APPENDIX H-2 ATTACHMENT 3:

CREEKVIEW WATER CONSERVATION PLAN

Technical Memorandum



To: Kris Steward

From: Kyle Horn

Reviewed by: Curtis Lam

Subject: Creekview Specific Plan Water Conservation Plan

Date: Novenmber 23, 2010

Introduction

HydroScience Engineers (HSe) was retained by the Granite Bay Development Corporation to prepare a Water Conservation Plan (WCP) for the Creekview Specific Plan (CSP). The City of Roseville (City) has requested that the CSP incorporate water conservation measures into the design of the CSP that reduce the overall water demands for the combination of potable and/or recycled water.

This technical memorandum presents potentially feasible efforts and planning approaches to reduce CSP water usage to meet the City's request for 20% water conservation within the CSP. The potential reduction in demand for several of these methods is presented in this memorandum. This is done in the followings steps:

- Develop a baseline water use inventory for the project;
- Identify and describe methods for reducing water consumption; and
- Estimate the reduction in water demand using the recommended measures.

This Technical Memorandum includes the future buildout associated with the Urban Reserve parcel of the CSP.

Baseline Water Use

The baseline water use for the project was provided to HSe by MacKay and Somps Civil Engineers. A summary of the water use factors and demands are presented in **Table 1**. It was noted that these water demands include both potable and recycled water usage in the CSP. Additionally, all water conservation calculations do not include the 2% system loss.

Table 1: Water Use Factors and Demands

Land Use Designation	Abbreviation	Total Area (acres)	Dwelling Units	Water Use Factor ¹	Annual Demand ¹ (AFY)
Creekview					
Residential					
Low Density Residential	LDR	155.8	836	varies	511
Medium Density Residential	MDR	64.3	655	varies	230
High Density Residential	HDR	17.1	520	177 gpd/DU	103
Non-Residential					
Commercial	СМИ	19.3	=	2,598 gpd/acre	56
Park	PR	15.7	in the second	2,988 gpd/acre	53
Open Space	os	136.2	=	0 gpd/acre	0
Public/Quasi-Public (all)	P/QP	9.6	a	varies	32
Right of Way	ROW	43.4 ²	*	2,988 gpd/acre	97
Sub-Total for Creekview		461.4	2,011		1,082
Urban Reserve			10		
Residential					
Medium Density Residential	MDR	16.7	167	varies	60
High Density Residential	HDR	11.9	238	177 gpd/DU	47
Non-Residential				11	
Park	PR	1.1	=	2,988 gpd/acre	4
Open Space	os	8.0	<u> </u>	0 gpd/acre	0
Right of Way	ROW	2.2 ³	3	2,988 gpd/acre	5
Sub-Total for Urban Reserve		39.9	405		116
Total Creekview + Urban Reserve		+/- 501.3	2,416		1,198
Total w/ 2% system loss					1,222

Notes:

- 1. Demand use factors and annual demand are based on the 'Creekview Land Use Summary', dated October 26, 2010.
- Out of the 43.4 acres, 29 acres were assumed to be irrigated. The remainder of that acreage was assumed to have a water use factor of zero.
- Out of the 2.2 acres, 1.50 acres were assumed to be irrigated. The remainder of that acreage was assumed to have a water use factor of zero.

For single-family residential areas, the annual water demands shown **Table 1** was subdivided based on estimated residential water usage for the City of Roseville, as presented in **Table 2**. This estimate was used to quantify the impact the various conservation measures would have on the Project's water demand.

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Table 2: Typical Single-Family Residential Water Usage

Use	Percent of Total Use ¹
Landscaping	51%
Toilets	13%
Faucets, cooking, cleaning	10%
Shower	9%
Clothes washer	8%
Bath	6%
Toilet leaks	2%
Dishwasher	1%

Notes:

For high-density residential (HDR) land usage, it was estimated that 20% of the overall water usage calculated in **Table 1** was used for exterior landscape irrigation. This estimate was based on recycled water demand estimates for HDR parcels. Exterior landscape irrigation demands for HDR parcels were estimated differently than single-family residential parcels due to the lack of front and back yards.

