Appendix C

Groundwater Resources and Supply for Kīhei High School Design/Build Project Kīhei, Maui, Hawai'i

Water Resource Associates – May 2011

GROUNDWATER RESOURCES AND SUPPLY
For
KIHEI HIGH SCHOOL DESIGN/BUILD PROJECT
Kihei, Maui, Hawaii

Prepared for:

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GROUNDWATER RESOURCES AND SUPPLY
for
PROPOSED KIHEI HIGH SCHOOL PROJECT
Kihei, Maui

INTRODUCTION

This report presents an assessment of water resources available to meet the water requirements of the proposed Kihei High School as well as an assessment of the probable impacts on those water resources that may result from meeting those water requirements. The proposed school site is located on the mauka side of Piilani Highway, across from Piilani Village in Kihei. The project site is situated on gentle volcanic slopes between two dry gulches and covers approximately 77.1 acres of land ranging in elevation from 40 to 100 ft. Kulanihakoi Gulch lies to the north of the project site and Waipuilani Gulch to the south and both drain westward toward the coast (see Figure 1). The project site includes existing parcels TMK 2-2-002:015 and TMK 2-2-02:54 which are to be consolidated into one parcel.

The conceptual site plan, developed by the Hawaii Department of Education and Group 70 International, Inc., envisions a high school facility consisting of multiple buildings for classrooms, library, cafeteria, gym, student center, and utilities with associated access roads and parking areas. Roughly half the project area is dedicated to sports including fields for softball, baseball, football/track/soccer combined, and practice/play. The high school will require a modest amount of *potable water* which presumably will be provided by the Maui Department of Water Supply (MDWS) from its existing Central Water System (no potable water resources are available within a

reasonable distance of the project site, as described later in this report). *Non-potable water*, on the other hand, required for irrigation of approximately 40 acres of proposed landscaped areas, are proposed to be provided by two new wells to be located and drilled within the project site to tap brackish water in the underlying Kamaole aquifer.

REGIONAL HYDROGEOLOGIC SETTING

The project site is located near the coast at Kihei on the western slopes of East Maui's Haleakala Volcano, some 14 miles from its summit. From Haleakala's summit, innumerable lava flows erupted and built up the western slopes of East Maui in three distinct phases. First, permeable basalt flows erupted during a period of volcanic activity that produced the Honomanu volcanic series and formed the volcanic core and primary aquifer of East Maui. After major erosion of the Honomanu series, a series of poorly permeable andesites and andesitic basalts called the Kula volcanic series erupted and capped the Honomanu series during a later stage of renewed volcanic activity.

Permeable Honomanu basalts underlie the project site and form the principal aquifer in the Kihei region.

Rainfall on the slopes above Kihei is the principal source of groundwater recharge in the region. Rainfall averages 10 inches a year near the coast and increases to 40 inches a year at approximately 6,000 feet and its distribution corresponds roughly with the topographic contours. Groundwater in the underlying aquifer is basal and is typically brackish along the coast with very gradual freshening inland from the coast. No perennial flows occur in the dry gulches that drain the Kihei coastal area, and runoff that does occur in the gulches does not reach the ocean except during large rainstorms.

KAMAOLE AQUIFER SYSTEM

Location and Description

The project site is located in the northern part of the Kamaole Aquifer System approximately ¾ mile inland from the coast (see Figure 2). The aquifer system comprises a triangular-shaped area of approximately 90 square miles, bounded on the south by the Southwest Rift Zone which extends from the coast near La Perouse Bay to the top of Haleakala summit and from there down slope back to the coast just north of Kihei.

Although the Kamaole Aquifer System embraces a large area with an environment ranging from low coastal areas to steep mountain slopes reaching 7,000 ft. in elevation, the system has an average annual rainfall of only 28 inches per year. The system's modest rainfall is primarily due to its location on the leeward side (leeward of Trade winds) of East Maui. Within the aquifer system, annual rainfall ranges from 10 inches a year at the Kihei coast to 40 inches a year at elevations of 5,000 to 6,000 ft.

Groundwater Recharge and Sustainable Yield

The State Commission on Water Resource Management (CWRM) has estimated the groundwater recharge from rainfall in the Kamaole Aquifer System to be 25 million gallons per day (Water Resource Protection Plan, CWRM, 1990). Of the estimated 25 million gallons per day (mgd) of groundwater recharge, CWRM estimates that 11 mgd of groundwater can be developed within the Kamaole Aquifer System on a sustainable basis (Water Resource Protection Plan, CWRM, 2008).

Existing Water Use

Existing water use (12-month moving average, July 2005) within the Kamaole Aquifer System amounted to 1.859 mgd (Water Resource Protection Plan, CWRM, June 2008, pg. 6-17). This reported water use is primarily for golf course and landscape irrigation purposes from brackish wells located near the coast. These wells yield non-potable water with chloride concentrations ranging from approximately 300 mg/L and higher.

Existing Wells

Most of the existing wells in the Kamaole Aquifer System have been drilled within ½ to ¾ miles of the coast to develop brackish groundwater or to dispose of waste effluent and storm runoff into the underlying aquifer. A few wells have been drilled further inland at higher elevations in search of potable or less brackish water. In the Kihei area, most of the existing wells have been drilled makai of Piilani Highway (see Figure 1). Data from these wells, although sparse and sometimes unreliable, indicate that wells located in the Kihei coastal area can be expected to yield small quantities of brackish water with varying chloride salinities (see Table 1). Approximately one mile north of the project site, two wells (4627-14, 16) located ¾ mile inland at elevations of 130 and 140 ft. encountered brackish water with 302 and 362 mg/L chlorides, respectively. One mile south of the project site, Well 4426-03, located at an elevation of 124 ft., encountered brackish water with chlorides initially ranging from 260 to 370 mg/L, but two years later with a 225 gpm pump installed, yielded water with 400 mg/L chlorides.

Approximately two miles southeast of the project site, two wells (4424-01, 4425-01) were drilled in 2005 and 2004 at a distance of 2¾ mile inland from the coast, at elevations of 553 and 551 ft. These two wells encountered brackish groundwater with chloride concentrations of 320 and 300 mg/L (250 mg/L is the arbitrary limit for potable water). The pump capacity installed in each of these wells is reported to be 300 gallons per minute (gpm).

At Wailea, five miles south of the project site, two wells (not shown in Table 1) drilled in 1991 approximately 1.3 miles inland from the coast also encountered groundwater of near-potable quality. One well (4125-01) was pump tested for four days at a constant rate of approximately 350 gpm (0.50 mgd) with an apparently stable drawdown of 0.5 to 0.7 ft. and a calculated chloride concentration ranging from 250 to 320 mg/L. The other nearby well (4125-02) was also pump tested for four days, but at a higher rate of 420 gpm (0.60 mgd) with a stable drawdown of approximately 1.6 ft. and an estimated chloride concentration of 160 to 175 mg/L.

KIHEI HYDROLOGY

The gulches in the Kihei area are normally dry and only during large rainstorms does runoff in them reach the ocean. The slopes above the Kihei area do not receive much rainfall. Rainfall averages only 10 inches a year at the project site and increases modestly to an average of 40 inches a year approximately 11 miles inland of the project site. Based on existing wells, the groundwater resources within a two-mile radius of the project site consist of a thin basal aquifer that is mostly, if not entirely brackish. The salinity of existing wells in the Kihei area range from roughly 2,000 mg/L chlorides near the coast to roughly 500-600 mg/L approximately ½ to ¾ mile inland from the coast. Wells located north and south of the project site at a distance of approximately ¾ to 1 mile inland from the coast have reported salinities of about 300 to 350 mg/L chlorides. Approximately two miles from the project site, two wells (4424-01, 4425-01) located 2¾ miles inland from the coast, also yielded groundwater with a chloride concentration of 300 to 320 mg/L (see Figure 1).

