

Maui County Water Use and Development Plan

Resource Options

Draft

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Maui County Water Use and Development Plan Resource Options

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I. Introduction

This chapter (Resource Options Chapter) is one component of a comprehensive update of the Maui County Water Use & Development Plan (WUDP). The purpose of this chapter is to present and explain the resource options that are considered in developing the WUDP.

Resource options are inclusively defined to include any measure, program, activity, policy or improvement that could further the planning objectives identified for the WUDP. A broad spectrum of resource options is initially identified and characterized for consideration as an element to be included in the WUDP. Resource options are components that are ultimately compiled into resource “sequences” or “strategies” that can be evaluated, optimized and ultimately selected as the basis of the WUDP.

This chapter presents the identification and initial characterization of the resource options considered in developing the WUDP. Several analyses are presented that approximate the costs of various supply and conservation resource options. Some basic attributes of some of the resource options are identified.

The characterization of the costs and other attributes of resource options in this chapter is necessarily general and approximate. The attributes of many resource options can only be determined accurately in the context of how they are implemented in specific applications. The costs and attributes of resource options will be more rigorously characterized in the analysis of the candidate resource strategies performed later in the WUDP process.

II. Identification of Resource Options

Resource options are inclusively defined to include any measure, program, activity, policy or improvement that could further the planning objectives identified for the WUDP. Resource options can include physical improvements to increase water supply (wells, treatment plants, storage and transmission) as well as programs to improve water use efficiency or reduce water system losses. For purposes of the WUDP resource options also include programs or policies to attain any of the full spectrum of planning objectives. For example, resource options include programs, measures and policies pertaining to watershed protection, stream protection, wellhead protection, water quality, and, more generally, the support of agricultural, environmental, cultural and Department of Hawaiian Homelands (DHHL) interests.

Process for Identification of Resource Options

Several resource options were identified by each Water Advisory Committee (WAC) at the initial WAC meetings for the Central and Upcountry districts. Additional resource options were identified by the Department of Water Supply (DWS) and its consultant. A list that included all of these options was presented and discussed at the fourth meetings of the Central and Upcountry WAC's. Based on the discussion at the WAC meetings several additional resource options were identified.

The identification of resource options is ongoing. As the analysis of resource strategies progresses both the scope of the list of resource options and the specificity of resource options may be extended. Additional resource options may continue to be identified by the DWS, its consultants, the WAC's, or overseeing agencies. The identification of resource options

continues throughout the WUDP process.

List of Resource Options

A list of resource options was identified by the DWS staff, its consultants and WAC members. Resource options were identified including the following categories:

- New potable water sources
- Demand-side management options
 - Indoor use measures
 - Landscape irrigation measures
 - Agricultural measures
 - Codes, regulations and incentives
- Recycled water use options
- Stream protection and restoration options
- Watershed protection and restoration options
- Well development policies
- Energy production and efficiency options

The resource options identified through August, 2005, including options added based on comments received at the fourth WAC meetings, are documented in the matrix of resource options and planning objectives in the following section of this chapter.

III. Characterization of Resource Options

The characterization of resource options in this chapter is necessarily general and approximate. The attributes of many resource options can only be determined accurately in the context of how they are implemented in specific applications. For example, the costs of water produced by a well may depend not only on the location and characteristics of the well but also upon the ultimate location of water use and how the well would be used in a particular application. A well that is quite expensive to operate may be an economical component of a resource plan in which the well serves primarily as a backup resource for source reliability and displaces the need for more extensive capital investments otherwise necessary to achieve this objective. The costs and attributes of resource options will be more rigorously characterized in the analysis of the candidate resource strategies performed later in the WUDP process.

Characterization of Resource Option Attributes

The attributes of resource options are characterized according to how they contribute to furthering the attainment of the WUDP planning objectives. The planning objectives were initially compiled from a list of goals, objectives and issues identified by the Central and Upcountry WAC's. The list of objectives was refined by the DWS and its consultant with review and further adjustments and additions by the WAC's. These objectives include providing sufficient water for identified needs, minimizing costs, maximizing water service reliability, protection of streams, water resources and environmental and cultural considerations, etc.

