City of Malibu

23825 Stuart Ranch Road ♦ Malibu, California ♦ 90265-4861
Phone (310) 456-2489 ♦ Fax (310) 317-0950 ♦ www.malibucity.org

COPY

December 29, 2011

Mr. Sam Unger, Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, CA 90013

RE: Memorandum of Understanding – Malibu Civic Center Wastewater Treatment Plan
Phase 1: Milestone 2 of 10

Dear Mr. Unger:

On August 19, 2001, the City of Malibu (City), the Los Angeles Regional Water Quality Control Board and the State Water Resources Control Board (Water Boards), entered into a Memorandum of Understanding (MOU) to essentially work together towards the common goal of designing and constructing a Wastewater Treatment Plan (Plan) for the City of Malibu Civic Center area. The MOU identifies a three-phased approach that requires Phase I to be implemented by November 5, 2015, and Phase 2 to be implemented by November 5, 2019. Implementation of Phase 3 will be dependent upon water quality monitoring data.

Phase 1 identifies 10 significant milestones and the due date for each. Milestone 1, which was submitted on September 30, 2011, required submission of a schedule and list of public outreach meetings and materials developed to inform the public about the development of a wastewater treatment facility. The second milestone reads:

2. *By **December 31, 2011**, submit a recycle/reuse/storage study which shall identify the potential location and options to maximize the reuse of the Title 22 effluent, including the evaluation of the use of storage infrastructure, recommended water recycling goals and storage volume targets.*

In accordance with Milestone 2 of the MOU, attached is the Recycled Water Use and Storage Study for the project.

I trust the attached study report provides a thorough understanding of the City's plan to maximize the reuse of the Title 22 effluent for this project. I believe this information also satisfies Milestone No. 2 of Phase One of the MOU.

If for any reason, additional information or clarification is needed, please do not hesitate to contact me at (310) 456-2489 ext. 226 or jthorsen@malibucity.org.

Sincerely,

Bob Brager for:

Jim Thorsen
City Manager

Attachment: City of Malibu Recycled Water Use and Storage Study, December 2011, RMC Water and Environment

cc: Mayor Rosenthal and Honorable Members of the Malibu City Council
Vic Peterson, Environmental and Sustainability Director
Bob Brager, Public Works Director
Tom Howard, Executive Director, State Water Resources Control Board
Eric Wu, Los Angeles Regional Water Quality Control Board
Steve Clary, RMC Water and Environment

City of Malibu

Recycled Water Use and Storage Study

December 2011

RMC
Water and Environment

Technical Memorandum

City of Malibu Wastewater Collection, Treatment, and Recycled Water System Design

Subject:	Recycled Water Use and Storage Study
Prepared For:	Los Angeles Regional Water Quality Control Board Jim Thorsen, City of Malibu Bob Brager, City of Malibu Rob DuBoux, City of Malibu
Prepared by:	Amanda Schmidt, RMC John Thayer, RMC
Reviewed by:	Steve Clary, RMC
Date:	December 23, 2011
Reference:	0127-004

This technical memorandum (TM) presents potential locations for Title 22 effluent reuse and evaluates the option of seasonal storage to potentially maximize annual recycled water use within the City of Malibu. This analysis is required per Article II. A.1 of the August 2011 Memorandum of Understanding between the City of Malibu and the Los Angeles Regional Water Quality Control Board.

This TM is organized in the following sections:

1 Introduction and Purpose of Technical Memorandum

In August 2011 the Los Angeles Regional Water Quality Control Board (RWQCB) formally adopted a Memorandum of Understanding (MOU) with the City of Malibu (City) which sets milestones for implementing centralized wastewater collection and treatment in the Malibu Civic Center Area. As one of the conditions of the MOU, the City must submit to the RWQCB a recycled/reuse/storage study that identifies potential locations and options to maximize the reuse of Title 22 effluent such as seasonal storage of treated effluent to potentially maximize annual recycled water use.

The purpose of this technical memorandum is to:

- Identify potential recycled water customers and demands that might be served using recycled wastewater effluent generated within the RWQCB-mandated Prohibition Zone

- Identify potential recycling water opportunities by developing a list of customers for which the City may seek user commitments
- Evaluate recycled water seasonal storage options in the Civic Center Area, if the concept of seasonal storage is found to be potentially viable
- Prepare a water balance that identifies the volumes of recycled water available vs. the potential reuse demand and effluent disposal for wastewater Phase One, Phase Two and Phase Three buildout conditions. These three phases correspond to the implementation phases for connection of Civic Center parcels to the centralized wastewater collection and treatment system, as described in the MOU with the RWQCB (see Figure 1).

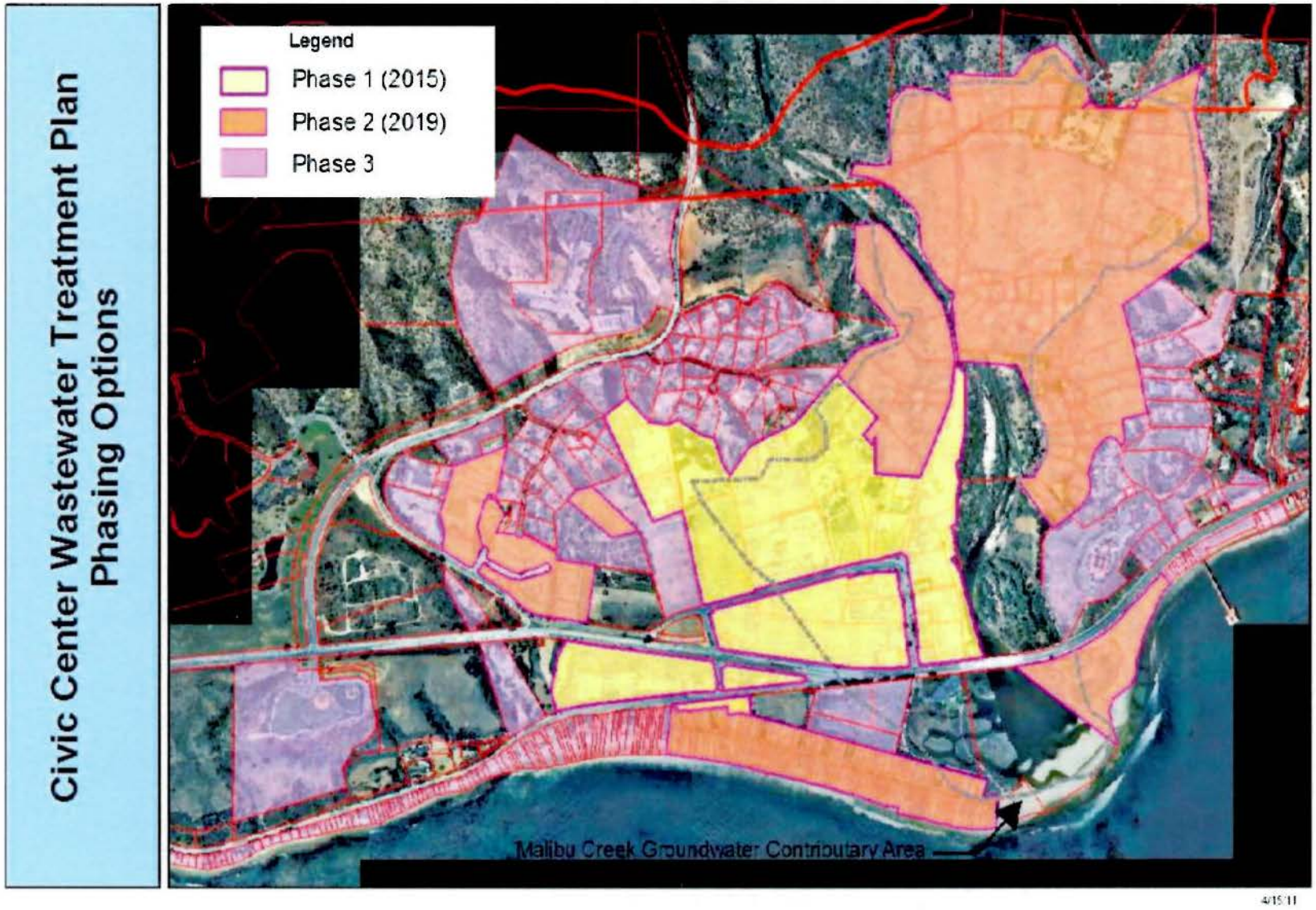
This TM does not include an evaluation of cost of recycled water service, cost recovery, or City policies needed to implement the recycled water program. This type of evaluation could be part of a recycled water master plan, which is beyond the scope of this TM.

