

Appendix B - Characterization of Central District Specific Resource Options

This appendix describes the specific new resource options that are or could be available for implementation for the DWS Central District water system. These options are the specific “ingredients” of the resource strategies considered for the Central system included in the Final Candidate Strategies Report.

As explained in the Final Candidate Strategies Report, there were several rounds of supporting analyses and, for some resources, several alternate assumptions were applied to test alternate scenarios. In some cases assumptions used in the Final Candidate Strategies Report may differ from the information documented in this appendix. In these cases the assumptions are noted in the Final Candidate Strategies Report. For example, the variable costs documented in this appendix reflect a “high” energy cost scenario assuming electrical energy prices in Spring of 2008 when crude oil prices were approximately \$125 per barrel. The analyses in the Final Candidate Strategies Report use several alternate variable cost assumptions for other scenarios in addition to the costs reported in this appendix.

Several additional specific resource options as well as information regarding assumptions used in earlier analyses are documented in the Central District Candidate Strategies Preliminary Draft (September 12, 2006).

The specific resource options are divided into several categories described below:

- **Committed Resource Options** - options that are in the process of being implemented but are not yet in service
- **Short Term Resource Options** - options that could mitigate immediate capacity reserve shortfalls
- **Long Term Resource Options** - alternative options that would form the fundamental basis of the resource strategies and would address the identified planning objectives over the time frame of the planning period
- **General Resource Options** - ancillary options and options that are not mutually exclusive (can be implemented in conjunction with most other combinations of options)

Committed Resource Options

Committed resource options are new projects that are in the process of being implemented but are not yet in service.

Option (Committed): Kupaa Well

The Kupaa well is located north of Waihee River at a elevation of 410 feet. This well will draw from the Waihee basal groundwater aquifer. Development of the Kupaa well includes well drilling and development, a new transmission line to the Kanoa well field and a 500 thousand gallon storage tank. The well is scheduled for completion to serve water to the DWS Central system starting in 2009.

The sustainable yield of the Waihee aquifer is currently set at 8 MGD. It is recommended, however, that the half of the Waihee aquifer south of Makamakaole gulch be pumped at only about half the 8 MGD sustainable yield of the entire Waihee aquifer. Because the Kupaa well is located in the south half of the Waihee aquifer which is already developed and producing at its recommended yield at about 4 MGD the well will not contribute substantial additional new sustained water source capability to the DWS system. The well will allow better distribution of

pumping and will provide needed pumping reserve capacity to meet the engineering design reliability criteria for the DWS Central system. In the near term, with careful monitoring of chlorides, operation of this well with total withdrawals from the south half of the Waihee aquifer in excess of 4 MGD is presumed as a reasonable short term contingency option.

The Kupaa well is the last of several wells currently planned to be developed by the DWS in the south half of the Waihee basal groundwater aquifer.

Information regarding the characteristics and costs of this well is provided in the tables at the end of this section describing committed resource options.

Option (Committed): Waikapu Tank Site Well

The Waikapu Tank Site Well is located next to the DWS Waikapu storage tank at an elevation of 670 feet. This well will draw from the lao basal groundwater aquifer. Development of the well includes primarily well drilling and development. The well is scheduled to begin delivering water to the DWS system in 2009.

Since this well draws from the lao basal groundwater aquifer, which is already developed and producing at up to its recommended sustainable yield, it will not contribute additional new sustained water source capability to the DWS system. The well will allow better distribution of pumping within the lao aquifer and will provide needed reserve capacity to meet the engineering reliability criteria for the DWS Central system.

Information regarding the characteristics and costs of this well is provided in the tables at the end of this section describing committed resource options.

Option (Committed): lao Tank Site Well

The lao Tank Site Well is located in Wailuku next to the DWS lao storage tank at an elevation of 506 feet. This well will draw from the lao basal groundwater aquifer. Development of the well includes primarily well drilling and development. The well is scheduled to begin delivering water to the DWS system in 2009.

Since this well draws from the lao basal groundwater aquifer, which is already developed and producing at up to its recommended sustainable yield, it will not contribute additional new sustained water source capability to the DWS system. The well will allow better distribution of pumping within the lao aquifer and will provide needed reserve capacity to meet the engineering reliability criteria for the DWS Central system.

Information regarding the characteristics and costs of this well is provided in the tables at the end of this section describing committed resource options.

Option (Committed): Maui Lani Wells

The Maui Lani wells are three new basal groundwater wells located in Wailuku/Kahului at an altitude of about 220 feet. These wells will draw from the Kahului basal groundwater aquifer. The wells are being developed by Alexander and Baldwin and will be turned over to the DWS upon completion.

The sustainable contribution of these wells is limited to about 1 MGD due to the limited sustainable yield of the Kahului aquifer.

Information regarding the characteristics and costs of this well is provided in the tables at the end of this section describing committed resource options.

Tables Characterizing Committed Resource Options

The following tables provide more detailed information regarding each of the committed resource options for the Central system.

The installed capacity is the nominal twenty-four hour per day pumping capability of the installed

pumps and motors. Actual capacity will depend upon the specific characteristics of the well and pump equipment and will ultimately be determined by flow testing.

The criteria capacity is the amount of source capability that is credited to the DWS system reserve capacity to meet the engineering reliability criteria for the DWS Central system. For most wells this is two thirds of the installed capacity.

The effective sustainable capacity is the amount of additional new water source capability that is provided by the source. In some cases, where the well is located in an aquifer that is already developed at or near its sustainable yield the effective sustainable capacity may be limited or zero.

Costs are expressed in year 2004 dollars. In deriving the costs the assumed annual rate of capital and fixed cost escalation is 3.0%. The annual rate of fuel cost escalation is 4.0%. The assumed annual cost of capital is 6.0%.

Capital costs are stated as one time expenses.

Fixed operating costs are expressed as annual expenses.

Variable operating costs are expressed as costs per thousand gallons of water production.

Pumping efficiency is based on the average pumping efficiency of existing DWS wells.

Electrical costs are Spring 2008 MECO rates de-escalated to year 2004 dollars.

For options with zero effective sustained capacity an error (ERR) value is posted for entries expressing costs in units per thousand gallons of effective capacity.

Well - Waikapu Tank (Committed)

New DWS Well at Existing Tank Site

Derivation:
 Capital Costs by HDA from DWS information using recent costs.
 Operation costs by HDA.

Type Basal Well
 System Central
 Source Groundwater
 Location Waikapu Tank
 Aquifer lao

Earliest Online Date		2008		Derivation
Capacity (MGD)				
Installed Capacity			2.016	1400 GPM
Criteria Capacity			1.344	2/3 Installed Capacity
Effective Sustainable Capacity				No incremental effective capacity from lao Aquifer
Capital Costs (\$2004)		Total	Per MGD	
Design		\$74,230	ERR	DWS Information
Drilling		\$543,765	ERR	DWS Information
Transmission			ERR	
Development		\$782,621	ERR	DWS Information
Storage Improvements			ERR	
Engineering Costs		\$898,700	ERR	DWS Information
Contingencies			ERR	
Total Plant Cost		\$2,299,316	ERR	
Expenditure Pattern	Year	Nom	Normalized	
	Serv Date			Contingency
	-1	\$782,621	34.0%	Development, Storage
	-2	\$543,765	23.6%	Transmission, Drilling
	-3	\$972,930	42.3%	Design, Engineering
	-4			
	-5			
	-6			
	-7			
	-8			
Const. Per. Esc. Rate (Nom.)		3.00%		
AFUDC Interest Rate (Nom.)		6.00%		
AFUDC Factor			1.062	
		Total	Per MGD	
Total Capitalized Cost		\$2,441,761	ERR	
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD	
Dedicated Operating Labor			ERR	
Apportioned Operating Labor		\$6,873	ERR	Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor			ERR	
Fixed Operating Costs				
Electrical Demand		\$24,535		5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials			ERR	
Maintenance Expenses				
Amort. of Capitalized Rebuild Costs				
Total Fixed Op. Costs		\$31,408		
Variable Operating Costs (\$2004)			Per KGal	
Vertical Lift		670		
Variable O&M				
Electrical Energy			\$0.974	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials			\$0.005	DWS 2001 Average escalated to 2004
Maintenance Expenses				
Total Variable Op. Costs			\$0.979	

Well - Iao Tank (Committed)

New DWS Well at Existing Tank Site

Derivation:

Capital Costs by HDA from DWS information using recent costs.

Operation costs by HDA.

Type	Basal Well
System	Central
Source	Groundwater
Location	Iao Tank
Aquifer	Iao

Earliest Online Date	2008	Derivation
Capacity (MGD)		
Installed Capacity	2.016	1400 GPM
Criteria Capacity	1.344	2/3 Installed Capacity
Effective Sustainable Capacity		No incremental effective capacity from Iao Aquifer
Capital Costs (\$2004)	Total	Per MGD
Design	\$56,405	DWS Information
Drilling	\$395,680	DWS Information
Transmission		
Development	\$1,200,000	DWS Information
Storage Improvements		
Engineering Costs	\$150,000	DWS Information
Contingencies		
Total Plant Cost	\$1,802,085	
Expenditure Pattern	Year	Normalized
	Serv Date	
	-1	66.6%
	-2	22.0%
	-3	11.5%
	-4	
	-5	
	-6	
	-7	
	-8	
Const. Per. Esc. Rate (Nom.)	3.00%	
AFUDC Interest Rate (Nom.)	6.00%	
AFUDC Factor		1.043
	Total	Per MGD
Total Capitalized Cost	\$1,878,987	
Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD
Dedicated Operating Labor		
Apportioned Operating Labor	\$6,873	Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor		
Fixed Operating Costs		
Electrical Demand	\$18,530	5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials		
Maintenance Expenses		
Amort. of Capitalized Rebuild Costs		
Total Fixed Op. Costs	\$25,402	
Variable Operating Costs (\$2004)		Per KGal
Vertical Lift	506	
Variable O&M		
Electrical Energy		\$0.735
		5 Kwh/Kgal/Kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials		\$0.005
Maintenance Expenses		DWS 2001 Average escalated to 2004
Total Variable Op. Costs		\$0.741

Well - Kupaa (Committed)

New DWS Well at New Site

Derivation:
Capital Costs by HDA from DWS information using recent costs.

Operation costs by HDA.

Type Basal Well
System Central
Source Groundwater
Location Waihee
Aquifer Waihee (South)

Earliest Online Date		2008		Derivation	
Capacity (MGD)					
Installed Capacity			2.016	1400 GPM	
Criteria Capacity			1.344	2/3 Installed Capacity	
Effective Sustainable Capacity				No incremental effective capacity from South Waihee Aquifer	
Capital Costs (\$2004)		Total	Per MGD		
Design		\$76,750		DWS Information	
Drilling		\$290,000		DWS Information	
Transmission		\$1,700,000			
Development		\$1,000,000		DWS Information	
Storage Improvements		\$1,200,000		DWS Information	
Engineering Costs				Included in other contracts	
Contingencies					
Total Plant Cost		\$4,266,750			
Expenditure Pattern	Year	Nom	Normalized		
	Serv Date			Contingency	
	-1	\$2,200,000	51.6%	Development, Storage	
	-2	\$1,990,000	46.6%	Transmission, Drilling	
	-3	\$76,750	1.8%	Exploration, Land, Engineering	
	-4				
	-5				
	-6				
	-7				
	-8				
Const. Per. Esc. Rate (Nom.)		3.00%			
AFUDC Interest Rate (Nom.)		6.00%			
AFUDC Factor			1.044		
		Total	Per MGD		
Total Capitalized Cost		\$4,455,342			
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD		
Dedicated Operating Labor					
Apportioned Operating Labor		\$6,873		Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.	
Maintenance Labor					
Fixed Operating Costs					
Electrical Demand		\$15,014		5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity	
Chemicals/Materials					
Maintenance Expenses					
Amort. of Capitalized Rebuild Costs					
Total Fixed Op. Costs		\$21,887			
Variable Operating Costs (\$2004)			Per KGal		
Vertical Lift		410			
Variable O&M					
Electrical Energy			\$0.596	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008	
Chemicals/Materials			\$0.005	DWS 2001 Average escalated to 2004	
Maintenance Expenses					
Total Variable Op. Costs			\$0.601		

Wells - Maui Lani (Committed)

(3) New Developer Wells at Maui Lani Site
Turnkey transfer to DWS

Derivation:
Capital Costs by HDA from DWS information using recent costs.
Operation costs by HDA.

