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2014 FEB 11 PM 4: 07

COMMISSION ON WATER RESOURCE MANAGEMENT

OF THE STATE OF HAWAII

In the Matter of: IAO GROUND WATER MANAGEMENT AREA HIGH-LEVEL SOURCE WATER USE WUPAS AND PETITION TO AMEND INTERIM INSTREAM FLOW STANDARDS OF WAIHEE, WAIEHU, IAO, & WAIKAPU STREAMS CONTESTED CASE HEARING	Case No. CCH-MA-06-01 HAWAIIAN COMMERCIAL AND SUGAR COMPANY'S SUPPLEMENTAL OPENING BRIEF; DECLARATION RICK W. VOLNER, JR.; DECLARATION OF IVAN K. NAKATSUKA; EXHIBIT E-R30 - EXHIBIT E-R31; CERTIFICATE OF SERVICE Hearing: Date: March 10-28, 2014 Hearing Officer: Dr. Lawrence Miike

HAWAIIAN COMMERCIAL AND SUGAR COMPANY'S SUPPLEMENTAL OPENING BRIEF

I. INTRODUCTION/PROCEDURAL BACKGROUND

Hawaiian Commercial and Sugar Company ("***HC&S***") respectfully submits this supplemental opening brief to address the issue of the practicability of HC&S re-using treated wastewater from the Wailuku-Kahului Wastewater Reclamation Facility (the "***WWRF***") as an alternative to using Nā Wai ʻEhā surface water for sugarcane irrigation. At the prehearing conference held on September 24, 2013, HC&S gave notice to the Hearings Officer and the parties herein that it had retained the engineering firm of Austin, Tsutsumi & Associates, Inc. ("***ATA***") to prepare a feasibility report pertaining to the use of reclaimed water produced at the WWRF for sugar irrigation. *See* Minute Order 27 at 1. HC&S filed an electronic copy of ATA's January 22, 2014 Feasibility Report for HC&S Use of Reclaimed Water from Wailuku-Kahului Wastewater Reclamation Facility (the "***ATA Report***") with CWRM on January 22, 2014. In Minute Order 29, the Hearings Officer set a deadline of February 11, 2014 for HC&S to file testimony regarding the Report. *See* Minute Order 29 at 1. HC&S hereby submits the declaration of Ivan K. Nakatsuka ("***Nakatsuka Decl.***"), Vice President and Chief Environmental Engineer at ATA, which attaches the ATA Report as Exhibit E-R31. HC&S also submits the declaration of Rick W. Volner, Jr. ("***Volner 2/11/14 Decl.***").

II. DISCUSSION

One of the issues that the Hawai'i Supreme Court instructed CWRM to address on remand is the practicability of using reclaimed wastewater from the WWRF as an alternative to using Nā Wai 'Ehā surface water for irrigation of HC&S's sugar cane fields. *See In re 'Īao Ground Water Management Area High-Level Source Water Use Permit Applications*, 128 Hawai'i 228, 262, 287 P.3d 129, 163 (2012). After reviewing the ATA Report, HC&S concludes that the re-use of treated effluent from the WWRF cannot be deemed to be a reasonably practicable alternative to the use of surface water at the current time. *See* Volner 2/11/14 Decl. at ¶ 2.

According to the ATA Report, there is approximately 2.95 mgd of treated effluent that could potentially be reliably made available to HC&S 365 days a year from the WWRF upon a definitive agreement being reached between HC&S and the County of Maui and the construction of improvements at an estimated capital cost of approximately $16.9 million. *See* Volner 2/11/14 Decl. at ¶ 3; Ex. E-R31 at 27. Upon completion of the improvements, projected to be sometime in 2020 at the earliest, there would then be an annual operating and maintenance ("***O&M***") cost to HC&S of approximately $521,000, which includes $161,512.50 in fees that the County of Maui would charge for treated effluent at the rate of $0.15/1,000 gallons as stated in the County of Maui's letter to ATA dated January 15, 2014. *See* Volner 2/11/14 Decl. at ¶ 3; Ex. E-R31, Appendix A thereto (1/15/14 Ltr from Eric Nakagawa to Ivan K. Nakatsuka ("***1/15/14 County Letter***") at 3).

The potential availability of this 2.95 mgd of reclaimed water to HC&S in the foreseeable future is speculative because it is subject to several contingencies. As a preliminary matter, there is no guarantee that the County of Maui will make the upgrades to the WWRF necessary to enable distribution of reclaimed water to HC&S. According to the ATA Report and the County of Maui's submissions in this proceeding, the County is currently studying the possibility of upgrading the WWRF to produce R-1 quality effluent and potentially constructing improvements that would enable the County to sell R-1 water to multiple users, including HC&S. *See* Volner 2/11/14 Decl. at ¶ 4; Ex. E-R31 at 31 and Appendix A thereto (1/15/14 County Letter at 4). It is unlikely that the County would undertake a project to enable the distribution of R-2 treated water until it completes and assesses the current study which is evaluating the alternative approach of instead modifying the WWRF to produce R-1 water. *See* Volner 2/11/14 Decl. at ¶ 4; Ex. E-R31 at 31. Until the County completes this study and decides what direction it will take with regard to the re-use issue, it is simply unknown whether and when a project along the lines of the conceptual approach evaluated by ATA has any prospect of being developed. *See* Volner 2/11/14 Decl. at ¶ 4.

If, after completion of the pending study, the County were to secure the necessary funding and elect to make the necessary upgrades to enable the WWRF to produce R-1 water, its tentative timeline would be to start the design of the required improvements in 2016 with construction to begin in 2018 or 2019 depending on the property acquisitions that would be necessary. *See* Volner 2/11/14 Decl. at ¶ 5; Ex. E-R31, Appendix A (1/15/14 County Letter at 4); *cf. In re Water Use Applications*, 105 Hawai'i 1, 17-18, 93 P.3d 643, 659-60 (2004) (citing difficulty of obtaining an easement necessary for development of an alternative water source as a factor supporting CWRM's finding that alternative was not practicable). According to ATA, the estimated construction period would be two years, bringing the project completion date to 2020 or 2021. *See* Volner 2/11/14 Decl. at ¶ 5; Ex. E-R31 at 31.

If the County decides not to proceed with the proposed upgrades that would enable the WWRF to produce R-1 water in favor of instead pursuing the R-2 reuse approach evaluated by ATA, HC&S and the County would then need to successfully negotiate agreements regarding, among other things, cost sharing, the volume of treated effluent that would be made available to HCS, whether treated effluent would also be made available to other users, access to and ownership of the transmission pipelines, delivery requirements, and the rates at which the County will sell the treated effluent to HC&S. *See* Volner 2/11/14 Decl. at ¶ 6; Ex. E-R31, Appendix A (1/15/14 County Letter at 4). Until the terms under which the County would provide, and HC&S would receive, reclaimed water are finalized, the practicability of HC&S using reclaimed water as an alternative to Nā Wai 'Ehā surface water cannot be properly analyzed. *See* Volner 2/11/14 Decl. at ¶ 7.

For example, the County is unable at this time to say whether, under the conceptual approach evaluated by ATA, where HC&S would be the sole user of the treated effluent, the

County would be able to fund any of the capital improvements that would be required. *See id.* If the project could only proceed if the capital improvements were to be funded solely by HC&S, it is not at all clear that it would be practicable. It is also important to note that the pricing in the ATA study reflects current cost and pricing information for a project that, even assuming all contingencies could be resolved in a timely manner, would not be completed and begin delivering water until 2020, at the earliest. Based on information that is currently available, however, it is questionable whether it would make economic sense for HC&S to incur the capital and annual O&M costs ATA has estimated in order to secure 2.95 mgd of treated effluent for sugar irrigation. *See id.* at ¶ 7.

In sum, the practicability of HC&S using reclaimed water from the WWRF is speculative at this time. There is no prospect of reclaimed water being available, under any circumstances, until 2020, at the earliest. Besides this extended timeline, there are too many unknowns and contingencies regarding the potential terms, conditions, the user rate that the County ultimately decides to charge HC&S and the allocation of responsibility for the necessary improvements for HC&S to be able to perform an accurate cost benefit analysis regarding whether replacing 2.95 mgd of irrigation water with 2.95 mgd of treated effluent from the WWRF would be practicable.

III. <u>CONCLUSION</u>

HC&S respectfully submits that CWRM cannot at present deem the use by HC&S of treated effluent from the WWRF to be a reasonably practicable alternative to the use of surface water diverted from the Nā Wai ʻEhā streams. If the County definitively decides to undertake the necessary upgrades and the County and HC&S develop a better understanding of the costs and the amount of water potentially available, then it would be appropriate for CWRM to revisit the issue at that time.

HC&S reserves the right to further address these and any other issues in its rebuttal submissions and at the hearing of this matter.

DATED: Honolulu, Hawai'i, February 11, 2014.

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COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII

‘Iao Groundwater Management Area High-Level Source Water Use Permit Applications and Petition to Amend Interim Instream Flow Standards of Waihe‘e, Waiehu, ‘Iao & Waikapu Streams Contested Case Hearing	Case No. CCH-MA06-01 DECLARATION OF RICK W. VOLNER, JR RE WASTEWATER RE-USE

DECLARATION OF RICK W. VOLNER, JR.

I, RICK W. VOLNER, JR., hereby declare:

1. I am General Manager of Hawaiian Commercial & Sugar ("***HC&S***"), and submit this supplemental testimony on behalf of HC&S on the issue of the practicability of HC&S's re-use of treated effluent from the Wailuku-Kahului Wastewater Reclamation Facility (the "***WWRF***") for sugar irrigation.

2. I have reviewed the January 22, 2014 Feasibility Report For HC&S Use of Reclaimed Water from Wailuku-Kahului Wastewater Reclamation Facility (the "***ATA Report***") prepared by Austin, Tsutsumi & Associates, Inc. ("***ATA***") for HC&S. For the reasons set forth below, HC&S does not consider the re-use of treated effluent from the WWRF to be a practicable alternative to the use of surface water at the current time.

3. According to the ATA Report, there is approximately 2.95 mgd of treated effluent that could potentially be reliably made available to HC&S 365 days a year from the WWRF upon a definitive agreement being reached between HC&S and the County of Maui and the construction of improvements at an estimated capital cost of approximately $16.9 million. Upon completion of the improvements, projected to be sometime in 2020 at the earliest, there would then be an annual operating and maintenance ("***O&M***") cost to HC&S of approximately

$521,000, which includes $161,512.50 in fees that the County of Maui would charge for treated effluent at the rate of $0.15/1,000 gallons as stated in the County of Maui's letter to ATA dated January 15, 2014 (attached as Appendix A to the ATA Report).

4. There is no guarantee that the County of Maui will make the upgrades to the WWRF necessary to enable distribution of reclaimed water to HC&S. According to the ATA Report and the County of Maui's submissions in this proceeding, the County is currently studying the possibility of upgrading the WWRF to produce R-1 quality effluent and potentially constructing improvements that would enable the County to sell R-1 water to multiple users, including HC&S. It is unlikely that the County would undertake a project to enable the distribution of R-2 treated water until it completes and assesses the current study which is evaluating the alternative approach of instead modifying the WWRF to produce R-1 water. Until the County completes this study and decides what direction it will take with regard to the re-use issue, it is unknown whether and when a project along the lines of the conceptual approach evaluated by ATA has any prospect of being developed.

5. If, after completion of the pending study, the County were to secure the necessary funding and elect to make the necessary upgrades to enable the WWRF to produce R-1 water, its tentative timeline would be to start the design of the required improvements in 2016 with construction to begin in 2018 or 2019 depending on the property acquisitions that would be necessary. According to ATA, the estimated construction period would be two years, bringing the project completion date to 2020 or 2021.

6. If the County decides not to proceed with the proposed upgrades that would enable the WWRF to produce R-1 water in favor of instead pursuing the R-2 reuse approach evaluated by ATA, HC&S and the County would then need to successfully negotiate agreements

regarding, among other things, cost sharing, the volume of treated effluent that would be made available to HCS, whether treated effluent would also be made available to other users, access to and ownership of the transmission pipelines, delivery requirements, and the rates at which the County will sell the treated effluent to HC&S.

7. Until the terms under which the County would provide, and HC&S would receive, reclaimed water are finalized, the practicability of HC&S using reclaimed water as an alternative to Nā Wai ʻEhā surface water cannot be properly analyzed. For example, the County is unable at this time to say whether, under the conceptual approach evaluated by ATA, where HC&S would be the sole user of the treated effluent, the County would be able to fund any of the capital improvements that would be required. If the project could only proceed if the capital improvements were to be funded solely by HC&S, it is not at all clear that it would be practicable. It is also important to note that the pricing in the ATA study reflects current cost and pricing information for a project that, even assuming all contingencies could be resolved in a timely manner, would not be completed and begin delivering water until 2020, at the earliest. Based on information that is currently available, it is questionable whether it would make economic sense for HC&S to incur the capital and annual O&M costs ATA has estimated in order to secure 2.95 mgd of treated effluent for sugar irrigation.

I, RICK W. VOLNER, JR., declare, verify, certify, and state under penalty of perjury that the foregoing is true and correct.

DATED: ________________, Maui, ______________, 2014.

____
RICK W. VOLNER, JR.

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COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII

'Iao Groundwater Management Area High-Level Source Water Use Permit Applications and Petition to Amend Interim Instream Flow Standards of Waihe'e, Waiehu, 'Iao & Waikapu Streams Contested Case Hearing	Case No. CCH-MA06-01 DECLARATION OF IVAN K. NAKATSUKA

DECLARATION OF IVAN K. NAKATSUKA

I, IVAN K. NAKATSUKA, hereby declare:

1. I am the Vice President and Chief Environmental Engineer of Austin, Tsutsumi & Associates, Inc. ("ATA"), and have served in that position since December 1981. I began working for ATA in May 1979, first as a project engineer, and later as Chief Environmental Engineer.

2. Attached hereto as Exhibit "E-R30" is a true and copy of my resume.

3. In September of 2013, ATA was retained by Cades Schutte LLP on behalf of Hawaiian Commercial and Sugar Company ("HC&S") to prepare a feasibility report pertaining to the use of reclaimed water produced at the County of Maui's Wailuku-Kahului Wastewater Reclamation Facility for sugar irrigation (the "Project"). I served as the principal in charge and project manager of the Project.

4. I took the lead in the investigation and analysis performed by ATA in order to complete the Project, and supervised other staff members of ATA who assisted in the performance of services required to complete the Project and to prepare the resulting report.

5. Attached hereto as Exhibit "E-R31" is a true and correct copy of ATA's January 22, 2014 Feasibility Report For HC&S Use of Reclaimed Water from Wailuku-Kahului Wastewater Reclamation Facility which describes the scope of the Project, the investigations and analysis performed and the resulting opinions of ATA regarding the Project.

I, IVAN K. NAKATSUKA, declare, verify, certify, and state under penalty of perjury that the foregoing is true and correct.

DATED: Honolulu, Hawaii, February ____, 2014.

____
IVAN K. NAKATSUKA

IVAN K. NAKATSUKA

Title: Vice President and Chief Environmental Engineer

Education: BSCE - University of Hawaii - 1974
MSCE - University of Hawaii - 1976

Experience: With firm 34 years Other firms 3 years

Professional Registration: Civil Engineer - State of Hawaii - #4759-CE - 1979

Technical Societies and Honors: American Society of Civil Engineers; American Water Works Association - Past Chair of Hawaii Section and George Warren Fuller Awardee; Water Environment Federation - Past President and National Director of Hawaii Section

Professional Experience:

April 1976 – May 1979

URS Company Hawaii, Junior Engineer. Worked on civil engineering projects, including water and wastewater projects.

May 1979 – December 1981

Austin, Tsutsumi & Associates, Inc. (ATA), Project Engineer. Worked on water and wastewater engineering projects under the direction of ATA's Chief Environmental Engineer.

December 1981 – Present

ATA Chief Environmental Engineer. Responsible for all water and wastewater engineering projects for ATA throughout Hawaii, Guam and other Pacific areas.

Notable water projects managed by Mr. Nakatsuka included the following:

West Maui Water Master Plan for Maui County Department of Water Supply's (DWS's) system in the Lahaina Judicial District between the southern end of Lahaina and Kapalua. The objectives of the Master Plan were to identify alternatives to upgrade DWS's system to comply with Federal and State drinking water quality standards; to determine long-term water demand towards establishing a cost-effective plan for developing additional, as well as alternative, water sources; and to develop and implement a plan for improvements to the system, including establishment of design criteria and other specifications, over a twenty-year planning period beginning in 1990.

Kaanapali Water Well System on Maui, comprised of several 900+ feet deep groundwater wells with vertical-line shaft and submersible pumps, several bolted glass-fused-to-steel panel and concrete water tanks, and thousands of linear feet of ductile iron pipe water lines.

Kaanapali Granular Activated Carbon Water Treatment Plant on Maui, which removes trace amounts of pesticides from 3.0 MGD of groundwater.

Exhibit E-R30

Waiale Water Treatment Facility on Maui to treat 10.0 MGD of surface water using a microfiltration process with immersed membranes.

Mahinahina Water Treatment Facility for Maui DWS, which treats 2.5 MGD of surface water using a direct filtration process, preceded by a 20 million-gallon raw water storage reservoir with a floating cover.

Lahaina Water Treatment Facility for Maui DWS, which treats 2.5 MGD of surface water using a microfiltration process with pressurized membranes.

Grove Farm Water Purification Facility on Kauai to treat 3.0 million gallons per day (MGD) of surface water using an ultra-filtration process with immersed membranes.

Kaupakulua Water Well System for dedication to Maui DWS, which included a 2.0 MGD, 1400-foot deep basal water well, a 200,000 gallon bolted stainless steel tank and a duplex booster pump system.

Piiholo Water Treatment Plant Organic Carbon Reduction Project for Maui DWS to reduce the amount of dissolved organic carbon in the filtered water, thereby reducing the potential concentration of disinfection byproducts after chlorine injection. The project includes a multi-pump booster pump station and four granular activated carbon vessels.

Haiku Source Development Project for Maui DWS to establish up to six groundwater wells, storage reservoirs, booster pump station(s) and thousands of linear feet of ductile iron pipe water lines.

Notable wastewater projects managed by Mr. Nakatsuka included the following:

Pukalani Wastewater Treatment Plant on Maui to convert a 500,000 gpd package wastewater treatment plant from an activated sludge process to a membrane bio-reactor process using ultra-filtration to produce a higher quality effluent. In addition to conversion of this main treatment process, the disinfection process would be converted from chlorination to ultra-violet light.

Expansion of the Manele Bay Resort Wastewater Treatment Plant on Lanai from a capacity of 140,000 gpd to 500,000 gpd by converting from a sequencing batch reactor process to a moving bed bio-reactor process, without constructing any additional treatment tanks. In addition to conversion of this main treatment process, the disinfection process would be converted from chlorination to ultra-violet light.

Waimea Wastewater Treatment Plant Expansion, Phase on Kauai to expand the capacity of a 300,000 gallon per day (gpd) extended aeration activation sludge secondary treatment process to a 700,000 gpd moving bed bio-reactor process, and improve the level of treatment to tertiary by adding filtration and ultra-violet light disinfection.

Backup Effluent Injection Well for Waimea Wastewater Treatment Plant on Kauai for disposal of secondary effluent during rainfall conditions when irrigation reuse is not possible.

IVAN K. NAKATSUKA, Continued

Filtration and Disinfection System at Lihue Wastewater Treatment Plant on Kauai to improve the quality of the secondary effluent to tertiary quality for unrestricted reuse. The project involved installation of two rotating disc cloth filters and a ultra-violet light (UV) disinfection unit with a capacity of 300,000 gallon per day (gpd). Provisions were incorporated for future installation of two additional filters and a second UV unit to double the capacity.

Rehabilitation of Sewer Lines and Manholes in Kaneohe and Kailua on Oahu, which includes cured-in-place pipe and epoxy coating of manholes.

Makaha Interceptor Sewer Rehabilitation/Replacement on Oahu, which includes cured-in-place pipe, repair of PVC linings and epoxy coating of manholes.

Rehabilitation of Sewer Lines and Manholes in the Sand Island Basin on Oahu, which includes cured-in-place pipe and epoxy coating of manholes.

Kahuku Septage Handling Facility on Oahu, which treats 60,000 gpd of septage using a sequencing batch reactor process.

Modifications to the East Honolulu Wastewater Treatment Plant on Oahu, which includes two 2.0-MGD traveling bridge filters, a chlorination/de-chlorination facility and a lime sludge pasteurization system.

FEASIBILITY REPORT FOR HC&S USE OF RECLAIMED WATER FROM WAILUKU-KAHULUI WASTEWATER RECLAMATION FACILITY

Kahului, Maui, Hawaii

January 22, 2014

Prepared for:

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Exhibit E-R31

FEASIBILITY REPORT FOR HC&S USE OF RECLAIMED WATER FROM WAILUKU-KAHULUI WASTEWATER RECLAMATION FACILITY

Kahului, Maui, Hawaii

Prepared for

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January 22, 2014

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

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FEASIBILITY REPORT FOR HC&S USE OF RECLAIMED WATER FROM WAILUKU-KAHULUI WASTEWATER RECLAMATION FACILITY

Kahului, Maui, Hawaii

I. INTRODUCTION

Austin, Tsutsumi and Associates, Inc. (ATA) was contracted by A&B Properties, Inc. (A&B) to prepare this feasibility report pertaining to the use of reclaimed water produced at the County of Maui's Wailuku-Kahului Wastewater Reclamation Facility (W-K WWRF) for irrigation of sugar cane being grown by Hawaiian Commercial & Sugar Company (HC&S), a division of A&B. The quality of the reclaimed water was assumed to be "R-2 Water", as defined by the Hawaii State Department of Health (DOH) in their "Guidelines for the Treatment and Use of Recycled Water", dated May 15, 2002. This is the highest quality effluent that can currently be produced by the W-K WWRF.

ATA's scope of work was as follows:

- Determine the volume, quality and variability of reclaimed water that is potentially available for delivery to HC&S for sugar irrigation.
- Evaluate the physical requirements, including the probable cost of capital improvements, necessary for the delivery of reclaimed water to HC&S.
- Evaluate the physical requirements for the safe receipt, storage, handling and use of reclaimed water by HC&S, including compliance with any applicable DOH guidance and environmental, health and safety, or other regulations applicable to the use of reclaimed wastewater, taking into account the operational

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requirements of HC&S's existing and planned agricultural operations and the potential need to mitigate the consequences of any unintended receipt of reclaimed water that does not meet, as a minimum, R-2 Water requirements.

- Work with HC&S to evaluate the probable operational changes that HC&S would need to undertake and the increased operating costs that HC&S would need to incur to utilize the available reclaimed water following completion of any necessary capital improvements.

- Contact the Maui Wastewater Reclamation Division (WWRD) to obtain the history of the plant performance and to discuss current and future conditions affecting the available effluent produced by the W-K WWRF, including the potential frequency and impact of plant upsets resulting in delivery of water that would not, as a minimum meet R-2 Water requirements. A letter was sent to WWRD, dated November 21, 2013, which discussed the conceptual design of pumping the R-2 Water to HC&S's existing irrigation pond. The letter also included questions pertaining to operation of the W-K WWRF and cost issues. A response letter from WWRD commenting on the conceptual design and addressing the questions was received on January 15, 2014. (See Appendix A for correspondence with WWRD.)

- Communicate and meet with HC&S staff as needed to understand existing farming operations and irrigation infrastructure and potential modifications that may be necessary to accommodate the safe receipt and use of reclaimed water by HC&S for irrigation in compliance with all applicable regulations.

- Investigate existing uses of reclaimed water by other agricultural operations and any past usage of effluent on cane crops in Hawaii to identify and evaluate any regulatory, operational, or agronomic hurdles encountered by others.

- Meet with DOH to discuss requirements under DOH's existing, and upcoming revisions to their Guidelines for the Treatment and Use of Recycled Water and other regulatory agencies, as may be necessary or appropriate.

- Communicate with the Maui Department of Water Supply to discuss any concerns it may have with regard to HC&S' use of reclaimed water.

- Conduct a literature search of publications relevant to the issues to be considered in this Feasibility Report.

II. EXISTING CONDITIONS

A. Wailuku-Kahului Wastewater Reclamation Facility (W-K WWRF)

The W-K WWRF average daily (dry weather) flow wastewater treatment capacity is 7.9 million gallons per day (mgd), with all of the treated wastewater (final effluent) capable of meeting R-2 Water standards. (See Exhibits 1 and 2 for location maps of the W-K WWRF, and Appendices B and C for final effluent water quality data.) Disinfection is currently with a gas chlorination system, which is expected to be replaced shortly with an on-site hypochlorite generation system.

The water quality data in Appendix B indicates that the final effluent being produced by the W-K WWRF is of excellent quality that would meet the requirements for R-2 Water. The average concentrations for biochemical oxygen demand (BOD) and total suspended solids (TSS) are less than 5 mg/L and at least 2 mg/L for chlorine residual. Furthermore, the average turbidity was less than 2 NTUs, which is the maximum allowable level for R-1 Water. However, there were days when the fecal coliform count (MPN/100mL) was recorded as being 1600, which is the default number when the fecal coliform result is "too numerous to count". However, as this effluent was being discharged into the injection wells at the WWRF, this was not in violation of any DOH rule, as disinfection of effluent discharged into injection wells is not required.

However, it should be mentioned that the water quality data in Appendix B was based on laboratory analyses of composite hourly grab samples, and not based on analyses with continuously monitoring on-line equipment. Therefore, there could have been excursions in the water quality between the hourly grab samples that went undetected. The water quality data in Appendix C is even less representative of continuously sustained conditions, as the data is based on laboratory analyses of quarterly grab samples.

The current average daily flow (ADF) of effluent being discharged into the injection wells at the WWRF is 4.40 mgd. This ADF is measured before 200,000 to 300,000 gallons per day (gpd) of effluent being produced by the WWRF is reused within the WWRF. The majority of this reuse is for continuous spraying of the surfaces of the aeration tanks for the purpose of froth control.

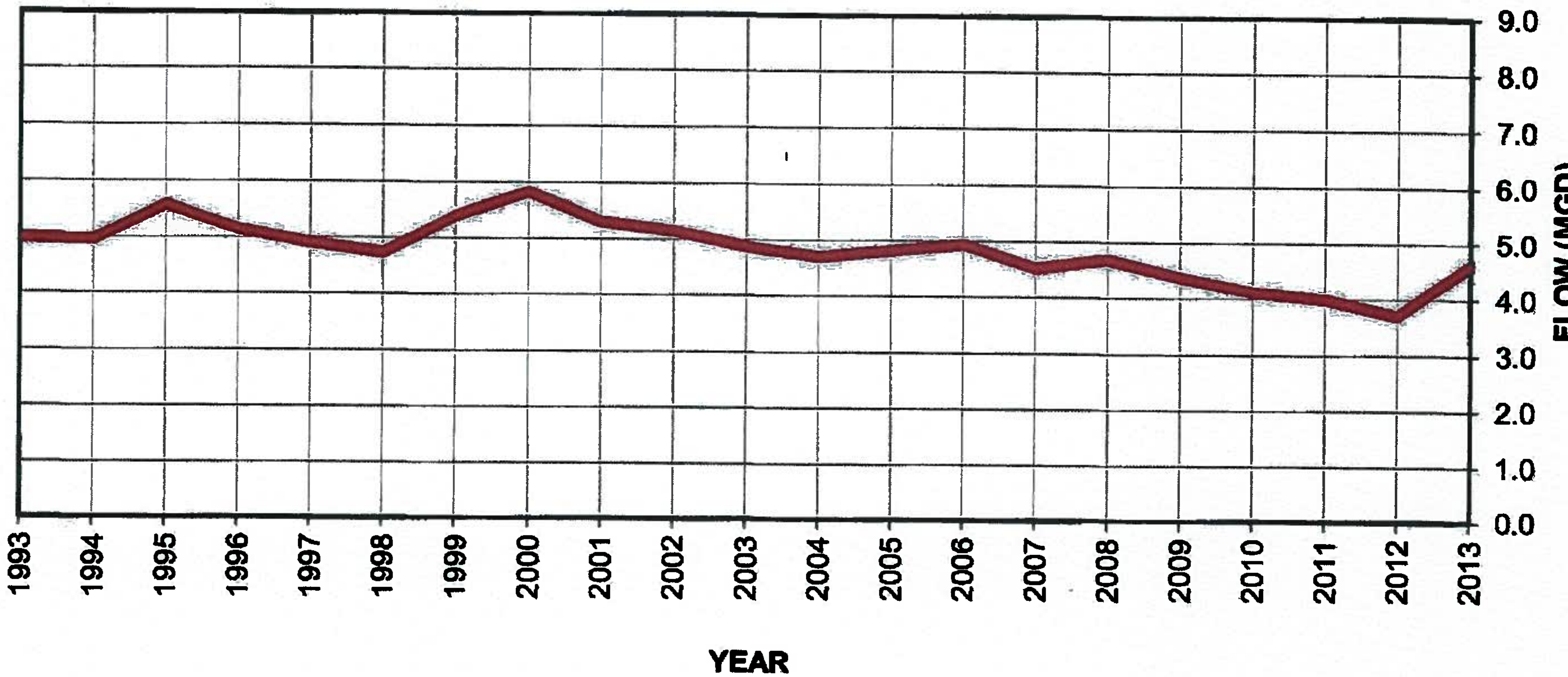
However, flow records over the past 20 years indicate that there has been a steady decline in the ADF since 2000, with a significant increase only since 2012. (See Graph 1 for historical data of ADFs.)

The ADF also varies during months of the year, with the lowest ADF recorded over the past 7 years being approximately 3.2 mgd during the consecutive months of August and September 2012. (See Graph 2 and Table 1 for historical variation of ADFs during months of the year.)

Flow of wastewater into the WWRF also fluctuates throughout the hours of the day, with peak flows experienced at 7:00 am and 6:00 pm. (See Graph 3 for diurnal flow factor curve.)

The only vacant area within the WWRF site that is deemed feasible for improvements towards pumping the R-2 Water to HC&S's facility – as discussed in a subsequent section of this report - is in the northwest corner of the WWRF site. (See Exhibit 3 and Photos 1 and 2 of this area.)

Another potential area for improvements may be within the existing basin with an approximate storage capacity of 4 to 5 million gallons (MG) on the east side of the WWRF site. This basin is regularly used for brief storage of backwash water from the injection well cleaning process before this water is pumped to the WWRF headworks, as well as for emergency storage of wastewater, if needed.



