FACSIMILE TRANSMITTAL

To: Gary Yamashiro
Company: City Bank
Fax Number: 535-2637
Phone Number: 535-2621

From: Lenore Nakama
Date: February 25, 2002
Pages Including Header: 2
Subject: Waianae Test Wells

Notes/Comments:

Here is a section of our well location maps showing your area of interest. I believe we do have information on the test wells (Test Well No. 1 has been assigned Well No. 2711-07; Test Well No. 2 has been assigned Well No. 2710-04). If you wish to view the file, you may come to our office at 1151 Punchbowl St, Rm 227, Mon-Fri between 7:00 am to 4:00 pm. The key to our filing system is the assigned Well Nos. Please call if there are any questions or if we can be of further assistance.
MEMORANDUM

TO: Lenore Nakama  
DLNR Water Resource Management

FR: Gary Yamashiro  
City Bank

DT: February 25, 2002

RE: Waianae Test Wells

Via Facsimile To: 587-0219

As discussed, we are trying to determine if your department has any information on the two (2) test wells that I mentioned in Waianae. We believe test well #1 is located on TMK 8-5-3-31 while test well #2 is located on TMK 8-5-3-32. A map indicated the approximate location of each test wells is attached.

Should you have any questions, please contact me at 535-2621.

Thank you.

FAX 535-2627

Loc. Map
DIVISION OF WATER RESOURCE MANAGEMENT

FROM: ____________________________

DATE: ____________________________

FILE IN: __________________________

TO: __________________ INITIAL: __________________

PLEASE:
- See Me
- Take Action By
- Route to Your Branch
- Review & Comment
- Draft Reply
- Acknowledge Receipt
- Xerox ______ copies
- File
- Mail

FOR YOUR:
- Approval
- Signature
- Information

REMARKS:
Requested this info from Steve B.
so we can enter in GW
Index/Summary. 2711-07 No. 1
2710-04 No. 2
Hydrogeologic Summary
Of Proposed Irrigation Source For
The Waianae Kai Golf Course

Prepared by S.P. Bowles
December, 1988
Background

A water resources evaluation and testing program has been conducted on three existing dug wells and two drilled exploration wells on the subject properties (see EXHIBIT A).

The study was undertaken to:

1. Evaluate the present status of existing wells on the subject property.

2. Drill test wells to further determine water development alternatives.

3. Conduct pumping tests of dug wells 1, 3, and 6 owned by the developer.

4. Based on results of this investigation, estimate the approximate quantity of irrigation water which can safely be developed.

Dug Well #6 has not been in use since the 1940's. Dug well #3 has been pumped continuously at a rate of about 200 gpm for dairy and some irrigation use on site. Dug Well #4 (adjacent to the site and next to the sanitary landfill) has been abandoned and back filled. Dug Well #1 has been in limited use for cattle drinking water (off site) and local truck farming (near site) totalling an occasional use of about 25,000 to 50,000 gpd.

The dug wells were constructed in the 1920's and 1930's by the Waianae Plantation Company. Dug wells #1, #3, and #6 are owned by the developer. The original pumpage capacities and quality are summarized as follows:
WATER RESOURCE PLAN
WAIANAE KAI GOLF COURSE

EXHIBIT A
<table>
<thead>
<tr>
<th>Name</th>
<th>Average Pumpage in MGD</th>
<th>Pump Capacity in gpm</th>
<th>Chlorides in MG/L</th>
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</thead>
<tbody>
<tr>
<td>DW 1</td>
<td>.400</td>
<td>790</td>
<td>520</td>
</tr>
<tr>
<td>DW 3</td>
<td>.250</td>
<td>490</td>
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<td>DW 4</td>
<td>.100</td>
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<td>470</td>
</tr>
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<td>DW 6</td>
<td>.080</td>
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<td>1000</td>
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<tr>
<td>Total</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

**Testing Results of Existing Dug Wells**

Recent tests have produced the following data:

1) Dug Well 1  
   Test rate 440 gpm (.63 MGD)  
   Chlorides 460 MG/L

2) Dug Well 3  
   Test rate 200 gpm (.29 MGD)  
   Chlorides 350 MG/L

3) Dug Well 6  
   Test rate 80 gpm (.09 MGD)  
   Chlorides 333 MG/L

Total (1.01 MGD)

**Exploration Wells**

Test well #1 was drilled to a total depth of 155 feet. The well penetrated alluvial boulders, cobbles and silty clay. Test results indicated that the water level stands at about +14 feet and the yield is 50 gpm with a chloride salinity of 88 mg/l.

Test well #2 was drilled to a total depth of 151 feet. The well penetrated alluvial cobbles, sands, gravels, and silty clay. The well was tested at a pumping rate of 50 gpm with a drawdown of 7 feet. The non-pumping water level was about 24 feet.

1 Typical for period of record 1933-1939.
Chlorides during pumping averaged 477 mg/l.

The relatively high yield of test well #2 (specific capacity of 7 gallons per foot of drawdown) demonstrates that it can be placed in service at a pumping rate of 100 gpm (.07 mgd) with a drawdown of less than 20 feet. Additional wells could be located near well #2 to provide better system hydraulics if needed. It is not anticipated that test well #1 will be used in the system as the present yield is poor.

**Hydrogeology**

Geologically, the majority of the land use area overlies the alluvial sediments of the buried valley and the ground waters are entering the sediments from areas of higher head (EXHIBIT B). The primary sources of irrigation water are to be the existing dug wells owned by the developer and constructed in either the alluvium of the valley fill or coralline limestone.

Attached are edited portions of two reports prepared by the U.S. Geological Survey to assist the reader. The first portions are from Circular C16 of D.L.N.R. by C. P. Zones, 1963 (Appendix A). The others are from Atlas HA-358 by K. J. Takasaki, 1971 (Appendix B).

The existing BWS facilities at Kamaile pump water from the basalt aquifer which is intruded by dikes. The wells for the State agricultural park, new BWS wells in the upper Waianae Valley, and wells in the upper Makaha Valley all extract water from this same groundwater system. Test Well #2 will tap the discharge edge of this same aquifer.
TYPICAL GEOLOGIC SECTION
FROM WAIANAE VALLEY ROAD THROUGH
THE WAIANAE KAI GOLF COURSE
The location of the project is such that it can be adversely affected by inland water developments. However, its pumpage cannot influence up gradient water developments such as those for the State Agricultural Park or the Honolulu Board of Water Supply (BWS).