Type Basal Wells
System Central
Source Groundwater
Location Maui Lani Subdivision
Aquifer Kahului

Earliest Online Date	2008		Derivation
Capacity (MGD)			
Installed Capacity		2.160	(3) 500 GPM Wells
Criteria Capacity		1.440	2/3 Installed Capacity
Effective Sustainable Capacity		1.000	Limited by Kahului Aquifer Sustainable Yield
Capital Costs (\$2004)			
Total Plant Cost	Total	Per MGD	DWS Information
	\$4,000,000	\$4,000,000	
Contingencies			
Total Plant Cost	\$4,000,000	\$4,000,000	
Expenditure Pattern	Year	Normalized	Estimated Developer Cost
	Serv Date	100.0%	
	Nom		
	\$4,000,000		
	-1		
	-2		
	-3		
	-4		
	-5		
	-6		
	-7		
	-8		
Const. Per. Esc. Rate (Nom.)	3.00%		
AFUDC Interest Rate (Nom.)	6.00%		
AFUDC Factor		1.000	
Total Capitalized Cost	Total	Per MGD	
	\$4,000,000	\$4,000,000	
Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD	
Dedicated Operating Labor			
Apportioned Operating Labor	\$6,873	\$6,873	Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor			
Fixed Operating Costs			
Electrical Demand	\$8,632	\$8,632	5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials			
Maintenance Expenses			
Amort. of Capitalized Rebuild Costs			
Total Fixed Op. Costs	\$15,504	\$15,504	
Variable Operating Costs (\$2004)		Per KGal	
Vertical Lift	220		
Variable O&M			
Electrical Energy		\$0.320	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq.\$125/bbl crude \$2008
Chemicals/Materials		\$0.005	DWS 2001 Average escalated to 2004
Maintenance Expenses			
Total Variable Op. Costs		\$0.325	

Short Term Resource Options

Short term resource options are projects that could serve to meet immediate capacity reserve shortfalls. These options are characterized by the ability to meet water demands or system capacity requirements in the next two to three years.

Option (Short Term): Waikapu South Wells

Two wells are being planned for the Waikapu aquifer above Waikapu town at an elevation of about 750 feet. Development of these wells would include well drilling and development and minor transmission improvements.

Negotiations are underway for easements and rights of way. These wells would draw from the Waikapu basal groundwater aquifer. The earliest these wells could provide water to the DWS system is 2009.

The sustainable contribution of these wells as a new source of water is limited to the 2 MGD sustainable yield of the Waikapu aquifer. These wells would provide needed reserve capacity to meet the engineering reliability criteria for the DWS Central system.

It is not certain that these wells can be developed by the DWS. It is possible that several other candidate wells in this area may be developed by private entities. Whether these wells or other private wells are developed, it is presumed in the analyses supporting the Final Candidate Strategies Report that the 2 MGD sustainable yield of the Waikapu aquifer will be developed to serve water demand in the Central District area.

Information regarding the characteristics and costs of these wells is provided in the following tables.

Option (Short Term): Backup Well at Existing Well Site

This is a generic resource option consisting of a new well drilled in near enough proximity to an existing well to rely on an existing storage tank to provide disinfection contact time and to minimize transmission and connection costs. The well would provide additional well pumping capacity, equipment redundancy and improved distribution of well pumping. The well would not provide additional annual system production capacity if it is located in an aquifer already limited by fully developed sustainable yield.

Option (Short Term): Shaft 33 Replacement Well

It is expected that the existing plantation-era Shaft 33 well will be retired when one or more replacement wells are developed. Since any wells to replace Shaft 33 would presume retirement of Shaft 33, this resource option would not provide any additional system pumping capacity, redundancy or annual system production capability. Since it is expected that several smaller wells would replace the large Shaft 33 well, this would provide improved distribution of pumping within the lao aquifer.

Well - Waikapu South #1

New DWS Well at New Site
1400 GPM

Derivation:
Capital Costs by HDA from DWS information using recent costs.
Exceptional expected escalation is accounted in substantial

Type Basal Well
System Central
Source Groundwater
Location Waikapu
Aquifer Waikapu

Earliest Online Date		2009		Derivation
Capacity (MGD)				
Installed Capacity			2.016	1400 GPM
Criteria Capacity			1.344	2/3 Installed Capacity
Effective Sustainable Capacity			1.344	2/3 Installed Capacity
Capital Costs (\$2004)		Total	Per MGD	
Exploration, Land		\$250,000	\$186,012	
Drilling		\$424,500	\$315,848	\$566 per foot per Kupaa
Transmission		\$425,000	\$316,220	1312 feet at \$340 per foot based on Kupaa Transmission costs
Development		\$1,000,000	\$744,048	
Storage Improvements				
Engineering Costs		\$150,000	\$111,607	
Contingencies		\$1,124,750	\$836,868	50% Contingency based on DWS Engineering estimates that costs would be much higher than \$2002 basis
Total Plant Cost		\$3,374,250	\$2,510,603	
Expenditure Pattern		Year	Nom	Normalized
Serv Date				
-1		\$1,124,750	33.3%	Contingency
-2		\$1,849,500	54.8%	Development, Storage, Transmission, Drilling
-3		\$400,000	11.9%	Exploration, Land, Engineering
-4				
-5				
-6				
-7				
-8				
Const. Per. Esc. Rate (Nom.)		3.00%		
AFUDC Interest Rate (Nom.)		6.00%		
AFUDC Factor			1.023	
Total Capitalized Cost		Total	Per MGD	
		\$3,451,759	\$2,568,273	
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD	
Dedicated Operating Labor				
Apportioned Operating Labor		\$6,873	\$5,114	Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor				
Fixed Operating Costs				
Electrical Demand		\$27,465	\$20,435	5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials				
Maintenance Expenses				
Amort. of Capitalized Rebuild Costs				
Total Fixed Op. Costs		\$34,337	\$25,549	
Variable Operating Costs (\$2004)			Per KGal	
Vertical Lift		750		
Variable O&M				
Electrical Energy			\$1.090	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials			\$0.005	DWS 2001 Average escalated to 2004
Maintenance Expenses				
Total Variable Op. Costs			\$1.095	

Well - Waikapu South #2

New DWS Well at New Site
1400 GPM

Derivation:
Capital Costs by HDA from DWS information using recent costs.
Exceptional expected escalation is accounted in substantial

Type Basal Well
System Central
Source Groundwater
Location Waikapu
Aquifer Waikapu

Earliest Online Date		2010		Derivation
Capacity (MGD)				
Installed Capacity			2.016	1400 GPM
Criteria Capacity			1.344	2/3 Installed Capacity
Effective Sustainable Capacity			0.656	Balance of Aquifer S.Yield
Capital Costs (\$2004)		Total	Per MGD	
Exploration, Land		\$50,000	\$76,220	
Drilling		\$424,500	\$647,104	\$566 per foot per Kupaa
Transmission		\$136,000	\$207,317	1312 feet at \$340 per foot based on Kupaa Transmission costs
Development		\$1,000,000	\$1,524,390	
Storage Improvements				
Engineering Costs		\$50,000	\$76,220	
Contingencies		\$830,250	\$1,265,625	50% Contingency based on DWS Engineering estimates that costs would be much higher than \$2002 basis
Total Plant Cost		\$2,490,750	\$3,796,875	
Expenditure Pattern		Year	Nom	Normalized
Serv Date			\$830,250	33.3%
-1			\$1,560,500	62.7%
-2			\$100,000	4.0%
-3				
-4				
-5				
-6				
-7				
-8				
Const. Per. Esc. Rate (Nom.)			3.00%	
AFUDC Interest Rate (Nom.)			6.00%	
AFUDC Factor				1.021
Total Capitalized Cost		Total	Per MGD	
		\$2,542,112	\$3,875,170	
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD	
Dedicated Operating Labor				
Apportioned Operating Labor		\$6,873	\$10,476	Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor				
Fixed Operating Costs				
Electrical Demand		\$27,465		5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials				
Maintenance Expenses				
Amort. of Capitalized Rebuild Costs				
Total Fixed Op. Costs		\$34,337		
Variable Operating Costs (\$2004)			Per KGal	
Vertical Lift		750		
Variable O&M				
Electrical Energy			\$1.090	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials			\$0.005	DWS 2001 Average escalated to 2004
Maintenance Expenses				
Total Variable Op. Costs			\$1.095	

Backup Well - Existing Well Site

New DWS Well at Existing Site

Derivation:
Capital Costs by HDA from DWS information using recent costs.
Operation costs by HDA.

Type Basal Well
System Central
Source Groundwater
Location Generic Existing Well Site
Aquifer Generic

Earliest Online Date		2008		Derivation	
Capacity (MGD)					
Installed Capacity			2.016	1400 GPM	
Criteria Capacity			1.344	2/3 Installed Capacity	
Effective Sustainable Capacity				No incremental effective capacity from Iao Aquifer	
Capital Costs (\$2004)		Total	Per MGD		
Design		\$60,000		DWS Information	
Drilling		\$400,000		DWS Information	
Transmission Development		\$1,000,000		DWS Information	
Storage Improvements					
Engineering Costs		\$150,000		DWS Information	
Contingencies		\$322,000		20% Contingency Allowance	
Total Plant Cost		\$1,932,000			
Expenditure Pattern		Year	Nom	Normalized	
	Serv Date				
	-1	\$322,000	16.7%	Contingency	
	-2	\$1,000,000	51.8%	Development, Storage	
	-3	\$400,000	20.7%	Transmission, Drilling	
	-4	\$210,000	10.9%	Exploration, Land, Engineering	
	-5				
	-6				
	-7				
	-8				
Const. Per. Esc. Rate (Nom.)		3.00%			
AFUDC Interest Rate (Nom.)		6.00%			
AFUDC Factor			1.037		
Total Capitalized Cost		Total	Per MGD		
		\$2,003,656			
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD		
Dedicated Operating Labor					
Apportioned Operating Labor		\$6,873		Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.	
Maintenance Labor					
Fixed Operating Costs					
Electrical Demand		\$18,530		5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity	
Chemicals/Materials					
Maintenance Expenses					
Amort. of Capitalized Rebuild Costs					
Total Fixed Op. Costs		\$25,402			
Variable Operating Costs (\$2004)			Per KGal		
Vertical Lift		506			
Variable O&M					
Electrical Energy			\$0.735	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008	
Chemicals/Materials			\$0.005	DWS 2001 Average escalated to 2004	
Maintenance Expenses					
Total Variable Op. Costs			\$0.741		

Well - Replacement for Shaft 33

New Developer Well at New Site

Derivation:
 Capital Costs by HDA from DWS information using recent costs.
 Operation costs by HDA.

Type Basal Well
 System Central
 Source Groundwater
 Location South of Iao Tank
 Aquifer Iao

Earliest Online Date		2008		Derivation	
Capacity (MGD)					
Installed Capacity			2.016	1400 GPM	
Criteria Capacity				2/3 Installed Capacity	
Effective Sustainable Capacity				No incremental effective capacity from Iao Aquifer	
Capital Costs (\$2004)		Total	Per MGD		
Design					
Drilling					
Transmission					
Development		\$2,000,000			
Storage Improvements					
Engineering Costs					
Contingencies					
Total Plant Cost		\$2,000,000			
Expenditure Pattern		Year	Nom	Normalized	
	Serv Date				Contingency
	-1		\$2,000,000	100.0%	Gross Well Development Costs
	-2				
	-3				
	-4				
	-5				
	-6				
	-7				
	-8				
Const. Per. Esc. Rate (Nom.)			3.00%		
AFUDC Interest Rate (Nom.)			6.00%		
AFUDC Factor				1.029	
		Total		Per MGD	
Total Capitalized Cost			\$2,058,252		
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD		
Dedicated Operating Labor					
Apportioned Operating Labor		\$6,873			Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor					
Fixed Operating Costs					
Electrical Demand		\$18,310			5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials					
Maintenance Expenses					
Amort. of Capitalized Rebuild Costs					
Total Fixed Op. Costs			\$25,182		
Variable Operating Costs (\$2004)			Per KGal		
Vertical Lift		500			
Variable O&M					
Electrical Energy			\$0.727		5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials			\$0.005		DWS 2001 Average escalated to 2004
Maintenance Expenses					
Total Variable Op. Costs			\$0.732		

Long Term Resource Options

Long term resource options form the fundamental basis of the resource strategies that address the identified planning objectives over the time frame of the planning period. The long term resource options tend to be mutually exclusive or need to be strategically sequenced and thus form the defining basis for the various alternative resource strategies.

Ground Water Production Options

Option (Long Term): North Waihee Aquifer Wells

The south half of the Waihee aquifer is currently developed and utilized at the limits of the recommendation that only half of the 8 MGD sustainable yield of the Waihee aquifer should be used from wells south of Makamakaole gulch. New wells in the north half of the Waihee aquifer would allow sustained pumping from the aquifer up to 7.2 MGD (90% of the sustainable yield).

Development of wells in the north half of the Waihee aquifer would require substantial transmission improvements.

The North Waihee Aquifer wells have been re-characterized based on updated information about hydrology and expected well yield in the north half of the Waihee aquifer and the Kahakuloa aquifer. These wells were characterized in earlier analyses as a series of three new wells in the north half of the Waihee aquifer. The updated configuration includes twice as many, much smaller wells than the initial characterization and assumes costs that have been updated with more recent information. The revised configuration is more expensive due to higher estimated project costs and lower expected production capability.

This option is characterized by the phased development of six wells in three phases. These phases are referred to in the information tables below as the Maluhia, Wailena and Waipili wells respectively. The first phase (Maluhia) would require both water and electric power transmission improvements across Makamakaole gulch. The second phase (Wailena) would also require substantial transmission improvements. The third phase (Waipili) would require transmission improvements as well as a 0.5 MG storage tank.