For purposes of discussion and characterization of the identified resource options a “matrix” was developed. The matrix is shown below with the revisions (shown in shaded cells) made based comments made at the fourth meetings of the Central and Upcountry WAC’s in August, 2004. A “plus” sign in a matrix cell indicates that the resource is likely to contribute positively to the attainment of the corresponding planning objective. A “minus” sign indicates that the resource may have negative impacts. In some cells both a plus and minus are shown indicating that both positive and negative effects were identified. An “a” in a matrix cell indicates that the impacts will be determined by analysis.

Resource Option	Planning Objectives														
	Availability	Cost	Efficiency	Environment	Equity	Sustainability	Quality	Reliability	Streams	Resources	Culture	DHHL	Agriculture	Conformity	Viability
	MGD Average	\$/kgal 20YR Lev.	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-
New Potable Water Sources															
Well Sys. - North Waihee (HDA per N.Saito 1990)	4.000	\$2.37													
Well Sys - Paia/Haiku (per N.Saito 1990)	8.700	\$2.68													
Well Sys - Paia/Haiku (per SEIS; 1000 gal w/no GAC)	8.011	\$2.37													
Well Sys - Paia to Honopou (HDA per BCA 1990)	15.392	\$3.09													
Well - Maluhia (w/storage, trans; per DWS CIP)	1.000	\$1.63													
Well - Waioloai (w/storage, trans; per DWS CIP)	1.000	\$1.58													
Well - Pookela (per contracts)	0.900	\$3.95													
Well - Piiloho															
Well - Perched (Generic)	1.000	\$1.06													
Production Tunnel - Perched (Generic)	1.000	\$1.42													
Stream Diversion (w/storage, treatment) (Generic)	6.000	\$2.84													
Ditch Withdrawal (w/storage, treatment) (Generic)	6.000	\$2.84													
Desalination (Seawater)															
Desalination (Brackish)															
HPoko connect wells to Cent.Sys (30 Yr Econ. Life)	1.000	\$4.10													
HPoko connect wells to Cent.Sys (4 Yr Econ. Life)	1.000	\$7.30													
HPoko close or use wells for emergency service only															
HPoko pump & trade for ditch water (add'l pump & treat)															
Piiloho 300MG Reservoir Expansion (Incremental)	2.530	\$5.17													
Long-term Water Storage Reservoir															
Supply-side Leak Detection / Reduction															
Catchment															
Upcountry to Central System Interconnection															
Aquifer Recharge Strategies															
Incentives for onsite catchment and storage															
Use Iao Stream Diversions for Aquifer Recharge															
Use Stormwater for Aquifer Recharge															
Condensation Using Seawater Cooling															
Dew Generators															
Artificial Capstone (as in Orange Co.)															

Resource Option	Planning Objectives														
	Availability	Cost	Efficiency	Environment	Equity	Sustainability	Quality	Reliability	Streams	Resources	Culture	DHHL	Agriculture	Conformity	Viability
	MGD Average	\$ / kgal 20YR Lev.	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -	+ / -
Recycled Water Use Options															
DPW Recycled Water - Waipulani St. Line Extension	0.156	\$1.76	+												
DPW Recycled Water - Liloa Dr. Line Extension	0.086	\$2.34	+												
DPW Recycled Water - Transmission Line to N.Kihei	0.300		+												
Trade Recycled Water for Ditch Water	+						+								
Upgrade Central WTP to R-1 with Distribution	+														
Stream Restoration Options															
Provide minimum streamflows on some streams															
Provide minimum streamflows on all streams															
Restore natural streamflows on some or all streams															
Eliminate some or all stream diversions															
Stream Channelization Restoration															
Restore Stream as Demonstration & For Research															
Watershed Protection and Restoration															
Adopt wellhead protection ordinance															
Support watershed protection partnerships and programs	+														
Watershed restoration programs	+														
Use native species	+														
Well Development Policies															
Wells provided by developers at subdivision sites		+													
Wells provided by developers at planned sites		+													
Land developer participation in well dev. program		+													
New well provided by DWS financing															
Pacing of Water Development															
Regulation / Oversight of Well Siting															
Energy Production and Efficiency Options															
Hydroelectric generation - run of the river															
Hydroelectric generation - storage dam															
Hydroelectric generation - inline micro-hydro		a													
Wind power for water pumping		a													
Pumped storage hydro systems															
Water storage for utility energy management															
Motor and pump efficiency improvements		+	+												
System operation efficiency improvements		+	+												

