Exhibit E

Irrigation Supply For the Kapa'a Highlands Agricultural Subdivision
Water Master Plan

TNWRE
Tom Nance Water Resource Engineering

No. of pages: 8
Email: gallen@harbormail.net

Original ☑ will ☐ will not be mailed to you.

October 27, 2006
06-281 (05-41)

MEMORANDUM

TO: Greg Allen

FROM: Tom Nance

SUBJECT: Irrigation Supply for the Kapaa Highlands Agricultural Subdivision

Introduction

This memo report assesses the feasibility of developing an onsite well (or wells) to provide the necessary irrigation supply for the Kapaa Highlands Agricultural Subdivision. The total area of the project is 163 acres. Wagner Engineering Services, Inc. has determined that up to 113 acres of the site is suitable for agricultural use (Figure 1). The Kauai Department of Water (DOW) standards require an average supply for irrigation for 2500 GPD/acre. For 113 acres, this translates to a year-round average of 0.283 MGD. Applying a maximum seasonal use factor of 1.5 results in a required summertime supply capability of 0.424 MGD (equivalent to 295 GPM operating continuously).

Results of an Onsite Exploratory Borehole

To investigate the possibility of providing the irrigation supply with an onsite well or wells, an exploratory borehole was drilled and pump tested. The location of this exploratory borehole is shown on Figures 1 and 2. Ground elevation at the well site is 25 feet. It was drilled to a depth of 260 feet or 235 feet below sea level. During the course of drilling, two separate aquifers were encountered. The upper aquifer has a static water level of about 19 feet above sea level (MSL) and it extends to a depth of about 80 feet (ie. to 55 feet below sea level). It has very limited yield (less than 30 GPM) as it is essentially a collection of water in the soil mantle perched on poorly permeable Koloa lavas beneath it.

The strata between 80- and 210-foot depth are poorly permeable and function as an aquiclude separating the upper and lower aquifers. The lower aquifer, which starts at 210-foot depth and extends below the 260-foot depth of the exploratory borehole, has a static water level about 13 feet (MSL). This lower aquifer is quite productive.

A pump test was run at my direction to define the potential yield and quality of water from the lower aquifer. Using a combination of casing and grout, water from the upper aquifer was sealed off for this test. Results of the 12-hour test conducted on October 19, 2006 are presented on Figures 3, 4, and 5. A series of flowrate steps were run initially to define hydraulic performance (Figure 3). Using a curve fitting technique, these results define expectable drawdown for a range of pumping rates (Figure 4). For example, at 500 GPM, the drawdown would be 7.5 feet.

The remainder of the 12-hour test was run at 550 GPM to see if any salinity change would occur. These results are shown on Figure 5 and Table 1. The salinity (as measured by conductivity) actually decreased for the first two hours and stabilized after that. Chlorides of just 53 MG/L demonstrate that the water is quite fresh and obviously suitable for irrigation use.

Conclusions and Recommendations Regarding the Irrigation Supply

1. Results of the exploratory borehole demonstrate that an adequate irrigation supply for the Agricultural Subdivision can be developed from a single onsite well located in the near proximity of the exploratory borehole.

2. The finished dimensions of the production well should be based on the following:

   a. A 17-inch borehole should be drilled to 300-foot depth.

   b. 220 feet of 8-inch solid casing and 80 feet of 8-inch perforated casing should be installed in the borehole.

   c. The annular space from 220 feet to the ground surface should be sealed with cement grout.

   d. Final pump testing at rates up to 550 GPM should be conducted to confirm the well's yield.

3. A companion report by ITC Water Management describes the delivery components of the irrigation system based on the following:

   a. A 7.5 horsepower, 450 GPM submersible pump and motor should be installed in the well at a depth of 30 to 40 feet.

   b. The well pump should deliver water to an adjacent storage tank of at least 30,000 gallons in size. Well pump cycles would be controlled by a level switch in the tank.

   c. An on-demand pump station of up to 600 GPM capacity should be installed next to the tank to draw water from the tank and deliver it to users in the agricultural subdivision.

Attachments

Specific Conductance and Chlorides of Samples
Collected During the 12-Hour Pump Test on October 19, 2006

Sample Time	Pumping Rate (GPM)	Specific Conductance (µS/cm @ 25° C.)	Chlorides (MG/L)
10:05	317	468	55
10:30	317	449	54
11:00	438	440	54
11:30	529	436	53
12:00	528	432	53
13:00	527	430	53
14:00	527	429	53
15:00	527	429	53
16:00	528	429	53
17:00	529	428	53
18:00	531	429	53
19:00	532	430	53
20:00	533	431	53
21:00	533	431	53
22:00	533	431	53

Notes:
1. Specific conductance measured in the TNWRE office using a HACH Sension5 meter calibrated with a 12.88 mS/cm standard.
2. Chlorides determined by mercuric nitrate titration in the TNWRE office. Samples were diluted 10 fold.

