# State of Hawaii
## COMMISSION ON WATER RESOURCE MANAGEMENT
### Department of Land and Natural Resources
#### Division of Water Resource Management

## EXISTING WELL REGISTRATION AND DECLARATION OF USE

**INSTRUCTIONS:** Please print or type. If information is not available or not applicable, indicate as N/A. If a value is estimated, indicate by letter "E." Fill out as completely as possible, sign, and mail to the Division of Water and Land Development, P.O. Box 373, Honolulu, Hawaii 96809. If necessary, phone 548-7143, Hydrology/Geology Section for assistance.

<table>
<thead>
<tr>
<th>STATE WELL NO.</th>
<th>WELL NAME</th>
<th>Puna Plant Pump Nos. 1, 2, 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3602-03-04-05</td>
<td>Does this well name describe a battery or system of wells? (Y) Yes (N) No</td>
<td></td>
</tr>
</tbody>
</table>

**A. WELL OWNER** (As of August 1988)

<table>
<thead>
<tr>
<th>Firm Name</th>
<th>Hawaii Electric Light Co., Inc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Person</td>
<td>Frank G. Kennedy</td>
</tr>
<tr>
<td>Street Address</td>
<td>1200 Kilauea Avenue</td>
</tr>
<tr>
<td>Hilo, Hawaii</td>
<td>Zip 96720</td>
</tr>
<tr>
<td>Phone</td>
<td>(808) 935-1171</td>
</tr>
</tbody>
</table>

**B. LANDOWNER**

<table>
<thead>
<tr>
<th>Firm Name</th>
<th>Same as Item A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Person</td>
<td></td>
</tr>
<tr>
<td>Street Address</td>
<td></td>
</tr>
<tr>
<td>Zip</td>
<td></td>
</tr>
<tr>
<td>Phone</td>
<td></td>
</tr>
</tbody>
</table>

**C. WELL LOCATION**

<table>
<thead>
<tr>
<th>Tax Map Key</th>
<th>1-6-3-5</th>
</tr>
</thead>
</table>

(Attach USGS map, scale 1"=2000', or any maps you currently have showing the well location.) If this well is part of a battery or a system of wells, one location map will suffice provided that it be attached, along with all related well registration forms and a diagram describing the system defined by the well name, into a single package for submittance. See USGS map provided and attached schematic of Puna circulating water system.

**D. WELL DATA**

(An as-built drawing of the well should be submitted, if available.)

<table>
<thead>
<tr>
<th>Ground elevation (above msl)</th>
<th>215 ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water level elevation (above msl)</td>
<td>14 ft.</td>
</tr>
<tr>
<td>Date of measurement</td>
<td>1968</td>
</tr>
<tr>
<td>Solid casing depth</td>
<td>224 ft.</td>
</tr>
<tr>
<td>Max. chloride N/A (ppm)</td>
<td>Year</td>
</tr>
<tr>
<td>Perforated casing depth</td>
<td>--- ft.</td>
</tr>
<tr>
<td>Min. chloride N/A (ppm)</td>
<td>Year</td>
</tr>
<tr>
<td>Total depth of well</td>
<td>375 ft.</td>
</tr>
<tr>
<td>Ave. chloride (1987)</td>
<td>N/A</td>
</tr>
<tr>
<td>Depth to water (below ground)</td>
<td>201 ft.</td>
</tr>
<tr>
<td>Well driller</td>
<td>Layne International</td>
</tr>
<tr>
<td>Year drilled</td>
<td>1968</td>
</tr>
</tbody>
</table>

(An as-built drawing of the well should be submitted, if available.) See attached sketch of Puna Deepwell Pump cross section.

**E. INSTALLED PUMP DATA** (check appropriate box)

<table>
<thead>
<tr>
<th>Pump Type:</th>
<th>Vertical Shaft</th>
<th>Submersible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor:</td>
<td>Diesel</td>
<td>Gas</td>
</tr>
<tr>
<td>Rated Pump Capacity</td>
<td>2,800 gallons per minute (gpm) each.</td>
<td></td>
</tr>
<tr>
<td>Measured Pumping Rate</td>
<td>N/A</td>
<td>gpm</td>
</tr>
<tr>
<td>Pump Installation Contractor</td>
<td>Amfac Inc. (Owner)</td>
<td></td>
</tr>
</tbody>
</table>

(continued over)

For Official Use Only:

<table>
<thead>
<tr>
<th>Field Checked By</th>
<th>Date</th>
<th>Latitude</th>
<th>Hydrologic Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comments</td>
<td></td>
<td>Longitude</td>
<td>State Well No. 3602-03-04-05</td>
</tr>
<tr>
<td>Rec'd</td>
<td>11-1-88</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ELEV. 214.77 FT

216-6"

ELEV. 0'-0"

1-8½"

6'

1-3½'

Suction Pipe

Static Water Level

14'-6" + 1'-0"

Static Water Level

12'-3"

12'-0"

24' Lowered Casing

"O'" Solid Casing

Gravel to Here, Grout Above

Notes:
1. No Gravel Fill in Deepwell No. 2. Well casing anchored at +294.0 ft elev.

Dimension

"a" "b" "c" "d"

Deepwell No. 1 5'-0" 18'-0½" 17'-0" 2.31 ft

Deepwell No. 2 5'-0" 12'-7½" 138'-0" 2.24 ft

Deepwell No. 3 5'-0" 13'-2½" 142'-0" 2.62 ft

Drawdown @ 2800 GPM

Pu`u SUGAR

Deepwell Pumps

Sketch 875-002-1
PROJECT: WELL REGISTRATION
SUBJECT: PUNA CIRCULATING WATER SCHEMATIC

PUMP NO. 1, 2, 3. 2800 GPM EA.

TURBINE CONDENSER

COOLING POND

INJECTION WELL
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
TH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 2 FEET

U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
LDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road

BASICALLY BOOKS
HILO, HAWAII
169 Keawe Street
Hilo, Hawaii 96720
(808) 961-0144
1981

HILO, HAWAII
N19°37.5' W155°00'17.5"
Division of Water and Land Development  
State of Hawaii  
Department of Land and Natural Resources  
P.O. Box 373  
Honolulu, Hawaii 96809

Attention: Mr. Robert T. Chuck  
Manager and Chief Engineer

Dear Mr. Chuck:

The three water wells described in our "Notice of Intent to Drill Well," transmitted with our letter of October 1, 1969, have been completed at Puna Sugar Company, Limited.

Enclosed are copies of the Well Tests for your files and information. The wells were drilled generally as outlined, except that separation between Well No. 1 and Well No. 2 is 117 feet, and the separation between Well No. 2 and Well No. 3 is 161 feet.

