

Appendix B - Characterization of Upcountry District Specific Resource Options

This appendix identifies the characteristics of the specific resource options that were included in the analyses described in the Upcountry Final Candidate Strategies Report (Report). These resource options are the specific “ingredients” of the resource strategies considered for the Upcountry system included in the Report.

As explained in the 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 Report may differ from the information documented in this appendix. In these cases the specific assumptions are noted in the 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 Report use several alternate variable cost assumptions for other scenarios in addition to the costs reported in this appendix. Similarly, the earliest online dates specified in the tables below are recent estimates. Several alternate assumptions and scenarios regarding the feasible timing of the specific resource options were considered in the analyses supporting the Report.

Several additional specific resource options as well as information regarding assumptions used in earlier analyses are documented in the Candidate Strategies Upcountry District Draft (February 16, 2007).

Text describing each of the specific resource options in the tables below is provided in the Report.

Tables Characterizing Specific Resource Options

The following tables provide detailed information regarding each of the specific resource options considered in the analysis of the Upcountry 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%.

Capital costs are stated as one time expenses including identified contingency allowance and including capitalization of financing costs incurred prior to commissioning .

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 Schedule P energy-related charges (reflecting then cur-

rent crude oil price of \$125 per barrel) 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 - Pookela (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	Upcountry - Makawao
Source	Groundwater
Location	Pookela Tank
Aquifer	Makawao

Earliest Online Date	2009	Derivation		
Capacity (MGD)				
Installed Capacity	1.296	900 GPM		
Criteria Capacity	0.864	2/3 Installed Capacity		
Effective Sustainable Capacity	1.000			
Capital Costs (\$2004)				
	Total	Per MGD		
Design	\$66,540	\$66,540	DWS Information	
Drilling	\$1,022,390	\$1,022,390	DWS Information	
Transmission		\$0		
Development	\$2,369,162	\$2,369,162	DWS Information	
Storage Improvements		\$0		
Engineering Costs	\$327,519	\$327,519	DWS Information	
Contingencies		\$0		
Total Plant Cost	\$3,785,611	\$3,785,611		
Expenditure Pattern	Year	Nom	Normalized	
	Serv Date			
	-1	\$2,369,162	62.6%	Contingency
	-2	\$1,022,390	27.0%	Development, Storage
	-3	\$394,059	10.4%	Transmission, Drilling
	-4	\$0	0.0%	Design, 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			1.044	
Total Capitalized Cost	Total	\$3,950,485	Per MGD	\$3,950,485
Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD		
Dedicated Operating Labor	\$0	\$0		
Apportioned Operating Labor	\$13,149	\$13,149		Fixed labor derived from FY03 Upcountry district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.036/kgal*eff.capacityMGD*365.25.
Maintenance Labor	\$0	\$0		
Fixed Operating Costs	\$0	\$0		
Electrical Demand	\$42,374	\$42,374		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	\$55,523	\$55,523		
Variable Operating Costs (\$2004)		Per KGal		
Vertical Lift	1800			
Variable O&M		\$0.000		
Electrical Energy		\$2.616		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		\$2.621		

Well - MLP Well #1

New Well at New Site Developed by MLP For DWS

Derivation:
 Capital Costs by HDA from DWS information using recent costs.
 Operation costs by HDA.
 1750 foot well pumping to 1850 foot elevation

Type	Basal Well
System	Upcountry - Makawao
Source	Groundwater
Location	Makawao Area
Aquifer	Makawao

Earliest Online Date	2010		Derivation
Capacity (MGD)			
Installed Capacity		1.296	900 GPM
Criteria Capacity		0.864	2/3 Installed Capacity
Effective Sustainable Capacity		1.000	
Capital Costs (\$2004)	Total	Per MGD	
Design and Engineering	\$200,000	\$200,000	HDA Estimate based on recent DWS information
Drilling	\$1,018,868	\$1,018,868	HDA Estimate based on recent DWS information
Transmission	\$1,125,000	\$1,125,000	5000' of 12" Line @ \$225 plf
Development	\$1,178,444	\$1,178,444	HDA Estimate based on recent DWS information
Storage Improvements	\$800,000	\$800,000	Control Tank and Booster Pumps
Site Costs	\$200,000	\$200,000	HDA Estimate based on recent DWS information
Contingencies	\$2,261,156	\$2,261,156	
Total Plant Cost	\$6,783,468	\$6,783,468	
Expenditure Pattern	Year	Nom	Normalized
Serv Date		\$2,261,156	33.3%
-1		\$1,978,444	29.2%
-2		\$2,143,868	31.6%
-3		\$400,000	5.9%
-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			1.032
Total Capitalized Cost	Total	Per MGD	
	\$7,003,776	\$7,003,776	
Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$0	\$0	
Apportioned Operating Labor	\$13,149	\$13,149	Fixed labor derived from FY03 Upcountry district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.036/kgal*eff.capacityMGD*365.25.
Maintenance Labor	\$0	\$0	
Fixed Operating Costs	\$0	\$0	
Electrical Demand	\$43,551	\$43,551	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	\$56,700	\$56,700	
Variable Operating Costs (\$2004)		Per KGal	
Vertical Lift	1850		
Variable O&M		\$0.000	
Electrical Energy		\$2.688	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		\$2.694	