This option is characterized as a project with transmission capability sized to accommodate the new wells in the north half of the Waihee aquifer. Installing transmission to this area could potentially facilitate development of wells further north in the adjoining Kahakuloa aquifer. This extended option is characterized as a separate option described below.

Information regarding the characteristics and costs of each of the wells is provided in the tables at the end of this section describing long term resource options. See in particular the tables for the Maluhia, Waiolai and Wailena wells.

Option (Long Term): Kahakuloa Aquifer Wells

The Kahakuloa basal groundwater aquifer is north and adjoining the Waihee aquifer. This aquifer has a sustainable yield of 8 MGD. Development of wells in the Kahakuloa aquifer would require substantial water and electric power transmission improvements to connect with the existing DWS Central system. This option is characterized as an extension and sequel to the development of the North Waihee Aquifer Wells option described above.

The Kahakuloa Aquifer wells have been re-characterized based on updated information about hydrology and expected well yield in the north half of the Waihee aquifer and the Kahakuloa aquifer. These wells were characterized in earlier analyses as a series of five new wells in three phases in the Kahakuloa aquifer. The updated configuration includes eight, much smaller wells and assumes costs that have been updated with more recent information. The revised configuration is more expensive due to higher estimated project costs and lower expected production capability.

This option is characterized as the development of eight wells in three phases.

The first phase (Kahakaloa) would include four wells north of the Kahakuloa valley and includes power and water transmission and a 0.5 MG storage tank. It is not contemplated that wells would be developed within the Kahakuloa valley. The first phase costs also include the incremental costs to upgrade the size of the necessary water transmission improvements that would have to be installed originally for the Maluhia, Wailena and Waipili wells from 24" to 30" pipe.

The second phase (Waihali) includes two wells with associated power and water transmission.

The third phase (Po'elua) includes four wells, power and water transmission, a 0.5 MG storage tank and a booster station.

Information regarding the characteristics and costs of each of the phases is provided in the tables at the end of this section describing long term resource options.

Option (Long Term): Haiku Aquifer Wells

The Haiku basal groundwater aquifer lies to the east of the Kahului and Paia aquifers. The sustainable yield of the Haiku aquifer is currently established at 31 MGD. Production of water from the Haiku aquifer would require development of substantial transmission improvements to carry water to the major transmission network of the central district system. Because of potential contamination of the aquifer at lower elevations, two higher elevation scenarios were examined (1000 foot elevation and 1500 foot elevation).

Costs for the characterization of this resource option were derived from several previous engineering studies identifying transmission requirements with transmission and well drilling and development costs updated based on recent DWS experience.

Information regarding the characteristics and costs of this option is provided in the tables at the end of this section describing long term resource options.

Option (Long Term): Honopou Aquifer Wells

The Honopou basal groundwater aquifer lies to the east of the Haiku aquifer with a sustainable yield currently established at 29 MGD. Production of water for the DWS Central District system from this aquifer would require substantial water transmission and electric power transmission improvements. Because this aquifer is not contaminated at lower elevations the elevation of the wells could be in the range of as low as 500 to 600 feet. This option could be implemented as an extension and sequel to development of the Haiku Aquifer resource option or as an independent option. It is characterized here as an alternative to development of the Haiku aquifer wells to determine whether the long range cost savings of developing wells at lower elevation (600 feet rather than 1000 or 1500 feet for the Haiku aquifer) justify the additional costs of longer transmission distances.

Two scenarios are characterized with the development of 8 and 12 wells respectively.

Information regarding the characteristics and costs of this option is provided in the tables at the end of this section describing long term resource options.

Option (Long Term): Waikamoi Aquifer Wells

Substantial concerns from residents in the Honopou area were expressed at several meetings of the Central District Water Advisory Committee. As a result of these concerns an additional well-field configuration was developed bypassing the Honopou aquifer and extending transmission to the Waikamoi aquifer (see option below).

This option requires additional transmission beyond the Honopou aquifer. The scenario is characterized as a series of twenty smaller wells with a combined installed capacity of 10 MGD and a 1.0 MG storage tank.

Information regarding the characteristics and costs of this option is provided in the tables at the end of this section describing long term resource options.

Option (Long Term): Waikamoi Aquifer Wells w/ Ditch Transmission

In response to a suggestion made by a member of the Central District Water Advisory Committee an additional analysis was conducted to determine the economics of using the Lowrie ditch to transport water to the Central Maui area rather than an expensive transmission line. In this scenario water from the wells would be pumped into the Lowrie ditch at approximately 600 foot elevation. Water would be taken from the ditch downstream eliminating a substantial length of new transmission pipe but requiring construction and operation of a water treatment plant to bring the water to potable standards.

Information regarding the characteristics and costs of this option is provided in the tables at the end of this section describing long term resource options.

The Lowrie Ditch is privately owned by HC&S and currently used for the transportation of irrigation water. Utilization of the ditch for transportation of water for public municipal purposes would require an agreement with HC&S.

Option (Long Term): Brackish Water and Seawater Desalination

A study of the cost and feasibility of desalination of brackish water and seawater was recently completed by Brown & Caldwell for the DWS. The costs and characteristics of a 5 MGD (nominal) desalination facility were derived from the study.

Three variations of this potential resource option were characterized. A brackish desalination and a seawater desalination facility were characterized as described in the Brown & Caldwell study. In addition a variation of the brackish desalination facility was developed assuming four parallel trains of membranes rather than two parallel trains as described in the study. Using four rather than two parallel trains increases the reliability of the facility and increases the credit the facility would provide towards the DWS reserve capacity reliability standards. Additional costs to configure the facility with four parallel trains were estimated.

Information regarding the characteristics and costs of this option is provided in the tables at the end of this section describing long term resource options.

Tables Characterizing Long Term Ground Water Production Options

Tables characterizing the long term ground water production resource options are provided below. A brief description of some of the terms used in the tables is provided at page 7.

Wells - Maluhia (2)

(2) New DWS Wells at New Site
500GPM
w/Transmission from Kupaa

Derivation:

Capital Costs by HDA from DWS information using recent costs.

Exceptional expected escalation is accounted in substantial contingency allowance.

Type	Basal Well
System	Central
Source	Groundwater
Location	North Waihee
Aquifer	Waihee (North)

Earliest Online Date

2010

Derivation

Capacity (MGD)

Installed Capacity
Criteria Capacity
Effective Sustainable Capacity

1.440

0.960

0.672

(2) 500 GPM

2/3 Installed Capacity

Effective capacity reduced based on expected sustainable yield

Capital Costs (\$2004)

Exploration, Land
Drilling
Transmission

Development
Storage Improvements
Engineering Costs
Contingencies

Total	Per MGD
\$500,000	\$744,048
\$849,000	\$1,263,393
\$7,016,680	\$10,441,488
\$1,500,000	\$2,232,143
\$200,000	\$297,619
\$2,013,136	\$2,995,738

\$566 per foot per Kupaa

9482 feet 30"DI at \$675 per foot based on 2007 Construction estimate plus \$65 per foot ancillary, SCADA, road

(2) 500 GPM Wells @ 750,000

20% Contingency

Total Plant Cost

\$12,078,816 \$17,974,429

Expenditure Pattern

Year
Serv Date
-1
-2
-3
-4
-5
-6
-7
-8

Nom	Normalized
\$2,013,136	16.7%
\$1,500,000	12.4%
\$7,865,680	65.1%
\$700,000	5.8%
\$0	0.0%
\$0	0.0%
\$0	0.0%
\$0	0.0%
\$0	0.0%
\$0	0.0%

Contingency
Development, Storage
Transmission, Drilling
Exploration, Land, Engineering

Const. Per. Esc. Rate (Nom.)

3.00%

AFUDC Interest Rate (Nom.)

6.00%

AFUDC Factor

1.047

Total Capitalized Cost

Total Per MGD
\$12,650,337 \$18,824,906

Fixed Operating Costs (\$2004)

Dedicated Operating Labor
Apportioned Operating Labor

Per Year	Per Y/MGD
\$0	\$0
\$6,873	\$10,227

Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume.
\$0.014/kgal*1.344MGD*365.25.

Maintenance Labor

\$0 \$0

Fixed Operating Costs

\$0 \$0

Electrical Demand

\$19,618 \$29,193

5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity

Chemicals/Materials

\$0 \$0

Maintenance Expenses

\$0 \$0

Amort. of Capitalized Rebuild Costs

\$0 \$0

Total Fixed Op. Costs

\$26,490 \$39,420

Variable Operating Costs (\$2004)

Vertical Lift
Variable O&M
Electrical Energy

Per KGal
750
\$0.000
\$1.090

5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008

DWS 2001 Average escalated to 2004

Chemicals/Materials

\$0.005

Maintenance Expenses

\$0.000

Total Variable Op. Costs

\$1.095

Wells - Wailena (2)

(2) New DWS Wells at New Site
500GPM

w/Transmission from Kupaa
Derivation:

Capital Costs by HDA from DWS information using recent costs.

Exceptional expected escalation is accounted in substantial contingency allowance.

Type Basal Well
System Central
Source Groundwater
Location North Waihee
Aquifer Waihee (North)

Earliest Online Date	2011		Derivation
Capacity (MGD)			
Installed Capacity		1.440	(2) 500 GPM
Criteria Capacity		0.960	2/3 Installed Capacity
Effective Sustainable Capacity		0.672	Effective capacity reduced based on expected sustainable yield
Capital Costs (\$2004)	Total	Per MGD	
Exploration, Land	\$500,000	\$744,048	
Drilling	\$905,600	\$1,347,619	\$566 per foot per Kupaa
Transmission	\$4,248,340	\$6,321,935	5741 feet 30"DI at \$675 per foot based on 2007 Construction estimate plus \$65 per foot ancillary, SCADA, road
Development	\$1,500,000	\$2,232,143	(2) 500 GPM Wells @ 750,000
Storage Improvements			
Engineering Costs	\$200,000	\$297,619	
Contingencies	\$1,470,788	\$2,188,673	20% Contingency
Total Plant Cost	\$8,824,728	\$13,132,036	
Expenditure Pattern	Year	Nom	Normalized
Serv Date			
-1		\$1,470,788	16.7%
-2		\$1,500,000	17.0%
-3		\$5,153,940	58.4%
-4		\$700,000	7.9%
-5		\$0	0.0%
-6		\$0	0.0%
-7		\$0	0.0%
-8		\$0	0.0%
Const. Per. Esc. Rate (Nom.)		3.00%	
AFUDC Interest Rate (Nom.)		6.00%	
AFUDC Factor			1.047
Total Capitalized Cost	Total	Per MGD	
	\$9,235,983	\$13,744,022	
Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$0	\$0	
Apportioned Operating Labor	\$6,873	\$10,227	Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor	\$0	\$0	
Fixed Operating Costs	\$0	\$0	
Electrical Demand	\$20,926	\$31,139	5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials	\$0	\$0	
Maintenance Expenses	\$0	\$0	
Amort. of Capitalized Rebuild Costs	\$0	\$0	
Total Fixed Op. Costs	\$27,798	\$41,366	
Variable Operating Costs (\$2004)		Per KGal	
Vertical Lift	800		
Variable O&M		\$0.000	
Electrical Energy		\$1.163	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials		\$0.005	DWS 2001 Average escalated to 2004
Maintenance Expenses		\$0.000	
Total Variable Op. Costs		\$1.168	

Wells - Waipili (2)

(2) New DWS Wells at New Site

500GPM

w/Transmission from Wailena Wells

Derivation:

Capital Costs by HDA from DWS information using recent costs.

Exceptional expected escalation is accounted in substantial contingency allowance.

Type Basal Well
 System Central
 Source Groundwater
 Location North Waihee
 Aquifer Waihee (North)

Earliest Online Date		2013		Derivation
Capacity (MGD)				
Installed Capacity			1.440	(2) 500 GPM
Criteria Capacity			0.960	2/3 Installed Capacity
Effective Sustainable Capacity			0.672	Effective capacity reduced based on expected sustainable yield
Capital Costs (\$2004)		Total	Per MGD	
Exploration, Land		\$500,000	\$744,048	
Drilling		\$905,600	\$1,347,619	\$566 per foot per Kupaa
Transmission		\$2,220,000	\$3,303,571	3000 feet 30"DI at \$675 per foot based on 2007 Construction estimate plus \$65 per foot ancillary, SCADA, road
Development		\$1,500,000	\$2,232,143	(2) 500 GPM Wells @ 750,000
Storage Improvements		\$1,200,000	\$1,785,714	Based on Kupaa Cost
Engineering Costs		\$200,000	\$297,619	
Contingencies		\$1,305,120	\$1,942,143	20% Contingency
Total Plant Cost		\$7,830,720	\$11,652,857	
Expenditure Pattern	Year	Nom	Normalized	
	Serv Date			
	-1	\$1,305,120	16.7%	Contingency
	-2	\$2,700,000	34.5%	Development, Storage
	-3	\$3,125,600	39.9%	Transmission, Drilling
	-4	\$700,000	8.9%	Exploration, Land, Engineering
	-5	\$0	0.0%	
	-6	\$0	0.0%	
	-7	\$0	0.0%	
	-8	\$0	0.0%	
Const. Per. Esc. Rate (Nom.)		3.00%		
AFUDC Interest Rate (Nom.)		6.00%		
AFUDC Factor			1.042	
Total Capitalized Cost		\$8,157,050	\$12,138,467	
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD	
Dedicated Operating Labor		\$0	\$0	
Apportioned Operating Labor		\$6,873	\$10,227	Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor		\$0	\$0	
Fixed Operating Costs		\$0	\$0	
Electrical Demand		\$20,926	\$31,139	5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials		\$0	\$0	
Maintenance Expenses		\$0	\$0	
Amort. of Capitalized Rebuild Costs		\$0	\$0	
Total Fixed Op. Costs		\$27,798	\$41,366	
Variable Operating Costs (\$2004)			Per KGal	
Vertical Lift		800		
Variable O&M			\$0.000	
Electrical Energy			\$1.163	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials			\$0.005	DWS 2001 Average escalated to 2004
Maintenance Expenses			\$0.000	
Total Variable Op. Costs			\$1.168	

Wells - Kahakuloa (4)

Four New DWS Wells at New Sites

500 GPM each

w/Transmission from Waipili Wells

Derivation:

Capital Costs by HDA from DWS information using recent costs.