The simultaneous pumping of the two wells was not done due to unavailability of a second pump. There was no discernible change in the water level in the County of Hawaii well, located approximately 200 feet away during any of the tests.

Our people have worked closely with Mr. Dan Lum of your division, and we very much appreciate his assistance.

Yours very truly,

Puna Sugar Company, Limited

Karl H. Berg  
President

KHB:blr  
Enclosure  
cc: Mr. Akira Fujimoto
DEEPWELL NO. 2 PUMP TEST July 8, 1963
WEATHER: OVERCAST, NO SUN, TRACES OF RAIN, NO WIND

DEEPWELL NO. 1
DEEPWELL NO. 2 - AIR LINE 7'-8' ABOVE CON. SALT; 230'-1 LONG

DEEPWELL NO. 3

---

<table>
<thead>
<tr>
<th>TIME (HOURS)</th>
<th>STATIC</th>
<th>PUMP</th>
<th>TEMP</th>
<th>PDF</th>
<th>PSD</th>
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<tbody>
<tr>
<td>00-05</td>
<td>14.90</td>
<td>16.01</td>
<td>64</td>
<td>6.9</td>
<td>5.4</td>
</tr>
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<td>05-10</td>
<td>15.04</td>
<td>16.07</td>
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<td>5.4</td>
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<tr>
<td>10-15</td>
<td>15.19</td>
<td>16.14</td>
<td>64</td>
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<td>15-20</td>
<td>15.34</td>
<td>16.21</td>
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<td>20-25</td>
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<td>25-30</td>
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<td>50-55</td>
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<td>16.52</td>
<td>64</td>
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<td>5.4</td>
</tr>
</tbody>
</table>

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DEEPWELL NO. 1: 197'-5 below bottom; 196'-0.5' below bottom.
DEEPWELL NO. 2: 198'5.5 below bottom; 198'5.5 below bottom.

---

stopped 3.06 5.5
3.07 5.5
3.08 5.5
3.09 5.5
### WELL TEST

**JOB NO. 250**

**DATE** July 8-69

Well No. 2  
Location PUNA MILL  
Depth 371 FT  
Dia. 16 1/2 X 13"  

Solid Casing 204 FT  
Screen 24 FT  
DIA. 4 1/2 FT SOLID  
Solid Side Open Hole 138 FT  

Datum + 220.40 FT  
Reference Point Rotary Table  

Test Pump Setting 224.00 FT  
Air Line 219 FT  

Static Water Elev. from

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**Equipment:**

- **Pump** 15 3/8" LAYNE BOWL  
  Mfg'r. LAYNE BOWLER.
- **Rated Q**
- **Operating Speed** 3500 RPM  
  Mfg'r. GMC

- **Present for Test** SYD VIERA - LAYNE DRILLER  
  W.R. CRADICK - LAYNE  
  WM. FAIRCHILD - PUNA MILL  
  IKEHORA - AMFAC.

---

**Static Air Line PSI** 6.57  

**Static Water Level**

**STATIC AIR LINE PSI WELL #1 - 5.4  
STATIC AIR LINE PSI WELL #3 - 5.7**

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME</th>
<th>Q/SEC</th>
<th>GPM</th>
<th>AIR PSI</th>
<th>DRAWDOWN</th>
<th>TEMP</th>
<th>AG NO.</th>
<th>CI's</th>
<th>SAMPLE NO.</th>
<th>REMARKS</th>
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</thead>
<tbody>
<tr>
<td>July 6</td>
<td>10 A.M</td>
<td>3000/57</td>
<td>5.4</td>
<td>2.9 ft</td>
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<tr>
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<td>10:23</td>
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<tr>
<td></td>
<td>10:33</td>
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<td>2.9 ft</td>
<td>8:00 P.M</td>
<td>1</td>
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<td></td>
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<tr>
<td></td>
<td>11:00</td>
<td>3000/57</td>
<td>5.4</td>
<td>2.9 ft</td>
<td>8:00 P.M</td>
<td>1</td>
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<tr>
<td></td>
<td>11:30</td>
<td>3000/57</td>
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<td>2.9 ft</td>
<td>8:00 P.M</td>
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<tr>
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<td>2.9 ft</td>
<td>8:00 P.M</td>
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<tr>
<td></td>
<td>12:30</td>
<td>3000/60</td>
<td>5.4</td>
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<td>8:00 P.M</td>
<td>1</td>
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<tr>
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<td>12:30</td>
<td>3000/60</td>
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<td>2.9 ft</td>
<td>8:00 P.M</td>
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<td></td>
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<td></td>
</tr>
<tr>
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<td>3000/60</td>
<td>5.4</td>
<td>2.9 ft</td>
<td>8:00 P.M</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>12:30</td>
<td>3000/60</td>
<td>5.4</td>
<td>2.9 ft</td>
<td>8:00 P.M</td>
<td>1</td>
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<tr>
<td>DATE</td>
<td>TIME</td>
<td>Q/SEC.</td>
<td>GPM</td>
<td>AIR PSI</td>
<td>DRAWDOWN TEMP</td>
<td>AG NO.</td>
<td>CI's</td>
<td>SAMPLE NO.</td>
<td>REMARKS</td>
<td></td>
</tr>
<tr>
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<td>-------</td>
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</tr>
<tr>
<td>July 6</td>
<td>12:20p</td>
<td>2500</td>
<td>5.60</td>
<td>5.60</td>
<td>68°F</td>
<td></td>
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<tr>
<td>1:00</td>
<td></td>
<td>2600</td>
<td>5.60</td>
<td>68°F</td>
<td></td>
<td>A</td>
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<td>1.25</td>
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<td>1.96ppm</td>
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<td>SHUT DOWN TIME</td>
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TEST STOPPED BY

Tom IKEHARA
# WELL TEST

**JOB NO. 380**  
**DATE** JUNE 6-69

<table>
<thead>
<tr>
<th>Well No.</th>
<th>Location</th>
<th>Depth</th>
<th>Dia.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>PUNA MILL</td>
<td>375 FT</td>
<td>110 1/2</td>
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</table>

<table>
<thead>
<tr>
<th>Solid Casing</th>
<th>Screen</th>
<th>SOLID SHOE</th>
<th>Open Hole</th>
</tr>
</thead>
<tbody>
<tr>
<td>204 FT</td>
<td>24 FT</td>
<td>5 FT</td>
<td>147 FT</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Datum</th>
<th>Reference Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>219.80 FT</td>
<td>ROTARY TABLE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Pump Setting</th>
<th>Air Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>224 FT</td>
<td>220 FT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Static Water Elev.</th>
<th>from</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Equipment:**

