BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

June 27, 2000

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
State of Hawaii
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

Subject: Finding of No Significant Impact for the Board of Water Supply's Proposed Waipahu Wells IV, State No. 2301-44, 45, 46, 47 Project, Waipahu, Oahu, TMK: 9-4-2: 05

The Board of Water Supply has reviewed the comments received during the public comment period which began on January 23, 2000. We have determined that the environmental impacts of this project have been adequately addressed as discussed in the final environmental assessment (EA) and are therefore, issuing a finding of no significant impact. We request that our proposed well project be published as finding of no significant impact in the next Office of Environmental Quality Control (OEQC) Bulletin.

Attached are the completed OEQC bulletin publication form and four (4) copies of the final EA for your review.

If you have any questions, please contact Kathryn Kami at 527-5221.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

Attachments

cc: Jim Niermann, R.M. Towill

2000-08-23-OA-FEA-

Final Environmental Assessment

Waipahu Wells IV
State No. 2301- 44, 45, 46, 47

Waipahu, Oahu, Hawaii
TMK 9-4-02:05

June 2000

Prepared For:

Board of Water Supply
City and County of Honolulu
State of Hawaii

Waipahu Wells IV
State No. 2301- 44, 45, 46, 47

Waipahu, Oahu, Hawaii
TMK 9-4-02:05

Final Environmental Assessment

June 2000

Prepared for:

Board of Water Supply
City and County of Hawaii
State of Hawaii

Prepared by:

R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817

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PROJECT SUMMARY

Project	Waipahu Wells IV, State No. 2301 - 44, 45, 46, 47 Waipahu, Oahu, Hawaii
Applicant:	City and County of Honolulu, Board of Water Supply
Accepting Authorities:	City and County of Honolulu, Board of Water Supply
TMKs:	9-4-02:05 (por.)
Location:	Manager's Drive, Makai (south) of Interstate Route H-1 Waipahu, Oahu, Hawaii
Project Area:	39.6 acres
Agent:	R. M. Towill Corporation 420 Waiakamilo Road, Suite 411 Honolulu, Hawaii 96817 Phone: (808) 842-1133 Facsimile: (808) 842-1937
Existing Land Uses:	Zoned Residential (R-5) Currently used by the City and County of Honolulu as a plant nursery.
Proposed Action:	The proposed project includes installation of four (4) deepwell pumps with mutes, piping and appurtenances, and a granular activated carbon (GAC) treatment system with 10 tanks. Additionally, the project includes construction of a pump control building with utility hookups, access roadways, landscaping, and irrigation. Approximately 2,200 linear feet of 20-inch diameter transmission main will be installed to connect the pump station to an existing 36-inch water main south of the project site.
Required Permits	• Pump Installation Permit and Water Use Permit, Commission on Water Resource Management (CWRM) • Development Plan Public Facilities Map Amendment, City and County of Honolulu, Department of Planning • National Pollutant Discharge Elimination System (NPDES), Notice of Intent (NOI) Form F, State Department of Health, Clean Water Branch

Chapter 1

PROJECT OVERVIEW

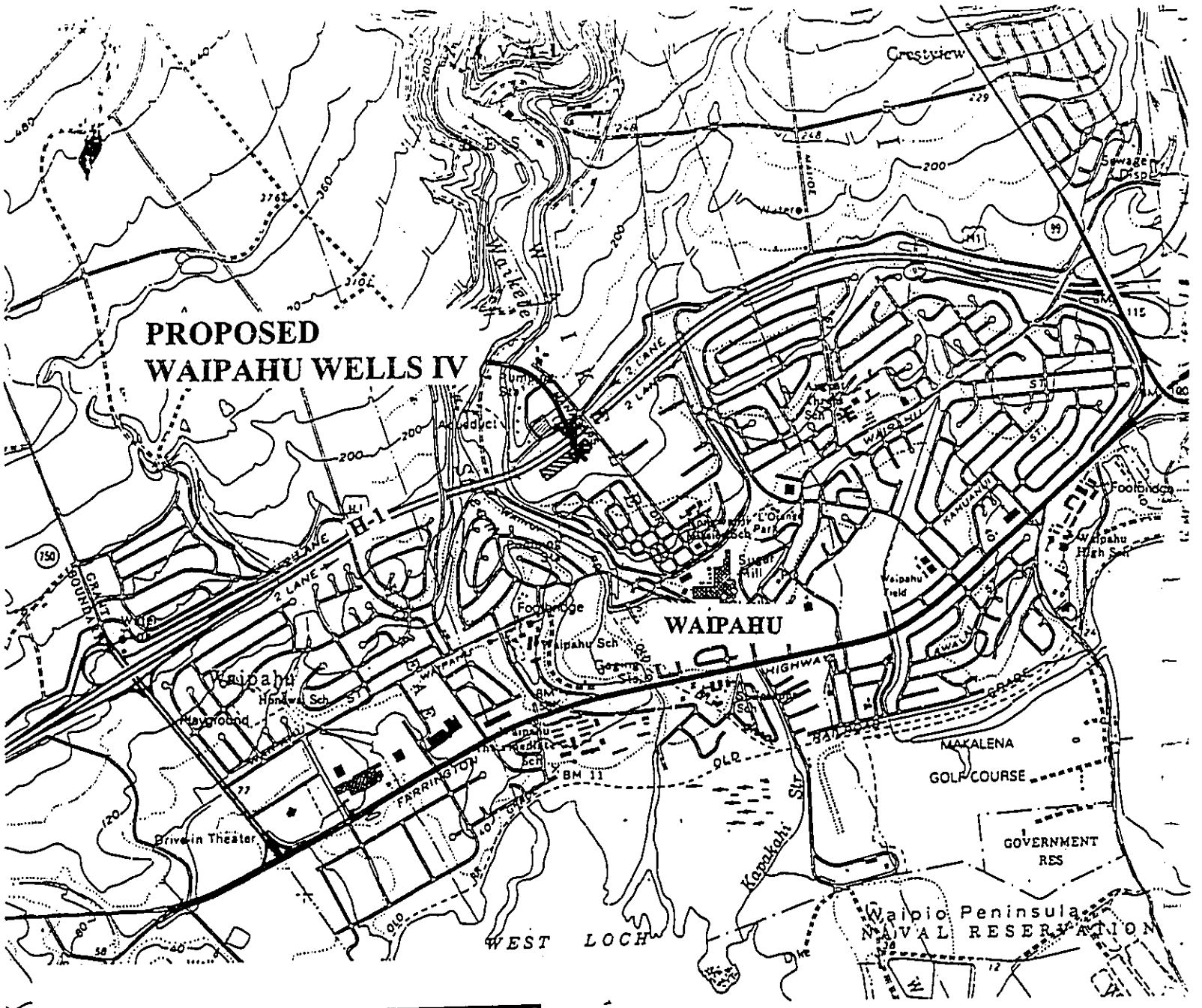
1.1 PROPOSING AGENCY AND ACTION

The Board of Water Supply (BWS), City and County of Honolulu, proposes to develop four permanent production potable water wells between Manager's Drive and Waikele Gulch in Waipahu, Oahu, Hawaii, TMK 9-4-02:05. See **Figure 1-1, Project Location**. The proposed action follows the drilling, casing and testing of four exploratory wells, which was completed in February, 1999. Step draw down tests conducted in July 1998 and February 1999 showed that the quantity and quality of water from the four exploratory wells is suitable for permanent potable water development (See **Appendix C, Test Pumping Results at Waipahu Wells IV**).

The proposed project includes installation of four (4) deepwell pumps with mutes, piping and appurtenances, and a granular activated carbon (GAC) treatment system. Additionally, the project includes construction of a pump control building with utility hookups, access roadways, landscaping, and irrigation. Approximately 2,200 linear feet of 20-inch diameter transmission main will be installed to connect the pump station to an existing 36-inch water main that passes through vacant land south of the project site connecting Waipahu Street (west) and Paiwa Street (east).

1.2 PURPOSE OF ENVIRONMENTAL ASSESSMENT

City and County of Honolulu funds will be used for this development. This project, therefore, is subject to preparation of environmental documentation per requirements of Chapter 200, Title 11, Hawaii Administrative Rules (HAR), and Chapter 343, Hawaii Revised Statutes (HRS). An Environmental Assessment (EA) was prepared previously for the Waipahu Wells IV exploratory phase and returned a Finding of No Significant Impact (FONSI). This EA focuses on the environmental impacts directly associated with the development of the Waipahu Wells IV Station for permanent production, including impacts on the sustainable yield of the underlying aquifer. A Final EA will be filed by BWS as part of the requirement for processing an EA. It is anticipated that this EA will be processed as a FONSI by the BWS, determining that the impacts of this project are not sufficient to require the preparation of an environmental impact statement and, thus, satisfying the requirements of Chapter 343, HRS.



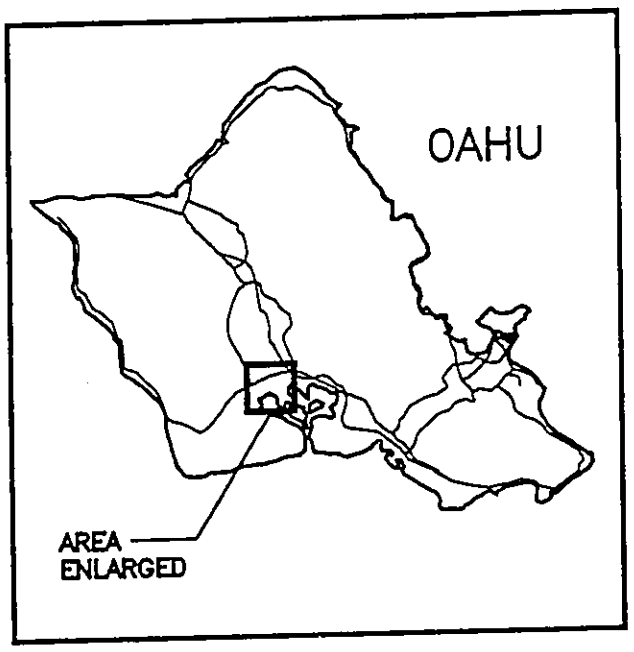


Figure 1-1
PROJECT LOCATION

0 1000 2000 4000
FEET

City & County of Honolulu
Board of Water Supply
WAIPAHU IV WELLS
STATE NO. 2301-44, 45, 46, 47

R. M. TOWILL CORPORATION
June 2000

1.3 PROJECT PURPOSE AND NEED

According to the 1997 *Oahu Water Management Plan* (OWMP), *Initial Revision of the Technical Reference Document*, (BWS 1997), the 1996 average municipal water demand on the Island of Oahu was approximately 148 million gallons per day (mgd) and projected demand in the year 2000 was 175 mdg. Updated statistics for 1999 show total actual daily pumpage averaging 149.14 mgd and total permitted uses at 175.75 mgd. The updated numbers are based on BWS data: "Oahu Source Pumpage vs. Permitted Use". Projected water demands were calculated in 1990 using data obtained in the last official census. Lower actual demands can be attributed to the following factors:

A. BWS water conservation programs have decreased daily use since 1990 as a result of mandated conservation measures that encourage lower consumer water use and repairs of leaking systems. This cannot be accurately quantified at this time, but, when the 2000 census is taken, water consumption rates can be updated to provide a better measure of the BWS conservation program's effectiveness.

B. Growth has not materialized as previously projected because of the downturn in economic conditions and, subsequently, in new business and residential development. The speculation of large economic growth on Oahu from 1990 to 2010 may have been the basis for high population growth projections from the State Department of Business and Economic Development, who provide the standard data for projecting growth in all the counties of Hawaii.

C. Projections that are 10 to 20 years in the future tend to have a wider range of uncertainty. Better water demand projections will be updated after the 2000 census is taken. Projections up to 2010 were last done in 1990 to get the best actual population count in proportion to actual water demand.

Most of the projected increase in water demand is expected to result from residential growth in Ewa, Central Oahu, and Honolulu, as directed by the State and City, and supported by their planning efforts. BWS is mandated to meet this demand by investigating, planning and developing

additional water supplies within the limits of available resources. BWS proposes to develop new sources of potable groundwater on Oahu within the Pearl Harbor, Windward, and North Water Management Areas (WMA) to fulfill this mandate. Water Management Area boundaries are established by the Department of Land and Natural Resources (DLNR), Commission on Water Resource Management's (CWRM).

The Waipahu Wells IV, which will consist of four single-bore drill holes, is a proposed BWS well project within the Pearl Harbor Groundwater Sector, Waipahu-Waiawa WMA. Tests for the quantity and quality of the groundwater from the exploratory wells meets required State Department of Health and Federal Environmental Protection Agency standards, therefore the wells are proposed to be converted to production use and integrated into the BWS's municipal potable water source, storage, and transmission system. Under permanent production status, the Waipahu Wells IV are planned to have a combined total yield of 3.0 mgd of potable water.

The two major development plan districts to benefit from the Waipahu IV project would be the Central Oahu and Ewa Districts. Projected population growth and water demand in these districts are shown in the following table:

Table 1-1
PROJECTED INCREASES IN POPULATION AND WATER DEMAND
*(in millions of gallons per day)

	1990	2020	% Increase
Central Oahu District			
M-K Population Served	105,917	162,121	53.1
Water Demand*	15.02	22.99	53.1
Ewa District			
M-K Population Served	31,321	122,579	291.4
Water Demand*	10.60	34.46	225.1

The major growth will occur in the Ewa District where the Secondary Urban Center is being planned. Water from this project will be part of the Waipahu 228' system which could also be

transported to Honolulu via the existing site transmission mains. The proposed wells will also furnish valuable data that will be added to Oahu's island-wide hydrogeological information base. This data will be valuable in estimating the quantity and quality of groundwater resources available within this aquifer, and, in combination with data from other wells, ultimately for the entire island.

1.4 PROPOSED ACTION

The recommended action is to proceed with development of the proposed project at Waipahu, Oahu, as detailed within Chapter 3 this EA. The proposed project is part of the BWS program for source development and has been carefully considered to meet the future water needs of the City and County of Honolulu.

1.5 ALTERNATIVES TO THE PROPOSED ACTION

This environmental assessment discusses the no action alternative, the delayed action alternative, and source alternatives.

1.5.1 No Action Alternative

The no action alternative would result in no effort to develop potable water wells at Waipahu. Under this option, environmental impacts resulting from well installation activities would be averted, and well development costs would be spared. The no action alternative was not considered a viable option because it does not fulfill the BWS mandate to provide potable water resources for the growing City and County of Honolulu. The no action alternative may also create restrictions to new development and may result in regional water shortages. The further development of water resources at Waipahu would maximize available potable resources for all Oahu residents.

1.5.2 Delayed Action

The delayed action alternative was considered but not pursued because this alternative would delay the provision of potable water. Under this alternative, resource expenditures for well development would be averted in the short-term, however project activities would ultimately incur higher development costs due to inflation while generating environmental outcomes similar to immediate action.

Development of the proposed site at a later date was not considered to be a viable alternative for meeting the objectives BWS's water development program. BWS has programmed development of the Waipahu Wells IV as part of its overall strategy for ensuring availability of potable resources. The delayed action alternative would delay the BWS implementation schedule and result in little to no change in the potential environmental impact of the project. Additionally, delayed action would increase the risk that population growth will generate water demands in excess of available, developed supplies.

1.5.3 Alternative Sites

In addition to the recommended site, one alternative site was considered for development of the Waipahu Wells IV. The alternative site is a 23.4 acre parcel (TMK: 9-4-07:42) mauka of the H-1 Freeway owned by Schuler Homes, Inc., and AMFAC Property Investment Corporation. This parcel was considered but not selected because of land acquisition constraints. The parcel is important to the delivery of affordable housing units pursuant to a City Council Unilateral Agreement controlling the development of the master planned community known as Waikele. (See **Appendix A, Correspondence**, Board of Water Supply, 1/9/97, and Schuler Homes, Inc., 11/1/96.)

1.5.4 Alternative Sources

Source alternatives to potable groundwater have been analyzed in the *Oahu Water Plan - Fifth Edition* (BWS, 1995). These include desalination, development of surface water and brackish groundwater sources, and recycling of treated wastewater. Although BWS is exploring development of these alternative potable water sources, it does not consider currently available technologies to be feasible or practical substitutes for ground water development due to high costs and technical difficulties. (BWS, 1995).

Alternatives to potable groundwater were analyzed by BWS in the *1995, Oahu Water Plan.* The alternatives investigated can be divided into two main categories:

- Alternative Sources of Potable Water
  - desalination
  - surface water development

- Alternative Sources of Non-Potable Water (which reduce the need for potable sources)
  - brackish groundwater development
  - recycling of treated wastewater
  - catchment systems

In addition to these categories, conservation of existing resources is also considered to be an important alternative to groundwater development.

All alternatives, with the exception of conservation, have high development costs, major technological challenges, and in the case of wastewater reuse, problems associated with social acceptance. Desalination, surface water, treatment of brackish water, and reuse of effluent wastewater all require high-cost water treatment plants. Use of alternative sources are also not without potential for environmental problems. Unrestrained removal of water from an underlying aquifer, whether fresh or brackish, can compromise and damage the transition zone between fresh and saline water.

Development of surface water is also constrained due to need to construct major new infrastructure to collect, treat, and transmit surface sources. Use of surface sources can also reduce habitat for native and indigenous species. Wastewater reuse, while costly, has the added difficulty of gaining public acceptance. Desalination plants show some promise as new technology becomes available. Major benefits include a virtually limitless resource base, the Pacific Ocean, while a significant impediment continues to be high development costs (BWS, 1995). According to BWS:

> "Desalination: Desalination will be implemented as groundwater withdrawals approach sustainable yields. A site and technology study is currently under way. While the capital cost of a large scale desalination plant per gallon is equivalent to groundwater development in rural areas, the O&M cost at $3.00 per thousand gallons is 10 times the cost of pumping groundwater. O&M cost directly affects water rates, which we are trying to keep as low as possible."(BWS, 1997).

The Board of Water Supply's forthcoming Fiscal Year (FY) 2001 Capital Improvement Plan (CIP) and FY 2001-2006 Six Year CIP allocates funding for development of a desalination plant at Barbers' Point. The scheduling and costs include $7 million in FY 2001 for construction of a 1 million gallon a day (mgd) pretreatment facility and $40 million in FY 2005 for a 5 mgd facility. Development of the Barber's Point Desalination Plant reflects the Board's commitment to exploring alternative sources of water development.

> "Surface Water: A 1996 surface Water Study indicated that surface water development for potable use was not feasible, given the small, variable flows, environmental impact and the intense regulatory process involved with the instream flow standards and the monitoring requirements of the Safe Drinking Water Act." (BWS 1997).

BWS has considered Waiahole Ditch as a potential potable surface source since the 1970's, as documented in previous Oahu Water Plans. BWS previously considered the option of developing nonpotable sources and giving them to the sugar plantations in exchange for BWS municipal use of potable plantation sources including Waiahole Ditch water.

Although the closing of central Oahu sugar plantations freed Waiahole Ditch water up for other uses, the State Water Commission designated the entire capacity of Waiahole Ditch for stream flow restoration and agriculture irrigation use. Current BWS planning, therefore, does not foresee Waiahole Ditch water being available for direct use as a potable municipal source. As a further consideration, the potable use of Waiahole Ditch would incur the high cost of microbiological treatment required to meet Safe Drinking Water standards for surface water sources. This high cost makes the alternative of developing Pearl Harbor groundwater sources preferable to developing Waiahole Ditch for potable use.

"Reclamation: The reuse of sewage effluent is a promising alternative resource that is being actively pursued by the City to replace potable use for irrigation and industrial process water and to relieve the development pressure for high quality groundwater supplies. Public health concerns and high costs for dual water system infrastructure limit the extent of reuse. The city is focusing on the Ewa Plains where dual water systems can be master planned in new developments rather than the more costly alternative to redevelop existing urban areas with dual systems. Additionally, the Honouliuli Wastewater Treatment plant effluent has chloride content very suitable for irrigation. Whereas the Sand Island plant chloride contact is much too high for irrigation use." (BWS, 1997).

BWS already emphasizes conservation of existing groundwater resources with a stated goal of 10 percent reduction in per capita consumption by the year 2000. Conservation efforts include use of public information programs on the limitation of Oahu's resources and benefits of conservation, use of low flow home and commercial water fixtures, private catchment systems for irrigation, use of xeriscaping, maintenance of home plumbing fixtures (e.g., repair of leaking faucets and hoses), and periodic adjustment of water rate structures.

Although not now feasible, alternatives to potable groundwater will grow in importance as existing aquifer resources approach the limits of their sustainable yield. It is possible that one day, technology improvements will permit development of these alternatives to supplement Oahu's potable groundwater. In so doing, alternative source development will help to protect and preserve the future of Oahu's potable aquifer resources.

Conservation efforts will continue to play a key role in helping to reduce demand for existing groundwater supplies. Conservation alone, however, cannot be relied upon to meet all of Oahu's future water needs. Until such time that alternative source development can reliably and economically supplement existing resources, conservation in conjunction with the development of potable groundwater will remain the preferred BWS management strategy.

Chapter 2

WATER RESOURCES AND SUSTAINABLE YIELD

2.1 THE STATE WATER CODE AND COMMISSION ON WATER RESOURCES MANAGEMENT (CWRM)

The State Water Code and CWRM was established in 1987 by the Hawaii State Legislature in Section 174-C of the HRS. The task of CWRM is to administer the new State Water Code. The State Water Code established a Hawaii Water Plan consisting of four parts:

- A water resource protection plan prepared by CWRM;
- water use and development plans prepared by each county;
- a state water project plan prepared by state agencies; and,
- a water quality plan prepared by the Department of Health.

The State Water Code requires that CWRM establish management boundaries for each WMA. CWRM designated WMAs are located in areas where research suggests that ground and/or surface water resources are threatened by current or future proposed withdrawals or diversions of water (BWS, 1995).

2.2 GROUND WATER SECTORS AND AQUIFERS

To assist in the planning and administration of WMAs and water resources in general, the CWRM has established six groundwater sectors that encompass the entire island of Oahu: Honolulu, Pearl Harbor, Waianae, Central, North, and Windward. The six groundwater sectors are further divided according to the boundaries of the underlying aquifers. In all sectors except Waianae, the aquifer divisions have been designated as WMAs. In some cases, several individual aquifers are combined into a single WMA. **Figure 2-1, Oahu Groundwater Sectors and Aquifers**, identifies these groundwater sectors and WMA boundaries for Oahu.

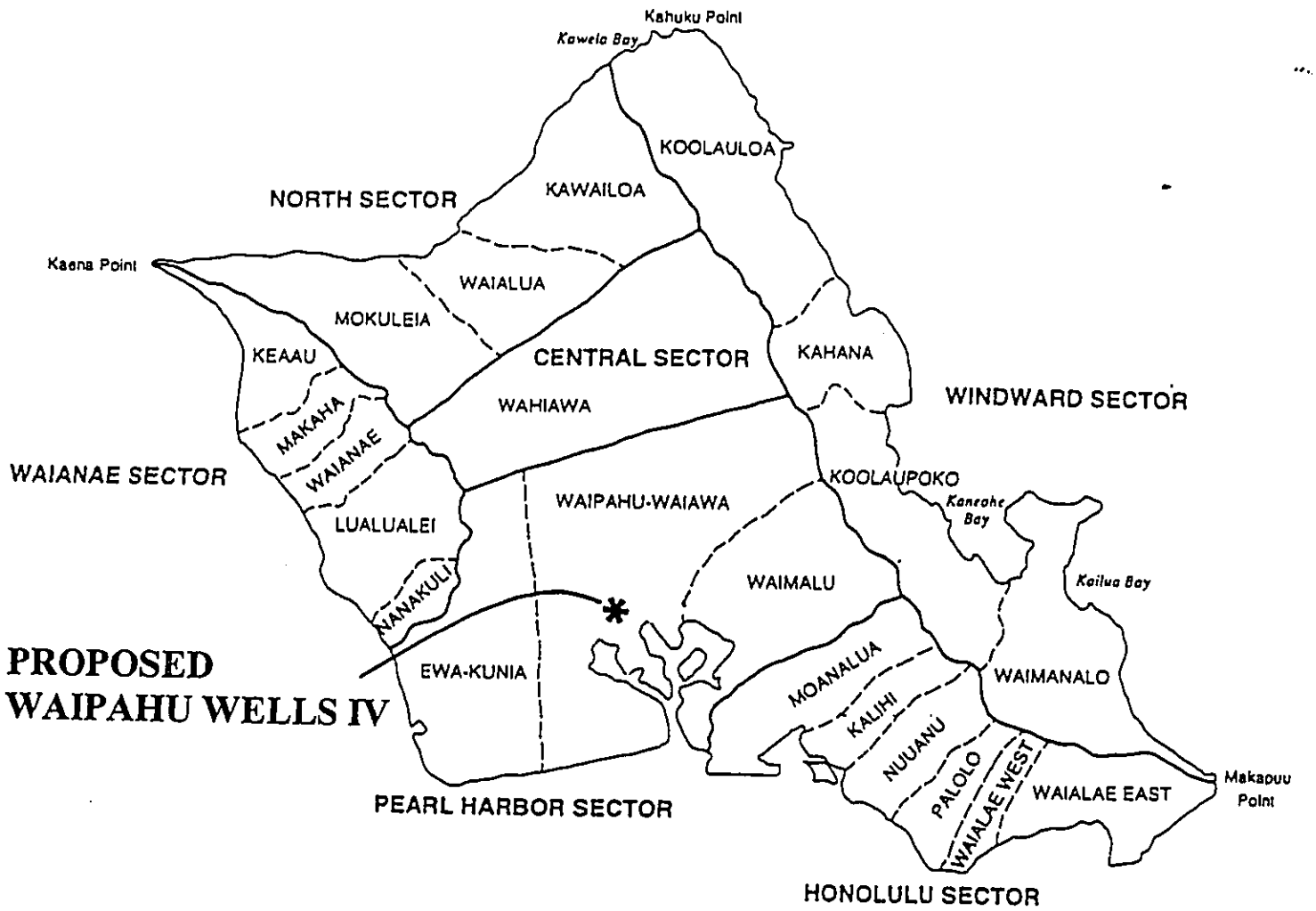


Figure 2-1
OAHU GROUNDWATER SECTORS AND AQUIFERS

Not to Scale

City & County of Honolulu
Board of Water Supply
WAIPAHU IV WELLS
STATE NO. 2301-44, 45, 46, 47

R. M. TOWILL CORPORATION
June 2000

The Pearl Harbor Groundwater Sector contains three WMAs: Waimalu, Waipahu-Waiawa, and Ewa-Kunia. The Pearl Harbor sector is bound on the north-east by the Koolau Mountain Range and extends west from Moanalua Valley and Ewa, and north through Central Oahu, including Waipahu and Waiawa. The proposed Waipahu Wells IV are located immediately north of West Loch, Pearl Harbor in the Waipahu-Waiawa WMA. The Waipahu-Waiawa WMA is bounded by arbitrary rather than hydrogeological boundaries. The west boundary of Waipahu-Waiawa is Kunia Road and the east boundary is Waimano Home Road. The natural hydrogeological boundaries of Waipahu-Waiawa are the Waianae-Koolau aquifer interface to the west, where younger Koolau lavas overlay the older Waianae lavas, and the Waiawa Stream to the east. If the CWRM adjusts the boundaries in the future, the sustainable yields will also be adjusted to account for the proper recharge area. (BWS, 1997).

2.3 SUSTAINABLE YIELD

The Hawaii State Water Plan requires that the CWRM determine sustainable yields of surface and groundwater sources for the State. Sustainable yield is the amount of groundwater that can be routinely extracted from an aquifer without adverse impacts to the quality or quantity of the water source. Based on the geologic and hydrologic characteristics of the various regions, CWRM produces estimates of sustainable yield for each aquifer, WMA, and groundwater sector. These estimates are used to guide the development of new water resources.

The purpose of this EA is to assess the potential impacts resulting from the development of permanent production wells at the proposed Waipahu Wells IV site. In addition to addressing anticipated environmental impacts associated with construction activities, the assessment includes evaluations of the capacity of the wells for sustained water production, estimated sustainable yield, and possible impact on the underlying aquifer.

Estimating sustainable yield for the island of Oahu and for its individual aquifers is complex. The sustainable yield of basal aquifers on any of the Hawaiian islands is always less than the average annual rate of recharge to the groundwater aquifer primarily because of the amount of fresh groundwater that is lost by mixing with the underlying salt water. Recharge itself is only an estimate based on sparse rainfall data, and evaporation, transpiration, and runoff estimates that are

not measured (only perennial streams are gauged, not intermittent streams, drains, overland flow, or shallow under flow). (BWS, 1997). To calculate the amount fresh groundwater loss, numerous factors must be considered including characteristics of aquifer confinement, the thickness of the basal lens, and the rate of water extraction due to agricultural and urban activities. Aggregate estimates of sustainable yield for the Pearl Harbor Aquifer System are relatively accurate, however, owing to advancements in hydrological and geological knowledge that is the byproduct of the long history of water development on Oahu. (BWS, 1995).

The Pearl Harbor Aquifer System has the highest estimated sustainable yield of all the Oahu aquifer systems' groundwater sectors, estimated at 184 mgd. The second highest sustainable yield is from the Windward Aquifer System WMA, provisionally estimated at 99 mgd. CWRM indicates that about 45 mgd of this total is not available due to potential stream flow impacts, however, case-by-case uses are allowable following an evaluation of impacts to sustainable yields. The third highest yield, 53.5 mgd, is from the Honolulu Aquifer System WMA, of which approximately 50.5 mgd is already permitted. (BWS, 1997).

The three aquifer sectors comprising the Pearl Harbor Aquifer System: Waipahu-Waiawa, Ewa-Kunia, and Waimalu, have a combined sustainable yield estimated at 184 mgd. Prior to the closure of the Oahu Sugar Company, the Waipahu-Waiawa Sector had an estimated sustainable yield of 119 mgd and permitted uses totaling 110.4 mgd, making it the highest yielding sector in this WMA. The estimated sustainable yields for the Waimalu Sector and the Ewa-Kunia Sector are 45 mgd and 20 mgd respectively.

See: *Table 2-1, Groundwater Use by Aquifer System and Sustainable Yield.*

Table 2-1
GROUNDWATER USE BY AQUIFER SYSTEM AND SUSTAINABLE YIELD
(in million gallons per day)

Aquifer SYSTEM / Sector	Dike / Basal Sustainable Yield	1996 Permitted Use[1]	Available Sustainable Yield	1994 Dike / Basal Use
HONOLULU				
Palolo	5	5.689	-0.689	5.207
Nuuanu	15	15.170	-0.170	14.994
Kalihi	9	8.492	0.508	7.818
Moanalua	18	18.570	-0.570	14.700
Waialae West	4	1.990	2.010	0.866
Waialae East	2	0.600	1.400	0.247
SUBTOTAL	53	50.511	2.489	43.832
PEARL HARBOR				
Waimalu	45	48.379	-3.379	45.070
Waipahu-Waiawa [5]	119	110.559	8.441	71.894
Ewa-Kunia	20	17.891	2.109	15.973
Makaiwa	0	0.000	0.000	0.000
SUBTOTAL	184	176.829	7.171	132.937
CENTRAL				
Wahiawa	23	20.746	2.254	9.710
WAIANAE				
Nanakuli [6]	1	0.000	1.000	0.000
Lualualei [6]	3	0.300	2.700	0.306
Waianae [6]	3	3.272	-0.272	2.886
Makaha [6]	4	2.228	1.772	2.204
Keaau [6]	4	0.000	4.000	0.000
SUBTOTAL	15	5.800	9.200	5.396
NORTH				
Mokuleia	12	6.030	5.970	2.123
Waialua	40	39.738	0.262	25.971
Kawailoa	39	7.053	31.947	2.003
SUBTOTAL	91	52.821	38.179	30.097
WINDWARD				
Koolauloa	35	18.590	16.410	11.714
Kahana [2]	13	1.101	11.899	0.715
Koolaupoko [2]	43	15.522	27.478	13.760
Waimanalo [2]	8	1.656	6.344	0.911
SUBTOTAL	99	38.869	62.131	27.100
EWA CAPROCK	N/A [3]			
GRAND TOTAL [4]	465	343.576	121.424	249.072

1 Dike/Basal Permitted Uses as of May 1996. Excludes highly saline to salt water use permits (chlorides>1,000 mg/1).
2 Permanent instream flow standards may reduce the availability of excess sustainable yield. Withdrawals affecting streams require amendments to instream flow standards.
3 Estimated sustainable yield is <21 mgd due to sugar plantation closure.
4 Grand total of Dike/Basal uses excludes caprock, springs and perched alluvial sources.
5 Waipahu-Waiawa & Waialua sustainable yields may be reduced to reflect recharge reduction from sugar plantation closure.
6 Waianae is not a designated water management area, therefore existing uses are shown in lieu of permitted use.
SOURCE: George Yuen and Associates, 1990; DLNR and BWS records.

2.4 EXISTING WATER SOURCES

According to CWRM's 1996 records, the Waipahu-Waiawa Sector contained 45 permitted production well sources. The estimated sustainable yield from the aquifer is 119 mgd and permitted uses total approximately 110.6 mgd leaving an approximate 8.4 mgd surplus yield. These figures are currently being reevaluated following the closure of the Oahu Sugar Plantation.

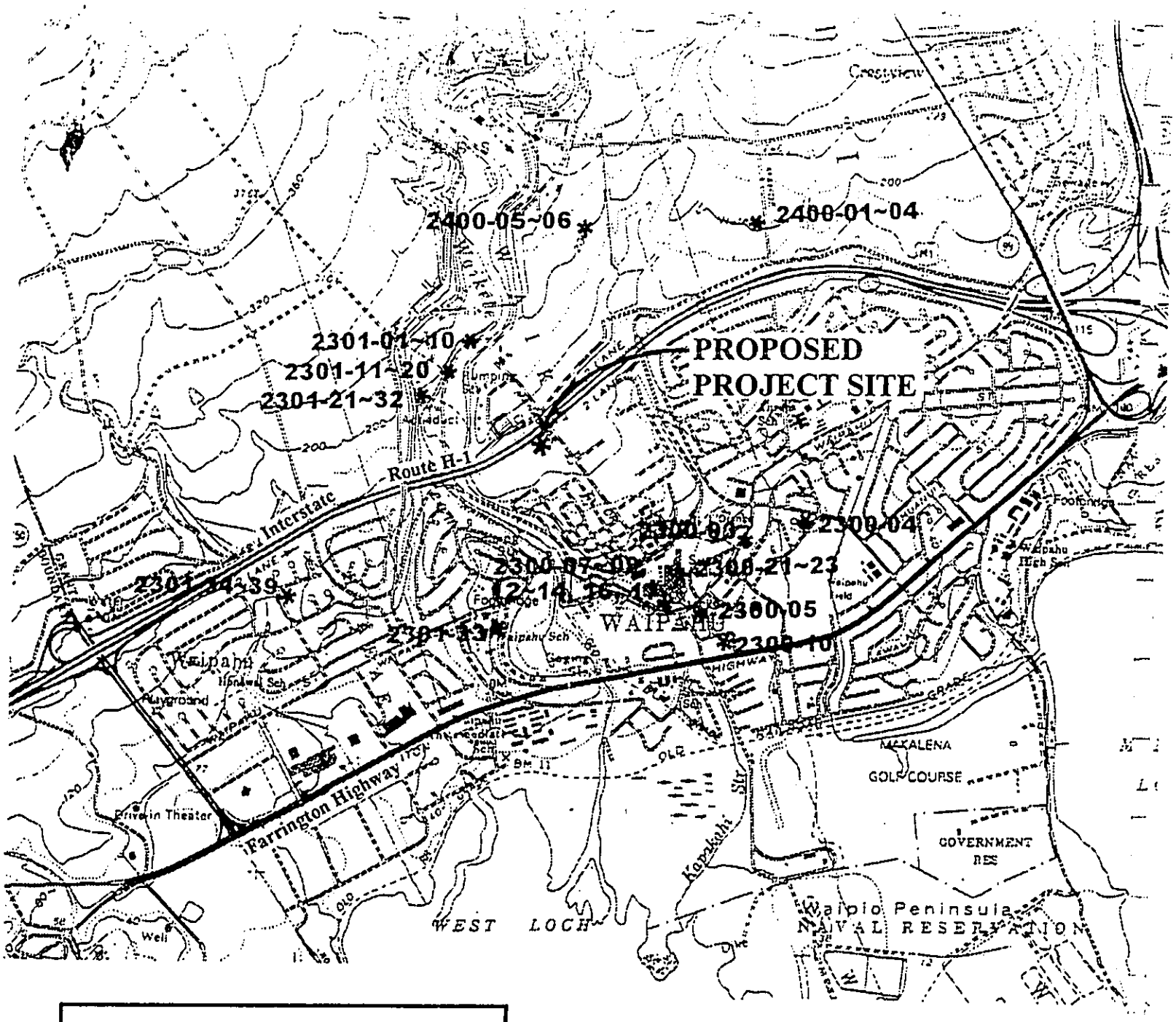
The nearest wells to the proposed site (within one-half mile) are the Oahu Sugar Company wells #2301-01 to 32, and # 2300-21-23. These wells have a combined permitted use of approximately 22.36 mgd, however they are not drawing their full allocation (BWS, 1997).

Figure 2-2, Proposed Well Site and Nearby Production Wells, identifies all production wells that draw from the Waipahu-Waiawa Sector within one mile of the project site. BWS is permitted to withdraw a total of 39.301 mgd from Waiawa-Waipahu Aquifer wells.

2.5 POTENTIAL FOR WATER SOURCE DEVELOPMENT AND REALLOCATION OF CWRM PERMITTED USES

Currently, permitted water uses within the Pearl Harbor Sector do not exceed estimated sustainable yields and there appears to be potential for additional water development and reallocation of existing sources within this aquifer system. Changes in land use, notably the closure of Oahu Sugar Company's (OSCo) agricultural operations and increases in residential development, continue to alter the algebra of water development and use in this sector. With the cessation of OSCo's agriculture operations in the Waipahu-Waiawa and Ewa-Kunia areas, some of the water previously used for irrigation will be available for reallocation to other uses. Additionally, other wells in these aquifer systems regularly operate below permitted capacity and can potentially be reallocated to new water source developments, including the proposed Waipahu Wells IV.

The estimated sustainable yield of the Waipahu-Waiawa Sector, in which the proposed Waipahu Wells IV are located, is 119 mgd, of which 110.6 mgd is allocated by CWRM permit to 45 wells. The balance between estimated sustainable yield and permitted use is potentially available to be developed through new wells or allocated to existing wells that are operating below capacity. Additionally, water use permits are currently being assessed by CWRM for reallocation. Where



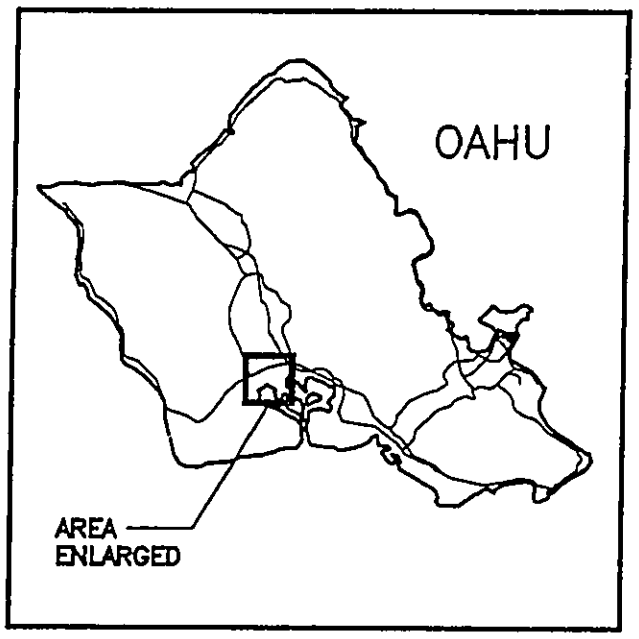


Figure 2-2
PROPOSED WELL SITE AND NEARBY PRODUCTION WELLS

0 1000 2000 4000
FEET

City & County of Honolulu
Board of Water Supply
WAIPAHU IV WELLS
STATE NO. 2301-44, 45, 46, 47

R. M. TOWILL CORPORATION
June 2000

current permit holders are not using the full measure of water that they have been allocated, CWRM may elect to reallocate permitted uses to existing wells or to new source development. Tests of the Waipahu IV Exploratory Wells have revealed that development of the site for permanent potable water production is feasible. (See **Appendix C, Test Pumping Results at Waipahu Wells IV**).