Well - MLP Well #2

New Well at New Site Developed by MLP For DWS

Derivation:

Capital Costs by HDA from DWS information using recent costs.

Operation costs by HDA.

1550 foot wells pumping to Pookela tank

Type	Basal Well
System	Upcountry - Makawao
Source	Groundwater
Location	Makawao Area
Aquifer	Makawao

Earliest Online Date

2010

Derivation

Capacity (MGD)

Installed Capacity	1.296	900 GPM
Criteria Capacity	0.864	2/3 Installed Capacity
Effective Sustainable Capacity	1.000	

Capital Costs (\$2004)

	Total	Per MGD	
Design and Engineering	\$200,000	\$200,000	HDA Estimate based on recent DWS information
Drilling	\$905,660	\$905,660	HDA Estimate based on recent DWS information
Transmission	\$675,000	\$675,000	3000' of 12" Line @ \$225 plf
Development	\$1,144,250	\$1,144,250	HDA Estimate based on recent DWS information
Storage Improvements	\$1,000,000	\$1,000,000	Control tank and booster pumps
Site Costs	\$200,000	\$200,000	HDA Estimate based on recent DWS information
Contingencies	\$2,062,455	\$2,062,455	
Total Plant Cost	\$6,187,365	\$6,187,365	

Expenditure Pattern

Year	Nom	Normalized
Serv Date	\$2,062,455	33.3%
-1	\$2,144,250	34.7%
-2	\$1,580,660	25.5%
-3	\$400,000	6.5%
-4	\$0	0.0%
-5	\$0	0.0%
-6	\$0	0.0%
-7	\$0	0.0%
-8	\$0	0.0%

Contingency
Development, Storage
Transmission, Drilling
Design, Engineering, Site Costs

Const. Per. Esc. Rate (Nom.)

3.00%

AFUDC Interest Rate (Nom.)

6.00%

AFUDC Factor

1.031

Total Capitalized Cost

\$6,379,216

\$6,379,216

Fixed Operating Costs (\$2004)

	Per Year	Per Y/MGD
Dedicated Operating Labor	\$0	\$0
Apportioned Operating Labor	\$13,149	\$13,149
Maintenance Labor	\$0	\$0
Fixed Operating Costs	\$0	\$0
Electrical Demand	\$42,374	\$42,374
Chemicals/Materials	\$0	\$0
Maintenance Expenses	\$0	\$0
Amort. of Capitalized Rebuild Costs	\$0	\$0
Total Fixed Op. Costs	\$55,523	\$55,523

Fixed labor derived from FY03 Upcountry district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. $\$0.036/\text{kgal} \times \text{eff. capacity MGD} \times 365.25$.

$5 \text{ Kwh/Kgal/Kft lift efficiency} \times \text{derived sys demand cost factor} \times \text{electrical energy cost} \times \text{installed capacity}$

Variable Operating Costs (\$2004)

	Per KGal
Vertical Lift	1800
Variable O&M	\$0.000
Electrical Energy	\$2.616
Chemicals/Materials	\$0.005
Maintenance Expenses	\$0.000
Total Variable Op. Costs	\$2.621

$5 \text{ Kwh/Kgal/Kft lift efficiency} \times \$0.34 \text{ per Kwh June 2008 energy cost} \times \text{kft lift} / \text{VarOpCost EscRate} \wedge (2008-2004) \Rightarrow \text{eq: } \$125/\text{bbl crude } \$2008$

DWS 2001 Average escalated to 2004

Well - DWS 1600' Site (Makawao)

New DWS Well at New Site

Derivation:

Capital Costs by HDA from DWS information using recent costs.

Operation costs by HDA.

