Otay Ranch Resort Village

March 2015

Water Conservation Plan

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OTAY RANCH RESORT VILLAGE
RESIDENTIAL WATER CONSERVATION PLAN

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Introduction

The objective of the Otay Ranch Resort Village Water Conservation Plan is to meet the applicants' goal of attaining a minimum 30% reduction in the outdoor water use for the proposed single-family residences in the Otay Ranch Resort Village community. In order to calculate how the project achieves such a reduction, this study assumes a typical single-family residence water use of 500 gallons per day.[1] The estimated average outdoor water use of a single-family residence is 58% of the total property water use; however, to maximize the potential for water conservation, this study set the baseline outdoor water use at 52%, or 260 gallons per day. The resulting 30% reduction provided by this study will achieve a maximum outdoor use of 182 gallons per day per single family residence. This conservation proposal can be achieved through several techniques, as outlined in the following sections.

Methodology

A number of guiding principles were used to achieve the minimum 30% reduction of outdoor water use:

1. Minimize the use of vegetation with high water use requirements. High water use vegetation may be specified on a limited basis, depending on use and function.
2. Maximize the use of water-efficient and native vegetation.
3. Establish vegetation hydrozones, which are landscape areas composed of plant materials that have similar water needs.
4. Use permeable and non-permeable decorative paving strategically to reduce the total irrigated area and decrease the overall water demand.

These principles were used to develop conceptual lot plans. This study provides water reduction solutions for three typical single-family lot configurations proposed within the Resort Village (Figures 1, 2, and 3). The three lot configurations provide a representative cross section of potential lot sizes within the project, each with differing total irrigated landscape areas. These solutions are not intended to be prescriptive detailed landscape plans, but represent one method of achieving water conservation.

Hydrozones

Each lot has been subdivided into hydrozones. Hydrozones consider water needs, plant types, densities, and microclimates. These hydrozones are as follows:

- High Water Use Hydrozone – turf grass and/or high water use vegetation
- Moderate Water Use Hydrozone – water-efficient vegetation requiring moderate amounts of water
- Low Water Use Hydrozone – vegetation native to Southern California or vegetation requiring minimal water

Additional zones which do not require irrigation have also been included as a part of this study, as they will impact the total area of each lot:

- Side Yard Zone – decorative pavement, decomposed granite, or bark mulch
- Hardscape Zone – any durable surface material, pervious or non-pervious.[3]

Hydrozones have been designed to maximize the functionality of the high water use zones and minimize the visibility of the low water use zones and to maximize the efficiency of the irrigation system.

A list of native, low, and moderate water use plant species has been provided (Figure 5). The list is intended to provide a broad cross-section of plant species appropriate for the proposed hydrozones; however, it does not represent all native and water-efficient plant species available. Plant material specified for single-family residences within the Otay Ranch Resort Village development must conform to the Otay Ranch Resort Village Fire Protection Plan, Resort Village Design Plan and all other applicable policy documents.

Water Use Calculations

The total water use of each hydrozone can be found in the Estimated Total Water Use Calculations Table (Figure 4). Each hydrozone has an estimated water use based on the similar water needs of the plant species. A number of factors influence the estimated water use of each hydrozone.

The first of these factors is the landscape coefficient. The landscape coefficient estimates the water needs for different plant types. A higher landscape coefficient indicates higher water use. For instance, turf has a higher water demand than native vegetation, resulting in a higher coefficient.

The second factor is the irrigation efficiency coefficient. This coefficient is a measurement of the amount of total water applied that is beneficially used (less water lost through evaporation, runoff, etc.). A higher irrigation efficiency coefficient indicates a more efficient application and management of water, and indicates lower water waste. Drip irrigation has a more efficient distribution uniformity than traditional spray heads, improving the efficiency coefficient.

The total area of each hydrozone, combined with the landscape coefficient, irrigation efficiency coefficient, evapotranspiration rate, and average plant factor for each hydrozone determines the Estimated Total Water Use (ETWU) for each hydrozone. For more detailed instructions on calculating the ETWU, see Section 86.713 of the County of San Diego Ordinance 10032.[3]

The ETWU shall not exceed the Maximum Applied Water Allowance (MAWA) as defined in Section 86.712 of the County of San Diego Ordinance 10032.[3] This calculation for each lot type can be found at the bottom of each Water Use Calculations Table (Figure 4).

