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MEMORANDUM

505-166

TO: Tim Gabrielson, P.E., Rick Engineering Company

FROM: Steven Henderson, P.E., Dexter Wilson Engineering, Inc.
Andrew Oven, P.E., Dexter Wilson Engineering, Inc.

DATE: July 23, 2019

SUBJECT: Water Use Estimation for the SDSU Mission Valley Campus
Master Plan Project

The SDSU Mission Valley Campus Master Plan (project) is a proposed campus redevelopment of the current SDCCU Stadium site, located in the City of San Diego. The project encompasses approximately 170+ acres and proposes to remove the existing stadium and redevelop the site with a 35,000 capacity stadium for SDSU football and other events; up to approximately 1,600,000 million square feet of campus academic buildings; two hotels with approximately 400 rooms for campus and related uses; 95,000 square feet of campus commercial/retail; 4,600 campus-related residential units; and a River Park with active and passive recreational facilities.

The purpose of this technical memorandum is to provide an estimate of potable water use for the proposed campus project based on the land use and site layout in the Development Package dated February 12, 2019, and the Civil Engineering Basis of Design report dated February 26, 2019 ^[1] ^[2]. Table A on the next page provides a summary of the proposed campus-related land use per the Development Package and Civil Engineering Basis of Design report at SDSU Mission Valley,

TABLE A SDSU MISSION VALLEY CAMPUS MASTER PLAN PROJECT PROPOSED LAND USE	
Land Use¹	Quantity¹
Campus Residential	8,510 people 4,600 DUs 2,129 EDUs ²
Campus Retail	95,000 SF 2.2 equivalent-acres ³
Campus Academic	1,565,808 SF 35.9 equivalent-acres ³
Campus Hotel	400 rooms 5.5 net-acres
Campus Stadium	35,000 seats
Park	38.2 gross-acres 30.6 net-acres ⁴
Other Landscaping	10.1 gross-acres ⁵

¹Land uses and quantities are referenced from the February 12, 2019 Development Package and/or the February 26, 2019 Civil Engineering Basis of Design

²Detailed residential density/equivalent dwelling unit (EDU) breakdowns by planning area are included in Attachment A

³Total square footage was spread across an equivalent acreage which is assumed to be equal to the net-acreage for water use estimating purposes

⁴Reduced by 20 percent from 38.2 gross acres of the River Park Open Space irrigated area (Attachment B)

⁵Includes landscaping principally surrounding each individual building and area of the project (Attachment B)

Three different methodologies were utilized to determine the best approach that would lead to the most accurate estimation of water use for the project based on the best available data for the project site. In the absence of detailed civil, architectural, and/or plumbing plans, water use planning criteria and empirical data from reputable sources was conservatively utilized and implemented into the water use estimations in this memorandum

The following sections outline and describe the three methodologies for estimating the water use components for the proposed project.

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**Methodology 1 – City of San Diego Water Department Facility Design Guidelines;
Book 2**

The first methodology in estimating the water use was to utilize the City of San Diego Water Department Facility Design Guidelines; Book 2 ^[3]. Public water studies performed in the City, including SDSU Mission Valley, are required to use this methodology to calculate a proposed project's and/or development's water use. The methodology is used for sizing potable water distribution systems in accordance with City of San Diego public standards and as reviewed by the Development Services Department, Water and Sewer Development Review Section.

Residential water demand is estimated based on EDUs and a water demand of 525 gpd/EDU. An EDU is synonymous with an average single family residence. Therefore, a density conversion from the campus project's 4,600 medium-to-high density residential units to total EDUs was requisite to accurately reflect the 525 gpd/EDU demand factor. That conversion is included as a part of Attachment A to this memorandum. All campus land use water demands were estimated based on acreage.

The campus stadium water demand is estimated using a demand factor based on stadium capacity. To be conservative, we used a factor of 4 gallons per attendee to estimate water use for a typical stadium event. This demand scenario was used for the stadium even though a stadium event does not occur on a daily basis. For sizing public water distribution systems we need to consider the combined maximum potential water demand.

Table 1 presents the projected average potable water demand for the proposed project. A breakdown of the average potable water demand for each type of land use is provided in Attachment A.