No attempt has been made to identify organic or other pollutants because of the nearby existence of the City and County sanitary landfill and agricultural fields. It should be expected that ground water in the lower Waianae Valley would contain some identifiable pollutants and the proposed land use should have very little positive or negative impact other than a salt water encroachment potential based on total ground water flow.

**Conclusions and Recommendations**

The total water to be developed and pumped from on site wells is not recommended or anticipated to exceed 1 MGD (700 gpm) in the maximum month or about the same as that pumped from the area in the 1930's. None of the wells are suitable for domestic uses as they either have too high a salinity or are vulnerable to surface pollutants or salt water encroachment. Seaward or down gradient wells are more vulnerable and have essentially been abandoned. A source development program should be planned to maintain the combined waters for all irrigation (including existing users) at a salinity of between 400 and 500 Mg/L chlorides.

It is recommended that the dug wells be designed as follows:

1. **Dug Well 1** - Three pumps at 200 gpm each or an
installed capacity of 600 gpm.

2. **Dug Well 3.** - Two pumps at 200 gpm each or an installed capacity of 400 gpm.

3. **Dug Well 6.** - 1 pump at 75 gpm if needed.

Test Well #2 should have an installed capacity of about 100 gpm. Additional drilled wells may be needed to provide for more flexibility in quality management. The combined installed capacity would be about 1,175 gpm and should not be pumped in excess of about 1 mgd during the dry months.

During the design phase of the irrigation system the following should be considered:

1. Adequate storage ponds in volume and location.
2. Operations (sources) flexibility.
3. Additional drilled wells similar to Well #2.
APPENDIX A

Excerpts From

Circular C18 of D.L.N.R.

by C. P. Zones, 1963
Figure 3. Map of part of the Waianae area, showing ground-water levels and probable areas of high-level water in dike compartments in Makaha, Waianae, and Lualualei Valleys. The ground-water levels shown were measured at different times over a period of several years. The effect of local pumping on ground-water levels is not shown.
Figure 7. Map of part of the Waianae area showing the concentration of chloride in parts per million in Makaha, Waianae, and Lualualei Valleys in 1955.
APPENDIX B

Excerpts From
Atlas HA-358
by K. J. Takasaki, 1971
GROUND WATER IN THE WAIANAE DISTRICT, OAHU, HAWAII

By

Kiyoshi J. Takanami

1971

GROUND WATER
WHERE AND HOW IT OCCURS

Most of the fresh ground-water supply in the Waianae District occurs in flows of the lower and middle members of the Waianae Volcanic Series. Flows of the upper member are mostly above the water table and contain only a small perennial supply. Some fresh ground water occurs in sedimentary materials, but development of this supply is generally limited by the low permeability of alluvium, the restricted storage available in talus, or by sea-water intrusion in coral or coral rubble.

The ground-water reservoir in the volcanic rocks is large. The top of the reservoir extends from an altitude of a few feet near the coast to more than 1,800 feet near the crest of the range at Kaaia. Although the reservoir seems to be continuous, it is far from being homogeneous (having a uniform water-level gradient). Instead, as shown by water levels in wells (geologic map), the gradient is step-like, reflecting the damming effects due to local changes in permeability, caused by variations in talus density and in number of talus intersections, and to breccia.

Local changes in permeability are reflected also in the wide range of specific capacities shown in the geologic map.

Springs, which discharge at altitudes as high as 1,500 feet in Waianae and Makaha Valleys, contribute to perennial flow of streams. Most of the flow disappears below an altitude of 1,000 feet in both valleys. These and other deep valleys that breach dikes and breccia deposits act as line sumps. Water in wells drilled near stream channels is either artesian or occurs at shallow depths. Artesian conditions prevail where wedged of poorly permeable older alluvium and weathered rock overlies the aquifer.

Ground water also occurs in highly permeable coral and coral rubble near sea level. Information from drillers' logs indicates that coralline rocks extend at least 3 miles inland in Lualualei Valley and about 1 mile inland in Waianae and Makaha Valleys (quality-of-water map). About 100 wells have been drilled into this aquifer, but most have been abandoned because of an increase in chloride content of the water with continued pumping. Water levels in wells tapping the coralline aquifer are shown by contours on the geologic map.

Several wells have been dug or drilled in younger alluvium adjacent to inland extensions of the coralline material. Water levels in those wells are somewhat higher than those in wells tapping the coralline material (geologic map). Prospects are good for developing small supplies of fresh water in younger alluvium.

Talus deposits apparently do not form ground-water reservoirs of any significance because most of them lie above the main water table. However, because of the high permeability of the deposits and their location at the base of cliffs, they provide excellent catchments during periods of heavy rainfall. Lack of heavy vegetation on most talus slopes indicates that they are quickly drained after rains.

QUALITY

Data on ground-water quality are given on the quality-of-water map which also shows probable distribution of the principal aquifer at sea level. The map was prepared from drillers' logs and by testing selected water from wells.

The quality of water from wells tapping the coralline aquifer is generally good, except in near-shore areas and areas affected by hydrothermally altered volcanic rocks in the central vent area and of carbonated rocks above or adjacent to the volcanics. Above, the coralline aquifer is intruded by sea water, so the volcanic aquifer is highly susceptible to sea-water intrusion where it is in contact with the coralline aquifer.

The high overall permeability of volcanic rocks, which is mostly caused by dikes intrusions, is the principal deterrent to sea-water seepage, whereas where dikes intersected by outcropping, landward movement of sea water is almost completely retarded. Where dikes are notably parallel, permeability is much greater above the trend of the dikes than it is at right angles to them. Where they are parallel to the shoreline, dikes channel fresh water along their trend by retarding its flow toward them, thereby acting to limit sea-water intrusion. The chloride content of water from wells 277-99 and 277-101, 252 and 261 m.p.p. (milliparts per liter), respectively, is unusually low for ground water near the coast and may reflect water channeling and sea-water dilution by dikes.

The high dissolved-solids content of more than 1,700 m.p.p. and sulfates content of 700 m.p.p. in well 277-22b probably reflects leaching of hydrothermally altered rocks in an area where the permeability and porosity of water-bearing rocks is reduced by intersecting dikes. The temperature, 28.6°C (Celsius), of water from this well compared with that of water from 277-99 in Waianae Valley, 18.5°C, water from the other dikes is slightly different, 21.1°C, and water from well 277-10, 35.3°C, is further evidence of spatial movement of water and effects of hydrothermal activity on the aquifer tapped by well 277-22.

Water in the coralline aquifer ranges widely in chloride concentration. The limits of equal chloride content shown on the map represent only the fresher upper part of a salinity water body that exists on the water. Because recharge from rainfall and run-off from other water bodies is small, the fresh-water lens is thin and unstable. It is subject to rapid contamination by sea water if wells tapping it are pumped heavily.

The lack of fresh water noted in deep parts of the Waianae Valley is probably due to a limited growth of alkali, or down. (Projected chloride), a close relative of monosodium, Trihalomethane by this plant, from shallow water bodies in volcanic rock and alluvium, and possibly underflow that would otherwise recharge the coralline aquifer. Where borrow growth is most luxuriant on the coralline aquifer, transpiration constitutes the chief discharge of ground water.

Ground water in the alluvium is generally fresh. Sea-water intrusion is limited to near-shore areas and to areas abutted against edges of the coralline aquifer.
Calcareous sedimentary materials
Includes coral, coral rubble, and beach sand

Noncalcareous sedimentary materials
Includes alluvium and talus

Cinder

Lava flows of upper member of the Waianae Volcanic Series

Brecia

Lava flows of lower and middle members of the Waianae Volcanic Series

Lava flows of the Koolau Volcanic Series

Dikes

Contact
Fault
Dashed where inferred; dotted where concealed

Length and direction of tunnel in Waianae Volcanic Series

Well
Shaft
Tapping rocks of Waianae Volcanic Series

Well
Shaft or dug well
Tapping alluvium

Well
Shaft or dug well
Tapping calcareous sedimentary material

Wells, shafts, and dug wells
Upper number, where present by well symbol, is altitude of water level, in feet above mean sea level. Lower number, where present by well symbol, is specific capacity, in gallons per minute per foot of drawdown. Single number, where present by well or shaft or dug well symbols, is altitude of water level, in feet above mean sea level

Water-level contour
Shows altitude of water level in calcareous sedimentary material. Contour interval 1 foot

Drainage divide and boundary of study area

GEOLOGIC MAP OF WESTERN OAHU SHOWING AREA OF ALTITUDE OF WATER LEVELS, AND SPECIFIC C.
AS BUILT WELL SECTION

NOT TO SCALE

COMMUNITY PLANNING, INC.
WAIA'NAE KAI
TEST WELL No. 1
WAIA'NAE, OAHU, HAWAI'I
DRILLING, CASING AND TESTING
WELL DETAIL
<table>
<thead>
<tr>
<th>Depth</th>
<th>Driller's Log</th>
<th>Geologist's Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-19'</td>
<td>Boulders with Dark Grey Clay</td>
<td></td>
</tr>
<tr>
<td>19'-97'</td>
<td>Brown Clay with Pebbles and Cobbles</td>
<td>Flood Plain Deposits</td>
</tr>
<tr>
<td>97'-104'</td>
<td>Reddish Soft Rock</td>
<td></td>
</tr>
<tr>
<td>104'-155'</td>
<td>Clay, Cobbles, Pebbles Drills like hard rock.</td>
<td>Cobbles and Pebbles are unweathered.</td>
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</tbody>
</table>
### Table 1: Pumping Test Results - September 1, 1988

<table>
<thead>
<tr>
<th>Elapsed Time (in Minutes)</th>
<th>Pumping Rate (in GPM)</th>
<th>Draw Down (in Feet)</th>
<th>Chlorides (in mg/L)</th>
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<tbody>
<tr>
<td>0</td>
<td>Start</td>
<td>0</td>
<td>0</td>
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<tr>
<td>5</td>
<td>14</td>
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<td>Dirty Water</td>
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<tr>
<td>10</td>
<td>34</td>
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<td>32</td>
<td>23.8                Stop</td>
<td>83</td>
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**Recovery**

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<tr>
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<th>Chlorides (in mg/L)</th>
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### Table 2: Pumping Test Results - November 4, 1988

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**Recovery**

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1. Raining heavy for 2 days prior to test.
AS BUILT WELL SECTION

NOT TO SCALE
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<tr>
<th>Depth</th>
<th>Driller's Log</th>
<th>Geologist's Notes</th>
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<tbody>
<tr>
<td>0-27'</td>
<td>Boulders and Clay</td>
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<tr>
<td>27'-37'</td>
<td>Clay, Boulders and Grey Rock</td>
<td>Flood Plain Sediments</td>
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<td>37'-50'</td>
<td>Clay and Grey Rock</td>
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<td>50'-60'</td>
<td>Clay - Grey Rock/Decomposed Rock</td>
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<tr>
<td>60'-92'</td>
<td>Clay - Grey Rock/Decomposed Rock</td>
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<tr>
<td>92'-117'</td>
<td>Grey Rock</td>
<td>Gravel and Cobbles</td>
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<tr>
<td>117'-119'</td>
<td>Boulders</td>
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<tr>
<td>119'-151'</td>
<td>Hard Grey Rock</td>
<td>Gravel and Cobbles</td>
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### Waianae Kai Golf Course
#### Test Well No. 2
##### Pumping Test
October 14, 1988

<table>
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<tr>
<th>Ground Elevation</th>
<th>101.0'</th>
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<td>Depth of casing</td>
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<td>Depth of Well</td>
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<td>Water Level</td>
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<thead>
<tr>
<th>Sluiced Time in Minutes</th>
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### Waianae Kai Golf Course
#### Test Well No. 2
##### Pumping Test
October 14, 1988

<table>
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<th>Sluiced Time in Minutes</th>
<th>Pumping Rate in GPM</th>
<th>Draw Down in Feet</th>
<th>Chlorides in ppm</th>
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<td>Recovery in 30 Sec.</td>
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NOTE: STANDARD WELL CAP & COLLAR BY: ROYER QUALITY CASTINGS, INC. BOYERTOWN, PA.
January 5, 1989

MEMORANDUM FOR THE RECORD

FROM: Roy Hardy

SUBJECT: Correspondance with BWS on Kamaile Wells

I spoke with Alwyn Morisako regarding the status of the two Kamaile wells in Waianae. Specifically, I asked him for well head measurements since our files show that they do not report head elevations for either well. He told me that they have not recorded head elevation on those wells since 1/5/76 when the head was measured to be +11.9 ft above msl at that time.

Roy Hardy
January 5, 1989

MEMORANDUM

TO: Roger C. Evans
Administrator
Office of Conservation and Environmental Affairs
Department of Land and Natural Resources

FROM: Manabu Tagomori
Manager-Chief Engineer
Division of Water and Land Development
Department of Land and Natural Resources
1151 Punchbowl Street
Honolulu, HI 96813

SUBJECT: Waianae Kai Golf Course

We have reviewed the Hydrogeologic Summary for the Proposed Irrigation Source(s) for the Waianae Kai Golf Course and would like to make a few comments regarding the project:

1) The water from the dug and test wells appear to indicate a brackish water source which is suitable for irrigation of the golf course;

2) Existing wells downgradient of the project are either abandoned or not in use due to high chloride concentrations and thus the project poses no threat to these wells;

3) However, the proximity of the two BWS Kamaile Wells, potable and currently pumping 0.5 mgd, to the project concerns us. Head measurements from the Kamaile wells have not been monitored since 1/5/76 when the head was measured and found to be +11.9 ft above msl. Since the test wells at the project have been measured to have heads of +14 and +24 ft above msl it would appear there may be some potential for contamination from the golf course. However, a sanitary landfill is also located in the valley and apparently has not affected the Kamaile Wells.

Manabu Tagomori
Manager-Chief Engineer
Division of Water and Land Development
Department of Land and Natural Resources
State of Hawaii
Moritsuko

Called Alwyn M. O'Bre concerning head of Kamaile wells in Wainaha.

He said that the head for those 2 wells have not been measured recently. Dec-Jan 5 1976 - 11.9 ft.
MEMORANDUM

TO: Aquatic Resources, Forestry & Wildlife, Land Management, State Parks/Historic Sites, Water & Land Development

FROM: Roger C. Evans, Administrator
Office of Conservation and Environmental Affairs

SUBJECT: Conditional Use Permit (Type 1) Application

PROJECT: Waianae Kai Golf Course
Waianae, Oahu, Hawaii

Please review the attached: Application

( ) DRAFT EIS
( ) EIS PREPARATION NOTICE
( ) ENVIRONMENTAL ASSESSMENT
( ) PLAN REVIEW
( ) CORRESPONDENCE AND OTHER MATERIALS AVAILABLE AT THE OFFICE OF CONSERVATION AND ENVIRONMENTAL AFFAIRS

and submit your comments within the time requested above. If more time is required, please call Roy Schaefer at x7837.

Attachment

( ) We have no comments.
( ) Comments attached.
( ) Please contact ____________ at ______ for our input.

Signed: __________________________
Date: ____________________________
December 15, 1988

Mr. William Paty, Director
Department of Land and
Natural Resources
State of Hawaii
Honolulu, Hawaii

Dear Mr. Paty:

Conditional Use Permit (Type 1) Application
Waianae Kai Golf Course
Tax Map Keys: 8-5-3: 9, 10, 29, 31, 32, and 43
8-5-4: 28
8-5-4: 36, 37, and 38

The attached letter from the Department of Health outlines conditions of approval for the Waianae Kai Golf Course application for a Conditional Use Permit. Please evaluate the conditions which will affect your agency and submit your comments or concerns to this office by December 31, 1988. If more time is required for your response, please contact Calvin Ching of the Zoning District Changes Branch at 527-5374.

Very truly yours,

John P. Whalen
Director of Land Utilization
Mr. Matthew Grady, Project Manager
PBR Hawaii
1042 Fort Street Mall, Suite 300
Honolulu, HI 96813

SUBJECT: Conditional Use Permit for Proposed 27-Hole Golf Course, Waianae, Oahu, Hawaii
TMKS: 8-5-03:09, 10, 29, 31, 32, and 43
        8-5-04:28
        8-5-19:35, 36, and 37

Dear Mr. Grady:

Pursuant to your letters of November 18, 1988 and December 1, 1988, we counter-propose the conditions listed below in the interest of groundwater protection. All other matters stated in your above mentioned letters will be assumed to have been agreed to.

Conditions:

1. Owner/Developer shall obtain a written statement from the Board of Water Supply regarding their intentions to utilize or not utilize groundwaters beneath and down gradient of the project site for potable drinking water, now and in the future.

2. Owner/Developer shall obtain a written statement from the state Department of Land and Natural Resources that they will not issue any private water well permits beneath and down gradient of the project sites whose uses are intended for potable drinking water, now and in the future.

3. In the event that the Board of Water Supply and/or the Department of Land and Natural Resources considers the groundwaters below or down gradient of the project site to be, now or in the future, a source of potable drinking water, the owner/developer and all subsequent owners shall establish a groundwater monitoring plan and system which shall be presented to the state.
Department of Health for its approval. The groundwater monitoring plan and system shall minimally describe the following components:

a. A system of monitoring wells constructed throughout the site. These monitoring wells shall extend approximately ten (10) feet below the water table.

b. A routine groundwater monitoring schedule of at least once every six (6) months and more frequently, as required by the state Department of Health, in the event that the monitoring data indicates a need for more frequent monitoring.

c. A list of compounds which shall be tested for as agreed to by the state Department of Health. This list may include, but not be limited to the following: total dissolved solids; chlorides; pH; nitrogen; phosphorus; or any other compounds associated with fertilizers, biocides or effluent irrigation.

4. If Condition #3 is in effect, baseline groundwater data shall be established as described in this paragraph. Once the test well sites and list of compounds to be monitored for have been determined and approved by the state Department of Health, the owner/developer shall contract with an independent third-party professional (approved by the state Department of Health) to have the groundwater sampled and its data reported to the state Department of Health. Testing of the groundwater shall be done by a certified laboratory.

5. If Condition #3 is in effect and the data from the monitoring wells indicate the presence of the measured compound and/or the increased level of such compound, the state Department of Health can require the owner/developer or subsequent owner to take immediate mitigating action to stop the cause of the contamination. Subsequently, the developer/owner or subsequent owner shall mitigate any adverse effects caused by the contamination.