1.1 Impact of Malibu's Landscaping Philosophy on Reuse Demand

Since February 2, 1996, the City has been guided by its Local Coastal Program (LCP) when considering landscape options and the potential use of recycled water. The LCP states that plantings shall be native, drought-tolerant plan species, and shall blend with existing natural vegetation and natural habitats on the site. The acceptable native plant species are those listed by the California Native Plant Society, Santa Monica Mountains Chapter, in their document entitled, 'Recommended List of Plants for Landscaping in the Santa Monica Mountains' dated February 5, 1996. Non-invasive ornamental plants and lawn may be planted to the extent needed for modification of brush fire fuel nearest structures. However, these species must be selected from the most drought tolerant species, subspecies, or varieties suited to the climate of the Santa Monica Mountains.

Consistent with this program, landscape irrigation demands may not be as high as other communities that use turf grass in medians and around commercial developments. Nonetheless, the City's policy of requiring drought-tolerant landscaping for new developments is intended to promote overall water conservation. The City does not wish to relax these drought-tolerance standards to artificially increase its recycled water demands, because doing so would defeat the purpose of water conservation in general.

Figure 1: Phased Prohibition Area Map from MOU



2 Recycled Water Market Assessment

In this section, the following items will be discussed:

- The projected amount of water available for reuse per prohibition phase and associated timing of phasing,
- Projected recycled water customers and demands, and
- Recycled water customer tiers and probability factors which quantify the likelihood that potential customers will connect to the recycled water system

2.1 Projected Amount of Recycled Water Available

The amount of water available for water recycling will be dependent upon the volume of wastewater available from the centralized treatment facilities. The volume of wastewater that will be available has been estimated on a phase-by-phase basis as shown in Table 1. As shown in that table, the ultimate volume available, if Phase 3 is implemented and development reaches buildout conditions, is approximately 502,000 gallons per day.

Table 1: Wastewater Flows by Phase

Phase	Effluent Generated (Estimated), gpd	Year Implemented [a]
1	211,100	2015
2	138,500	2019
3	152,400	To be determined
Total	**502,000**	

Footnote:

a. Implementation year per MOU between City of Malibu and LA RWQCB dated July 14, 2011.

2.2 Basis of Recycled Water Demands

Wastewater effluent from the new Malibu wastewater recycling facility will meet Title 22 regulations for unrestricted reuse. Recycled water is commonly used for landscape irrigation, in toilets for flushing (dual plumbed buildings), and cooling tower make-up water. This study has identified existing commercial customers that have an irrigation demand and/or a cooling tower. It has not been assumed that existing buildings will be retrofitted with dual plumbing to allow toilet flushing with recycled water. Future commercial developments can use recycled water for landscape irrigation and could also be dual plumbed to allow toilet flushing with recycled water. (Dual plumbing consists of separate plumbing for recycled water and potable water within a facility with recycled water being used for toilet and urinal flushing.)

Fire fighting demands are unplanned events by nature; therefore it is difficult to include these demands in a water budget analysis. However, recycled water infrastructure could be designed in order to use recycled water for firefighting events.

2.3 Definition of Customer Tiers and Probability Factors

For planning purposes, the likelihood of connecting an individual customer is accounted for as follows: Customers are grouped into "Tiers" based on their location in the phased prohibition area and whether they are an existing or future customer, not on proximity to proposed pipelines. Customer Tiers are summarized in Table 2.

Existing recycled water customers within the Phase 1 wastewater service area are identified as Tier A. Phase 1 future and Phase 2 existing customers are in Tier B. Phase 2 future and all Phase 3 customers are in Tier C. Each recycled water tier would be implemented in conjunction with the new phase of wastewater collection and treatment. A probability factor is also given to each Tier based on how realistic it is for the City to connect these customers. The probability factors are a conservative numbers in order to determine a conservative approach to determine ultimate dispersal quantities. It is anticipated that through the continued increasing cost of water that future recycling would be likely exceed the conservative estimates. The probability factor is multiplied by the total potential recycled water demand in the Tier to obtain the adjusted demand for project planning purposes. This probability adjustment will account for the fact that not all customers who are identified as having a potential recycled water demand will actually end up connecting.

Table 2: Definition of Customer Tiers and Associated Probability Factors

Recycled Water Customer "Tier"	Wastewater Prohibition Phase	Year Implemented	Recycled Water Customer Existing or Future	Probability Factor to Adjust Demand [a]
A	Phase 1		Existing	82% (aggregate) [b]
B	Phase 1	Phase 1 (2015)	Future	50%
	Phase 2	Phase 2 (2019)	Existing	50%
C	Phase 2	Phase 3 (year to be determined)	Future	30%
	Phase 3		Existing	30%
	Phase 3		Future	30%

Footnote:

a. Probability factors reflect the ultimate degree to which potential customers use recycled water; it may take several years after initiation of each wastewater prohibition phase to achieve the implied degree of reuse.

b. Tier A probability factor is a flow weighted aggregate. Further detail of Tier A probability factors is shown in Table 4.

Potential recycled water customers identified are detailed in Table 3. Customers are a mix of private and public properties and City of Malibu-owned facilities. Irrigation demands assumptions listed under the column "Recycled Water Demand Assumptions" are based on evapotranspiration values and estimated acres of irrigated landscaping, unless another method is noted. In some instances irrigation demands are provided from RWQCB permits or by customers themselves. A detailed explanation of irrigation demand calculations and peaking factors is in Appendix A. Recycled water opportunities exist outside the Prohibition Zone, such as agricultural properties north of HRL. However, these opportunities have not been evaluated in this TM. Figure 2 shows the location of the potential customers listed in Table 3. Figure 2 also shows a preliminary recycled water pipe alignment to serve customers.

Table 3: Potential City of Malibu Recycled Water Customers and Demands

Potential Customer Number	RWQCB Prohibition Phase	Recycled Water Customer Tier	Existing/ Future	Customer/ Development Name	Recycled Water Demand Assumptions	Area (acres)	Type of Demand	Average Day Demand, gpd	Peak Day Demand, gpd
1	1	A	Existing	Malibu City Hall	20% irrigation demand (landscape)	6.08	Commercial Irrigated Area	657	1,445
2	1	A	Existing	Los Angeles County Offices	5% irrigation (turfgrass), 10% landscape	9.37	Commercial Irrigated Area	1,462	3,216
3	1	A	Existing	Malibu Country Mart	30% of parcel irrigation (turfgrass)	2.62	Commercial Irrigated Area	1,603	3,528
4	1	A	Existing	Malibu Country Mart	10% of parcel irrigation (landscape)	2.87	New Development [b]	155	341
5	1	A	Existing	Professional Arts Building	10% of parcel irrigation (landscape)	0.30	Commercial Irrigated Area	16	36
6	1	A	Existing	J&P Limited	only field (turfgrass)	0.43	Commercial Irrigated Area	877	1,930
7	1	A	Existing	Drug Store	20% of parcel irrigation (turfgrass)	0.81	Commercial Irrigated Area	331	727
8	1	A	Existing	Malibu Legacy Park [a]	20% of parcel irrigation (landscape)	19.12	See footnote a	0	0
9	1	A	Existing	Miramar Properties	20% of parcel irrigation (landscape)	2.89	Commercial Irrigated Area	312	686
10	1	A	Existing	GTE Bldg.	5% of parcel irrigation (landscape)	0.80	Commercial Irrigated Area	22	47
11	1	A	Existing	Stone/Masonry Yard	5% of parcel irrigation (landscape)	7.56	Trees Irrigated	204	449
12	1	A	Existing	Masonry Yard	15% of parcel irrigation (landscape)	1.88	Trees Irrigated	152	335
13	1	A	Existing	SoCal Edison	10% of parcel irrigation (landscape)	0.44	Commercial Irrigated Area	24	52
14	1	A	Existing	Malibu Creek Plaza	5% of parcel irrigation (landscape)	4.76	Commercial Irrigated Area	129	283
15	1	A	Existing	Shell Station	5% of parcel irrigation (landscape)	0.52	Commercial Irrigated Area	14	31
16	1	A	Existing	Malibu Lumber Yard	5% of parcel irrigation (landscape)	2.22	Commercial Irrigated Area	60	132
17	1	A	Existing	Prudential Realty	5% of parcel irrigation (landscape)	0.22	Commercial Irrigated Area	6	13
18	1	A	Existing	Malibu Colony Plaza	30% of parcel irrigation (landscape)	13.94	Commercial Irrigated Area	2,258	4,968
19	1	A	Existing	Post Office	10% of parcel (landscape) and 10% turfgrass	1.72	Commercial Irrigated Area	443	974
20	1	A	Existing	Former Gas Station	5% of parcel irrigation (landscape)	0.54	Commercial Irrigated Area	14	32
21	1	A	Existing	PCH Landscaping	100% of area irrigation (landscape)	0.27	Irrigated Median Strips	145	319
22	1	A	Existing	Cross Creek Road Landscape	100% of area irrigation (landscape)	0.02	Irrigated Median Strips	12	26
		Tier A Subtotal						**8,890**	**19,570**
23	1	B	Future	La Paz Ranch - Parcel A	per permit - 8,540 gpd ave dual use	5.88	New Development [b]	8,540	8,540
24	1	B	Future	La Paz Ranch - Parcel B	per permit - 10,460 gpd ave irrigation	8.62	New Development [b]	10,460	23,012
25	1	B	Future	Proposed Whole Foods	Per prelim engineering report Sept 2011	5.78	New Development [b] (dual plumbing and decorative water wall)	3,776	5,662
26	1	B	Future	Vacant - Upper Yamaguchi	similar to proposed La Paz Ranch	6.40	New Development [b]	8,386	13,927
27	1	B	Future	Vacant - Ioki	similar to proposed La Paz Ranch	9.65	New Development [b]	12,645	20,999
28	2	B	Existing	Webster Elementary School	only fields (turfgrass)	1.02	School Irrigated Area	2,081	4,578
29	2	B	Existing	Serra Retreat	75% of parcel irrigation (landscape)	26.52	Commercial Irrigated Area	10,741	23,629
30	2	B	Existing	Sycamore Farms Polo Fields	50% of parcel irrigation (turfgrass)	5.22	Commercial Irrigated Area	5,324	11,714