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(If NOT 1-inches : Scale Accordingly)

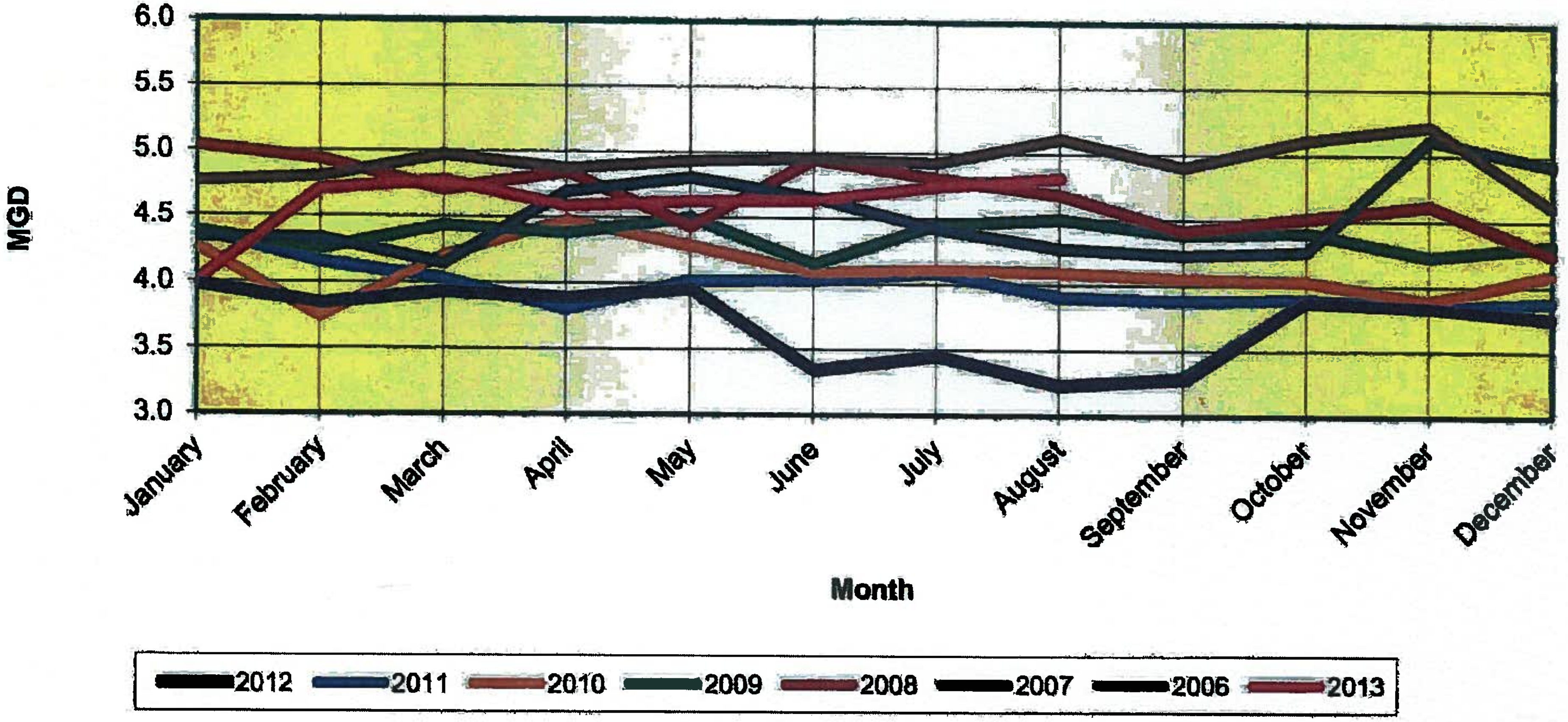
A&B PROPERTIES, INC.

FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER
FROM W-K WWRF
PUUNENE, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

W-K WWRF AVERAGE DAILY FLOWS
(JANUARY 1993 THROUGH AUGUST 2013)

GRAPH
1



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A&B PROPERTIES, INC.
FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER
FROM W-K WWRF
PUUNENE, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

W-K WWRF AVERAGE DAILY FLOWS
DURING MONTHS OF THE YEAR
(JANUARY 2006 THROUGH AUGUST 2013)

GRAPH
2

Table 1. W-K WWRF Monthly Plant Average and Injection Well Flows
(January 2005 through August 2013)

	2005 Flows (MGD)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plant Average	4.448	4.797	4.925	4.836	4.802	4.831	4.836	4.895	4.846	4.760	4.875	4.869
Injection Well												
Average	4.006	3.792	4.356	4.225	4.091	4.111	4.207	4.063	4.195	4.208	4.027	4.310
Maximum	5.292	4.164	4.792	4.729	4.478	4.69	4.531	4.483	4.471	4.529	4.816	4.634
Minimum	3.298	3.493	3.014	2.856	3.674	3.489	3.923	3.045	3.856	3.943	2.974	3.771

	2006 Flows (MGD)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plant Ave	4.760	4.800	4.970	4.870	4.930	4.950	4.920	5.110	4.900	5.110	5.220	4.600
Injection Well												
Average	4.204	4.163	4.273	4.025	4.397	4.375	4.548	4.590	4.303	4.295	4.547	4.046
Maximum	4.650	4.462	5.455	4.869	4.830	4.894	5.664	5.177	4.600	4.952	5.191	5.002
Minimum	3.915	3.640	3.116	2.5342	3.923	3.882	3.7513	3.978	3.836	3.901	4.192	2.069

	2007 Flows (MGD)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plant Average	4.334	4.334	4.145	4.694	4.803	4.651	4.420	4.276	4.230	4.260	5.117	4.920
Injection Well												
Average	4.209	4.204	3.984	4.123	4.089	4.201	4.202	4.095	4.065	4.094	4.314	4.593
Maximum	4.664	4.667	4.655	4.657	4.772	4.699	4.834	4.493	4.398	4.600	4.708	5.921
Minimum	3.597	3.787	2.864	2.968	2.662	3.767	3.236	3.311	3.584	3.811	3.333	3.369

	2008 Flows (MGD)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plant Average	5.030	4.930	4.700	4.840	4.430	4.940	4.800	4.680	4.410	4.510	4.610	4.240
Injection Well												
Average	4.370	4.421	4.331	4.034	4.047	4.577	4.191	4.186	4.012	3.841	3.939	4.041
Maximum	4.917	5.037	4.734	5.300	4.425	11.285	4.602	4.662	4.587	4.274	4.305	5.568
Minimum	3.977	2.337	3.365	2.624	3.361	3.732	3.471	3.788	3.514	3.526	3.000	2.740

	2009 Flows (MGD)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plant Average	4.380	4.250	4.431	4.377	4.496	4.148	4.451	4.496	4.385	4.404	4.225	4.316
Injection Well												
Average	3.961	3.948	4.024	3.966	3.892	3.847	3.831	3.967	3.813	3.876	3.817	3.900
Maximum	4.960	4.303	4.636	4.477	4.239	4.722	4.253	4.341	4.174	4.389	4.315	4.620
Minimum	2.450	3.685	3.599	3.310	3.197	2.328	3.213	3.520	3.463	3.480	2.9337	2.892

Table 1. W-K WWRF Monthly Plant Average and Injection Well Flows
(January 2005 through August 2013)

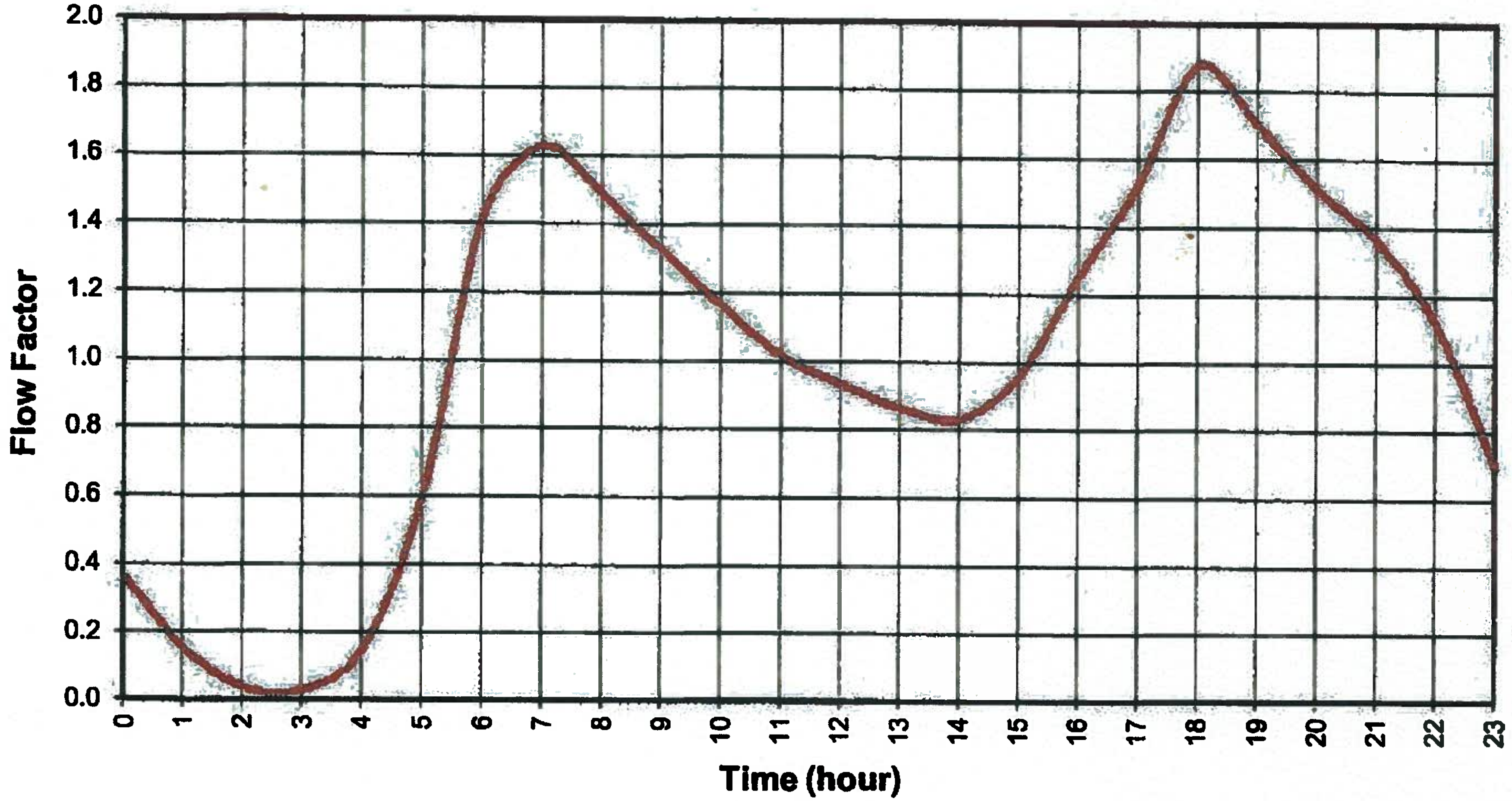
	2010 Flows (MGD)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plant Average	4.258	3.738	4.200	4.472	4.281	4.083	4.109	4.090	4.046	4.033	3.882	4.085
Injection Well												
Average	3.963	3.875	3.971	3.672	4.021	3.897	3.596	3.305	3.209	3.303	4.023	4.399
Maximum	4.305	4.277	4.5811	4.357	4.671	4.190	4.902	3.671	3.688	4.334	4.392	12.176
Minimum	3.686	3.462	3.409	2.596	3.287	3.641	2.223	3.068	2.953	2.954	3.719	3.849

	2011 Flows (MGD)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plant Average	4.381	4.152	4.027	3.801	4.016	4.021	4.083	3.907	3.880	3.897	3.842	3.882
Injection Well												
Average	4.066	3.835	3.746	3.671	3.912	3.850	3.898	4.000	3.843	3.832	3.861	3.827
Maximum	5.313	4.940	4.559	4.097	4.377	4.374	5.876	4.842	4.273	4.338	4.370	4.247
Minimum	2.933	3.281	2.425	3.062	3.643	3.298	2.917	3.278	3.392	2.839	3.414	3.517

	2012 Flows (MGD)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plant Average	3.978	3.838	3.930	3.876	3.964	3.344	3.454	**3.228**	**3.291**	3.885	3.884	3.753
Injection Well												
Average	3.919	4.073	3.729	3.408	3.485	3.344	3.426	3.194	3.291	3.874	3.868	3.800
Maximum	4.673	4.436	4.777	3.778	4.091	3.952	3.77	4.096	4.305	4.291	4.406	4.101
Minimum	3.113	3.568	3.162	2.633	3.023	3.006	2.648	2.818	2.647	3.083	3.235	3.291

	2013 Flows (MGD)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Plant Average	4.000	4.705	4.767	4.581	4.620	4.631	4.739	4.805
Injection Well								
Average	4.011	4.038	3.860	3.685	3.906	4.044	4.132	4.140
Maximum	4.535	4.432	4.698	4.040	4.212	4.308	4.631	4.552
Minimum	3.402	3.377	2.918	3.357	3.306	3.862	3.850	3.132

Shaded flow rates in March 2011 and May 2013 are corrected rates of what was provided by WWRD.
Bold flow rates in August and September 2012 were lowest recorded rates from January 2005 through August 2013.



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A&B PROPERTIES, INC.

FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER
FROM W-K WWRF
PUUNENE, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

W-K WWRF DIURNAL FLOW
FACTOR CURVE

GRAPH
3

(See Exhibit 3 for W-K WWRF site plan for location of this basin, and Photo 3 of this basin.)

B. Off-site Pipelines as Potential Force Mains

Cannery wastewater previously generated at Maui Land & Pineapple Company Inc.'s (MLP's) facility in Kahului was pumped to HC&S's irrigation pond via approximately 9,000 linear feet (l.f.) of a dual 10" PVC pipe, followed by approximately 11,400 l.f. of a single 15" PVC pipe. It should be noted that the construction plans indicate that this dual pipe is of high-density polyethylene (HDPE). However, based on discussions with the firm that supplied these pipes, PVC pipes were installed instead.

These pipes served as force mains for a pump station at MLP's facility, and were used to convey an average flow of 1.0 mgd and a peak flow of 1.8 mgd to HC&S's irrigation pond. The transition from the dual 10" force main to the single 15" force main is within a manhole just off Kuihelani Highway. A portion of the 10" PVC pipes is rated at 200 pounds per square inch (psi), with the balance being rated at 160 psi. The 15" PVC pipe has a rating of 125 psi. (See Exhibits 1 and 2 for alignments of the force mains and location of the transition manhole, and Photo 3 of this manhole.) These pipes have not been in use since the shut-down of MLP's cannery facility a few years ago.

C. HC&S Irrigation Facility

HC&S has indicated that the R-2 Water could best be utilized for irrigation of a portion of its seed cane farm where seed cane is currently grown on more than 1,000 acres. Based on an average application rate of 6,000 gallons per day per acre, more than 6 mgd of irrigation water would be required to irrigate the entire 1,000 acres. The seed cane area proposed for irrigation with R-2 Water is not within 1,000 feet of any existing – or currently proposed - potable water wells. (See Exhibit 5.) Therefore, contamination of any existing or potential potable groundwater sources is not expected to be a concern. This was confirmed with both DOH and Maui County Department of Water Supply.

The R-2 Water would be discharged into HC&S's existing 500,000 gallon pond for initial storage - just as was the concept when MLP's cannery wastewater was being discharged into and stored within this pond. (See Exhibits 1 and 2 for location of HC&S's irrigation pond, Exhibit 4 for a site plan and Photo 4 of the pond.) The maximum achievable depth within the pond is only about 4 feet, which results in algae formation due to sunlight penetration through such a shallow depth of water combined with concentrations of nutrients in the stored water. Therefore, past practice has been to add copper sulfate to the water to control the growth of algae as well as potassium to minimize the potential for formation of clams – as both algae and clams in the water would be problematic towards operation of the filters.

The 12-foot long, 15" perforated (puka) outlet pipe for this pond reduces to a 12" suction line for two of the three pumps of the adjacent filter station. All three pumps have their own 12" suction lines from 12-foot long 12" perforated pipes within the Waihee Ditch intake screen structure. All three pumps discharge into a manifold that conveys the water to the filter station, which is comprised of three banks of eight sand filter pressure tanks. As MLP's cannery wastewater is no longer being pumped into the pond, the sole source of water for the filter station is from the Waihee Ditch. (See Exhibit 4 and Photo 5 of the filter station.)

An evaluation of the system capacity at HC&S's filter station was performed by Wai Engineering, Inc. (See Appendix D for Wai Engineering's report.) The findings of the report are summarized below:

- The pump suction manifold is adequate to take 2,050 gpm from the storage pond that has a capacity of about 500,000 gallons. Two of the three pumps can take water from the pond at the same time. The rated capacity of a single pump is 1,900 gpm.

- The minimum recommended operating depth is about 18 inches above the floor of the lined pond. The pump station is equipped with level sensors to stop the pumps in the event of low water level in the pond.

- The filter station consists of 24 each sand media filters with 8 units supplied by each individual pump. The capacity is adequate for 8 tanks to take the 1900 gpm from its supply pump. With two pumps supplied by the pond, the flow can exceed the desired flow rate of 2,050 gpm.

- System upgrades and modifications may be required to meet the operational needs of HC&S.

Irrigation of the sugar cane by the filtered water is with subsurface drip. HC&S intends to bury the drip tubing deeper than they have in the past, with the expectation that replacement of damaged tubes after harvesting would be extended to 6-7 years instead of on an annual basis.

III. DESIGN PARAMETERS

A. General

The physical requirements for the safe receipt, storage, handling and use of reclaimed water by HC&S should meet the requirements of DOH and WWRD. The design parameters should be based on compliance with any applicable DOH guidance and environmental, health and safety, or other regulations applicable to the use of reclaimed wastewater. The design parameters should also take into account the requirements of HC&S's existing and planned agricultural operations and the potential need to mitigate the consequences of any unintended receipt of reclaimed water that may not meet, as a minimum, R-2 Water requirements.

Since the effluent from the W-K WWRF is of high quality, equipment more typically used for clean water, rather than wastewater, systems should be considered. Therefore, some sections of the County of Maui's, Department of Water Supply's Water System Standards may be applicable to the design of the reuse system.

B. Effluent Regulations

The Hawaii State law on Water Pollution, Hawaii Revised Statute 342D, is administered by the Director of the Department of Health (DOH), State of Hawaii. Based on the provisions of this statute, DOH promulgated Public Health Regulations (PHR) under Hawaii Administrative Rules (HAR), Title 11 addressing the control and abatement of water pollution. These include Chapter 62, "Wastewater Systems", and Chapter 54, "Water Quality Standards". These PHRs and the Federal Clean Water Act established the current water quality standards and the effluent limitations to protect the water quality and water uses of the State of Hawaii.

In addition to the HAR, guidelines for wastewater effluent irrigation systems are presented in, "Guidelines for the Treatment and Use of Recycled Water", prepared by the DOH Wastewater Branch, which were completed in May 2002. These guidelines are not rules; however, they will be the basis upon which administrative rules will be promulgated in the near future. Therefore, any wastewater treatment facility, which reuses recycled wastewater, must follow the criteria set forth in the guidelines.

Applicable sections of the guidelines are presented in Appendix E. The following sections apply specifically to irrigation with R-2 Water.

1. HAR Title 11, Chapter 62 - Wastewater Systems

<u>Subchapter 2, §11-62-25 – Wastewater effluent disposal systems</u>

For effluent irrigation systems, the rules state that owners of the effluent systems must submit the following information to DOH:

- Details of the area, type of vegetation to be irrigated and an assessment on the impact to the adjacent areas.
- Method and controls to be used in the irrigation system such that no runoff or ponding will occur.

- Method of controlling public access to the system and reuse area to minimize public contact with the effluent.
- Plan of action to adequately warn the public that effluent is being used for irrigation and that the water is unfit for human consumption.
- How the piping and appurtenances are properly marked to distinguish potable water from sewage effluent.

The owners must also provide adequate storage or a backup disposal system to prevent any discharges from the system when the irrigation system is not in operation, or when wastewater effluent quantities exceed the irrigation requirements. The existing injection wells at the W-K WWRF would be the backup disposal system for the reuse system.

<u>Subchapter 2,§11-62-26 – Wastewater effluent requirements applicable to treatment works</u>

Wastewater effluent requirements applicable to treatment works are set forth in HAR Title 11, Chapter 62, Subchapter 2, §11-62-26. The following effluent requirements are applicable for irrigation and subsurface disposal systems:

- For R-2 water, provide continuous disinfection of the effluent as follows:
  - A theoretical contact time of 15 minutes or more and an actual modal time of 10 minutes or more throughout which the chlorine residual is 0.5 mg/l or greater; and
  - Automatic control of chlorine dosage and automatic continuous measuring and recording of chlorine residual shall be provided. The chlorine facilities shall have adequate capacity to maintain a residual of 2 mg/l.

- The number of total coliform organisms in the effluent for five grab samples during a 30-day period shall not exceed a median of 23 per 100 ml.

2. Guidelines for the Treatment and Use of Recycled Water

The guidelines address the following subjects:

- Uses and specific requirements for recycled water.
- Treatment design parameters.
- Design parameters for the distribution of recycled water.
- Engineering reports and submittals for treatment facilities and water reuse projects.
- Approval processes for treatment facilities and water reuse projects.
- Compliance reports and submittals.

"R-2 Water (Disinfected Secondary-23 Recycled Water)" means recycled water that has been oxidized, and disinfected such that the median fecal coliform density measured in the disinfected effluent does not exceed 23 per 100 ml utilizing the bacteriological results of the last seven days for which analyses have been completed; and the density does not exceed 200 per 100 ml in more than one sample in any 30-day period.

The guidelines also require reports that contain sufficient information to assure DOH that the degree of treatment and reliability is commensurate with the proposed use, and that the distribution and use of the recycled water will not create a health hazard or nuisance. The following reports are required.

a. Basis of Design Report for a Water Reuse Projects

The Basis of Design Report shall present descriptions of new or existing reuse areas, and existing and/or new distribution systems.

The design should conform to the Guidelines for the Treatment and Use of Recycled Water. The necessity of any proposed deviation from the guidelines must be discussed in the report.

b. Engineering Design Report for a Water Reuse Projects

The Engineering Design Report includes an Irrigation Plan, a Management Reuse Plan, a Public Education Plan, an Employee Training Plan, a Vector Control Plan and a Monitoring System Construction Report (MSCR). Below are excerpts from the guidelines regarding these reports.

- The objective of the Irrigation Plan is to delineate Best Management Practices methods and controls to be used in the irrigation system to mitigate runoff or ponding. The owner/developer and all subsequent owners shall establish an irrigation plan and system which shall be presented to the DOH for its approval.

- The objective of the Management Reuse Plan is to establish and delineate the responsibilities of operation and maintenance of the reuse system. If the use of recycled water becomes the choice for this project, then the owner/developer and all subsequent owners shall develop and adhere to a Management Reuse Plan which shall address at a minimum, the following items:

    - The procedures, restrictions, and other requirements that are to be followed by the distributor and/or user must be described. The requirements and restrictions shall be codified into a set of rules and regulations. The "Rules and Regulations" shall be developed in accordance with Water Reclamation Guidelines. The procedures and restrictions shall include measures to be used to protect the public health, prevent cross-connections and address the appropriate precautions presented in Section D of Chapter III. The plan shall present a schedule for the adoption of enforceable procedures and restrictions to cover all the distributions systems and proposed use areas, and it shall identify the organization or organizations that would adopt them.

- The plan shall also provide operation criteria for irrigation.

- Contingency Plan. The report shall identify the actions and precautions to be taken to protect public health in the event of a non-approved use. Notification protocol of the appropriate regulatory agencies and the exposed public as required shall be included in the plan. The plan must identify these non-approved uses and appropriate action to be taken, e.g., overspray, runoff of recycled water off the property, ponding of recycled water on the property (due to pipe breakage).

- Inspection, supervision and employee training shall be provided by the user to assure proper operation of the recycled water system. The user shall maintain records of inspection and training.

- The report shall outline staffing and their assignments and responsibilities and provide maintenance procedures and frequency.

- The user shall maintain as-built plans of the approved use area showing all buildings, reclamation facilities, wastewater collection systems, and potable water systems and recycled water systems. Plans shall be updated as modifications are made.

- A recycled water User Supervisor shall be appointed by the user. The user shall include in this submittal the following information regarding the individual designated as the User Supervisor: name, address, and telephone number at which this individual or designated representative can receive messages during "off hours." The user is to notify the reclamation agency of a change in designation of the User Supervisor.

- The User Supervisor should be aware of the entire system within his or her responsibility and of all applicable conditions of recycled water use. The User Supervisor shall be responsible for installation, operation, and maintenance of the recycled system, prevention of potential hazards, implementing these guidelines, and coordination with the cross-connection control program of the water purveyor or DOH.

- The objective of a Public Education plan is to inform persons likely to come in contact with reclamation water where recycled water is in use.

- An Employee Training Plan shall be prepared which encompasses the following topics:

  1) The following provisions shall be made for workers who handle R-2 Water (or even R-1 Water) or may be exposed to it.

     - Workers shall be notified that recycled water is in use. Notification shall include the posting of conspicuous informational signs with wording of sufficient size to be clearly read at the work place, with language presented in paragraph (1) of the

Public Education Plan. Where a worker's primary language is not English, this message will be provided to the worker in a form he can understand.

- Workers shall be informed orally and in writing that recycled water is not suitable for ingesting and that drinking recycled water may result in potential illness.

- Potable water shall be supplied for workers for drinking and washing hands and face. Where bottled water is provided, the water shall be in separate, boldly labeled, contamination-proof containers protected from recycled water and dust.

2) Employee Training. The plan shall describe the training that the employees will receive to ensure compliance with the Water Reclamation Guidelines. The plan shall identify the entity that will provide the training and the frequency of the training.

- Vector Control Plan. It is important that the Vector Control Branch of DOH be notified and consulted about impending reuse projects. Coordination and cooperation is vital to avoid creation of unnecessary conditions conductive to mosquito production. Certain projects may require a contractual arrangement between the owner and the local mosquito control contractors. This contract should provide for ongoing surveillance and for control measures should these become necessary.

- Monitoring System Construction Report (MSCR) shall conform with the guidelines in Appendix F of the Guidelines for the Treatment and Use of Recycled Water.

C. Improvements at W-K WWRF

The following parameters apply to any proposed improvements at the W-K WWRF:

- Available Site: It is anticipated that an approximate area of 1 acre would be required for the improvements. The only vacant area within the W-K WWRF site of such area is in the northwest corner of the WWRF site. This area was used as a staging area for previous construction, and therefore, portable storage containers and office trailers still exist, which would have to be removed. Consideration was given to converting a portion of the existing 4 to 5 MG basin on the east end of the WWRF site, which encompasses an area of 4 to 5 acres. This basin is regularly used for brief storage of backwash water from the injection well cleaning process before this water is pumped to the WWRF headworks, as well as for emergency storage of wastewater in the event that the effluent does not meet treatment objectives. WWRD has indicated that the most appropriate storage solution appears to be to construct the improvements in the aforementioned vacant northwest corner of the WWRF site. However, WWRD noted that further discussion/evaluation to determine if a portion of the overflow basin might be used may be considered.

- Hydraulic Profile: The final effluent from the Chlorine Contact Tank has sufficient head to allow for discharge into the multiple injection wells by gravity. However, the head would only be enough to partially fill any aboveground storage tank/reservoir by gravity. Therefore, it is anticipated that a pump station would be required to fill such a storage tank to its full capacity.

- Minimal Flow: The improvements should be based on the anticipated minimal generation of final effluent from historical flow data to assure that this volume of R-2 Water will consistently be made available to HC&S.

- Diurnal Flow: WWRD has indicated that the diurnal flow factor curve of Graph 3 is a reasonable representation of how flows into the WWRF vary throughout a 24-hour period for any given year and time of year. Therefore, it would serve as the basis for determining the amount of storage required at the WWRF for the purpose of flow equalization throughout the day.

- Continuous Monitoring of Final Effluent Quality: Continuous monitoring equipment – typically a requirement for R-1 Water systems – should be installed to assure no excursion in water quality would go undetected, which may occur with only hourly composite sampling. The two most appropriate equipment items would be a turbidity meter and a chlorine residual analyzer. Turbidity measurements can be correlated to the concentration of total suspended solids (TSS) - which is one of the DOH regulated parameters for R-2 Water. It should be noted that turbidity is a DOH regulated parameter for R-1 Water, whereas TSS is not. A correlation could also be established between fecal coliform count – which is another DOH regulated parameter for R-2 Water, as well as for R-1 Water - and chlorine residual concentration.

- R-2 Water Quality: The water quality parameters for R-2 Water are set by DOH in their Guidelines for the Treatment and Use of Recycled Water. R-2 Water means recycled water that has been oxidized, and disinfected to meet the following Fecal coliform bacteria densities:

    - The median density measured in the disinfected effluent does not exceed 23 per 100 ml utilizing the bacteriological results of the last seven days for which analyses have been completed; and

    - The density does not exceed 200 per 100 ml in more than one sample in any 30-day period.

Filtration is not required for facilities intended to produce R-2 Water. However, WWRD noted that it would be useful to install a turbidimeter at the W-K WWRF for continuous monitoring of turbidity.

Disinfection is required to meet the Level 2 Chlorination of disinfection for R-2 Water. The disinfection should ensure that the requirements for Fecal coliform bacteria densities is met. Also, the disinfection needs to meet the following criteria:

- A theoretical chlorine contact time of 15 minutes or more and an actual modal contact time of 10 minutes of more throughout which the chlorine residual is 0.5 mg/l or greater; and

- Automatic control of chlorine dosage and automatic, continuous measuring and recording of chlorine residual shall be provided. The chlorination facilities shall have adequate capacity to maintain a residual of 2 mg/l.

- The County would be responsible for maintaining the minimum chlorine residual at the W-K WWRF of 0.5 mg/l. (As stated previously, the average chlorine residual being maintained by the County at the WWRF has been at least 2 mg/L.) While this does not absolutely guarantee that all effluent will be R-2 quality when it leaves the W-K WWRF, it would be reasonable to presume that in most cases it will be, and that any excursions detected at the W-K WWTP will result in the prompt cessation of delivery to HC&S and redirection of the effluent to the injection wells.

- Standby Power: Standby power for the improvements from the existing standby generator for the W-K WWRF is required to assure continuous conveyance of the R-2 Water to HC&S's pond during a primary (Maui Electric Company) power outage. WWRD has confirmed that the existing standby generator has the capacity to provide standby power for the proposed improvements.

- Pump Total Dynamic Head (TDH): The TDH would apply to the pump station to be used to pump the R-2 Water to the HC&S pond. Based on the elevation difference between this pump station and the pond and the length of the force main between these two points, it is anticipated that the TDH may be excessive such that there would be a potential for destructive surges (water hammer) in the force main.

- Tsunami Protection: The W-K WWRF is in a tsunami inundation zone. Recorded run-up heights (water levels above ground elevation) for tsunamis experienced in Kahului were 12 feet in 1923, 25 feet in 1948 and 11 feet in 1960 (U.S. Department of the Interior and U.S. Geological Survey, "Atlas of Natural Hazards in the Hawaiian Coastal Zone, 2002). Therefore, any proposed structures should have a finish floor elevation that is significantly above grade and/or with features such as water-tight doors ("submarine doors") to prevent entry of water into the building during a tsunami. Although lower than the aforementioned run-up heights, the finish floor elevation of the existing Administration Building of the WWRF of approximately 14 feet above mean sea level (msl) would be a reasonable objective for any new building – possibly still in conjunction with doors with some level of water tightness.

- Corrosion Protection: The W-K WWRF is located in an extremely corrosive environment, being right off the coast with prevailing trade winds blowing over the coastal water towards the WWRF. Therefore, materials of construction should be of concrete wherever possible, with non-concrete metallic components being of at least Type 316 stainless steel.

D. Utilization of Existing and New Off-site Pipelines as Force Mains

The following parameters apply to utilization of existing pipelines as force mains, as well as towards installation of new force mains:

- Velocity: It would be reasonable to establish the maximum velocity through the force main at 6 feet per second (fps). This is consistent with the 2002 Water System Standards (WSS) used by the counties of the State of Hawaii in that 6 fps is the maximum velocity allowed in distribution mains. It should be noted that a higher velocity would result in an increase in the frictional losses through the force main, which would in turn increase the TDH to the point of being even more excessive and further raise concerns about surges.

- Pressure: It would be reasonable to establish the maximum pressure in the force main at 125 psi, which is the maximum pressure allowed by the WSS in water lines. It should be noted that the existing 15" PVC pipe from the transition manhole to HC&S's pond - proposed to be used as the third segment of the force main in conveying the R-2 Water from the W-K WWRF to this pond - is rated at only 125 psi.

- DOH Requirements: DOH's "Guidelines" require that all new buried transmission piping in the recycled water system, including service lines, valves, and other appurtenances shall both be colored purple (suggested color Pantone 522 or equal) and embossed or be integrally stamped/marked "CAUTION: RECYCLED WATER-DO NOT DRINK," or be installed with a purple identification tape, or a purple polyethylene wrap, suggested color index 77742 violet #16, Pantone 512 or equal.

  Existing piping being converted to recycled use shall first be accurately located and tested in coordination with DOH. If verification of the existing piping is not possible, the lines shall be uncovered, inspected and identified prior to use.

E. HC&S Irrigation Facility

The following parameters apply to any proposed improvements at the HC&S Irrigation Facility:

- Capacity of Pond: The existing pond has a capacity of 0.5 MG, and therefore, would not provide much storage at the rate that the R-2 Water is proposed to be pumped from the W-K WWRF. Therefore, any flow equalization to offset the diurnal production of R-2 Water at the W-K WWRF would have to be addressed at the WWRF. As recommended by Wai Engineering, Inc., the minimum water level in the pond should be 18 inches to ensure proper operation of the filter station pumps – which results in the "working" capacity of the pond being only about 0.3 MG.