1600 foot well pumping to 1800 foot elevation

Type	Basal Well
System	Upcountry - Makawao
Source	Groundwater
Location	Makawao Area
Aquifer	Makawao

Earliest Online Date

2010

Derivation

Capacity (MGD)

Installed Capacity	1.296
Criteria Capacity	0.864
Effective Sustainable Capacity	1.000

900 GPM
2/3 Installed Capacity

Capital Costs (\$2004)

	Total	Per MGD
Design and Engineering	\$200,000	\$200,000
Drilling	\$905,660	\$905,660
Transmission	\$488,250	\$488,250
Development	\$1,144,250	\$1,144,250
Storage Improvements	\$1,000,000	\$1,000,000
Site Costs	\$200,000	\$200,000
Contingencies	\$1,969,080	\$1,969,080
Total Plant Cost	\$5,907,240	\$5,907,240

HDA Estimate based on recent DWS information
HDA Estimate based on recent DWS information
2170' of 12" Line @ \$225 plf
HDA Estimate based on recent DWS information
Control tank and booster pumps to Pookela tank
HDA Estimate based on recent DWS information

Expenditure Pattern

Year	Nom	Normalized
Serv Date	\$1,969,080	33.3%
-1	\$2,144,250	36.3%
-2	\$1,393,910	23.6%
-3	\$400,000	6.8%
-4	\$0	0.0%
-5	\$0	0.0%
-6	\$0	0.0%
-7	\$0	0.0%
-8	\$0	0.0%

Contingency
Development, Storage
Transmission, Drilling
Design, Engineering, Site Costs

Const. Per. Esc. Rate (Nom.)

3.00%

AFUDC Interest Rate (Nom.)

6.00%

AFUDC Factor

1.031

Total Capitalized Cost

Total
Per MGD
\$6,088,054
\$6,088,054

Fixed Operating Costs (\$2004)

	Per Year	Per Y/MGD
Dedicated Operating Labor	\$0	\$0
Apportioned Operating Labor	\$13,149	\$13,149
Maintenance Labor	\$0	\$0
Fixed Operating Costs	\$0	\$0
Electrical Demand	\$42,374	\$42,374
Chemicals/Materials	\$0	\$0
Maintenance Expenses	\$0	\$0
Amort. of Capitalized Rebuild Costs	\$0	\$0
Total Fixed Op. Costs	\$55,523	\$55,523

Fixed labor derived from FY03 Upcountry district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. \$0.036/kgal*eff.capacityMGD*365.25.

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

Variable Operating Costs (\$2004)

	Per KGal
Vertical Lift	1800
Variable O&M	\$0.000
Electrical Energy	\$2.616
Chemicals/Materials	\$0.005
Maintenance Expenses	\$0.000
Total Variable Op. Costs	\$2.621

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

Well - DWS 1300' Site (Makawao)

New DWS Well at New Site

Derivation:

Capital Costs by HDA from DWS information using recent costs.

Operation costs by HDA.

1300 foot well pumping to 1800 foot elevation

Type	Basal Well
System	Upcountry - Makawao
Source	Groundwater
Location	Makawao Area
Aquifer	Makawao

Earliest Online Date

2010

Derivation

Capacity (MGD)

Installed Capacity		1.296
Criteria Capacity		0.864
Effective Sustainable Capacity		1.000

900 GPM
2/3 Installed Capacity

Capital Costs (\$2004)

	Total	Per MGD
Design and Engineering	\$200,000	\$200,000
Drilling	\$679,245	\$679,245
Transmission	\$612,000	\$612,000
Development (includes booster pumps)	\$1,064,844	\$1,064,844
Storage Improvements	\$1,000,000	\$1,000,000
Site Costs	\$200,000	\$200,000
Contingencies	\$1,878,045	\$1,878,045

HDA Estimate based on recent DWS information
HDA Estimate based on recent DWS information
2720' of 12" Line @ \$225 p/f
HDA Estimate based on recent DWS information
Control tank and booster to Pookela tank
HDA Estimate based on recent DWS information

Total Plant Cost \$5,634,134 \$5,634,134

Expenditure Pattern

Year	Nom	Normalized
Serv Date	\$1,878,045	33.3%
-1	\$2,064,844	36.6%
-2	\$1,291,245	22.9%
-3	\$400,000	7.1%
-4	\$0	0.0%
-5	\$0	0.0%
-6	\$0	0.0%
-7	\$0	0.0%
-8	\$0	0.0%

Contingency
Development, Storage
Transmission, Drilling
Design, Engineering, Site Costs

Const. Per. Esc. Rate (Nom.) 3.00%

AFUDC Interest Rate (Nom.) 6.00%

AFUDC Factor

1.031

Total Capitalized Cost

Total Per MGD
\$5,806,567 \$5,806,567

Fixed Operating Costs (\$2004)

	Per Year	Per Y/MGD
Dedicated Operating Labor	\$0	\$0
Apportioned Operating Labor	\$13,149	\$13,149
Maintenance Labor	\$0	\$0
Fixed Operating Costs	\$0	\$0
Electrical Demand	\$30,604	\$30,604
Chemicals/Materials	\$0	\$0
Maintenance Expenses	\$0	\$0
Amort. of Capitalized Rebuild Costs	\$0	\$0
Total Fixed Op. Costs	\$43,753	\$43,753

Fixed labor derived from FY03 Upcountry district costs from R.W.Beck Rate Study district cost analysis, apportioned by project volume. $\$0.036/\text{kgal} \times \text{eff. capacity MGD} \times 365.25$.

