WATER SUPPLY ASSESSMENT STUDY

Facebook Campus Expansion
Menlo Park, California

Prepared for:
City of Menlo Park

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Water Supply Assessment Study
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1 INTRODUCTION

Erler and Kalinowski, Inc. ("EKI") is pleased to present this water supply assessment study ("WSA Study") in support of the proposed Facebook Campus Expansion Project ("Project"). The Project is a proposed office complex development located on approximately 58 acres at 300-309 Constitution Drive in the City of Menlo Park, California ("Subject Property"; see Figure 1). The Subject Property also includes Facebook's Building 23 (formerly 300 Constitution Drive); however, Building 23 is not part of this Project (i.e., in December 2014, the City of Menlo Park approved the conversion of Building 23 into offices).

The proposed Project includes replacing the existing commercial and light industrial land uses at the Subject Property with a new office development that includes approximately:

- 962,400 square feet of office space in two (2) office buildings;
- 174,800 square feet of hotel space, or 200 hotel rooms, in one (1) hotel building; and
- 12.9 acres of landscaped open space.[1]

The information provided in this WSA Study is consistent with California Water Code ("CWC" or "Water Code") §10910-10915 requirements and the California Department of Water Resource's ("DWR's") *Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001: To Assist Water Suppliers, Cities, and Counties in Integrating Water and Land Use Planning*, dated 8 October 2003. The text of specific sub-sections of the Water Code is included in indented and italicized font at the beginning of specific sections of this WSA Study. The information presented in those respective sections, and the associated tables and figures, respond directly to Water Code requirements.

Water service for the Subject Property is provided by the Menlo Park Municipal Water District ("MPMWD"). The purpose of this WSA Study is to evaluate whether the MPMWD has sufficient water supply to meet the current and planned water demands within its service area, including the demands associated with the proposed Project, during normal and dry hydrologic years over a 20-year time horizon. More specifically, this WSA Study includes:

- A summary of the WSA requirements articulated in Water Code §10910-10915 and a description of how they apply to the Project;
- A description and analysis of the current and projected future water demands of the proposed Project through the year 2040;
- A description and analysis of the historical, current, and projected future water demands for the MPMWD service area through the year 2040;

[1] The 12.9 acres of landscaped area associated with the proposed Project does not include landscaped area on the Subject Property that is associated with Facebook's previously-approved Building 23 Project, as discussed in more detail in Section 4.2.

- A description and analysis of the current and projected future water supplies for the MPMWD service area through the year 2040; and
- A comparison of the water supplies and demands for MPMWD's water service area, including the projected water demands associated with the proposed Project.

The information contained in this WSA Study is based primarily on MPMWD's 2010 Urban Water Management Plan ("UWMP"), MPMWD's draft 2015 UWMP (which is in development), information provided by the City of Menlo Park ("City") staff, and information specific to the proposed Project (i.e., square footage of specific land uses; ICF, 2015).

This WSA Study has been prepared for the sole use and benefit of the City of Menlo Park and MPMWD. Unless specifically authorized in writing in an agreement acceptable to EKI, reliance on this WSA Study by any other entity or third party is not permitted or authorized.

2 GENERAL REQUIREMENTS FOR THE PREPARATION OF A WATER SUPPLY ASSESSMENT

The purpose of this section is to outline what types of projects require WSAs, who is responsible for their preparation, and the necessary components of a WSA.

2.1 APPLICABILITY OF SENATE BILL 610 TO THE PROJECT

Water Code Section 10910

(a) Any city or county that determines that a project, as defined in Section 10912, is subject to the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) under Section 21080 of the Public Resources Code shall comply with this part.

Water Code Section 10912

For the purposes of this part, the following terms have the following meanings:

(a) "Project" means any of the following:
- *(1) A proposed residential development of more than 500 dwelling units.*
- *(2) A proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet of floor space.*
- *(3) A proposed commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space.*
- *(4) A proposed hotel or motel, or both, having more than 500 rooms.*
- *(5) A proposed industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area.*
- *(6) A mixed-use project that includes one or more of the projects specified in this subdivision.*
- *(7) A project that would demand an amount of water equivalent to, or greater than, the amount of water required by a 500 dwelling unit project.*

The City of Menlo Park has determined that the proposed Project is subject to the California Environmental Quality Act ("CEQA"). The proposed Project is a commercial project that contains, among other elements, proposed commercial office buildings with more than 250,000 square feet of floor space. Thus, in accordance with Water Code §10910(a) and 10912(a)(3), the proposed Project is defined as a "Project" under the Water Code and a WSA is required.

2.2 RESPONSIBILITY FOR PREPARATION OF THE WSA

Water Code Section 10910

(b) The city or county, at the time that it determines whether an environmental impact report, a negative declaration, or a mitigated negative declaration is required for any project subject to the California Environmental Quality Act pursuant to Section 21080.1 of the Public Resources Code, shall identify any water system that is, or may become as a result of supplying water to the project identified pursuant to this subdivision, a public water system, as defined in Section 10912, that may supply water for the project. If the city or county is not able to identify any public water system that may supply water for the project, the city or county shall prepare the water assessment required by this part after consulting with any entity serving domestic water supplies

whose service area includes the project site, the local agency formation commission, and any public water system adjacent to the project site.

Water for the proposed Project will be supplied by the MPMWD public water system, and therefore, in accordance with Water Code §10910(b), the City is the entity responsible for the WSA for the Project.

2.3 COMPONENTS OF A WATER SUPPLY ASSESSMENT

Water Code Section 10910

(c) (4) If the city or county is required to comply with this part pursuant to subdivision (b), the water supply assessment for the project shall include a discussion with regard to whether the total projected water supplies, determined to be available by the city or county for the project during normal, single dry, and multiple dry water years during a 20-year projection, will meet the projected water demand associated with the proposed project, in addition to existing and planned future uses, including agricultural and manufacturing uses.

As listed above in Water Code §10910(c)(4), the primary purpose of a WSA is to evaluate whether sufficient water supply is available to meet all future demands within the water supplier's service area, including those associated with the proposed Project, during normal and dry hydrologic years for a 20-year time horizon. In order to complete an equivalent assessment, the following information is included in this WSA Study:

- A description and analysis of the current and projected future water demands of the proposed Project through the year 2040;
- A description and analysis of the historical, current, and projected future water demands for the MPMWD service area through the year 2040;
- A description and analysis of the current and projected future water supplies for the MPMWD service area through the year 2040; and
- A comparison of the water supplies and demands for MPMWD's water service area, including the projected water demands associated with the proposed Project.

3 PROJECT DESCRIPTION

The proposed Project is an infill project that includes the redevelopment of existing uses on an approximately 58-acre site located at 300-309 Constitution Drive (i.e., the Subject Property). The Project includes the demolition of certain existing buildings and hardscape at the Subject Property, as well as removal of vegetation that would be replaced in accordance with the Project's landscape plan. For the purposes of this WSA, it is conservatively assumed that completion and full occupancy of the proposed Project would occur by 2018.

The proposed Project would include new development of approximately:

- 962,400 square feet of office space in two (2) office buildings;
- 174,800 square feet of hotel space, or 200 hotel rooms, in one (1) hotel building; and
- 12.9 acres of landscaped open space.[2]

The Subject Property was owned and occupied by TE Connectivity Ltd. ("TE") for office and light industrial uses prior to being purchased by Hibiscus Properties, LLC, a wholly owned subsidiary of Facebook, Inc. ("Facebook") in 2014. Figure 1 shows the location of the Subject Property, which is located in the northern portion of the City, between Highway 84 and Highway 101. The Subject Property also includes the former warehouse and distribution building at 300 Constitution Drive. However, this building (now known as Building 23) was approved by the City for conversion to office uses in December 2014 and is not a part of the proposed Project.

Water service to the Subject Property is provided by MPMWD. Historical water use at the Subject Property was associated with office, light industrial activities, and manufacturing uses (e.g. restrooms, process, cooling, and landscape irrigation). Future water demand associated with the proposed Project will be associated with office-related activities. The proposed Project will also increase the gross floor area and employee density, which will result in a net incremental increase in water demand at the Subject Property.

[2] The 12.9 acres of landscaped area associated with the proposed Project does not include landscaped area on the Subject Property that is associated with Facebook's previously-approved Building 23 Project, as discussed in more detail in Section 4.2.

4 PROJECT WATER DEMAND

The City requires that all new residential and non-residential construction comply with the mandatory CALGreen Requirements.[3] The City also requires that new and rehabilitated landscapes on projects subject to city review and approval comply with the City's Water Efficient Landscaping Ordinance ("Landscaping Ordinance"), which was updated on 26 January 2016 to reflect recent changes to the State's Model Water Efficient Landscape Ordinance ("MWELO"; DWR, 2015). As such, the proposed Project will include a number of water-efficiency features, including, but not limited to:

- Use of low-flow lavatory faucets, kitchen faucets, toilets, and urinals in accordance with CALGreen Code; and
- Inclusion of low-water use landscaping and high-efficiency irrigation systems to minimize outdoor water use in accordance with the Landscaping Ordinance.

As described below, average annual water use for the proposed Project was estimated based on: (1) the application of well-established methodologies for estimating indoor and outdoor water use factors, and (2) assumptions regarding water efficiency for certain end uses based on conformance with the City requirements described above.

4.1 FUTURE WATER DEMAND ASSOCIATED WITH THE PROJECT

A summary of the water use projections at Project completion are provided in Table 1. Based on the methodologies described below, the annual water use associated with the proposed Project is projected to be 88 million gallons ("MG") at buildout.

4.1.1 Indoor Water Use Factors

The Project's indoor water use factors were developed using the data and methodology presented in the Pacific Institute's *Waste Not, Want Not: The Potential for Urban Water Conservation in California* (2003), also referred to as the "Pacific Institute Study." This study developed indoor "employee water use factors" for wide range of commercial and industrial facilities based on statewide averages of (1) measured water use data, and (2) the number of employees for each type of facility. To account for implementation of more-stringent water efficiency standards since the study was completed, and the anticipated water-efficient design of the proposed Project, the "best" potential "conservation saving factors"[4] estimated in Appendix E of the Pacific Institute Study were applied to the employee water use factors. For reference, additional detail regarding the derivation of the Pacific Institute's water conservation factors is included as Appendix A.

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[3] As described on the City's website: http://www.menlopark.org/DocumentCenter/Home/View/93

[4] As shown in Attachment A, the Pacific Institute Study presented conservation saving factors for "high," "low," and "best" potential savings for each type of land use, and for specific end-uses. According to the Pacific Institute, the "best" potential conservation saving factors represent the most accurate estimate of likely conservation potential based on the source of the data, age of the data, and/or sample size.

The employee water use factors were multiplied by the estimated number of employees to calculate the indoor water use factors. The indoor water use factors were estimated for the assumed mix of office and hotel land uses that are contemplated in the proposed Project.

Table 2a summarizes the land use parameters that were used to estimate the indoor water use factors. Each of these parameters is discussed in the following sections.

Number of Employees

The number of employees assumed for office and hotel land uses for the proposed Project shown in Table 2a was based on information provided by City staff on 20 November 2015.

Employee Indoor Water Use Factors

The employee water use factors presented in the Pacific Institute Study identified the average indoor water consumption per employee per working day for each type of commercial land use, normalized for a 225-day work year. For example, if the applicable employee water use factor was 100 gallons per employee per work day, each employee within the applicable commercial land use category would annually consume 100 gallons per day multiplied by 225 working days per year, or 22,500 gallons per year.

The employee water use factors developed in the Pacific Institute Study were based on water use data collected prior to 2001.[5] The water use efficiency for new commercial construction has generally improved since these data were collected. As a result, the employee water use factors developed as part of the Pacific Institute Study provide a conservative (i.e., high) estimate of commercial water use for new buildings, a fact that was anticipated in the study and addressed through the development of conservation saving factors, as discussed below.

Conservation Saving Factors

The Pacific Institute Study was based on water use data that predated the adoption of the current CALGreen Code and other applicable water efficiency standards. Anticipating improved future water-efficiency, the Pacific Institute Study developed conservation saving factors, which can be applied to the employee water use factors to account for the implementation of more-stringent water efficiency standards. Specifically, the Pacific Institute Study estimated that the implementation of water conservation measures, such as those required by the current

[5] According to the Pacific Institute study (2003), employee water use factors were estimated from data gathered from commercial water users around California in several surveys (DWR, 1995 and 2000; Davis et al., 1988; Dziegielewski et al., 1990; and Dziegielewski et al., 2000). To estimate statewide water use, these employee water use coefficients were then applied to statewide employment data to project the total water use for each sector. These estimated water usages were then compared with water-delivery data by sector, as reported by nearly 150 water districts across the state. The difference between commercial water use estimates developed using these two methods was less than 10%.

CALGreen Code and similar regulations, could reduce water demands by 26% to 42% compared with the water use factors developed in their study, depending on the conservation scenario, land use type, and type of water fixture or appliance. The water conservation measures accounted for in the Pacific Institute Study that would be implemented by the proposed Project include:

- Installation of ultra-low flush toilets and urinals, plus low-flow faucet aerators and showerheads[6];
- Improvements to mechanical cooling systems by installation of conductivity controllers, addition of chemical treatments to improve the concentration ratio, and improved energy efficiency of other mechanical components; and
- Other technologies appropriate for kitchens and laundries such as water-efficient dishwashers and washing machines.

Based on assumed implementation of these water-efficiency measures within the proposed Project, conservation saving factors for indoor water uses were estimated based on the "best" potential[7] savings identified in the Pacific Institute Study, as shown in Tables A-1 and A-2 of Appendix A. These estimated conservation factors were incorporated into the proposed Project demand calculations, as shown in Table 2a.

However, it should be noted that these conservation savings factors do not directly account for the water savings associated with use of high-efficiency toilets required by the CALGreen Code (i.e., those that use 1.28 gallons per flush or less), or the increased efficiency of other water fixtures relative to the assumptions imbedded in the Pacific Institute Study. Nor do they account for the potential conversion of the proposed Project's landscape irrigation or other non-potable demands to recycled water, or other non-potable sources. As such, to the extent that actual water use at the proposed Project is less than what has been conservatively estimated herein (for the reasons stated above, or other reasons), the resultant impacts to MPMWD's water supply and demand projections (as discussed in Sections 5 and 6), will likewise be reduced.

4.1.2 Outdoor Water Use Factors

The Project's outdoor water use factors were estimated using the landscape irrigation demand model described in the recently-updated MWELO (DWR, 2015), which the City adopted and is implementing as part of its Landscaping Ordinance. The MWELO requires that the annual

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[6] Effective January 2014, only high-efficiency toilets that use 1.28 gallons per flush will be available for purchase in California. The water savings estimates assumed in the Pacific Institute study only reflected installation of 1.6 gallon per flush toilets. Therefore, these conservation savings estimates are conservative (i.e., they likely underestimate the water savings potential).

[7] As shown in Attachment A, the Pacific Institute Study presented conservation saving factors for "high," "low," and "best" potential savings for each type of land use, and for specific end-uses. According to the Pacific Institute, the "best" potential conservation saving factors represent the most accurate estimate of likely conservation potential based on the source of the data, age of the data, and/or sample size.

estimated total water use for landscape irrigation not exceed a Maximum Applied Water Allowance ("MAWA"). As shown below, the MAWA is calculated based on the regional reference evapotranspiration rate, an evaporation adjustment factor, the total landscaped area, and the area of "special landscaped area".[8] For the proposed Project, we have conservatively assumed that outdoor water use will be equal to the MAWA, which is the upper limit of annual applied water for the established landscaped area, which is estimated to be 12.9 acres[9].

The MAWA is calculated using the following equation:

$$MAWA = ETo \times [(ETAF \times LA) + (1\text{-}ETAF) \times SLA]$$

where:

ETo	=	The regional reference evapotranspiration rate[10]
ETAF	=	Evapotranspiration Adjustment Factor
	=	For City's Landscaping Ordinance, non-residential areas = 0.7
	=	For MWELO, non-residential areas = 0.45
LA	=	Total landscape area (including SLA)
SLA	=	Special Landscape Area

Based on the above methodology and assumptions, annual outdoor water use is estimated to be 7 MG. The estimated outdoor water use calculations are shown in Table 2b.

4.1.3 Total Project Water Use

Based on the above methodologies and assumptions, the total indoor and outdoor annual water use for the proposed Project at full occupancy is estimated to be 88 MG, as shown in Table 1.