TABLE 1 SDSU MISSION VALLEY CAMPUS MASTER PLAN PROJECT ESTIMATED AVERAGE ANNUAL WATER USE (CITY OF SAN DIEGO WATER DEPARTMENT FACILITY DESIGN GUIDELINES; BOOK 2)				
Land Use¹	Quantity¹	Water Demand Factor²	Water Use, gpd	Water Use, AFY
Campus Residential (Multi-Family)	2,129 EDUs	525 gpd/EDU	1,117,725	1,252
Campus Retail	2.2 net-acres	5,000 gpd/net-acre	11,000	12.3
Campus Academic	35.9 net-acres	4,680 gpd/net-acre	168,012	188
Campus Hotel	5.5 net-acres	6,555 gpd/net-acre	36,053	40.4
Stadium	35,000 seats	4 gpd/seat	140,000	157
Park	30.6 net-acres	4,000 gpd/net-acre	122,400	137
TOTAL			1,595,190	1,787

¹Land uses and applicable quantities are referenced from Table A

²Water demand factors cited from the City of San Diego ^[3]

This methodology for estimating water use at SDSU Mission Valley is likely to be overly conservative because several completed developments in the City have been shown to use less water than calculated in the City’s Design Guidelines. In determining a more realistic water use estimation for large projects, the City utilizes different water use factors. These factors are presented as the next methodology.

Methodology 2 – City of San Diego Water Supply Assessment Water Use Factors

The next methodology analyzed was to apply the City’s Water Supply Assessment (WSA) Water Use Factors to the project. To comply with State requirements, the City Public Utilities Department, Engineering and Program Management reports estimated water use for all projects within the City that are slated for more than 500 units. The City has developed more realistic, lower water use factors to apply towards these projects in order to better report to the State how future water use and supply will be impacted due to said projects. These water use factors are shown on Table 2 and in the corresponding footnotes.

TABLE 2 SDSU MISSION VALLEY CAMPUS MASTER PLAN PROJECT ESTIMATED AVERAGE ANNUAL WATER USE (CITY OF SAN DIEGO WSA GUIDELINES)				
Land Use ¹	Quantity ¹	Water Demand Factor	Water Use, gpd	Water Use, AFY
Campus Residential (Multi-Family)	4,600 DUs	176 gpd/DU ²	809,600	907
Campus Retail	95,000 SF	60 gpd/500 SF ^{3, 4}	11,400	12.8
Campus Academic	1,565,808 SF	110 gpd/1,000 SF ⁵	172,239	193
Campus Hotel	400 rooms	119 gpd/room ⁶	47,600	53.3
Stadium	35,000 seats	4 gpd/seat ⁷	140,000	157
Park	38.2 gross-acres	2,803 gpd/gross-acre ⁸	107,075	120
TOTAL			1,287,914	1,443

¹Land uses and applicable quantities are referenced from Table A

²80 gpcd is the City's acceptable standard for multi-family water consumption (includes landscaping water demand). It is estimated that there are 2.2 persons per household.

³The utilization of 60 gpcd is the City's acceptable standard for employment water use (includes landscaping water demand)

⁴Number of retail employees estimated at 500 square feet per employee (City Data)

⁵110 gpd/SF per UCSD Long Range Development Plan Update City of San Diego WSA Data

⁶AWWA Research Foundation Data: For Hotel low End Water Usage 107 gallons/room/day, High End Usage 148 gallons/room/day, Hotel water usage is estimated with an occupancy rate of 80%. (Water usage using data from Table 6.12 of AWWA's "Commercial and Institutional End Uses of Water – 2000")

⁷From Table 1

⁸Irrigated park areas estimated per the City's Landscape Watering Calculator

This methodology using the City's WSA water use factors is a more accurate estimation of water use for the project compared to the City's Facility Design Guidelines described as Methodology 1. When estimating water use across a wide breadth of developments, these water use factors serve as a useful resource to better determine an accurate average water demand at the preliminary stages of a project.

Methodology 3 – Best Available Technology and Alternative Sources

For this final water use estimation methodology, we analyzed recent legislation and regulations, buildings standards, and third party research for impacts on water use.

Residential Indoor Water Use. The California Green Building Standards Code (CALGreen) requires new buildings in the State to become more efficient by requiring new development to meet minimum standards ^[4]. The City of San Diego adopted CALGreen through its most recent Land Development Code (Chapter 14 Article 10).

For new residences, CALGreen requires installation of low water use prescriptive required fixtures (showerheads, bathroom and kitchen faucets, and toilets). For dishwashers and clothes washers, the Environmental Protection Agency (EPA) WaterSense program was referenced. WaterSense also publishes criteria for overall indoor water use akin to CALGreen. Taking into account criteria from both resources, it can be expected for residential indoor water use to be approximately 40 gallons per person per day ^[5].