Potential Customer Number	RWQCB Prohibition Phase	Recycled Water Customer Tier	Existing/ Future	Customer/ Development Name	Recycled Water Demand Assumptions	Area (acres)	Type of Demand	Average Day Demand, gpd	Peak Day Demand, gpd
31	2	B	Existing	Serra Area Homes	20% of parcel irrigation (turfgrass), 20% landscape [c]	170.20	Residential Irrigated Area	87,823	193,212
32	2	B	Existing	Malibu Canyon Village HOA	5% of parcel irrigation (turfgrass), 10% landscape	3.82	Residential Irrigated Area	596	1,311
33	2	B	Existing	Vista Pacifica HOA	20% of parcel irrigation (landscape)	1.49	Residential Irrigated Area	161	354
34	2	B	Existing	Maison DeVille HOA	10% of parcel irrigation (turfgrass), 20% landscape	2.69	Residential Irrigated Area	839	1,846
35	2	B	Existing	Toscana (DeVille Way)	40% of parcel irrigation (landscape)	3.60	Residential Irrigated Area	778	1,712
		Tier B Subtotal						**152,150**	**310,500**
36	3	C	Existing	Our Lady of Malibu Church/ School	15% of parcel irrigation (turfgrass), 20% landscape	3.46	Residential Irrigated Area	1,431	3,148
37	3	C	Existing	Perenchio Golf Course	95% of parcel irrigation (turfgrass)	9.85	Large Private Golf Course	19,090	41,998
38	3	C	Existing	Allied Nursery	90% of parcel irrigation (landscape)	9.17	Nursery	4,457	9,806
39	3	C	Existing	Malibu Bluffs Park	only fields (turfgrass)	6.63	Irrigated Area	13,523	29,750
40	3	C	Existing	Malibu Lagoon State Beach - Overlook	only field (turfgrass)	0.48	Irrigated Area	971	2,136
41	3	C	Existing	Hughes Research Lab	per email from B. Thorell 12/2/11	8.50	Irrigated Area, Cooling Tower, Laboratory Uses	58,439	125,000
42	3	C	Existing	Serra Area Homes	20% of parcel turfgrass & 20% landscape [c]	51.72	Residential Irrigated Area	26,688	58,713
43	3	C	Future	Vacant - Lower Yamaguchi	similar to proposed La Paz Ranch	10.17	New Development [b]	13,327	22,130
44	3	C	Future	Vacant - Island	50% of parcel irrigation (landscape)	1.11	Commercial Irrigated Area	301	662
		Tier C Subtotal						**138,230**	**293,340**
		Total						**299,270**	**623,410**

Footnotes:

a. Legacy Park has an estimated irrigation demand of 2 AFY based on 20% of the parcel being irrigated with drought tolerant landscape. However, the park must store 4 AFY of stormwater for irrigation; therefore the recycled water demand goes to zero because all of the irrigation demand is met with stormwater.

b. New development assumes potential for dual-plumbed systems in future buildings.

c. Serra Area homes irrigation percentages based on aerial photos of properties.

Customer No.	RW Tier	Development Name
1	A	Malibu City Hall
2	A	County Offices
3	A	Malibu Country Mart
4	A	Malibu Country Mart
5	A	Professional Arts Building
6	A	J&P Limited
7	A	Drug Store
8	A	Malibu Legacy Park
9	A	Miramar Properties
10	A	GTE Bldg.
11	A	Stone/Masonry Yard
12	A	Masonry Yard
13	A	SoCal Edison
14	A	Malibu Creek Plaza
15	A	Shell Station
16	A	Malibu Lumber Yard
17	A	Prudential Realty
18	A	Malibu Colony Plaza
19	A	Post Office
20	A	Former Gas Station
21	A	PCH Landscaping
22	A	Cross Creek Road Landscape
23	B	La Paz Ranch - Parcel A
24	B	La Paz Ranch - Parcel B
25	B	Proposed Whole Foods
26	B	Vacant - Upper Yamaguchi
27	B	Vacant - Ioki
28	B	Webster Elementary School
29	B	Serra Retreat
30	B	Sycamore Farms Polo Fields
31	B	Serra Area Homes
32	B	Malibu Canyon Village HOA
33	B	Vista Pacifica HOA
34	B	Maison DeVille HOA
35	B	Toscana
36	C	Our Lady of Malibu Church/ School
37	C	Perenchio Golf Course
38	C	Allied Nursery
39	C	Malibu Bluffs Park
40	C	Overlook
41	C	Hughes Research Lab
42	C	Serra Area Homes
43	C	Vacant - Lower Yamaguchi
44	C	Vacant - Island

Figure 2: Proposed Recycled Water Customers

Legend

- Proposed RW Customers

Parcels in Prohibition Area

- Phase 1
- Phase 2
- Phase 3
- Malibu Parcels

Because customers in Tier A would be the first to connect to the system, they were individually assigned a probability factor ranging from 30% to 100%, as shown in Table 4. The probability factor is an assumption based on discussions with the City, and discussions with various property owners. The majority of the customers identified in Tier A have a small irrigation demand. This is due in part to a small area of landscaping and the use of drought tolerant plants. Potential recycled water demands in Tier A are based on current property uses; redevelopment of existing underdeveloped properties is not included in the estimates because of the relatively short timeframe for Phase 1 implementation.

Table 4: Individual Probability Factors of Tier A Customers in Order of Probability

Probability Factor [a]	Proposed Customer Number	Potential Customer Name	Average Annual Demand, AFY	Average Day Demand, gpd
100%	1	Malibu City Hall	0.74	657
100%	7	Drug Store	0.37	331
100%	21	PCH Landscaping	0.16	145
100%	22	Cross Creek Road Landscaping	0.01	12
90%	3,4	Malibu Country Mart	1.97	1,785
90%	16	Malibu Lumber Yard	0.07	60
80%	9	Miramar Properties	0.35	312
80%	2	Los Angeles County Offices	1.64	1,462
80%	5	Professional Arts Building	0.02	16
80%	17	Prudential Realty	0.01	6
80%	18	Malibu Colony Plaza	2.53	2,258
80%	6	J&P Limited	0.98	877
80%	13	SoCal Edison	0.03	24
80%	14	Malibu Creek Plaza	0.14	129
80%	15	Shell Station	0.02	14
70%	10	GTE Bldg.	0.02	22
70%	19	Post Office	0.50	443
50%	11	Stone/Masonry Yard	0.23	204
50%	12	Masonry Yard	0.17	152
30%	20	Former Gas Station	0.02	14
		Flow Weighted Aggregated Probability Factor		**82%**

Footnote:

a. Probability factors reflect the ultimate degree to which potential customers use recycled water; it may take several years after initiation of each wastewater prohibition phase to achieve the implied degree of reuse.

Table 5 summarizes the recycled water demands per phase. The unadjusted total peak day recycled water demand within the City prohibition zone is estimated to be 623,400 gpd. This assumes all customers identified are connected. However, the adjusted peak day demands are far less: in Tier A it is 16,200 gpd, the Tier B adjusted demand is 155,250 gpd and at buildout it is 259,460 gpd.

Table 5: Recycled Water Demands by Tier

RW Available, gpd	RW Customer Tier	Customers Included	Unadjusted Average Day Demand, gpd	Unadjusted Peak Day Demand, gpd	Probability Factor to Adjust Demand [a]	Adjusted Average Day Demand, gpd	Adjusted Peak Day Demand, gpd
211,000	A	Phase 1, Existing	8,900	19,570	30% - 100% [b]	7,340	16,200
		Tier A Subtotal	**8,900**	**19,570**		**7,340**	**16,200**
350,000	B	Phase 1, Future	43,810	72,140	50%	21,910	36,070
		Phase 2, Existing	108,340	238,360	50%	54,170	119,180
		Tier B Subtotal	**152,150**	**310,500**		**76,080**	**155,250**
502,000	C	Phase 2, Future	0	0	30%	0	0
		Phase 3, Existing	124,600	270,550	30%	37,380	81,170
		Phase 3, Future	13,630	22,790	30%	4,090	6,840
		Tier C Subtotal	**138,230**	**293,340**		**41,470**	**88,010**
502,000		***Total***	***299,270***	***623,410***		***124,890***	***259,460***

Footnotes:

a. Probability factors reflect the ultimate degree to which potential customers use recycled water; it may take several years after initiation of each wastewater prohibition phase to achieve the implied degree of reuse.

b. A range is provided as probability factors are assessed individually to customers in Tier A, as shown in Table 4.

3 Seasonal Storage Evaluation

Seasonal storage of recycled water can be a valuable component and asset of a recycled water system, when tertiary effluent is stored during winter months to meet demand during high demand summer months. However, seasonal storage can increase the annual recycled volume only if the system wide peak day recycled water demand is greater than the amount of water produced by the treatment plant.

At Phase 3 buildout, the recycled water supply from the treatment plant will be approximately 502,000 gpd (see Table 1). As shown in Table 5, the adjusted buildout peak day demand (Tier C) of 259,460 gpd is less than the daily treatment plant production of 502,000 gpd; therefore all recycled water demands can be met without seasonal storage. That is, seasonal storage would not increase annual reuse volumes.

In Tier A, the adjusted peak day demand of 16,200 gpd would be less than the daily treatment plant production of 211,000 gpd; and in Tier B, the adjusted peak day demand of 171,450 gpd would be less than the daily treatment plant production of 350,000 gpd. Seasonal storage would not increase the annual volume of reuse at any Tier of expansion. Furthermore, an additional means of effluent disposal is required because adjusted recycled water demands are projected to be less than the amount of effluent generated.

Operational storage at the treatment plant site would be enough in all the tiers/phases to meet peak day demands, if recycled water implementation was confined to the Prohibition Zone. A typical example of operational storage at the treatment plant site would be a steel storage tank constituting one day's worth of plant production (e.g. 200,000 gallons for a 200,000 gpd plant). With this approach, seasonal storage is not necessary, as operational storage can suffice to even out diurnal flow fluctuations. If the recycled water service area expanded outside the Prohibition Zone, seasonal storage may make more sense. An example of such a scenario encompassing Pepperdine University is described in the following section.

3.1 Storage at Pepperdine University

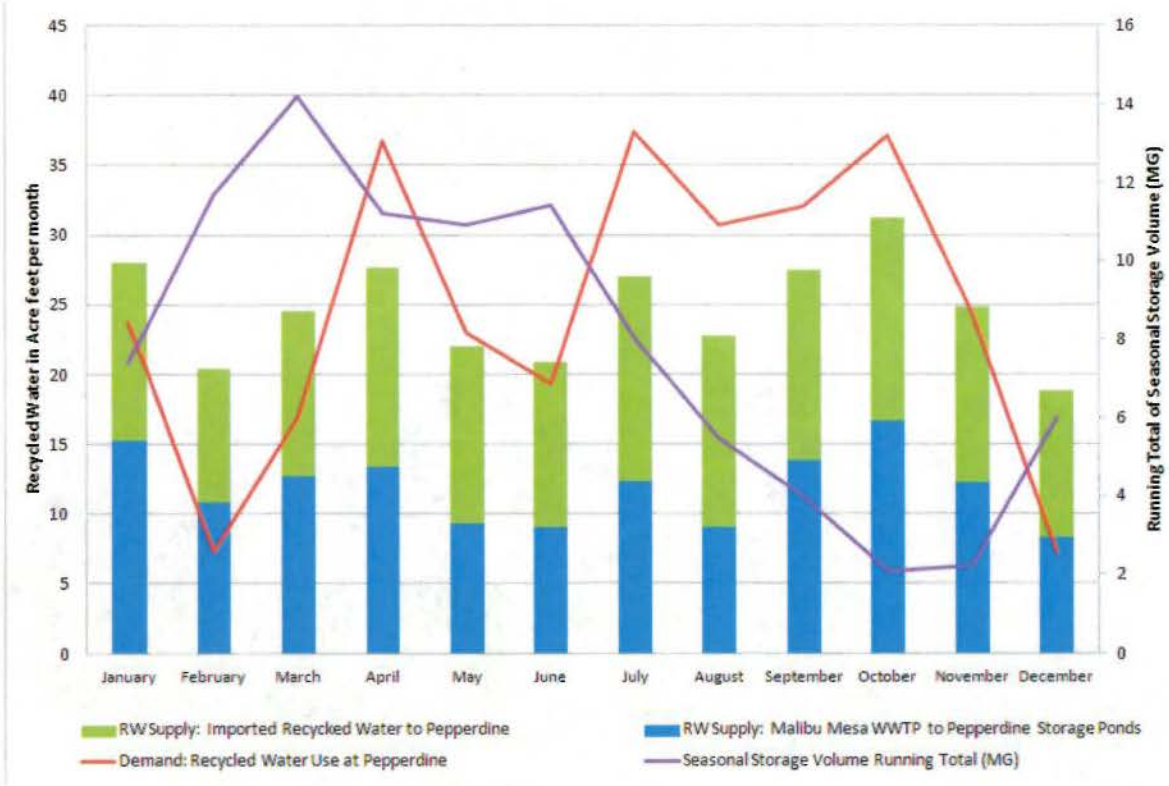
Pepperdine University is a recycled water opportunity in close proximity to the Civic Center area, but located outside of the prohibition zone. It has a large recycled water demand that cannot be supplied by its own water reclamation plant in the summer months. Recycled water is imported from a neighboring agency. The City of Malibu could serve recycled water throughout the year to Pepperdine. The following section describes this opportunity and the possibility of expanding Pepperdine's seasonal storage as part of a multi-agency solution. (Pepperdine University has kindly shared its water balance data for this analysis, but has not committed to a joint project with the City of Malibu.)

Pepperdine University has two existing recycled water storage ponds with a total usable volume of about 8 million gallons (24.6 acre-ft (AF)). These ponds, shown in Figure 3, provide seasonal storage of unused effluent from Malibu Mesa Treatment Plant in the winter. Malibu Mesa Treatment Plant, which is owned and operated by the County of Los Angeles, treats wastewater from Pepperdine. This treatment plant also provides the university with a significant percentage of the on-campus recycled water. Summertime recycled water demands exceeding the production of the Malibu Mesa Plant are met by importing recycled water from Las Virgenes Municipal Water District (LVMWD), or by drawing from the two seasonal storage ponds illustrated in Figure 3.

Figure 3: Location of Pepperdine Recycled Water Storage Ponds

The annual operational water balance of Pepperdine's recycled water facilities is shown in Figure 4 for the period of October 2008 to September 2009. Six months of the year Pepperdine's recycled water demand, shown as the red line in Figure 4, exceeds the recycled water supplies shown as vertical bars. Recycled water from Malibu Mesa WWTP is shown as the blue vertical bar and imported recycled water from LVMWD is the green bar. Each month during this period there was at least 9.3 acre-feet of recycled water (equivalent to approximately 100,000 gal/day) imported from LVMWD. This same amount of water could be supplied from the City of Malibu rather than LVMWD on a year-round basis. Whether Pepperdine University is willing to change water sources from LVMWD to Malibu is a discussion that needs to happen between the City and Pepperdine before the opportunity can be realized.