Since OSCo stopped growing sugar cane in 1995, substantial sources of groundwater recharge, including pumped ground water and Waiahole Ditch water used for sugar irrigation within the Waipahu-Waiawa and Ewa-Kunia Aquifers, have been shut off or diverted. Reduction in groundwater recharge to these aquifers causes a reduction in their sustainable yields. However, closure of OSCo's wells also frees up water allocations for new source development. The surplus from unused OSCo allocations will be realized primarily within the Waipahu-Waiawa Aquifer and, to a lesser extent, within the Ewa-Kunia Aquifer. (BWS, 1997). At present, the Oahu Sugar Company is permitted to draw approximately 21 mgd from the Waipahu-Waiawa Sector's estimated sustainable yield of 119 mgd. CWRM is currently reevaluating the sustainable yields of the aquifers in the Pearl Harbor Sector to adjust for water use and recharge changes resulting from the closure of OSCo.

Table 2-2, Estimated Sustainable Yield and Permitted Use, Waipahu-Waiawa Aquifer presents the current list of water use permit holders drawing from the Waipahu-Waiawa Aquifer.

Table 2-2
ESTIMATED SUSTAINABLE YIELD AND PERMITTED USE
WAIPAHU-WAIAWA SECTOR

Well User	Well Name	Permitted Use (mgd)
DHHL	Reservation	1.581
BWS	Various	2.599
Kahua Meat Co.	Kahua Meat Co.	0.110
Campbell Estate	EP 3 & 4	3.304
Gary Takiguchi	Honouliuli	0.020
C&C DHCD	EP 2	1.124
Harris Rug	Harris Rug	0.003
Robert Loo	Honouliuli	0.003
Tadahiro Abe	Honouliuli	0.009
Campbell Estate	EP 5 & 6	5.208
Campbell Estate	EP 7 & 8	6.113
Campbell Estate	EP 15 & 16	12.154
Watanabe, A.	Watanabe, A.	1.080
Oahu Sugar Co.	WP 6A, 6B	1.430
Oahu Sugar Co.	WP 7A, 7B, 7C	9.000
Oahu Sugar Co.	WP 1	1.151
Oahu Sugar Co.	WP 4A, 4B	3.305
Oahu Sugar Co.	WP 2A, 2B	5.594
Oahu Sugar Co.	WP 2C, 2D	1.862
BWS	Hoaeae Wells	6.610
BWS	Kunia I Wells	4.357
Nazarene Church	Pearl City	0.003
BWS	Waipahu I	6.000
BWS	Waipahu II	2.100
BWS	Waipahu III	2.657
DHHL	Waipahu III	0.027
C&C DHCD	Kunia III	1.088
H.H. Hamamoto	Royal Oahu	0.600
BWS	Kunia II, 3	1.260
BWS	Pearl City II	2.190
BWS	Pearl City Shaft	1.320
BWS	Pearl City I	0.310
BWS	Waipio Heights	0.630
Yoshimura, D.	Waipahu	0.006
BWS	Waipio Heights I	0.500
BWS	Waipio Heights II	2.000

Table 2-2

ESTIMATED SUSTAINABLE YIELD AND PERMITTED USE

WAIPAHU-WAIAWA SECTOR
(continued)

Well User	Well Name	Permitted Use (mgd)
BWS	Pearl City III	0.500
U.S. Navy	Waiawa Shaft	14.997
Ige Y	Dairy Company	0.100
BWS	Mililani III	1.550
Hawaii Country Club	Hawaii Country Club	0.220
BWS	Waipio Heights III	0.850
Del Monte Corp.	Del Monte Corp.	0.154
BWS	Mililani I	2.980
BWS	Mililani II	1.900
WATER ALLOCATION TOTALS		110.559
WAIPAHU-WAIAWA AQUIFER ESTIMATED SUSTAINABLE YIELD		119

Source: Commission on Water Resources Management, Department of Land and Natural Resources, State of Hawaii, *Well and Water Use Permit Index*, May 28, 1997

Chapter 3

PROJECT DESCRIPTION

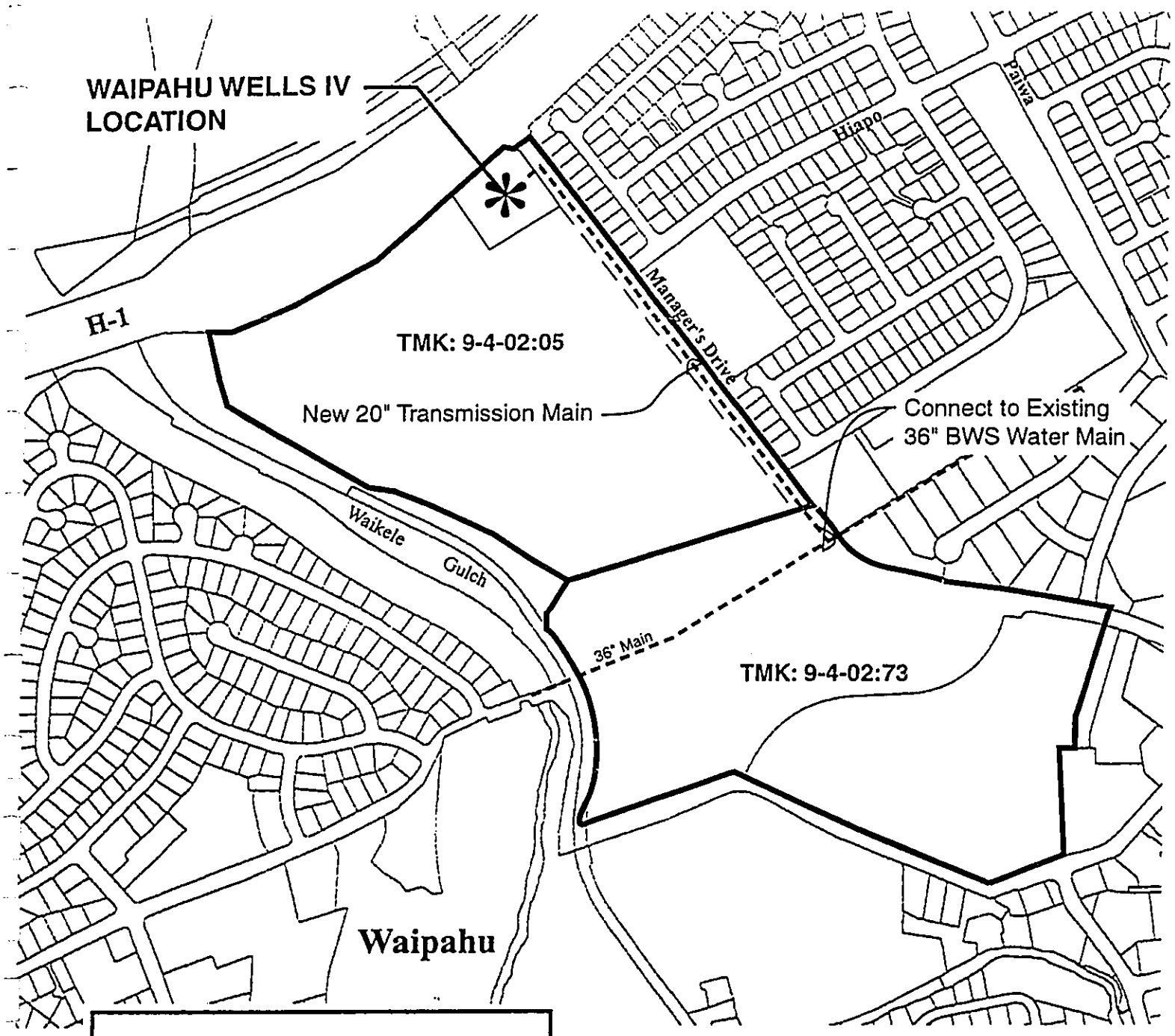
3.1 PROJECT LOCATION AND SITE CHARACTERISTICS

The proposed project site is located in Waipahu on a parcel of land currently owned by the City and County of Honolulu (TMK# 9-4-02:05). Pursuant to City Council Resolution No. 99-249, CD1, Castle & Cooke Homes Hawaii, Inc. will take ownership of the parcel as part of a land exchange with the City. Under the terms of the resolution, the City will exchange land in Waipahu, including the well site, for land in Waiola owned by Castle & Cooke Homes Hawaii, Inc.. (See **Appendix B, Responses to Comments and Received During the Draft Environmental Assessment 30-Day Comment Period,** letter from City Department of Planning and Permitting dated January 7, 2000, with attached resolution.)

Approximate coordinates are longitude 158° 00' 57" and latitude 21° 23' 45". The site is situated immediately makai (south) of Interstate Route H-1 between Manager's Drive and Waikele Gulch. It is surrounded by undeveloped land formerly in agriculture and a well-established residential neighborhood to the east. The site rests on a flat to gradually sloping plain at an elevation of approximately 135 feet above mean sea level (msl). The site is currently used by the City and County of Honolulu as a landscape plant nursery. **Figure 3-1, Project Site and Tax Map Key Location,** identifies the site location by tax map key number.

3.2 TECHNICAL CHARACTERISTICS

The design for the Waipahu Wells IV Station consists of four drill holes anticipated to yield a combined average of about 3.0 million gallons a day (mgd) for distribution to Waipahu, Ewa, and the Honolulu Primary Urban Center. The proposed project involves construction of a pump control building with utility connections, a chlorination facility, electrical control and telemetering system, and appurtenances to meet the latest fire code. Development of the well station also includes a Granular Activated Carbon (GAC) treatment system including installation of ten (10) GAC contactor tanks, a 50,000-gallon backwash tank, high flow rate micron filter units, and an in-line acid neutralization system with pH and turbidity meters. There are no requirements for a water storage tank for this project.



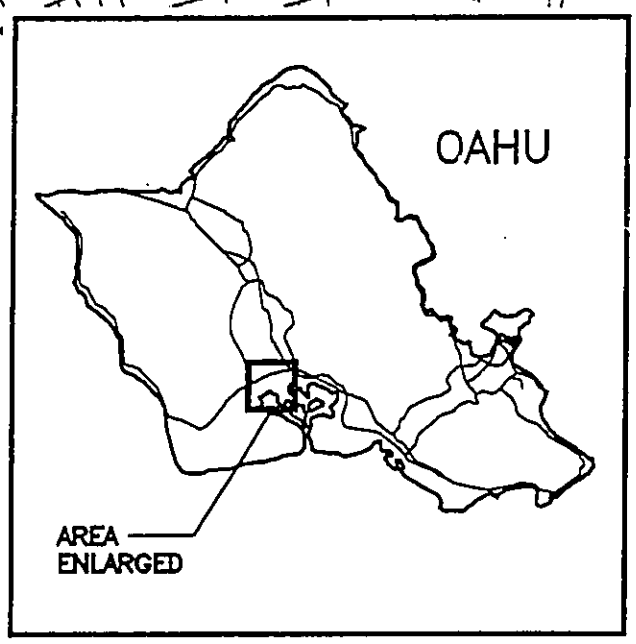


Figure 3-1
TAX MAP KEY LOCATION

0 500 1000 2000
FEET

City & County of Honolulu
Board of Water Supply
WAIPAHU IV WELLS
STATE NO. 2301-44, 45, 46, 47

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The overall diameter of each drill hole is 18 inches with a 14-inch inner-diameter casing and a 1 ½-inch grout-filled annulus. The total depth of each drill-hole is about 280 feet to about 145 feet below mean sea level (msl) where they will extract potable water from the underlying basalt. The upper 180 feet of each bore will be cased with 14-inch inner-diameter, 3/8-inch thick solid steel casing. The lower 100 feet will be uncased. Well intake will begin at approximately 45 feet below msl and continue to draw from the full length of the uncased bore to its termination point. See **Figure 3-2, Project Site Plan**, and **Figure 3-3, Typical Well Cross-Section.**

Testing of the wells was conducted in March of 1998 and February of 1999 by the BWS. The results recommended a design flow of 1,000 gpm for each of the wells at the Waipahu Wells IV Station. As tested, the drawdowns for the four well holes were as follows:

Well Hole	Drawdown
#1	2.1 feet
#2	1.8 feet
#3	1.5 feet
#4	1.2 feet

Chloride concentrations during the step draw-down tests varied from 54 to 60 parts per million (ppm). (See **Appendix C, Test Pumping Results at Waipahu Wells IV.**)

Each drill hole will be equipped with a 1.5 mgd deepwell pump. All four pumps will be in operation drawing a combined average of 3.0 mgd of potable water. Piping and appurtenances necessary for a complete and usable system will be designed for a peak pumping capacity of 8 mgd to accommodate possible future increases in deepwell pump size to 2 mgd for each drill hole. The installed pumps and power source will be engineered to reduce pump noise to levels below the regulatory limit.

The well station will be connected to the BWS's municipal potable water source, storage, and transmission system. Approximately 2,200 linear feet of 20-inch diameter transmission main will be installed to make the connection to an existing BWS 36-inch water main that passes through vacant land south of the project site connecting Waipahu Street (west) and Paiwa Street (east). The

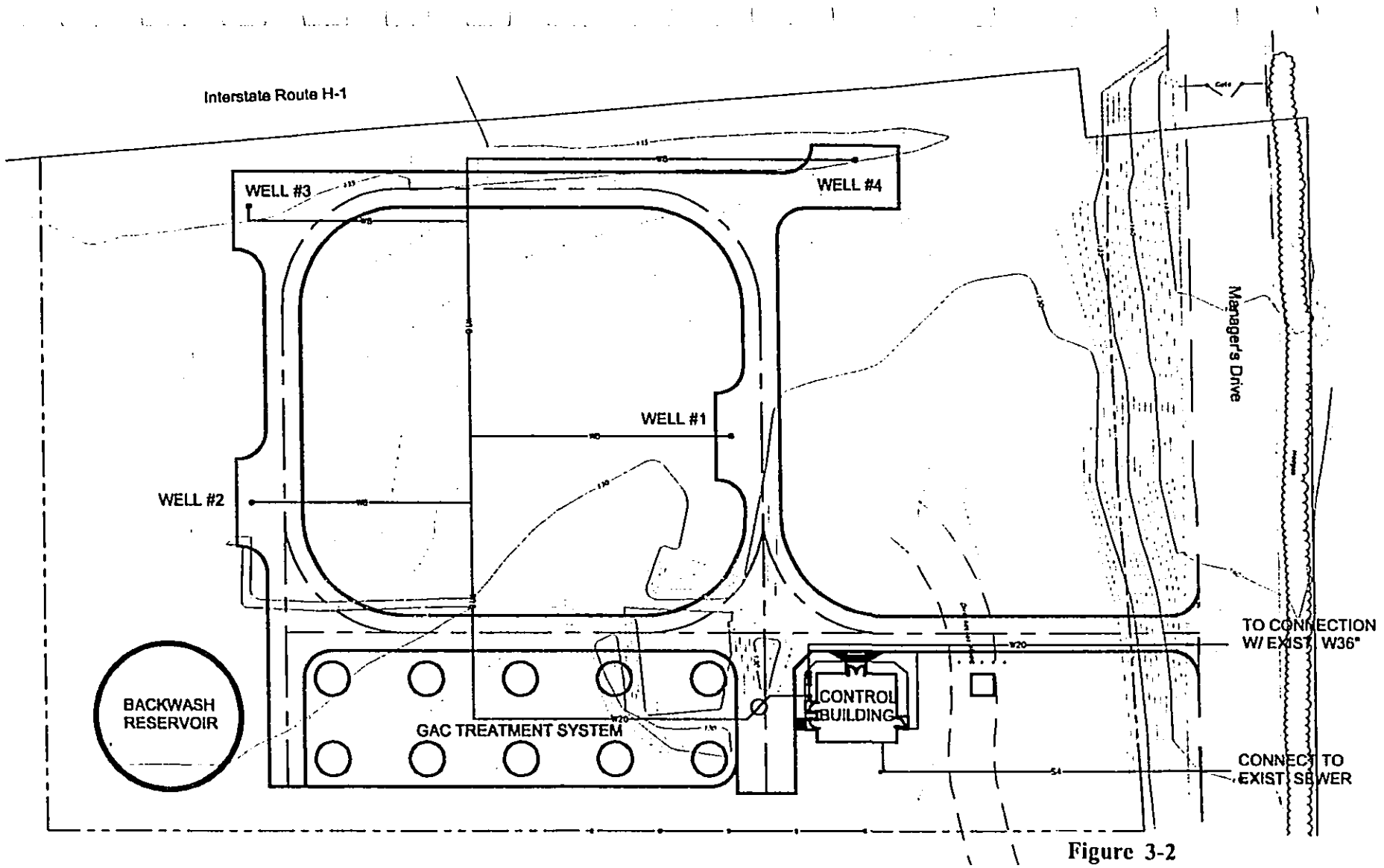

Figure 3-2
PROJECT SITE PLAN

Not to Scale

City & County of Honolulu
Board of Water Supply
WAIPAHU IV WELLS
STATE NO. 2301-44, 45, 46, 47

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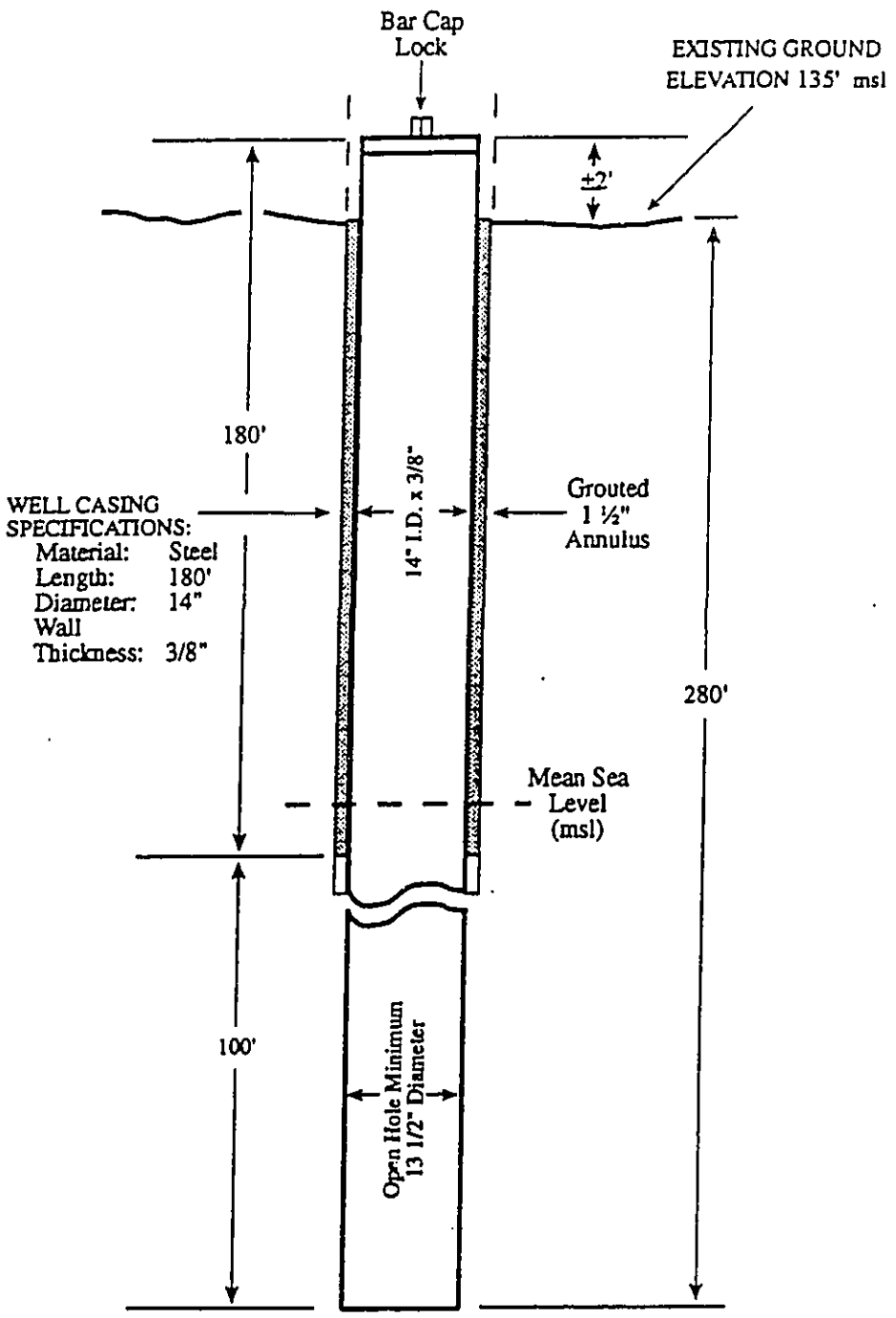

Figure 3-3
TYPICAL WELL CROSS-SECTION

Not to Scale

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Board of Water Supply
WAIPAHU IV WELLS
STATE NO. 2301-44, 45, 46, 47

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new well station control building will contain the motor control center, a toilet, water disinfection equipment, and instrument air compressor.

3.3 GRANULAR ACTIVATED CARBON WATER TREATMENT SYSTEM

Granular activated carbon treatment units will be installed to remove any volatile organic chemicals (VOC) present in the water supply. GAC contactors filter raw groundwater prior to being placed into the municipal distribution system. GAC contactors are pressurized vessels 12 feet in diameter and 8 to 13 feet in height. They can be sized to hold either 20,000 or 30,000 pounds of activated carbon material. The activated carbon lasts between 8 to 12 months depending on the initial concentration of the targeted chemicals being removed and the flow rate and contact time within the activated carbon. When activated carbon becomes "fully used" it is tested for toxicity before disposal. Carbon that tests within safe parameters is disposed of in the Waimanalo Gulch Landfill. The cost of removing and disposing the carbon is $160 per ton.

The pressurized GAC contactors are downflow fixed bed units, where untreated well water enters the top of the vessel and flows down through the bed of activated carbon. Treated water leaves the unit at the bottom. Ten GAC contactor tanks will be installed in order to accommodate the designed 8 mgd pump capacity of the production facility (one GAC tank is required per 1 mgd of installed pump capacity). At least one GAC contactor tank will always remain on standby. Water sampling points prior to and down stream of the contactors allow BWS lab technicians to regularly sample the efficiency of the carbon filtration system. Once low level breakthrough is detected, the standby contactors are brought on line, while the contactors with spent carbon are taken off line and scheduled for carbon replacement.

The GAC filtration plant also consists of backwash equipment to prepare a new load of activated carbon. The backwash system allows the new carbon to be flushed and stratified while not violating any effluent discharge standards. The backwash system consists of the backwash piping, the backwash tank, and the filtration equipment. The backwash piping is 12"-inch diameter ductile iron piping. It is sized to handle the backwash flow from one GAC tank at a time. There is a butterfly valve in each of the main backwash lines to allow for controlling the flow rate of the backwashing. The backwash tank is designed to hold the water generated during backwashing of the GAC tanks.

It has a capacity of approximately 50,000 gallons. The typical backwash tank is 34 feet in diameter and 9 feet tall.

The filtration equipment associated with the backwash system consists of a pump, a basket strainer, and a cartridge filter. The pump withdraws water from the tank at approximately 150 gpm. The basket strainer removes the larger particles, those larger than 300 microns (0.019"), from the backwash water, while the cartridge filter removes the particles that are larger than 30 microns. The purpose of straining and filtering the backwash water prior to discharge is to prevent the release of potentially contaminated particles into the drain system.

The GAC treatment units will need to be hydrotested. An NPDES general permit for hydrotesting, as well as any other applicable discharge permits will be secured before any hydrotesting water is discharged.

3.4 CONSTRUCTION ACTIVITIES

The well site will be cleared to provide room for construction activities and storage of all necessary materials and equipment. All excavated material from clearing and grading will be stored on-site during project development.

Drainage due to flushing and hydrotesting the water transmission main will be conveyed via a flexible discharge hose to a storm drain on Manager's Drive. BWS will secure a permit from the City and County of Honolulu, Department of Environmental Services to dispose of potable groundwater discharge from the well pumps into the City and County storm sewer system. BWS will also secure a National Pollution Discharge Elimination System Permit (NPDES) from the State Department of Health for the discharge of effluent associated with hydrotesting and disinfection of water mains and GAC treatment units into waters of the State through the municipal separate storm sewer system.

An allocation from CWRM for permitted use will be requested for the well station and an amendment to the Development Plan Public Facilities Map will be completed showing the facility to be a "site determined, water well programmed for construction within 6 years." The wells will

then be converted to production status and the water will be discharged into the BWS 36-inch main located south of the project site.

Upon completion of the proposed improvements, the contractor shall restore the project site as much as possible to pre-project conditions:

- All construction-related material, including excavated material, fill material, and refuse shall be removed from the project site and disposed of properly by the contractor.

- All construction equipment shall be removed from the project site promptly after construction is complete.

- Any temporary modifications to existing utilities, such as power lines or water sources, shall be repaired to their pre-existing condition.

- Roadways providing access to the site shall be cleared of construction debris and any damage from construction traffic repaired. Gates and/or fencing removed to provide access to the site shall be replaced.

- All areas damaged by construction staging shall be restored. Any trees removed, damaged, or destroyed shall be replaced. Exposed ground areas shall be seeded or hydromulched as appropriate.

- Temporary pumps, pipelines, and electrical lines will be removed from the site and all surplus excavation material and construction debris will be removed and disposed of off-site in compliance with applicable State, and City and County regulations.

3.5 BEST MANAGEMENT PRACTICES

A site-specific Best Management Practices (BMP) plan will be prepared by the project contractor as part of the project construction plan. The BMPs will include guidelines and mitigation measures to prevent erosion, discharge pollution, and other detrimental impacts related to construction activities.

Special conditions outlined by the State Department of Health (DOH) per National Pollution Discharge Elimination System Permit requirements (HAR, Chapter 11-55, Water Pollution Control) will also be addressed in the site-specific BMPs. Mitigation measures, shall include, but not be limited to the following:

- Clearing and excavation shall be held to a minimum necessary to meet project design and construction plan requirements.
- Construction shall be phased to minimize the exposure time of cleared or excavated areas. Existing ground cover shall not be destroyed, removed or disturbed more than 20 calendar days prior to the start of construction.
- Work on one phase shall be stabilized before another phase is initiated.
- Stabilization shall be accomplished by temporarily or permanently protecting the disturbed surface from rainfall impacts and runoff.
- Storm water flowing toward active project areas shall be diverted as much as practicable using appropriate controls, including berms and silt fences, as determined by the contractor according to site conditions.
- Areas that remain unfinished for more than 30 calendar days shall be hydromulched or seeded to provide temporary soil stabilization.
- The project contractor will select a location for stockpiling construction material. The stockpile site will be identified in the site-specific BMPs and construction plans.
- No fuel will be stored on the project site. Fueling of construction equipment will only be performed off-site or within an area designated by the contractor. Any site designated for refueling shall be located away from the stream, enclosed by a containment berm and constructed to contain spills and seepage and prevent storm water runoff from carrying pollutants into state coastal waters.

The contractor, based on professional experience and expertise, may modify the proposed BMP mitigation measures as necessary to account for unanticipated or changed site conditions.

3.6 PROJECT SCHEDULE AND COST

Construction is expected to begin in November 2000. Mobilization, construction, testing, and demobilization is expected to take approximately 10 months to complete. The capital cost for the entire project is estimated at ±$6,800,000 and will be funded solely by BWS. Administration of project funds will be through BWS.

Chapter 4

ENVIRONMENTAL SETTING, POTENTIAL IMPACTS, AND MITIGATION

4.1 LAND USE AND OWNERSHIP

4.1.1 Land Use

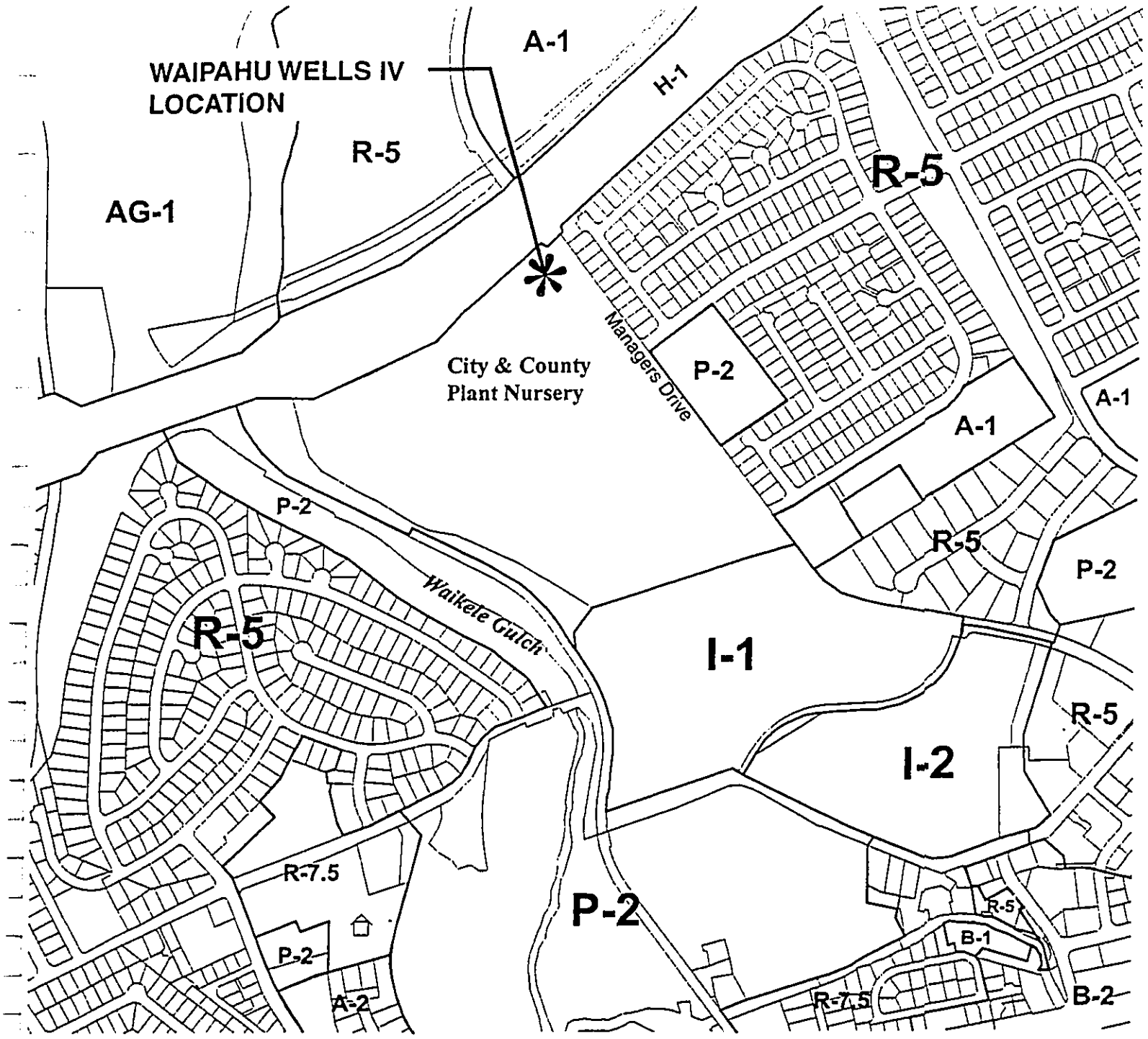
The proposed Waipahu Wells IV Station will be located on 2.2 acres of a 39.6 acre parcel, immediately makai (south) of Interstate Route H-1, between Manager's Drive and Waikele Gulch. The undeveloped parcel of land stretches approximately 1,200 feet westward to Waikele Gulch. The parcel was formerly under sugar cane cultivation. It is now zoned Residential (R-5) and is currently being used by the City and County as a plant nursery for large landscaping trees. The remainder of the parcel is unused. The State Land Use Commission classifies the area as "Urban".

The proposed well site is bordered on the north by Interstate Route H-1 and on the east by Manager's Drive. Manager's Drive is an asphalt concrete road currently owned by the City and County. At present, the road is closed to public use. A recently completed bridge over Interstate Route H-1 connects Lumi'aina Street (in the Waikele Development mauka (north) of Interstate Route H-1) with Manager's Drive alongside the proposed project site. The bridge will remain closed until completion of a connector road between Manager's Drive and Mokuola Street .

Across Manager's Drive from the proposed project site is a residential neighborhood of single family homes. The residential area contains a large community park that abuts Manager's Drive. To the south of the site is the old Oahu Sugar Company sugar mill. Other land use zoning in the area includes Low-Density Apartments (A-1), Preservation lands (P-2), and Light Industry (I-2) lands. See **Figure 4-1, Zoning and Land Use.**

4.1.2 Ownership

The proposed project site is located on a parcel that is currently owned by the City and County of Honolulu and identified as TMK: 9-4-02: 05. Pursuant to City Council Resolution No. 99-249, CD1, Castle & Cooke Homes Hawaii, Inc. will take ownership of this parcel as part of a land exchange with the City. Under the terms of the resolution, the City will exchange land in Waipahu,



ZONING

A-1	Apartments - Low-density
A-2	Apartments - Med-density
AG-1	Agriculture - Restricted
B-1	Business - Neighborhood
B-2	Business - Community
I-1	Industrial - Limited
I-2	Industrial - Intensive
P-2	Preservation
R-5	Residential
R-7.5	Residential

Figure 4-1
ZONING AND LAND USE

Not to Scale

City & County of Honolulu
Board of Water Supply
WAIPAHU IV WELLS
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including the well site, for land in Waiola owned by Castle & Cooke Homes Hawaii, Inc.. (See **Appendix B, Responses to Comments and Received During the Draft Environmental Assessment 30-Day Comment Period**, letter from City Department of Planning and Permitting dated January 7, 2000, with attached resolution.) Manager's Drive, designated by an easement for roadway access and utility purposes, is also located on this parcel. Adjacent to the parcel to the south and west is land owned and managed by the Oahu Sugar Company, Ltd. (TMK: 9-4-02: 07, 73). The residential neighborhood east of the project site is comprised of individually-owned lots.

The 20-inch water transmission main proposed in this project will cross out of City and County property and into parcel 9-4-02: 73, owned by the Oahu Sugar Company, Ltd., where it will connect with the existing BWS 36-inch water main that passes through the parcel on an easement.

4.1.3 Project Impacts

Installation of the Waipahu Wells IV will not change any of the surrounding land uses or ownership patterns. Development of these wells will help facilitate future residential development in the area, however the proposed wells will not, in their own right, lead to changes in land use or ownership patterns.

4.1.4 Mitigation Measures

No mitigation measures are proposed or required.

4.2 TOPOGRAPHY, CLIMATE, AND RAINFALL

4.2.1 Topography

The proposed well site is situated just inland of Pearl Harbor's West Loch at about 145 feet above mean sea level. The topography is characterized by gradual slopes of up to 7 percent. The land surrounding the site has been extensively modified by grading and no significant geological features exist in the immediate area.

In general, the project site is situated on an elevated plain relative to the surrounding topography. The most prominent topographic feature in the vicinity is Waikele Gulch which lies to the west. From the 135 foot elevation at the project site, Waikele Gulch carves between 70 and 80 feet deep

to a bottom elevation of approximately 60 above msl. Additionally, a berm approximately 25 feet in height descends from the proposed project site to the Interstate Route H-1 right-of-way, forming the northern boundary of the site. Bridge construction on Manager's Drive has resulted in the creation of an elevated earthen ramp that rises from 10 to 15 feet above the project site

4.2.2 Climate

The climate of the Waipahu area is comfortably uniform. The area is characterized by abundant sunshine, prevailing northeast tradewinds, relatively constant temperatures, moderate humidities, and the infrequency of severe storms. Temperatures in the area range on average from 65 to 90 degrees Fahrenheit throughout the year. Annual average rainfall is less than 30 inches. Monthly rainfall measured at the nearest rain gage station (in Waipahu) ranges between 2 to 5 inches. (University of Hawaii, 1983).

4.2.3 Project Impacts

Construction of the Waipahu Wells IV will not have any impact on the topography, climate, or rainfall in the area.

4.2.4 Mitigation Measures

No mitigation measures are proposed or required.

4.3 GEOLOGY AND HYDROLOGY

4.3.1 Geology

The Pearl Harbor Coastal Plain was primarily developed from alluvium deposited on the highly permeable Koolau basalt formations, and on the coral reefs that formed when sea level was higher than the present level. The project site is located on the leeward flank of the Koolau volcanic shield. The soil at the surface of the proposed site is classified by the U.S. Soil Conservation Service as Molokai silty clay (MuB), 3 to 7 percent slope. This soil type consists of well-drained upland soils. Runoff is generally slow to medium and the erosion hazard is slight to moderate. Additionally, Waipahu silty clay soils (WzA - 0 to 2 percent slope, and WzB - 2 to 6 percent slope) are also present at the project site. This type is a well-drained soil found on marine terraces. It is developed in old alluvium derived from basic igneous rock. Permeability in this soil is moderately

slow. Runoff is slow and the erosion hazard is none to slight. **Figure 4-2, Soil Map**, identifies the U.S. Department of Agriculture, Soil Conservation Service soil typology for the proposed project site. (U.S. Department of Agriculture, 1972).

4.3.2 Groundwater Hydrology

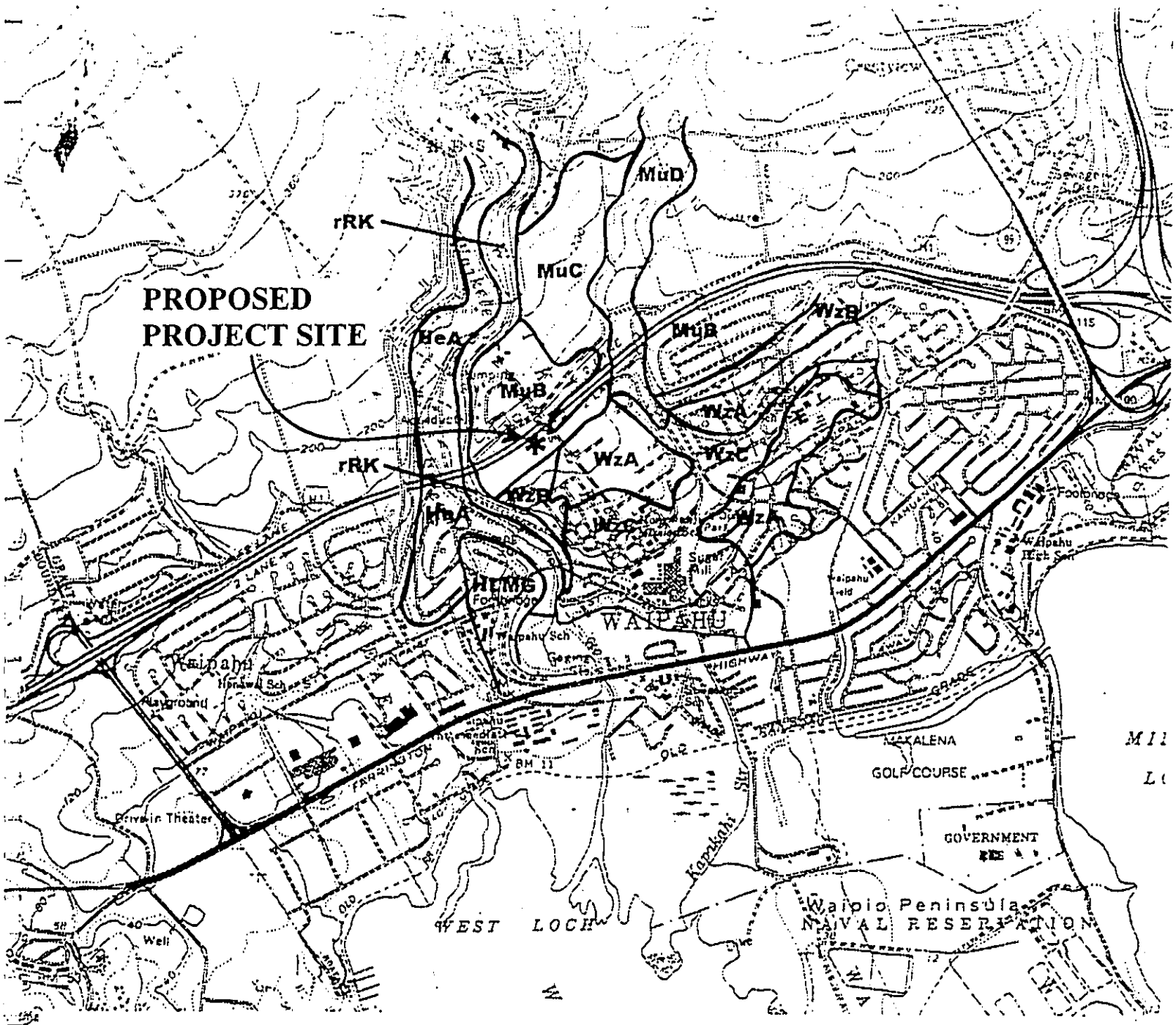
The proposed Waipahu Wells IV are located in the thick basal aquifer that is confined between Waiawa Valley and Waimalu Valley. The basal aquifer is a lens-shaped body floating upon salt water. The basal lens is hydrologically confined along the coast by coastal plain deposits. Due to the relative impermeability of the coastal caprock, which retards outflow to the sea, the head of the basal lens is approximately 18 feet above sea level at the site. Based on the density ratio between fresh water to salt water, for every foot that the fresh water lens extends above sea level, the lens theoretically extends forty feet below sea level to the midpoint where salinity is half sea water. The basal lens of the Waipahu-Waiawa aquifer, thus, theoretically extends approximately 720 feet below sea level before reaching the midpoint. (BWS, 1997).