Resource Option	Planning Objectives														
	Availability	Cost	Efficiency	Environment	Equity	Sustainability	Quality	Reliability	Streams	Resources	Culture	DHHL	Agriculture	Conformity	Viability
	MGD Average	\$/kgal 20YR Lev.	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-
Demand-Side Management Options															
Domestic Indoor Uses															
Toilet replacement rebate program		\$2.16	+												
Toilet replacement targeted direct install		\$1.44	+												
Urinal replacement rebate program		\$2.03	+												
Efficient dishwasher rebate program		\$44.64	+												
Efficient clothes dryer rebate program		\$9.24	+												
Leak Detection Audits			+												
Landscape Irrigation															
Greywater for landscape/crop irrigation		\$35.17	+												
Irrigation timers and controls		\$1.74	+												
Low water-use plantings		\$1.23	+												
Xeriscaping		\$1.34	+												
Replace spray with drip irrigation			+												
Agricultural Uses															
Irrigation timers and controls			+												
Untreated water distribution and use			+												
Recycled water distribution and use			+												
Replace spray or flood with drip irrigation			+												
Codes, Regulations, Incentives															
Drought restriction policies		a	+												
Water rate design and pricing policies			+												
Education and public awareness programs			+												
Enforcement of codes and ordinances			+												
Identify Permitted Range of Uses for R-2 Water Zoning - Require Higher Density Housing	+		+												
Adopt Landscape Ordinance			+												
Restrictions for Pools, Water Features, Excess Uses			+												

Preliminary Cost Analysis

The characterization of resource options regarding all of the WUDP planning objectives is important. One important attribute that lends itself to quantitative analysis for some resource options is monetary costs. Although the costs of each resource option can be determined accurately only in the context of application to a specific resource strategy or plan, the development of preliminary, approximate cost estimates is valuable in determining which resources should be considered as worthy components of candidate resource strategies. Several conventions used to characterize resource options are discussed and a preliminary analysis of the costs of some supply and conservation resource options is presented below.

Conventions Used to Characterize Resource Option Costs

Long range resource planning requires the comparison of various resource options that have very different characteristics. Some resource options have high initial capital costs but lower operating costs. Other options may have lower initial capital costs and higher operation costs. Some resource options provide additional supply or service capability. Other options may meet water demand needs by reducing required water production requirements by end-use efficiency improvements or displacement of potable needs with non-potable sources. In order to make meaningful comparisons of the costs of different types of resource options several “normalizing” conventions are used.

The costs of resource options that are presented in the sections below are expressed in “levelized unit costs”. The term “unit costs” means that costs are expressed in terms of dollars per unit of water produced or saved (dollars per thousand gallons). The term “levelized” means that costs are expressed in equalized, amortized terms (much like the costs of a mortgage are amortized into equal payments spread over the term of the mortgage). Levelized costs consider the magnitude and timing of the capital and operating costs of each option over the whole life of the option (in accordance with explicit assumptions regarding inflation, cost escalation and time value of money).¹ The levelized costs presented below assume an inflation rate of 3% per year, real energy price escalation of 2% per year and a time value of money (discount rate) of 6% per year.

These costs are applicable only for purposes of rough characterization. As noted above, accurate determination of the cost of resource options can only be made in the context of specific circumstances including how the resource would be used in a particular resource strategy. For example, the operating cost of wells are expressed below as the costs to pump water from the bottom of the well to the elevation of the well head. For the Central system these costs fairly closely approximate the costs to deliver water to most DWS customers at lower elevations. For the Upcountry system or some higher elevation Central district customers, however, substantial additional costs could be required to boost the water produced by the well to higher elevations where the water might be required. In comparisons of costs of water produced by wells to water produced by treatment of higher elevation surface water the unit costs presented below are not directly applicable without further considerations of the specific

¹ More specifically, the “levelized unit costs” express the amount of nominal (current) dollars per unit of water that, if paid over the life of the option for the amount of water produced by the option, would equal the magnitude of capital and operating costs for the option considering the timing of costs, inflation and cost escalation when discounted to present day dollars.

application. Some caution is therefore advised regarding how the costs are applied.