$5 \text{ Kwh/Kgal/Kft lift efficiency} \times \text{derived sys demand cost factor} \times \text{electrical energy cost} \times \text{installed capacity}$

Variable Operating Costs (\$2004)

	Per KGal
Vertical Lift	1300
Variable O&M	\$0.000
Electrical Energy	\$1.889
Chemicals/Materials	\$0.005
Maintenance Expenses	\$0.000
Total Variable Op. Costs	\$1.895

$5 \text{ Kwh/Kgal/kft lift efficiency} \times \$0.34 \text{ per Kwh June 2008 energy cost} \times \text{kft lift} / \text{VarOpCost EscRate} \wedge (2008-2004) \Rightarrow \text{eq: } \$125/\text{bbl crude } \$2008$

DWS 2001 Average escalated to 2004

GAC Treatment for Groundwater Well

Granulated Activated Carbon (GAC) Treatment Facility for Well Storage Tank

Derivation:
Capital Costs from DWS CIP for West Maui well treatment

Type	Groundwater Treatment
System	Upcountry - Makawao
Source	0
Location	Generic
Aquifer	0

Earliest Online Date 2010 **Derivation**

Capacity (MGD)			
Installed Capacity		0.000	900 GPM
Criteria Capacity		0.000	2/3 Installed Capacity
Effective Sustainable Capacity		2.000	

Capital Costs (\$2004)		Total	Per MGD	
Design and Engineering		\$250,000	\$125,000	DWS CIP
0			\$0	
0			\$0	
Basic Plant Costs		\$2,000,000	\$1,000,000	DWS CIP
0			\$0	
0			\$0	
Contingencies			\$0	
Total Plant Cost		\$2,250,000	\$1,125,000	

Expenditure Pattern	Year	Nom	Normalized	
	Serv Date			
	-1	\$0	0.0%	Contingency
	-2	\$2,000,000	88.9%	Construction
	-3	\$250,000	11.1%	Design, 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			1.032	

	Total	Per MGD
Total Capitalized Cost	\$2,323,028	\$1,161,514

Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD
Dedicated Operating Labor	\$0	\$0
Apportioned Operating Labor	\$26,298	\$13,149
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	\$26,298	\$13,149

Variable Operating Costs (\$2004)	Per KGal	
Vertical Lift	0	
Variable O&M	\$0.000	
Electrical Energy	\$0.000	
Chemicals/Materials	\$0.050	Filter Amortization
Maintenance Expenses	\$0.000	
Total Variable Op. Costs	\$0.050	

100 MG Raw Water Reservoir for Piiholo WTP

New raw water storage reservoir

Derivation:

Costs based on Mink 7 Yuen and DWS information

Incremental capacity per HDA based on Mink & Yuen

Type Raw Surface Water Storage
 System Upcountry - Makawao
 Source Existing Stream Diversions
 Location Near Piiholo WTP
 Aquifer 0

Earliest Online Date

2016

Derivation

Capacity (MGD)

Installed Capacity

1.190
1.190
1.190

Incremental reliable capacity increase based on mass flow analysis for increasing raw water storage capacity from 50MG to 150MG and providing new separate transmission to reservoir for existing Waikamoi stream intakes

Criteria Capacity

Effective Sustainable Capacity

Capital Costs (\$2004)

Total Per MGD

Basic Plant Cost

\$20,000,000 \$16,806,723

DWS Estimate

Engineering

\$4,500,000 \$3,781,513

DWS Estimate

0

\$0

0

\$0

0

\$0

0

\$0

Contingencies

\$4,900,000 \$4,117,647

20% Contingency

Total Plant Cost

\$29,400,000 \$24,705,882

Expenditure Pattern

Year	Nom	Normalized
Serv Date	\$4,900,000	16.7%
-1	\$20,000,000	68.0%
-2	\$4,500,000	15.3%
-3	\$0	0.0%
-4	\$0	0.0%
-5	\$0	0.0%
-6	\$0	0.0%
-7	\$0	0.0%
-8	\$0	0.0%

Contingency
 Construction
 Design, Engineering, Site Costs

Const. Per. Esc. Rate (Nom.)

3.00%

AFUDC Interest Rate (Nom.)

