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AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
MO'IKEHA BUILDING, SUITE 275
LIHU'E, KAUA'I, HAWAI'I 96766

January 11, 2001

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

Dear Ms. Salmonson:

SUBJECT: FINAL ENVIRONMENTAL ASSESSMENT FOR
WAIMEA WASTEWATER TREATMENT PLANT BACKUP
EFFLUENT INJECTION WELL

The County of Kauai reviewed the final Environmental Assessment for the subject project and determined that this project will not have significant environmental effects and issued a Finding Of No Significant Impact. Please publish this notice in your next Bulletin.

Submitted under separate cover by our consultant, Austin, Tsutsumi & Associates, Inc., is a completed OEQC Bulletin Publication Form and four copies of the final EA. Please contact Mr. Ivan Nakatsuka of Austin, Tsutsumi, & Associates, Inc. at (808) 533-3646 if you have any questions.

Very truly yours,

CESAR C. PORTUGAL
County Engineer

HF

cc: Austin, Tsutsumi & Associates, Inc.

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2001-02-08-KA-FEA-

WAIMEA WASTEWATER TREATMENT PLANT BACKUP INJECTION WELL FINAL ENVIRONMENTAL ASSESSMENT

Waimea, Kauai, Hawaii
TMK: 1-2-06:37

December 6, 2000

Prepared for:

COUNTY OF KAUAI
Department of Public Works

Austin, Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-5031
Telephone: (808) 533-3646
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Honolulu • Wailuku, Hawaii

WAIMEA WASTEWATER TREATMENT PLANT
BACKUP INJECTION WELL
FINAL ENVIRONMENTAL ASSESSMENT
Waimea, Kauai, Hawaii
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WAIMEA WASTEWATER TREATMENT PLANT
BACKUP INJECTION WELL
FINAL ENVIRONMENTAL ASSESSMENT

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APPENDICES

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

TED S. KAWAHIGASHI, P.E., FACEC
KENNETH K. KUROKAWA, P.E.
DONOHUE M. FUJII, P.E.
STANLEY T. WATANABE
TERRANCE S. ARASHIRO, P.E.
MERNA S. KIBE

WAIMEA WASTEWATER TREATMENT PLANT

BACKUP INJECTION WELL

FINAL ENVIRONMENTAL ASSESSMENT

I. EXECUTIVE SUMMARY

A. Applicant

The Applicant for the proposed project is the County of Kauai, Department of Public Works. The contact person for the County is:

Mr. Harry Funamura
Division of Wastewater Management
Department of Public Works
County of Kauai
4444 Rice Street, Suite 500
Lihue, Kauai, Hawaii 96766
Phone: (808) 241-6610

B. Agencies Consulted

1. Safe Drinking Water Branch
   Department of Health
   State of Hawaii
   919 Ala Moana Boulevard, #308
   Honolulu, Hawaii 96814

2. Wastewater Branch
   Department of Health
   State of Hawaii
   919 Ala Moana Boulevard, #309
   Honolulu, Hawaii 96814

REPLY TO:
501 SUMNER STREET, SUITE 521 • HONOLULU, HAWAII 96817-5031
PHONE (808) 533-3646 • FAX (808) 526-1267 • EMAIL: atahnl@earthlink.net

OFFICES IN:
HONOLULU, HAWAII
WAILUKU, MAUI, HAWAII

3. State Historic Preservation Division
Land and Natural Resources Department
State of Hawaii
5532 Tapa Street
Koloa, Kauai, Hawaii 96756

4. Office of Hawaiian Affairs
State of Hawaii
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813

5. National Marine Fisheries Service
Southwest Region
Pacific Islands Area Office
1601 Kapiolani Boulevard, Suite 1110
Honolulu, Hawaii 96814-0047

6. Kikiaola Land Company, Ltd.
P.O. Box 367
Waimea, Kauai, Hawaii 96796

C. References

1. State of Hawaii, Hawaii Revised Statutes, Chapter 343, "Environmental Impact Statements".

2. State of Hawaii, Hawaii Administrative Rules, Title 11, Department of Health, Chapter 200, "Environmental Impact Statement Rules".

3. "A Guidebook for the Hawaii State Environmental Review Process", October 1997, prepared by the Office of Environmental Quality Control (OEQC), State of Hawaii.

4. "Applicant SRF Manual (Procedures to Participate in the Hawaii State Revolving Fund Load Program)", June 1995 (Revised March 1999), prepared by the Hawaii Department of Health, Wastewater Branch.

D. Required Permits

1. Department of Health (DOH) Underground Injection Control (UIC) Permit Application – the UIC Permit Application has been submitted to DOH for their approval.

2. DOH, National Pollutant Discharge Elimination System (NPDES) permits – permits for construction dewatering effluent, and treated process wastewater associated with well drilling activities, will most likely be required. These permits will be submitted to DOH for approval by the well drilling contractor prior to start of construction of the project.

3. County of Kauai Planning Commission Use Permit Application – this permit application will be submitted to the Planning Commission for approval prior to construction of the project.

E. Landowner

The landowner of the parcels for the existing Waimea Wastewater Treatment Plant (WWTP) and the site for the proposed injection well which is the same as for Wastewater Pump Station (WWPS) 'A' is the County of Kauai. The proposed effluent line from the WWTP to the injection well will be within an existing 20-foot wide easement in favor of the County.

F. *Project Location and Description*

The proposed project is located in the Waimea-Kekaha region on the southwestern portion of the island of Kauai. The Tax Map Keys for the Waimea WWTP and WWPS 'A' are, respectively, 1-2-06:36 and 1-2-06:37. WWPS 'A' abuts the mauka edge of Kaumualii Highway, and the WWTP is approximately 800 feet mauka of WWPS 'A'.

The surrounding area is primarily owned by Kikiaola Land Company, Ltd. (Kikiaola), and is currently used for cultivating seed corn under lease agreements.

G. History of Project

Historically, the primary method of effluent disposal has been irrigation reuse. The effluent is discharged into Kikiaola's lower of two existing reservoirs. Kikiaola's upper reservoir receives water from an irrigation ditch and storm water that enters the upper reservoir during rain events. Water from the upper reservoir is then discharged into the lower reservoir, where it is mixed with the effluent, prior to use as irrigation water. In 1994, several alternatives for disposal and reuse of the Waimea WWTP effluent were evaluated based on the anticipated cessation of discharging effluent into Kikiaola's reservoir and the uncertainty of continued reuse by Kekaha Sugar. The evaluation

concluded that two injection wells should be utilized for primary disposal of the effluent. Accordingly, ATA prepared an environmental assessment (EA) report, "Waimea Wastewater Treatment Plant Effluent Injection Wells Final Environmental Assessment," dated May 2, 1995. It should be noted that this 1995 EA and accompanying report by Mink & Yuen, Inc. (included in Appendix A of this report) were based on drilling a deep well only. The alternative of drilling a shallow well was not considered at that time, because of the concern that shallow injection would impact coastal waters, and that in all likelihood this option would not be acceptable to DOH.

The 1995 EA was submitted to the Department of Health (DOH) Office of Environmental Quality Control (OEQC) with a negative declaration, as determined by the County. OEQC published a finding of no significant impact (FONSI) for the injection wells in their May 23, 1995 bulletin. A FONSI determination allows the project to proceed without further study. Subsequently, a Use Permit Application for the proposed injection wells was submitted to the County of Kauai Planning Commission for approval. However, the commission denied the Use Permit Application for the injection wells in August 1995, based on concerns about environmental impacts to groundwater and near-shore coastal waters. The commission also expressed a desire to have reuse options explored further. Therefore, although the County had declared a FONSI for the injection wells, the project was suspended in August of 1995.

Since that time, the County of Kauai and Kikiaola have executed a "Wastewater (Domestic) Reuse for Existing Projects (WREP) Survey of Irrigation Plan Form", for management of the treated effluent currently being disposed into Kikiaola's effluent reservoirs. An agreement between the County and Kikiaola to provide for the disposal of treated effluent according to the WREP Plan has also been executed. This agreement expires on December 31, 2002. However, the County is negotiating with Kikiaola to extend this agreement.

H. Proposed Action

The primary method of effluent disposal will be continued discharge into Kikiaola's reservoir for storage prior to use as irrigation water. However, the reservoir does not have adequate capacity to act as a backup to the irrigation system, as required by DOH. Consequently, DOH sent Kikiaola an informal notice of violation regarding the inadequacy of the current effluent disposal system. Therefore, the proposed action is to

construct one effluent injection well, which will be used for backup disposal of treated effluent from the Waimea WWTP.

The injection well will only be used when Kikiaola is unable to accept disposal of the treated effluent in their reservoir, e.g., due to rainy weather, when irrigation with the effluent would not be practical. If, in the future, Kikiaola ceases irrigation reuse for a prolonged period of time (or permanently), a new primary method of disposal for the effluent would have to be established, which would most likely require preparation of a new EA. It should be reiterated that this EA is based on the injection well being utilized as a backup disposal method for the effluent. Using the well as a primary effluent disposal method is not being considered as part of this EA.

Two alternatives for the injection well are now being considered. The alternative of drilling a shallow well was recently discussed with the DOH Clean Water Branch and Safe Drinking Water Branch. DOH did not express any serious concerns regarding a shallow well at that time. Therefore, the first alternative (Alternative A) would involve drilling a shallow well (less than 400 feet deep) in the caprock, for effluent injection *above the Napali basalt aquifer.* The caprock will be tested during well drilling to determine if there is a shallow formation that can successfully receive the effluent. If testing determines that there are no shallow layers of material adequate for effluent injection, then the second alternative (Alternative B) would involve drilling the well 600± feet into the basalt aquifer for effluent injection.

The backup well will be located at the site of the existing WWPS 'A', and will have a proposed maximum discharge capacity of 1,000,000 gallons per day (gpd). This discharge rate would accommodate diurnal and seasonal variations in flow of relatively short duration. The proposed average discharge capacity will be 300,000 gpd, which is the same as the average capacity of the WWTP. The well head will have valves and appurtenances to allow for backflushing with a portable air compressor.

A proposed 12-inch pipe along the existing dirt road between the WWTP and WWPS 'A' will convey disinfected secondary effluent from the WWTP to the backup injection well. This pipe will be buried at least three feet below grade.

If the injection well is drilled into the basalt aquifer (Alternative B), then a monitoring well will be constructed in the northeast corner of the WWTP. This well would

be used to monitor any upgradient migration of the effluent plume. If a shallow injection well is drilled (Alternative A), then a monitoring well will not be necessary.

I. Determination

The primary disposal method for the effluent will continue to be irrigation reuse. As mentioned previously, the existing reservoir does not have adequate storage for the effluent. Therefore, construction of the injection well will provide a reliable backup means of effluent disposal from the existing Waimea WWTP in the event that the effluent cannot be discharged to the existing effluent reservoir prior to being used for irrigation.

The majority of the work will be done at the injection well site, which is the parcel for the County's WWPS 'A' and at the monitoring well site, which is at the WWTP. The project will also involve installation of 800± feet of pipeline along the dirt road from the WWTP to the injection well site.

The "Significance Criteria", Section 12 of the Hawaii Administrative Rules, Title 11, Chapter 200, "Environmental Impact Statement Rules", were reviewed and analyzed to determine whether the proposed project will have significant impacts to the environment.

The most significant concern is the impact of the injected effluent on the groundwater and coastal water. Injecting effluent into the caprock above the basalt aquifer (Alternative A) could result in nearshore discharge of the effluent. However, the injection well will be used for backup purposes only, when the reservoir is unable to accept the effluent from the WWTP, due to wet weather. The times that the well will be used will be during storm conditions, when significant volumes of stormwater runoff would be discharging into the ocean. Therefore, the potential impact to the coastal water from the effluent is expected to be negligible compared to the impact of this runoff. Separating and determining the potential impact of the injected effluent on the coastal water, versus negative impacts from typical storm runoff, would be extremely difficult – if not impossible – to determine or quantify.

Injection of the effluent below the caprock (Alternative B) should result in the effluent moving makai, and eventually discharging into the overlaying sedimentary caprock over a wide area and distance to approximately 6,000 feet offshore. During passage of the effluent through the caprock, the effluent will mix with ambient formation water having the salinity of sea water and become highly diluted. Therefore, there should be no

resultant impact on the coastal water. There should also be no negative impact on the groundwater. Although there will be a plume of effluent generated at the point of injection, the flow to the well will be sporadic since the well will be used for backup purposes only. For occasional flows of 300,000 gpd, the plume can be expected to extend less than a distance of 160 feet. A monitoring well located in the northeast corner of the Waimea WWTP, approximately 1,000 feet upgradient from the injection well, would detect whether groundwater quality is affected by the effluent injection beyond this calculated "stagnation point" for the plume.

Neither the shallow nor deep injection well alternatives are expected to have any significant impact on existing wildlife or recreation usage of the coastal water.

II. DESCRIPTION OF PROPOSED PROJECT

Presently, the primary method of effluent disposal is irrigation reuse. The effluent is discharged into Kikiaola's lower of two existing reservoirs. Kikiaola's upper reservoir receives water from an irrigation ditch and storm water that enters the upper reservoir during rain events. Water from the upper reservoir is then discharged into the lower reservoir, where it is mixed with the effluent, prior to use as irrigation water. DOH requires that all reuse irrigation systems have a backup disposal method for the effluent, either a storage reservoir or an injection well. Kikiaola's reservoir acts as backup storage to the primary method of effluent disposal, which is the irrigation system. Unfortunately, the reservoir does not have adequate storage, and Kikiaola has been sent an informal notice of violation from the DOH. Therefore, the County of Kauai Department of Public Works proposes to construct an injection well for backup disposal of disinfected secondary effluent from the County's existing Waimea Wastewater Treatment Plant (WWTP).

However, the importance of continued use of Kikiaola's reservoir should be stressed, since it is anticipated that the backup injection well will rarely have to be utilized, as long as the reservoir is available for storage of the effluent. The number of days which the well would be utilized if the reservoir is not available for storage purposes cannot be easily determined. However, DOH reuse guidelines state that a time period of 20 days be used to determine the required storage volume of a backup reservoir. Therefore, applying the same guidelines to a backup injection well, an assumption can be made that the number of days that the well would be used would be 20 days per year.

The primary components of the backup disposal system will be:

- Backup injection well within the parcel for the County's existing Wastewater Pump Station (WWPS) 'A'. (See Exhibits 1 and 2 for maps and Exhibit 3 for site plan.) The well will have a 14-inch diameter casing.
- Approximately 800 feet of 12-inch effluent line along the existing dirt road between the WWTP and WWPS 'A'. This pipe will be buried at least three feet below grade.
- A monitoring well located in the northeast corner of the Waimea WWTP, if a deep injection well is drilled into the basalt aquifer.

If the backup well is utilized, the proposed average discharge rate into the injection well will be 300,000 gallons per day (gpd), which is the same as the average capacity of the WWTP. The proposed maximum discharge rate is 1.0 million gallons per day (mgd). The proposed maximum capacity of the injection wells stated in the previous 1995 EA was 1.2 mgd. This rate of 1.2 mgd was based on applying a peak factor of 2.0 to an average future flow rate of 600,000 gpd from an expanded WWTP. However, flow records for the WWTP indicate that the highest influent flow was 994,000 gpd, which occurred on January 21, 1990 during a severe rain event. There have also been several other flows that were approaching or higher than 920,000 gpd. Based on these high flows, the previous peak factor of 2.0 does not appear to be justified.

It should be noted that Mink & Yuen, Inc., consultant hydrogeologists, based their August 1993 report, which is included in Appendix A, on the previously proposed flow rate of 1.2 mgd. Therefore, the conclusions of Mink & Yuen's report is conservative in its application to the reduced maximum discharge rate of 1.0 mgd.

The backup injection well, with a capacity of 1.0 mgd, will be able to accommodate diurnal and seasonal variations in the flow from the WWTP, based on an average flow rate of 300,000 gpd. However, any future expansion of the WWTP may require drilling additional wells. Also, if the injection well is determined to have a capacity of less than 1.0 mgd (after testing), then an additional well will need to be drilled.

Two alternatives for the backup injection well are being considered. The first alternative (Alternative A) would involve drilling a shallow well (less than 400 feet deep) into the caprock for effluent injection above the Napali basalt aquifer. The caprock will be tested during well drilling to determine if there is a shallow formation that can successfully receive the effluent. If testing determines that there are no shallow layers of material adequate for effluent injection, then the second alternative (Alternative B) would involve drilling 600± feet into the basalt aquifer for effluent injection.

Mink & Yuen's August 1993 report (included in Appendix A) addresses only a deep well. They have recently been consulted to determine the feasibility of developing a shallow injection well. (Various correspondence regarding construction of a deep or shallow well are included in Appendix B.) Their conclusions are summarized in the following discussion:

The sedimentary sequence at the proposed injection well site is unknown, except for the uppermost layer. The nearest well with a lithology log is at the Kekaha Mill (Well 5812-01), which

is two miles to the west of the proposed will site. From well logs throughout the Mana Plain, the caprock stratigraphic succession appears to be as follows:

Depth (ft)	Material	Thickness (ft)
0-60	Coralline	60
60-110	Clay	50
110-125	Sand/coral	15
125-205	Clay	80
205-220	Sand/coral	15
220-400	Clay	180
>400	Basalt	

This sequence of material is similar to that of southern Oahu, for which the nomenclature in the Ewa Plain is as follows:

Material	Thickness (ft)
Limestone 1	100
Clay aquitard 1	40
Limestone 2	20-40
Clay aquitard 2	
Basalt	

If the similarity between the Ewa Plain and the Mana Plain holds, then the second sand/coral layers (similar to limestones 1 and 2) would be possible layers for effluent injection.

DOH requirements state that injection is not allowed where the groundwater has a concentration of 5,000 mg/l total dissolved solids (TDS) or less. Mink & Yuen's August 1993 report is based on the EPA requirement of 10,000 mg/l TDS. However, the lower value of 5,000 mg/l, stipulated by DOH, does not compromise the selection of the well site. Mink & Yuen states in their report, "To avoid the 10,000 TDS isoconcentration, wells will have to be more than 500 feet deep." Therefore, construction of a shallow well appears to contradict this statement. The following discussion addresses this apparent conflict.

Water in the upper caprock stratum will likely have a TDS content of less than 10,000 mg/l, although there is no data to verify this assumption. If caprock aquifers beneath the first clay layer are discovered, their TDS content will likely exceed 10,000 mg/l. However, aquifers in the caprock are not considered suitable for development for domestic use, even if the TDS content is less than 10,000 mg/l. In the Ewa Plain of southern Oahu, water in the upper limestone layer has TDS of 2,000 mg/l or less, but arrangements are being made for injecting effluent into this aquifer.

Criteria for determining whether or not the caprock is adequate for effluent injection will follow from examination of the drill cuttings and the results of pumping and injection tests. The selected stratum will have to have sufficient permeability, storativity and thickness to accept at least 1.0 mgd of effluent that will drain by gravity alone. The rate of injection that a layer would be able to sustain depends on the thickness of the layer, hydraulic conductivity, effective porosity and extent.

To test the sand/coral layer, or a deeper coralline layer, for injection capacity, standard tests should be performed. A 4-hour step-drawdown test at rates of 250 gallons per minute (gpm), 500 gpm, 750 gpm and 1000 gpm, each sustained for an hour, followed by a constant rate test over 8 hours at 750 gpm should be conducted. If the pump test indicates that the formation is acceptably permeable, gravity injection at rates of 750 gpm and 1000 gpm should be performed. The results from these tests will determine the allowable rate of injection and the head which the injection will create in the well bore. The proposed action is to discharge effluent into the injection well by gravity only, i.e., not by pumping.

If injection of the effluent into the caprock is not feasible, then the well will be drilled approximately 600 feet into the basalt aquifer (Alternative B). The upper 400± feet in the caprock would have a solid casing, grouted into the caprock, and the lower 200± feet in the Napali basalt would have an open boring. (See Exhibit 4 for well elevation section.)

A concern raised during the review of the previous EA was that there was no data on the injection capacity of nearby wells. The following is Mink & Yuen's response to this comment. (It should be noted that this comment was based on drilling a deep well.)

The Napili basalt is highly permeable and wells can be developed to yield several mgd each. An aquifer responds to injection in the same ways it does to pumping. Pump capacity data and length of penetration into the Napali basalt for wells listed on page 17 of Mink & Yuen's August 1993 report are as follows:

Well	Pump Capacity (mgd)	Napali Basalt (ft)
5842-01	N/A	87
0044-23	3.02	53
0044-14	2.30	82
0045-03	2.30	71
0145-22	2.45	87
0145-23	2.30	90
0145-24	2.30	113
0146-04	N/A	117
0245-01	N/A	83

Napili wells are capable of yielding twice the proposed injection rate for a length of penetration less than half that proposed.

The injection well will include an airline within the well casing, extending from the well head to the bottom of the casing. A portable compressor will be mobilized at the well site, and high-pressure air will be injected to scour the solids buildup on the well surface. This procedure will also result in air-lifting of the scoured solids to the well head, at which point the waste product would be discharged into the wet well of the adjacent existing pump station, via a proposed standpipe with connected flexible hose. The waste would then be pumped – like the normal domestic wastewater entering the pump station – to the existing Waimea WWTP for treatment. It is proposed that this backflushing program be conducted on an as needed basis as a preventive maintenance measure. The well head piping will also include provisions for addition of caustic to allow for chemical cleansing of the well.

This type of air scouring/lifting maintenance/rehabilitation program for injection wells is being practiced at Maui County's three major WWTPs and at the Waimanalo WWTP on Oahu.

III. DESCRIPTION OF EXISTING ENVIRONMENT

A. Land Ownership

The project is located in the Waimea-Kekaha region on the southwestern portion of the island of Kauai. The majority of the land surrounding the project is owned by Kikiaola (Tax Map Keys: TMK: 1-2-06:3, 9, 41 and 42). Land owned by the County is limited to the sites for the Waimea WWTP (TMK: 1-2-06:36) and WWPS 'A' (TMK: 1-2-06:37). (See Exhibit 5.)

Areas mauka of Kaumualii Highway consist primarily of cultivated seed corn. The fields are divided by dirt roads and drainage ditches.

Parcel 42, the 42-acre area makai of the highway, is presently the site of a small resort development owned by Kikiaola called Plantation Cottages. Parcel 3 is presently being leased to Northrup King Co. for seed corn cultivation, and the remaining portion of the area makai of the highway consists primarily of wasteland with grass and shrubs.

Land uses of property farther east (2000+ feet) and west (5000+ feet) include residential and government activities. The Pacific Ocean is to the south, while to the north is the sloping lower mountains which extend northward to Kokee.

The State Land Use Commission and the County Planning Department have different land use classifications for the different parcels within the vicinity of the project. (See Table1 for a brief summary.) The Conservation areas of Parcels 3 and 41 are along the shoreline.

TABLE 1. LAND USE CLASSIFICATIONS

PARCEL NUMBER	LAND USE CLASSIFICATION	
	State Land Use Commission	County of Kauai, Planning Department
3	Agricultural Conservation Urban	Project District
9	Agricultural	Project District
41	Agricultural Conservation	Project District; Open
42	Urban	Project District; Open

B. Climate

Temperatures in the Waimea-Kekaha region range from the mid 50's to the low 90's (degrees Fahrenheit), with an average temperature of 75°F. Average daily temperatures vary by about ten degrees between winter and summer and about 15 to 18 degrees between day and night.

Mean annual rainfall recorded at Station 944.00 from 1916 to 1983 amounted to 21.77 inches. (See Exhibit 2 for location of Station.) The distribution of rainfall from month to month varies from heavy rainfalls at times to very light at others. Winter months typically have the most rainfall.

The mean annual pan evaporation recorded at Station 944.00 from 1960 to 1983 amounted to 73.53 inches. Summer months typically have the highest evaporation rates. Table 2 summarizes the mean monthly precipitation and pan evaporation for Station 944.00.

TABLE 2. MEAN MONTHLY PRECIPITATION AND PAN EVAPORATION AT STATION 944.00

MONTH	PRECIPITATION[1] (inches)	PAN EVAPORATION[2] (inches)
January	4.17	4.54
February	2.48	4.98
March	2.44	6.31
April	1.42	6.67
May	0.98	7.07
June	0.47	7.29
July	0.51	7.59
August	0.75	7.55
September	0.79	6.82
October	1.89	5.96
November	2.13	4.89
December	3.70	4.15
ANNUAL	21.77	73.53

(1) From "Rainfall Atlas of Hawaii", Report R76, State of Hawaii Department of Land and Natural Resources, June 1986. Years of data include: 1916 to 1983.

(2) From "Pan Evaporation: State of Hawaii, 1894-1983", Report R74, State of Hawaii, Department of Land and Natural Resources, August 1985. Years of data include: 1960 to 1983.

C. Topographic Features

The project is within the Mana Plain, which is characterized by generally flat slopes, with elevations ranging from sea level at the shoreline to about 30 feet mean sea level (msl) at the northern (mauka) boundary. The elevation at the WWTP, approximately 1000 feet mauka of the highway, is about 6 feet msl. The elevation at WWPS 'A' is approximately 9 feet msl.

D. Geology and Soils

The project area is comprised of a sequence of sedimentary strata (caprock) resting on the basement rock of Napali basalt. The caprock varies in depth from 310 feet thick at the Waimea WWTP to 400 feet thick near the Kekaha Sugar Mill. The caprock sediments as a whole are poorly permeable and act as a confining layer on the Napali aquifer. (See Mink & Yuen Inc.'s report in Appendix A for additional information.)

Areas mauka of Kaumualii Highway consist mainly of Kekaha Series soils classified as clay, silty clay and stony silty clay loam. These series consist of well-drained soils with moderate permeability and zero to moderate erosion hazard. (See Exhibit 6 for soils maps based on information published by the U.S. Soils Conservation Service (SCS) for the Islands of Oahu, Kauai, Maui, Molokai, Lanai and Hawaii, in 1972.)

The area between the Department of Health's Underground Injection Control (UIC) Line and the highway is mostly filled land, which consists primarily of bagasse and slurry from sugar mills. This land type is not in a capability classification. Therefore, permeability and the amount of erosion are not provided by the SCS. However, information obtained from Kekaha indicates that the soil consists of a poorly drained, heavy clay, with a depth ranging from 3 to 6 feet.

The WWTP is in the Nohili Clay area. Although WWPS 'A' and the dirt road between this pump station and the WWTP is in filled land, the road and pump station site itself have not been areas for bagasse/slurry disposal since their establishment over 20 years ago.

E. Floods and Tsunamis

The National Flood Insurance Program publishes Flood Insurance Rate Maps for the State of Hawaii which designate areas of flood hazard. (See Exhibit 7.) A large portion of the study area mauka of Kaumualii Highway, including the WWTP and WWPS 'A' sites, are in a Special Flood Hazard Area inundated by 100-year floods with base flood elevations of eight and nine feet, respectively. However, except for the wellhead valves and appurtenances, the components for the project will be totally below grade. The exposed well head piping will not be subject to damage when flooding occurs at the WWPS 'A' site.

F. Flora and Fauna

Vegetation in the immediate vicinity of the project is primarily seed corn, common grass and weeds. There are no known rare, threatened or endangered plant species in the vicinity of the project.

The areas to be disturbed by construction WWTP site, WWPS 'A' site and the dirt road between these two sites are totally cleared and, except for minimal grassed areas within the WWTP site to be disturbed, are devoid of any vegetation.

Avifauna and mammals common to the project area are typical of species found in cane fields. There are no known endangered or threatened wildlife species in the vicinity of the project.

G. Archaeological Resources

The project site is fully cleared and the areas to be disturbed have been utilized for years as County Wastewater facilities, or well-traveled access ways for these facilities. Therefore, surface archaeological resources should not be encountered at the project site.

H. Air Quality

The rural setting of the project area precludes exposure to adverse air quality conditions. There are no fixed sources of emission in the area, although harvesting activities may effect levels of carbon monoxide and suspended particulate matter. However, these conditions are intermittent and of temporary duration.

I. Water Quality

Information on the drinking water system in the area of the proposed backup injection well is not easily available. The nearest drinking water wells, State Well Nos. 5840-01 and 5840-02, are 0.9 mile and 0.75 mile upgradient of the proposed injection site, respectively. Due to the distance between the injection site and the water wells, variations in groundwater quality between the two sites may differ significantly. Therefore, information on the water system may not represent accurate groundwater quality at the injection site, and hence, is not included in this report.

The ambient water quality of nearby irrigation wells which tap the basalt aquifer is presented in Table 3. At these irrigation wells, the groundwater has a concentration of less than 10,000 mg/l TDS. However, the injection well site is downgradient of these

wells, and is located where the TDS of the groundwater is expected to be much greater than 10,000 mg/l.

TABLE 3. AMBIENT WATER QUALITY OF IRRIGATION WELLS

Chemical Constituent	Well 0044-02 USGS – 11/3/72	Well 0044-10 USGS – 11/3/72	Well 5842-02 DOH – 9/11/72
SiO_2	75	72	39
Ca	270	420	29
Mg	390	560	32
Na	650	720	60
K	8.8	10	3.6
HCO_3	160	1134	180
SO_4	257	396	24
Cl	2,350	3,200	130
NO_3	4.5	2.9	--
Ph	--	7.8	--

J. Noise Characteristics

The primary fixed noise generator in the vicinity is the WWTP, primarily the positive displacement blowers. Other background noise can be attributed to traffic along Kaumualii Highway.

K. Community Setting

The project area is located in the Waimea-Kekaha region of Kauai. The population has remained stable in this region over the past several years, as evidenced by no significant increase in wastewater flow to the Waimea WWTP during this period. Although some development by Kikiaola in the existing Waimea service areas is anticipated within the next few years, the treatment capacity of the existing treatment plant includes allocation of flows for these developments. Therefore, the additional wastewater generated from these developments shouldn't exceed the current reserve capacity of the

WWTP such that expansion of the WWTP, beyond its current capacity of 300,000 gpd, is required. However, any wastewater generated by new developments outside of the existing service area – which is to be treated at the WWTP – would require a plant expansion.

L. Infrastructures

Kaumualii Highway is the major route serving the Waimea-Kekaha region. WWPS 'A' abuts the mauka edge of the highway, and the dirt road which defines the alignment of the proposed effluent line – provides access to the WWTP from the highway.

There is water and electrical service to both WWPS 'A' and the WWTP. There is no drainage system, other than the irrigation ditches within the surrounding fields.