4.2 BASELINE WATER USE AT THE SUBJECT PROPERTY

Historical water use at the Subject Property was measured by a single meter and recorded by MPMWD on a monthly basis. As such, there are no water meter data that exclusively reflect historical water use on the portion of the Subject Property that will be replaced by the proposed

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[8] Special Landscaped Area includes landscaping dedicated solely to edible plants, recreational areas, areas irrigated with recycled water, or water features using recycled water. No Special Landscaped Area is included in the proposed Project.

[9] The 12.9 acres of landscaped area associated with the proposed Project does not include landscaped area on the Subject Property that is associated with Facebook's previously-approved Building 23 Project, as discussed in more detail in Section 4.2.

[10] Location-specific reference evapotranspiration ("ETo") data is required for calculating the MAWA. Reference evapotranspiration data were obtained from Appendix A of the MWELO (DWR, 2015) based on values for Redwood City, which is the closest available City to the Subject Property. The total annual reference evapotranspiration is 42.8 inches as shown in Table 2b.

Project (i.e., the historical water use data includes the water use at Building 23, which is not part of the proposed Project). Therefore, as described below, for the purposes of this WSA Study, a modified "baseline" water use for the proposed Project was estimated by subtracting the future water demands associated with the Building 23 (i.e., 300 Constitution Drive) from the total historical water use at the Subject Property.

Specifically, the City approved a project in December 2014 to convert Building 23 from a warehouse to offices ("the Building 23 Project"). As part of the City's analysis for the Building 23 Project, all of the vehicle trips and the associated population and a portion of water use from the former TE campus was allocated to the Building 23 Project. The structure of this prior entitlement created a modified "baseline" for the Subject Property that is used for the proposed Project's CEQA analysis, including for this WSA Study (Menlo Park, 2015a).

As described further below, and shown in Table 3, after accounting for the proposed future water use associated with the Building 23 Project, for the purposes of this analysis, the baseline annual water use at the Subject Property is estimated to be 58 MG.

4.2.1 Historical Water Use at the Former TE Campus

Water use billing data for the period from 2010 through 2015[11] for the former TE campus on the Subject Property was provided by Facebook on 24 September 2015. A summary of the historical water use at the Subject Property is included in Table 3. Average annual water use at the Subject Property from 2010 through 2015 was approximately 77 MG, with annual water use ranging from 62 MG in 2012 to 99 MG in 2010. The trends observed in historical water use at Subject Property are generally consistent with those observed throughout MPMWD's service area (see Section 5.3), and likely reflect the influence of the recent droughts, TE Connectivity's cessation of operations at the Subject Property, and building vacancies during the economic downturn.

4.2.2 Indoor Water Use Factors at Building 23

As with the proposed Project, the future indoor water use factors for the Building 23 Project were estimated herein using data and methodology included in the Pacific Institute Study for office land uses. Table 4a summarizes the land use parameters that were used to estimate the indoor water use factors. The number of future employees for Building 23 was assumed based on information provided by City staff on 16 September 2015. The "best" potential conservation saving factor for indoor water uses was incorporated into the Building 23 Project demand estimates based on the Pacific Institute Study data, see also Table A-1 of Appendix A.

[11] Water use in 2015 was only available from January through May and was interpolated to estimate annual water use.

4.2.3 Outdoor Water Use Factors at Building 23

The landscaping area at the Building 23 Project is compliant with the City's prior 2010 Landscaping Ordinance (i.e., it does not reflect changes to the State's MWELO). Therefore, the outdoor water use factors for the Building 23 Project were estimated using the landscape irrigation demand model described in the 2010 Landscaping Ordinance. As with the updated MWELO discussed above in Section 4.1.2, the 2010 Landscaping Ordinance requires that the annual estimated total water use for landscape irrigation not exceed the MAWA. For the Building 23 Project estimate we have conservatively assumed that outdoor water use will be equal to the MAWA, which is the upper limit of annual applied water for the established landscaped area, which was estimated to be one (1) acre. The MAWA was calculated using an evaporation adjustment factor of 0.7 for non-residential areas per the 2010 Landscaping Ordinance, which is less stringent than the updated MWELO.

Future annual outdoor water use at the Building 23 Project is estimated to be 0.8 MG. The estimated outdoor water use calculations are shown in Table 4b.

4.3 INCREMENTAL WATER DEMAND ASSOCIATED WITH THE PROJECT

When compared to the modified baseline water use for the existing Subject Property (i.e., which is estimated to by 58 MG, or the difference between the total historical use [77 MG] and the estimated Building 23 Project demand [19 MG]), the incremental water demand associated with the proposed Project is approximately 30 MG, as shown in Table 1.

We note that this incremental demand has been estimated based on the following conservative assumptions:

- The proposed Project demand estimates to do not directly account for the water savings associated with use of high-efficiency toilets (i.e., those that use 1.28 gallons per flush or less), or the increased efficiency of other water fixtures relative to the assumptions imbedded in the Pacific Institute Study; and
- The proposed Project demand estimates to do not account for the potential conversion of the Project's landscape irrigation or other non-potable demands to recycled water, or other non-potable sources.

To the extent that actual water use at the proposed Project is less than what has been conservatively estimated herein (for the reasons stated above, or other reasons), the resultant impacts to MPMWD's water supply and demand projections (as discussed in Sections 5 and 6), will likewise be reduced.

5 MPMWD WATER DEMAND

Water Code Section 10910

(c) (1) The city or county, at the time it makes the determination required under Section 21080.1 of the Public Resources Code, shall request each public water system identified pursuant to subdivision (b) to determine whether the projected water demand associated with a proposed project was included as part of the most recently adopted urban water management plan adopted pursuant to Part 2.6 (commencing with Section 10610).

(c) (2) If the projected water demand associated with the proposed project was accounted for in the most recently adopted urban water management plan, the public water system may incorporate the requested information from the urban water management plan in preparing the elements of the assessment required to comply with subdivisions (d), (e), (f), and (g).

(c) (3) If the projected water demand associated with the proposed project was not accounted for in the most recently adopted urban water management plan, or the public water system has no urban water management plan, the water supply assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single dry, and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses.

As part of the development of its 2015 UWMP, the City estimated the current and projected future water demand for the MPMWD water system service area based on buildout of the current General Plan and other approved projects. In accordance with the UWMP Act (Water Code §10610-10656), MPMWD's projected future water demand is estimated in five year increments, between the years 2015 and 2040, and is subdivided between the following six customer sectors: (1) residential single family, (2) residential multi-family, (3) commercial and institutional, (4) industrial, (5) landscape, and (6) other.[12]

The proposed Project was not accounted for in the water demand projections of the current General Plan buildout. Therefore, we have considered the incremental demand attributed to the proposed Project to be additive to the water demands associated with the City's current General Plan buildout.

5.1 HISTORICAL AND CURRENT USE WITHIN THE MPMWD SERVICE AREA

Water use within the MPMWD service area is measured using water meters that are installed at each customer account and is summarized in Table 5. Records of current and historical water use at each account are maintained by the City Public Works Department. According to information provided by City staff on 30 September 2015, total annual water use for MPMWD was approximately 1,030 MG in 2014, which was a decrease relative to 2013 and a departure from

[12] System water loss is also included in the future water demand listed in the UWMP (Menlo Park, 2015b). Losses were assumed to be approximately 4.5 percent of the total system water use.

the increases in water use observed each year between 2011 and 2013. Prior to 2011, water use had decreased each year since 2007; this decrease is thought to reflect impacts of the 2007-2009 drought and the economic downturn, which resulted in lower residential and non-residential water use. The rebound in water use in 2011 and 2013 are thought to reflect improved economic conditions. Despite the economic rebound in the Bay Area, the resultant calls for water use cutbacks locally and mandatory state-wide restrictions[13] in response to the recent historic drought led to another decline in water use in 2014.

5.2 POPULATION AND EMPLOYMENT PROJECTIONS

Future water demands for MPMWD's service area were projected by BAWSCA on behalf of MPMWD in the 2014 *Regional Water Demand and Conservation Projections Report* (BAWSCA, 2014b). Future water demands were projected using the Demand Management Decision Support System Model ("DSS Model") based on population and employment projections within MPMWD's service area, which were in turn developed using Associate of Bay Area Governments ("ABAG") 2013 data.

MPMWD's DSS Model was updated in 2015. The 2015 DSS Model update includes revised population and employment projections developed by the City's Planning Division based on information related to the City's recently-approved projects and the current General Plan.

Future population within MPMWD's water service area is projected in the draft 2015 UWMP and 2015 DSS Model based on buildout of the current General Plan. The current General Plan estimates that there will be 18,614 residents within MPMWD's service area in 2040, an increase of 2,548 relative to the current 2015 population of 16,066.

The MPMWD also supplies water to its CII customers, which were collectively estimated to provide 12,443 jobs within MWMPD's water service area in 2015. Based on the current General Plan and the City's approved projects, the number of jobs within MWMPD is anticipated to grow to 17,143 in 2020, and to 20,543 in 2040. Anticipated job growth within MPMWD is the net effect of growth in the commercial sector and decline in the industrial sector. Specifically, commercial jobs are expected to increase by 8,796, while industrial jobs are expected to decrease by 696 between 2015 and 2040 (Menlo Park, 2015b).

5.3 WATER DEMAND PROJECTIONS - CURRENT GENERAL PLAN BUILDOUT

The projected future water demands within MPMWD's service area are reported in the draft 2015 UWMP, and are summarized below and in Table 6. As described above, projected water

[13] On 28 July 2014, the SWRCB adopted emergency regulations to mandate water agencies, including the MPMWD, to implement their Water Shortage Contingency Plan and minimum actions to reduce outdoor water use. On 5 May 2015, SWRCB adopted Resolution 2015-0032 to mandate further minimum actions by water suppliers and their customers to reduce potable water use into 2016 and assigns a mandatory water conservation savings goal to each water supplier based on their residential water use. MPMWD has a SWRCB-mandated reduction target of 16%.

demands within the MPMWD service area are the sum of water uses projected in each sector and water that is projected to be lost during distribution ("system losses" or "non-revenue water").

Projected water demands within the MPMWD service area are provided in Table 6 in five year increments between 2020 and 2040. Projected annual water demands associated with the City's current General Plan buildout are approximately 1,310 MG in 2020 and 1,240 MG in 2040. The anticipated decline in water demands between 2020 and 2040 in spite of growth in total population and jobs is largely due to:

- Decreasing projected water use in the industrial sector; and
- Increased water efficiency in the residential and non-residential sectors as a result of plumbing code changes and planned MPMWD conservation efforts.

5.4 OTHER PLANNED PROJECTS WITHIN MPMWD'S WATER SERVICE AREA

Table 7 identifies other planned projects within MPMWD's water service area that are included in the draft 2015 UWMP and the 2015 DSS Model. These projects were identified on the basis of information provided by the City's Planning Division.[14]

There are two projects that are pending City's approval that are not accounted for in the water demand projections of the City's current General Plan buildout or in the 2015 DSS Model. These projects and their potential annual water demands are included in Table 7. The total annual demand of these projects is approximately 344 MG.

5.5 TOTAL PROJECTED MPMWD WATER DEMAND

Total projected MPMWD water demand, as shown in Table 8, is the sum of water demands associated with the City's current General Plan buildout (i.e., as reflected in the 2015 DSS Model), water demands for other approved projects, and the incremental water demand associated with the proposed Project. It is estimated that the total annual water demand will be approximately 1,584 MG in 2040 within MPMWD's service area (i.e., 1,240 MG for buildout of the current General Plan plus 344 MG for other planned projects), excluding the proposed Project. Including the estimated incremental water demand for the proposed Project (i.e., 30 MG per year), approximately 1,614 MG of water demand is expected in 2040 within MPMWD's service area.

[14] Projects were identified from the City of Menlo Park Planning Division on 9 September 2015.

6 MPMWD SUPPLY

This section identifies MPMWD's water supplies and discusses the vulnerability of the various supplies to drought and other factors affecting water reliability.

6.1 IDENTIFICATION OF WATER SUPPLY RIGHTS

Water Code Section 10910

(d) (1) The assessment required by this section shall include an identification of any existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project, and a description of the quantities of water received in prior years by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), under the existing water supply entitlements, water rights, or water service contracts.

Pursuant to Water Code §10910(d)(1), a WSA is required to include identification of all water supply entitlements, water rights, and water service contracts relevant to the identified water supply for the Project. In accordance with these requirements, this WSA Study includes a summary of MPMWD's water supply sources and the agreements between MPMWD and its wholesale supplier.

6.1.1 SFPUC Regional Water System

MPMWD receives water from the City and County of San Francisco's Regional Water System ("Regional System"), which is operated by the San Francisco Public Utilities Commission ("SFPUC"). This supply originates predominantly from the Sierra Nevada and is delivered through the Hetch-Hetchy aqueducts. The supply also includes treated water produced by the SFPUC from its local watersheds and facilities in Alameda and San Mateo Counties. Approximately 85% of the Regional System supply comes from the Tuolumne River and the Hetch-Hetchy Reservoir. The remaining 15% comes from local watersheds through the San Antonio, Calaveras, Crystal Springs, Pilarcitos and San Andreas Reservoirs.

The business relationship between San Francisco and its wholesale customers (including MPMWD) is largely defined by the Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County and Santa Clara County ("Agreement") entered into in July 2009. The Agreement, which has a 25-year term, addresses water supply availability for the Regional System as well as the methodology used by the SFPUC in setting wholesale water rates. This agreement supersedes an earlier 25-year agreement signed in 1984.

The Agreement provides 184 million gallons per day ("MGD") to the wholesale customers during normal water years. This volume, referred to as the "Supply Assurance" is subject to reduction during periods of water shortage due to drought, emergencies, or other scenarios resulting in a water shortage. Each wholesale customer's share of the 184 MGD is referred to as their Individual Supply Guarantee ("ISG"). The MPMWD's ISG is 4.465 MGD (approximately

1,630 MG per year). Although the Agreement expires in 2034, the Supply Assurance and ISG continue in perpetuity.

The Agreement also recognizes the SFPUC's decision made in October 2008 to (a) defer any consideration of an increase to the 184 MGD Supply Assurance until 2018, (b) place an interim limit on sales of 184 MGD for all wholesale customers, including San Jose and Santa Clara, (i.e., those customers who do not have ISGs), (c) establish interim supply allocations ("ISAs") for each wholesale customer through 2018, and (d) develop an environmental enhancement surcharge to be applied to wholesale agencies that exceed their ISA, if total use by SFPUC's retail customers and wholesale customers exceeds 265 MGD.

However, these ISAs are entirely distinct from the permanent ISGs as they will last only until 2018 and will only be used as basis for applying the surcharge. Therefore, although the establishment of the ISAs may potentially increase the cost of water supplied by SFPUC to MPMWD if MPMWD exceeds its ISA at a time when collective deliveries from the Regional System exceed 265 MGD, the ISAs will not affect MPMWD's ISG of 4.465 MGD. Therefore, projected water supplies to MPMWD from SFPUC that are identified in the 2010 UWMP and rely on MPMWD's ISG have not been modified based upon the provisions of the new Agreement.

Currently MPMWD purchases 100% of its potable water supply from the SFPUC. The MPMWD's current and projected purchase quantities are approximately equal to an average of 2.79 MGD in 2014 (1,017 MG per year, Table 9) and 4.42 MGD based on projected demands in 2040 (1,614 MG per year), respectively. Both current and projected purchase quantities are less than MPMWD's ISG of 4.465 MGD.

6.1.2 Other Water Supplies

The MPMWD does not currently operate any potable groundwater wells for water supplies, but plans to construct approximately three to four emergency wells to provide water supply reliability to its northern service area, which includes the Subject Property. The wells will be designed to operate following a major earthquake or other emergency. The MPMWD is currently preparing environmental documents for the first well at the Corporation Yard and continues to review potential sites for the remaining wells.

The MPMWD is also assessing the feasibility of delivering recycled water to its southern service area in collaboration with the West Bay Sanitary District ("WBSD"). In November 2015, WBSD certified a *Mitigated Negative Declaration for the West Bay Sanitary District Recycled Water Project – Sharon Heights* (WBSD, 2015). The subject of this document is a proposed satellite wastewater treatment plant and recycled water treatment facility in the Sharon Heights area to serve irrigation demands to the Sharon Heights Golf and Country Club and potentially other customers in its vicinity. The MPMWD is also considering options related to service of recycled water to the northern service area, or options related to onsite recycling and reuse. These and other options will be developed in more detail as part of the update to MPMWD's *Water System Master Plan* that has an estimated completion date in 2017.