6.00%

AFUDC Factor

1.029

Total Capitalized Cost

Total Per MGD
\$30,248,478 \$25,418,889

Fixed Operating Costs (\$2004)

Per Year Per Y/MGD

Dedicated Operating Labor

\$0 \$0

Apportioned Operating Labor

\$60,000 \$50,420

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

\$60,000 \$50,420

Variable Operating Costs (\$2004)

Per KGal

Vertical Lift

0 \$0.000

Variable O&M

\$0.000

Electrical Energy

\$0.000

Variable Operation Costs are Treatment Plant Costs

Chemicals/Materials

\$0.000

Maintenance Expenses

\$0.000

Total Variable Op. Costs

\$0.000

300 MG Raw Water Reservoir for Piiholo WTP

New raw water storage reservoir and intake and collector system modifications

Derivation:

Costs based on Mink 7 Yuen and DWS information

Incremental capacity per HDA based on Mink & Yuen

Type	Raw Surface Water Storage
System	Upcountry - Makawao
Source	Existing Stream Diversions
Location	East of Piiholo WTP
Aquifer	0

Earliest Online Date

2016

Derivation

Capacity (MGD)

Installed Capacity

2.590

Incremental reliable capacity increase based on mass flow analysis for increasing raw water storage capacity from 50MG to 350MG and providing new separate transmission to reservoir for existing Waikamoi stream intakes

Criteria Capacity

2.590

Effective Sustainable Capacity

2.590

Capital Costs (\$2004)

Total

Per MGD

Basic Plant Cost

\$60,000,000

\$23,166,023

DWS Estimate

Engineering

\$4,500,000

\$1,737,452

DWS Estimate

0

\$0

0

\$0

0

\$0

0

\$0

Contingencies

\$12,900,000

\$4,980,695

20% Contingency

Total Plant Cost

\$77,400,000

\$29,884,170

Expenditure Pattern

Year
Serv Date

Nom

Normalized

-1

\$12,900,000

16.7%

Contingency

-2

\$60,000,000

77.5%

Construction

-3

\$4,500,000

5.8%

Design, Engineering, Site Costs

-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

1.026

Total Capitalized Cost

Total

Per MGD

\$79,413,526

\$30,661,593

Fixed Operating Costs (\$2004)

Per Year

Per Y/MGD

Dedicated Operating Labor

\$0

\$0

Apportioned Operating Labor

\$60,000

\$23,166

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

\$60,000

\$23,166

Variable Operating Costs (\$2004)

Per KGal

Vertical Lift

0

Variable O&M

\$0.000

Electrical Energy

\$0.000

Variable Operation Costs are Treatment Plant Costs

Chemicals/Materials

\$0.000

Maintenance Expenses

\$0.000

Total Variable Op. Costs

\$0.000

500 MG Raw Water Reservoir for Piiholo WTP

New raw water storage reservoir and intake and collector system modifications

Derivation:

Costs based on Mink 7 Yuen and DWS information

Incremental capacity per HDA based on Mink & Yuen

Type Raw Surface Water Storage
 System Upcountry - Makawao
 Source Existing Stream Diversions
 Location East of Piiholo WTP
 Aquifer 0

Earliest Online Date

2016

Derivation

Capacity (MGD)

Installed Capacity

3.510
3.510
3.510

Incremental reliable capacity increase based on mass flow analysis for increasing raw water storage capacity from 50MG to 550MG and providing new separate transmission to reservoir for existing Waikamoi stream intakes

Criteria Capacity

Effective Sustainable Capacity

Capital Costs (\$2004)

Total Per MGD

Basic Plant Cost

\$100,000,000 \$28,490,028

DWS Estimate

Engineering

\$4,500,000 \$1,282,051

DWS Estimate

0

\$0

0

\$0

0

\$0

0

\$0

Contingencies

\$20,900,000 \$5,954,416

20% Contingency

Total Plant Cost

\$125,400,000 \$35,726,496

Expenditure Pattern

Year	Nom	Normalized
Serv Date	\$20,900,000	16.7%
-1	\$100,000,000	79.7%
-2	\$4,500,000	3.6%
-3	\$0	0.0%
-4	\$0	0.0%
-5	\$0	0.0%
-6	\$0	0.0%
-7	\$0	0.0%
-8	\$0	0.0%

Contingency
 Construction
 Design, Engineering, Site Costs

Const. Per. Esc. Rate (Nom.)

3.00%

AFUDC Interest Rate (Nom.)