Exceptional expected escalation is accounted in substantial contingency allowance.

Type Basal Well
 System Central
 Source Groundwater
 Location Kahakuloa
 Aquifer Kahakuloa

Earliest Online Date		2014		Derivation
Capacity (MGD)				
Installed Capacity			2.880	(4) 500 GPM
Criteria Capacity			1.920	2/3 Installed Capacity
Effective Sustainable Capacity			1.344	Effective capacity reduced based on expected sustainable yield
Capital Costs (\$2004)		Total	Per MGD	
Exploration, Land		\$1,000,000	\$744,048	
Drilling		\$1,811,200	\$1,347,619	\$566 per foot per Kupaa
Transmission		\$5,180,000	\$3,854,167	7000 feet 30"DI at \$675 per foot based on 2007 Construction estimate plus \$65 per foot ancillary, SCADA, road
Development		\$3,000,000	\$2,232,143	(4) Wells @ \$750K
Storage Improvements		\$1,200,000	\$892,857	
Engineering Costs		\$250,000	\$186,012	
Contingencies		\$2,488,240	\$1,851,369	20% Contingency
Total Plant Cost		\$14,929,440	\$11,108,214	
Expenditure Pattern	Year	Nom	Normalized	
	Serv Date	\$2,488,240	16.0%	Contingency
	-1	\$4,200,000	26.9%	Development, Storage
	-2	\$6,991,200	44.8%	Transmission, Drilling
	-3	\$1,250,000	8.0%	Exploration, Land, Engineering
	-4	\$175,313	1.1%	Waiolai to Wailena incremental transmission costs
	-5	\$185,938	1.2%	Maluhia to Waiolai incremental transmission costs
	-6	\$307,062	2.0%	Kupaa to Maluhia incremental transmission costs
	-7	\$0	0.0%	
	-8	\$0	0.0%	
Const. Per. Esc. Rate (Nom.)		3.00%		
AFUDC Interest Rate (Nom.)		6.00%		
AFUDC Factor			1.048	
Total Capitalized Cost		\$15,652,772	\$11,646,408	
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD	
Dedicated Operating Labor		\$0	\$0	
Apportioned Operating Labor		\$13,745	\$10,227	Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor		\$0	\$0	
Fixed Operating Costs		\$0	\$0	
Electrical Demand		\$41,851	\$31,139	5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials		\$0	\$0	
Maintenance Expenses		\$0	\$0	
Amort. of Capitalized Rebuild Costs		\$0	\$0	
Total Fixed Op. Costs		\$55,596	\$41,366	
Variable Operating Costs (\$2004)			Per KGal	
Vertical Lift		800		
Variable O&M			\$0.000	
Electrical Energy			\$1.163	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials			\$0.005	DWS 2001 Average escalated to 2004
Maintenance Expenses			\$0.000	
Total Variable Op. Costs			\$1.168	

Wells - Waihali (2)

Two New DWS Wells at New Site

500 GPM

w/Transmission from Kahakalua Wells

Derivation:

Capital Costs by HDA from DWS information using recent costs.

Exceptional expected escalation is accounted in substantial contingency allowance.

Type	Basal Well
System	Central
Source	Groundwater
Location	Kahakalua
Aquifer	Kahakalua

Earliest Online Date	2015	Derivation
Capacity (MGD)		
Installed Capacity	1.440	(2) 500GPM
Criteria Capacity	0.960	2/3 Installed Capacity
Effective Sustainable Capacity	0.672	Effective capacity reduced based on expected sustainable yield
Capital Costs (\$2004)	Total	Per MGD
Exploration, Land	\$500,000	\$744,048
Drilling	\$905,600	\$1,347,619
Transmission	\$2,070,000	\$3,080,357
		\$566 per foot per Kupaa
Development	\$1,500,000	\$2,232,143
Storage Improvements		
Engineering Costs	\$200,000	\$297,619
Contingencies	\$1,035,120	\$1,540,357
		3000 feet 24"DI at \$625 per foot based on 2007 Construction estimate plus \$65 per foot ancillary, SCADA, road
		(2) Wells @ \$750K
		20% Contingency
Total Plant Cost	\$6,210,720	\$9,242,143
Expenditure Pattern	Year	Normalized
	Serv Date	
	-1	16.7%
	-2	24.2%
	-3	47.9%
	-4	11.3%
	-5	0.0%
	-6	0.0%
	-7	0.0%
	-8	0.0%
		Contingency
		Development, Storage
		Transmission, Drilling
		Exploration, Land, Engineering
Const. Per. Esc. Rate (Nom.)	3.00%	
AFUDC Interest Rate (Nom.)	6.00%	
AFUDC Factor		1.045
Total Capitalized Cost	\$6,493,233	\$9,662,550
Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD
Dedicated Operating Labor	\$0	\$0
Apportioned Operating Labor	\$6,873	\$10,227
		Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor	\$0	\$0
Fixed Operating Costs	\$0	\$0
Electrical Demand	\$20,926	\$31,139
		5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials	\$0	\$0
Maintenance Expenses	\$0	\$0
Amort. of Capitalized Rebuild Costs	\$0	\$0
Total Fixed Op. Costs	\$27,798	\$41,366
Variable Operating Costs (\$2004)		Per KGal
Vertical Lift	800	
Variable O&M		\$0.000
Electrical Energy		\$1.163
		5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials		\$0.005
Maintenance Expenses		\$0.000
		DWS 2001 Average escalated to 2004
Total Variable Op. Costs		\$1.168

Wells - Po'elua (4)

Four New DWS Wells at New Sites

500 GPM each

w/Transmission from Waihalo Wells

Derivation:

Capital Costs by HDA from DWS information using recent costs.

Exceptional expected escalation is accounted in substantial contingency allowance.

Type Basal Well
 System Central
 Source Groundwater
 Location Kahakuloa
 Aquifer Kahakuloa

Earliest Online Date		2016		Derivation
Capacity (MGD)				
Installed Capacity			2.880	(4) 500 GPM
Criteria Capacity			1.920	2/3 Installed Capacity
Effective Sustainable Capacity			1.344	Effective capacity reduced based on expected sustainable yield
Capital Costs (\$2004)		Total	Per MGD	
Exploration, Land		\$1,000,000	\$744,048	
Drilling		\$1,811,200	\$1,347,619	\$566 per foot per Kupaa
Transmission		\$3,450,000	\$2,566,964	5000 feet 24"DI at \$625 per foot based on 2007 Construction estimate plus \$65 per foot ancillary, SCADA, road
Development		\$3,500,000	\$2,604,167	(4) Wells + Includes booster station
Storage Improvements		\$1,200,000	\$892,857	
Engineering Costs		\$300,000	\$223,214	
Contingencies		\$2,252,240	\$1,675,774	20% Contingency
Total Plant Cost		\$13,513,440	\$10,054,643	
Expenditure Pattern	Year	Nom	Normalized	
Serv Date		\$2,252,240	16.7%	Contingency
-1		\$4,700,000	34.8%	Development, Storage
-2		\$5,261,200	38.9%	Transmission, Drilling
-3		\$1,300,000	9.6%	Exploration, Land, Engineering
-4		\$0	0.0%	
-5		\$0	0.0%	
-6		\$0	0.0%	
-7		\$0	0.0%	
-8		\$0	0.0%	
Const. Per. Esc. Rate (Nom.)		3.00%		
AFUDC Interest Rate (Nom.)		6.00%		
AFUDC Factor			1.042	
Total Capitalized Cost		\$14,078,207	\$10,474,856	
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD	
Dedicated Operating Labor		\$0	\$0	
Apportioned Operating Labor		\$13,745	\$10,227	Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor		\$0	\$0	
Fixed Operating Costs		\$0	\$0	
Electrical Demand		\$41,851	\$31,139	5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials		\$0	\$0	
Maintenance Expenses		\$0	\$0	
Amort. of Capitalized Rebuild Costs		\$0	\$0	
Total Fixed Op. Costs		\$55,596	\$41,366	
Variable Operating Costs (\$2004)			Per KGal	
Vertical Lift		800		
Variable O&M			\$0.000	
Electrical Energy			\$1.163	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials			\$0.005	DWS 2001 Average escalated to 2004
Maintenance Expenses			\$0.000	
Total Variable Op. Costs			\$1.168	

Wellfield - Haiku Aquifer (1500')

(8) New DWS Wells In Haiku Aquifer @ 1500' el.
w/Transmission to Central System

Derivation:

Prospective engineering and capital cost estimates by HDA
based on prior engineering studies and recent DWS unit cost
information.

Operation costs by HDA.

Type Basal Wells
System Central
Source Groundwater
Location Haiku
Aquifer Haiku

Earliest Online Date

2014

Derivation

Capacity (MGD)

Installed Capacity

16.128

(8) wells @1400 GPM

Criteria Capacity

10.752

2/3 Installed Capacity

Effective Sustainable Capacity

10.752

2/3 Installed Capacity

Capital Costs (\$2004)

Total

Per MGD

Exploration, Land

\$2,000,000

\$186,012

Drilling

\$6,792,000

\$631,696

\$566 per foot per Kupaa

Transmission

\$44,298,347

\$4,120,010

Based on LS 2007 Construction estimate \$46.906M +
Ancillary \$1.5M
70,000 ft. 36" line + 4000 ft 12" line
Deescalated to \$2004

Development

\$8,000,000

\$744,048

Storage Improvements

\$2,400,000

\$223,214

(1) 1MG Tank

Engineering Costs

\$400,000

\$37,202

Includes EIS

Contingencies

\$12,778,069

\$1,188,437

20% Contingency

Total Plant Cost

\$76,668,417

\$7,130,619

Expenditure Pattern

Year
Serv Date

Nom

Normalized

-1

\$12,778,069

16.7%

-2

\$10,400,000

13.6%

-3

\$51,090,347

66.6%

-4

\$2,400,000

3.1%

-5

\$0

0.0%

-6

\$0

0.0%

-7

\$0

0.0%

-8

\$0

0.0%

Contingency
Development, Storage
Transmission, Drilling
Exploration, Land, Engineering

Const. Per. Esc. Rate (Nom.)

3.00%

AFUDC Interest Rate (Nom.)

6.00%

AFUDC Factor

1.046

Total Capitalized Cost

\$80,206,684

\$7,459,699

Fixed Operating Costs (\$2004)

Per Year

Per Y/MGD

Dedicated Operating Labor

\$0

\$0

Apportioned Operating Labor

\$54,060

\$5,028

Fixed labor derived from FY03 Central district costs from
R.W.Beck Rate Study district cost analysis, apportioned by
project volume. \$0.014/kgal*1.344MGD*365.25.

Maintenance Labor

\$0

\$0

Fixed Operating Costs

\$0

\$0

Electrical Demand

\$439,438

\$40,870

5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost
factor*electrical energy cost*installed capacity

Chemicals/Materials

\$0

\$0

Maintenance Expenses

\$0

\$0

Amort. of Capitalized Rebuild Costs

\$0

\$0

Total Fixed Op. Costs

\$493,498

\$45,898

Variable Operating Costs (\$2004)

Per KGal

Vertical Lift

1500

Variable O&M

\$0.000

Electrical Energy

\$2.180

5 Kwh/Kgal/Kft lift efficiency * \$.34 per Kwh June 2008 energy
cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl
crude \$2008

Chemicals/Materials

\$0.005

DWS 2001 Average escalated to 2004

Maintenance Expenses

\$0.000

Total Variable Op. Costs

\$2.185

Wellfield - Haiku Aquifer (1000')

(8) New DWS Wells In Haiku Aquifer @ 1000' el.
w/Transmission to Central System

Derivation:

Prospective engineering and capital cost estimates by HDA
based on prior engineering studies and recent DWS unit cost
information.

Operation costs by HDA.