Cost of New Sources of Water Supply

The monetary costs of several new sources of water supply were calculated using the conventions described above. These are presented in the table below titled “Supply Resource Option Characterization”

Cost of Water Conservation Programs

The costs of several conservation (demand-side management) programs were calculated using the conventions described above. These are presented in the table below titled “Candidate DSM Program Characterization”.

Supply Resource Option Characterization (Preliminary Draft Estimates)

Option Name	Option Description	Plant Capacity		Capital Cost		Fixed Operating Cost		Variable Operating Cost		Plant Life Economic	Total NPV Unit \$/MGD	Economic Life Total Capital Levelized \$/kgal	Total Discounted Cost Fixed Op. Levelized \$/kgal	Var. Op. Levelized \$/kgal
		Installed	Average Effective Output	Cost	Unit Cost	Cost	Unit Cost	Cost	Unit Cost					
Wells - North Waihehe	Per 1992 WUDP Update per N. Saito August 1990 (5) 2 MGD wells, storage, transmission Costs include some transmission already installed HDA Modification of 1992 Update Configuration (4) Wells w/ 4MGD aquifer limit	MGD	MGD	\$M	\$/Year	\$/Year	\$/Year	\$/kgal	Years	NPV \$2002 \$/MGD	Levelized \$/kgal	Levelized \$/kgal	Levelized \$/kgal	Levelized \$/kgal
Wells - North Waihehe		14,000	8,000	\$24,343	\$3,043	\$235,405	\$29,426	\$0.75	30	\$9,818	\$1.95	\$0.61	\$0.12	\$1.23
Wells @ Paia/Haiku Area	Per 1992 WUDP Update per N. Saito August 1990 (28) 1 MGD wells @ 600', storage, transmission Includes Hamakuaokoko wells Per EMPLAN SEIS, Revised well depth 1000' (8) Wells 1.7MGD, storage, transmission	8,000	4,000	\$19,359	\$4,840	\$129,596	\$32,399	\$0.78	30	\$11,889	\$2.37	\$0.96	\$0.13	\$1.27
Wells @ Paia to Honopou	Per 1992 WUDP Update per N. Saito August 1990 (25) 2 MGD wells, storage, transmission HDA modification of 1992 WUDP Update configuration Costs adjusted for even comparison to N. Saito estimates 2.0 MGD Well per DWS CIP, includes storage, transmission	14,000	13,000	\$69,505	\$7,989	\$219,396	\$25,218	\$0.60	30	\$13,450	\$2.68	\$1.59	\$0.10	\$0.99
Wells @ Paia to Honopou		13,680	11,970	\$23,646	\$2,952	\$276,337	\$34,496	\$1.00	30	\$11,903	\$2.37	\$0.59	\$0.14	\$1.64
Well @ Maluhia	Per 1992 WUDP Update per Beit Collins & Assoc, Oct 1990 (25) Wells 1MGD, storage, transmission HDA modification of 1992 WUDP Update configuration Costs adjusted for even comparison to N. Saito estimates 2.0 MGD Well per DWS CIP, includes storage, transmission	25,000	23,000	\$80,272	\$5,215	\$531,243	\$34,514	\$0.81	30	\$12,555	\$2.50	\$1.04	\$0.14	\$1.32
Well @ Waiolai	2.0 MGD Well per DWS CIP; includes storage, transmission Incremental development following Maluhia Well Well at Pookela site per construction specs	25,000	23,000	\$99,345	\$6,454	\$593,743	\$38,574	\$1.01	30	\$15,528	\$3.09	\$1.28	\$0.15	\$1.65