The square footage areas for each hydrozone in this study are not intended to be set minimums or maximums. The lots may be designed in a number of configurations to attain the minimum 30% water use reduction.

Irrigation Equipment

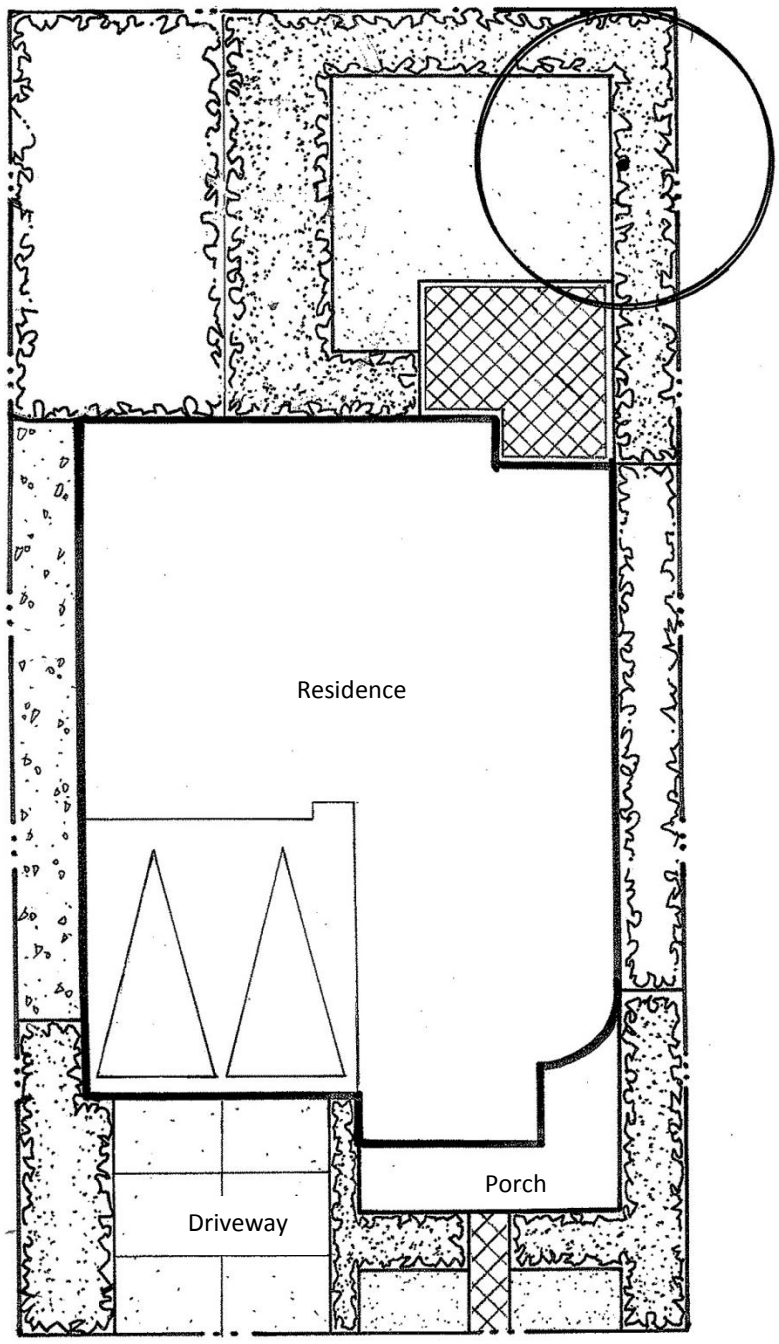
The design of the irrigation system and equipment specified play a significant role in the overall water use of each lot. Ideally, irrigation controllers are specified with the ability to schedule run-times based on site-specific weather data or soil moisture levels. The weather data can be in the form of historical averages, a residential weather station, or Internet-based software or service connected to the home computer.