Type Basal Wells
System Central
Source Groundwater
Location Haiku
Aquifer Haiku

Earliest Online Date

2014

Derivation

Capacity (MGD)

Installed Capacity

16.128

(8) wells @1400 GPM

Criteria Capacity

10.752

2/3 Installed Capacity

Effective Sustainable Capacity

10.752

2/3 Installed Capacity

Capital Costs (\$2004)

Total

Per MGD

Exploration, Land

\$2,000,000

\$186,012

Drilling

\$4,528,000

\$421,131

\$566 per foot per Kupaa

Transmission

\$44,298,347

\$4,120,010

Based on LS 2007 Construction estimate \$46.906M +
Ancillary \$1.5M
70,000 ft. 36" line + 4000 ft 12" line
Deescalated to \$2004

Development

\$8,000,000

\$744,048

Storage Improvements

\$2,400,000

\$223,214

(1) 1MG Tank

Engineering Costs

\$400,000

\$37,202

Includes EIS

Contingencies

\$12,325,269

\$1,146,323

20% Contingency

Total Plant Cost

\$73,951,617

\$6,877,941

Expenditure Pattern

Year

Nom

Normalized

Serv Date

\$12,325,269

16.7%

Contingency

\$10,400,000

14.1%

Development, Storage

\$48,826,347

66.0%

Transmission, Drilling

\$2,400,000

3.2%

Exploration, Land, Engineering

\$0

0.0%

\$0

0.0%

\$0

0.0%

\$0

0.0%

\$0

0.0%

Const. Per. Esc. Rate (Nom.)

3.00%

AFUDC Interest Rate (Nom.)

6.00%

AFUDC Factor

1.046

Total Capitalized Cost

\$77,356,080

\$7,194,576

Fixed Operating Costs (\$2004)

Per Year

Per Y/MGD

Dedicated Operating Labor

\$0

\$0

Fixed labor derived from FY03 Central district costs from
R.W.Beck Rate Study district cost analysis, apportioned by
project volume. \$0.014/kgal*1.344MGD*365.25.

Apportioned Operating Labor

\$54,060

\$5,028

Maintenance Labor

\$0

\$0

Fixed Operating Costs

\$0

\$0

Electrical Demand

\$292,958

\$27,247

5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost
factor*electrical energy cost*installed capacity

Chemicals/Materials

\$0

\$0

Maintenance Expenses

\$0

\$0

Amort. of Capitalized Rebuild Costs

\$0

\$0

Total Fixed Op. Costs

\$347,018

\$32,275

Variable Operating Costs (\$2004)

Per KGal

Vertical Lift

1000

Variable O&M

\$0.000

Electrical Energy

\$1.453

5 Kwh/Kgal/Kft lift efficiency * \$.34 per Kwh June 2008 energy
cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl
crude \$2008

Chemicals/Materials

\$0.005

DWS 2001 Average escalated to 2004

Maintenance Expenses

\$0.000

Total Variable Op. Costs

\$1.459

Wellfield - Waikamoi Aquifer Redesign

(20) New DWS Wells In Waikamoi Aquifer
w/Transmission to Central System

Derivation:
Prospective engineering and capital cost estimates by HDA
based on prior engineering studies and recent DWS unit cost
information.

Operation costs by HDA.

Type Basal Wells
System Central
Source Groundwater
Location Waikamoi
Aquifer Waikamoi

Earliest Online Date		2014		Derivation
Capacity (MGD)				
Installed Capacity			10.000	(20) wells @350 GPM
Criteria Capacity			6.667	2/3 Installed Capacity
Effective Sustainable Capacity			6.667	2/3 Installed Capacity
Capital Costs (\$2004)		Total	Per MGD	
Exploration, Land		\$4,000,000	\$600,000	(20) Well sites
Drilling		\$7,924,000	\$1,188,600	\$566 per foot per Kupaa
Transmission		\$75,070,901	\$11,260,635	Based on LS 2007 Construction estimate \$70.612M + Ancillary, roads, SCADA \$2.8M 113,000 ft. 36" line + 2000 ft 12" line Deescalated to \$2004 Plus 20,000ft extension 24" line @ \$557plf
Development		\$15,000,000	\$2,250,000	(20) Wells @ \$750,000
Storage Improvements		\$2,400,000	\$360,000	(1) 1MG Tank
Engineering Costs		\$400,000	\$60,000	Includes EIS
Contingencies		\$20,958,980	\$3,143,847	20% Contingency
Total Plant Cost		\$125,753,881	\$18,863,082	
Expenditure Pattern	Year	Nom	Normalized	
Serv Date		\$20,958,980	16.7%	Contingency
-1		\$17,400,000	13.8%	Development, Storage
-2		\$82,994,901	66.0%	Transmission, Drilling
-3		\$4,400,000	3.5%	Exploration, Land, Engineering
-4		\$0	0.0%	
-5		\$0	0.0%	
-6		\$0	0.0%	
-7		\$0	0.0%	
-8		\$0	0.0%	
Const. Per. Esc. Rate (Nom.)		3.00%		
AFUDC Interest Rate (Nom.)		6.00%		
AFUDC Factor			1.046	
Total Capitalized Cost		\$131,561,512	\$19,734,227	
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD	
Dedicated Operating Labor		\$0	\$0	
Apportioned Operating Labor		\$54,060	\$8,109	Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.
Maintenance Labor		\$0	\$0	
Fixed Operating Costs		\$0	\$0	
Electrical Demand		\$127,152	\$19,073	5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity
Chemicals/Materials		\$0	\$0	
Maintenance Expenses		\$0	\$0	
Amort. of Capitalized Rebuild Costs		\$0	\$0	
Total Fixed Op. Costs		\$181,212	\$27,182	
Variable Operating Costs (\$2004)			Per KGal	
Vertical Lift		700		600' well lift + 100' dynamic transmission head
Variable O&M			\$0.000	
Electrical Energy			\$1.017	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials			\$0.005	DWS 2001 Average escalated to 2004
Maintenance Expenses			\$0.000	
Total Variable Op. Costs			\$1.023	

Wellfield - Waikamoi w Ditch Transmission and WTP

(20) New DWS Wells In Honopou Aquifer
w/Ditch Transmission to Central Maui

Derivation:

Prospective engineering and capital cost estimates by HDA
based on prior engineering studies and recent DWS unit cost
information.

Type	Basal Wells
System	Central
Source	Groundwater
Location	Waikamoi
Aquifer	Waikamoi

Earliest Online Date		2014		Derivation	
Capacity (MGD)					
Installed Capacity			9.000	(20) wells @350 GPM Minus 10% Ditch Losses	
Criteria Capacity			6.000	2/3 Installed Capacity	
Effective Sustainable Capacity			6.000	2/3 Installed Capacity	
Capital Costs (\$2004)		Total	Per MGD		
Exploration, Land		\$4,000,000	\$666,667	(20) Well sites	
Drilling		\$6,792,000	\$1,132,000	\$566 per foot per Kupaa	
Transmission		\$26,469,557	\$4,411,593	Based on breakdown from LS 2007 Construction estimate: (20)12" laterals and valves \$1.520M 45,000 ft.36"line @ \$557p/ft + Itemized transmission pipeline costs = \$27.124M Ancillary, roads, SCADA \$2.8M De-escalated to \$2004	
Development		\$15,000,000	\$2,500,000	(20) Wells @ \$750,000	
Treatment Plant		\$27,454,000	\$4,575,667	\$30M \$2007 de-escalated to \$2004 (per Waiale WTP cost)	
Engineering Costs		\$400,000	\$66,667	Includes EIS	
Contingencies		\$16,023,111	\$2,670,519	20% Contingency	
Total Plant Cost		\$96,138,669	\$16,023,111		
Expenditure Pattern		Year	Nom	Normalized	
	Serv Date				
	-1	\$16,023,111	16.7%	Contingency	
	-2	\$42,454,000	44.2%	Development, Storage	
	-3	\$33,261,557	34.6%	Transmission, Drilling	
	-4	\$4,400,000	4.6%	Exploration, Land, Engineering	
	-5	\$0	0.0%		
	-6	\$0	0.0%		
	-7	\$0	0.0%		
	-8	\$0	0.0%		
Const. Per. Esc. Rate (Nom.)		3.00%			
AFUDC Interest Rate (Nom.)		6.00%			
AFUDC Factor			1.037		
Total Capitalized Cost		\$99,736,749	\$16,622,792		
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD		
Dedicated Operating Labor		\$0	\$0		
Apportioned Operating Labor		\$54,060	\$9,010	Fixed labor derived from FY03 Central district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.014/kgal*1.344MGD*365.25.	
Treatment Plant Operating		\$638,239	\$106,373	Per Waiale WTP cost	
Fixed Operating Costs		\$0	\$0		
Electrical Demand		\$98,089	\$16,348	5 Kwh/Kgal/Kft lift efficiency*derived sys demand cost factor*electrical energy cost*installed capacity	
Chemicals/Materials		\$0	\$0		
Maintenance Expenses		\$0	\$0		
Amort. of Capitalized Rebuild Costs		\$0	\$0		
Total Fixed Op. Costs		\$790,388	\$131,731		
Variable Operating Costs (\$2004)			Per KGal		
Vertical Lift		600		600' well lift	
Treatment Electrical Energy			\$0.438	Electric cost from similar DWS membrane filtration plants consistent with Brewer Waihee WTP study = \$0.302 / kgal Escalated by 45% to reflect June 2008 \$0.34/KWH electricity prices de-escalated to \$2004	
Pumping Electrical Energy			\$0.872	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq.\$125/bbl crude \$2008	
Treatment Chem/Materials			\$0.228	Chemicals and amortized membrane filter replacement	
Water Delivery Fee			\$0.060		
Total Variable Op. Costs			\$1.598		

Brackish Desalination - 2 Train

Brackish Water Desalination Plant per Brown & Caldwell

Derivation:
Per Brown & Caldwell Final Report March 2006
Derivation of Effective Output per HDA

Type Brackish Desal
System Central
Source Groundwater
Location Puunene
Aquifer Kahului

Earliest Online Date		2010		Derivation
Capacity (MGD)				
Installed Capacity			5.000	Two parallel trains
Criteria Capacity			2.500	One train out of service
Effective Sustainable Capacity			4.250	85% of installed capacity
Capital Costs (\$2004)		Total	Per MGD	
Site, Design, EA, Management		\$4,430,201	\$1,042,400	B&C 2006 estimate de-escalated to \$2004
Source Wells, Distribution, Storage		\$4,147,422	\$975,864	B&C 2006 estimate de-escalated to \$2004
Desalination Plant Cost		\$11,311,151	\$2,661,447	B&C 2006 estimate de-escalated to \$2004
Concentrate Disposal Facilities		\$1,696,673	\$399,217	B&C 2006 estimate de-escalated to \$2004
Contingencies		\$10,792,723	\$2,539,464	50% Contingency
Total Plant Cost		\$32,378,169	\$7,618,393	
Expenditure Pattern	Year	Nom	Normalized	
	Serv Date			Contingency
	-1	\$17,155,246	53.0%	Construction
	-2	\$0	0.0%	
	-3	\$4,430,201	13.7%	Site, Design, EA, Management
	-4	\$0	0.0%	
	-5	\$0	0.0%	
	-6	\$0	0.0%	
	-7	\$0	0.0%	
	-8	\$0	0.0%	
Const. Per. Esc. Rate (Nom.)		3.00%		
AFUDC Interest Rate (Nom.)		6.00%		
AFUDC Factor			1.028	
Total Capitalized Cost		\$33,276,326	\$7,829,724	
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD	
Dedicated Operating Labor		\$235,649	\$55,447	B&C 2006 estimate de-escalated to \$2004
Apportioned Operating Labor		\$0	\$0	
Maintenance Labor		\$0	\$0	
Fixed Operating Costs		\$0	\$0	
Electrical Demand		\$103,965	\$24,462	Derived sys demand cost factor * electrical energy cost * installed capacity
Chemicals/Materials		\$0	\$0	
Maintenance Expenses		\$75,408	\$17,743	B&C 2006 estimate de-escalated to \$2004
Amort. of Capitalized Rebuild Costs		\$93,317	\$21,957	B&C 2006 estimate de-escalated to \$2004
Total Fixed Op. Costs		\$508,338	\$119,609	
Variable Operating Costs (\$2004)			Per KGal	
Vertical Lift		1145		Desal Plant Equiv. Electrical Efficiency Factor
Raw Water Cost			\$0.000	
Electrical Energy			\$1.663	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials			\$0.139	B&C 2006 estimate de-escalated to \$2004
Maintenance Expenses			\$0.000	
Total Variable Op. Costs			\$1.802	

Brackish Desalination - 4 Train

Brackish Water Desalination Plant per Brown & Caldwell

Derivation:
 Per Brown & Caldwell Final Report March 2006
 Deration of Effective Output per HDA
 Assumed Split to 4 Parallel Train per HDA

Type	Brackish Desal
System	Central
Source	Groundwater
Location	Puunene
Aquifer	Kahului