IV. DESCRIPTION OF EXISTING WASTEWATER SYSTEM

The Waimea WWTP, which treats domestic wastewater generated in Waimea, was constructed in 1972. The collection system for the service areas was constructed in four phases from 1972 through 1983. All of the flow is pumped to the WWTP from WWPS 'A'. The effluent from the WWTP is discharged into Kikiaola's lower of two existing reservoirs. Water from Kikiaola's upper reservoir – which receives water from an irrigation ditch and storm water – discharges into the lower reservoir, where it is mixed with the effluent, prior to use as irrigation water. (See Exhibit 8 for extent of service area and locations of WWTP, WWPS 'A' and effluent reservoirs

The first, and current, phase of the treatment plant was designed for an average wastewater flow of 300,000 gallons per day (gpd). The WWTP included a standard two-tank system with a capacity of 300,000 gpd, which allowed for a 10% increase in wastewater flow. The two tanks allowed for partial treatment of the wastewater during emergencies when one tank might be taken off-line.

Treatment process of the wastewater includes comminuting and degritting, aeration, final settling and then chlorination. The chlorinated effluent is then pumped to the effluent reservoirs. The sludge is routed to the aerated sludge holding tank, for stabilization, and subsequently pumped to the sludge drying beds for dewatering. Exhibits 9 and 10 show the existing Waimea WWTP site plan, and the Waimea WWTP hydraulic profile, respectively. Design data for the existing WWTP are presented in Table 4.

Allowances were made for future expansion of the WWTP of up to 600,000 gpd to accept future flows from Waimea as well as wastewater flows from Kekaha Town, which lies less than three miles from the Waimea WWTP. This could be accomplished by installing two more tanks at 150,000 gpd capacity, each. Theoretically, the Waimea WWTP could be expanded to 900,000 gpd by enriching the oxygen supply in the compressed air, should it ever become necessary. However, as of September 1999, the average wastewater influent flow rate has been in the range of 230,000-300,000 gpd, with no monthly average exceeding 300,000 gpd. Furthermore, anticipated near-term (within next 5 years) developments are expected to be within existing service areas. Since the treatment capacity of the existing plant has already been allocated to

existing service areas, these developments should not require expansion of the current Waimea WWTP.

The wastewater treatment plant was designed in accordance with the ASCE - WPF Manual 36 on "Sewage Treatment Plant Design" and the Ten States Standards. The plant was also designed to meet practical requirements of the State and Federal Water Quality Administration Standards.

TABLE 4. TREATMENT PLANT DESIGN DATA

ITEM	QUANTITY
DESIGN POPULATION	3,000
DAILY SEWAGE FLOW PER CAPITA	100 gpd
DESIGN DAILY FLOW	300,000 gpd
DESIGN AVERAGE FLOW RATE	208 gpm
DESIGN MAXIMUM FLOW RATE (PUMP CAPACITY)	1,050 gpm
DESIGN RAW SEWAGE BIOCHEMICAL OXYGEN DEMAND (B.O.D.)	250 mg/l 625 #/day
DESIGN RAW SEWAGE SUSPENDED SOLIDS (S.S.)	200 mg/l 510 #/day
AERATION TANKS:	
DETENTION TIME (TOTAL)	24 hours
VOLUME OF AIR	2,000 cf/#BOD 870 cfm
SETTLING TANKS:	
SURFACE SETTLING RATE	<600 gal/sf/day
WEIR OVERFLOW RATE	<7,000 gal/f/day
RECIRCULATION RATE	>1 to 1
FINAL CLARIFIER DETENTION	>4 hrs.
VOLUME OF AIR (SLUDGE HOLDING TANK)	90 cfm
VOLUME OF HOLDING TANK	3,000 cf
B.O.D. REMOVAL	90 %
B.O.D. IN CLARIFIER EFFLUENT	25 mg/l
AVERAGE CHLORINE DOSAGE	8-10 mg/l
CHLORINE USAGE	25-26 #/day
CHLORINE CONTACT TIME	30 min. +
OVERALL EFFICIENCY	93 %

Recent conditions, and performance, of the WWTP are summarized in Table 5. The effluent flow rate ranged from a minimum of 230,000 gpd to a maximum of 299,000 gpd, with a median of 255,000 gpd, during the period of January 1998 through September 1999. On January 21, 1990 an extremely high influent flow rate of 920,000 gpd was measured at WWPS 'A'. This occurrence was due to a very unusual storm event. There have been only two instances of plant influent flows higher than, or approaching, 920,000 since 1990. (The highest flow was 994,000 gpd.) However, both instances involved unusual circumstances (i.e., power failure and a check valve stuck open).

The effluent is of high quality with both the Biochemical Oxygen Demand (BOD) and the Total Suspended Solids (TSS) well below 10 mg/l, and most of the time, below 5 mg/l.

TABLE 5. CURRENT FLOW RATES AND CHEMICAL CHARACTERISTICS OF INFLUENT WASTEWATER AND EFFLUENT

PARAMETER	1998											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
FLOW												
Influent (mgd)	.236	.236	.244	.247	.244	.252	.266	.269	.273	.270	.266	.265
Effluent (mgd)	.241	.230	.239	.239	.242	.262	.255	.263	.261	.258	.250	.243
BOD												
Influent (mg/l)	208	271	307	385	373	411.5	394	288	365	**	820	488
Effluent (mg/l)	1.2	1.5	3.15	3.2	1.7	1.93	4.0	1.61	4.25	**	6.2	3.6
TSS												
Influent (mg/l)	226	238	226	225	191	210	236	283	203	242	185	170
Effluent (mg/l)	3.3	2.35	2.0	2.4	2.5	2.18	2.55	3.48	4.08	3.21	5.1	7.9
TOTAL COLIFORM (count per 100 ml)	< 2	< 2	< 2	4.2	< 2	2	2	2	2	2	2	5.6
CHLORINE RESIDUAL (ppm)	3.1	3.2	3.0	2.6	3.0	4.0	3.3	3.4	3.2	2.9	2.8	3.1

TABLE 5. CURRENT FLOW RATES AND CHEMICAL CHARACTERISTICS OF INFLUENT WASTEWATER AND EFFLUENT (Cont.)

PARAMETER	1999								
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
FLOW									
Influent (mgd)	.263	.271	.269	*.285	*	*	*	*	
Effluent (mgd)	.248	.253	.254	.262	.272	.282	.299	.284	.287
BOD									
Influent (mg/l)	752	476	431	269	235	305	247	150	235
Effluent (mg/l)	5.8	2.4	2.5	1.8	1.1	2.37	1.99	2.11	4.9
TSS									
Influent (mg/l)	212	186	208	213	164	251	184	170	198
Effluent (mg/l)	4.28	2.74	2.16	2.81	2.51	2.51	3.36	3.48	4.86
TOTAL COLIFORM (count per 100 ml)	2	2	< 2	< 2	< 2	2	< 2	< 2	< 2
CHLORINE RESIDUAL (ppm)	3.4	3.4	3.4	3.3	3.4	3.3	3.0	2.7	2.5

*Inf. Meter Broken
**BOD Probe Broken

In addition to the regularly analyzed parameters, grab samples were analyzed for nutrient concentration. The first grab sample was taken in 1993, and a recent grab sample of the effluent was taken in August 1999. (See Table 6 for the results of these analyses.) Although some of the parameters analyzed varied between the two dates, the results are typical of a secondary treatment plant receiving domestic wastewater.

TABLE 6. GRAB SAMPLE ANALYSIS FOR NUTRIENTS

ITEM	1993		August 1999
	INFLUENT	EFFLUENT	EFFLUENT
Total Kjeldahl Nitrogen	34.7 mg/l	.058 mg/l	0.72 mg/l
Inorganic Nitrogen	.007 mg/l	20.4 mg/l	20.0 mg/l
Total Nitrogen	34.8 mg/l	21.0 mg/l	21.0 mg/l
Phosphorus	5.13 mg/l	0.58 mg/l	
Orthophosphate	3.15 mg/l	2.70 mg/l	2.4 mg/l
Turbidity		3.50 NTU	1.9 NTU

V. POTENTIAL IMPACTS

A. Land Ownership

There should be no impact on land ownership, since all components of the project will be on County land/easements.

B. Topography/Drainage

There should be no impact on the existing topography, or drainage conditions since almost all of the components will be below grade except for the well head valves and appurtenances and no grading is involved.

C. Water Quality

The only well downgradient of the proposed injection site is an unused irrigation well, and thus, this well will not be negatively impacted by the injection well.

The most significant concern is the impact of the injected effluent on the groundwater and coastal water. For Alternative A, injecting effluent into the caprock above the basalt aquifer could result in nearshore discharge of the effluent. The possibility of nearshore discharge of the effluent was discussed with the DOH Clean Water Branch and Safe Drinking Water Branch. At that time, DOH did not express any serious concerns regarding a shallow well. The ocean water at the discharge point is classified as Class A water by the Department of Health (DOH) Office of Environmental Planning. The objective of class A waters is that their use for recreational purposes and aesthetic enjoyment be protected. Other uses shall be permitted as long as the use is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. As mentioned previously, the injection well will be used for backup purposes only, in the event that the existing reservoir cannot accept the effluent from the WWTP. The times that the well will be used will be during storm conditions, when significant volumes of stormwater runoff would be discharging into the ocean. Therefore, the potential impact to the coastal water from the effluent is expected to be negligible compared to the impact of this runoff. Separating and determining the potential impact of the injected effluent on the coastal water, versus negative impacts from typical storm runoff, would be extremely difficult – if not impossible – to determine or quantify.

For Alternative B, the impact of effluent disposal into the basalt aquifer was evaluated by Mink & Yuen, in their August 1993 report, which was based on a deep well (600± feet) and a maximum injection rate of 1.2 mgd. Mink & Yuen concluded that injection of the effluent below the caprock should result in the effluent moving makai, and eventually discharging into a wide area over a considerable distance (6000+ feet) offshore. The effluent will be disseminated over a large area (thousands of square feet) in deep water. The unit rate of effluent seepage will be extremely small compared with the column of water above it. During its upward passage into the caprock, the effluent will mix with ambient formation water having the salinity of sea water and become highly diluted. Therefore, there should be no resultant impact on the coastal water.

There will be a constant plume of effluent at the point of injection. Mink & Yuen calculated that for a constant injection rate of 1.2 mgd, the plume is expected to extend only about 640 feet mauka of the injection well site. The equation for computing the stagnation point is linear, thus, for an average rate of 300,000 gpd, the upgradient distance of the stagnation point would be only one fourth of 640 feet, or about 160 feet. Since the well will be used for backup purposes only, the flow to the well will be sporadic. For occasional flows, rather than constant injection, the plume can be expected to extend even less than the calculated distance of 160 feet. A monitoring well located in the northeast corner of the Waimea WWTP, approximately 1,000 feet upgradient from the injection well, would detect whether groundwater quality is affected by the effluent injection beyond this calculated "stagnation point" for the plume.

Subsequent to Mink's August 1993 report, Kikiaola disclosed their intent to construct as part of their Master Plan for the lands owned by them an Aquamarine Center makai of Kaumualii Highway in the vicinity of the proposed injection well. As part of this Aquamarine Center, Kikiaola plans to withdraw saline water from the basal aquifer at approximately the same depth as the injection well for Alternative B. Since the injection well will be used for backup purposes only, and the flow will be intermittent, the impact on the well for the Aquamarine Center is not expected to be significant. If the shallow well is constructed (Alternative A), there would be no impact on the proposed well.

Neither the shallow nor deep injection well alternatives are expected to have any significant impact on existing wildlife or recreation usage of the coastal water.

An Underground Injection Control (UIC) Permit Application has been submitted to the DOH Safe Drinking Water Branch for approval. The DOH regulations for the UIC Permit Application are based upon the federal regulations contained in 40 CFR 144 and 145, and comply with the federal requirements.

D. Flora and Fauna

There are no known rare, endangered or threatened species of flora or fauna within the vicinity of the project site. Furthermore, construction will be limited to areas that are already cleared. Therefore, construction of the project is not anticipated to adversely impact the area's flora and fauna.

E. Air Quality and Noise

Air quality and noise parameters in the immediate vicinity of the project are anticipated to be affected by short-term construction activities, primarily from operation of the drilling rig at the injection well site and the monitoring well site. However, the affected areas are relatively small and removed (2000± feet) from any inhabited areas. Therefore, there should be no significant adverse impact in regards to air quality and noise generation associated with the project.

F. Archaeological Resources

The project site has been in its present use for a number of years. Accordingly, the proposed project is not anticipated to have adverse impacts to archaeological resources.

G. Community Setting

Construction of the injection well should not impact development in the Waimea-Kekaha region, since it is a backup for the current method of effluent disposal.

H. Infrastructures

No improvements to existing infrastructures (roads, water, electrical) are required for the project.

VI. ALTERNATIVES CONSIDERED

The primary disposal method for the effluent will continue to be irrigation reuse. The effluent will discharge into Kikiaola's lower of two existing reservoirs. Water from Kikiaola's upper reservoir – which receives water from an irrigation ditch and storm water – discharges into the lower reservoir, where it is mixed with the effluent, prior to use as irrigation water.

Several alternatives to provide a backup method of disposal for the effluent were considered. One alternative would be to construct a new reservoir to provide the necessary backup storage for the effluent during wet weather. As mentioned previously, the existing reservoir does not have adequate capacity. The disadvantage of this alternative is that there is lack of a viable location for a new reservoir, since the County does not own a large enough parcel of land in the vicinity of the WWTP. Also, this alternative requires compatibility with Kikiaola's Master Plan, which is still unknown at this time. Due to these disadvantages, this alternative was not considered to be feasible.

The alternative of discharging the effluent into the ocean via an ocean outfall as a primary method of disposal was considered in previous studies. However, this alternative was not considered feasible due to cost, permit requirements and environmental issues, and was not pursued further. This alternative would also not be feasible as a backup method of disposal for the effluent.

The alternative of a "no project" was also considered, which would mean that the effluent would continue to be discharged into Kikiaola's reservoir prior to irrigation reuse. However, the reservoir does not have adequate storage, and Kikiaola has been sent an informal notice of violation regarding the inadequacy of the current effluent disposal system.

VII. FINDINGS AND CONCLUSIONS

Construction of the injection well will provide a reliable backup means of effluent disposal from the existing Waimea WWTP. The primary method of effluent disposal will be continued discharge into Kikiaola's reservoir for storage prior to use as irrigation water. The injection well will only be used when Kikiaola is unable to accept disposal of the treated effluent in their reservoir, e.g., due to rainy weather, when irrigation with the effluent would not be practical. If, in the future, Kikiaola ceases irrigation reuse for a prolonged period of time (or permanently), a new primary method of disposal for the effluent would have to be established, which would require preparation of a new EA. It should be reiterated that this EA is based on the injection well being utilized as a backup disposal method for the effluent.

The majority of the work will be done at the injection well site, which is the parcel for the County's WWPS 'A' and at the monitoring well site, which is at the WWTP. The project will also involve installation of 800± feet of pipeline along the dirt road from the WWTP to the injection well site.

The "Significance Criteria", Section 12 of the Hawaii Administrative Rules, Title 11, Chapter 200, "Environmental Impact Statement Rules", were reviewed and analyzed to determine whether the proposed project will have significant impacts to the environment. The following analysis of the 13 significance criteria is provided:

1. Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;

   There are no known rare, endangered or threatened species of flora, fauna or avifauna located in the vicinity of the project site. Construction will be limited to areas that are already cleared – the WWTP, WWPS 'A'; and the access road to the WWTP – which do not contain any surface archaeological features. Should any cultural remains be identified during construction, work will stop in the immediate vicinity and the State Historic Preservation Division will be consulted to establish an appropriate mitigation strategy.

2. Curtails the range of beneficial uses of the environment;

   The project is not expected to curtail the range of beneficial uses of the environment.

3. Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344 of the Hawaii Revised Statutes;

The State's Environmental Policy and Guidelines, which are set forth in Chapter 344, of the Hawaii Revised Statutes, were reviewed in connection with the proposed project. The proposed action does not appear to conflict with the environmental policies and guidelines set forth in Chapter 344.

4. Substantially affects the economic or social welfare of the community or State;

The construction of the backup injection well, monitoring well and effluent pipeline should have no negative affect on the economic or social welfare of the community or the state.

5. Substantially affects public health;

No impacts to public health and welfare are anticipated as a result of the proposed project.

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

The project should not have any impact on the current population, and should not affect public services – such as roadways, police, fire and medical services – or educational and solid waste facilities. The road within which the pipeline will be installed is primarily used for access to the WWTP, and not a publicly used road. Furthermore, installation of the pipeline is expected to be completed within a few weeks of commencement. Therefore, any impact from this activity will be very short-term and minimal.

7. Involves a substantial degradation of environmental quality;

During the construction phase of the project, there will be short-tem air quality and noise impacts as a result of the project, primarily from operation of the drilling rig. In the long term, effects upon air quaiity and noise parameters should be minimal. Since the majority of the work will be located below ground, the project is not anticipated to significantly affect the open space and scenic character of the area. Therefore, no substantial degradation of environmental quality from the project is anticipated.

8. Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;

The proposed project does not involve a commitment to larger actions.

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

There are no rare, threatened or endangered species of flora or fauna or their habitats in the vicinity of the project.

10. Detrimentally affects air or water quality or ambient noise levels;

The project should not detrimentally affect air quality levels. A drilling rig will be the primary visible equipment item at the sites throughout most of the project construction period. The short-term impact generated from construction activities at these sites will primarily be related to noise during the daytime hours from operation of the rig.

The only well downgradient of the proposed injection site is an irrigation well. However, this well is not being used, and thus, will not be negatively impacted by this project.

The most significant concern is the impact of the injected effluent on the groundwater and coastal water. As mentioned in Section V.C., injecting effluent into the caprock above the basalt aquifer (Alternative A) could result in nearshore discharge of the effluent. However, the injection well will be used for backup purposes only, when the reservoir is unable to accept the effluent from the WWTP, due to wet weather. The times that the well will be used will be during storm conditions, when significant volumes of stormwater runoff would be discharging into the ocean. Therefore, the potential impact to the coastal water from the effluent is expected to be negligible compared to the impact of this runoff. Separating and determining the potential impact of the injected effluent on the coastal water, versus negative impacts from typical storm runoff, would be extremely difficult – if not impossible – to determine or quantify. It is anticipated that the shallow injection well will not result in any significant impacts to the existing wildlife or recreational purposes of the water

Injection of the effluent below the caprock (Alternative B) should result in the effluent moving makai, and eventually discharging into a wide area at a considerable distance (6000+ feet) offshore. During passage of the effluent through the caprock,

the effluent will mix with ambient formation water having the salinity of sea water and become highly diluted. Therefore, there should be no resultant impact on the coastal water. There should also be no negative impact on the groundwater. Although there will be a plume of effluent at the point of injection, the flow to the well will be sporadic since the well will be used for backup purposes only. For occasional flows of 300,000 gpd, the plume can be expected to extend less than a distance of 160 feet. A monitoring well located in the northeast corner of the Waimea WWTP, approximately 1,000 feet upgradient from the injection well, would detect whether groundwater quality is affected by the effluent injection beyond this calculated "stagnation point" for the plume.

Neither the shallow nor deep injection well alternatives are expected to have any significant impact on existing wildlife or recreation usage of the coastal water.

11. Affects or is likely to suffer damage by being located in an environmentally sensitive area;

The backup injection well site and the WWTP are in a Special Flood Hazard Area inundated by 100-year floods with base flood elevations of nine and eight feet, respectively. However, except for the wellhead valves and appurtenances, the components for the project will be totally below grade. The exposed well head piping will not be subject to damage when flooding occurs at the well site.

The well site is approximately 1,300 feet from the beach and should not have any negative impact on the beach. The project area is mostly flat and is not subject to erosion. The well site and WWTP are not located on geologically hazardous land, or are located near any estuaries or fresh water.

As mentioned previously, injecting effluent into the caprock above the basalt aquifer (Alternative A) could result in nearshore discharge of the effluent. However, since the well will be used for backup purposes only, the possible impact to coastal waters is expected to be minimal.

12. Substantially affects scenic vistas and viewplanes identified in county or state plans or studies;

Except for the wellhead valves and appurtenances, the components for the project will be totally below grade. The exposed well head piping is located at the already

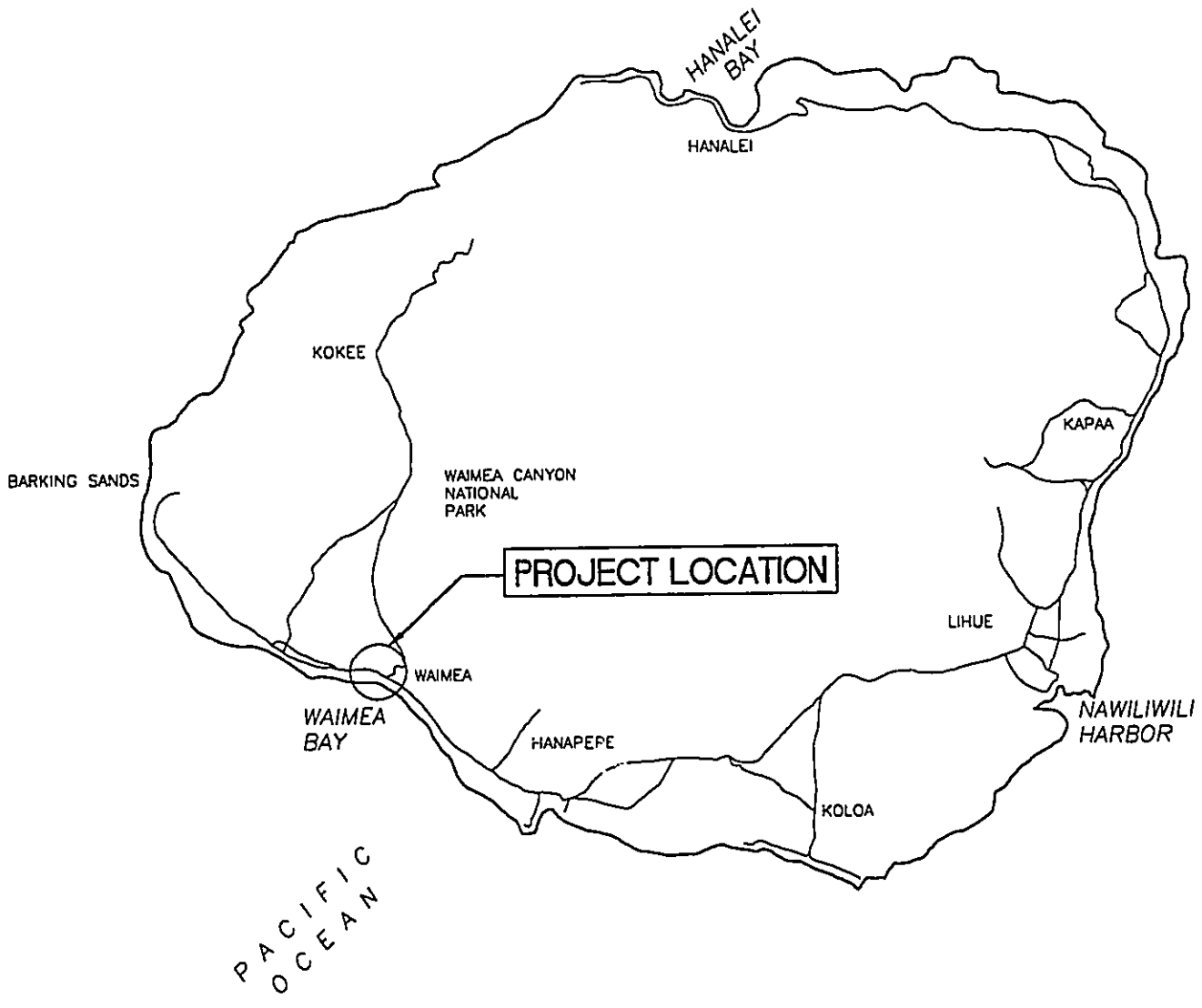
developed WWPS 'A'. Therefore, the project will not affect any scenic vistas or viewplanes.

13. Requires substantial energy consumption;

The proposed project will not require substantial energy consumption.

Based on the above stated findings, it is concluded that the proposed action will not result in any significant impacts.

EXHIBITS



ISLAND OF KAUAI

NORTH

5 0 5 10

SCALE IN MILES

DEPARTMENT OF PUBLIC WORKS
COUNTY OF KAUAI

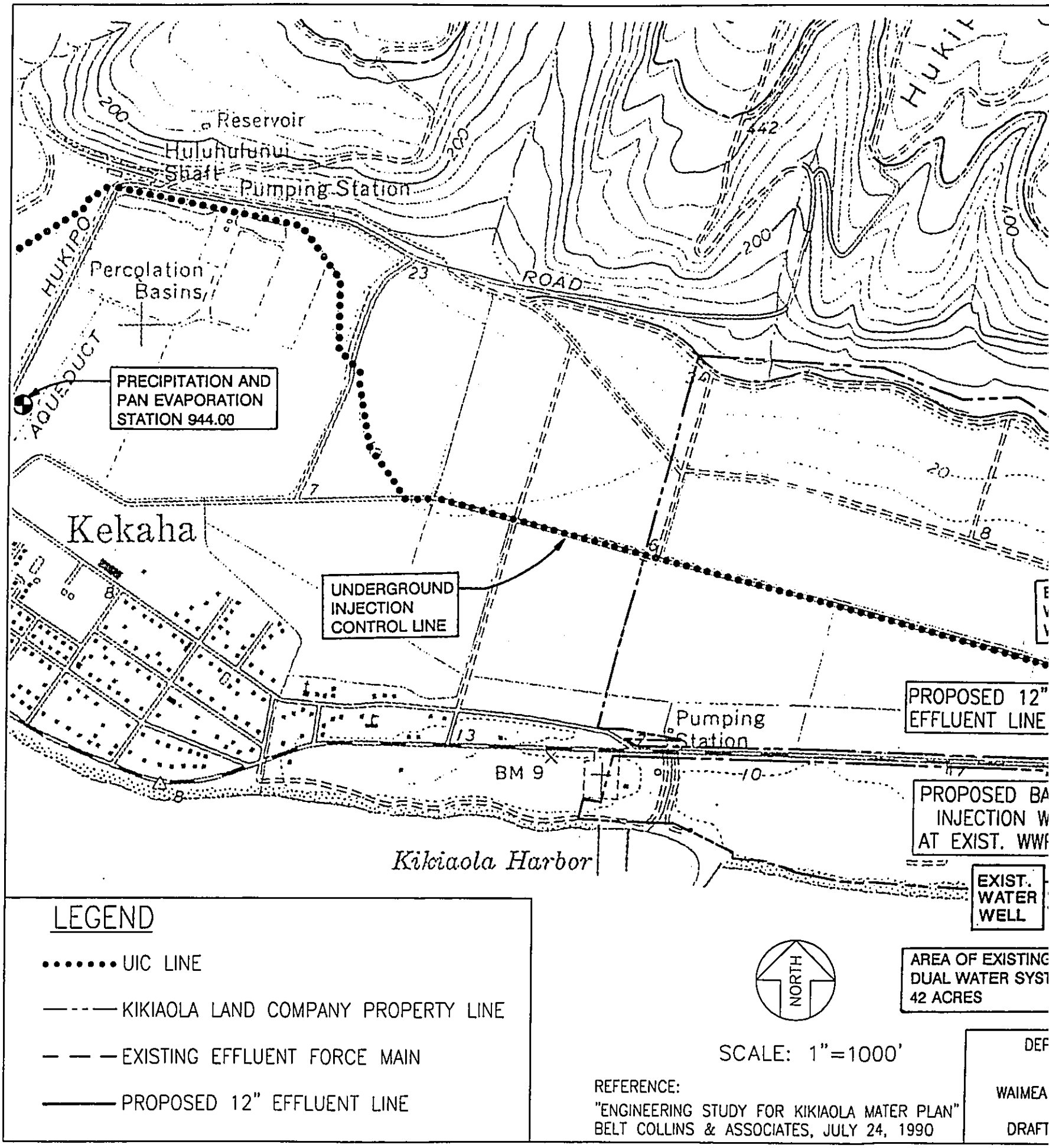
WAIMEA WASTEWATER TREATMENT PLANT
BACKUP INJECTION WELL
DRAFT ENVIRONMENTAL ASSESSMENT