The use of high-efficiency equipment shall be implemented whenever possible. Numerous low-volume drip irrigation technologies are available to meet the needs of various planting types and arrangements. Point-source drip emitters should be used for planting areas with low-density plantings. This approach will allow precise delivery of water directly to each plant. Drip tubing with integral pressure-compensating emitters should be used for higher density planting areas. Emitter flow rates and spacing may vary based on plant types, soil types, and densities to best meet the needs of specific plant materials. Dripline products are available with moisture wicking fabric that will facilitate even distribution of water between the emission points. This approach may be appropriate for denser planting arrangements. Rotator heads shall be used in turf areas, where possible, as a more efficient alternative to conventional spray heads.

An application for outdoor water use must be approved by the Director of Planning and Land Use as a condition of obtaining a building permit for a single-family residence with a landscaped area less than 5,000 square feet. This process will include establishing a MAWA for the project. Refer to Section 86.706 of the County of San Diego Ordinance 10032.[3]

Conclusion

The approach outlined in this document will enable homeowners in the Otay Ranch Resort Village community to meet the minimum 30% reduction of outdoor water use. As previously stated, the calculations and square footages in this study present only one solution to achieve this reduction. This approach allows for homeowners to have design flexibility in the way they choose to landscape their properties. Homeowners should work with landscape design and construction professionals to select a plant palette and develop a plan for their properties that meets their objectives and attains a maximum outdoor use of 182 gallons per day.



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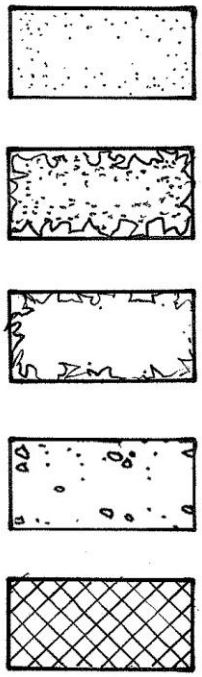


High Water Use Hydrozone

Moderate Water Use Hydrozone

Low Water Use Hydrozone

Side Yard Zone

Hardscape Zone (excluding driveway)

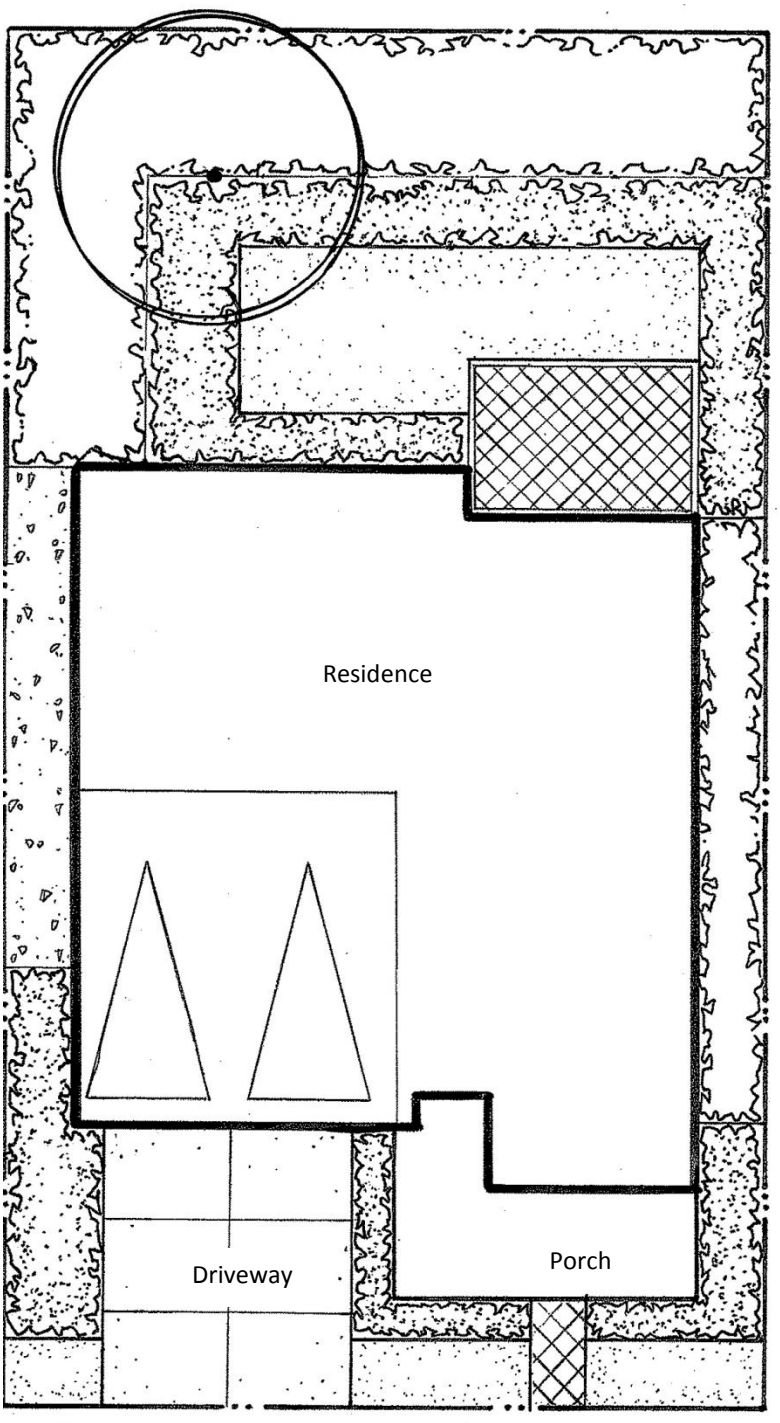
Landscape Area Summary:

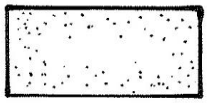
High Water Use Hydrozone	440 sq. ft.
Moderate Water Use Hydrozone	957 sq. ft.
Low Water Use Hydrozone	690 sq. ft.
Total Landscape Area	**2,087 sq. ft.**

Additional Non-Landscape Area:

Side Yard Zone	226 sq. ft.
Hardscape Zone	210 sq. ft.

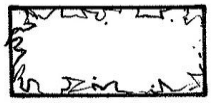
Figure 1. Typical 50 x 100 Foot Lot Hydrozones



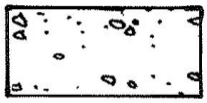


High Water Use Hydrozone

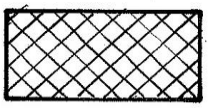
Moderate Water Use Hydrozone



Low Water Use Hydrozone



Side Yard Zone



Hardscape Zone (excluding driveway)

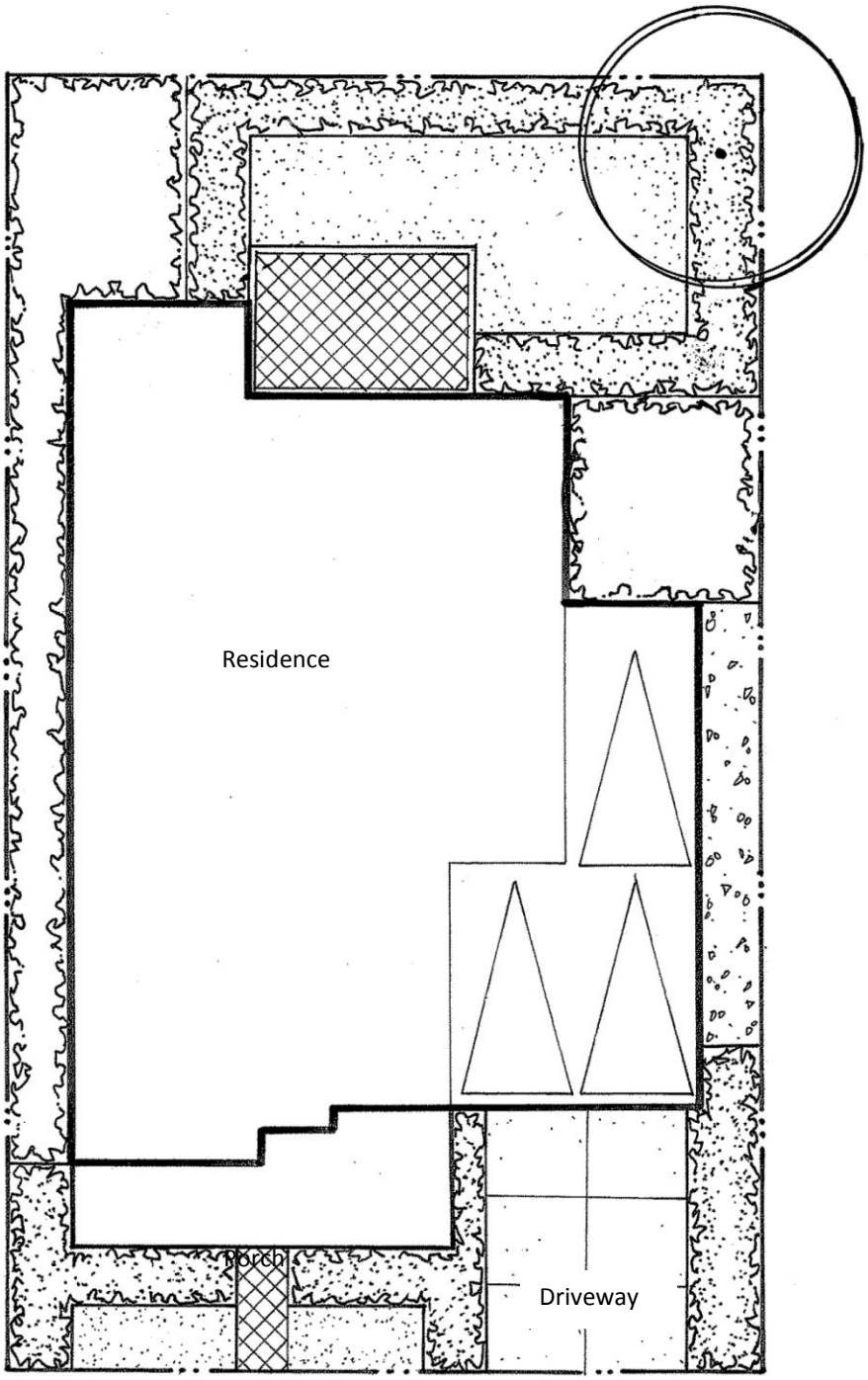
Landscape Area Summary:

High Water Use Hydrozone	504 sq. ft.
Moderate Water Use Hydrozone	844 sq. ft.
Low Water Use Hydrozone	1009 sq. ft.
Total Landscape Area	**2,357 sq. ft.**

Additional Non-Landscape Area:

Side Yard Zone	182 sq. ft.
Hardscape Zone	224 sq. ft.

Figure 2. Typical 55 x 100 Foot Lot Hydrozones



High Water Use Hydrozone

Moderate Water Use Hydrozone

