September 22, 1967

Mr. Walter L. Briant, Jr.
Manager & Chief Engineer
Board of Water Supply
County of Kauai
Lihue, Kauai

Dear Walt:

Waimea and Kakaha Domestic Sources

We have reviewed the chemical analyses of water from your Board's Waimea Shaft 9 and Kakaha Shaft 12 sources. Preliminary indications are that the basal water tapped by these sources is affected by contamination from agricultural activities, i.e., leaching of fertilizers by rainfall and irrigation. Secondly, the higher-than-expected chloride contents of these sources may be due to contamination by leaching of fertilizer and/or by mixing of fresh water with saline water.

A preliminary study on Oahu suggests that contamination by agricultural fertilizers is recognizable by increases in nitrate ($\text{NO}_3$) and silica ($\text{SiO}_2$) contents. Results of the study show the following average nitrate and silica contents (ppm) of a number of selected wells:

<table>
<thead>
<tr>
<th></th>
<th>Non-irrigated Areas</th>
<th>Mid-portion Irrigated Areas</th>
<th>Makai-portion Irrigated Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{NO}_3$</td>
<td>1.0</td>
<td>2.7</td>
<td>8.2</td>
</tr>
<tr>
<td>$\text{SiO}_2$</td>
<td>34</td>
<td>54</td>
<td>63</td>
</tr>
</tbody>
</table>

The Waimea and Kakaha sources show nitrate contents of 2.9 and 4.1 ppm and silica contents of 35 and 54 ppm, respectively, suggesting possible contamination by agricultural activities.
The reasons for higher-than-expected chloride contents in the Waimea and Kekaha sources are not as apparent. According to a 1959 report, Kekaha Sugar Co. uses muriate of potassium (KCl) in fertilizing its cane. Whether a significant quantity, if any, of chloride is leached to the basal aquifer to affect chloride contents is not known, but KCl appears a possible source of chloride contamination. On the other hand, chloride contamination by saline water is possible, as suggested by test results on the Waimea exploratory well 26. At a depth of -52 ft. mean sea level, the well produced water having chlorides ranging upward from 90 ppm and at a depth of -23 ft. it produced water having a chloride content of 25-35 ppm.

Exploratory test hole drilling to penetrate 100 to 200 feet of the basal aquifer would be required to investigate further the extent of contamination by leaching of fertilizers and by mixing of saline water. Such exploration would involve the logging of the chemical quality of the aquifer with depth to determine whether or not fresher potable water can be developed from lower parts of the aquifer below any artificially contaminated zones. The Waimea Shaft 9 source, situated inland, appears to have more merit for exploration than the Kekaha source.

Very truly yours,

ROBERT T. CHUCK
Manager-Chief Engineer
September 5, 1967

Mr. Daniel Lum
Division of Water & Land Development
P. O. Box 373
Honolulu, Hawaii

Per your request, through Mr. Walter Briant, enclosed are copies of the chemical analysis results for the Waimea and Kekaha county domestic water sources.

Larry Nishikawa
Deputy Manager-Engineer

Enc.
August 21, 1967

Mr. Walter Briant  
Manager and Engineer  
Board of Water Supply  
County of Kauai  
P. O. Box 1706  
Lihue, Kauai 96766

Dear Walt:

Below is the result of our chloride titration analyses of water samples from your Kekaha and Waimea sources.

<table>
<thead>
<tr>
<th>Source</th>
<th>Sample Taken</th>
<th>Chlorides (ppm)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kekaha</td>
<td>7:30 a.m. 8/7/67</td>
<td>110</td>
<td>Pump Running</td>
</tr>
<tr>
<td>Waimea</td>
<td>8:00 a.m. 8/7/67</td>
<td>190</td>
<td>Pump Running</td>
</tr>
</tbody>
</table>

This result compares with your analyses of 103 ppm and 184 ppm for Kekaha and Waimea sources, respectively.

Very truly yours,

[Signature]

ROBERT T. GUCK  
Manager-Chief Engineer

DL:In
August 9, 1967

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

Under separate cover you will receive two separate water samples properly labeled. These are the samples you requested through Mr. Briant at a meeting in your office during the first week of August.

We have made an independent chloride test of the same stock samples with our portable titration kit, namely for comparative purposes in order to be able to determine whether our test chemical has deteriorated to some degree to give the high chloride readings we have been having.

The results of this test (all in total chloride) were:

- Waimea: 184 ppm
- Kekaha: 103 ppm

Chemical analysis samples were also sent to the State Dept. of Health as per your request. We will forward results to you as soon as we can.

Thank you for your help.

Larry Nishikawa
Deputy Manager-Engineer
August 22, 1967

To: Supervisor, Sanitary Engineering Section (Through Official Channels)

From: Public Health Officer, Laboratory Branch

Subject: WATER CHEMICAL ANALYSIS: Yuma Lines, Yuma, Arizona (County), 1967/68

### Analysis

<table>
<thead>
<tr>
<th>Substance</th>
<th>ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>0.5</td>
</tr>
<tr>
<td>Zinc</td>
<td>0.5</td>
</tr>
<tr>
<td>Copper</td>
<td>0.5</td>
</tr>
<tr>
<td>Fluoride</td>
<td>1.0</td>
</tr>
<tr>
<td>Chloride</td>
<td>30.0</td>
</tr>
<tr>
<td>Sodium</td>
<td>41.0</td>
</tr>
<tr>
<td>Calcium</td>
<td>100.0</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.0</td>
</tr>
<tr>
<td>Silica</td>
<td>0.0</td>
</tr>
<tr>
<td>Temporary hardness</td>
<td>0.0</td>
</tr>
<tr>
<td>Chlorides</td>
<td>200.0</td>
</tr>
<tr>
<td>Total solids</td>
<td>200.0</td>
</tr>
</tbody>
</table>

### Remarks

[Signature]

[Note]

[Initials]