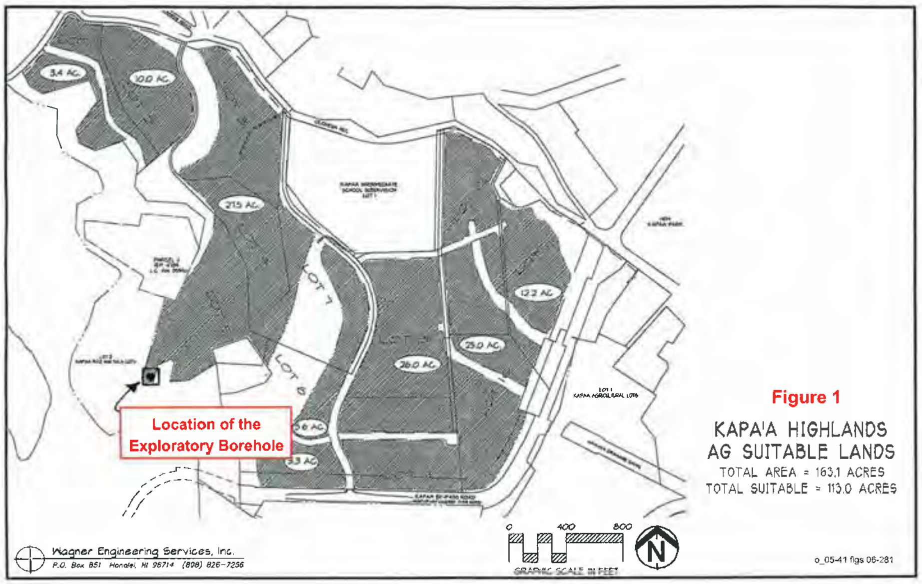

Figure 1

KAPA'A HIGHLANDS
AG SUITABLE LANDS

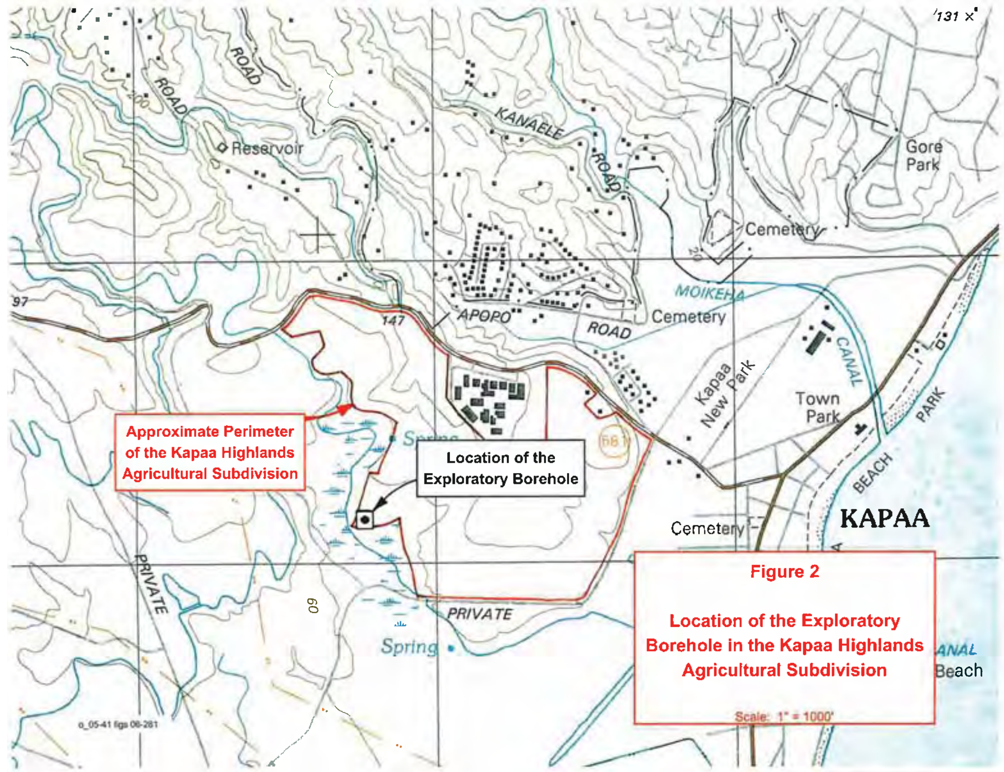

Figure 2

Location of the Exploratory
Borehole in the Kapaa Highlands
Agricultural Subdivision