Non-Residential Indoor Water Use. Similar to residential indoor water use, non-residential indoor water use is mandated by CALGreen through the installation of low water use fixtures. All new non-residential construction at SDSU Mission Valley is expected to have these fixtures.

However, compared to residential indoor water use, there is less empirical non-residential indoor water use data available for analysis. The most extensive research study surrounding non-residential indoor water use was undertaken by the American Water Works Association (AWWA) in 2000 ^[6]. Commercial and institutional end uses were studied and analyzed at five sites in the Southwest: Irvine Ranch Water District, San Diego Water Department, Santa Monica Water Department, Phoenix Water Department, and Los Angeles Department of Water and Power.

The benchmark analyses from the study determined a median indoor water use for commercial buildings and schools of 21.9 and 38.7 gallons per square foot per year respectively and 206.7 gallons per occupied room per day for hotels. Taking into account the 30 percent overall decline in indoor water use since 2000 and an average hotel occupancy rate of 80 percent, the current projected indoor water use for commercial buildings and schools are 15.3 and 27.1 gallons per square foot per year, respectively, and 115.8 gallons per room per day for hotels ^[6] ^[7].

Stadium Water Use. As part of the preliminary efforts of the stadium redevelopment, AECOM prepared a Water Utility Technical Memorandum that evaluated and analyzed existing water infrastructure and recommended improvements for the stadium site ^[8]. Most recent actual water consumption data from existing water meters servicing the stadium from 2011 through 2015 showed an average water use of 51,000 gallons per day for the site.

SDSU football games as well as concerts and other events are assumed to occur at the same frequency as before. Only NFL football use will be eliminated as a stadium water use event. Using previous average water use for the stadium is a conservative approach due to the reduction in stadium capacity (approximately 70,000 seats to 35,000 seats), along with the elimination of approximately 10 NFL events per year.

Landscaping and Irrigation Water Use. Unlike Methodologies 1 and 2, all the water uses described here in Methodology 3 only account for indoor water use. Therefore, outdoor landscaping and irrigation water use will need to be accounted for as its own category. This includes not only the public access parks, but also the landscaping principally surrounding each individual building and area of the project. This area amounts to approximately 10.1 gross-acres.

Table 3 on the next page presents the water use factors and total estimated water use per Methodology 3 described in this memorandum.

TABLE 3 SDSU MISSION VALLEY CAMPUS MASTER PLAN PROJECT ESTIMATED AVERAGE ANNUAL WATER USE (BEST AVAILABLE TECHNOLOGY)				
Land Use¹	Quantity¹	Water Demand Factor	Water Use, gpd	Water Use, AFY
Campus Residential (Multi-Family)	8,510 people	40 gpd/person ²	340,400	381
Campus Retail	95,000 SF	15.3 gpd/SF/year ³	3,982	4.5
Campus Academic	1,565,808 SF	27.1 gpd/SF/year ⁴	116,256	130
Campus Hotel	400 rooms	115.8 gpd/room ⁵	46,320	51.9
Stadium	35,000 seats	51,000 gpd ⁶	51,000	57.1
Park	38.2 gross-acres	2,803 gpd/gross-acre ⁷	107,075	120
Other Landscaping	10.1 gross-acres	2,803 gpd/gross-acre ⁷	28,310	31.7
TOTAL			693,343	776

¹Land uses and applicable quantities are referenced from Table A

²40 gpd/person for indoor residential water use is per CALGreen and EPA WaterSense

³15.3 gpd/SF/year is per AWWA Research Foundation Data

⁴27.1 gpd/SF/year is per AWWA Research Foundation Data

⁵115.8 gpd/room is per AWWA Research Foundation Data

⁶51,000 gpd is from existing water meter data for the stadium site

⁷Irrigated areas estimated per the City's Landscape Watering Calculator

The estimated water use methodology for the proposed project presented in Table 3 is likely to be the most accurate projection of the three methodologies described in this memorandum. It reflects the most recent and best water savings technologies that State and local municipalities have adopted.

Water Use During Construction of the Campus Master Plan Project

A short-term demand for water will occur during project construction, primarily in association with dust control, grading, utilities installation and testing, concrete mixing, cleaning of equipment, and other related construction activities. These activities will occur incrementally through project build-out and be temporary in nature. The amount of water used during construction will vary depending on the conditions of the soil, weather, size of the area being worked, and site-specific operations, but is not expected to be substantial. The City of San Diego will supply water through a construction-metered connection from existing public water mains adjacent to the project site, and water tankers will deliver water for dust control to the development areas throughout project construction as needed. Therefore, an adequate supply of water will be available during project construction, and potential construction-related water supply impacts will be less than significant.