Low Water Use Hydrozone

Side Yard Zone

Hardscape Zone (excluding driveway)

Landscape Area Summary:

High Water Use Hydrozone	554 sq. ft.
Moderate Water Use Hydrozone	939 sq. ft.
Low Water Use Hydrozone	873 sq. ft.
Total Landscape Area	**2,366 sq. ft.**

Additional Non-Landscape Area:

Side Yard Zone	179 sq. ft.
Hardscape Zone	256 sq. ft.

TYPICAL 50 x 100 LOT Total Landscape Area 2087 sf		Annual Eto 51.77 Inches	Hydrozone Area	Plant Factor	Irrigation Efficiency	Estimated Total Water Use	
Landscape Area	Planted Area	Percent of Total LA	HA	PF	IE	Annual ETWU	
	Sq Ft	%	Sq Ft			Gallons	Gallons/SF
High Water Use Hydrozone	440	21%	440	0.80	0.57	19,781	45
Moderate Water Use Hydrozone	957	46%	957	0.50	0.75	20,563	21
Low Water Use Hydrozone	690	33%	690	0.20	0.75	5,930	9
Lot Area Totals	2087	100%	2087				
Water Demand Totals					ETWU	**46,274**	**Gallons**
Average Gallons/Day **126**						**125.8**	**GPD ave**
* **Percent Reduction** **52%**							
MAWA 46,891 Gallons						**35.57**	**Inches**