The Pearl Harbor basal aquifer consists of the Waianae aquifer and the Koolau aquifer. The Waimalu and Waipahu-Waiawa subareas are in the Koolau volcanic series. The Ewa-Kunia subarea is in the Waianae volcanic series. In Volume I of the State Water Resources Protection Plan, dated March 1992, the sustainable yields of these aquifer sectors are assessed as shown in **Table 4-1**. These figures are consistent with CWRM's Well and Water Use Permit Index, for March 28, 1997.

Table 4-1
Pearl Harbor Aquifer System Sectors

Sectors	Current Sustainable Yield (mgd)
Waimalu	45
Waipahu-Waiawa	119
Ewa-Kunia	20

These estimates include agricultural irrigation returns in the Waipahu-Waiawa Sector. With the cessation of agricultural activities, the quantity of irrigation recharge contributing to sustainable yield will be reduced.



LEGEND

MuB	Molokai Silty Clay Loam, 3 to 7 percent slope
MuC	Molokai Silty Clay Loam, 7 to 15 percent slope
MuD	Molokai Silty Clay Loam, 15 to 25 percent slope
WzA	Waipahu Silty Clay, 0 to 2 percent slope
WzB	Waipahu Silty Clay, 2 to 6 percent slope
WzC	Waipahu Silty Clay, 6 to 12 percent slope
rRK	Rock Land
HeA	Haleiwa Silty Clay, 0 to 2 percent slope
HLMG	Helemano Silty Clay, 30 to 90 percent slope

Source: Soil Survey of Oahu, State of Hawaii, August 1972
United States Department of Agriculture, Soil Conservation Service, and University of Hawaii, Agricultural Experiment Station

Figure 4-2
SOIL MAP

0 1000 2000 4000
FEET

City & County of Honolulu
Board of Water Supply
WAIPAHU IV WELLS
STATE NO. 2301-44, 45, 46, 47

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Wells in the area include two existing BWS installations and numerous wells in Waikele Gulch to the west. The BWS installations are Waipahu Wells I, consisting of four wells about 5,200 feet to the northeast; and Waipahu Wells II, a three-well source about 3,500 feet to the north. A fourth well is proposed for Waipahu Wells II. The wells in Waikele Gulch were once irrigation sources for the Oahu Sugar Company. There are a total of thirty-two wells drilled nearly a century ago.

The Waipahu Wells IV fall within the Waipahu-Waiawa Sector. All of the wells in the Waipahu-Waiawa Sector or subarea draw from the basal lens in the Koolau Basalt. Aquifer parameters are extremely favorable for pumping. Heads are high and ground water flux is large. The regional head is 18 feet. Natural flux in the Koolau portion of the Pearl Harbor Sector totals 206 mgd (CWRM Report R-78, 1988).

Current CWRM Allocations (January 24, 1997) for the combined Waipahu-Waiawa Sector are shown in **Table 4-2:**

Table 4-2
Water Use Allocations, Waipahu-Waiawa Sector

Permittee	**Allocation (mgd)**
Campbell Estate	26.779
Oahu Sugar Co.	20.912
BWS	41.628
U.S. Navy	14.977
Others	6.263
Total	**110.559**

The Waipahu Wells IV Station is anticipated to yield an average of 3.0 mgd of potable water for distribution to the Waipahu, Ewa, and Honolulu areas.

4.3.3 Surface Water Hydrology

No sources of surface water exist on the proposed well site. The closest surface source, Waikele Stream, flows by approximately 1,000 feet to the west of the Waipahu Wells IV site. Stream flow averages 37.6 cubic feet per second (cfs), based on 51 years of record at gaging station #213000.

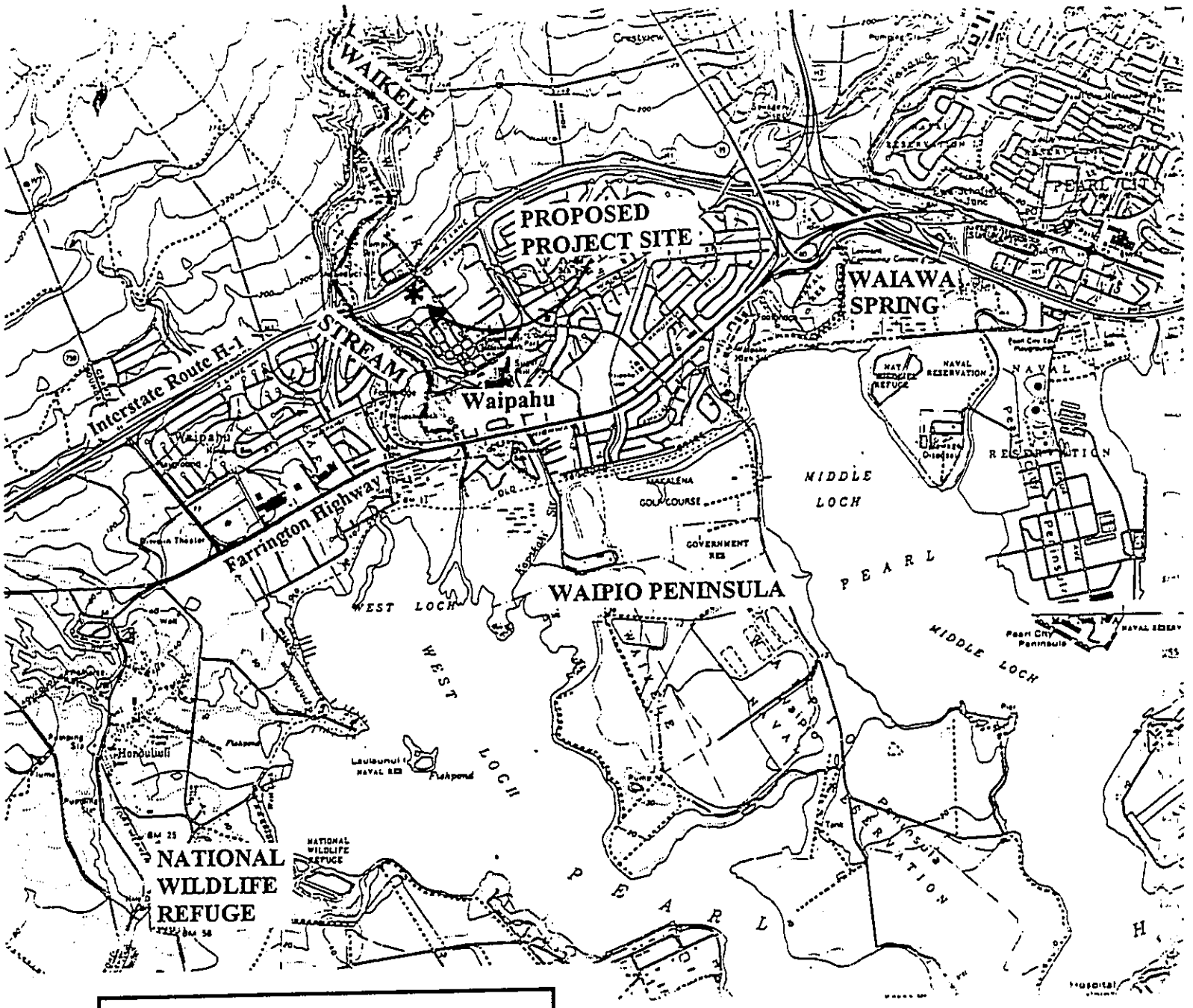
The stream collects from a drainage area of approximately 45.7 square miles. (CWRM and National Park Service, 1990). The stream bed elevation at this location is 60 to 70 feet above sea level and does not intersect the basal lens.

Waikele Stream is the confluence of waters originating in both the Waianae and Koolau Mountain Ranges. On the Waianae side, Waikele Stream collects water flow from Ekahanui Gulch and Poliwai Gulch in Honouliuli. The main stream channel collects irrigation and storm runoff water from the central Oahu plain, passing through Wheeler Air Force Base, Waikele, and Waipio along the border between Wahiawa and Ewa Districts. On the Koolau side, Waikele Stream collects water from Waikakalaua Stream and Kipapa Stream. At higher elevations, the tributary streams flow over permeable basalt surfaces. At lower elevations, the stream flows over poorly permeable alluvium that greatly reduces the amount of recharge to the Pearl Harbor Aquifer (Lau, 1987).

In the Pearl Harbor area, basal ground water outflows as springs. The springs closest to the project site include Waikele Spring and Waiawa Spring. Waikele Spring is located on the north shore of Pearl Harbor's West Loch, approximately 1 mile south of the project site. Waiawa Springs is on the north shore of Pearl Harbor's Middle Loch, approximately 2 miles east of the project site.

These springs are among several Pearl Harbor springs fed by overflow from the basal aquifer in the underlying basaltic rock layer. The springs act as spillways for the underground reservoir, issuing from this section in the caprock. Discharge from the springs is directly related to the height of the basal head and may vary with changes in the static level of adjacent wells.

Several wetland areas exist around Pearl Harbor. On the southern bank of West Loch is the Pearl Harbor National Wildlife Refuge Wetlands (jurisdiction of the U.S. Navy and USFWS). The Waipio Peninsula Wetlands (jurisdiction of the U.S. Navy) is located several miles to the east of the project. General hydrologic features surrounding the proposed project area are displayed in **Figure 4-3, Surface Hydrology**. (Wentworth, 1951; Stearns & Vaksvik, 1935).



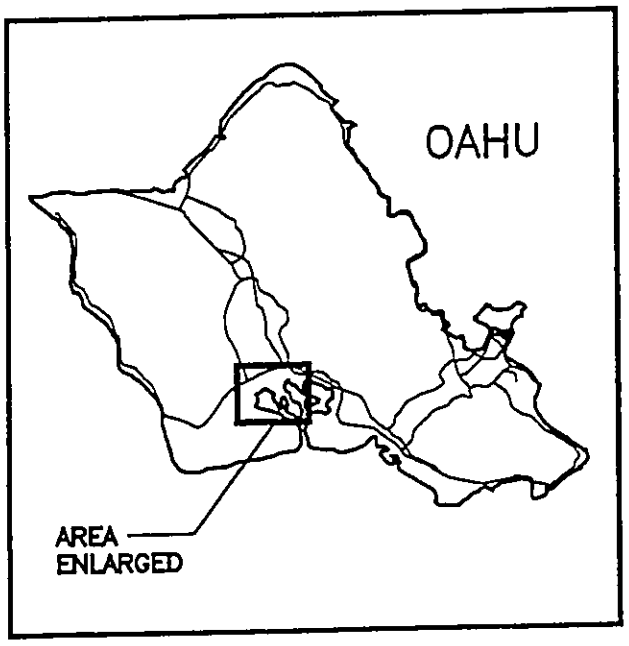


Figure 4-3
SURFACE HYDROLOGY

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4.3.4 Watershed and Aquifer Recharge

Waipahu-Waiawa Aquifer recharge depends on rainfall in the Waianae and Koolau Mountains and on the Central Oahu Plain. Rain seeps through permeable rock, natural faults, cooling joints and fissures in the basaltic layers to the underlying water table. Fed by rainfall and springs issuing from dike-confined water in the mountains, the major streams in the region, including Waikakalaua, Kipapa, Waiawa, Waikele, Manana, and Waimalu, also transmit substantial amounts of water to Pearl Harbor, much of which percolates into the underground reservoir prior to reaching the areas of impermeable alluvium deposits.

While most of the aquifer recharge results from runoff, water recharge in the past also resulted from agricultural irrigation infiltrating through the soil. However, with the cessation of sugar production, *agricultural recharge is sharply reduced. The result has been a decrease in sustainable yield and a* decrease in contaminant dilution with a subsequent increase in pesticide concentrations. In response, BWS has spent approximately $40 million dollars since 1995 on granular activated carbon (GAC) filtration systems to remove chemical contaminants from potable water wells.

Surficial water, including that provided irrigation and by direct rainfall on the plain, does not immediately transmit downward into the aquifer, and may take considerable time to reach the basal level. In general, surficial water recharge is significant, however, some of the water absorbed into the soil is held immediately below the surface or lost to evaporation and transpiration. Some of this water may also seep out as stream runoff into the sea. (BWS, 1995; Wentworth, 1951).

4.3.5 Project Impacts

Waikele Stream, in the vicinity of the project site, is perched over low-permeability alluvium at an elevation of approximately 60 to 70 feet above msl. The layers of alluvium serve to isolate the surface water of Waikele Stream from the basal groundwater found at much lower depths. The upper 180 feet of the Waipahu Wells IV are cased to about 45 feet below msl within the Koolau basalt, with the uncased intake extending another 100 feet to approximately 145 feet below msl. The water withdrawn from pumping of the wells is not expected to affect excess flow into Waikele Stream because the stream is approximately 1000 feet distant from the project site. Additionally,

the intake depth of the wells is approximately 80 feet deeper than the level of the stream's invert, and is separated by intervening layers of alluvium.

Although Waikele, Waiau, and Waiawa Springs are fed from basal water overflow at this section in the caprock, pumping from the Waipahu Wells IV is not expected to significantly impact water flows to the springs due to the lengthy distance between the well station and the springs. Springflow to Waikele Springs and other Pearl Harbor springs will be maintained indirectly by setting and monitoring sustainable yield for the Waipahu-Waiawa and Waimalu Sectors.

Sustainable yield is related to a set equilibrium head level in the basal aquifer that must be maintained to ensure continued water production. If an amount of water in excess of the sustainable yield is withdrawn from the aquifer, the freshwater lens will shrink and allow salt water to intrude into the aquifer in its place. If water withdrawal does not exceed sustainable yield, then the equilibrium head level will not decrease. (BWS, 1997).

Water withdrawal has been significantly reduced due to the closure of OSCo. CWRM is currently evaluating the Waipahu-Waiawa sustainable yield and is expected to reduce it to address the reduction in recharge from the cessation of sugar cane irrigation. The new sustainable yield will address ground water pumping and be set to maintain regional head at present levels. Because future withdrawals will remain within the revised sustainable yield set for the aquifer and will not exceed historical extraction levels, the springs will not be adversely affected. Located approximately 1 mile away, the Waipahu Wells IV are sufficiently distant from the nearest spring to avoid causing an adverse impact to spring flow or to the wetlands fed by these springs (BWS, 1997).

4.3.6 Mitigation Measures

Pursuant to Section 14-12.22 Revised Ordinances of Honolulu 1990, as amended, BWS is permitted by the County Department of Public Works to discharge test water from pumping operations into the City and County storm sewer system. A National Pollutant Discharge Elimination System Permit (NPDES Permit) will be required from the State Department of Health for discharges of hydrotesting water.

Best Management Practices will be employed in the disposal of all water pumped for hydrotesting, flushing, and disinfecting water transmission lines. Pumped water will be tested, flow rates will be regulated, and the flow path, including all necessary piping, will be routed and monitored to prevent contamination of the hydrotest water before it enters the county system. Additionally, the use of a temporary pipeline to transmit test water will eliminate impacts caused by flushed debris.

No special monitoring of Waikele Stream is required because well operations are not expected to affect stream flows. Waikele Stream is more than 1000 feet away from the well site and is separated by intervening layers of low-permeability alluvium. These conditions prevent the streams from being affected by groundwater draw down from the Waipahu Wells IV Station. Normal stream flow monitoring, including routine readings from the Waikele Stream gaging station, are maintained by USGS.

4.4 NATURAL HAZARDS

4.4.1 Flood Zones

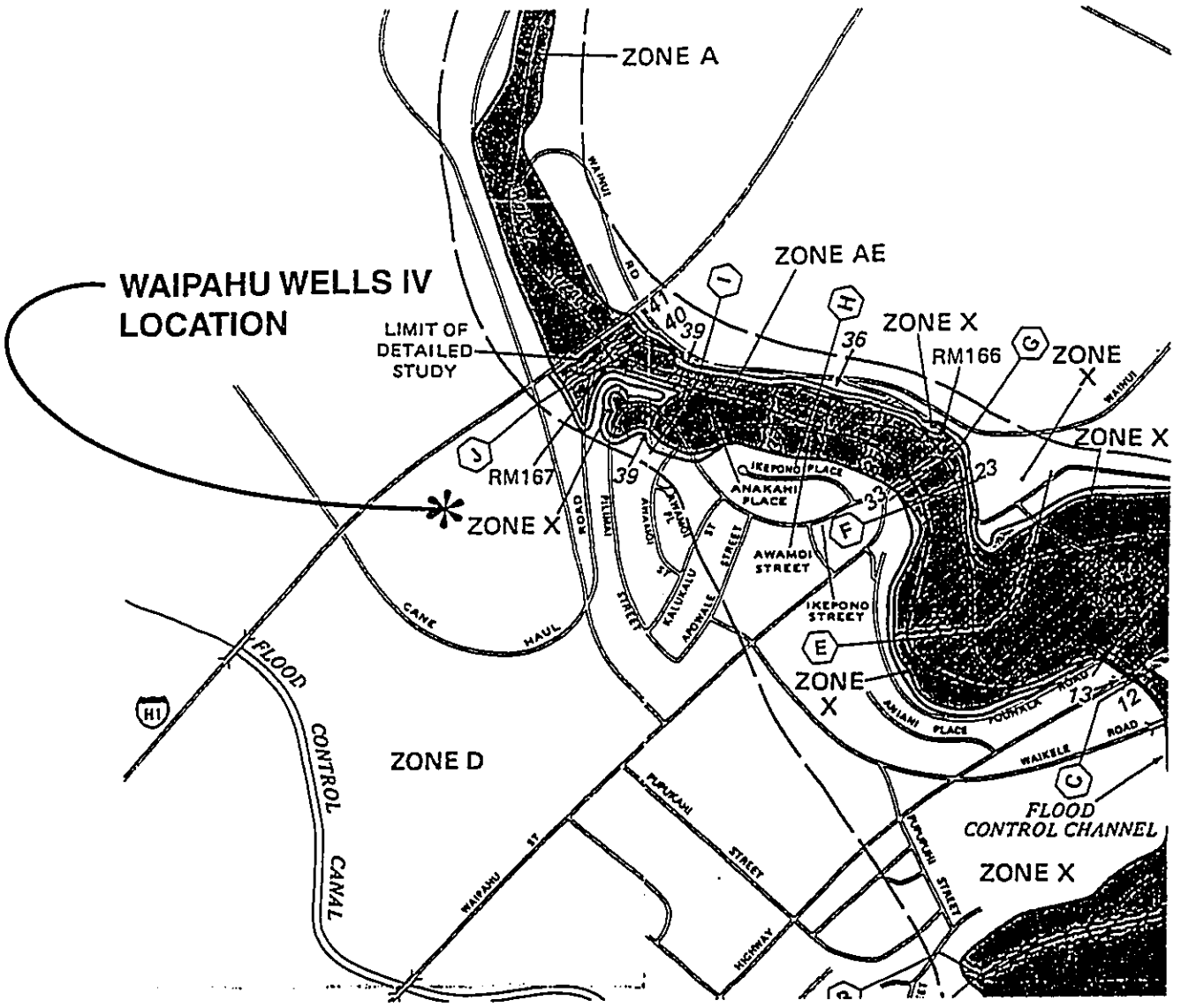
The Federal Emergency Management Agency Flood Insurance Rate Map (FIRM) of March 4, 1987, identifies the project site as lying within "Zone D", an area of undetermined, but possible flood hazard (**Figure 4-4, FEMA/FIRM Map**) This designation indicates the site is not likely to be subject to floods which would impact the project (National Flood Insurance Program, 1987).

4.4.2 Seismic Activity

The Uniform Building Code (UBC) provides minimum design criteria to address potential for damages due to seismic disturbances. The UBC scale is rated from Seismic Zone 1 through Zone 4, with 1 the lowest level for potential seismic induced ground movement. Oahu has been designated within Seismic Zone 1. BWS , in the interest of public health and safety has adopted UBC Seismic Zone 3 standards for all its structures. All structures proposed for this project, therefore, will be built according to standards for UBC Seismic Zone 3.

4.4.3 Project Impacts

Flooding is not anticipated to affect the proposed project. Because seismic risk at the project site is minimal the proposed project is not expected to be affected by seismic activity.



LEGEND

ZONE D Areas in which flood hazards are undetermined.

Figure 4-4
FEMA/FIRM MAP

0 1000 2000 4000
FEET

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Board of Water Supply
WAIPAHU IV WELLS
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4.4.4 Mitigation Measures

All construction for this project will be in accordance with standards for Seismic Zone 3 to meet health and public safety requirements. No other mitigation measures are required or recommended.

4.5 DEMOGRAPHICS

4.5.1 Population, Housing, and Employment

The Waipahu Wells IV site is located in Census Tract 88, which lies within the Waipahu Neighborhood Statistics Program Area and is part of the Census Bureau's Ewa Division Statistic. According to the U.S. Census, the Ewa Division population grew 12.4% between 1990 and 1994, increasing from 230,189 to 258,700 residents. By the year 2010, the Ewa Division population is expected to grow an additional 6% to approximately 273,900 persons.

According to the 1990 Census, the Waipahu Neighborhood Statistics Program Area contained 13,921 households with an average household size of 3.68. See **Figure 4-5, Neighborhood Statistics Area Number 22, Waipahu**. Developable land in the area is in demand primarily for additional housing. Other service facilities and more employment opportunities proximate to existing housing are also in demand. Demands for new housing are being met by current and proposed residential development in Waipahu and Waikele, in addition to development in Ewa and Central Oahu. Employment in this area includes commercial retail services at Waikele Shopping Center and along Farrington Highway, services and skilled labor at Pearl Harbor, and teaching, service and administrative jobs in area schools.

4.5.2 Project Impacts

The proposed Waipahu Wells IV project will generate some employment opportunities from construction work. However, this work will be temporary and will most likely be conducted by workers from outside of the area. Existing and future population, and employment in the project vicinity will not be affected by this project. The development of an additional potable water source at the Waipahu Wells IV site will help meet the needs of proposed residential development in the Waipahu area as well as other developments at Ewa and Kapolei.

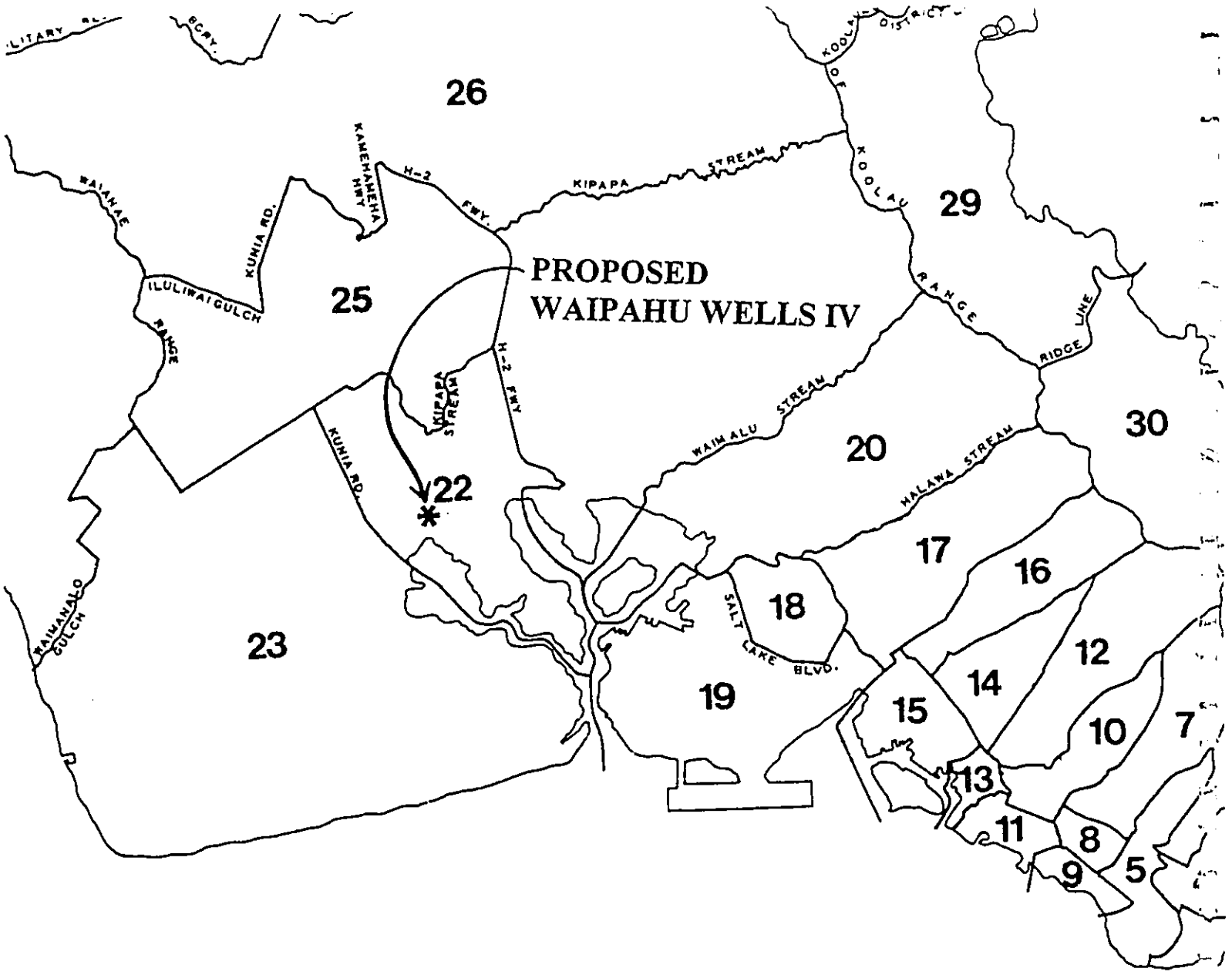

Figure 4-5
NEIGHBORHOOD STATISTICS
AREA NO. 22 - WAIPAHU

Not to Scale

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Board of Water Supply
WAIPAHU IV WELLS
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4.5.3 Mitigation Measures

No measures to mitigate potential for demographic impacts are required or recommended.

4.6 ROADWAYS AND ACCESS

4.6.1 Site Access

The proposed Waipahu Wells IV site is located immediately adjacent to Interstate Route H-1, off of the Paiwa Street Exit (Interstate Route H-1 Exit 7). Paiwa Street is a four-lane roadway which runs north/south and provides access between H-1, Waipahu Street, and Farrington Highway.

Manager's Drive forms the eastern boundary of the project site. Manager's Drive is an unused roadway that originally provided access to the Oahu Sugar Company Sugar Mill and the town of Waipahu. A recently completed bridge over Interstate Route H-1 connects Lumi'aina Street (in the Waikele Development mauka (north) of Interstate Route H-1) with Manager's Drive alongside the proposed project site. The bridge will remain closed until completion of a connector road between Manager's Drive and Mokuola Street .

At present, the project site is accessed off of Paiwa Street via Hiapo Street. Hiapo Street is an entrance street that provides access to the neighborhood and cul-de-sacs between Manager's Drive and Paiwa Street. The west end of Hiapo Street terminates at a gate that opens to a dirt road leading to the proposed project site. No other access to the site is available at present. When complete, the overpass connecting Lumiaina Street with Manager's Drive across Interstate Route H-1, will provide an additional access route to the well station. **Figure 4-6, Area Roadways**, displays area roadways.

4.6.2 Project Impacts

The project will create a slight and temporary rise in heavy truck traffic, particularly during mobilization and demobilization activities. No significant or long-term impacts to Paiwa Street, Hiapo Street, or other neighborhood streets in the vicinity are expected with this project.

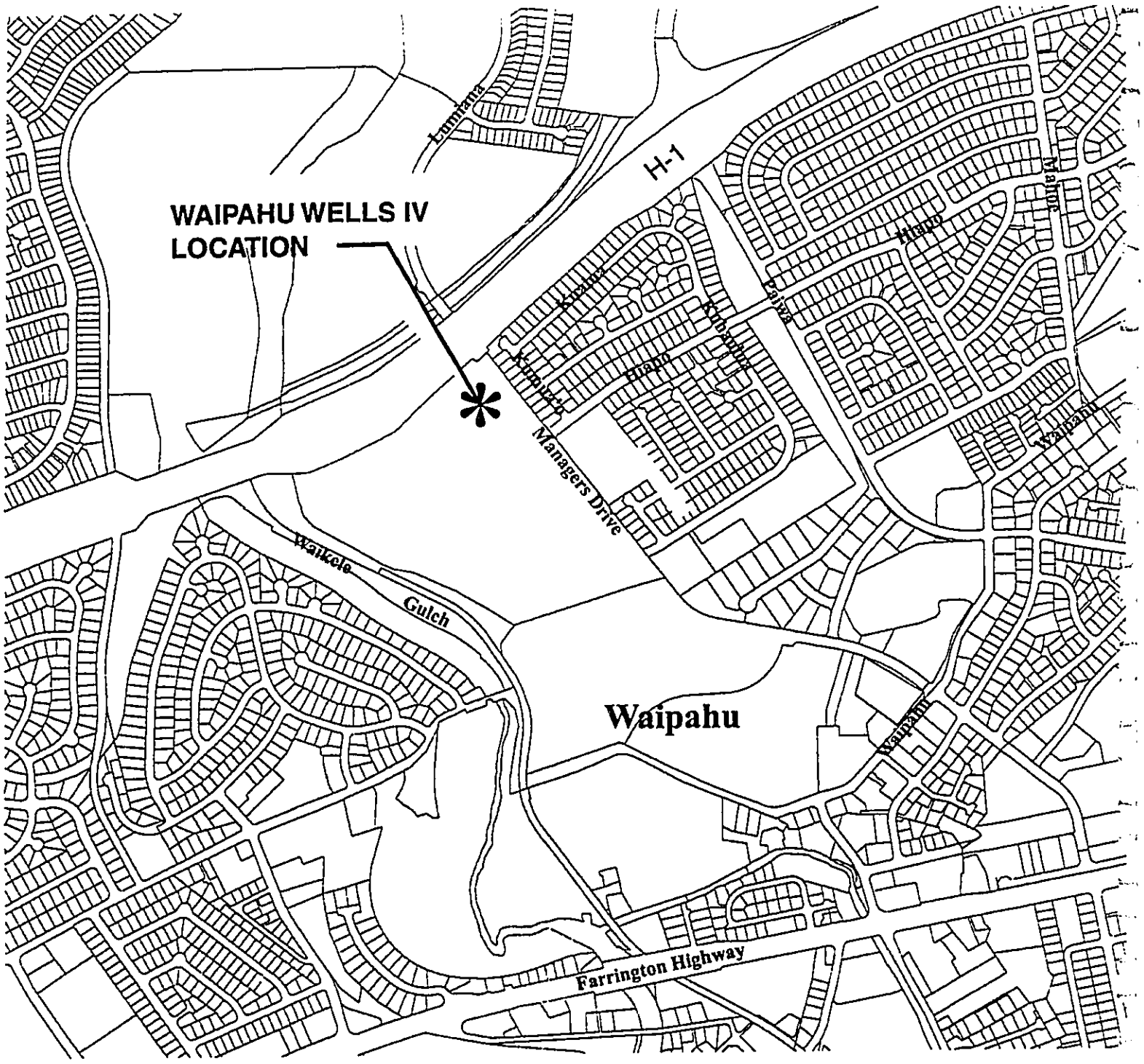

Figure 4-6
AREA ROADWAYS

NOT TO SCALE

City & County of Honolulu
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4.6.3 Mitigation Measures

To minimize traffic impacts to the nearby residents, the contractor will schedule heavy truck activity between the hours of 9:00 am and 3:00 pm on weekdays and will suspend activity on weekends and State holidays.

4.7 SCENIC AND RECREATIONAL RESOURCES

4.7.1 Scenic Resources

The State and County have not identified any view plains or scenic vistas in the project vicinity. The project site is located on a slightly sloping elevated plain that offers limited views toward Pearl Harbor and more expansive views toward Ewa and the Waianae Mountains. Views to the east are blocked by the rising ramp of the Manager's Drive overpass currently being constructed, and by the residential development beyond. To the north, the view is limited by the rise in topography and dominated by the residential development at Waikele.

4.7.2 Recreational Resources

The closest public recreational facility to the project site is the Waipahu Uka Park, a neighborhood park at the corner of Hiapo Street and Manager's Drive. The park consists of an open playing field and a backstop for baseball or softball. Several other neighborhood parks occur throughout the nearby residential areas. Additionally, the Waikele Golf Course is located on Paiwa Street, across Interstate Route H-1 from the project site.

4.7.3 Project Impacts

Short-term visual impacts associated with the project primarily relate to construction activities. Temporary signage, the presence of heavy equipment, and ongoing modifications to the landscape will all create short-term impacts on the visual setting surrounding the project site. Construction activities will be apparent from several homes in the immediate vicinity, however the project site will not be noticeable from vicinity streets or from Interstate Route H-1. Visual impacts related to construction activities are temporary in nature and not considered significant.

The proposed project will result in long-term impacts in the form of a new well station facility. The new facility will include a pump control building, ten (10) granular activated carbon treatment tanks, and a 50,000 gallon backwash tank, with appurtenances. The well station will be landscaped.

4.7.4 Mitigation Measures

To minimize the visual impact of construction activities, the project contractor will ensure that work crews, heavy equipment, and signage will be utilized only to the extent required for project operations.

Landscaping of the facility grounds will soften the visual presence of the well station. The exterior design of the pump control building and other built facilities will be guided by the City to reflect the residential character of the community as envisioned in the *Central Oahu Sustainable Communities Plan.*

4.8 CULTURAL RESOURCES

4.8.1 Cultural Resources

The proposed wells will be located in an area which was formerly under cane cultivation. Due to extensive grading and other modifications to the land surface, no significant archaeological or cultural sites are expected to exist on the project site. The Historic Preservation Office of the Department of Land and Natural Resources (DLNR), State of Hawaii, was contacted during the preparation of the draft EA for information regarding any significant historic or archaeological features within the project area. DLNR staff reviewed their records using TMK #9-04-02:05 as reference.

4.8.2 Project Impacts

According to DLNR, no cultural resources are recorded on the project site. Based on the extensively modified condition of the project area, it is anticipated that additional development will not adversely impact any cultural or archaeological resources. (Personal Communication, DLNR, Historic Preservation Division, 8/17/98.)

4.8.3 Mitigation Measures

There is always the possibility that previously unknown or unexpected subsurface cultural features, deposits, or burials may be encountered. To ensure that no subsurface cultural features will be destroyed during project construction, any site work within the project area will be monitored. In the unlikely event that archaeologically significant remains are encountered, work should cease in the immediate area and the DLNR, Historic Preservation Division will be notified at (808) 587-0047 to determine significance and treatment of any findings.

Cultural assessment consultations will also be handled through the Draft EA review process, with a copy of the Draft EA provided to the State Department of Hawaiian Home Lands and Office of Hawaiian Affairs. Archaeological and cultural resource related comments and concerns will be addressed in the Final EA.

4.9 BIOLOGICAL RESOURCES

4.9.1 Botanical Resources

The Waipahu Wells IV site was formerly under cane cultivation. Due to the extensive land modifications from previous grading and agricultural activities, the original flora at the project site and surrounding area has been almost entirely replaced by introduced weed species and grass cover. Physical inspection of the site reveals that vegetation in the area consists mainly of an assortment of grasses and shrubs among which are cane grass, guinea grass, and haole koa. Also, there are some areas that have been scraped down to bare soil. Mr. Clyde Imada, botanist with the Bishop Museum, states that no record of rare species is available but he believes that the existence of endangered species is highly unlikely. (Yuen & Associates, 1997).

4.9.2 Faunal Resources

Animals found in the area are common to Hawaii. Typical are field mice, rats, mongooses, geckos, and small feral animals. Birds include doves of various kinds, pigeons, finches, mynahs, cardinals, white eyes, bulbuls, and sparrows. No endemic birds or waterfowl were observed at the site. Endangered native species that do, on rare occasions occur in lowland areas of Oahu, such as the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) and Short-eared Owl or Pu'eo (*Asio flammeus sandwichensis*) are highly unlikely to visit the proposed project

site or its vicinity (Bruner, 1995). Dr. Dan Polhemus, biologist with the Bishop Museum-Smithsonian Institute, believes it is unlikely that any rare or endangered species of animal life is inhabiting the project area. (Yuen and Associates, 1997).

4.9.3 Project Impacts

Given the above findings, the proposed project is not anticipated to have a significant negative impact on botanical resources. There are no reasons to impose restrictions, conditions, or impediments to the proposed project based on conditions of botanical resources at the site.

The U.S. Fish and Wildlife Service (USFWS) was consulted during the preparation of the Environmental Assessment for the exploratory well phase of the Waipahu Wells IV development (Yuen and Associates, 1997). The USFWS determined that due to the historical use of the project site for intensive agriculture, and the resulting environmental disturbance, no direct impacts to fish or wildlife are likely to result from the project. Project activities might alter the local distribution and abundance of birds presently using the land, but will not impact the overall abundance of these species on Oahu.

USFWS did express concern over indirect, long-term impacts the project may have on water supply to wetlands found within the Pearl Harbor Watershed (See **Appendix A, Correspondence**, USFWS, December 19, 1996), and the wildlife found there. The loss of wetland habitat is a primary reason for the decline of Hawaii's four endangered waterbird species: the Hawaiian stilt (*Himantopus mexicanus knudseni*), the Hawaiian coot (*Fulica alai*), the Hawaiian moorhen (*Gallinula chloropus sandvicensis*), and the Hawaiian duck (*Anas wyvilliana*). Wetlands within the Pearl Harbor Watershed, including those at Waipio Peninsula, Pouhala Marsh, and the Pearl Harbor National Wildlife Refuge support all four of these species as well as large numbers of wintering shorebirds and migratory waterfowl.

As described in Section 4.3.5, no adverse impacts to Pearl Harbor springs and associated wetlands are anticipated from the proposed project because the sustainable yield of the Waipahu-Waiawa Aquifer will not be exceeded by development of the Waipahu Wells IV. Pumping levels from existing and proposed wells within this aquifer will not exceed historical

pumping levels. Therefore, spring flow impacts are expected to be less than previously experienced when the aquifer was pumped at higher levels. (See **Appendix A, Correspondence**, BWS, February 26, 1997.)

4.9.4 Mitigation Measures

No mitigation measures are required or recommended for botanical and faunal resources.

4.10 AIR QUALITY AND NOISE

4.10.1 Air Quality and Noise

Air quality on Oahu is excellent overall due to prevailing northeast trade winds. The Waipahu Wells IV site also benefits from these trade winds and enjoys generally good air quality. The *Atlas of Hawaii*, indicates that particulate matter at the site averages 40 micrograms per cubic meter of suspended particulates over a twelve-hour daytime period. The maximum concentration of carbon monoxide for any one-hour period falls between 20 and 30 micrograms per cubic meter (1983:67-68).

Existing air pollution at the project site is minimal, primarily resulting from vehicles on Interstate Route H-1. There are no stationary sources of air pollution in the area. Fugitive dust from human activities represents the only other likely source of air pollution. Heavy equipment used in the operation of the plant nursery currently occupying the project site, and construction equipment presently employed in the Manager's Drive Overpass project are the primary source of fugitive dust.

Ambient noise at and around the project site is generally steady and also low-level, resulting primarily from vehicular traffic on Interstate Route H-1, and to a lesser extent on Paiwa Street and neighborhood cul-de-sacs. Remote noise from aircraft combined with naturally occurring sounds from wind and birds generates relatively low background noise. (PKF Hawaii & PBR Hawaii, 1996).

4.10.2 Project Impacts

Construction activities and the operation of heavy vehicles and equipment at the project site will generate some fugitive dust. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, and from workers' vehicles may also affect air quality during the period of construction. The residential area east of the project site, including several houses situated within 100 feet of the proposed well station, may be temporarily affected by dust and pollution, however, these impacts will cease when construction is completed.

Noise impacts will likewise result from clearing, grading, heavy equipment operations, and other construction activities. Nearby residential areas, particularly those units immediately adjacent to the project site, will likely be affected by noise levels exceeding the allowable daytime standards of 55 dBA set by DOH Rules, Title 11, Chapter 46, "Community Noise Control". No schools, hospitals, or other such noise sensitive facilities are located in the project vicinity. These noise impacts will stop after the construction is completed.

The operation of the pump facility is not expected to result in long-term noise impacts.

4.10.3 Mitigation Measures

To mitigate impacts on air quality caused by project activities, dust control measures will be undertaken by the project contractor. Such measures will include use of dust screens and water sprinkling as necessary to minimize levels of fugitive dust. To minimize exhaust emissions, project contractors will properly maintain their internal combustion engines and comply with DOH Rules Title 11, Chapter 59 and 60, regarding Air Pollution Control.

Excessive noise levels generated by project activities will require that a noise permit be filed with DOH, Noise and Radiation Branch. The provisions of the noise permit will require that contractors muffle all construction vehicles and machinery and maintain all noise attenuation equipment in good operating condition. Faulty equipment will be repaired or replaced.

Deepwell pumps with mutes will be used in each drill hole to reduce noise levels. Further, the power source and water treatment system will be engineered to reduce facility noise to levels below the regulatory limit.

4.11 CONTAMINATION SOURCES

4.11.1 Known Contamination

According to the CWRM *Water Quality Plan* (1990), substances reported in the Waipahu-Waiawa Aquifer include traces of Atrazine, Trichloropropane (TCP), Dibromochloropropane (DBCP), and Ethylene dibromide (EDB). All but the latter, EDB, fell well within safe drinking standards (Lau, 1987). Chemical analysis of test water from the wells detected TCP in water from Well #2. However, the detected level of 0.27 parts per million (ppm) is safely below the State's maximum contamination level standard for TCP of 0.8 ppm. Most of the substances known from the aquifer are associated with pesticide and herbicide use from extensive agricultural operations west of the Waiawa Valley. A search of the DOH, Underground Storage Tank (UST) Leak Log found no events near the project site that would negatively impact underground water quality. Results of the chemical analysis of water samples taken from test borings for the Waipahu Wells IV has been added as Appendix D in the Final EA.

4.11.2 Potential Sources of Contamination

The proposed project site is located less than a mile from the West Loch estuary of Pearl Harbor on former agricultural land that for over 100 years was cultivated with sugar cane. Until the demise of sugar, cane was grown to elevations in excess of 600 feet where water from Waiahole Ditch could be delivered. Above this elevation, pineapple was cultivated to the boundary with the military reservation. Diversified agriculture has replaced some of the cane land.

Extensive use of agricultural chemicals, including fertilizer, has resulted in soluble components entering the ground water body. At this time, the only ground water areas needing treatment are at lower elevations between Kunia Road and Kamehameha Highway where agricultural chemicals formerly used on pineapple (Trichloropropane (TCP), ethylenedibromide (EDB) and Dicbromochloropropane (DBCP)) have been detected. Additionally, nitrates appear to be on the rise, especially below areas cultivated with seed corn. Herbicides have also been found in trace

amounts. Because application of these chemicals was very widespread, these contamination forms are considered non-point source and are likely to be found over a broad area.

Potential contaminants incidental to agricultural operations including fuel, oil and solvents from machinery, autos and truck operations have not been found nor are we aware that any large spills have occurred. While solvents have been found in the Wahiawa high-level ground water body, none has been found in basal water. Fuels have not been found above trace amounts in the Waipahu-Waiawa subarea of the Pearl Harbor aquifer.

Where modern human settlements exist, there is always a potential for contaminants. Urban development, including housing units, landscaping and lawns, may pose a contamination hazard from pesticides and fertilizer use. The impact of these activities compared to the contamination impact of sugarcane, however, is unclear. Low levels of termicides (such as dieldrin and chlordane) have been found in well stations located in long-time residential areas. Source development in urban areas includes water treatment systems to ensure that existing and potential future contaminant sources are removed before water is introduced to the municipal potable water system.

Additionally, an accident on the freeway could pose a contaminant hazard if spill materials percolate into the ground. Emergency response measures for containing and cleaning up hazardous material spills are regulated by the State. The Honolulu Fire Department maintains a hazardous material team that performs first-response and containment of any hazardous material spills. Incidents are reported to the State Department of Health, Office of Hazard Evaluation and Emergency Response, which oversees and coordinates clean-up efforts.

4.11.3 Project Impacts

The proposed project is not expected to result in adverse impacts to municipal potable water resources. Similarly, project operations including heavy equipment and vehicle use, are not expected to result in contamination of the project site.

4.11.4 Mitigation Measures

To minimize potential construction related contamination sources, best management practices shall be employed during project activities. Sites designated for fueling and for stockpiling materials that could potentially contaminate water sources will be enclosed by a containment berm constructed to contain potential spills and seepage and prevent storm water runoff from carrying pollutants into the storm sewer system and into state coastal waters.

To ensure potable quality, the permanent production well station will utilize a granular activated carbon (GAC) water treatment system to remove any volatile organic chemical (VOC) contaminants. If future monitoring reveals that the water does not meet standards for potable quality according to HAR, Section 11-20-29, the treatment or filtration system might be modified, as necessary, to purify the water to potable quality.

Chapter 5

RELATIONSHIP TO LAND USE DESIGNATIONS AND CONTROLS

5.1 HAWAII STATE PLAN

The Hawaii State Plan, Chapter 226, Hawaii Revised Statutes (HRS), serves as a written guide for the future long range development of the State. The Plan identifies goals, objectives, policies, and priorities for the State.

The proposed project would be in conformance to the State Plan objectives and policies for facility systems - in general:

> "(a) Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives."

> "(b) To achieve the general facility systems objective, it shall be the policy of this State to: (1) Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans." and "(3) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user" (HRS, Section 226-14).

The project would also conform to HRS, Section 226-16, Water,

> "(a) Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities" (HRS, Section 226-16).

5.2 STATE LAND USE DESIGNATIONS

The project site is located within the State Land Use Urban District. According to State Law, Chapter 205, HRS, land use controls in the Urban Districts on the Island of Oahu are under the jurisdiction of the City and County of Honolulu. No action from the State Land Use Commission is required to implement the proposed Waipahu Wells IV project or its conversion to production status.

5.3 CITY AND COUNTY OF HONOLULU GENERAL PLAN

The proposed project is supported by the following provisions in the General Plan of the City and County of Honolulu:

Section V. Transportation and Utilities

Objective B: To meet the needs of the people of Oahu for an adequate supply of water and for environmentally sound systems of waste disposal.

Policy 1: Develop and maintain an adequate supply of water for both residents and visitors.

According to BWS, demand for water is expected to increase from its current level of approximately 175 million gallons a day (mgd) to more than 193 mgd by the year 2010 (BWS 1997). BWS is mandated to meet this demand by developing new water supplies within the limits of available resources. The Waipahu Wells IV site will contribute a total yield of 3.0 mgd of potable water to help meet increased demand, particularly in the Ewa and Central Oahu districts were most of the growth is expected to take place.

Objective C: To maintain a high level of service for all utilities.

Policy 3: Plan for the timely and orderly expansion of utility systems.

BWS is developing the wells in anticipation of increases in demand related to planned residential growth in the Ewa and Central Oahu Districts. The well station will be integrated into the BWS's municipal potable water source, storage, and transmission system.

Objective D: To maintain transportation and utility systems which will help Oahu continue to be a desirable place to live and visit.

Policy 4: Evaluate the social, economic, and environmental impacts of additions to the transportation and utility systems before they are constructed.

The proposed project is being planned and designed in compliance with environmental assessment and documentation requirements set forth in Chapter 200, Title 11, Hawaii Administrative Rules, and Chapter 343, Hawaii Revised Statutes.

5.4 CITY AND COUNTY OF HONOLULU CENTRAL OAHU SUSTAINABLE COMMUNITIES PLAN

The Board of Water Supply is developing the Waipahu Wells IV site as part of an integrated, island-wide water system that will remain current with increasing demands for potable water. In compliance with the Oahu Sustainable Communities Plan, Section 4.2.1, General Policies, Water Allocation and System Development, BWS will coordinate the development and allocation of potable water under the authority of the State Commission on Water Resource Management (CWRM). Prior to putting the well site into production status, BWS will obtain a Water Use Permit from CWRM and will incorporate well production into the County's Water Use and Development Plan.

In order to preserve the residential character and small town sense of the community as envisioned in the *Sustainable Communities Plan*, the exterior of the well station facilities will be designed and landscaped to blend in with the adjacent properties.

5.5 CITY AND COUNTY OF HONOLULU LAND USE DESIGNATIONS AND CONTROLS

Land uses in the Urban District are controlled by the City's General Plan, Development Plan and Land Use Ordinance.

The project site is designated as R-5, Residential, on the City and County of Honolulu's Zoning Map. See **Section 4.1, Figure 4-1, Zoning and Land Use**. To the west, Waikele Gulch and Stream are designated P-2, Preservation Land. Other zoned uses in the area include A-1, Apartments, and I-2, Light Industrial.

On the Central Oahu Development Plan Land Use Map, which is utilized by the City to plan for future public expenditures and capital improvements, the larger parcel, on which the project site is located, is designated as Residential. On the Central Oahu Development Plan Public Facilities Map, the proposed project site is located adjacent to Manager's Drive, which is designated as privately funded "additional right-of-way and new streets".

A Development Plan Public Facilities Map Amendment for the Waipahu Wells IV was enacted by the Honolulu City Council on August 5, 1999 by Ordinance 99-50. With the implementation of the City's Regional Development Plan Reports, the Development Plan Public Facility Map may be replaced with the Public Infrastructure Maps. The Waipahu Wells IV Station has been incorporated into the Oahu Water Management Plan, which is one of the BWS's functional plans.

Chapter 6

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Development of the proposed project will commit the necessary construction and human effort, and fiscal resources. Use of these resources will benefit residents and visitors to the City and County of Honolulu by ensuring safe and clean potable water. Long-term gains resulting from the proposed project include the long term use and benefits accruing from this resource. The proposed project will enhance economic productivity by making possible future development.

Chapter 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES BY THE PROPOSED ACTION

Development of the proposed project will involve the irretrievable loss of certain environmental and fiscal resources. However, the costs associated with the use of these resources should be evaluated in light of recurring benefits to the residents of Honolulu.

It is anticipated that the construction of the proposed project will commit the necessary construction materials and human resources (in the form of planning, engineering, construction and labor). Reuse for much of these resources is not practicable. Although labor is compensated during the various stages of development, labor expended for project development is non-retrievable.

Chapter 8

NECESSARY PERMITS AND APPROVALS

8.1 CITY AND COUNTY OF HONOLULU

8.1.1 Department of Environmental Services

BWS will secure a permit from the City and County of Honolulu, Department of Environmental Services to dispose of discharge from GAC system and backwash tank hydrotesting into the City and County storm sewer system pursuant to Section 14-12-22, Revised Ordinances of Honolulu 1990, as amended.

8.1.2 Department of Health

Development of the wells will require filing of a Noise Permit from the State Department of Health, Noise and Radiation Branch.

Additionally, an NPDES permit is required from the State Department of Health for the discharge of effluent associated with hydrotesting and disinfection of water mains and GAC treatment units into waters of the State through the municipal separate storm sewer system.

No other DOH permits for the wells are expected. However, development of production wells will require authorization for connection to a public water system (Public Health Regulations, Chapter 20, Title II, Potable Water Systems).

8.1.3 Department of Planning and Permitting

Wells are considered minor and are not required to be shown on the City and County of Honolulu's Development Plan Public Facilities Map. Conversion of the exploratory drill holes to production wells will require that an application be filed for a Development Plan Public Facilities Map amendment from the City and County of Honolulu, Department of Planning and Permitting. Review and approval for this permit is from the Honolulu City Council.

It is expected that this permit will be filed during preparation and processing of the environmental assessment for the installation of the production wells. However, with the implementation of the City's Regional Development Plan Reports, the Development Plan Public Facility Maps may be replaced with existing functional infrastructure plans. The Waipahu Wells IV Station has been incorporated into the Oahu Water Management Plan, which is one of the BWS's functional plans.

8.2 STATE OF HAWAII

8.2.1 Department of Land and Natural Resources

Commission on Water Resources Management (CWRM)

BWS has filed a Well Construction permit with the Commission on Water Resource Management (CWRM). This permit is for work including test pumping. The production wells will require a permanent Pump Installation Permit and Water Use Permit.

- The Pump Installation Permit is required for conversion to production status and would be issued when the Water Use Permit has been approved.
- A Water Use Permit of a defined allocation amount is required to draw water out of the Waipahu-Waiawa WMA. Both the Pump Installation Permit and the Water Use Permit will be filed upon satisfactory completion of pumping and testing.

Chapter 9

DETERMINATION

In accordance with the provisions set forth in Chapter 343, Hawaii Revised Statutes, and the significance criteria in Section 11-200-12 of Title 11, Chapter 200, this assessment has determined that the project will have no significant adverse impact to water quality, air quality, existing utilities, noise, archaeological sites, or wildlife habitat. All anticipated impacts will be temporary and will not adversely impact the environmental quality of the area. According to the significance criteria:

1. *Irrevocable commitment to loss or destruction of natural or cultural resources* -

   The proposed project is not anticipated to adversely impact any natural or cultural resources. The proposed well site is located on a parcel that was previously under intense agricultural use. No significant archaeological or cultural sites are known or expected to exist on the project site due to extensive plowing, cultivation, and other modifications to the land surface. (Personal Communication, Historic Preservation Division, 8/17/98).

2. *Curtailment of the range of beneficial uses of the environment* -

   The proposed location of the well site is along the northeast end of TMK: 9-4-02:05, an undeveloped parcel formerly in agricultural production and zoned for residential use. Development of the well station will not displace any existing structures or activities and will not detract from the function or use of the remaining area of the parcel. Upon completion, the appearance of the well structure, e.g., pump(s), valves and appurtenances, is expected to be consistent with the surrounding structures and buildings within the parcel.

3. *Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders* -

The proposed project is consistent with the environmental polices, goals and guidelines delineated in Chapter 343, HRS, and the National Environmental Policy Act. Potential sources of adverse impacts have been identified and appropriate measures developed to mitigate or minimize impacts to negligible levels.

4. *Substantially affects the economic or social welfare of the community or state* -

The proposed project is intended to ensure the long-term provision of clean, potable water necessary for the future health, welfare, and growth of the surrounding community, the Central Oahu region, and the Ewa plain.

5. *Substantially affects public health* -

The proposed project will be developed in accordance with federal, state, and City and County of Honolulu, rules and regulations governing public safety and health. The primary public health concerns will involve air, water, noise, and traffic impacts. However, it is expected that these impacts can be minimized or brought to negligible levels by appropriate use of the mitigation measures described in this document.

6. *Involves substantial secondary impacts, such as population changes or effects on public facilities* -

The proposed project is part of the BWS program for development of water sources to serve the present and future population of the area. The project in itself, however, will not generate new population growth.

7. *Involves substantial degradation of environmental quality* -

The proposed project will be developed in accordance with the environmental polices of Chapter 343, HRS, and the National Environmental Policy Act. The project site is on

land previously used for agricultural purposes. The existing site, therefore, has already been subject to extensive plowing, cultivation activities, and other modifications. The proposed activity will be developed in such a manner as to avoid causing short or long-term adverse impacts, guided by the environmental policies, goals and guidelines delineated in Chapter 343, HRS, and the National Environmental Policy Act.

Use of the underlying groundwater will also be subject to review and approval by the State Commission on Water Resource Management. This will ensure the long-term protection of the Waipahu-Waiawa Aquifer.

8. *Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger actions -*

The proposed project addresses the needs of existing and future area residents, businesses, and institutional users. Although Oahu's growing population will continue to place demands on need for more water, the island's potable resources are finite and limited. CWRM, which is charged with regulation of Hawaii's water resources, will ensure that permitted withdrawals are consistent with the available sustainable yield of aquifer systems such as Waipahu-Waiawa.

9. *Substantially affects a rare, threatened or endangered species or its habitat -*

There are no endangered flora or fauna species within the project site.

10. *Detrimentally affects air or water quality or ambient noise levels -*

Any potential impacts to air, water quality, or noise levels will be addressed by use of appropriate measures described in this document.

11. *Affects or is likely to suffer damage by being located in an environmentally sensitive area, such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, freshwater, or coastal waters -*

The proposed project is located in an area appropriate for urban development and related development of potable water sources. The proposed project site itself does not contain any especially sensitive environmental characteristics which would detract from the proposed activity.

12. *Substantially affects scenic vistas and view planes identified in county or state plans or studies -*

No view plains or scenic vistas have been identified in the project area. Construction equipment will be visible during construction of the well station and installation of water mains and appurtenances. However, upon completion the construction equipment will be removed from the site. The permanent facilities will be comprised of a pump control house, ten (10) granular activated carbon contactor tanks, and a 50,000-gallon backwash tank. The facility grounds will be landscaped to soften the visual presence of the well station.

13. *Requires substantial energy consumption -*

Construction of the well station facilities and installation of water transmission mains will require some energy consumption. Energy will also be used during the transport of construction equipment, machinery, and personnel to the project site. None of these activities are expected to result in use of energy significantly greater than similar well projects.

Based on analysis and review of the above factors, it has been determined that an Environmental Impact Statement (EIS) will not be required and that a Finding of No Significant Impact (FONSI) be issued for this project.

Chapter 10

ORGANIZATIONS AND AGENCIES CONSULTED IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL ASSESSMENT

The following organizations and agencies were contacted during preparation of the Waipahu Wells IV Draft Environmental Assessment, August 1997:

10.1 FEDERAL AGENCIES

- U.S. Department of the Interior
  - Geological Survey, Water Resources Division
  - Fish and Wildlife Service, Ecological Services
- U.S. Army Corps of Engineers

10.2 STATE AGENCIES

- Department of Business, Economic Development and Tourism
  - Office of Planning
- Department of Health
  - Clean Water Branch
  - Office of Environmental Quality Control (OEQC)
  - Environmental Management Division
- Department of Land and Natural Resources
  - Commission on Water Resource Management
  - Aquatic Resources Division
  - State Historic Preservation Division
- Office of Hawaiian Affairs

10.3 CITY AND COUNTY OF HONOLULU

- Board of Water Supply
- Department of Land Utilization
- Department of Planning and Permitting

10.4 OTHER ORGANIZATIONS

- Waipahu Cultural Garden Park
- Waipahu Neighborhood Board, No. 22
- Mufi Hanneman, City Council District VIII, Halawa Heights to Waipahu
- John Desoto, City Council District IX, Waipahu to Kaena Point

REFERENCES

(Listed in Chronological Order)

Central Oahu Sustainable Communities Plan, City and County of Honolulu, Department of Planning and Permitting, September 1999.

Oahu Water Management Plan, Initial Revision of the Technical Reference Document, Wilson Okamoto & Associates, Inc., Prepared for City and County of Honolulu, Board of Water Supply, September 1997.

Well and Water Use Permit Index, Commission on Water Resources Management, Department of Land and Natural Resources, State of Hawaii, May 28, 1997.

Species list by federal status as of November 7, 1996, U.S. Fish and Wildlife Service, 1996.

Oahu Water Plan, Fifth Edition. City and County of Honolulu, Board of Water Supply, March 1995.

Kapalama Exploratory Wells, Final Environmental Assessment, Kapalama, Honolulu, Oahu, Hawaii. *City and County of Honolulu, Board of Water Supply, CH2M Hill*, June 1995.

Hawaii Stream Assessment: A Preliminary Appraisal of Hawaii's Stream Resources, Report R84, State Department of Land and Natural Resources, Commission on Water Resource Management, and Hawaii Cooperative Park Service Unit, National Park Service, Honolulu, Hawaii, 1990.

Manual of the Flowering Plants of Hawai'i, Bishop Museum Special Publication 83. Wagner, W.L., D. R. Herbst and S.H. Sohmer, 1990.

Water Quality Plan, State Department of Land and Natural Resources, Commission on Water Resource Management, 1990.

Report R-78, Review and Re-Evaluation of Ground Water Conditions in the Pearl Harbor Ground Water Control Area, Commission on Water Resource Management, Oahu, Hawaii, 1988.

Organic Chemical Contamination of O'ahu Groundwater, Technical Report No. 181. Lau, Stephen L., Water Resources Research Center, University of Hawaii at Manoa, July 1987.

Atlas of Hawaii. Department of Geography, University of Hawaii, University of Hawaii Press, 1973.

Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. U.S. Department of Agriculture, Soil Conservation Service, and University of Hawaii Agricultural Experiment Station, August 1972.

Geology and Ground-water Resources of the Honolulu-Pearl Harbor Area, Oahu, Hawaii, Wentworth, Chester K., Board of Water Supply, City and County of Honolulu, Hawaii, 1951.

Geology and Groundwater Resources of the Island of Oahu, Hawaii. Stearns, Harold T. and K.N. Vaksvik. Hawaii Division of Geography, Bulletin I, 1935.

Appendices

Appendix A

Correspondence

United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS ECOREGION
300 ALA MOANA BOULEVARD, ROOM 3108
BOX 50088
HONOLULU, HAWAII 96850
PHONE: (808) 541-3441 FAX: (808) 541-3470

December 19, 1996

In Reply Refer To: CAW

Mr. John Chang
George A. L. Yuen and Associates
100 North Beretania Street, Suite 303
Honolulu, Hawaii 96817

Re: Draft Environmental Assessment, Waipahu Wells II Addition, Oahu, Hawaii and Draft Environmental Assessment, Waipahu Wells IV, Oahu, Hawaii.

Dear Mr. Chang:

The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Environmental Assessment (EA) for the proposed Waipahu Wells II Addition, Oahu, Hawaii and the Draft EA for the proposed Waipahu Wells IV, Oahu, Hawaii. The Service has combined our response to these projects because both well proposals will withdraw water from the Pearl Harbor aquifer. The proposing agency for these projects is the Honolulu Board of Water Supply (BWS), City and County of Honolulu.

The proposed projects involve the drilling of a total of five exploratory water production wells. The first proposed well as described in the Draft EA for the Waipahu Wells II Addition is located within the grounds of the BWS's existing Waipahu Wells II facility. The four additional proposed wells described in Draft EA for the Waipahu Wells IV will be located about 2,300 feet southwest of the BWS's existing Waipahu Wells II facility.

General Comments

Because the proposed construction projects are on previously disturbed sites (the first well lies within existing facilities and the additional four wells will be located in an area that was formerly under sugar cane cultivation), the Service does not anticipate direct adverse impacts to fish and wildlife resources. However, the Service is concerned with the potential indirect long-term impacts that the proposed projects may have on the water supply currently available to the wetlands found within the Pearl Harbor Watershed.

C

The Service has estimated that 31% of the coastal wetlands in Hawaii were lost between 1780 and 1980. The loss of wetland habitat is a primary reason for the decline of Hawaii's four endangered waterbird species: the Hawaiian stilt (*Himantopus mexicanus knudseni*), the Hawaiian coot (*Fulica alai*), the Hawaiian moorhen (*Gallinula chloropus sandvicensis*), and the Hawaiian duck (*Anas wyvilliana*). Wetlands within the Pearl Harbor Watershed, including those at Waipio Peninsula (jurisdiction of the U.S. Navy), Pouhala Marsh (jurisdiction of the State of Hawaii), and the Pearl Harbor National Wildlife Refuge (jurisdiction of the U.S. Navy and the Service), support all four of these species, as well as large numbers of wintering shorebirds and migratory waterfowl. These wetlands have been identified as important habitat in the Hawaiian Waterbirds Recovery Plan.

Specific Comments

On page 14 of the Draft EA for Waipahu Wells II, it states that "pumping at Waipahu II may affect the spring that feeds Waikele Stream and the springs that break out in the lowland plain between Waipio Peninsula and Waipahu Town." On page 12, the Draft EA states that "The entire Koolau basalt region of the Pearl Harbor Sector is actually a single aquifer." Therefore, it is reasonable to assume that springs feeding Waipio Peninsula, Pouhala Marsh, and Pearl Harbor National Wildlife Refuge wetlands could be affected by the water withdrawals proposed for the Waipahu Wells II Addition.

On page 11 of the Draft EA for Waipahu Wells IV, it states that "Pumping at Waipahu IV may affect these springs but not measureable so." The springs refered to in this statement are the same springs that may be affected by the Waipahu Wells II Addition. The Service is concerned that these four additional wells may negatively affect the springs feeding the Waipio Peninsula wetlands.

Summary Comments

The Service does not have the expertise within the Pacific Islands Office to (1) determine if the pump test design is adequate to identify potential long-term effects of water withdrawals from the Pearl Harbor Aquifer on wetlands within the Pearl Harbor Watershed or (2) evaluate subsequent results of the pump test. The Service believes that such evaluations are best accomplished by our sister agency; the U.S. Geological Service (USGS).

The Service recommends that the BWS request that the USGS review the adequacy of the pump test design and evaluate the results of the actual pump test. If the BWS is unable to obtain assurances from the USGS that the proposed water withdrawals will not affect the hydrology of the wetlands within the Pearl Harbor Watershed, we request that the BWS conduct a long-term monitoring program that will provide the Service, the State of Hawaii, and the U.S. Navy with the information necessary to make recommendations to protect the water needs of the wetlands at the Pearl Harbor National Wildlife Refuge, Pouhala Marsh, and Waipio Peninsula.

Until the above concerns are addressed, the Service can not concur with a Negative Declaration and finding that the proposed activity will not result in any significant adverse environmental impacts. The Service appreciates the opportunity to comment. If you have questions regarding these comments, please contact Fish and Wildlife Biologist Christine Willis at 808/541-3441.

Sincerely,

Brooks Harper

Brooks Harper
Field Supervisor
Ecological Services

cc: DOFAW, Honolulu
DAR, Honolulu
CWB, Honolulu
USGS, Hawaii
Refuge Manager, Pearl Harbor NWR
U.S. Navy, PACDIV

C

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843
PHONE (808) 527-6180
FAX (808) 533-2714

February 26, 1997

Mr. Brooks Harper
Fish and Wildlife Service
Pacific Islands Ecoregion
United States Department of the Interior
300 Ala Moana Boulevard, Room 3108
P. O. Box 50088
Honolulu, Hawaii 96850

Dear Mr. Harper:

Subject: Your Letter of December 19, 1996 to George A. L. Yuen and Associates on Draft Environmental Assessments for the Proposed Waipahu Wells II Addition and Waipahu Wells IV, Oahu, Hawaii

Thank you for reviewing the Draft Environmental Assessments for the proposed Waipahu Wells II Addition and Waipahu Wells IV project.

We have the following comments on your concerns:

1. We acknowledge that the U.S. Fish and Wildlife Service does not anticipate direct adverse impacts to fish and wildlife resources because the proposed well projects are within previously disturbed agricultural lands. There will be minimal impacts on the basal aquifer and Pearl Harbor springs from these well projects because the sustainable yield which was based on production from the Waipahu-Waiawa aquifer, will not be exceeded. The 1996 permitted use for the Waipahu-Waiawa aquifer is 106 mgd which is within the current 119 mgd sustainable yield. A significant amount of the permitted use is assigned to the defunct Oahu Sugar Co. (OSCo), of which a portion may become available if not retained in agriculture. We note that the Pearl Harbor aquifer has been historically pumped at higher levels prior to OSCo's close. These wells and stream diversions are located within the Waikele gulch and at the old sugar mill. Historical pumping levels of these sources which amounted to over 22 mgd, will not be exceeded now that OSCo has closed. Therefore, any stream flow impacts associated with pumping levels that are less than previous pumpage, is expected to be less.

C

Perennial stream flow monitoring of Oahu's major streams is an on-going process and responsibility of the U.S. Geological Survey (USGS) and the Commission on Water Resource Management (CWRM) as part of a comprehensive water resource management program. In equity, monitoring the cumulative impact of aquifer wide withdrawal's should involve military, state, county and private users of both groundwater and surface water.

The cumulative benefit is that additional water source capacity will be made available within the same areas that will be absorbing the islands growth; namely the Ewa and Central Oahu areas. Developing a few large capacity sources within the growth areas is one-half the cost of developing many small capacity sources in the windward and north sectors and transporting water to the growth areas. This reduces the economic impact to the water consumers. These directed growth areas in South Oahu relieve the growth pressures in the rural areas of windward and north shore.

2. The Board of Water Supply follows standard test pumping procedures which are a standard condition of the well construction permit. The USGS and the CWRM collaborated on the test pumping protocol.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

RAYMOND H. SATO
Manager and Chief Engineer

cc: George Yuen, George Yuen and Associates

C

SCHULER HOMES, INC.

November 1, 1996

Mr. Ray Sato
Manager and Chief Engineer
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

RE: Waipahu Wells IV and V

Dear Ray:

We received on October 25, 1996, a Draft Environmental Assessment on the referenced wells. The indicated location for the wells is on our property known as Parcel 15 at Waikele. I attach a copy of our land plan.

I was surprised to receive the Draft EA since in the past 6 months in several meetings with the BWS Land Department, I had indicated that Parcel 15 was very important to our delivery of affordable units pursuant to the Unilateral Agreement that controlled the development of the master planned community that is known as Waikele. Pursuant to the Unilateral Agreement we must build 270 housing units on Parcel 15. In the meetings I had with the Land Department we tried to see if there was anyplace on the parcel that the well sites would fit but once we learned during the discussions that the BWS also wanted to locate 8 GAC tanks on the site, we indicated that we felt that such a use was not appropriate to be located within a relatively dense residential development. Actually there is simply no room on the site for the wells without the displacement of housing units and as I have stated we must put at least 270 units on the site.

In the Draft EA at page 2, there is a reference to an alternative site that is owned by the City and County of Honolulu and is available. We respectfully request that the BWS consider the Waikele Parcel 15 as not available and that the alternative site be utilized for the well facilities.

Sincerely,

Harvey L. Goth
Senior Vice President

cc: Mr. John Chang
George A.L. Yuen and Associates, Inc.

828 FORT STREET MALL • 4TH FLOOR • HONOLULU, HAWAII 96813 • (808) 521-5661 • FAX (808) 538-1476

C

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843
PHONE (808) 527-6180
FAX (808) 533-2714

January 9, 1997

COPY

Mr. Harvey L. Goth
Senior Vice President
Schuler Homes, Inc.
828 Fort Street Mall, 4th Floor
Honolulu, Hawaii 96813

Dear Mr. Goth:

Subject: Your Letter of November 1, 1996 Regarding the Draft Environmental Assessment for the Board of Water Supply's Proposed Waipahu Wells IV

Thank you for your letter regarding the proposed location of the Board of Water Supply's Waipahu Wells IV site within Parcel 15 of the Waikele development. We understand that Parcel 15 is subject to the City Council's Unilateral Agreement on the Waikele development which requires 270 housing units to be constructed. Our recent hydro-geological evaluation indicates that both alternative well sites are suitable for adequate water source development. Therefore, we will pursue the alternative site makai of H-1.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

For RAYMOND H. SATO
Manager and Chief Engineer

SM/BU:do
cc: R. Sato
Land
B. Usagawa

96-3435

C

Pure Water . . . our greatest need – use it wisely

Appendix B

Responses to Comments Received During the Draft Environmental Assessment 30-Day Comment Period

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

December 16, 1999

Regulatory Branch

Mr. Mike Araki
Planning and Engineering
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Araki:

This responds to your request for review of the Draft Environmental Assessment (DEA) for the proposed Waipahu Wells IV (State No. 2301-44, 45, 46, 47) at Waipahu, Oahu, Hawaii.

Based on the information provided in the DEA, I have determined that the proposed project will not require a Department of the Army permit. However, I recommend that best management practices be employed during construction to prevent potential discharges from entering waters of the U.S.

Should you have any questions regarding this determination, please contact Peter Galloway of my staff at 438-8416 and refer to file number 200000054.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

Copies Furnished:

Clean Water Branch, State of Hawaii Department of Health, P.O. Box 3378, Honolulu, HI 96801-3386
State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management, P.O. Box 621 Honolulu, HI 96809
Mr. Chester Koga, R. M. Towill Corporation, 420 Waiakamilo Road, Suite 411, Honolulu, HI 96817-4941

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

December 30, 1999

Mr. George P. Young, Chief
Regulatory Branch
Department of the Army
U.S. Army Engineer District
Fort Shafter, Hawaii 96858-5440

Dear Mr. Young:

Subject: Your Letter of December 16, 1999 Regarding the Draft Environmental Assessment for the Proposed Waipahu Wells IV (State No. 2301-44, 45, 46, 47), Waipahu, Oahu, Hawaii, TMK: 9-4-02: 05

Thank you for reviewing the Draft Environmental Assessment for the proposed Waipahu Wells IV project.

We acknowledge that the proposed project will not require a Department of the Army permit. In addition, best management practices will be employed during construction to prevent potential discharges from entering waters of the U.S.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

ec: R.M. Towill Corporation

BENJAMIN J. CAYETANO
GOVERNOR
SEIJI F. NAYA, Ph.D.
DIRECTOR
BRADLEY J. MOSSMAN
DEPUTY DIRECTOR
DAVID W. BLANE
DIRECTOR, OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

Telephone: (808) 587-2846
Fax: (808) 587-2824

OFFICE OF PLANNING
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Ref. No. P-8403

December 23, 1999

Mr. Mike Araki
Planning & Engineering
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Araki,

Subject: Draft Environmental Assessment for Waipahu Wells IV, State No. 2301-44, 45, 46, 47, TMK 9-4-02:05

This project proposes to develop four permanent production potable water wells in Waipahu, Hawaii. We do not oppose the project which aims to develop additional water sources to meet projected demand for Oahu residents.

However, we do share the concerns of the U.S. Fish and Wildlife Service that the project has the potential to adversely impact wetlands in the Waipio Peninsula, Pouhala Marsh and the Pearl Harbor National Wildlife Refuge. The potential adverse impact to the wetlands could thereby impact the four endangered waterbird species that use those wetlands for habitat. We suggest including in the draft environmental assessment mitigation measures that will be taken to prevent wetland and habitat loss.

Should you have any questions, please contact Lynn Nakagawa of our Coastal Zone Management Program at 587-2898.

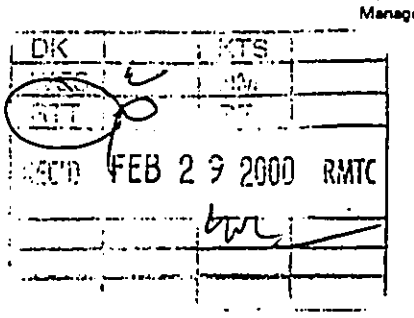
Sincerely,

David W. Blane
Director
Office of Planning

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

February 10, 2000



Mr. David W. Blane, Director
Office of Planning
State of Hawaii
P. O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Blane:

Subject: Your Letter Dated December 23, 1999 Regarding the Draft Environmental Assessment, Waipahu Wells IV, State No. 2301-44, 45, 46, 47, TMK: 9-4-02: 05

Thank you for reviewing the Draft Environmental Assessment (EA) for the proposed Waipahu Wells IV project.

We have the following response to your concerns:

1. We acknowledge that you do not oppose the project to develop additional water sources to meet projected demand for Oahu residents. In addition, we note your concerns that the project has the potential to adversely impact wetlands in the Waipio Peninsula, Pouhala Marsh, and the Pearl Harbor National Wildlife Refuge.

2. It is expected that there will be minimal impacts on the basal aquifer and Pearl Harbor springs from this well project because the sustainable yield, which is based on production from the Waipahu-Waiawa aquifer, will not be exceeded by proposed source production from the Waipahu Wells IV. As stated in Section 4.3.5 of the Draft EA, the Commission on Water Resource Management (CWRM) is currently evaluating the Waipahu-Waiawa sustainable yield and is expected to reduce it to address the reduction in recharge from the cessation of sugar cane irrigation following the closure of the Oahu Sugar Company. The new sustainable yield will address groundwater pumping and will be set to maintain regional head at present levels.

3. As a precondition to development of the well site for permanent production, pump tests have been conducted to evaluate potential long-term effects of water withdrawals from the Pearl Harbor Aquifer. The Board of Water Supply follows a test pumping protocol developed collaboratively with CWRM and the United States Geological Survey, sister agency to United States Fish and Wildlife Service. The results of these tests are included in Appendix B of the Draft EA.

4. Because proposed future withdrawals will remain within the revised sustainable yield set for the aquifer and will not exceed historical extraction levels, the springs will not be adversely affected. Additionally, the Waipahu Wells IV are sufficiently distant, at least one mile, from the nearest spring, to avoid causing adverse impacts to spring flow or to wetlands fed by those springs.

If you have any questions, please contact Scot Muraoka at 527-5221.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

cc: R.M. Towill Corporation

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

January 11, 2000

Mr. Mike Araki, Planning & Engineering
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, HI 96843

Dear Mr. Araki:

Draft Environmental Assessment for Waipahu Wells IV, State Nos. 2301-44 to 47

Thank you for the opportunity to review the subject document. Our comments related to water resources are marked below.

In general, the CWRM strongly promotes the efficient use of our water resources through conservation measures and use of alternative non-potable water resources whenever available, feasible, and there are no harmful effects to the ecosystem. Also, the CWRM encourages the protection of water recharge areas, which are important for the maintenance of streams and the replenishment of aquifers.

[X] We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

[ ] We recommend coordination with the Land Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[ ] We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[X] A Well Construction Permit and/or a Pump Installation Permit from the Commission would be required before ground water is developed as a source of supply for the project.

[X] The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the Commission would be required prior to use of this source.

[ ] Groundwater withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

[ ] We recommend that no development take place affecting highly erodible slopes which drain into streams within or adjacent to the project.

[ ] If the proposed project includes construction of a stream diversion, the project may require a stream diversion works permit and amend the instream flow standard for the affected stream(s).

[ ] If the proposed project alters the bed and banks of a stream channel, the project may require a stream channel alteration permit.

[ ] OTHER:

If there are any questions, please contact the Commission staff at 587-0218.

Sincerely,

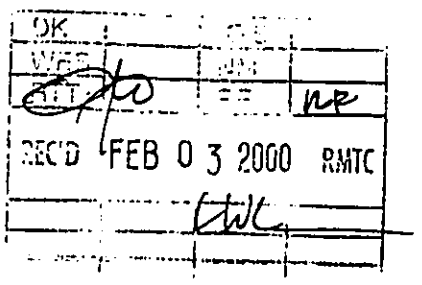
LINNEL T. NISHIOKA
Deputy Director

LN:ss

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

January 31, 2000



Ms. Linnel T. Nishioka, Deputy Director
Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Nishioka:

Subject: Your Letter of January 11, 2000 Regarding the Draft Environmental Assessment for the Proposed Waipahu Wells IV (State No. 2301-44, 45, 46, 47), Waipahu, Oahu, Hawaii, TMK: 9-4-02: 05

Thank you for reviewing the Draft Environmental Assessment for the proposed Waipahu Wells IV project.