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

LOCATION MAP

EXHIBIT 1

FN: 99-013\EXHIBITS



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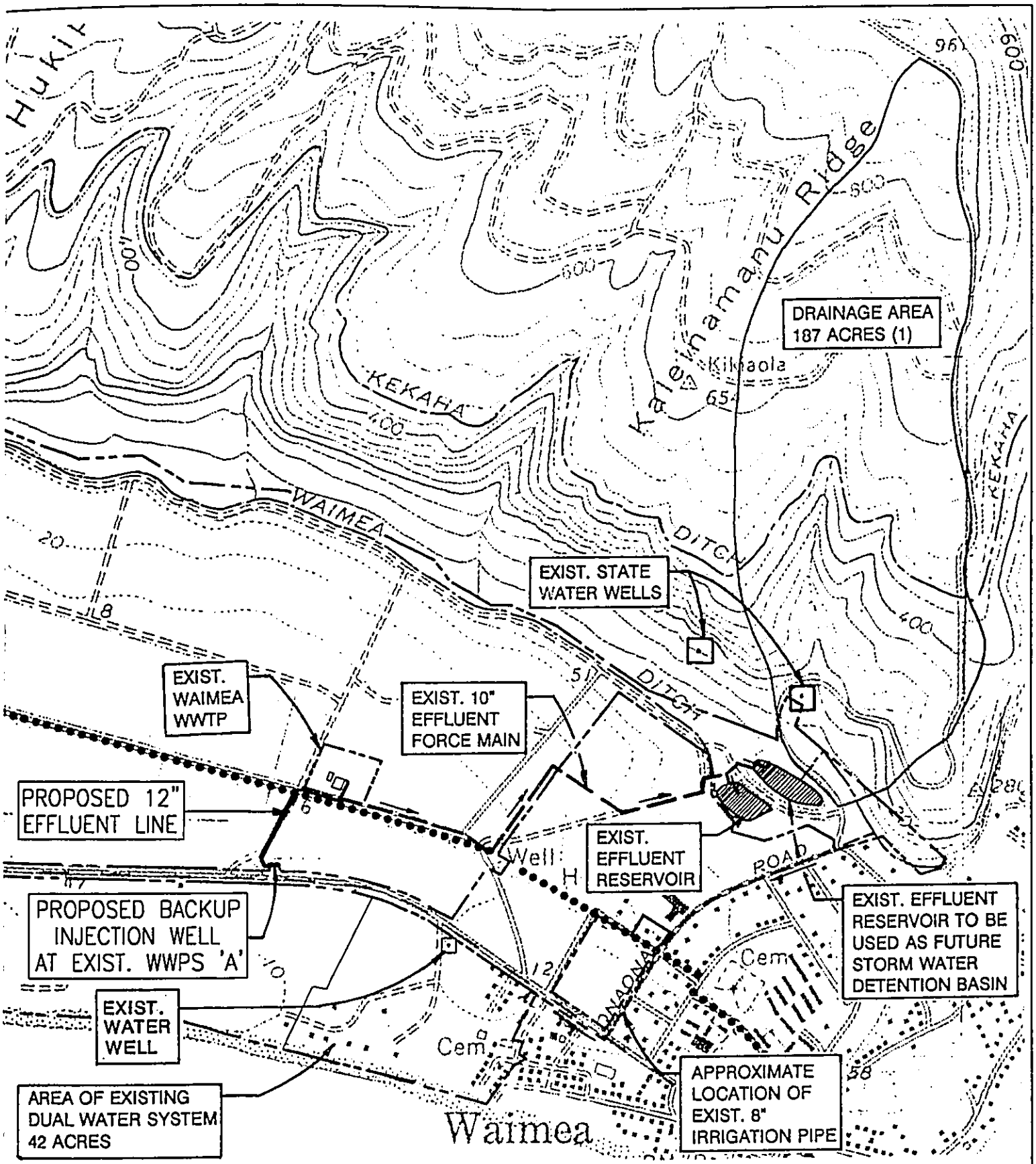
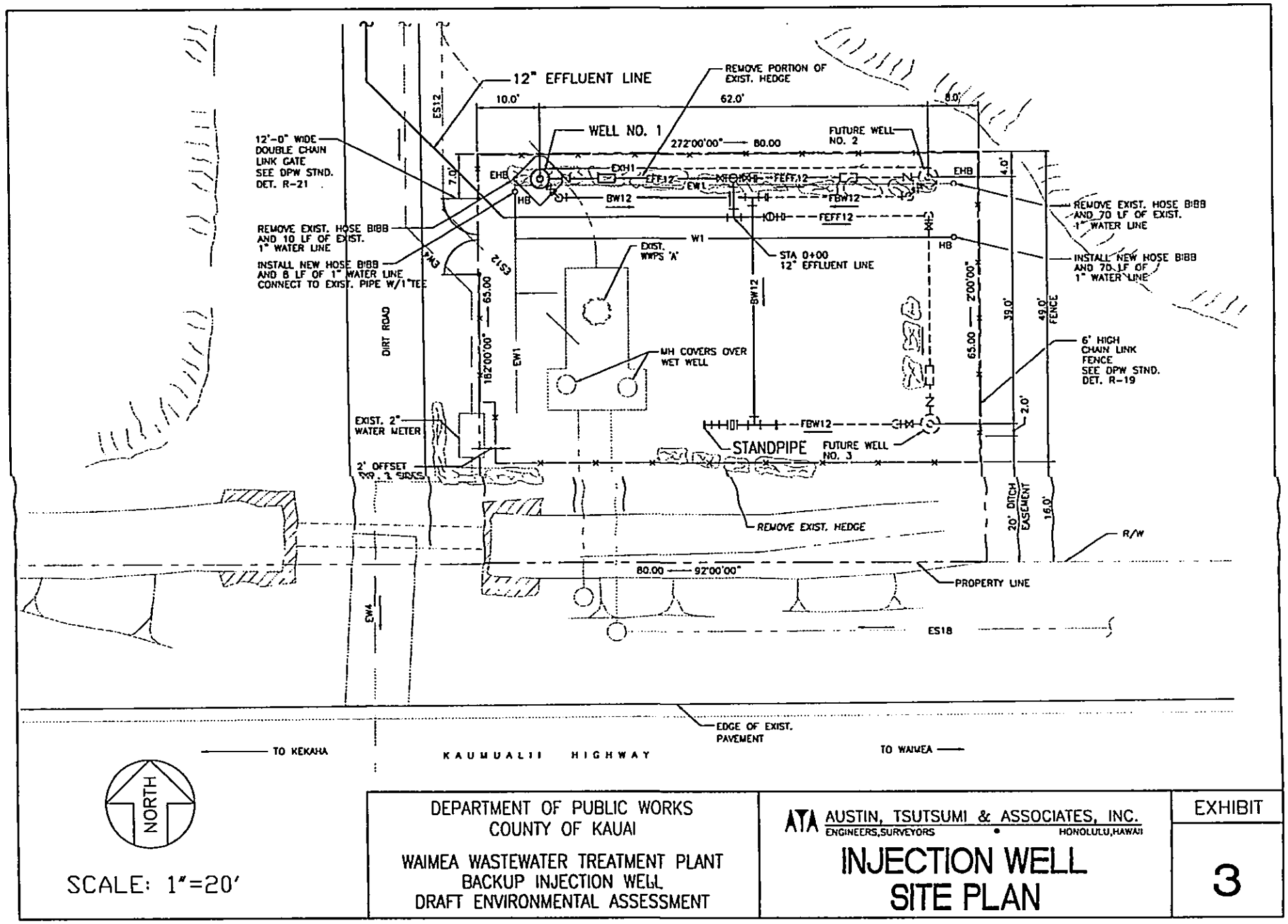


0'	DEPARTMENT OF PUBLIC WORKS COUNTY OF KAUAI WAIMEA WASTEWATER TREATMENT PLANT BACKUP INJECTION WELL DRAFT ENVIRONMENTAL ASSESSMENT	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII SITE MAP	EXHIBIT 2
TER PLAN" , 1990			



DEPARTMENT OF PUBLIC WORKS
COUNTY OF KAUAI

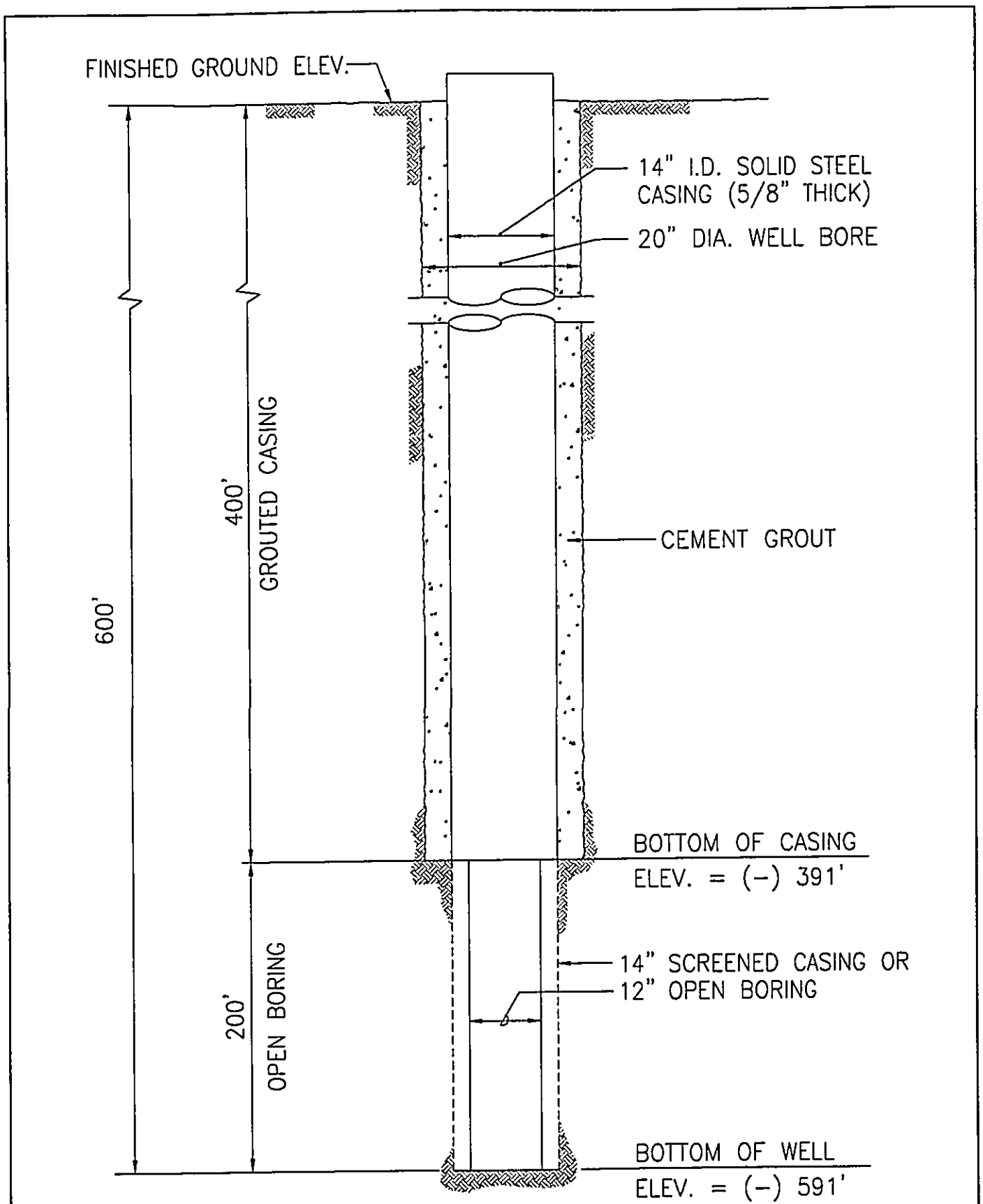
WAIMEA WASTEWATER TREATMENT PLANT
BACKUP INJECTION WELL
DRAFT ENVIRONMENTAL ASSESSMENT

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

INJECTION WELL SITE PLAN

EXHIBIT 3

FN: 99-013\EXHIBITS

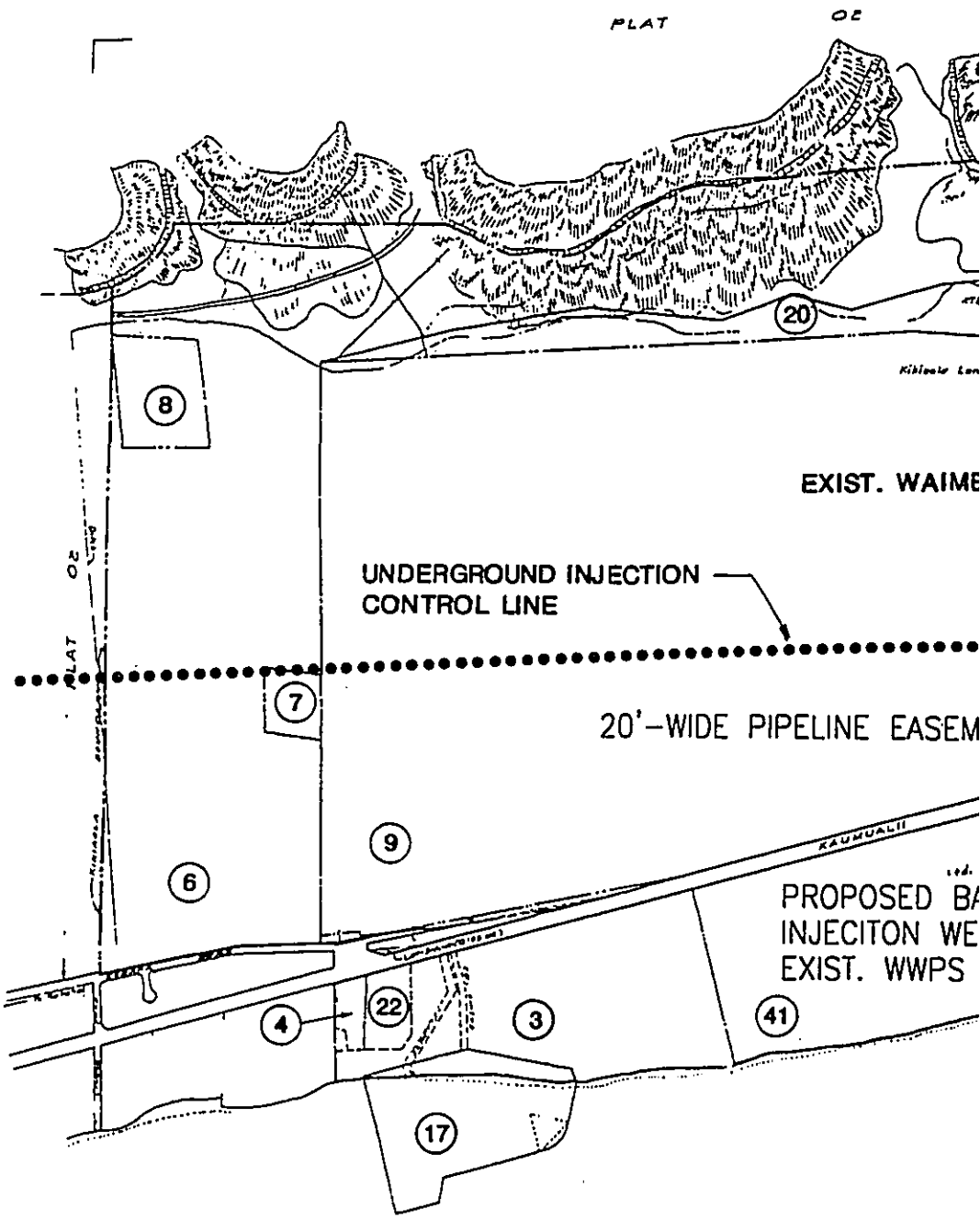


DEPARTMENT OF PUBLIC WORKS COUNTY OF KAUAI WAIMEA WASTEWATER TREATMENT PLANT BACKUP INJECTION WELL DRAFT ENVIRONMENTAL ASSESSMENT	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS.SURVEYORS • HONOLULU,HAWAII **DEEP INJECTION WELL ELEVATION SECTION**	EXHIBIT **4**

FN: 99-013\EXHIBITS

LOT NO.	LAND OWNER	LOT NO.	LAND OWNER
1	KIKIAOLA LAND CO.	21	STATE OF HAWAII
2	OTHER	22	KIKIAOLA LAND CO.
3	KIKIAOLA LAND CO.	31	KIKIAOLA LAND CO.
4	STATE OF HAWAII	32	KIKIAOLA LAND CO.
6	KNUDSEN	33	STATE OF HAWAII
7	KNUDSEN	34	KIKIAOLA LAND CO.
8	KNUDSEN	35	STATE OF HAWAII
9	KIKIAOLA LAND CO.	36	COUNTY OF KAUAI
13	OTHER	37	COUNTY OF KAUAI
14	KIKIAOLA LAND CO.	38	STATE OF HAWAII
15	KIKIAOLA LAND CO.	39	KIKIAOLA LAND CO.
17	STATE OF HAWAII	40	OTHER
18	STATE OF HAWAII	41	KIKIAOLA LAND CO.
19	KNUDSEN	42	KIKIAOLA LAND CO.
20	KIKIAOLA LAND CO.		

NOTE: Land owned by Augustus Knudsen is leased to Kekaha Sugar Co. Ltd.



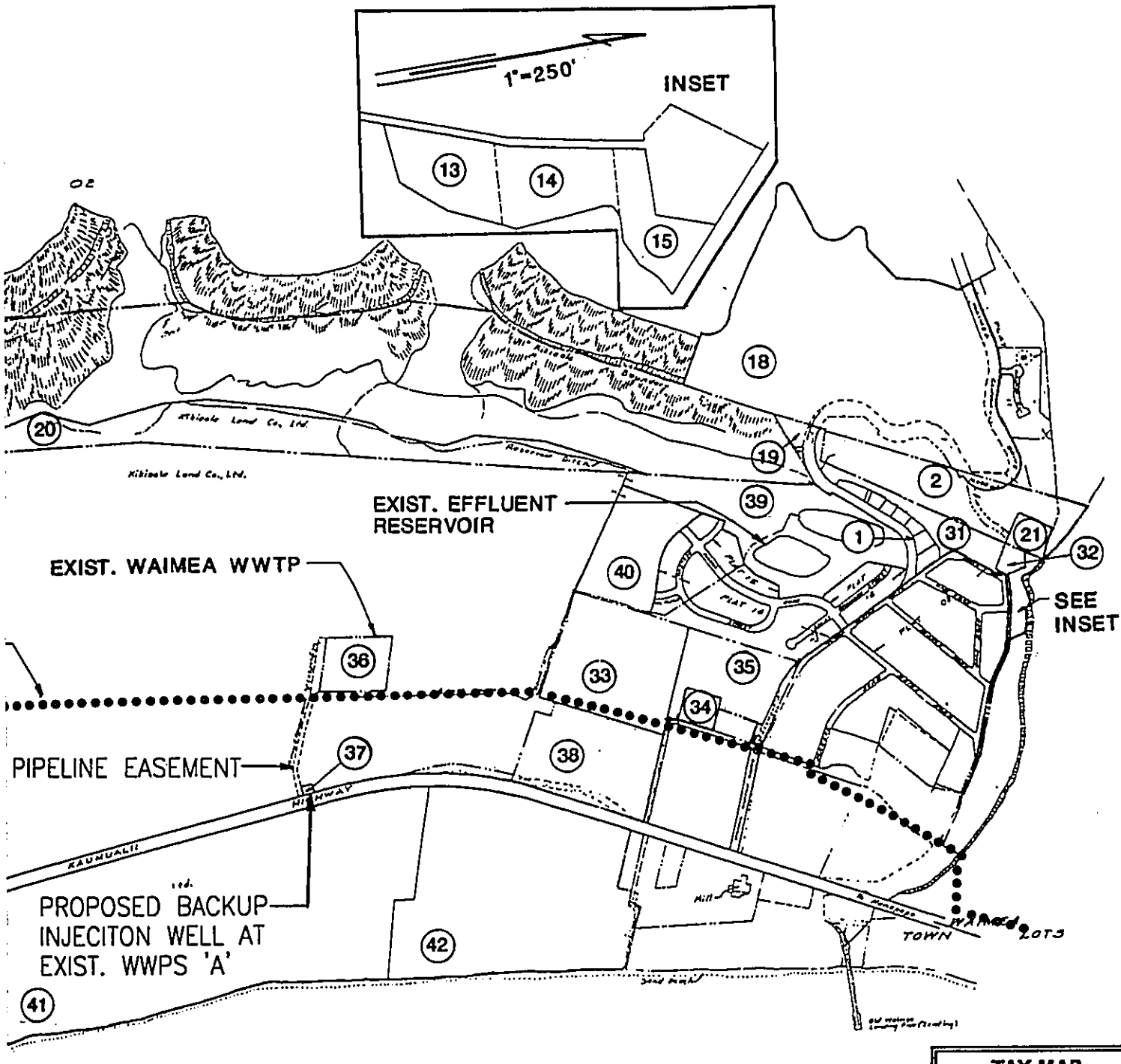
SCALE: 1"=1000'

DE

WAIMEA

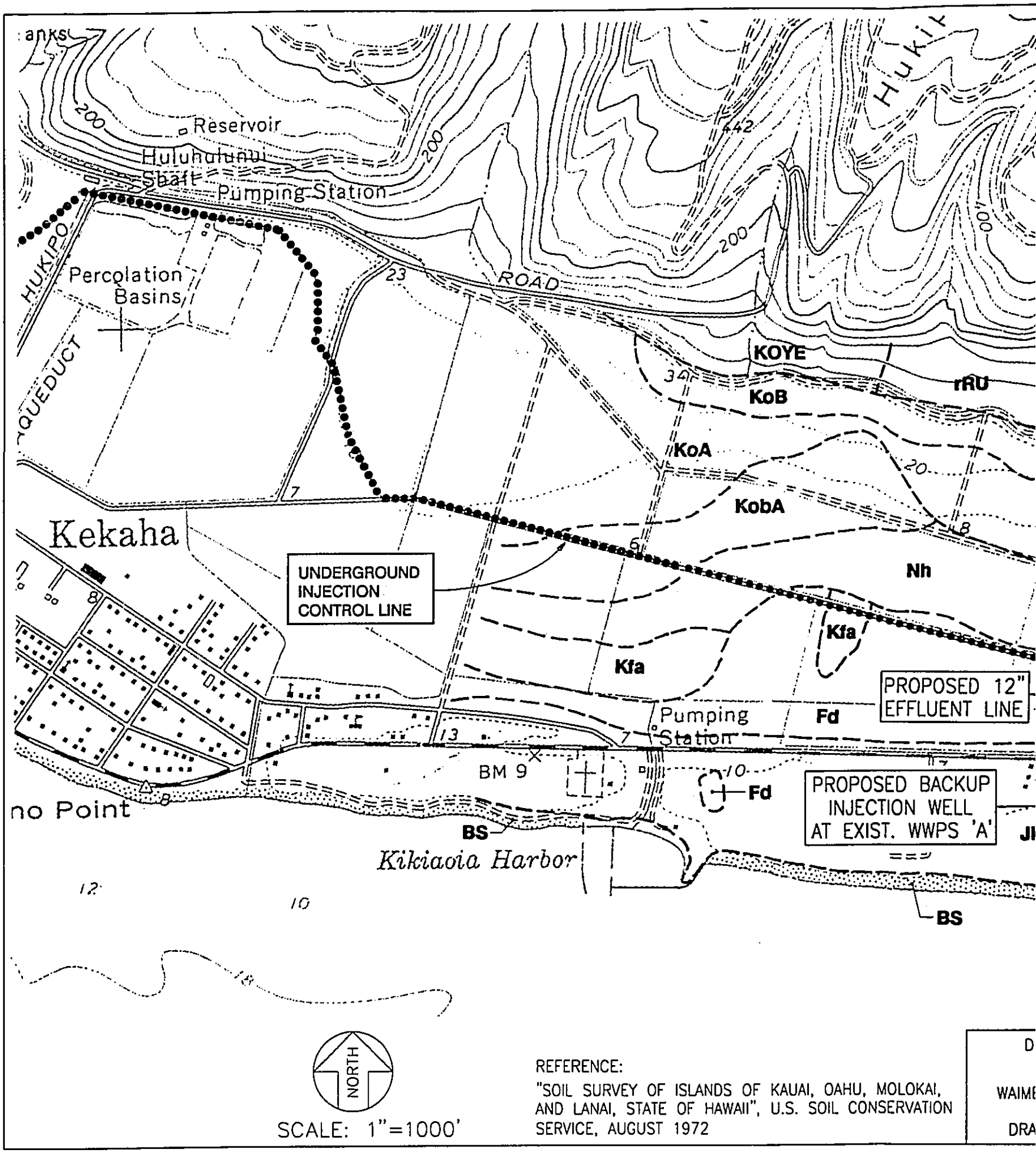
DRAF

FN: 99-013\EXHIBITS



TAX MAP		
FOURTH DISTRICT		
ZONE	SEC	PLAT
1	2	06
SCALE: 1" = 1000'		

DEPARTMENT OF PUBLIC WORKS COUNTY OF KAUAI WAIMEA WASTEWATER TREATMENT PLANT BACKUP INJECTION WELL DRAFT ENVIRONMENTAL ASSESSMENT	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII TAX MAP	EXHIBIT 5

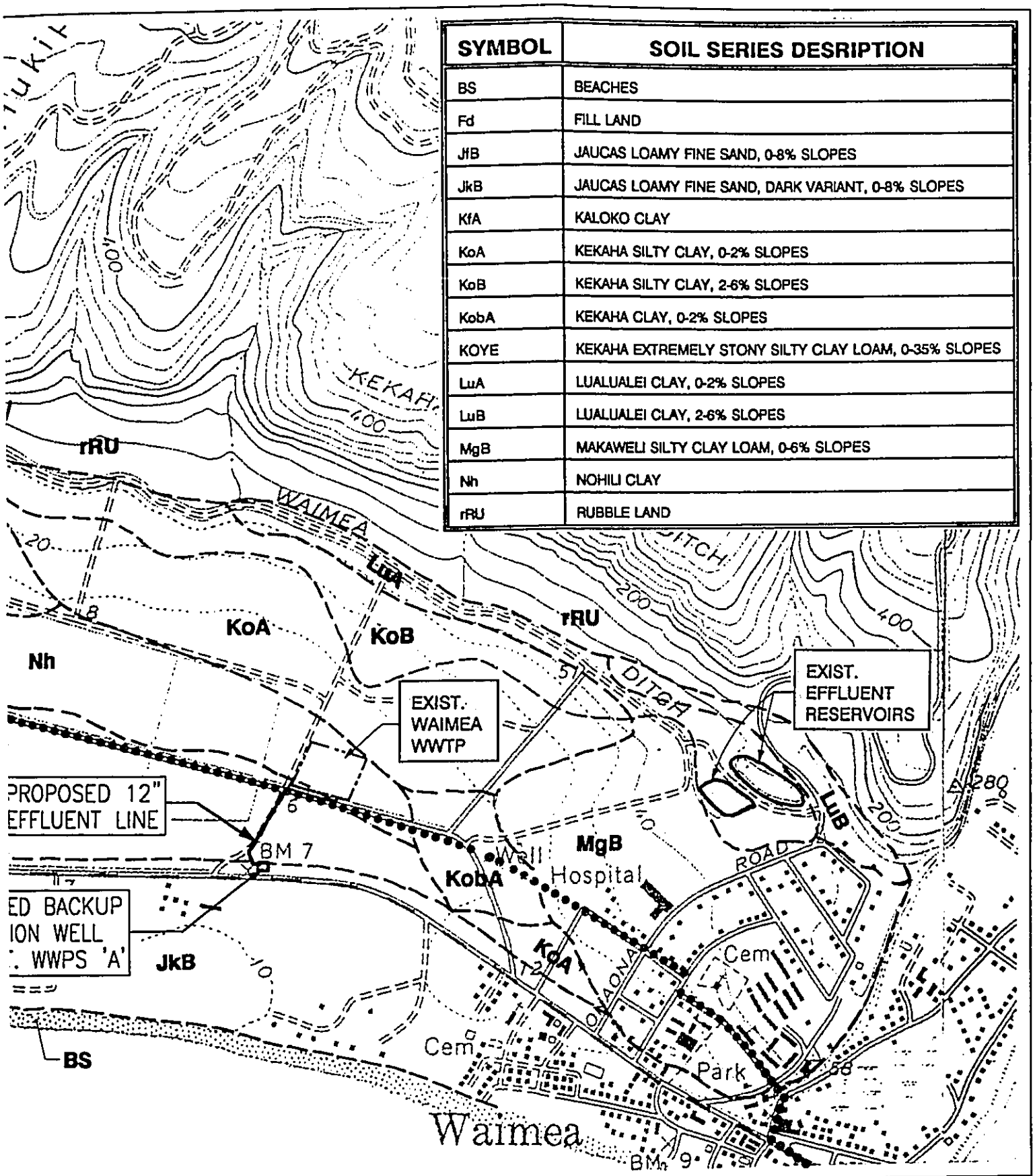


REFERENCE:
"SOIL SURVEY OF ISLANDS OF KAUAI, OAHU, MOLOKAI, AND LANAI, STATE OF HAWAII", U.S. SOIL CONSERVATION SERVICE, AUGUST 1972

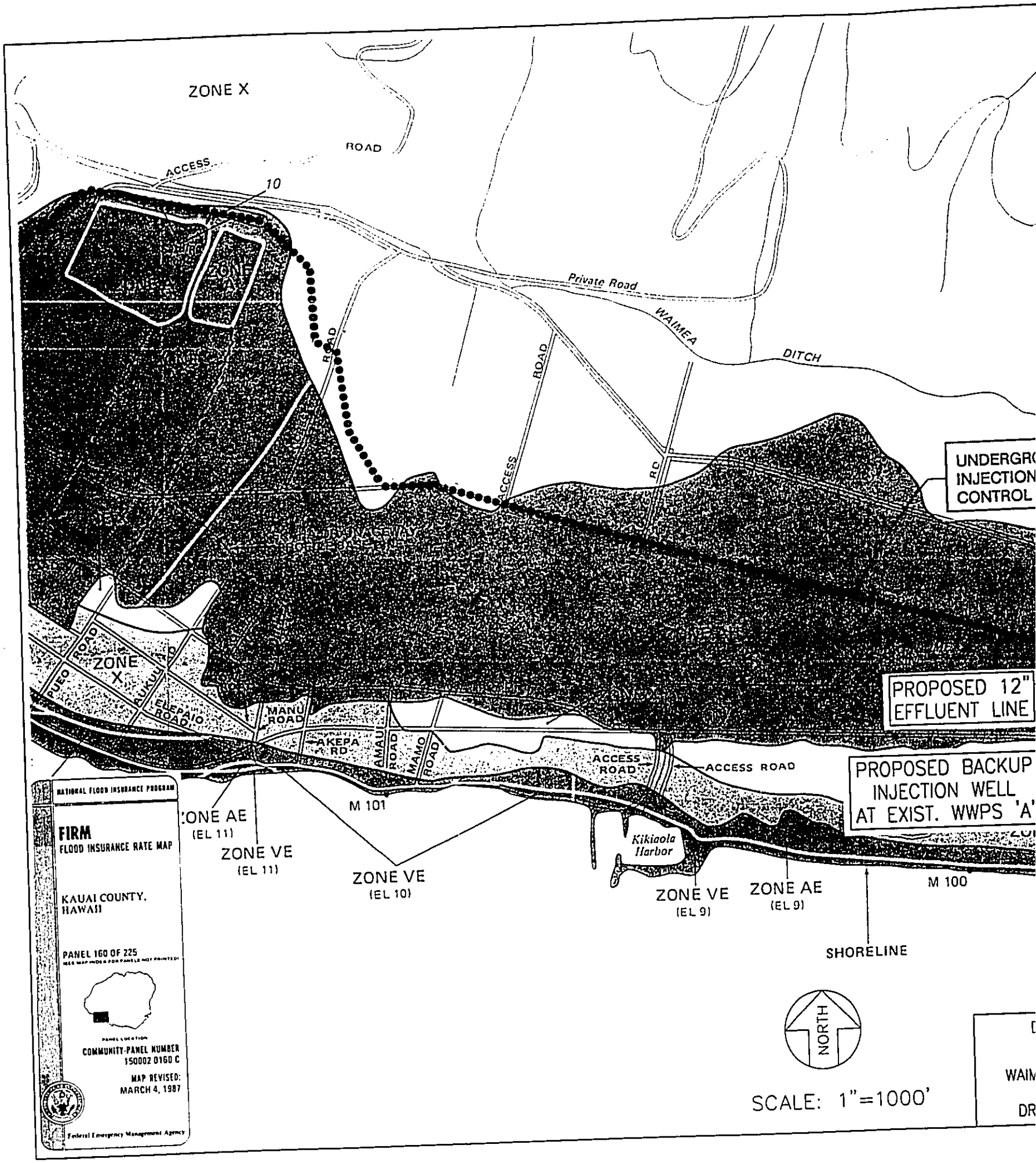
D
WAIME
DRA

FN: 99-013\EXHIBITS

SYMBOL	SOIL SERIES DESRIPTION
BS	BEACHES
Fd	FILL LAND
JfB	JAUCAS LOAMY FINE SAND, 0-8% SLOPES
JkB	JAUCAS LOAMY FINE SAND, DARK VARIANT, 0-8% SLOPES
KfA	KALOKO CLAY
KoA	KEKAHA SILTY CLAY, 0-2% SLOPES
KoB	KEKAHA SILTY CLAY, 2-6% SLOPES
KobA	KEKAHA CLAY, 0-2% SLOPES
KOYE	KEKAHA EXTREMELY STONY SILTY CLAY LOAM, 0-35% SLOPES
LuA	LUALUALEI CLAY, 0-2% SLOPES
LuB	LUALUALEI CLAY, 2-6% SLOPES
MgB	MAKAWELI SILTY CLAY LOAM, 0-6% SLOPES
Nh	NOHILI CLAY
rRU	RUBBLE LAND