Figure 4: Pepperdine Recycled Water Supply and Demand Comparison



3.1.1 Infrastructure and Permitting Required

To assess whether additional seasonal storage is needed at Pepperdine if the City of Malibu supplied a consistent 100,000 gallons/day, a water balance analysis was conducted assuming the existing pond volume was full at the 1st of January. (See Appendix B, column 6.) This conservative scenario would represent the condition wherein there was minimal irrigation reuse of effluent in the 10 weeks prior to January due to El Nino effects, resulting in the ponds being full on the 1st of January. This type of conservative scenario needs to be assessed because the Malibu Mesa Treatment Plant needs to have reliable effluent storage available in the event of an out-of-the-ordinary condition (El Nino, mechanical breakdown, treatment plant upset, etc.)

The analysis shows that under this conservative scenario the total storage volume would need to be expanded to 43.1 AF (14.2 million gallons). (See Appendix B, column 6.)

This is 6.2 million gallons more than the currently available storage of 8 million gallons. (This increase was rounded up to 7 million gallons for cost estimating purposes.) The median between the ponds could be excavated and expanded to accommodate the additional 7 million gallon storage. No additional pumps should be necessary at Pepperdine to serve the university's distribution system.

Conveyance facilities would also be needed to deliver the potential 100,000 gpd to Pepperdine. These facilities would include a 4-inch diameter pipe constructed along Civic Center Way and Malibu Canyon Road as shown in Figure 5.

Bluffs Park, a City-operated park, is near the pipeline route to Pepperdine. Bluffs Park could also be served if the pipeline route is extended south on Malibu Canyon Road.

Figure 5: Recycled Water Pipeline Alignment to Serve Pepperdine Storage Ponds

Note: Final recycled water pipeline alignment is subject to change based on location of pond inlet upon reconstruction and discussions with various property owners.

Conceptual cost estimates have been developed based on preliminary knowledge of facilities at Pepperdine. Unit costs and contingencies are from "Cost Estimating Basis for Recycled Water Master Planning TM", (RMC 2011b). A summary of the conceptual cost estimate is in Table 6; a further breakdown is in Appendix C.

Table 6: Preliminary Cost Estimate to Serve Recycled Water to Pepperdine University

Item	Cost 2011 Dollars
Raw Construction Costs	1,000,000
Construction Contingency (30%) [a]	300,000
Construction Cost Subtotal	*1,300,000*
Implementation Costs	
Planning, Design (30%) [b]	390,000
Project Cost Total	**1,690,000**

Footnotes:

a. For planning studies, typical construction contingencies range between 20 and 50 percent to account for unknown or unforeseen costs. A construction contingency of 30 percent is applicable at this stage of planning.

b. Implementation contingency costs consist of the expenditures for planning and environmental documentation, permits, engineering design and construction services, construction management, and inspection, and typical overhead items such as legal and administrative services.

The seasonal storage project would require environmental documentation, and could delay the project. The project may also be in the jurisdiction of the Coastal Commission which would require review and approval of the construction. In addition, the project would need approval from the County of Los Angeles. These permitting activities may delay the project. If the recycled water system is in the Prohibition Zone there is no need for seasonal storage, only daily operational storage is needed and can fit on the recycling facility site. If the recycled water system expands beyond the Prohibition Zone, seasonal storage may be needed as shown by the Pepperdine opportunity.

4 Recycled Water Customers Contacts

A short list of recycled water customers based on the market assessment and discussions with the City of Malibu were contacted to assess their interest in recycled water and to obtain potential average day and peak day demands. These customers were chosen based on the volume or recycled water demand and whether they could be connected in the near-term Tier A. Potential customers are summarized in Table 7. A log of contact information and discussion summaries for the potential recycled water customers is in Appendix D.

Table 7: Customer Contact Summary

Customer Name	Recycled Water Tier	Contact Made	Interest
County Offices	A	No, only left messages	Unknown
Malibu Country Mart	A	Yes	Yes, interested
J&P Limited	A	No, not able to leave message	Unknown
Malibu Lagoon State Beach – Overlook Area	C	No, only left messages	Unknown
Proposed Whole Foods	B	Yes	Yes, interested
Webster Elementary School	B	Yes	Not interested
Serra Retreat	B	Yes	Yes, interested
Sycamore Farms (Polo Fields)	B	Yes	Yes, interested
Maison DeVille HOA	B	Yes	Yes, interested
Malibu Canyon Village HOA	B	Yes	Yes, interested
Allied Nursery	C	No, only left messages	Unknown
Malibu Bluffs Park	C	Yes	Yes, interested
Hughes Research Lab	C	Yes	Yes, interested

5 Water Balance for Each Phase of WWRF Expansion

Based on the strategies described in previous sections, water balances have been developed that identify the volumes of recycled water use and effluent disposal via direct groundwater injection for Phase One, Phase Two and Phase Three buildout conditions. Adjusted average day and peak day recycled water demands are listed in Table 8. Minimum demand has also been calculated to mimic wintertime storm event conditions when irrigation demands are zero. Dual plumbing and cooling towers are year-round uses which persist in the minimum-demand wintertime period. These minimum year-round demands are also shown in Table 8.

Table 8: Recycled Water Customers and Adjusted Demands

Potential Customer No.	Recycled Water Tier	Customer / Development Name	Unadjusted Ave. Day Demand, gpd	Unadjusted Peak Day Demand, gpd	Unadjusted Min. Day Demand, gpd	Probability Factor [a]	Adjusted Ave. Day Demand, gpd	Adjusted Peak Day Demand, gpd	Adjusted Min. Day Demand, gpd
1	A	Malibu City Hall	657	1,445	0	100%	657	1,445	0
2	A	Los Angeles County Offices	1,462	3,216	0	80%	1,169	2,573	0
3	A	Malibu Country Mart	1,603	3,528	0	90%	1,443	3,175	0
4	A	Malibu Country Mart	155	341	0	90%	139	307	0
5	A	Professional Arts Bldg.	16	36	0	80%	13	28	0
6	A	J&P Limited	877	1,930	0	80%	702	1,544	0
7	A	Drug Store	331	727	0	100%	331	727	0
8	A	Malibu Legacy Park [b]	0	0	0	0%	0	0	0
9	A	Miramar Properties	312	686	0	80%	250	549	0
10	A	GTE Bldg.	22	47	0	70%	15	33	0
11	A	Stone/Masonry Yard	204	449	0	50%	102	225	0
12	A	Masonry Yard	152	335	0	50%	76	168	0
13	A	SoCal Edison	24	52	0	80%	19	42	0
14	A	Malibu Creek Plaza	129	283	0	80%	103	226	0
15	A	Shell Station	14	31	0	80%	11	25	0
16	A	Malibu Lumber Yard	60	132	0	90%	54	119	0
17	A	Prudential Realty	6	13	0	80%	5	11	0
18	A	Malibu Colony Plaza	2,258	4,968	0	80%	1,807	3,975	0
19	A	Post Office	443	974	0	70%	310	682	0
20	A	Former Gas Station	14	32	0	30%	4	10	0
21	A	PCH Landscaping	145	319	0	100%	145	319	0

Potential Customer No.	Recycled Water Tier	Customer / Development Name	Unadjusted Ave. Day Demand, gpd	Unadjusted Peak Day Demand, gpd	Unadjusted Min. Day Demand, gpd	Probability Factor [a]	Adjusted Ave. Day Demand, gpd	Adjusted Peak Day Demand, gpd	Adjusted Min. Day Demand, gpd
22	A	Cross Creek Road Landscape	12	26	0	100%	12	26	0
		Tier A Subtotal	**8,900**	**19,570**	**0**		**7,340**	**16,200**	**0**
23	B	La Paz Ranch - Parcel A	8,540	8,540	8,540	50%	4,270 [c]	4,270 [c]	2,270 [c]
24	B	La Paz Ranch - Parcel B	10,460	23,012	0	50%	5,230 [c]	11,506 [c]	0 [c]
25	B	Proposed Whole Foods	3,776	5,662	2,205	50%	1,888	2,831	1,103
26	B	Vacant - Upper Yamaguchi	8,386	13,927	3,769	50%	4,193	6,963	1,885
27	B	Vacant - Ioki	12,645	20,999	5,684	50%	6,323	10,499	2,842
28	B	Webster Elementary School	2,081	4,578	0	50%	1,040	2,289	0
29	B	Serra Retreat	10,741	23,629	0	50%	5,370	11,815	0
30	B	Sycamore Farms Polo Fields	5,324	11,714	0	50%	2,662	5,857	0
31	B	Serra Area Homes	87,823	193,212	0	50%	43,912	96,606	0
32	B	Malibu Canyon Village HOA	596	1,311	0	50%	298	656	0
33	B	Vista Pacifica HOA	161	354	0	50%	80	177	0
34	B	Maison DeVille HOA	839	1,846	0	50%	420	923	0
35	B	Toscana	778	1,712	0	50%	389	856	0
		Tier B Subtotal	**152,150**	**310,500**	**20,200**		**76,080**	**155,250**	**10,100**
36	C	Our Lady of Malibu Church/ School	1,431	3,148	0	30%	429	944	0