- **Pump:** 15 3/4 LAYNE BOWL  
  - **Mfg'r.:** LAYNE BOWLER  
  - **Rated Q:**  
  - **Operating Speed:** 3500 R.P.M  
  - **Driver:** V-1271 DIESEL  
  - **Mfg'r.:** GMC

**Present for Test:**

- SYD VIERA - LAYNE DRILLER
- TOM IKEYARA - AMFAC ENG
- Wm. FAIRCILD - PUNA MILL
- W.R. CRADICK - LAYNE

**Equipment Data:**

- Static Air Line PSI: 7.76 *
- Static Water Level
- Static Air Line PSI WELL #1 - 6.50

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME</th>
<th>Q/SEC.</th>
<th>GPM</th>
<th>AIR PSI</th>
<th>DRAWDOWN</th>
<th>TEMP</th>
<th>AG NO.</th>
<th>CTs</th>
<th>SAMPLE NO.</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>JUNE 6</td>
<td>7:21 AM</td>
<td>STATIC</td>
<td>7.78</td>
<td>11°F</td>
<td></td>
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<td>START PUMP.</td>
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<td>7:22</td>
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<td>6.90</td>
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<td>SHUT DOWN PUMP</td>
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PUMP TEST STOPPED BY
Tom IKEHARA.

WELL WAS SURGED 4 TIMES AT REQUEST of Tom IKEHARA IN ORDER TO DEMONSTRATE THAT NO ROCKS WERE DISCHARGING FROM THE WELL. WELL IS OK.
**CHLORIDE TITRATION RECORD**

for

**Pine Run**  
Well #2  
(No.)

**Island Drd 5/69**  
Project or Job No. 6/12 1969

Titrations conducted by

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Date Taken (ml)</th>
<th>Sample Taken (ml)</th>
<th>Burette Rdg Before</th>
<th>AgNO₃ (ml)</th>
<th>AgNO₃ -.2 ml</th>
<th>Mult. Factor</th>
<th>Chlorides (ppm)</th>
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<tr>
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May 8, 1969

Mr. Akira Fujimoto
Manager-Engineer
Board of Water Supply
County of Hawaii
Hilo, Hawaii

Dear Akira:

Puna Sugar Co. Well #1

On April 28, 1969, Dan Lum accompanied Mike Victor as observers of a 5-hour pumping test on Puna Sugar Co's. new well.

Results of this test indicated no adverse effects on the BWS well located nearby. Drawdown in the new well was 2.3 ft. (1 psi, gage reading) at a sustained pumping rate of 2,800 gpm. No drawdown was observed in the BWS well, using an airline pressure gage; and a drawdown of less than 1 inch was reported in the Puna Sugar Co. shaft, which was continuously pumped at a rate of 2,400 gpm.

The pumped water of the new well had a constant chloride content of 7 ppm and a temperature of 67°F.

Very truly yours,

ROBERT T. CHUCK
Manager-Chief Engineer
<table>
<thead>
<tr>
<th>Date</th>
<th>Rate</th>
<th>EOF</th>
<th>FLG</th>
<th>DPT</th>
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## WELL TEST (continued)

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<th>GPM</th>
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<th>DRAWDOWN</th>
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</table>

**WELL TEST COMPLETED AND SHUT DOWN BY ORDER FROM MR. W. FAIRCHILD.**
EXPERIMENT STATION
HAWAIIAN SUGAR PLANTERS' ASSOCIATION
SUGAR TECHNOLOGY DEPARTMENT

Honolulu, May 18, 1946

Laboratory No. 67

Analysis of Water

Marked As below


Sample by Puna Sugar Company

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<tr>
<th>Sample No.</th>
<th>Sodium Chloride (MgCl)</th>
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<td>9</td>
<td>14</td>
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<tr>
<td>11</td>
<td>14</td>
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Remarks:
3 Puna
1 Amfac, Inc.

Anita Hamilton

E. E. Sloan
## Puna Deepwell No. 1 Pump Test 4-28-1969

**DATE:** April 28, 1969  
**LOCATION:** Puna Sugar Factory Site  
**WEATHER:** Light drizzle continuously.  
Heavy rain at times. Downpour at 3:45 P.M.  
**TEST BEGUN:** 10:45 AM, April 28, 1969  
**TEST STOPPED:** 4:00 PM, April 28, 1969  
**DATA ON OTHER WELLS IN VICINITY**

<table>
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<tr>
<th>BS $\text{WELL NO. 1}$</th>
<th>SEPARATION: 242 ft approx</th>
<th>CONDITIONS: Continuously pumping during test</th>
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<table>
<thead>
<tr>
<th>BS $\text{WELL NO. 2}$</th>
<th>SEPARATION: 200 ft approx</th>
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<table>
<thead>
<tr>
<th>Olaa Shaft</th>
<th>SEPARATION: 780 ft approx</th>
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<table>
<thead>
<tr>
<th>Estimated Static Water Level: +21.9 ft</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Pumping Level: +15.17 ft</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Pumping Rate: Approx 2400 GPM during test</th>
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</table>

<table>
<thead>
<tr>
<th>Drop in Water Level during test: 0.75 inches</th>
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</thead>
</table>

**TEST RESULTS:**  
<table>
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<tr>
<th>Pumping Rate</th>
<th>Drawdown</th>
<th>Chloride PPM</th>
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<td>4.5 ft/min</td>
<td>4.7 ft</td>
<td>1.4 ft/min</td>
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<td>3.3 ft/min</td>
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<tr>
<td>6.5 ft/min</td>
<td>6.4 ft</td>
<td>4.9 ft/min</td>
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## WELL TEST

**JOB NO.** R120  
**DATE** AGILU-29-51

### Well Information

- **Well No.** 1  
- **Location** Puuna Sugar Mill  
- **Depth** EAY = 163  
- **Screen** EAV = 0.5 FT  
- **Open Hole** EAY = 13.3 FT

### Casing

- **Solid Casing** APM = 3.2 FT  
  - **Screen** EAV = 0.5 FT  
  - **Open Hole** EAY = 13.3 FT

### Test Details

- **Test Pump Setting**  
  - **Location AT EAY = 26.1 FT**  
  - **Air Line** EAY = 17.7 FT

### Static Water

- **Static Water Elev.** 194 FT  
- **from Cement Floor**  
- *** 243.96° C-certified**

### Equipment

- **Pump**  
  - **Type** 1/4"  
  - **Discharge** 50 SF  
  - **Start Line** 3000 RPM