For low-density residential (LDR) and medium density residential (MDR), the water demand for landscaping was split between the front and back yards of the residence. It was assumed that 60% of the landscaping demand would be in the back yard and 40% would be in the front yard. This division of landscaping between the front and back yards was estimated with greater demand in the back yard than the front yard due to driveways limiting the irrigation in a typical front yard. High Density Residential (HDR) parcels do not have a distinction between front- and back-yard areas, as such, the irrigation demand associated with HDR parcels is represented as the total irrigated area; Annual Irrigation Demand.

This assumption established that the percentage of the residential demand attributable to front and back yards were 20.4% and 30.6% respectively, of total residential water usage. This baseline water use data can be seen in **Table 3**.

Typical water usage based on information in the City of Roseville FAQs regarding water conservation -http://www.roseville.ca.us/faqs/categoryqna.asp?id=7#790

Table 3: Residential Base Water Use

Land Use Designation	Annual Demand (AFY)	Annual Front Yard Demand (AFY)	Annual Back Yard Demand (AFY)	Annual Irrigation Demand (AFY)
Creekview				
Low Density Residential	511	104	156	260
Medium Density Residential	230	47	89	136
High Density Residential ¹	103	NA	NA	21
Sub-Total Creekview	844	151	245	417
Urban Reserve				
Medium Density Residential	60	12	18	30
High Density Residential ¹	47	NA	NA	9
Şub-Total Urban Reserve	107	12	18	39
Total Creekview + Urban Reserve	951	163	263	456

Notes:

Water demands were separated for the front and back yards of LDR and MDR parcels to allow for different conservation measures in each. Steps like limiting turf in the front yards may not necessarily be feasible in the back yard.

Methods for Reducing Water Consumption

Methods that could be used in combination to reduce the CSP water consumption by an estimated 20% are presented below.

Limiting the amount of turf in front yards and replacing turf with low water use plantings: One of the simplest and most effective ways to conserve water is to limit the area of turf being irrigated or exchanging higher water use plant materials such as turf for lower water using plant materials. There are a number of plantings that can be used that dramatically reduce water demand when they replace turf. The actual demand for these plantings will depend on the individual species planted. Data provided by the City of Roseville water conservation staff assumes replacing turf with low water use plantings could yield a 70% savings as compared to irrigation of turf.

Residential: It was assumed that replacing turf with low water use plantings could be accomplished on all types of residential property, including low, medium, and high-density residential parcels. In order to assess the potential impact of this change on residential parcels, the following assumptions were made:

 When accounting for driveways and hardscape areas, the landscaped area in the front yard for Low and Medium Density Residential units represents 75% of the front yard area. Of this

Demand for HDR parcels was calculated differently from LDR and MDR parcels, as described above. Demand for HDR
parcels was not separated into front and back yard demand since traditional front and back yards are not typically present on
HDR parcels.

landscaped area, it was assumed that 70% of the front yard area was turf and 5% was low water use plantings. The turf area would be reduced to 42% of the front yard. See the attached figure for an example of the locations where turf would be reduced for a typical single-family residence.

- The area converted from turf to low water use plantings represents 28% of the front yard landscaped area. This resulted in the following front yard areas: 25% hardscape (driveway, paths), 42% turf, 33% low water use plantings:
- For the Roseville area, low water use plantings on average use 30% of water used on turf (a 70% water savings). This estimate is based on data collected by the Fair Oaks Horticultural Center (Garden Notes, June 2008), which shows that low water use plantings use between 65-75% less water than an average lawn (i.e. turf).
- Low water use plantings will utilize low volume irrigation systems like a drip or micro-spray system design to achieve uniformity of 90% rather than an overhead spray irrigation system. This also assumes that landscaping is irrigated properly (no over- or under-watering).

Table 4 presents the base and new residential landscaped areas.

Table 4: Reduced Landscape Turf Areas

Land Has Designation	Front Yard	Base Condition		with water Co		
Land Use Designation	Irrigated Area ¹	Turf Area	Low Water Use Area	Turf Area	Low Water Use Area ²	
Low Density Residential	75%	70%	5%	42%	33%	
Medium Density Residential	75%	70%	5%	42%	33%	
High Density Residential	75%³	70%	5%	42%	33%	

^{1.} As a percentage of the front yard

It was noted that recycled water would be used to irrigate the high-density residential land uses, and thus would conserve recycled water.

Table 5 presents the results of the residential water savings for replacing landscape turf.

^{2.} Includes 5% existing low water use plantings + 28% new water use plantings.

Represents the percentage of the entire exterior area for HDRs.