Potential Customer No.	Recycled Water Tier	Customer / Development Name	Unadjusted Ave. Day Demand, gpd	Unadjusted Peak Day Demand, gpd	Unadjusted Min. Day Demand, gpd	Probability Factor [a]	Adjusted Ave. Day Demand, gpd	Adjusted Peak Day Demand, gpd	Adjusted Min. Day Demand, gpd
37	C	Perenchio Golf Course	19,090	41,998	0	30%	5,727	12,599	0
38	C	Allied Nursery	4,457	9,806	0	30%	1,337	2,942	0
39	C	Malibu Bluffs Park	13,523	29,750	0	30%	4,057	8,925	0
40	C	Malibu Lagoon State Beach - Overlook	971	2,136	0	30%	291	641	0
41	C	Hughes Research Lab	58,439	125,000	12,400	30%	17,532	37,500	8,671
42	C	Serra Area Homes	26,688	58,713	0	30%	8,006	17,614	0
43	C	Vacant - Lower Yamaguchi	13,327	22,130	5,990	30%	3,998	6,639	1,797
44	C	Vacant - Island	301	662	0	30%	90	198	0
		Tier C Subtotal	**138,230**	**293,340**	**18,400**		**41,470**	**88,010**	**5,520**
		Total	**299,270**	**623,410**	**38,600**		**124,890**	**259,460**	**15,620**

Footnotes:

a. Probability factors reflect the ultimate degree to which potential customers use recycled water; it may take several years after initiation of each wastewater prohibition phase to achieve the implied degree of reuse.

b. Legacy Park has an estimated irrigation demand of 2 AFY. However, the park must store 4 AFY of stormwater for irrigation; therefore the recycled water demand goes to zero.

c. La Paz – Parcel A is assumed to have dual plumbing; per RWQCB permit – unadjusted 8,540 gpd average dual use. La Paz – Parcel B is assumed to have irrigation demands; per RWQCB permit – unadjusted 10,460 gpd average.

The Phase 1 water balance is shown in Table 9. The average annual wastewater effluent generated daily would be 211,000 gpd. On an average day, approximately 7,340 gpd could be supplied to the recycled water customers; the remaining 203,700 gpd would be disposed of by another means. On a peak day (in the summer) recycled water demands increase to 16,200 gpd and the remaining approximate 194,800 gpd would have to be disposed of by another means. On a minimum use day, recycled water demand would reduce to zero and all effluent would be disposed of by another means.

Table 9: Water Balance Phase 1

	Average Day, gpd	Peak Day, gpd	Minimum Day, gpd
Average Annual Tertiary Effluent Generated	211,000	211,000	211,000
Tier A Recycled Water Demand	7,340	16,200	0
Other Disposal Method	203,660	194,800	211,000

The Phase 2 water balance is shown in Table 10. The average annual wastewater effluent generated daily would be 350,000 gpd. On an average day, approximately 83,400 gpd could be supplied to the recycled water customers; the remaining approximate 266,600 gpd would be disposed of by another means. On a peak day (in the summer) recycled water demands would increase to 171,500 gpd and the remaining 178,500 gpd would have to be disposed of. On a minimum use day, recycled water demand would reduce to approximately 10,100 gpd and 333,900 gpd would be disposed of by another means.

Table 10: Water Balance Phase 2

	Average Day, gpd	Peak Day, gpd	Minimum Day, gpd
Average Annual Tertiary Effluent Generated	350,000	350,000	350,000
Tiers A & B Recycled Water Demand	83,420	171,450	10,100
Other Disposal Method	266,580	178,550	339,900

The Phase 3 water balance is shown in Table 11. The average annual wastewater effluent generated daily would be 502,000 gpd. On an average day, approximately 124,900 gpd could be supplied to the recycled water customers; the remaining approximate 377,100 gpd would be disposed of by another means. On a peak day (in the summer) recycled water demands increase to approximately 259,500 gpd and the remaining 242,600 gpd would have to be disposed of. On a minimum day, recycled water demand reduces to 15,600 gpd and 486,400 gpd would be disposed of by another means.

Table 11: Water Balance Phase 3

	Average Day, gpd	Peak Day, gpd	Minimum Day, gpd
Average Annual Tertiary Effluent Generated	502,000	502,000	502,000
Buildout Recycled Water Demand	124,890	259,460	15,620
Other Disposal Method	377,110	242,540	486,380

6 Conclusions

Opportunities exist to recycle Title 22 effluent from Malibu's wastewater recycling facility. These opportunities exist at each expansion phase of the RWQCB Prohibition Zone. However, recycled water cannot be relied upon to avoid another type of effluent disposal. An alternate means of effluent disposal is necessary in all phases.

Adjusted recycled water demands expand from approximately 16,200 gpd in Tier A to 259,500 gpd in Tier C on a peak day basis. The demand in Tier A is low because the majority of the demands are irrigation of drought tolerant landscaping. In each tier of expansion, the recycled water demand is less than the effluent generated by the wastewater recycling facility. Because of this, the concept of seasonal storage would be hard to justify if the recycled water service area is within the Prohibition Zone. Expanding recycled water use outside of the Prohibition Zone and serving Pepperdine University could be a potential future opportunity. This opportunity could justify seasonal storage to increase the annual volume of water recycled from Malibu's treatment plant. Serving Pepperdine University with Malibu's Title 22 recycled effluent would require additional negotiation between the City of Malibu and Pepperdine.

References

RMC, January 2011. "Preliminary Design Concept Report for Malibu Wastewater System".

RMC, January 2011b. "Cost Estimating Basis for Recycled Water Master Planning TM."

Appendix A – Irrigation Demand Calculations

Demand Calculations and Peaking Factors

Annual recycled water irrigation demands for the Malibu Recycled Water Use and Storage Study were calculated using crop evapotranspiration (ET) values and estimated acres of irrigated landscaping. The methodology used is described in the following sections.

Turfgrass Irrigation

Turfgrass evapotranspiration values were calculated using methods described in A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California, developed by the University of California Cooperative Extension (UC Extension) and California Department of Water Resources (DWR). The crop evapotranspiration value for turfgrass is calculated by:

$$ET_C = Kc \times ET_O$$

Where:

ET_C = Crop Evapotranspiration (inch/month)

K_C = Crop Coefficient

ET_o = Reference Evaporation (inch/month)

The ET_o value is obtained from the California Irrigation Management Information System (CIMIS). The City of Malibu does not have a CIMIS weather station, therefore an average of two stations, #99 (Santa Monica) and #156 (Oxnard). These two stations are in the closest proximity to Malibu. CIMIS provides monthly ET_o and precipitation. CIMIS data was obtained from 2001 to 2011 to for both stations. The K_c value used was 0.6, for year-round warm weather turfgrass.

Calculate Irrigation Requirement. After calculating the crop evapotranspiration, the irrigation demand (ID) was determined considering precipitation, infiltration, irrigation efficiency and leaching rate. Precipitation data was provided by the CIMIS website. Infiltration, irrigation efficiency and loss rate factors were determined from UC Extension and DWR as well as previous RMC experience. The following equation is used to calculate the Irrigation Demand:

$$ID = \frac{\left[ET_C - (P \times Inf)\right] \times L}{IE}$$

Where:

ID = Irrigation Demand (inch/unit area)

ET_C = Turfgrass Evapotranspiration (inch/unit area)

P = Precipitation (inches)

Inf = Percent Infiltration, 0.75, assumes that 25% of rainfall during growing season is lost to evaporation

L = Leaching Rate, equal to 1.1, assumes that approximately 10% of applied water passes through the grass zone

IE = Irrigation Efficiency, equal to 0.8, assumes 20% of applied irrigation is lost to the environment

Calculate Irrigated Areas. To determine the number of irrigated areas, aerial photography was analyzed along with ArcGIS data information. Existing recycled water users were identified from discussions with the City of Malibu and identified visually from the GIS and aerial photography. **Table 1** provides a summary irrigation demand calculation month by month.