Earliest Online Date	2010		Derivation
Capacity (MGD)			
Installed Capacity		5.000	Four parallel trains
Criteria Capacity		3.750	One train out of service
Effective Sustainable Capacity		4.250	85% of installed capacity
Capital Costs (\$2004)	Total	Per MGD	
Site, Design, EA, Management	\$4,430,201	\$1,042,400	B&C 2006 estimate de-escalated to \$2004
Source Wells, Distribution, Storage	\$4,147,422	\$975,864	B&C 2006 estimate de-escalated to \$2004
Desalination Plant Cost	\$12,442,266	\$2,927,592	B&C 2006 estimate de-escalated to \$2004 + 10% per HDA (split trains)
Concentrate Disposal Facilities	\$1,696,673	\$399,217	B&C 2006 estimate de-escalated to \$2004
Contingencies	\$11,358,281	\$2,672,537	50% Contingency
Total Plant Cost	\$34,074,842	\$8,017,610	
Expenditure Pattern	Year	Nom	Normalized
Serv Date			
-1	\$11,358,281	33.3%	Contingency
-2	\$18,286,361	53.7%	Construction
-3	\$0	0.0%	
-4	\$4,430,201	13.0%	Site, Design, EA, Management
-5	\$0	0.0%	
-6	\$0	0.0%	
-7	\$0	0.0%	
-8	\$0	0.0%	
Const. Per. Esc. Rate (Nom.)	3.00%		
AFUDC Interest Rate (Nom.)	6.00%		
AFUDC Factor		1.027	
Total Capitalized Cost	Total	Per MGD	
	\$35,005,944	\$8,236,693	
Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$235,649	\$55,447	B&C 2006 estimate de-escalated to \$2004
Apportioned Operating Labor	\$0	\$0	
Maintenance Labor	\$0	\$0	
Fixed Operating Costs	\$0	\$0	
Electrical Demand	\$103,965	\$24,462	Derived sys demand cost factor * electrical energy cost * installed capacity
Chemicals/Materials	\$0	\$0	
Maintenance Expenses	\$75,408	\$17,743	B&C 2006 estimate de-escalated to \$2004
Amort. of Capitalized Rebuild Costs	\$93,317	\$21,957	B&C 2006 estimate de-escalated to \$2004
Total Fixed Op. Costs	\$508,338	\$119,609	
Variable Operating Costs (\$2004)		Per KGal	
Vertical Lift	1145		Desal Plant Equiv. Electrical Efficiency Factor
Raw Water Cost		\$0.000	
Electrical Energy		\$1.663	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq.\$125/bbl crude \$2008
Chemicals/Materials		\$0.139	B&C 2006 estimate de-escalated to \$2004
Maintenance Expenses		\$0.000	
Total Variable Op. Costs		\$1.802	

Seawater Desalination - 2 Train

Brackish Water Desalination Plant per Brown & Caldwell

Derivation:

Per Brown & Caldwell Final Report March 2006

Derivation of Effective Output per HDA

Type	Brackish Desal
System	Central
Source	Seawater
Location	Puunene
Aquifer	Seawater

Earliest Online Date		2010		Derivation
Capacity (MGD)				
Installed Capacity			5.000	Two parallel trains
Criteria Capacity			2.500	One train out of service
Effective Sustainable Capacity			4.250	85% of installed capacity
Capital Costs (\$2004)		Total	Per MGD	
Site, Design, EA, Management		\$13,761,900	\$3,238,094	B&C 2006 estimate de-escalated to \$2004
Source Wells, Distribution, Storage		\$6,315,393	\$1,485,975	B&C 2006 estimate de-escalated to \$2004
Desalination Plant Cost		\$45,600,000	\$10,729,412	B&C 2006 estimate de-escalated to \$2004
Concentrate Disposal Facilities		\$3,520,000	\$828,235	B&C 2006 estimate de-escalated to \$2004
Contingencies		\$34,598,646	\$8,140,858	50% Contingency
Total Plant Cost		\$103,795,939	\$24,422,574	
Expenditure Pattern	Year	Nom	Normalized	
	Serv Date			
	-1	\$34,598,646	33.3%	Contingency
	-2	\$55,435,393	53.4%	Construction
	-3	\$0	0.0%	
	-4	\$13,761,900	13.3%	Site, Design, EA, Management
	-5	\$0	0.0%	
	-6	\$0	0.0%	
	-7	\$0	0.0%	
	-8	\$0	0.0%	
Const. Per. Esc. Rate (Nom.)		3.00%		
AFUDC Interest Rate (Nom.)		6.00%		
AFUDC Factor			1.027	
Total Capitalized Cost		Total	Per MGD	
		\$106,648,423	\$25,093,747	
Fixed Operating Costs (\$2004)		Per Year	Per Y/MGD	
Dedicated Operating Labor		\$235,649	\$55,447	B&C 2006 estimate de-escalated to \$2004
Apportioned Operating Labor		\$0	\$0	
Maintenance Labor		\$0	\$0	
Fixed Operating Costs		\$0	\$0	
Electrical Demand		\$340,223	\$80,052	Derived sys demand cost factor * electrical energy cost * installed capacity
Chemicals/Materials		\$0	\$0	
Maintenance Expenses		\$329,909	\$77,626	B&C 2006 estimate de-escalated to \$2004
Amort. of Capitalized Rebuild Costs		\$471,298	\$110,894	B&C 2006 estimate de-escalated to \$2004
Total Fixed Op. Costs		\$1,377,078	\$324,018	
Variable Operating Costs (\$2004)			Per KGal	
Vertical Lift		3746		Desal Plant Equiv. Electrical Efficiency Factor
Raw Water Cost			\$0.000	
Electrical Energy			\$5.444	5 Kwh/Kgal/kft lift efficiency * \$.34 per Kwh June 2008 energy cost * kft lift / VarOpCost EscRate ^ (2008-2004) => eq:\$125/bbl crude \$2008
Chemicals/Materials			\$0.287	B&C 2006 estimate de-escalated to \$2004
Maintenance Expenses			\$0.000	
Total Variable Op. Costs			\$5.730	

Surface Water Treatment Options

Option (Long Term): Waiale Water Treatment Plant

Construction design for the Waiale surface water treatment plant using water collected by existing diversions from the Na Wa Eha streams is currently more than 90% complete. This project design is sponsored by Alexander & Baldwin (A&B).

The water treatment plan would be a membrane filtration facility with three trains of 4.5 MGD (nominal) filters. The facility would have an installed capacity of 13.5 MGD and an expected average capacity of 9 MGD.

No contractual agreements between A&B and the DWS have been finalized but several cost and water sharing arrangements have been discussed. Several cost and water sharing configurations were analyzed. Costs reported in this appendix show the total estimated capital costs of the treatment plant.

One substantial uncertainty regarding the economics of this resource option is the cost of the raw water charged by A&B and the Wailuku Water Company (WWC). Estimates of the costs that would be charged by these entities to the DWS for operation of the facility range from a total of \$0.30 per thousand gallons of raw water to \$0.90 per thousand gallons. Costs are reported in this appendix for three raw water cost scenarios (\$0.30, \$0.60 and \$0.90 per thousand gallons).

Information regarding the characteristics and costs of this option is provided in the tables at the end of this section describing long term resource options.

Option (Long Term): Waihee Water Treatment Plant

A water treatment plant similar to the Waiale facility discussed above to be developed by the WWC is being considered for the longer term. This option is characterized with a range of water costs similar to the Waiale facility.

There is no specific current proposal for a water treatment plant at this location. This site was considered in light of several features. It would reduce some potential water contamination issues associated with the Waiale WTP which would use water transported in open ditches further through more populated areas. Analysis of this site also measures the economic advantages of using a higher elevation site which would require less energy to pump water to the Central system hydraulic gradient pressure.

Information regarding the characteristics and costs of this option based on preliminary studies and characterizations is provided in the tables at the end of this section describing long term resource options.

Option (Long Term): Iao Stream “Flash” Water Storage

One resource option suggested for consideration at a DWS WUDP Water Advisory Committee meeting was use of water from the Iao Stream during high water stages for storage and later treatment and use as a source for the DWS Central District system. The existing Waiale reservoir was suggested as a storage reservoir for this option. This option also characterizes the costs of providing reasonably reliable water production capability for the DWS system if sufficient baseflow is not allocated for a water treatment plant on a long term basis to serve municipal water needs.

The characteristics of the source, reservoir and water treatment plant system are based on a mass flow analysis (described in the Central District Final Candidate Strategies Report). Several reservoir size and source water allocation and availability scenarios were examined. Two scenarios are documented in this appendix that are included as final candidate strategies in the Report. One strategy assumes a 1000 MG reservoir with the same water treatment plant configuration as characterized in the Waiale WTP option. A second strategy assumes a smaller 300

MG reservoir, lower overall reliability and a smaller WTP configuration.

Information regarding the characteristics and costs of this option based on preliminary studies and characterizations is provided in the tables at the end of this section describing long term resource options.

Tables Characterizing Long Term Surface Water Treatment Options

Tables characterizing the long term surface water treatment resource options are provided below. A brief description of some of the terms used in the tables is provided at page 7.

Waiale WTP @30cpkal

Surface Water Treatment Plant at Waiale Reservoir
Construction by A&B

Derivation:
Per DWS

Type Surface Water Treatment
System Central
Source Surface Water
Location Kahului
Aquifer Iao & Waihee Surface

Earliest Online Date	2009		Derivation
Capacity (MGD)			
Installed Capacity		13.500	Three 3MGD parallel units
Criteria Capacity		9.000	One unit out of service
Effective Sustainable Capacity		9.000	2/3 Installed Capacity
Capital Costs (\$2002)			
Project Cost	Total	Per MGD	
	\$27,454,000	\$3,050,444	\$30M \$2007 de-escalated to \$2004
Contingencies	\$5,490,800	\$610,089	20% Contingency
Total Plant Cost (	\$32,944,800	\$3,660,533	
Expenditure Pattern	Year	Nom	Normalized
Serv Date		\$5,490,800	16.7%
-1		\$0	0.0%
-2		\$27,454,000	83.3%
-3		\$0	0.0%
-4		\$0	0.0%
-5		\$0	0.0%
-6		\$0	0.0%
-7		\$0	0.0%
-8		\$0	0.0%
Const. Per. Esc. Rate (Nom.)		3.00%	
AFUDC Interest Rate (Nom.)		6.00%	
AFUDC Factor			1.049
Total Capitalized Cost	Total	Per MGD	
	\$34,567,352	\$3,840,817	
Fixed Operating Costs (\$2002)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$0	\$0	
Apportioned Operating Labor	\$569,400	\$63,267	
Maintenance Labor	\$0	\$0	
Fixed Operating Costs	\$0	\$0	
Electrical Demand	\$103,258	\$11,473	
Chemicals/Materials	\$0	\$0	
Maintenance Expenses	\$0	\$0	
Amort. of Capitalized Rebuild Costs	\$0	\$0	
Total Fixed Op. Costs	\$672,658	\$74,740	
Variable Operating Costs (\$2002)		Per KGal	
Vertical Lift	0		
Raw Water Cost		\$0.300	
Electrical Energy		\$0.612	Electric cost from similar DWS membrane filtration plants consistent with Brewer Waihee WTP study = \$0.302 / kgal Plus cost to boost to DWS system pressure at 100' additional head = \$0.12 / kgal Escalated by 45% to reflect June 2008 \$0.34/KWH electricity prices de-escalated to \$2004
Chemicals/Materials		\$0.228	Chemicals and amortized membrane filter replacement
Maintenance Expenses		\$0.000	
Total Variable Op. Costs		\$1.140	

Waiale WTP @60cpkal

Surface Water Treatment Plant at Waiale Reservoir
Construction by A&B

Derivation:
Per DWS

Type Surface Water Treatment
System Central
Source Surface Water
Location Kahului
Aquifer Iao & Waihee Surface

Earliest Online Date		2009		Derivation
Capacity (MGD)				
Installed Capacity			13.500	Three 3MGD parallel units
Criteria Capacity			9.000	One unit out of service
Effective Sustainable Capacity			9.000	2/3 Installed Capacity
Capital Costs (\$2002)		Total	Per MGD	
Project Cost		\$27,454,000	\$3,050,444	\$30M \$2007 de-escalated to \$2004
Contingencies		\$5,490,800	\$610,089	20% Contingency
Total Plant Cost (		\$32,944,800	\$3,660,533	
Expenditure Pattern	Year	Nom	Normalized	
	Serv Date	\$5,490,800	16.7%	Contingency
	-1	\$0	0.0%	
	-2	\$27,454,000	83.3%	Total Plant Cost
	-3	\$0	0.0%	
	-4	\$0	0.0%	
	-5	\$0	0.0%	
	-6	\$0	0.0%	
	-7	\$0	0.0%	
	-8	\$0	0.0%	
Const. Per. Esc. Rate (Nom.)		3.00%		
AFUDC Interest Rate (Nom.)		6.00%		
AFUDC Factor			1.049	
Total Capitalized Cost		\$34,567,352	\$3,840,817	
Fixed Operating Costs (\$2002)		Per Year	Per Y/MGD	
Dedicated Operating Labor		\$0	\$0	
Apportioned Operating Labor		\$569,400	\$63,267	
Maintenance Labor		\$0	\$0	
Fixed Operating Costs		\$0	\$0	
Electrical Demand		\$103,258	\$11,473	
Chemicals/Materials		\$0	\$0	
Maintenance Expenses		\$0	\$0	
Amort. of Capitalized Rebuild Costs		\$0	\$0	
Total Fixed Op. Costs		\$672,658	\$74,740	
Variable Operating Costs (\$2002)			Per KGal	
Vertical Lift		0		
Raw Water Cost			\$0.600	
Electrical Energy			\$0.612	Electric cost from similar DWS membrane filtration plants consistent with Brewer Waihee WTP study = \$0.302 / kgal Plus cost to boost to DWS system pressure at 100' additional head = \$0.12 / kgal Escalated by 45% to reflect June 2008 \$0.34/KWH electricity prices de-escalated to \$2004
Chemicals/Materials			\$0.228	Chemicals and amortized membrane filter replacement
Maintenance Expenses			\$0.000	
Total Variable Op. Costs			\$1.440	