- Potential for Algae Formation within Pond: Due to the shallow depth of the exposed water (to sunlight), with a minimum water level of 18 inches at all times, and concentration of nutrients in the water, the potential for algae formation in the water is significant. Therefore, it would be beneficial to displace the water within the pond with "fresh" R-2 Water as quickly as possible. The minimal size of the pond is an advantage towards meeting this objective. However, consideration should still be given to installing a floating cover to prevent exposure of the water to sunlight, thereby significantly reducing algae formation. This would likely eliminate the need to add copper sulfate to control algae growth and potassium to minimize the potential for formation of clams, as was the past practice when the pond received waste from cannery wastewater from MLP.

- Capacity of Filter Station: Two of the three pumps are currently able to draw out of the pond, and each pump can pump 1,900 gpm. Thus, one pump cannot quite keep up with the incoming pumped flow of 2,050 gpm. Therefore, there may be periods during the day when two pumps are operating together. Consideration should be given to modifying the piping to allow the third pump to also draw out of the pond, in the event that one of the two pumps becomes inoperable. The single outlet line from the pond has enough capacity to keep up with the rate at which R-2 Water will be filling the pond.

As stated previously, the average chlorine residual being maintained by the County at the WWRF has been at least 2 mg/L. This is expected to decrease as the R-2 Water is conveyed from the WWRF to HC&S's pond such that the residual of the R-2 Water stored in the pond may at times be less than 0.5 mg/l. The proposed floating cover on the pond is expected to help maintain the chlorine residual. However, a means of boosting the chlorine residual at the pond should still be considered. Currently, there is a tablet chlorination system at the Waihee Ditch intake screen structure that is being used to disinfect the ditch water prior to the water being pumped through the filters. Consideration should be given to installing a similar tablet chlorination system on the pond outlet line – which is also the suction line for the filter station pumps - that could increase the chlorine concentration of the R-2 water before being pumped through the filters.

III. PROPOSED IMPROVEMENTS

A. W-K WWRF

This section describes the improvements proposed within the northwest corner of the W-K WWRF site. (See Exhibit 6 for proposed improvements.)

The effluent that is currently being discharged into the existing injection wells would flow to a Tank Influent Booster Pump Station (TI-BPS) via the existing 36" line that conveys effluent to the injection wells along the north edge of the W-K WWRF site. The TI-BPS is required because of insufficient head after the existing chlorine contact tank to fill the proposed 1.0 million gallon (MG) Reuse Water Storage Tank, as described hereinafter.

The TI-BPS would be comprised of two vertical line shaft pumps (one duty pump and one standby pump) with variable frequency drives, drawing out of a subsurface wet well. The top of the wet well would have to be several feet above existing grade to allow the effluent to reach a sufficiently high level within the wet well to be able to backflow within the 36" line and discharge by gravity into the injection wells. This would normally occur when the level in the 1.0 MG Reuse Water Storage Tank is at its maximum level.

The pumpage rate of the TI-BPS pumps is proposed to be 3,900 gallons per minute (gpm) to be able to accommodate the peak flow during the day. This peak flow is based on 1.9 times an average daily flow (ADF) of 2.95 million gallons per day (mgd) (2,050 gpm continuous). This ADF was based on the W-K WWRF minimal ADF recorded over the past 10 years of approximately 3.2 mgd during the months of August and September of 2012. This ADF included the effluent that is typically used throughout the treatment process, which was assumed to be an average of approximately 250,000 gpd. Therefore, the flow that was being discharged to the injection wells during this two month period was approximately 2.95 mgd.

A concrete building would house the pump motors and motor control center. The building finish floor elevation would be 14 feet above mean sea level (msl) to prevent inundation of the building during a potential tsunami. Alternatively, the building could be lower – if the aforementioned ability to backflow out of the wet well to the injection wells can still be met – in conjunction with having "submarine doors" and other measures to prevent inundation.

The head requirement for the TI-BPS pumps is expected to be less than 20 feet – sufficient to pump the effluent into the proposed 1.0 MG Reuse Water Storage Tank. Therefore, the pump motor horsepower (HP) of each pump is expected to be 30 HP.

The concrete 1.0 MG Reuse Water Storage Tank would be constructed at grade and have a maximum stored water depth of 20 feet. Water levels in the tank would determine the automatic activation/de-activation of the duty pump for the TI-BPS, as well as the duty pump for the Tank Effluent Booster Pump Station (TE-BPS), as described hereinafter.

The TE-BPS would have two vertical line shaft pumps (one duty pump and one standby pump) with constant speed motors. The pumps would be installed within suction barrels (i.e., no wet well) to draw the effluent out of the tank.

A concrete building would house the pump motors and motor control center. The building finish floor elevation would be 14 feet above msl to prevent inundation of the building during a potential tsunami. Alternatively, the building could be lower in conjunction with having "submarine doors" and other measures for protection against inundation.

The pumpage rate of the TE-BPS pumps is proposed to be 2,050 gpm to be able to accommodate the ADF, as the 1.0 MG capacity of the tank would allow for equalizing the diurnal flow rates.

If the TE-BPS were to pump the R-2 Water directly to HC&S's irrigation pond, then the estimated TDH would be 288 feet (which equates to 125 psi of pressure) and would require 200 HP motors. (See Appendix F for TDH calculations.) This TDH may be excessive such that there would be a potential for destructive surges (water hammer) in the force main. A detailed analysis would have to be conducted to verify this potential. Therefore, in the absence of such an analysis at this time, the recommendation is to construct an intermediate booster pump station (I-BPS) that would be located at the existing transition manhole. To pump to the I-BPS, the TE-BPS TDH was estimated to be 156 feet, which is expected to require 100 HP motors. See Section IV.C for further discussion on the I-BPS.

An aboveground flow meter would be installed on the ductile iron pipe pump discharge line before this line transitions to a buried 16" PVC pipe force main.

B. Off-site Pipelines as Force Mains

This section describes the three segments of the off-site force main to convey the R-2 Water from the TE-BPS at the W-K WWRF to HC&S's existing irrigation pond, which has a capacity estimated at 0.5 MG. (See maps of Exhibits 1 and 2 for alignment of force main.)

The first segment would be 7,600± linear feet (l.f.) of a new 16" PVC pipe force main from the TE-BPS to a connection point with the second segment, 9,000± l.f.

of an existing dual 10" PVC pipe force main. A new valve vault would be constructed at the connection point. The end of this second segment already connects to a third segment, 11,400± l.f. of an existing 15" PVC force main, at a transition manhole just off the east edge of Kuihelani Highway. This third existing segment would convey the R-2 Water to HC&S's existing irrigation pond.

C. Intermediate Booster Pump Station (I-BPS)

The I-BPS would be located near the existing transition manhole. A 200,000 gallon bolted-steel-panel tank would be constructed into which the TE-BPS would pump the R-2 Water. The I-BPS would pump the R-2 Water out of the 200,000 gallon tank to HC&S's irrigation pond. The I-BPS would have two vertical line shaft pumps (one duty pump and one standby pump) with constant speed motors. The pumps would be installed within suction barrels (i.e., no wet well), drawing the R-2 Water out of the 200,000 gallon tank and pumping it to the existing HC&S irrigation pond. A concrete building would house the pump motors, motor control center and a generator that would be necessary to provide emergency backup power.

The TDH for the I-BPS pumps was estimated to be 132 feet, based on a pumped flow of 2,050 gpm, which is expected to require 100 HP motors. (See Appendix F for TDH calculations.)

D. HC&S Irrigation Facility

This section describes the proposed improvements at the HC&S pond and filter station.

As MLP's Kahului Cannery has not been in operation for the past few years, the existing dual 10" PVC pipe force main followed by 15" PVC pipe force main has been abandoned, and the pond has been dry. Therefore, the sediment accumulated within the pond has to be removed. (See Photo 4 of accumulated sediment.) If damage to the pond lining is detected during such cleanup operation, then the lining has to be repaired. It would also be beneficial to install a floating cover to prevent algae formation within the pond.

Consideration should be given to modifying the pump piping to allow for all three pumps to pump from the pond to allow for greater operational flexibility. Also, a pond water level detection system should be installed to send signals back to the W-K WWRF to control the TE-BPS. This would require some electrical work at the pond site.

HC&S intends to pump backwash from the sand filters back into the irrigation pond through screen filters which will need to be periodically cleaned. Depending on the quality of the backwash, there may be some costs incurred by HC&S associated with disposal of residue removed from the backwash by, and overflow from, the screen filters.

To meet DOH's guidelines for reuse, the existing aboveground components of the irrigation system will need to be painted purple to indicate that they are used for non-potable purposes, and appropriate signage will need to be installed.

E. Permits

In order to proceed with the project many permits would be required. The County of Maui Planning Department could require a Special Management Area (SMA) Use Permit, a Conservation District Use Application (CDUA) and possibly an Environmental Assessment (EA). A Building Permit would be needed for improvements at the W-K WWRF. An application for the Right to Perform Work in the County Roadway Permit would be required from the County, as well as a similar approval from the State Department of Transportation for any work performed in a State highway.

Approval from DOH and the County would be required for usage of the R-2 Water by HC&S. The County would issue a Use Permit once improvements were constructed and inspection completed.

F. Timeframe

The County is currently undertaking a study evaluating a project to expand recycled water use and distribution in the Central Maui area, including an upgrade of the W-K WWRF to produce R-1 Water. It is unlikely that the County would undertake a project to enable the distribution of R-2 treated water until it completes and assesses the current study. However, the timeline included in this study is a good baseline indicator of what the timeline would be for a R-2 reuse project, should the County choose to go in that direction instead. The tentative timeline was to start design of the required improvements to the W-K WWRF in 2016 with construction to begin in 2018 or 2019 dependent on any property acquisitions that are necessary. The estimated construction period would be two years, which would bring the project completion to 2020 or 2021. The County will have a clearer understanding of the costs and timeline required once the study is completed. An additional consideration would be the completion and approval of any necessary agreements involving cost sharing and/or water delivery requirements between the County and HC&S.

IV. COSTS

A. Construction

An Opinion of Probable Construction Cost for the proposed upgrades at the W-K WWRF and off-site improvements is shown in Table 2. The cost for the upgrades at the WWRF was estimated to be $8.4 million, and the cost for the off-site improvements was estimated to be $8.5 million, for a total construction cost of approximately $16.9 million.

B. Operation and Maintenance (O&M)

A portion of the O&M cost for the proposed reuse system is the cost to purchase the R-2 Water from the County. Fees for recycled water service are set in the County's annual budget. The recycled water rate for the fiscal year 2011 (which is still applicable today) was $0.15 per 1,000 gallons for "Major Agriculture" and $0.30

Table 2. Opinion of Probable Construction Cost

Item No.	*Item Description*	*Est. Quantity*	*Unit*	*Unit Price*	*Total Price*
	UPGRADES AT W-K WWRF				
1	Mobilization	1	LS	$ 150,000	$ 150,000
2	Sitework	1	LS	$ 50,000	$ 50,000
3	Infuent Pump Station Building with wet well	1,400	SF	$ 600	$ 840,000
4	Effluent Pump Station Building	1,300	SF	$ 500	$ 650,000
5	30 HP variable frequency drive pumps and piping	1	LS	$ 300,000	$ 300,000
6	100 HP variable frequency drive pumps and piping	1	LS	$ 350,000	$ 350,000
7	24" tank overflow line	1,000	LF	$ 300	$ 300,000
8	Miscellaneous piping	1	LS	$ 50,000	$ 50,000
9	16" PVC force main to fence line	250	LF	$ 400	$ 100,000
10	1.0 MG Concrete Reuse Water Storage Tank	1	EA	$ 2,500,000	$ 2,500,000
11	Electrical	1	LS	$ 500,000	$ 500,000
				Total (Items 1-11)	$ 5,790,000
				25% Engineering, Legal and Administrative Costs	$ 1,447,500
				Subtotal	$ 7,237,500
				15% Contingency	$ 1,085,625
				TOTAL (UPGRADES AT W-K WWRF)	$ 8,323,125
				SAY	**$ 8,400,000**

	OFF-SITE IMPROVEMENTS				
12	16" PVC force main	7,600	LF	$ 400	$ 3,040,000
13	Valve vault at MLP	1	LS	$ 100,000	$ 100,000
				Total (Items 12 and 13)	$ 3,140,000
14	Intermediate Pump Station				
a	Mobilization	1	LS	$ 150,000	$ 150,000
b	Sitework	1	LS	$ 100,000	$ 100,000
c	Effluent Pump Station Building	1,400	SF	$ 450	$ 630,000
d	100 HP variable frequency drive pumps and piping	1	LS	$ 350,000	$ 350,000
e	Miscellaneous piping	1	LS	$ 50,000	$ 50,000
f	200,000-gallon bolted-steel-panel tank	1	LS	$ 900,000	$ 900,000
g	Electrical, including standby generator	1	LS	$ 300,000	$ 300,000
				Total (Item 14)	$ 2,480,000

Table 2. Opinion of Probable Construction Cost

Item No.	*Item Description*	*Est. Quantity*	*Unit*	*Unit Price*	*Total Price*
15	Improvements at HC&S Pond				
a	Cleanup and possible spot repair of HC&S Pond	1	LS	$ 10,000	$ 10,000
b	Floating cover for HC&S Pond	27,000	SF	$ 7	$ 189,000
c	Modify Piping for Sand Filter Pumps	1	LS	$ 10,000	$ 10,000
d	Sand Filter Backwash Screen Filters	1	LS	$ 50,000	$ 50,000
e	Painting aboveground equipment and signage	1	LS	$ 10,000	$ 10,000
f	Electrical work	1	LS	$ 20,000	$ 20,000
				Total (Item 15)	$ 289,000
				Total (Items 12-15)	$ 5,909,000
				25% Engineering, Legal and Administrative Costs	$ 1,477,250
				Subtotal	$ 7,386,250
				15% Contingency	$ 1,107,938
				TOTAL (OFF-SITE IMPROVEMENTS)	$ 8,494,188
				SAY	**$ 8,500,000**

TOTAL CONSTRUCTION COST	**$ 16,900,000**

per 1,000 gallons for "Agriculture". A "Major agricultural consumer" is defined as those agricultural consumers, including golf courses, that use more than 3 mgd of reclaimed water per day based on average daily flow, or that have more than 400 acres served by the reclaimed water distribution system, or that have any pasture land served by the reclaimed water distribution system. Since HC&S would most likely be irrigating more than 400 acres, they would be considered a major agricultural user. Therefore, the cost to purchase an average day demand of 2.95 mgd would be $443 per day (2,950,000 gpd / 1,000 gallons x $0.15), which would result in an annual purchase price of approximately $162,000. The understanding is that this cost is inclusive of all O&M costs that the County has to expend associated with components within the W-K WWRF - including power costs. Therefore, power costs associated with the proposed TI-BPS and TE-BPS are not included.

Other O&M costs for the proposed reuse system include labor and materials required to operate the components of the system and provide for regular repair and/or replacement of the components. These costs exclude the costs for power to operate any equipment. O&M costs were calculated based on a percentage of the total estimated construction costs for the components. Typical industry standards for various components are as follows:

- 1.0 percent for pipelines, distribution system, facilities, tanks and wells.
- 1.5 percent for dams and reservoirs.
- 2.5 percent for intake and pump stations.

For the purposes of this report, the assumption is that O&M costs associated with proposed improvements constructed before the meter, e.g., TI-BPS, 1.0 MG Storage Reservoir, TE-BPS and on-site piping, would be paid by the County.

O&M costs were calculated for the force mains, although the responsible party for maintaining these force mains may be the County. For existing force mains, the expected construction cost for a similar force main was calculated and used for the basis of calculating the O&M costs.

Operation of HC&S's irrigation system at the pond was assumed to be the same as current operations. The installation of a floating cover at the pond is expected to ensure that the quality of R-2 Water would be similar to the quality of the ditch water. Therefore, there should be no increase in O&M costs associated with operation of the pumps and filter station. Also, although it is recommended that a chlorination system be installed at the pond to maintain a minimum level of chlorine residual in the R-2 Water, the total amount of water being disinfected (from the ditch plus the pond) would still be the same. Therefore, the cost for the chlorine tablets is expected to remain about the same. However, O&M costs associated with proposed improvements, such as the floating cover, were calculated. An opinion of probable O&M costs is shown in Table 3. The total O&M cost calculated by ATA, including purchasing of the R-2 Water from Maui County, is expected to be approximately $521,000 per year.

Table 3. Opinion of Probable Operation & Maintenance Cost

Item No.	*Item Description*	*Est. Quantity*	*Unit*	*Unit Price*	*Construction Cost*	*% of Const Cost*	*Annual O&M Cost*
	OFF-SITE IMPROVEMENTS						
1	16" PVC force main	7,600	LF	$ 400	$ 3,040,000	1.0%	$ 30,400
2	Existing10" PVC dual force main	9,000	LF	$ 300	$ 2,700,000	1.0%	$ 27,000
3	Intermediate Booster Pump Station	-	LS	-	$ 2,480,000	2.5%	$ 62,000
4	Power cost for Intermediate Booster Pump Station*	-	LS	-	-	-	$ 192,200
5	Existing 15" PVC Force main	11,400	LF	$ 400	$ 4,560,000	1.0%	$ 45,600
6	Floating cover for HC&S Pond	27,000	SF	$ 7	$ 189,000	1.0%	$ 1,890
						TOTAL (OFF-SITE IMPROVEMENTS)	**$ 359,000**
						PURCHASE OF RECYCLED WATER @ $0.15/1,000 GALLONS	**$ 162,000**
						TOTAL O&M COST	**$ 521,000**

* Based on a power cost of $0.35/kilowatt-hour.

Other O&M costs, such as for employee training, vector control, management of backflush water, including disposal of residue from the screen filters, and other miscellaneous costs associated with compliance with all relevant laws and regulations, have not been calculated by ATA.

V. SUMMARY

Austin, Tsutsumi and Associates, Inc. (ATA) was contracted by A&B Properties, Inc. (A&B) to prepare this feasibility report pertaining to the use of reclaimed water produced at the County of Maui's Wailuku-Kahului Wastewater Reclamation Facility (W-K WWRF) for irrigation of sugar cane being grown by Hawaiian Commercial & Sugar Company (HC&S), a wholly owned subsidiary of A&B.

The W-K WWRF average daily (dry weather) flow wastewater treatment capacity is 7.9 million gallons per day (mgd), with all of the treated wastewater (final effluent) capable of meeting R-2 Water standards. The WWRF minimal average daily flow (ADF) of effluent produced, as recorded over the past 10 years, was approximately 3.2 mgd during the months of August and September of 2012, and the average in-plant use was assumed to be approximately 250,000 gpd. Therefore, this report is based on HC&S using approximately 2.95 mgd for irrigation of sugar cane.

HC&S has indicated that the R-2 Water could best be utilized for irrigation of seed cane on a portion of its more than 1,000-acre seed farm. The R-2 Water would be discharged into HC&S's existing 500,000 gallon pond for initial storage. The existing pumps and filtration system at the pond would still be utilized.

Proposed improvements at the W-K WWRF include construction of a new Tank Influent Booster Pump Station (TI-BPS), a 1.0 MG Reuse Water Storage Tank, a Tank Effluent Booster Pump Station (TE-BPS), a 16" PVC pipe force main, and two concrete buildings to house the pump motors and motor control centers for the BPSs.

The TI-BPS is required because of insufficient head after the existing chlorine contact tank to fill the 1.0 MG Reuse Water Storage Tank. The pumpage rate of the TI-BPS pumps is proposed to be 3,900 gallons per minute (gpm) to be able to accommodate the peak flow during the day. This peak flow is based on 1.9 times an average daily flow (ADF) of 2,050 gpm – which equates to an ADF of 2.95 million gallons per day (mgd). The total dynamic head (TDH) for the TI-BPS pumps is expected to be less than 20 feet – sufficient to pump the R-2 Water into the proposed 1.0 MG Reuse Water Storage Tank. Therefore, the pump motor horsepower (HP) of each pump is expected to be 30 HP.

The concrete 1.0 MG Reuse Water Storage Tank would be constructed at grade and have a maximum stored water depth of 20 feet. Water levels in the tank would determine the automatic activation/de-activation of the duty pump for the TI-BPS, as well as the duty pump for the TE-BPS.

The TE-BPS would have two vertical line shaft pumps (one duty pump and one standby pump) with constant speed motors. A detailed analysis is required to determine if the TDH for the TE-BPS pumps would be excessive if the R-2 Water was to be pumped all the way to the HC&S irrigation pond without the potential for destructive surges (water hammer) in the force main. In the absence of such an analysis at this time, it is recommended that an Intermediate Booster Pump Station (I-BPS) be constructed approximately half-way between the TE-BPS and the pond, just within HC&S's property. Therefore, the TE-BPS would pump the R-2 Water to a 200,000-gallon bolted-steel-panel tank at the site of this I-BPS. The TE-BPS pumps would then have 100 HP motors, based on an estimated total dynamic head (TDH) of 156 feet.

The I-BPS would have two vertical line shaft pumps (one duty pump and one standby pump) with constant speed motors to pump the R-2 Water out of the 200,000-gallon tank to the existing HC&S irrigation pond. The I-BPS pumps would have 100 HP motors, based on an estimated TDH of 132 feet.

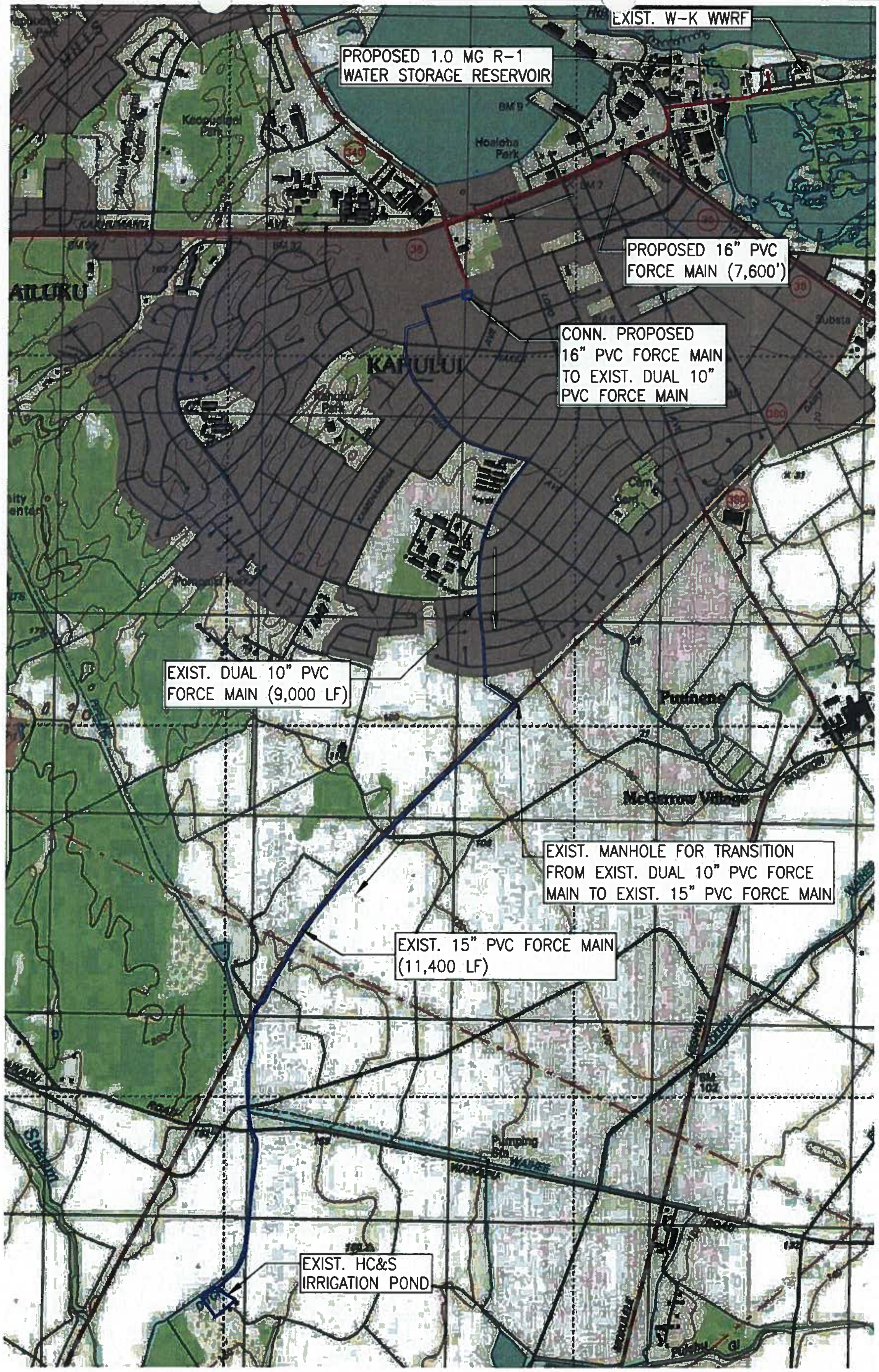
The R-2 Water would be pumped from the TE-BPS to the tank at the I-BPS via 7,600± linear feet (l.f.) of a new 16" PVC pipe force main followed by 9,000± l.f. of an existing dual 10" PVC pipe force main. A new valve vault would be required at the transition from the new 16" PVC pipe force main to the existing dual 10" PVC force main. The R-2 Water would then be pumped from the I-BPS to the existing HC&S irrigation pond via 1,400± l.f. of an existing 15" PVC force main.

Consideration should be given to installing a floating cover for HC&S's pond to minimize, if not eliminate, algae formation and other organisms that would negatively impact the filtration process. Other improvements at this site would be modification of the filter station pump piping to allow all three pumps to pump out of the pond, painting of the filter station components purple to conform to DOH's requirements for a reclaimed water system and electrical work associated with sending pond water level signals to the W-K WWRF to control the TE-BPS pumps.

There would be many permit requirements associated with implementation of the reuse system. The timeframe for startup of the system is expected to be in the year 2020 or 2021.

The total construction cost for the proposed upgrades at the W-K WWRF and off-site improvements are expected to be approximately $16.9 million. The total O&M cost, including purchasing the R-2 Water at the county's current rate of $0.15/1000 gallons for "Major Agriculture" usage, is expected to be approximately $521,000 per year. This does not include additional costs that HC&S will need to incur related to operational changes that HC&S will need to undertake in order to comply with relevant laws and regulations, including those discussed in Section III. B.

EXHIBITS



NORTH

SCALE: 1" = 1500'

0 1

1 INCHES AT FULL SIZE
(If NOT 1-inches : Scale Accordingly)

A&B PROPERTIES, INC.
FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER
FROM W-K WWRF
PUUNENE, MAUI, HAWAII

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

GENERAL PLAN - USGS MAP

EXHIBIT

1

NORTH

SCALE: 1" = 1500'

0 1

1 INCHES AT FULL SIZE
(If NOT 1-inches ; Scale Accordingly)

A&B PROPERTIES, INC.

FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER
FROM W-K WWRF

PUUNENE, MAUI, HAWAII

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

GENERAL PLAN - GOOGLE MAP

EXHIBIT

2

SOURCE: GOOGLE EARTH

NORTH

SCALE: 1" = 100'

0 1

1 INCHES AT FULL SIZE (If NOT 1-inches Scale Accordingly)

A&B PROPERTIES, INC.

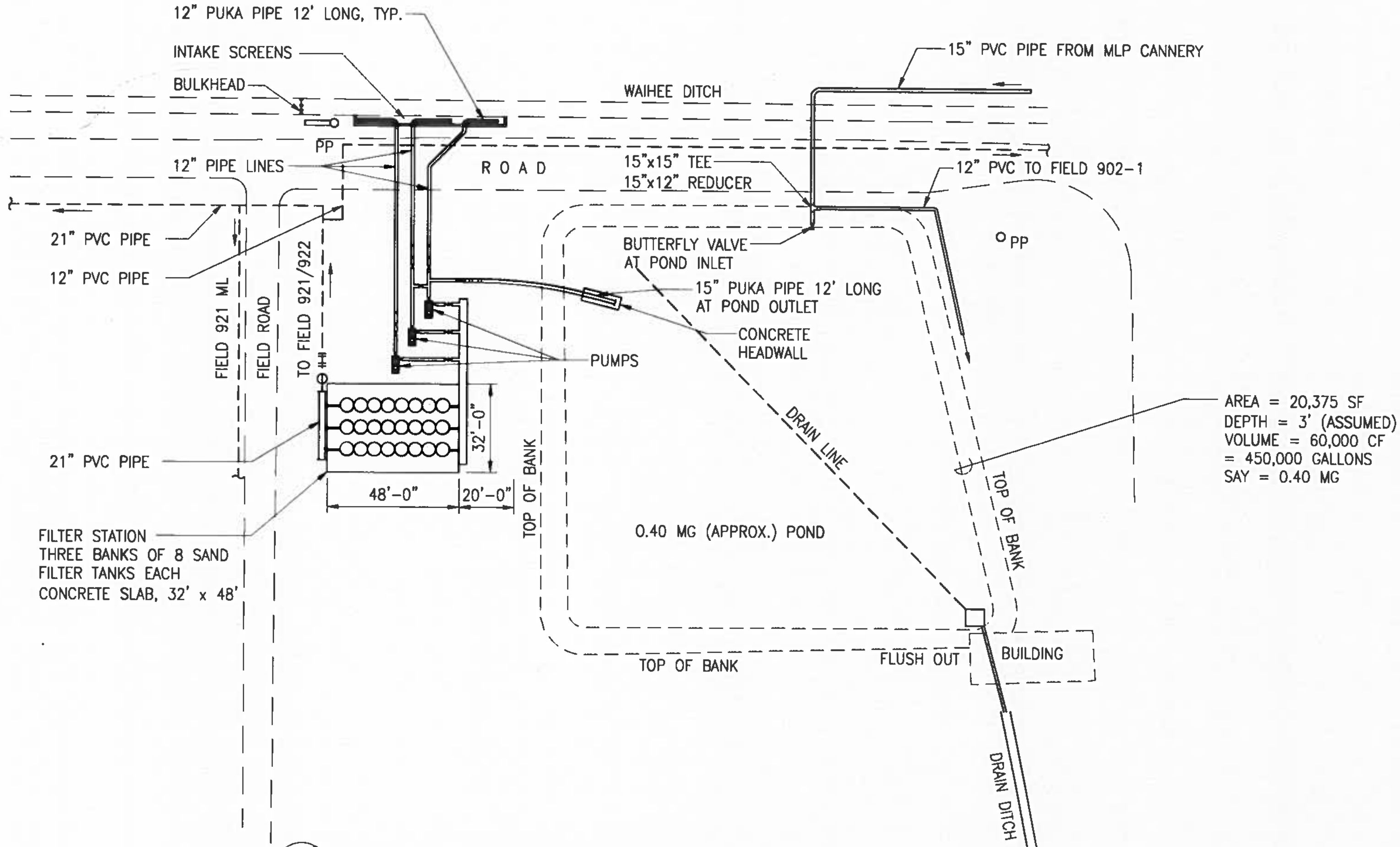
FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER FROM W-K WWRF
PUUNENE, MAUI, HAWAII

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

WAILUKU-KAHULUI WWRF SITE PLAN

EXHIBIT

3



SITE PLAN – HC&S POND AND FILTER STATION

SCALE: 1" = 40'

0 1

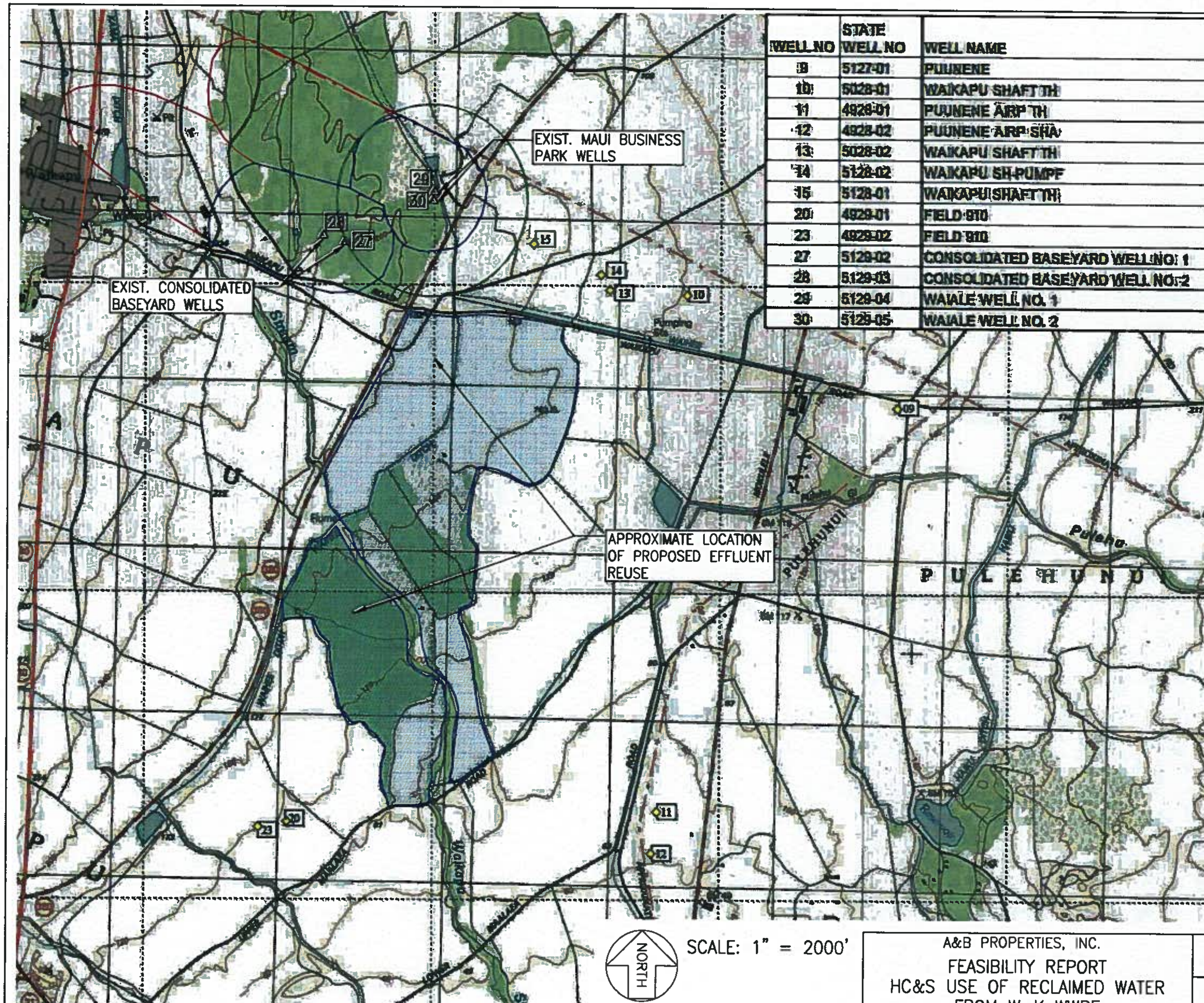
1 INCHES AT FULL SIZE
(If NOT 1-inches : Scale Accordingly)

A&B PROPERTIES, INC.
FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER
FROM W-K WWRF
PUUNENE, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

SITE PLAN - HC & S POND AND FILTER STATION

EXHIBIT
4



WELL NO	STATE WELL NO	WELL NAME	OWNER	USE
9	5127-01	PUUNENE	MAUI COUNTY	OTHER
10	5028-01	WAIKAPU SHAFT TH	HC &'S CO	LOST
11	4928-01	PUUNENE AIRP TH	STATE DOT-AIRPORT	UNUSED
12	4928-02	PUUNENE AIRP SHA	HC & S CO	UNUSED
13	5028-02	WAIKAPU SHAFT TH	U S G S	OBSERVATION
14	5128-02	WAIKAPU SH-PUMPF	HC & S CO	IRRIGATION
15	5128-01	WAIKAPU SHAFT TH	HC & S CO	LOST
20	4929-01	FIELD 910	HC &'S CO	UNUSED
23	4929-02	FIELD 910	HC &'S CO	UNUSED
27	5129-02	CONSOLIDATED BASEYARD WELL NO. 1	CONSOLIDATED BASEYARDS, LLC	DOMESTIC
28	5129-03	CONSOLIDATED BASEYARD WELL NO. 2	CONSOLIDATED BASEYARDS, LLC	DOMESTIC
29	5129-04	WAIALE WELL NO. 1	A&B PROPERTIES, INC.	DOMESTIC
30	5129-05	WAIALE WELL NO. 2	A&B PROPERTIES, INC.	DOMESTIC

LEGEND

- UNDERGROUND INJECTION CONTROL LINE
- PROPOSED AREA OF EFFLUENT REUSE
- ZONE B – AREA THAT CONTRIBUTES GROUNDWATER OVER A 2-YEAR TIME PERIOD [1]
- ZONE C – AREA THAT CONTRIBUTES GROUNDWATER OVER A 10-YEAR TIME PERIOD [1]
- 2-YR TRAVEL RADIUS – AREA THAT CONTRIBUTES GROUNDWATER OVER A 2-YEAR TIME PERIOD [2]
- 10-YR TRAVEL RADIUS – AREA THAT CONTRIBUTES GROUNDWATER OVER A 10-YEAR TIME PERIOD [2]

[1] FROM "HAWAII SOURCE WATER ASSESSMENT PROGRAM REPORT, VOLUME V, APPENDIX A, FOR CONSOLIDATED BASEYARD".

[2] FROM "ENGINEERING RPORT FOR WAIALE WELL 2 (STATE NO. 5129-05) AS A NEW DRINKING WATER SOURCE, KAHULUI, MAUI, HAWAII", BY TOM NANCE WATER RESOURCE ENGINEERING.

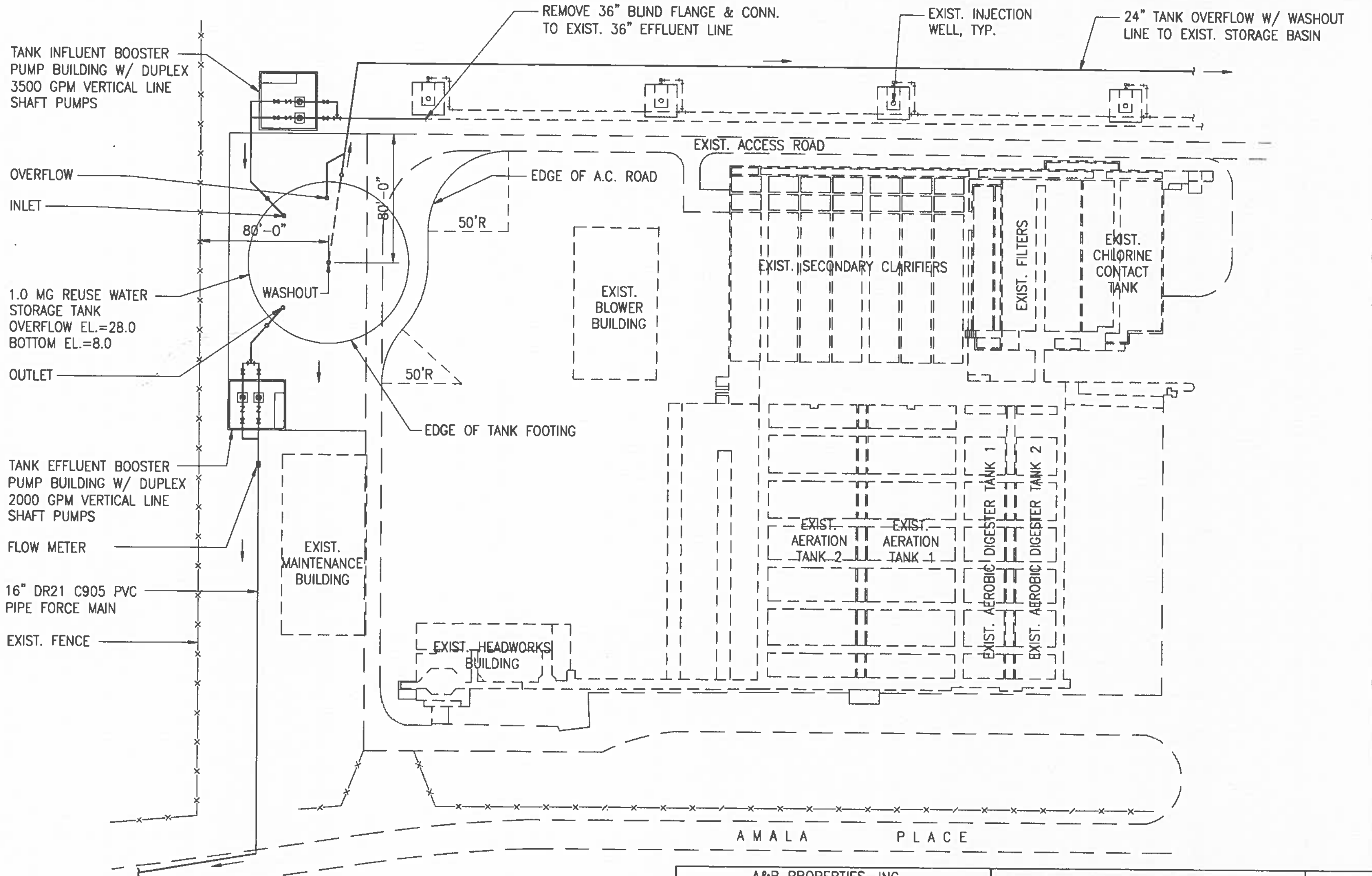
SCALE: 1" = 2000'

A&B PROPERTIES, INC.
FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER FROM W-K WWRF
PUUNENE, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

WELLS IN VICINITY OF PROPOSED IRRIGATION AREA

EXHIBIT 5



NORTH

SITE PLAN – 1.0 MG REUSE WATER STORAGE TANK AT WAILUKU-KAHULUI WWRF

SCALE: 1" = 60'

0 1

1 INCHES AT FULL SIZE
(If NOT 1-inches : Scale Accordingly)

A&B PROPERTIES, INC.
FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER FROM W-K WWRF
PUUNENE, MAUI, HAWAII

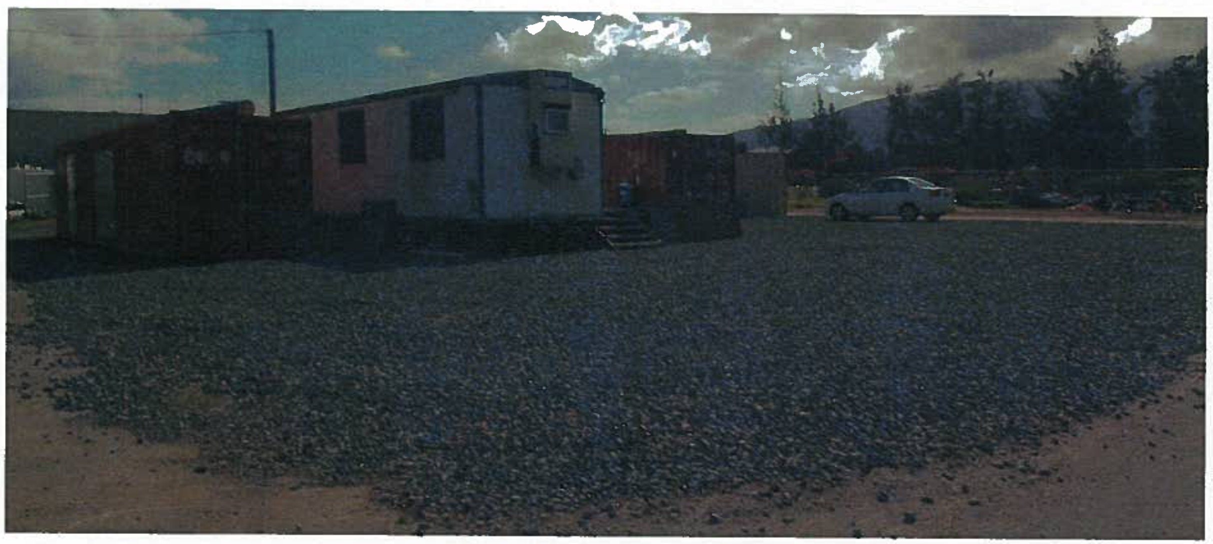
ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

SITE PLAN-1.0 MG REUSE WATER STORAGE TANK AT WAILUKU-KAHULUI WWRF

EXHIBIT 6

PHOTOGRAPHS

FILENAME: Y:\13-524.1 (HC&S IRRIGATION STUDY - JOB NO. 13-070) JESSICA\DRAWINGS\PHOTO 1.DWG Dec 18, 2013-2:27 PM



A&B PROPERTIES, INC.
FEASIBILITY REPORT FOR HC&S USE OF RECLAIMED WATER FROM W-K WWRF
PUUNENE, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU • WAILUKU • HILO, HAWAII

SITE FOR PROPOSED 1.0 MG REUSE WATER STORAGE RESERVOIR AT W-K WWRF

PHOTO 1

FILENAME: Y:\13-524.1 (HC&S IRRIGATION STUDY - JOB NO. 13-070) JESSICA\DRAWINGS\PHOTO 2.DWG Dec 18, 2013-2:35 PM

A&B PROPERTIES, INC. FEASIBILITY REPORT FOR HC&S USE OF RECLAIMED WATER FROM W-K WWRF PUUNENE, MAUI, HAWAII	AUSTIN, TSUTSUMI & ASSOCIATES, INC. HONOLULU • WAILUKU • HILO, HAWAII EXISTING STORAGE BASIN AT W-K WWRF	PHOTO 2

A&B PROPERTIES, INC. FEASIBILITY REPORT FOR HC&S USE OF RECLAIMED WATER FROM W-K WWRF PUUNENE, MAUI, HAWAII	AUSTIN, TSUTSUMI & ASSOCIATES, INC. HONOLULU • WAILUKU • HILO, HAWAII TRANSITION MANHOLE FOR MLP DUAL 10" PVC PIPE TO SINGLE 15" PVC PIPE	PHOTO 3

FILENAME: Y:\13-524.1 (HC&S IRRIGATION STUDY - JOB NO. 13-070) JESSICA\DRAWINGS\PHOTO 3.DWG Dec 18, 2013-3:17 PM

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A&B PROPERTIES, INC. FEASIBILITY REPORT FOR HC&S USE OF RECLAIMED WATER FROM W-K WWRF PUUNENE, MAUI, HAWAII	AUSTIN, TSUTSUMI & ASSOCIATES, INC. HONOLULU • WAILUKU • HILO, HAWAII	PHOTO
	HC&S POND INLET, OUTLET AND FILTER STATION	4

A&B PROPERTIES, INC.

FEASIBILITY REPORT FOR
HC&S USE OF RECLAIMED WATER
FROM W-K WWRF

PUUNENE, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU • WAILUKU • HILO, HAWAII

FILTER STATION NEXT TO HC&S POND

PHOTO

5

APPENDICES

APPENDIX A

CORRESPONDENCE WITH COUNTY OF MAUI WASTEWATER RECLAMATION DIVISION

Austin, Tsutsumi & Associates, Inc.
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-5031

Civil Engineers • Surveyors
Phone: (808) 533-3646 • Fax: (808) 526-1267
E-mail: atahnl@atahawaii.com

MINUTES OF MEETING

#O-13-070

DATE: September 19, 2013

TIME: 1:30 p.m.

PLACE: Wailuku-Kahului Wastewater Reclamation Facility (W-K WWRF) Conference Room

PRESENT: Scott Rollins – County of Maui Wastewater Reclamation Division (WWRD)
Ivan Nakatsuka – Austin, Tsutsumi & Associates, Inc. (ATA)

PROJECT: HC&S Seed Cane Irrigation with W-K WWRF Effluent Study

This meeting was held for the purpose of ATA obtaining information from WWRD on the quantity and quality of effluent available from the W-K WWRF towards the potential of the effluent being conveyed to Hawaiian Commercial & Sugar Company (HC&S) for seed cane irrigation.

Prior to this meeting, Scott had e-mailed to Ivan the following W-K WWRF information:

- Annual and monthly average effluent production for the period of January 2005 through August 2013.
- Daily discharge into injection wells for the period of January 2005 through August 2013.
- Internal lab data for effluent quality, based on analyzing daily composite samples, for the period of January 2005 through August 2013.
- Diurnal flow factor curve.

1. There have been no significant deviations from the diurnal flow factor curve over the past several years.

2. There is no known reason for the slight decrease in effluent production over the past few years. Speculation is that it was due to more accurate meter readings at the WWRF and the wastewater pump stations (WWPSs) throughout WWRD's collection system, and possibly conversion to low flow water usage plumbing fixtures throughout the service area.

3. It is not anticipated that there will be significant future increases in flows to the WWRF, as the county's direction of late has been for major developments to construct their own WWRF.

4. The county would be amenable to HC&S taking all of the effluent that is currently being discharged into the on-site injection wells. Based on the current total average effluent production of 4.4 million gallons per day (MGD), with 0.2-0.3 MGD being used at the

WWRF throughout the treatment process (e.g., primarily continuous spraying water within the aeration tanks for froth control), 4.1-4.2 MGD would be available for HC&S's use.

5. There has rarely been any incident of the WWRF being unable to produce R-2 Water, as standby units are available for the treatment processes. However, as a safeguard, any effluent of poor quality (i.e., effluent deemed unsuitable for discharge into the injection wells) can be discharged into the on-site basin, which should have sufficient capacity to store all of the effluent until the problem is resolved. Normally, this basin only receives flush water from the quarterly cleansing of the injection wells, which flows towards a pump station in the southwest corner of the basin for conveyance to the WWRF headworks facility.

6. In addition to qualitative data on daily composite samples, data is available for samples analyzed on a semi-annual basis as required for the Underground Injection Control (UIC) permit for discharging into the injection wells. Scott will send Ivan this additional data.

7. There is no continuous monitoring of the effluent quality (e.g., with a turbidimeter). Therefore, if there is any non-compliant R-2 Water produced for a short period of time (e.g., up to a few hours), this may not be apparent from the results of the daily composite analysis, as the non-compliant hourly sample(s) would be blended with the compliant hourly samples such that the 24-hour composite sample test results could still indicate compliancy. Also, results would not be available for several days after the samples are analyzed because standard analytical procedures for some of the parameters require an incubation/reaction period of a couple of days or more (e.g., fecal coliform and five-day biochemical oxygen demand).

8. Construction is on-going to replace the existing force mains that convey wastewater from the Wailuku WWPS and Kahului WWPS to the W-K WWRF. The existing force mains are not expected to be retained as backup force mains.

9. As an analogy, the Kihei WWRF, which produces R-1 Water, has a reservoir with floating cover, out of which the R-1 Water is pumped to an off-site 1 million gallon tank. This tank, which has a turnover period of about one to one-and-a half days, is cleaned every 5-10 years, with hardly any residue noted in the discharge water.

Submitted by,

Ivan K. Nakatsuka

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

TERRANCE S. ARASHIRO, P.E.
STANLEY T. WATANABE
IVAN K. NAKATSUKA, P.E.
ADRIENNE W. L. H. WONG, P.E., LEED AP
KEITH K. NIIYA, P.E.
DEANNA HAYASHI, P.E.
PAUL K. ARITA, P.E.

13-070

November 21, 2013

Mr. Scott Rollins
County of Maui
Department of Environmental Management
Wastewater Reclamation Division
One Main Plaza
2200 Main Street, Suite 610
Wailuku, HI 96793-2155

Dear Mr. Rollins:

Subject: **Feasibility Report for Hawaiian Commercial & Sugar Company (HC&S) Use of Reclaimed Water from Wailuku-Kahului Wastewater Reclamation Facility (W-K WWRF) Puunene, Maui, Hawaii**

Thank you for having provided us with data over the past 10 years for the subject W-K WWRF. We have used this data from Wastewater Reclamation Division (WWRD) towards preparation of a conceptual plan for pumping R-2 Water from the W-K WWRF to HC&S's existing irrigation pond.

Our proposed conceptual design would involve pumping the R-2 Water to HC&S's existing irrigation pond located as shown on the General Plan Exhibits 1 and 2 (attached). To do this, improvements within the W-K WWRF site as well as off-site would have to be made.

The following describes the improvements within the northwest corner of the W-K WWRF site. (Refer to the attached W-K WWRF site Exhibits 3 and 4.)

The effluent that is currently being discharged into the existing injection wells would flow to a Tank Influent Booster Pump Station (TI-BPS) via the existing 36" line that conveys effluent to the injection wells along the north edge of the W-K WWRF site. The TI-BPS is required because of insufficient head after the existing chlorine contact tank to fill the proposed 1.0 MG Reuse Water Storage Tank, as described hereinafter.

The TI-BPS would be comprised of two vertical line shaft pumps (one duty pump and one standby pump) with variable frequency drives, drawing out of a subsurface wet well. The top of the wet well would be a few feet above grade to allow the effluent to reach a sufficiently high level to be able to backflow within the 36" line and discharge by gravity into the injection wells.

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

OFFICES IN:
HONOLULU, HAWAII
WAILUKU, MAUI, HAWAII
HILO, HAWAII

The pumpage rate of the TI-BPS pumps is proposed to be 3500 gallons per minute (gpm) to be able to accommodate the peak flow during the day. This peak flow is based on an average flow over a 24-hour period of 2000 gpm – which equates to 2.88 million gallons per day (MGD). This average flow was based on the W-K WWRF minimal average flow recorded over the past 10 years of approximately 3.2 MGD during the months of August and September of 2012. It was assumed that this flow included the approximately 0.3 MGD of effluent that is typically used throughout the treatment process. Therefore, the flow that was being discharged to the injection wells during this two month period was approximately 2.9 MGD.

A concrete building would house the pump motors and motor control center. The head requirement for the pumps is expected to be less than 20 feet – sufficient to pump the effluent into the proposed tank. Therefore, the pump motor horsepower (HP) is expected to be 30 HP.

The concrete 1.0 MG Reuse Water Storage Tank would be constructed at grade and have a maximum stored water depth of 20 feet. Water levels in the tank would determine the automatic activation/de-activation of the duty pump for the TI-BPS, as well as the duty pump for the Tank Effluent Booster Pump Station (TE-BPS), as described hereinafter.

The TE-BPS would have two vertical line shaft pumps (one duty pump and one standby pump) with constant speed motors. The pumps would be installed within suction barrels (i.e., no wet well), drawing the effluent out of the tank and pumping it to the existing HC&S irrigation pond. The pumpage rate of the TI-BPS pumps is proposed to be 2000 gpm to be able to accommodate the average flow during the day, as the 1.0 MG capacity of the tank would allow for equalizing the diurnal flow rates.

The TE-BPS pumps would have much higher HP motors than that of the TI-BPS, due to the significantly higher head requirement. We have estimated that head to be 285 feet, which is expected to require 250 HP motors.

An aboveground flow meter would be installed on the ductile iron pipe pump discharge line before this line transitions to a buried 16" PVC pipe force main.

All of the aboveground components would be designed to withstand a possible tsunami of magnitude commensurate with the design of other components within the W-K WWRF.

The following describes the three segments of the off-site force main to convey the R-2 Water from the TE-BPS at the W-K WWRF to HC&S's existing irrigation pond, which has a capacity estimated at 0.5 MGD. (Refer to the attached General Plan Exhibits 1 and 2, and the HC&S Pond and Filter Station Exhibit 5.)

The first segment would be 7,600± linear feet (l.f.) of a new 16" PVC pipe force main from the TE-BPS to a connection point with the second segment, 9,000± l.f. of an existing dual 10" PVC pipe force main. A new valve vault would be constructed at the connection point. The end of this second segment connects to a third segment, 11,400± l.f. of an existing 15" PVC force main, at a transition manhole just off the east edge of Kuihelani Highway.

The second and third segments were previously used by Maui Land & Pineapple Company, Ltd. (MLP) to convey the discharge water from their Kahului Cannery operations to HC&S's irrigation pond. A filter station comprised of pumps and pressure filters adjacent to HC&S's irrigation pond was utilized to draw water out of the pond for filtering, prior to drip irrigation usage.

As MLP's Kahului Cannery has not been in operation for the past few years, the existing dual 10" PVC pipe force main followed by 15" PVC pipe force main has been abandoned, and the irrigation pond has been dry.

We would appreciate your comments on this conceptual design, including whether the County would allow these improvements to be made on the W-K WWRF site, as well as responses to the following questions:

1. With regard to the data previously provided, at what locations within the W-K WWRF were the flows measured? Has this remained consistent for the entire time range of the data provided?

2. The data previously provided indicates a relatively steady decrease in flow from 2000 to 2012, with the lowest flows recorded in August and September of 2012. Are there particular sets of conditions that correspond to the observed long-term diminution of flows from 2000 to 2012, and the lowest flows that were recorded in August / September of 2012?

3. Does WWRD project an increase (or decrease) in flow to W-K WWRF in the future? By what amount?

4. Is the head requirement for the TE-BPS pumps of 285 feet acceptable?

5. Can the existing primary and standby (generator) power systems accommodate the proposed improvements - especially the power requirement for the TE-BPS pumps?

6. In order to enable real-time monitoring of effluent quality, we anticipate the need for WWRD to install an additional composite sampler, a turbidimeter and a chlorine residual monitor at the TE-BPS. Would WWRC approve and undertake the operation and maintenance of these and the other on-site improvements described above so as to guaranty a continuous flow of 2.9 MGD R-2 quality water to HC&S for a set number of years? If so, how many years?

7. Would county funding be available to cover all or any part of the necessary improvements for this project – both within the W-K WWRF site and the off-site force main?

8. Does WWRD expect to charge HC&S for any R-2 Water delivered to HC&S and, if so, at what rate per 1000 gallons?

9. Apart from any charge to HC&S for delivered quantities of R-2 water, would WWRD expect to additionally bill HC&S for power to run the new pumps or any other increased operation and maintenance costs associated with the necessary improvements to W-K WWRF? If so, how would this be determined and implemented?

10. Assuming such a project is deemed to be feasible and desirable, generally, what County approvals would be required to implement it and, from the County's perspective, what would be a reasonable timeframe for implementation?

Thank you for your continued assistance on this project. Please do not hesitate to contact me at (808) 533-3646 ext. 634 should have any questions.

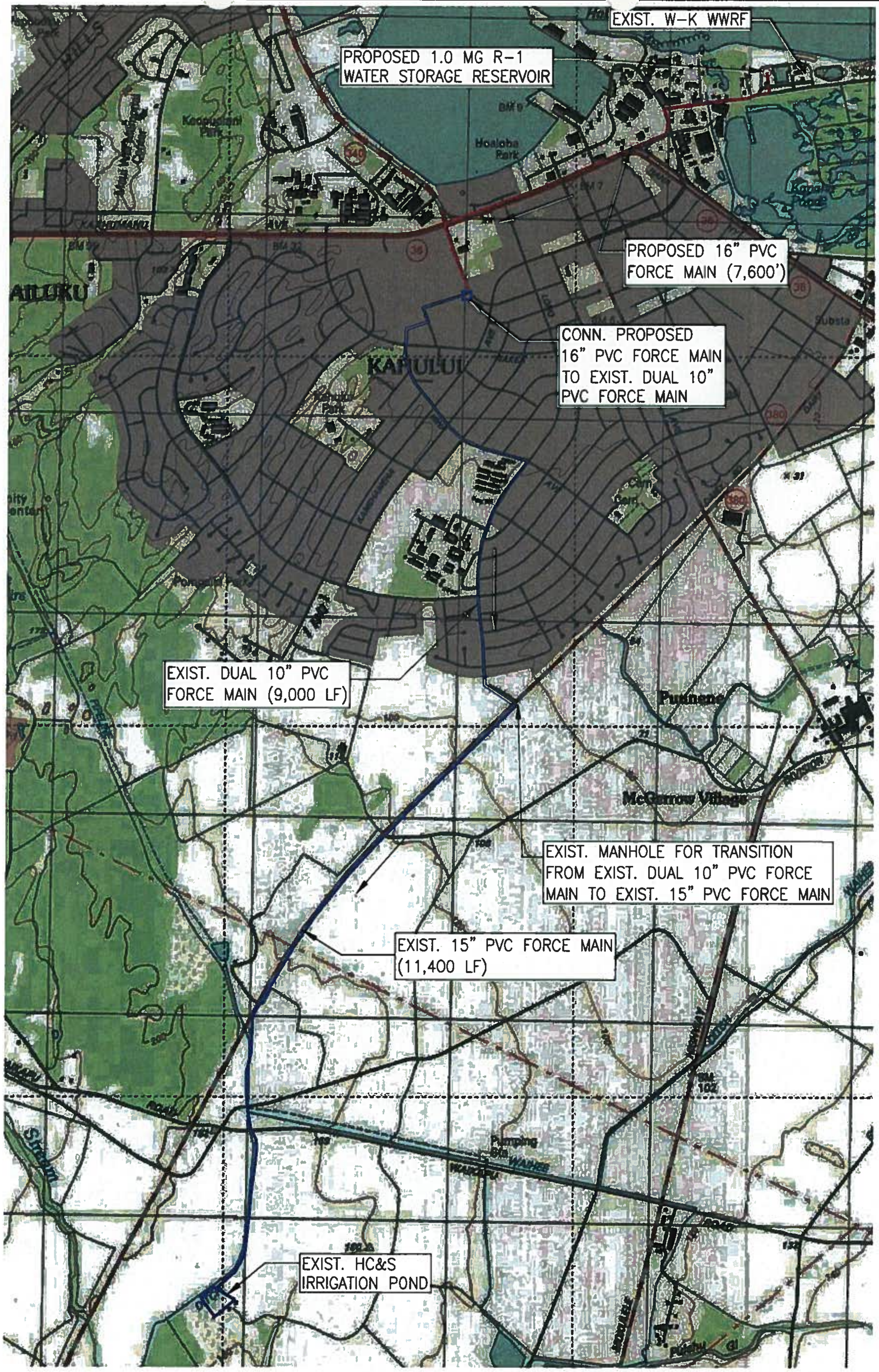
Sincerely,

AUSTIN, TSUTSUMI & ASSOCIATES, INC.

By

IVAN K. NAKATSUKA, P.E.
Vice President

Attachments: Exhibits



SCALE: 1" = 1500'

0 1

1 INCHES AT FULL SIZE
(If NOT 1-inches : Scale Accordingly)

A&B PROPERTIES, INC.

FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER
FROM W-K WWRF
PUUNENE, MAUI, HAWAII

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

GENERAL PLAN - USGS MAP

EXHIBIT

1

NORTH SCALE: 1" = 1500' 0 1 1 INCHES AT FULL SIZE (If NOT 1-inches : Scale Accordingly)	A&B PROPERTIES, INC. FEASIBILITY REPORT HC&S USE OF RECLAIMED WATER FROM W-K WWRF PUUNENE, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. HONOLULU WAILUKU, HAWAII GENERAL PLAN - GOOGLE MAP	EXHIBIT 2

SOURCE: GOOGLE EARTH

NORTH

SCALE: 1" = 100'

0 1

1 INCHES AT FULL SIZE (If NOT 1-inches : Scale Accordingly)

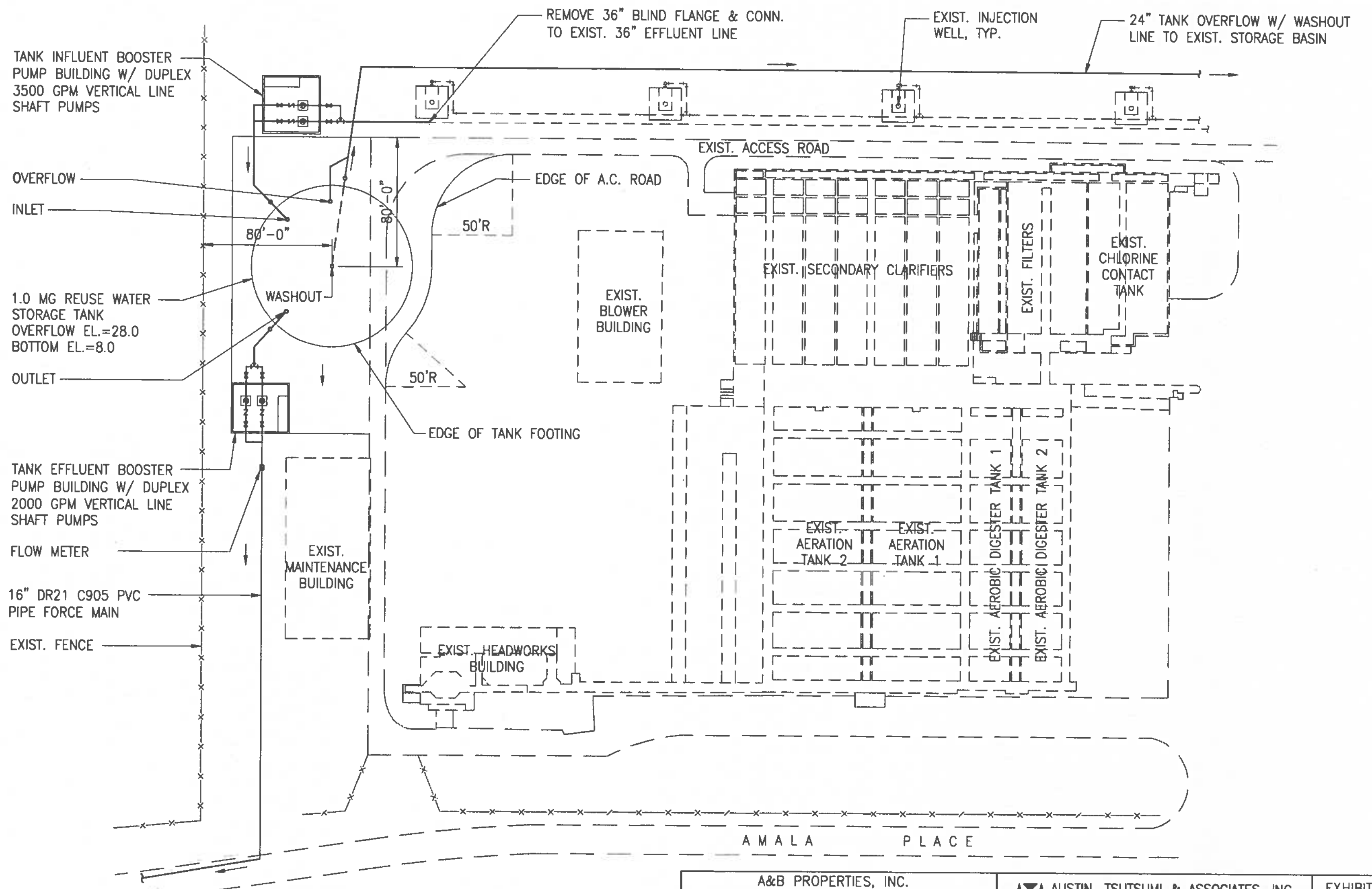
A&B PROPERTIES, INC.

FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER FROM W-K WWRF
PUUNENE, MAUI, HAWAII

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

WAILUKU-KAHULUI WWRF SITE PLAN

EXHIBIT 3



SITE PLAN – 1.0 MG REUSE WATER STORAGE TANK AT WAILUKU-KAHULUI WWRF

SCALE: 1" = 60'

0 1

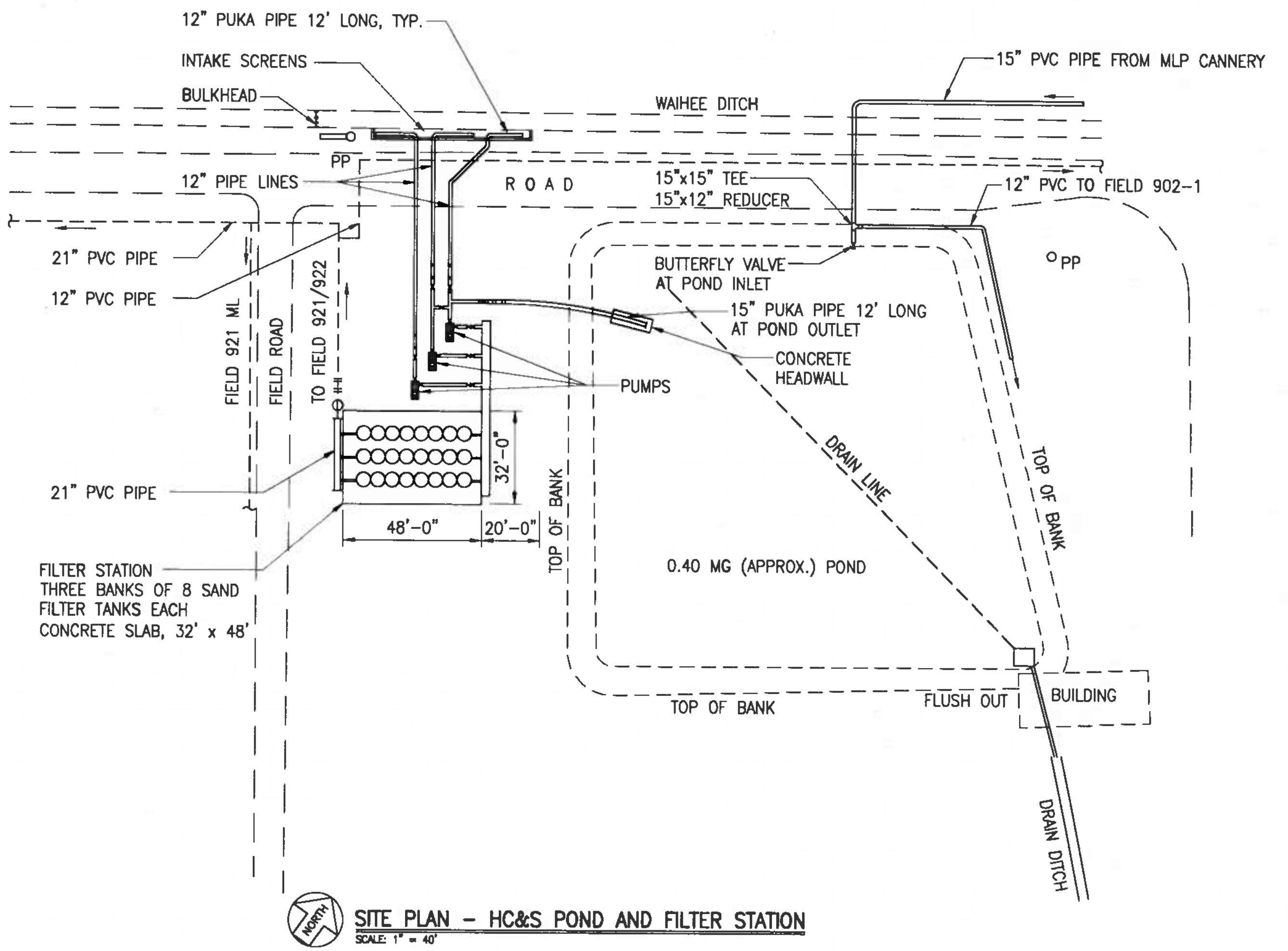
1 INCHES AT FULL SIZE (If NOT 1-inches : Scale Accordingly)

A&B PROPERTIES, INC.
FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER FROM W-K WWRF
PUUNENE, MAUI, HAWAII

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

SITE PLAN-1.0 MG REUSE WATER STORAGE TANK AT WAILUKU-KAHULUI WWRF

EXHIBIT
4



SITE PLAN – HC&S POND AND FILTER STATION
SCALE: 1" = 40'

0 1
1 INCHES AT FULL SIZE
(If NOT 1-inches : Scale Accordingly)

A&B PROPERTIES, INC.
FEASIBILITY REPORT
HC&S USE OF RECLAIMED WATER
FROM W-K WWRF
PUUNENE, MAUI, HAWAII

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
HONOLULU WAILUKU, HAWAII

SITE PLAN - HC&S POND AND FILTER STATION

EXHIBIT
5

ALAN M. ARAKAWA
Mayor

KYLE K. GINOZA, P.E.
Director

MICHAEL M. MIYAMOTO
Deputy Director

TRACY TAKAMINE, P.E.
Solid Waste Division

ERIC NAKAGAWA, P.E.
Wastewater Reclamation Division

COUNTY OF MAUI
DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
2200 MAIN STREET, SUITE 100
WAILUKU, MAUI, HAWAII 96793

January 15, 2014

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

Dear Mr. Nakatsuka,

SUBJECT: FEASIBILITY REPORT FOR HAWAIIAN COMMERCIAL & SUGAR COMPANY USE OF RECYCLED WATER FROM WAILUKU/KAHULUI WASTEWATER RECLAMATION FACILITY (WWRF).

Our division has reviewed your report and discussed its merits and implications with staff and our department director. This proposal is in line with the County's objective to limit the use of injection wells and facilitate the expanded use of this often overlooked water resource. As you know we have been looking at the possibilities of creating a distribution system for recycled water however, costs are currently somewhat prohibitive for the County to embark upon alone.

As previously discussed, WWRD has engaged a consultant to do a more in depth evaluation of the improvements required to produce R-1 water at the treatment plant and those needed for the distribution system. We expect it to be completed in early 2014. This report will help us better understand the costs involved in providing recycled water to customers like HC&S.

In reply to your questions included on your November 21, 2013 letter we offer the following:

A. Conceptual design:

The County feels that this is a good opportunity, one which has been discussed with HC&S off and on over the past 20 years. The Wastewater Reclamation Division conceptually supports this project because it mutually benefits the County, HC&S and the community. It is a project that has the potential to help address the needs, concerns and desires of many entities on the island. From the County's perspective, using recycled water for agricultural irrigation has the added feature of significantly lowering the usage of injection wells. Another bonus is the possibility of utilizing existing infrastructure to reduce project costs, as well as, limit impacts on the environment. The system outlined in your report is a good basis to start a more detailed design.

B. Whether the County would allow these improvements to be made on the W-K WWRF site?

We agree that many of the improvements would need to be made on the WWRF site and would accept them as part of our permanent maintained facility only if they can be used to serve multiple users.

C. Responses to the following specific questions:

1. With regard to the data previously provided (from OP10), at what locations within the W-K WWRF were the flows measured? Has this remained consistent for the entire time range of the data provided?

Note that the flow at the Kahului WWRF is measured at the effluent end of the facility near the end of the chlorine contact chamber. This area provides more reliable data than influent flow monitoring. This measurement location has been consistent over the years of data provided.

2. The data previously provided indicates a relatively steady decrease in flow from 2000 to 2012, with the lowest flows recorded in August and September of 2012. Are there particular sets of conditions that correspond to the observed long-term diminution of flows from 2000 to 2012, and the lowest flows that were recorded in August and September of 2012?

There is always a possibility that there was some inaccurate flow monitoring but no major issues have been logged over the years. It seems that the reduced flows are partly due: (a) to replacement of some gravity collection lines that were in ground water (reducing infiltration); (b) the installation of low flow fixtures replacing existing fixtures; (c) continuing and worsening drought conditions over the time period (reduced inflow); and (d) the economic recession coupled with continually rising water and sewer bills forcing further household cutbacks.

3. Does WWRD project an increase (or decrease) in flow to W-K WWRF in the future? By what amount?

Flows are difficult to project due to the many factors involved. It appears that the economy is beginning to rebound thus we do expect flows to start to increase in the future when additional commercial/housing is constructed (Maui Lani / Kehalani / Maui Business Park / etc.), In addition, if drought conditions decrease then we would also expect flows to rise due to increased inflow/infiltration and more household usage at existing properties (landscape irrigation would decrease thus freeing more money for in-house consumption.) We could expect the current flows to increase by as much as 25% over next 20 years.

4. Is the head requirement for the TE-BPS pumps of 285 feet acceptable?

Our operations section discussed this issue and it does appear that due to the length of the pipeline required to reach the existing reservoir that the 285 foot TDH is a realistic preliminary estimate. The actual value should be determined during the design phase of the project.

5. Can the existing primary and standby (generator) power systems accommodate the proposed improvements - especially the power requirement for the TE-BPS pumps?

Our WWRD Operations Electrical Staff has evaluated the electrical capacity of the Kahului WWRF and has determined that the facility's primary and secondary power systems can accommodate the power requirements of the two TE-BPS pumps. With full normal load and two pumps running the Kahului WWRF will be using approximately 75% of the available power from both its primary and secondary power systems.

6. In order to enable real-time monitoring of effluent quality, we anticipate the need for WWRD to install an additional composite sampler, a turbidimeter and a chlorine residual monitor at the TE-BPS. Would WWRD approve and undertake the operation and maintenance of these and the other on-site improvements described above so as to guaranty a continuous flow of 2.9 MGD R-2 quality water to HC&S for a set number of years? If so, how many years?

Yes, the WWRD Operations Section will operate and maintain the additional equipment necessary to insure that a consistent flow of recycled water is provided to HC&S provided the County has the option to serve multiple users with the system. We would plan to distribute R-2 water to HC&S, however we would reserve the right to switch to a higher quality (R-1) if it better fulfilled our regulatory or operational requirements. The number of years would be as long as HC&S requires the R-2 water unless the County decides that there is a better and more cost effective use of the recycled water.

Regarding the additional equipment, turbidity monitoring is not required by the Department of Health (DOH) for R-2 water. However, it would be a good idea to install it since the system will instantaneously inform the facility staff if a process problem is interfering with the water quality. We would not want to deliver water to HC&S that does not meet the required quality for recycled water. (Note that there are no guarantees of reclaimed water being available 100% of the time as plant upsets, equipment replacement or other factors may interfere with the final effluent quality.)

7. Would county funding be available to cover all or any part of the necessary improvements for this project — both within the W-K WWRF site and the off-site force main?

The County will consider funding some/all of the improvements. The actual amount is dependent on several variables including who ultimately owns the offsite improvements, if the offsite facilities will be used to provide water to additional customers, what HC&S's business plan is as it pertains to consuming water (5, 10, 25 year agreement), etc. Note that any proposal to fund improvements will ultimately need to be included in the Department/Division's Capital Improvement Plan that will need to be approved by the mayor and ultimately the County Council in the annual budget.

8. Does WWRD expect to charge HC&S for any R-2 Water delivered to HC&S and, if so, at what rate per 1000 gallons?

Yes, the County would charge HC&S for all of the recycled water they use. The rate is not dependent on the quality of the water (R-1 or R-2). HC&S would be categorized as either an Agricultural User or Major Agricultural User depending on the volume of water consumed and/or how many acres are irrigated*. The current rates (FY2014) for these categories are $0.33/1,000 gallons and $0.15 /1,000 gallons, respectfully. Note that the cost of producing and delivering recycled water is heavily subsidized by sewer user fees and thus is provided at a very reasonable cost which is governed by the County of Maui Budget Ordinance. Rates are reviewed annually and approved by the County Council.

It is expected that the long term pumping and maintenance costs to provide this water will be absorbed by the County.

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* (Definition: "Major agricultural consumers" means those agricultural consumers, including golf courses, that use more than three million gallons of reclaimed water per day based on average daily flow, or that have more than 400 acres served by the reclaimed water distribution system, or that have any pasture land served by the reclaimed water distribution system.)

9. Apart from any charge to HC&S for delivered quantities of R-2 water, would WWRD expect to additionally bill HC&S for power to run the new pumps or any other increased operation and maintenance costs associated with the necessary improvements to W-K WWRF? If so, how would this be determined and implemented?

If the system serves multiple users then HC&S would not have to pay any other costs. They would only pay for the volume of recycled water consumed based on the customer class they qualified for. If, however, the system is designed to only provide water to HC&S then HC&S may be responsible for some or all of the associated costs. A determination would need to be made during the process of formulating an agreement between HC&S and the County.

10. Assuming such a project is deemed to be feasible and desirable, generally, what County approvals would be required to implement it and, from the County's perspective, what would be a reasonable timeframe for implementation?

In order to proceed with the project many permits are required. Planning Department could require SMA, CDUA and EA processing and possibly other approvals. A building permit will be needed for the improvements at the treatment plant. An application for the Right to Perform Work in the County Roadway Permit will be required from the County, as well as, a similar approval from the State Department of Transportation for any work in a State highway.

Approval from the State Department of Health (DOH) and County of Maui would be required for usage of the water by HC&S. The County would issue a use permit once improvements were constructed and inspections completed.

As previously mentioned, the County has been evaluating a project to expand recycled water production and distribution in the Central Maui area. The tentative timeline was to start design of the required improvements in 2016 with construction to begin in 2018 or 2019 dependent on any property acquisitions that were necessary. We will have a clearer understanding of the costs and timeline required once the study is completed in the next few months. An additional consideration will be the completion of any necessary agreements involving cost sharing and/or water delivery requirements between the County and HC&S.

11. *Any other concerns or comments?*

a) The assumption that the 0.3 MGD used for in-plant uses is drawn prior to flow measurement is incorrect. Flows are measured at the effluent end of the treatment process. Thus minimum flows are approximately 3.2 mgd.

b) The possibility of rehabilitating and using a portion of the County's old Wailuku Force Main from the treatment plant to the Kahului Beach Road/ Kaahumanu Avenue intersection as an alternative to a new 16" force main is unlikely as it is currently planned to use it as a backup to the new force main. In the unlikely event this use is abandoned then this repurposing should be investigated as it would significantly reduce the amount of new line that would need to be installed.

c) We believe that the material for the existing dual 10" force mains previously utilized by the cannery is HDPE not PVC.

d) The integrity of the existing dual 10" and 15" force mains are currently unknown.

e) We assume that HC&S intends to purchase and operate/maintain the final two segments of the force main if it is soley used for the distribution of water to their site. Is this correct or would HC&S plan to analyze/validate the condition of the lines and offer them for dedication to the County?

f) The proposed tank appears to be the most appropriate storage solution, however, further discussion/evaluation to determine if a portion of the overflow basin might be used may be considered.

g) The County is unclear on the volume of water HC&S will require. Is the intent to take as much recycled water as is available or are there limitations?

h) Would HC&S consume the same volume of water during rainy/wet seasons?

The County will further discuss your issues and forward any additional comments from policy making officials or staff as they become available. We may also be able to supply additional comments once our consultant's study is complete. We suggest that you further discuss the information provided with your client. We would appreciate information on the actual probability of this project moving forward so we can begin to formulate an agreement or look more seriously at alternative users for this resource.

We look forward to working with HC&S and your firm to further refine this proposal and develop a schedule to implement the delivery and use of recycled water for sugar cane irrigation. Please contact me at (808) 270-7422 if you have any questions or wish to discuss further.

Sincerely,

Eric Nakagawa, Chief
Wastewater Reclamation Division

cc: Kyle Ginoza, Director, Department of Environmental Management

EN:sr(hc&s reuse feasibility reply.doc)

Ivan K. Nakatsuka

From:	Ivan K. Nakatsuka
Sent:	Friday, January 17, 2014 8:31 AM
To:	'Scott Rollins'
Cc:	Lisa L. Appelgate
Subject:	HC&S Study
Attachments:	Page 4 of County's letter to ATA (01-15-14).pdf; Page 2 of ATA's letter to County (11-21-13).pdf

Scott,

This is to confirm the phone discussion that Lisa and I had with you yesterday morning in regards to Item 11.a) on page 4 of the county's 1/15/14 letter to us (attached), during which time we agreed that the 0.3 MGD for in-plant use is drawn after flow measurement. Our assumption in the first paragraph of page 2 of our 11/21/13 letter to the county (attached) was as such - just worded differently. Therefore, our assumption was correct, rather than incorrect. Consequently, your closing sentence in Item 11.a) of, "Thus minimum flows are approximately 3.2 mgd (MGD)" refers to flows before in-plant use of 0.3 MGD, resulting in minimum flows to the injection wells of 2.9 MGD.

Thank you for the opportunity to confirm this matter, as minimum flows is an important parameter for our study.

Ivan K. Nakatsuka, P.E.
Vice President & Chief Environmental Engineer
Austin, Tsutsumi & Associates, Inc.
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Honolulu, Hawaii 96817
Phone: 808-533-3646 ext. 634
Fax: 808-526-1267
Email: inakatsuka@atahawaii.com

9. Apart from any charge to HC&S for delivered quantities of R-2 water, would WWRD expect to additionally bill HC&S for power to run the new pumps or any other increased operation and maintenance costs associated with the necessary improvements to W-K WWRF? If so, how would this be determined and implemented?

If the system serves multiple users then HC&S would not have to pay any other costs. They would only pay for the volume of recycled water consumed based on the customer class they qualified for. If, however, the system is designed to only provide water to HC&S then HC&S may be responsible for some or all of the associated costs. A determination would need to be made during the process of formulating an agreement between HC&S and the County.

10. Assuming such a project is deemed to be feasible and desirable, generally, what County approvals would be required to implement it and, from the County's perspective, what would be a reasonable timeframe for implementation?

In order to proceed with the project many permits are required. Planning Department could require SMA, CDUA and EA processing and possibly other approvals. A building permit will be needed for the improvements at the treatment plant. An application for the Right to Perform Work in the County Roadway Permit will be required from the County, as well as, a similar approval from the State Department of Transportation for any work in a State highway.

Approval from the State Department of Health (DOH) and County of Maui would be required for usage of the water by HC&S. The County would issue a use permit once improvements were constructed and inspections completed.

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11. *Any other concerns or comments?*

a) The assumption that the 0.3 MGD used for in-plant uses is drawn prior to flow measurement is incorrect. Flows are measured at the effluent end of the treatment process. Thus minimum flows are approximately 3.2 mgd.

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d) The integrity of the existing dual 10" and 15" force mains are currently unknown.

e) We assume that HC&S intends to purchase and operate/maintain the final two segments of the force main if it is soley used for the distribution of water to their site. Is this correct or would HC&S plan to analyze/validate the condition of the lines and offer them for dedication to the County?

The pumpage rate of the TI-BPS pumps is proposed to be 3500 gallons per minute (gpm) to be able to accommodate the peak flow during the day. This peak flow is based on an average flow over a 24-hour period of 2000 gpm – which equates to 2.88 million gallons per day (MGD). This average flow was based on the W-K WWRF minimal average flow recorded over the past 10 years of approximately 3.2 MGD during the months of August and September of 2012. It was assumed that this flow included the approximately 0.3 MGD of effluent that is typically used throughout the treatment process. Therefore, the flow that was being discharged to the Injection wells during this two month period was approximately 2.9 MGD.

A concrete building would house the pump motors and motor control center. The head requirement for the pumps is expected to be less than 20 feet – sufficient to pump the effluent into the proposed tank. Therefore, the pump motor horsepower (HP) is expected to be 30 HP.

The concrete 1.0 MG Reuse Water Storage Tank would be constructed at grade and have a maximum stored water depth of 20 feet. Water levels in the tank would determine the automatic activation/de-activation of the duty pump for the TI-BPS, as well as the duty pump for the Tank Effluent Booster Pump Station (TE-BPS), as described hereinafter.

The TE-BPS would have two vertical line shaft pumps (one duty pump and one standby pump) with constant speed motors. The pumps would be installed within suction barrels (i.e., no wet well), drawing the effluent out of the tank and pumping it to the existing HC&S irrigation pond. The pumpage rate of the TI-BPS pumps is proposed to be 2000 gpm to be able to accommodate the average flow during the day, as the 1.0 MG capacity of the tank would allow for equalizing the diurnal flow rates.

The TE-BPS pumps would have much higher HP motors than that of the TI-BPS, due to the significantly higher head requirement. We have estimated that head to be 285 feet, which is expected to require 250 HP motors.

An aboveground flow meter would be installed on the ductile iron pipe pump discharge line before this line transitions to a buried 16" PVC pipe force main.

All of the aboveground components would be designed to withstand a possible tsunami of magnitude commensurate with the design of other components within the W-K WWRF.

The following describes the three segments of the off-site force main to convey the R-2 Water from the TE-BPS at the W-K WWRF to HC&S's existing irrigation pond, which has a capacity estimated at 0.5 MGD. (Refer to the attached General Plan Exhibits 1 and 2, and the HC&S Pond and Filter Station Exhibit 5.)

The first segment would be 7,600± linear feet (l.f.) of a new 16" PVC pipe force main from the TE-BPS to a connection point with the second segment, 9,000± l.f. of an existing dual 10" PVC pipe force main. A new valve vault would be constructed at the connection point. The end of this second segment connects to a third segment, 11,400± l.f. of an existing 15" PVC force main, at a transition manhole just off the east edge of Kuihelani Highway.