OLOKAI, ERVATION	DEPARTMENT OF PUBLIC WORKS COUNTY OF KAUAI WAIMEA WASTEWATER TREATMENT PLANT BACKUP INJECTION WELL DRAFT ENVIRONMENTAL ASSESSMENT	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS.SURVEYORS • HONOLULU,HAWAII SOIL TYPES IN PROJECT AREA	EXHIBIT 6



FN: 99-013\EXHIBITS

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- ZONE A — No base flood elevations determined.
- ZONE AE — Base flood elevations determined.
- ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE A99 — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- ZONE V — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- ZONE VE — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- ZONE X — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- ZONE X — Areas determined to be outside 500-year flood plain.
- ZONE D — Areas in which flood hazards are undetermined.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet*

D — D — Cross Section Line

(EL 987) — Base Flood Elevation In Feet Where Uniform Within Zone*

RM7 X — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

UNDERGROUND INJECTION CONTROL LINE

EXIST. WAIMEA WWTP

EXIST. EFFLUENT RESERVOIRS

PROPOSED 12" EFFLUENT LINE

PROPOSED BACKUP INJECTION WELL EXIST. WWPS 'A'

ZONE X

ZONE AE (EL 8)

ZONE AE

ZONE AH (EL 6)

WAIMEA DITCH

KAUMUALII HIGHWAY

WAENA ROAD (550)

ONAONA ROAD

HAINA ROAD

MAULE RD

OIOI ROAD

NELE ROAD

OMA ROAD

MAKEKE ROAD

HAIKI ROAD

OLA ROAD

LAAU ROAD

ACCESS ROAD

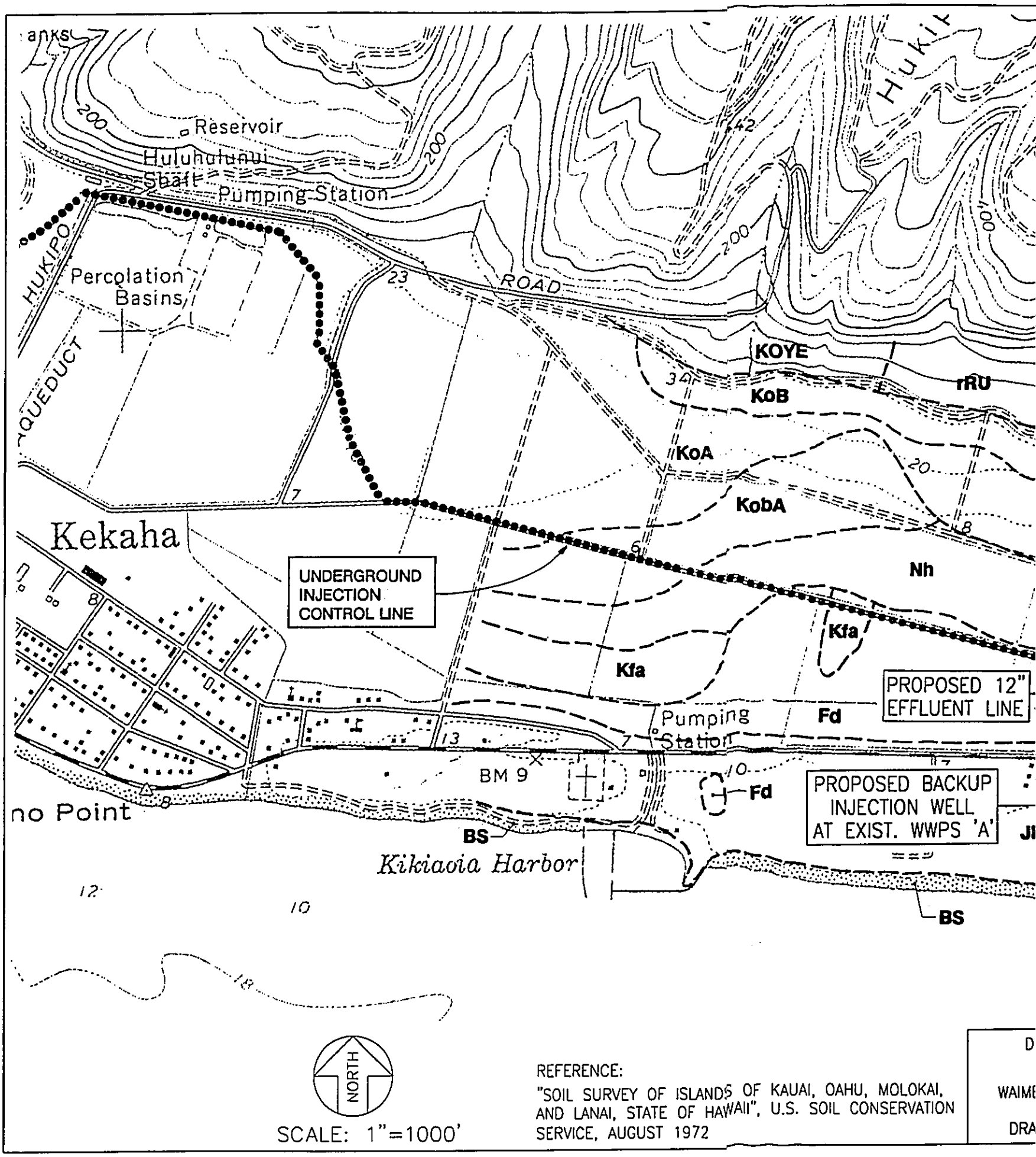
WAIMEA ROAD

M 100

DEPARTMENT OF PUBLIC WORKS COUNTY OF KAUAI WAIMEA WASTEWATER TREATMENT PLANT BACKUP INJECTION WELL DRAFT ENVIRONMENTAL ASSESSMENT	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII FLOOD MAP	EXHIBIT 7

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING



FN: 99-013\EXHIBITS

SYMBOL	SOIL SERIES DESRIPTION
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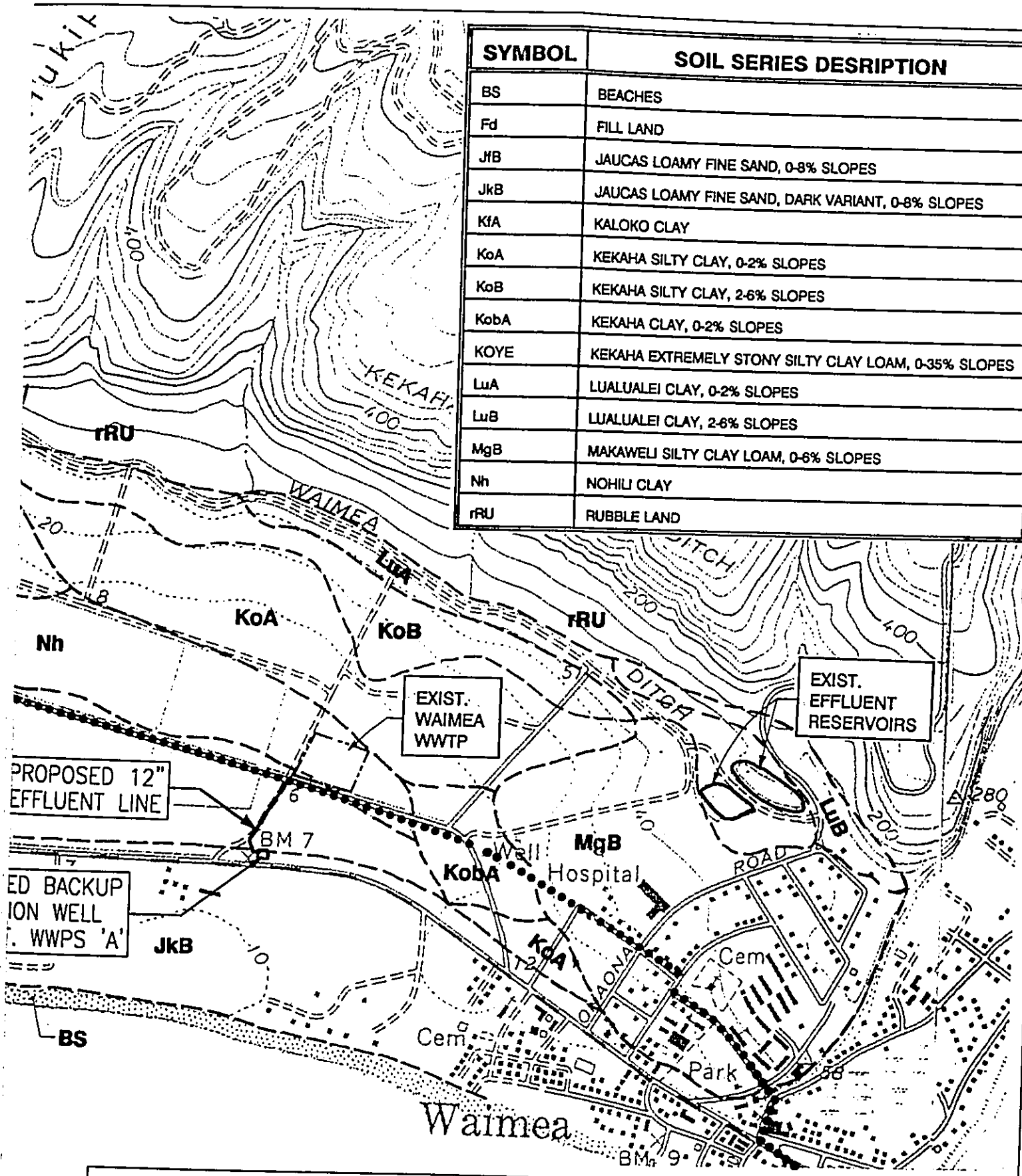
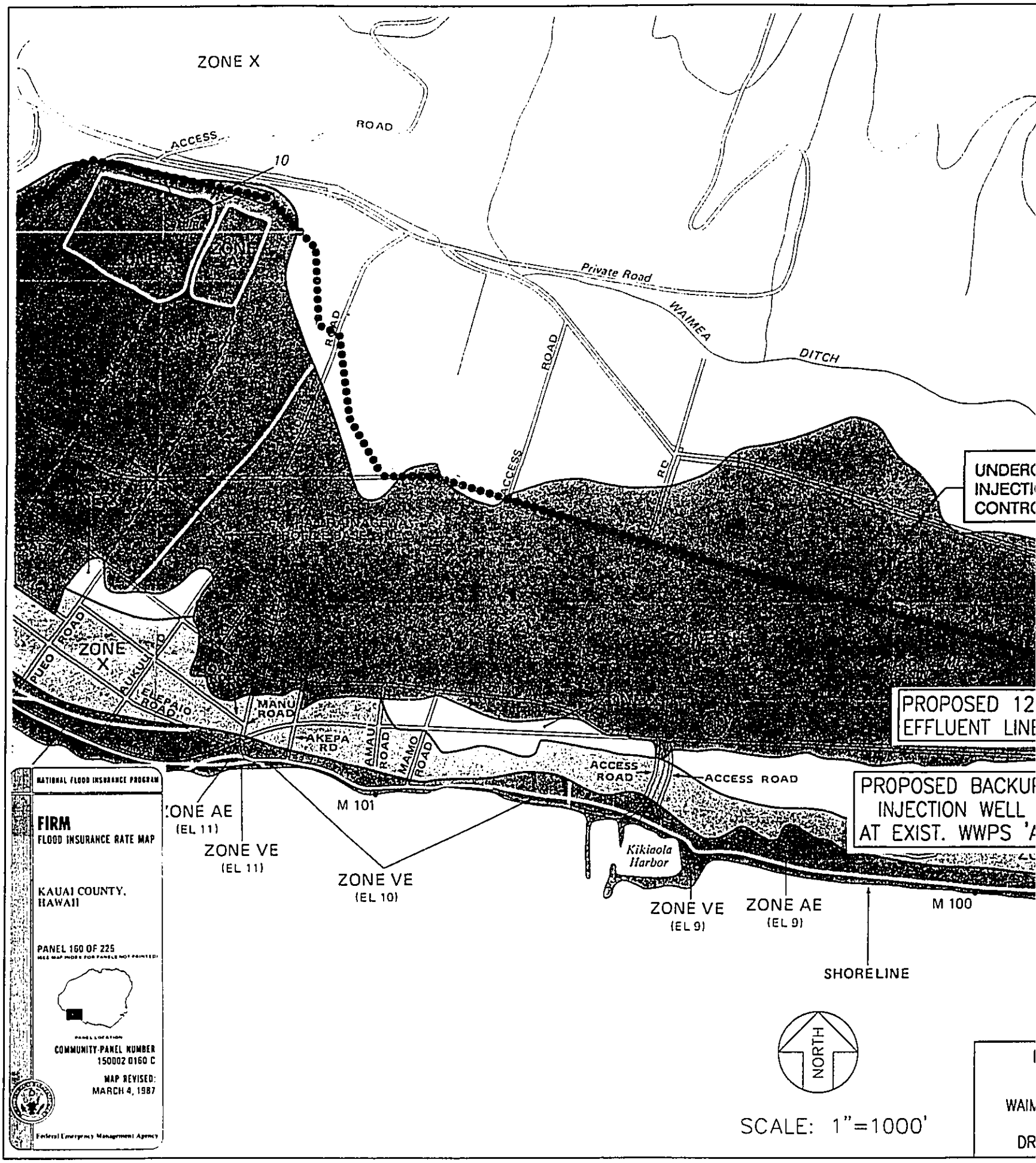


OLOKAI, ERVATION	DEPARTMENT OF PUBLIC WORKS COUNTY OF KAUAI WAIMEA WASTEWATER TREATMENT PLANT BACKUP INJECTION WELL DRAFT ENVIRONMENTAL ASSESSMENT	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS,SURVEYORS • HONOLULU,HAWAII SOIL TYPES IN PROJECT AREA	EXHIBIT 6



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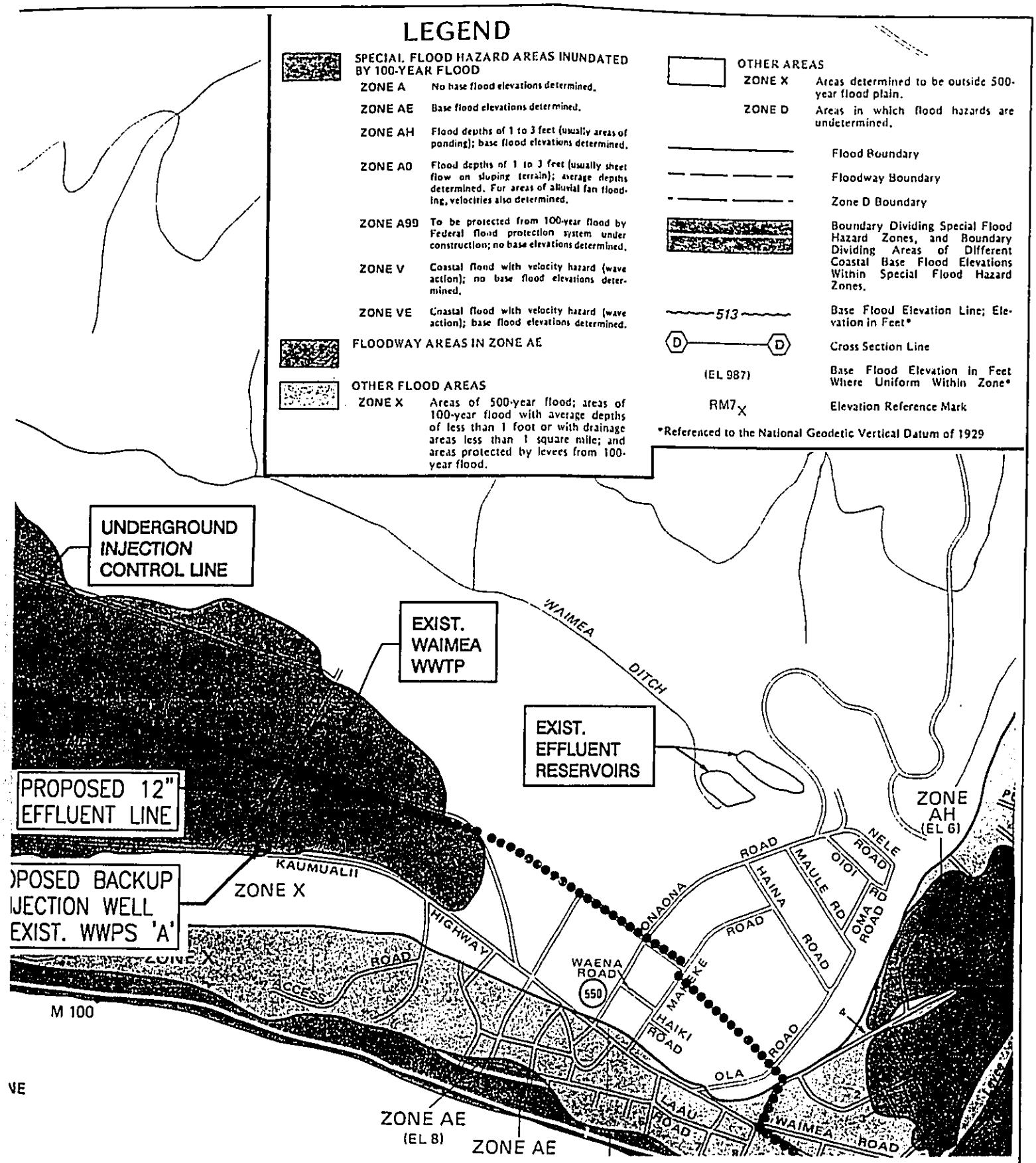


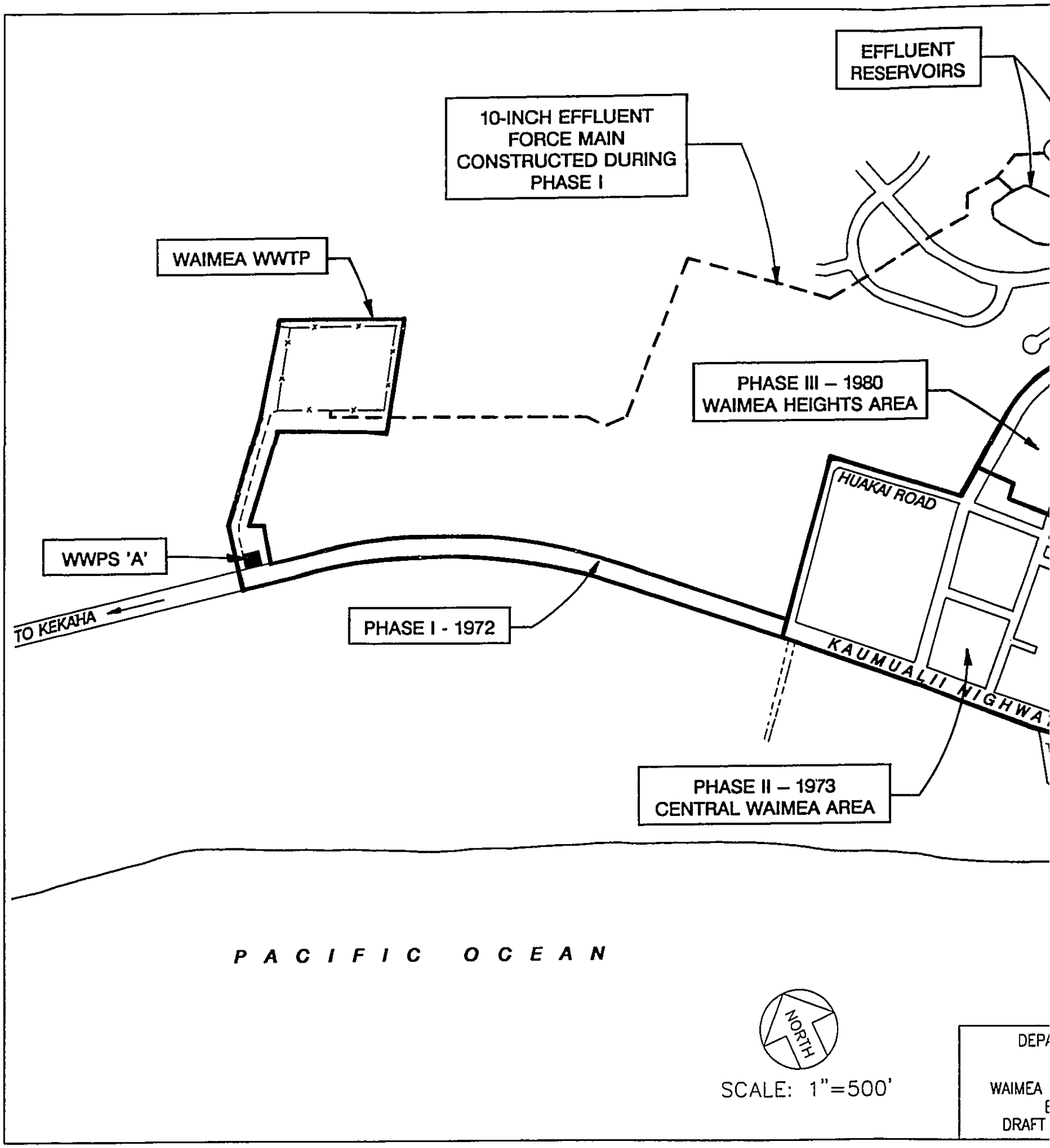
DEPARTMENT OF PUBLIC WORKS
COUNTY OF KAUAI

WAIMEA WASTEWATER TREATMENT PLANT
BACKUP INJECTION WELL
DRAFT ENVIRONMENTAL ASSESSMENT

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

FLOOD MAP

EXHIBIT 7



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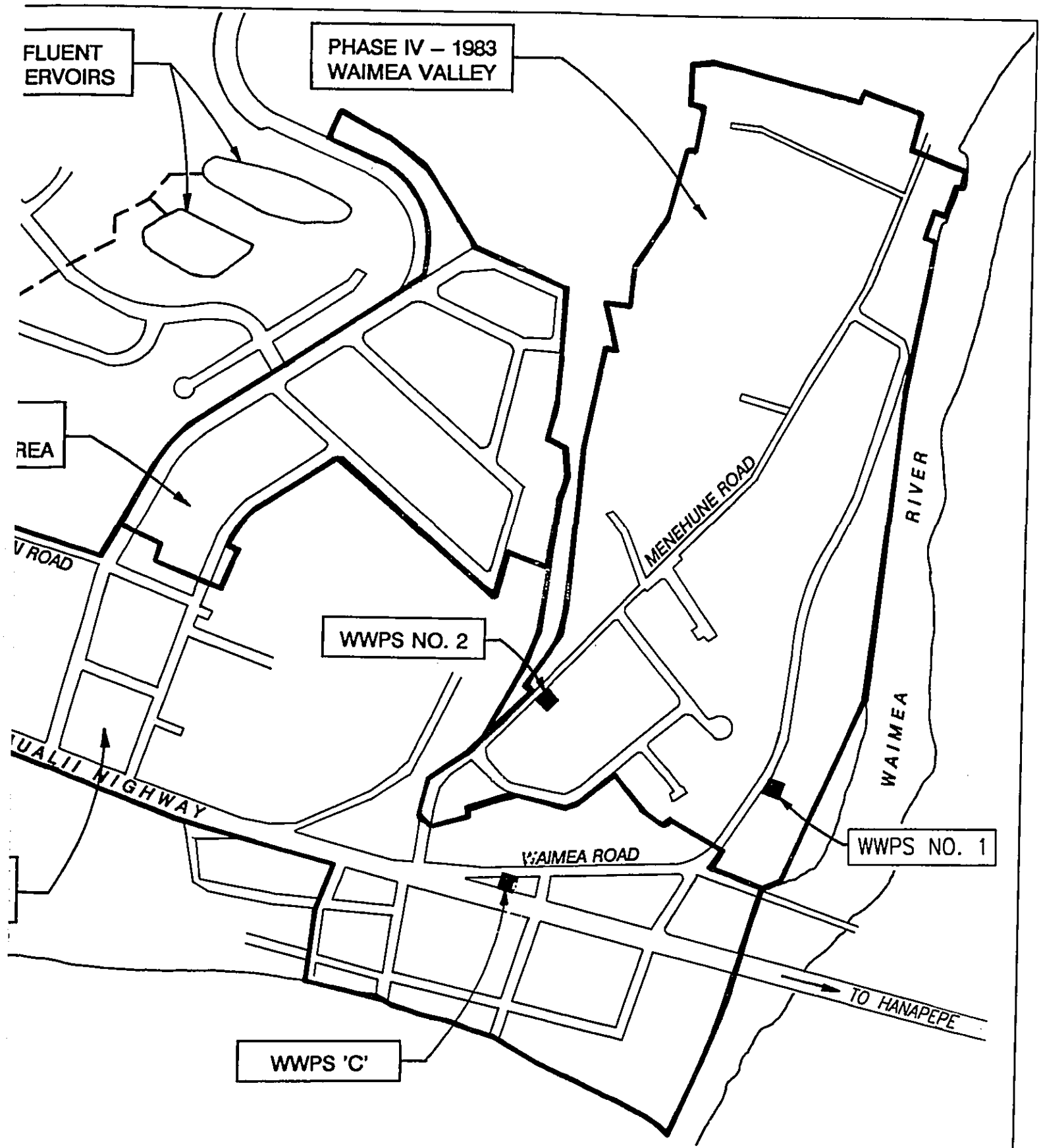


DEPARTMENT OF PUBLIC WORKS COUNTY OF KAUAI WAIMEA WASTEWATER TREATMENT PLANT BACKUP INJECTION WELL DRAFT ENVIRONMENTAL ASSESSMENT	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII EXISTING WAIMEA WASTEWATER SYSTEM	EXHIBIT 8

APPENDICES

APPENDIX A

Mink & Yuen, Inc.'s
"Wastewater Effluent Disposal by Injection Wells,
Kikiaola, Kauai, Hawaii,"
August 1993

WASTEWATER EFFLUENT DISPOSAL BY INJECTION WELLS

KIKIAOLA, KAUAI, HAWAII

Prepared by

Mink & Yuen, Incorporated

100 North Beretania Street, Suite 303

Honolulu, Hawaii 96817

Prepared for

Austin, Tsutsumi & Associates, Incorporated

501 Sumner Street, Suite 521

Honolulu, Hawaii 96817

August, 1993

TABLE OF CONTENTS

FIGURES

Introduction

The hydrogeological data base for the coastal plain lying between Waimea and Polihale State Park in western Kauai is sparse, even though numerous wells have been drilled. This report utilizes the existing data base and extrapolates beyond it with conceptual models consistent with known patterns of hydrogeological conditions in analogous situations. The analyses that follow are keyed to the State Department of Health requirement that injection is not allowed where the groundwater has a concentration of 10,000 mg/l total dissolved solids (TDS) or less.

For the analyses in this report, the proposed maximum injection rate of 1.2 mgd is used.

General Geology of the Mana-Kekaha Plain

The waste water treatment plant (WWTP) and the sites where injection wells would be feasible are located in the eastern part of the coastal plain as it narrows between Kekaha and Waimea. The plain consists of a sequence of

sedimentary strata resting on the basement rock of Napali basalt. The sedimentary column, also called the caprock, is approximately 270 feet deep at the WWTP and 600 feet thick at the coast. Two miles to the west at well 5842-01 by the Kekaha Sugar Mill the caprock is 400 feet deep. Figure 2 is a lithology log of this well. Figure 1 is a map of the region showing the general surface geology and well locations.

The caprock sediments as a whole are poorly permeable and act as a confining layer on the Napali aquifer. Most of the strata are dominated by clay, but a few horizons of permeable coral and sand are sandwiched between the clays. A typical geological column in the vicinity of the WWTP starts with a layer of sand and coral reaching to about 60 feet below sea level where it rests on clay. Another coral layer about 20 feet thick lies between 110 and 125 feet below sea level, and another about 15 feet thick is sandwiched between clays from about 205 to 220 feet below sea level. The final stratum in the sedimentary column is a clay overlying the weathered zone of the Napali formation. Figure 3 illustrates all of the lithologic logs available for wells in the Mana Plain, and Figure 4, modified from DOWALD Report R 53, shows locations of the wells.

The probable distribution of the coral and clay layers between Kekaha and Waimea is illustrated in Figure 5. This

diagram is a cross-section of the subsurface geology along a line drawn perpendicular to the coast and the cliffs at the inner margin of the plain while passing through the WWTP. Noted on the figure are TDS concentrations encountered in wells when they were first drilled in 1929-1930, before continuous pumping started. The TDS concentrations are converted from chloride concentrations using the chloride to TDS ratio in sea water. The estimated half sea water isoconcentration at 17,500 mg/l TDS is also indicated.

Coral layers are much more permeable than clays and may be able to accept injected fluid. However, only the highest stratum starting at ground level is thick enough to accommodate a high rate of injection. The other two coralline layers are probably too thin to take 1.2 mgd.

The top sand and coral stratum probably could accommodate an injection rate of 1.2 mgd, but this formation is open to the sea at and for some distance off the coast. Unless mixing of sea water with effluent seepage along the coast were rapid, the effluent nutrients might provide an opportunity for marine blooms. The cesspools and septic tanks emplaced in this layer already add nutrient-rich effluent to the ambient groundwater.