Table 5: Reduced Landscape Turf Water Savings - Residential

Land Use Designation	Annual Front Yard Demand ^{1,2} (AFY)	Annual Front Yard Turf Demand (AFY)	Reduced Annual Front Yard Demand (AFY)	Water Savings for Reduced Turf (AFY)	Water System Savings
Creekview					
Low Density Residential	104	102	75	29	Potable
Medium Density Residential	47	46	34	13	Potable
High Density Residential	21	21	15	6	Recycled
Sub-Total Creekview	172	169	124	48	
Urban Reserve					
Medium Density Residential	12	12	9	3	Potable
High Density Residential	9	9	7	2	Recycled
Sub-Total Urban Reserve	21	21	16	5	
Total Creekview + Urban Reserve	193	190	140	53	

Notes:

1. From Table 3:

As an example of how these values were calculated, the calculation for the annual front yard turf demand and the reduced annual front yard demand is presented below.

For the annual front yard turf demand, as calculated for low-density residential land-uses, 75% of the front yard area is landscaped; 70% turf and 5% low water use plantings. Since low water use plantings use 30% of the water required for turf, this 5% area is equal to 1.5% turf area. This resulted in the following annual front yard demands.

Turf:
$$104AFY*\left(\frac{70\%}{71.5\%}\right) = 102AFY$$
 Low Water Use: $104AFY*\left(\frac{1.5\%}{71.5\%}\right) = 2AFY$

For the reduced annual front yard demand, as calculated for low-density residential land uses, reducing the base turf area in the front yards from 70% to 42% and replacing that area (28%) with low water use plantings resulted in the following annual demands.

$$102AFY*\left(\frac{42\%}{70\%} + \frac{28\%*30\%}{70\%}\right) + 2AFY = 75AFY$$

Non-Residential: Turf reduction on non-residential parcels within the CSP was assumed to be employed in the parks, and right-of-ways. The assumptions utilized to estimate water conservation in these areas are as follows:

^{2.} Demands for High Density Residential parcels represent full irrigation demand since there is no distinction between front yard and back yard

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- Parks were assumed to use 98% of all water for landscape irrigation.
- Parks were estimated to irrigate approximately 80% of their parcel area. It was assumed the 80% turf would be reduced to 60%, with the remaining 20% turf being converted to low water use plantings.
- For the Roseville area, low water usage plantings were assumed to use 30% of the water used on turf (a 70% water savings).
- Low water use areas will utilize low volume irrigation systems like a drip or micro spray system design to achieve uniformity of 90% rather than an overhead spray irrigation system.
- Right-of-Way streetscapes are assumed to use 100% of their water for landscape irrigation.
- Right-of-Way streetscapes were assumed to irrigate approximately 80% of their parcel area with turf. This was reduced to 30% turf and 50% low water use plantings.

Table 6 presents the results of the water savings for replacing landscape turf for non-residential parcels.

Table 6: Reduced Landscape Turf Water Savings - Non-Residential

Land Use Designation	Annual Irrigation Demand ² (AFY)	Base Turf Area ¹	New Turf Area ¹	Low Water Use Area ¹	Reduced Irrigation Demand (AFY)	Water Savings for Reduced Turf (AFY)	Water System Savings
Creekview							
Parks	51	80%	60%	20%	42	9	Recycled
Right of way	97	80%	30%	50%	55	42	Recycled
Sub-Total Creekview	148				97	51	
Urban Reserve							
Parks	4	80%	60%	20%	3	1 1	Recycled
Right of way	5	80%	30%	50%	3	2	Recycled
Sub-Total Urban Reserve	9				6	3	
Total Creekview + Urban Reserve	157				103	54	

Notes

1. As a percentage of the parcel area.

2. This incorporates the reduction in water demand to account for only the fraction used for irrigation of parks described above.

Smart Irrigation Controller: A smart irrigation controller restricts irrigation to only the times and water application rates that are really needed. Demand for water varies greatly with weather patterns and time of year. Standard irrigation schedules do not account for actual weather conditions during the day, week, or month that could vary significantly from normal weather patterns. This deviation can result in significant water waste. A smart irrigation controller can account for these variations by using information for both weather and soil moisture conditions.

Fourteen studies estimating the percentage of water conservation associated with the use of smart irrigation controllers were summarized in a paper published by the US Bureau of Reclamation (USBR, April 2008). These studies estimated the range of water savings associated with their use to be between 7 to 41%. This document instead uses a value of 20% for the estimate of water savings from the use of smart irrigation controllers.