Current Region Wide Water Use and Conclusion

The current (2018) county- and city-wide average water use is published by the San Diego County Water Authority (SDCWA). The SDCWA is a public agency and wholesale supplier of water for San Diego County from the Colorado River and Northern California. Depending on the individual municipal water district, San Diego County water use ranges from approximately 55 to 360 gallons per day per person ^[9]. SDCWA reports the county-wide water use average as 91 gallons per person per day while the city-wide water use average is measured as 65 gallons per person per day ^[9].

The 693,343 gpd projected in Table 3 can be spread across the projected increase in population from the proposed project as a supplemental verification of the estimated average water use. Spread across 8,510 people (Table A and Mission Valley Community Plan Update ^[1]) 693,343 gpd corresponds to 81 gallons per person per day.

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The proposed project is anticipated to be compatible with projected development for the region based on the project's population projection being in line with the overall Mission Valley community area. Water use is also anticipated to reflect current trends as reported by the SDCWA. The estimated average annual water use stated in Table 3 for the project fits within those current water use trends and is expected to be the most accurate water use estimate of actual water use anticipated for the SDSU Mission Valley Campus Master Plan project presented in this technical memorandum.

SH:AO:ps

cc: Michael P. Masterson, Gatzke Dillon & Ballance LLP

Attachments

REFERENCES

- [1] Development Package SDSU Mission Valley by Carrier Johnson, February 12, 2019.
- [2] *Civil Engineering Basis of Design Report* by Rick Engineering Company, February 26, 2019.
- [3] City of San Diego Water Department Facility Design Guidelines; Book 2, July 2014.
- [4] California Green Building Standards Code (CALGreen), 2016.
- [5] *Water-Efficient Single Family New Home Specification Supporting Statement* United States Environmental Protection Agency – WaterSense, May 2008.
- [6] *Commercial and Institutional End Users of Water* by American Water Works Association Research Foundation, 2000.
- [7] *Codes and Standards Research Report California's Residential Indoor Water Use* by ConSol, March 2014.
- [8] *Stadium Reconstruction Project – Water Utility Technical Memorandum* by AECOM, August 6, 2015.
- [9] San Diego County Water Authority, 2018.

ATTACHMENT A

LAND USE AND EQUIVALENT DWELLING UNITS (EDU) BREAKDOWN

**SDSU MISSION VALLEY PROJECT
AVERAGE POTABLE WATER DEMAND**

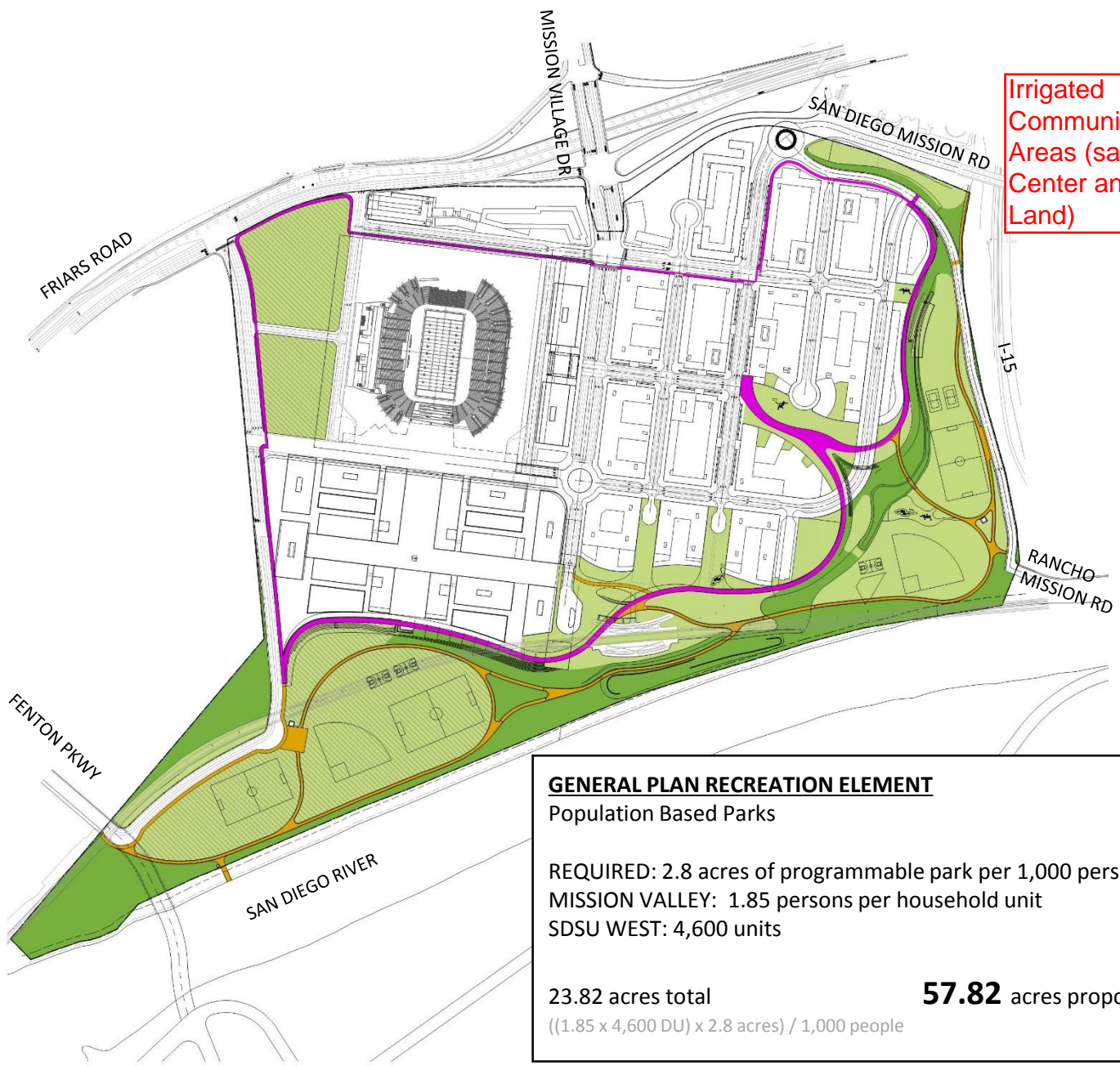
Area	Net Area, ft2	Net Area, ac	Dwelling Units	Dwelling Unit Density, DU/ac	Unit Density, Pop./DU	Total EDUs (3.5 persons per EDU)	Average Water Demand, gpd
Campus						<i>Stories</i>	
A1	28,084	0.64	--	--	--	5	15,086
A2	20,064	0.46	--	--	--	3	6,467
A3	27,720	0.64	--	--	--	3	8,935
A4	28,084	0.64	--	--	--	4	12,069
B1	28,084	0.64	--	--	--	5	15,086
B2	20,064	0.46	--	--	--	3	6,467
B3	16,720	0.38	--	--	--	3	5,389
C1	16,720	0.38	--	--	--	3	5,389
C2	28,084	0.64	--	--	--	3	9,052
C3	23,718	0.54	--	--	--	5	12,741
D1	27,720	0.64	--	--	--	3	8,935
D2	22,880	0.53	--	--	--	3	7,375
D3	33,630	0.77	--	--	--	3	10,839
D4	28,084	0.64	--	--	--	4	12,069
E1	30,090	0.69	--	--	--	5	16,164
F1	30,090	0.69	--	--	--	5	16,164
Sub-Total	409,836	9.4					168,012
Residential							
R1	118,102	2.7	302	111	1.8	155	81,540
R2	81,911	1.9	353	188	1.6	161	84,720
R3	77,895	1.8	356	199	1.5	153	80,100
R4	47,483	1.1	29	27	3.0	25	13,050
R5	76,000	1.7	313	179	1.6	143	75,120
R6	76,000	1.7	488	280	1.5	209	109,800
R7	82,930	1.9	485	255	1.5	208	109,125
R8	101,102	2.3	347	150	1.7	169	88,485
R9	32,351	0.7	40	54	2.5	29	15,000
R10	75,573	1.7	319	184	1.6	146	76,560
R11	76,000	1.7	465	267	1.5	199	104,625
R12	81,240	1.9	209	112	1.8	107	56,430
R13	67,288	1.5	311	201	1.5	133	69,975
R14	52,295	1.2	260	217	1.5	111	58,500
R15	57,935	1.3	261	196	1.6	119	62,640
H1 Res	108,518	2.5	71	28	3.0	61	31,950
Sub-Total	1,212,623	1.7	4609	165	1.7	2129	1,117,620
Hotel							
H1	173,934	4.0	255				26,174
H2	63,644	1.5	145				9,577
Sub-Total		5.5	400				36,053
Parks							
SDSU Parks	1,350,360	31.0					124,000
Stadium							
SDSU Stadium	NA	NA	35000				140,000
Retail	95,000	2.2					11,000
TOTAL							1,596,685

ATTACHMENT B

IRRIGATED LANDSCAPE AREAS

RIVER PARK OPEN SPACE

71.87 ACRES








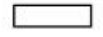

Irrigated
Community Park
Areas (sans Rec
Center and MTD
Land)

GENERAL PLAN RECREATION ELEMENT
Population Based Parks

REQUIRED: 2.8 acres of programmable park per 1,000 persons
MISSION VALLEY: 1.85 persons per household unit
SDSU WEST: 4,600 units

23.82 acres total **57.82** acres proposed
(1.85 x 4,600 DU) x 2.8 acres / 1,000 people

RIVER PARK OPEN SPACE










ACTIVE		
	SHARED SDSU/COMMUNITY ACTIVE PARKS INCLUDING: RECREATION FIELD AND TAIL GATE ZONE (7.19 ACRES) FIELDS AT RIVER PARK (15.32 ACRES)	22.51 ACRES
	ACTIVE PARK AND GREEN SPACE INCLUDING: DOG PARK (1.08 ACRES) PAD FOR AQUATIC & RECREATIONAL CENTER (0.85) MTD LAND (1.3 ACRES)	21.48 ACRES
	COMMUNITY HIKE AND BIKE LOOP	4.09 ACRES
	COMMUNITY HIKE AND BIKE TRAIL	3.77 ACRES
SUBTOTAL		51.85 ACRES
PASSIVE		
	COMMUNITY PASSIVE PARK AND GREEN SPACE	18.82 ACRES
SUBTOTAL		18.82 ACRES
DEVELOPABLE STRUCTURES		
	TROLLEY STATION	0.69 ACRES
	RESTROOM (COUNT 1)	400 SF
	MAINTENANCE SHED	80 SF
SUBTOTAL		0.70 ACRES
CIRCULATION		
	SIDEWALKS	0.50 ACRES
SUBTOTAL		0.50 ACRES
TOTAL		71.87 AC

PROJECT OPEN SPACE

83.53 ACRES



OPEN SPACE

ACTIVE		
	SHARED SDSU/COMMUNITY ACTIVE PARKS INCLUDING: RECREATION FIELD AND TAIL GATE ZONE (7.19 ACRES) FIELDS AT RIVER PARK (15.32 ACRES)	22.51 ACRES
	ACTIVE PARK AND GREEN SPACE INCLUDING: DOG PARK (1.08 ACRES) PAD FOR AQUATIC & RECREATIONAL CENTER (0.85) TROLLEY GREEN LINE STATION (0.69) RESTROOMS (0.02) MAINTENANCE SHED (80 SF)	21.48 ACRES
	COMMUNITY HIKE AND BIKE LOOP	4.09 ACRES
	COMMUNITY HIKE AND BIKE TRAIL	3.77 ACRES
SUBTOTAL		51.85 ACRES
PASSIVE		
	CAMPUS PASSIVE PARK AND GREEN SPACE INCLUDING: CAMPUS MALL (2.18 ACRES) CAMPUS GREEN (2.07 ACRES) 50 YARD LINE PLAZA (0.29 ACRES) COURTYARDS (3.91 ACRES)	8.46 ACRES
	COMMUNITY PASSIVE PARK AND GREEN SPACE	18.82 ACRES
	MEDIANS & STORM WATER	1.70 ACRES
SUBTOTAL		28.97 ACRES
PASEOS		
	CAMPUS PASEO	2.01 ACRES
	NEIGHBORHOOD PASEO	0.20 ACRES
SUBTOTAL		2.20 ACRES
CIRCULATION		
	SIDEWALKS	0.50 ACRES
SUBTOTAL		0.50 ACRES
TOTAL		83.53 ACRES

Other/Additional Landscaping/Irrigated Areas

SAN DIEGO RIVER	31.7 acres
ENVIRONMENTALLY SENSITIVE LAND (ESL)	11.8 acres
OPEN SPACE	83.53 acres
TOTAL	127.03 acres
	(58.84% of Project Site)
<i>*Does not include medians & storm water</i>	

83.53 AC