In addition, the City is considering the adoption of recycled water requirements as part of new projects meeting certain criteria and are within the M-2 Zoning Area, located in the northern portion of MPMWD's service area. As part of the recent Menlo Park General Plan Land Use & Circulation Elements and the M-2 Area Zoning Update, several new zoning district categories, including Office ("O"), Life Science ("LS"), and Mixed Use Residential ("MU-R"), are being added to the General Plan land use designations. Corresponding zoning district regulations will propose requirements for recycled water use such as provide dual plumbing, use recycled water for landscape irrigation, and / or evaluate alternative water sources, including on-site recycling, for toilet and cooling water uses.

6.2 TOTAL SUPPLY IN NORMAL, SINGLE DRY, AND MULTIPLE DRY YEARS

Water Code Section 10910

(c) (3) If the projected water demand associated with the proposed project was not accounted for in the most recently adopted urban water management plan, or the public water system has no urban water management plan, the water supply assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single dry, and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses.

As shown in Table 10, the MPMWD's current and planned future water supply for normal hydrologic years is assumed to be equal to its ISG of 4.465 MGD, or 1,630 MG per year. The anticipated dry-year supply estimates presented below are based on the delivery estimates provided by BAWSCA and SFPUC as part of the 2015 UWMP update process (SFPUC, 2016; BAWSCA, 2016) and per application of the Tier 1 and Tier 2 allocation processes described in the City's Water Supply Agreement[15] and the BAWSCA Drought Implementation Plan ("DRIP").

During single dry years, the MPMWD draft 2015 UWMP estimates that annual deliveries from SFPUC will be reduced to 1,281 MG (Menlo Park, 2015b). Supply shortfalls relative to total demands during single dry years are estimated to range between 4.5% in 2020 and 21% in 2040 (see Table 11).

During multiple dry years, the MPMWD draft 2015 UWMP estimates that annual deliveries from SFPUC will be reduced to 1,108 MG during a multi-year drought (Menlo Park, 2015b). Supply shortfalls relative to total demands during the second and third year of a drought are estimated to range between 17% in 2020 and 31% in 2040 (see Table 12).

[15] The Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County and Santa Clara County entered into in July 2009.

Projected supply shortfalls will be met through the implementation of MPMWD's Water Shortage Contingency Plan. As described in the 2010 UWMP and the draft 2015 UWMP, MPMWD has developed a Water Shortage Contingency Plan that systematically identifies ways in which MPMWD can reduce water demands during dry years. The most recent update to the Water Shortage Contingency Plan was completed in May 2015. The overall reduction goals in the Water Shortage Contingency Plan are established in five drought stages and for water demand reductions up to 50%.

As a customer within the MPMWD service area, the proposed Project would be obligated to comply with the demand reduction efforts imposed by MPMWD through implementation of the Water Shortage Contingency Plan. Therefore, the Project would contribute a proportionate share of the reduction in water demands during dry years.

7 COMPARISON OF SUPPLY AND DEMAND

Water Code Section 10910

(c) (3) If the projected water demand associated with the proposed project was not accounted for in the most recently adopted urban water management plan, or the public water system has no urban water management plan, the water supply assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single dry, and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses.

As shown in Tables 8, 10, and 13, MPMWD is expected to have adequate water supplies during normal years to meet its total annual projected demands including the proposed Project's incremental water demand (i.e., 30 MG per year) based on MPMWD's draft 2015 UWMP.

During single-dry years in 2040, MPMWD's total annual water demand, including the proposed Project demand, is estimated to exceed total annual supply by approximately 333 MG, which results in a total water supply shortfall of 21% (Table 11). Without the proposed Project, the single dry year shortfall in 2040 is projected to be 303 MG, which represents a supply shortfall of 19%. Therefore, the proposed Project creates an incremental shortfall of approximately 2% in 2040 compared to the without-Project conditions (Table 13).

During multiple-dry years in 2040, MPMWD's total annual water demand, including the proposed Project demand, is projected to exceed the total annual supply by approximately 506 MG, which results in a total water supply shortfall of 31% (Table 12). Without the proposed Project, the multiple dry year shortfall in 2040 is projected to be 30%. Therefore, the proposed Project creates an incremental shortfall of approximately 1% compared to the without-Project conditions (Table 13).

As described in Section 6, in response to anticipated future dry-year shortfalls, MPMWD has developed a Water Shortage Contingency Plan that systematically identifies ways in which MPMWD can reduce water demands and augment supplies during dry years. It is expected that, even without the proposed Project, the City would have to rely on implementation of its Water Shortage Contingency Plan during dry years to reduce demands. Given the small incremental impact of the Project on the shortage projections, it is not expected that MPMWD would have to change its operations or the implementation of its Water Shortage Contingency Plan in response to a drought, even after the Project was completed.

As described above, the City is considering the adoption of recycled water requirements as part of new projects within the M-2 Zoning Area, located in the northern portion of MPMWD's service area. To the extent that the City develops recycled water supplies or individual projects within the City implement on-site water recycling, the total future potable demands within the MPMWD service area would likely decrease; therefore, the resultant supply shortage would likely be smaller. The MPMWD is developing plans for recycled water and other supplemental

supplies as part of its 2017 *Water System Master Plan* update to minimize future dry year impacts.

8 CONCLUSIONS

As listed in Water Code §10910(c)(4), the primary purpose of this WSA Study is to evaluate whether sufficient water supply is available to meet all future water demands within the water supplier's service area, including those associated with the proposed Project, during normal and dry hydrologic years for a 20-year time horizon.

As described in Section 4.3, the incremental demand of the proposed Project (i.e., 30 MG per year at buildout) has been conservatively estimated, and is likely to be less than projected based on implementation of water-efficient fixtures and landscaping, and the potential use of non-potable supplies.

Even with these conservative estimates of demand, based on the results of this WSA Study, MPMWD expects to have sufficient water supply to meet its planned demands, plus the demands of the proposed Project, during normal years through 2040.

During the 2040 worst-case drought scenario, MPMWD projects a water supply shortfall of 30%, wherein it will implement its Water Shortage Contingency Plan. Using well-established methodologies for estimating water use, buildout of the proposed Project is estimated to increase this shortfall by 1% in 2040, resulting in a total shortage of 31%.

Therefore, this study concludes that MPMWD has sufficient water supply to meet all future demands within its service area, including those associated with the proposed Project, during normal years for a 20-year time horizon. During dry years, MPMWD expects to experience some supply shortfalls over a 20-year time horizon and plans to meet these shortfalls through implementation of its Water Shortage Contingency Plan. Buildout of the proposed Project is conservatively estimated to increase the severity of these shortfalls by 1% in the 2040 worst-case drought scenario.

As above, it is expected that even without the Project MPMWD would have to rely on implementation of its Water Shortage Contingency Plan during dry years to reduce demands. Given the small incremental impact of the Project on the water shortage projections, it is not anticipated that MPMWD would need to change its operations or the implementation of its Water Shortage Contingency Plan in response to a drought, even after the Project was completed.

Further, to the extent that the City develops recycled water supplies or individual projects within the City implement on-site water recycling, the total future potable demands within the MPWSD service area would likely decrease and the resultant supply shortage will likely to be smaller. The MPMWD is developing plans for recycled water and other supplemental supplies as part of its 2017 *Water System Master Plan* update to minimize future dry year impacts.

9 REFERENCES

BAWSCA, 2014a. *Annual Survey, FY 2013-14,* Bay Area Water Supply & Conservation Agency, dated May 2014.

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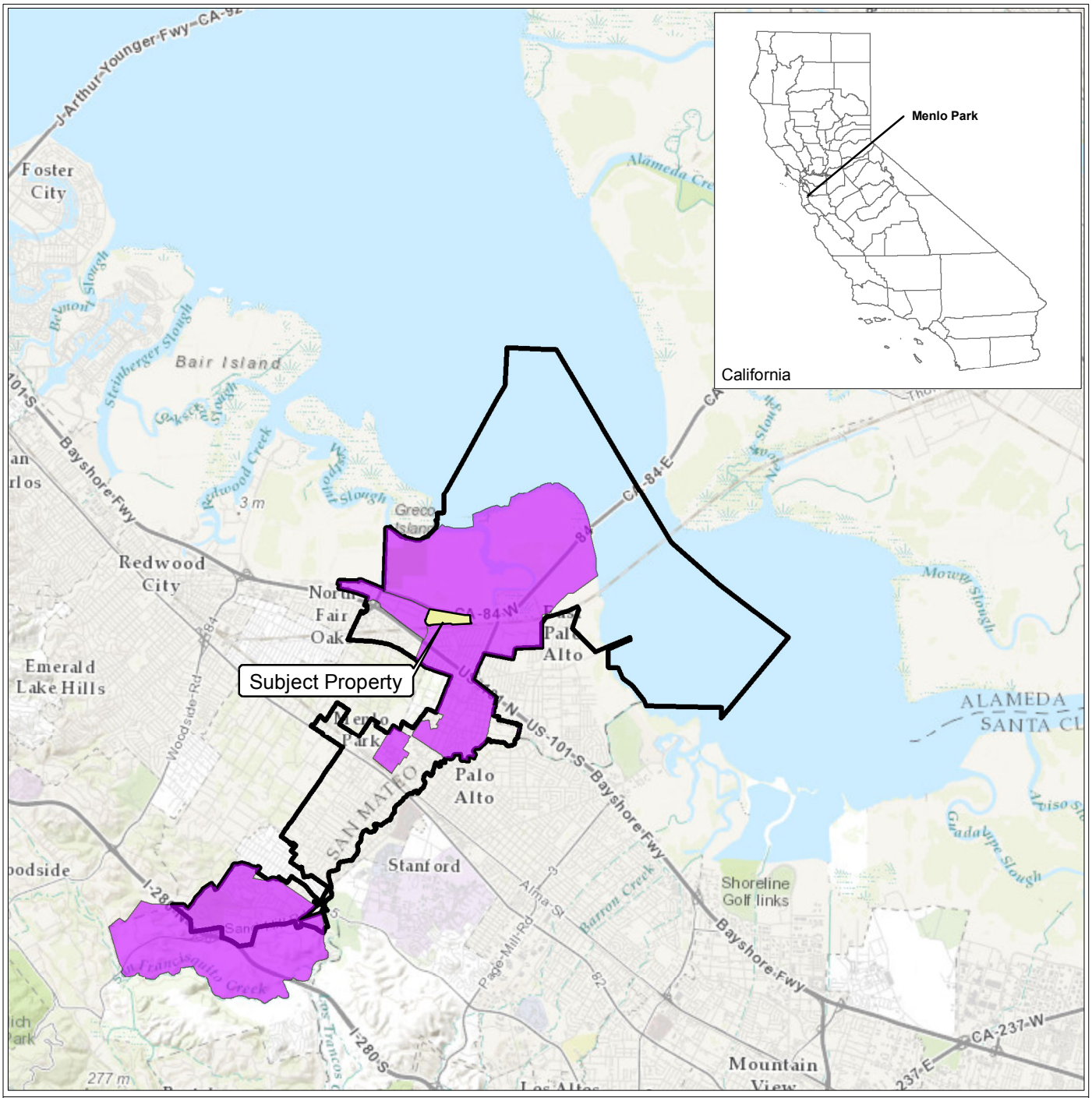

Legend

- Subject Property
- MPMWD Service Area
- Menlo Park City Limit

Abbreviation

MPMWD = Menlo Park Municipal Water District

Note

1. All locations are approximate.

Source

World Topographic base map provided by ArcGIS Online (ESRI, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordinance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, OpenStreetMap contributors, and the GIS User Community), obtained 11 January 2016.

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0 2 4

(Approximate Scale in Miles)

Erler & Kalinowski, Inc.

Site Location Map
Facebook Campus Expansion

Menlo Park, CA
February 2016
EKI B50071.00

Figure 1

Path: X:\B50071\Maps\11\Fig1_FacebookProjectLocation.mxd

Table 1
Summary of Estimated Project Water Demand
Facebook Campus Expansion, Menlo Park, California

Project Component	Annual Demand for the Proposed Project (MG) (a)
Indoor	81
Outdoor	7
Total Project Water Demand	**88**
Baseline Water Use (Table 3)	*58*
Incremental Project Water Demand	**30**

Abbreviations:
"MG" = million gallons

Notes:
(a) The estimated annual demand for the proposed project is calculated in Tables 2a and 2b.

Table 2a
Estimated Project Annual Indoor Water Demand
Facebook Campus Expansion, Menlo Park, California

Land Use	[A] Area (sq ft) (a)	[B] Employees (emp) (b)	[C] Employee Indoor Water Use Factor (gpd/emp) (c)	[D] Indoor Conservation Factor (%) (d)	[E] E = C x D Employee Water Use After Conservation (gpd/emp) (e)	[F] F = E x B Daily Indoor Water Use (gpd) (f)	[G] G = F x 225 / 1,000,000 Total Annual Indoor Water Demand (MG) (g)
Office	962,400	6,400	79	33%	53	338,611	76
Hotel	174,800	150	216	32%	147	21,999	4.9
						Total Project Indoor Water Demand	**81**

Abbreviations:

"MG" = million gallons
"emp" = employees
"gpd" = gallons per day
"sq ft" = square feet

Notes:

(a) Areas of proposed land uses and the number of planned employees for the project are based on project information provided by City staff on 16 September 2015.
(b) The number of proposed employees for each land use are based on information provided by City staff on 20 November 2015.
(c) The employee indoor water use factors are based on information contained in Appendix E of Reference 1, which are each based on a 225-day work year.
(d) The employee water use factors reported in Reference 1 represent water use in older buildings; they do not incorporate the benefits of more recent water saving technologies or account for the CALGreen standards. Therefore, to account for reductions in water use associated with the installation of water-efficient plumbing fixtures, appliances, and other recent technologies, conservation savings, based on the "best" conservation savings potential estimated in Appendix E of Reference 1, were calculated in Appendix A and applied to each land use.
(e) Daily employee water use after conservation is calculated by multiplying the employee indoor water use factor by 100% minus the conservation potential.
(f) Total daily indoor water use for each land use is estimated by multiplying the number of employees by the land use-specific employee water use after conservation.
(g) Average annual water use is calculated by multiplying the daily indoor water use, from Column F by the 225-day work year from Reference 1 for the employee water use factors, then dividing by 1,000,000 gallons per MG.

References:

1. Pacific Institute, 2003. *Waste Not, Want Not: The Potential for Urban Water Conservation in California* , November 2003.

Table 2b
Estimated Project Annual Outdoor Water Demand
Facebook Campus Expansion, Menlo Park, California

Land Use	[A] Total Landscaped Area (acres) (a)	[B] Reference ET (ETo) (inches/year) (b)	[C] ET Adjustment Factor (c)	[D] D = B / 12 x C x A * 0.326 Total Annual Outdoor Water Demand (MG) (d)
Landscape	12.9	42.8	0.45	7
			Total Project Outdoor Water Demand	**7**

Abbreviations:

"ET" = evapotranspiration

"MG" = million gallons

"MAWA" = Maximum Applied Water Allowance

"MWELO" = Model Water Efficient Landscape Ordinance

Notes:

(a) Areas dedicated to landscaping are based on project information provided by City staff on 20 November 2015.

(b) The Reference ET is based on values for Redwood City in Appendix A of Reference 1. Redwood City is the closest available City to the project area.

(c) The proposed Project will be compliant with the 2015 update of the California Model Water Efficient Landscape Ordinance ("MWELO", Reference 1), which the City adopted on 26 January 2016. Per the MWELO, an ET adjustment factor of 0.45 is used to calculate the Maximum Applied Water Allowance ("MAWA") for non-residential areas. The project does not include any Special Landscape Areas, which include recreation areas, areas permanently and solely dedicated to edible plants, and areas irrigated with recycled water.

(d) Total annual landscaping water demand, in MG, is calculated based on the MAWA formula in Reference 1. Total annual landscaping water demand is conservatively assumed to be equal to the MAWA, which is the upper limit of annual applied water for the established landscaped area based upon the area's reference evapotranspiration, the ET Adjustment Factor, and the size of the landscape area.

References:

1. California Model Water Efficient Landscape Ordinance, 2015 Update.

Table 3
Baseline Annual Water Use
Facebook Campus Expansion, Menlo Park, California

Year	Total Annual Water Use (MG) (a)
2010	99
2011	95
2012	62
2013	68
2014	70
2015 (b)	67
Average Annual Water Use, 300-309 Constitution Drive (2010 - 2015)	**77**
Estimated Future Water Demand at Building 23 (c)	
Indoor (Table 4a)	*18.3*
Outdoor (Table 4b)	*0.8*
Baseline Water Use at the Subject Property (c)	**58**

Abbreviations:

"MG" = million gallons

"CEQA" = California Environmental Quality Act

Notes:

(a) Metered water use data for the TE Connectivity buildings located at 300-309 Constitution Drive was provided by City staff on 16 September 2015. The campus was not submetered.

(b) Water use in 2015 was only available from January through May and was interpolated to estimate annual water use.

(c) Total baseline annual water use for existing facilities within the proposed Project (301-309 Constitution Drive) is calculated by subtracting estimated future water demand at Building 23 (300 Constitution Drive) (Tables 4a and 4b) from historical water use at 300-309 Constitution Drive, as directed by the City.

References:

1. Memorandum: Proposed Modified CEQA Baseline for Facebook Campus Expansion Project, City of Menlo Park, dated October 1, 2015.

Table 4a
Estimated Future Indoor Water Demand for Building 23
Facebook Campus Expansion, Menlo Park, California

Land Use	[A] Employees (emp) (a)	[B] Employee Water Use Factor (gpd/emp) (b)	[C] Indoor Conservation Factor (%) (c)	[D] D = B x (1 - C) Employee Water Use After Conservation (gpd/emp) (d)	[E] E = D x A Average Daily Indoor Water Use (gpd) (e)	[F] F = E x 225 / 1,000,000 Total Annual Indoor Water Demand (MG) (f)
Office	1,540	79	33%	53	81,478	18
					Total Indoor Water Demand, Building 23	**18**

Abbreviations:

"MG" = million gallons "gpd" = gallons per day

"emp" = employees

Notes:

(a) The number of employees in Building 23 (300 Constitution Drive) was provided by City staff on 16 September 2015.

(b) The employee water use factors are based on information contained in Appendix E of Reference 1, which are based on a 225-day work year.

(c) The employee water use factors reported in Reference 1 represent water use in older buildings; they do not incorporate the benefits of more recent water saving technologies or account for the CALGreen standards. Therefore, to account for reductions in water use associated with the installation of water-efficient plumbing fixtures, appliances, and other recent technologies, conservation savings, based on the "best" conservation savings potential estimated in Appendix E of Reference 1, were calculated in Appendix A and applied to each land use.

(d) Daily employee water use after conservation is calculated by multiplying the employee water use factor by 100% minus the conservation potential.

(e) The average daily indoor water use is estimated by multiplying the number of employees by the employee water use after conservation.

(f) Total annual indoor water demand, in MG, is calculated as the product of daily indoor water use and the 225-day work year from Reference 1, then divided by the number of gallons per MG (1,000,000).

References:

1. Pacific Institute, 2003. *Waste Not, Want Not: The Potential for Urban Water Conservation in California* , November 2003.

Table 4b
Estimated Future Outdoor Water Demand for Building 23
Facebook Campus Expansion, Menlo Park, California

Land Use	[A] Total Landscaped Area (acres) (a)	[B] Reference ET (ETo) (inches/year) (b)	[C] ET Adjustment Factor (c)	[D] D = B / 12 x C x A * 0.326 Total Annual Outdoor Water Demand (MG) (d)
Landscape	1.0	42.8	0.7	0.8
			Total Outdoor Water Demand, Building 23	**0.8**

Abbreviations:

"ET" = evapotranspiration

"MAWA" = Maximum Applied Water Allowance

"MG" = million gallons

Notes:

(a) Area dedicated to landscaping at Building 23 (300 Constitution Drive) is based on project information provided by City staff on 16 December 2015.

(b) The Reference ET is provided in Reference 1.

(c) The landscaping area at Building 23 is compliant with the City's 2010 Water Efficient Landscape Ordinance ("2010 Landscaping Ordinance", Reference 1). Per the 2010 Landscaping Ordinance, an ET adjustment factor of 0.7 is used to calculate the MAWA for non-residential areas. The project does not include any Special Landscape Areas, which include recreation areas, areas permanently and solely dedicated to edible plants, and areas irrigated with recycled water.

(d) Total annual landscaping water demand, in MG, is calculated based on the MAWA formula in Reference 1. Total annual landscaping water demand is conservatively assumed to be equal to the MAWA, which is the upper limit of annual applied water for the established landscaped area based upon the area's reference evapotranspiration, the ET Adjustment Factor, and the size of the landscape area.

References:

1. City of Menlo Park Water Efficient Landscaping Ordinance, adopted 18 May 2010.

Table 5
Historical Water Use for MPMWD
Facebook Campus Expansion, Menlo Park, California

Customer Category	Measured Annual Water Use (MG) (a)										Percent of Total 2014 Use
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	
Single Family Residential	473	408	485	483	456	382	376	386	402	354	34%
Multi-family Residential	72	71	76	79	70	108	115	119	118	106	10%
Commercial	156	173	193	189	191	162	141	153	206	183	18%
Industrial	360	347	362	298	244	234	240	217	231	215	21%
Public Facility	92	76	90	88	81	49	52	66	63	50	5%
Landscape Irrigation (b)	110	109	122	128	119	117	108	137	167	117	11%
Other (c)	4	3	1	1	1	0	0	1	3	4	0.42%
Total Water Use (d)	**1,268**	**1,187**	**1,329**	**1,267**	**1,163**	**1,052**	**1,033**	**1,079**	**1,189**	**1,030**	**100%**

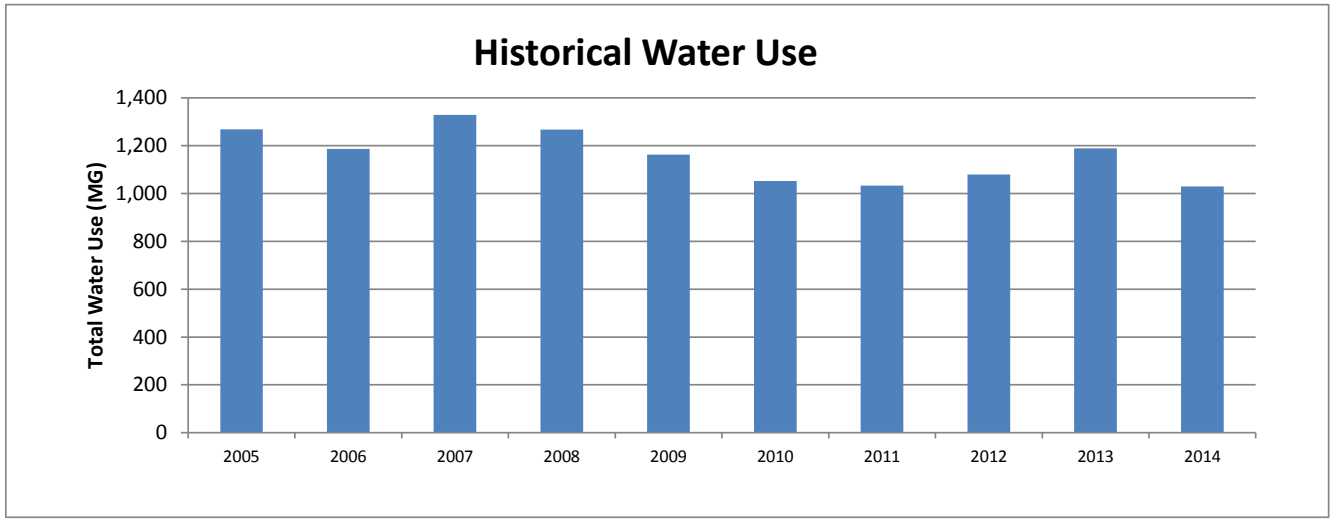


Table 5
Historical Water Use for MPMWD
Facebook Campus Expansion, Menlo Park, California

Abbreviations:

"MG" = million gallons

"MPMWD" = Menlo Park Municipal Water District

"UWMP" = Urban Water Management Plan

Notes:

(a) The measured annual water use for years 2005 through 2010 was from MPMWD's 2010 UWMP (Reference 1). The measured annual water use for years 2011 through 2014 was obtained from City staff on 30 September 2015. Totals may not sum exactly due to rounding.

(b) Irrigation water use includes water use for irrigation meters of accounts that are sub-metered. For most accounts, indoor and outdoors water use are measured by one meter and are shown in other categories. Therefore, irrigation water use shown here does not represent all of the outdoor irrigation water use within MPMWD.

(c) Other water use includes water used for temporary meters.

(d) "Non-revenue water" is defined herein as the difference between the MPMWD's customers' metered use and the MPMWD's metered supply. The total water use shown here does not include non-revenue water.

References:

1. 2010 Urban Water Management Plan, prepared by the City of Menlo Park, amended November 2014.

Table 6
Projected Future Water Demands of Current General Plan Buildout for MPMWD
Facebook Campus Expansion, Menlo Park, California

Customer Category	Projected Annual Water Demand of Current General Plan Buildout (MG) (a)				
	2020	**2025**	**2030**	**2035**	**2040**
Single Family Residential	447	438	430	425	422
Multi-family Residential	119	117	115	114	113
Commercial/Institutional	150	158	166	174	182
Industrial	315	289	264	241	221
Institutional/Governmental	86	86	87	87	88
Landscape Irrigation (b)	128	133	139	145	151
Other (Temporary Meters) (c)	3	3	3	3	3
Total Water Use	1,248	1,224	1,204	1,189	1,179
Non-Revenue Water (d)	*62*	*62*	*61*	*61*	*61*
Total Water Demand (e)	**1,310**	**1,286**	**1,265**	**1,251**	**1,240**

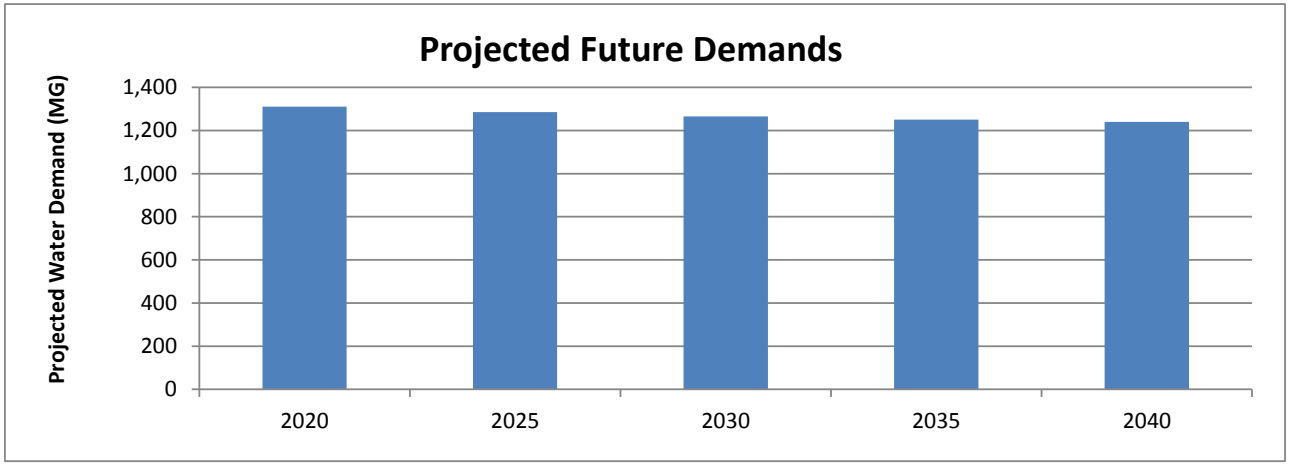


Table 6
Projected Future Water Demands of Current General Plan Buildout for MPMWD
Facebook Campus Expansion, Menlo Park, California

Abbreviations:

"MPMWD" = Menlo Park Municipal Water District
"MG" = million gallons
"UWMP" = Urban Water Management Plan

Notes:

(a) The projected future water demands of current General Plan buildout are from the MPMWD's draft 2015 UWMP (Reference 1).
(b) Irrigation water use includes water use for irrigation meters of accounts that are sub-metered and does not represent all of the outdoor irrigation water use within MPMWD.
(c) Other water use includes water used for temporary meters.
(d) "Non-revenue water" is defined herein as the difference between the MPMWD's customers' metered use and the MPMWD's metered supply. Thus, non-revenue water includes apparent losses such as customer metering inaccuracies, real losses such as distribution main leakage, and authorized unmetered uses such as fire hydrant flow testing. The values for non-revenue water were from MPMWD's draft 2015 UWMP and are assumed to be approximately 4.5% of the total water use.
(e) The total water demand is the sum of total water use and non-revenue water. The projected water demands include savings from plumbing code updates and conservation efforts the City plans to undertake.

References:

1. 2015 Urban Water Management Plan, prepared by the City of Menlo Park, in development.

Table 7

Preliminary Water Demand Estimates for Planned Projects within the MPMWD

Facebook Campus Expansion, Menlo Park, California

Project Name (a)	Type of Use	Size		Status	Project Location	Included in General Plan Water Demand Projections?	Estimated Annual Water Demand (MG)
ConnectMenlo (Bayfront Area New Allowable Development) (b)	Residential Office R&D Campus Commercial Hotel	4,500 700,000 1,400,000 200,000 400	du sq ft sq ft sq ft rooms	Pending	North of U.S. 101	No	343
New Magnate High School (c)	School	400	students	Pending	North of U.S. 101	No	0.6
333 Ravenswood Ave	R&D Campus	3,000	employees	Pending	West Menlo/Downtown/El Camino Real	Yes	--
1283 Willow Rd (Police/City Service Center)	Office Retail	3,800 5,096	sq ft sq ft	Approved	North of U.S. 101	Yes	--
100-155 Constitution Dr & 100-190 Independence Dr (Menlo Gateway)	Office Health Club Restaurant Hotel Hotel	694,664 41,000 6,947 250 197,050	sq ft sq ft sq ft rooms sq ft	Approved	North of U.S. 101	Yes	--
Facebook West (Building 20) (d)	Office	433,656	sq ft	Approved	North of U.S. 101	Yes	--
Commonwealth Corp. Center	Office	259,920	sq ft	Approved	North of U.S. 101	Yes	--
VA/Core 605 Willow Rd	Residential	60	du	Approved	South of U.S. 101	Yes	--
Anton Menlo	Residential	394	du	Approved	North of U.S. 101	Yes	--
777 Hamilton Ave	Residential	195	du	Approved	North of U.S. 101	Yes	--
3645 Haven Ave	Residential	146	du	Approved	North of U.S. 101	Yes	--

Table 7
Preliminary Water Demand Estimates for Planned Projects within the MPMWD
Facebook Campus Expansion, Menlo Park, California

Project Name (a)	Type of Use	Size	Status	Project Location	Included in General Plan Water Demand Projections?	Estimated Annual Water Demand (MG)
Sequoia Belle Haven	Residential	90 du	Approved	North of U.S. 101	Yes	--
Facebook Building 23	Office	180,108 sq ft	Approved	North of U.S. 101	Yes	--
German American School	School	400 students	Approved	South of U.S. 101	Yes	--
Water Demands for Planned Projects not Included in Current General Plan Buildout Demand Projections (MG)						**344**

Abbreviations:

"du" = dwelling units
"Cal Water" = California Water Service Company
"MG" = million gallons
"MPMWD" = Menlo Park Municipal Water District
"R&D" = Research and Development
"sq ft" = square feet

Notes:

(a) Projects were identified by City staff based on applications received before or near June 18, 2015 Notice of Preparations. Table includes all projects within MPMWD's service area (and not those within Cal Water's service area) that have filed a complete development application for five (5) or more net new residential units or 5,000 sq ft or more of net new commercial space.
(b) Water demand for the ConnectMenlo project was estimated in Reference 1.
(c) Water demand for the New Magnate High School was provided by City staff on 21 December 2015. The annual water demand was estimated using 7.9 gallons per day per student for 400 students and 180 school days per year.
(d) Facebook West (Building 20) was completed early 2015 but is included in the approved project list because 2015 City water meter data are not yet available.

References:

1. Water Supply Evaluation Study, ConnectMenlo - General Plan and M-2 Area Zoning Update, Menlo Park, California, prepared by the City of Menlo Park, in development.

Table 8
Total Projected Future Water Demands for MPMWD
Facebook Campus Expansion, Menlo Park, California

Water Demand Estimate	Projected Future Water Demand (MG)				
	2020	**2025**	**2030**	**2035**	**2040**
Water Demand of Current General Plan Buildout (a)	*1,310*	*1,286*	*1,265*	*1,251*	*1,240*
Water Demand for Other Planned Projects (b)	*1*	*87*	*173*	*258*	*344*
Total Water Demand without Project	**1,311**	**1,373**	**1,438**	**1,509**	**1,584**
Additional Project Water Demand (c)	30	30	30	30	30
Total Water Demand with Project	**1,341**	**1,403**	**1,468**	**1,539**	**1,614**

Abbreviations:

"MG" = million gallons

"MPMWD" = Menlo Park Municipal Water District

"UWMP" = Urban Water Management Plan

Notes:

(a) The total projected MPMWD-wide water demand between 2010 and 2040 is based on water demand projections within the MPMWD's draft 2015 UWMP (Reference 1) (see Table 6).