- **Driver**  
  - **Model** 50 HP  
  - **Engine** RIGHT SIDE

### Manager

- **Mfg't.** Layne

### Present for Test

- **Dan Linn - Division of Water & Land**
- **F. R. Chudleigh - Layne**
- **Tom Ireland - Ogden**
- **Mike Victoria - Board Member Sugar**
- **W. F. Allard - Puuna Sugar**

### Water Meter

- **Type** S. Indication

### Meter Supplied by Board of Water & Land

### Measurement Table

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<tr>
<th>DATE</th>
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<th>GPM</th>
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<td>294</td>
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</table>
**WELL TEST**

**JOB NO. P2E**

**DATE** APRIL 25, 1966

**Well No.** 1  
**Location** Puana Sugar Mill  
**Depth** Elevation 163  
**Screen** Elevation 147

**Solid Casing** Elevation 100  
**Open Hole** Elevation 107

**Datum**  
**Reference Point** Elevation 104

**Test Pump Setting** Elevation 103  
**Air Line** Elevation 17.7

**Static Water Elev.** 19.4 FT  
**Equipment**

**Pump**  
**Type**  
**Discharge**  
**Rating**

**Operating Speed** 3200 RPM  
**Mfr.** Layne

**Present for Test**

**Static Air Line PSI** 16.2

**Static Water Level** + 17.7 FT

**WATER METER  3" TYPE S, INDIANA**
**METER SUPPLIED BY BOARD OF WATER W. FOR CHILDS - PUANA SUGAR**

<table>
<thead>
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<th>Date</th>
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<th>Cold hr</th>
<th>Hot hr</th>
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*23.96'-CERTIFIED*
### PUMPING TEST RECORD

**Well:** #1  
**Location:** Island Project or Job No. 4-28 1969

**Drilled:** 4/69

---

**Description of Well:**
1. Elevation: ground surface 222 ft., top of casing ___ ft., table ___ ft., referenced to ___ benchmark.
2. Total depth of well ___ ft.; or ___ ft. elevation, msl.
3. ___ in. solid casing to ___ ft. depth, perforated to ___ ft. depth.
4. Static water level on ___ 19 ft. below ground surface, top of casing; or ___ ft. elevation, msl.

**Description of Pump and Pump Setting:**
5. ___ type pump with ___ stage bowl assembly.
6. Gasoline diesel, electric, power with ___ horsepower.
7. Shaft speed: ___ rpm at ___ gpm flow.
8. Depth of pump intake: ___ ft. below ___; or ___ ft. elevation, msl.
9. Depth of airline bottom: ___ ft. below ___; or ___ ft. elevation, msl.
10. Center of gage: ___ ft. elevation, msl. Flow measured with ___.

---

**Date & Time** | **Pumping rate** | **Airline** | **Drawdown** | **Chlorides** | **Temperature** | **Cond.**
---|---|---|---|---|---|---
4/26/69 | 10:40 | Static | 16.7 ps | 0 | | |
10:45 | Start Pump | 10:41 | 10.5 | 15.2 | 85 | 67°F
10:50 | 11:51 | 15.2 | 82 | 65.5 | 81 |
10:53 | 11:00 | 15.2 | 80 | 65.6 | 77 |
10:55 | 11:10 | 15.2 | 77 | 65.6 | 77 |
11:00 | 11:30 | 2000/18.5 | 15.2 | 65.6 | 27 |
11:35 | 12:00 | 15.2 | 17 | 65.6 | 77 |
12:00 | 12:30 | 15.2 | 77 | 65.6 | 77 |
12:30 | 1:00 | 15.2 | 77 | 65.6 | 77 |
1:00 | 1:30 | 15.2 | 77 | 65.6 | 77 |
1:30 | 2:00 | 2800 | 15.2 | 65.6 | 76 |
2:00 | 2:30 | 15.2 | 76 | 65.6 | 76 |
November 7, 1968

Mr. Robert T. Chuck
Manager-Chief Engineer
Division of Water and Land Development
P. O. Box 373
Honolulu, Hawaii 96809

Re: Proposed Puna Sugar Company Wells

Thank you for sending us your views on the proposed Puna Sugar Company's Wells. We are happy to know that Puna Sugar Company has kept you informed on its three proposed wells.

We hope they will invite your staff to witness the pumping tests so that we may be assured that the wells will not affect our wells adversely.

W. Y. Thompson
Manager-Engineer

...Water brings progress...
October 9, 1968

Mr. William Thompson
Manager-Engineer
Board of Water Supply
County of Hawaii
Hilo, Hawaii

Dear Bill:

**Proposed Puna Sugar Co. Wells**

Amfac's Plantation Division has kept our office informed of their three proposed industrial wells for Puna Sugar Co. at Olaa, through Mr. Tom Ikehara, mechanical engineer.

Our basic comment to Mr. Ikehara was that no problem could be anticipated in developing the additional wells, but that there should be both an awareness and concern regarding possible adverse effects on the nearby Board of Water Supply source wells. With this in mind, I recommended that appropriate pumping test data (including observations of the County wells during testing) be obtained on the first well to adequately analyze aquifer characteristics and proposed total well development.

In the interest of safe development of ground water, we have offered to assist in the pumping tests as observers. Presumably, their decision to drill the second and third wells will await favorable results of the first well.

An extensive ground water source exists at Olaa on the basis of a static water level of 17 feet, mean sea level, and a chloride content of 9 ppm. Definitive information on aquifer characteristics to corroborate this should be available from appropriate pumping test data. Some increase in chlorides can be expected, but in all probability not significantly.

After use, we understand that the well water is to be recharged back into the ground through open pits. Return of this water to the ground water body would help offset long-term pumping effects.
Again, the Board of Water Supply wells probably will not be adversely affected by the proposed well development. However, we should look to the pumping test data for definitive information. The interest of your office in the pumping tests should facilitate cooperative results with Amfac and Puna Sugar Co.

Very truly yours,

ROBERT T. CHUCK
Manager-Chief Engineer
October 4, 1968

Mr. Dan Lum
Division of Water and Land Development
P. O. Box 373
Honolulu, Hawaii 96809

Enclosed are copies of our correspondence with Amfac regarding their Puna Sugar Company three mill site deep wells. I note that they are consulting with you. While we foresee no problem, we would appreciate your thoughts on this as we have expressed them to Puna Sugar.

W. Y. Thompson
Manager-Engineer

Encs.
October 4, 1968

Mr. Boyd T. Townsley
Director of Mechanical Engineering
Plantation Division, Amfac Inc.
P. O. Box 3230
Honolulu, Hawaii 96801

Thank you for sending us the information and specifications on the drilling of three industrial wells at the Puna Sugar Company mill site. While we do not foresee any problem, we are happy to note that you are consulting Mr. Dan Lum, State Geologist.