6.00%

AFUDC Factor

1.025

Total Capitalized Cost

Total Per MGD
\$128,578,575 \$36,632,073

Fixed Operating Costs (\$2004)

Per Year Per Y/MGD

Dedicated Operating Labor

\$0 \$0

Apportioned Operating Labor

\$60,000 \$17,094

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

\$60,000 \$17,094

Variable Operating Costs (\$2004)

Per KGal

Vertical Lift

0

Variable O&M

\$0.000

Electrical Energy

\$0.000

Variable Operation Costs are Treatment Plant Costs

Chemicals/Materials

\$0.000

Maintenance Expenses

\$0.000

Total Variable Op. Costs

\$0.000

300 MG Raw Water Reservoir for Olinda WTP

New raw water storage reservoir

Derivation:

Type Raw Surface Water Storage
 System Upcountry - Makawao
 Source Existing Stream Diversions
 Location East of Olinda WTP
 Aquifer 0

Earliest Online Date	2016		Derivation
Capacity (MGD)			
Installed Capacity		1.050	
Criteria Capacity		1.050	
Effective Sustainable Capacity		1.050	
Capital Costs (\$2004)	Total	Per MGD	
Basic Plant Cost	\$60,000,000	\$57,142,857	DWS Estimate for Lower Kula System Reservoir
Engineering	\$4,500,000	\$4,285,714	DWS Estimate for Lower Kula System Reservoir
0		\$0	
0		\$0	
0		\$0	
0		\$0	
Contingencies	\$12,900,000	\$12,285,714	20% Contingency
Total Plant Cost	\$77,400,000	\$73,714,286	
Expenditure Pattern	Year	Nom	Normalized
Serv Date		\$12,900,000	16.7%
-1		\$60,000,000	77.5%
-2		\$4,500,000	5.8%
-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			1.026
Total Capitalized Cost	Total	Per MGD	
	\$79,413,526	\$75,631,930	
Fixed Operating Costs (\$2004)	Per Year	Per Y/MGD	
Dedicated Operating Labor	\$0	\$0	
Apportioned Operating Labor	\$60,000	\$57,143	
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	\$60,000	\$57,143	
Variable Operating Costs (\$2004)		Per KGal	
Vertical Lift	0		
Variable O&M		\$0.000	
Electrical Energy		\$0.000	Variable Operation Costs are Treatment Plant Costs
Chemicals/Materials		\$0.000	
Maintenance Expenses		\$0.000	
Total Variable Op. Costs		\$0.000	

100 MG Raw Water Reservoir for Kamole WTP

New raw water storage reservoir and intake system modifications

Derivation:

Type	Raw Surface Water Storage
System	Upcountry - Makawao
Source	Existing Stream Diversions
Location	Kamole WTP
Aquifer	0

Earliest Online Date
Capacity (MGD)

2014

Derivation

Installed Capacity

4.500

Net drought period reliable capacity based on mass flow analysis for Kamole WTP assuming 20 MG reduced base flows in Wailoa Ditch due to implementation of amendments to East Maui tributary stream IIFS. Potable yield @ 90% raw water availability.

Criteria Capacity

4.500

Effective Sustainable Capacity

4.500

Capital Costs (\$2004)

	Total	Per MGD
Basic Plant Cost	\$16,666,667	\$3,703,704
Engineering	\$4,500,000	\$1,000,000
0	0	\$0
0	0	\$0
0	0	\$0
0	0	\$0
Contingencies	\$4,233,333	\$940,741
Total Plant Cost	\$25,400,000	\$5,644,444

Estimate based on 80% of Lower Kula Construction Costs
DWS Estimate

20% Contingency

Expenditure Pattern

Year	Nom	Normalized
Serv Date	\$4,233,333	16.7%
-1	\$16,666,667	65.6%
-2	\$4,500,000	17.7%
-3	\$0	0.0%
-4	\$0	0.0%
-5	\$0	0.0%
-6	\$0	0.0%
-7	\$0	0.0%
-8	\$0	0.0%

Contingency
Construction
Design, Engineering, Site Costs

Const. Per. Esc. Rate (Nom.)

3.00%

AFUDC Interest Rate (Nom.)

6.00%

AFUDC Factor

1.030

Total Capitalized Cost

Total	Per MGD
\$26,151,390	\$5,811,420

Fixed Operating Costs (\$2004)

	Per Year	Per Y/MGD
Dedicated Operating Labor	\$0	\$0
Apportioned Operating Labor	\$60,000	\$13,333
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	\$60,000	\$13,333

Variable Operating Costs (\$2004)

	Per KGal
Vertical Lift	0
Variable O&M	\$0.000
Electrical Energy	\$0.000
Chemicals/Materials	\$0.000
Maintenance Expenses	\$0.000
Total Variable Op. Costs	\$0.000

Variable Operation Costs are Treatment Plant Costs

200 MG Raw Water Reservoir for Kamole WTP

New raw water storage reservoir and intake system modifications

Derivation:

Type	Raw Surface Water Storage
System	Upcountry - Makawao
Source	Existing Stream Diversions
Location	Kamole WTP
Aquifer	0

Earliest Online Date

2014

Derivation

Capacity (MGD)

Installed Capacity

7.290

Net drought period reliable capacity based on mass flow analysis for Kamole WTP assuming 20 MG reduced base flows in Wailoa Ditch due to implementation of amendments to East Maui tributary stream IIFS. Potable yield @ 90% raw water availability.