Pookela Well		2,000	2,000	\$4,525	\$4,525	\$15,114	\$15,114	\$0.41	30	\$8,173	\$1.63	\$0.90	\$0.06	\$0.67
Well @ Central Perched Generic	2.0 MGD Well per DWS CIP; includes storage, transmission Incremental development following Maluhia Well Well at Pookela site per construction specs	2,000	2,000	\$4,300	\$4,300	\$15,114	\$15,114	\$0.41	30	\$7,948	\$1.58	\$0.86	\$0.06	\$0.67
Tunnel @ Central Perched Generic	Genetic hypothetical project, unspecified location	0,900	0,900	\$3,786	\$4,206	\$33,399	\$37,110	\$1.80	30	\$19,823	\$3.95	\$0.84	\$0.15	\$2.96
Connect Hamakuaokoko to Central System	Genetic hypothetical project, unspecified location	2,000	2,000	\$4,325	\$4,325	\$7,614	\$7,614	\$0.11	30	\$5,344	\$1.06	\$0.86	\$0.03	\$0.17
Connect Hamakuaokoko to Central System	Connect (2) existing wells to Central system Costs presume later use for system expansion	1,000	1,000	\$6,825	\$6,825	\$5,364	\$5,364	\$0.03	30	\$7,138	\$1.42	\$1.36	\$0.02	\$0.04
Connect Hamakuaokoko to Central System	Connect (2) existing wells to Central system Cost as contingency w/ no later use for system expansion	2,000	2,000	\$6,900	\$6,900	\$63,798	\$63,798	\$1.51	30	\$20,607	\$4.10	\$1.37	\$0.25	\$2.47
Central Treatment and Storage	Generic surface water source system w/ ditch source Includes TP, storage, engineering, no specific transmission New 300MG reservoir for Pihohe TP (Lower Kula) Incremental capacity increase per HDA mass flow analysis	2,000	2,000	\$6,900	\$6,900	\$63,798	\$63,798	\$1.51	4	\$9,235	\$7.30	\$5.45	\$0.19	\$1.66
Pihohe 300MG Reservoir Expansion	Connect existing 12" Waipulani line to S.Khei Rd. line Costs per kgal based on displaced potable water only	9,000	6,000	\$64,900	\$10,817	\$350,000	\$58,333	\$0.28	30	\$14,288	\$2.84	\$2.15	\$0.23	\$0.46
DPW Recycled Water - Waipulani St. Line	Connect existing 12" Liloa Dr. line to S. Khei Rd. line Costs per kgal based on displaced potable water only	2,530	2,530	\$64,500	\$25,494	\$60,000	\$23,715	\$0.00	30	\$25,964	\$5.17	\$5.07	\$0.09	\$0.00
DPW Recycled Water - Liloa Dr. Line	Connect existing 12" Liloa Dr. line to S. Khei Rd. line Costs per kgal based on displaced potable water only	0,156	0,156	\$1,000	\$6,410	\$0	\$0	\$0.30	30	\$8,852	\$1.76	\$1.28	\$0.00	\$0.49
Notes:	Levelized costs are calculated based on 3.0% inflation, 6.0% DWS cost of capital and 6.0% discount rate. Operating costs are HDA estimates. All estimates, calculated costs and impacts should be considered preliminary draft approximations for purposes of initial resource characterization and review. Costs from prior studies are escalated to year 2002 dollars according to Consumer Price Index for Honolulu (all goods, urban) NPV = net present value MGD = millions of gallons per day kgal = one thousand gallons \$2002 = constant (real) dollars HDA = Haiku Design & Analysis (Carl Freedman)													
Abbreviations:														