Figure 3. Pumping Rate and Water Level During the 12-Hour Test

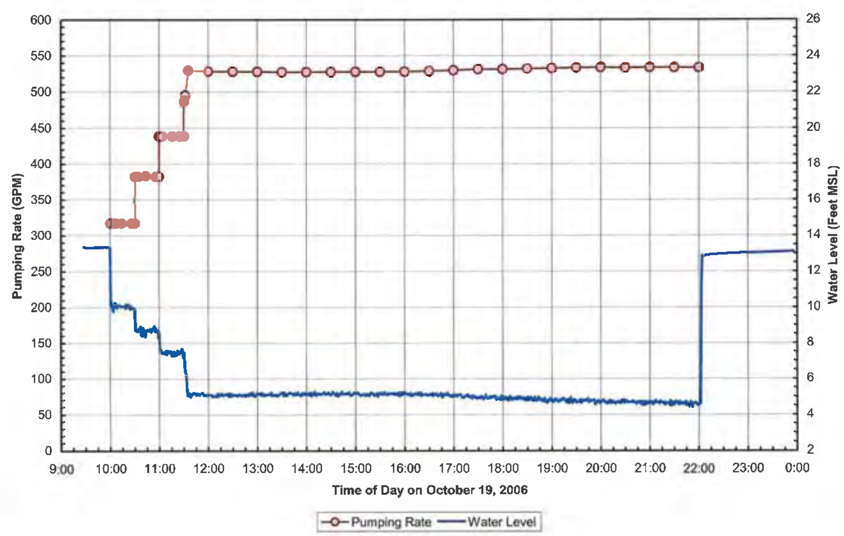

Figure 4. Hydraulic Performance of the Well Based on Step Test Data

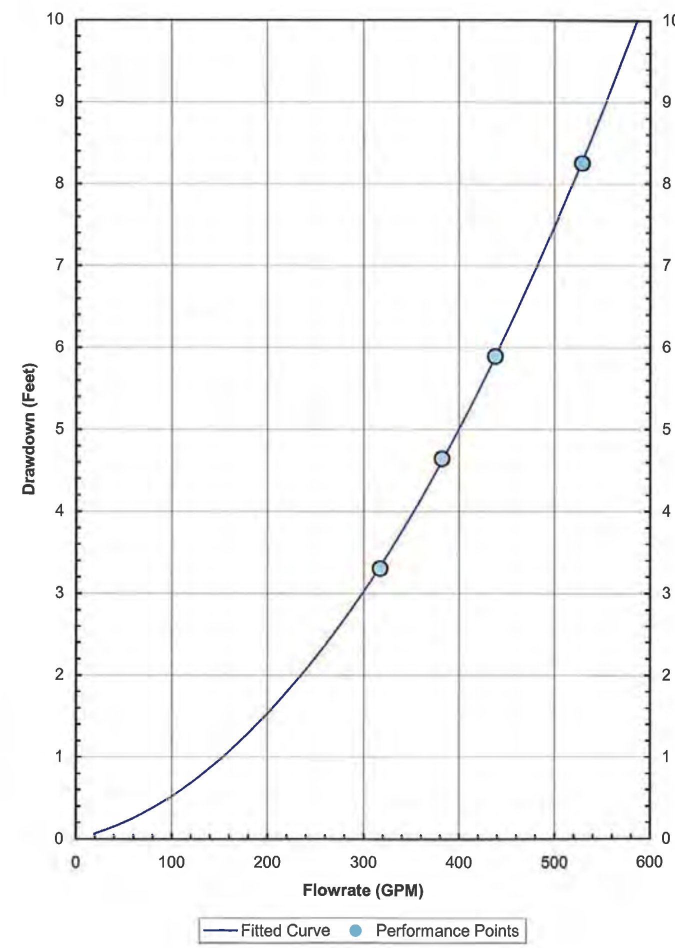

Figure 5. Pumped Water Conductivity through the 12-Hour Test

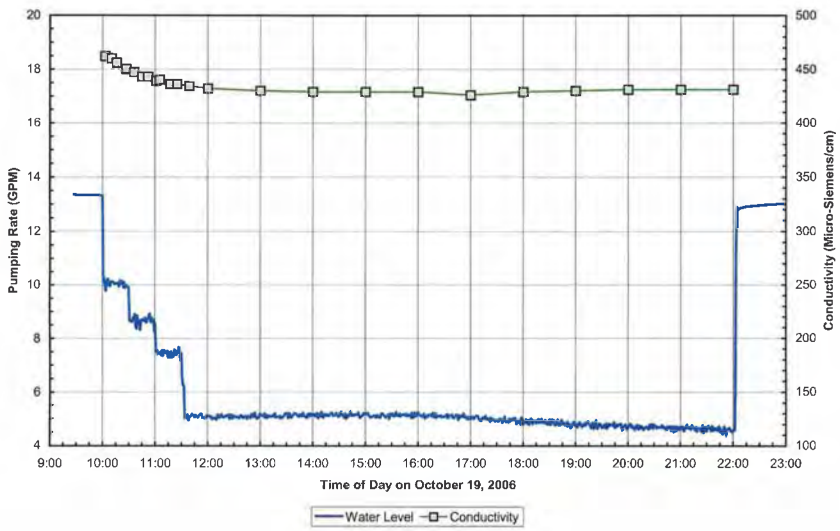

Exhibit E - Part 2

Private Water System

BELLES GRAHAM PROUDFOOT WILSON & CHUN, LLP

ATTORNEYS AT LAW

MICHAEL J. BELLES
MAX W.J. GRAHAM, III
DONALD H. WILSON
JONATHAN J. CHUN

Federal I.D. No. 99-0317663

WATUMULL PLAZA
4334 RICE STREET, SUITE 202
LIHUE, KAUAI, HAWAII 96766-1388

TELEPHONE NO: (808) 245-4705
FACSIMILE NO: (808) 245-3277
E-MAIL: mail@kauai-law.com

OF COUNSEL
DAVID W. PROUDFOOT

COUNSEL
LORNA A. NISHIMITSU

October 2, 2012

Mr. David R. Craddick
Manager & Chief Engineer
Department of Water
County of Kauai
P. O. Box 1706
Lihue, Kauai, Hawaii 96766

VIA EMAIL & HAND DELIVERY

Re: **Kapaa Highlands Subdivision (S-99-45)**
(fna Kūlana Kai/Kauai Highlands)
Subdivision Of Parcel 1 Being A Portion Of
Grant 5266 To Rufus P. Spalding Into Lots 1 To 18, Inclusive
Kapaa and Waipouli, Kauai, Hawaii
Kauai Tax Map Key No. (4) 4-3-003:001 (por.)
Owner: Allen Family LLC; Moloaa Bay Ventures, LLC; and The Three Stooges LLC

Dear Mr. Craddick:

I am writing to you on behalf of the above-identified applicants ("Applicants") in the Kapaa Highlands Subdivision matter ("Subdivision"). In lieu of obtaining water for the Subdivision from the public water system operated by the Department of Water ("Department"), the Applicants have decided to construct an on-site private water system ("PWS").

The PWS is described in an enclosed Memorandum dated September 12, 2012 prepared by Tom Nance of Tom Nance Water Resource Engineering ("Nance Report"). The essential design specifications are described below.

A. Private Water System.

1. The Applicants will construct a well ("Well") and two storage tanks ("Tanks") on-site.

2. The Well will be located along the south boundary of Lot 5, as shown in Figure 3 of the Nance Report.

3. The Storage Tanks will be located on the north boundary of Lot 3, as shown in Figure 3 of the Nance Report.

4. The Well design is shown on Figure 2 of the Nance Report. The Well will be twelve (12) inches in diameter and operated by two identical 100 gallons per minute ("GPM") pumps, each driven by 7.5 horsepower motors. The first pump will supply the needs of the Subdivision, which is 97,310 gallons per day ("GPD") maximum day use, and the second will serve as a standby pump.

5. Based on the water needs for 50 farm dwelling units, the total maximum day demand is 93,750 GPD. The two 50,000 gallon Tanks will be adequately sized to provide necessary storage plus fire flowrate protection. The Tanks will be lined with bolted steel with reinforced concrete base and passive cathodic protection (zinc anode rods).

6. The pipelines ("Pipelines") for the PWS will be sized to provide: fire flowrate with coincident maximum day demand and a minimum residual pressure of 20 psi (velocities not exceeding 10 fps); and peak flowrate with minimum residual pressure of 40 psi (maximum velocity in Pipelines of 6 fps). NSF-approved, high density polyethylene (HPDE), pipes will be used for the PWS. The Pipeline system is shown on Figure 3 of the Nance Report.

7. Pursuant to the Agricultural Master Plan submitted in this matter, the agricultural activities in the Subdivision will be limited to a goat raising operation ("Goat Project"). The Goat Project will require minimal water (at the most, 3,560 GPD), which will be supplied by the PWS.

8. The on-site Tank elevations will not provide adequate gravity pressure to meet the Department's delivery pressure requirements. Providing the necessary pressure would be done with parallel domestic and fire flowrate pumping systems with a generator to provide back power. These pump systems would provide up to 70 GPM for peak domestic use and 500 GPM for the fire flowrate condition. Both pumping systems would be sized to produce a total dynamic head of 110 feet, in effect creating a single, 270-foot service pressure zone across the entire project site.

B. Modification Of Requirements.

The Applicants are requesting the Department and/or the Board of Water Supply ("Water Board") to grant a modification from the Department's Water System Standards for the PWS as follows:

1. DOW Rule Part 3, Section XII, provides as follows:

"**SECTION XII – MODIFICATION OF REQUIREMENTS**

When conditions pertaining to any subdivision are such that the public may be properly served with water and with fire protection without full and strict compliance with these rules and regulations, or where the subdivision site or layout is such that the public interest will be adequately protected, such modification thereof as is reasonably necessary or expedient, and not contrary to law or the intent and purposes of these rules and regulations, may be made by the Department."

2. As part of the Subdivision in this case, the Applicants propose to have water for potable, fire, and agricultural uses for the Subdivision supplied by the PWS.

3. The PWS does not comply strictly with all of the Department's Water System Standards ("DOW Standards") which typically apply to the DOW's public water systems. These differences are set forth in the enclosed Comparison Of Kapaa Highlands PWS With DOW Water System Standards.