Table 1. Selected Wells in the Kihei Area, Maui

Well No.	Well Name	Year Drilled	Owner/User	Dia. (inch)	Elev (ft.)	Depth (ft.)	Head (ft.	Chloride (mg/L)	Pump Cap. (mgd)
4424-01	Keokea Highlands 2	2005	Maui Highlands Pro	8	553	577	2.6	320	0.432
4425-01	Keokea Highlands	2004	Maui Highlands LLC	6	551	570	2.8	300	0.432
4426-03	Kihei-Maui R&T	1990	Maui R&T Part	8	124	157	1.9	260-400	0.321
4427-03	Medo	1948	Miranda, H.	10		22		803	
4427-09	Kihei Baptist Chapel	1978	Kihei Baptist Chapel	20		15			0.021
4527-01	Tmk 3-9-02-36	1945	Akina, R.	6		30		635	0.170
4527-02	Tmk 3-9-02-32	1946	Yee, W.	8		35		555	
4527-03	Tmk 3—01-02	1947	Perreira, L.	8		20		610	
4527-05	Tmk 3-9-08	1948	Maui County					528	
4527-06	Tmk 3-9-9-01-09	1948	Teruya, E.	6		25		1820	
4527-07	Tmk 3-9-23-30	1949	Uyeno, H.	8		42			
4527-08	Kihei-Piilani	1990	Blackfield Haw	10	41	71	0.8	420	0.057
4527-10	Kihei-Koa	1992	Koa Res Assoc.	24	7	14		697	0.043
4527-12	Waiohuli 1	1989	Baldwin Malama	60		20			
4527-14	Kauhale Makai	2001	Kauhale Makai	6	9	86	1.7	2897	0.216
4527-16	St. Theresa Church	2007		6		45		300	0.086

Well No.	Well Name	Year Drilled	Owner/User	Dia. (inch)	Elev (ft.)	Depth (ft.)	Head (ft.	Chloride (mg/L)	Pump Cap. (mgd)
4527-18	Kaonoulu 5	2007		6	18	50	3.1	184	
4626-01	Waiakea Gulch	1949	Maui County	8	236	260	3.6	453	
4627-03	Tmk 3-9-01-54	1947	Ting, L.	10		29		538	
4627-08	Tmk 3-9-01-33	1948	Hashimoto, T.	6		116		477	
4627-11	Tmk 3-9-01-99	1949	Alo, S.	8		19		515	
4627-14	Tmk 3-9-01-34	1969	Hashimoto, T.		130	200		302	
4627-15	Tmk 3-9-26-43	1969	Neubauer, A.	4		110			
4627-16	Tmk 3-9-26-67	1969	Batoon A	4	140	161		362	
4627-17	Tmk 3-9-26-66	1969	Tavares, H.	4		120			
4627-19	Maui Lu	1956	Maui Lu Resort						0.857

Source of Data: Commission on Water Resource Management and personal notes

PROJECT WATER REQUIREMENT

Potable Water Requirement

The potable water requirement of the Kihei High School project has been estimated by Gray, Hong, Nojima & Associates, Inc. (see Table 2), based on the project having dual water systems: one supplying *potable water* for domestic use from the Maui Department of Water Supply's Central System and one supplying *non-potable water* for landscape irrigation use from two new brackish water wells to be drilled within the project site.

Table 2. ESTIMATED POTABLE WATER REQUIREMENT
(Does not include irrigation water use)

Year	No. of Students	No. of Staff	No. of Students & Staff	Demand Factor (gpcd)	No. of Visitors	Demand Factor (gpcd)	Demand (gpd) Avg Day	Max Day	Peak Hr
2015	200	40	240	20	10	10	4,900	7,350	14,700
2016	400	40	440	20	20	10	9,000	13,500	27,000
2017	600	100	700	20	30	10	14,300	21,450	42,900
2018	800	120	920	20	40	10	18,800	28,200	56,400
*	1,650	180	1,830	20	85	10	37,450	56,175	112,350

Source of Data: Gray, Hong, Nojima & Associates, Inc., April 2011
*Design capacity at year 2025
gpd - gallons per day
gpcd - gallons per capita per day

In its opening year (2015), the proposed Kihei High School is expected to have an average daily potable water requirement of 4,900 gallons per day (gpd), or approximately 13% of the total requirement at design capacity at year 2025. In the second year of the school's opening (2016), the average daily potable water requirement is expected to increase to 9,000 gpd, or approximately 24% of the total requirement. In the third year (2017), the average daily potable water requirement is estimated at 14,300 gpd, or

approximately 38% of the total requirement. In the fourth year (2018), the average daily potable water requirement is estimated at 18,800 gpd, or approximately 50% of design capacity.