Candidate DSM Program Characterization (Preliminary Draft Estim

Program Name	Delivery Mechanism	Measure Cost		Rebate per unit	Utility Cost		Program Cost		Savings Efficacy gpd/ft	Measure Life Years	Levelized Unit Cost			
		Equip Cost	Instal Cost		Total per unit	Admin per unit	Participant per unit	TRC per unit			Participant \$ / kgal	Utility \$ / kgal	TRC \$ / kgal	
Toilet Retro Rebate	Rebate Application based on Honolulu program	\$80	\$100	\$180	\$50	\$150	\$80	\$150	\$230	30.00	15	\$0.752	\$1,410	\$2,162
Toilet Retro Rebate	Bounty for old fixtures brought to depot (dumpster) and destroyed.	\$80	\$100	\$180	\$50	\$150	\$80	\$150	\$230	30.00	15	\$0.752	\$1,410	\$2,162
Toilet Targeted Retro	Direct installation of fixtures in targeted buildings with existing 5-7 gpf fixtures	\$80	\$100	\$180	\$75	\$255	\$0	\$255	\$255	50.00	15	\$0.000	\$1,438	\$1,438
Toilet Flapper Install	Per SPU CPA	\$8	\$0	\$8	\$12	\$20	\$0	\$20	\$20	9.25	10	\$0.000	\$0.804	\$0.804
Showerhead Giveaway	Showerheads distributed at public events or by request			\$0	\$10	\$10	\$0	\$10	\$10	1.62	10	\$0.000	\$2,296	\$2,296
Shwrhd Canvass	Showerheads distributed by door-to-door canvase with choice of type			\$0	\$20	\$20	\$0	\$20	\$20	4.86	10	\$0.000	\$1,531	\$1,531
Shwrhd Direct Install	Showerheads installed by trained technicians			\$0	\$30	\$30	\$0	\$30	\$30	7.29	10	\$0.000	\$1,531	\$1,531
Shwrhd Mass Mail	Showerheads mailed to all customers			\$0	\$15	\$15	\$0	\$15	\$15	1.62	10	\$0.000	\$3,444	\$3,444
Urinal Retro Rebate	Rebate Application similar to Honolulu to rebate program	\$250	\$100	\$350	\$50	\$200	\$200	\$200	\$400	55.55	15	\$1.015	\$1,015	\$2,031
Water Eff Clothes Wash	Rebate Application with purchase documentation	\$350	\$0	\$350	\$70	\$220	\$200	\$220	\$420	16.91	10	\$4.400	\$4,840	\$9,240
Water Eff Dish Washer	Rebate Application with purchase documentation	\$50	\$0	\$50	\$70	\$120	\$0	\$120	\$120	1.00	10	\$0.000	\$44,640	\$44,640
Auto Rain Shut Off	Per SPU CPA - Install automatic rain shut-off on automatic irrigation systems	\$50	\$0	\$50	\$9	\$59	\$0	\$59	\$59	10.66	10	\$0.000	\$2,063	\$2,063
Soil Moisture Sensor	Per SPU CPA - Install soil moisture sensors on automatic irrigation systems	\$150	\$0	\$150	\$9	\$159	\$0	\$159	\$159	34.11	10	\$0.000	\$1,735	\$1,735
Improve Perf. of Irr. Sys.	Per SPU CPA - repair, replacement, adjustment of in-ground irr. system	\$188	\$0	\$188	\$9	\$197	\$0	\$197	\$197	38.03	10	\$0.000	\$1,923	\$1,923
Improve Irr. Scheduling	Per SPU CPA - Improve irrigation efficiency by better scheduling	\$25	\$0	\$25	\$9	\$34	\$0	\$34	\$34	23.77	10	\$0.000	\$0,534	\$0,534
Greywater for Irrigation	Per SPU CPA - Install grey water collect/dist. system - new and remod.	\$2,000	\$0	\$2,000	\$9	\$2,009	\$0	\$2,009	\$2,009	16.11	15	\$0.000	\$35,169	\$35,169
Rain Barrel Catchment	Per SPU CPA - Install 50 gallon barrels t gutter downspouts for irrigation	\$50	\$0	\$50	\$9	\$59	\$0	\$59	\$59	1.99	10	\$0.000	\$11,050	\$11,050
Low Water Use Plantings	Per SPU CPA - Replace 300sq.ft. lawn w low water req. plants	\$25	\$0	\$25	\$9	\$34	\$0	\$34	\$34	10.31	10	\$0.000	\$1,231	\$1,231
Xeriscaping	HDA per SPU CPA - Replace irrigated landscaping with zeriscape	\$500	\$1,000	\$1,500	\$300	\$800	\$1,000	\$800	\$1,800	500.00	10	\$0.744	\$0,595	\$1,339

Notes:

Shaded cells are data entry cells; other numerical cells are calculated
 SPU CPA = Seattle Public Utilities Conservation Potential Assessment Final Project Report, May 1998. Delivery mechanisms were not explicitly identified for s
 Documentation, calculations of estimates and sources are identified on a more detailed source spreadsheet
 Levelized costs are calculated according to the identified measure life assuming a 3.0% inflation rate, 6.0% cost of capital, 6.0% discount r
 All estimates and calculated costs and savings impacts should be considered rough approximations for purposes of initial measure and program asse
 gpd = gallons per day; gpd/ft = gallons per day per fixture; kgal = thousand gallons; TRC = Total Resource Cost Test HDA = Haiku Design & Analysis (

Abbreviations: