged to the basin by seepage losses.

Consumptive Use, by evaporation and phreatophytes is calculated as the product of the acreage occupied by this vegetation (approximately 650 acres) and a consumptive use factor of 2 acre feet per acre per year. This factor may be somewhat low, but accounts for the prevalence of coastal fog in reducing the amount of evaporation and consumptive use.

Pumpage for Irrigated acreage is taken as an applied water use factor of 2 acre feet per acre over an irrigated acreage determined from recent aerial photographs to be about 500 acres, mostly in the Denniston Creek Subarea.

Subsurface Outflow, to the Bay is estimated from the same relationship used for Subsurface Inflow, above. The critical cross-section width is taken at 1 mile.

Surface Water Export , to the Coastside County Water District's water treatment plant is based on data supplied by the District; other pumpage data obtained from Department of Water Resources estimates.