Table 1: Irrigation Demands for Turf Grasses

Month	ET-Turf Grass (inches)	Precipitation (inches)	Irrigation Demand (inches)	Percentage of Annual Irrigation Demand
January	1.09	2.70	0.0	0.0%
February	1.30	2.73	0.0	0.0%
March	2.02	1.82	0.9	3.3%
April	2.69	0.77	2.9	10.6%
May	2.99	0.17	3.9	14.4%
June	3.21	0.05	4.4	15.9%
July	3.38	0.02	4.6	16.8%
August	3.30	0.07	4.5	16.3%
September	2.53	0.16	3.3	12.1%
October	2.05	0.39	2.4	8.8%
November	1.43	1.39	0.5	2.0%
December	1.22	1.84	0.0	0.0%
Total	27.20	12.11	27.50	100%

Peaking Factors for Turfgrass Irrigation

Peak demands (peak day and peak hour) were calculated using peaking factors described below.

Peak Day. The peak day demand was determined based on the evapotranspiration calculation methods described in the previous section. The irrigation demand value for the peak month (July) was divided by the average annual irrigation demand, shown in the equation below:

$$\text{Peak Day Peaking Factor} = \frac{\text{ID (Peak Month)}}{\text{ID (Annual Average)}} = \frac{4.6\,(inch/month)}{2.3\,(inch/month)} = 2.02$$

The peak day demand is calculated by multiplying the average annual day demand by the above peaking factor, as shown below:

$$\text{Peak Day} = 2.02 \times (\text{Average Annual Demand})$$

Peak Hour. Peak hour demands were calculated based on the assumption of an 8 hour irrigation period. The peaking factor for peak hour was determined by the following equation:

$$\text{Peak Hour Factor} = \frac{24\ \text{hr/day}}{8\ \text{hr/ irrigation period}} = 3.0$$

$$\text{Peak Hour} = 3.0 \times \text{Peak Day}$$

Landscape Irrigation

A number of commercial developments in Malibu will have landscape plantings instead of turf grass. The following paragraphs describe the assumptions made for calculating irrigation demand for landscaping at commercial properties. The landscape irrigation formula utilizes the same formula as calculating the crop evapotranspiration value but the crop coefficient is replace with the landscape coefficient as shown below.

$$ET_L = K_L \times ET_O$$

Where:

ET_L = Landscape Evapotranspiration (inch/month)

K_L = Landscape Coefficient

ET_o = Reference Evaporation (inch/month)

The landscape coefficient (K_L) is calculated using three factors: species factor, density factor, and microclimate factor in the equation below.

$$K_L = K_S \times K_D \times K_{MC}$$

The Species Factor (K_S) accounts for differences in species water needs. It is assumed that multiple species planting will have low water needs. $K_S = 0.2$

The Density Factor (K_D) estimates the difference in vegetation density among landscape plantings. It is assumed there will be trees, shrubs, and groundcover. The landscaping will be widely spaced. The mixed planting would be low density, with $K_D = 0.8$.

The Microclimate Factor (K_{MC}) accounts for the differences the climate immediately around the landscaped area compared to the general climate of the area. Planting may be next to a heat absorbing surface, like a paved trail, and would cause microclimate factor to increase. It is assumed the microclimate factor will be higher than average because properties are southwest facing, near hardscape and in a windy area; $K_{MC} = 1.2$.

Using the factors described above the landscape coefficient (K_L) is 0.19. Using the reference evaporation for the Malibu, the irrigation demand (*ID*) using the equation on first page. **Table 2** provides a summary irrigation demand calculation month by month for landscaping.

Table 2: Irrigation Demands for Landscaping

Month	ET-Landscaping (inches)	Precipitation (inches)	Irrigation Demand (inches)	Percentage of Annual Irrigation Demand
January	0.35	2.70	0.0	0.0%
February	0.41	2.73	0.0	0.0%
March	0.65	1.82	0.0	0.0%
April	0.86	0.77	0.4	5.4%
May	0.96	0.17	1.1	15.9%
June	1.03	0.05	1.4	18.9%
July	1.08	0.02	1.5	20.4%
August	1.06	0.07	1.4	19.2%
September	0.81	0.16	0.9	13.2%
October	0.65	0.39	0.5	6.9%
November	0.46	1.39	0.0	0.0%
December	0.39	1.84	0.0	0.0%
Total	8.71	12.11	7.2	100%

Peaking Factors for Landscape Irrigation

Peak day demand was calculated using peaking factors described below.

Peak Day Demand. The peak day demand was determined based on the evapotranspiration calculation methods described in the previous section. The irrigation demand value for the peak month (July) was divided by the average annual irrigation demand, shown in the equation below:

$$\text{Peak Day Peaking Factor} = \frac{\text{ID (Peak Month)}}{\text{ID (Annual Average)}} = \frac{1.5\,(inch/month)}{0.6\,(inch/month)} = 2.4$$

The peak day demand is calculated by multiplying the average annual day demand by the above peaking factor, as shown below:

$$\text{Peak Day} = 2.4 \times (\text{Average Annual Demand})$$

Peak Hour. Peak hour demands were calculated based on the assumption of an 8 hour irrigation period. The peaking factor for peak hour was determined by the following equation:

$$\text{Peak Hour Factor} = \frac{24\text{ hr/day}}{8\text{ hr/ irrigation period}} = 3.0$$

$$\text{Peak Hour} = 3.0 \times \text{Peak Day}$$

Appendix B – Pepperdine Recycled Water Demand and Storage Table

APPENDIX B

Flowstream - Year 2016		1			2		3		4		5	6	7
		Recycled Water Demand at Pepperdine			Recycled Water Supply at Malibu Mesa (onsite)		Additional Supply Needed *(- is deficit, + is surplus)*		Imported from Malibu WWRF		Volume to Storage *(+ to storage, - from storage)*	Volume in Storage (AF) Pond Volume End of Dec. [a]	Imported from LVMWD
	Days per Month	AF/month	monthly flow factor	MGD	AF/month	MGD	AF/month	MGD	AF/month	MGD	AF/month	24.60	AF
January	31	23.7	0.963	0.249	15.2	0.160	-8.5	-0.090	9.52	0.100	1.00	25.60	0.00
February	28	7.2	0.294	0.084	10.8	0.126	3.6	0.041	8.60	0.100	12.15	37.75	0.00
March	31	16.9	0.684	0.177	12.7	0.133	-4.2	-0.044	9.52	0.100	5.36	43.11	0.00
April	30	36.7	1.491	0.399	13.3	0.144	-23.4	-0.254	9.21	0.100	-14.23	28.88	0.00
May	31	22.9	0.932	0.241	9.3	0.098	-13.6	-0.143	9.52	0.100	-4.13	24.75	0.00
June	30	19.3	0.785	0.210	9.0	0.098	-10.3	-0.112	9.21	0.100	-1.12	23.62	0.00
July	31	37.4	1.517	0.393	12.3	0.129	-25.1	-0.263	9.52	0.100	-15.56	8.07	0.00
August	31	30.7	1.246	0.323	9.0	0.095	-21.7	-0.228	9.52	0.100	-12.19	0.00	-4.13
September	30	32.0	1.299	0.347	13.8	0.150	-18.2	-0.197	9.21	0.100	-8.98	0.00	-8.98
October	31	37.1	1.505	0.390	16.6	0.174	-20.5	-0.215	9.52	0.100	-10.95	0.00	-10.95
November	30	24.5	0.994	0.266	12.2	0.132	-12.3	-0.134	9.21	0.100	-3.09	0.00	-3.09
December	31	7.1	0.290	0.075	8.3	0.087	1.2	0.012	9.52	0.100	10.67	10.67	0.00
	TOTAL AFY	295.6			142.5		-153.1		112.1				

Footnote:
a. This scenario assumes existing ponds are full at January 1 due to minimal irrigation in Nov, Dec (i.e. El Nino conditions)

Assumptions:
1. All historical flows are taken from October 2008 to September 2009.
2. New City of Malibu WWTP supplies constant RW flow of about 100,000 gpd to Pepperdine storage lakes starting in 2016.
3. Pepperdine expands the operating volume of their existing storage lakes from 8 Million Gallons to 15 Million Gallons.
4. Water balance assumes 2008-2009 historical influent flows to Malibu Mesa WWTP and historical 2008-2009 RW demand at Pepperdine. This calculation does NOT account for future changes in raw sewage flow to Malibu Mesa WWTP or future changes in RW demand at Pepperdine. Additional scenarios could be
5. Annual average recycled water irrigation within the City of Malibu is 7 AFY. Seasonal demand variation within the City is assumed to mirror the seasonal demand variation of Pepperdine's irrigation.