The injection alternative having the greatest chance of success with fewest constraints is by way of deep wells

penetrating into brackish to saline water below the fresh water core of the basal lens in the Napali formation. The caprock/Napali contact slopes at an angle of about 8 degrees near Kekaha. To avoid the 10,000 TDS isoconcentration, wells will have to be more than 500 feet deep.

The Groundwater Environment

In Figure 5 the theoretical half sea water concentration (17,500 mg/l TDS) is plotted from head data. This concentration contour is the middle of the transition zone, and its depth below sea level is calculated by multiplying the head by the Ghyben-Herzberg constant, 40. Salinity above the midpoint decreases symmetrically. A fresh water core lies above the transition zone.

The thickness of the upper limb of the transition zone depends on the groundwater flux and the mode of discharge of the lens. In a lens unprotected by caprock, the transition is thin if flux is high because discharge takes place as a line sink along the coast. In a thick lens confined by caprock, the transition zone would be wider for the same rate of groundwater flow because discharge is hampered by the low permeability of the caprock/basalt interface. The upper limb of the transition zone in the vicinity of Kikiaola is probably on the order of 100 feet thick. In this limb the

10,000 mg/l TDS contour lies.

To avoid encountering groundwater containing less than 10,000 mg/l TDS, the injection wells will have to placed seaward of the WWTP somewhere in the vicinity of Highway 50 (Kaumuali Road) or further seaward. At the highway the caprock/Napali contact is about 400 feet below sea level and TDS of the ambient groundwater is at least 13,000 mg/l (the original concentration at the Kekaha Mill well at the time of drilling in 1930) and more likely 22,000 mg/l (an analysis in 1972). To handle 1.2 mgd, the injection well will have to penetrate 200 feet into the Napali aquifer. Thus, at the highway an injection well will have to be 600 feet deep to be reliable. Further seaward the required depth will increase. At the coast, for example, a well would have to be 800 feet deep.

Injection Hydraulics

The waste water injected into the Napali aquifer will have a lower density than the ambient groundwater, and if the density difference is significant, the waste water will rise as a plume around the well until it encounters the caprock. A portion will travel upgradient along the interface to a stagnation point, and the bulk will move downgradient as a slug in the ambient flow field. Eventually the wastewater

will seep into the caprock, driven by a positive potential in the aquifer relative to the potential in the caprock. The area of seepage depends on the permeability of the caprock interface and the injection rate.

If the difference in density between the ambient groundwater and the injected fluid is very small, the injectant will not rise but, instead, will form a plume in the ambient flow field. The difference in density for the Kikiaola injection, however, is likely to be significant enough to result in vertical movement of the injectant. Assuming the injection takes place in the lower limb of the transition zone where the TDS concentration ranges from 17,500 mg/l to sea water, the average density of the ambient groundwater will be 1.0188. The density of the waste water is taken as 1.0000 because it is very nearly fresh water.

To predict where the injectant will travel and if it might impact ambient groundwater having less than 10,000 mg/l TDS, four behavioral characteristics of the injectant need to be examined: 1) the buoyancy gradient, 2) radius of the buoyant column, 3) upgradient movement of the slug along the caprock interface, and 4) rate of discharge into the caprock and area over which discharge takes place. Once in the caprock, the injectant will move seaward to eventually discharge at the sea bottom.

Buoyancy Gradient

The buoyancy gradient is expressed as:

$$\{g(a) - g(c)\}/g(a)$$

in which g(a) is density of the ambient groundwater, taken as 1.0188, and g(c) is density of the waste water, 1.0000. The density difference is .0188; if the ambient groundwater were sea water, the difference would be .025. Derivations of the buoyancy gradient are given in Mink and Lau (1980); Burnham, Larson and Cooper (1977); and Wheatcraft (1979).

The gradient is high, and therefore the upward velocity of flow is rapid. Assuming the vertical hydraulic conductivity (k) in the Napali basalt is 200 ft/day, equal to about one tenth the horizontal conductivity, and effective porosity (n) is .05 (these parameters are commonly used in numerical modeling), the velocity is:

$$v = .0188\ (k/n) = 75 \text{ ft/day.}$$

Manifestly the vertical plume will quickly establish itself all the way from the bottom of the screen to the caprock interface because the vertical velocity is much greater than the ambient flow field velocity of 5 to 10 ft/day.

Radius of the Vertical Cylindrical Slug

In their analysis of the fate of injected waste water at

the Kahului, Maui WWTP, Burnaham, et al (1977) derived an expression for the radius of the cylindrical slug along the screen of the injection well. The average radius, r(av), is written as:

$$r(av) = (2/3)\ (Q/\pi\, kg)^{1/2}$$

in which Q is injection rate, k is vertical hydraulic conductivity, and g is the buoyancy gradient. For an injection rate of 1.2 mgd over a screen length of 200 feet, the average radius of the slug will be 78 feet. The maximum radius at the top of the screen will be 117 feet.

The caprock, because of its low permeability, can't accept all of the injectant over this small a radius. The injectant will move upgradient to a stagnation point where the potential of the slug equals that of the ambient flow, and downgradient along the caprock/basalt interface.

Upgradient Movement of Injectant

The methods employed to predict injected effluent behavior are simple and straightforward because the absence of reliable caprock and basalt aquifer parameters does not justify use of numerical modeling. The vertical distribution of salinity is based on information from pumping wells, and the position of the transition zone is inferred from heads measured at wells. The depth to the midpoint of the

transition zone is equal to 40 times the head. The position of the fresh water core, transition zone and sea water is illustrated in Figure 5.

The injectant enters the aquifer with a higher potential than the ambient groundwater and therefore will travel as a slug upgradient until the potential of the two fluids are equal. At the edges of the slug hydrodynamic dispersion will occur, but by and large the slug will retain its identity. The stagnation radius, or the distance the slug will travel upgradient before stopping, is:

$$r(stag) = Q/(2\pi bki)$$

in which Q is the injection rate, b is the thickness of the slug, k is horizontal hydraulic conductivity, and i is gradient of the ambient flow field.

This formula assumes the aquifer is homogeneous and isotropic, confined and infinite in extent. In spite of these limitations, it is a reasonable approximation of behavior of the injectant after it rises into the basal lens. The EPA software program WHPA utilizes this equation. Hydrodynamic dispersion is not accounted for.

For Q of 1.2 mgd, b of 100 feet, k at 2000 ft/day, and i of 1/5000, r(stag) is 638 feet. The b value is a compromise, chosen as one half the screen length; the k and i values are typical of basal aquifers in Hawaii.

Under the stated assumptions the maximum width of the plume can be calculated as:

$$w = Q/kbi.$$

The plume will expand to this width several miles downgradient of the well. However, the caprock, beneath which the plume travels, behaves as a leaky confining layer into which the injectant is able to seep. If the caprock contact were impermeable, the plume would continue downgradient until it encountered openings where the sedimentary blanket tails off.

Employing the same values for Q, k, b and i as above, the width of the plume at the injection site will be 2000 feet, or 1000 feet on either side of the well. Two wells located next to each other but receiving 0.6 mgd each would generate a similar plume width. Injection wells capable of accepting a combined rate of 1.2 mgd do not have to be distant from each other because neither the plume width nor the stagnation radius will impact other wells.

For a well located at Highway 50, the slug of injected waste water would travel upgradient to about where the 50 percent sea water concentration encounters the caprock. Under these circumstances, groundwater with less than 10,000 mg/l would not be impacted. A well between the WWTP and the road, however, would encroach into the upper limb of the transition

zone and might affect water having less than 10,000 mg/l TDS. Note that if the average injection rate was to be as high as 0.6 mgd, the stagnation radius would be only 316 feet.

The landward extent of the injection slug will not affect any operational wells driven into the basalt aquifer. The nearest Kauai County Water Department wells are 5840-01, about 0.9 miles upgradient of the proposed injection site, and 5840-02, about 0.75 miles upgradient (see Figure 1). The upgradient reach of the injection plume will be less than 1000 feet and will be restricted to a depth of about 300 feet below sea level. The depth of wells 5840-01 and 5840-02 are 52 and 18 feet below sea level, respectively. According to the Department of Water Supply, the next well to be drilled will be located between Waimea and Kekaha at the cliff line at the inner margin of the coastal plain. The well will be at least one mile upgradient of the injection site.

Well 5840-01 is the principal well used for municipal water supply. It is equipped with a 500 gpm pump. At this rate of pumpage the downgradient stagnation point is 380 feet. This distance added to the upgradient stagnation distance of 638 feet for the proposed injection well will allow a separation of about 3000 feet between the envelope of flow to 5840-01 and the upgradient reach of the injection plume.

Seepage of Waste Water into the Caprock

The permeability of the clay at the base of the caprock is quite low, probably less than 1 ft/day and perhaps on the order of 0.1 ft/day. The seepage rate per unit area from the Napali aquifer into the caprock is correspondingly small. Yet the caprock is the ultimate destination of the basal water.

An analysis employing leaky aquifer concepts provides an estimate of the area of caprock required to accept the injected waste water. Figure 6 illustrates the hydrogeological environment on which the analysis is based. The expression:

$$q(x)/q(0) = exp\ \{-x/(kbC)^{1/2}\}$$

gives the ratio of flow remaining at a distance downgradient of the section where flow is q(0). In the expression, q(x) is flow at a distance x from the section q(0), k is horizontal hydraulic conductivity, b is depth of flow, and C = b'/k' in which b' is the thickness of the caprock stratum receiving seepage and k' is hydraulic conductivity of this stratum.

For k (Napali) = 2000 ft/day, b = 100 feet, b' = 50 feet and k' = 0.1 ft/day,

$$q(x)/q(0) = .9048$$

which states that approximately 10 percent of the flow in the Napali seeps into the caprock over a distance of 1000 feet.

Over a linear distance of 10,000 feet, 63 percent seeps into the caprock. For k' = 1 ft/day, the respective seepage values would be 27 percent and 96 percent.

A large caprock/Napali interface area is required to discharge the basal lens and its slug of injected waste water, but most of the area of seepage will be downgradient of the injection well. Over the upgradient distance (638 feet) less than 10 percent of the effluent will enter the caprock; the remainder moves down the interface slope.

Fate of Nutrients

Nutrients and other dissolved matter in the injectant will eventually dissipate into the sedimentary caprock, and then ultimately discharge into the sea at a considerable distance from the coast and deep below sea level. The process of dispersion in the saline water of the caprock and distributed seepage from the caprock into sea water will reduce the concentration of dissolved matter at the caprock-sea water interface.

The injected effluent will be prevented from mixing in coastal waters by the thick wedge of caprock. The caprock extends as a low permeability blanket for an unknown distance off shore. It is not possible to state just where the injectant will finally mix with water in the open sea, but

unquestionably it will be a considerable distance off shore and at a depth of hundreds of feet.

The sea floor slopes gently from 0 to 60 feet depth over a distance of 3000 feet from the coast, indicating that the caprock wedge extends at least over this distance. It then slopes more steeply, from depth 60 to depth 300 feet over the next 3000 feet, and more steeply over the next 1000 feet from depth 300 to depth 600 feet. The steepening slope traces the descent of the front of the caprock wedge. The depth of 600 feet lies 7000 feet off shore. Whether the injectant seepas into the caprock or remains in the basalt aquifer, its emergence in the sea floor will take place no closer than one half mile from the coast.

Summary

Groundwater in the Napali basalt aquifer inland of the WWTP contains less than 10,000 mg/l TDS and therefore is ineligible for injection wells. The 10,000 mg/l TDS isoconcentration intersects the caprock about midway between the WWTP and Highway 50. Between here and the coast all groundwater has more than 10,000 mg/l TDS.

The waste water effluent will have a density nearly that of fresh water while the ambient groundwater will range from half to full sea water salinity. At Highway 50 groundwater in

the Napali constitutes the lower half of the transition zone and has an average composition of 26,000 mg/l TDS and density of 1.0188. In an injection well located here, the difference in density between the waste water and the ground water will cause the injectant to rapidly rise as a cylindrical slug around the well screen. On reaching the caprock/Napali contact, a plume will move to a stagnation point about 640 feet upgradient, and the remainder will move downgradient along the contact. The upgradient slug will not interfere with groundwater containing less than 10,000 mg/l TDS.

Eventually the waste water injectant will seep into the caprock. A large surface area of the caprock/Napali interface is required to discharge the basal lens, including the injectant fluid. Most of the seepage into the caprock will take place downgradient of Highway 50 and will have no impact at the shore line where the caprock is 600 feet thick. Groundwater seeping into the caprock has no opportunity to rise to discharge at an open coast.

Recommendation

Locate two injection wells at Highway 50, or between the Highway and the coast, wherever a site is available. If each well is rated at a maximum of 1.2 mgd, with an average that is up to half of this rate (i.e., 0.6 mgd), they can be placed within 50 feet of each other.

Wells at Highway 50 will have to be 600 feet deep. They will be cased and grouted throughout the 400 feet thickness of the caprock. The 200 feet section in the Napali basalt will either be screened or open, depending upon the nature of the formations encountered. The diameter of the casing and screen will depend on the volume rate of injection. At an injection rate of 1.2 mgd for each well, a 12 or 14 inch diameter casing will be required.

Data Summary

Mana Coastal Plain Wells with a Data Record

Well	Grd. El(ft)	Napali El(ft)	Depth El(ft)	Cl(0) mg/l	Cl(P) mg/l	h(ft)
5842-01	9	-394	-481	7130	11,800	8.3
0044-13	8	-153	-206	81	200-800	10.5
0044-14	8	-155	-237	139	400-900	10.3
0045-03	10	-181	-252	135	130-180	9.5
0145-22	9	-149	-236	94	310-650	10.4
0145-23	10	-154	-244	93	250-700	10.4
0145-24	10	-152	-265	114		
0146-04	9	-235	-352	498	1000	9.6
0245-01	55	-160	-243			

Column Explanation

Well: State number.
Grd.El(ft): Elevation of ground surface above sea level.
Napali El(ft): Elevation of caprock/Napali contact.
Depth El(ft): Elevation bottom of well.
Cl(0) mg/l: Initial chloride during drilling, before pumping.
Cl(P) mg/l: Chloride during pumping.
h(ft): Average head, feet above sea level.

References

1. Burnham, W.L., Larson, S.P., and Cooper, H.H., 1977, Distribution of Injected Wastewater in the Saline Lava Aquifer, Wailuku-Kahului Wastewater Treatment Facility, Kahului, Maui, Hawaii: U.S. Geological Survey OFR 77-469.

2. Burt, R.J., 1979, Availability of Groundwater for Irrigation on the Kekaha-Mana Coastal Plain, Island of Kauai, Hawaii: State of Hawaii Dept. Land and Natural Resources, Report R53.

3. Mink, J.F., and Lau, L.S., 1980, Hawaiian Groundwater Geology and Hydrology and Early Mathematical Models: Univ. Hawaii Water Resources Research Center, Tech. Mem. 62.

4. Macdonald, G.A., Davis, D.A., and Cox, D.C., 1960, Geology and Ground-Water Resources of the Island of Kauai, Hawaii: State of Hawaii Division Hydrography, Bulletin 13.

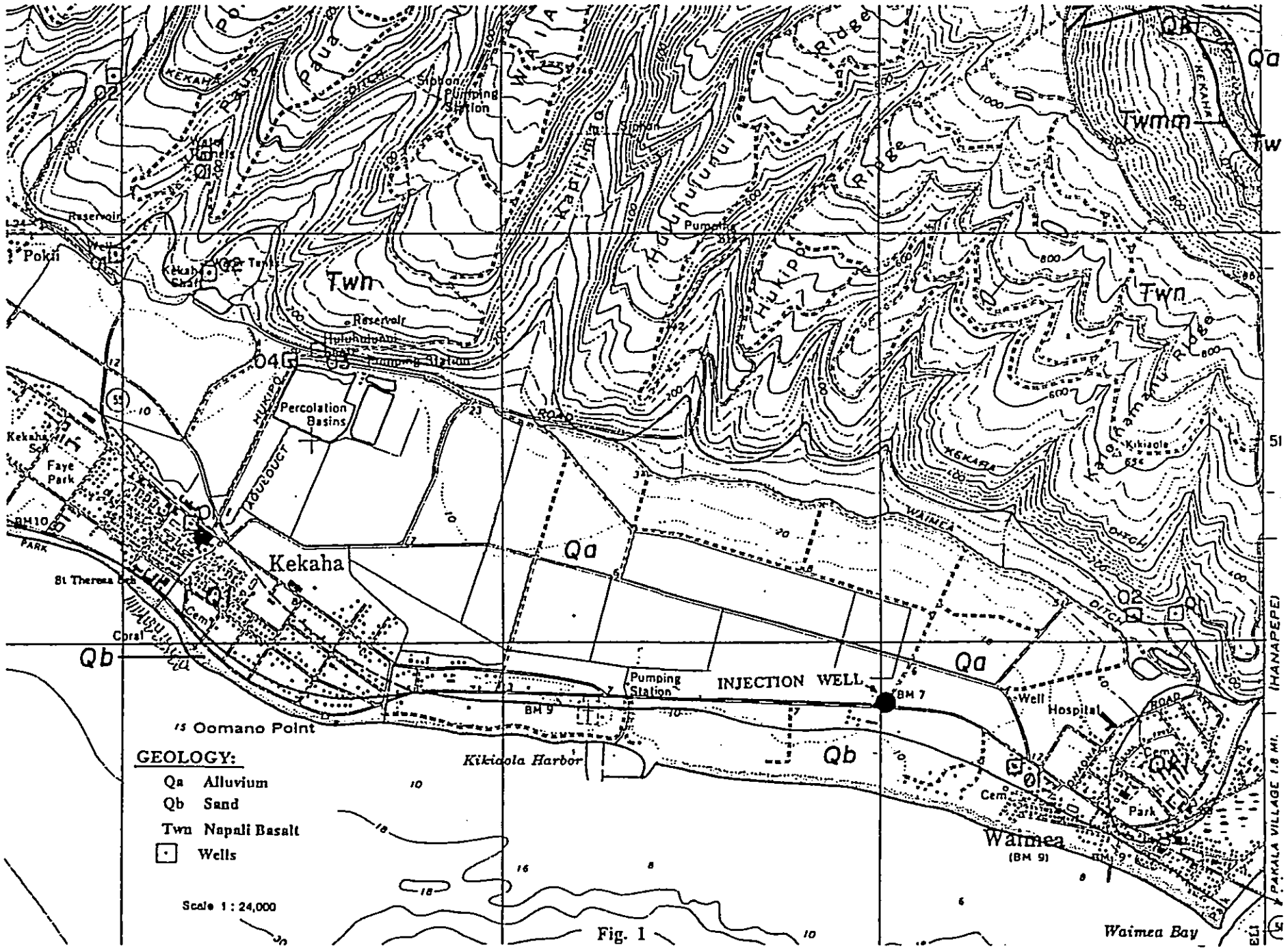

Qa
Twmm
Tw
Twn
Reservoir
Pumping Station
Percolation Basins
AQUEDUCT
Kekaha
Qa
Qb
Pumping Station
INJECTION WELL
BM 7
BM 9
Oomano Point
Kikiaola Harbor
Hospital
Park
Waimea
(BM 9)
Waimea Bay
GEOLOGY:
Qa Alluvium
Qb Sand
Twn Napali Basalt
Wells
Scale 1 : 24,000

Fig. 1

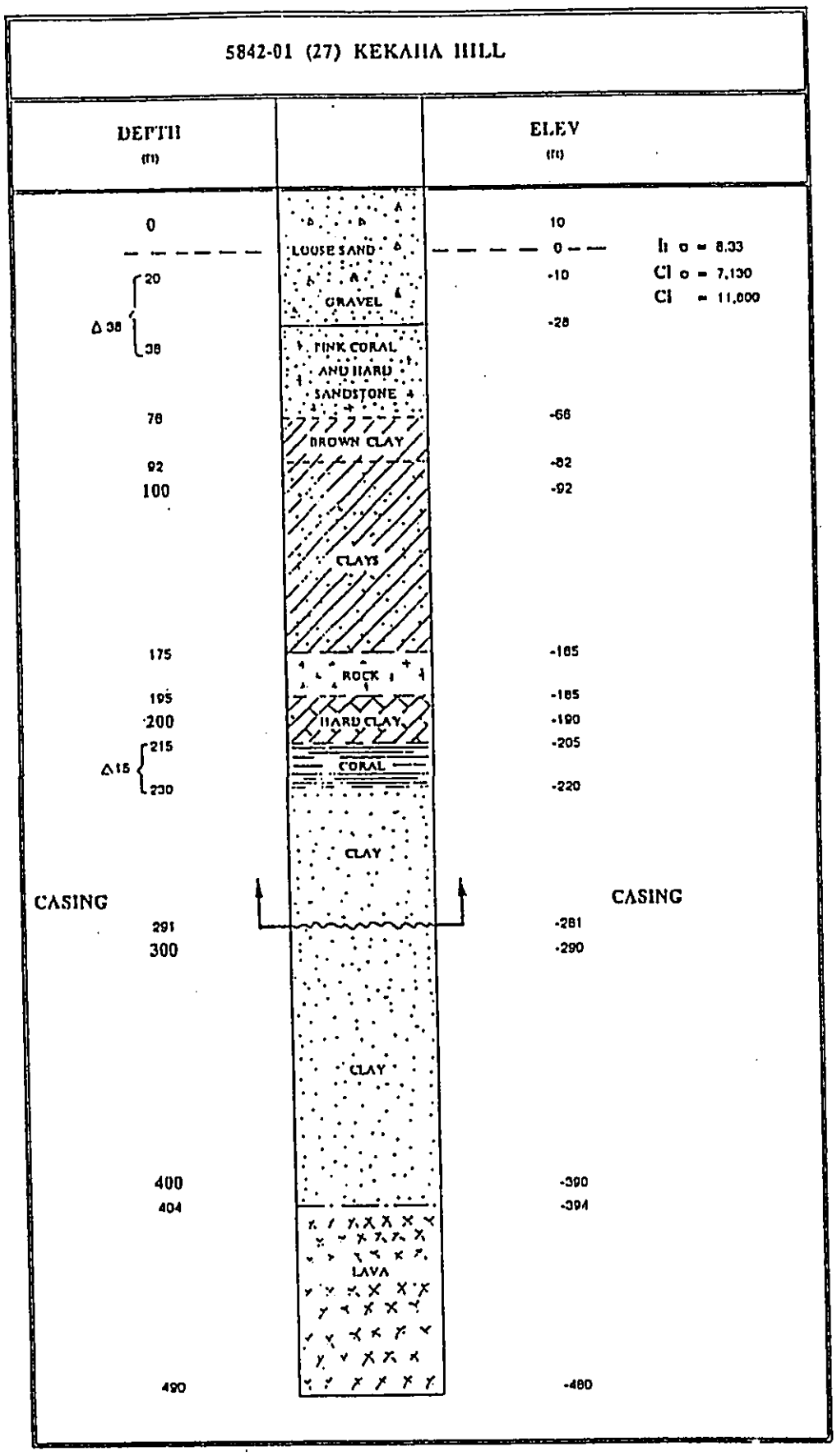

5842-01 (27) KEKAHA HILL
DEPTH
(ft)
ELEV
(ft)
0
10
LOOSE SAND
0
Ti o = 8.33
Cl o = 7,130
Cl = 11,000
20
-10
GRAVEL
Δ 38
38
-28
PINK CORAL
AND HARD
SANDSTONE
78
-68
BROWN CLAY
92
-82
100
-92
CLAYS
175
-165
ROCK
195
-185
200
-190
HARD CLAY
215
-205
Δ 15
CORAL
230
-220
CLAY
CASING
CASING
291
-281
300
-290
CLAY
400
-390
404
-394
LAVA
490
-480

Fig. 2

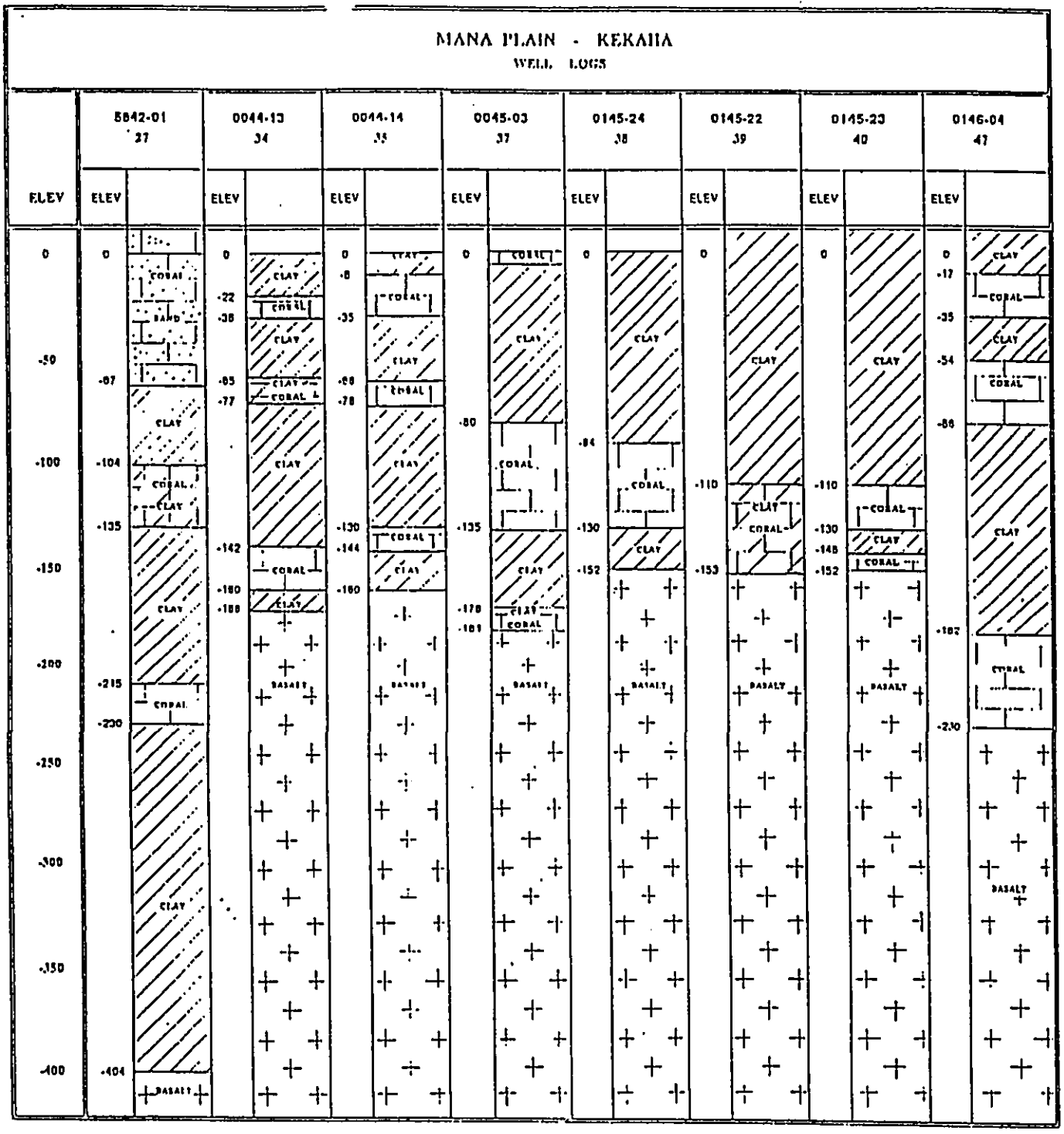
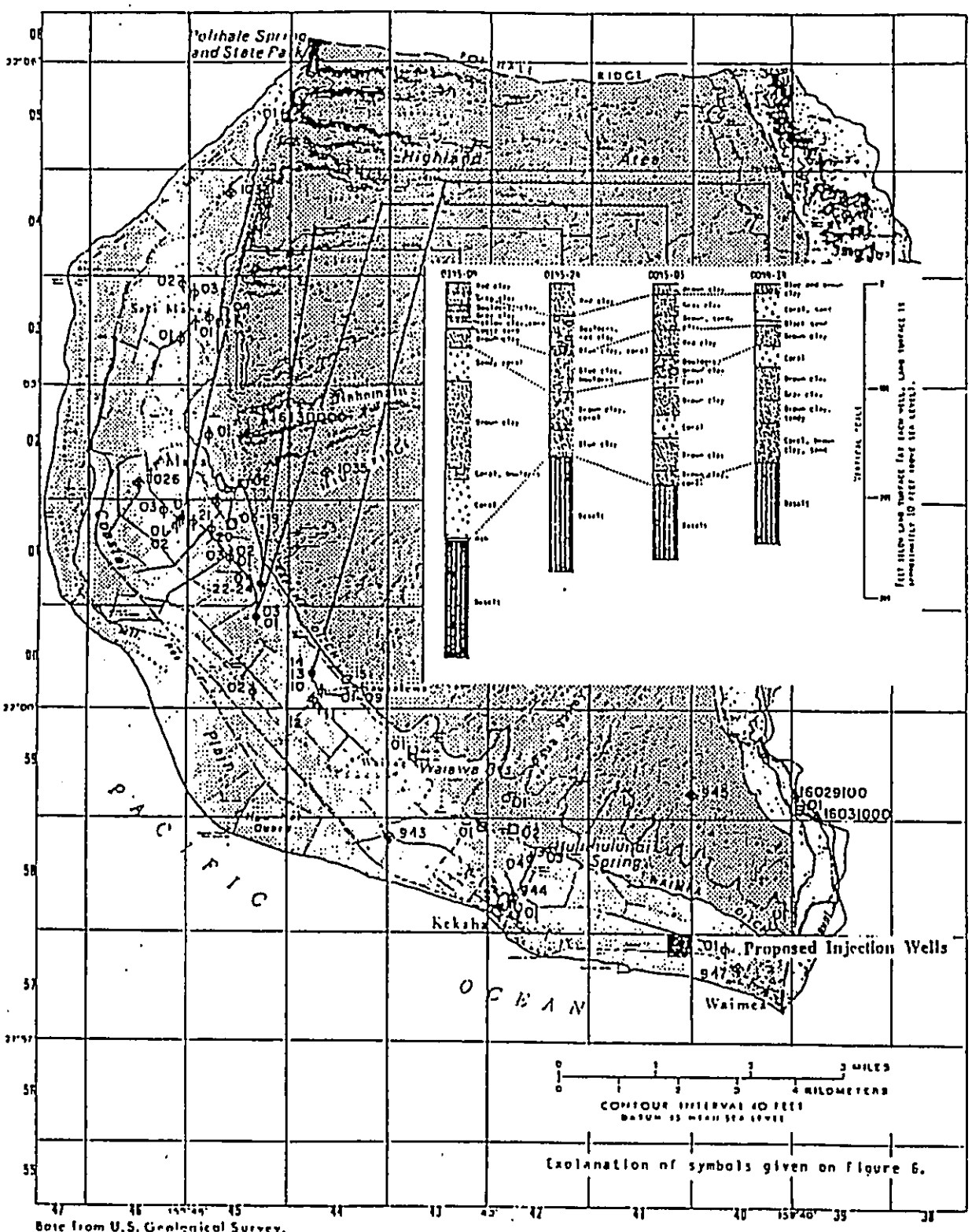