6. Owner/Developer shall provide sewage disposal by means of connection to the Wai'anae Municipal Sewer System; or by means of a wastewater treatment works providing treatment to a secondary
level with chlorination. Effluent from this wastewater treatment works may be used for golf course irrigation, subject to Condition #5. The entire system shall be approved by the state Department of Health.

7. If a wastewater treatment works with effluent reuse becomes the choice of wastewater disposal, then the owner/developer and all subsequent owners shall develop and adhere to a Wastewater Reuse Plan which shall address as a minimum, the following items:

a. Management Responsibility. The managers of the irrigation system using reclaiming wastewater shall be aware of the possible hazards and shall evaluate their system for public health, safety, and efficiency. They must recognize that contact with the reclaimed wastewater from treated domestic sewage poses potential exposure to pathogenic organisms which commonly cause infectious diseases (bacteria, viruses, protozoa, and helminths or worms).

b. General Recommendations

1) Irrigated areas should be no closer than 500 feet from potable water wells and reservoirs.

2) Irrigated areas should be no closer than 100 feet from any private residence.

3) Application rates should be controlled to minimize ponding. Excess irrigation tailwater in the reclaimed wastewater irrigation area shall be contained and properly disposed. An assessment should be made of the acceptable time and rate of application based on factors such as type of vegetation, soil, topography, climate and seasonal variations.

4) Effluent holding/mixing ponds shall be designed to prevent the infiltration of the wastewater into the subsurface. The holding/mixing ponds shall be made impervious.
5) Irrigation shall be scheduled such that the public is not in the vicinity and the soil is sufficiently dry to accept the irrigation water.

6) Permanent fencing or barriers shall be erected around polishing or holding ponds to prevent public entry or stray feral and tame animals from gaining access to the ponds.

7) Adequate irrigation records shall be maintained. Records should include dates when the fields are irrigated, rate of application, total application and climatic conditions. Records should also include any operational problems, diversions to emergency storage or safe disposal and corrective or preventive action taken.

8) The holding/mixing ponds shall be periodically monitored for the purpose of detecting leakage into the subsurface. If leakage is detected, corrective action shall be immediately taken.

c. Adequate Notice. Appropriate means of notification shall be provided to inform the employees and public that reclaimed wastewater is being used for irrigation on the site.

1) Posting of conspicuous signs with sufficient letter size for clear visibility with proper wording should be distributed around the use areas.

2) Signs shall be securely fastened. Periodic surveillance shall be conducted to assure permanent posting at all times. Immediate replacements shall be made when necessitated by deterioration, vandalism or misuse.

d. Adequate Employee Education. Employees or users should be cautioned and warned of the potential health hazards associated with the ingestion of reclaimed wastewater being used at the site.
1) Employees should be warned that the ingestion of reclaimed wastewater is unsafe.

2) Employees should be protected from direct contact of the reclaimed wastewater. If necessary, protective clothing should be provided.

3) Employees should be informed of the following:
   
   • The irrigation water is unsafe for drinking or washing.
   
   • Avoid contact of the water or soil with any open cuts or wounds
   
   • Avoid touching the mouth, nose, ear or eyes with soiled hands, clothes or any other contaminated objects.
   
   • Be aware that inanimate objects such as clothes or tools can transport pathogenic organisms.
   
   • Always wear shoes or boots to protect feet from the pathogenic organisms in the soil or irrigation water.

8. Use of electrical golf carts will be employed. It is recognized that underground storage tank(s) to store gasoline for gas driven golf carts will impose potential risks to the groundwater.

9. On and off-site wells will be utilized for irrigation purposes only. Potable water will be accommodated by the Board of Water Supply 12-inch transmission lines located along Waianae Valley Road.

10. Building designated to house the fertilizer and biocides shall be bermed to a height sufficient to contain a catastrophic leak of all fluid containers. It is also recommended that the floor of this room be made waterproof so that all leaks can be contained within the structure for cleanup.
Mr. Matthew Grady, Project Manager  
December 9, 1988  
Page 6  

11. A golf course maintenance plan and program will be established based on "Best Management Practices (BMP)" in regards to utilization of fertilizers and biocides as well as the irrigation schedule. BMP's will be revised as an ongoing measure. The golf course maintenance plan will be reviewed by the state Department of Health prior to implementation.

If there are any questions regarding the eleven (11) conditions mentioned in this letter, please contact me at 548-6455. We ask your cooperation in the protection of Hawaii's valuable groundwater resource.

Sincerely,

[Signature]

James K. Ikeda, Acting Chief  
Environmental Protection and Health Services Division

cc: DLU  
    BWS  
    DLNR
November 18, 1988

Mr. James Ikeda
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96813

SUBJECT: CONDITIONAL USE PERMIT FOR PROPOSED 27-HOLE GOLF COURSE WAIANAE, OAHU, HAWAI
TMKS: 8-5-03:09, 10, 29, 31, 32, AND 43
8-5-04:28
8-5-19:35, 36, AND 37

Dear Mr. Ikeda:

Pursuant to a memorandum dated October 20, 1988 and a letter dated October 24, 1988, directed to John P. Whalen about concerns of the proposed golf course project we have the following responses.

A. Groundwater Protection

1. We stand corrected that the project area is located above the Underground Injection Control (UIC) line and appreciate the correction. By definition according to Title 11 Department of Health, Chapter 23 Underground Injection Control Section 11-23-03 "Underground Source of Drinking Water (USDW)" means an aquifer or its portion:

   a. Which supplies any public of private drinking water system; or contains a sufficient quantity of groundwater to supply a public water system; and

      1) Currently supplies drinking water for human consumption; or

      2) Contains fewer than ten thousand milligrams per liter (mg/l) total dissolved solids (TDS); and

   b. Which is not an exempted aquifer.
As your letter states "While there are no current drinking water sources located within or downgradient of the project site, the area must be afforded a level of protection commensurate with it's USDW designation."

We are uncertain of the level of protection we must meet based upon the definition of the USDW designation. It appears as if the Board of Water Supply has no intentions of utilizing the project site for drinking water purposes as shown by their pass, no pass line.