We have the following comments to your concerns:

1. The proposed well project will be coordinated with the County's Water Use and Development Plan.

2. A Well Construction Permit and Pump Installation Permit will be submitted prior to drilling the well. A Water Use Permit will be obtained before groundwater is developed as a source of water supply.

If you have any questions, please contact Kathryn Kami at 527-5221.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

cc: R. M. Towill Corporation

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

TIMOTHY E. JOHNS, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DEPUTIES
JANET E. KAWELO
LINNEL NISHIOKA

Faxed 1/11/00 9:10 a

JAN 11 2000 RMTC

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS
WATER RESOURCE MANAGEMENT

January 4, 2000

Chester Koga, AICP
Project Manager
R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

LOG NO: 24663
DOC NO: 0001EJ01

Dear Mr. Koga:

SUBJECT: **Chapter 6E-8 Historic Preservation Review - Draft Environmental Assessment (DEA) for Waipahu Wells IV, State No. 3201-44,45,46,47**
Waipahu, 'Ewa, O'ahu
TMK: 9-4-02:05

Thank you for the opportunity to review the DEA for this project. Archaeological inventory surveys conducted for this parcel located two historic sites within this tax map parcel. However, State Site 50-80-09-530, a petroglyph site located in the outcrop above Waikele Gulch and site 50-80-09-4660, the remnants of former sugar plantation Higashi Camp are not located in the vicinity of the proposed well site. The petroglyph site has been recommended for preservation while the Higashi Camp has completed documentation and is not recommended for any further historic preservation mitigation measures.

The proposed wells are located in an area that was commercially cultivated with sugar cane which altered the land for many years. The depth of cane cultivation exceeded the expected depth of historic sites in the area, based on site patterns in similar environmental contexts. Because it is unlikely that any other significant historic sites will be found in the area, we believe that this project will have "no effect" on any historic sites.

Although the petroglyph site is located approximately 1,000 feet from the proposed well location, we would like to be sure that construction activities have no adverse impact on this significant historic site. Consequently, we would like to request that our office be provided with construction plans when they are available so that we may review them in order to ensure preservation and protection of the petroglyph site.

Also, our previous comments which are included in Appendix A were for alternate locations for the proposed wells. The appendix should be revised to include correspondence related to the new location.

If you have any questions please call Elaine Jourdane at 692-8027.

Aloha,

Don Hibbard, Administrator
State Historic Preservation Division

EJ:jk

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

February 7, 2000

Mr. Don Hibbard, Administrator
State Historic Preservation Division
Department of Land and Natural Resources
State of Hawaii
601 Kamokila Boulevard, Room 555
Kapolei, Hawaii 96707

Dear Mr. Hibbard:

Subject: Your Letter of January 4, 2000 to R.M. Towill Corporation, Regarding the Draft Environmental Assessment for the Proposed Waipahu Wells IV (State No. 2301-44, 45, 46, 47), Waipahu, Oahu, Hawaii TMK: 9-4-02: 05

Thank you for reviewing the Draft Environmental Assessment for the proposed Waipahu Wells IV project.

We have the following comments to your concerns:

1. We acknowledge that the proposed project will have "no effect" on any historical sites.

2. Construction plans will be provided to your office for review to ensure the preservation and protection of State Site 50-80-09-530, a petroglyph site located in the outcrop above Waikele Gulch, approximately 1,000 feet from the proposed well station.

3. Appendix A of the Final Environmental Assessment will include correspondence from the State Historic Preservation Division related to the proposed will location.

If you have any questions, please contact Kathryn Kami at 527-5221.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

cc: R.M. Towill Corporation

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

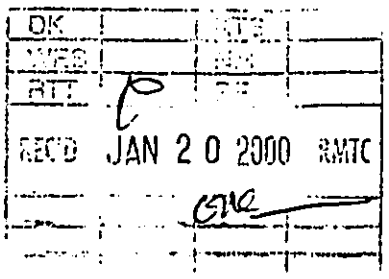
STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

In reply, please refer to:
File:

January 14, 2000

99-014A/epo



Mr. Chester Koga, AICP
Project Manager
R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

Dear Mr. Koga:

Subject: Draft Environmental Assessment (DEA)
Waipahu Wells IV
Waipahu, Oahu
TMK: 9-4-02: 5 (por.)

Thank you for allowing us to review and comment on the subject project. We have the following comments to offer:

These proposed wells will be located in an aquifer that is irreplaceable and highly vulnerable to contamination.

In addition, we have the following comments for all new sources of potable water:

1. Federal and state regulations define a public water system as a system that serves 25 or more individuals at least 60 days per year or has at least 15 service connections. All public water system owners and operators are required to comply with Hawaii Administrative Rules, Title 11, Chapter 20, "Rules Relating to Potable Water Systems."

2. Section 11-20-29 of Chapter 20 requires that all new sources of potable water serving a public water system be approved by the Director of Health prior to its use. Such an approval is based primarily upon the submission of a satisfactory engineering report which addresses the requirements set in Section 11-20-29.

3. The engineering report must identify all potential sources of contamination and evaluate alternative control measures which could be implemented to reduce or eliminate the potential for contamination, including treatment of the water source. In addition, water quality analyses, performed by a laboratory certified in the State of Hawaii, must be submitted as part of the report to demonstrate compliance with all drinking water standards. The Director, upon his review of the information submitted, may require additional tests.

4. Section 11-20-30 requires that the Director approve new or substantially modified distribution systems for public water systems. However, if the water system is under the jurisdiction of the County of Honolulu, the Honolulu Board of Water Supply will be responsible for the review and approval of the plans.

5. In 1996, Congress amended the Safe Drinking Water Act and added several new programs. One of these new programs was the Source Water Assessment Program (SWAP). The objective of SWAP is to assess the susceptibility of a drinking water source to activities that have significant potential to release contaminants to the source. It is anticipated that Hawaii's SWAP will begin implementation in February 2000. Any new drinking water source for a public water system must then be required to submit the following information for review:

   a. Delineation of the assessment area around the drinking water source.

   b. Inventory of the assessment area to identify potential contaminating activities.

   c. Susceptibility of the drinking water source to become contaminated from the identified potential contaminating activities.

If you should have any questions, please contact Ms. Queenie Komori of the Safe Drinking Water Branch, Engineering Section, at 586-4258.

Sincerely,

GARY GILL
Deputy Director for
Environmental Health

c: SDWB

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

February 10, 2000

Mr. Gary Gill, Deputy Director
Environmental Health
Department of Health
State of Hawaii
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Gill:

Subject: Your Letter of January 14, 2000 to R.M. Towill Corporation Regarding the Draft Environmental Assessment for the Proposed Waipahu Wells IV (State No. 2301-44, 45, 46, 47), Waipahu, Oahu, Hawaii, TMK: 9-4-02: 05

Thank you for reviewing the Draft Environmental Assessment for the proposed Waipahu Wells IV project.

We have the following comments to your concerns:

1. The Board of Water Supply (BWS) will comply with Hawaii Administrative Rules (HAR), Title 11, Chapter 20, "Rules Relating to Potable Water Systems," in the development of the proposed Waipahu Wells IV.

2. In compliance with HAR, Section 11-20-29, an engineering report for the proposed project will be submitted to the Director of Health for approval prior to development of the well station for potable water use.

3. The engineering report prepared for the proposed project will identify all sources of contamination, evaluate alternative control measures which could be implemented to reduce or eliminate the potential for contamination,and provide water quality analysis demonstrating compliance with all drinking water standards.

4. The BWS will be responsible for reviewing and approving the proposed well development plans in accordance with HAR, Section 11-20-30.

5. The BWS appreciates being updated on the new Source Water Assessment Program. We request that you keep us informed of plans for program implementation.

If you have any questions, please contact Kathryn Kami at 527-5221.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

cc: R. M. Towill Corporation

BENJAMIN J. CAYETANO
GOVERNOR

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

REC'D FEB 23 2000 RMTC

February 22, 2000

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

Dear Mr. Jamile:

Subject: Draft Environmental Assessment for the Waipahu Wells IV, Oahu

Thank you for the opportunity to review the subject document. We have the following comments.

1. Please describe the standard procedure that the Board of Water Supply follows to handle the disposal of the spent carbons. Are the spent carbons tested for hazardous materials before disposal?

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

Genevieve Salmonson
Director

c: R.M. Towill Corporation

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

April 4, 2000

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
State of Hawaii
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

Subject: Your Letter of February 22, 2000 Regarding the Draft Environmental Assessment for the Proposed Waipahu Wells IV (State No. 2301-44, 45, 46, 47), Waipahu, Oahu, Hawaii, TMK: 9-4-02: 05

Thank you for reviewing the Draft Environmental Assessment for the proposed Waipahu Wells IV project.

We have the following comments to your concerns:

1. The Board of Water Supply hires a private contractor to periodically remove and dispose of the Granular Activated Carbon (GAC) spent carbon once it is exhausted. The contractor disposes of the spent carbon at Waimanalo Gulch landfill.

2. A Toxicity Characteristics Leeching Process (TCLP) is performed to test the spent carbon for hazardous materials. Before the spent carbon is removed from the GAC contactor, a composite carbon sample is taken and a TCLP test is performed. The spent carbon is not considered a hazardous material.

If you have any questions, please contact Kathryn Kami at 527-5221.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

cc: Jim Niermann, R.M. Towill Corporation

000057

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET • HONOLULU, HAWAII 96813
TELEPHONE: (808) 523-4414 • FAX: (808) 527-6743

RECEIVED
BD OF WATER SUPPLY
JAN 7 4 27 PM '00

JAN 7 2000 Mgr
Dep
JAN 11 2000 PE

JEREMY HARRIS
MAYOR

RANDALL K. FUJIKI, AIA
ACTING DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

1999/CLOG-7997(as)

JAN 11 3 24 PM '00

January 7, 2000

MEMORANDUM

TO: CLIFFORD S. JAMILE, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

ATTN: MIKE ARAKI
PLANNING AND ENGINEERING

FROM: for RANDALL K. FUJIKI, AIA, ACTING DIRECTOR Barbara A Moon
DEPARTMENT OF PLANNING AND PERMITTING

SUBJECT: PUBLIC REVIEW OF DRAFT ENVIRONMENTAL ASSESSMENT FOR WAIPAHU WELLS IV, STATE NO. 2301-44, 45, 46, 47

This is in response to your request dated December 22, 1999 for comments on the Draft Environmental Assessment (DEA) for the Waipahu Wells project. We have the following comments:

(From Long Range Planning and Community Planning Divisions)

1. Sections 3.1 and 4.1.2 of the DEA should be revised to identify Castle & Cooke Homes Hawaii, Inc. as the future landowner of the parcel. Pursuant to City Council Resolution No. 99-249, CD1, the City would exchange 37.268 acres of land in Waipahu and $4.518 M (?) for 269.454 acres in Waiola (see attached resolution).

2. Sections 4.1.1 and 4.6.1 should be revised to indicate that the proposed Lumiaina Street/Managers Drive bridge is completed. The bridge would remain closed until the Mokuola Street/Manager's Drive Connector Road project is completed.

3. The exterior design of the pump control building should reflect the residential character of the community as envisioned for the *Central Oahu Sustainable Communities Plan* and blend in with the adjacent City-owned Manager's Drive property.

4. The applicant should provide a short discussion (between Sections 5.2 and 5.3), of how this project relates to The General Plan of the City and County of Honolulu, 1992 Edition, specifically Objective B ("To meet the needs of the people of Oahu for an adequate supply of water ...") under Transportation and Utilities.

5. The applicant should also provide a short discussion of how the project satisfies the *Central Oahu Sustainable Communities Plan*'s "Vision and General Design Guidelines" and the Development Plan Public Facilities Map proposed for Central Oahu's future development. The Project Manager, Robert Stanfield, may be contacted at 527-6094 for the current status of the plan review.

6. The applicant is correct that the current Development Plan Public Facilities Maps (DPPFM) will be replaced (the last paragraph of Section 5.3 on page 54), but they will be replaced with the Public Infrastructure Maps (PIM) instead of the "existing functional infrastructure plans" as listed.

7. Section 5.3 should be revised to indicate the Waipahu Wells IV Development Plan Public Facilities Map amendment was enacted on August 5, 1999 by Ordinance 99-50.

8. The zoning map is outdated.

Thank you for the opportunity to review and comment. Should you have any questions, you may contact Adrian Siu-Li of our staff at 527-5072.

Attachment

POSSE dec. no-20979

6/13

CITY COUNCIL
CITY AND COUNTY OF HONOLULU
HONOLULU, HAWAII

No. 99-249, CD1

RESOLUTION

APPROVING THE LAND EXCHANGE WITH CASTLE & COOKE HOMES HAWAII, INC.

WHEREAS, Paragraph 16, Section 46-1.5, Hawaii Revised Statutes, as amended, authorizes the counties, under certain conditions, to dispose of real property as the interests of the inhabitants of the county may require; and

WHEREAS, the Director, Department of Budget and Fiscal Services may recommend to the Council the disposal of real property by exchange in accordance with Section 37-1.7, Revised Ordinances of Honolulu, as amended; and

WHEREAS, Castle & Cooke Homes Hawaii, Inc. is the owner of the 269.454 acre parcel identified as TMK: 9-4-05:74, and said parcel is shown on the map attached as Exhibit "A" to this resolution and made a part hereof; and

WHEREAS, said 269.454 acre parcel is estimated to have a fair market value of $12,718,000.00, based on appraisal; and

WHEREAS, the City has previously communicated to Castle & Cooke Homes Hawaii, Inc. its intent to acquire through agreement or condemnation the 269.454 parcel for public purposes; and

WHEREAS, the City is the owner of the Manager's Drive parcels, total area of 37.268 acres, which parcels are described as Lot 6-A, area 18.293 acres, TMK: 9-4-02:05; and Lot 6-B, area 18.975 acres, TMK: 9-4-02:por. of 74; both lots are shown on the map attached as Exhibit "B" to this resolution and made a part hereof; and

WHEREAS, said Manager's Drive parcels are estimated to have a fair market value of $8,200,000.00, based on appraisal; and

WHEREAS, under threat of condemnation, Castle & Cooke Homes Hawaii, Inc. has agreed to exchange its parcel for said Manager's Drive parcels and a cash payment by the City of $4,518,000.00 which is the difference in appraised values; and

BED

CITY COUNCIL

CITY AND COUNTY OF HONOLULU
HONOLULU, HAWAII

No. 99-249, CD1

RESOLUTION

WHERRAS, the city agrees to this land exchange; now, therefore,

BE IT RESOLVED by the Council of the City and County of Honolulu that the exchange of properties between Castle & Cooke Homes Hawaii, Inc. and the City is hereby approved in accordance with the above recommendation of the Director, Department of Budget and Fiscal Services, and with all applicable laws; and

BE IT FURTHER RESOLVED that the Director, Department of Budget and Fiscal Services, shall be authorized to sign the exchange deed and other necessary related documents; and

RESOLUTION

BE IT FINALLY RESOLVED that the Clerk be directed to transmit a certified copy of this resolution to the Director, Department of Budget and Fiscal Services.

INTRODUCED BY:

Jon Yoshimura (BR)

Councilmembers

DATE OF INTRODUCTION:

September 8, 1999

Honolulu, Hawaii

(OCS/091399/mg)

CITY COUNCIL

CITY AND COUNTY OF HONOLULU
HONOLULU, HAWAII

I hereby certify that the foregoing RESOLUTION was adopted by the COUNCIL OF THE CITY AND COUNTY OF HONOLULU on the date and by the vote indicated to the right.

ATTEST:

GENEVIEVE G. WONG
City Clerk

JON C. YOSHIMURA
CHAIR AND PRESIDING OFFICER

Dated 9/22/99

ADOPTED MEETING HELD 9/22/99	AYE	NO	A/E
BAINUM	X		
DeSOTO	X		
FELIX	X		
HANNEMANN	X		
HOLMES	X		
KIM	X		
MANSHO	X		
MIRIKITANI	X		
YOSHIMURA	X		
	9	0	0

Reference:

Report No. BED-483

Resolution No.

99-249
CD1

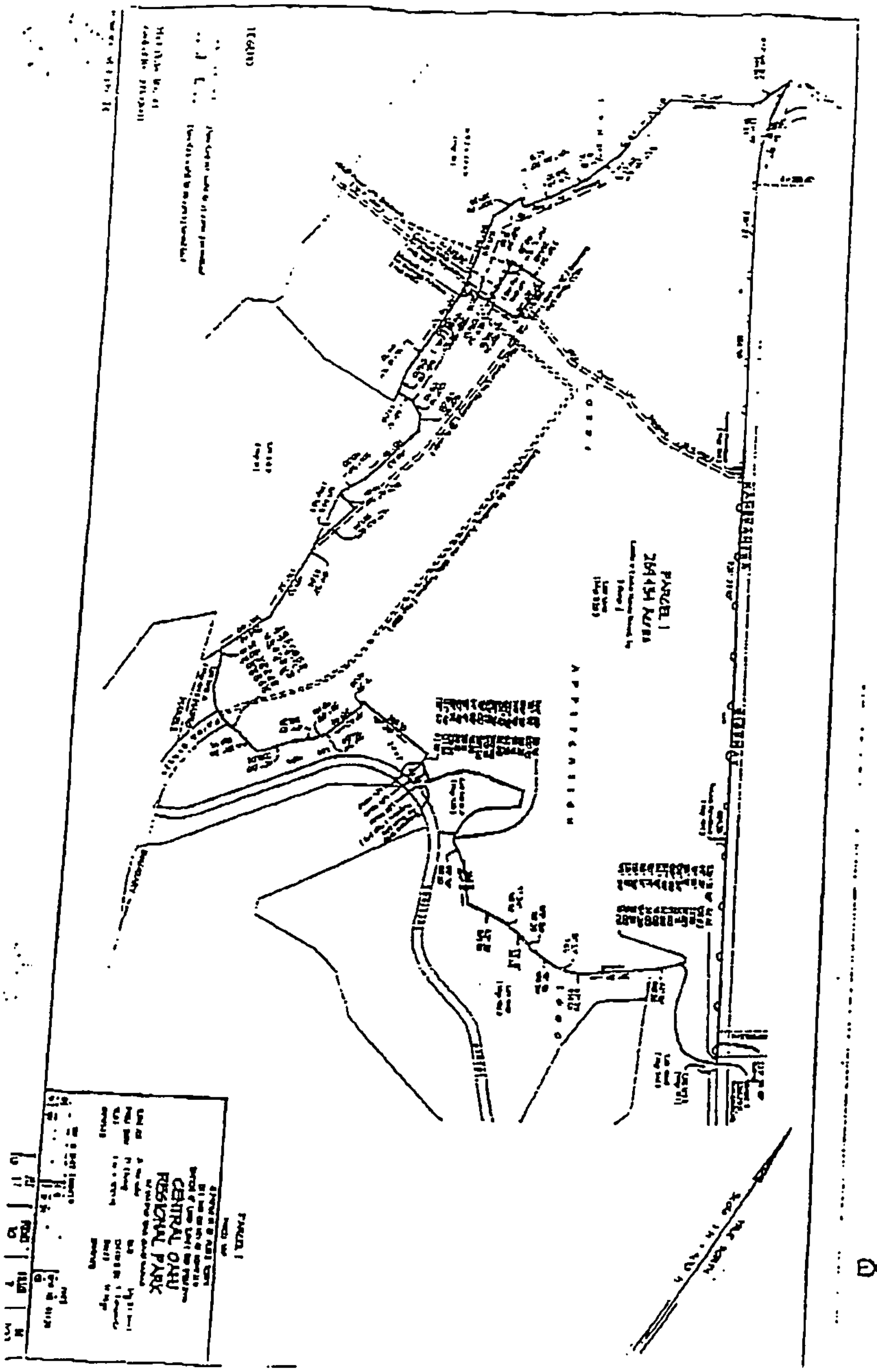
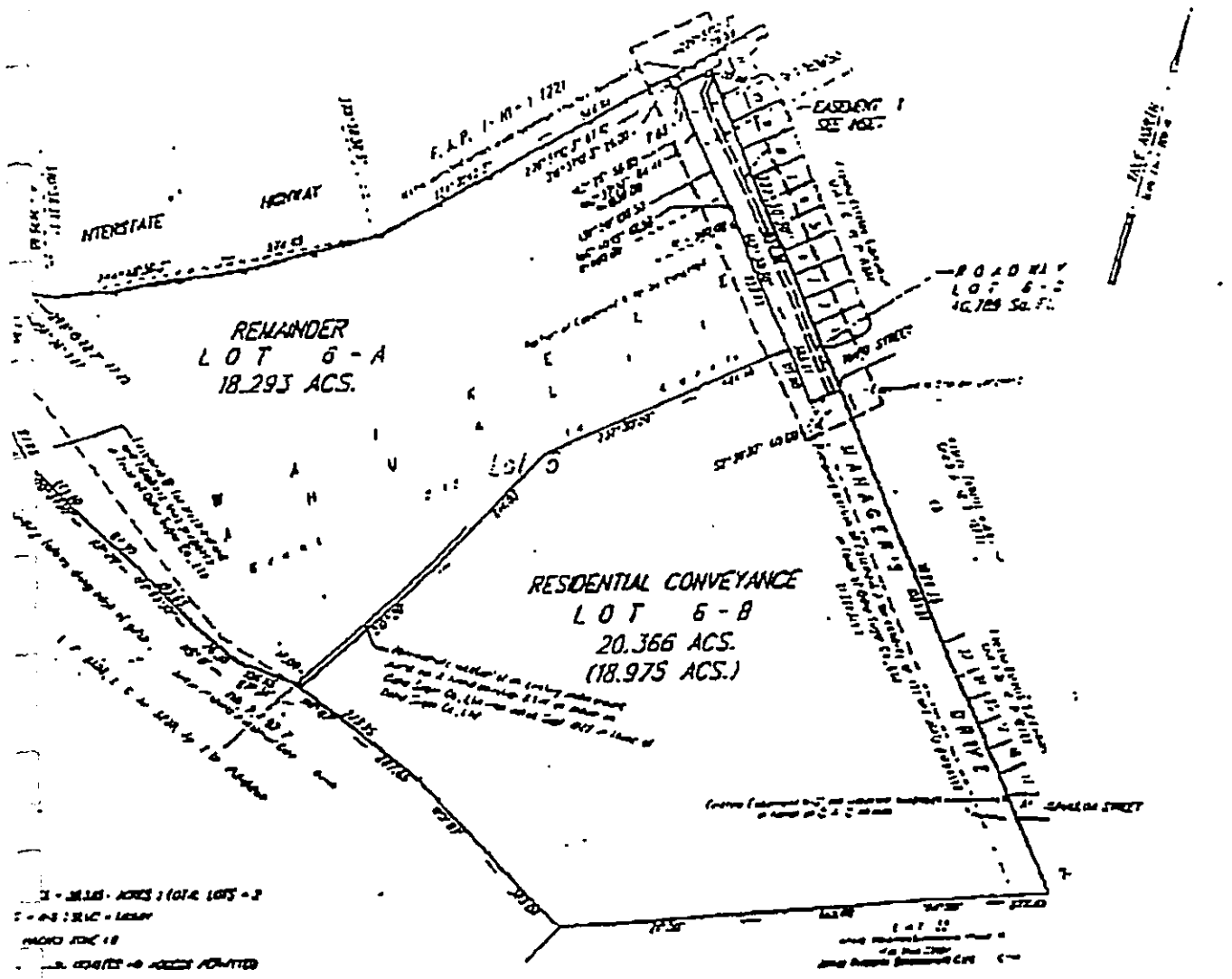


EXHIBIT A



MANAGER'S DRIVE EXTENSION CONVEYANCE SUBDIVISION

SUBDIVISION OF LOT 6
BEING A PORTION OF GRANT 712 TO KAHOLO
INTO LOTS 6-A, 6-B AND 6-C
CANCELLATION OF PORTION OF EASEMENT A
AFFECTING LOTS 6-A AND 6-C
AND EASEMENT W-1 AFFECTING LOT 6-C
DESIGNATION OF EASEMENT 1 AFFECTING LOT 6-C

At Ahuaki, Waiawa, Ewa, Oahu, Hawaii

Owner: City and County of Honolulu
Date: April 30, 1998

EXHIBIT B

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

February 9, 2000

TO: MR. RANDALL K. FUJIKI, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

FROM: CLIFFORD S. JAMILE

SUBJECT: YOUR LETTER OF JANUARY 7, 2000 REGARDING THE DRAFT ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED WAIPAHU WELLS IV (STATE NO. 2301-44, 45, 46, 47), WAIPAHU, OAHU, HAWAII, TMK: 9-4-02: 05

Thank you for reviewing the Draft Environmental Assessment (EA) for the proposed Waipahu Wells IV project. We offer the following response to your comments:

1. Sections 3.1 and 4.2.1 of the Final EA will be revised to identify Castle and Cooke Homes Hawaii, Inc. as the future landowner of the parcel.

2. Sections 4.1.1 and 4.6.1 of the Final EA will be revised to indicate that the proposed Lumiaina Street/Managers Drive bridge is completed.

3. The exterior of the pump control building will be designed to blend in with the adjacent properties and will reflect the residential character of the community as envisioned in the Central Oahu Sustainable Communities Plan. This information will be included in Section 4.7.4 of the Final EA.

4. A short discussion of how the proposed project relates to the City and County General Plan, 1992 Edition, will be included in Section 5 of the Final EA. Specifically, the discussion will address how the project meets the needs of the people of Oahu for an adequate supply of water (Objective B under Transportation and Utilities).

5. A short discussion of how the proposed project satisfies the Central Oahu Sustainable Communities Plan's "Vision and General Design Guidelines" and the Development Plan Public Facilities Map (DPPFM) proposed for Central Oahu's future development will also be included in Section 5 of the Final EA.

6. Section 5.3 of the Final EA will be revised to reference the Public Infrastructure Map as the replacement for the DPPFM.

7. Section 5.3 of the Final EA will be revised to indicate that Waipahu Wells IV DPPFM amendment was enacted on August 5, 1999 by Ordinance 99-50.

8. The zoning map depicted in Figure 4-1 will be updated in the Final EA.

If you have any questions, please contact Scot Muraoka at 527-5221.

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU
3375 KOAPAKA STREET SUITE H425
HONOLULU HAWAII 96819-1869

JEREMY HARRIS
MAYOR

ATTILIO K. LEONARDI
FIRE CHIEF

JOHN CLARK
DEPUTY FIRE CHIEF

December 21, 1999

TO: MIKE ARAKI
PLANNING AND ENGINEERING DIVISION
BOARD OF WATER SUPPLY

FROM: ATTILIO K. LEONARDI, FIRE CHIEF

SUBJECT: PUBLIC REVIEW OF DRAFT ENVIRONMENTAL ASSESSMENT (EA) FOR WAIPAHU WELLS IV, STATE NO. 2301-44, 45, 46, 47

We received the letter from R. M. Towill Corporation dated December 8, 1999, regarding the public review of draft environmental assessment for Waipahu Wells IV.

The Honolulu Fire Department requests compliance with the following:

1. Maintain fire apparatus access throughout the construction site for the duration of the project.

2. Notify the Fire Communication Center (523-4411) of any interruption in the existing fire hydrant system during the project.

Should you have any questions, please call Acting Battalion Chief Lloyd Rogers of our Fire Prevention Bureau at 831-7778

Attilio K. Leonardi

ATTILIO K. LEONARDI
Fire Chief

AKL/LR:jo

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

January 4, 2000

DK		KTS	
WES		NM	
RTT		SF	

REC'D JAN 03 2000 RMTC

CWL

TO: MR. ATTILIO K. LEONARDI, FIRE CHIEF
FIRE DEPARTMENT

FROM: CLIFFORD S. JAMILE

SUBJECT: YOUR LETTER OF DECEMBER 21, 1999 REGARDING THE DRAFT ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED WAIPAHU WELLS IV (STATE NO. 2301-44, 45, 46, 47), WAIPAHU, OAHU, HAWAII, TMK: 9-4-02: 05

Thank you for reviewing the Draft Environmental Assessment for the proposed Waipahu Wells IV project.

We provide the following comments to your concerns:

1. Access for fire apparatus will be maintained throughout the construction site for the duration of the project.

2. The Fire Communication Center will be notified of any interruptions in the existing fire hydrant system during the project.

If you have any questions, please contact Barry Usagawa at 527-5235.

cc: R.M. Towill Corporation

P

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96813 - AREA CODE (808) 529-3111
http://www.honolulupd.org

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BD OF WATER SUPPLY
JAN 11 10 31 AM '00

JAN 11 3 24 PM '00

JEREMY HARRIS
MAYOR

LEE D. DONOHUE
CHIEF

MICHAEL CARVALHO
DEPUTY CHIEFS

OUR REFERENCE CS-DL

January 10, 2000

TO: CLIFFORD S. JAMILE, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

ATTENTION: MIKE ARAKI, PLANNING AND ENGINEERING

FROM: LEE D. DONOHUE, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: PUBLIC REVIEW OF DRAFT ENVIRONMENTAL ASSESSMENT (EA) FOR WAIPAHU WELLS IV, STATE NO. 2301- 44, 45, 46, 47

Thank you for the opportunity to review and comment on the subject document.

Provided that Mitigation Measures (4.6.3) in Roadways and Access (4.6) on page 43 are observed relative to traffic impacts, we believe that there will be minimal impact on calls for police service to the area.

If there are any questions, please call me at 529-3255 or Captain Thomas Nitta of District 3 at 455-9055.

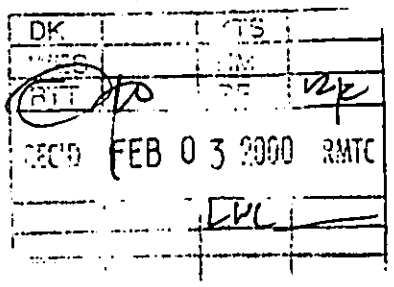
LEE D. DONOHUE
Chief of Police

By
EUGENE UEMURA
Assistant Chief
Support Services Bureau

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

January 27, 2000



TO: MR. LEE D. DONOHUE, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

FROM: CLIFFORD S. JAMILE

SUBJECT: YOUR MEMORANDUM OF JANUARY 10, 2000 REGARDING THE DRAFT ENVIRONMENTAL ASSESSMENT FOR WAIPAHU WELLS IV

Thank you for reviewing the Draft Environmental Assessment for the proposed Waipahu Wells IV project.

We acknowledge that there should be minimal impact on calls for police service to the area due to the traffic mitigative measures specified in the document.

cc: R.M. Towill Corporation

P

000056

RECEIVED
BD OF WATER SUPPLY
JAN 7 4 26 PM '00

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
PACIFIC PARK PLAZA • 711 KAPIOLANI BOULEVARD, SUITE 1200 • HONOLULU, HAWAII 96813
TELEPHONE: (808) 523-4529 • FAX: (808) 523-4730

JAN 7 2000 Mgt Dep PE
JAN 11 2000

JEREMY HARRIS
MAYOR

CHERYL D. SOON
DIRECTOR

JOSEPH M. MAGALDI, JR.
DEPUTY DIRECTOR

JAN 11 3 24 PM '00

TP12/99-06043R

January 5, 2000

MEMORANDUM

TO: CLIFFORD S. JAMILE, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

ATTN: MIKE ARAKI, PLANNING AND ENGINEERING

FROM: CHERYL D. SOON, DIRECTOR

SUBJECT: WAIPAHU WELLS IV

In response to the December 8, 1999 letter from R.M. Towill Corporation, the draft environmental assessment for the subject project was reviewed. The following comments are the result of this review:

1. This project should have minimal long-term impact on the surrounding City streets.

2. No significant short-term traffic operational problems are anticipated as a result of this project. However, to ensure that the project's impact on area residents is minimized, truck drivers should be encouraged to use only the main roadways (i.e., Paiwa Street and Hiapo Street) which lead directly to the project site and discouraged from using other local residential streets.

3. All trucks, equipment, materials, etc. should be parked/stored only on the project site and not on City streets, especially Hiapo Street.

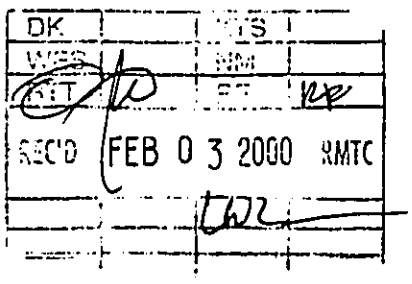
Should you have any questions regarding these comments, please contact Faith Miyamoto of the Transportation Planning Division at Local 6976.

Cheryl D Soon
CHERYL D. SOON

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

January 27, 2000



TO: MS. CHERYL D. SOON, DIRECTOR
DEPARTMENT OF TRANSPORTATION SERVICES

FROM: CLIFFORD S. JAMILE

SUBJECT: YOUR MEMORANDUM OF JANUARY 5, 2000 REGARDING THE DRAFT ENVIRONMENTAL ASSESSMENT FOR WAIPAHU WELLS IV

Thank you for reviewing the Draft Environmental Assessment for the proposed Waipahu Wells IV project.

We have the following comments to your concerns:

1. We acknowledge that the proposed project should have minimal long-term impact on the surrounding City streets and no significant short-term traffic operational impacts.

2. Truck drivers will be encouraged to use only the main roadways (i.e., Paiwa Street and Hiapo Street) to the project site instead of local residential streets to minimize traffic impacts to area residents.

3. We note that all trucks, equipment and materials should be parked/stored only on the project site and not on City streets, especially Hiapo Street.

If you have any questions, please contact Scot Muraoka at 527-5221.

cc: R. M. Towill Corporation

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

Post-it® Fax Note 7671	Date 1/24/00	# of pages ▶ 3
To JIM NEARMAN	From KATHRYN KAMI	
Co./Dept. EM TOWILL	Co. BWS	
Phone # 842-1133	Phone # 527-5221	
Fax # 842-1937	Fax # 527-5703	

Scott W.H. Seu, P.E.
Manager
Environmental Department

January 4, 2000

Mr. Mike Araki, Planning and Engineering
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, HI 96843

Dear: Mr. Araki

Subject: **Waipahu Wells IV**

Thank you for the opportunity to comment on your October 1999 Draft EA for the Waipahu Wells IV. We have reviewed the subject document and have determined that HECO has no electrical facilities near this site and would require a minimum of 1500 feet of overhead line extension from its nearest line (on an easement) along Waikele Gulch. The area adjacent to the Waipahu Wells IV site is an underground residential development and is not adequate to provide 3-phase power to the pump load.

Our point of contact for this project, and the originator of these comments, is Bill Muench (543-5657) senior customer engineer. I suggest your staff and consultants deal directly with Bill to coordinate HECO's continuing input on this project.

Sincerely,

cc: B. Muench

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

February 7, 2000

Mr. Scott W.H. Seu, Manager
Environmental Department
Hawaiian Electric Company
P. O. Box 2750
Honolulu, Hawaii 96840-0001

Dear Mr. Seu:

Subject: Your Letter of January 4, 2000 Regarding the Draft Environmental Assessment for the Proposed Waipahu Wells IV (State No. 2301-44, 45, 46, 47), Waipahu, Oahu, Hawaii, TMK: 9-4-02: 05

Thank you for reviewing the Draft Environmental Assessment for the proposed Waipahu Wells IV project.

We have the following comments to your concerns:

1. We acknowledge that Hawaiian Electric Company has no electrical facilities near the project site and would require a minimum of 1,500 feet of overhead line extension from the nearest line located along Waikele Gulch.

2. We understand that the area adjacent to the Waipahu Wells IV site is an underground residential development and is not adequate to provide 3-phase power to the pump load.

If you have any questions, please contact Kathryn Kami at 527-5221.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

cc: R. M. Towill Corporation

University of Hawai'i at Mānoa

Environmental Center
A Unit of Water Resources Research Center
2550 Campus Road · Crawford 317 · Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 · Facsimile: (808) 956-3980

February 23, 2000
EA:00183

Mr. Barry Usagawa
City and County of Honolulu
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Usagawa:

Draft Environmental Assessment
Waipahu Wells IV
State No. 2301-44, 45, 46, 47
Waipahu, Oahu

The Board of Water Supply (BWS) of the City and County of Honolulu is proposing to develop four, permanent production, potable, water wells in the Waipahu area of Oahu. This Environmental Assessment (EA) addresses the potential impacts of the installation of deepwell pumps, and a Granular Activated Carbon (GAC) treatment system to remove volatile organic chemicals (VOC) that have been identified in the water supply. Our review of this document has been prepared with the assistance of Paul Ekern, Emeritus, Agronomy and Soils; and Chittaranjan Ray, Civil Engineering. Both Drs. Ekern and Ray are also affiliated with the Water Resources Research Center of the University of Hawaii.

The Draft EA adequately addresses many of the potential impacts associated with the proposed development. However, our reviewers have called attention to several issues that should be more fully addressed in the Final EA as they may have a bearing on the long-term effects of the development of the proposed wells.

1.5 Alternatives to the Proposed Action

The Project Overview section of the Draft EA provides very little substantive information regarding specific alternatives to the proposed project. In particular, Section 1.5.4 makes brief mention of the possible use of surface water or brackish groundwater sources and recycling of treated wastewater, but there does not appear to be any substantive discussion of these alternatives. We note in particular that there should be some discussion of the possible importation of fresh water from the Waiahole Ditch system. This source of water might be suitable for potable purposes with relatively modest processing requirements and would also provide some recharge to the present aquifer. Under Section 1.5.4 we also note that there is no

information on the most recent data (post 1995) available for desalting plants. Both these alternatives should be more fully discussed in the Final EA.

3.1 Project Location and site Characteristics

Neither the description of the project nor the characteristics of the site describe the contaminants to the water supply latter acknowledged on page 51. A complete description of these contaminants, their sources, the plume size, and possible migration rates should be included in the descriptive presentation of the wells. The final EA should include a map of the water distribution system for these wells. If the distribution system and potential contamination sources are presented then the BWS statements about the unavailability of potential alternative sources will be clearly indicated. Otherwise such statements are subject to question. We note that the average demand for water in 1996 was 148 MGD and the BWS projected the demand to grow to 175 MGD in 2000 and 193 MGD by year 2010. The reference to these predictions is not included in the bibliography, however it would be interesting to verify if the current pumpage (which is year 2000) is 175 MGD? If this is the case then what caused an increase in pumpage by 27 MGD between 1996 and 2000?

3.3 Granular Activated Carbon Water Treatment System

Section 3.3 discusses the installation of a GAC treatment system but up to this point in the EA no mention has been made of the contaminants that are present in the wells and that will require the use of such a cleaning system. At this point in the document, it would appear that the BWS is speculating that contaminants "will appear" rather than designing to meet those already know to be present. What will be done with the activated carbon when it becomes "fully" used? Will it be cleaned and recycled or will it be disposed and if so where? What will be the costs of the clean up, recycling, or disposal? Would Air Stripping be a suitable alternative? Why is GAC being considered over Air Stripping? How frequently will the BWS monitor the water to assure that contaminants are not escaping the carbon filtration? Is the supply of activated carbon relatively stable and assured? Is their any concern that it may become difficult to replenish? What contingencies have been developed to assure a supply of filter material in the event of emergency situations?

Is the new well site in compliance with the Hawaii State Department of Health guidelines for source water assessment and protection? We note that the well site is very close to the H-1 freeway. Could it be contaminated by an accident on the freeway? Does the BWS have contingency planning in place for such an event? It is our understanding that many states have well siting criteria for new wells. These criteria specify the distance to potential sources of contamination. Are such criteria available for Hawaii and if so, they should be presented in the Final EA.

4.2 Topography, Climate, and Rainfall

This section discusses the general physical characteristics of the Waipahu area and in particular makes a statement (4.2.3 Project Impacts) that the construction of the wells will not

have any impact on the topography, climate or rainfall in the area. This statement fails to consider the measured effects of land use changes on the evaporation demands. Evaporation demands are needed to develop a long-term water budget. The cessation of sugar cane irrigation has increased the pan evaporation downwind by some 10%, with a consequent increase in air temperatures where the evaporative cooling has stopped. The reintroduction of evaporation from urban lawns will induce change in the climate as air quality is changed. This is a consideration also in the discussion in Section 4.10 on Air Quality. (See pan evaporation records from Kunia HSPA substation and pages 8 and 20 in the Ewa Plain Evapotranspiration Study Report by PSI, Project No. 643-7L011, for the City and County of Honolulu, Board of Water Supply Water Conservation, August 29, 1999.)