Waiale WTP @90cpkal

Surface Water Treatment Plant at Waiale Reservoir
Construction by A&B

Derivation:
Per DWS

Type Surface Water Treatment
System Central
Source Surface Water
Location Kahului
Aquifer Iao & Waihee Surface

Earliest Online Date		2009		Derivation
Capacity (MGD)				
Installed Capacity			13.500	Three 3MGD parallel units
Criteria Capacity			9.000	One unit out of service
Effective Sustainable Capacity			9.000	2/3 Installed Capacity
Capital Costs (\$2002)		Total	Per MGD	
Project Cost		\$27,454,000	\$3,050,444	\$30M \$2007 de-escalated to \$2004
Contingencies		\$5,490,800	\$610,089	20% Contingency
Total Plant Cost (		\$32,944,800	\$3,660,533	
Expenditure Pattern	Year	Nom	Normalized	
	Serv Date	\$5,490,800	16.7%	Contingency
	-1	\$0	0.0%	
	-2	\$27,454,000	83.3%	Total Plant Cost
	-3	\$0	0.0%	
	-4	\$0	0.0%	
	-5	\$0	0.0%	
	-6	\$0	0.0%	
	-7	\$0	0.0%	
	-8	\$0	0.0%	
Const. Per. Esc. Rate (Nom.)		3.00%		
AFUDC Interest Rate (Nom.)		6.00%		
AFUDC Factor			1.049	
Total Capitalized Cost		\$34,567,352	\$3,840,817	
Fixed Operating Costs (\$2002)		Per Year	Per Y/MGD	
Dedicated Operating Labor		\$0	\$0	
Apportioned Operating Labor		\$569,400	\$63,267	
Maintenance Labor		\$0	\$0	
Fixed Operating Costs		\$0	\$0	
Electrical Demand		\$103,258	\$11,473	
Chemicals/Materials		\$0	\$0	
Maintenance Expenses		\$0	\$0	
Amort. of Capitalized Rebuild Costs		\$0	\$0	
Total Fixed Op. Costs		\$672,658	\$74,740	
Variable Operating Costs (\$2002)			Per KGal	
Vertical Lift		0		
Raw Water Cost			\$0.900	
Electrical Energy			\$0.612	Electric cost from similar DWS membrane filtration plants consistent with Brewer Waihee WTP study = \$0.302 / kgal Plus cost to boost to DWS system pressure at 100' additional head = \$0.12 / kgal Escalated by 45% to reflect June 2008 \$0.34/KWH electricity prices de-escalated to \$2004
Chemicals/Materials			\$0.228	Chemicals and amortized membrane filter replacement
Maintenance Expenses			\$0.000	
Total Variable Op. Costs			\$1.740	

Waihee Location WTP @30cpkal

Surface Water Treatment Plant at Waiale Reservoir
Specs per Waiale WTP

Derivation:
Per DWS

Type Surface Water Treatment
System Central
Source Surface Water
Location Kahului
Aquifer Iao & Waihee Surface

Earliest Online Date	2009		Derivation
Capacity (MGD)			
Installed Capacity		13.500	Three 3MGD parallel units
Criteria Capacity		9.000	One unit out of service
Effective Sustainable Capacity		9.000	2/3 Installed Capacity
Capital Costs (\$2002)	Total	Per MGD	
Project Cost	\$27,454,000	\$3,050,444	\$30M \$2007 de-escalated to \$2004
Contingencies	\$5,490,800	\$610,089	20% Contingency
Total Plant Cost (	\$32,944,800	\$3,660,533	
Expenditure Pattern	Year	Nom	Normalized
Serv Date		\$5,490,800	16.7%
-1		\$0	0.0%
-2		\$27,454,000	83.3%
-3		\$0	0.0%
-4		\$0	0.0%
-5		\$0	0.0%
-6		\$0	0.0%
-7		\$0	0.0%
-8		\$0	0.0%
Const. Per. Esc. Rate (Nom.)		3.00%	
AFUDC Interest Rate (Nom.)		6.00%	
AFUDC Factor			1.049
Total Capitalized Cost	Total	Per MGD	
	\$34,567,352	\$3,840,817	
Fixed Operating Costs (\$2002)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$0	\$0	
Apportioned Operating Labor	\$569,400	\$63,267	
Maintenance Labor	\$0	\$0	
Fixed Operating Costs	\$0	\$0	
Electrical Demand	\$73,896	\$8,211	
Chemicals/Materials	\$0	\$0	
Maintenance Expenses	\$0	\$0	
Amort. of Capitalized Rebuild Costs	\$0	\$0	
Total Fixed Op. Costs	\$643,296	\$71,477	
Variable Operating Costs (\$2002)		Per KGal	
Vertical Lift	0		
Raw Water Cost		\$0.300	
Electrical Energy		\$0.438	Electric cost from similar DWS membrane filtration plants consistent with Brewer Waihee WTP study = \$0.302 / kgal Plus cost to boost to DWS system pressure at 100' additional head = \$0.12 / kgal Escalated by 45% to reflect June 2008 \$0.34/KWH electricity prices de-escalated to \$2004
Chemicals/Materials		\$0.228	Chemicals and amortized membrane filter replacement
Maintenance Expenses		\$0.000	
Total Variable Op. Costs		\$0.966	

Waihee Location WTP @60cpkal

Surface Water Treatment Plant at Waiale Reservoir
Specs per Waiale WTP

Derivation:
Per DWS

Type Surface Water Treatment
System Central
Source Surface Water
Location Kahului
Aquifer Iao & Waihee Surface

Earliest Online Date	2009		Derivation
Capacity (MGD)			
Installed Capacity		13.500	Three 3MGD parallel units
Criteria Capacity		9.000	One unit out of service
Effective Sustainable Capacity		9.000	2/3 Installed Capacity
Capital Costs (\$2002)			
Project Cost	Total	Per MGD	
	\$27,454,000	\$3,050,444	\$30M \$2007 de-escalated to \$2004
Contingencies	\$5,490,800	\$610,089	20% Contingency
Total Plant Cost (	\$32,944,800	\$3,660,533	
Expenditure Pattern	Year	Nom	Normalized
	Serv Date	\$5,490,800	16.7%
	-1	\$0	0.0%
	-2	\$27,454,000	83.3%
	-3	\$0	0.0%
	-4	\$0	0.0%
	-5	\$0	0.0%
	-6	\$0	0.0%
	-7	\$0	0.0%
	-8	\$0	0.0%
Const. Per. Esc. Rate (Nom.)		3.00%	
AFUDC Interest Rate (Nom.)		6.00%	
AFUDC Factor			1.049
Total Capitalized Cost	Total	Per MGD	
	\$34,567,352	\$3,840,817	
Fixed Operating Costs (\$2002)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$0	\$0	
Apportioned Operating Labor	\$569,400	\$63,267	
Maintenance Labor	\$0	\$0	
Fixed Operating Costs	\$0	\$0	
Electrical Demand	\$103,258	\$11,473	
Chemicals/Materials	\$0	\$0	
Maintenance Expenses	\$0	\$0	
Amort. of Capitalized Rebuild Costs	\$0	\$0	
Total Fixed Op. Costs	\$672,658	\$74,740	
Variable Operating Costs (\$2002)		Per KGal	
Vertical Lift	0		
Raw Water Cost		\$0.600	
Electrical Energy		\$0.612	Electric cost from similar DWS membrane filtration plants consistent with Brewer Waihee WTP study = \$0.302 / kgal Plus cost to boost to DWS system pressure at 100' additional head = \$0.12 / kgal Escalated by 45% to reflect June 2008 \$0.34/KWH electricity prices de-escalated to \$2004
Chemicals/Materials		\$0.228	Chemicals and amortized membrane filter replacement
Maintenance Expenses		\$0.000	
Total Variable Op. Costs		\$1.440	

Waihee Location WTP @90cpkal

Surface Water Treatment Plant at Waiale Reservoir
Specs per Waiale WTP

Derivation:
Per DWS

Type Surface Water Treatment
System Central
Source Surface Water
Location Kahului
Aquifer Iao & Waihee Surface

Earliest Online Date	2009		Derivation
Capacity (MGD)			
Installed Capacity		13,500	Three 3MGD parallel units
Criteria Capacity		9,000	One unit out of service
Effective Sustainable Capacity		9,000	2/3 Installed Capacity
Capital Costs (\$2002)			
Project Cost	Total	Per MGD	
	\$27,454,000	\$3,050,444	\$30M \$2007 de-escalated to \$2004
Contingencies	\$5,490,800	\$610,089	20% Contingency
Total Plant Cost (	\$32,944,800	\$3,660,533	
Expenditure Pattern	Year	Nom	Normalized
	Serv Date		
	-1	\$5,490,800	16.7%
	-2	\$0	0.0%
	-3	\$27,454,000	83.3%
	-4	\$0	0.0%
	-5	\$0	0.0%
	-6	\$0	0.0%
	-7	\$0	0.0%
	-8	\$0	0.0%
Const. Per. Esc. Rate (Nom.)		3.00%	
AFUDC Interest Rate (Nom.)		6.00%	
AFUDC Factor			1.049
Total Capitalized Cost	Total	Per MGD	
	\$34,567,352	\$3,840,817	
Fixed Operating Costs (\$2002)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$0	\$0	
Apportioned Operating Labor	\$569,400	\$63,267	
Maintenance Labor	\$0	\$0	
Fixed Operating Costs	\$0	\$0	
Electrical Demand	\$103,258	\$11,473	
Chemicals/Materials	\$0	\$0	
Maintenance Expenses	\$0	\$0	
Amort. of Capitalized Rebuild Costs	\$0	\$0	
Total Fixed Op. Costs	\$672,658	\$74,740	
Variable Operating Costs (\$2002)		Per KGal	
Vertical Lift	0		
Raw Water Cost		\$0.900	
Electrical Energy		\$0.612	Electric cost from similar DWS membrane filtration plants consistent with Brewer Waihee WTP study = \$0.302 / kgal Plus cost to boost to DWS system pressure at 100' additional head = \$0.12 / kgal Escalated by 45% to reflect June 2008 \$0.34/KWH electricity prices de-escalated to \$2004
Chemicals/Materials		\$0.228	Chemicals and amortized membrane filter replacement
Maintenance Expenses		\$0.000	
Total Variable Op. Costs		\$1.740	

300 MG Reservoir and WTP

300 MG Reservoir w Reconfigured Iao Diversion w 10 MGD IFS
w 6MGD Reliable Yield

Derivation:
Per DWS

Type Surface Water Treatment
System Central
Source Surface Water
Location Kahului
Aquifer Iao & Waihee Surface

Earliest Online Date		2009		Derivation
Capacity (MGD)				
Installed Capacity			9.000	Three 3MGD parallel units
Criteria Capacity			6.000	One unit out of service
Effective Sustainable Capacity			6.000	2/3 Installed Capacity
Capital Costs (\$2002)		Total	Per MGD	
WTP Project Cost		\$21,048,258	\$3,508,043	\$23M \$2007 de-escalated to \$2004
Reservoir Cost		\$29,851,921	\$4,975,320	\$32.620M \$2007 de-escalated to \$2004
Ditch Trans Improvements		\$2,000,000	\$333,333	
Contingencies		\$10,580,036	\$1,763,339	20% Contingency
Total Plant Cost (		\$63,480,215	\$10,580,036	
Expenditure Pattern		Year	Nom	Normalized
Serv Date			\$10,580,036	33.5%
-1			\$0	0.0%
-2			\$21,048,258	66.5%
-3			\$0	0.0%
-4			\$0	0.0%
-5			\$0	0.0%
-6			\$0	0.0%
-7			\$0	0.0%
-8			\$0	0.0%
Const. Per. Esc. Rate (Nom.)		3.00%		
AFUDC Interest Rate (Nom.)		6.00%		
AFUDC Factor				1.039
Total Capitalized Cost		Total	Per MGD	
		\$65,976,947	\$10,996,158	
Fixed Operating Costs (\$2002)		Per Year	Per Y/MGD	
Dedicated Operating Labor		\$0	\$0	
Apportioned Operating Labor		\$438,438	\$73,073	
Maintenance Labor		\$0	\$0	
Fixed Operating Costs		\$0	\$0	
Electrical Demand		\$68,839	\$11,473	
Chemicals/Materials		\$0	\$0	
Maintenance Expenses		\$0	\$0	
Amort. of Capitalized Rebuild Costs		\$0	\$0	
Total Fixed Op. Costs		\$507,277	\$84,546	
Variable Operating Costs (\$2002)			Per KGal	
Vertical Lift		0		
Raw Water Cost			\$0.000	
Electrical Energy			\$0.612	Electric cost from similar DWS membrane filtration plants consistent with Brewer Waihee WTP study = \$0.302 / kgal Plus cost to boost to DWS system pressure at 100' additional head = \$0.12 / kgal Escalated by 45% to reflect June 2008 \$0.34/KWH electricity prices de-escalated to \$2004
Chemicals/Materials			\$0.228	Chemicals and amortized membrane filter replacement
Maintenance Expenses			\$0.000	
Total Variable Op. Costs			\$0.840	