2. The preliminary hydrogeologic summary does indicate that test wells #1 and #2 are capable of producing ground water with chlorides below the 250 mg/l secondary standard. As such, these sources "can be regarded as a potential source of potable water" as stated in your letter. We agree that these wells given this preliminary information could be used for a drinking source. It should be noted that initial chloride tests are not representative of chloride levels on wells that have been pumped on a continual basis. Based upon further studies conducted by the hydrologist, test well #1 will not be used for any purpose and is to be capped. Test well #2 is to be used to supplement the existing wells only if the water quality (salinity) from other wells (dug wells 1, 3 and 6) becomes excessive and requires dilution.

3. We believe the report "Potential Environmental Impacts of Groundwater Supplies Resulting from the Application of Fertilizers and Biocides on the Proposed Waianae Kai Golf Course" does provide analysis of pesticide and fertilizer migration to the groundwater in the following sections; Section 4.2 describes irrigation water quality and schedule including description of how water molecules move through the soils and how it is taken up by the vegetation; Section 5.3 Soil/Plant Relationships indicates fertilizers and biocides are "fairly rapidly taken up by the grasses and shrubbery and or/biodegrade rather rapidly due to the soil/plant relationships and bacterial action in the soil." Further description is indicated on pages 23 and 24.

4. The report in Section 4.2 discusses how watering rates and schedules are determined in a general manner. As stated, it is estimated that the golf course would require approximately 4,000 gallons of water per day per acre. This estimation would be adjusted to the
conditions of the golf course and daily climate conditions. The report states in Section 5.3 "the soils of the project site are generally poorly suited for agricultural purposes because of their clayey and/or rocky nature. Runoff from the existing soils varies from slow to moderate and permeability is slow to moderate. As such, it is probable that top soils will be brought in for the golf course, thereby creating a layer of soil that could act as a permeability barrier, further inhibiting the possibility of leaching of irrigation water and/or rainwater into the ground water supplies." Consequently if importation of soils is employed, minimum watering conducted the risk of ground water contaminations would be greatly reduced.

In response to monitoring of the environmental conditions, who would be responsible? What rules and regulations would the monitoring program follow since no rules or regulations affecting the rate of irrigation are established?

5. The golf course maintenance program will establish "Best Management Practices (BMP)" in regards to utilization of fertilizers and biocides as well as the irrigation schedule. BMP's will be revised as an ongoing measure. Should the golf course operators acquire BMP approval from your office?

B. Use of Golf Carts

The use of all electric golf carts will be employed at the proposed development as installation of an underground storage tank would impose potential risks to potential drinking waters.

C. Golf Course Fertilizer-Biocide Structure

Your recommendations will be incorporated into the design of the structure and will be reviewed prior to the time building permits are issued.

D. Air Pollution

By means of "Best Management Practice" chemical drift would be minimized. No odors are expected to be generated form the
Mr. James Ikeda  
SUBJECT: CUP FOR PROPOSED  
27-HOLE WAIANE GOLF COURSE  
November 18, 1988  
Page 4

proposed project. The project will act as a buffer between  
the Agricultural park and the residential units thereby  
creating an open space for farm odors to dissipate.

E. Wastewater Disposal

The estimated wastewater of 20,000 gallons per day would be 
treated by a package treatment plant which would meet the 
requirements of D.O.H. The effluent waters from the 
treatment plant would require disposal methods acceptable to 
the D.O.H. and in compliance with the USDW designation.

F. Noise

Golf course operation and maintenance are expected to be  
performed during daylight hours and equipment used would  
meet appropriate federal and state noise and air quality  
control regulations as stated in Section 5.1 page 21 and 22  
of the application. The design of the proposed project sites 
the clubhouse in the center of the project area, thus  
reducing potential noise impacts to surrounding land owners.

G. Vector Control

The developer will comply with all requirements of 11-26-35 
as related to rodents: demolishing of structure and clearing 
of vacant lots and 11-26-31 as related rodent proofing 
structures.

If you have any questions please give me a call.

Sincerely,

PBR HAWAII

Matthew Grady  
Project Manager
December 1, 1988

Mr. James Ikeda
State of Hawaii
Department of Health
Environmental Health Division
1250 Punchbowl Street
Honolulu, Hawaii 96813

SUBJECT: CONDITIONAL USE PERMIT FOR PROPOSED 27-HOLE GOLF COURSE
WAIANAE, OAHU, HAWAII
TMKS: 8-5-03:09, 10, 29, 31, 32, AND 43
8-5-04:28
8-5-19:35, 36, AND 37

Dear Mr. Ikeda:

Pursuant to our meeting November 28, 1988 about the proposed golf course project we have the following responses.

A. Groundwater Protection

1. We are corresponding with the Board of Water Supply to verify their position regarding the usage of potable water below and down gradient of the project site.

2. Through proper irrigation, application of fertilizers and herbicides included in "best management practices" infiltration of fertilizers and biocides can be restricted to the root zone thus reducing the potential for groundwater contamination.

3. In the event that the Board of Water Supply considers the ground waters below or down gradient of the project site for potable drinking water, the owner/developer could monitor on-site well water quality for organic compounds that might result from the herbicides to be used on the golf course. Monitoring could be performed quarterly during the first year of golf course operation with
SUBJECT: WAIANAE KAI CUP
December 1, 1988
Page 2

the results of that monitoring compared to baseline groundwater quality data to be provided by the Department of Health.

B. Sewage Disposal

1. Sewage disposal will be accommodated by either the construction of a package plant treating wastes to a secondary level with chlorination and effluent used for golf course irrigation approved by the Department of Health or connection to the Waianae Municipal Sewer System.

C. Other

1. The use of electric golf carts will be employed as an underground storage tank for fuel would impose potential risks to the groundwaters.

2. The owner/developer will comply with all federal, state, city and county rules and regulations regarding noise, vector control, and building codes for fertilizer-biocide structures.

3. The on and off-site wells will be utilized for irrigation purposes only. Potable water will be accommodated by the Board of Water Supply 12-inch transmission lines located along Waianae Valley Road.

We would appreciate a timely response from your department to the Department of Land Utilization indicating that we have met and discussed items which could become conditions to the issuance of the Conditional Use Permit. The specific items would include:

A. Owner/Developer to obtain a statement from the Board of Water Supply regarding their intentions to utilize or not utilize groundwaters beneath and down gradient of the project site for potable drinking water.