Section 4.3.5 states that the Waikele Stream flows over a low-conductivity alluvium about 1000 feet away from the well site. There are also springs in this area that are fed by the basal water overflow from the caprock. The report suggests that pumping from Waipahu Wells IV is not expected to significantly impact water flow to the springs due to the distance between the well and the springs. It seems quite certain that pumpage will have some impact if not "significant" impact. We suggest that a modeling study should be undertaken by the BWS to show that the pumping has marginal or negligible effect on spring discharge and stream flow.

What are the "best management practices" to be followed for the disposal of contaminated water, if such disposal becomes necessary during the well testing and prior to the installation of the carbon filters?

4.5 Demographics

Section 4.5.2 discusses project impacts with respect to demographics, however, there is no discussion of the importance of demographics on water use that might negate the conclusions expressed in Section 4.5.3.

Section 4.11.2 discusses potential sources of contamination and states that except for those sources cited in 4.11.1, no other major sources are known on the site. Will the proposed urban development including housing units, landscaping and lawns pose a contaminant hazard from pesticides and fertilizer use thereby replacing the previous contaminant sources from the former sugarcane cultivation? The Final EA should also discuss what portion of the well waters will be used for house lot watering and if any of the waters will be used for golf course irrigation.

5.3 City and County of Honolulu Land Use Designations and Controls

This section discusses the various land uses in the Urban District but fails to provide information on the impacts of these land uses on the well waters. The Final EA should address this deficiency.

In summary, while the wells themselves and the quantity of water that will be withdrawn may not be significant, removal or disposal of the contaminants they contain may create costly

and hazardous waste products, and the subsequent uses of the waters may have an impact on climate and recharge. These issues should be more fully discussed in the Final EA.

We appreciate the opportunity to comment on the Draft EA and look forward to your response.

Sincerely,

Jacquelin N. Miller

Jacquelin N. Miller, Ph.D.
Associate Environmental Coordinator

cc: Mark Araki, Board of Water Supply
Clifford Jamile, Board of Water Supply
Craig Luke, R.M. Towill Corporation
OEQC
James Moncur
Paul Ekern
Chittaranjan Ray

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

June 30, 2000

DK		KTS	
WES		NM	
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REC'D JUL 05 2000 RMTC			
		LWL	

Jacquelin N. Miller, Ph.D.
Environmental Center
University of Hawaii
2550 Campus Road, Crawford 317
Honolulu, Hawaii 96822

Dear Dr. Miller:

Subject: Your Letter Dated February 23, 2000 Regarding the Draft Environmental Assessment, Waipahu Wells IV, State No. 2301-44, 45, 46, 47, TMK: 9-4-02: 05

Thank you for reviewing the Draft Environmental Assessment (EA) for the proposed Waipahu Wells IV project.

We provide the following response to your concerns in each associated section:

1. Alternatives to the Proposed Action

The discussion of alternative water sources in Section 1.5 is intended to provide an overview of the water source development options that have been and continue to be considered by the Board of Water Supply (BWS) for source production. BWS continues to actively investigate alternatives to groundwater development, including desalination, surface water, brackish groundwater and reclaimed water. Conservation efforts and the development of potable groundwater will continue to be pursued in conjunction with measured amounts of reclamation and desalination.

Desalination Plants

With regards to desalination plants, cost information and scheduling are included in the BWS Fiscal Year (FY) 2001-2006 Six Year Capital Improvement Program (CIP), in conjunction with an engineering study of March 2000.

The study evaluated and selected desalination technologies and potential sites in Honolulu and Ewa. The preferred plan is to construct a reverse osmosis (RO) plant at Kalaeloa, East of Campbell Industrial Park. Exploratory well drilling and pilot testing different RO systems will occur prior to building a production facility.

Waiahole Ditch

The Waiahole Ditch is an important high quality irrigation supply primarily for agricultural use with some urban uses.

Although the closing of the Oahu Sugar Company released Waiahole Ditch water for other uses, the State Commission on Water Resource Management (CWRM) has balanced the uses of Waiahole Ditch for stream flow restoration, agriculture and urban irrigation. Current BWS planning, therefore, does not foresee Waiahole Ditch water being available for direct use as a potable municipal source. As a further consideration, the potable use of Waiahole Ditch would incur the high cost of microbiological treatment and increased distribution system monitoring required to meet Safe Drinking Water standards for surface water influenced sources.

2. Project Location and Site Characteristics

Disclosure of Contaminants

Contaminants known from the area and detected in the water samples are described in Section 4.11 of the Final EA, along with discussion of likely sources of the contaminants. Results of the chemical analysis of water samples taken from test borings for the Waipahu Wells IV have been added as Appendix D in the Final EA.

The proposed project site is located adjacent and makai of H-1 Freeway near Managers Drive on former agricultural land that for over 100 years was cultivated with sugar cane. Sugar cane was grown on lands with elevations in excess of 600 feet where water from Waiahole Ditch could be delivered. Above this elevation, pineapple was cultivated to the boundary with the military reservation. Diversified agriculture has replaced some of the cane land.

Extensive use of agricultural chemicals, including fertilizer, has resulted in soluble components entering the groundwater aquifer. At this time, the groundwater areas needing treatment are those elevations down gradient of where agricultural chemicals were formerly used on pineapple [Trichloropropane (TCP), Ethylenedibromide (EDB) and Dibromochloropropane (DBCP).] Additionally, elevated nitrate levels occur where large amounts of fertilizers have been applied, especially below areas cultivated with seed corn. Pesticides used for ground termite treatment and herbicides have also been found in wells in trace amounts. Because the application of these chemicals was very widespread, these contamination forms are considered nonpoint source and are likely to be found over a broad area. BWS undertakes rigorous monitoring of potable water sources for contamination and maintains extensive records of chemical analysis of water wells throughout Oahu. However, information about plume size and migration rates of detected contaminants has not been compiled.

Potential contaminants incidental to agricultural operations including fuel, oil and solvents from machinery, autos and truck operations have not been found nor are we aware that any large spills have occurred. While solvents have been found in the Wahiawa high-level groundwater body, none has been found in basal water.

Map of Water Distribution System

With regards to your request for a map of the water distribution system for the proposed well, Figure 3-1 in the Final EA shows the proposed well station connection with the existing BWS 36-inch water main that is part of the municipal potable water source, storage, and transmission system. Water from the well will supplement the City's potable water resources as part of the Waipahu 228' system. Water in this system can be transported between Waipahu and Honolulu via the existing transmission mains to meet *fluctuating demands*. Figure 3-1 adequately depicts the link between the well station and the water distribution system

Projected Water Demands

Water demand and use statistics referred to in your letter were obtained from the 1997 draft Oahu Water Management Plan, Initial Revision of the Technical Reference Document.

Projected 2000 water demands of 175 mgd were calculated using data obtained in the 1990 official census. The projections at the time anticipated a growth in water demand of about 2.0 mgd per year. Municipal pumpage in 1990 was 155 mgd and by 2000, an additional 20 mgd was expected. 1999 pumpage, however, was 149 mgd, a 6 mgd decrease from our 1990 pumpage. Lower actual demands can be attributed to the following factors:

a. BWS water conservation programs have decreased daily use since 1990 as a result of mandated conservation measures that encourage lower consumer water use and repairs of leaking systems. The conservation programs include low flow water fixtures, inverted block water rates, public education, drought tolerant landscaping and leak detection/water audits.

b. Growth has not materialized as previously projected because of the downturn in economic conditions and, subsequently, in new business and residential development. The speculation of large economic growth on Oahu from 1990 to 2010 may have been the basis for high population growth projections from the State Department of Business and Economic Development, who provides the standard data for projecting growth in all the counties of Hawaii. With the 2000 census, the population projections will be updated and the water demand projections will then be revised.

Most of the projected increase in water demand are expected to result from residential growth in Ewa, Central Oahu, and Honolulu, as directed by the City General Plan and development plans.

3. Granular Activated Carbon (GAC) Water Treatment System

Carbon Supply

BWS obtains activated carbon for potable well filtration systems through a supplier under scheduled contract throughout the year. If the current supplier is unable to fulfill an order, BWS will contact and make an emergency purchase from a list of past vendors. The use of activated carbon to treat potable water has increased throughout the country and become more competitive in pricing and sourcing. BWS has been replacing activated carbon since 1987 and has not experienced any difficulties in obtaining the material.

Carbon Disposal

When activated carbon becomes "fully used", it is tested for toxicity before disposal. Carbon that tests within safe parameters is disposed of in the Waimanalo Gulch Landfill. The cost of removing and disposing the carbon is $160 per ton. To date, BWS has never had a situation where spent carbon has tested positive for excessive levels of hazardous contaminants.

Air Stripping

GAC is preferred over air stripping in response to community and Department of Health (DOH) concerns about vaporizing the contaminants (DBCP, TCP, EDB) into the air. In addition, air stripping requires additional booster pumps to repressurize the water to meet hydraulic conditions within the system. The additional costs of the booster pumps, air filters and land constraints make air stripping less feasible than GAC.

Source Water Assessment and Protection Program

According to the Hawaii State DOH, the Source Water Assessment and Protection (SWAP) program has not yet been implemented. BWS will maintain communication with DOH regarding plans for SWAP program implementation and will ensure that water source development projects meet SWAP guidelines.

An accident on the freeway could pose a contaminant hazard if spill materials percolate into the ground. Emergency response measures for containing and cleaning up hazardous material spills are regulated by the State. The Honolulu Fire Department maintains a hazardous material team that performs first-response and containment of any hazardous material spills. Incidents are reported to the State DOH, Office of Hazard Evaluation and Emergency Response, which oversees and coordinates clean-up efforts.

4. Topography, Climate, and Rainfall

Evaporation Demands

We agree with your comments about changes in evaporation demands and temperatures caused by land use changes from the cessation of sugar cane irrigation to fallow lands, future diversified agriculture and urban development. The CWRM has accounted for these changes and especially the loss of aquifer recharge in their downward revision of the sustainable yields of the Ewa-Kunia and Waipahu-Waiawa aquifers.

Waikele Stream and Spring Flow

Regarding your concern on potential adverse impacts to springs along Waikele Stream:

a. It is expected that there will be no significant impacts on the basal aquifer and Pearl Harbor springs from this well project because the sustainable yield, which is based on production from the Waipahu-Waiawa aquifer, will not be exceeded by the proposed Waipahu Wells IV. The CWRM has evaluated the Waipahu-Waiawa sustainable yield and reduced it from 119 mgd to 104 mgd to address the reduction in recharge from the cessation of sugar cane irrigation and land use changes following the closure of the Oahu Sugar Company. The new sustainable yield addresses sustainable groundwater pumping and will maintain regional head levels such that Pearl Harbor spring flows will not decrease below historical levels.

b. As a precondition to development of the well site for permanent production, pump tests have been conducted to evaluate potential effects of water withdrawals from the Pearl Harbor Aquifer. The BWS follows a test pumping protocol developed collaboratively with CWRM and the United States Geological Service. The results of these tests are included in Appendix C of the Draft and Final EA.

b. The Waipahu Wells IV are sufficiently distant from the nearest spring -- at least 1 mile -- to avoid causing localized adverse impacts to spring flow as compared to a well drilled right next to the spring.

Best Management Practices (BMP) Plan

A National Pollutant Discharge Elimination System (NPDES) permit will be obtained from the State DOH, Clean Water Branch, prior to the discharge of any effluent associated with hydrotesting and disinfection of water mains and GAC treatment units. Under the terms of the permit, all water

discharged from hydrotesting will be dechlorinated and filtered prior to being released into waters of the State via the municipal separate storm sewer system. The project contractor will monitor all pipes, tanks, and appurtenances of the treatment system during hydrotesting and discharge procedures. The contractor will take water samples prior to discharge and at the point of discharge to ensure that effluent is disinfected and dechlorinated to acceptable standards of DOH, Hawaii Administrative Rules, Chapter 11-54, Water Quality Standards. Additional BMP's are outlined in the NPDES permit.

5. Demographics

Increased Water Demand

The impact of demographic characteristics and trends on water use is implicit in the discussion concerning increased water demand in Section 1.3. The proposed well station is programmed to help meet increased residential demands while keeping water source development within the sustainable yield level of the underlying aquifer, as discussed in Section 2.3.

Contamination

Urban land uses, including housing units, landscaping and lawns, may pose a contamination hazard from pesticides and fertilizer use. The impact of these activities compared to the contamination impact of sugarcane, however, is unclear. We do know that low levels of termicides (such as dieldrin and chlordane) have been found in well stations located in long-time residential areas. Source development in urban areas includes water treatment systems to ensure that existing and potential future contaminant sources are removed before water is introduced to the municipal potable water system.

Water Allocation

The capacity of Waipahu Wells IV will most likely serve the Ewa-Waianae districts and potentially, the Primary Urban Center (PUC). On average, about 60 percent of water use on Oahu is for residential use and 40 percent is for non-residential use, including agriculture. Of the residential use, approximately 40 percent is used for landscape irrigation

Golf courses are required by our Rules and Regulations to use nonpotable water for irrigation. In Ewa, reclaimed water will be provided to most golf courses. BWS provides domestic water and fire protection to golf courses from the potable water system.

6. Land Use Impacts

Section 4.1 describes land uses in the vicinity of the well as primarily residential. Installation of the Waipahu Wells IV station will service future residential and non-residential developments in response to the directed growth and projected population increases of the development plans for Ewa, Waianae and potentially the PUC. Impacts from increased water demand are discussed in Section 1.3. Additionally, Section 4.11, Contamination Sources, will be expanded to include discussion of potential contaminants related to use.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

cc: R.M. Towill Corp.

Appendix C

Test Pumping Results at Waipahu Wells IV

Honolulu Board of Water Supply

to RICHARD MATSUI

from PLANNING BRANCH

subject TEST PUMPING RESULTS AT WAIPAHU WELLS IV, WELL #1 (2301-46), WELL #2 (2301-44) AND WELL #3 (2301-45)

date JUL. 20, 1998

JUL 20 11 56 AM '98

We recommend an installed capacity of 1,000 gpm for each of the three wells. The expected drawdown at this capacity at Well #1 is 2.1 feet. The expected drawdown at Well #2 is 1.8 feet and the expected drawdown at Well #3 is 1.5 feet. Chloride concentrations during the three long term test varied from 54 to 60 ppm.

We also attach the as-built drawings and the data from the step-drawdown and sustained pumping tests. We previously submitted the plumbness and alignment data.

The fourth well in the field will be constructed and tested in the Fall by a contractor selected by the state. We will submit a report when the test results are available.

Well #1 (State No. 2301-46)

Step-drawdown pumping rates were 703 gpm, 908 gpm, 1,102 gpm and 1,294 gpm with drawdowns of 1.04 feet, 1.73 feet, 2.42 feet and 3.47 feet, respectively. Chloride concentrations varied from 58 to 60 ppm. We do not believe that the increase in chloride concentrations were related to increased pumping rates. The specific capacity at the proposed rate of 1,000 gpm is 453 gpm/ft.

We conducted the long term test for 72 hours at an average rate of 1,018 gpm. The average drawdown was 2.1 feet. A total of 4,395,700 gallons were pumped. Chloride concentrations were progressively lower each day of the test. Concentrations varied from 64 to 56 ppm chloride.

Well #2 (State No. 2301-44)

Step-drawdown pumping rates were 696 gpm, 908 gpm, 1,086 gpm and 1,300 gpm with drawdowns of 0.81 feet, 1.39 feet, 1.85 feet and 2.66 feet, respectively. Chloride concentrations remained stable at 58 ppm. The specific capacity at the proposed rate of 1,000 gpm if 586 gpm/ft of drawdown.

We conducted the long term test for about 120 hours at an average rate of 1,043 gpm. The average drawdown was 1.8 feet. A total of 7,558,300 gallons were pumped. Chloride levels declined from 58 ppm on the first day to 54 ppm on the four remaining sampling days.

Well #3 (State No. 2301-45)

Step-drawdown pumping rates were 750 gpm, 920 gpm, 1,147 gpm and 1,348 gpm with drawdowns of 0.81 feet, 1.39 feet, 1.96 feet and 2.54 feet, respectively. Chloride concentrations remained steady at 60 ppm. The specific capacity at the proposed rate of 1,000 gpm is 660 gpm/ft.

We conducted the long term test for about 72 hours at an average rate of 1,069 gpm. The average drawdown was 1.7 feet. A total of 4,622,655 gallons were pumped. Chloride levels declined from 60 ppm to 58 ppm.

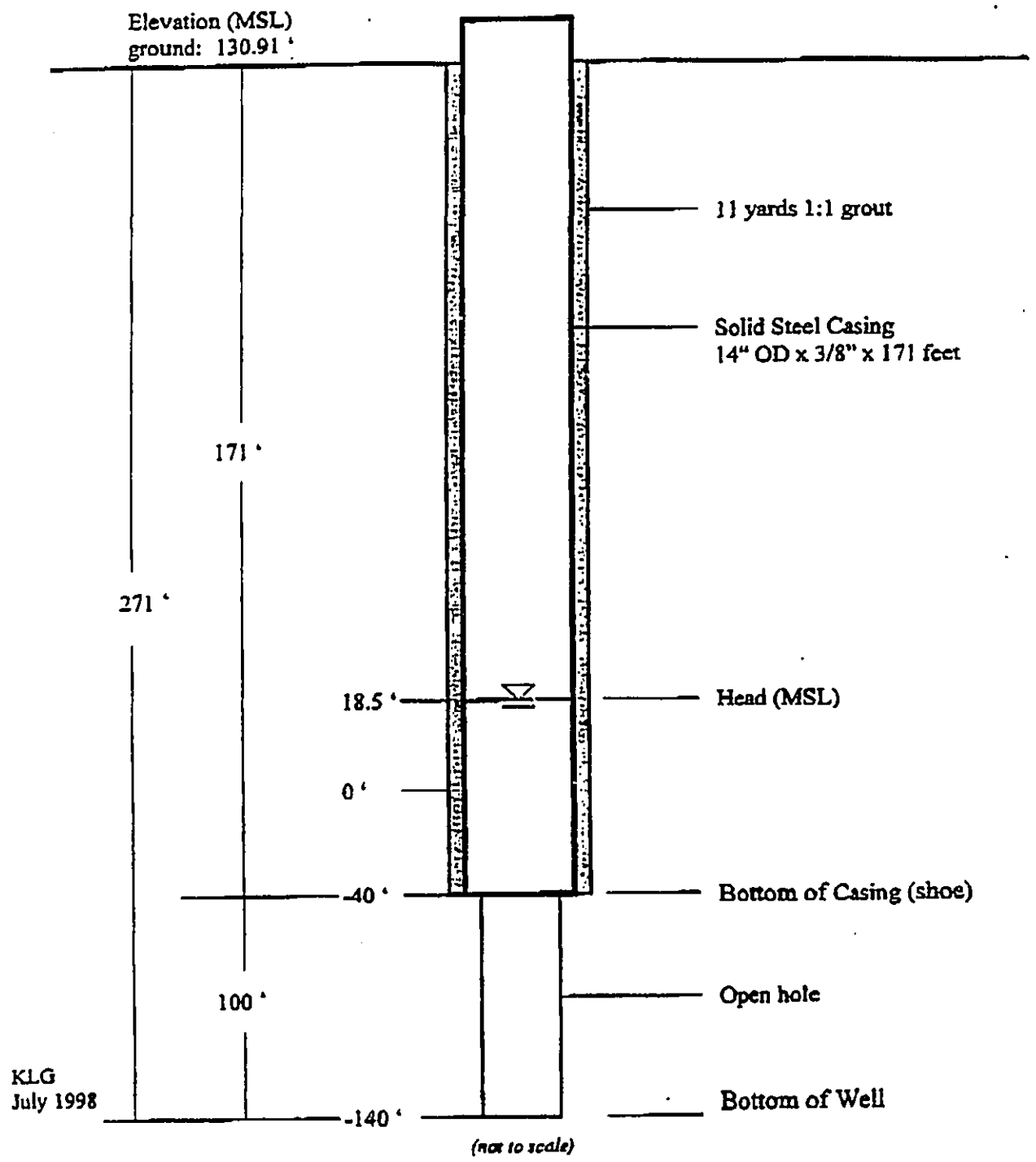
If you have any questions, please contact Kevin Gooding at ext. 5285.

Attachments

KLG:js
cc: Plant Operations
H. Minakami
Long-Range Planning (G. Kuo)
C. Lao

Waipahu Wells IV Well # 1 State No. 2301-46
Waipahu, Oahu, Hawaii
TMK 9-4-02:05

As-Built Section
Drilling Completed March 1998
Drilling Contractor: Water Resources International, Inc.



Sustained Yield Test - Waipahu Wells IV well # 1

Well no.: 2301-46

County: Honolulu
Well: Waipahu IV # 1
ground elev. : 130.91 ft

drawdown in pumped well
water level measurements by airline

Date	time	elapsed time min	Depth to water	psi	draw-down (feet)	Discharge (gpm)	Chloride (ppm)	Temp deg F	Remarks
5/18/98	0948		112.48	20.75	0.00				
	1000	0							start test
	1004	4	115.00	19.65	2.54				
	1006	6	114.65	19.80	2.19	1000		71.2	
	1012	12	114.65	19.80	2.19	1033	64		sample #1
	1021	21	114.54	19.85	2.08	1022		71.2	
	1033	33	114.54	19.85	2.08	1025			
	1114	74	114.42	19.90	1.96	1021			
	1200	120	114.54	19.85	2.08				
	1400	240	114.54	19.85	2.08				
	1600	360	114.42	19.90	1.96				
	1800	480	114.54	19.85	2.08				
	2000	600	114.54	19.85	2.08				
	2200	720	114.65	19.80	2.19				
	2400	840	114.77	19.75	2.31				
	0200	960	114.77	19.75	2.31				
	0400	1080	114.77	19.75	2.31				
	0600	1200	114.77	19.75	2.31				
	0800	1320	114.65	19.80	2.19				
5/19/98	0903	1383	114.65	19.80	2.19	1013			overnight average rate 1019 gpm
	0911	1391	114.54	19.85	2.08	1013	60	71.2	sample #2
	0919	1399	114.54	19.85	2.08	1031			
	1000	1440	114.65	19.80	2.19				
	1200	1560	114.65	19.80	2.19				
	1400	1680	114.42	19.90	1.96				
	1600	1800	114.42	19.90	1.96				
	1800	1920	114.54	19.85	2.08				
	2000	2040	114.65	19.80	2.19				
	2200	2160	114.65	19.80	2.19				
	2400	2280	114.65	19.80	2.19				
	0200	2400	114.77	19.75	2.31				
	0400	2520	114.77	19.75	2.31				
	0600	2640	114.77	19.75	2.31				
	0800	2760	114.65	19.80	2.19				
5/20/98	0948	2868	114.42	19.90	1.96	1018			overnight average rate 1018 gpm
	0953	2873	114.42	19.90	1.96	1010		71.2	
	0957	2877	114.42	19.90	1.96	1011	58		sample #3
	1200	3000	114.54	19.85	2.08				
	1400	3120	114.42	19.90	1.96				
	1600	3240	114.42	19.90	1.96				
	1800	3360	114.42	19.90	1.96				
	2000	3480	114.65	19.80	2.19				
	2200	3600	114.65	19.80	2.19				
	2400	3720	114.77	19.75	2.31				
	0200	3840	114.77	19.75	2.31				
	0400	3960	114.77	19.75	2.31				
	0600	4080	114.77	19.75	2.31				
	0800	4200	114.65	19.80	2.19				

2301-46									
		elapsed	Depth		draw-				
Date	time	time	to	psi	down	Discharge	Chloride	Temp	Remarks
		min	water		(feet)	(gpm)	(ppm)	deg F	
5/21/98	0923	4283	114.54	19.85	2.08	1016		71.2	overnight average rate 1016 gpm
	0929	4289	114.54	19.85	2.08	1008			
	0934	4294	114.54	19.85	2.08	1009	56	71.2	sample #4
	0945	4305	114.64	19.85	2.08				
	0957	4317	114.54	19.85	2.08	1017		71.2	
	0958.5	4319							end test
	0959	4319	112.11	20.90	-0.35				recovery
	0959.5	4320	112.34	20.80	-0.12				
	1000	4320	112.34	20.80	-0.12				
	1002	4322	112.34	20.80	-0.12				
	1007	4327	112.34	20.80	-0.12				
	1026	4346	112.34	20.80	-0.12				
Total Pumpage:		4,395,700 gallons							
average rate:		1018 gpm							
sustained pumping test									

Step Draw Down Test

County: Honolulu | Well No. 2301-46

Well: Waipahu Wells IV, Well # 1 | drawdown in pumping well

ground elevation: 130.91 ft | 5/15/98

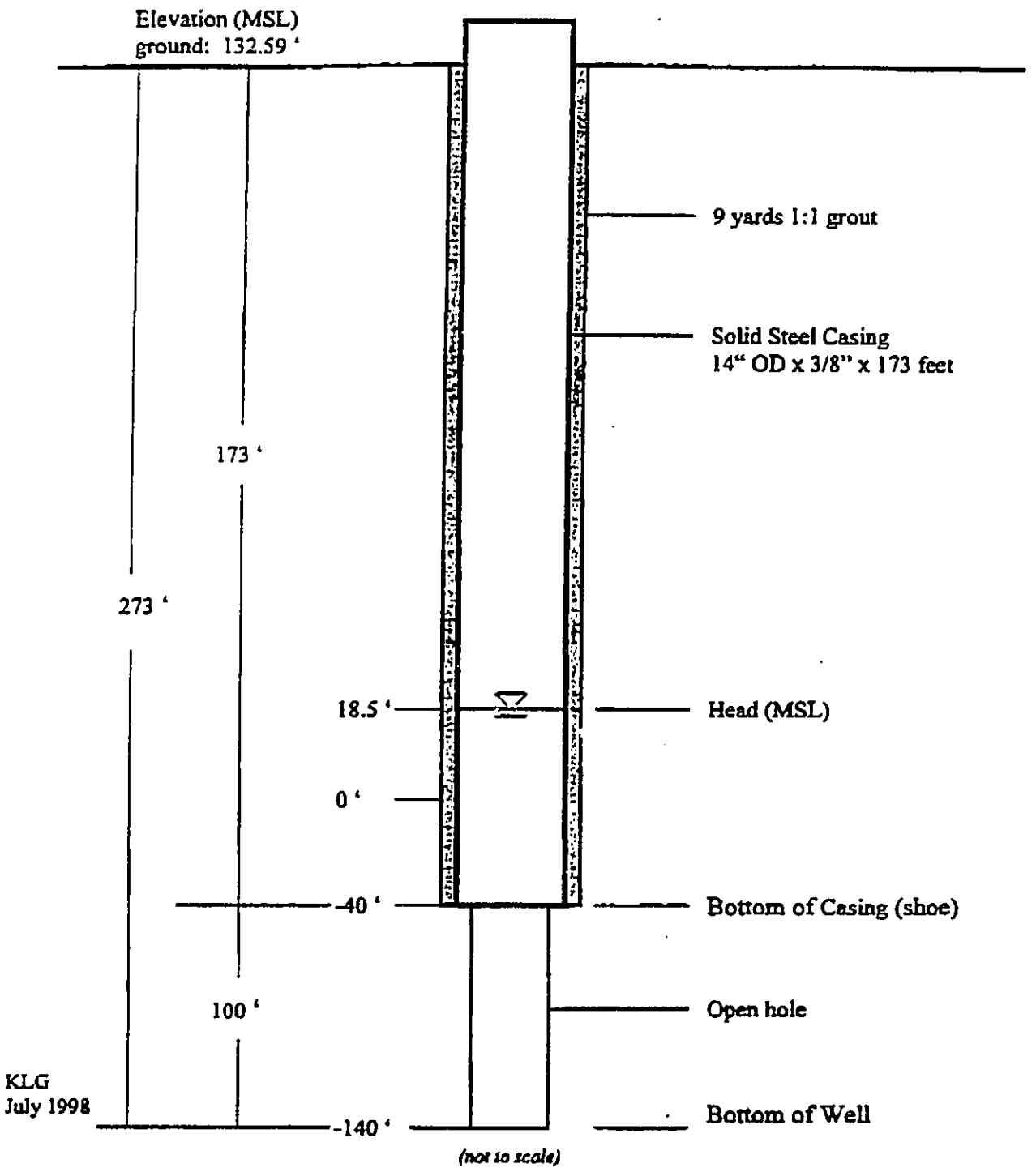
time	elapsed time min	Depth to water(ft)	airline (psi)	draw-down (feet)	Dis-charge (gpm)	Chloride (ppm)	Temp deg F	Remarks
0912		112.84	20.80	0.00				static pressure
0924	0		20.80	0.00				
0930	0	112.84	20.80	0.00				
0947	0	112.84	20.80	0.00				start test
0951	4	114.46	20.10	1.62	714	60		sample #1
0958	11	113.88	20.35	1.04	700		70.9	
1003	16	113.88	20.35	1.04	720			
1023	36	113.88	20.35	1.04	710		70.9	
1033	46	113.88	20.35	1.04	710			
1043	56	113.88	20.35	1.04	710	58		sample #2
1046	59							change rate, av rate 703 gpm
1054	67	114.34	20.15	1.50	894		71.1	
1105	78	114.34	20.15	1.50	868			
1108	79							adjust rate up
1110	83	114.57	20.05	1.73	921			
1115	88	114.57	20.05	1.73	910			
1131	104	114.57	20.05	1.73	928			
1144	117	114.57	20.05	1.73	931			
1148	121	114.57	20.05	1.73	929	58	71.1	sample #3
1152	125							change rate, av rate 908 gpm
1155	128	115.15	19.80	2.31	1119			
1159	132	115.15	19.80	2.31	1100		71.2	
1208	141	115.27	19.75	2.43	1100			
1221	154	115.27	19.75	2.43	1100		71.2	
1229	162	115.38	19.70	2.54	1100			
1243	176	115.27	19.75	2.43	1092	58		sample #4
1244	177							change rate, av. rate 1102 gpm
1247	180	116.31	19.30	3.47	1300		71.4	
1258	191	116.31	19.30	3.47	1320			
1310	203	116.31	19.30	3.47	1300		71.4	
1321	214	116.31	19.30	3.47	1308			
1330	223	116.31	19.30	3.47	1300	60		sample #5
1333	226							end test, av rate 1294
1333.5	226.5	113.07	20.70	0.23				
1334	227	112.84	20.80	0.00				
1335	228	112.84	20.80	0.00				
1345.0	238	112.84	20.80	0.00				
1350	243	112.84	20.80	0.00				

total amount pumped: 222,100 gallons

step test

Waipahu Wells IV Well # 2 State No. 2301-44
Waipahu, Oahu, Hawaii
TMK 9-4-02:05

As-Built Section
Drilling Completed April 1998
Drilling Contractor: Water Resources International, Inc.



Step Drawdown Test

Waipahu Wells IV Well # 2

County: Honolulu | Well No. 2301-44 | 3/16/98

Well: Waipahu Wells IV, Well # 2 | drawdown in pumping well

ground elevation: 132.59 ft

Date	time	elapsed time min	Depth to water(ft)	airline (psi)	drawdown (ft)	Discharge (gpm)	Chloride (ppm)	Temp deg F	Remarks
3/16/98	1003		113.38	20.35	0.00				static pressure
	1008	0				731			start test
	1013	5	114.31	19.95	0.92			71.0	
	1015	7	114.31	19.95	0.92	697	58		sample 1
	1019	11	114.19	20.00	0.81			71.0	
	1030	22	114.19	20.00	0.81			70.9	
	1035	27	114.19	20.00	0.81	700			
	1047	39	114.19	20.00	0.81	692			
	1052	44	114.19	20.00	0.81	705	58		sample 2
	1054	46							change rate, av. rate 696 gpm
	1100	52	114.88	19.70	1.50	941		71.1	
	1102	54	114.77	19.75	1.39				
	1107	59	114.77	19.75	1.39	920			
	1115	67	114.77	19.75	1.39				
	1123	75	114.77	19.75	1.39	927			
	1139	91	114.77	19.75	1.39	929	58		sample 3
	1143	95							change rate, av. rate 939 gpm
	1147	99	115.35	19.50	1.96	1107			
	1148	100	115.35	19.50	1.96			71.2	
	1154	106	115.35	19.50	1.96	1094			
	1203	115	115.35	19.50	1.96	1093		71.2	
	1214	126	115.23	19.55	1.85	1109			
	1222	134	115.23	19.55	1.85	1088			
	1227	139	115.23	19.55	1.85	1100	58		sample 4
	1231	143	115.23	19.55	1.85				
	1232	144							change rate, av rate 1086 gpm
	1238	148	115.92	19.25	2.54	1293			
	1239	151	116.04	19.20	2.66	1325			
	1244	156	116.04	19.20	2.66	1300		71.4	
	1254	166	116.04	19.20	2.66	1300			
	1306	.78	116.04	19.20	2.66	1308		71.4	
	1320	192	116.04	19.20	2.66	1300	58		sample 5
	1326	198	116.04	19.20	2.66				
	1329	201							end test average rate 1300 gpm
	1330	202	113.38	20.35	0.00				recovery instantaneous
	1330.5	202.5	113.38	20.35	0.00				
	1332	204	113.38	20.35	0.00				
	1341	213	113.38	20.35	0.00				

total amount pumped: 205,300 gallons

step test

Sustained Yield Test - Waipahu Wells IV Well # 2

Well no.: 2301-44
County: Honolulu
Well: Waipahu IV # 2
ground elev. : 132.59 ft

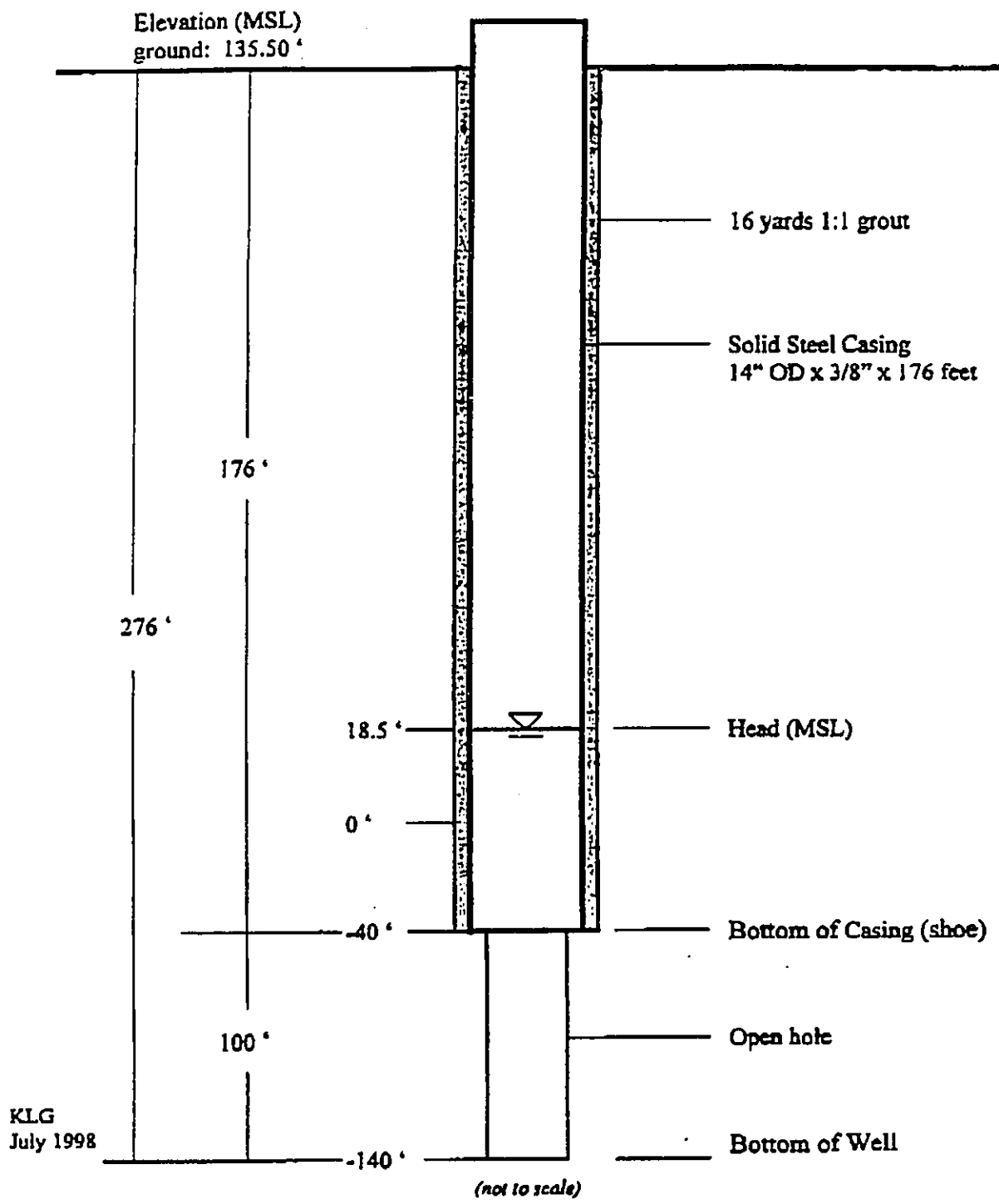
drawdown in pumped well
water level measurements by airline

Date	time	elapsed time min	Depth to water	psi	draw-down (feet)	Discharge (gpm)	Chloride (ppm)	Temp deg F	Remarks
5/6/98	1039		113.96	20.10					static pressure
	1043	0							start test
	1052	9	115.81	19.30	1.85	1133			adjusting rate
	1055	12	115.81	19.30	1.85			71.2	
	1059	16	115.81	19.30	1.85	1057	58		sample #1
	1106	23	115.81	19.30	1.85	1043			
	1112	29	115.81	19.30	1.85	1055		71.1	
	1202	79	115.81	19.30	1.85	1050		71.2	
5/7/98	1107	1464							overnight rate 1043 gpm
	1112	1469				1020	54	71.3	sample #2
	1147	1504				1043			repaired leaking airline
	1154	1611	115.69	19.35	1.73	1043		71.2	
	1203	1520	115.69	19.35	1.73	1033			
	1400	1637	115.81	19.30	1.85				
	1600	1757	115.69	19.35	1.73				
	1800	1877	115.69	19.35	1.73				
	2000	1997	115.69	19.35	1.73				
	2200	2117	115.69	19.35	1.73				
5/8/98	2400	2237	115.69	19.35	1.73				
	0200	2357	115.81	19.30	1.85				
	0400	2477	115.81	19.30	1.85				
	0600	2597	115.81	19.30	1.85				
	0800	2717	115.81	19.30	1.85				
	1000	2837	115.81	19.30	1.85				
	1158	2955	115.81	19.30	1.85			71.2	overnight rate 1044 gpm
	1202	2959	115.81	19.30	1.85	1050			
	1241	2998	115.81	19.30	1.85	1041	54	71.2	sample #3
	1400	3077	115.58	19.40	1.62				
	1600	3197	115.58	19.40	1.62				
	1800	3317	115.69	19.35	1 73				
	2000	3437	115.69	19.35	1.73				
	2200	3557	115.69	19.35	1.73				
5/9/98	2400	3677	115.81	19.30	1.85				
	0200	3797	115.81	19.30	1.85				
	0400	3917	115.81	19.30	1.85				
	0600	4037	115.81	19.30	1.85				
	0817	4174	115.81	19.30	1.85				overnight rate 1043 gpm.
	0822	4179	115.81	19.30	1.85	1040		71.3	
	0827	4184	115.81	19.30	1.85	1050	54	71.2	sample #4
	0847	4204	115.81	19.30	1.85	1040			
	1000	4277	115.81	19.30	1.85				
	1200	4397	115.58	19.40	1.62				
	1600	4637	115.46	19.45	1.50				
	1800	4757	115.58	19.40	1.62				
	2000	4877	115.69	19.35	1.73				
	2200	4997	115.69	19.35	1.73				

Date	time	elapsed time min	Depth to water	psi	draw-down (feet)	Discharge (gpm)	Chloride (ppm)	Temp deg F	Remarks
5/10/98	2400	5117	115.81	19.30	1.85				
	0200	5237	115.81	19.30	1.85				
	0400	5357	115.81	19.30	1.85				
	0600	5477	115.81	19.30	1.85				
	0724	5561	115.81	19.30	1.85			71.3	overnight rate 1041 gpm
	0731	5568	115.81	19.30	1.85	1043	54	71.3	sample #5
	0752	5589	115.81	19.30	1.85	1038			
	1200	5837	115.58	19.4	1.62				
	1400	5957	115.58	19.4	1.62				
	1600	6077	115.58	19.4	1.62				
	1800	6197	115.58	19.4	1.62				
	2000	6317	115.69	19.4	1.73				
	2200	6437	115.69	19.4	1.73				
5/11/98	2400	6557	115.81	19.3	1.85				
	0200	6677	115.81	19.3	1.85				
	0400	6797	115.81	19.3	1.85				
	0600	8917	115.81	19.3	1.85				
	0800	7037	115.69	19.4	1.73				
	1008	7185	115.69	19.35	1.73			71.2	overnight rate 1041 gpm
	1058	7215	115.58	19.40	1.62	1036		71.3	
	1103	7220	115.58	19.40	1.62	1040			
	1128	7245	115.58	19.40	1.62	1032	54		sample #6
	1129	7246							shutdown
	1129.5	7247	113.73	20.20	-0.23				
	1131	7248	113.84	20.15	-0.12				
	1132	7249	113.84	20.15	-0.12				
	1140	7257	113.84	20.15	-0.12				
	1150	7267	113.84	20.15	-0.12				
	1220	7297	113.84	20.15	-0.12				
Total Pumpage:		7,558,300 gallons							
average rate:		1043 gpm							
Sustained Pumping Test									

Waipahu Wells IV Well # 3 State No. 2301-45
Waipahu, Oahu, Hawaii
TMK 9-4-02:05

As-Built Section
Drilling Completed May 1998
Drilling Contractor: Water Resources International, Inc.