APPENDIX B

W-K WWRF FINAL EFFLUENT WATER QUALITY DATA

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Jan, 2005 Kahului WWTP	Sum	8	6	70.7	9.6		20	54	0.35	6.06	44.07	50.13			700
	Avg	2	1.5	6.427272727	0.872727273			13.5	0.175	1.515	11.0175	12.5325			175
	Max	2	2	6.6	1		2	15.8	0.21	1.75	11.93	13.37			181
	Min	2	1	6.3	0.7		2	11.1	0.14	1.4	10.12	11.59			164
	G Mean						2								
Feb, 2005 Kahului WWTP	Sum	10	5	180.1	21.5		56	36.44		3.5	34.16	37.66			585
	Avg	2	1	6.432142857	0.767857143			12.14666667		1.166666667	11.38666667	12.55333333			195
	Max	2	1	6.7	1.1		4	12.46		1.26	11.78	13.04			212
	Min	2	1	6.2	0.5		2	11.9		1.12	10.82	11.94			185
	G Mean						2.052008969								
Mar, 2005 Kahului WWTP	Sum	12	6	192	25.76		84	53.7	6.5	11.76	38.63	50.39			875
	Avg	2.4	1.5	6.4	0.858666667			13.425	6.5	2.94	9.6575	12.5975			218.75
	Max	4	2	6.7	3		8	16.2	6.5	8.19	11.81	16.06			243
	Min	2	1	6.2	0.4		2	10.85	6.5	1.05	7.87	10.53			204
	G Mean						2.497509781								
Apr, 2005 Kahului WWTP	Sum	11	8	185.6	26.1		147	58.4	8.68	14.19	28.5	42.69			728
	Avg	2.2	1.6	6.4	0.9			14.6	2.17	3.5475	7.125	10.6725			182
	Max	3	2	6.8	1.6		50	19.6	2.52	3.85	7.9	11.53			193
	Min	2	1	6.2	0.4		2	12.5	1.82	3.29	5.23	8.94			172
	G Mean						2.752274178								
May, 2005 Kahului WWTP	Sum	10	6	197.6	22.2		193	36.61	2.2	7.25	40.92	48.17			695
	Avg	2	1.2	6.374193548	0.716129032			12.20333333	0.733333333	1.8125	10.23	12.0425			173.75
	Max	2	2	6.8	1.8		80	21.49	1.71	2.51	10.75	12.54			199
	Min	2	1	6.1	0.4		2	6.26	0.21	1.27	9.75	11.02			153
	G Mean						2.993455974								
Jun, 2005 Kahului WWTP	Sum	10	7	194.1	19.6		64	68	0.14	4.97	35.45	40.42			531
	Avg	2	1.4	6.47	0.653333333			22.66666667	0.14	1.656666667	11.81666667	13.47333333			177
	Max	2	2	6.9	0.9		4	29.4	0.14	2.24	14.04	16.28			195
	Min	2	1	6.2	0.5		2	11.2	0.14	1.33	9.62	11.02			158
	G Mean						2.094588246								
Jul, 2005 Kahului WWTP	Sum	10	10	202.4	55.28		62	5.11	5.37	10.48	25.88	31.34	10.7	4.1	760
	Avg	2	2	6.746666667	1.842666667			1.703333333	1.3425	2.62	8.626666667	10.44666667	2.675	1.025	190
	Max	2	3	7.2	5.5		4	3.57	1.45	5.02	13.33	14.66	3.2	1.2	237
	Min	2	1	6.2	0.5		2	0.35	1.26	1.33	4	6.45	1.8	0.9	167
	G Mean						2.046747784								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Aug, 2005 Kahului WWTP	Sum	11	5	204.7	26.9		76	4.32	7.05	11.37	48.63	60	8.1	4	888
	Avg	2.2	1	6.823333333	0.896666667			1.44	1.41	2.274	9.726	12	1.62	0.8	177.6
	Max	3	1	7.2	4.8		13	3.1	1.75	4.48	11.86	12.84	3	1	215
	Min	1	1	6.4	0.3		2	0.1	0.98	0.98	6.93	10.7	1	0.7	146
	G Mean						2.219538635								
Sep, 2005 Kahului WWTP	Sum	12	11	200.7	19.35		64		2.73	2.73	21.84	24.57	3.2	2.7	338
	Avg	2.4	2.2	6.920689655	0.667241379				1.365	1.365	10.92	12.285	1.6	1.35	169
	Max	4	4	7.1	0.95		4		1.4	1.4	11.58	12.91	1.9	1.6	182
	Min	2	1	6.4	0.5		2		1.33	1.33	10.26	11.66	1.3	1.1	156
	G Mean						2.148676479								
Oct, 2005 Kahului WWTP	Sum	15	10	206.3	18.55		62	0.28	6.25	6.53	30.61	35.23	7.4	8.6	501
	Avg	3.75	2.5	6.876666667	0.618333333			0.28	1.5625	1.6325	10.20333333	11.74333333	1.85	2.15	167
	Max	6	3	7.1	1.2		4	0.28	1.68	1.91	11.46	13.14	4.2	5.7	175
	Min	2	2	6.4	0.5		2	0.28	1.26	1.26	9.29	10.55	1	0.9	160
	G Mean						2.046747784								
Nov, 2005 Kahului WWTP	Sum	10	13	199.1	17.8		58	0.28	6.79	7.07	47.47	53.49	7.3	5.5	784
	Avg	2.5	2.6	6.865517241	0.613793103			0.14	1.358	1.414	11.8675	13.3725	1.46	1.1	196
	Max	3	5	7.3	1		2	0.21	1.61	1.82	12.55	13.88	2.6	1.7	220
	Min	2	1	6.4	0.5		2	0.07	1.05	1.05	11.23	12.49	0.8	0.7	165
	G Mean						2								
Dec, 2005 Kahului WWTP	Sum	10	12	209	21.44		66	0.44	5	5.46	44.2	49.66	12.3	11.5	677
	Avg	2	2.4	6.966666667	0.714666667			0.44	1.25	1.365	8.84	12.415	3.075	2.875	169.25
	Max	2	4	7.4	1.6		8	0.44	1.47	1.68	12.41	13.67	8.2	8	176
	Min	2	1	6.6	0.5		2	0.44	1.05	1.05	0	11.55	1.3	1	163
	G Mean						2.094588246								
Jan, 2006 Kahului WWTP	Sum	11	8	215.4	31.67		60	6.7	7.8	14.5	37.77	52.27	9	17.6	1055
	Avg	2.2	1.6	6.948387097	1.021612903			2.233333333	1.56	2.9	7.554	10.454	1.8	3.52	211
	Max	3	2	7.2	3.42		2	4.02	1.89	5.36	10.61	12.43	2.2	11.2	370
	Min	2	1	6.4	0.35		0	1.02	1.26	1.82	4.35	8.9	1.2	1.4	147
	G Mean						0								
Feb, 2006 Kahului WWTP	Sum	16	8	181.1	19.08		69	7.21	6.76	13.97	33.62	47.59	5.7	3.8	761
	Avg	3.2	1.6	6.965384615	0.733846154			2.403333333	1.69	3.4925	8.405	11.8975	1.425	0.95	190.25
	Max	4	2	7.3	4		14	3.29	2.03	4.45	12.37	14.4	1.7	1.4	192
	Min	2	1	6.6	0.3		2	1.61	1.16	2.03	6.39	10.73	1.2	0.7	189
	G Mean						2.261827398								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Mar, 2006 Kahului WWTP	Sum	13	7	205.6	17.85		3016	2.66	5.78	8.44	25.37	30.81	5.5	3.8	551
	Avg	2.6	1.4	6.853333333	0.575806452			0.886666667	1.926666667	2.813333333	8.456666667	10.27	1.833333333	1.266666667	183.6666667
	Max	4	2	7.5	1.3		1600	1.26	2.73	3.99	10.66	13.11	3.3	1.9	185
	Min	2	1	6.3	0.07		2	0.56	1.44	2	6.2	7.19	0.8	0.8	182
	G Mean						5.442928645								
Apr, 2006 Kahului WWTP	Sum	7	12	194.4	50.78		1818	3.47	4.62	8.09	28.76	36.85	6.2	5.5	727
	Avg	2.333333333	2.4	6.703448276	1.751034483			1.156666667	1.155	2.0225	7.19	9.2125	1.55	1.375	181.75
	Max	3	5	7	6.5		1600	1.47	1.26	2.73	8.38	10.69	2.8	2.6	194
	Min	2	1	6.3	0.01		2	0.88	1.01	1.16	5.23	6.39	1	0.9	163
	G Mean						3.498256165								
May, 2006 Kahului WWTP	Sum	13	3	204.7	130.6		76	18.92	7.13	26.05	13.97	40.02	5.6	10	762
	Avg	3.25	1	6.603225806	4.212903226			4.73	1.7825	6.5125	3.4925	10.005	1.4	2.5	190.5
	Max	6	1	6.9	8.6		17	7.99	2.05	10.04	7.59	11.28	1.6	5	221
	Min	2	1	6.4	0.5		2	0.56	1.55	2.28	1.24	8.04	1	1.2	168
	G Mean						2.177109812								
Jun, 2006 Kahului WWTP	Sum	10	6	190.7	50.62		5331	7.49	5.95	13.44	23.1	36.54	4.1	4.3	755
	Avg	2	1.2	6.575862069	1.745517241			2.496666667	1.4875	3.36	5.775	9.135	1.025	1.075	188.75
	Max	2	2	6.8	5.5		1600	2.59	1.96	4.41	8.13	10.01	1.7	1.6	209
	Min	2	1	6.3	0		2	2.45	1.12	1.12	3.51	7.92	0.4	0.4	178
	G Mean						6.154735636								
Jul, 2006 Kahului WWTP	Sum	10	8	144.3	15.95		2520	2.38	6.2	8.02	22.86	31.44	6.6	4.6	727
	Avg	2	1.6	6.559090909	0.725			0.793333333	1.55	2.005	5.715	7.86	1.65	1.15	181.75
	Max	2	2	6.7	1.7		1600	1.12	1.82	2.94	8.08	9.9	2.4	1.4	200
	Min	2	1	6.4	0.03		2	0.56	1.12	1.54	4.11	6.29	0.8	0.7	160
	G Mean						9.506327058								
Aug, 2006 Kahului WWTP	Sum	8	5	202.5	76.41		1725	5.18	7.77	12.95	27.08	40.03	3.9	2.5	839
	Avg	2	1	6.532258065	2.46483871			1.036	1.554	2.59	5.416	8.006	0.78	0.5	167.8
	Max	2	1	6.9	9.2		1600	1.68	1.89	3.22	6.86	8.82	1	0.6	176
	Min	2	1	6.2	0.04		2	0.49	1.12	1.96	4.36	6.71	0.5	0.4	160
	G Mean						3.262233656								
Sep, 2006 Kahului WWTP	Sum	9	5	195.6	115.42		838	3.92	5.25	9.17	19.41	24.1	5.1	3.1	566
	Avg	1.8	1	6.52	3.847333333			1.306666667	1.3125	2.2925	6.47	8.033333333	1.275	0.775	188.6666667
	Max	2	1	6.8	11.9		300	2.8	1.68	4.48	7.88	8.72	1.4	0.8	229
	Min	1	1	6.2	0.33		2	0.28	0.84	0.84	5.42	7.45	1.2	0.7	160
	G Mean						3.876252499								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
	Sum	8	5	203.5	127.6		62	20.69	6.96	27.65	19.46	40.95	5.6	4.1	624
Oct, 2006 Kahului WWTP	Avg	2	1.25	6.564516129	4.116129032			5.1725	1.392	5.53	4.865	10.2375	1.866666667	1.366666667	156
	Max	2	2	6.8	12.3		2	10.29	1.82	11.55	9.18	12.48	3.2	2.1	172
	Min	2	1	6.3	0.68		2	2.24	1.08	1.08	0.93	9.09	1.2	0.8	140
	G Mean						2								
	Sum	8	5	195.5	76.94		1658	0.28	3.92	4.22	27.62	31.82	1.4	1.3	523
Nov, 2006 Kahului WWTP	Avg	2	1	6.516666667	2.564666667			0.28	1.306666667	1.406666667	9.206666667	10.60666667	1.4	1.3	174.3333333
	Max	2	1	6.7	10		1600	0.28	1.68	1.98	10.68	11.94	1.4	1.3	186
	Min	2	1	6.3	0.23		2	0.28	0.98	0.98	6.96	8.92	1.4	1.3	158
	G Mean						2.49919223								
	Sum	12	15	201	41.17		726	3.57	6.16	9.73	29.34	39.07	1	1	803
Dec, 2006 Kahului WWTP	Avg	2.4	3	6.483870968	1.328064516			1.19	1.54	2.4325	7.335	9.7675	1	1	200.75
	Max	4	6	6.7	2.14		500	2.66	1.82	4.48	7.64	11.3	1	1	221
	Min	2	1	6.3	0.8		2	0.35	1.33	1.33	6.82	8.86	1	1	182
	G Mean						3.043628833								
	Sum	445	4628	158.6	124.03		4580	7.14	19.18	18.06	32.58	54.77	2.2	2.1	167
Jan, 2007 Kahului WWTP	Avg	111.25	925.6	6.344	4.9612			2.38	3.836	3.612	6.516	10.954	2.2	2.1	167
	Max	266	3400	6.8	18.4		1600	4.13	8.4	8.12	12.26	13.03	2.2	2.1	167
	Min	2	2	5.9	0.09		2	0.28	0.49	0.77	2.48	8.61	2.2	2.1	167
	G Mean						9.233148093								
	Sum	10	6	182.3	39.46		56	0.35	3.29	3.64	31.4	35.04			446
Feb, 2007 Kahului WWTP	Avg	2	1.2	6.510714286	1.409285714			0.35	1.096666667	1.213333333	10.46666667	11.68			223
	Max	2	2	6.8	2.6		2	0.35	1.4	1.4	11.61	12.66			279
	Min	2	1	6.2	0.62		2	0.35	0.7	1.05	9.12	10.31			167
	G Mean						2								
	Sum	8	9	201	49.1		1677		3.53	3.53	39.61	43.14			615
Mar, 2007 Kahului WWTP	Avg	2	1.8	6.483870968	1.583870968				0.8825	0.8825	9.9025	10.785			205
	Max	2	3	6.8	7.4		1600		0.98	0.98	10.61	11.59			248
	Min	2	1	6.4	0.5		2		0.84	0.84	8.92	9.79			175
	G Mean						2.756273828								
	Sum	10	11	198.2	53.25		60		3.99	3.99	46.32	50.31	6.8	4.8	815
Apr, 2007 Kahului WWTP	Avg	2	2.2	6.606666667	1.775				0.9975	0.9975	11.58	12.5775	2.266666667	1.6	203.75
	Max	2	7	7	8.8		2		1.12	1.12	12.72	13.84	2.9	2	227
	Min	2	1	6.3	0.54		2		0.84	0.84	9.96	10.94	1.8	1	188
	G Mean						2								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
May, 2007 Kahului WWTP	Sum	10	8	202.7	33.23		3273	0.21	5.01	5.22	56.85	62.07	9.4	8.6	770
	Avg	2	1.6	6.538709677	1.071935484			0.21	1.2525	1.305	14.2125	15.5175	2.35	2.15	192.5
	Max	2	2	6.9	1.9		1600	0.21	1.58	1.58	15.8	17.13	3.3	2.6	220
	Min	2	1	6.3	0.03		2	0.21	0.98	0.98	12.54	13.87	1.5	1.4	165
	G Mean						3.298430818								
Jun, 2007 Kahului WWTP	Sum	9	8	194.4	75.92		1740	0.07	1.82	1.89	23.16	25.05	2.4	1.9	330
	Avg	1.8	1.6	6.48	2.530666667			0.07	0.91	0.945	11.58	12.525	1.2	0.95	165
	Max	2	2	6.9	9.3		1600	0.07	1.12	1.19	13.03	13.73	2.2	1.1	171
	Min	1	1	6.3	0.05		2	0.07	0.7	0.7	10.13	11.32	0.2	0.8	159
	G Mean						2.931606686								
Jul, 2007 Kahului WWTP	Sum	9	5	199.4	147.57		234		6.86	6.86	57.18	62.71	13.2	10.6	679
	Avg	1.8	1	6.432258065	4.760322581				1.372	1.372	14.295	15.6775	2.64	2.12	169.75
	Max	2	1	7	15.9		170		1.96	1.96	15.35	16.63	5.3	3.2	194
	Min	1	1	6.2	0.36		2		0.91	0.91	13.06	14.8	0	1.1	160
	G Mean						2.413740658								
Aug, 2007 Kahului WWTP	Sum	10	6	202	87.6		140		2.87	2.87	23.37	26.24	5	2.7	404
	Avg	2	1.2	6.516129032	2.825806452				1.435	1.435	11.685	13.12	2.5	1.35	202
	Max	2	2	7.1	9.4		80		1.54	1.54	13.07	14.61	2.6	1.6	209
	Min	2	1	6.2	0.3		2		1.33	1.33	10.3	11.63	2.4	1.1	195
	G Mean						2.252731077								
Sep, 2007 Kahului WWTP	Sum	9	7	199.3	93.88		62	0.28	5.84	6.12	38.15	44.27	6.8	4.5	652
	Avg	1.8	1.4	6.643333333	3.129333333			0.28	1.46	1.53	9.5375	11.0675	1.7	1.125	163
	Max	2	2	7.3	14.2		4	0.28	1.96	1.96	14	15.96	2	1.4	179
	Min	1	1	6.4	0.5		2	0.28	1.22	1.22	7.31	8.56	1.5	0.8	149
	G Mean						2.046747784								
Oct, 2007 Kahului WWTP	Sum	12	10	200.9	109.02		2033	0.21	8.33	8.54	41.49	48.07	12.1	6.9	766
	Avg	2.4	2	6.480645161	3.516774194			0.21	1.666	1.708	10.3725	12.0175	2.42	1.38	191.5
	Max	3	3	6.8	11.6		1600	0.21	1.82	1.96	11.32	12.93	4.2	2	266
	Min	2	1	6.2	0.2		2	0.21	1.4	1.4	9.15	10.9	1.4	1	158
	G Mean						3.791344311								
Nov, 2007 Kahului WWTP	Sum	10	10	197.6	31.89		172	0.28	2.9	3.18	12.18	13.96	5.8	1.8	172
	Avg	2	2	6.586666667	1.063			0.28	1.45	1.59	12.18	13.96	2.9	0.9	172
	Max	2	2	6.8	2		70	0.28	1.5	1.78	12.18	13.96	3.8	1	172
	Min	2	2	6.3	0.63		2	0.28	1.4	1.4	12.18	13.96	2	0.8	172
	G Mean						3.025638276								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Dec, 2007 Kahului WWTP	Sum	9	7	184.8	42.4		61		2.87	2.87	21.21	24.08	4	1.7	465
	Avg	1.8	1.4	6.6	1.514285714				1.435	1.435	10.605	12.04	2	0.85	232.5
	Max	2	2	6.8	4.9		7		1.47	1.47	10.91	12.31	3	0.9	257
	Min	1	1	6.5	0.64		2		1.4	1.4	10.3	11.77	1	0.8	208
	G Mean						2.091515066								
Jan, 2008 Kahului WWTP	Sum	10	6	203	53.89		71	0.28	7.63	7.91	49.4	55.56	6.9	6	596
	Avg	2	1.2	6.548387097	1.738387097			0.14	1.526	1.582	12.35	13.89	1.725	1.5	198.6666667
	Max	2	2	6.9	4.6		7	0.21	1.75	1.82	12.85	14.32	3.5	3.4	209
	Min	2	1	6.3	0.38		2	0.07	1.12	1.12	11.55	13.37	0.9	0.8	185
	G Mean						2.177719138								
Feb, 2008 Kahului WWTP	Sum	23	16	183.9	62.11		71	32.9	10.19	43.09	21.56	56.88	17.2	14.2	796
	Avg	4.6	4	6.567857143	2.218214286			6.58	2.038	8.618	5.39	14.22	4.3	3.55	199
	Max	11	7	7	5.2		13	10.71	3.05	12.53	9.92	16.86	10.4	9.4	214
	Min	2	1	2.8	0.7		2	1.19	1.33	2.94	2.06	12.57	1.4	1	182
	G Mean						2.246801774								
Mar, 2008 Kahului WWTP	Sum	64	41	75.5	24.16		33	69.89	16.07	85.96	3.68	69.55	17.4	11.7	716
	Avg	12.8	8.2	6.863636364	2.196363636			17.4725	4.0175	21.49	1.226666667	23.18333333	4.35	2.925	238.6666667
	Max	18	13	7	4.5		9	18.72	6.76	25.48	3.35	25.69	8	5.7	299
	Min	2	2	6.5	0.46		2	14.98	1.89	16.87	0.12	20.22	1.6	0.6	201
	G Mean						2.601031896								
Apr, 2008 Kahului WWTP	Sum	41	27	191.8	50.95		4884	56.63	13.62	70.25	9.75	80	20.15	9.2	1018
	Avg	8.2	5.4	6.85	1.819642857			11.326	2.724	14.05	1.95	16	4.03	1.84	203.6
	Max	14	7	7	3.6		1600	18.83	3.36	21.88	4.93	22.31	6.35	3.8	252
	Min	2	4	6.5	0.04		2	6.58	2.1	8.68	0.43	10	2.7	0.8	182
	G Mean						5.395800991								
May, 2008 Kahului WWTP	Sum	35	23	167.3	42		2683	10.01	5.11	15.12	7.2	19.54	6.7	3.5	182
	Avg	7	4.6	6.692	1.68			3.336666667	1.703333333	5.04	3.6	9.77	2.233333333	1.166666667	182
	Max	8	7	6.8	4.2		1600	6.79	2.66	9.45	4.32	12.33	2.8	1.4	182
	Min	4	3	6.6	0.04		2	0.42	0.28	2.59	2.88	7.21	1.4	1	182
	G Mean						6.94271557								
Jun, 2008 Kahului WWTP	Sum	29	12	206.2	69.45		1658	8.83	6.22	15.05	15.52	30.57	12.5	8.9	197
	Avg	5.8	2.4	6.873333333	2.315			2.943333333	2.073333333	5.016666667	5.173333333	10.19	4.166666667	2.966666667	197
	Max	10	3	7.2	5.9		1600	5.19	2.8	6.37	7.56	11.62	7.4	5.1	197
	Min	4	2	6.6	0.04		2	1.82	1.18	4.06	2.16	8.53	1.4	1	197
	G Mean						2.49919223								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Jul, 2008 Kahului WWTP	Sum	14	10	207.8	50.15		306	10.99	9.11	20.09	30.17	50.26	16.7	9	872
	Avg	2.8	2	6.703225806	1.617741935			2.198	1.822	4.018	6.034	10.052	3.34	1.8	174.4
	Max	6	3	7.1	3.9		240	4.62	2.66	7.28	7.53	11.43	5	3.5	219
	Min	2	1	6.5	0.24		2	0	0.84	1.26	3.84	8.71	2.3	1	154
	G Mean						2.495929382								
Aug, 2008 Kahului WWTP	Sum	10	10	210.8	56.59		302	1.33	4.41	5.74	21.16	26.9	10.45	3.6	330
	Avg	2	2	6.8	1.825483871			0.443333333	1.47	1.913333333	7.053333333	8.966666667	3.483333333	1.2	165
	Max	2	3	7.9	4.6		240	1.33	1.54	2.87	9.64	11.04	4.8	1.8	192
	Min	2	1	6.6	0.26		2	0	1.4	1.4	5.23	7.76	2.65	0.8	138
	G Mean						2.38677238								
Sep, 2008 Kahului WWTP	Sum	10	5	201	61.86		232	0	6.51	6.51	7.22	9.04	12.8	5.3	673
	Avg	2	1	6.7	2.062			0	1.6275	1.6275	7.22	9.04	3.2	1.325	168.25
	Max	2	1	7	19.3		170	0	1.96	1.96	7.22	9.04	4.8	1.8	186
	Min	2	1	6.4	0.5		2	0	1.05	1.05	7.22	9.04	2.2	0.9	154
	G Mean						2.42891673								
Oct, 2008 Kahului WWTP	Sum	10	5	203.8	26.11		62	0	3.43	3.43	11.51	13.68	12.5	6.5	628
	Avg	2	1	6.574193548	0.842258065			0	1.143333333	1.143333333	5.755	6.84	3.125	1.625	209.3333333
	Max	2	1	6.8	3.2		2	0	1.26	1.26	6.2	7.25	3.9	2.2	252
	Min	2	1	6.4	0.48		2	0	1.05	1.05	5.31	6.43	2	1	186
	G Mean						2								
Nov, 2008 Kahului WWTP	Sum	10	8	198.7	27.24		66	1.96	4.83	6.79	0.67	2.14	9.7	7.4	1005
	Avg	2	1.6	6.623333333	0.908			0.49	1.2075	1.6975	0.67	2.14	2.425	1.85	251.25
	Max	2	2	6.9	4.1		8	1.19	1.33	2.38	0.67	2.14	3	2.3	412
	Min	2	1	6.4	0.5		2	0	1.12	1.12	0.67	2.14	1.9	1.5	190
	G Mean						2.094588246								
Dec, 2008 Kahului WWTP	Sum	9	10	203.8	31.32		70	0	3.08	3.08	9.09	9.86	7.1	4.4	580
	Avg	2.25	2	6.574193548	1.010322581			0	1.026666667	1.026666667	9.09	9.86	2.366666667	1.466666667	193.3333333
	Max	3	3	6.9	2.2		10	0	1.26	1.26	9.09	9.86	2.6	2.1	200
	Min	2	1	6.2	0.5		2	0	0.77	0.77	9.09	9.86	2	0.8	190
	G Mean						2.106577373								
Jan, 2009 Kahului WWTP	Sum	12	17	204.8	33.74		64	3.36	5.53	8.89	35.25	44.14	16	15.4	584
	Avg	2.4	3.4	6.606451613	1.088387097			0.84	1.3825	2.2225	8.8125	11.035	4	3.85	194.6666667
	Max	3	10	6.9	3		4	0.98	1.68	2.66	10.15	12.39	4.9	4.4	203
	Min	2	1	6.5	0.5		2	0.56	0.77	1.33	7.95	9.28	2.4	3.1	179
	G Mean						2.045222871								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Feb, 2009 Kahului WWTP	Sum	12	7	182.8	56.85		317	5.04	6.37	11.41	35.95	47.36	16.8	8.8	746
	Avg	2.4	1.4	6.528571429	2.030357143			1.26	1.5925	2.8525	8.9875	11.84	4.2	2.2	186.5
	Max	4	2	6.8	10.2		240	1.4	1.68	3.01	9.95	12.96	5.1	2.6	191
	Min	2	1	6.3	0.28		2	0.91	1.47	2.38	7.95	10.96	3.4	1.8	178
	G Mean						2.654114201								
Mar, 2009 Kahului WWTP	Sum	11	9	202.5	45.21		1662	6.72	7.84	14.56	23.7	38.26	16	7.2	994
	Avg	2.2	1.8	6.532258065	1.458387097			1.344	1.568	2.912	4.74	7.652	3.2	1.44	198.8
	Max	3	3	6.7	3.6		1600	2.59	1.82	4.34	7.7	10.01	3.6	2	209
	Min	1	1	6.4	0		2	0.84	1.05	2.24	3.2	5.93	1.9	1.2	183
	G Mean						2.537398652								
Apr, 2009 Kahului WWTP	Sum	18	14	176.9	33.54		78	2.66	3.01	5.67	13.4	19.07	11.1	10.1	353
	Avg	3.6	2.8	6.551851852	1.242222222			1.33	1.505	2.835	6.7	9.535	5.55	5.05	176.5
	Max	5	5	6.7	4.2		17	1.54	1.54	3.01	10.5	13.51	6	5.3	190
	Min	2	2	6.3	0.51		2	1.12	1.47	2.66	2.9	5.56	5.1	4.8	163
	G Mean						2.333687907								
May, 2009 Kahului WWTP	Sum	23	12	205.4	38.25		260	10.57	7.14	17.71	7.53	25.24	8	3.75	539
	Avg	4.6	2.4	6.625806452	1.233870968			2.6425	1.785	4.4275	1.8825	6.31	2.666666667	1.25	179.6666667
	Max	8	4	6.8	4		170	7	2.38	8.82	3.12	9.56	3.2	1.5	227
	Min	2	2	6.4	0.44		2	0	1.19	2.1	0.74	4	1.8	1	152
	G Mean						2.874121067								
Jun, 2009 Kahului WWTP	Sum	21	33	200.9	28.34		466	0.42	1.68	2.1	7.86	9.96	5.7	2	180
	Avg	4.2	6.6	6.696666667	0.944666667			0.42	1.68	2.1	7.86	9.96	5.7	2	180
	Max	8	21	6.9	2.6		240	0.42	1.68	2.1	7.86	9.96	5.7	2	180
	Min	2	1	6.5	0.13		2	0.42	1.68	2.1	7.86	9.96	5.7	2	180
	G Mean						3.336746308								
Jul, 2009 Kahului WWTP	Sum	10	19	208.1	23.45		493	0.42	3.71	4.13	20.9	25.03	10.95	8.4	1034
	Avg	2	3.8	6.712903226	0.756451613			0.14	1.236666667	1.376666667	6.966666667	8.343333333	3.65	2.8	517
	Max	2	8	7	1.89		140	0.28	1.54	1.54	8.5	9.83	5.5	5.2	851
	Min	2	2	6.3	0.32		2	0	0.98	1.26	6.1	7.36	2.65	1.4	183
	G Mean						5.386467254								
Aug, 2009 Kahului WWTP	Sum	26	14	211.66	69.63		64	2.52	6.44	8.96	24.1	33.06	6.4	4.1	508
	Avg	6.5	2.8	6.827741935	2.246129032			0.84	2.146666667	2.986666667	8.033333333	11.02	2.133333333	1.366666667	169.3333333
	Max	8	4	7	6.4		4	1.89	3.22	3.22	10	13.22	2.2	1.8	189
	Min	5	1	6.5	0.62		2	0	1.33	2.52	6.1	8.62	2.1	1.1	159
	G Mean						2.045222871								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Sep, 2009 Kahului WWTP	Sum	11	14	206.01	44.26		66	0.35	8.54	8.89	51.27	60.16	11	8	873
	Avg	2.2	2.8	6.867	1.475333333			0.07	1.708	1.778	10.254	12.032	2.2	1.6	174.6
	Max	3	5	7.1	7.5		8	0.35	1.89	2.24	11.35	13.1	2.6	2	199
	Min	2	2	6.6	0.5		2	0	1.61	1.61	8.21	9.89	1.6	1.1	150
	G Mean						2.094588246								
Oct, 2009 Kahului WWTP	Sum	17	19	211.2	50.91		61.4	0.21	5.67	5.88	53.95	41.9	11.4	6.7	786
	Avg	3.4	3.8	6.812903226	1.642258065			0.0525	1.4175	1.47	13.4875	13.96666667	2.85	1.675	196.5
	Max	4	5	7	8.32		2	0.14	1.54	1.54	16.6	14.81	3.1	1.7	204
	Min	2	1	6.5	0.5		1.8	0	1.33	1.33	11.54	13.08	2.3	1.6	187
	G Mean						1.979711252								
Nov, 2009 Kahului WWTP	Sum	22	30	196.78	71.55		2131.1	0.77	1.82	2.59	19.1	10.39	5.8	3.7	405
	Avg	4.4	6	6.785517241	2.467241379			0.77	1.82	2.59	9.55	10.39	2.9	1.85	202.5
	Max	8	11	7	11.1		1600	0.77	1.82	2.59	11.3	10.39	3.3	2.2	215
	Min	2	1	6.6	0.05		1.8	0.77	1.82	2.59	7.8	10.39	2.5	1.5	190
	G Mean						5.24686939								
Dec, 2009 Kahului WWTP	Sum	19	22	209.82	32.77		251.8	0.42	4.55	4.97			5.8	3.4	620
	Avg	3.8	4.4	6.768387097	1.057096774			0.14	1.516666667	1.656666667			1.933333333	1.133333333	206.6666667
	Max	10	16	7	3		170	0.28	1.68	1.82			2.2	1.2	209
	Min	2	1	6.66	0.42		1.8	0	1.33	1.47			1.6	1	205
	G Mean						2.648904676								
Jan, 2010 Kahului WWTP	Sum	27	19	210.03	36.082		1734.7	1.46	4.22	5.68	33.9	39.58	2.6	2.7	426
	Avg	4.5	3.8	6.77516129	1.163935484			0.486666667	1.406666667	1.893333333	11.3	13.19333333	1.3	1.35	213
	Max	10	7	7	6.4		920	0.63	2.1	2.73	12	14.73	1.3	1.8	218
	Min	3	3	6.35	0.022		1.8	0.2	0.86	1.06	10.7	12.26	1.3	0.9	208
	G Mean						4.651380299								
Feb, 2010 Kahului WWTP	Sum	8	11	190.26	39.31		1435.5	6.86	3.5	10.36	16.5	26.86	3.2	2.4	381
	Avg	2	2.2	6.795	1.403928571			3.43	1.75	5.18	8.25	13.43	1.6	1.2	190.5
	Max	2	3	7.18	5.79		920	6.16	1.82	7.98	10.8	13.68	1.8	1.4	223
	Min	2	1	6.5	0.22		1.8	0.7	1.68	2.38	5.7	13.18	1.4	1	158
	G Mean						5.812310623								
Mar, 2010 Kahului WWTP	Sum	17	20	197.3	63.69	49.09	2107.2	1.82	7.28	36.82	22.2	36.76	1.2	1.2	463
	Avg	3.4	4	6.803448276	2.196206897	1.753214286		0.606666667	2.426666667	12.27333333	7.4	12.25333333	1.2	1.2	231.5
	Max	4	7	7	12.5	4.89	920	0.91	2.66	30.8	9.4	17.94	1.2	1.2	235
	Min	2	2	6.3	0.13	0.89	1.8	0.14	2.17	2.8	4.3	7.52	1.2	1.2	228
	G Mean						5.361744701								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
	Sum	22	16	208.2	38.92	37.73	2245.6	6.16	4.13	10.29	29.35	23.14	2.2	1.1	240
Apr, 2010	Avg	4.4	3.2	6.94	1.297333333	1.3475		3.08	2.065	5.145	7.3375	11.57	2.2	1.1	240
Kahului	Max	8	5	7.2	7.2	2.3	1600	3.43	2.1	5.53	8.5	11.76	2.2	1.1	240
WWTP	Min	2	1	6.8	0.02	0.85	1.8	2.73	2.03	4.76	5.85	11.38	2.2	1.1	240
	G Mean						6.2980523								
	Sum	48	8	217.64	61.38	38.41	1777.5	25.97	8.33	34.3	8.45	26.16	4.5	13.4	788
May, 2010	Avg	12	1.6	7.020645161	1.98	1.280333333		6.4925	2.0825	8.575	4.225	13.08	2.25	3.35	197
Kahului	Max	19	2	7.3	3.9	1.8	1600	11.69	3.22	14.91	7.2	16.16	2.4	8.2	200
WWTP	Min	8	1	6.8	0.12	1.05	1.8	1.12	1.61	2.8	1.25	10	2.1	1.2	191
	G Mean						3.530269147								
	Sum	57.9	13	208.4	45.1	40.28	100.2	30.52	5.32	35.77	17.1	52.86	11.8	11.2	746
Jun, 2010	Avg	11.58	2.6	6.946666667	1.503333333	1.342666667		7.63	1.33	8.9425	4.275	13.215	3.933333333	2.8	186.5
Kahului	Max	19.9	3	7.1	4.4	2.04	33	10.92	2.03	12.95	6.3	16.15	5.3	3.6	208
WWTP	Min	5	2	6.8	0.42	0.77	1.8	4.76	0	6.37	3.2	10.53	2.9	1.8	160
	G Mean						2.407214318								
	Sum	50	15	214.98	28.42	39.85	151.2	6.3	8.54	14.84	11.68	21.62	19.7	10.7	809
Jul, 2010	Avg	12.5	3	6.93483871	0.916774194	1.285483871		1.575	2.135	3.71	5.84	10.81	4.925	2.675	202.25
Kahului	Max	19	5	7.1	2.19	2.09	33	3.43	2.24	5.39	5.88	11.19	9.2	4.7	210
WWTP	Min	9	2	6.7	0.42	0.77	1.8	0.07	1.96	2.31	5.8	10.43	2.8	1.7	189
	G Mean						3.134125479								
	Sum	56	23	216.1	27.72	42.522	81.3	5.18	12.18	17.36	44.89	59.8	18.7	12.5	929
Aug, 2010	Avg	11.2	4.6	6.970967742	0.894193548	1.371677419		1.036	2.436	3.472	8.978	11.96	3.74	2.5	185.8
Kahului	Max	15	6	7.1	2.18	3.4	7.8	2.45	3.85	4.27	13.1	17.37	6.1	3.3	210
WWTP	Min	8	3	6.8	0.33	0.79	1.8	0	1.26	2.59	3.32	4.58	2.4	1.8	175
	G Mean						2.250815137								
	Sum	52	19	208.25	19.427	35.11	3373	2.73	9.38	12.11	24.8	36.91	11.6	4.4	573
Sep, 2010	Avg	10.4	3.8	6.941666667	0.647566667	1.210689655		0.91	3.126666667	4.036666667	8.266666667	12.30333333	3.866666667	1.466666667	191
Kahului	Max	13	6	7.1	1.13	1.8	1600	2.1	4.41	5.04	9.05	13.24	5	1.9	208
WWTP	Min	7	1	6.6	0.037	0.94	1.8	0	2.03	2.03	7.55	11.08	2.1	1.2	181
	G Mean						4.355234578								
	Sum	7	13	215.6	33.64	31.78	76	4.9	7.4	12.3	34.05	47.07	10.9	3.7	935
Oct, 2010	Avg	3.5	2.6	6.95483871	1.08516129	1.02516129		1.225	1.85	3.075	8.5125	11.7675	2.725	0.925	233.75
Kahului	Max	5	6	7.1	2.44	1.67	17	3.29	2.24	4.76	9.8	13.09	4.6	1.3	239
WWTP	Min	2	1	6.8	0.23	0.78	1.8	0	1.47	1.8	7.25	10.02	1.2	0.8	228
	G Mean						2.019995203								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L
Nov, 2010 Kahului WWTP	Sum	36	8	205.47	44.24	27.22	110.45	6.93
	Avg	7.2	1.6	6.849	1.474666667	0.907333333		1.386
	Max	9	3	7	5	1.52	41	2.87
	Min	5	1	6.6	0.32	0.63	1.8	0.7
	G Mean						2.380569392	
Dec, 2010 Kahului WWTP	Sum	45	7	212.92	30.43	34.82	76.8	19.11
	Avg	9	1.4	6.868387097	0.981612903	1.123225806		4.7775
	Max	13	3	7.1	3.7	1.83	22	9.38
	Min	5	1	6.7	0.31	0.68	1.8	3.08
	G Mean						1.978090048	
Jan, 2011 Kahului WWTP	Sum	60	17	204.5	39.37	38.28	54	11.97
	Avg	12	3.4	6.816666667	1.312333333	1.276		2.9925
	Max	20	8	7.1	2.6	1.96	1.8	7.84
	Min	7	2	5.8	0.8	0.68	1.8	0.42
	G Mean						1.8	
Feb, 2011 Kahului WWTP	Sum	42	12	189.61	25.98	37.73	66	13.16
	Avg	8.4	2.4	6.771785714	0.927857143	1.3475		3.29
	Max	11	4	7	1.72	1.96	17	7.7
	Min	6	2	6.5	0.39	0.86	1.8	0.84
	G Mean						1.965027472	
Mar, 2011 Kahului WWTP	Sum	63	15	210.6	39.07	45.85	152.7	24.01
	Avg	12.6	3	6.793548387	1.260322581	1.479032258		4.802
	Max	20	5	7.1	3.1	2.94	49	12.18
	Min	8	2	6.7	0.41	0.95	1.8	0.84
	G Mean						2.701312112	
Apr, 2011 Kahului WWTP	Sum	49	19	200.42	72.89	53.61	771.6	12.67
	Avg	9.8	3.8	6.680666667	2.429666667	1.787		3.1675
	Max	16	6	7	27	2.91	170	5.74
	Min	5	1	6.5	0.08	1.16	1.8	1.47
	G Mean						7.634492537	
May, 2011 Kahului WWTP	Sum	52	9	202.49	41.97	57.38	2249.6	35.63
	Avg	10.4	1.8	6.749666667	1.353870968	1.850967742		7.126
	Max	16	3	6.9	4.5	3.23	1600	14.21
	Min	6	1	6.5	0.28	1.29	1.8	1.12
	G Mean						8.745722395	

		CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Nov, 2010 Kahului WWTP	Sum	8.26	15.19	46.8	62.01	8.9	4.4	1182
	Avg	1.652	3.038	9.36	12.402	1.78	0.88	236.4
	Max	2.52	5.39	11.05	16.44	2.5	1	254
	Min	1.05	2.31	8	10.66	1.4	0.8	230
	G Mean							
Dec, 2010 Kahului WWTP	Sum	9.24	28.35	29.9	58.25	3.9	4.7	737
	Avg	2.31	7.0875	7.475	14.5625	1.3	1.566666667	245.6666667
	Max	2.94	12.32	8.5	20.82	2	1.9	266
	Min	1.61	4.69	5.7	10.39	0.8	1.1	229
	G Mean							
Jan, 2011 Kahului WWTP	Sum	7.91	19.88	35.4	55.28	8.2	5.3	962
	Avg	1.9775	4.97	8.85	13.82	2.05	1.325	240.5
	Max	2.31	9.52	10.05	19.57	3	2	266
	Min	1.68	2.52	6.95	11.62	1.1	0.9	220
	G Mean							
Feb, 2011 Kahului WWTP	Sum	7.63	20.79	26.35	49.03	6.5	4.8	880
	Avg	1.9075	5.1975	6.5875	12.2575	1.625	1.2	220
	Max	2.17	9.31	8.6	13.86	2.7	1.9	230
	Min	1.61	2.66	4.55	11.15	1.2	0.9	211
	G Mean							
Mar, 2011 Kahului WWTP	Sum	11.27	35.28	42.6	77.88	7.9	5.1	1149
	Avg	2.254	7.056	8.52	15.576	1.58	1.02	229.8
	Max	2.52	14.7	10.4	19.38	2.5	1.5	263
	Min	1.75	3.08	2.9	13.38	0.9	0.6	217
	G Mean							
Apr, 2011 Kahului WWTP	Sum	7.07	19.74	32.55	52.29	7.6	11.1	977
	Avg	1.7675	4.935	8.1375	13.0725	2.533333333	2.775	244.25
	Max	2.17	7.91	9.8	13.23	5.1	5.3	250
	Min	1.4	3.43	5.05	12.87	1.2	0.8	238
	G Mean							
May, 2011 Kahului WWTP	Sum	10.22	45.85	28.1	73.95	36.05	30	1182
	Avg	2.044	9.17	5.62	14.79	7.21	6	236.4
	Max	2.52	16.17	9.2	18.12	10.2	8.2	319
	Min	1.54	2.87	1.95	11.82	2.95	2.6	201
	G Mean							

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Jun, 2011 Kahului WWTP	Sum	49	33	202.43	40.91	49.78	200.8	25.13	9.1	34.23	18.75	52.98	13.9	10.7	874
	Avg	12.25	6.6	6.747666667	1.363666667	1.659333333		6.2825	2.275	8.5575	4.6875	13.245	3.475	2.675	218.5
	Max	18	8	7.02	4.5	2.75	31	8.26	2.59	10.85	5.85	16.7	6.4	5.1	233
	Min	4	4	6.43	0.29	1.16	1.8	4.9	2.03	7.28	4.15	11.73	1.3	1.2	208
	G Mean						4.037986571								
Jul, 2011 Kahului WWTP	Sum	149	35	212.62	45.55	59.76	169.7	23.1	8.61	30.17	17.45	47.62	18.5	14.2	885
	Avg	29.8	7	6.858709677	1.469354839	1.927741935		5.775	2.1525	7.5425	4.3625	11.905	4.625	3.55	221.25
	Max	34	8	7.06	3.16	3.58	49	8.19	2.8	10.43	5.2	14.38	8.4	7.4	241
	Min	24	6	6.62	0.18	1.44	1.8	1.61	1.47	1.54	3.1	6.74	2.2	1.6	209
	G Mean						2.671115178								
Aug, 2011 Kahului WWTP	Sum	132	12	198.75	35.33	46.6	4869.9	34.3	9.73	44.03	11.95	55.98	10.7	9.2	1182
	Avg	33	3	6.853448276	1.218275862	1.606896552		8.575	2.4325	11.0075	2.9875	13.995	3.566666667	2.3	295.5
	Max	37	4	7	3.4	2.12	1600	11.48	2.8	13.51	3.9	15.94	4.4	3.6	571
	Min	28	2	6.7	0	0.87	1.8	5.18	1.96	7.98	1.9	11.88	2.1	0.4	180
	G Mean						4.273312898								
Sep, 2011 Kahului WWTP	Sum	73	22	198.64	31.25	48.11	10242.6	13.54	7.84	20.58	15.75	36.33	6.8	5.6	705
	Avg	14.6	4.4	6.849655172	1.077586207	1.658965517		3.385	2.613333333	6.86	5.25	12.11	3.4	2.8	235
	Max	19	9	7.09	2.16	2.2	1600	5.6	2.8	8.05	6.5	13.15	4.9	4	265
	Min	11	3	6.5	0.04	1.24	1.8	0.8	2.45	5.88	4.15	10.8	1.9	1.6	207
	G Mean						11.32602422								
Oct, 2011 Kahului WWTP	Sum	119	28	212.25	33.33	76.01	58.7	26.11	11.12	37.23	22.7	59.93	7.4	5.6	1035
	Avg	23.8	5.6	6.846774194	1.07516129	2.451935484		6.5275	2.78	9.3075	5.675	14.9825	2.466666667	1.866666667	258.75
	Max	32	8	7.12	3.1	6.4	4.5	12.88	3.15	15.12	8.95	19.12	3.2	2.5	292
	Min	13	3	6	0.25	1.42	1.8	3.71	2.24	6.65	4	12.31	1.6	1.2	233
	G Mean						1.86031003								
Nov, 2011 Kahului WWTP	Sum	137	26	207.71	45.3	74.9	54.8	29.61	10.29	39.9	20.15	57.8	17	12.7	1446
	Avg	27.4	5.2	6.923666667	1.51	2.496666667		7.4025	2.5725	9.975	4.03	14.45	3.4	2.54	289.2
	Max	32	7	7.3	3.94	3.7	2	10.15	2.94	13.09	5	17.64	4.3	3.6	310
	Min	19	3	6.5	0.36	1.68	1.8	5.18	2.31	7.7	2.25	12.1	2.2	1	242
	G Mean						1.825464972								
Dec, 2011 Kahului WWTP	Sum	50	17	191.39	46.17	42.27	74.4	10.01	6.51	16.52	23	39.52	3.9	4.1	825
	Avg	12.5	3.4	6.835357143	1.648928571	1.509642857		3.336666667	2.17	5.506666667	7.666666667	13.17333333	1.3	1.366666667	275
	Max	25	6	7.13	8.5	2.14	13	4.76	2.52	6.79	9.75	14.51	1.8	1.8	309
	Min	5	1	6.62	0.53	1.02	1.8	2.45	1.96	4.76	6.25	11.97	0.9	0.7	243
	G Mean						2.177526245								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Jan, 2012 Kahului WWTP	Sum	56	26	210.48	55.22	53.61	56.9	13.93	11.48	25.41	26.7	42.8	3.1	2.2	1281
	Avg	14	5.2	6.789677419	1.781290323	1.729354839		3.4825	2.87	6.3525	6.675	14.26666667	1.033333333	0.733333333	256.2
	Max	18	9	7.21	5.5	3.06	4.5	6.16	3.92	8.75	8.8	15.5	1.7	1	280
	Min	7	4	6.36	0.24	1.21	1.8	0.35	2.31	2.66	4.5	13.11	0.7	0.6	221
	G Mean						1.862354796								
Feb, 2012 Kahului WWTP	Sum	87	22	199.76	77.79	42.21	69.8	8.05	4.69	12.74			3.4	2	647
	Avg	17.4	4.4	6.888275862	2.682413793	1.455517241		4.025	2.345	6.37			1.7	1	323.5
	Max	23	6	7.1	9.4	2.27	13	4.27	2.45	6.51			1.8	1.2	390
	Min	12	3	6.51	0.31	1.14	1.8	3.78	2.24	6.23			1.6	0.8	257
	G Mean						2.041723448								
Mar, 2012 Kahului WWTP	Sum	46	12	216.26	43.62	43.48	127.7	9.52	8.47	17.99			13.1	11.8	1065
	Avg	9.2	2.4	6.976129032	1.407096774	1.402580645		2.38	2.1175	4.4975			3.275	2.95	266.25
	Max	17	3	7.3	7.5	1.97	70	5.67	2.38	7.63			5.6	5.5	275
	Min	5	2	6.46	0.34	0.97	1.8	0.56	1.96	2.94			1.4	1.1	254
	G Mean						2.122140895								
Apr, 2012 Kahului WWTP	Sum	55	11	208.34	20.31	47.4	56.7	14.84	10.43	25.27			9	6.1	1195
	Avg	11	2.2	6.944666667	0.677	1.58		3.71	2.6075	6.3175			2.25	1.525	298.75
	Max	18	4	7.23	1.99	2.92	4.5	4.55	3.43	7.98			3	2	332
	Min	6	1	6.05	0.21	1.15	1.8	2.52	2.17	4.69			1	0.7	254
	G Mean						1.855825646								
May, 2012 Kahului WWTP	Sum	27	11	213.237	15.54	37.26	1855.4	7.21	10.71	17.92			8	6.1	1392
	Avg	6.75	2.2	6.878612903	0.501290323	1.201935484		1.442	2.142	3.584			1.6	1.22	278.4
	Max	10	3	7.77	5.9	1.66	1600	2.45	2.87	5.32			2.3	2.2	334
	Min	4	1	6.58	0.01	0.81	1.8	0.42	1.82	2.24			1.3	0.7	222
	G Mean						3.99855161								
Jun, 2012 Kahului WWTP	Sum	24	24	204.632	12.56	37.2	5465.7	8.75	9.03	17.78			27.1	24.3	801
	Avg	4.8	4.8	6.821066667	0.418666667	1.24		2.1875	2.2575	4.445			6.775	6.075	267
	Max	7	6	7.062	4.9	1.9	1600	2.87	2.59	5.04			14	12.6	314
	Min	4	4	6.24	0.01	0.95	1.8	0.56	1.82	3.01			2.8	2.6	225
	G Mean						6.938130767								
Jul, 2012 Kahului WWTP	Sum	39	21	210.22	25.95	35.51	241.3	6.16	8.82	14.98			14.8	13.9	811
	Avg	7.8	4.2	6.781290323	0.837096774	1.145483871		1.232	1.764	2.996			3.7	3.475	202.75
	Max	14	6	7.08	7.1	1.66	79	1.68	2.17	3.57			4.9	4.8	228
	Min	5	3	6.54	0.09	0.82	1.8	0.28	1.19	2.1			1.6	1.3	175
	G Mean						3.469225634								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Aug, 2012 Kahului WWTP	Sum	12	17	205.84	96.1	40.42	7421	0.21	3.99	4.2			10.4	9.5	611
	Avg	2.4	3.4	6.64	3.1	1.303870968		0.21	1.995	2.1			5.2	4.75	203.6666667
	Max	3	5	6.9	17.6	3.26	1600	0.21	2.24	2.24			6	5.4	214
	Min	1	2	6.03	0.02	0.67	1.8	0.21	1.75	1.96			4.4	4.1	196
	G Mean						13.67046351								
Sep, 2012 Kahului WWTP	Sum	10	8	198.64	61.06	28.64	1948.5	2.03	5.67	7.7			19.9	15.9	896
	Avg	2	1.6	6.621333333	2.035333333	0.954666667		0.676666667	1.89	2.566666667			6.633333333	5.3	224
	Max	3	2	6.89	11.6	1.31	540	0.84	2.17	3.01			10.8	9.2	281
	Min	1	1	6.45	0.25	0.69	1.8	0.35	1.61	1.96			3.8	2.2	189
	G Mean						7.683188176								
Oct, 2012 Kahului WWTP	Sum	11	13	193.97	77.85	27.83	2060.4	1.47	7.7	9.17			17.9	21.6	1074
	Avg	2.2	2.6	6.68862069	2.684482759	0.959655172		0.3675	1.54	1.834			4.475	5.4	214.8
	Max	3	5	6.86	13.6	1.44	1600	0.7	1.75	2.31			11.6	9.9	246
	Min	2	1	6.24	0.04	0.65	1.8	0.14	1.12	1.26			1.6	1	185
	G Mean						3.826444996								
Nov, 2012 Kahului WWTP	Sum	16	11	203.3	79.94	27.76	137	0.63	1.47	2.1			4.1	5.6	1113
	Avg	3.2	2.2	6.776666667	2.664666667	0.925333333		0.63	1.47	2.1			2.05	1.4	278.25
	Max	8	4	7.13	8.8	1.42	49	0.63	1.47	2.1			2.6	2.1	313
	Min	2	1	6.46	0.51	0.7	1.8	0.63	1.47	2.1			1.5	0.4	265
	G Mean						2.450860418								
Dec, 2012 Kahului WWTP	Sum	16	13	187.91	74.1	33.21	483.9	0.63	2.59	3.22	18.3		14.8	9.5	1130
	Avg	3.2	2.6	6.711071429	2.646428571	1.186071429		0.21	0.863333333	1.073333333	9.15		3.7	2.375	282.5
	Max	6	5	7.07	8.3	2.99	240	0.28	1.61	1.89	9.8		5	4.7	308
	Min	2	1	6.45	0.5	0.77	1.8	0.14	0.42	0.63	8.5		2.8	0.6	254
	G Mean						3.13835426								
Jan, 2013 Kahului WWTP	Sum	11	12	204.97	85.68	40.11	98.9	1.4	3.01	4.41	36.8	32.51	20	16	1317
	Avg	2.75	3	6.611935484	2.763870968	1.293870968		0.466666667	1.003333333	1.47	9.2	10.83666667	4	3.2	263.4
	Max	4	4	7.07	11	2.15	13	0.7	1.54	1.75	10.1	11.78	6.9	4.9	298
	Min	2	2	6.2	0.37	0.93	1.8	0.21	0.49	0.98	8.7	9.88	2	1.6	238
	G Mean						2.487663827								
Feb, 2013 Kahului WWTP	Sum	18	15	183.02	144.04	38.01	1660.6	0.56	1.4	1.96	18.7	13.03	18	15.8	810
	Avg	3.6	3	6.536428571	5.144285714	1.3575		0.28	0.7	0.98	9.35	13.03	6	5.266666667	270
	Max	4	5	7.02	17.6	1.82	1600	0.35	1.12	1.33	11.7	13.03	6.4	5.6	289
	Min	3	1	6.24	0.04	0.93	1.8	0.21	0.28	0.63	7	13.03	5.8	5	259
	G Mean						2.54654915								

W-K WWRF Final Effluent Water Quality Data

		CENTRAL LAB KAHULUI FINAL EFFLUENT BOD mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TSS mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT pH S.U.	CENTRAL LAB KAHULUI FINAL EFFLUENT Total Residual Chlorine mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TURBIDITY NTU	CENTRAL LAB KAHULUI FINAL EFFLUENT Fecal Coliform MPN/100mL	CENTRAL LAB KAHULUI FINAL EFFLUENT AMMONIA-N mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT ORGANIC NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL KJELDAHL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT NITRATE-NITRITE mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL NITROGEN mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT TOTAL P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT REACTIVE P as PO_4 mg/L	CENTRAL LAB KAHULUI FINAL EFFLUENT CHLORIDE mg/L
Mar, 2013 Kahului WWTP	Sum	16	16	201.82	293.4	45.95	3296.4	0	1.19	1.19					511
	Avg	3.2	2.666666667	6.510322581	9.464516129	1.482258065		0	1.19	1.19					255.5
	Max	4	4	7.15	46	2.38	1600	0	1.19	1.19					262
	Min	2	1	5.94	0	1.05	1.8	0	1.19	1.19					249
	G Mean						3.475674522								
Apr, 2013 Kahului WWTP	Sum	22	22	195.4	81.58	33.06	422.1								246
	Avg	4.4	4.4	6.513333333	2.719333333	1.102									246
	Max	5	8	6.93	6.3	1.78	350								246
	Min	4	2	5.97	0.13	0.79	1.8								246
	G Mean						2.435341139								
May, 2013 Kahului WWTP	Sum	11	12	203.98	128.63	34.12	1789.5	0.28	0.56	0.84					249
	Avg	2.2	2.4	6.58	4.149354839	1.100645161		0.28	0.56	0.84					249
	Max	3	4	7.12	15.6	1.65	1600	0.28	0.56	0.84					249
	Min	1	1	6.3	0	0.83	1.8	0.28	0.56	0.84					249
	G Mean						3.200846618								
Jun, 2013 Kahului WWTP	Sum	15	20	198.29	81.76	32.99	58.2	0.42	2.1	2.52			12.2	11.4	658
	Avg	3	4	6.609666667	2.725333333	1.099666667		0.21	1.05	1.26			12.2	11.4	219.3333333
	Max	4	8	6.9	7.9	1.47	4.5	0.35	1.68	2.03			12.2	11.4	229
	Min	2	2	6.27	0.07	0.86	1.8	0.07	0.42	0.49			12.2	11.4	210
	G Mean						1.938430244								
Jul, 2013 Kahului WWTP	Sum	17	12	205.12	174.23	37.76	3322.5	4.48	6.23	10.71	25.3	33.77	13.7	8.8	1311
	Avg	3.4	2.4	6.616774194	5.620322581	1.218064516		1.12	1.5575	2.6775	8.433333333	11.25666667	3.425	2.933333333	262.2
	Max	5	3	7.15	44	1.9	1600	2.73	2.1	3.99	9.9	11.93	5.6	5.4	318
	Min	2	2	6.05	0.03	0.79	1.8	0.14	1.26	2.03	6.4	10.39	1.2	0.6	184
	G Mean						4.103083179								
Aug, 2013 Kahului WWTP	Sum	14	8	203.26	146.74	33.48	5547.5	0.35	5.04	5.39	42.2	37.39	1.6	0.2	899
	Avg	2.8	1.6	6.556774194	4.733548387	1.08		0.35	1.68	1.796666667	10.55	12.46333333	1.6	0.2	224.75
	Max	6	2	7.1	17.6	1.47	1600	0.35	1.89	2.17	12.9	14.23	1.6	0.2	258
	Min	1	1	6.25	0.06	0.8	1.8	0.35	1.33	1.33	7.9	9.79	1.6	0.2	168
	G Mean						5.995613914								

APPENDIX C

W-K WWRF WATER QUALITY DATA FOR UNDERGROUND INJECTION CONTROL (UIC) PERMIT REPORTS

W-K WWRF Semi-Annual Water Quality Data for UIC Permit Reports

Sample Date	BOD mg/L	Field pH	Total Residual Chlorine mg/L	Total Suspended Solids mg/L	Turbidity NTU	Ammonia (as N) mg/L	Dissolved Oxygen mg/L	Fecal Coliform MPN/100mL	Field Temperature °C	Kjeldahl Nitrogen mg/L	Nitrate - Nitrite mg/L	Orthophosphate mg/L	Total Dissolved Solids mg/L	Total Phosphorus mg/L
10/14/03 - 10/15/03	<2	7.2	1.0	2	0.5	ND	5.2	<2	29	ND	ND	ND	ND	ND
4/13/04 - 4/14/04	2	6.6	1.3	1	0.8	ND	5	<2	27.6	ND	ND	ND	ND	ND
10/20/04 - 10/21/04	2	6.5	0.7	2	0.8	ND	4.5	<2	29	ND	ND	ND	ND	ND
4/20/05 - 4/21/05	2	6.4	0.5	2	0.8	ND	4.8	<2	27.4	ND	ND	ND	ND	ND
10/19/05 - 10/20/05	3	7	0.7	2	0.9	ND	6	<2	29	ND	ND	ND	ND	ND
4/11/06 - 4/12/06	3	6.8	0.5	2	0.7	ND	4	2	27	ND	ND	ND	ND	ND
10/25/06 - 10/26/06	<2	6.6	0.7	2	0.8	ND	3.1	<2	28.6	ND	ND	ND	ND	ND
4/3/07 - 4/4/07	<2	6.6	0.9	1	0.7	ND	2.2	<2	28	ND	ND	ND	ND	ND
10/16/07 - 10/17/07	2	6.3	1.9	2	0.9	ND	4.3	<2	28	ND	ND	ND	ND	ND
4/8/08 - 4/9/08	8	7	2.9	7	2.8	ND	3.3	2	28	ND	ND	ND	ND	ND
10/15/2008	2	6.8	1.09	1	1.4	0.45	3.5	<2	28.7	0.51	10.3	0.42	619	0.47
4/1/2009	4	6.5	2	2	1	1.62	3.44	<2	26	2.62	5.76	0.36	553	0.46
10/21/2009	3	6.7	0.55	5	0.88	0.5	2.1	<1.8	29.5	0.84	10.5	1.06	649	1.13
4/14/2010	6	7	0.98	5	1.53	1.51	4	2	27.2	2.69	6.51	0.3	781	0.5
10/13/2010	>12	7.1	1.1	6	1.37	1.81	4.4	<1.8	27.6	4.12	9.65	0.47	699	0.56
4/13/2011	7	6.6	0.39	1	1.5	0.5	1.73	130	28.5	1.74	10.4	0.3	718	0.5
10/20/2011	24	6.6	0.4	3	2.59	6.5	4.9	<1.8	26.5	8	5.52	0.27	630	0.47
11/19/02 - 11/20/02	<2	6.6	0.7	2	1	ND	4.5	<2	28	ND	ND	ND	ND	ND
10/24/2012	2	6.56	1.5	5	0.85	ND	2.4	<1.8	29.3	1.1	10.28	0.2	619	0.3
4/18/2012	6	7.1	0.4	2	1.4	0.42	3.44	<1.8	27.4	5.5	4.56	0.29	677	0.47
4/17/2013	4	6.8	2.6	4	1.3	ND	3.2	<1.8	27.4	1.8	7.89	0.4	682	0.7

ND - Not determined

APPENDIX D

EVALUATION OF SYSTEM CAPACITY HC&S FIELD 921/922 FILTER STATION BY WAI ENGINEERING, INC.

Wai Engineering, Inc.
95-522 Kipapa Drive, Mililani HI 96789
Phone: (808) 623-1449, E-mail: waiadmin@hawaii.rr.com

Ivan K. Nakatsuka, P.E.
Austin, Tsutsumi & Associates, Inc.

Evaluation of System Capacity HC&S Fields 921/922 Filter Station

A site visit was completed yesterday and final data was accumulated to address your questions about the system to be supplied by wastewater from Kahului and Wailuku.

The pump suction manifold is adequate to take 2,000 gpm from the storage pond that has a capacity of about 500,000 gallons. Two of the three pumps can take water from the pond at the same time. The rated capacity of a single pump is 1,900 gpm. A photo of the pump plate is included.

The pump curve is included. The site has 3 pumps that have the same performance. The curve is representative for the same pump but rated at 1800 rpm and not at the 1200 rpm motor that is coupled to the pump. The pump spec plate indicates a 14" impeller rated at 80 feet total dynamic head at 1900 gpm at 1200 rpm.

A photo of the pond outlet that can supply two of the three pumps is included. Minimum recommended operating depth is about 18 inches above the floor of the lined pond. The pump station is equipped with level sensors to stop the pumps in the event of low water level in the pond.

The filter station consists of 24 each AGF sand media filters with 8 units supplied by each individual pump. The capacity is adequate for 8 tanks to take the 1900 gpm from its supply pump. A spec sheet for the filter tank is included. With two pumps supplied by the pond, the flow can exceed the desired flow rate of 2000 gpm.

System upgrades and modifications may be required to meet the operational needs of HC&S.

Respectfully submitted,

David A. Young
David A. Young

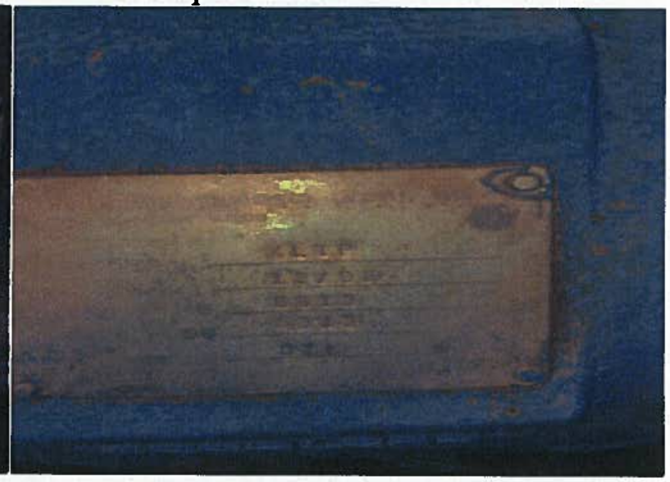
cc: File, G. Hew, F. Brittain

Wai Engineering, Inc.
95-522 Kipapa Drive, Mililani HI 96789
Phone: (808) 623-1449, E-mail: waiadmin@hawaii.rr.com

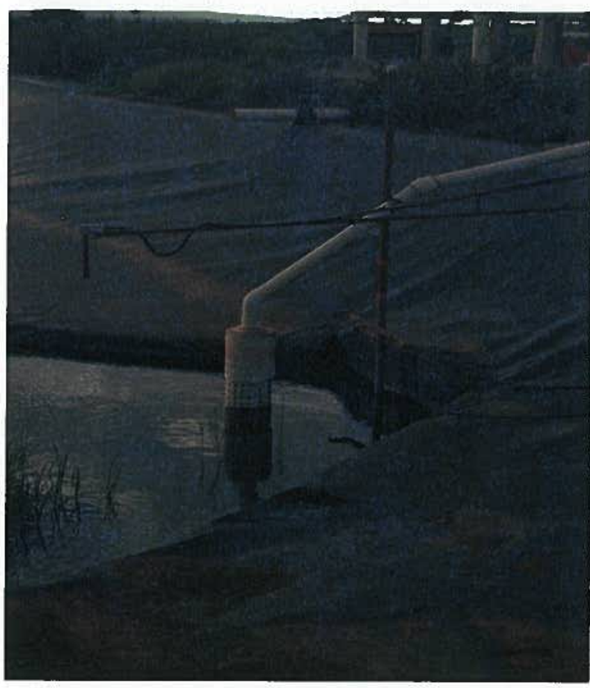
Informational Photos

Pump Spec Plate

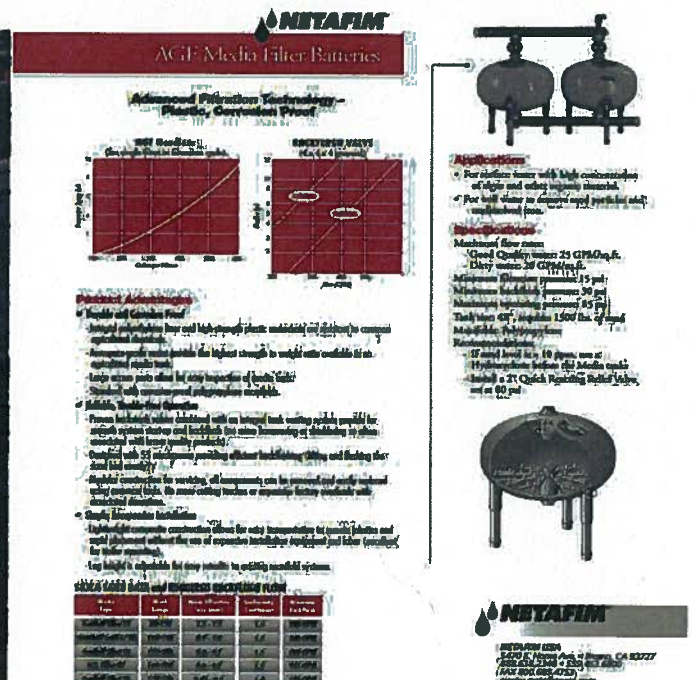
Motor Spec Plate



Pond outlet to pump suction



AGF filter spec sheet



Wai Engineering, Inc.

95-522 Kipapa Drive, Mililani HI 96789

Phone: (808) 623-1449, E-mail: waiadmin@hawaii.rr.com

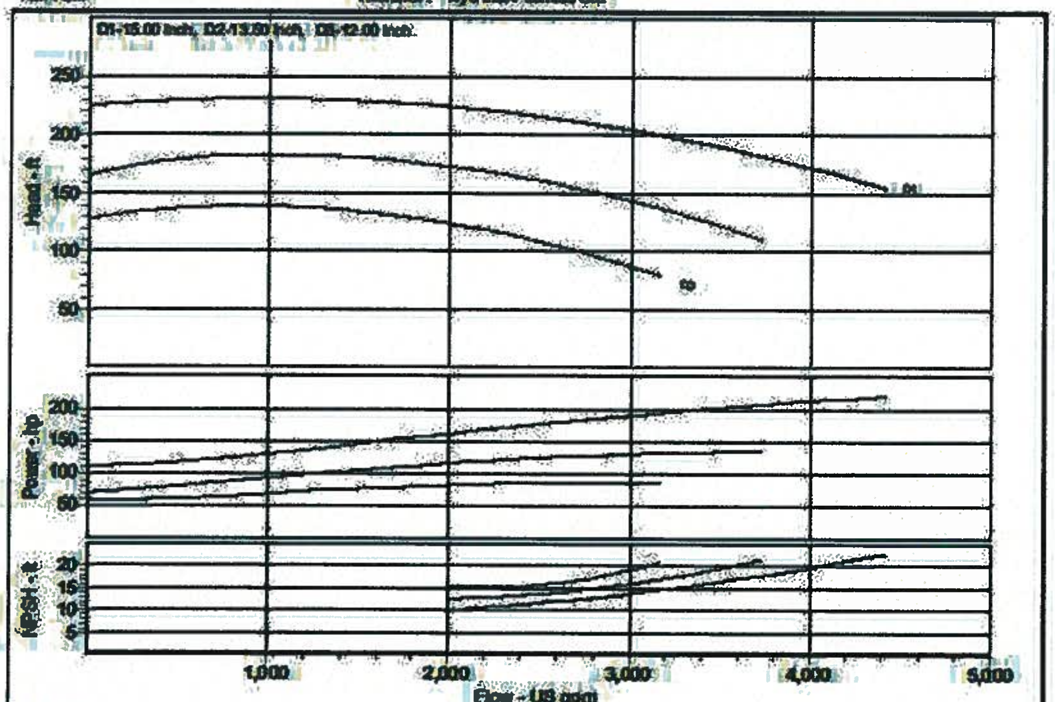
Field 921-922 pump curve

Peerless Pump Company, LLC
Indianapolis, Indiana [illegible]

Customer :

Project :
Quote No. :
Page No. :
Contact :
Phone :
Date :
Fax :

Pump Model:	Peerless - [illegible]	Nom. Speed:	1750 RPM, 60 Hz Electric	Duty Flow :		US gpm
Type:	[illegible] - ANSI Standard End Suction	Impeller Dia.:	[illegible] Inch	Duty Head :		ft
				Efficiency :		%
		Temperature:	68 °F	Power Required :		hp
		Viscosity:	1.000 cP	NPSH Required :		ft
Curve No:	[illegible]	Sp. Gravity:	1.000	Peak Power:	[illegible]	hp
Impeller No.		Fluid:	Water	Closed Valve Pressure	[illegible]	ft
Item:	1					
Your Ref:		Tolerance :	Hyd Inst-Peerless Std			



Comments:
Performance curve represents typical performance.

APPENDIX E

EXCERPTS FROM DEPARTMENT OF HEALTH "GUIDELINES FOR THE TREATMENT AND USE OF RECYCLED WATER"

Excerpts from the Guidelines that are pertinent to this project have been included below. The paragraph letters and numbers are directly from the Guidelines.

II DEFINITIONS

"R-1 Water (Significant reduction in viral and bacterial pathogens)" means recycled water that is at all times oxidized, then filtered, and then exposed, after the filtration process, to:

A. A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque-forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least_resistant to disinfection as polio virus may be used for purposes of demonstration; and

B. A disinfection process that limits the concentration of fecal coliform bacteria to the following criteria:

(1) The median density measure in the disinfected effluent does not exceed 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed; and

(2) The density does not exceed 23 per 100 milliliters in more than one sample in any 30-day period; and

(3) No sample shall exceed 200 per 100 milliliters.

"R-2 Water (Disinfected Secondary-23 Recycled Water)" means recycled water that has been oxidized, and disinfected to meet the following criteria:

A. Fecal coliform bacteria densities as follows:

(1) The median density measured in the disinfected effluent does not exceed 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed; and

(2) The density does not exceed 200 per 100 milliliters in more than one sample in any 30-day period.

"R-3 Water (Undisinfected Secondary Recycled Water)" means oxidized wastewater.

III USES AND SPECIFIC REQUIREMENTS FOR RECYCLED WATER

There are three categories of recycled water:

R-1 Water (Significant reduction in viral and bacterial pathogens);

R-2 Water (Disinfected secondary-23 recycled water, which means secondary treatment with disinfection to achieve a median fecal coliform limit of 23 per 100 ml based on the last seven days for which analyses have been completed); and

R-3 Water (Undisinfected secondary recycled water).

B. USES FOR R-2 WATER

1. Recycled water used for the purposes cited in paragraph 2 of this section shall be at all times R-2 Water or recycled water with concentrations of potentially pathogenic organisms lower than those of R-2 and R-1 Waters.

2. R-2 Water is suitable for, from a public health standpoint, the purposes cited under R-3 Water in these guidelines and shall be restricted to the following purposes:

   a. Subsurface irrigation:

      (1) Landscape and turf on parks, elementary school yards;

      (2) Residential property where managed by an irrigation supervisor;

      (3) Golf courses;

      (4) Vineyards and orchards (e.g., banana, papaya);

      (5) Food crops that are above ground and not contacted by recycled water; and

      (6) Pastures for milking and other animals.

   b. Any form of irrigation for:

      (1) Fodder crops (e.g., alfalfa) and fiber crops;

      (2) Sod not installed by the general public;

      (3) Trees grown for timber or firewood, and Christmas trees, whether or not they are harvested by the general public;

      (4) Trees and vines that do not have food crops on them when irrigated;

      (5) Seed crops that are not eaten by humans;

      (6) Food crops which must undergo extensive commercial, physical or chemical processing determined by DOH to be sufficient to render it free of viable pathogenic agents, before it is suitable for human consumption;

(7) Landscape on cemeteries, and around freeways;

(8) Other landscape vegetation and non-edible plants. This is allowed only where:

(a) The public would have access and exposure to irrigation water similar to that which would occur along a freeway or on a cemetery; and

(b) access is controlled so the irrigated area cannot be used as if it were a part of a park, school yard or athletic field;

(9) Landscaping of developments under construction, with no access by the public during establishment period, no overspray, and where workers use appropriate protective equipment and clothing;

c. Surface, drip or subsurface irrigation of ornamental plants for commercial use. This is allowed only if plants are harvested above any portion contacted by recycled water. Subsurface irrigation shall be supplied for the growth of all material used in the production of leis or other flowers used in human apparel;

d. Use in an industrial process that does not generate mist, does not involve facial contact with recycled water, and does not involve incorporation into food or drink for humans or contact with anything that will contact food or drink for humans;

e. Water jetting for consolidation of backfill material around underground pipelines except potable water pipelines;

f. Dampening unpaved roads and other surfaces for dust control;

g. Dampening soil for compaction at construction sites, landfills, and elsewhere;

h. Washing aggregate and making concrete;

i. Dampening brushes and street surfaces during street sweeping;

j. A source of supply for a landscape impoundment without a decorative fountain; and

k. Flushing sanitary sewers; or

l. Such other uses as approved by DOH.

D. PRECAUTIONS FOR ALL USES OF RECYCLED WATER

1. The provisions of this section shall be complied with when any recycled water is used on an approved use area. Use of recycled water without an approval from DOH is prohibited;

2. The purveyor of recycled water shall provide a copy of these guidelines to the users (i.e. property managers) to whom it provides recycled water, and shall obtain their agreement in writing to comply with all applicable provisions of these guidelines;

3. Signs shall be posted where recycled water is used pursuant to the PUBLIC EDUCATION and EMPLOYEE TRAINING PLAN specified in Chapter VIII;

4. Best Management Practices shall be taken to prevent ponding of recycled water;

5. Recycled water shall always be managed to avoid conditions conducive to proliferation of mosquitoes and other vectors, and to avoid creation of a public nuisance or health hazard;

6. Best Management Practices shall be used to mitigate discharge, runoff, or overspray beyond the approved use area boundaries;

7. Spray of recycled water shall not be allowed to contact an external drinking water fountain;

8. The following precautions pertain to the use of R-1 Water only:

   a. There shall be no irrigation within a minimum of 50 feet of any drinking water supply well;

   b. The outer edge of an impoundment shall be located at least 100 feet from any drinking water supply well; and

   c. Drainage shall be controlled to prevent recycled water from coming within 50 feet of a drinking water supply well;

9. When R-2 WATER is used, spray irrigation of landscape or crops shall be limited so that the outer periphery of the irrigated area is not within 500 feet of:

   a. A residence property; or

   b. A place where public exposure could be similar to that at a park, elementary school yard or athletic field;

10. The following precautions pertain to the use of R-2 Water only:

   a. There shall be no irrigation within a minimum of 100 feet of any drinking water supply well;

   b. The outer edge of the impoundment shall be located at least 300 feet from any drinking water supply well; and

   c. Drainage shall be controlled to prevent recycled water from coming within 100 feet of a drinking water supply well;

d. Spray irrigation shall be performed during periods beginning when the area is closed to the public and the public is absent from the area, and end at least one hour before the area is open to the public. Subsurface irrigation may be performed any time;

11. Whether the discharge is from a tank truck, sprinkler, or other device, or runoff, the application of R-2 WATER shall be controlled by complying with the following:

a. Creation of visible mist is minimized;

b. Direct, overspray, or runoff, is confined to the approved use area;

c. Direct, overspray, or runoff does not contact or enter a dwelling, food handling facility, passing vehicle, or a place where the public may be present;

d. Direct, overspray, or runoff does not contact a drinking fountain, a table, a chair, bench, barbecue area, a yard at a residence, or an area with frequent human contact; and

e. Direct, overspray, or runoff shall not be allowed to contact or enter a place where access and exposure to wetted surface, could be similar to that at a park, playground, or school yard;

14. Table 3-1 is an attempt to present in table form, many of the above mentioned suitable uses, class of recycled water and mode of application in a summary table. When using this summary table, one should check the written text in this section and in Section D "Precaution" for All Uses of Recycled Water for additional limitations associated with the use.

TABLE 3-1 SUMMARY OF SUITABLE USES FOR RECYCLED WATER

SUITABLE USES OF RECYCLED WATER	R1	R2	R3
IRRIGATION: (S)pray, (D)rip & Surface, S(U)bsurface, (A)LL=S D & U, Spray with (B)uffer, (N)ot allowed, /=or			
Golf course landscapes	A	U/B	N
Freeway and cemetery landscapes	A	A	N
Food crops where recycled water contacts the edible portion of the crop, including all root crops	A*	N	N
Parks, elementary schoolyards, athletic fields and landscapes around some residential property	A	U	N
Roadside and median landscapes	A	U/B	N

SUITABLE USES OF RECYCLED WATER	R1	R2	R3
Non-edible vegetation in areas with limited public exposure	A	AB	U
Sod farms	A	AB	N
Ornamental plants for commercial use	A	AB	N
Food crops above ground & not contacted by irrigation	A	U	N
Pastures for milking and other animals	A	U	N
Fodder, fiber, and seed crops not eaten by humans	A	AB	DU
Orchards and vineyards bearing food crops	A	D/U	DU
Orchards and vineyards not bearing food crops during irrigation	A	AB	DU
Timber and trees not bearing food crops	A	AB	DU
Food crops undergoing commercial pathogen destroying process before consumption	A	AB	DU
SUPPLY TO IMPOUNDMENTS: (A)llowed (N)ot allowed			
Restricted recreational impoundments	A	N	N
Basins at fish hatcheries	A	N	N
Landscape impoundments without decorative fountain	A	A	N
Landscape impoundments with decorative fountain	A	N	N
SUPPLY TO OTHER USES: (A)llowed (N)ot allowed			
Flushing toilets and urinals	A	N	N
Structural fire fighting	A	A	N
Nonstructural fire fighting	A	A	N
Commercial and public laundries	A	N	N
Cooling saws while cutting pavement	A	N	N
Decorative fountains	A	N	N
Washing yards, lots and sidewalks	A	N	N
Flushing sanitary sewers	A	A	N
High pressure water blasting to clean surfaces	A	N	N
Industrial Process without exposure of workers	A	A	N
Industrial Process with exposure of workers	A	N	N
Cooling or air conditioning system without tower, evaporative	A	A	N

SUITABLE USES OF RECYCLED WATER	R1	R2	R3
condenser, spraying, or other features that emit vapor or droplets			
Cooling or air conditioning system with tower, evaporative condenser, spraying, or other features that emit vapor or droplets	A	N	N
Industrial boiler feed	A	A	N
Water jetting for consolidation of backfill material around potable water piping during water shortages	A	N	N
Water jetting for consolidation of backfill material around piping for recycled water, sewage, storm drainage, and gas; and electrical conduits	A	A	N
Washing aggregate and making concrete	A	A	N
Dampening roads and other surfaces for dust control	A	A	N
Dampening brushes and street surfaces in street sweeping	A	A	N

*Allowed under the following conditions:

The turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes. The UV disinfection unit must conform to Appendix K: UV Disinfection Guidelines for R-1 Water.

IV TREATMENT DESIGN PARAMETERS

D. FILTRATION

5. Filtration is not required for facilities intended to produce R-2 and R-3 Waters. However, new R-2 facilities constructed after May 30, 2002, will be required to install a continuous recording turbidimeter at a point after the secondary treatment. Continuous monitoring of the turbidity will be required.

E. DISINFECTION

In Hawaii, wastewater effluent is most commonly disinfected by chlorine. However, chlorine is known to have serious toxic effects on aquatic life following discharge of chlorinated effluent to surface waters. In addition, chlorine can react with organics contained in wastewater to form various chlorinated hydrocarbons, such as trihalomethanes. Chloroform ($CHCl_3$), for example is a known animal carcinogen and a suspected human carcinogen. Chlorine gas is also highly volatile and deadly. The transportation, handling, and use of chlorine gas require a number of costly safety precautions. Therefore, DOH encourages the use of other disinfection processes and agents that can satisfy the effluent requirements.

1. Disinfection by means of chlorination:

b. Level 2 Chlorination which meets the requirements of disinfection for R-2 Water and is exposed to chlorine in a well-baffled contact basin or pipeline that provides:

(1) A chlorine contact time and residual, either or both of which differ from that cited in paragraph (2) below, that have been shown to the satisfaction of DOH to reliably reduce the concentration of fecal coliform bacteria so that at some location in the treatment process the median number of fecal coliform bacteria in the effluent, as determined by approved laboratory methods, does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of fecal coliform bacteria does not exceed 200 per 100 milliliters in more than one sample in any 30-day period; or

(2) A theoretical chlorine contact time of 15 minutes or more and an actual modal contact time of 10 minutes of more throughout which the chlorine residual is 0.5 mg/l or greater, and the median number of fecal coliform bacteria in the effluent, as determined by approved laboratory methods, does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of fecal coliform bacteria does not exceed 200 per 100 milliliters in more than one sample in any 30-day period; and

(3) Automatic control of chlorine dosage and automatic, continuous measuring and recording of chlorine residual shall be provided. The chlorination facilities shall have adequate capacity to maintain a residual of 2 mg/l.

c. The following are minimum design parameters for all levels of chlorination:

(1) A high-energy rapid mix of chlorine should be provided at the point of application;

(2) Standby equipment of sufficient capacity should be available to replace the largest unit during shutdowns. Spare parts should be available for all disinfection equipment to replace parts which are subject to wear and breakage; and

(3) A high-energy rapid mix of chlorine should be provided at the point of application;

K. STORAGE IMPOUNDMENTS

The reuse system shall include adequate storage impoundment(s) or a backup disposal system to prevent any overflows or discharges from the system when the irrigation system is not in operation or when wastewater effluent quantities exceed the irrigation requirements.

2. The time period of 20 days related to storage is subject to reduction, expansion, or elimination if the project proponent demonstrates to the satisfaction of the DOH that another

time period is adequate or that less or no storage is needed. The record should be at least a 30-year period (if available) or statistically adjusted to a 30-year period (See example in Appendix H).

3. The design and operation of system storage capacity shall be sufficient to assure the retention of the recycled water under adverse weather conditions, harvesting conditions, maintenance of irrigation equipment, or other conditions which preclude reuse; and

4. The control of public access is left to the discretion of the owner. However, signs shall be posted that are consistent with the Public Education Plan of these guidelines.

L. EMERGENCY BACKUP SYSTEMS

Recycled water produced at the treatment facility that fails to meet the filtered effluent and disinfection criteria established in these guidelines shall not be discharged into the reuse system storage or to the reuse system. Such substandard recycled water (reject water) shall be either stored for subsequent additional treatment or shall be discharged to another reuse system requiring lower levels of treatment or to an effluent disposal conforming with Title 11 Chapter 62 Sections 11-62-25 & 26 and approved by DOH.

1. Emergency system storage shall not be required where another approved alternate reuse area is incorporated into the system design to ensure continuous facility operation in accordance with these guidelines. The emergency storage shall have sufficient capacity to ensure the retention of recycled water of unacceptable quality. At a minimum, this capacity shall be the volume equal to one day's flow at the average daily design flow of the reclamation facility, or the average daily design flow of the approved alternate reuse area whichever is less.

2. Emergency system storage shall not be required where an alternate effluent disposal system has been approved by DOH. Effluent disposal shall conform to Title 11 Chapter 62 Sections 11-62-25 & 26.

5. Automatically actuated emergency storage or disposal provisions and diversion to an approved alternate reuse area by DOH for emergency reuse is required and shall include all necessary sensors, instruments, valves, and other devices to enable fully automatic diversion of untreated or partially treated wastewater to approved emergency storage or disposal in the event of treatment process failure or violation of operational parameters, and a manual reset to prevent automatic restart until the problem is corrected.

V. DESIGN PARAMETERS FOR THE DISTRIBUTION OF RECYCLED WATER

The provisions of this section shall be complied with when any recycled water is used. The information in this Chapter is based on the "Guidelines for the Distribution of Nonpotable Water" which were prepared and published by the California-Nevada Section, American Water Works Association [43]. For clarification, the distribution system will be delineated into two segments.

The term transmission lines will be used for the piping from the treatment facility to the approved use area, and terminate after the meter which will be addressed in Section A. "Transmission Lines". The reuse distribution system on the site of the approved use area will be addressed in Section C. "On-site Distribution System".

A. TRANSMISSION LINES

This section is intended to provide criteria for protection against the misuse of transmission facilities. Cross-connection control is needed to prevent a nonpotable main from mistakenly being connected to a potable water system. Therefore, the location, depth, mode of identification, and type of aboveground appurtenances such as air/vac assemblies, and drain assemblies are essential in order to avoid cross-connections or inappropriate uses.

1. Pressure requirements should be based on system design and practice. In any case, minimum pressure at the user's meter should be maintained at the peak demand hour. It is desirable that a pressure differential of 10 psi or greater be maintained with the potable water supply having the higher pressure.

2. Horizontal and vertical clearances between potable water and other utilities, namely recycled water lines shall conform with the "Water System Standards" Department of Water, County of Kauai; Board of Water Supply, City and County of Honolulu; Department of Water Supply, County of Maui; Department of Water Supply, County of Hawaii; Volume 1 [26]. Furthermore, the minimum easement or right-of-way widths, and minimum cover and requirements for non-potable shall also conform to this reference.

3. All new buried transmission piping in the recycled water system, including service lines, valves, and other appurtenances shall both be colored purple, suggested color Pantone 522 or equal, and embossed or be integrally stamped/marked "CAUTION: RECYCLED WATER-DO NOT DRINK," or be installed with a purple identification tape, or a purple polyethylene wrap, suggested color index 77742 violet #16, Pantone 512 or equal.

4. Existing potable or nonpotable water lines that are being converted to recycled use shall first be accurately located and tested in coordination with DOH. If required, the necessary actions to bring the water line and appurtenances into compliance with regulatory standards shall be taken. If the existing lines meet the approval of the water supplier and DOH, the lines shall be approved for recycled water. If verification of the existing lines is not possible, the lines shall be uncovered, inspected and identified prior to use.

5. Identification tape shall be prepared with white or black printing on a purple field, suggested color index 77742 violet #16, Pantone 512 or equal, having the words "CAUTION: RECYCLED WATER - DO NOT DRINK." The overall width of the tape shall be at least three (3) inches. Identification tapes shall be installed on top of new transmission pipe longitudinally and shall be centered. The identification shall be continuous in their coverage on the pipe and shall be fastened to each pipe length no more than ten feet apart. Tape attached to sections of pipe before they are placed in the trench shall have flaps sufficient for continuous coverage. Other satisfactory means of securing the tape during backfill of the trench may be used if suitable for the work, as determined by the reclamation agency.

6. Valve boxes shall be the standard concrete or fiberglass box conforming with "Water System Standards" Volume 1 [26], and "Approved Material List and Standard Details for Water systems Construction", Volume 2 [27] with a special triangular, heavy-duty cover. All valve covers on offsite reclamation transmission water lines shall be of non-

interchangeable shape with potable water covers and with a recognizable inscription cast on the top surface "Recycled Water".

7. All above ground existing and new facilities shall be consistently color-coded purple, suggested color index 77742 violet #16, Pantone 512 or equal and marked to differentiate recycled water appurtenances from potable water or wastewater.

8. Either an in-line type or end-of-line type drain (blow-off) assembly shall be installed for removing water or sediment from the pipe. The line tap for the assembly shall be no closer than 18-inches to a valve, coupling, joint, or fitting unless it is at the end of the line. Since there are restrictions on runoff and ponding and there may be restrictions on infiltration, the method for disposal of the drain water shall be presented to DOH for approval.

B. PUMPING FACILITIES

Reclamation agencies with pumping facilities to transmit or distribute recycled water shall identify the type of water being conveyed, provide acceptable backflow protection, avoid release of recycled water and provide for proper drainage of the pump packing seal water.

1. All existing and new exposed and above ground piping, fittings, pumps, valves and other appurtenances shall be painted purple, suggested color index 77742 violet #16, Pantone 512 or equal. In addition, all piping shall be identified using an acceptable means of labeling reading "CAUTION: RECYCLED WATER-DO NOT DRINK." In a fenced pump station area, at least one sign shall be posted on the fence which conforms with the Public Education Plan in Chapter VIII of these guidelines.

2. Any potable water used as seal water for nonpotable water pump seals should be adequately protected from backflow.

3. The design of recycled water pump stations shall either conform with the reclamation agencies standards or Chapter 30 "Design Standards" of the Division of Wastewater Management Volume 1, [24].

C. ON-SITE DISTRIBUTION SYSTEM

Reclamation water distribution systems may require special accessories. Because of suspended matter which may accumulate from open storage or other sources, water strainers may be required before any meter or other mechanical type of device such as a pressure-reducing valve. Since irrigation operations are frequently at night, automatic electronic controllers should be used on-site. Backflow prevention is required when a nonpotable water system shares a use area with a potable system. This must be accomplished with the approval by DOH or the potable water purveyor. Facility identification is as important as the separation consideration discussed earlier. Pipelines, equipment and irrigated areas shall be clearly identified.

1. Depending on the quality of the recycled water and the type of storage utilized, strainers may be required at the consumer's meter. Strainers can range in mesh size from 20 to 325. A mesh of 20 to 80 is normally adequate. An analysis of potential debris will aid in

prescribing the optimum size. In order to reduce maintenance, material that will not plug on site irrigation nozzles should normally be allowed to pass. Strainers of the following types are generally satisfactory:

a. Wye strainers: Not recommended for below-ground (in vaults) installations;

b. Basket strainers: Suitable for above or below-ground (in vaults) installations; and

c. Filter strainers: Normally used above ground on drip irrigation systems.

3. Controllers are used to automatically open and close on-site distribution valves.

VIII. ENGINEERING REPORTS AND SUBMITTALS FOR WATER REUSE PROJECTS

The reports shall contain sufficient information to assure the DOH that the degree of treatment and reliability is commensurate with the proposed use, and that the distribution and use of the recycled water will not create a health hazard or nuisance.

A. Basis of Design Report for a Water Reuse Project

B. Engineering Design Report for a Water Reuse Project

C. Construction Plans for a Water Reuse Project

The reports and plans shall be prepared and stamped by a qualified engineer registered in the State of Hawaii and experienced in the field of irrigation systems. The report shall clearly indicate the means for compliance with the rules in Title 11 Chapter 62 and with these guidelines. The full Basis of Design and Engineering Reports may be waived for smaller reuse projects such as dust control and landscape and irrigation areas less than five acres, on the approval of DOH. A simplified application form meeting the requirements of HAR 11-62 and the provisions of the reuse guidelines can be submitted to DOH in lieu of an engineering report.

A. BASIS OF DESIGN REPORT FOR A WATER REUSE PROJECT

For all reclamation projects, the data specified below shall be presented in the report. (Not included in this Appendix.) The report shall present descriptions of new or existing reuse areas, and existing and/or new distribution systems. The design should conform with the Guidelines for the Treatment and Use of Recycled Water. The necessity of any proposed deviation from the guidelines must be discussed in the report.

B. ENGINEERING DESIGN REPORT
FOR A WATER REUSE PROJECT

1. The objective of the Irrigation Plan is to delineate Best Management_Practices methods and controls to be used in the irrigation system to mitigate runoff or ponding. The owner/developer and all subsequent owners shall establish an irrigation plan and system which shall be presented to the DOH for its approval.

2. The objective of the Management Reuse Plan is to establish and delineate the responsibilities of operation and maintenance of the reuse system. If the use of recycled water becomes the choice for this project, then the owner/developer and all subsequent owners shall develop and adhere to a Management Reuse Plan which shall address at a minimum, the following items:

    a. The procedures, restrictions, and other requirements that are to be followed by the distributor and/or user must be described. The requirements and restrictions shall be codified into a set of rules and regulations. The "Rules and Regulations" shall be developed in accordance with Water Reclamation Guidelines. The procedures and restrictions shall include measures to be used to protect the public health, prevent cross-connections and address the appropriate precautions presented in Section D of Chapter III. The plan shall present a schedule for the adoption of enforceable procedures and restrictions to cover all the distributions systems and proposed use areas, and it shall identify the organization or organizations that would adopt them.

        (1) The plan shall also provide operation criteria for irrigation which encompasses the following:

            (a) The rationale for how to schedule irrigation;

            (b) How to tell when to stop irrigation;

            (c) How many fields can or should be irrigated at the same time;

            (d) Which fields should be irrigated first, second, etc.;

            (e) Sequence to follow in starting the irrigation system;

            (f) Sequence to follow in stopping the irrigation system; and

            (g) How to control flow and pressure.

        (2) Contingency Plan. The report shall identify the actions and precautions to be taken to protect public health in the event of a non-approved use. Notification protocol of the appropriate regulatory agencies and the exposed public as required shall be included in the plan. The plan must identify these non-approved uses and appropriate action to be taken, e.g., overspray, runoff of recycled water off the property, ponding of recycled water on the property (due to pipe breakage).

(6) Inspection, supervision and employee training shall be provided by the user to assure proper operation of the recycled water system. The user shall maintain records of inspection and training.

(7) The report shall outline staffing and their assignments and responsibilities and provide maintenance procedures and frequency.

(8) The user shall maintain as-built plans of the approved use area showing all buildings, reclamation facilities, wastewater collection systems, and potable water systems and recycled water systems. Plans shall be updated as modifications are made.

b. A recycled water User Supervisor shall be appointed by the user. The user shall include in this submittal the following information regarding the individual designated as the User Supervisor: name, address, and telephone number at which this individual or designated representative can receive messages during "off hours." The user is to notify the reclamation agency of a change in designation of the User Supervisor.

The User Supervisor should be aware of the entire system within his or her responsibility and of all applicable conditions of recycled water use. The User Supervisor shall be responsible for installation, operation, and maintenance of the recycled system, prevention of potential hazards, implementing these guidelines, and coordination with the cross-connection control program of the water purveyor or DOH.

3. The objective of a <u>Public Education plan</u> is to inform persons likely to come in contact with reclamation water where recycled water is in use.

4. An Employee Training Plan shall be prepared which encompasses the following topics:

a. The following provisions shall be made for workers who handle R-1 and R-2 Water or may be exposed to it.

(1) Workers shall be notified that recycled water is in use. Notification shall include the posting of conspicuous informational signs with wording of sufficient size to be clearly read at the work place, with language presented in paragraph (1) of the Public Education Plan. Where a worker's primary language is not English, this message will be provided to the worker in a form he can understand.

(2) Workers shall be informed orally and in writing that recycled water is not suitable for ingesting and that drinking recycled water may result in potential illness.

(3) Potable water shall be supplied for workers for drinking and washing hands and face. Where bottled water is provided, the water shall be in separate,

boldly labeled, contamination-proof containers protected from recycled water and dust.

c. Employee Training. The plan shall describe the training that the employees will receive to ensure compliance with the Water Reclamation Guidelines. The plan shall identify the entity that will provide the training and the frequency of the training.

5. Vector Control Plan. The following criteria are based on knowledge of mosquito ecology. It is important that the Vector Control Branch of DOH be notified and consulted about impending reuse projects. Coordination and cooperation is vital to avoid creation of unnecessary conditions conductive to mosquito production. Certain projects may require a contractual arrangement between the owner and the local mosquito control contractors. This contract should provide for ongoing surveillance and for control measures should these become necessary.

6. Monitoring System Construction Report (MSCR) shall conform with the guidelines in Appendix F.

APPENDIX F

TANK EFFLUENT PUMP STATION TOTAL DYNAMIC HEAD (TDH) CALCULATIONS

HC & S Irrigation Reuse - TDH Calculations
ALTERNATIVE 1 - Single WWPS @ 2050 GPM with 16" FM for Tank Effluent Pump Station

Elevations:

New 1.0 MG Storage Tank		
Finish Floor Elevation =	8.0	feet
Maximum Water Depth =	22	feet
O.F. Elevation =	30.0	feet
TE-Booster Pump On Elevation =	11.0	feet
HC&S Pond Elevation =	173	feet (from USGS map, 177 feet per Google Earth)
Static Head =	162.0	feet

Pipe Lengths:

New 16" PVC FM (1.0 MG Tank to old MLP Cannery) =	7,600	feet
Minor Losses	7%	
Equivalent Length (rounded) =	**8,100**	**feet**
Exist. Dual 10" PVC FM =	9,000	feet
Minor Losses	7%	
Equivalent Length (rounded) =	**9,600**	**feet**
Exist. 15" PVC Force Main	11,400	feet
Minor Losses	7%	
Equivalent Length (rounded) =	**12,200**	**feet**

Flows:

Average Effluent Production Available for Irrigation =	3	mgd
Maximum Hourly Effluent Production (1.1xAverage) =	3.3	mgd
Pump Capacity =	**2050**	**gpm**

TDH:

Friction l($10.44 / C^{1.852}$)*($Qgpm^{1.852} / Din^{4.8655}$)

Pipeline	Q (gpm)	C	D (in)	Inside D[1] (in)	VEL. (fps)	hf ft/1000'	L (FT)	HL (FT)	STATIC HEAD (FT)	TDH (FT)	TDH (PSI)
New 16" PVC	2,050	140	16	15.3	3.58	2.59	8,100	20.98			
Exist. Dual 10" HDPE	1,000	140	10	9.667	4.37	6.40	9,600	61.43			
Exist. 15" PVC	2,050	140	15	14.3	4.09	3.60	12,200	43.90			
Total								126.32	162.0	**288**	**125**

[1] 16" PVC - ID based on JMM Big Blue C905 DR 21 Pipe, Class 200.
10" PVC - ID based on JM Eagle IPS Pressure RingTite Pipe, Class 160.
15" PVC - ID based on JMM Eagle Irrigation P.I.P. pipe, DR 32.5, Class 125.

HC & S Irrigation Reuse - Booster Pump Station TDH Calculations
ALTERNATIVE 2 - Two WWPSs @ 2050 GPM with 16" FM for Tank Effluent Pump Station

Elevations:

New 1.0 MG Storage Tank
- Finish Floor Elevation = 8.0 feet
- Maximum Water Depth = 22 feet
- O.F. Elevation = 30.0 feet

TE-Booster Pump On Elevation = 11.0 feet
Intermediate BPS Elevation = 85.0 feet
Static Head 1 (TE-BPS) = 74.0 feet

HC&S Pond Elevation = 173 feet (from USGS map, 177 feet per Google Earth)
Static Head 2 (I-BPS) = 88.0 feet

Pipe Lengths:

New 16" PVC FM (1.0 MG Tank to old MLP Cannery) = 7,600 feet
- Minor Losses 7%
- Equivalent Length (rounded) = **8,100 feet**

Exist. Dual 10" PVC FM = 9,000 feet
- Minor Losses 7%
- Equivalent Length (rounded) = **9,600 feet**

Exist. 15" PVC Force Main 11,400 feet
- Minor Losses 7%
- Equivalent Length (rounded) = **12,200 feet**

Flows:

Average Effluent Production Available for Irrigation = 3 mgd
Maximum Hourly Effluent Production (1.1xAverage) = 3.3 mgd
Pump Capacity = **2050 gpm**

TDH:

Intermediate WWPS at end of Exist. Dual 10" PVC FM

Friction I(10.44 / $C^{1.852}$)*($Qgpm^{1.852}$ / $Din^{4.8655}$)

Pipeline	Q (gpm)	C	D (in)	Inside D[1] (in)	VEL. (fps)	hf ft/1000'	L (FT)	HL (FT)	STATIC HEAD (FT)	TDH (FT)	TDH (psi)
TE-BPS											
New 16" PVC	2,050	140	16	15.3	3.58	2.59	8,100	20.98			
Exist. Dual 10" PVC	1,000	140	10	9.667	4.37	6.40	9,600	61.43			
Total								82.41	74.0	156	68
I-BPS											
Exist. 15" PVC	2,050	140	15	14.3	4.09	3.60	12,200	43.90			
Total								43.90	88.0	132	57

[1] 16" PVC - ID based on JM Eagle Big Blue C905 DR 21 Pipe, Class 200.
10" PVC - ID based on JM Eagle IPS Pressure RingTite Pipe, Class 160.
15" PVC - ID based on JMM Eagle Irrigation P.I.P. pipe, DR 32.5, Class 125.

COMMISSION ON WATER RESOURCE MANAGEMENT

OF THE STATE OF HAWAII

IAO GROUND WATER MANAGEMENT AREA HIGH-LEVEL SOURCE WATER USE WUPAS AND PETITION TO AMEND INTERIM INSTREAM FLOW STANDARDS OF WAIHEE, WAIEHU, IAO, & WAIKAPU STREAMS CONTESTED CASE HEARING & COMPLAINT C04-31 REGARDING WASTE OF SURFACE WATER, WAILUKU MAUI CONTESTED CASE HEARING	Case No. CCH-MA-06-01 CERTIFICATE OF SERVICE

CERTIFICATE OF SERVICE

The undersigned hereby certifies that, on this date, a true and correct copy of the foregoing document was duly served on the following parties by U.S. Mail:

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