We appreciate your cooperation.

W. Y. Thompson
Manager-Engineer

cc: Mr. W. D. Fairchild
October 3, 1968

Mr. Karl H. Berg
President
Puna Sugar Company, Ltd.
Keaau, Hawaii 96749

Dear Mr. Berg:

This is to acknowledge receipt of your "Notice of Intent" and "Specifications" for drilling three wells at Keaau, Hawaii, for industrial purposes.

We appreciate your cooperation in providing us this information and would welcome additional data on the drilling and testing, when they become available.

Should you feel that we could be of any help regarding these wells, please do not hesitate to let us know.

Very truly yours,

ROBERT T. CHUCK
Manager-Chief Engineer
October 1, 1968

Manager-Chief Engineer
Division of Water and Land Development
P.O. Box 373
Honolulu, Hawaii

Dear Sir:

Enclosed find two copies of "Notice of Intent to Drill Well" along with a "Specification for Drilling of Industrial Water Wells" and a Plot Plan of the proposed site.

The wells are intended for industrial use at Puna Sugar Co.'s factory at Keaau, Hawaii, and recharge is contemplated for ultimate disposal of the water.

Very truly yours,

PUNA SUGAR COMPANY, LTD.

[Signature]
Karl H. Berg
President

KHB:pn
Encls.
October 1, 1968

Manager-Chief Engineer
Division of Water and Land Development
P.O. Box 373
Honolulu, Hawaii

Dear Sir:

Enclosed find two copies of "Notice of Intent to Drill Well" along with a "Specification for Drilling of Industrial Water Wells" and a Plot Plan of the proposed site.

The wells are intended for industrial use at Puna Sugar Co.'s factory at Keaau, Hawaii, and recharge is contemplated for ultimate disposal of the water.

Very truly yours,

PUNA SUGAR COMPANY, LTD.

Karl H. Berg
President

KHB:pn

Encls.
September 17, 1968

Mr. William Fairchild
Puna Sugar Company
Hilo, Hawaii

I have been informed that Layne International has been the successful bidder to drill three wells for your factory expansion program.

As I stated earlier, while we do not anticipate any problem, we are concerned about the size of your well, the distance that the well will be away from the Board of Water Supply existing wells, the maximum discharge in GPM, and the approximate anticipated drawdown at the maximum discharge. You had mentioned a study by a consultant. I would appreciate a copy of his report for our review.

Your cooperation will be greatly appreciated.

W. Y. Thompson
Manager-Engineer

...Water brings progress...
NOTICE OF INTENT TO DRILL WELL

INSTRUCTIONS: Send two (2) copies to: Manager-Chief Engineer, Division of Water and Land Development, P. O. Box 373, Honolulu, Hawaii 96809. In filling out this form, refer to Chapter 101, entitled “Artesian Wells, Generally,” RLH 1955, 1963 Supplement.

Location of Well: (Describe and attach sketch or map) Attached find two plot plans for the three proposed wells at Puna Sugar Company, Ltd., together with a specification describing the wells themselves.

Parcel No. 5 of Tax Map Key: Zone 1, Section 6 Plat. 03

Owner of Well: Puna Sugar Company, Ltd.

Mailing Address: Keaau, Hawaii 96749, with copies to: Amfac, Inc. (Plantation Div.) P.O.Box 3230, Hon., Hawaii 96801

Well Driller: Layne International, Inc.

Mailing Address: P.O. Box 9206, Honolulu, Hawaii 96820

Proposed Use of Well: (a) Domestic (d) Others (Specify) ______________
(b) Industrial X ______________
(c) Irrigation ______________

Remarks:

Development of three (3) 2,800 GPM industrial water wells to yield a total of 8,400 GPM of water for factory operations. Each well will consist of approximately 217 ft. of 16" I.D. cased hole and approximately 133 ft. of 15½" open hole. After use, for factory operations, recharge is contemplated by the "open-pit" method "makai" of the well site. Drilling to begin approximately December 1, 1968.

Attachments: Plot Plan Specification

K. H. Berg

President

Date Submitted Title (If applicable)
Q = 29.5 mgd flow
Q = 5.9 mgd

Assume T = 5 Yrs

Q = 11.8 mgd/in. ft
I = 47/yr, 5.9 ft/yr
T = 270, Assume 270
G = 9 ft
Q = TIL

Food, Water Accessories
Static Water Access

Point, Route, Access

Weir, Water Access

Weir, Route, Access
SPECIFICATION
for
DRILLING
of
INDUSTRIAL WATER WELLS

for

PUNA SUGAR COMPANY, LTD.

KEAAU, HAWAII 96749

(Ref.: 875-002)
PUNA INDUSTRIAL WATER WELLS

I. Introduction

Puna Sugar Company is interested in developing three (3) 2800 GPM industrial water wells to yield a total of 8,400 GPM of water for factory operations. The project as envisioned is to be completed in four phases.

PHASE I - Will consist of drilling a vertical well at approximately 214 feet elevation to a total depth of approximately 350 feet, installing necessary casing, and conducting appropriate performance testing to demonstrate the suitability of the well.

PHASE II - Upon completion of the performance testing in Phase I Puna Sugar Company at its sole discretion may or may not decide to proceed with Phase II. If Phase II is authorized, it will be a duplicate of Phase I.

PHASE III - Upon completion of the performance testing in Phase II, Puna Sugar Company at its sole discretion may or may not decide to proceed with Phase III. If Phase III is authorized, it will be a duplicate of Phase I.

PHASE IV - Is the installation at a later date (presently estimated at some ten (10) months after Phase III) of Puna supplied 14-inch vertical turbine pumps in the three wells.

SUMMARY

Puna Sugar desires to enter into an agreement with a reputable well drilling firm to undertake this project, which consists of furnishing all material, labor, methods, implements, tools and other incidentals to construct the three wells in complete order ready for installation of the permanent pumping facility and to leave the grounds in a neat condition as broadly outlined as Phases I, II, III and IV.

Puna Sugar reserves the right to increase, decrease, or omit portions of the project using the lump sum or unit prices in Part V as may be deemed advisable during the progress of the work.
The desire is to have a close working relationship with the contracting firm to take advantage of any mutually beneficial opportunities that may arise.

II. Scope of Work

PHASE I. The work outlined in Phase I will consist of 4 steps. Step 1 will be to drill a well approximately 217 feet in depth of sufficient (not less than 20 inches) diameter to take a 16-inch I.D. 5/16-inch wall casing. Step 2 will be to install the permanent casing and to extend the well another 133 feet or more with a 15½-inch diameter bore generally in accordance with the accompanying sketch. Step 3 will consist of completing the casing, grouting and the installation of a 5 x 5 x 3 concrete-reinforced pump foundation block. Step 4 is to conduct a pump test, with appropriate records, curves, etc. to demonstrate the suitability of the well and to temporarily cap the well after all testing is completed in readiness for the future installation of the permanent pump which is a part of Phase IV.