1000 MG Reservoir and WTP

1000 MG Reservoir w Reconfigured Iao Diversion w 10 MGD
IFS

Derivation:
Per DWS

Type Surface Water Treatment
System Central
Source Surface Water
Location Kahului
Aquifer Iao & Waihee Surface

Earliest Online Date	2009		Derivation
Capacity (MGD)			
Installed Capacity		13.500	Three 3MGD parallel units
Criteria Capacity		9.000	One unit out of service
Effective Sustainable Capacity		9.000	2/3 Installed Capacity
Capital Costs (\$2002)	Total	Per MGD	
WTP Project Cost	\$27,454,000	\$3,050,444	\$30M \$2007 de-escalated to \$2004
Reservoir Cost	\$99,506,098	\$11,056,233	\$108.733M \$2007 de-escalated to \$2004
Ditch Trans Improvements	\$2,000,000	\$222,222	
Contingencies	\$25,792,020	\$2,865,780	20% Contingency
Total Plant Cost (	\$154,752,118	\$17,194,680	
Expenditure Pattern	Year	Nom	Normalized
Serv Date		\$25,792,020	48.4%
-1		\$0	0.0%
-2		\$27,454,000	51.6%
-3		\$0	0.0%
-4		\$0	0.0%
-5		\$0	0.0%
-6		\$0	0.0%
-7		\$0	0.0%
-8		\$0	0.0%
Const. Per. Esc. Rate (Nom.)		3.00%	
AFUDC Interest Rate (Nom.)		6.00%	
AFUDC Factor			1.030
Total Capitalized Cost	Total	Per MGD	
	\$159,467,839	\$17,718,649	
Fixed Operating Costs (\$2002)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$0	\$0	
Apportioned Operating Labor	\$569,400	\$63,267	
Maintenance Labor	\$0	\$0	
Fixed Operating Costs	\$0	\$0	
Electrical Demand	\$103,258	\$11,473	
Chemicals/Materials	\$0	\$0	
Maintenance Expenses	\$0	\$0	
Amort. of Capitalized Rebuild Costs	\$0	\$0	
Total Fixed Op. Costs	\$672,658	\$74,740	
Variable Operating Costs (\$2002)		Per KGal	
Vertical Lift	0		
Raw Water Cost		\$0.000	
Electrical Energy		\$0.612	Electric cost from similar DWS membrane filtration plants consistent with Brewer Waihee WTP study = \$0.302 / kgal Plus cost to boost to DWS system pressure at 100' additional head = \$0.12 / kgal Escalated by 45% to reflect June 2008 \$0.34/KWH electricity prices de-escalated to \$2004
Chemicals/Materials		\$0.228	Chemicals and amortized membrane filter replacement
Maintenance Expenses		\$0.000	
Total Variable Op. Costs		\$0.840	

Water Reclamation / Recycling Options

This option consists of building a new non-potable water transmission line from the existing Kihei Wastewater Treatment Plant (WWTP) to the Wailea area where water could be used to displace existing potable water now used for outdoor irrigation purposes. The viability of this strategy needs to be verified by further study to determine the long term capacity of the Kihei WWTP to produce R-1 recycled water and the amount of potable water in the Wailea area that could be displaced by making R-1 water available.

Three scenarios are characterized assuming different amounts of potable water that could be displaced (1.5, 1.0 and 0.5 MGD).

DEM Kihei R-1 So.Trans. 1.5MGD Displaced Potable

24,000' Line South of Kikei WWTP

Derivation:
Connect existing Kihei WWTP R-1 system with 1.5 MGD of displaceable potable irrigation water

Type	0
0	0
Source	0
Location	0
Aquifer	0

Earliest Online Date	2012		Derivation
Capacity (MGD)			
Installed Capacity		1.500	
Max. Day Capacity		3.000	
Effective Sustainable Capacity		1.500	
Capital Costs (\$2004)	Total	Per MGD	
Basic Plant Cost			Uses existing R-1 capacity of Kikei WTP
Distribution / Metering	\$970,874	\$647,249	(25) connection distribution and meter installations @ \$40k \$2007
Transmission Improvements	\$14,454,663	\$9,636,442	24,300 feet 18" Transmission Line w/valves, connections, installed @ \$650 pif \$2007 De-escalated to \$2004
Treatment Improvements			Uses existing R-1 capacity of Kikei WTP
Storage Improvements	\$4,575,708	\$3,050,472	(2) 1.0 MGD Storage Tanks @ \$2.50/gal. \$2007 De-escalated to \$2004
Engineering Costs	\$485,437	\$323,625	
Contingencies	\$4,097,336	\$2,731,558	20% Contingency
Total Plant Cost	\$24,584,018	\$16,389,345	
Expenditure Pattern	Year	Nom	Normalized
	Serv Date		
	-1	\$5,068,210	20.6%
	-2	\$19,030,371	77.4%
	-3	\$485,437	2.0%
	-4	\$0	0.0%
	-5	\$0	0.0%
	-6	\$0	0.0%
	-7	\$0	0.0%
	-8	\$0	0.0%
Const. Per. Esc. Rate (Nom.)		3.00%	
AFUDC Interest Rate (Nom.)		6.00%	
AFUDC Factor			1.024
Total Capitalized Cost	Total	Per MGD	
	\$25,166,990	\$16,777,993	
Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$0	\$0	
Apportioned Operating Labor	\$0	\$0	
Maintenance Labor	\$0	\$0	
Fixed Operating Costs	\$0	\$0	
Electrical Demand	\$0	\$0	
Chemicals/Materials	\$0	\$0	
Maintenance Expenses	\$0	\$0	
Amort. of Capitalized Rebuild Costs	\$0	\$0	
Total Fixed Op. Costs	\$0	\$0	
Variable Operating Costs (\$2004)		Per KGal	
Operating Labor	0		
Maintenance Labor		\$0.000	
Electrical Energy		\$0.331	FY04 Reuse Elec Cost \$123,110 for 536,003 Kgal Increased by 45% to reflect \$2008 \$0.34/KWH de-escalated to \$2004
Chemicals/Materials		\$0.050	FY04 UV Bulbs and Muriatic Acid
Maintenance Expenses		\$0.017	FY04 Expenses \$9,674 for 536,003 Kgal
Total Variable Op. Costs		\$0.398	

DEM Kihei R-1 So.Trans. 1.0MGD Displaced Potable

24,000' Line South of Kikei WWTP

Derivation:
Connect existing Kihei WWTP R-1 system with 1.5 MGD of displaceable potable irrigation water

Type	0
0	0
Source	0
Location	0
Aquifer	0

Earliest Online Date	2012		Derivation
Capacity (MGD)			
Installed Capacity		1.000	
Max. Day Capacity		2.000	
Effective Sustainable Capacity		1.000	
Capital Costs (\$2004)	Total	Per MGD	
Basic Plant Cost			Uses existing R-1 capacity of Kikei WTP
Distribution / Metering	\$970,874	\$970,874	(25) connection distribution and meter installations @ \$40k \$2007
Transmission Improvements	\$14,454,663	\$14,454,663	24,300 feet 18" Transmission Line w/valves, connections, installed @ \$650 pft \$2007 De-escalated to \$2004
Treatment Improvements			Uses existing R-1 capacity of Kikei WTP
Storage Improvements	\$4,575,708	\$4,575,708	(2) 1.0 MGD Storage Tanks @ \$2.50/gal. \$2007 De-escalated to \$2004
Engineering Costs	\$485,437	\$485,437	
Contingencies	\$4,097,336	\$4,097,336	20% Contingency
Total Plant Cost	\$24,584,018	\$24,584,018	
Expenditure Pattern	Year	Nom	Normalized
	Serv Date	\$5,068,210	20.6%
	-1	\$19,030,371	77.4%
	-2	\$485,437	2.0%
	-3	\$0	0.0%
	-4	\$0	0.0%
	-5	\$0	0.0%
	-6	\$0	0.0%
	-7	\$0	0.0%
	-8	\$0	0.0%
Const. Per. Esc. Rate (Nom.)		3.00%	
AFUDC Interest Rate (Nom.)		6.00%	
AFUDC Factor			1.024
Total Capitalized Cost	Total	Per MGD	
	\$25,166,990	\$25,166,990	
Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$0	\$0	
Apportioned Operating Labor	\$0	\$0	
Maintenance Labor	\$0	\$0	
Fixed Operating Costs	\$0	\$0	
Electrical Demand	\$0	\$0	
Chemicals/Materials	\$0	\$0	
Maintenance Expenses	\$0	\$0	
Amort. of Capitalized Rebuild Costs	\$0	\$0	
Total Fixed Op. Costs	\$0	\$0	
Variable Operating Costs (\$2004)		Per KGal	
Operating Labor	0		
Maintenance Labor		\$0.000	
Electrical Energy		\$0.331	FY04 Reuse Elec Cost \$123,110 for 536,003 Kgal Increased by 45% to reflect \$2008 \$0.34/KWH de-escalated to \$2004
Chemicals/Materials		\$0.050	FY04 UV Bulbs and Muriatic Acid
Maintenance Expenses		\$0.017	FY04 Expenses \$9,674 for 536,003 Kgal
Total Variable Op. Costs		\$0.398	

DEM Kihei R-1 So.Trans. 0.75MGD Displaced Potable

24,000' Line South of Kikei WWTP

Derivation:
Connect existing Kihei WWTP R-1 system with 1.5 MGD of displaceable potable irrigation water

Type	0
0	0
Source	0
Location	0
Aquifer	0

Earliest Online Date	2012		Derivation
Capacity (MGD)			
Installed Capacity		0.750	
Max. Day Capacity		1.500	
Effective Sustainable Capacity		0.750	
Capital Costs (\$2004)	Total	Per MGD	
Basic Plant Cost			Uses existing R-1 capacity of Kikei WTP
Distribution / Metering	\$970,874	\$1,294,498	(25) connection distribution and meter installations @ \$40k \$2007
Transmission Improvements	\$14,454,663	\$19,272,883	24,300 feet 18" Transmission Line w/valves, connections, installed @ \$650 pft \$2007 De-escalated to \$2004
Treatment Improvements			Uses existing R-1 capacity of Kikei WTP
Storage Improvements	\$4,575,708	\$6,100,944	(2) 1.0 MGD Storage Tanks @ \$2.50/gal. \$2007 De-escalated to \$2004
Engineering Costs	\$485,437	\$647,249	
Contingencies	\$4,097,336	\$5,463,115	20% Contingency
Total Plant Cost	\$24,584,018	\$32,778,690	
Expenditure Pattern	Year	Nom	Normalized
	Serv Date	\$5,068,210	20.6%
	-1	\$19,030,371	77.4%
	-2	\$485,437	2.0%
	-3	\$0	0.0%
	-4	\$0	0.0%
	-5	\$0	0.0%
	-6	\$0	0.0%
	-7	\$0	0.0%
	-8	\$0	0.0%
Const. Per. Esc. Rate (Nom.)		3.00%	
AFUDC Interest Rate (Nom.)		6.00%	
AFUDC Factor			1.024
Total Capitalized Cost	Total	Per MGD	
	\$25,166,990	\$33,555,987	
Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$0	\$0	
Apportioned Operating Labor	\$0	\$0	
Maintenance Labor	\$0	\$0	
Fixed Operating Costs	\$0	\$0	
Electrical Demand	\$0	\$0	
Chemicals/Materials	\$0	\$0	
Maintenance Expenses	\$0	\$0	
Amort. of Capitalized Rebuild Costs	\$0	\$0	
Total Fixed Op. Costs	\$0	\$0	
Variable Operating Costs (\$2004)		Per KGal	
Operating Labor	0		
Maintenance Labor		\$0.000	
Electrical Energy		\$0.331	FY04 Reuse Elec Cost \$123,110 for 536,003 Kgal Increased by 45% to reflect \$2008 \$0.34/KWH de-escalated to \$2004
Chemicals/Materials		\$0.050	FY04 UV Bulbs and Muriatic Acid
Maintenance Expenses		\$0.017	FY04 Expenses \$9,674 for 536,003 Kgal
Total Variable Op. Costs		\$0.398	