Non-Potable Water Requirement

The project's non-potable water requirement for irrigation of the proposed landscaped areas, which comprise approximately 40 acres, has been estimated by Walters, Kimura, Motoda, Inc. to average 185,000 gpd (see Table 3, third column). This average daily demand is based on an application rate of 1.5 inches of water per acre per week for lawn areas and 1.0 inch of water per acre per week for groundcover areas. The 185,000 gpd amount does not include irrigation of the infield area of the running track.

Total Project Water Requirement

The project's total water requirement, which includes potable water for domestic use from the MDWS's Central System and non-potable water for irrigation use from two new onsite brackish water wells, amounts to 189,900 gpd in the opening year (2015) of the high school. In subsequent years as student enrollment increases, potable water use will increase slightly, while non-potable water use for irrigation will remain unchanged. Consequently, the total project water requirement is estimated to increase only slightly each year, from an average 189,900 gpd in 2015 to 222,450 gpd in the year 2025 (see Table 3, last column).

Table 3. Estimated Total Project Water Requirement

Year	Potable Water Requirement (gpd)	Non-potable Water Requirement (gpd)	Total (gpd)
2015	4,900	185,000	189,900
2016	9,000	185,000	194,000
2017	14,300	185,000	199,300
2018	18,800	185,000	203,800
2025	37,450	185,000	222,450

WATER AVAILABILITY

Potable Water Availability

A study of hydrologic conditions and existing well data indicates that potable water resources do not occur in the project site or within a radius of two miles. No streams or springs occur anywhere and all gulches are normally dry. Groundwater, however, does occur as a thin basal aquifer in permeable basaltic Honomanu lava flows; but with limited regional rainfall and recharge, the underlying aquifer is characteristically brackish and sensitive to increases in salinity under pumping conditions. With no prospect for potable water development within a two mile radius of the project site, the proposed Kihei High School project must look to the Maui County Department of Water Supply (MDWS) to meet its potable water requirements.

Non-Potable Water Availability

A separate non-potable water supply will be developed to meet the project's irrigation water needs and the planned source of water will be the brackish basal aquifer that underlies the project site. Based on a study of existing well data, it is estimated that the aquifer, although thin, will yield brackish water of a quality suitable for irrigation use. In order to maximize chances of success, the aquifer should be explored first by a well located in the northeast (mauka) part of the project site. At this general location, it is estimated that a well will have a salinity ranging from 400 to 500 mg/L chlorides at a pumping rate ranging from 250 to 350 gpm. This projection assumes that the geologic formation encountered by the well will be typical permeable Honomanu basalts and that the well design and construction will be appropriate for a thin basal aquifer.

Alternative consideration is also being given to the use of surplus R-1 effluent from the County's Kihei Wastewater Reclamation Facility located approximately a mile south of the project site. However, the feasibility of using this alternative source of water to meet the project's irrigation water requirement will be studied by others.

PROPOSED WATER SUPPLY

Potable Water Supply

As described earlier in this report, there are no potable water resources, either surface or groundwater, available within a two-mile radius of the project site that could be economically or feasibly developed for the proposed high school. Consequently, the State Department of Education (DOE) will request potable water service for the proposed project from MDWS. Although MDWS does not currently provide service to the project site, the Department does have an existing water system (Central Water System) located nearby. This system serves the Kihei area (as well as others) and has an 18-inch

transmission main located directly makai of the project site, across Piilani Highway. The DOE will construct two water systems for the school project: a *potable water* system to serve the school and a separate *non-potable* water system to irrigate the school grounds. For the potable water system, the DOE will request and seek all necessary approvals of MDWS to supply potable water for both domestic and fire flow requirements in accordance with the department's water system standards. The potable water system will include a main pipeline connecting to the County's 18-inch transmission main, booster pumps, storage tanks, and other appurtenances as may be required by the MDWS. When completed, the potable water system leading to the school property will be dedicated to MDWS.