MANA PLAIN - KEKAHA
WELL LOGS
5842-01
27
0044-13
34
0044-14
35
0045-03
37
0145-24
38
0145-22
39
0145-23
40
0146-04
41
ELEV
0
-50
-100
-150
-200
-250
-300
-350
-400
-404
CORAL
SAND
CLAY
BASALT

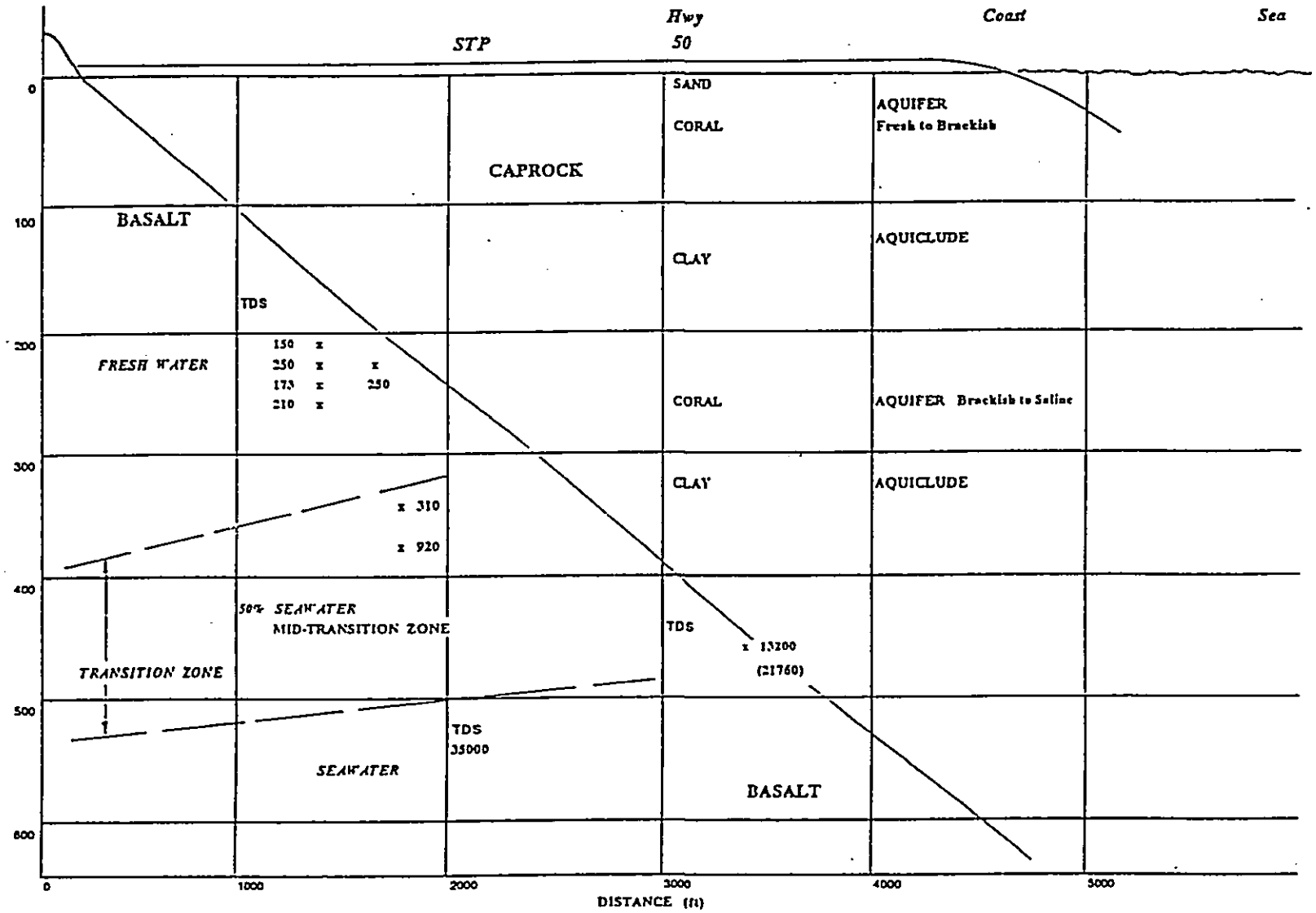
Fig. 3



Base from U.S. Geological Survey.
Makaha Point, 1:24,000, 1965; Kekaha 1:24,000, 1963;
Honopepe 1:24,000, 1963; Waimea Canyon, 1:24,000, 1965.

Schematic Sections of Representative Wells Showing the Top of the Basalt and Coralline Layers.
[from State of Hawaii DOWALD Report R-53]

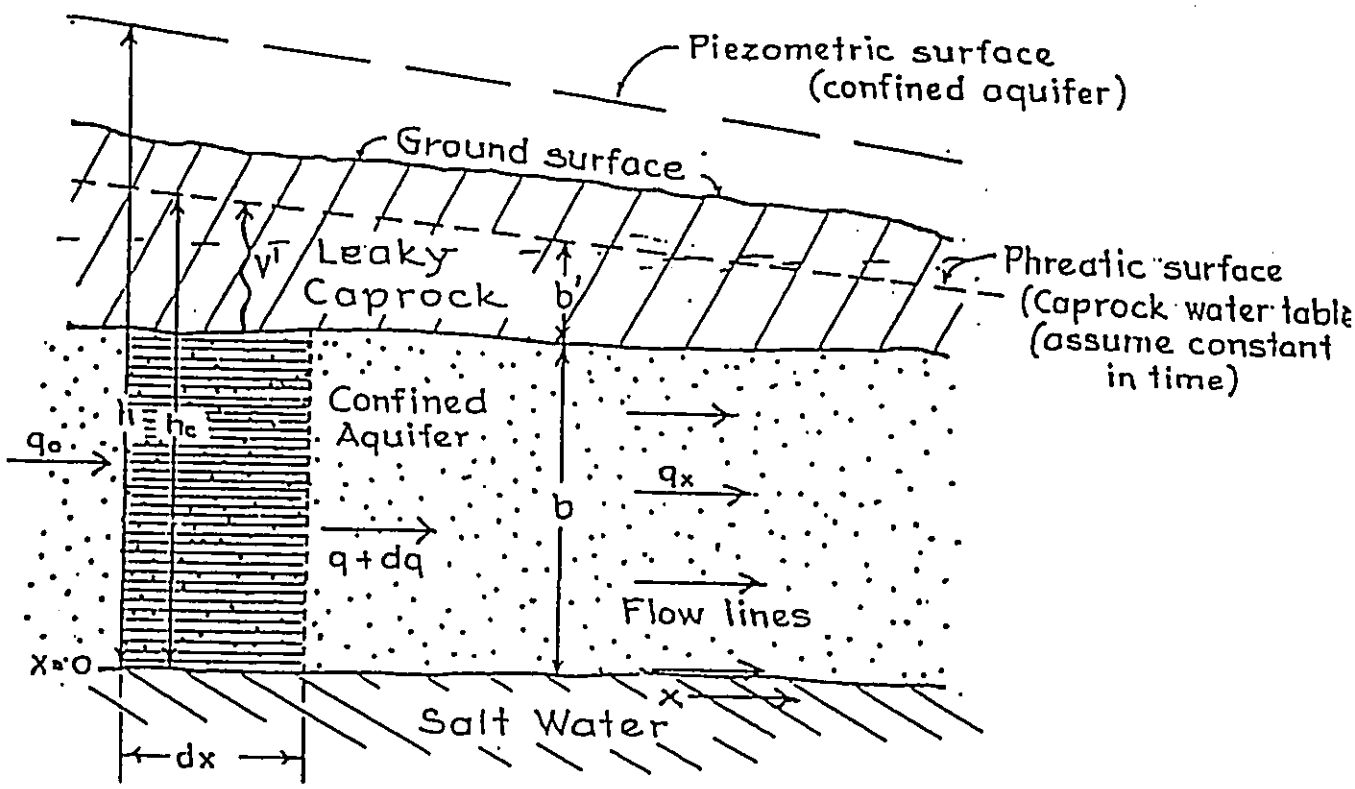
Fig. 4



KIKIAOLA
SECTION
CLIFF LINE
THROUGH STP to COAST

Fig. 5

Steady flow, two dimensional, flow through aquifer horizontal; flow through caprock vertical. Aquifer and caprock isotropic, infinite extent.



NOTE: Assume sharp interface, lowest fresh water flow line undeformable, thus salt water equivalent to impermeable boundary.

Fig. 6

APPENDIX B

Miscellaneous Correspondence

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

LAWRENCE MIIKE
DIRECTOR OF HEALTH

In reply, please refer to:
EMD / SDWB
Honolulu, Hawaii 96817-5031

July 20, 1995

Mr. Steve Oliver, County Engineer
Department of Public Works
County of Kauai
3021 Umi Street
Lihue, Kauai, Hawaii 96766

ATTENTION: Mr. Larry Dill

Dear Mr. Oliver:

SUBJECT: TIME EXTENSION ON THE APPROVAL TO CONSTRUCT DEADLINE
WAIMEA WASTEWATER TREATMENT PLANT
UNDERGROUND INJECTION CONTROL (UIC)
UIC APPLICATION NO. UK-1376

Pursuant to your request dated February 7, 1995, the Department of Health hereby extends the deadline of the approval to construct two (2) injection wells at the subject facility until January 23, 1996. However, this extension is subject to the conditions, as described in this letter, which change the original approach for the construction of the injection wells.

As you know, concerns about deep injection into volcanic aquifers have been expressed by Kikiaola Land Company. Pursuant to those concerns, the Department had deliberated on alternative injection approaches to identify injection practices that would be least adversely impactive on underground sources of drinking water, although recognizing that any form of injection practice would result in some form of environmental impact. The Department concluded that, as a first choice, the viability of shallow injection should be explored before deep injection, and that deep injection should only occur as a last resort practice if shallow injection proves unfeasible.

The Department's approach regarding shallow injection had been expressed to the Environmental Protection Agency (EPA), Region 9 in a letter to Ms. Doris Betuel dated June 22, 1995; a copy of that letter is enclosed. In turn, EPA made a response in concurrence with the approach for shallow injection as expressed in EPA's letter dated July 12, 1995; a copy is also enclosed.

The following conditions shall apply to the construction and testing of the two proposed injection wells:

1. Shallowest possible injection zones shall be carefully sought to serve the purpose of disposal of secondary treated sewage effluent. Consequently, injection zone(s) in the caprock shall be sought and performance tested. In general, granular or coralline layers shall be sought during drilling and when encountered shall be adequately injection tested for performance.

   The search for granular or coralline layers will necessitate incremental drilling and injection testing. Drilling and injection testing increments shall not exceed twenty (20) feet unless soil or core samples explicitly indicate no presence of granular or coralline layers. In order to prevent overdrilling and encroachment on underlying volcanic formations, drilling shall be not be hastily conducted.

   Logging of the injection wells shall be conducted by a geologist or a geological technician under the supervision of a geologist. Driller's logging is not acceptable for official purposes. Accurate logging is imperative for the objective of finding shallow injection zones.

   A small diameter, for example 4-inch, pilot rotary boring could be made to specifically investigate the subsurface formations under the injection well site before the construction of the actual injection wells. The advantage of a pilot boring is the collection of accurate formation (soil and rock) information that would be normally difficult to collect from a larger diameter percussion-style drilling operation. Once accurate information is known from the pilot boring, drilling of the actual injection wells would primarily focus on construction and not investigation, which may result in greater construction efficiency. Although a pilot boring is highly recommended, it is not a requirement at this time.

2. If a pilot boring is not utilized, daily field reporting to the Department during the construction of the injection wells is required. The daily report shall be made by telephone to the Department on the next working day for the preceding day's drilling work. The daily field report shall focus on identification of subsurface formations, drilling depths, and injection test results. The purpose of this condition is to prevent the occurrence of overdrilling beyond depths that would be sufficient to sustain design rates of effluent discharge.

3. Once injection depths are finalized and the injection wells are constructed to the extent that casing and annular backfill have been installed, a minimum 12-hour injection test at design rates shall be conducted for each injection well. Moreover, preliminary injection testing over extended durations before the injection wells are finalized is highly recommended. Preliminary injection test results will provide a liberal estimate of injection capacities which tend to diminish with the installation of well casings and annular backfill.

   Official injection tests, utilizing finalized injection wells at design discharge rates, must show satisfactory performance. A UIC permit will not be issued for injection wells that are incapable of successfully supporting the proposed quantity of discharge.

4. If shallow injection opportunities are not found, deep injection as originally planned will be the next approach. Before any switch in field work from shallow injection drilling to deep injection drilling, the Department must first authorize in writing the switch in approach. Any switch in approach without the approval of the Department will constitute a violation of Hawaii Administrative Rules, Title 11, Chapter 23, Underground Injection Control (UIC).

5. Please refer to the Department's letter to Mr. Steve Oliver dated January 23, 1995. Although this letter refers to the original approval to construct which is now superseded, the requirements of the second page of that letter are still applicable as those requirements describe conditions of the final certified engineering report that must be submitted to the Department in order to obtain a UIC permit to operate the injection wells. Also, the second page mentions the reporting of any encountered artesian conditions; this condition still applies.

6. This approval to construct is valid for a time period of 180 calendar days from the date of this letter. You are requested to notify the Safe Drinking Water Branch verbally and in writing before the commencement and completion of construction activities. Unless construction is commenced within the 180-day time period, this approval to construct will be void. If construction is expected to occur after the 180-day time period, you are required to apply for a time extension of this approval a minimum of 30 days before the expiration of this approval. Copies of this approval and the preliminary application shall be kept at the construction site, where practicable, for inspection by departmental personnel.

If you have any questions about this subject, please call Chauncey Hew or Jaime Rimando of the Safe Drinking Water Branch at 586-4258 or call toll free from the neighbor islands at 1-800-468-4644, ext. 64258.

Sincerely,

THOMAS E. ARIZUMI, P.E., Chief
Environmental Management Division

CH:JR:kh

Enclosures: 1. DOH Letter Dated 6/22/1995
2. EPA Letter Dated 7/12/1995

c: 1. Harold Eichelberger, SDWB Sanitarian, Kauai (w/encls.)
2. ✓ Mr. Ivan Nakatsuka
501 Sumner Street, Suite 521
Honolulu, HI 96817-5031 (w/o encls.)
3. Ms. Doris Betuel
Source Water Protection Section
U.S. EPA, Region 9
75 Hawthorne Street, (W-6-3)
San Francisco, CA 94105-3901 (w/o encls.)
4. Dennis Tulang, Chief, Wastewater Branch (w/o encls.)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901
Mail Code: W-6-3

JUL 12 1995

RECEIVED
SAFE DRINKING WATER BRANCH

JUL 17 '95

William Wong, P.E., Chief
Safe Drinking Water Branch
State Department of Health
919 Ala Moana Blvd.
Honolulu, HI 96814

Re: Waimea Wastewater Treatment Plant, State Underground Injection Control (UIC) Application No. UK-1876

Dear Mr. Wong:

Thank you for informing us of your approach regarding the proposed injection wells that the County of Kauai plans to construct at its Waimea Wastewater Treatment Plant. As we have previously stated, we strongly encourage reclamation of the treated wastewater effluent and see injection as a temporary solution to the loss of the current user for the reclaimed effluent.

In the light of the current situation, we support your decision to explore injection into the shallow caprock aquifer rather than into the basal aquifer where injection might impact drinking water wells. Under federal regulations, the caprock aquifer is still considered an Underground Source of Drinking Water (USDW). Therefore, when we require a permit application for the facility, we will require conditions that are protective of this USDW. In the meantime, we will work with you to ensure that the State's permit will be compatible. Since this is a wastewater facility, please continue to work with your Clean Water Branch on this permit. We have heard that the County plans to conduct nearshore monitoring to detect any impacts from shallow injection and we support that action.

If injection into the shallower aquifer is impractical due to low permeability, thus necessitating injection into the basal aquifer, we strongly recommend the installation of monitoring wells between the injection wells and the drinking water wells for early detection of possible impacts to the drinking water wells.

If you have any questions, please call Jose Gutierrez at (415) 744-1829 or Shannon FitzGerald at (415) 744-1830.

Sincerely,

Doris Betuel, Chief
Source Water Protection Section

Mink & Yuen, Inc.

100 N. Beretania Street • Suite 303 • Honolulu, Hawaii 96817 • Telephone: (808) 536-0081 • Fax: (808) 536-0082

April 19, 1995

Mr. Ivan Nakatsuka
Austin, Tsutsumi and Associates, Inc.
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-3646

Re: Response to Comments by J. T. Harrison, Environmental Coordinator, University of Hawaii

The following will respond to comments by J.T. Harrison of the UH relative to the proposed Waimea Injection Wells, Kauai:

J.T.H.: NO DATA AVAILABLE ON INJECTION CAPACITY

M&Y: The Napali basalt is highly permeable and wells can be developed to yield several million gallons per day (gpd) each. An aquifer responds to injection in the same ways it does to pumping. Pump capacity data and length of penetration into the Napali basalt for wells listed on page 17 of the Mink & Yuen, Inc. report are as follows:

Well	Pump Capacity (mgd)	Napali Basalt (ft)
5842-01	N/A	87
0044-13	3.02	53
0044-14	2.30	82
0045-03	2.30	71
0145-22	2.45	87
0145-23	2.30	90
0145-24	2.30	113
0146-04	N/A	117
0245-01	N/A	83

Napali wells are capable of yielding twice the proposed injection rate for a length of penetration less than half that proposed.

J.T.H.: SCREENED OR PERFORATED CASING

M&Y: Based on our knowledge and experience and the experience of others, it is our opinion that a screened casing is not necessary. We cannot guarantee that caving will not occur but our hydrologist feels that the Napali basalt is sufficiently stable to preclude such an occurrence. We believe that the

perforations in the screen tend to get clogged faster, thereby reducing the efficiency of the well. Moreover, clogging of the fissures and interstices in the open hole outside of the screen will make it very difficult to clean because of the interference of the screen.

Our opinion is confirmed by the experience of injection wells in Waimanalo, Oahu, Wailuku-Kahului, Lahaina, and Kihei, Maui, all of which have unscreened open holes that are air-cleaned.

J.T.H.: POSSIBLE IMPACTS TO DEEP SEA ECOLOGY

M&Y: The dispersal of the injectant over a wide area of caprock into which the injectant will seep means that the unit rate of seepage into the sea floor will be very small. The injectant plume will dissipate into thousands of square feet of caprock, then further disperse in the saturated caprock before emerging into the sea floor. An example based on approximations and assumptions will illustrate the phenomenon. The maximum width of the injection plume will be on the order of 4000 feet (based on standard capture zone analysis), and all of the injectant is likely to be dissipated over a down gradient distance of 10,000 feet from the well. Thus, the total caprock surface will be 10 to 40 million square feet. The seepage rate for an area of 10 million square feet at an injection rate of 1.2 mgd is 0.12 gpd/sq. ft. Because seepage is into saturated caprock, it will mix with caprock water, diluting its composition. The seepage rate will be very small, and its effect on sea floor ecology would be negligible. The seepage rate and composition will be many magnitudes less than discharges from ocean outfalls and natural shore discharges.

We hope this will provide the clarification desired.

Sincerely,

George A.L. Yuen
President

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, Ca. 94105-3901
Mail Code: W-6-2

OCT 4 1993

Bill Wong, Branch Chief
Safe Drinking Water Branch
State Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Wong:

Thank you for sending us a copy of the draft Waimea Wastewater Treatment Plant Effluent Reuse/Disposal Alternative Study prepared for the County of Kauai by Austin, Tsutsumi & Associates, Inc. Your staff requested our comments on the UIC paragraph of the August 25, 1993 letter from Kiyoji Masaki, Chief Engineer for County of Kauai, to Pete Madrigal of the HDOH Wastewater Branch regarding the formentioned study. Nutrient removal would not be necessary if certain conditions are met. Our comments are as follows:

- If injection is into an aquifer that has greater than 10,000 mg/l total dissolved solids, then injection is not into an underground source of drinking water (USDW) and drinking water standards do not apply.

- If injection is into a USDW or the injectate migrates into a USDW, then EPA could require the injectate to meet maximum contaminant levels (MCLs).

- Should an injection well be approved and surface water quality problems develop, such as algal blooms, EPA may request studies to determine if effluent from the injection wells is reaching the ocean. If it is shown that effluent is entering the ocean, then the injectate would be subject to surface water standards.

EPA strongly supports reclamation of treated wastewater, especially in Hawaii where water is a valuable and limited resource. I appreciate the reclamation that has occurred due to the cooperative efforts of the County of Kauai and Kekaha Sugar.

The County of Kauai has requested a federal UIC permit application and we will be sending one to them. Once we have a completed application from the County, we will then be able to make a determination on the suitability of the injection wells and what standards would apply to the injectate if the wells are approved.

Thank you for soliciting our input. If you have any questions, please do not hesitate to call me at (415) 744-1835 or Luisa Valiela of my staff at (415) 744-1842.

Sincerely,

Doris Betuel

Doris Betuel, Acting Chief
Groundwater Pollution Control Section

cc: Edmond Renaud, County of Kauai
Doug Haigh, County of Kauai
Pete Madrigal, Wastewater Branch, HDOH
Harold Eichelberger, HDOH, Kauai

Mink & Yuen, Inc.

100 N. Beretania Street • Suite 303 • Honolulu, Hawaii 96817 • Telephone: (808) 536-0081 • Fax: (808) 536-0082

January 30, 1995

Mr. Ivan Nakatsuka
Austin, Tsutsumi & Associates, Inc.
501 Sumner St. Suite 521
Honolulu, HI 96817-5031

Re: Kauai County Waimea WWTP effluent disposal; Nance Memo.

We believe that our report adequately addressed the matters raised in the Nance memo. These matters and our responses are as follows.

Nance: Mink and Yuen assumes a mauka-makai groundwater gradient in the basalt aquifer of 1/5000, for which data is not provided. The gradient may be substantially less than 1/5000, quite possibly approaching zero.

Response: First, the suggestion that the gradient may be near zero should be ignored. The groundwater must move in order to discharge. The gradient in the M & Y report is the common one measured in basaltic aquifers covered by a coastal plain of sediments (caprock) elsewhere in Hawaii. When reliable data is not available, analogy must be made with similar hydrogeological environments, tempered by common sense and judgement. In fact, a data set suggests that the gradient in this part of the Kekaha Plain could be less than 1/5000. USGS records show that the original head at Huluhulunui Shaft (5842-03), which is directly upgradient of the Kekaha Mill well (5842-01) was 11.9 feet in 1947, while the original head at the mill was 8.3 feet. If this data set is employed, the gradient is 3.6/3000 (1/833). This would reduce the up-gradient radius of stagnation of the effluent plume to about 100 feet. However, we reject this as being unrealistic.

Nance: The possibility of disposing of effluent into the caprock by means of shallow wells has not been considered.

Response: Evidently our report was not carefully read. We discuss in some detail this alternative and rejected it because of the probable consequences to near shore waters and the complexity of having to have numerous small capacity wells (see M & Y report, page 3). The report points out that

the top 60 feet of the caprock consists of sand and coral resting on clay, and that at least two more thin sand-coral layers occur deeper in the section. Injection into the top stratum, which might be able to accomodate the proposed rates, would eventually discharge at the coast. We rejected this option because the Department of Health would oppose it. The deeper sand-coral layers are thin and probably not sufficiently capacious to accept high injection rates. In addition, much or all of the injectant in these layers would pass upward into the top stratum through the leaky aquitards.

John F. Mink

January 30, 1995

Date: June 28, 1999
To: Ivan Nakatsuka, ATA
From: John F. Mink, M&Y
Re: Waimea WWTP Monitor Well

Assuming that the injection well remains at the original location adjacent to the highway where there is a benchmark at 7 feet on the USGS quadrangle (BM 7), the re-location of the monitor well to the northeast corner of the WWTP is a good move and places the monitor 1000+ feet from the injection well. It is also on a direct line upgradient of the injection well and therefore on the axis of the effluent zone should effluent reach that far.

Complying with all of the suggestions in Tom Nance's letter of March 3, 1997, may prove costly. If cost is immaterial, or if the extra cost is small, then his suggestions should be incorporated in the planning. Following is a review of his proposals with possible alternatives to keep costs reasonable.

1. TN: drill core hole before a full monitor well to test for possible strata in the caprock that might be able to accept the injected effluent.

We pointed out in previous reports/memoranda that the topmost approximately 60 feet of the caprock consists of coralline material that could probably successfully receive effluent, but the consequences would be discharge of the effluent along the open coast line. This was considered an unacceptable alternative. From well logs in the region the caprock stratigraphic succession appears to be as follows.

Depth (ft)	Material	Thickness (ft)
0 – 60	Coralline	60
60 – 110	Clay	50
110 – 125	Sand/coral	15
125 – 205	Clay	80
205 – 220	Sand/coral	15
220 – 400	Clay	180
> 400	Basalt	

The two 15 feet thick strata of coralline material below the first clay layer may accept effluent and could be tested during normal drilling.

As an alternative to coring, which may be expensive, a standard pilot hole that would eventually be converted to the monitor well probably would yield the stratigraphic information needed to make a decision. Drilling with cable tool would be more informative than with rotary.

2. TN: test caprock strata if encountered. Agree.
3. TN: If injection must take place in the basalt aquifer,
   a. Agree that valid survey tying well elevations to common benchmark is necessary.
   b. Agree that accurate water level measurements are needed.
   c. Agree that sounding tubes are required.
   d. Continuous record of water levels using transducers: this is more of a research than an engineering project. My experience with data collected by transducers where changes in water level are small (less than approx. 0.3 ft.) suggests that random perturbations in addition to tidal and barometric signals significantly affect accuracy. By the time all possible corrections are made the remaining data set is often uninterpretable. On the other hand, there is no harm in collecting transucer data providing the cost is acceptable.
   e. Agree that a protocol should be established for effluent disposal.
   f. Agree that routine water sampling should be done at both the effluent and monitor wells. A dedicated small pump in the monitor well is desireable.

4. Agree that Kikiaola Land Co. should have access to contract documents and test results. The same will be provided to CWRM and DOH.

Date: July 13, 1999.
To: Lisa Applegate, ATA.
From: John F. Mink, Mink and Yuen.
Re: Waimea WWTP injection well.

Identifying and testing potential coralline layers in the Mana Plain caprock will be an exploratory venture because the sedimentary sequence at the proposed injection site is unknown except for the uppermost layer. The nearest well with a lithology log is at the Kekaha Mill (well 5842-01) which is two miles to the west of the proposed site. Whether or not the coralline layers embedded in the caprock extend from Kekaha to the injection site can only be verified by drilling. I believe, however, the probability that coralline layers will be encountered is good.

The rate of injection that a layer would be able to sustain depends on its thickness, hydraulic conductivity, effective porosity and extent. The apparent caprock sequence from surface downward based on logs from throughout the Mana Plain is: fossil coral and marine sediments/clay/fossil coral and marine sediments/clay ... ... possible fossil coral .... clay/bedrock basalt. This sequence is similar to that of southern Oahu for which the nomenclature in the Ewa Plain is: limestone 1/clay aquitard 1/ limestone 2/clay aquitard ..... variable .... /basalt. Limestone 1 averages about 100 feet thick, clay aquitard 1 about 40 feet, and limestone 2 about 20 to 40 feet. If the similarity between the Ewa Plain and the Mana Plain holds, limestone 2 would be the first candidate for testing, assuming that limestone 1 is eliminated from consideration because effluent injected into it would eventually seep out along the coastline.

To test limestone 2, or a deeper coralline layer, for its injection capacity, a standard pump or injection test will have to be conducted. The annulus through limestone 1 and clay aquitard 1 will have to be cemented. Both a step-drawdown and constant rate test should be planned. Test results will indicate the allowable rate of injection and the head which the injection will create in the well bore. If this head is too high, the injectant will have to be pumped into the formation rather than drain into it by gravity.

On page 5 of your EA it is stated that Kikiaola plans to withdraw saline water from approximately the same depth in the basalt aquifer as the depth of and down-gradient of the proposed injection well. Such a well will entrain injectant with the salt water unless it is located beyond the injection plume envelope. This plan adds a serious constraint to the original injectant proposal.

Mink & Yuen, Inc.
1670 Kalakaua Avenue • Suite 605 • Honolulu, Hawaii 96826 • Telephone: (808) 943-1822 • Fax: (808) 943-1821

Date: March 22, 2000.
To: Ivan Nakatsuka, ATA.
From: John F. Mink, Mink and Yuen, Inc.
Re: Waimea WWTP; disposal of effluent into caprock.

As explained in previous reports and memoranda, permeable coralline layers may occur in the caprock that may be able to accept wastewater injection at rates of about 1 mgd. Based on well logs from the Mana Plain and by analogy with the sedimentary coastal plain of southern Oahu, layers in the caprock at the WWTP may lie in sequence as follows (all values approximate).

Depth	Thickness	Description
0 – 65 ft.	50 – 65	Marine sediments, fossil coral in lower portion. Potential injection stratum.
65 – 110	50 – 60	Clay. Not an injection stratum.
110 – 120	10	Marine sediments. Possible injection stratum, but may not be thick enough to take 1 mgd.
120 – 200		Clay. Not an injection stratum.
200 – 400		Clay with a few layers of marine sediments. Not likely to be injection strata.

The most favorable stratum for injection is the uppermost formation which may consist of marine particulate sediments underlain by a fossil reef. If this stratum is acceptable to the State Department of Health and other government agencies as the receptor for injection, it should be tested in the following way.

1. Drill a 20 inch diameter boring until the first clay layer is encountered. Carefully examine the cuttings to determine the nature of the formation and its probable level of permeability.