PHASE II will commence after the performance testing in Phase I has been completed and results indicate to Puna's sole satisfaction that a second well is feasible. The second well will be in general a duplicate of the first well as drilled in Phase I, and will be temporarily capped for the future installation of the permanent pump after all testing is completed. During the pump test of this well, the contractor shall measure water levels in both wells simultaneously.

PHASE III will commence after the tests in Phase II have indicated that a third well would be feasible, to Puna's sole satisfaction. The third well will, in general, be a duplicate of the first well drilled in Phase I and is to be temporarily capped after all tests are completed for the future installation of the permanent pump. During the pump test of this well, the Contractor shall measure water levels in all three wells simultaneously.

PHASE IV will consist of the setting of three deep well, electric motor driven, vertical turbine pumps and water level devices some months after Phase I through III are completed and will include all necessary grouting, alignment and operational testing. The discharge pipeline beyond the discharge head and electrical wiring will be by Puna Sugar Company.
III. General Conditions

1. **Sanitary Conditions**: The purpose of this project is to supply power plant and factory cooling water and as such it is not intended for domestic use, however, all sanitary regulations covering work for domestic water shall be followed.

2. **Location**: The wells are to be located generally in the vicinity of the Puna Sugar Company factory at Keaau, Hawaii. It is the responsibility of the Contractor to study the site and become thoroughly familiar with all local conditions.

3. **Performance**: The wells shall be drilled plumb and straight. The drilling and casing work will meet all the constructing, testing and alignment requirements as defined in the Standards of the American Water Works Association. The exact depth of the hole to be drilled and cased shall depend on the nature of the material penetrated and hydraulic conditions encountered during drilling. The depth of the open hole to be drilled below the casing will also be determined during the course of the work but shall approximate the information on the attached sketch.

   The Contractor shall begin his drilling work within 30 days after being issued a purchase order. Phase I through Phase III shall be completed within 135 calendar days. Phase IV shall commence some months after completion of Phase III. The Contractor shall commence setting the pumps 30 days after receipt of notice by Puna Sugar Company and complete within 20 calendar days.

   The work shall be done to the complete satisfaction of Puna Sugar Company and in accordance with the laws of the State of Hawaii. The general specifications of the State Department of Land and Natural Resources shall be followed.

4. **Licenses, Safety, Property**: The Contractor shall obtain all necessary permits and licenses, pay all charges and fees and give all required notices. The Contractor shall at all times provide adequate safeguards for the protection of the work and safety of the public. The Contractor shall respect the rights of the owners and will be responsible for any damages to fences, buildings, livestock, etc.
5. **Abandonment:** In the event the well or wells should be abandoned for reasons such as lack of water, the cost incurred up to that point shall be paid by the owners. However, if the well must be abandoned because of failure to drill to the desired depth, loss of tools, faulty alignment, etc., the cost incurred up to this point as well as the cost of sealing the well shall be borne by the Contractor.

6. **Public Liability Insurance:** The Contractor shall execute and deliver to the owner a certificate showing that the contractor carries and has in force a public liability insurance policy in an amount of not less than One Hundred Thousand Dollars for a single person and Three Hundred Thousand Dollars for one accident. The policy shall not contain any clause to the effect that the insurer is not liable on account of any accident arising out of work performed by the subcontractors or their employees.

7. **Property Damage Insurance:** The Contractor shall execute and deliver to the owner a certificate showing that the Contractor carries and has in force a property damage insurance policy in an amount of not less than Fifty Thousand Dollars per accident and One Hundred Thousand Dollars aggregate.

8. **Quality of Materials:** Materials not furnished by the owner, and specified by manufacturer's name and catalog number are for the purpose of establishing quality desired. Materials having equal or better quality of other makes may be substituted subject to the owner's approval.

IV. **Proposal:**

The proposal shall include the supply of all labor, materials, equipment, tools, transportation, supplies, plant, equipment, appurtenances, and other incidental work necessary to fully complete the three wells as described herein as Phase I through Phase IV of the project, with the single exception of the permanent vertical turbine pumps required in Part IV which shall be supplied by Puna Sugar Company.

A. **Boundaries of Work:** The Contractor may enter or occupy suitable areas adjacent to the site with men, tools, equipment or materials as long as the area does not include any cane land and which will not hamper Puna Sugar Company's operations. The site will be leveled and an all-weather access road provided by Puna Sugar Company. The actual well sites will be staked and flagged by Puna Sugar Company.
B. Availability of Electric Power: There is limited electric service in the vicinity from the local utility and shall be between the Contractor and the utility.

C. Availability of Water: Limited water is available in the vicinity.

D. Diameter and Depth of Wells: Each well shall be drilled to a sufficient diameter to permit the installation of a 16-inch inside diameter corrosion resistant 5/16-inch wall, steel casing and shall provide sufficient additional space for proper alignment, plumbing and grouting around the casing. The well shall be approximately 350 feet in overall depth, and the casing shall extend to a depth of approximately 214 feet below the top of the concrete foundation block and grouted in place. The open hole below the 16-inch I.D. casing shall be 15½ inches in diameter and uncased and shall extend approximately 133 feet below the bottom of the 20-inch hole.

E. Order of Operation for Each Well

1. General

The contractor shall at all times provide adequate safeguards for the protection of the work, the public and Puna Sugar Company's property. Site and well cleanliness and sanitation will be observed.

2. Records and Samples

The Contractor shall maintain accurate records of the material encountered and shall furnish Puna Sugar Company with sample of the material at each change of material and stratum (in any case, no more than at 5-foot intervals). Samples shall be placed in jars, sealed and marked as to depth taken. Contractor is to report when water is encountered at the beginning or end of each shift.

3. Temporary Plug

During the progress of the work, the Contractor shall provide a temporary plug or cover over the top of the hole when the drill tools are not in operation.
4. Drilling Method

The drilling may be accomplished by churn or rotary drill operation. In the case of rotary drilling, the well must be surged and cleaned with appropriate chemicals, using procedures approved by Puna Sugar Company to remove all trace of bentonite or other drilling aides. The Contractor shall employ only competent and experienced men in drilling the wells. Equipment used shall be extended and heavy enough to handle the tools and casing used on the project. The Contractor shall drill approximately 217 feet of 20-inch diameter hole below the top of the concrete foundation. The alignment and plumbness of the hole shall be adequate to permit the proper installation of a 16-inch I.D. casing with respect to alignment and plumbness and subsequent grouting of the casing specified hereunder.