B. Well water monitoring could be conducted by Owner/Developer as stated in section A. 3.

C. Department of Health to review "best management practice" plans for the golf course maintenance prior to golf course operation.
Mr. James Ikeda  
SUBJECT: WAIANAE KAI CUP  
December 1, 1988  
Page 3

D. Owner/Developer to provide sewage disposal by means of a package plant providing treatment to a secondary level with chlorination and effluent use for golf course irrigation approved by DCH or connect to the Waianae Municipal Sewer System.

Should you have any questions or require additional information please do not hesitate to call.

Sincerely,

PBR HAWAII

Matthew Grady
Project Manager
Mr. Matthew E. Grady  
PBR Hawaii  
130 Merchant Street, Suite 1111  
Honolulu, Hawaii 96813

Dear Mr. Grady:


Thank you for allowing us to comment additionally on the groundwater protection issue. We provide the following comments:

PBR Hawaii has gone to great lengths to discuss the potential environmental impacts on groundwater supplies resulting from the application of fertilizers and biocides on the proposed Waianae Kai Golf Course. There are, however, several small details that we would like to see mentioned or discussed prior to the issuance of a Conditional Use Permit (CUP).

1. The report should mention the fact that the entire project is located above the Underground Injection Control (UIC) line. By definition, all groundwater underlying the project area is a potential or current source of drinking water. While there are no current drinking water sources located within or downgradient of the project site, the area must be afforded a level of protection commensurate with its USDW designation. The proximity of agricultural wastewater disposal ponds is anomalous with this designation, but the fact remains that the project area is located above the line and not below it.

2. The hydrogeologic summary report indicates that test wells #1 and #2 are capable of producing groundwater with chlorides below the 250 mg/l secondary standard. Based on this finding, groundwater at the site can be regarded as a potential source of potable water and we, therefore, disagree with the statement that "None of the wells are suitable for domestic uses ..." Although the report on impacts to groundwater supplies, "Potential Environmental Impacts on Groundwater Supplies Resulting from the Application of Fertilizers and Biocides on the Proposed Waianae Kai Golf Course," does provide a discussion on the types of pesticides to be used on golf courses, it does not provide any detailed analysis on pesticide and fertilizer migration to the groundwater. Without such detailed analysis, we will have to conclude that the groundwater will likely be contaminated should the construction of the golf course be approved.
3. The report should identify the major procedures that will be used to establish the minimum rate of irrigation needed throughout the year, taking into account such factors as annual rainfall, pan evaporation, transpiration, field capacity, etc. If the infiltration of fertilizers and biocides can be restricted to the root zone, the risk of groundwater contamination can be greatly reduced. The monitoring of environmental conditions should be made part of the CUP, if possible, since there are no rules or regulations affecting the rate of irrigation unless they result in extreme runoff problems.

4. The report should discuss procedures for establishing best management practices (BMP) with respect to the use of fertilizers and biocides. The use of biocides in accordance with label instructions is a legal requirement and does not guarantee that these chemicals will be used in the most conservative manner possible. BMPs can also govern the selection of biocides and minimize the threat to groundwater quality in the case where a number of different chemicals could accomplish the same end. The development and revision of BMPs should be viewed as an ongoing process since no one biocide will remain effective against a target organism forever.

In addition, the following issues are of concern:

1. Will the project use electric golf carts or gasoline-powered vehicles?

The Department of Health previously voiced its concern over the installation of a gasoline underground storage tank (UST) for a proposed Makakilo Golf Course because of the potential environmental impacts on drinking water quality. Although the project area for the Waianae Kai Golf Course is not located over or upgradient of a current source of drinking water, it is classified as a USDW and must be afforded similar levels of protection.

2. How will the building designated to house all the above-mentioned fertilizers and biocides be constructed?

The Department's comments on the CUP for the Makakilo Golf Course stated that the room designated to house these chemicals should be bermed to a height sufficient to contain a catastrophic leak of all fluid containers. It was also recommended that the floor of this room be made waterproof so that all leaks could be contained within the structure for cleanup.

3. Leaking ponds, although technically not similar to injection wells, can have the same long-term effect as an injection well.

Sincerely yours,

BRUCE S. ANDERSON, Ph.D.
Deputy Director for Environmental Health

cc: Mr. John Whalen
Mr. William W. Paty, Chairperson
Commission on Water Resources Management
Department of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Subject: Well Modifications to Well No. 2711-07, Waianae

We forward a copy of the approval granted by Board of Water Supply for well modification to exploratory wells being drilled under a permit issued on May 23, 1988 to Black Development Corporation. The purpose of the wells is for golf course irrigation. The wells will be permitted to be deepened and to withdraw water from the basal aquifer.

If you have any questions, please call Herbert H. Minakami at 527-6183.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

Attachment

cc: Water Resources Research Center
United States Geological Survey

Pure Water ... man's greatest need – use it wisely
September 6, 1988

Mr. Robert Y. Akinaka  
President  
Akinaka and Associates, Ltd.  
250 North Beretania Street  
Suite 300  
Honolulu, Hawaii  96817-4716

Dear Mr. Akinaka:

Subject:  Your Letter of September 2, 1988 Regarding Waianae  
Kai Test Wells

We approve your request to continue drilling to permeable  
producing bedrock to obtain a yield of about 100 gpm.

If you have any questions, please contact Herbert H. Minakami  
at 527-6103.

Very truly yours,

KAZU HAYASHIDA  
Manager and Chief Engineer
June 23, 1988

Black Development Corporation
P.O. Box 3203
Honolulu, Hawaii 96801

Gentlemen:

We understand that Black Development Corporation has received a Board of Water Supply permit to drill two irrigation test wells in Waianae.

In accordance with Administrative Rules, upon completion of the wells the attached Driller's Report form must be completed and filed with our Division for each well.

Thank you for your cooperation in this matter and if you have any questions, please call the Hydrology-Geology Section at 548-7619.

Sincerely,

MANABU TAGOMORI
Deputy for Water Resource Management

ES:ko
Encl. (Driller's Report form)
cc: P.R. Drilling Co., Inc.
June 23, 1988

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Thank you for sending us a copy of the well application and approved well drilling permit issued to Black Development Corporation for the drilling of two irrigation test wells in Waianae.