Step Draw Down Test

County: Honolulu | Well No. 2301-45
Well: Waipahu Wells IV, Well # 3 | drawdown in pumping well
ground elevation: 135.50 ft | 6/1/98 | sounder not used - oil in chase tube

time	elapsed time min	Depth to water(ft)	airline (psi)	draw-down (feet)	Dis-charge (gpm)	Chloride (ppm)	Temp deg F	Remarks
0924		117.31	18.65	0.00				static pressure
0944		117.31	18.65	0.00				
1001	0							start test
1010	9	118.12	18.30	0.81				
1011	10	118.12	18.30	0.81			70.9	
1017	16							adjusting rate
1023	22	118.23	18.25	0.92	750			
1028	27	118.12	18.30	0.81	746	60		sample #1
1034	33	118.12	18.30	0.81	758		70.9	
1048	47	118.12	18.30	0.81	750		71.0	
1055	54	118.12	18.30	0.81	757	60		sample #2
1058	57	118.12	18.30	0.81	755			
1059	58							change rate, av rate 750 gpm
1102	61	118.69	18.05	1.39			71.1	
1107	66	118.69	18.05	1.39	940			
1116	75	118.69	18.05	1.39	939			
1127	86	118.69	18.05	1.39	941		71.1	
1143	102	118.69	18.05	1.39	940			
1147	106	118.69	18.05	1.39	938	60		sample #3
1148	107							change rate, av rate 920 gpm
1149	108	119.27	17.80	1.96			71.2	
1154	113	119.27	17.80	1.96	1140			
1205	124	119.27	17.80	1.96	1136			
1216	135	119.16	17.85	1.85	1136		71.3	
1230	149	119.27	17.80	1.96				
1232	151	119.27	17.80	1.96	1145	60		sample #4
1233	152							change rate, av rate 1147 gpm
1235	154	119.85	17.55	2.54				
1238	157	119.85	17.55	2.54			71.4	
1240	159	119.85	17.55	2.54	1340			
1247	166	119.85	17.55	2.54	1343			
1258	177	119.85	17.55	2.54	1336		71.5	
1312	191	119.85	17.55	2.54	1336		71.5	
1318	197	119.85	17.55	2.54	1342	60		sample #5
1319	198							end test, av rate 1348 gpm
1320	199	117.19	18.70	-0.12				
1321	200	117.19	18.70	-0.12				
1324	203	117.19	18.70	-0.12				
1327	206	117.19	18.70	-0.12				
1340	219	117.19	18.70	-0.12				

total amount pumped: 202,200 gallons

step test

Table 1

AQUIFER TEST DATA

County: Honolulu Waipahu Wells IV well #3 Observation well no. 2301-44 ground level: 135.50
Location: Waipahu Pumped well no. 2301-45
Average Q: 1069 gpm Distance between observation and pumped well: 102 ft.

Date	Hour	t(min)	Depth to water (airline) (ft)	s unadjusted	airline pressure (psi)	Q (gpm)	Cl	Temp X °F or __°C	Remarks
6/2/98	9:17		117.42		18.60				Meter Rdg. 191616700
Tuesday	9:23		117.42		18.60				
	9:29		117.42		18.60				191616700
	9:31								start test
	9:33	2	119.16	1.73	17.85	1150			191619000
	9:34	3	119.16	1.73	17.85	1133		71.2	191620100
	9:38	7	119.16	1.73	17.85	1100			191624400
	9:42	11	119.16	1.73	17.85	1091	60	71.2	sample #1. 191628700
	9:52	21	119.16	1.73	17.85	1083			191639450
	10:02	31	119.16	1.73	17.85	1081		71.2	191650200
	10:13	42	119.16	1.73	17.85	1077			191661950
	11:00	89	119.16	1.73	17.85	1070			
	12:00	149	119.16	1.73	17.85	1069			
	13:00	209	119.16	1.73	17.85	1069			
	14:00	269	119.04	1.62	17.90	1070			
	15:00	329	119.04	1.62	17.90	1071			
	16:00	389	119.04	1.62	17.90	1068			
	17:00	449	119.04	1.62	17.90	1072			
	18:00	509	119.04	1.62	17.90	1068			
	19:00	569	119.16	1.73	17.85	1072			
	20:00	629	119.16	1.73	17.85	1067			
	21:00	689	119.16	1.73	17.85	1072			
	22:00	749	119.16	1.73	17.85	1072			
	23:00	809	119.16	1.73	17.85	1072			
6/3/98	0:00	869	119.16	1.73	17.85	1072			
Wednesday	1:00	929	119.16	1.73	17.85	1071			
	2:00	989	119.27	1.85	17.80	1071			
	3:00	1049	119.27	1.85	17.80	1070			
	4:00	1109	119.27	1.85	17.80	1071			
	5:00	1169	119.27	1.85	17.80	1071			
	6:00	1229	119.27	1.85	17.80	1071			
	7:00	1289	119.27	1.85	17.80	1071			
	8:00	1349	119.27	1.85	17.80	1068			
	9:00	1409	119.27	1.85	17.80	1069			
	9:43	1452	119.04	1.62	17.90	1070			overnight average: 1070 gpm
	9:49	1458	119.04	1.62	17.90	1070		71.2	193177000
	9:53	1462	119.04	1.62	17.90	1070	60	71.2	sample #2. 193181300
	10:00	1469	119.04	1.62	17.90	1070			
	10:01	1470	119.04	1.62	17.90	1070			193189800
	11:00	1529	119.16	1.73	17.85	1071			
	12:00	1589	119.16	1.73	17.85	1069			
	13:00	1649	119.04	1.62	17.90	1072			
	14:00	1709	119.04	1.62	17.90	1068			
	15:00	1769	119.04	1.62	17.90	1067			

Sustained Pumpage Test

Table 1

AQUIFER TEST DATA

County: Honolulu
Location: Waipahu
Average Q: 1069 gpm

Observation well no. 2301-44
Pumped well no. 2301-45
Distance between observation and pumped well: 102 ft

Date	Hour	t(min)	Depth to water (airline) (ft)	s unadjusted	airline pressure (psi)	Q (gpm)	Cl	Temp X °F or __°C	Remarks
6/3/98	16:00	1829	119.04	1.62	17.90	1069			
Wednesday	17:00	1889	119.04	1.62	17.90	1081			
	18:00	1949	119.04	1.62	17.90	1083			
	19:00	2009	119.04	1.62	17.90	1079			
	20:00	2069	119.04	1.62	17.90	1074			
	21:00	2129	119.16	1.73	17.85	1073			
	22:00	2189	119.16	1.73	17.85	1069			
	23:00	2249	119.16	1.73	17.85	1060			
6/4/98	0:00	2309	119.16	1.73	17.85	1058			
Thursday	1:00	2369	119.16	1.73	17.85	1071			
	2:00	2429	119.16	1.73	17.85	1071			
	3:00	2489	119.16	1.73	17.85	1071			
	4:00	2549	119.16	1.73	17.85	1071			
	5:00	2609	119.16	1.73	17.85	1071			
	6:00	2669	119.16	1.73	17.85	1071			
	7:00	2729	119.16	1.73	17.85	1071			
	8:00	2789	119.16	1.73	17.85	1068			
	9:00	2849	119.16	1.73	17.85	1070			
	9:40	2889	119.04	1.62	17.90	1069		71.2	overnight average 1069 gpm
	9:47	2896	119.04	1.62	17.90	1069			194713400
	9:50	2899	119.04	1.62	17.90	1069	58	71.2	sample #3. 194716600
	10:03	2912	119.16	1.73	17.85	1069			194730500
	11:00	2969	119.16	1.73	17.85	1071			
	12:00	3029	119.04	1.62	17.90	1072			
	13:00	3089	119.04	1.62	17.90	1072			
	14:00	3149	119.04	1.62	17.90	1070			
	15:00	3209	119.04	1.62	17.90	1074			
	16:00	3269	119.04	1.62	17.90	1069			
	17:00	3329	119.04	1.62	17.90	1070			
	18:00	3389	119.04	1.62	17.90	1071			
	19:00	3449	119.04	1.62	17.90	1068			
	20:00	3509	119.04	1.62	17.90	1073			
	21:00	3569	119.04	1.62	17.90	1071			
	22:00	3629	119.04	1.62	17.90	1073			
	23:00	3689	119.16	1.73	17.85	1071			
6/5/98	0:00	3749	119.16	1.73	17.85	1071			
Fnday	1:00	3809	119.16	1.73	17.85	1070			
	2:00	3869	119.16	1.73	17.85	1072			
	3:00	3929	119.16	1.73	17.85	1071			
	4:00	3989	119.16	1.73	17.85	1070			
	5:00	4049	119.16	1.73	17.85	1068			
	6:00	4109	119.16	1.73	17.85	1070			
	7:00	4169	119.16	1.73	17.85	1070			
	8:00	4229	119.27	1.85	17.80	1068			

Table 1

AQUIFER TEST DATA

County: Honolulu
Location: Waipahu
Average Q: 1069 gpm

Observation well no. 2301-44
Pumped well no. 2301-45
Distance between observation and pumped well: 102 ft.

Date	Hour	t(min)	Depth to water (airline) (ft)	s unadjusted	airline pressure (psi)	Q (gpm)	Cl	Temp X °F or __°C	Remarks
6/5/98	8:14	4243				1069			overnight average 1068 gpm
Friday	9:00	4289	119.16	1.73	17.85	1065			
	9:21	4310				1069			196223000
	9:24	4319					58	71.3	sample #4
	9:30	4319	119.16	1.73	17.85				
	9:33	4322							
	9:36	4325				1069			end test. meter 196239365
	9:38		117.42	0	18.60				
	9:39		117.42	0	18.60				average pumpage rate: 1069 gpm
	9:40		117.42	0	18.60				
					total pumpage: 4,622,655 gallons				

Sustained Pumpage Test

Honolulu Board of Water Supply

to ENGINEERING BRANCH

from PLANNING BRANCH

subject TESTING AND CONSTRUCTION OF WAIPAHU WELLS IV, WELL #4 (STATE NO. 2301-47)

date APR. 13, 1999

The construction of Waipahu Wells IV, Well #4 was contracted by the Department of Land and Natural Resources, Division of Water and Land Development. BWS Hydrology-Geology Section personnel monitored the construction and conducted the testing of well #4. This well meets BWS specifications. We attach the as-built drawing, site drawing and data from the plumbness and alignment test, step-drawdown and sustained pumping test.

We recommend an installed capacity of 1,040 gpm (1.5 mgd) for this well. The estimated drawdown at this rate is 1.1 feet. The pump intake should be set at -15 feet (msl).

Step-drawdown pumping rates were 670 gpm, 780 gpm, 884 gpm and 1,091 gpm with drawdowns of 0.55 feet, 0.74 feet, 0.91 feet and 1.20 feet, respectively. The specific capacity at the proposed rate of 1,040 gpm is 945 gpm/ft. Chloride concentrations remained constant at 60 ppm during the step-drawdown test.

We conducted the long term test for 72 hours at an average rate of 1,063 gpm. The average drawdown was 1.21 feet. A total of 4,636,000 gallons were pumped. Chloride concentrations varied between 58 and 60 ppm.

We conducted the well casing plumbness test on February 24, 1999. The maximum drift per 100 feet found in this well casing is 4.98 inches. This drift is found between 60 feet and 160 feet. The maximum allowable drift for any 100 feet of casing for the well is 8.83 inches. Hydrology-Geology personnel also witnessed the alignment test. The dummy was lowered through the casing successfully. This well meets BWS standards for plumbness and alignment.

If you have any questions, please contact Chester Lao at ext. 5286.

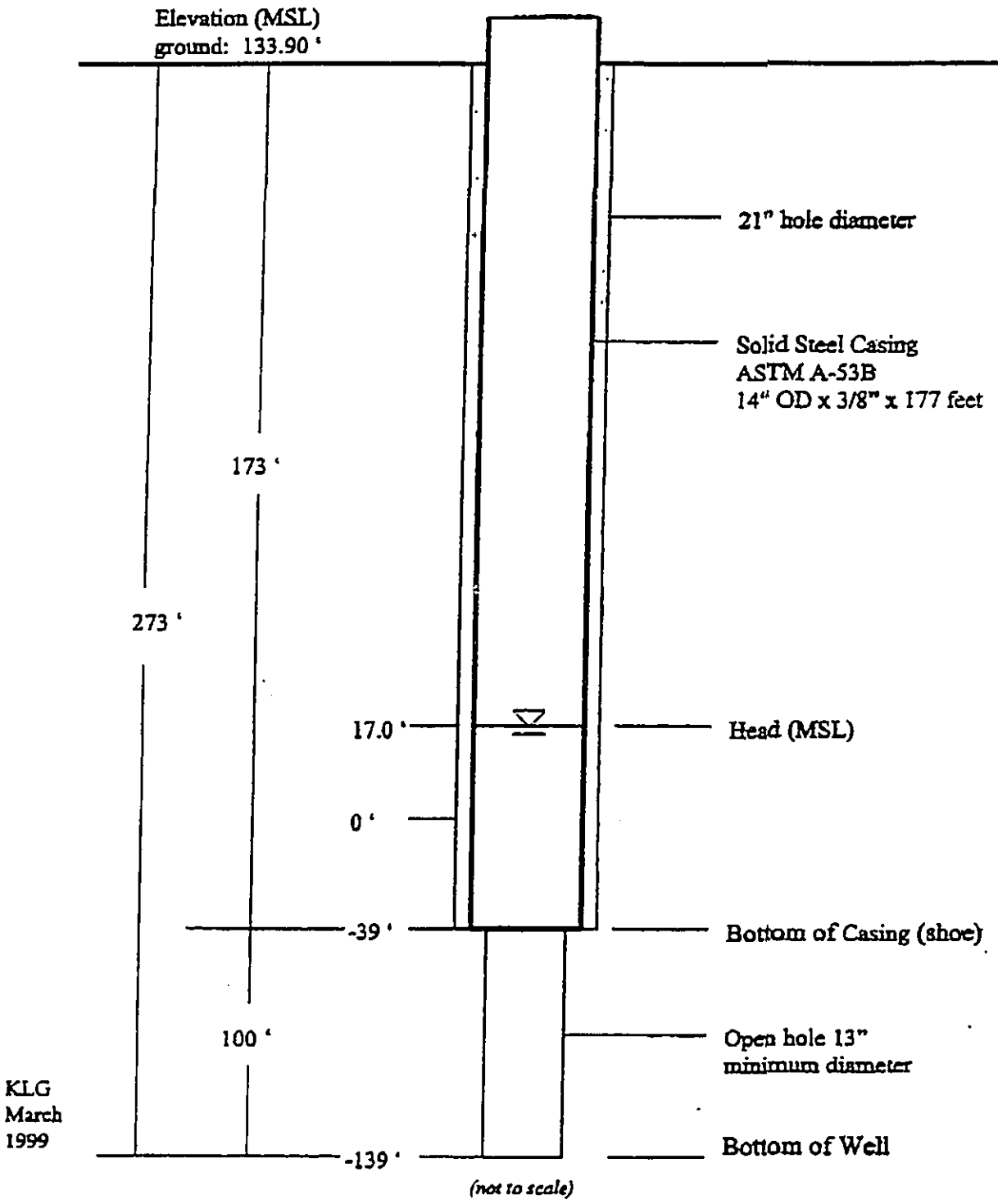
Attachments

KLG:js

cc: Engineering (Design B, J. Yasuda)
Long Range Planning (I. Oda)
J. Kaakua
C. Lao

Waipahu Wells IV Well # 4 State No. 2301-47
Waipahu, Oahu, Hawaii
TMK 9-4-02:05

As-Built Section
Drilling Completed March 18, 1999
Drilling Contractor: Impact Well Drilling



Plumbness Test

Waipahu Wells IV Well #4 State No. 2301-47

February 24, 1999
Ground elevation: 133.90 feet
Casing length : 173 feet
Casing diameter : 13.25 inches ID (14 inches OD)
Pulley height : 29 feet
Maximum allowable drift (per any 100 feet): 8.83 inches

Depth (feet)	Drift (inches)	Drift (inches per any 100 feet)
0		
20	0.35	
40	0.86	
60	1.75	
80	2.33	
100	2.93	2.92
120	3.61	3.50
140	4.95	4.54
160	6.20	4.98
168	6.80	4.62 (drift per 88 feet of casing)

* A maximum drift of 4.98 inches per any 100 feet of casing occurs between 60 feet and 160 feet.

Step Draw Down Test

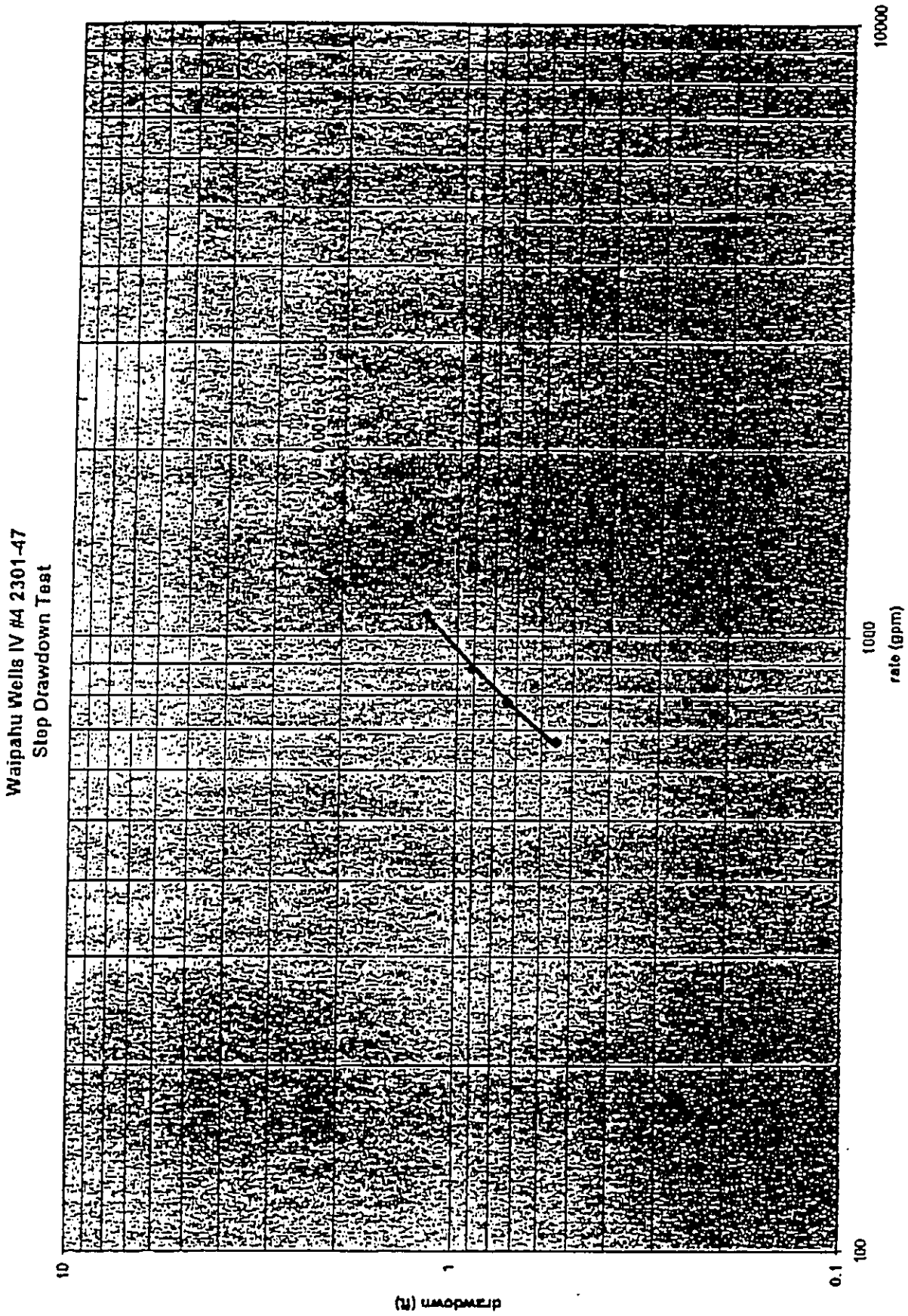
County: Honolulu | Well No. 2301-47

Well: Waipahu Wells IV #4 | drawdown in pumping well

ground elevation: 133.90 ft | 3/12/99 | depth sounder measurements

time	time (min)	elapsed time min	Depth to water(ft)	draw-down (feet)	head (feet)	Dis-charge (gpm)	Chloride (ppm)	Temp deg F	Remarks
0811			118.58	0.00	17.01				static water level
0821		0							start test
0822	1	1	119.11	0.53	16.48	660			
0824	2	3				660			
0826	2	5						71.3	
0829	3	8	119.11	0.53	16.48				
0831	2	10				660	60		sample # 1
0839	8	18	119.11	0.53	16.48	670			
0849	10	28	119.12	0.54	16.47	670			
0856	7	35	119.12	0.54	16.47	660		71.4	
0911	15	50	119.13	0.55	16.46		60		sample # 2
0914	3	53							change rate av rate 670 gpm 0.55 ft dd
0915	1	54	119.27	0.69	16.32	800		71.3	
0920	5	59	119.30	0.72	16.29	800			
0922	2	61				800			
0932	10	71	119.31	0.73	16.28			71.3	
0942	10	81	119.31	0.73	16.28	800			
0952	10	91	119.32	0.74	16.27	790	60		sample # 3
0955	3	94							change rate av rate 780 gpm 0.74 ft dd
0956	1	95	119.48	0.90	16.11	910			
0958	2	97	119.48	0.90	16.11	910		71.2	
1015	17	114	119.48	0.90	16.11	900			
1021	6	120	119.49	0.91	16.10	910		71.1	
1029	8	128	119.49	0.91	16.10	900			
1036	7	135	119.49	0.91	16.10	900	60		sample # 4
1038	2	137							change rate av rate 884 gpm 0.91 ft dd
1039	1	138	119.76	1.18	15.83	1060			
1041	2	140	119.77	1.19	15.82	1070		71.1	
1050	9	149	119.78	1.20	15.81	1060			
1102	12	161	119.78	1.20	15.81	1070		71.1	
1112	10	171	119.78	1.20	15.81	1070		71.1	
1121	9	180	119.78	1.20	15.81	1070	60		sample # 5
1122	1	181							end test av rate 1091 gpm 1.20 ft dd
1124	2	183	118.66	0.08	16.93				
1125	1	184	118.66	0.08	16.93				
1126	1	185	118.65	0.07	16.94				
1129	3	188	118.65	0.07	16.94				
1134	5	193	118.65	0.07	16.94				
1142	8	201	118.65	0.07	16.94				
1145	3	204	118.65	0.07	16.94				
Total amount pumped: 153,000 gallons									

step test


Waipahu Wells IV #4 2301-47
Step Drawdown Test
10000
1000
rate (gpm)
10
1
0.1
100
drawdown (ft)

Sustained Yield Test - Waipahu Wells IV #4

Well no.: 2301-47

County: Honolulu | drawdown in pumped well
Well: Waipahu Wells IV well #4 | water level measurements
ground elev.: 133.90 ft | depth sounder measurements

Date	time	elapsed time min	Depth to water	draw-down (feet)	Discharge (gpm)	Chloride (ppm)	Temp deg F	Remarks
3/15/99	0934		118.52					
	0941		118.52					
	1004		118.52	0.00				
	1008	0						start test
	1009	1	119.60	1.08				
	1011	3	119.69	1.17	1080			
	1012	4	119.69					
	1018	10	119.69	1.17	1070	60		sample #1
	1029	21	119.69	1.17				
	1041	33	119.69	1.17	1070			
	1050	42					71.1	
	1200	112	119.69	1.17	1070			
	1400	232	119.69	1.17	1070			
	1600	352	119.69	1.17	1070			
	1800	472	119.71	1.19	1070			
	2000	592	119.72	1.20	1070			
	2200	712	119.73	1.21	1070			
	2400	832	119.74	1.22	1070			
3/16/99	0200	952	119.74	1.22	1070			
	0400	1072	119.74	1.22	1070			
	0600	1192	119.73		1070			
	0800	1312	119.72	1.20	1070			
	1000	1432	119.72	1.20	1070			
	1200	1552	119.73	1.21	1070			
	1348	1680	119.74	1.22	1070			overnight average 1066 ppm
	1400	1672	119.74	1.22	1070	58	71.1	sample #2
	1600	1792	119.73	1.21	1070			
	1800	1912	119.74	1.22	1070			
	2000	2032	119.74	1.22	1070			
	2200	2152	119.74	1.22	1070			
	2400	2272	119.74	1.22	1070			
3/17/99	0200	2392	119.74	1.22	1070			
	0400	2512	119.74	1.22	1070			
	0600	2632	119.74	1.22	1070			
	0800	2752	119.74	1.22	1070			
	1009	2961	119.76	1.24	1070			overnight average 1058 ppm
	1013	2885	119.76	1.24	1070	59	71.1	sample #3
	1200	2992	119.74	1.22	1070			
	1400	3112	119.73	1.21	1070			
	1600	3232	119.71	1.19	1070			
	1800	3352	119.70	1.18	1070			
	2000	3472	119.71	1.19	1070			
	2200	3592	119.73	1.21	1070			
	2400	3712	119.75	1.23	1070			
3/18/99	0200	3832	119.74	1.22	1070			
	0400	3952	119.73	1.21	1070			
	0600	4072	119.73	1.21	1070			

Date	time	elapsed time min	Depth to water	drawdown (feet)	Discharge (gpm)	Chlorids (ppm)	Temp deg F	Remarks
	0800	4182	119.73	1.21	1070			
	0941	4283	119.74	1.22	1070		71.2	
	0948	4300	119.74	1.22	1070			overnight average 1059 gpm
	1016	4327	119.74	1.22	1070	60	71.2	client lab gets samples
	1048	4360	119.76	1.23	1070			
	1051	4363						stop pumping
	1052	4364	118.62	0.10				test average 1063 gpm
	1052.5	4365.5	118.58	0.04				
	1053	4366	118.58	0.04			-	
	1054	4367	118.62	0.10				
	1055	4368	118.62	0.10				
	1056	4369	118.62	0.10				
	1058	4371	118.62	0.10				
	1100	4373	118.62	0.10				
	1103	4376	118.62	0.10				
	1111	4384	118.62	0.10				
	1119	4392	118.62	0.10				
	1127	4400	118.62	0.10				
	Total pumpage: 4,636,000 gallons							
	Average rate: 1063 gpm for three days							

Appendix D

Chemical Analysis of Test PumpWaters
Waipahu Wells IV

MONTGOMERY WATSON LABORATORIES

555 East Walnut Street
Pasadena, California 91101
818 568 6400; Fax: 818 568 6324;
1 800 566 LABS (1 800 566 5227)

Laboratory Report

for

Honolulu Board of Water Supply (E. Kawata)
630 S. Beretania St.

Honolulu , HI 96843

Attention: Erwin Kawata
Fax: (808) 527-6195

Report#: 43035
PHASEV

MONTGOMERY WATSON LABORATORIES

555 East Walnut Street
Pasadena, California 91101
818 568 6480; Fax: 818 568 6324;
1 800 566 LABS (1 800 566 5227)

Report
Comments
#43035

Group Comments

Result for TCDD analysis submitted by Quanterra Environmental Services.
(508) LCS recoveries fail low for aldrin and heptachlor; sample results not reported, use 525.2 data for these analytes. QIR-GC-98-059.
(515.1) LCS recovery fails low for dinoseb; sample results are not reported for this analyte. QIR-GC-98-055.

Report Summary of positive results, PR43035

		Result	MDL	UNITS
Analyzed	980513115 WAIPAHU WELL IV-W. 2 (2301-44)			
05/19/98	1,2,3-Trichloropropane	0.27	.100	UGL
05/19/98	1,2-Dibromoethane	0.02	.010	UGL
05/19/98	Data Entry	05/28/98		--
06/02/98	Barium, Total, ICAP/MS	3.9	2.000	UGL
06/02/98	Chromium, Total, ICAP/MS	2.8	2.000	UGL
06/02/98	Copper, Total, ICAP/MS	4.3	2.000	UGL
06/02/98	Lead, Total, ICAP/MS	1.3	.500	UGL
05/19/98	Data Entry	05/27/98		--
05/20/98	Isophorone	0.6	.500	UGL
05/21/98	Data Entry	06/03/98		--
05/20/98	Data Entry	05/27/98		--
05/29/98	Calcium, Total, ICAP	14	1.000	MGL
05/14/98	Fluoride	0.13	.100	MGL
05/28/98	Nitrate plus Nitrite by RFA	2.6	.300	MGL
Analyzed	980513116 TRAV BLANK-ANALYZE			
05/20/98	Data Entry	05/28/98		--
05/19/98	Data Entry	05/27/98		--

MONTGOMERY WATSON LABORATORIES
555 East Walnut Street
Pasadena, California 91101
818 568 6480; Fax: 818 568 6324;
1 800 566 LABS (1 800 566 5227)

Laboratory
Report
#43035

Honolulu Board of Water Supply (E. Kawata)
Erwin Kawata
630 S. Beretania St.
Honolulu , HI 96843

Samples Received

13-may-1998 15:34:05

Prepared	Analyzed	QC Batch#	Method	Analyte	Result	Units	MDL	Dilution
WAIPAHU WELL IV-W. 2 (2301-44) (980513115) Sampled on 05/11/98								
05/29/98	05/29/98	78108	(EPA/ML 200.7)	Calcium, Total, ICAP	14	mg/l	1.0	1
	05/15/98	77483	(ML/SM 4500CN)	Cyanide	ND	mg/l	0.025	1
05/14/98	05/22/98	77901	(ML/EPA 548.1)	Endothall	ND	ug/l	5.0	1
	05/14/98	77436	(ML/SM 4500F)	Fluoride	0.13	mg/l	0.10	1
	05/26/98	77986	(ML/EPA 547)	Glyphosate	ND	ug/l	6.0	1
05/18/98	05/18/98	77608	(EPA/ML 245.1)	Mercury	ND	ug/l	0.20	1
	05/13/98	77579	(ML/EPA 300.0)	Nitrite, Nitrogen by IC	ND	mg/l	0.10	1
	05/28/98	78039	(ML/EPA 353.2)	Nitrate plus Nitrite by RFA	2.6	mg/l	0.30	1
05/22/98	05/23/98		(EPA 1613)	2,3,7,8 - TCDD	ND	PGL	1.2	1
				525 Semivolatiles by GC/MS				
05/19/98	05/20/98	77781	(ML/EPA 525.2)	2,4-Dinitrotoluene	ND	ug/l	0.10	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	alpha-Chlordane	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Acenaphthylene	ND	ug/l	0.10	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Alachlor	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Aldrin	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Anthracene	ND	ug/l	0.020	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Atrazine	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Benz(a)Anthracene	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Benzo(a)pyrene	ND	ug/l	0.020	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Benzo(b)Fluoranthene	ND	ug/l	0.020	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Benzo(g,h,i)Perylene	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Benzo(k)Fluoranthene	ND	ug/l	0.020	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Di(2-Ethylhexyl)phthalate	ND	ug/l	0.60	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Butylbenzylphthalate	ND	ug/l	0.50	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Bromacil	ND	ug/l	2.0	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Butachlor	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Caffeine	ND	ug/l	0.020	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Chrysene	ND	ug/l	0.020	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Dibenz(a,h)Anthracene	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Di-(2-Ethylhexyl)adipate	ND	ug/l	0.60	1

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Honolulu Board of Water Supply (E. Kawata)
(continued)

Prepared	Analyzed	QC Batch#	Method	Analyte	Result	Units	MDL	Dilution
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Diethylphthalate	ND	ug/l	0.50	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Dieldrin	ND	ug/l	0.20	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Dimethylphthalate	ND	ug/l	0.50	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Dimethoate	ND	ug/l	10	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Di-n-Butylphthalate	ND	ug/l	0.50	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Endrin	ND	ug/l	0.10	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Fluorene	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	gamma-Chlordane	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Hexachlorobenzene	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Hexachlorocyclopentadiene	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Heptachlor	ND	ug/l	0.040	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Heptachlor Epoxide	ND	ug/l	0.020	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Indeno(1,2,3,c,d)Pyrene	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Isophorone	0.6	ug/l	0.50	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Lindane	ND	ug/l	0.020	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Methoxychlor	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Metribuzin	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Molinate	ND	ug/l	0.20	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Metolachlor	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	trans-Nonachlor	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Pentachlorophenol	ND	ug/l	1.0	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Phenanthrene	ND	ug/l	0.020	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Prometryn	ND	ug/l	0.50	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Propachlor	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Pyrene	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Simazine	ND	ug/l	0.050	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Thiobencarb	ND	ug/l	0.20	1
05/19/98	05/20/98	77781	(ML/EPA 525.2)	Trifluralin	ND	ug/l	0.10	1
			(Surrogate)	Perylene-d12	110	% Rec		
Aldicarbs								
	05/19/98	77782	(ML/EPA 531.1)	3-Hydroxycarbofuran	ND	ug/l	2.0	1
	05/19/98	77782	(ML/EPA 531.1)	Aldicarb (Temik)	ND	ug/l	0.50	1
	05/19/98	77782	(ML/EPA 531.1)	Aldicarb sulfone	ND	ug/l	0.80	1
	05/19/98	77782	(ML/EPA 531.1)	Aldicarb sulfoxide	ND	ug/l	0.50	1

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Prepared	Analyzed	QC Batch#	Method	Analyte	Result	Units	MDL	Dilution
	05/19/98	77782	(ML/EPA 531.1)	Baygon	ND	ug/l	2.0	1
	05/19/98	77782	(ML/EPA 531.1)	Carbofuran (Furadan)	ND	ug/l	0.90	1
	05/19/98	77782	(ML/EPA 531.1)	Carbaryl	ND	ug/l	2.0	1
	05/19/98	77782	(ML/EPA 531.1)	Methiocarb	ND	ug/l	2.0	1
	05/19/98	77782	(ML/EPA 531.1)	Methomyl	ND	ug/l	1.0	1
	05/19/98	77782	(ML/EPA 531.1)	Oxamyl (Vydate)	ND	ug/l	2.0	1
			(Surrogate)	BDMC	101	% Rec		
			Diquat and Paraquat					
05/16/98	06/04/98	78380	(ML/EPA 549.1)	Diquat	ND	ug/l	0.40	1
05/16/98	06/04/98	78380	(EPA 549.1)	Paraquat	ND	ug/l	2.0	1
			EPA Method 504.1					
05/19/98	05/19/98	78034	(ML/EPA 504)	1,2-Dibromo-3-chloropropane	ND	ug/l	0.010	1
05/19/98	05/19/98	78034	(ML/EPA 504)	1,2-Dibromoethane	0.02	ug/l	0.010	1
05/19/98	05/19/98	78034	(ML/EPA 504)	1,2,3-Trichloropropane	0.27	ug/l	0.10	1
			(Surrogate)	1,2-dibromopropane	103	% Rec		
			Herbicides by 515.1					
05/18/98	05/21/98	78053	(ML/EPA 515.1)	2,4,5-T	ND	ug/l	0.20	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	2,4,5-TP (Silvex)	ND	ug/l	0.20	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	2,4-D	ND	ug/l	0.10	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	2,4-DB	ND	ug/l	2.0	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	Dichlorprop	ND	ug/l	0.50	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	Acifluorfen (qualitative)	ND	ug/l	0.20	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	Bentazon	ND	ug/l	0.50	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	Dalapon (qualitative)	ND	ug/l	1.0	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	3,5-Dichlorobenzoic acid	ND	ug/l	0.60	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	DCPA	ND	ug/l	0.20	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	Dicamba	ND	ug/l	0.080	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	Pentachlorophenol	ND	ug/l	0.040	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	Picloram	ND	ug/l	0.10	1
05/18/98	05/21/98	78053	(ML/EPA 515.1)	4-Nitrophenol (qualitative)	ND	ug/l	5.0	1
			(Surrogate)	2,4-Dichlorophenylacetic acid	92	% Rec		

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				ICPMS Metals				
	06/02/98	78213	(EPA/ML 200.8)	Arsenic, Total, ICAP/MS	ND	ug/l	1.0	1
	06/02/98	78213	(EPA/ML 200.8)	Barium, Total, ICAP/MS	3.9	ug/l	2.0	1
	06/02/98	78213	(EPA/ML 200.8)	Beryllium, Total, ICAP/MS	ND	ug/l	1.0	1
	06/02/98	78213	(EPA/ML 200.8)	Cadmium, Total, ICAP/MS	ND	ug/l	0.50	1
	06/02/98	78213	(EPA/ML 200.8)	Chromium, Total, ICAP/MS	2.8	ug/l	2.0	1
	06/02/98	78213	(EPA/ML 200.8)	Copper, Total, ICAP/MS	4.3	ug/l	2.0	1
	06/02/98	78213	(EPA/ML 200.8)	Nickel, Total, ICAP/MS	ND	ug/l	5.0	1
	06/02/98	78213	(EPA/ML 200.8)	Lead, Total, ICAP/MS	1.3	ug/l	0.50	1
	06/02/98	78213	(EPA/ML 200.8)	Antimony, Total, ICAP/MS	ND	ug/l	1.0	1
	06/02/98	78213	(EPA/ML 200.8)	Selenium, Total, ICAP/MS	ND	ug/l	5.0	1
	06/02/98	78213	(EPA/ML 200.8)	Thallium, Total, ICAP/MS	ND	ug/l	1.0	1
				SDWA Pesticides				
	05/15/98	05/20/98	77989	(ML/EPA 508) PCB 1016 Aroclor	ND	ug/l	0.10	1
	05/15/98	05/20/98	77989	(ML/EPA 508) PCB 1221 Aroclor	ND	ug/l	0.10	1
	05/15/98	05/20/98	77989	(ML/EPA 508) PCB 1232 Aroclor	ND	ug/l	0.10	1
	05/15/98	05/20/98	77989	(ML/EPA 508) PCB 1242 Aroclor	ND	ug/l	0.10	1
	05/15/98	05/20/98	77989	(ML/EPA 508) PCB 1248 Aroclor	ND	ug/l	0.10	1
	05/15/98	05/20/98	77989	(ML/EPA 508) PCB 1254 Aroclor	ND	ug/l	0.10	1
	05/15/98	05/20/98	77989	(ML/EPA 508) PCB 1260 Aroclor	ND	ug/l	0.10	1
	05/15/98	05/20/98	77989	(ML/EPA 508) Alpha-BHC	ND	ug/l	0.010	1
	05/15/98	05/20/98	77989	(ML/EPA 508) Alachlor (Alanex)	ND	ug/l	0.050	1
	05/15/98	05/20/98	77989	(ML/EPA 508) Beta-BHC	ND	ug/l	0.010	1
	05/15/98	05/20/98	77989	(ML/EPA 508) Chlordane	ND	ug/l	0.10	1
	05/15/98	05/20/98	77989	(ML/EPA 508) Chlorthalonil (Draconil,Bravo)	ND	ug/l	0.010	1
	05/15/98	05/20/98	77989	(ML/EPA 508) DeIta-BHC	ND	ug/l	0.010	1
	05/15/98	05/20/98	77989	(ML/EPA 508) p,p' DDD	ND	ug/l	0.010	1
	05/15/98	05/20/98	77989	(ML/EPA 508) p,p' DDE	ND	ug/l	0.010	1
	05/15/98	05/20/98	77989	(ML/EPA 508) p,p' DDT	ND	ug/l	0.010	1
	05/15/98	05/20/98	77989	(ML/EPA 508) Dieldrin	ND	ug/l	0.010	1
	05/15/98	05/20/98	77989	(ML/EPA 508) Endrin Aldehyde	ND	ug/l	0.010	1
	05/15/98	05/20/98	77989	(ML/EPA 508) Endrin	ND	ug/l	0.010	1