2. Stabilize the boring by inserting and grouting a 14 inch diameter casing, the depth depending on the thickness and character of the receiving stratum. To be determined in the field.
3. If the open boring is stable, proceed with testing, otherwise screen and gravel pack may be necessary.
4. Test the capacity of the formation, first by pumping, then by injection. The static water levl lies 1 to 2 feet above sea level, or about 5 feet below ground surface. A 4 hour step drawdown test at rates of 250, 500, 750 and 1000 gpm, each sustained for an hour, followed by a constant rate test over 8 hours at 750 gpm, is desirable. Water table measurements should be made frequently during each rate of the step drawdown test, as well as during the constant rate test. Several water samples for analysis of nitrogen and chloride content should be collected, one before the pumping begins, another at the end of the step drawdown test, and others during and at the end of the constant rate test.
5. If the pump test indicates that the formation is acceptably permeable, injection tests should be performed after a day's rest. Gravity injection at rates of 750 and 1000 gpm should be attempted. During the tests, water level increases and decays should be measured.
6. Should the pumping and injection tests in the first stratum fail, drilling should continue through the first clay layer into the next marine sequence, and the tests repeated. If the tests are to be restricted to the lower formation, the formations above need to be isolated with "packers". The alternative is to use both the upper and lower marine strata as the injection horizons, thus obviating the need for packers.
7. Should the tests be succesful, insert screen and gravel-pack the annulus around the screen. The gravel must be non-reactive to wastewater and the carbonate formations.
8. In th event of failure, continue the sequence of drilling and testing until the basalt basement is reached.

The above assumes that each formation penetrated will be stable and will not cave and accumulate in the open boring. If the formations are unstable, the likely situation, casing will have to be installed to prevent caving. The boring, casing and screen diameters will have to be progressively decreased below each formation tested (see my memorandum of November 16, 1999.)

Mink & Yuen, Inc.

1670 Kalakaua Avenue • Suite 605 • Honolulu, Hawaii 96826 • Telephone: (808) 943-1822 • Fax: (808) 943-1821

Date: August 8, 2000.
To: Ivan Nakatsuka and Lisa Applegate, ATA.
From: John F. Mink, Mink and Yuen.
Re: Waimea WWTP injection well in caprock.

The lithology of the caprock at the injection site is unknown, but by analogy with the sedimentary sequence derived from well logs elsewhere in the Mana Plain we speculate in our memo to you of 6/28/99 that the top 60 feet of the caprock is coralline sediments, the next 50 feet clay, the following 15 feet sand and coral, etc. (see our 6/28/99 memo). Because DOH evidently will permit injection in the uppermost stratum, which is likely to be the most permeable in the sequence, the requirement that a 50 feet thick buffer zone of caprock separating the bottom of the well from the artesian volcanic aquifer is met. The estimated depth of the caprock at the injection site is 400 feet.

Injection presumably will be by gravity so that the pressure head of injection will not exceed the artesian head in the volcanic aquifer.

In view of the DOH dismissal of concern about injection in the top stratum of the caprock, rather than restricting the receiving medium to a single stratum, the entire caprock section to a depth which meets the DOH rules should be considered. The first drilling increment could be to the base of the upper stratum (top of the first clay layer). If this layer is not thick and permeable enough to accept the injectant, drilling can proceed through the clay to the base of the next coralline stratum at a depth about 125 feet below ground without sealing off the upper stratum with packers. This depth, which includes both the upper layer and the second coralline stratum, could then be tested. The drilling sequence can be continued to depth 300 to 350 feet and the full depth of penetration tested. Only temporary screen will be needed for testing; neither packers nor telescoping of permanent casing-screen will be required because injection would not be limited to a single stratum.

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

Responses to Comments on Report "Waimea Wastewater Treatment Plant Backup Injection Well Draft Environmental Assessment," June 23, 2000

BENJAMIN J. CAYETANO
GOVERNOR

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

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

In reply, please refer to:
EMD/CWB

07028pkp.00

July 10, 2000

Mr. Ivan K. Nakatsuka, P.E.
Chief Environmental Engineer
Austin, Tsutsumi & Associates, Inc.
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-5031

Dear Mr. Nakatsuka:

Subject: Waimea Wastewater Treatment Plant
Backup Injection Well
Draft Environmental Assessment

The Clean Water Branch has reviewed the subject draft environmental assessment and has the following comments:

1. The Army Corps of Engineers should be contacted to identify whether a Federal permit (including a Department of Army permit) is required for this project. If it is determined that a Federal permit is required for the subject project, then a Section 401 Water Quality Certification would also be required from our office.

2. If the project involves any of the following discharges into state waters, a NPDES general permit is required for each activity:

   a. Storm water runoff associated with construction activities, including clearing, grading, and excavation that result in the disturbance of equal to or greater than five (5) acres of total land area (Note: After March 10, 2003, NPDES general permit coverage would also be required for discharges of storm water associated with construction activities, including clearing, grading, and excavation that result in the disturbance of one (1) acre or more but less than five (5) acres);

   b. Hydrotesting water;

   c. Construction dewatering effluent; and

   d. Treated process wastewater associated with well drilling activities.

The Department requires that Notices of Intent (NOIs) for NPDES general permits be submitted thirty days before the discharge is to occur. NOIs can be picked up at our office or downloaded from our website at *http://www.state.hi.us/doh/eh/cwb/forms/index.html*.

Should you have any questions, please contact Ms. Kris Poentis, Engineering Section of the Clean Water Branch, at 586-4309.

Sincerely,

DENIS R. LAU, P.E., CHIEF
Clean Water Branch

MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
ADMINISTRATIVE ASSISTANT

CESAR C. PORTUGAL
COUNTY ENGINEER
TELEPHONE 241-6500

IAN K. COSTA
DEPUTY COUNTY ENGINEER
TELEPHONE 241-6640

AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
MO'IKEHA BUILDING, SUITE 275
LIHU'E, KAUA'I, HAWAI'I 96766

October 13, 2000

Mr. Denis R. Lau, Chief
Clean Water Branch
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Mr. Lau:

Subject: Waimea Wastewater Treatment Plant
Backup Injection Well
Draft Environmental Assessment

Thank you for your letter of July 10, 2000, commenting on the subject Environmental Assessment (EA). The following are our responses to your comments:

1. The Department of the Army (DA) was contacted to determine if any DA permits are required for this project. They responded that no DA permits are required. (See attached letter from the DA, dated August 11, 2000.)

2. It is anticipated that NPDES permits will be required for construction dewatering effluent and for treated process wastewater associated with well drilling activities. The required NPDES permits will be obtained prior to commencement of construction.

If you have any questions, please feel free to contact Harry Funamura, Division of Wastewater Management at (808) 241-6610.

Very truly yours,

CESAR C. PORTUGAL
County Engineer

Attachment

Cc: Austin, Tsutsumi & Associates, Inc.

C:\My Documents\Harry's Correspondence\Clean Water Letter

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

REPLY TO
ATTENTION OF

August 11, 2000

Regulatory Branch

Mr. Ivan K. Nakatsuka, P.E.
Chief Environmental Engineer
Austin, Tsutsumi & Associates, Inc.
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-5031

Dear Mr. Nakatsuka:

This letter is written regarding a jurisdictional determination on whether the proposed project at the Waimea Wastewater Treatment Plant (WWTP), Waimea, Kauai will require a Department of the Army (DA) permit. The work would involve the construction of a backup injection well, monitoring well and the installation of approximately 800 feet of 12-inch pipeline along a dirt road for effluent disposal.

Information contained in the Draft Environmental Assessment (DEA) identifies the existing reservoir and reuse system as historically being used to accommodate effluent from the WWTP. The construction of the new injection well would be used as a backup to dispose of effluent from the WWTP.

For your information, under Section 404 of the Clean Water Act, DA permits are required for the discharge of dredged or fill material in waters of the U.S., including wetlands. Waters of the U.S. does not include groundwater and waste treatment systems to include treatment ponds or lagoons. Based on this and a review of the DEA and other office reference materials, no impact to waters of the U.S. has been identified, therefore a DA permit will not be required.

File number 200000287 is assigned to this project. Please refer to this number in any correspondence with our

office. Should you have further questions, you may contact Ms. Lolly Silva of my staff at 438-7023 or by fax at 438-4060.

Sincerely,

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

Copy Furnished:

Clean Water Branch, Environmental Management Division,
P.O. Box 3378, Honolulu, Hawaii 96801-3386

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

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

In reply, please refer to:
EMD / WB

July 20, 2000

200611

Mr. Ivan K. Nakatsuka, P.E.
Chief Environmental Engineer
Austin, Tsutsumi & Associates, Inc.
501 Summer Street, Suite 521
Honolulu, Hawaii 96817-5031

Dear Mr. Nakatsuka:

Subject: Waimea Wastewater Treatment Plant
Backup Injection Well
Draft Environmental Assessment (DEA)
Waimea, Kauai, Hawaii

The Wastewater Branch staff reviewed the documents for the subject matter and has the following comments and recommendations for your consideration:

1. For your information the Department of Health has sent an informal notice of violation to Kikiaola Land Company regarding the inadequacy of the current effluent disposal system. The Waimea treatment facility has also been given an UNACCEPTABLE rating;

2. The conclusion in the DEA that the reservoir and reuse system have always been able to accommodate the effluent from the WWTP is not completely true. The effluent from the treatment plant is blended with stream water at the reservoir. Blended water from the reservoir then feeds four major irrigation canals which becomes the source for irrigating seed corn fields. Tail water from the irrigated areas as well as from the canal is controlled by slide gates that allow or prevent water from entering into a ditch which connects to Kikiaola Harbor. Past investigations by the Department indicates that the gates were open, allowing irrigation water to freely enter into the ditch leading to Kikiaola Harbor. These discharges violate provisions of Hawaii Administrative Rules ("HAR"), Chapter 11-54-03.

The reservoir also fails to provide the necessary backup disposal requirements for reclaimed water that fails to meet the effluent quality. All of the plant's effluent is delivered to the reservoir regardless of quality. Please revise statements/conclusions in the DEA that the current disposal system is acceptable; and

3. It appears that uncertainties still exist with the effluent fate in the proposed injection well. We recommend that the County considers upgrading the Waimea WWTP to an R-1 facility. This will minimize concerns about environmental and health impacts to groundwater and near-shore coastal waters.

If you need additional information or clarification, please call Tomas See at 586-4294.

Sincerely,

DENNIS TULANG, P.E., CHIEF
Wastewater Branch

TS:erm

c: Chauncey Hew, Safe Drinking Water Branch

MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
ADMINISTRATIVE ASSISTANT

CESAR C. PORTUGAL
COUNTY ENGINEER
TELEPHONE 241-6600

IAN K. COSTA
DEPUTY COUNTY ENGINEER
TELEPHONE 241-6640

AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
MO'IKEHA BUILDING, SUITE 275
LIHU'E, KAUA'I, HAWAI'I 96766

October 13, 2000

Mr. Dennis Tulang, Chief
Wastewater Branch
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Mr. Tulang:

Subject: **Waimea Wastewater Treatment Plant Backup Injection Well**
Draft Environmental Assessment (DEA)
Waimea, Kauai, Hawaii

Thank you for your letter of July 20, 2000, commenting on the subject DEA. The following are our responses to your comments:

1. The EA will be revised to mention the violation regarding the inadequacy of the current effluent disposal system and the unacceptable rating of the Waimea Wastewater Treatment Plant. However, solutions to these problems will be pursued by the parties involved, and thus, are not considered part of the scope of the EA.

2. The Final EA will not indicate that the current disposal system is acceptable.

3. The County is considering upgrading the Waimea Wastewater Treatment Plant (WWTP) to an R-1 facility in the future. However, this upgrade will not occur before construction of the proposed backup injection well, and thus, will not be discussed in the Final EA.

If you have any questions, please feel free to contact Harry Funamura, Division of Wastewater Management at (808) 241-6610.

Very truly yours,

CESAR C. PORTUGAL
County Engineer

Attachment

Cc: Austin, Tsutsumi & Associates, Inc.

C:\My Documents\Harry's Correspondence\Wastewater Letter

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

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

In reply, please refer to:
EMD/SDWB

August 1, 2000

Mr. Harry Funamura, P.E., Chief
Division of Wastewater Management
Department of Public Works
County of Kauai
4444 Rice Street, Suite 500
Lihue, Kauai, Hawaii 96766

Dear Mr. Funamura:

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (DEA)
WAIMEA WASTEWATER TREATMENT PLANT
BACKUP INJECTION WELL

We have received and reviewed the subject DEA document. The following are our comments:

1. In the project area, confining sedimentary layers known as caprock overlie the volcanic aquifer (Napali Basalt); thus, the volcanic aquifer may be under artesian pressure. If such a condition exists, Chapter 11-23 requires that protection be afforded to the volcanic aquifer. Subsection 11-23-10 states: "(a) Where an injection well is located in a caprock formation which overlies a volcanic USDW (underground source of drinking water) under artesian pressure, the following conditions shall be applied: (1) A buffer zone of at least fifty feet of the confining materials (caprock) or other impermeable substance shall remain between the bottom of the injection well and the top of the volcanic aquifer, and (2) Injection pressure, as measured at the feed elevation or well head, shall remain below the hydrostatic pressure of the volcanic aquifer (the artesian head) or two p.s.i., whichever is greater... (c) If the ratio of the depth of the proposed injection well, to the estimated depth of caprock less fifty feet, is 1:2 or less, the applicant need not extend the depth of the injection well... to verify caprock thickness...(d) If the ratio of the depth of the proposed injection well, to the estimated depth of caprock less fifty feet, is greater than 1:2, the applicant shall have the depth of the injection well temporarily extended by fifty feet to verify that artesian aquifer conditions are not encountered within that range. The fifty feet of extended hole shall be properly sealed by the tremie method..."

2. We concur with the proposal to construct a monitoring well to monitor upgradient migration of the effluent plume if a deep injection well is used. We recommend that effluent intended for injection disposal meets the highest practicable level of effluent quality to safeguard USDWs.

3. On page 6, it was stated that "as long as the reservoir can continue to be used as backup storage of the effluent, the injection well will not need to be utilized."

   Questions: If reservoir usage ceases, how would reuse irrigation occur? Can reuse occur without discharging to the reservoir first? Can effluent be pumped directly into the irrigation system?

4. On page 25, it was stated that "the County and Kikiaola have executed an agreement to provide for the disposal of treated effluent by reuse, with the injection well acting as a backup disposal method."

   Question: How long is the term of this agreement?

5. On page 8, it was stated that "DOH requirements state that injection is not allowed where the groundwater has a concentration of 10, 000 mg/l total dissolved solids (TDS) or less."

   The USDW's TDS criterion for the State is based on groundwater having a TDS concentration of 5, 000 mg/l or less. The position of the UIC line generally depicts the difference in groundwater quality based on this criterion, but not solely on this criterion.

If you have any questions, please contact Jaime Rimando of the Safe Drinking Water Branch (SDWB) at 586-4258 (Honolulu) or call from Kauai the direct toll free number 274-3141, ext. 64258.

Sincerely,

for WILLIAM WONG, P.E., CHIEF
Safe Drinking Water Branch
Environmental Management Division

JR:chl

c: 1. Harold Eichelberger, SDWB Sanitarian, Kauai
2. Wastewater Branch, DOH
3. Mr. Ivan K. Nakatsuka, P.E.
Austin, Tsusumi & Associates, Inc.
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-5031

MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
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DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
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LIHU'E, KAUA'I, HAWAI'I 96766

October 13, 2000

Mr. William Wong, Chief
Safe Drinking Water Branch
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Mr. Wong:

Subject: Draft Environmental Assessment (DEA)
Waimea Wastewater Treatment Plant
Backup Injection Well

Thank you for your letter of August 1, 2000, commenting on the subject DEA. The following are our responses to your comments:

1. Please refer to the attached memorandum from Mink & Yuen, Inc., dated August 8, 2000, and the referenced 6/28/99 memo.

2. The County believes that the effluent from the Waimea Wastewater Treatment Plant (WWTP) currently meets the highest practicable level of effluent quality.

3. This project is based on the assumption that the reservoir will continue to receive effluent from the Waimea WWTP for irrigation reuse. There is an agreement between the County and Kikiaola Land Company, Ltd (Kikiaola) which provides for continued discharge of the effluent into Kikiaola's reservoir. This agreement expires on December 31, 2002. However, the County is negotiating with Kikiaola to extend this agreement.

   The reservoir may not be able to receive effluent during rainy weather, if the reservoir level is too high and it is not practical to irrigate with the effluent. In this case, the backup injection well will be used for effluent disposal. We do not address the issue of the reservoir being taken out of service indefinitely (or permanently), since this would then constitute a major change in the operation of the Waimea WWTP. If this were to be the case, then the injection well would most likely be used as the primary means of disposal until a new effluent reuse system could

be established. This situation would require a change in the Underground Injection Control (UIC) Permit, and probably a new EA would have to be prepared.

There is the possibility that the effluent could be pumped directly into the irrigation ditches, rather than into the effluent reservoir. However, as stated previously, this EA is based on the effluent reservoir being in use. Therefore, this issue will not be discussed in the Final EA.

4. The agreement between the County and Kikiaola expires on December 31, 2000. The County is negotiating on extending this agreement.

5. The hydrogeologists for this project – Mink & Yuen, Inc. – were advised by the U.S. EPA that only groundwater with greater than 10,000 mg/l TDS is acceptable for injection of effluent. The lower value of 5,000 mg/l, stipulated by DOH, does not compromise the selection of the well site. The report will be revised to clarify the difference between the U.S. EPA and the State DOH standards.

If you have any questions, please feel free to contact Harry Funamura, Division of Wastewater Management at (808) 241-6610.

Very truly yours,

for CESAR C. PORTUGAL
County Engineer

Attachments

Cc: Austin, Tsutsumi & Associates, Inc.

C:\My Documents\Harry's Correspondence\Safe Drinking Water

Mink & Yuen, Inc.

1670 Kalakaua Avenue • Suite 605 • Honolulu, Hawaii 96826 • Telephone: (808) 943-1822 • Fax: (808) 943-1821

Date: August 8, 2000.
To: Ivan Nakatsuka and Lisa Applegate, ATA.
From: John F. Mink, Mink and Yuen.
Re: Waimea WWTP injection well in caprock.

The lithology of the caprock at the injection site is unknown, but by analogy with the sedimentary sequence derived from well logs elsewhere in the Mana Plain we speculate in our memo to you of 6/28/99 that the top 60 feet of the caprock is coralline sediments, the next 50 feet clay, the following 15 feet sand and coral, etc. (see our 6/28/99 memo). Because DOH evidently will permit injection in the uppermost stratum, which is likely to be the most permeable in the sequence, the requirement that a 50 feet thick buffer zone of caprock separating the bottom of the well from the artesian volcanic aquifer is met. The estimated depth of the caprock at the injection site is 400 feet.

Injection presumably will be by gravity so that the pressure head of injection will not exceed the artesian head in the volcanic aquifer.

In view of the DOH dismissal of concern about injection in the top stratum of the caprock, rather than restricting the receiving medium to a single stratum, the entire caprock section to a depth which meets the DOH rules should be considered. The first drilling increment could be to the base of the upper stratum (top of the first clay layer). If this layer is not thick and permeable enough to accept the injectant, drilling can proceed through the clay to the base of the next coralline stratum at a depth about 125 feet below ground without sealing off the upper stratum with packers. This depth, which includes both the upper layer and the second coralline stratum, could then be tested. The drilling sequence can be continued to depth 300 to 350 feet and the full depth of penetration tested. Only temporary screen will be needed for testing; neither packers nor telescoping of permanent casing-screen will be required because injection would not be limited to a single stratum.

Date: June 28, 1999
To: Ivan Nakatsuka, ATA
From: John F. Mink, M&Y
Re: Waimea WWTP Monitor Well

Assuming that the injection well remains at the original location adjacent to the highway where there is a benchmark at 7 feet on the USGS quadrangle (BM 7), the re-location of the monitor well to the northeast corner of the WWTP is a good move and places the monitor 1000+ feet from the injection well. It is also on a direct line upgradient of the injection well and therefore on the axis of the effluent zone should effluent reach that far.

Complying with all of the suggestions in Tom Nance's letter of March 3, 1997, may prove costly. If cost is immaterial, or if the extra cost is small, then his suggestions should be incorporated in the planning. Following is a review of his proposals with possible alternatives to keep costs reasonable.

1. TN: drill core hole before a full monitor well to test for possible strata in the caprock that might be able to accept the injected effluent.

We pointed out in previous reports/memoranda that the topmost approximately 60 feet of the caprock consists of coralline material that could probably successfully receive effluent, but the consequences would be discharge of the effluent along the open coast line. This was considered an unacceptable alternative. From well logs in the region the caprock stratigraphic succession appears to be as follows.

Depth (ft)	Material	Thickness (ft)
0 – 60	Coralline	60
60 – 110	Clay	50
110 – 125	Sand/coral	15
125 – 205	Clay	80
205 – 220	Sand/coral	15
220 – 400	Clay	180
> 400	Basalt	

The two 15 feet thick strata of coralline material below the first clay layer may accept effluent and could be tested during normal drilling.

As an alternative to coring, which may be expensive, a standard pilot hole that would eventually be converted to the monitor well probably would yield the stratigraphic information needed to make a decision. Drilling with cable tool would be more informative than with rotary.

2. TN: test caprock strata if encountered. Agree.
3. TN: If injection must take place in the basalt aquifer,
   a. Agree that valid survey tying well elevations to common benchmark is necessary.
   b. Agree that accurate water level measurements are needed.
   c. Agree that sounding tubes are required.
   d. Continuous record of water levels using transducers: this is more of a research than an engineering project. My experience with data collected by transducers where changes in water level are small (less than approx. 0.3 ft.) suggests that random perturbations in addition to tidal and barometric signals significantly affect accuracy. By the time all possible corrections are made the remaining data set is often uninterpretable. On the other hand, there is no harm in collecting transucer data providing the cost is acceptable.
   e. Agree that a protocol should be established for effluent disposal.
   f. Agree that routine water sampling should be done at both the effluent and monitor wells. A dedicated small pump in the monitor well is desireable.

4. Agree that Kikiaola Land Co. should have access to contract documents and test results. The same will be provided to CWRM and DOH.

LIFE OF THE LAND

Ua Mau Ke Ea O Ka 'Aina I Ka Pono

Hawai'i's own local Community Action Group
Protecting our Fragile Natural & Cultural Resources
through Research, Education, Advocacy & Litigation

August 2, 2000

Harry Funamura
Division of Wastewater Management
Department of Public Works
County of Kauai
4444 Rice Street, Suite 500
Lihue, Kauai, HI 96766

Safe Drinking Water Branch
Department of Health
919 Ala Moana Blvd #308
Honolulu, HI 96814

Wastewater Branch
Department of Health
919 Ala Moana Blvd #309
Honolulu, HI 96814

re: Waimea WWTF Injection Well Draft EA

Aloha,

1. Isn't the DOH trying to eliminate injection wells in order to protect groundwater?

2. How deep is the water table where you are putting this injection well?

3. Does a point source discharge of wastewater from a specific injection well need an NPDES permit for degradation of coastal waters?

The County of Kauai Department of Public Works proposes to construct an injection well for backup disposal of disinfected secondary effluent from the County's existing Waimea Wastewater Treatment Plant (WWTP). ... an assumption can be made that the number of days that the well would be used would be 20 days per year. ... the proposed average discharge rate into the injection well will be 300,000 gallons per day" (EA, page 6)

4. What is the assumption based on?

5. Under what conditions would a new EA have to be written (in terms of days-of-use or mgd)

"The proposed maximum capacity of the injection wells ... was 1.2 mgd. ... the highest effluent flow was 994,000 gpd." (pages 6-7)

* 76 North King Street * Suite 203 * Honolulu, Hawai'i 96817 * phone: 533-3454 * fax: 533-0993 *
* email: <lifeofthaland@hotmail.com> *

6. What is the maximum capacity of the injection well?

7. Under what conditions can wastewater bypass the WWTF?

8. Are there any conditions under which raw sewage would flow into the injection well?

"Water in the upper caprock stratum will likely have a [Total Dissolved Solids] TDS of less than 10,000 mg/l, **although there is no data to verify this assumption**". (page 8)

9. What other data-less assumptions are you using?

"Criteria for determining whether or not the caprock is adequate for effluent injection will follow from examination of the drill cuttings and the results of pumping and injection tests. ... If injection of the effluent into the caprock is not feasible, then the drill will be drilled approximately 600 feet" (page 9)

"1995 EA ... were based on drilling a deep well only ... The [Kauai Planning] commission denied the Use Permit Application ... based on concerns about environmental impacts to groundwater and near-shore coastal waters."

10. What other options exist for wastewater disposal?

11. Two old studies from 1995 are referenced. What assumptions did they use?

12. How have these assumptions changed?

13. Please include more information about these studies. Environmental reviews should be "self-contained". Referencing other documents makes it difficult to analyze the current proposal.

14. How close are the closest threatened or endangered species downgradient of the outlet for the injection well?

15. What method will be used for drilling the injection well?

16. If horizontal directional drilling is used, how will burial sites be dealt with?

17. What was the basis for the conclusions drawn in the March 1994 ATA study?

18. What was the basis for the conclusions drawn in the December 1994 study?

19. With the development of Kapalawai and Waimea Plantation Cottages, wouldn't expanding the Waimea WWTF with further levels of water purification make more sense?

20. Can the Department of Public Works make a realistic assessment of the quality of the EA when they are the benefactors of the project?

21. What tests have been performed on wastewater to or from the Waimea WWTF regarding toxics, heavy metals, pesticides, etc.?

22. How often are these tests performed?

Mahalo,

Henry Curtis

Henry Curtis
Executive Director

MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
ADMINISTRATIVE ASSISTANT

CESAR C. PORTUGAL
COUNTY ENGINEER
TELEPHONE 241-6600

IAN K. COSTA
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AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
MO'IKEHA BUILDING, SUITE 275
LIHU'E, KAUA'I, HAWAI'I 96766

October 19, 2000

Mr. Henry Curtis, Executive Director
Life of the Land
76 North King Street, Suite 203
Honolulu, Hawaii 96817

Dear Mr. Curtis:

Subject: **Waimea Wastewater Treatment plant**
Backup Injection Well
Draft Environmental Assessment (EA)

Our letter of October 16, 2000, responding to your comments of August 2, 2000 on the subject Draft EA, inadvertently contained an erroneous response. Response to Item 20 should read:

20. The regulations for the Hawaii State Environmental Review Process, more specifically, Chapter 343, Hawaii Revised Statutes, provides for the proposing agency, in this situation the Department of Public Works, to also be the approving agency for any agency action environmental assessments.

We apologize for any inconvenience this oversight may cause you.

Very truly yours,

/s/ CESAR C. PORTUGAL
County Engineer

HF

Cc: Austin, Tsutsumi & Associates, Inc.

MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
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LIHU'E, KAUA'I, HAWAI'I 96766

October 16, 2000

Mr. Henry Curtis, Executive Director
Life of the Land
76 North King Street, Suite 203
Honolulu, Hawaii 96817

Dear Mr. Curtis:

Subject: Waimea Wastewater Treatment Plant
Backup Injection Well
Draft Environmental Assessment (EA)

Thank you for your letter of August 2, 2000, commenting on the subject Draft EA. The following are our responses to your comments:

1. Please refer to the attached August 25, 2000 letter from the Department of Health (DOH) Safe Drinking Water Branch (SDWB).

2. Please refer to the attached September 28, 2000 letter from Mink & Yuen, Inc.

3. Please refer to the attached August 25, 2000 letter from the SDWB.

4. The assumption that the backup well will need to be used 20 days per year is based on DOH's reuse guidelines, which require a reuse irrigation system to have 20 days of backup storage in the event of wet weather when the effluent cannot be used for irrigation.

5. The DOH Office of Environmental Quality Control (OEQC) requires that a new EA be prepared if there is a major change in the scope of the project, or if state funds are required for construction. This EA is based on the assumption that the primary means of effluent disposal will be via irrigation reuse, and that the injection well will be used for backup disposal only. If, in the future, Kikiaola Land Company, Ltd. will not accept the effluent into their reservoir, then the well would most likely be used as the primary disposal method for the effluent. If this should happen, then a new EA would be prepared, since this would constitue a major change in the operation of the Waimea Wastewater Treatment Plant (WWTP).

The well is expected to be used approximately 20 days per year, during wet weather when irrigating with the effluent would not be practicable. If the number of days the well is required to be used is more than 20, e.g., an unusually wet year, this would be considered a temporary situation and a new EA would not be required.

In the future, the Waimea WWTP may be expanded to a capacity of approximately 600,000 gallons per days (gpd), versus the current capacity of 300,000 gpd. This expansion would be considered a major change in the project, and would also require State funds. Therefore, this situation would require that a new EA be prepared.

6. The maximum capacity of the injection well will be 1.0 million gallons per day (mgd). The previous EA prepared in 1995 was based on the capacity of the injection wells being 1.2 mgd. However, the capacity has been revised since that time.

7. Please refer to the attached August 30, 2000 letter from the DOH Wastewater Branch (WB). The injection well will only receive effluent from the Waimea WWTP.

8. There are no conditions under which raw sewage would flow into the injection well.

9. Please refer to the attached September 28, 2000 letter from Mink & Yuen, Inc.

10. The alternatives for wastewater disposal are discussed in Section VI. Alternatives Considered, in the Draft EA.

11. The two old studies from 1994 were based on the assumption that Kikiaola would cease to accept effluent from the Waimea WWTP from entering the reservoir. These studies focused on alternatives for a primary means of effluent disposal. In both studies, it was concluded that injection wells be used for primary disposal of the effluent. Therefore, the 1995 EA was based on utilizing injection wells for primary disposal of the effluent. However, since that time, the County and Kikiaola have executed an agreement to provide for continued disposal of the effluent into Kikiaola's reservoir. Therefore, the proposed injection well will be used as a backup to the primary disposal method of irrigation. To avoid future confusion, we will not mention the 1994 studies, or include them, in the Final EA.

12. Please refer to Response 11.

13. Please refer to Response 11.

14. There are no threatened or endangered species in the ground, which is where the effluent will be injected. We don't expect there to be any endangered species in the ocean in the vicinity of the effluent well.

15. Please refer to the attached September 28, 2000 letter from Mink & Yuen, Inc.

16. Horizontal drilling will not be used.

17. Please refer to Response 11.

18. Please refer to Response 11.

19. Please refer to the attached August 30, 2000 letter from the DOH WB. The development of Kapalawai and Waimea Plantation Cottages is not relevant to this EA, since this EA pertains to disposal of the effluent from the Waimea WWTP, based on the present capacity of 300,000 gallons per day. The County is considering upgrading the WWTP to produce R-1 quality effluent in the future. If the WWTP is expanded or upgraded, then a new EA will be prepared at that time.