(b) The total estimated water demand for currently planned projects is 344 MG (see Table 7), however, the ConnectMenlo project is expecting buildout by 2040 over a 25-year horizon based on Reference 2. Project water demand at buildout for the ConnectMenlo project is phased from 2020 to 2040 to reflect its phased buildout.

(c) Additional water demand for the proposed project is 30 MG as calculated in Table 2. The proposed project is expecting full occupany by 2018, based on information provided by City staff on 3 November 2015.

References:

1. 2015 Urban Water Management Plan, prepared by the City of Menlo Park, in development.
2. Water Supply Evaluation Study, ConnectMenlo - General Plan and M-2 Area Zoning Update, Menlo Park, California, prepared by the City of Menlo Park, in development.

Table 9
Historical Water Supply for MPMWD
Facebook Campus Expansion, Menlo Park, California

Water Supply Source	Historical Water Supply (MG) (a)									
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SFPUC (b)	1,259	1,185	1,314	1,267	1,159	1,085	1,084	1,190	1,344	1,017
Total Water Supply	1,259	1,185	1,314	1,267	1,159	1,085	1,084	1,190	1,344	1,017

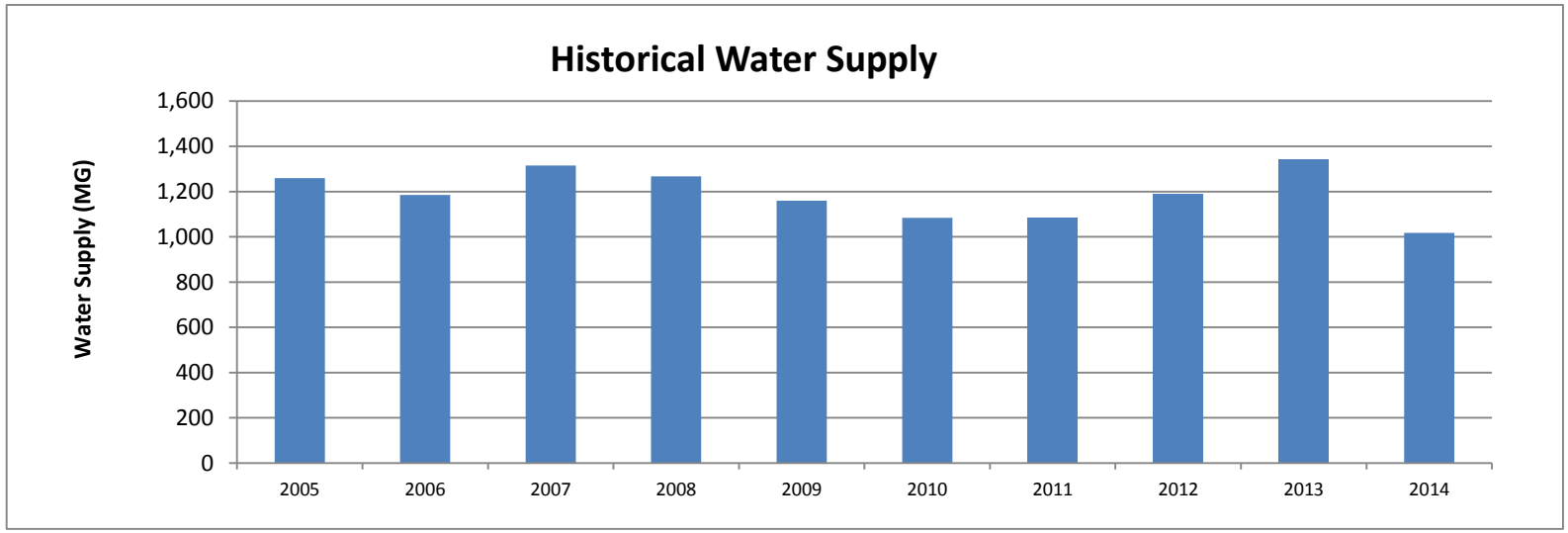


Table 9
Historical Water Supply for MPMWD
Facebook Campus Expansion, Menlo Park, California

Abbreviations:

"MG" = million gallons

"MGD" = million gallons per day

"MPMWD" = Menlo Park Municipal Water District

"SFPUC" = San Francisco Public Utilities Commission

Notes:

(a) The annual water supply values for 2005 through 2014 are based on monthly wholesale water meter readings provided by City staff on 13 and 16 October 2015.

(b) The MPMWD has a SFPUC individual supply guarantee of 4.465 MGD, or approximately 1,630 MG per year (Reference 1).

References:

1. 2010 Urban Water Management Plan, prepared by the City of Menlo Park, amended November 2014.

Table 10
Projected Future Normal Year Water Supply for MPMWD
Facebook Campus Expansion, Menlo Park, California

Water Supply Source	Projected Normal Year Supply (MG)				
	2020	**2025**	**2030**	**2035**	**2040**
Primary Supply Sources					
SFPUC (a)	*1,630*	*1,630*	*1,630*	*1,630*	*1,630*
Groundwater	*0*	*0*	*0*	*0*	*0*
Total Normal Year Potable Supply	1,630	1,630	1,630	1,630	1,630
Recycled Water	0	0	0	0	0
Total Normal Year Water Supply (b)	1,630	1,630	1,630	1,630	1,630

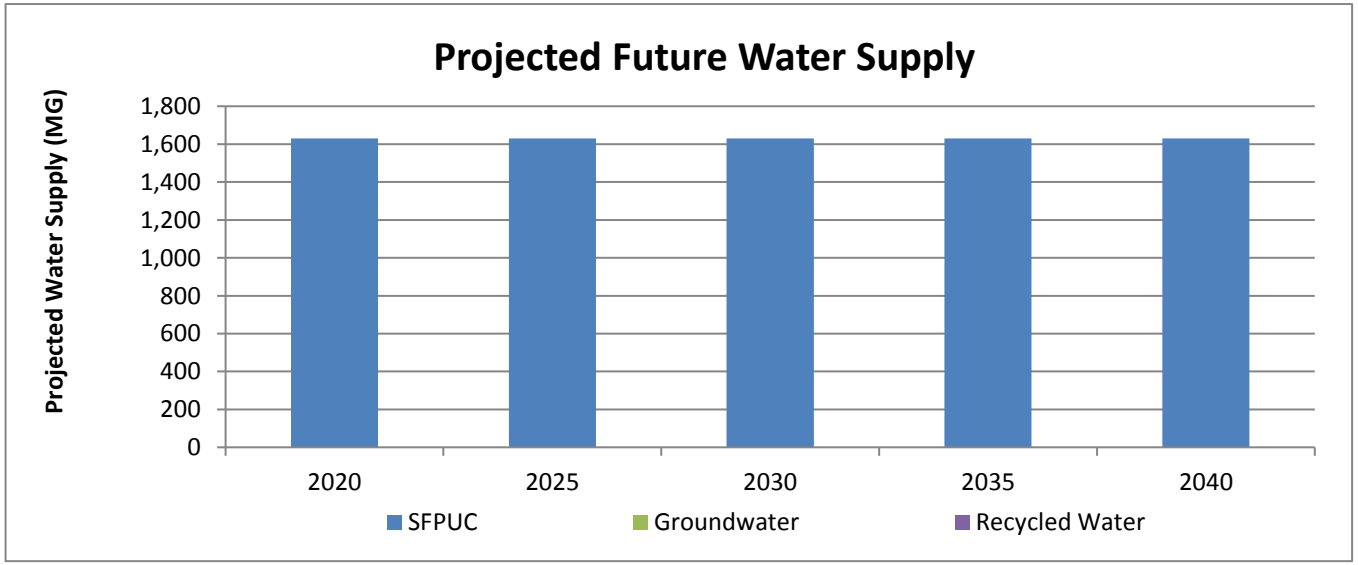


Table 10
Projected Future Normal Year Water Supply for MPMWD
Facebook Campus Expansion, Menlo Park, California

Abbreviations:

"ISA" = Interim Supply Allocation
"MG" = million gallons
"MGD" = million gallons per day
"MPMWD" = Menlo Park Municipal Water District
"SFPUC" = San Francisco Public Utilities Commission

Notes:

(a) The MPMWD has a SFPUC individual supply guarantee of 4.465 MGD, or approximately 1,630 MG per year. The MPMWD's ISA through 2018 is 4.4 MGD, or approximately 1,607 MG per year, but this ISA is only triggered when the demand of the Regional System as a whole exceeds 265 MGD, and then it only means that MPMWD would be charged a surcharge for any incremental use over the ISA amount (Reference 1).

(b) Total supply is the sum of the potable and recycled water supplies.

References:

1. 2015 Urban Water Management Plan, prepared by the City of Menlo Park, in development.

Table 11
Comparison of Single Dry Year Water Supply and Demand for MPMWD
Facebook Campus Expansion, Menlo Park, California

Water Supply Source	Projected Water Supply and Demand (MG)				
	2020	2025	2030	2035	2040
Primary Supply Sources (a)					
SFPUC	*1,281*	*1,281*	*1,281*	*1,281*	*1,281*
Groundwater	*0*	*0*	*0*	*0*	*0*
Total Dry Year Potable Supply	1,281	1,281	1,281	1,281	1,281
Potable Demand	1,341	1,403	1,468	1,539	1,614
Supply Shortfall	60	122	187	258	333
Supply Shortfall (% demand)	4.5%	8.7%	13%	17%	21%

Abbreviations:

"MG" = million gallons
"UWMP" = Urban Water Management Plan
"MPMWD" = Menlo Park Municipal Water District
"SFPUC" = San Francisco Public Utilities Commission

Notes:

(a) Projected available water supplies and demand during multiple dry years are from the MPMWD's draft 2015 UWMP (Reference 1).

References:

1. 2015 Urban Water Management Plan, prepared by the City of Menlo Park, in development.

Table 12
Comparison of Multiple Dry Year Water Supply and Demand for MPMWD
Facebook Campus Expansion, Menlo Park, California

	Projected Water Supply and Demand During Mutiple Dry Years (MG)														
	2020			2025			2030			2035			2040		
Supply Source	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Primary Supply Sources (a)															
SFPUC	*1,281*	*1,108*	*1,108*	*1,281*	*1,108*	*1,108*	*1,281*	*1,108*	*1,108*	*1,281*	*1,108*	*1,108*	*1,281*	*1,108*	*1,108*
Groundwater	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total Dry Year Potable Supply	1,281	1,108	1,108	1,281	1,108	1,108	1,281	1,108	1,108	1,281	1,108	1,108	1,281	1,108	1,108
Potable Demand	1,341	1,341	1,341	1,403	1,403	1,403	1,468	1,468	1,468	1,539	1,539	1,539	1,614	1,614	1,614
Supply Shortfall	60	233	233	122	295	295	187	360	360	258	431	431	333	506	506
Supply Shortfall (% demand)	4.5%	17%	17%	8.7%	21%	21%	13%	24%	24%	17%	28%	28%	21%	31%	31%

Abbreviations:

"MG" = million gallons
"MPMWD" = Menlo Park Municipal Water District
"SFPUC" = San Francisco Public Utilities Commission
"UWMP" = Urban Water Management Plan

Notes:

(a) Projected available water supplies and demand during multiple dry years are from the MPMWD's draft 2015 UWMP (Reference 1).

References:

1. 2015 Urban Water Management Plan, prepared by the City of Menlo Park, in development.

Table 13
Incremental Impact of the Project on MPMWD's Water Supply and Demand in Normal and Dry Years
Facebook Campus Expansion, Menlo Park, California

Year			[A] Total Potable Supply (MG) (a)	Without Project [B] Potable Demand (MG) (b)	Without Project [C] C = (A - B) / B Supply Shortfall (% of Demand)	With Project [D] Potable Demand (MG) (b)	With Project [E] E = (A - D) / D Supply Shortfall (% of Demand)	With Project [F] F = E - C Incremental Shortage (c)
2020	Normal		1,630	1,311	No Shortfall	1,341	No Shortfall	0%
	SDY		1,281	1,311	2.3%	1,341	4.5%	2%
	MDY	Year 1	1,281	1,311	2.3%	1,341	4.5%	2%
		Year 2	1,108	1,311	15%	1,341	17%	2%
		Year 3	1,108	1,311	15%	1,341	17%	2%
2025	Normal		1,630	1,373	No Shortfall	1,403	No Shortfall	0%
	SDY		1,281	1,373	6.7%	1,403	8.7%	2%
	MDY	Year 1	1,281	1,373	6.7%	1,403	8.7%	2%
		Year 2	1,108	1,373	19%	1,403	21%	2%
		Year 3	1,108	1,373	19%	1,403	21%	2%
2030	Normal		1,630	1,438	No Shortfall	1,468	No Shortfall	0%
	SDY		1,281	1,438	11%	1,468	13%	2%
	MDY	Year 1	1,281	1,438	11%	1,468	13%	2%
		Year 2	1,108	1,438	23%	1,468	24%	2%
		Year 3	1,108	1,438	23%	1,468	24%	2%
2035	Normal		1,630	1,509	No Shortfall	1,539	No Shortfall	0%
	SDY		1,281	1,509	15%	1,539	17%	2%
	MDY	Year 1	1,281	1,509	15%	1,539	17%	2%
		Year 2	1,108	1,509	27%	1,539	28%	1%
		Year 3	1,108	1,509	27%	1,539	28%	1%
2040	Normal		1,630	1,584	No Shortfall	1,614	No Shortfall	0%
	SDY		1,281	1,584	19%	1,614	21%	2%
	MDY	Year 1	1,281	1,584	19%	1,614	21%	2%
		Year 2	1,108	1,584	30%	1,614	31%	1%
		Year 3	1,108	1,584	30%	1,614	31%	1%

Table 13
Incremental Impact of the Project on MPMWD's Water Supply and Demand in Normal and Dry Years
Facebook Campus Expansion, Menlo Park, California

Abbreviations:

"MG" = million gallons
"MDY" = Multiple Dry Year
"MPMWD" = Menlo Park Municipal Water District
"SDY" = Single Dry Year
"UWMP" = Urban Water Management Plan

Notes:

(a) Projected available water supplies during normal, single dry and multiple dry years are from MPMWD's draft 2015 UWMP (Reference 1), and are documented in Tables 10, 11, and 12.

(b) Values for projected water demand with and without project are calculated in Table 8.

(c) Values are subject to rounding.

References:

1. 2015 Urban Water Management Plan, prepared by the City of Menlo Park, in development.

Appendix A

Summary of Conservation Saving Factors for Indoor Water Uses

and

Appendix E to the Pacific Institute's *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, November 2003.

Savings potential for each end use in office buildings and hotels are listed in Tables E-3 and E-6 of Appendix E of the Pacific Institute Study, respectively. Using data from the Pacific Institute Study, the conservation factor for indoor water use is calculated in Tables A-1 and A-2 below.

Table A-1: Indoor Conservation Factor for Office Buildings

End Use	**Water Use (TAF)** (a) (b)	**Conservation Potential** (c)		
		Best	**Low**	**High**
Restroom	88	49%	49%	49%
Cooling	77.9	26%	9%	41%
Kitchen	10.2	20%	20%	20%
Other	33.9	10%	0%	25%
Indoor Total (d)	**210**	**33%**	**25%**	**41%**

Notes and Abbreviations:

(a) TAF = Thousand Acre-Feet
(b) Total water use in sampled office buildings obtained from Table E-1 of the Pacific Institute Study.
(c) Conservation potential for each end use in office buildings are obtained from Table E-3 of the Pacific Institute Study.
(d) The indoor total conservation potential is calculated as the weighted average of the conservation potential for each end use based on their water use.

Table A-2: Indoor Conservation Factor for Hotels

End Use	**Water Use (TAF) (a) (b)**	**Conservation Potential**		
		Best	**Low**	**High**
Restroom	16.7	31%	31%	31%
Laundry	4.2	54%	42%	66%
Cooling	3	26%	9%	41%
Kitchen	2.4	20%	20%	20%
Other	0.9	0%	0%	0%
Indoor Total	**27.2**	**32%**	**28%**	**36%**

Notes and Abbreviations:

(a) TAF = Thousand Acre-Feet
(b) Total water use in sampled hotels obtained from Table E-4 of the Pacific Institute Study.
(c) Conservation potentials for each end use in hotels are obtained from Table E-6 of the Pacific Institute Study.
(d) The indoor total conservation potential is each calculated as the weighted average of the conservation potential based on total water use for “best”, “high”, or “low” potential.

Appendix E

Details of Commercial Water Use and Potential Savings, by Sector

Office Buildings
(SIC codes 60–64, 67, 73, 81, 87, and 90)

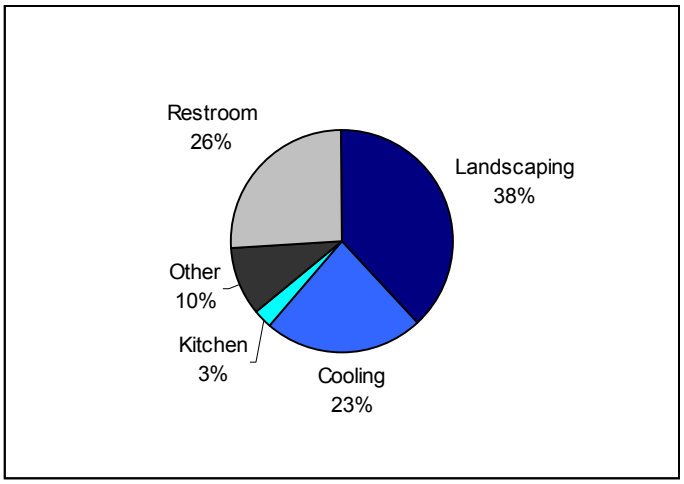
Offices buildings house a wide variety of companies ranging from insurance brokers to law offices. Although the types of offices differ, their employees are usually engaged in similar activities and can therefore be aggregated under one category. We did not, however, include SIC code 65 (real estate) or SIC code 86 (membership organizations) in our analysis, because the GEDs estimated were unreasonably high; indicating problems with either the data or the categorization. For example, we suspect that SIC code 65 includes multi-family housing in addition to real estate offices because it includes in its description "apartment building operators," and rental offices are often located within apartment complexes, where water is used for residential purposes.

Table E-1
Employment and Water Use in Office Buildings (2000)

Sub-industry	SIC code	Gallons per Employee Day (GED)[1,2]	Employees	Annual Use, Thousand Acre-Feet (TAF)
Depository	60	58	198,500	7.9
Non-Depository	61	135	84,700	7.9
Security, Broker	62	176	75,100	9.1
Insurance	63	169	136,300	15.9
Insurance	64	129	83,400	7.4
Holding/Investment	67	176	39,680	4.8
Business	73	129	1,350,530	120.1
Legal	81	99	123,204	8.4
Engineering	87	113	472,069	36.7
Government	90	136	1,279,745	120.3
Office Buildings Total		**127 (average)**	**3,843,303**	**338.5**

[1] Based on a 225-day year.
[1] Note that the GED coefficients estimated for 1995 were decreased by 20% to obtain the GED coefficients for 2000 for the commercial sector. See the write-up on correcting GED Estimates for 2000 in the report.

Figure E-1
Water Use, by End Use, in Office Buildings



Source: Calculated from MWD audit data of selected office buildings (MWD 2002).

Comparison of GED-derived Estimate to Modeled Water Use

We modeled water use in office buildings, using published estimates of restroom visits by employees, irrigated turf area, cooling requirements etc. We compared our GED-derived estimate of water use per employee to that predicted by the model Table E-2. The end-use calculations in the GED-derived estimate are from Figure E-1 and the model's assumptions are derived from the end use data in Appendix D.

Table E-2
Modeled Water Use in Office Buildings (2000)

End Use	Unit	Rate	Number	Modeled Water Use (GED)	GED-derived (GED)
Toilets[1]					
Employee use	gpf	3.00	2.60 flushes/day	7.8	
Visitor use	gpf	3.00	0.33 flushes/day	1.0	
Urinals[1]					
Employee use	gpf	1.60	1.25 flushes/day	2.0	
Visitor use	gpf	1.60	0.17 flushes/day	0.3	
Faucets[1]					
Employee use	gpf	0.11	3.85 flushes/day	0.4	
Visitor use	gpf	0.11	0.50 flushes/day	0.1	
Total restroom				11.6	33.0
Cooling	gal/sq ft/day	0.07[2]	350[3] sq.ft/employee	23.3	29.2
Landscaping	gal/sq ft	0.08[4]	547[5] sq. ft/employee	20.7	48.3
Kitchen	gal/meal	10.1[6]	0.33 meals/employee/day	3.3	3.8
Other				12.7	12.7
Total				**72**	**127**

[1] See Appendix D.

[2] Two case studies estimated 15 and 34 gal/sq ft./year. The average is about 25 gal/sq.ft/year. We estimate that only 60 percent of office buildings have cooling towers so this works out to 15 gal/sq ft/year on average or 0.07 gal/sq ft/day (Dziegielewski et al. 2000).
[3] Statistical average of 67 office buildings (Dziegielewski et al. 2000).
[4] See Appendix D.
[5] MWD 2002.
[6] See Appendix D.

Estimate of Potential Savings

By applying the conservation potential calculated in the end use studies (see Appendix D) to our GED-derived estimates of end use, we estimated potential water savings (shown in Table E-3).

Table E-3
Potential Water Savings in Office Buildings (2000)

End Use	Water Use (TAF)	Conservation Potential (percent)			Conservation Potential (TAF)		
		Low	High	Best	Low	High	Best
Landscaping	128.6	38%	53%	50%	48.3	68.0	64.2
Restroom	88.0	49%	49%	49%	43.4	43.4	43.4
Cooling	77.9	9%	41%	26%	7.4	32.3	20.0
Kitchen	10.2	20%	20%	20%	2.0	2.0	2.0
Other	33.9	0%	25%	10%	0.0	8.5	3.4
Total	**338.5**	**30%**	**46%**	**39%**	**101.1**	**154.1**	**133.0**

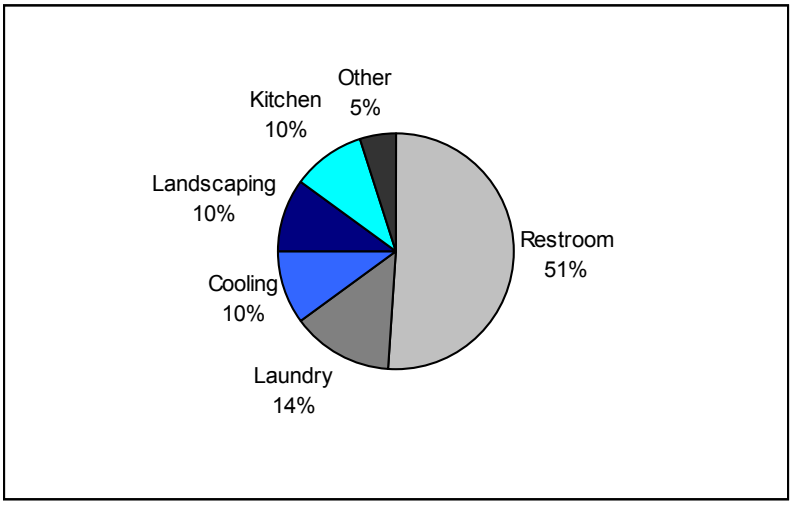
Hotels (SIC codes 701 and 704)

Sub-industries under SIC code 70 include hotels, motels, rooming and boarding houses, recreational vehicle parks, camp sites, and a variety of other types of lodging establishments. Because the literature focuses primarily on water use in hotels, motels, and bed and breakfasts (SIC codes 701 and 704), we limited our focus to these three types of lodging establishments, which we refer to collectively as hotels.

Table E-4
Employment and Water Use in the Hotel Industry (2000)

Industry	SIC codes	GED	Employees	Annual Use (TAF)
Hotels	701,704	240	182,640	30.3

Figure E-2
Water Use, by End Use, in the Hotel Industry



Source: Calculated from MWD audit data of 93 hotels (MWD 2002).

Comparison of GED-derived Estimate to Modeled Water Use

We modeled the water use in hotels, using published estimates of restroom visits, showers, faucet use by guests and employees, irrigated turf area, cooling requirements etc. We converted our GED-derived estimate of water use per employee into water use per occupied room per day and then compared it to that predicted by the water use model. The end use calculations in the GED-derived estimate are from Figure E-2 and the model's assumptions are based on the end use data in Appendix D and a study of water use in the hotel industry (Redlin and deRoos 1990).

Table E-5
Modeled Water Use in Hotels (2000)

		Typical Use/Occupied Room/Day			
	Measurement Unit	Rate/Unit	Number of Units	Water Use (gal/day)	GED-derived Use (gal/day)
Showers[1]	gal/minute	2.2	16.0	35.2	
Faucets[1]	gal/minute	1.3	0.4	0.6	
Toilets[1]	gal/flush	3.0	4.0	12.0	
Laundry[2]	gal/lb.	2.5	8.0[3]	20.0	
Kitchen	gal/meal	7.6[4]	2.2[5]	17.0	
Icemakers	gal/meal	0.5[6]	2.2[5]	1.1	
Misc.	gal			25.0	

INDOOR				**111.0**	
Cooling[7]	gal/CDD	5.6	1.4	8.0	
COOLING				**8.0**	
Irrigation[8]	gal/sq. ft.	0.2	50.0	10.0	
Pool				0.5	
OUTDOOR				**10.5**	
TOTAL				**130**	**117[9]**

[1] See Appendix D.
[2] See Appendix D.
[3] Pounds/occupied room/day of laundry is obtained from the average of the 12 hotels in Redlin and de Roos (1990). Eighty-nine percent of hotels have in-house laundries (Redlin and de Roos 1990).
[4] Average gal/meal is obtained from the restaurant sector. Seventy-six percent of hotels have restaurants (Redlin and de Roos 1990).
[5] Meals/occupied room (Redlin and de Roos 1990)
[6] 0.5 lbs/meal * 1 gal/lb : lbs/meal taken from 1994 ASHRAE Refrigeration Handbook, 1 gal/lb estimated from Pike 1995.
[7] Nearly 50 percent of the hotels surveyed in Redlin and de Roos (1990) had central cooling. Average annual Cooling Degree Days (CDD) in California was 1035. Therefore Cooling Degrees per day = 1035*50%/365 = 1.4 gal/CDD obtained from Redlin and de Roos (1990).
[8] See Appendix D.
[9] We used information on the total number of occupied hotel rooms and total water used by the hotel sector in 2000. When we divided 2000 water use (30.3 TAF) by 350,000 rooms times the average occupancy rate for the year (66%), the water use/occupied room/day was about 117 gallons.

Estimate of Potential Savings

By applying the conservation potential calculated in the end use studies (see Appendix D) to our GED-derived estimates of water use, we estimated potential water savings (shown in Table E-6).

Table E-6
Potential Water Savings in the Hotel Industry (2000)

End Use	**Water Use (TAF)**	**Conservation Potential (percent)**			**Conservation Potential (TAF)**		
		Low	**High**	**Best**	**Low**	**High**	**Best**
Restrooms	16.7	31%	31%	31%	5.3	5.3	5.3
Laundry	4.2	42%	66%	54%	1.8	2.8	2.3
Cooling	3.0	9%	41%	26%	0.3	1.3	0.8
Landscaping	3.0	47%	53%	50%	1.1	1.6	1.5
Kitchen	2.4	20%	20%	20%	0.5	0.5	0.5
Other	0.9	0%	0%	0%	0.0	0.0	0.0
Total Savings	**30.3**	**30%**	**38%**	**34%**	**9.0**	**11.4**	**10.3**

Golf Courses (SIC code 7992)

SIC code 79 includes various recreational establishments such as theaters, amusement parks, movie studios, and golf courses. Because water use in these industries varies tremendously, we included only golf courses (SIC code 7992), which comprise a very water intensive sub-industry, in our analysis. Indeed, in 2000, there were nearly 900 golf courses in the state, covering close to 89,000 acres (Horton, 2002), and using 342 TAF of water annually.

Table E-7
Employment and Water Use at Golf Courses (2000)

Industry	SIC	GED	Employees	Annual Use (TAF)
Golf Courses	7992	7,718	34,100	341.8[1]

[1] Freshwater comprised 229 AF of 2000 use and the remaining water was reclaimed water (California State Water Resources Control Board 2002).

Although we do not know the exact breakdown of water use at golf courses, we do know that water is used primarily for landscaping. Without published data, we assumed that 95 percent of golf course water use is used for irrigating turf while the remaining 5 percent is used in restrooms, kitchens, and cooling, which we consolidated as "other." Golf courses tend to use high amounts of reclaimed water in addition to self-supplied and agency-supplied water.[1]

Comparison of GED-derived Estimate to Modeled Water Use

Since landscaping comprises nearly all of a golf course's water use and little or no information was available on restroom, kitchen, or cooling uses, we modeled only the irrigation component to crosscheck our GED-derived estimate. First, we totaled the number and acreage of golf courses by hydrological region and then applied what we know about turf water use in different regions to these acreages to determine total water use in 2000.[2]

[1] According to the National Golf Foundation, in 1998, about 33% of the water supply to golf courses in Region 8 (which includes So Cal, W.AZ and So NV) was supplied from reclaimed water. This percentage was assumed to apply to California. The rest of the water supply to golf courses was from freshwater sources: lakes and streams (22%), wells (32%), public supply(9%), and other (5%). (Thompson, 2002).

Table E-8
Modeled Irrigation Water Use at Golf Courses

Hydrologic Region	Percentage Golf Acreage[1]	Acreage 2000[2]	EV Ratio w.r.t Central Coast[3]	Annual Water Use (AF/Acre)	Modeled Total Irrig. Use (TAF)	GED-derived Estimate of Total Use (TAF)
North Coast	3%	2,945	1.01	2.02	**5.9**	
San Francisco	15%	13,394	1.26	2.52	**33.8**	
Central Coast	7%	6,126	1.00	2.00	**12.3**	
South Coast	46%	41,012	1.37	2.74	**112.4**	
Tulare Lake	5%	4,082	1.80	3.60	**14.7**	
San Joaquin	6%	5,687	1.80	3.60	**20.5**	
Sacramento River	13%	11,211	1.80	3.60	**40.4**	
North Lahontan	1%	544	1.56	3.12	**1.7**	
South Lahontan	4%	3,412	2.08	4.16	**14.2**	
Colorado River	0%	360	2.53	5.06	**1.8**	
Total Irrigation		**88,773**			**258**	**324.6**
Total All End Uses						**341.8**

[1] The number of golf courses was reported by county and we translated this into hydrologic region (California Golf Owners Association 2002). We then converted the number of golf courses in each region into a percentage of the state's total golf course acreage.
[2] The total acreage of golf courses was reported by the California Golf Owners Association (2002) and then distributed among regions based on the percentage of golf courses in each region.
[3] see Appendix D.

Estimate of Potential Savings

By applying the conservation potential calculated in the end use studies (see Appendix D) to our GED-derived estimates of water use, we estimated potential water savings (shown in Table E-9).

Table E-9
Potential Water Savings at Golf Courses (2000)

End Use	Water Use (TAF)	Conservation Potential (percent)			Conservation Potential (TAF)		
		Low	High	Best	Low	High	Best
Irrigation (Freshwater)	211.9[1]	26%	100%	39%	60.1	211.9[2]	88.7
Irrigation (Reclaimed)	112.8[1]	0%	0%	0%	0	0	0
Other	17.1	0%	0%	0%	0	0	0
Total	**341.8**	**26%**	**100%**	**39%**	**55.6**	**82.1xx**	**211.9xx**

[1] According to the National Golf Foundation, in 1998, about 33% of the water supply to golf courses in Region 8 (which includes So Cal, W.AZ and So NV) was supplied from reclaimed water. (Thompson, 2002)
[2] The low and best estimates coincide with the findings in Appendix D while the high estimate includes potential freshwater savings if all freshwater currently used in golf course irrigation (229 AF/year) was replaced with reclaimed water.

Hospitals (SIC code 806)

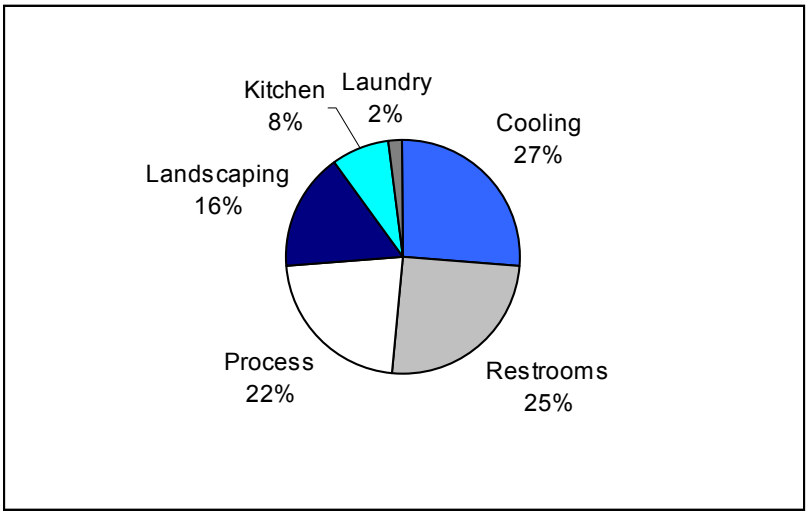
Hospitals are classified under SIC code 80, which also includes physicians' offices (SIC codes 801, 802, and 804), nursing homes and special care facilities (SIC code 805), laboratories and dental clinics (SIC code 807), and outpatient clinics and blood banks (SIC codes 808 and 809). Because the water use in these facilities varies considerably, we focused solely on hospitals (SIC code 806), which are the largest single sub-industry in SIC code 80. Table E-10 and Figure E-3 show water use in hospitals by end-use.

Table E-10
Employment and Water Use in the Hospital Industry (2000)

Industry	SIC code	GED[1,2]	Employees	Annual Use (TAF)
Hospitals	806	124	428,450	36.7

[1] Based on a 225-day year.
[2] Note that the GED coefficients estimated for 1995, were decreased by 20% to obtain the GED coefficients for 2000 for the commercial sector.

Figure E-3
Water Use, by End Use, in the Hospitals



Source: Calculated from MWD audit data of regional hospitals (MWD 2002).

Process Water Description

Hospitals use process water to operate the following equipment:

- X-ray machines (as part of the film development process);
- Steam sterilizers (for sterilizing equipment);
- Washers;
- Autoclaves (for sterilizing equipment);
- Laboratories;
- Boilers;
- Vacuum pumps (for sterilizing environments); and

- Other, misc. processes.

Potential Process Water Savings

Table E-11
Potential Process Water Savings in the Hospital Industry (2000)

Sub-end Use	Water Conservation Measure	Sub-end Use (x) [1]	Technology Savings (c)	Penetration Rate (p)	Conservation Potential (s) [2]
		(percent)			
X-ray	Recirculating x-ray machines[3]	22%	90%[3]	5%[4]	90%
Steam sterilizers	Replace steam sterilizers with ozone based ones; recirculate water where replacement is not possible	23%	70%[5]	50%[6]	65%
Washers	None				
Autoclave	None				
Laboratories	Improve efficiency of reverse osmosis units; install ultrasonically controlled sinks; retrofit sterilizers	1%	20%	30%[6]	20%
Boilers	Recycle boiler condensate	1%	50%	85%[6]	50%
Vacuum pumps	Replace with oil-ring pumps	4%	100%[7]	95%[8]	100%
Other			0%	50%	30%
Total			**52%**		

[1] Estimated from data in three case studies (B&V 1991 (c&d), MWD 1996, B&M, 1995).
[2] Percent Savings Potential = Savings * (1-Penetration)/ (1- Savings*Penetration Rate)
[3] Water Saver/Plus ™ units can save 98 percent of water used for x-ray machines (CUWCC 2001). Because this technology is relatively new, only a handful of machines have been retrofitted and we assumed that 95 percent of x-ray machines in California are yet to be replaced.
[4] Estimated from data in CUWCC (2001).
[5] The typical conservation recommendations for sterilizers include installing auto-shutoff valves, running the sterilizer or autoclave with full loads only, and recycling steam condensate and non-contact cooling water from sterilizers as make-up water in cooling towers or boilers. These conservation measures could result in savings up to 60 percent (LADWP 1991). However, more recently a few hospitals have replaced steam sterilization with chemical-based sterilizers, saving both water and energy. Almost 70 percent of a hospital's sterilizing needs can be met without steam (Scaramelli and Cohen 2002).
[6] Estimate based on how many years the technology has been around
[7] Converting from water ring pumps to oil ring pumps eliminate water use altogether. Where steam must be used, recirculation is increasingly becoming common (Scaramelli and Cohen 2002).
[8] Oil-ring vacuum pumps currently dominate 80 percent of the market, about 17 percent are oil-less, and roughly 3 percent are still water-ring pumps (Britain 2002).

Estimate of Potential Savings

By applying the conservation potential calculated in the end use studies (see Appendix D) and Table E-11 to our GED-derived estimates of water use, we estimated potential water savings (shown in Table E-12).

Table E-12
Potential Water Savings in the Hospital Industry (2000)

End Use	Water Use (TAF)	Conservation Potential (percent)			Conservation Potential (TAF)		
		Low	**High**	**Best**	**Low**	**High**	**Best**
Cooling	9.6	9%	41%	26%	0.9	4.0	2.5
Restrooms	9.2	47%	47%	47%	4.3	4.3	4.3
Process	8.1	39%	57%	52%	3.1	4.6	4.2
Landscaping	5.9	38%	53%	50%	2.2	3.1	2.9
Kitchen	2.9	20%	20%	20%	0.6	0.6	0.6
Laundry	0.7	42%	42%	42%	0.3	0.3	0.3
	36.7	**31%**	**46%**	**40%**	**11.4**	**16.8**	**14.8**

Laundries (SIC code 721)

SIC code 721 consists of a range of facilities that include carpet and upholstery cleaners, large linen rental companies, and a variety of laundries, including industrial laundries that clean rags used to wipe inks and solvents off equipment. We include all laundries except SIC code 7215, coin laundries. Table E-13 shows employment and gallons per employee per day coefficients. Figure E-4 shows laundry end-use estimates. As expected, most water use in this industry goes to washing clothes, though about 15% goes to other end uses.

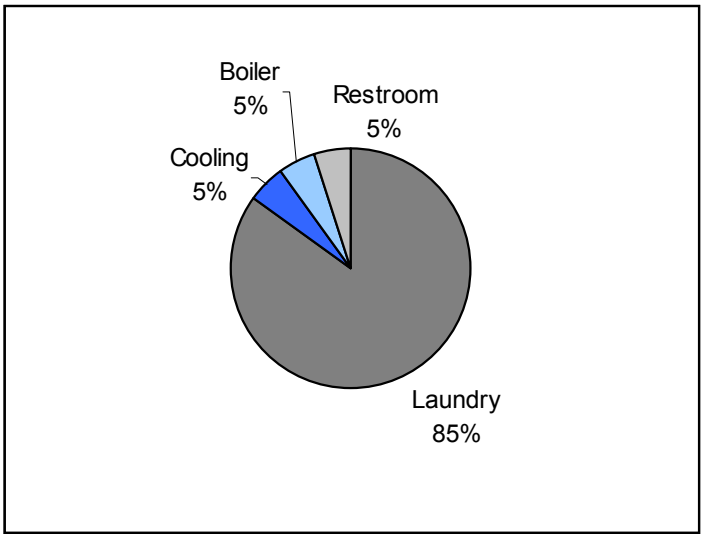
Table E-13
Employment and Water Use in the Laundry Industry (2000)

Sub-industry	SIC code	GED[1,2]	Employees	Annual Use (TAF)
Dry cleaning & laundry	7216	981	21,410	14.5
Linen supply	7213	977	7,860	5.3
Carpet & upholstery	7217	984	5,890	4.0
Industrial launderers	7218	981	9,150	6.2
Total	**49,965**		**44,310**	**30.0**

[1] Based on a 225-day year.
[2] Note that the GED coefficients estimated for 1995, were decreased by 20% to obtain the GED coefficients for 2000 for the commercial sector.

In the laundry industry, water is used primarily to remove soil and odors from textiles through laundering and very little water (<15 percent) is used for other purposes.

Figure E-4
Water Use, by End Use, in the Laundry Industry



Source: Based on average of two laundry case studies (AWWARF 2000)

Estimate of Potential Savings

By applying the conservation potential calculated in the end use studies (see Appendix D) to our GED-derived estimates of water use, we estimated potential water savings (as shown in Table E-14).

Table E-14
Potential Water Savings in the Industrial Laundry Industry (2000)

	Water Use (TAF)	Conservation Potential (percent)			Conservation Potential (TAF)		
End Use		**Low**	**High**	**Best**	**Low**	**High**	**Best**
Laundry	25.5	42%	66%	54%	10.8	16.9	13.8
Cooling	1.5	9%	41%	26%	0.1	0.6	0.4
Boiler[1]	1.5	0%	25%	10%	0.0	0.4	0.2
Restroom	1.5	34%	34%	34%	0.5	0.5	0.5
Total	**30.0**	**38%**	**61%**	**49%**	**11.4**	**18.4**	**14.8**

[1] Assumed Range

Restaurants (SIC code 58)

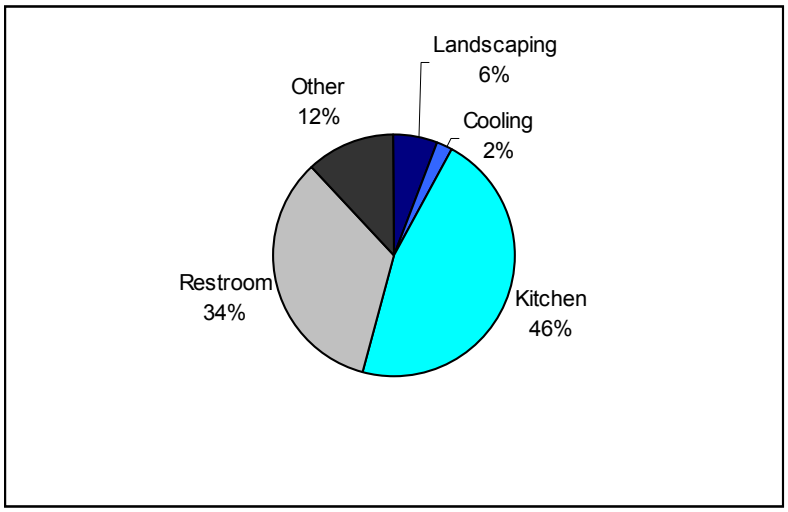
Water is used in restaurants primarily for kitchen purposes, such as washing dishes, making ice, and preparing food (see Appendix D for a description of these uses). A significant amount of water is also used for restrooms. Table E-15 and Figure E-5 provide our estimates of total water use in the restaurant industry by end use.

Table E-15
Employment and Water Use in the Restaurant Industry (2000)

Industry	SIC code	GED[1,2]	Employees	Annual Use (TAF)
Restaurants	58	265	890,600	163.0

[1] Based on a 225-day year.
[2] Note that the GED coefficients estimated for 1995, were decreased by 20% to obtain the GED coefficients for 2000 for the commercial sector.

Figure E-5
Water Use, by End Use, in the Restaurant Industry



Source: Calculated from MWD audit data of 89 restaurants (MWD 2002).

Comparison of GED-derived Estimate to Modeled Water Use

We modeled water use in restaurants using published estimates of restroom visits by employees and customers, irrigated turf area, cooling requirements, dishwashing water use etc. We converted our GED-derived estimate of water use per employee into water use per meal and then compared it to that predicted by the water use model. To convert the GED-derived estimate, we first divided the amount of water used in the restaurant sector in 2000 by the number of meals eaten to calculate the average gallons/meal/day.

Because the number of meals eaten at California restaurants per day was not available, we estimated this number with two different methods (see Tables E-16 and E-17).

Table E-16
Number of Meals Served in California (2000), Method One

Data	Source	Value (2000)
A) Employees in California	US Census Bureau	895,000
B) Meals/employee/day	Average of restaurants[1]	15
C) Total meals/day in California	A*B	13,500,000
D) Percentage of drive-through meals	Restaurant USA	18%
E) Take out meals/day	C*D	2,400,000
F) Sit down meals/day	C-E	11,100,000

[1] Average of data from several case studies (LADWP, 1991 (a & b), MWD, 1992, MWRA, 1990)

Table E-17
Number of Meals Served in California (2000), Method Two

Data	Source	Value (2000)
A) Population in California in 2000	US Census Bureau	33,800,000
B) Meals eaten out/week	Restaurant USA	4.2
C) Total meals/day in California	A*B/7	18,200,000
D) Fraction of meals eaten at cafeterias (not in SIC code 58)	Fraction of establishments not included in SIC code 58	25%[1]
E) Meals in SIC code 58	C*(1-D)	13,700,000
F) Percentage of drive-through meals	Restaurant USA	18%
G) Number of drive-through meals	D*E	2,500,000
H) Sit-down meals/day in restaurants	D-F	11,200,000

[1] We used the number of establishments (74,000) published by the California Restaurants Association (www.calrest.org). The number listed under SIC code 58 (57,000), is about 77 percent of the total restaurants.

To model the water use in a medium-sized restaurant, we considered a food establishment with 25 employees and 60 seats. The meal turnover industry average of 5 meals/seat/day (or 250 meals/day) (LADWP, 1991 (a & b), MWD, 1992, MWRA, 1990) was applied to end-use data from Appendix D.

Table E-18
Modeled Daily Water Use in Restaurants (2000)

Water End Use	Volume[1]	Times Per Day[1]	Use Gal/Day	Use Gal/Meal/Day	Use Efficient Gal/Meal/Day[2]
Dishwasher					
Pre-rinse nozzles	2.5 gpm	60 min	150	0.6	0.40
Pot and pan sink	40 gal	3 sinks * 2 fills[3]	300	1.20	1.20
Garbage disposal	4.5 gpm	30 min	135	0.54	0.20
Dishwasher	2.4 gal/rack	0.5 racks/meal, 70 percent capacity[4]	429	1.71	0.79
Restrooms[5]					
Employee use restrooms	2.8 gal/visit	25 employees * 4.6 visits/day gal/day	322	1.3	0.72
Customer use restrooms	2.7 gal/visit	250 customers *50 percent of customers	338	1.4	0.79
Food Prep					
Preparation sink	15 gal	2 fills/day	30	0.12	0.12
Water used in food	0.5 gal/meal	250 meals/day	125	0.50	0.50
Icemaker					
Ice maker	1 gal/lb[6]	1.5 lb/meal[7]*250 meals	338	1.5	1.2
General Sanitation					
Floor wash	12 gal/clean	3 cleans[8]	36	0.14	0.14
Other[9]	30 gal		125	0.50	0.50
Miscellaneous	100 gal		100	0.40	0.40
Total			**25,607**	**9.91**	**6.96**

[1] Volume and use were estimated from data in several case studies (LADWP, 1991 (a & b), MWD, 1992, MWRA, 1990), except where otherwise noted.
[2] See Appendix D
[3] Three pot sinks of 50 gallons capacity are filled and emptied twice daily.
[4] The amount of dishes generated was assumed to be 2.5 racks/guest (Bohlig 2002).
[5] See Appendix D.

[6] Ice used per meal was about 1.5 lbs and icemaker water use of 1 gal/lb was assumed (note that one gallon of water produces only one pound of ice because, during the process, several gallons are lost to bleed-off.
[7] ASHRAE 1994
[8] Assuming the restaurant uses about 25 gallons each time it cleans the floor and counters and it does this twice daily.
[9] The restaurant uses 100 gallons daily in other uses including laundry and landscaping (about 5 percent of total use). The restaurant does not have a cooling tower.

Our comparison of the GED-derived and modeled estimates is shown in Table E-19 below.

Table E-19
Comparison of Estimates of Water Use in a Typical Restaurant

	GED-derived (gallons/meal)	Model 1 (typical use)	Model 2 (efficient use)
Total	12.9[1]	9.9	7.0

[1] Using 163 TAF in 2000 for SIC code 58 and dividing this by the number of meals per day and then by 365 days in a year, we got about 12.9 gal/meal.

Estimate of Potential Savings

By applying the conservation potential calculated in the end use studies (see Appendix D) to our GED-derived estimates of water use, we estimated potential water savings (shown in Table E-20).

Table E-20
Potential Water Savings in the Restaurant Industry (2000)

	Water Use (TAF)	Conservation Potential (percent)			Conservation Potential (TAF)		
End Use		**Low**	**High**	**Best**	**Low**	**High**	**Best**
Landscaping[1]	9.8	38%	53%	50%	3.7	5.2	4.9
Cooling	3.3	9%	41%	26%	0.3	1.4	0.8
Kitchen	75.0	20%	20%	20%	14.9	14.9	14.9
Restrooms	55.4	46%	46%	46%	25.2	25.2	25.2
Other[2]	19.6	0%	25%	10%	0.0	4.9	2.0
Total	**163.0**	**27%**	**32%**	**29%**	**44.0**	**51.5**	**47.7**

[1] Based on our modeled landscaping use, we assumed that about 18 TAF, or 4 percent, of total restaurant use is used for landscaping. The remaining 13 TAF, or 6 percent, of the other/landscaping category was used for other purposes. See Appendix D for more information on landscaping.
[2] Range assumed

Retail Stores (SIC codes 53, 54, 55, 56, 57, 59)

Retail stores include grocery stores, department stores, gas stations, and non-store retailers (i.e., retailers who work from home). In 2000, there were nearly 800,000 retail stores in the state. Due to known differences in water use, we categorize retail establishments as grocery stores or "miscellaneous retail" stores. These are shown in Table E-21 and Figure E-6 and Figure E-7.

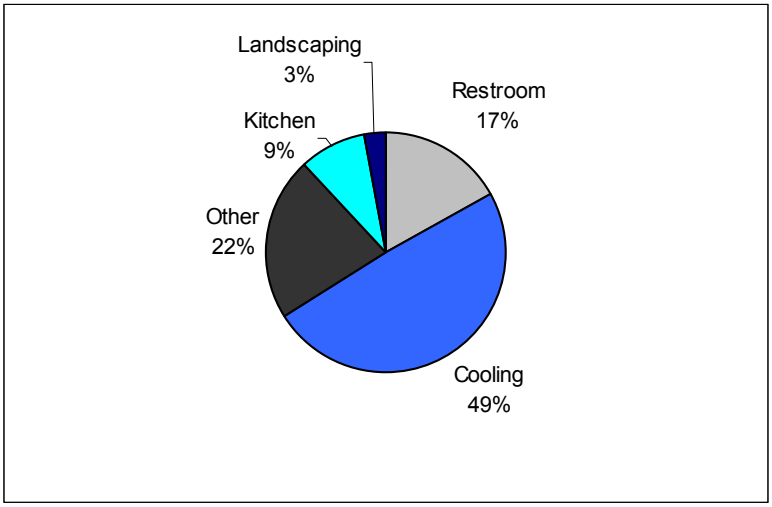
Table E-21
Employment and Water Use in the Retail Industry (2000)

Sub-industry	SIC code	GED[1,2]	Employees	Annual Use (TAF)
Grocery	540	170	293,224	34.5
Misc. Retail	53,55,56,57,59	152	1,128,210	118.1
Total			**1,421,434**	**153.0**

[1] Based on a 225-day year.
[2] Note that the GED coefficients estimated for 1995, were decreased by 20% to obtain the GED coefficients for 2000 for the commercial sector.

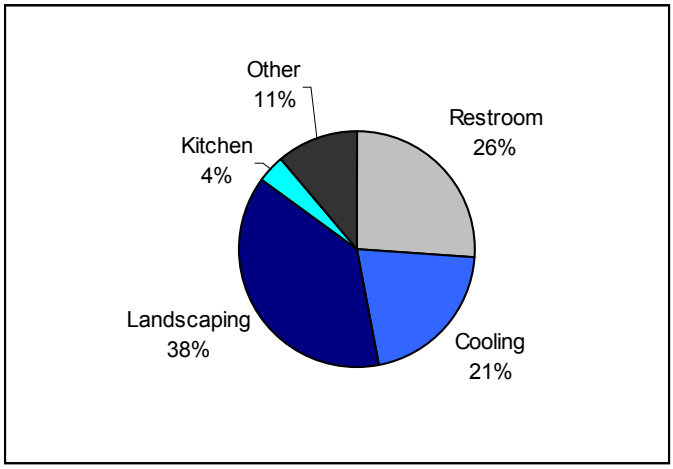
Retail stores use water in kitchens and restrooms and for cooling and irrigation. Although no process water is typically used in the Retail industry, water use varies considerably among the different types of retail stores. For example, grocery stores use water more intensively than other retail stores because they have sinks and dishwashing nozzles in meat and deli departments, misters to keep produce moist, and ice makers. In contrast, department and other retail stores use water mostly for restrooms and space cooling.

Figure E-6
Water Use, by End Use, in the Grocery Sub-industry



Source: Calculated from MWD audit data of 45 grocery stores (MWD 2002).

Figure E-7
Water Use, by End Use, in Misc. Retail Sub-industries



Source: Calculated from MWD audit data of 38 miscellaneous retail stores (MWD 2002).

Comparison of GED-derived Estimate to Modeled Water Use

We could not create a complete model of typical water use because of data insufficiency on kitchen and cooling water use in retail establishments. However, we did compare our GED-derived estimates to some of the various end uses that were calculated in Appendix D, as shown in Table E-22.

Table E-22
Comparison of Estimates of Annual Water Use in the Retail Industry

End Use	Modeled End Use	GED-derived Use
	(TAF)	
Kitchen	n/a	7.8
Restrooms	22.5	36.6
Cooling	n/a	41.7
Landscaping	33.7	45.9
Other	n/a	20.6
Total		**153**

Estimate of Potential Savings

By applying the conservation potential calculated in the end use studies (see Appendix D) to our GED-derived estimates of water use, we estimated potential water savings (shown in Table E-23).

Table E-23
Potential Water Savings in Grocery Stores (2000)

Grocery End Use	Water Use (TAF)	Conservation Potential (percent)			Conservation Potential (TAF)		
		Low	High	Best	Low	High	Best
Restroom	5.9	51%	51%	51%	3.0	3.0	3.0
Cooling	16.9	9%	41%	26%	1.6	7.0	4.3
Landscaping	1.0	38%	53%	50%	0.4	0.5	0.5
Other	7.6	0%	25%	10%	0.0	1.9	0.8
Kitchen	3.1	20%	20%	20%	0.6	0.6	0.6
Total	**34.5**	**16%**	**38%**	**27%**	**5.6**	**13.1**	**9.2**

Table E-24
Potential Water Savings in the Other Retail Stores (2000)

Misc. Retail End Use	Water Use (TAF)	Conservation Potential (percent)			Conservation Potential (TAF)		
		Low	High	Best	Low	High	Best
Restroom	30.7	44%	51%	51%	51%	15.7	15.7
Cooling	24.8	7%	9%	41%	26%	2.4	10.3
Landscaping	44.9	47%	38%	53%	50%	16.9	23.7
Other	13.0	0%	0%	25%	10%	0.0	3.2
Kitchen	4.7	20%	20%	20%	20%	0.9	0.9
Total	**118.1**	**28%**	**43%**	**37%**	**33.2**	**50.9**	**43.4**

Schools (SIC codes 8219, 9382)

There are 8,330 public and 4,370 private schools in California, including elementary, middle, high, continuing, and vocational schools. Total enrollment (public and private) was 4.73 million in elementary and middle schools, 1.85 million in high schools, and 2.20 million in other[3] types of schools (CDE 2002, California Postsecondary Education Commission 2002).

Table E-25
Employment and Water Use in Schools (2000)

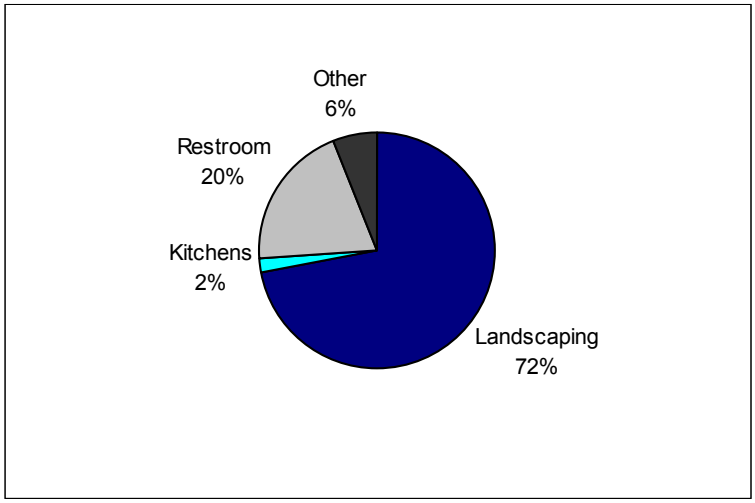
Sub-industry	SIC	GED[1,2]	Employees	Annual Use (TAF)
K-12		308	1,009,130	214.6
Other		190	280,200	36.7
Total			**1,289,300**	**251.3**

[1] Based on a 225-day year.
[2] Note that the GED coefficients estimated for 1995, were decreased by 20% to obtain the GED coefficients for 2000 for the commercial sector.

Although most schools use water for restrooms, cooling and heating, irrigation, and kitchens, the percentage of water consumption devoted to different end uses varies among schools. The most significant difference appears to result from the large use of irrigation water in schools with athletic fields. High schools generally have more irrigated athletic field area per student than elementary schools or other types of schools. Because the end use percentages can vary greatly among the different types of schools, we analyzed water use in elementary/middle schools, high schools, and other schools separately (see Figures E-8 and E-9).[4]

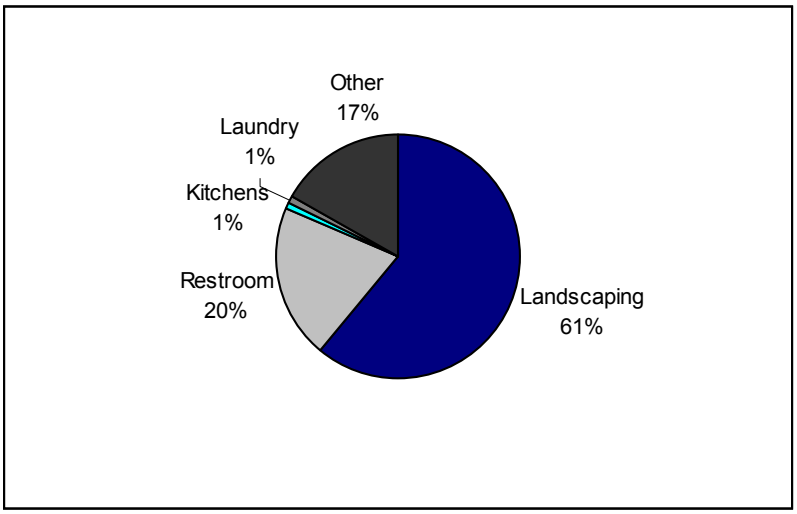
[3] Other types of schools, as referred to herein, include colleges, universities, trade schools, and other non-K-12 schools.
[4] In some cases we had enough data to also analyze elementary and high schools separately.

Figure E-8
Water Use, by End Use, in K-12 Schools



Source: Calculated from MWD audit data of 149 schools (MWD 2002).

Figure E-9
Water Use, by End Use, Other Schools



Source: Calculated from MWD audit data of selected non-K-12 schools (MWD 2002).

Comparison of GED-derived Estimate to Modeled Water Use

We modeled water use in schools using published estimates of restroom visits by students and staff, irrigated turf area, cooling requirements, etc. We converted our GED-derived estimate of water use per employee into water use per student per day and then compared it to that predicted by the water use model. The end use calculations in the GED-derived estimate are from Figures E-8 and E-9 and the model's assumptions are derived from the end-use data in Appendix D. Table E-26 shows the results.

Table E-26
Modeled Water Use per Student

End Uses	Unit Measuring Area or Volume of Use	Area or Volume	Unit Measuring Frequency of Use	Frequency of Use	Total gal/ student/ day
Elementary and Middle Schools					
Irrigation[1]	irrigated acres/student	0.004	gal/acre/school day	varies	24.3
Toilet[2]	gpf	3.00	visits/day	2.11	6.3
Urinal[3]	gpf	1.60	visits/day	1.01	1.6
Faucet Use[4]	gpf	0.11	flushes/day	3.12	0.3
Kitchen	gal/meal	9.91[5]	meals/day/student	0.4[6]	4.0
Other[7]					2.0
Total					**38.5**
High Schools					
Irrigation[1]	irrigated acres/student	0.008	gal/acre/school day	varies	55.6
Toilet[2]	gpf	3.00	visits/day	2.11	6.3
Urinal[3]	gpf	1.60	visits/day	1.01	1.6
Faucet Use[4]	gpf	0.11	flushes/day	3.12	0.3
Kitchen	gal/meal	9.91[5]	meals/day/student	0.4[6]	4.0
Other[7]					4.0
Total					**71.8**
Other Schools					
Irrigation	irrigated acres/student	0.002	gal/acre/school day	varies	6.9
Toilet[8]	gpf	3.00	visits/day	1.03	3.1
Urinal[9]	gpf	1.60	visits/day	0.39	0.6
Faucet Use	gpf	0.11	min/day	0.96	0.1
Kitchen	gal/meal	9.91	meals/day/student	0.4	4.0
Other					1.0
Total					**15.7**

[1]

[2] Assuming that each K-12 student and staff uses the toilet 1.95 times per day (see Appendix D) and a student-staff ratio of about 11.8 (based on student enrollment obtained from the Educational Demographics Office (2002) and employment data from California Employment Development Department (2002), we calculated 2.11 daily toilet visits per K-12 student.

[3] Assuming that each K-12 student and staff uses urinals 0.94 times per day (see Appendix D) and a student-staff ratio of about 11.8 (Based on Student Enrollment obtained from the Educational Demographics Office (2002) and Employment Data from California Employment Development Department (2002)), we calculated 1.01 daily urinal visits per student.

[4] Faucet use was based on the number of daily toilet and urinal flushes reported above.

[5] Average gal/meal was obtained from the model in Appendix D.

[6] The USDA estimated that there were about 489 million school meals served in 2000 (about 2.7 million meals per day). The total enrollment in California's public and private schools is about 6.6 million, implying about 40 percent of students have cafeteria meals.

[7] Other use is estimated at 5 percent of total use and includes cooling, pools, etc.

[8] Assuming that each non K-12 student uses the toilet 0.86 times per day and staff uses the toilet 1.95 times per day and a student-staff ratio of 11.8, we calculated 1.03 daily visits per non K-12 student.

[9] Assuming that each non K-12 student uses urinals 0.31 times per day and staff uses them 0.94 times per day and a student-staff ratio of 11.8, we calculated 0.39 daily visits per student.

Table E-27
Comparison of Estimates of Water Use in Typical Schools

	GED-Based Estimate[1]	Modeled Estimate
	(gal/student/day)	
Elementary and middle schools	48.1	38.5
High schools	87.4	71.8
Other schools	30.5	15.8

[1] Based on the assumption that elementary and middle school students use 55 percent of the water used by high schools students (see Table E-26), we converted elementary and middle students into 2.60 million "additional" high school students. We then divided total K-12 water use (215 TAF) by the number of high school students plus the "additional" high school students to yield 87.43 gallons/high school student/school day. Then, we took 55 percent of the high school use in gal/student/day to get gallons/K-8 student/day. For gallons/other student/day, we divided total other use by the number of other students and then by the number of school days.

Estimate of Potential Savings

By applying the conservation potential calculated in the end-use studies (see Appendix D) to our GED-derived estimates of water use, we estimated potential water savings (shown in Table E-28 and E-29).

Table E-28
Potential Water Savings in K-12 Schools (2000)

K-12 End Uses	Water Use (TAF)	Conservation Potential (percent)			Conservation Potential (TAF)		
		Low	High	Best	Low	High	Best
Landscaping	154.5	38%	53%	50%	58.1	81.6	77.1
Kitchens	4.3	20%	20%	20%	0.9	0.9	0.9
Restroom	42.9	45%	45%	45%	19.4	19.4	19.4
Other	12.9	0%	25%	10%	0.0	3.2	1.3
Total K-12	**214.6**	**36%**	**49%**	**46%**	**78.3**	**105.1**	**98.6**

Table E-29
Potential Water Savings in Other Schools (2000)

Other Schools End Uses	Water Use (TAF)	Conservation Potential (percent)			Conservation Potential (TAF)		
		Low	High	Best	Low	High	Best
Landscaping	26.4	38%	53%	50%	9.9	14.0	13.2
Kitchens	8.8	45%	45%	45%	4.0	4.0	4.0
Restroom	0.4	20%	20%	20%	0.1	0.1	0.1
Laundry	0.4	42%	66%	54%	0.2	0.2	0.2
Other	0.7	0%	25%	10%	0.0	0.2	0.1
Total Higher and Special-Ed.	**36.7**	**39%**	**50%**	**48%**	**14.1**	**18.4**	**17.5**