It was noted that the references estimated water savings when going from one type of controller to the smart irrigation controller. However, not all houses have controllers for both the front and back yards. Some existing houses use impact heads connected to a hose to irrigate their front or back yards. This irrigation method is less efficient and results in higher water waste. Considering these issues, the percent of water savings for this measure was estimated at 20%.

The additional savings expected with the use of a smart irrigation controller are presented in **Table 7**. All of the land using turf reduction measures would also employ smart irrigation controllers. These calculations assume that the area of turf is reduced as described above.

Table 7: Smart Irrigation Controller Water Savings

Land Use Designation	Original Demand (AFY) ¹	Reduced Demand (AFY)	Water Savings (AFY)	Water System Savings
Creekview				
Low Density Residential				
Front Yard	75	60	15	Potable
Back Yard	156	125	31	Potable
Medium Density Residential				
Front Yard	34	27	7	Potable
Back Yard	70	56	14	Potable
High Density Residential	15	12	3	Recycled
Parks	42	34	8	Recycled
Right of Way	55	44	11	Recycled
Sub-Total Creekview	447	358	89	
Urban Reserve				
Medium Density Residential				
Front Yard	9	7	2	Potable
Back Yard	18	14	4	Potable
High Density Residential	7	6	1	Recycled
Parks	3	2	1	Recycled
Right of Way	3	2	1	Recycled
Sub-Total Urban Reserve	40	31	. 9	
Total Creekview + Urban Reserve	487	389	98	

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Notes:

1. Original demand includes the turf reduction water conservation measures that were previously described.

As an example, for the low-density residential front yards, the annual demand is 75 AFY. Assuming that this demand is reduced by 20% when using smart irrigation controllers, the reduced demand is estimated to be:

$$75AFY*(80\%) = 60AFY$$

Recirculating hot water: Recirculating hot water systems use a pump to keep the water in the hot water lines circulating back to the water heater to keep the water in the hot water lines hot. This provides hot water at the tap immediately and prevents having to let cold water flow until the water heats up. These systems can be operated in a number of different ways but all conserve water in the same manner. For this study, it was estimated that each draw for hot water would waste approximately 1.25 gallons per day per dwelling unit. This is equivalent to drawing water through 50 ft of ¾-inch pipe with each draw, and drawing hot water in this manner six times per day per dwelling unit. The expected savings are presented in **Table 8**.

Table 8: Re-circulating Hot Water Savings

Land Use Designation	Dwelling Units (DU)	Water Savings for Recirculating Hot Water (AFY)	Water System Savings
Creekview			
Low Density Residential	836	7	Potable
Medium Density Residential	655	6	Potable
High Density Residential	520	4	Potable
Sub-Total Creekview	2,011	17	
Urban Reserve			
Medium Density Residential	167	1	Potable
High Density Residential	238	2	Potable
Sub-Total Urban Reserve	405	3	
Total Creekview + Urban Reserve	2,416	20	

As an example, for the low-density residential land use, the total number of dwelling units is 836. The reduced water demand would be estimated to be:

$$836DU*7.5\frac{gal}{day}*\frac{AF}{325,851gal}*365day/yr = 7AFY$$

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Summary

The water conservation measures selected for implementation for the CSP are the same measures recently adopted by the City for the Sierra Vista Specific Plan. These measures were selected based on their ability to cost-effectively achieve the necessary water savings.

The total volume of water conservation estimated when implementing these water conservation measures for the CSP land use plan is summarized in **Table 9**. This volume of water conservation includes both conservation of potable and recycled water. The water savings calculation is based on the total water demands for each land use in either the CSP or Urban Reserve calculated in Table 1, including the 2% addition for water losses.