4. The Applicants are requesting the Department and/or the Water Board to find that the PWS: will properly serve the water and fire protection needs of the Subdivision without full and strict compliance with the DOW Standards; that, given the fact that the Subdivision will be served by the PWS, the public interest will be adequately protected by the PWS; that the differences between the PWS and the DOW Standards are, under all of the circumstances of this case, reasonably necessary and expedient; and that such differences are not contrary to the law or the intent or purposes of the DOW Rules.

Based on the above, the Applicants are requesting the Department and/or the Water Board to approve the proposed PWS for the Subdivision, together with the requested modifications. In the event this matter needs to be referred to the Water Board, then I am requesting that it be placed on the next available agenda of the Water Board. For these purposes, I have enclosed a Supporting Information For The Board Of Water Supply, County of Kauai in compliance with the Department's requirements for persons wishing to testify at Water Board Meetings.

Thank you very much for your consideration of this request.

Sincerely yours,

BELLES GRAHAM PROUDFOOT
WILSON & CHUN, LLP

Max W. J. Graham, Jr.

MWJG:jgm
Enclosures
cc: Mr. Greg Allen, Jr., w/encls. (via email only)
Andrea A. Suzuki, Esq., w/encls. (via email only)
Mr. William Eddy, DOW, w/encls. (via email only)
Mr. Gregg Fujikawa, DOW, w/encls. (via email only)
Mr. Dale A. Cua, Staff Planner, w/encls. (via email only)

TNWRE
Tom Nance Water
Resource Engineering

No. of pages: 7
Email: gallen@harbormall.net
mwg@kauai-law.com
greg@tnwre.com

Original ☑ will ☐ will not be mailed to you.

September 10, 2012
12-177 | 09-12

MEMORANDUM

To: Greg Allen

From: Tom Nance

Subject: Sizing and Layout of a Private Water System to Supply the Kapaa Highlands Project

Introduction

This memo and its attachments present the sizing and layout of major infrastructure elements of a private water system that would be developed to supply the Kapaa Highlands project. The basis of the water system sizing assumes the project would be developed in two phases. Phase 1 would consist of 16 residential units on five lots in an agricultural subdivision. Phase 2 would consist of an urban residential development comprised of 86 SF residential units, 683 MF residential units, and parks (3.1 ac.), church (0.8 ac.), commercial (0.4 ac.), roads (9.4 ac.), and unirrigated open space (14.3 ac.). In the event that land use entitlements are not obtained for the residential development, Phase 2 would consist of 34 residential units on seven lots in an agricultural subdivision.

Required Water Supply

Due to the size of the residential lots in the agricultural subdivision, which vary from 1.47 to 6.67 acres in size for the Phase 1 development, an allocation of 2000 GPD as the average demand per residential lot is recommended, a rate which is four times greater than the Kauai Department of Water (DOW) design standard for single family residential units. For the residential subdivision in Phase 2, use of DOW's design criteria is recommended. Based on these recommendations, Tables 1 and 2 are tabulations of the average and maximum day demands for the private water system. Maximum day demand is defined as 1.5 times the average demand, also in accord with DOW design standards.

Required Water System Capacities

Well Supply. DOW's design criterion for well pumping capacity is to provide the maximum day demand in a 24-hour pumping day with the largest well pump out of service. For Phase 1, this requirement amounts to 48,000 GPD, equivalent to 33 GPM. With the addition of the Phase 2 residential development, this requirement becomes 496,275 MGD, equivalent to 345 GPM. If Phase 2 was limited to the agricultural subdivision, the ultimate well supply requirement would be 150,000 GPD or 104 GPM.

A test well, identified as State No. 0419-05, was drilled and pump tested in October 2006. Over its 260-foot drilled depth, two aquifers were encountered. The upper aquifer can not provide a sufficient source of supply and it is also potentially subject to contamination due to its shallow depth. The lower and confined aquifer was reached at a depth of about 215 feet or 190 feet below sea level. Its piezometric head was about 13 feet above sea level or about 10 feet below ground. Pump testing showed that a properly designed well to exclusively tap this lower aquifer could develop up to 500 GPM of low salinity (chlorides of 55 MG/L), potable quality water. At its depth and overlying confining layers, it is not subject to contamination.

The low ground elevation (about 20 feet), high piezometric head (about 13 feet above sea level), and modest drawdown (3 feet or less at 350 GPM) provide the opportunity to develop one well configured with a pump sump that would enable two pumps to draw from the same well, thereby providing the necessary standby pumping capacity for a stand-alone system with a single well. The recommendation herein is to drill a new 12-inch well to 300-foot depth, complete it with a pump sump as shown on Figure 1, and outfit it with two, 25 horsepower, 350 GPM submersible pumps. Either of the 350 GPM pumps would provide the ultimate maximum demand requirement with the other providing full back-up capacity.

Reservoir Storage. With regard to the reservoir storage volume, DOW's two design criteria are appropriate for the private water system: (1) provide the maximum day demand with no credit for well inflow; and (2) provide the fire flowrate with coincident maximum day demand for the duration of the fire with the largest well pump out of service and the reservoir 3/4 full at the start of the fire. For the Phase 1 fire flowrate, DOW's standards require only 250 GPM for one hour. A stricter criterion of 500 GPM for two hours is used herein. Application of the two sizing criteria results in the required storage volumes tabulated below. In all cases, the maximum day sizing criterion governs.

Summary of Computed Required Reservoir Storage Volumes*

Design Criteria	Phase 1 Ag Subd.	Phase 2 Residential	Phased 2 Ag Subd.
(1) Maximum Day Demand (Gallons)	48,000	496,275	150,000
(2) Fire Flowrate			
• Fire Flowrate (GPM)	500	2000	500
• Fire Duration (Hours)	2	2	2
• Coincident Max. Demand (GPM)	33	345	104
• Well Inflow Credit (GPM)	350	350	350
• Required Storage Volume (Gallons)	29,280	319,200	40,640

*Phase 2 storage volumes include the Phase 1 requirement.

Based on the foregoing calculations, the recommended reservoir storage is as follows:

- For Phase 1, a 50,000-gallon storage tank would be installed.
- For the Phase 2 residential project, a second tank of 500,000-gallon capacity would be installed.
- In the event that Phase 2 consists of the 34 SF residential units in an agricultural subdivision, the second tank would be 100,000 gallons.
- All storage tanks would be lined and bolted steel with a concrete floor and passive cathodic protection.
- The tanks would be located at the project's highest elevation which is adjacent to residential Lot 7 in Phase 1. The Phase 1 and Phase 2 tanks would have identical floor and spillway elevations of 142 and 160 feet, respectively.
- Except at the project's lowest elevations, pumped delivery from the storage tanks will be necessary to provide adequate delivery pressures and fire flowrates. These pumping requirements are described in the section following.