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05/15/98	05/20/98	77989	(ML/EPA 508)	Endosulfan I (alpha)	ND	ug/l	0.010	1
05/15/98	05/20/98	77989	(ML/EPA 508)	Endosulfan II (beta)	ND	ug/l	0.010	1
05/15/98	05/20/98	77989	(ML/EPA 508)	Endosulfan sulfate	ND	ug/l	0.010	1
05/15/98	05/20/98	77989	(ML/EPA 508)	Heptachlor Epoxide	ND	ug/l	0.010	1
05/15/98	05/20/98	77989	(ML/EPA 508)	Lindane (gamma-BHC)	ND	ug/l	0.010	1
05/15/98	05/20/98	77989	(ML/EPA 508)	Methoxychlor	ND	ug/l	0.050	1
05/15/98	05/20/98	77989	(ML/EPA 508)	Toxaphene	ND	ug/l	0.50	1
			(Surrogate)	Dibutyl Chlorendate	96	% Rec		
			(Surrogate)	Tetrachlorometaxylene	104	% Rec		
				Volatile Organic Compounds				
	05/19/98	77938	(ML/EPA 502.2)	1,1,1,2-Tetrachloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1,1-Trichloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1,2,2-Tetrachloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1,2-Trichloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1-Dichloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1-Dichloroethene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1-Dichloropropene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2,3-Trichloropropane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2,3-Trichlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2,4-Trichlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2,4-Trimethylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2-Dichloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2-Dichlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2-Dichloropropane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,3,5-Trimethylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,3-Dichlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,3-Dichloropropane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,4-Dichlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	2,2-Dichloropropane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	2-Chlorotoluene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	4-Chlorotoluene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Bromodichloromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Benzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Bromobenzene	ND	ug/l	0.50	1

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Prepared	Analyzed	QC Batch#	Method	Analyte	Result	Units	MDL	Dilution
	05/19/98	77938	(ML/EPA 502.2)	Bromochloromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Bromomethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	cis-1,2-Dichloroethene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Chlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Carbon tetrachloride	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	cis-1,3-Dichloropropene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Bromoform	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Chloroform	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Chloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Chloromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Dibromochloromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2-Dibromo-3-chloropropane	ND	ug/l	1.0	1
	05/19/98	77938	(ML/EPA 502.2)	Dibromomethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Dichlorodifluoromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2-Dibromoethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Ethylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Hexachlorobutadiene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Isopropylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Methylene chloride	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	m+p-Xylenes	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Methyl tert-butyl ether	ND	ug/l	5.0	1
	05/19/98	77938	(ML/EPA 502.2)	Naphthalene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	n-Butylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	n-Propylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	o-Xylene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Tetrachloroethylene (PCE)	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	p-Isopropyltoluene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	sec-Butylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Styrene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	trans-1,2-Dichloroethene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	tert-Butylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Trichloroethylene (TCE)	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Trichlorotrifluoroethane(Freon	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	trans-1,3-Dichloropropene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Toluene	ND	ug/l	0.50	1

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	05/19/98	77938	(ML/EPA 502.2)	Trichlorofluoromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Vinyl chloride	ND	ug/l	0.30	1
			(Surrogate)	Bromofluorobenzene-ELCD	87	% Rec		
			(Surrogate)	Bromofluorobenzene-PID	90	% Rec		
			(Surrogate)	Chlorofluorobenzene-ELCD	92	% Rec		
			(Surrogate)	Chlorofluorobenzene-PID	91	% Rec		
TRAV BLANK-ANALYZE (980513116)			**Sampled on 05/11/98**					
			EPA Method 504.1					
05/19/98	05/20/98	78034	(ML/EPA 504)	1,2-Dibromo-3-chloropropane	ND	ug/l	0.010	1
05/19/98	05/20/98	78034	(ML/EPA 504)	1,2-Dibromoethane	ND	ug/l	0.010	1
05/19/98	05/20/98	78034	(ML/EPA 504)	1,2,3-Trichloropropane	ND	ug/l	0.10	1
			(Surrogate)	1,2-dibromopropane	107	% Rec		
			Volatile Organic Compounds					
	05/19/98	77938	(ML/EPA 502.2)	1,1,1,2-Tetrachloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1,1-Trichloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1,2,2-Tetrachloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1,2-Trichloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1-Dichloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1-Dichloroethene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,1-Dichloropropene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2,3-Trichloropropane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2,3-Trichlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2,4-Trichlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2,4-Trimethylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2-Dichloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2-Dichlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2-Dichloropropane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,3,5-Trimethylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,3-Dichlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,3-Dichloropropane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,4-Dichlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	2,2-Dichloropropane	ND	ug/l	0.50	1

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Honolulu Board of Water Supply (E. Kawata)
(continued)

Prepared	Analyzed	QC Batch#	Method	Analyte	Result	Units	MDL	Dilution
	05/19/98	77938	(ML/EPA 502.2)	2-Chlorotoluene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	4-Chlorotoluene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Bromodichloromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Benzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Bromobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Bromochloromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Bromomethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	cis-1,2-Dichloroethene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Chlorobenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Carbon tetrachloride	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	cis-1,3-Dichloropropene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Bromoform	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Chloroform	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Chloroethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Chloromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Dibromochloromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2-Dibromo-3-chloropropane	ND	ug/l	1.0	1
	05/19/98	77938	(ML/EPA 502.2)	Dibromomethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Dichlorodifluoromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	1,2-Dibromoethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Ethylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Hexachlorobutadiene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Isopropylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Methylene chloride	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	m+p-Xylenes	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Methyl tert-butyl ether	ND	ug/l	5.0	1
	05/19/98	77938	(ML/EPA 502.2)	Naphthalene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	n-Butylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	n-Propylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	o-Xylene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Tetrachloroethylene (PCE)	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	p-Isopropyltoluene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	sec-Butylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Styrene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	trans-1,2-Dichloroethene	ND	ug/l	0.50	1

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Prepared	Analyzed	QC Batch#	Method	Analyte	Result	Units	MDL	Dilution
	05/19/98	77938	(ML/EPA 502.2)	tert-Butylbenzene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Trichloroethylene (TCE)	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Trichlorotrifluoroethane(Freon	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	trans-1,3-Dicnloropropene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Toluene	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Trichlorofluoromethane	ND	ug/l	0.50	1
	05/19/98	77938	(ML/EPA 502.2)	Vinyl chloride	ND	ug/l	0.30	1
			(Surrogate)	Bromofluorobenzene-ELCD	85	% Rec		
			(Surrogate)	Bromofluorobenzene-PID	90	% Rec		
			(Surrogate)	Chlorofluorobenzene-ELCD	91	% Rec		
			(Surrogate)	Chlorofluorobenzene-PID	90	% Rec		

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QC Batch #77436 — Fluoride

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 98	0507073		(0.00 - 0.00)	
LCS1	Fluoride	0.87	0.85	97.7	(90.00 - 110.00)	
LCS2	Fluoride	0.87	0.85	97.7	(90.00 - 110.00)	0.00
MBLK	Fluoride	ND				
MS	Fluoride	0.909	1.05	115.5	(80.00 - 120.00)	
MSD	Fluoride	0.909	1.05	115.5	(80.00 - 120.00)	0.00

QC Batch #77483 — Cyanide

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 98	0514003		(0.00 - 0.00)	
LCS1	Cyanide	0.10	0.107	107.0	(90.00 - 110.00)	
MBLK	Cyanide	ND				
MS	Cyanide	0.096	0.097	101.0	(80.00 - 120.00)	
MSD	Cyanide	0.096	0.098	102.1	(80.00 - 120.00)	1.0

QC Batch #77579 — Nitrite, Nitrogen by IC

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 98	0513204		(0.00 - 0.00)	
LCS1	Nitrite, Nitrogen by IC	1.0	0.93	93.0	(90.00 - 110.00)	
LCS2	Nitrite, Nitrogen by IC	1.0	0.91	91.0	(90.00 - 110.00)	2.2
MBLK	Nitrite, Nitrogen by IC	ND				
MS	Nitrite, Nitrogen by IC	1.0	0.91	91.0	(80.00 - 120.00)	
MSD	Nitrite, Nitrogen by IC	1.0	0.91	91.0	(80.00 - 120.00)	0.00

QC Batch #77608 — Mercury

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 98	80513093		(0.00 - 0.00)	
LCS1	Mercury	1.56	1.67	107.1	(85.00 - 115.00)	
LCS2	Mercury	1.56	1.65	105.8	(85.00 - 115.00)	1.2

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MBLK	Mercury	ND				
MS	Mercury	1.56	1.66	106.4	(80.00 - 120.00)	
MSD	Mercury	1.56	1.65	105.8	(80.00 - 120.00)	0.60

QC Batch #77781 525 Semivolatiles by GC/MS

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
LCS1	alpha-Chlordane	2	2.12	106.0	(70.00 - 130.00)	
MBLK	alpha-Chlordane	ND				
MS	alpha-Chlordane	2	2.06	103.0	(70.00 - 130.00)	
MBLK	Diazinon	ND				
MS	Spiked sample	Lab # 98	0514039		(0.00 - 0.00)	
LCS1	Acenaphthylene	2	2.01	100.5	(70.00 - 130.00)	
MBLK	Acenaphthylene	ND				
MS	Acenaphthylene	2	1.94	97.0	(70.00 - 130.00)	
LCS1	Alachlor	2	2.17	108.5	(70.00 - 130.00)	
MBLK	Alachlor	ND				
MS	Alachlor	2	2.05	102.5	(70.00 - 130.00)	
LCS1	Aldrin	2	2.12	106.0	(70.00 - 130.00)	
MBLK	Aldrin	ND				
MS	Aldrin	2	1.94	97.0	(70.00 - 130.00)	
LCS1	Anthracene	2	1.98	99.0	(70.00 - 130.00)	
MBLK	Anthracene	ND				
MS	Anthracene	2	1.94	97.0	(70.00 - 130.00)	
LCS1	Atrazine	2	2.05	102.5	(70.00 - 130.00)	
MBLK	Atrazine	ND				
MS	Atrazine	2	2.02	101.0	(70.00 - 130.00)	
LCS1	Benz(a)Anthracene	2	1.95	97.5	(70.00 - 130.00)	
MBLK	Benz(a)Anthracene	ND				
MS	Benz(a)Anthracene	2	1.97	98.5	(70.00 - 130.00)	
LCS1	Benzo(a)pyrene	2	2.18	109.0	(70.00 - 130.00)	
MBLK	Benzo(a)pyrene	ND				
MS	Benzo(a)pyrene	2	2.18	109.0	(70.00 - 130.00)	
LCS1	Benzo(b)Fluoranthene	2	2.13	106.5	(70.00 - 130.00)	
MBLK	Benzo(b)Fluoranthene	ND				

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MS	Benzo(b)Fluoranthene	2	2.17	108.5	(70.00 - 130.00)
LCS1	Benzo(g,h,i)Perylene	2	2.33	116.5	(70.00 - 130.00)
MBLK	Benzo(g,h,i)Perylene	ND			
MS	Benzo(g,h,i)Perylene	2	2.17	108.5	(70.00 - 130.00)
LCS1	Benzo(k)Fluoranthene	2	2.15	107.5	(70.00 - 130.00)
MBLK	Benzo(k)Fluoranthene	ND			
MS	Benzo(k)Fluoranthene	2	2.13	106.5	(70.00 - 130.00)
LCS1	Di(2-Ethylhexyl)phthalate	2	2.17	108.5	(70.00 - 130.00)
MBLK	Di(2-Ethylhexyl)phthalate	ND			
MS	Di(2-Ethylhexyl)phthalate	2	2.16	108.0	(70.00 - 130.00)
LCS1	Butylbenzylphthalate	2	2.04	102.0	(70.00 - 130.00)
MBLK	Butylbenzylphthalate	ND			
MS	Butylbenzylphthalate	2	2.00	100.0	(70.00 - 130.00)
MBLK	Bromacil	ND			
MBLK	Butachlor	ND			
LCS1	Caffeine	2	2.11	105.5	(70.00 - 130.00)
MBLK	Caffeine	ND			
MS	Caffeine	2	1.81	90.5	(70.00 - 130.00)
LCS1	Chrysene	2	1.99	99.5	(70.00 - 130.00)
MBLK	Chrysene	ND			
MS	Chrysene	2	1.96	98.0	(70.00 - 130.00)
LCS1	Dibenz(a,h)Anthracene	2	2.25	112.5	(70.00 - 130.00)
MBLK	Dibenz(a,h)Anthracene	ND			
MS	Dibenz(a,h)Anthracene	2	2.24	112.0	(70.00 - 130.00)
LCS1	Di-(2-Ethylhexyl)adipate	2	2.04	102.0	(70.00 - 130.00)
MBLK	Di-(2-Ethylhexyl)adipate	ND			
MS	Di-(2-Ethylhexyl)adipate	2	1.95	97.5	(70.00 - 130.00)
LCS1	Diethylphthalate	2	2.10	105.0	(70.00 - 130.00)
MBLK	Diethylphthalate	ND			
MS	Diethylphthalate	2	2.10	105.0	(70.00 - 130.00)
MBLK	Dieldrin	ND			
LCS1	Dimethylphthalate	2	2.10	105.0	(70.00 - 130.00)
MBLK	Dimethylphthalate	ND			
MS	Dimethylphthalate	2	2.04	102.0	(70.00 - 130.00)
MBLK	Dimethoate	ND			
LCS1	Di-n-Butylphthalate	2	2.08	104.0	(70.00 - 130.00)

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MBLK	Di-n-Butylphthalate	ND			
MS	Di-n-Butylphthalate	2	1.86	93.0	(70.00 - 130.00)
LCS1	Endrin	2	2.03	101.5	(70.00 - 130.00)
MBLK	Endrin	ND			
MS	Endrin	2	1.89	94.5	(70.00 - 130.00)
LCS1	Fluorene	2	2.03	101.5	(70.00 - 130.00)
MBLK	Fluorene	ND			
MS	Fluorene	2	2.00	100.0	(70.00 - 130.00)
LCS1	gamma-Chlordane	2	2.20	110.0	(70.00 - 130.00)
MBLK	gamma-Chlordane	ND			
MS	gamma-Chlordane	2	1.92	96.0	(70.00 - 130.00)
LCS1	Hexachlorobenzene	2	1.94	97.0	(70.00 - 130.00)
MBLK	Hexachlorobenzene	ND			
MS	Hexachlorobenzene	2	1.89	94.5	(70.00 - 130.00)
LCS1	Hexachlorocyclopentadiene	2	2.10	105.0	(70.00 - 130.00)
MBLK	Hexachlorocyclopentadiene	ND			
MS	Hexachlorocyclopentadiene	2	1.48	74.0	(70.00 - 130.00)
LCS1	Heptachlor	2	1.96	98.0	(70.00 - 130.00)
MBLK	Heptachlor	ND			
MS	Heptachlor	2	2.01	100.5	(70.00 - 130.00)
LCS1	Heptachlor Epoxide	2	2.06	103.0	(70.00 - 130.00)
MBLK	Heptachlor Epoxide	ND			
MS	Heptachlor Epoxide	2	2.05	102.5	(70.00 - 130.00)
LCS1	Indeno(1,2,3,c,d)Pyrene	2	2.30	115.0	(70.00 - 130.00)
MBLK	Indeno(1,2,3,c,d)Pyrene	ND			
MS	Indeno(1,2,3,c,d)Pyrene	2	2.26	113.0	(70.00 - 130.00)
MBLK	Isophorone	ND			
LCS1	Lindane	2	1.97	98.5	(70.00 - 130.00)
MBLK	Lindane	ND			
MS	Lindane	2	1.95	97.5	(70.00 - 130.00)
LCS1	Methoxychlor	2	2.07	103.5	(70.00 - 130.00)
MBLK	Methoxychlor	ND			
MS	Methoxychlor	2	2.13	106.5	(70.00 - 130.00)
MBLK	Metribuzin	ND			
LCS1	Molinate	2	2.07	103.5	(70.00 - 130.00)
MBLK	Molinate	ND			

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MS	Molinate	2	1.98	99.0	(70.00 - 130.00)
MBLK	Metolachlor	ND			
LCS1	trans-Nonachlor	2	2.22	111.0	(70.00 - 130.00)
MBLK	trans-Nonachlor	ND			
MS	trans-Nonachlor	2	2.00	100.0	(70.00 - 130.00)
LCS1	Pentachlorophenol	8	8.44	105.5	(70.00 - 130.00)
MBLK	Pentachlorophenol	ND			
MS	Pentachlorophenol	8	7.53	94.1	(70.00 - 130.00)
LCS1	Phenanthrene	2	2.01	100.5	(70.00 - 130.00)
MBLK	Phenanthrene	ND			
MS	Phenanthrene	2	1.97	98.5	(70.00 - 130.00)
MBLK	Prometryn	ND			
MBLK	Propachlor	ND			
LCS1	Pyrene	2	2.07	103.5	(70.00 - 130.00)
MBLK	Pyrene	ND			
MS	Pyrene	2	2.12	106.0	(70.00 - 130.00)
LCS1	Simazine	2	2.14	107.0	(70.00 - 130.00)
MBLK	Simazine	ND			
MS	Simazine	2	2.23	111.5	(70.00 - 130.00)
LCS1	Thiobencarb	2	2.12	106.0	(70.00 - 130.00)
MBLK	Thiobencarb	ND			
MS	Thiobencarb	2	2.08	104.0	(70.00 - 130.00)
MBLK	Trifluralin	ND			

QC Batch #77782 Aldicarbs

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
LCS1	3-Hydroxycarbofuran	20.0	19.9	99.5	(80.00 - 120.00)	
MBLK	3-Hydroxycarbofuran	ND				
MS	3-Hydroxycarbofuran	20.0	20.7	103.5	(80.00 - 120.00)	
MS	Spiked sample	Lab # 98	0508137		(0.00 - 0.00)	
LCS1	Aldicarb (Temik)	20.0	19.1	95.5	(80.00 - 120.00)	
MBLK	Aldicarb (Temik)	ND				
MS	Aldicarb (Temik)	20.0	20.8	104.0	(80.00 - 120.00)	
LCS1	Aldicarb sulfone	20.0	18.2	91.0	(80.00 - 120.00)	

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MBLK	Aldicarb sulfone	ND			
MS	Aldicarb sulfone	20.0	19.6	99.0	(80.00 - 120.00)
LCS1	Aldicarb sulfoxide	20.0	19.4	97.0	(80.00 - 120.00)
MBLK	Aldicarb sulfoxide	ND			
MS	Aldicarb sulfoxide	20.0	20.2	101.0	(80.00 - 120.00)
LCS1	Baygon	20.0	19.5	97.5	(80.00 - 120.00)
MBLK	Baygon	ND			
MS	Baygon	20.0	20.3	101.5	(80.00 - 120.00)
LCS1	Carbofuran (Furadan)	20.0	18.9	94.5	(80.00 - 120.00)
MBLK	Carbofuran (Furadan)	ND			
MS	Carbofuran (Furadan)	20.0	19.3	96.5	(80.00 - 120.00)
LCS1	Carbaryl	20.0	19.4	97.0	(80.00 - 120.00)
MBLK	Carbaryl	ND			
MS	Carbaryl	20.0	19.9	99.5	(80.00 - 120.00)
LCS1	Methiocarb	20.0	19.3	96.5	(80.00 - 120.00)
MBLK	Methiocarb	ND			
MS	Methiocarb	20.0	20.1	100.5	(80.00 - 120.00)
LCS1	Methomyl	20.0	18.9	94.5	(80.00 - 120.00)
MBLK	Methomyl	ND			
MS	Methomyl	20.0	19.8	99.0	(80.00 - 120.00)
LCS1	Oxamyl (Vydate)	20.0	19.3	96.5	(80.00 - 120.00)
MBLK	Oxamyl (Vydate)	ND			
MS	Oxamyl (Vydate)	20.0	19.9	99.5	(80.00 - 120.00)

QC Batch #77901 Endothall

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 98	C507205		(0.00 - 0.00)	
LCS1	Endothall	25	22.4	89.6	(80.00 - 120.00)	
MBLK	Endothall	ND				
MS	Endothall	25	18.8	75.2	(80.00 - 120.00)	

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Criteria for MS and DUP are not applicable for ICR monitoring.

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QC Batch #77938

Volatile Organic Compounds

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
MBLK	1,1,1,2-Tetrachloroethane	ND				
LCS1	1,1,1-Trichloroethane	4.00	3.71	92.8	(80.00 - 120.00)	
LCS2	1,1,1-Trichloroethane	4.00	4.20	105.0	(80.00 - 120.00)	12
MBLK	1,1,1-Trichloroethane	ND				
MBLK	1,1,2,2-Tetrachloroethane	ND				
MBLK	1,1,2-Trichloroethane	ND				
MBLK	1,1-Dichloroethane	ND				
MBLK	1,1-Dichloroethene	ND				
MBLK	1,1-Dichloropropene	ND				
MBLK	1,2,3-Trichloropropane	ND				
LCS1	1,2,3-Trichlorobenzene	4.00	3.90	97.5	(80.00 - 120.00)	
LCS2	1,2,3-Trichlorobenzene	4.00	4.03	100.8	(80.00 - 120.00)	3.3
MBLK	1,2,3-Trichlorobenzene	ND				
MBLK	1,2,4-Trichlorobenzene	ND				
MBLK	1,2,4-Trimethylbenzene	ND				
MBLK	1,2-Dichloroethane	ND				
MBLK	1,2-Dichlorobenzene	ND				
MBLK	1,2-Dichloropropane	ND				
MBLK	1,3,5-Trimethylbenzene	ND				
MBLK	1,3-Dichlorobenzene	ND				
MBLK	1,3-Dichloropropane	ND				
MBLK	1,4-Dichlorobenzene	ND				
MBLK	2,2-Dichloropropane	ND				
MBLK	2-Chlorotoluene	ND				
MBLK	4-Chlorotoluene	ND				
LCS1	Bromodichloromethane	4.00	4.28	107.0	(80.00 - 120.00)	
LCS2	Bromodichloromethane	4.00	4.54	113.5	(80.00 - 120.00)	5.9
MBLK	Bromodichloromethane	ND				
LCS1	Benzene	4.00	4.12	103.0	(80.00 - 120.00)	
LCS2	Benzene	4.00	4.11	102.8	(80.00 - 120.00)	0.24
MBLK	Benzene	ND				

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MBLK	Bromobenzene	ND				
MBLK	Bromochloromethane	ND				
MBLK	Bromomethane	ND				
MBLK	cis-1,2-Dichloroethene	ND				
MBLK	Chlorobenzene	ND				
LCS1	Carbon tetrachloride	4.00	3.78	94.5	(80.00 - 120.00	
LCS2	Carbon tetrachloride	4.00	4.33	108.2	(80.00 - 120.00)	14
MBLK	Carbon tetrachloride	ND				
MBLK	cis-1,3-Dichloropropene	ND				
LCS1	Bromoform	4.00	4.10	102.5	(80.00 - 120.00)	
LCS2	Bromoform	4.00	4.42	110.5	(80.00 - 120.00)	7.5
MBLK	Bromoform	ND				
LCS1	Chloroform	4.00	3.86	96.5	(80.00 - 120.00)	
LCS2	Chloroform	4.00	4.26	106.5	(80.00 - 120.00)	9.9
MBLK	Chloroform	ND				
MBLK	Chloroethane	ND				
MBLK	Chloromethane	ND				
LCS1	Dibromochloromethane	4.00	4.18	104.5	(80.00 - 120.00)	
LCS2	Dibromochloromethane	4.00	4.34	108.5	(80.00 - 120.00)	3.8
MBLK	Dibromochloromethane	ND				
MBLK	Dibromomethane	ND				
MBLK	Dichlorodifluoromethane	ND				
MBLK	Ethylbenzene	ND				
MBLK	Hexachlorobutadiene	ND				
LCS1	Isopropylbenzene	4.00	4.05	101.2	(80.00 - 120.00)	
LCS2	Isopropylbenzene	4.00	4.13	103.2	(80.00 - 120.00)	2.0
MBLK	Isopropylbenzene	ND				
MBLK	Methylene chloride	ND				
MBLK	m+p-Xylenes	ND				
MBLK	Naphthalene	ND				
MBLK	n-Butylbenzene	ND				
MBLK	n-Propylbenzene	ND				
MBLK	o-Xylene	ND				
LCS1	Tetrachloroethylene (PCE)	4.00	3.98	99.5	(80.00 - 120.00)	
LCS2	Tetrachloroethylene (PCE)	4.00	4.19	104.8	(80.00 - 120.00)	5.1
MBLK	Tetrachloroethylene (PCE)	ND				

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MBLK	p-Isopropyltoluene	ND				
LCS1	sec-Butylbenzene	4.00	4.03	100.8	(80.00 - 120.00)	
LCS2	sec-Butylbenzene	4.00	4.12	103.0	(80.00 - 120.00)	2.2
MBLK	sec-Butylbenzene	ND				
MBLK	Styrene	ND				
LCS1	Chlorofluorobenzene (surr) PID	100	100	100.0	(80.00 - 120.00)	
LCS2	Chlorofluorobenzene (surr) PID	100	100	100.0	(80.00 - 120.00)	0.00
MBLK	Chlorofluorobenzene (surr) PID	100	92	92.0		
LCS1	Bromofluorobenzene (surr) PID	100	106	106.0	(80.00 - 120.00)	
LCS2	Bromofluorobenzene (surr) PID	100	106	106.0	(80.00 - 120.00)	0.00
MBLK	Bromofluorobenzene (surr) PID	100	94	94.0		
LCS1	Chlorofluorobenzene (surr) ELC	100	97	97.0	(80.00 - 120.00)	
LCS2	Chlorofluorobenzene (surr) ELC	100	104	104.0	(80.00 - 120.00)	7.0
MBLK	Chlorofluorobenzene (surr) ELC	100	91	91.0		
LCS1	Bromofluorobenzene (surr) ELCD	100	98	98.0	(80.00 - 120.00)	
LCS2	Bromofluorobenzene (surr) ELCD	100	109	109.0	(80.00 - 120.00)	11
MBLK	Bromofluorobenzene (surr) ELCD	100	87	87.0		
LCS1	trans-1,2-Dichloroethene	4.00	3.75	93.8	(80.00 - 120.00)	
LCS2	trans-1,2-Dichloroethene	4.00	4.24	106.0	(80.00 - 120.00)	12
MBLK	trans-1,2-Dichloroethene	ND				
MBLK	tert-Butylbenzene	ND				
LCS1	Trichloroethylene (TCE)	4.00	3.79	94.8	(80.00 - 120.00)	
LCS2	Trichloroethylene (TCE)	4.00	4.18	104.5	(80.00 - 120.00)	9.8
MBLK	Trichloroethylene (TCE)	ND				
MBLK	Trichlorotrifluoroethane(Freon	ND				
MBLK	trans-1,3-Dichloropropene	ND				
MBLK	Toluene	ND				
MBLK	Trichlorofluoromethane	ND				
MBLK	Vinyl chloride	ND				

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QC Batch #77986 Glyphosate

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 98	0515026		(0.00 - 0.00)	
LCS1	Glyphosate	50	42.1	84.2	(70.00 - 130.00)	
MBLK	Glyphosate	ND				
MS	Glyphosate	50	52.8	105.6	(70.00 - 130.00)	

QC Batch #77989 SDWA Pesticides

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
MBLK	PCB 1016 Aroclor	ND				
MBLK	PCB 1221 Aroclor	ND				
MBLK	PCB 1232 Aroclor	ND				
LCS1	PCB 1242 Aroclor	0.500	0.415	83.0	(70.00 - 130.00)	
MBLK	PCB 1242 Aroclor	ND				
MBLK	PCB 1248 Aroclor	ND				
MBLK	PCB 1254 Aroclor	ND				
MBLK	PCB 1260 Aroclor	ND				
MBLK	Alpha-BHC	ND				
MS	Spiked sample	Lab # 98	0514056		(0.00 - 0.00)	
MBLK	Alachlor (Alanex)	ND				
LCS1	Aldrin	0.050	0.012	<u>24.0</u>	(56.00 - 116.00)	
MBLK	Aldrin	ND				
MS	Aldrin	0.050	0.024	<u>48.0</u>	(75.56 - 142.71)	
MBLK	Beta-BHC	ND				
MBLK	Chlordane	ND				
MBLK	Chlorthalonil (Draconil,Bravo)	ND				
MBLK	Delta-BHC	ND				
MBLK	p,p' DDD	ND				
MBLK	p,p' DDE	ND				
LCS1	p,p' DDT	0.100	0.088	88.0	(37.03 - 169.44)	
MBLK	p,p' DDT	ND				

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MS	p,p' DDT	0.100	0.098	98.0	(57.41 - 158.86)
LCS1	Dieldrin	0.100	0.095	95.0	(65.75 - 149.79)
MBLK	Dieldrin	ND			
MS	Dieldrin	0.100	0.105	105.0	(77.36 - 141.97)
MBLK	Endrin Aldehyde	ND			
LCS1	Endrin	0.100	0.102	102.0	(70.07 - 149.66)
MBLK	Endrin	ND			
MS	Endrin	0.100	0.104	104.0	(86.46 - 138.80)
MBLK	Endosulfan I (alpha)	ND			
MBLK	Endosulfan II (beta)	ND			
MBLK	Endosulfan sulfate	ND			
LCS1	Gamma-BHC (Lindane)	0.050	0.055	110.0	(81.57 - 148.43)
MBLK	Gamma-BHC (Lindane)	ND			
MS	Gamma-BHC (Lindane)	0.050	0.056	112.0	(88.58 - 141.42
LCS1	Heptachlor	0.050	0.015	30.0	(60.95 - 145.71)
MBLK	Heptachlor	ND			
MS	Heptachlor	0.050	0.026	52.0	(78.23 - 146.04)
MBLK	Heptachlor Epoxide	ND			
MBLK	Methoxychlor	ND			
LCS1	Tetrachlorometaxylene (surr)	100	74	74.0	(70.00 - 130.00)
MBLK	Tetrachlorometaxylene (surr)	100	88	88.0	
MS	Tetrachlorometaxylene (surr)	100	86	86.0	(70.00 - 130.00)
LCS1	Dibutyl chlorendate (surr)	100	108	108.0	(70.00 - 130.00)
MBLK	Dibutyl chlorendate (surr)	100	92	92.0	
MS	Dibutyl chlorendate (surr)	100	100	100.0	(70.00 - 130.00)
MBLK	Toxaphene	ND			

QC Batch #78034 EPA Method 504.1

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
LCS1	1,2-Dibromo-3-chloropropane	0.10	0.11	110.0	(60.00 - 140.00)	
LCS2	1,2-Dibromo-3-chloropropane	0.10	0.10	100.0	(60.00 - 140.00)	9.5
MBLK	1,2-Dibromo-3-chloropropane	ND				
MS	1,2-Dibromo-3-chloropropane	0.10	0.09	90.0	(60.00 - 140.00)	
LCS1	1,2-Dibromoethane	0.10	0.10	100.0	(60.00 - 140.00)	

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LCS2	1,2-Dibromoethane	0.10	0.10	100.0	(60.00 - 140.00)	0.00
MBLK	1,2-Dibromoethane	ND				
MS	1,2-Dibromoethane	0.10	0.09	90.0	(60.00 - 140.00)	
LCS1	1,2,3-Trichloropropane	1.00	1.15	115.0	(60.00 - 140.00)	
LCS2	1,2,3-Trichloropropane	1.00	0.99	99.0	(60.00 - 140.00)	15
MBLK	1,2,3-Trichloropropane	ND				
MS	1,2,3-Trichloropropane	1.00	0.93	93.0	(60.00 - 140.00)	
DUP	1,2,3-Trichloropropane	0.27	0.28		(0.00 - 20.00)	3.6
DUP	Spiked sample	Lab # 98	0513115		(0.00 - 0.00)	
MS	Spiked sample	Lab # 98	0513116		(0.00 - 0.00)	
DUP	Dibromochloropropane (DBCP)	ND	ND		(0.00 - 20.00)	
DUP	Ethylene Dibromide (EDB)	0.02	0.03		(0.00 - 20.00)	40.0
DUP	1,2-dibromopropane (surr)	100	102		(60.00 - 140.00)	102.0
LCS1	1,2-dibromopropane (surr)	100	113	113.0	(60.00 - 140.00)	
LCS2	1,2-dibromopropane (surr)	100	102	102.0	(60.00 - 140.00)	10
MBLK	1,2-dibromopropane (surr)	100	97	97.0		
MS	1,2-dibromopropane (surr)	100	94	94.0	(60.00 - 140.00)	

QC Batch #78039

Nitrate plus Nitrite by RFA

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	Lab # 98	0513115		(0.00 - 0.00)	
LCS1	Nitrate plus Nitrite by RFA	5	4.8	96.0	(80.00 - 120.00)	
LCS2	Nitrate plus Nitrite by RFA	5	4.9	98.0	(80.00 - 120.00)	2.1
MBLK	Nitrate plus Nitrite by RFA	ND				
MS	Nitrate plus Nitrite by RFA	5	5.3	106.0	(80.00 - 120.00)	
MSD	Nitrate plus Nitrite by RFA	5	5.3	106.0	(80.00 - 120.00)	0.00

QC Batch #78053

Herbicides by 515.1

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
MBLK	2,4,5-T	ND				
LCS1	2,4,5-TP (Silvex)	0.50	0.47	94.0	(67.00 - 120.00)	
MBLK	2,4,5-TP (Silvex)	ND				

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MS	2,4,5-TP (Silvex)	0.50	0.47	94.0	(42.00 - 226.00)
LCS1	2,4-D	1.00	0.91	91.0	(72.00 - 127.00)
MBLK	2,4-D	ND			
MS	2,4-D	1.00	0.92	92.0	(49.00 - 214.00)
MBLK	2,4-DB	ND			
MBLK	Dichlorprop	ND			
MS	Spiked sample	Lab # 98	0514057		(0.00 - 0.00)
MBLK	Acifluorfen (qualitative)	ND			
LCS1	Bentazon	1.00	1.10	110.0	(75.00 - 134.00)
MBLK	Bentazon	ND			
MS	Bentazon	1.00	0.96	96.0	(70.00 - 170.00)
LCS1	Dalapon (qualitative)	6.50	5.96	91.7	(40.00 - 160.00)
MBLK	Dalapon (qualitative)	ND			
MS	Dalapon (qualitative)	6.50	5.64	86.8	(40.00 - 160.00)
MBLK	3,5-Dichlorobenzoic acid	ND			
MBLK	DCPA	ND			
LCS1	Dicamba	0.50	0.48	96.0	(38.00 - 232.00)
MBLK	Dicamba	ND			
MS	Dicamba	0.50	0.44	88.0	(38.00 - 232.00)
MS	Dinoseb	1.00	0.57	57.0	(0.00 - 85.00)
LCS1	Dinoseb	1.00	0.0	0.0	(0.00 - 85.00)
MBLK	Dinoseb	ND			
LCS1	Pentachlorophenol	0.50	0.44	88.0	(36.00 - 224.00)
MBLK	Pentachlorophenol	ND			
MS	Pentachlorophenol	0.50	0.45	90.0	(36.00 - 224.00)
LCS1	Picloram	0.50	0.40	80.0	(45.00 - 138.00)
MBLK	Picloram	ND			
MS	Picloram	0.50	0.43	86.0	(45.00 - 138.00)
MBLK	4-Nitrophenol (qualitative)	ND			
LCS1	2,4-Dichlorophenylacetic acid	100	93	93.0	(70.00 - 130.00)
MBLK	2,4-Dichlorophenylacetic acid	100	91	91.0	
MS	2,4-Dichlorophenylacetic acid	100	96	96.0	(70.00 - 130.00)

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QC Batch #78108 Calcium, Total, ICAP

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
LCS1	Calcium, Total, ICAP	50	45.2	90.4	(90.00 - 110.00)	
LCS2	Calcium, Total, ICAP	50	49.7	99.2	(90.00 - 110.00)	9.5
MBLK	Calcium, Total, ICAP	ND				
MS	Calcium, Total, ICAP	50	45.2	90.4	(80.00 - 120.00)	
MSD	Calcium, Total, ICAP	50	45.5	91.0	(80.00 - 120.00)	0.66

QC Batch #78213 ICPMS Metals

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
LCS1	Arsenic, Total, ICAP/MS	20	20.1	100.5	(85.00 - 115.00)	
MBLK	Arsenic, Total, ICAP/MS	ND		0.0		
LCS1	Barium, Total, ICAP/MS	100	103	103.0	(85.00 - 115.00)	
MBLK	Barium, Total, ICAP/MS	ND		0.0		
LCS1	Beryllium, Total, ICAP/MS	5	4.70	94.0	(85.00 - 115.00)	
MBLK	Beryllium, Total, ICAP/MS	ND		0.0		
LCS1	Cadmium, Total, ICAP/MS	20	20.5	102.5	(85.00 - 115.00)	
MBLK	Cadmium, Total, ICAP/MS	ND		0.0		
LCS1	Chromium, Total, ICAP/MS	100	102	102.0	(85.00 - 115.00)	
MBLK	Chromium, Total, ICAP/MS	ND		0.0		
LCS1	Copper, Total, ICAP/MS	100	101	101.0	(85.00 - 115.00)	
MBLK	Copper, Total, ICAP/MS	ND		0.0		
LCS1	Nickel, Total, ICAP/MS	50	49.4	98.8	(85.00 - 115.00)	
MBLK	Nickel, Total, ICAP/MS	ND		0.0		
LCS1	Lead, Total, ICAP/MS	20	18.6	93.0	(85.00 - 115.00)	
MBLK	Lead, Total, ICAP/MS	ND		0.0		
LCS1	Antimony, Total, ICAP/MS	50	48.5	97.0	(85.00 - 115.00)	
MBLK	Antimony, Total, ICAP/MS	ND		0.0		
LCS1	Selenium, Total, ICAP/MS	20	20.3	101.5	(85.00 - 115.00)	
MBLK	Selenium, Total, ICAP/MS	ND		0.0		
LCS1	Thallium, Total, ICAP/MS	20	18.5	92.5	(85.00 - 115.00)	

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MBLK	Thallium, Total, ICAP/MS	ND	0.0	

QC Batch #78380 Diquat and Paraquat

QC	Analyte	Spiked	Recovered	Yield (%)	Limits (%)	RPD (%)
MS	Spiked sample	0514062	ND		(0.00 - 0.00)	
LCS1	Diquat	10.0	9.70	97.0	(70.00 - 130.00)	
MBLK	Diquat	ND				
MS	Diquat	10.0	8.81	88.1	(70.00 - 130.00)	
LCS1	Paraquat	10.0	9.22	92.2	(70.00 - 130.00)	
MBLK	Paraquat	ND				
MS	Paraquat	10.0	8.42	84.2	(70.00 - 130.00)	

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Criteria for MS and DUP are not applicable for ICR monitoring.