Non-Potable Water Supply

The proposed non-potable water system for irrigation of approximately 40 acres of school grounds will include two brackish wells, transmission and distribution pipelines, control valves, and other appurtenances, but is not proposed to include a storage tank. The first proposed well (Well No. 1, Figure 1) is located in the northeast corner of the school property at an elevation of approximately 90 ft. and near the foot of a planned 2:1 cut slope. The nearest existing well (4527-08) which lies approximately 2,000 ft. away had an initial salinity of 420 mg/L chlorides when drilled in 1990 (see Figure 1 and Table 1).

A second well is proposed as a standby/supplemental source for the non-potable water system. This second well (Well No. 2, Figure 1) lies approximately 1,600 ft. south of Well No. 1 in the southeast corner of the school property and is also located at an elevation of approximately 90 ft near the foot of a planned 2:1 cut slope. Construction of the second well will depend on the results of the first well.

Based on existing well data, it is projected that each well will have a pump capacity in the range of 250 to 350 gpm while producing suitable brackish water in the salinity range of 400 to 500 mg/L chlorides. Because the proposed non-potable system will operate as a pressurized system without a storage tank, the system's wells must produce at least 385 gpm in order to supply the estimated daily requirement of 185,000 gpd within an

irrigation period of 8 hours. However, the pumping rate required can be decreased by increasing the irrigation period, and vice versa.

The dimensions and other aspects of *each* proposed well are listed below:

Ground Elevation:	90 feet, mean sea level (msl)
Total Depth:	110 feet. (-20 ft., msl)
Casing Diameter:	12 inches
Solid Casing Depth:	90 feet (0 ft., msl)
Louvered Screen Casing Depth:	110 feet (-20 ft., msl)
Casing Material:	Corrosion-Resistant Steel
Anticipated Well Capacity:	250 to 350 gpm
Anticipated Aquifer Head:	2 feet, msl, approx.
Anticipated Total Dynamic Head:	118 psi
Anticipated Salinity (Chlorides):	400 to 500 mg/L
Anticipated Well Drilling/Testing Cost:	$160,000
Stainless Steel Lineshaft Pump (300 gpm) and Controls Cost:	$160,000

Regulatory Requirements

Development of the project's proposed non-potable wells will require permits for well construction and pump installation from the Commission on Water Resources Management (CWRM). Construction and testing of the wells and installation of pumps must conform to the Hawaii Well Construction and Pump Installation Standards of the CWRM. As provided in the Standards, each proposed well must be tested with a pump, including a step-drawdown test of several hours duration and a constant-rate test of 24 to 48 hours duration. Under the well construction and pump installation permits issued for each well, the licensed contractor must promptly file two reports: (1) a Well Completion Report, Part I, after well construction and testing have been completed, and (2) a Well Completion Report, Part II, after installation of the permanent pump has been completed.

Applications for a well and pump installation permit are usually submitted by the licensed well drilling contractor representing the well owner.

Based on a preliminary query, the CWRM currently has no particular concerns regarding the project's proposed brackish wells, but it was pointed out that others in the dry Kihei area are utilizing non-potable wells for landscape irrigation (C. Ice, personal communication, May 2011).

PROBABLE IMPACTS ON GROUNDWATER RESOURCES AND MITIGATION MEASURES

The proposed Kihei High School project is located in the northern part of the Kamaole Aquifer System where the underlying aquifer consists of a thin, brackish, basal aquifer. The proposed project is not expected to have any adverse impact on either the sustainable yield or quality of the underlying brackish aquifer due to the proposed development of 185,000 gpd of brackish groundwater. There are no surface water resources in the vicinity of the project site. The probable impacts of the proposed project on groundwater resources are discussed below.

Impacts on Water Supply

The proposed Kihei High School will require an estimated average of 37,450 gpd of potable water for student and staff and an estimated average of 185,000 gpd of non-potable water for irrigation of approximately 40 acres of landscaping. The potable water requirement for the school is expected to be provided by MDWS by connecting to an existing 18-inch transmission main located near the project site (part of MDWS' Central Water System) located on the North-South Connector Road situated makai of the project site across Piilani Highway. The project's potable water requirement of 37,450 gpd,

represents less than one percent of the County's Central Water System sources of supply which include wells located in a five mile stretch of windward West Maui, extending from Wailuku to north of Waihee Valley.