The State well numbers assigned to the wells are as follows:

Waianae Kai Test Well No. 1 - 2711-07
Waianae Kai Test Well No. 2 - 2710-04

If you have any questions, please call the Geology-Hydrology Section at 548-7619.

Sincerely,

MANABU TAGOMORI
Deputy for Water Resource Management

ES:ko
cc: Black Development Corp.
Mr. Manabu Tagomori
Manager-Chief Engineer
Department of Land and Natural Resources
Division of Water and Land Development
P. O. Box 373
Honolulu, Hawaii 96809

Dear Mr. Tagomori:

Subject: Well Use Permit to Black Development Corporation

We forward for your information and files, copies of the well application and the approved well drilling permit issued to Black Development Corporation for the drilling of two irrigation test wells in Waianae.

If you have any questions, please call Chester Lao at 527-5276.

Very truly yours,

HERBERT H. MINAKAMI
Chief, Planning and Engineering Division

Enclosures
TO: Black Development Corporation  
P. O. Box 3203  
Honolulu, Hawaii  96801

Your application of May 10, 1988 has been approved in accordance with Chapter III of our Rules and Regulations for the Protection, Development and Conservation of Water Resources in the City and County of Honolulu.

You are hereby granted a permit to drill two irrigation test wells at TMK: 8-5-03:31 and 32 as shown on the plans.

This permit is granted subject to the Rules and Regulations of the Board of Water Supply and the following conditions:

1. The Board of Water Supply Hydrology-Geology Section shall be notified before any work covered by this permit commences.

2. This permit will be valid upon receipt by the Board of Water Supply of a permittee bond in the amount of $8,000 ($4,000/well) in accordance with Sec. 3-305 (2a.) of these Rules and Regulations.

3. If basaltic bedrock is encountered during drilling, drilling will cease and the Board will be notified. The Board will then decide if drilling should be allowed to continue.

4. A geological log of formations encountered shall be maintained by the well owner.

5. This permit covers only the drilling of the wells.

6. Although test pumping of these wells is permitted, any further development of these test wells will require a water use permit.

KAZU HAYASHIDA  
Manager and Chief Engineer  
Board of Water Supply

MAY 23, 1988  
Date of Permit

Pure Water... man's greatest need – use it wisely
APPLICATION FOR DRILLING, MODIFYING, RECASING OR REUSING WELLS

INSTRUCTIONS: Please send 1 copy to Honolulu Board of Water Supply, who will distribute to other agencies concerned. In filling out, refer to Rules and Regulations of the Honolulu Board of Water Supply adopted on May 10, 1976 and applicable rules and regulations of the State Department of Health.

OWNER: (See BWS Rules and Regulations Chapter III, Sec. 3-305, Item 1a)

Black Development Corporation

ADDRESS: P.O. Box 3203
Honolulu, Hawaii 96801

1. APPLICATION FOR WELL: (See Chapter III, Sec. 3-305, Item 1)

Drill X Reuse __________
Modification ______ Recase ______
Change in use ______

2. WORK TO BE PERFORMED BY: (See Chapter III, Sec. 3-311)

PR Drilling Co. Inc.
98-710A Kuahao Place
Pearl City, Hawaii 96782

WR 900 (Rev. 10-76)
APPLICATION FOR DRILLING, MODIFYING, RECASING, OR REUSING WELLS

3. USE OF WELL: (See Chapter III, Sec. 3-305, Item 1c)
   For Irrigation Purposes

4. ATTACHMENTS: (Each copy of the application shall have a complete set of attachments)
   a. Location of well: Waianae, Oahu, Hawaii
      Tax Map Key: 8-5-03:31 and 32

   b. Land area served: (Attach map showing exact location of well and area served. See Chapter III, Sec. 3-305, Items 1b and 1d)
      See Attached Site Plan Sheet 1

   c. Description of well and appurtenant details:
      (See Chapter III, Sec. 3-305, Item 1e)
      See Attached Well Section and Details Sheets 2 and 3
5. The Owner hereby agrees to install, operate, and maintain control of the well in accordance with the laws of the State of Hawaii and the Rules and Regulations of the Honolulu Board of Water Supply and the State Department of Health.

The Owner hereby understands that a fee of One Hundred Dollars ($100.00) and a permittee bond of the amount not greater than Twenty-five Thousand Dollars ($25,000.00), said amount of the bond to be set by the Engineer, are required for the drilling or excavation of each new well. The $100.00 fee per well shall be payable to the Board and shall accompany this application. The amount of the permittee bond shall be stipulated when the well owner is notified that his permit has been granted.

(See Chapter III, Sec. 3-305, Items 2 and 2a)

6. The Owner hereby agrees to the following special conditions for this well:

Date Submitted ____________________________

Signature of Owner ________________________

Black Development Corp.

Name of applicant if other than Owner
TOP OF CASING

STANDARD CAP
SEE COVER DETAIL
SHEET 3

ELEV. = 75 ±

6" I.D. STEEL CASING

TOP OF CASING

ELEV. = 75 ±

8" MIN. DIA.
OPEN HOLE

APPROX. WATER SURFACE
ELEV. = +5.0' TO +25.0'

TORCH CUT SLOTS

5-7/8" OPEN HOLE
IF NEEDED

TYPICAL WELL SECTION
NOT TO SCALE

COMMUNITY PLANNING, INC.
WAIAANAE KAI TEST WELLS
NO.1 AND NO.2
WAIAANAE, OAHU, HAWAII
DRILLING, CASING AND
TESTING TWO WELLS
WELL DETAIL

SHEET 2 OF 3 SHEETS
BAR CAP LOCK DETAILS

PLAN

SLOT TO MATE WITH STEEL BAR

SECTION

4" BAR PLUG

6" I.D. STEEL CASING

COVER DETAIL

STEEL SHOE DETAIL

SLOT DETAIL

COMMUNITY PLANNING, INC.
WAIAHAE KAI TEST WELLS
NO. 1 AND NO. 2
WAIAHAE, OAHU, HAWAI'I
DRILLING, CASING AND TESTING TWO WELLS
MISCELLANEOUS DETAILS

SHEET 3 OF 3