Table 9: Water Conservation Estimate

Method	Original Total Water Demand (AFY)	Potable Water Savings (AFY)	Recycled Water Savings (AFY)	Total Volume of Water Savings (AFY)	Total Percentage of Water Savings ^{1,2}
Creekview					
Reduced landscape turf – residential		42	6	48	4.3%
Reduced landscape turf – parks, right of way	1,104	0	51	51	4.6%
Smart irrigation controllers – all types of land uses	1,104	67	22	89	8.1%
Re-circulating hot water – residential		17	0	17	1.5%
Sub-Total Creekview		126	79	205	18.6%
Urban Reserve					
Reduced landscape turf – residential		3	2	5	4.2%
Reduced landscape turf – parks, right of way	118	0	3	3	2.5%
Smart irrigation controllers – all types of land uses	110	6	3	9	7.6%
Re-circulating hot water – residential		3	0	3	2.5%
Sub-Total Urban Reserve		12	8	20	16.9%
Total Creekview + Urban Reserve	1,222	138	87	225	18.4%

Notes

If the described water conservation measures described in this memorandum were taken for the CSP without the Urban Reserve, it is estimated that the CSP overall water demand would be reduced by 205 AFY yielding an adjusted water demand of 899 AFY. This represents a 18.6% reduction from the original water demand for the CSP of 1,104 AFY. When considering both the CSP and the Urban Reserve together, water demands are reduced by a total of 225 AFY for an adjusted water demand of 997 AFY. This represents a 18.4% overall reduction in water usage.

Percentages rounded to two significant figures, and represent overall water conservation percentages for both potable and recycled water.

Percentages were independently calculated for Creekview and the Urban Reserve. The total was calculated for the combined Creekview with urban reserve.

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Though the actual water conservation realized will depend in part on the participation of the homeowners or tenants of the affected parcels, it is expected that these measures could be implemented and maintained in the end by employing the following measures:

- Constructing the parcels with these water conservation measures in place. By simply
 having an available smart irrigation controller with the capacity to run the front and back yard
 systems pre-wired and in place, using this controller is a financially sound decision for the
 land owner versus replacing the controller with a different one.
- Landscape areas for non-single family land uses will be maintained by the City, the
 applicable school district, commercial owners or a homeowners association. It is expected
 that these professionals will be able to maintain these water savings through the
 professional management of these landscapes.
- For single-family residences, it is expected that a two-fold measure will be required to realize long-term water savings.
 - 1. Restrictions in the codes, covenants and restrictions for each parcel that would limit the types and/or locations of landscape in the front yards of each residence.
 - Ongoing outreach by the City to remind and reinforce the need for water conservation.
 This can include attachments to the water bill, water audits that can be made available to CSP landowners by City staff, the promotion of the City's water conservation website, and the availability of City water conservation staff to respond to specific questions.
 - 3. Educating homeowners on how to use and set up their smart irrigation controllers, and how to add onto it for their backyard irrigation.

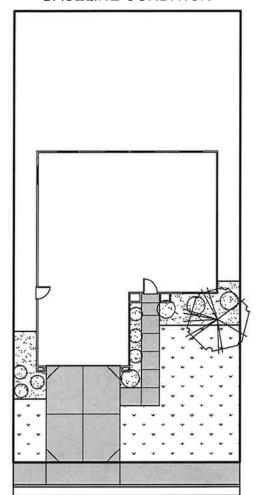
References

- 1. Mackay & Somps Civil Engineering, Inc. *Creekview Land Use Plan DRAFT*, October 26, 2010.
- 2. MacKay & Somps Civil Engineering, Inc., email communications, November 2010.
- 3. University of California Cooperative Extension, Sacramento County Agriculture and Natural Resources, Garden Notes, June 2008.
- 4. US Bureau of Reclamation, Summary of Smart Controller Water Savings Studies, April 2008.

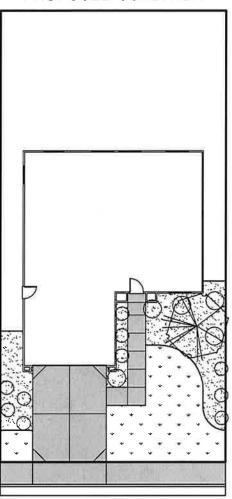
CREEKVIEW SPECIFIC PLAN

FRONT YARD WATER CONSERVATION EXHIBIT

BASELINE CONDITION



PROPOSED CONDITION



AREA	BASELINE	PROPOSED
HARDSCAPE LANDSCAPE	25%	25%
- TURF - LOW WATER PLANTING	70% 5%	42% 33%
TOTAL	100%	100%

HARDSCAPE

TURF

LOW WATER PLANTING

TACKAY & SONPS
ENGINEERS PLANNERS SURVEYORS
5142B FRANKLIN DR, PLEASANTON, CA 94588 (925)225-0690

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