Pumped Delivery for the Distribution System. DOW's design criteria for required delivery pressures are appropriate for this private water system. These are: (1) to provide a minimum of 40 psi residual pressure during the peak flowrate condition, with peak flowrate defined as three times the average demand; and (2) to provide a minimum 20 psi residual pressure at the critical hydrant during fire flowrate at that hydrant and coincident maximum day demand throughout the system.

The onsite storage reservoir elevations will not provide adequate gravity pressure to meet either of these criteria. In each development phase, this will require parallel domestic and fire flowrate pumping systems with a generator to provide back up power. For Phase 1, the pump systems would provide up to 70 GPM for peak domestic use and a 500 GPM fire pump. For the Phase 2 residential development, the domestic pumping capacity would be increased to 700 GPM and the fire pump to 2000 GPM. All pumping systems would be sized to produce a total dynamic head of 110 feet, in effect creating a single, 270-foot service pressure zone across the entire project site.

Water System Layout

Figure 2 illustrates all of the water system components described above with the assumption that Phase 2 would consist of the 769-unit residential development. By development phase, these would consist of:

Phase 1

- 12-inch, 300-foot deep well, pump sump, and two 350 GPM pumps in the pump sump located at the makai end of the Phase 1 development area.
- A dedicated 8-inch transmission pipeline from the well pumps to the storage reservoir.
- A 50,000-gallon storage tank.
- Parallel domestic and fire flowrate pump systems at the storage tank with backup generator power.
- A distribution pipeline loop consisting of 12-inch for the section that will also serve Phase 2 and 6-inch for the remainder of the loop.

Phase 2

- No change or additions to the well, well pumps, or transmission pipeline.
- Second storage tank of 500,000-gallon capacity.
- Substantial capacity increases for the parallel domestic and fire pumping systems and generator backup power.
- Distribution pipelines of 12-, 8-, and 6-inch size.

cc: Max Graham [Email Only]
greg@tnwre.com

Attachments

Table 1

Average and Maximum Day Demands for the
Phase 1 Agricultural Subdivision and Phase 2 Residential Development

Development Phase	Land Use	Design Criterion (GPD / Unit)	Average Demand (GPD)	Maximum Demand (GPD)
1	16 SF Residential	2,000	32,000	48,000
2	86 SF Residential	500	43,000	64,500
	683 MF Residential	350	239,050	358,575
	3.1 Ac. Parks	4,000	12,400	18,600
	0.8 Ac. Church	4,000	3,200	4,800
	0.4 Ac. Commercial	3,000	1,200	1,800
	Total for Phase 2		298,850	448,275
Total for Both Phases			330,850	496,275

Table 2

Average and Maximum Day Demands for Development of
Phases 1 and 2 as Agricultural Subdivisions

Development Phase	Land Use	Design Criterion (GPD / Unit)	Average Demand (GPD)	Maximum Demand (GPD)
1	16 SF Residential	2,000	32,000	48,000
2	34 SF Residential	2,000	68,000	102,000
Total for Both Phases			100,000	150,000

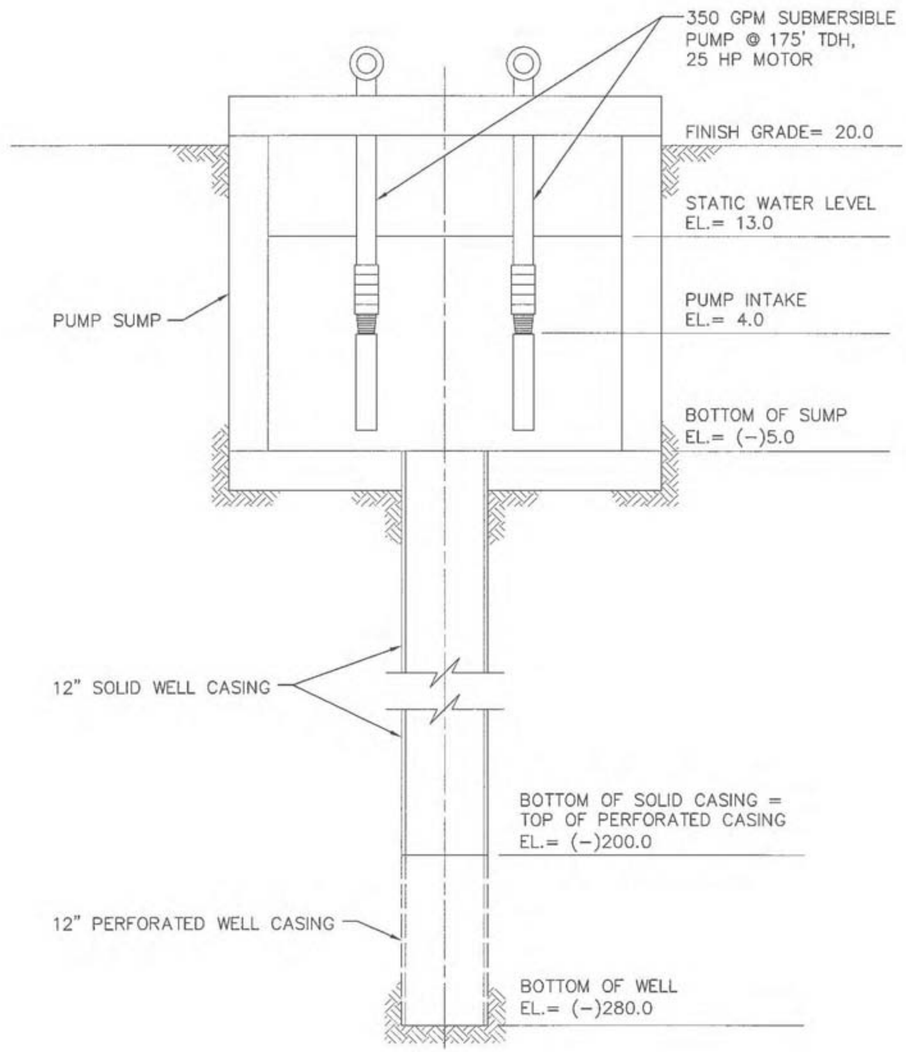

FIGURE 1
RECOMMENDED WELL DEVELOPMENT AND PUMP INSTALLATION
FOR THE KAPAA HIGHLANDS PROJECT
NOT TO SCALE

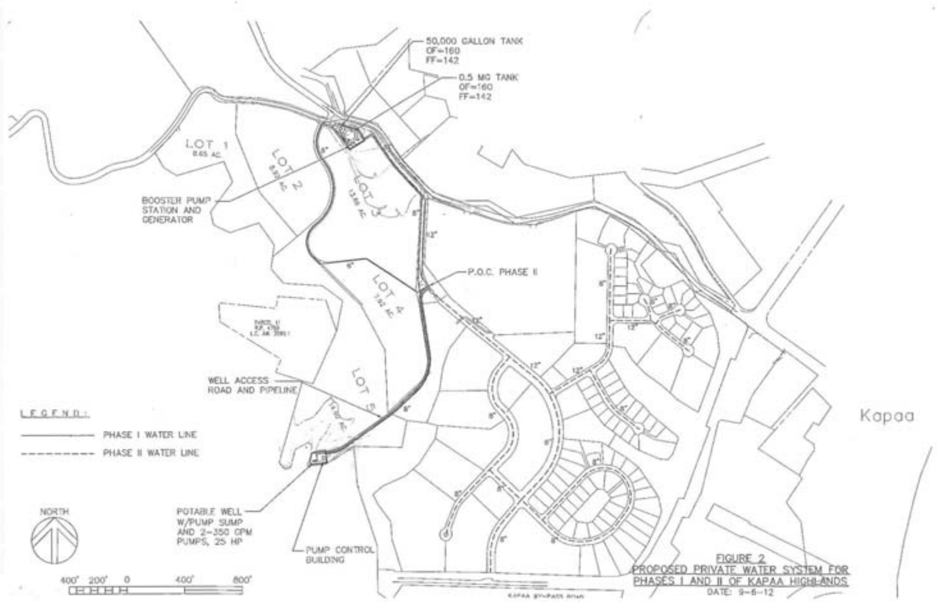

FIGURE 2
PROPOSED PRIVATE WATER SYSTEM FOR PHASES I AND II OF KAPAA HIGHLANDS
DATE: 9-6-12

TNWRE
Tom Nance Water
Resource Engineering

No. of pages: 7
Email: gallen@harbormall.net
mwg@kauai-law.com
greg@tnwre.com

Original ☑ will ☐ will not be mailed to you.

September 12, 2012
12-183 | 09-12

MEMORANDUM

To:	Greg Allen
From:	Tom Nance
Subject:	Basis of Design of the Private Water System for the Kapaa Highlands Agricultural Subdivision

Introduction

This memo and its attachments describe the basis of design for a private water system to serve the 12-lot Kapaa Highlands Agricultural Subdivision. Figure 1 depicts the 12-agricultural lots and the 50-half acre homesites that ultimately would be developed on the 12 lots. The water system would consist of: one 12-inch, 300-foot deep well outfitted with two 100 GPM pumps, one of which would provide back-up capacity; two side-by-side and identical 50,000-gallon storage reservoirs located next to Homesite 7, the highest elevation on the property; two parallel pumping systems to provide pressure and flowrates for peak and fire flowrate conditions; and 8- and 6-inch distribution pipelines.

As described herein, there are differences between the standards used for the private system's design and the standards of the Kauai Department of Water (DOW). These differences are noted and discussed as appropriate in the sections following.

Required Water Supply

The agricultural use in the subdivision will be for raising goats for which no specific water allocation is made. An average demand of 1250 GPD for each of the 50-half acre homesites is recommended, a use rate which is 2.5 times DOW's standard for single family residential units. The higher use rate is an appropriate allowance due to the larger than typical size of the homesites.

For the 50 homesites, the total average demand is 62,500 GPD. In conformance with DOW's standards, maximum day use is defined as 1.5 times the average demand. For the 50 homesites, the total maximum day demand is 93,750 GPD.

560 N. Nimitz Hwy. - Suite 213 • Honolulu, Hawaii 96817 • Phone: (808) 537-1141 • Fax: (808) 538-7757 • Email: tom@tnwre.com

Required Well Supply

Well Configuration. A test well, identified as State No. 0419-05, was drilled and pump tested at the makai end of the project site in October 2006. Over its 260-foot drilled depth, two aquifers were encountered. The upper aquifer can not provide a sufficient source of supply and it is also potentially subject to contamination due to its shallow depth. The lower and confined aquifer was reached at a depth of about 215 feet or 190 feet below sea level. Its piezometric head was about 13 feet above sea level or about 10 feet below ground. Pump testing showed that a properly designed well to exclusively tap this lower aquifer could develop up to 500 GPM of low salinity (chlorides of 55 MG/L), potable quality water. At its depth and due to the presence of the overlying and poorly permeable confining layers, this lower aquifer is not subject to contamination.

The low ground elevation (about 20 feet), high piezometric head (about 13 feet above sea level), and modest drawdown provide the opportunity to develop one well configured with a pump sump that would enable two pumps to draw from the same well, thereby providing the necessary standby pumping capacity for a stand-alone system with a single well. The recommendation herein is to drill a new 12-inch well to 300-foot depth and complete it with a pump sump and two pumps as shown on Figure 2. This will enable one pump to provide the required supply and the other pump to provide full back up capacity.

Required Well Pumping Capacity. DOW's design criteria of having the well pumping capacity capable of delivering the maximum day use in a 24-hour pumping day with the largest well pump out of service is adopted for the private water system. The project's 93,750 GPD maximum day use translates to a required well pump capacity of 65 GPM. The proposal herein is to install two identical 100 GPM pumps, each driven by 7.5 horsepower motors. Either pump would provide the required capacity with the other as standby.

Reservoir Storage

DOW's two reservoir storage sizing criteria are appropriate for the private water system. The first, to provide the maximum day use with no credit for well inflow, translates to a required storage volume of 93,750 gallons. The second is to provide the fire flowrate plus the coincident maximum day demand for the duration of the fire with the reservoir 3/4 full at the start of the fire. There is credit for well inflow with the largest well pump considered to be out of service.

For an agricultural subdivision, DOW standards require a fire flowrate of 250 GPM for one hour. A stricter standard of 500 GPM for two hours is adopted for the private water system. With one of the two 100 GPM well pumps on, this higher fire flowrate and longer duration translates to reservoir storage of 74,417 gallons (calculation below). The first criterion governs.

$$\frac{4}{3}(120\text{ min})\left(500 + \frac{93{,}750}{1{,}440} - 100\right) = 74{,}417\text{ gallons}$$

Proposed reservoir storage consists of two, side-by-side and identical 50,000-gallon tanks with 142- and 160-foot floor and spillway elevations, respectively. The storage tanks would be lined and bolted steel with reinforced concrete base and passive cathodic protection consisting of zinc anode rods suspended in the water. DOW's standards require storage tanks to be constructed of reinforced concrete. However, lined and bolted steel tanks have a successful operating history in Hawaii. With two side-by-side tanks, one can be taken offline when necessary for maintenance with no interruption of service to customers.

Pumping Systems for Peak and Fire Flowrate Design Conditions

DOW's design criteria for required delivery pressures are appropriate for this private water system. These are: (1) to provide a minimum of 40 psi residual pressure during the peak flowrate condition, with peak flowrate defined as three times the average demand; and (2) to provide a minimum 20 psi residual pressure at the critical hydrant during fire flowrate at that hydrant and coincident maximum day demand throughout the system.

The onsite storage reservoir elevations will not provide adequate gravity pressure to meet either of these delivery pressure requirements. Providing the necessary pressure would be done with parallel domestic and fire flowrate pumping systems with a generator to provide back up power. These pump systems would provide up to 70 GPM for peak domestic use and 500 GPM for the fire flowrate condition. Both pumping systems would be sized to produce a total dynamic head of 110 feet, in effect creating a single, 270-foot service pressure zone across the entire project site.

Distribution Pipelines

The design criteria used for pipeline sizing for the private system are equivalent to DOW's standards. Pipelines shall be sized to provide: (1) fire flowrate with coincident maximum day demand and a minimum residual pressure of 20 psi at the critical hydrant with velocities not exceeding 10 fps; and (2) peak flowrate with a minimum residual pressure of 40 psi and a maximum velocity in pipelines of 6 fps.

DOW's standards require pipelines to be of ductile iron or PVC, the latter conforming to ASTM C-900. However, NSF-approved, high density polyethylene (HPDE) pipes will be used for the private water system. SDR (pressure ratings) of the HDPE pipe will be selected so as not to exceed 80 percent of the recommended working pressure rating. Hazen-Williams "C" values of 130 will be used for all

September 12, 2012
12-183 | 09-12

HDPE pipes. This is less (ie. more conservative) than manufacturer's suggested values of 140 to 150 but greater than DOW's standards for ductile iron and PVC pipes.

Water System Layout

Figure 3 illustrates the water system components as described above. There would be a dedicated 6-inch pipeline from the well to the storage tanks. Distribution pipeline sizing, driven by the fire flowrate sizing criterion, would be 8- and 6-inch to the last hydrants and 4-inch beyond the last hydrants.

cc: Max Graham [Email Only]
greg@tnwre.com

Attachments

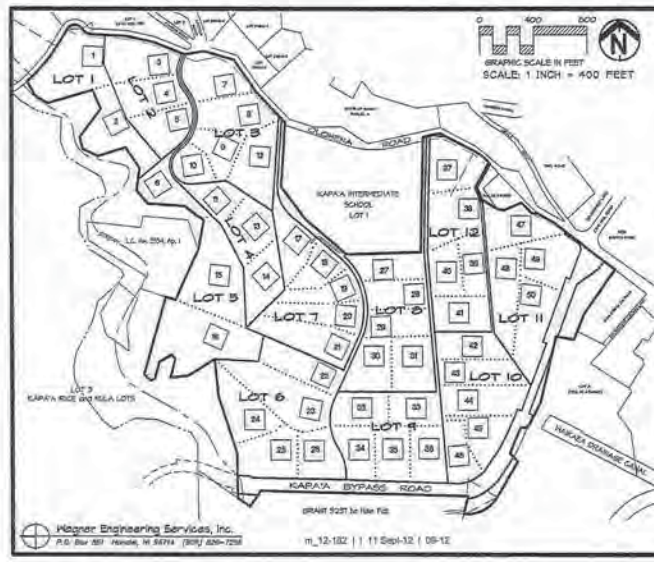

Figure 1
Kapaa Highlands
Agricultural Subdivision

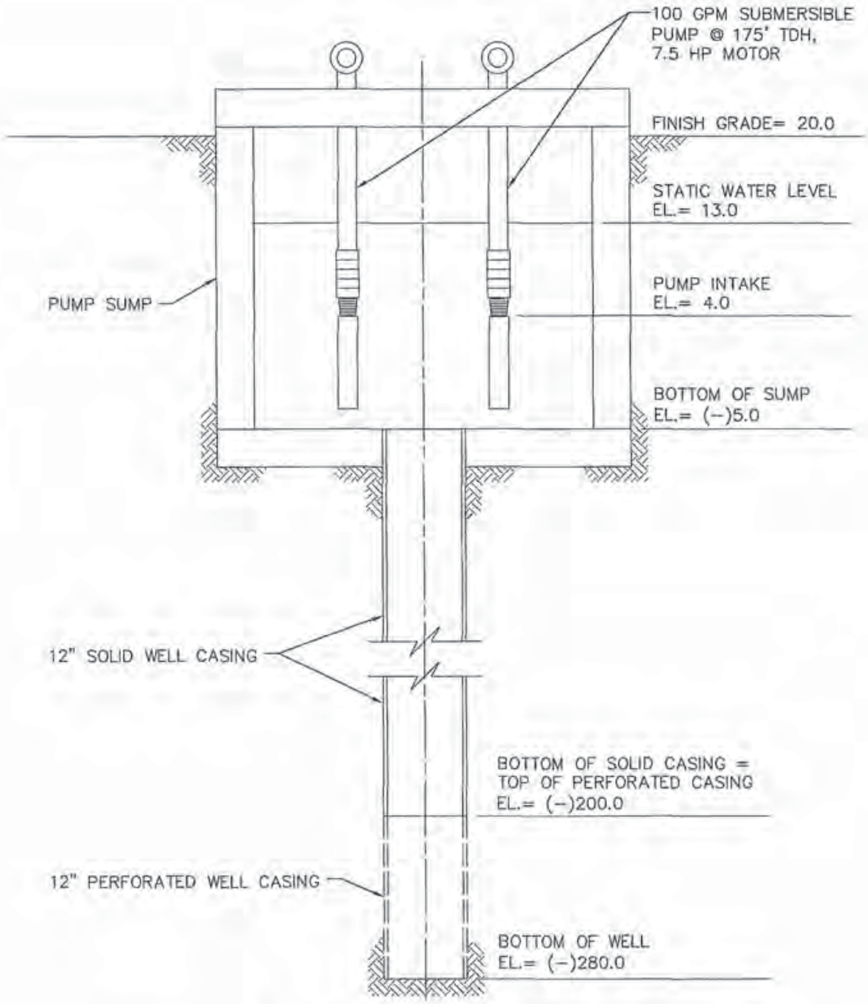

FIGURE 2
RECOMMENDED WELL DEVELOPMENT AND PUMP INSTALLATION FOR THE KAPAA HIGHLANDS AGRICULTURAL SUBDIVISION
NOT TO SCALE

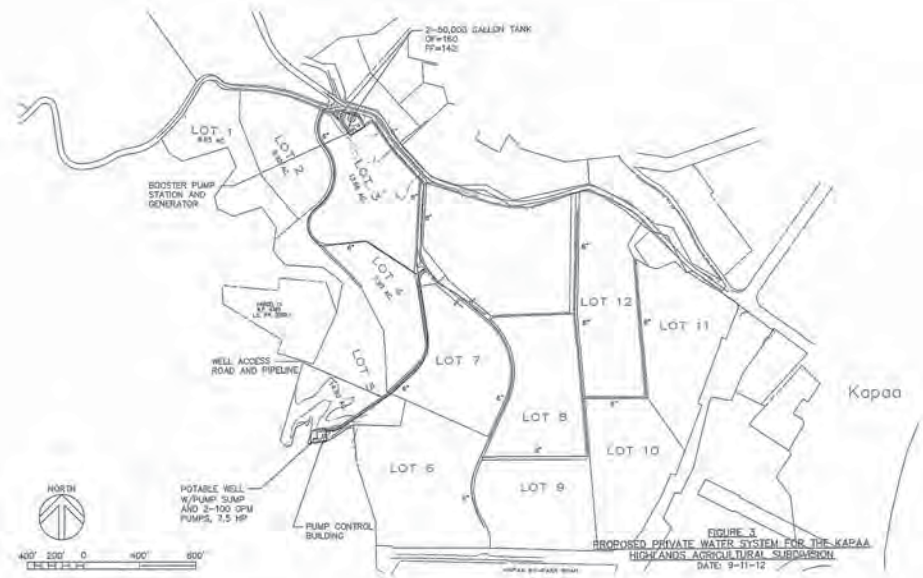

FIGURE 3
PROPOSED PRIVATE WATER SYSTEM FOR THE KAPAA HIGHLANDS AGRICULTURAL SUBDIVISION
DATE: 9-11-12

Table 1

Cost Estimate of the Major Water System Components
for Kapaa Highlands Phase I

Item Description	Quantity	Unit	Unit Price	Amount	Total
Drill, Case, and Pump Test Supply Well					
Mobilization		LS		15,000	
Drill 12-Inch Pilot Hole	300	LF	150	45,000	
Video Log Pilot Hole	1	EA	2,500	2,500	
Test Pump Pilot Hole	1	EA	12,500	12,500	
Ream Pilot Hole to 19 Inches	300	LF	125	37,500	
12" Solid Casing	220	LF	175	38,500	
12" Perforated Casing	80	LF	200	16,000	
Furnishing and Installing grout	215	LF	60	12,900	
Plumbness and Alignment Test	1	EA	3,000	3,000	
Furnishing and Installing Test Pump	1	EA	15,000	15,000	
Development and Test Pumping	72	HRS	250	18,000	
Demobilization		LS		5,000	
Total					$220,900
Well Site Work and Pump Outfitting					
Site Earthwork	450	CY	50	22,500	
Site Basecourse	805	SY	20	16,100	
Site Fencing	348	LF	35	12,180	
Site Gate	1	EA	2,500	2,500	
Site Drainage System		LS		15,000	
Wet Well Sump and Cover at Well Casing		LS		60,000	
Submersible Pump (350 GPM, 4-Pole, 25 HP)	2	EA	45,000	90,000	
Discharge Unit, includes Support Pads and Piping		LS		25,000	
Pump Control Building		LS		35,000	
Chlorination System		LS		25,000	
Control Building Mechanical		LS		15,000	
Pump and Building Electrical		LS		50,000	
KIUC Transformer Pad and Ducts		LS		35,000	
Metering, Motor Control Center, SCADA System		LS		150,000	
Back Generator with Fuel Tank (60 KW)		LS		40,000	
Transfer Switch for Generator		LS		3,000	
KIUC Facility Charge for Service (OH Service Available)		LS		50,000	
Total					$646,280
New Well Access Road (from existing culdesac)					
Access Road Excavation and Preparation	1,530	LF	50	76,500	
Basecourse	3,400	SY	25	85,000	
Drainage and Erosion Control		LS		30,000	
Total					$191,500

Table 1

Cost Estimate of the Major Water System Components
for Kapaa Highlands Phase I

Item Description	Quantity	Unit	Unit Price	Amount	Total
0.05 MG Tank					
Site Earthwork	1,935	CY	40	77,400	
Basecourse	1,890	SY	20	37,800	
Gravel Fill	452	SY	15	6,780	
Site Fencing	590	LF	35	20,650	
Site Gate	1	EA	2,500	2,500	
Site Drainage System		LS		20,000	
Tank Drainage System		LS		25,000	
Pipe Valves and Fittings		LS		15,000	
0.05 MG Steel Tank With Concrete Floor		LS		150,000	
Tank Level Transmitter System		LS		15,000	
Pipe and Tank Testing		LS		15,000	
Erosion and Dust Control		LS		10,000	
Construction Survey		LS		5,000	
Total					$400,130
Booster System					
Sitework for Booster Pump Station		LS		25,000	
Booster Station Connection Piping & Valves		LS		30,000	
Domestic Booster Pump Station (VFD 25 to 70 gpm, 5 HP)		LS		25,000	
Fire Pump Station (500 GPM at 110-ft TDH, 20 HP)		LS		80,000	
Power and Control Connections		LS		30,000	
MCC for both station with SCADA Controls		LS		125,000	
Back Generator with Fuel Tank (60 KW)		LS		50,000	
Transfer Switch for Generator		LS		3,000	
Total					$368,000
Pipeline in Phase I Subdivision (includes 8-inch well feed line)					
Main Installation Access and Site Preparation		LS		50,000	
12" HDPE Pipe	1,500	LF	85	127,500	
8" HDPE Pipe	3,115	LF	55	171,325	
6" HDPE Pipe	2,256	LF	40	90,240	
12" GV w/VB	2	EA	3,000	6,000	
8" GV w/VB	3	EA	2,500	7,500	
6" GV w/VB	2	EA	2,000	4,000	
12" DI Fittings	5	EA	1,800	9,000	
8" DI Fittings	6	EA	1,200	7,200	
6" DI Fittings	4	EA	800	3,200	
Fire Hydrant w/GV	5	EA	3,500	17,500	
Pipe Testing and Chlorination		LS		25,000	
Erosion and Dust Control		LS		30,000	
Construction Survey		LS		15,000	
Total					$563,465
Total for Construction					**$2,390,275**
Engineering Design (8%)					**190,725**
Construction Management (3%)					**73,000**
Total Cost					**$2,654,000**