NOTE: This is an initial hypothetical scenario for the purposes of discussion. Additional scenarios can be developed.

The purpose of this initial water balance is to foster discussion between Pepperdine and City of Malibu on meeting the recycled water and disposal needs of both parties. Pepperdine University has kindly shared their operating data, but has made no committment to a joint project.

Appendix C – Pepperdine Seasonal Storage Preliminary Cost Estimates

PROJECT: Malibu RW Use and Storage Study

ASPECT: Conceptual Cost Estimate

DESCRIPTION: **Intrastructure to Expand Pepperdine Storage Ponds**

Date: December 22, 2011
RMC Project Number: 0127-004
Prepared by: Amanda Schmidt, P.E. (RMC)
Checked by:
Check Date:
Estimate Type: Conceptual Level

Item	Qty	Units	Unit Cost	Cost (2011)	Notes
Capital Costs					
Open Cut from Malibu WWRF to Civic Center Wy & Malibu Canyon Rd.	1,480	$LF/in-dia	$ 20.00	$ 119,000	Unit Cost per Cost Estimating TM
Open Cut from Civic Center Wy & Malibu Canyon Rd. to Pepperdine Ponds	1,340	$LF/in-dia	$ 20.00	$ 108,000	Unit Cost per Cost Estimating TM
Site Work - Exacavation and Backfill	34,657	$/CY	$ 22.00	$ 763,000	assume excav. and backfill 7 MG
Site Piping to Reconfigure Piping at Pond	1	LS	$ 10,000.00	$ 10,000	lump sum assumption
Construction Cost Estimate				**$ 1,000,000**	
Contingency	30%	Allowance		$ 300,000	
Total Construction Cost				**$ 1,300,000**	
Implementation Costs					
Planning, Design	30%	Allowance		$ 390,000	
Total Project Cost				**$ 1,690,000**	
Post Construction O&M Costs					
Pipeline O&M	2,820	$/LF	$ 0.60	$ 2,000	Unit Cost per Cost Estimating TM
O&M Cost Subtotal				**$ 10,000**	

Cost Estimates from "Cost Estimating Basis for Recycled Water Master Planning TM", RMC 2011

Appendix D –Recycled Water Customers Contact Log

Potential Cust. No.	Development Name	Contact Name	Contact Number	Date	Time	Contact? / Message?	Interest in RW	Customer Concerns	Types of Uses	Approximate Usage	Other Notes
2	LA County Offices	Katharine Schwartz - Library Manager	(310) 456-6438	11/30/11	1:15pm	Contact	No Reponse				
		Pam Hartley - Interim Head of Facilities	(562) 940-8481	11/30/11	1:45pm	No answering machine					
		Pam Hartley - Interim Head of Facilities	(562) 940-8481	12/02/11	2:15pm	Other staff, call back Monday					
		Mike Cornelius - Internal Service Department	(562) 940-2405	12/06/11	3:30pm	Call back					
3,4	Malibu Country Mart	Julie Layben - Environmental Program	(310) 456-7300 general	11/30/11	11:00am	Message	Yes		Gardens, Irrigation	n/a; suggested looking at water meter records	drought tolerant plants, most likely minimal usage
		Julie Layben - Environmental Program	(310) 826-5636 ext. 230	12/02/11	2:30pm	Contact					
6	Charter Communications	Operator - Corporate Office	(888) 438-2427	11/30/11	3:30pm	Contact, verified wrong address	No Reponse				irrigated behind SCE Facility, new construction of parking lot?
	98 Percent Angel Catalog	line disconnected	(310) 317-8558	11/30/11	3:45pm	n/a					
	Craveiro Music & Entertainment	line disconnected	(310) 456-5700	11/30/11	3:45pm	n/a					
	Great Music Inc	Owner of business	(310) 457-2207	11/30/11	3:45pm	Contact, gave name of Proprietor					
	J&P Schultz Partnership	n/a	n/a	11/30/11	4:30pm	n/a					
38	Malibu Lagoon State Beach - Overlook Area	Dennis Tolmer	(818) 880-0384 office (310) 699-	11/30/11	11:30am	Messages	No Reponse				Angeles District Office; State owned, just the lookout
				12/02/11	3:00pm	Message - Office line					
				12/06/11	2:45pm	Message - Office line					
23	Proposed Whole Foods	Bonnie Blue - Planner, City of Malibu	(310) 456-2489 ext. 258	12/01/11	2:10pm	contact	Yes	staining/odors in dual plumbing, feel pretreatment is necessary	irrigation, dual plumbing and decorative water wall	irrigation = 1.76 AFY, water wall = 0.49 AFY, dual plumbing, 1.98 AFY	contact Whole Foods through Bonnie Blue at Malibu. Bonnie provided preliminary WW/RW report from EPD Consultants dated 9/2/11
26	Webster Elementary School	Terry Kamibayashi - Manager of Maint. & Construction	(310) 450-8338 ext.70303	11/30/11	11:15am	Contact	No	Direct Contact, DPH Stringent Restrictions	Irrigation of Fields	n/a	Malibu/ Santa Monica school district; Strict on water cleanliness, can't use greywater at school
27	Serra Retreat	Operator	(310) 456-6631	11/30/11	3:15pm	No message, call back	Yes, Hesitant	Costs to customer, reliability	Irrigation, Landscaping	n/a	very interested in preservation of resources, unsure of lawsuits and legality
		Father Mel		12/01/11	9:30am	Contact					

Potential Cust. No.	Development Name	Contact Name	Contact Number	Date	Time	Contact? / Message?	Interest in RW	Customer Concerns	Types of Uses	Approximate Usage	Other Notes
28	Sycamore Farms (Polo Fields)	*Sam* Phillips	(310) 456-7245	11/30/11	2:00pm	Contact	Yes	Worried about "sludgy residues"	Horse Arenas, Landscaping	Summer: ~330,000 gal/mo	Private; was present at meeting with Whole Foods;
32	Maison DeVille HOA (23900 De Ville Way)	Micah Micah	(818) 225-9191 ext. 113 (818) 225-9191 ext. 113	11/30/11 12/06/11	3:00pm 2:45pm	Contact Message about water demands	Yes	None	Irrigation, Landscaping	Micah to call back	Ross Morgan Company (Prop Mgmt); Calabasas office; will discuss at upcoming meeting
30	Malibu Canyon Village HOA (23901 Civic Center Way)	same Prop. Management from #9	same as #9	same as #9	same as #9	same as #9	Yes	None	Irrigation, Landscaping	Micah to call back	Ross Morgan Company (Prop Mgmt); Calabasas office; will discuss at upcoming meeting
36	Allied Nursery	Masoud Masmoud	(310) 456-2537	11/30/11 12/02/11 12/06/11	11:00am 2:30pm 2:30pm	Message Message Message	No Reponse				No name on voice message system, may be wrong number? irrigate plants, seedlings, etc
37	Malibu Bluffs Park	Drew Belter - City Parks Supervisor Drew Belter	(310) 456-2489 ext. 271	11/30/11 12/02/11	4:45pm 9:45am	Message Contact	Yes - City Facility	Not discussed	Turf, Ball Fields	2011: 4.5 MG, 07/2011: 26,450	6 Acres, turf requires 36" of water/yr, minus ~12" of rain,
39	Hughes Research Lab	Brent Thorell, EH&S Specialist, HRL	(310) 317-5188	11/28/11	11:00am	contact	Yes	water quality for cooling towers and laboratory use.	irrigation, cooling tower make up, and laboratory water (feed for DI, humidity control, wet scrubber make-up)	AVE: Irrigation: 19,400 gpd, cooling tower: 30,000 gpd, laboratory water: 9,000 gpd	HRL has not made any commitments, they will need to conduct a engineering feasibility study prior to commitments.