5. Casing

After completion of the 20-inch hole to approximately 217 feet below the concrete block (or deeper if water samples indicate surface or leaching contaminants). The Contractor shall install approximately 214 feet of 16-inch I.D. 5/16-inch wall corrosion resistant casing. The physical properties of the steel used in the fusion welded pipe for the permanent steel casing shall conform to standard specifications A283 Grade B of ASTM. Casing shall have a shell thickness of not less than .3125 (5/16) inch. Individual length of casing shall be provided with beveled ends for butt welding. Individual lengths of casing shall not be less than 24 feet and not more than 32 feet. The limits of chemical composition shall be as follows:

<table>
<thead>
<tr>
<th>Element</th>
<th>Max. Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>.12 max.</td>
</tr>
<tr>
<td>Manganese</td>
<td>.60 max.</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>.12 max.</td>
</tr>
<tr>
<td>Sulfur</td>
<td>.05 max.</td>
</tr>
<tr>
<td>Silicon</td>
<td>.50 max.</td>
</tr>
<tr>
<td>Copper</td>
<td>.50 max.</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>.10 max.</td>
</tr>
<tr>
<td>Chromium</td>
<td>.40 max.</td>
</tr>
<tr>
<td>Nickel</td>
<td>1.00 max.</td>
</tr>
</tbody>
</table>

The material furnished shall be U.S.S. COR-TEN; Bethlehem Mayari R; Lukens COR-TEN; Kaisaloy 45 FG, or approved equal.

6. Welding

Welding of the casing shall be done by operators who have previously qualified by test prescribed in the American Welding Society Standards of Qualification Procedures for this type of work. Surface
to be welded shall be free from loose scale, rust, grease or other foreign materials except that mill scale which will withstand vigorous wire brushing may remain. Joint surfaces shall be free from fins and tears. Adjacent lengths of casing shall be held in proper alignment while the joint is being welded.

7. Preliminary Well Alignment

No casing shall be installed in any section of the drilled well until that section has been checked for alignment and plumbness and the Contractor has corrected any defects shown up by the test.

8. Temporary Casing

The Contractor shall furnish, install and remove any temporary casing he finds necessary as a part of the drilling or pumping operations of the well to hold the material encountered near the surface or at other points of the drill well from sluffing into the completed hole. The cost of any temporary casing and work entailed in its installation and removal will be considered incidental to and part of the Contractor's price for drilling the well.

9. Casing Integrity

The string of pipe used as the permanent casing shall be continuous from its bottom terminal at the bottom of the 20-inch hole to a point 8 inches above the top of the concrete foundation block (elevation 214 feet plus). All joints shall be welded. No driving of casing which will likely damage the pipe or cause a change in the circular cross section of the pipe will be permitted. A reinforcing collar shall be placed on the bottom of the casing to assist in retaining the shape.

10. Alignment of Casing

After the installation of the casing and welding of the joints, the pipe shall be tested for alignment and plumbness. Any kinks or twists, etc. of alignment which will not permit the proper installation and operation of the 14-inch deep well turbine pump or when installed, will cause undue wear and strain on the pump casing, shaft or bearings shall be corrected before the casing is grouted in place. The
casing shall be tested for plumbness and alignment and shall conform to the tolerances set for deepwells. The standard specifications for deepwells as promulgated by the American Water Works Association and designated as AWWA A100-58, shall be adhered to for method of testing the units of tolerance (See Section 1-6.1 to 6.3 inclusive and Section A1-9 to 1 to 9.4 inclusive) and shall be considered a part of the specification. The casing as installed must be within a maximum of 6-inch deviation per 100-foot of hole and will be demonstrated by:

a. A Tutco alignment indicator

or

b. A short dummy at least 15-inch O.D. by 18-inch long on a plumb line

and

c. A long dummy, at least 40 feet of 8 or 10 inch pipe with three 15" x 12" sleeves evenly spaced along the length to demonstrate pump installation, ease and alignment.

11. 15½" Open Hole

After the Contractor has completed his installation of the 16-inch I.D. casing, the Contractor shall drill a 15½-inch uncased hole, approximately 133 feet below the bottom of the 20-inch hole. During the progress of this work, the Contractor shall provide a temporary plug or cover over the top of the hole when the drill tools are not in operation. The final depth of the 15½" hole will be determined by Puna Sugar Company and the price per foot shall be on the unit basis as shown in the pricing tabulations.

12. Pump Test and Cleaning

After the well has been drilled to 350 feet or deepened as indicated by the work, a pump test will be performed. Prior to the pump test, the well shall first be cleaned of all material and drilling aids as indicated in the preceding sections. The Contractor shall furnish and install a deepwell turbine pump having a capacity of not less than 3500 GPM. Setting of the pump shall be at sea level or as indicated by the operation. The
installation shall be such that continuous pumping can be maintained for 72 hours or more at 2800 GPM. Should mechanical failure cause the pump test to stop prior to completion as determined by Puna Sugar Company, no payment will be made for the portion of the test run prior to the pump run failure. During the last few hours of the pump test, the rate shall be increased to the 3500 GPM capability of the pump.

13. **Measuring Equipment**

The Contractor shall provide suitable equipment to measure the water level in the well both under static and pumping conditions as well as the measure of the discharge from the well in gallons per minute. The type of equipment and method to be employed in measuring the discharge from the pump and the level of the water in the well shall be subject to approval by Puna Sugar Company. During the pump tests after two and three wells have been completed, the Contractor shall furnish suitable water level measuring equipment in the unpumped wells. During each pump test, the Contractor shall take and titrate water samples for chlorides and conductivity.

14. **Discharge Piping**

The Contractor shall provide the necessary pipe from the weir box or other measuring device for the proper disposal of the water at a site designated by Puna Sugar Company. Pumping shall continue until such time as the ground water table becomes stabilized or until pumping is stopped by Puna Sugar Company. Records and logs of water levels and samples and discharge volumes shall be kept throughout each test on all wells.

15. **Notification**

Notification shall be given to Puna Sugar Company and approval shall be received before the pump test begins. The test will be started on a day that does not have rain. Payments will be made for the use of the pump equipment measuring devices and piping on a lump sum basis. This lump sum will include pumping for a satisfactory period of 72 hours. Additional pumping may be conducted on an hourly basis at the unit price. The actual length of the pump test to be determined by Puna Sugar Company.
16. **Grouting**

After all pumping tests have been completed, the grouting and back filling of the casing shall be completed as shown on the attached sketch. Puna Sugar Company may elect to grout the entire annular space between the hole and casing in lieu of the gravel shown on the sketch. If Puna elects to grout the entire hole, the pour will be made in three separate pours to prevent the hydrostatic head of the wet grout from collapsing the casing. Grout is to be tremied in place. Cost of this additional grouting will be an adder to the base price.

17. **Pump Block**

After completion of a satisfactory pump test and the possible deepening of the wells as required, the Contractor shall excavate a hole 5-foot square and 4-foot deep and construct a concrete reinforced pump foundation block over the center of the well. The block shall be accurately made to the dimension shown on the drawing. Concrete may be placed without forms if the earth and rock are tight and will stand vertically. If the earth is loose, forms will be required. The metal forms (12 or 16 gauge) required for the center hole shall be securely held in place in a vertical position during the placing of this concrete. Concrete used shall be 2500 pounds per square inch. The earth sides and bottoms of the excavation shall be sprinkled with water before placing the concrete and the concrete shall be cured by daily soaking with water for a week or by painting the exposed surfaces with Hunts processed liquid immediately after the concrete has set.

18. **Temporary Capping**

After completion of the concrete block, the Contractor shall protect the well in such a manner as to effectively prevent either tampering with the well or the entrance of foreign matter. Upon completion of the well, he shall provide and set a substantial flanged or welded cap of a design approved by Puna Sugar Company. The cost of the cap shall be included in the lump sum bid for the first section of casing for the well.
19. **Abandonment**

In the event that the Contractor shall fail to sink the well to the specified depth or to such greater depth as ordered by Puna Sugar Company, or should he abandon the well because of loss of tools or other cause, the Contractor shall seal the abandoned well in a manner acceptable to the Hawaii State Department of Land & Natural Resources, Division of Water and Land Development. Salvaged material furnished by the Contractor shall remain his property.

20. **Cleanup**

Upon completion of the work in Phases I to III and after Phase IV, the Contractor shall remove all equipment used on the project and all surplus material from the site. The site shall be left in a neat condition free of all debris.

21. **Installation of Final Pump Unit**

Some ten months after Phase III, the Contractor shall mobilize at Puna Sugar and install three 14-inch vertical turbine pumps in the three wells at Puna Sugar Company. Each pump will be driven by a 300 H.P. electric motor. Wiring of the pump and piping beyond the discharge head will be by Puna Sugar Company. The installation will include all necessary grouting, alignment and operational testing.
V. Pricing

Please furnish pricing breakdowns in the proposal using the form shown here:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Unit Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobilization and Demobilization of drilling equipment as required for Phases I, II, and III.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Lump Sum</strong></td>
<td></td>
<td>$______</td>
</tr>
<tr>
<td>2</td>
<td>Moving as required from Phase I to Phase II and from Phase II to Phase III (approximately 50 feet for each subsequent well). (Two moves required for the three Phases.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Per Move</strong></td>
<td></td>
<td>$______</td>
</tr>
<tr>
<td>3</td>
<td>Drilling approximately 651 feet of 20-inch diameter hole and installing approximately 644 feet of 16-inch I.D. 5/16 inch wall corrosion resistant casing including concrete plug at end (bottom) of each casing.</td>
<td><strong>Per Lineal Foot</strong></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Backfilling approximately 516 feet of annular space with clean #4 gravel around casing.</td>
<td><strong>Per Lineal Foot</strong></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Grouting approximately 117 feet of annular space with a 1:1 grout mixture, and pure concrete as indicated on sketch.</td>
<td><strong>Per Lineal Foot</strong></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Drilling approximately 399 feet of 15½&quot; open hole below the 20-inch hole.</td>
<td><strong>Per Lineal Foot</strong></td>
<td></td>
</tr>
<tr>
<td>Item No.</td>
<td>Description</td>
<td>Unit Price</td>
<td>Total</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<td>-------</td>
</tr>
<tr>
<td>7.</td>
<td>Furnishing a 2800 GPM (at ground level) pump which has a 5-hour 3500 GPM capability, measuring equipment, piping etc. for the three pump tests.</td>
<td>Lump Sum</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Installation of Pump, measuring devices in each well, piping, etc. for three wells.</td>
<td>Per Installation</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Provide fuel supervision, labor, etc. to operate test for 72 continuous hours at 2800 GPM at the ground level, the last five hours at 3500 GPM and record all significant data and produce well drawn curves approximately 216 hours of pumping.</td>
<td>Per Hour</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Simultaneous pumping of two wells over and above amount allowed for each well in Item 7 - including all additional measuring devices, casing, piping, etc. as required</td>
<td>Lump Sum</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Operating the two pumps under the direction of the owner on an hourly basis over and above the 72-hour test.</td>
<td>Per Hour</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Mobilization and demobilization for installation of three 14-inch deepwell turbine pumps provided by Puna Sugar Company, Phase III.</td>
<td>Lump Sum</td>
<td></td>
</tr>
<tr>
<td>Item No.</td>
<td>Description</td>
<td>Unit Price</td>
<td>Total</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------</td>
<td>-------</td>
</tr>
<tr>
<td>13</td>
<td>Setting and testing of three 14-inch Deepwell (pumps, power and control equipment by Puna Sugar Co.) at a later date as developed in Phase IV - to include all grouting, leveling, alignment, etc. required to leave the pumps in a fully operational condition.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lump Sum</td>
<td></td>
<td>$______</td>
</tr>
<tr>
<td>14</td>
<td>Grouting approximately 516 feet of annular space with a 1 to 1 grout mixture, in lieu of clean No. 4 gravel in Item No. 4 under PRICING.</td>
<td>$_________</td>
<td>______</td>
</tr>
</tbody>
</table>
TOP OF FOUNDATION FLUSH WITH LEVELED SITE AREA -
(APPROXIMATELY 214' ELEVATION)

16" I.D. STEEL CASING
5/16" CORROSION RESISTANT STEEL
214' ELEV (APPROX)

5'X5'X3' STEEL REINFORCED CONCRETE BLOCK
(1:2:4 - 2500#)

DRILL 20" BORE MINIMUM

ANNULAR STEEL RING
TACK WELDED 19" ± O.D.

#4 CLEAN GRAVEL OR
1:1 CEMENT

REINFORCING COLLAR
5/16" X 9" - TACK WELDED TOP AND BOTTOM

OPEN HOLE

NOTES:

a) STATIC WATER LEVEL
± 17' ABOVE SEA LEVEL

b) DRAWDOWN 8'

133' OR MORE DEPENDING ON WATER CONDITIONS

10' APPROX SEA LEVEL

172' APPROX

1:1 CEMENT

35'

15 1/2" I.D.

16" I.D.

1/1 CEメント