The project's non-potable water requirement of 185,000 gpd, which will be met from two new onsite wells which will develop basal groundwater from the underlying Kamaole Aquifer System, represents only 1.7 % of the aquifer system's 11 mgd sustainable yield. Consequently, no adverse impacts on existing water supplies are expected from meeting the project's potable and non-potable water requirements.

Impacts on Groundwater Recharge and Sustainable Yield

The proposed withdrawal of 185,000 gpd of brackish groundwater for the Kihei High School is not expected to have any impact on the recharge or sustainable yield of the underlying Kamaole Aquifer System. Rainfall at the project site averages only 10 inches a year and does not contribute recharge to the underlying aquifer. The bulk of aquifer recharge comes from rainfall over much higher elevations inland of Kihei. The withdrawal of 185,000 gpd of brackish water from two new onsite wells represents 1.7% of the 11 mgd sustainable yield of the underlying Kamaole Aquifer System. Thus, the project's proposed non-potable water development is not expected to have any measurable impact on aquifer recharge and sustainable yield.

Impacts on Existing Wells

The project's proposed development and use of an average 185,000 gpd of non-potable water for landscape irrigation from new brackish wells located in the mauka corners of the project site (see Figure 1), is not expected have any adverse impact on existing wells. No existing wells are located up slope of the proposed brackish wells within a radius of two miles. Down slope, the nearest well (4527-08) to proposed Well No.1, lies approximately 2,500 ft. away in a southwest direction, has a brackish water

quality of 420 mg/L chlorides, and has a 40 gpm (57,600 gpd) pump installed. The next three closest wells (4527-06, 4527-07, and 4527-18) all lie approximately 3,400 ft. away in various down slope directions, but none of them have pumps to withdraw water. The existing well closest to proposed Well No. 2 also happens to be Well 4527-08 which is the only nearby well with a pump. Because Well No. 2 lies approximately up-gradient, it has the potential to increase the salinity of Well 4527-08, located 1,900 ft. away, if withdrawals were to become excessive. However, Well No.2 is not expected to have any adverse impact on Well 4527-08 because Well No. 2 is proposed as a standby/supplemental source with limited groundwater withdrawal. Most of the estimated 185,000 gpd of irrigation water supply will be provided by Well No.1 which lies 0.5 mile away and not directly up gradient of Well 4527-08.

Based on an assessment of existing wells in the Kihei coastal area, comparative distances between existing wells, and little groundwater withdrawals from nearby wells; the project's proposed brackish wells and estimated withdrawal of an average 185,000 gpd for landscape irrigation are not expected to have any adverse effect on existing wells located nearby or in the general vicinity of the project.

Impacts on Water Quality

The proposed development of two non-potable wells and the withdrawal of an average 185,000 gpd of brackish groundwater for landscape irrigation are not expected to have any adverse impact on the existing water quality of the Kamaole aquifer at Kihei. The project's proposed development of only 185,000 gpd is also not expected to have any adverse impact on the brackish water quality of any existing wells and their existing primary use for landscape irrigation.

Mitigation Measures

Because no adverse impacts on water resources are expected from the withdrawal of an average 185,000 gpd of brackish groundwater from two new wells located in the project site for landscape irrigation, no direct mitigation measures are proposed.

However, the proposed project will indirectly mitigate impacts on Maui's water resources in the following ways:

- By utilizing brackish groundwater for irrigation purposes, instead of potable water.
- By designing the brackish wells for optimum water withdrawal from a thin basal aquifer.
- By designing the irrigation system for efficient operation to conserve water resources.
- By utilizing efficient irrigation practices to conserve water resources.
- By utilizing drought and brackish-water tolerant plants appropriate for water conservation and Kihei's dry climate.

REFERENCES

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

_____, Water Resource Protection Plan Update, 2008.

_____, Hawaii Well Construction and Pump Installation Standards, 2004.

Maui County, Department of Water Supply. Water System Standards, 2002.