** Based on typical outdoor water use of 260 gallons/day*

Estimated water use calculated using the equation: ETWU=(ETo)(0.62)(PF x HA / IE)

TYPICAL 55 x 105 LOT Total Landscape Area 2357 sf		Annual Eto 51.77 Inches	Hydrozone Area	Plant Factor	Irrigation Efficiency	Estimated Total Water Use	
Landscape Area	Planted Area	Percent of Total LA	HA	PF	IE	Annual ETWU	
	Sq Ft	%	Sq Ft			Gallons	Gallons/SF
High Water Use Hydrozone	504	21%	504	0.80	0.57	22,658	45
Moderate Water Use Hydrozone	844	36%	844	0.50	0.75	18,135	21
Low Water Use Hydrozone	1009	43%	1,009	0.20	0.75	8,672	9
Lot Area Totals	2357	100%	2357				
Water Demand Totals					ETWU	**49,465**	**Gallons**
Average Gallons/Day **134**						**134.5**	**GPD ave**
* **Percent Reduction** **48%**							
MAWA 52,958 Gallons						**38.02**	**Inches**

** Based on typical outdoor water use of 260 gallons/day*

Estimated water use calculated using the equation: ETWU=(ETo)(0.62)(PF x HA / IE)

TYPICAL 60 x 105 LOT Total Landscape Area 2366 sf		Annual Eto 51.77 Inches	Hydrozone Area	Plant Factor	Irrigation Efficiency	Estimated Total Water Use	
Landscape Area	Planted Area	Percent of Total LA	HA	PF	IE	Annual ETWU	
	Sq Ft	%	Sq Ft			Gallons	Gallons/SF
High Water Use Hydrozone	554	23%	554	0.80	0.57	24,906	45
Moderate Water Use Hydrozone	939	40%	939	0.50	0.75	20,176	21
Low Water Use Hydrozone	873	37%	873	0.20	0.75	7,503	9
Lot Area Totals	2366	100%	2366				
Water Demand Totals					ETWU	**52,586**	**Gallons**
Average Gallons/Day **143**						**143.0**	**GPD ave**
* **Percent Reduction** **45%**							
MAWA 53,160 Gallons						**40.42**	**Inches**

** Based on typical outdoor water use of 260 gallons/day*

Estimated water use calculated using the equation: ETWU=(ETo)(0.62)(PF x HA / IE)

Figure 4. Estimated Total Water Use Calculations

TREE SPECIES

Native	*Botanical Name*	*Common Name*
	Agonis flexuosa	*Peppermint Tree*
X	*Arbutus menziesii*	*Madrona*
	Callistemon citrinus	*Lemon Bottlebrush*
X	*Cercis occidentalis*	*Western Redbud*
	Chamaerops humillis	*Mediterranean Fan Palm*
	Chitalpa tashkentensis	*Chitalpa*
	Chorisia speciosa	*Floss Silk Tree*
	Cycas revolute	*Sago Palm*
	Fraxinus oxycarpa	*Raywood Ash*
	Geijera parvifolia	*Australian Willow*
	Koelreuteria paniculata	*Golden Rain Tree*
	Lagerstroemia indica	*Crape Myrtle*
	Laurus nobilis 'Saratoga'	*Saratoga Laurel*
	Olea europaea 'fruitless'	*Fruitless Olive*
	Pistacia chinensis	*Chinese Pistache*
	Phoenix raelenii	*Pigmy Date Palm*
X	*Platanus Racemosa*	*California Sycamore*
	Prosopis hybrid 'Phoenix'	*Thornless Mesquite*
X	*Quercus agrifolia*	*Coast Live Oak*
	Rhus lancea	*African Sumac*
	Tabebuia ipe	*Pink Trumpet*
	Trachycarpus fortunie	*Windmill Palm*
	Tristania conferta	*Brisbane Box*
	Zamia furfuraccea	*Cardboard Palm*