Criteria Capacity

7.290

Effective Sustainable Capacity

7.290

Capital Costs (\$2004)

Total

Per MGD

Basic Plant Cost

\$33,333,333

\$4,572,474

Estimate based on 80% of Lower Kula Construction Costs

Engineering

\$4,500,000

\$617,284

DWS Estimate

0

\$0

0

\$0

0

\$0

0

\$0

Contingencies

\$7,566,667

\$1,037,952

20% Contingency

Total Plant Cost

\$45,400,000

\$6,227,709

Expenditure Pattern

Year

Nom

Normalized

Serv Date

\$7,566,667

16.7%

Contingency

-1 \$33,333,333

73.4%

Construction

-2 \$4,500,000

9.9%

Design, Engineering, Site Costs

-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

1.027

Total

Per MGD

\$46,636,827

\$6,397,370

Per Year

Per Y/MGD

Dedicated Operating Labor

\$0

\$0

Apportioned Operating Labor

\$60,000

\$8,230

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

\$60,000

\$8,230

Per KGal

Vertical Lift

0

Variable O&M

\$0.000

Electrical Energy

\$0.000

Variable Operation Costs are Treatment Plant Costs

Chemicals/Materials

\$0.000

Maintenance Expenses

\$0.000

Total Variable Op. Costs

\$0.000

300 MG Raw Water Reservoir for Kamole WTP

New raw water storage reservoir and intake system modifications

Derivation:

Type	Raw Surface Water Storage
System	Upcountry - Makawao
Source	Existing Stream Diversions
Location	Kamole WTP
Aquifer	0

Earliest Online Date

2014

Derivation

Capacity (MGD)

Installed Capacity

8.640
8.640
8.640

Net drought period reliable capacity based on mass flow analysis for Kamole WTP assuming 20 MG reduced base flows in Wailoa Ditch due to implementation of amendments to East Maui tributary stream IIFS. Potable yield @ 90% raw water availability.

Criteria Capacity

Effective Sustainable Capacity

Capital Costs (\$2004)

	Total	Per MGD
Basic Plant Cost	\$50,000,000	\$5,787,037
Engineering	\$4,500,000	\$520,833
0		\$0
0		\$0
0		\$0
0		\$0
Contingencies	\$10,900,000	\$1,261,574
Total Plant Cost	\$65,400,000	\$7,569,444

Estimate based on 80% of Lower Kula Construction Costs
DWS Estimate

Expenditure Pattern

Year	Nom	Normalized
Serv Date	\$10,900,000	16.7%
-1	\$50,000,000	76.5%
-2	\$4,500,000	6.9%
-3	\$0	0.0%
-4	\$0	0.0%
-5	\$0	0.0%
-6	\$0	0.0%
-7	\$0	0.0%
-8	\$0	0.0%

Contingency
Construction
Design, Engineering, Site Costs

Const. Per. Esc. Rate (Nom.)

AFUDC Interest Rate (Nom.)

AFUDC Factor

Total	Per MGD
\$67,122,264	\$7,768,781

Dedicated Operating Labor

Apportioned Operating Labor

Per Year	Per Y/MGD
\$0	\$0
\$60,000	\$6,944

Maintenance Labor

Fixed Operating Costs

Electrical Demand

Chemicals/Materials

Maintenance Expenses

Amort. of Capitalized Rebuild Costs

Total Fixed Op. Costs

\$60,000	\$6,944
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Per KGal

Vertical Lift

Variable O&M

Electrical Energy

Chemicals/Materials

Maintenance Expenses

Total Variable Op. Costs

0	\$0.000
0	\$0.000
0	\$0.000
0	\$0.000
0	\$0.000
0	\$0.000

Variable Operation Costs are Treatment Plant Costs

500 MG Raw Water Reservoir for Kamole WTP

New raw water storage reservoir and intake system modifications

Derivation:

Type	Raw Surface Water Storage
System	Upcountry - Makawao
Source	Existing Stream Diversions
Location	Kamole WTP
Aquifer	0

	2014
Installed Capacity	9.450
Criteria Capacity	9.450
Effective Sustainable Capacity	9.450

Derivation

Net drought period reliable capacity based on mass flow analysis for Kamole WTP assuming 20 MG reduced base flows in Wailoa Ditch due to implementation of amendments to East Maui tributary stream IIFS. Potable yield limited by Kamole WTP criteria capacity.