20. The accountability issue is relevant in this particular situation, since the County of Kauai is acting as both the proposing and approving agencies. The County is bound by Chapter 343, HRS, and is providing the maximum possible amount of segregation with the Department of Public Works as the proposing Department, and the Planning Department as the approving Department. The Planning Department also approves the Special Use Permit, which is required for construction of the backup injection well.

21. The results of BOD, TSS, Total Coliform and Chlorine Residual tests are given in Table 5 of the EA. However, tests are not performed for toxics, heavy metal, pesticides, etc., as such tests are not required by DOH. Please refer to the attached August 30, 2000 letter from the DOH WB.

22. The BOD, TSS and Total Coliform tests are performed weekly. The Chlorine Residual test is performed daily.

If you have any questions, please feel free to contact Harry Funamura, Division of Wastewater Management at (808) 241-6610.

Very truly yours,

CESAR C. PORTUGAL
County Engineer

Attachments

Cc: Austin, Tsutsumi & Associates, Inc.

C:\My Documents\Harry's Correspondence\Life of the Land

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

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

In reply, please refer to:
EMD/SDWB

August 25, 2000

Mr. Harry Funamura, Chief
Division of Wastewater Management
Department of Public Works
County of Kaua'i
4444 Rice Street
Mo'ikeha Building, Suite 200
Lihu'e, Hawai'i 96766

Dear Mr. Funamura:

SUBJECT: RESPONSE TO QUESTIONS POSED BY LIFE OF THE LAND FOR THE WAIMEA WASTEWATER TREATMENT PLANT BACKUP INJECTION WELL DRAFT ENVIRONMENTAL ASSESSMENT

Herein are the answers to two questions posed by Life of the Land in their letter dated August 2, 2000. The questions relate to Underground Injection Control (UIC) and have been answered from the UIC program's perspective. You may use the answers verbatim.

QUESTION NO. 1:

Isn't the DOH trying to eliminate injection wells in order to protect groundwater?

ANSWER:

This question covers a broad topic with important objectives. Perhaps the best way to answer is to describe the understandings and relevant objectives of the Underground Injection Control (UIC) program.

1. Injection wells are essential because they are an alternative for wastewater disposal when other alternatives, such as outfalls or reuse, are not possible. However, the use of an injection well has restrictions and may not be permissible in certain areas.

2. Injection wells can be categorized by the nature of the wastewater (injectant). Certain types of injectant are generally less polluting than others, for example, rainfall runoff water has less associated risk as compared to sewage or industrial effluent.

3. Potable groundwater resources typically occur within the interior land areas of tropical islands. Coastal land areas may contain fresh groundwater but are likely to be influenced by sea water. The UIC line generally identifies interior groundwater land areas from coastal groundwater land areas and is therefore used to regulate the siting of injection wells with the intent to prohibit high-pollution-risk injection wells in interior groundwater land areas. (The location of the proposed Waimea WWTP injection well is within a coastal groundwater land area.)

4. If injection is permissible, a UIC permit is necessary to authorize the injection well's operation. The UIC permit contains monitoring and reporting conditions and limitations that restrict the use of the well for a specifically defined purpose. Periodic effluent testing is required, and effluent quality must be within acceptable effluent standards. UIC permit violations are subject to enforcement and penalties.

5. Great emphasis is placed on the proper sealing and abandonment of unwanted or unused injection wells because such wells are open conduits that may penetrate deep into the ground or into groundwater. If left unattended, such injection wells may become the means of contaminant transport into groundwater. The UIC program issues specific injection well abandonment instructions for injection well abandonment projects and will enforce the instructions, if necessary, to accomplish proper sealing and abandonment. In this regard, the UIC program's desire is to eliminate all unwanted or unused injection wells.

QUESTION NO. 3:

Does a point source discharge of wastewater from a specific injection well need an NPDES permit for degradation of coastal waters?

ANSWER:

An NPDES permit has not yet occurred for an injection well because an injection well represents discharge into the subsurface and not into a surface water body. However, should there be found a direct link between an injection well discharge and a surface body, an NPDES permit would be applicable.

If you have any questions, please contact Chauncey Hew or Jaime Rimando of the Safe Drinking Water Branch (SDWB) at 586-4258 (Honolulu) or call from Kaua'i the direct toll free number 274-3141, ext. 64258.

Sincerely,

WILLIAM WONG, P.E., CHIEF
Safe Drinking Water Branch
Environmental Management Division

CH/JR:chl

c: Hal Eichelberger, SDWB Sanitarian, Kaua'i

Mink & Yuen, Inc.

1670 Kalakaua Avenue • Suite 605 • Honolulu, Hawaii 96826 • Telephone: (808) 943-1822 • Fax: (808) 943-1821

Date: September 28, 2000.

Subject: Response to review comments of Life of the Land concerning the ATA, Inc., EA for the Kauai WWTP injection well near Waimea.

Life of the Land

2. The caprock water table at the injection site is less than 5 feet below ground. The deep aquifer artesian water table rises 5 to 10 feet above ground level when the artesian pressure is released, but the artesian water is restrained by about 400 feet of caprock.

9. There are no existing data specific to the site of the proposed injection well. Assumptions are based on data in the record for nearby wells and by analogy with presumed similar conditions elsewhere. The geometry of the caprock/basalt contact is extrapolated employing well logs at other sites near Kekaha and Waimea, and salinity of the water is estimated from pumpage records and sampling elsewhere in the coastal plain, and by application of groundwater hydraulic theory. The methods used are the common practice in hydrological analysis in the absence of specific data.

15. Cable tool should be used in drilling to allow identification of formations with more reliability than is possible with rotary drilling.

J.F. Mink P.G.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

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

In reply, please refer to:
EMD/WB

August 30, 2000

200722

Mr. Harry Funamura
Chief, Division of Wastewater Management
Department of Public Works
County of Kauai
4444 Rice Street
Mo'ikeha Bldg., Suite 200
Lihue, Kauai, Hawaii 96766

Dear Mr. Funamura:

Subject: **Response to Questions Posed by Life of the Land for the Waimea WWTP Back-up Injection Well Draft Environmental Assessment (EA)**

The Wastewater Branch staff received your letter of August 17, 2000 requesting help in responding to various questions posed by Life of the Land (LOTL) regarding the draft EA for the Waimea WWTP back-up injection well project. The following are the Department's responses to the questions posed:

Question #7: **Under what conditions can wastewater bypass the WWTP?**

Response: The Department does not allow direct discharges of raw wastewater to the injection well or the effluent reuse system. It is our understanding that the only pipe feeding the well will be from the WWTP's effluent pump station. The County should confirm this.

Question #10: **What other options exist for wastewater disposal?**

Response: The Department recognizes that reuse is the primary disposal method for the effluent. However, during non-irrigation events a back up disposal method is necessary. Options available to the County include subsurface disposal such as injection wells, containment and discharges to coastal waters. Various permits and other studies may be required if any of these options are exercised. As the County prepared a study regarding disposal alternatives, it should be able to provide this information to LOTL.

Question #19: **With the development of Kapalawai and Waimea Plantation Cottages, wouldn't expanding the Waimea WWTP with further levels of water purification make more sense?**

Response: There are no provisions in Hawaii Administrative Rules (HAR) Chapter 11-62 that require the County to upgrade the effluent quality of the existing wastewater facility. However, it appears that uncertainties still exist with the use of effluent and use of injection wells. The Department recommends and encourages the County to consider upgrading the Waimea WWTP to an R-1 facility.

Question #21: **What test have been performed on wastewater to or from the Waimea WWTP regarding toxics, heavy metals, pesticides, etc.?**

Response: HAR Chapter 11-62 does not require testing for toxics, heavy metals or pesticides. Testing requirements for domestic wastewater effluent is limited to BOD_5 (Biochemical Oxygen demand) and TSS (Total Suspended Solids). If effluent is used for irrigation, total coliform and chlorine residual testing is required. The County may have done testing of the water quality parameters mentioned above and should be able to provide this information to LOTL.

Should you have any questions, please contact Tomas See of the Wastewater Branch at (808) 586-4294.

Sincerely,

for DENNIS TULANG, P.E., CHIEF
Wastewater Branch

TS:erm

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

August 4, 2000

Mr. Harry Funamura
County of Kaua'i - Department of Public Works
Division of Wastewater Management
4444 Rice Street, Suite 500
Lihu'e, Hawai'i 96766

Dear Mr. Funamura:

We have reviewed the draft environmental assessment for the Waimea Wastewater Treatment Plant Backup Injection Well, District of Waimea, Island of Kaua'i, TMK (5) 1-2-06:37, and offer the following comments for your consideration and response.

1. **CLARIFICATION OF STATEMENT CONCERNING YOUR 1995 FONSI DETERMINATION FOR THIS PROJECT:** Page 3, paragraph 2, of the draft EA mentions that "...OEQC issued a FONSI for the injection wells... ." This statement is erroneous. Please correct it in the final environmental assessment. Our office published <u>your</u> 1995 FONSI determination in the May 23, 1995, edition of the OEQC Bulletin. Chapter 343, Hawai'i Revised Statutes confers the authority to make a determination on the need for an EIS on <u>your agency</u>. Our office does not make that determination; we simply publish <u>your</u> agency's determination. This is made evident if one examines the language of Section 343-7, Hawai'i Revised Statutes; the agency making the determination on the need for an EIS (and <u>not</u> OEQC) is the agency who is sued in court.
2. **LISTING AND STATUS OF PERMITS FOR THE PROJECT:** Please include in the environmental assessment a listing of, and the status of, all federal, state and county permits required for this project.
3. **SEPARATELY BOUND DOCUMENTS:** Page iii of the table of contents lists two separately bound studies (March 7, 1994, Waimea Wastewater Treatment Plant Effluent Reuse/Disposal Alternative Study, and the December 9, 1994, Alternatives Study for Disposal of Effluent from Waimea Wastewater Treatment Plant via Injection Wells or Rapid Infiltration). Since these are listed in your table of contents for the draft environmental assessment, we conclude that these are integral parts of the environmental assessment. We have yet to receive copies of these separately bound documents. Please transmit these documents to us and attach bound copies of these in the environmental assessment.
4. **HISTORIC/CULTURAL/ARCHAEOLOGICAL FEATURES:** The site of the proposed injection well just makai of fill land (Fd) appears to lay within Jaucus loamy fine sand (JkB). Please consult with the Office of Hawaiian Affairs and the State Historic Preservation Division as to the possible presence of subsurface archaeological features and possible mitigative measures.

If there are any questions, please call Leslie Segundo at 586-4185. Thank you for the opportunity to comment.

Sincerely,

GENEVIEVE SALMONSON
Director

c: Mr. Ivan K. Nakatsuka
Austin Tsutsumi & Associates, Inc.
501 Sumner Street, Suite 521
Honolulu, Hawai'i 96817-5031

MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
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LIHU'E, KAUA'I, HAWAI'I 96766

October 13, 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: **Waimea Wastewater Treatment Plant Backup Injection Well**
Draft Environmental Assessment (EA)
Waimea, Kauai
TMK (5) 1-2-06:37

Thank you for your letter of August 4, 2000, commenting on the subject Draft EA. The following are our responses to your comments:

1. The erroneous statement on Page 3, paragraph 2 of the Draft EA, regarding OEQC issuing a FONSI for the injection wells, will be corrected per your comment.

2. All federal, state and county permits required for this project will be listed in the Final EA.

3. Upon further consideration, it was determined that the earlier studies mentioned in the Draft EA are not relevant to this project. Therefore, these studies will not be mentioned in the Final EA.

4. The Office of Hawaiian Affairs (OHA) was consulted regarding possible archaeological features in the vicinity of the project. OHA does not have an in-house archaeologist, however, they suggested that the State Historic Preservation Division (HPD) be contacted regarding this matter.

   HPD was contacted regarding this project. They concurred that the area just makai of the project site, which lies within soil classified as Jaucus loamy fine sand (JkB), most likely contains subsurface archaeological features. The nearby Plantation Cottages has archaeological features. HPD recommended that if construction is to take place in sandy substrate, i.e., JkB

soil, that an archaeological monitor be present during construction. If construction is to take place in fill land, which is where the subject project will be constructed, then a monitor would not be necessary.

If you have any questions, please feel free to contact Harry Funamura, Division of Wastewater Management at (808) 241-6610.

Very truly yours,

for CESAR C. PORTUGAL
County Engineer

Attachment

Cc: Austin Tsutsumi & Associates, Inc.

C:\My Documents\Harry's Correspondence\OEQC Letter

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: (000) 956-7361 • Facsimile: (000) 956-3980

August 8, 2000
EA: 1205

Mr. Harry Funamura
County of Kauai
Department of Public Works
4444 Rice Street, Suite 500
Lihue, Hawaii 96766

Dear Mr. Funamura:

Waimea Wastewater Treatment Plant Backup Injection Well
Draft Environmental Assessment
Waimea, Kauai

The County of Kauai Department of Public Works proposes the development of a backup injection well to provide additional options for the disposal of treated effluent on those occasions when the Kikiaola reservoir is at capacity. The Kikiaola Reservoir serves as a storage basin for treated effluent from the Waimea Wastewater Treatment Plant (WWTP) so it can be utilized for irrigation. Effluent would not be accepted into the Kikiaola Reservoir during such times as rainy weather. Also, due to the uncertain nature of the viability of Kekaha Sugar, there is the anticipation of an end to the County agreement with Kikiaola that allows for the Reservoir to accept treated wastewater.

This review was conducted with the assistance of Roger Babcock, Environmental Engineering; Roger Fujioka, Water Resources Research Center; and Sherri Hiraoka, Environmental Center.

General Comments

The Environmental Assessment (EA) lacks a full discussion of the need and justification of the project, especially considering that most WWTPs do not have a backup disposal method. Sufficient detail on the agreements which are held with Kikiaola and Kekaha Sugar is also lacking. The EA is similarly deficient on details of the coastal waters and the potential impacts this project may have on those waters. An informed evaluation of the potential environmental impacts of the disposal of treated sewage effluent into the two levels under consideration can not be adequately made based on the information available in this document. Specific areas of deficiencies in information are listed below.

Need for the Project

The justification for the project was not well defined. The description of the proposed action on page 2 states that in 1994, "the uncertainty of continued reuse by Kekaha Sugar" was one factor in developing "alternatives for disposal and reuse of Waimea WWTP effluent." What is the current situation with regard to Kekaha Sugar reusing the treated effluent?

The nature of the agreement that the County has with Kikiaola to accept the treated effluent should be detailed in the final EA so it is clear what terms and conditions apply. This type of information is necessary to evaluate the potential long term effects and management of the project, as well as the adequacy of the EA. For example, if Kikiaola is not designated to be a long-term partner with the Waimea WWTP, then the backup injection well may need to be used for primary disposal, and the discussion presented that suggests the well will only serve as a temporary disposal site is invalid. If the use of the injection well becomes a primary means of disposal, what would be the potential effects on public health and the environment?

Description of the Proposed Project

The EA mentions that the Hawaii DOH has an Underground Injection Control (UIC) program (contained in HAR 11-23) and indicates on page 23 that there are currently no federal UIC regulations that need to be considered. This is a bit confusing, since the Hawaii regulation is based upon the federal regulations contained in 40 CFR 144 and 145 and complies with the federal regulation.

HAR 11-23 indicates that wastewater effluent injection is specifically allowed into aquifers that are exempted from designation as an underground source of drinking water (USDW), makai of the UIC line on each island. The proposed well is clearly located makai of the established UIC line. In areas makai of the UIC line, the entire geologic column is exempted (suitable for injection) in non-artesian aquifers. If the aquifer is artesian, then only the geologic column from the ground surface to 50 feet above the artesian confining layer is suitable (if the underlying volcanic aquifer is a USDW). The basalt aquifer for the proposed site is likely artesian and the upper caprock layers should be suitable irrespective of the TDS encountered. The underlying basalt aquifer should be suitable as well if the TDS is greater than 5,000 mg/L. HAR 11-23-04 states that aquifers can be exempted if the TDS is greater than 5,000 mg/L and if the aquifer "is not reasonably expected to supply a public or private drinking water system." It is not clear where Austin, Tsutsumi & Associates obtained the information it used in the EA on page 8 when making the statement that "DOH requirements state that injection is not allowed where the groundwater has a concentration of 10,000 mg/L total dissolved solids (TDS) or less."

The proposed injection well will likely be a Class V, Subclass AB injection well. The HAR 11-23-09 specifies that injection wells must be located at least ¼ mile (1,320 feet) from any drinking water well, a regulation that seems barely satisfied (Exhibit 2 shows a water well approximately 1,500 feet away). This close proximity leads us worry about the effects the project may have on this water well, especially considering that the water well is downgradient of the proposed injection well.

Water Quality

Exhibit 2 shows an "existing water well" approximately 1,500 feet to the southeast of the proposed injection well. What formation is the well drawing from and how will it be impacted by the injection well? The EA also mentions a possible "Aquamarine Center" on Kikiaola land downgradient of the proposed well. The EA states that because the flow to the backup well will only be used intermittently, there will not be a significant impact. In the case of both of these downgradient wells, what would be considered a significant effect and what calculations were made to determine that there would not be a significant effect? One would expect some effects. What might those effects be?

Throughout the EA, there are several key assumptions that are utilized, including that the well will rarely be used and that injected effluent will mix well with the ambient water in either the caprock formation or the basalt aquifer. How accurate is the mixing assumption and what is it based upon? In the basalt aquifer, the effluent will have a significantly lower density (due to approximately 30,000 mg/L lower TDS and a slightly higher temperature) which will tend to make the effluent "float" and resist extensive mixing. Please justify the assumption that the effluent will completely mix throughout the aquifer thereby spreading diluted effluent over an extensive area. Even in the caprock formation, where apparently effluent would only be injected if the ambient TDS is greater than 10,000 mg/L, there would be a tendency for stratification of the effluent plume.

Coastal water is mentioned in several areas of the EA as being potentially impacted by the project. More information on the coastal waters, including the current uses and popularity of the area and water circulation patterns should be included in the final EA.

Shallow vs. Deep Injection Well

The limited data provided by the EA did not allow for an informed decision to be made on the use of a shallow versus a deep injection well. Both alternatives have potential benefits and drawbacks that should be evaluated carefully. The success of a shallow well alternative seems to be limited, due to the fact that the EA indicates that the upper sand/coral layer will likely have TDS less than 10,000 mg/L presumably due to primarily freshwater recharge sources. Second, the presumed caprock stratigraphic succession indicates only very thin layers of sand/coral (15 feet) which will not likely accept 1 mgd of flow through a single well. Is accurate head data available in these caprock layers? Is it known which direction the water flows? One or more monitoring wells should be required to indicate whether any unforeseen connections exist between different strata and where the effluent plume goes.

A deep injection well also has its drawbacks, including many more unanswered questions (movement of effluent, impact on groundwater quality, impacts to the ecosystem) than for a shallow well. Moreover, contamination of groundwater is more difficult to remediate than coastal waters, where impacts can be more easily measured, and where there are more naturally self-cleaning mechanisms such as water circulation, dilution, physical and chemical processes that degrade contaminants, and transport.

Mandatory monitoring should be required for either alternative to ensure that coastal water contamination does not create problems. Monitoring of nearby coastal waters for residual chlorine and a fecal indicator bacteria should occur initially to obtain baseline levels.

Alternatives

The development of alternatives seems limited. Have long-term disposal methods been investigated? This seems especially important considering the level of development that the state is undergoing. The County may want to consider creating an ordinance requiring effluent reuse for agriculture wherever it is available. This is done in Maui County and could be a viable "no action" alternative.

Conclusion

The need for backup wastewater systems is appreciated, however, there seems to be many questions that have not yet been answered. For example, it has not been decided if a shallow well or a deep well will be used. Each type of injection well carries with it, it's own set of potential impacts. Also, the potential coastal impacts should be considered in greater detail. A full assessment and response to these questions and concerns is necessary prior to any decisionmaking for this project.

Thank you for the opportunity to comment on this Draft Environmental Assessment.

Sincerely,

Jacquelin N. Miller

Jacquelin N. Miller
Associate Environmental Coordinator

cc: Lisa Appelgate, Austin, Tsutsumi & Associates
OEQC
James Moncur, WRRC
Roger Babcock, Environmental Engineering
Roger Fujioka, WRRC
Sherri Hiraoka, Environmental Center

MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
ADMINISTRATIVE ASSISTANT

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4444 RICE STREET
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October 13, 2000

Ms. Jacquelin N. Miller
Associate Environmental Coordinator
Environmental Center
University of Hawaii at Manoa
2550 Campus Road
Crawford 317
Honolulu, Hawaii 96822

Dear Ms. Miller:

Subject: Waimea Wastewater Treatment Plant Backup Injection Well
Draft Environmental Assessment (EA)
Waimea, Kauai

Thank you for your letter of August 8, 2000, commenting on the subject Draft EA. The following are our responses to your comments:

General Comments

The primary disposal method for the effluent is irrigation. However, the effluent reservoir does not have adequate storage to be used as backup for the irrigation system. In fact, Kikiaola Land Company (Kikiaola) has been sent an informal notice of violation from the Department of Health regarding the inadequacy of the current effluent disposal system. Therefore, the injection well, which will be used as a backup to the primary method of disposal, is fully justifiable. This will be explained more fully in the Final EA.

There is currently no agreement between Kikiaola and Kekaha Sugar, since Kekaha Sugar has stopped sugar cane cultivation in the immediate vicinity of the Waimea Wastewater Treatment Plant (WWTP). However, there is an agreement between the County and Kikiaola to provide for continued discharge of the effluent into Kikiaola's reservoir. This agreement expires on December 31, 2002. The County is negotiating with Kikiaola to extend this agreement.

The injection well will be used for backup purposes only, when the reservoir is unable to accept the effluent from the WWTP, due to wet weather. The times that the well will be used will be during storm conditions, when runoff enters the ocean, causing degradation of the coastal water.

The County feels that potential impact to the coastal water from the effluent, (if a shallow well is drilled) would be negligible compared to the impact from storm runoff entering the ocean. Separating and determining the potential impacts of the injected effluent on the coastal water, versus negative impacts from typical storm runoff, would be extremely difficult – if not, impossible – to determine or quantify.

Please refer to the attached letter dated September 28, 2000 from Mink & Yuen, Inc. The 7/20/95 letter to Steve Oliver, and the 7/12/95 letter to DOH referenced in Mink & Yuen, Inc.'s letter were not included in the Draft EA, but will be included in the Final EA. The referenced technical report, (Wastewater Effluent Disposal by Injection Wells, Kikiaola, Kauai, Hawaii dated August 1993) was included in the Draft EA. A revised letter to John Harrison, dated April 19, 1995 (as opposed to the referenced response, dated 3/17/95), was also included in the Draft EA.

Need for the Project

Kekaha Sugar no longer has any involvement with the effluent reuse, since they are no longer cultivating sugar cane in the area of the Waimea WWTP. The agreement between Kikiaola and the County to provide for discharge of the effluent expires on December 31, 2002. However, the County is negotiating with Kikiaola to extend the agreement beyond 2002.

This EA is based on the assumption that Kikiaola intends to continue accepting the effluent, and that the injection well will be used on a backup basis only. If, in the future, Kikiaola decides not to accept the effluent, then a new primary method of disposal for the effluent must be developed. Any major changes to the proposed disposal method (e.g., using the injection well for primary disposal of the effluent) would require preparation of a new EA. Therefore, the possibility of using the injection well as the primary means of effluent disposal is not applicable to this EA, and therefore, will not be addressed.

Description of the Proposed Project

The EA will be clarified to indicate that the Department of Health (DOH) Underground Injection Control (UIC) program is based upon the federal regulations contained in 40 CFR and complies with the federal regulation.

Please refer to the attached letter dated September 28, 2000 from Mink & Yuen, Inc. The referenced letter of 10/4/93 from the EPA to Bill Wong, was not included in the Draft EA, but will be included in the Final EA.

Water Quality

Please refer to the attached letter dated September 28, 2000 from Mink & Yuen, Inc. The April 19, 1995 response letter to the UH Environmental Center should have been referenced by Mink & Yuen, Inc., rather than the referenced 3/17/98 letter.

An attempt will be made to obtain more information on the coastal waters, including the current uses and popularity of the area. However, based on the previous response pertaining to the negligible impact of the effluent during storm conditions, it is our opinion that an ocean study to determine the circulation patterns is not warranted.

Shallow vs. Deep Injection Well

Please refer to the attached letter dated September 28, 2000 from Mink & Yuen, Inc. The five memos referenced by Mink & Yuen, Inc., were not included in the Draft EA, but will be included in the Final EA.

As previously stated, the injection well will be used for backup purposes only, when the reservoir is unable to accept the effluent from the WWTP. The times that the well will be used will be during storm conditions, when irrigation with the effluent will not take place. Separating and determining the potential impacts of the injected effluent on the coastal water, versus negative impacts from typical storm runoff, would be extremely difficult – if not impossible – to determine or quantify. Therefore, it is our opinion that monitoring of the coastal waters for residual chlorine and fecal indicator bacteria would not be practical.

Alternatives

The long-term primary disposal method will be irrigation reuse. As mentioned earlier, the current agreement between Kikiaola and the County expires at the end of 2002, however, the County is negotiating to extend the agreement. The purpose of the injection well is to act as a backup to the irrigation system. All reuse systems require a backup disposal method – either a storage reservoir or an injection well. Since the existing effluent storage reservoir is inadequate to act as a backup to the irrigation system, the County is proposing construction of the injection well.

One alternative would be to construct a new storage reservoir, rather than utilizing an injection well. This alternative requires compatibility with Kikiaola's Master Plan, which is still unknown at this time. Also, there is a lack of a viable location for a new reservoir. This alternative will be discussed in the Final EA. However, due to the disadvantages stated, it is not considered a feasible alternative.

Conclusion

We agree that it would be preferable to know if a shallow or deep well will be constructed. However, the viability of a shallow well cannot be determined until the drilling of the well has started, and the well can be tested.

We acknowledge that the effluent may appear in the coastal waters if a shallow well is constructed. However, as mentioned earlier, the well will most likely only be used during storm conditions when the effluent cannot be used for irrigation. During storm conditions, the quality of the coastal water is negatively impacted by storm runoff. Therefore, the actual impact to the coastal water by

the effluent would be extremely difficult – if not impossible – to determine. More than likely, the negative impact would be negligible compared to the impact from the storm runoff entering the ocean.

In regards to the deep well, Mink & Yuen, Inc. feels very strongly that there will not be any adverse impacts to the groundwater. However, the monitoring well that will be constructed at the WWTP will be used to determine if there are any negative impacts to the groundwater.

If you have any questions, please feel free to contact Harry Funamura at (808) 241-6610.

Very truly yours,

for CESAR C. PORTUGAL
County Engineer

Attachment

Cc: Austin, Tsutsumi & Associations, Inc.

Mink & Yuen, Inc.

1670 Kalakaua Avenue • Suite 605 • Honolulu, Hawaii 96826 • Telephone: (808) 943-1822 • Fax: (808) 943-1821

Date: September 28, 2000.

Subject: Response to review comments of the University of Hawaii Environmental Center concerning the ATA, Inc., EA for the Kauai WWTP injection well near Waimea.

General Comments:

The concern with reference to the injection well drilled in the caprock was raised and and its importance stressed by Mink and Yuen (M & Y), but evidently the State DOH and the County believe that the coastal consequences of injection in the shallow sedimentary aquifers will be minimal (see DOH Environmental Management Division letter of 7/20/95 to Steve Oliver, Kauai County Engineer, and EPA letter of 7/12/95 to DOH). Also, the accusation that the EA does not address coastal water impacts suggests that the reviewers have not studied the M & Y technical report (Waste Water Effluent Disposal by Injection Wells, Kikiaola, Kauai, Hawaii: August, 1993). *The Environmental Center reviewer of the first EA, John* Harrison, raised similar questions, which were responded to by memo dated 3/17/95. The technical report should be appended to the EA.

Description of the proposed project:

Paragraph 2 ... M & Y were advised that U.S. EPA allows only groundwater with greater than 10,000 mg/l TDS as acceptable for the injection medium, and so this standard was applied (letter of 10/4/93 from Doris Betuel of EPA to Bill Wong of DOH). The lower value of 5,000 mg/l stipulated by DOH does not compromise the selection of the well site.

Paragraph 3 ... There are no drinking water wells down gradient of the injection well site. The nearest County water supply well is in an up gradient quadrant. The M & Y technical report discusses this matter in detail.

<u>Water Quality</u>

Paragraph 1 ... The well referred to as "an existing water well" is not a drinking water well. Presumably the reference is to well 5740-01, which is not an active well and for which no record of use exists. When it was an active well, it probably was used for irrigation. Also, the groundwater flow direction in the Waimea Canyon Volcanics aquifer most likely is normal to the coast, although this cannot be proved with available data.

The concept and location of the Aquamarine Center came about after M & Y prepared and submitted its technical report. Later M & Y noted that a well located in the Center could be impacted by the injectant but was not contracted to extend the technical analysis to include this possibility. An "Aquamarine" well directly down gradient would have a very high likelihood of being affected by the injectant.

Paragraph 2 ... The M & Y technical report does not assume that the injectant will readily mix with the ambient groundwater. The reviewers' comments based on this misinterpretation are answered in the M & Y technical report. Also, the M & Y response to the original criticisms of the UH Environmental Center more than a year ago covered these topics (response dated 3/17/98).

Shallow vs. Deep Injection Well

Paragraph 1 ... The primary recharge to the uppermost layer of the caprock is not fresh water but brackish water originating as upward leakage of artesian water from the deep aquifer. M & Y memoranda of explanation consider the issues raised for caprock injection. The presumed flow direction of caprock groundwater is normal to the coast. M & Y have commented on the heterogeneity, both lateral and vertical, of caprock layers and conclude that the caprock groundwater will eventually reach the coast, even though the pathways may be tortuous (Technical Report of August, 1993; memo of 1/30/95 responding to Tom Nance WRE; memo of 6/28/99 titled, Waimea WWTP Monitor Well; memo of 7/13/99 titled, Waimea WWTP Injection Well; memo of 3/22/2000 titled, Waimea WWTP Disposal of Effluent into Caprock; and memo of 8/18/00 titled, Waimea WWTP Injection Well to Caprock).

Paragraph 2 ... The issues concerning the deep injection well are discussed in the M & Y technical report.

J. F. Mink
R.G.