SHRUB, PERENNIAL, AND SUCCULENT SPECIES

Native	*Botanical Name*	*Common Name*
X	*Agave species and hybrids*	*Agave*
	Aloe species and hybrids	*Aloe*
	Alyogyne huegelii	*Blue Hibiscus*
	Anigozanthos species and hybrids	*Kangaroo Paw*
X	*Artemesia caucasica*	*Caucasica artemisia*
	Bougainvillea 'Crimson Jewel'	*Trailing Bougainvillea*
	Buxus microphylla 'Green Beauty'	*Dwarf Boxwood*
X	*Calliandra eriophylla*	*Fairy Duster*
	Callistemon citrinus 'Little John'	*Dwarf Lemon Bottlebrush*

Figure 5. Plant Palette

Native	Botanical Name	Common Name
	Carrisa grandiflora	*Natal Plum*
X	*Ceonothus species and hybrids*	*California Lilac*
	Cistus species	*Rockrose*
	Cuphea hyssopifolia	*False Heather*
X	*Dasylirion species*	*Desert Spoon*

SHRUB, PERENNIAL, AND SUCCULENT SPECIES CONTINUED

Native	Botanical Name	Common Name
	Dietes bicolor	*Fortnight Lily*
	Echium fastuosum	*Pride of Madeira*
X	*Epilobum*	*California Fuschia*
X	*Galvesia speciosa 'Firecracker'*	*Galvesia*
	Grevillea species and hybrids	*Grevillea*
X	*Hesperaloe parviflora*	*Red Yucca*
X	*Heteromeles arbutifolia*	*Toyon*
	Lantana camara	*Lantana*
	Lavendula augustifolia	*English Lavender*
	Leucophyllum species	*Texas Sage*
X	*Limonium perezii*	*Sea Lavender*
X	*Mimulus*	*Monkey Flower*
	Nandina domestica	*Heavenly Bamboo*
	Nolina recurvata	*Elephant's Foot Palm*
X	*Penstamon species and hybrids*	*Penstamon*
X	*Rhus integrifolia*	*Lemonade Berry*
	Rosmarinus officinalis	*Rosemary*
	Strelitzia nicolia	*Giant Bird of Paradise*
	Strelitzia reginae	*Bird of Paradise*
	Tecoma stans	*Yellow Bells*
	Westringia mundi	*Coast Rosemary*
X	*Yucca species and hybrids*	*Yucca*

GRASS SPECIES

Native	Botanical Name	Common Name
	Carex	
X	*Carex species*	*Sedge*
	Dianella species	*Flax Lily*
	Festuca glauca	*Blue Fescue*

Figure 5. Plant Palette (Continued)

Native	*Botanical Name*	*Common Name*
X	*Festuce californica*	*California Fescue*
	Liriope muscari 'Isabella'	*Isabella Lily Turf*
	Ophiopogon japonicus	*Mondo Grass*
	Paspalum vaginatum 'Aloha'	

GROUNDCOVER SPECIES

Native	*Botanical Name*	*Common Name*
	Agapanthus africanus	*Lily-of-the-Nile*
X	*Arctostaphylos 'Emerald Carpet'*	*Manzanita*
X	*Ceanothus graceus horizontalis*	*Ceanothus 'Yankee Point'*
	Gaillardia grandiflora	*Blanket Flower*
	Lantana montividensis	*Trailing Lantana*
	Scaevola aemula 'Purple Fusion'	*Fairy-Fan Flower*
	Sedum species and hybrids	*Stonecrop*
	Senecio serpens	*Chalk Sticks*
X	*Sisyrinchium bellum*	*Blue-Eyed Grass*
	Verbena rigida	*Verbena*

TURF SPECIES

Native	*Botanical Name*	*Common Name*
	Buchloe dactyloides 'UC Verde'	UC Verde Buffalo Grass
	Stenotaphrum secundatum	St. Augustine Grass

***X* -** Native to Southern California

Figure 5. Plant Palette (Continued)

References

[1] *Overview of Water Service for the Otay Ranch Resort Village*, Dexter Wilson Engineering, Inc., September 2014.

[2] Residential Water Use Summary. Available at http://www.aquacraft.com/Publications/resident.htm.

[3] County of San Diego Ordinance No. 10032, Title 8, Division 6, Chapter 7, Relating to Water Conservation in Landscaping, San Diego County Board of Supervisors, January 2010.