	Total	Per MGD
Basic Plant Cost	\$83,333,333	\$8,818,342
Engineering	\$4,500,000	\$476,190
0		\$0
0		\$0
0		\$0
0		\$0
Contingencies	\$17,566,667	\$1,858,907
Total Plant Cost	\$105,400,000	\$11,153,439

Estimate based on 80% of Lower Kula Construction Costs

DWS Estimate

20% Contingency

Year	Nom	Normalized
Serv Date	\$17,566,667	16.7%
-1	\$83,333,333	79.1%
-2	\$4,500,000	4.3%
-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		1.026

Contingency

Construction

Design, Engineering, Site Costs

	Total	Per MGD
	\$108,093,138	\$11,438,427

	Per Year	Per Y/MGD
Dedicated Operating Labor	\$0	\$0
Apportioned Operating Labor	\$60,000	\$6,349
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	\$60,000	\$6,349

	Per KGal
Vertical Lift	0
Variable O&M	\$0.000
Electrical Energy	\$0.000
Chemicals/Materials	\$0.000
Maintenance Expenses	\$0.000
Total Variable Op. Costs	\$0.000

Variable Operation Costs are Treatment Plant Costs

Awalau / Opana Tunnel Source Development

Treatment Facilities, Storage and Intake Structure Reconstruction for Existing Awalau Source

Derivation:
Costs from DWS Estimates Updated by HDA

Type Surface Water Treatment
System Upcountry - Makawao
Source Opana Stream Diversion to Awalau Tunnel
Location Piiholo Area
Aquifer 0

		2011		Derivation
Installed Capacity			2.590	(2) 90 element Memcor parallel units
Criteria Capacity			0.000	Not reliable source without raw water storage
Effective Sustainable Capacity			0.400	Average source diversion is 0.5MGD, Drought period source diversion is 0.3MGD. With 2MG tank average output is estimated at 0.4MGD and drought output at .15MGD
		Total	Per MGD	
Design and Engineering		\$444,500	\$1,111,250	DWS 1996 estimate escalated to \$2004 at 3% =>1.27x
Treatment Construction		\$3,556,000	\$8,890,000	DWS 1996 estimate escalated to \$2004 at 3% =>1.27x
Reconstruction of Intake		\$2,540,000	\$6,350,000	DWS 1996 estimate escalated to \$2004 at 3% =>1.27x
0			\$0	
Storage Improvements		\$2,857,500	\$7,143,750	DWS 1996 estimate escalated to \$2004 at 3% =>1.27x
0			\$0	HDA Estimate based on recent DWS information
Contingencies		\$1,879,600	\$4,699,000	20% Contingency
Total Plant Cost		\$11,277,600	\$28,194,000	
Expenditure Pattern	Year	Nom	Normalized	
	Serv Date			Contingency
	-1	\$1,879,600	16.7%	Construction, Storage
	-2	\$8,953,500	79.4%	Design, Engineering
	-3	\$444,500	3.9%	
	-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			1.025	
		Total	Per MGD	
		\$11,564,652	\$28,911,630	
		Per Year	Per Y/MGD	
Dedicated Operating Labor		\$0	\$0	
Apportioned Operating Labor		\$14,000	\$35,000	Labor and fixed electric based on DWS lao WTP costs \$0.252 * 279,000 = ca. \$7000 (Doubled due to remote location)
Maintenance Labor		\$0	\$0	
Fixed Operating Costs		\$0	\$0	
Electrical Demand		\$0	\$0	Labor and fixed electric based on DWS lao WTP costs included in operating labor above
Chemicals/Materials		\$0	\$0	
Maintenance Expenses		\$0	\$0	
Amort. of Capitalized Rebuild Costs		\$0	\$0	
Total Fixed Op. Costs		\$14,000	\$35,000	
			Per KGal	
Vertical Lift		0		
Variable O&M			\$0.000	
Electrical Energy			\$0.658	Based on lao WTP operating costs (includes energy and var. chemical costs) Jan-Apr 2008 Division Report costs (Avg \$95/bbl w/ MECO Lag) adjusted to \$125/bbl = \$0.34/kwh J/P rate. De-escalated to 2004 base year costs
Chemicals/Materials			\$0.000	Included in electrical energy costs above
Maintenance Expenses			\$0.058	Amortized Filter Replacement Cost
Total Variable Op. Costs			\$0.716	