



MEMORANDUM

To: Michael Lindquist, City of Davis
From: Martin Lewis, Cunningham Engineering Corporation
Date: 12 December, 2014

Subject: Mace Ranch Innovation Center – Preliminary Water Infrastructure Study - Update

The purpose of this memo is to summarize the proposed water infrastructure improvements for the Mace Ranch Innovation Center (Project), and document the methodologies and assumptions made in determining preliminary on-site water demands. This update to the November 20, 2014 memo reflects further review of unit demands, and is intended to supersede the previous memo.

Existing Conditions

The 211-acre project site is located north of County Road 32A and I-80, and east of Mace Boulevard. Existing water facilities adjacent to the site include a 12” City of Davis water main located in Mace Blvd., and the City’s recently constructed 4 million gallon (MG) Southeast Water Tank and booster pumping station located just south of the site. The pumping station discharges to a 20” pipe, which traverses adjacent the park-and-ride lot and connects to existing distribution piping in Mace Blvd near the intersection of Mace and 2nd Street.

Proposed Onsite Improvements

It is proposed that a public water main loop be constructed through the site, primarily located within roadway corridors, but also possibly traversing non-roadway areas in some locations, as conceptually shown in Figure 1. The loop will provide the site’s interior-use service connections for the planned office/R&D/industrial uses, plus fire-fighting. It is expected that the improvements required to tie the proposed site loop to the City’s existing water infrastructure at two or three locations on Mace Blvd will be relatively minor, and can likely be coordinated with proposed surface improvements along the site’s western frontage. Alternatively, the Project may consider the option making one of the loop connections to the existing 20” main that connects to the booster pumping station at the 4MG Water Tank.

The Project also proposes to install a new irrigation well in the west-central portion of the site, within the proposed park area adjacent Mace Blvd. A conceptual location for this well is shown on Figure 2. The irrigation well will serve the proposed park and recreation field area as well as other open-space areas onsite, using a dedicated irrigation distribution piping system. It may also be used for irrigating street landscaping within the proposed street corridors onsite, as well as other public common areas. As an alternative to installing a new irrigation well, the Project may utilize an existing ag well, provided it proves

adequate for the intended use.

The City of Davis Engineering Design Standards do not differentiate between interior and exterior use for estimating commercial water demand. Since the Project proposes two sources of water, one for interior (domestic) and one for exterior (irrigation) use, it is necessary to calculate these demands separately. The approach to each calculation is summarized below.

Water Demand – Interior Use

Preliminary interior-use water demand calculations have been performed at a planning-level of detail. For the proposed land use, it was initially assumed that interior water usage rates are equivalent to the expected wastewater generation rates. As such, average daily demands for interior use were initially estimated based on City of Davis standard wastewater generation rates, assuming that the predominant uses will be Commercial/R&D/Office uses. Our preliminary estimates were based on per-capita usage, type of use, and expected occupancy per square foot of building area, using the City standard generation rates of 15gcd for R&D/Office, retail, manufacturing, and hotel common area uses, and 55gcd for hotel guest rooms.

However, it is noted that the City-standard unit rates were published in 1991. Since that time, plumbing codes and plumbing fixture designs have changed, generally resulting in lower flow plumbing fixtures. More specifically, the CALgreen building code requires the installation of low-flow (20% below 1992 EPAAct baseline) interior plumbing fixtures in new buildings. Assuming that the final delivery point for interior water use is via code-regulated interior plumbing fixtures, and if user behavior can be assumed not to have changed, then it might be expected that the 15 gallons per-capita per-day (gcd) unit rate could be factored down by 20%. The resulting expected generation would be 12 gcd for R&D/Office, retail, manufacturing, and hotel common area uses, and 44 gcd for hotel guest rooms and gym facilities. For present purposes, the City has directed that the published standard rates be used, with the exception of the hotel and fitness uses, where the reduced rate of 44 gcd may be applied.

Table 1 – Average Daily Demand by Land Use

| Land Use | Person/ Square Foot | Per Person ADD (gcd) |
|---------------------|------------------------|-------------------------|
| R&D/Office | 1/425* | 15 |
| Manufacturing | 1/425* | 15 |
| Hotel - Employee | 50 Persons | 15 |
| Hotel – Guest Rooms | 150 Rooms | 44 |
| Hotel – Convention | 1/75** | 15 |
| Retail – Employee | 1/500* | 15 |
| Retail Sales | 1/60*** | 2 |
| Retail Café | 1/30*** | 2 |
| Retail Fitness | 1/100*** | 44 |

*Based on BAE Urban Economics Report, December 2014

**Based on California Building Code Occupancy Levels, assumed daily average of 20% of max. occ.

***Based on California Building Code Occupancy Levels, assumed 50% use at any given time.

Populations are adjusted in demand calculations for retail uses to account for repeated



occupancy throughout the day. Sales assumes a turnover of 8 (1 per hour open) and Café assume a turnover of 3 (3 high capacity peak hours). Fitness has not been factored for turnover assuming only a fraction of users will use facilities at 44 gpd.

A peaking factor of 1.0 as been assumed for maximum day demand/average day demand, as interior use is expected to remain substantially consistent year-round. A peaking factor of 1.8 has been applied for the maximum hour demand/maximum day demand, in accordance with City standards. Based on these assumptions, the interior use demands are estimated at 83 gpm for Average Day and 150 gpm for Peak Hour (refer to Figure 4). Based on an Average Day demand of 83 gpm, the estimated annual interior use is 43.6 MG.

While time-of-use is expected to be predominantly during regular business hours of Monday-Friday 8:00-5:00, the particulars of the Project's diurnal use patterns are currently not known.

In addition to interior-use, gross fire flow demands were estimated using City standard planning-level criteria. For industrial land-uses, the City's planning-level guidelines yield a fire flow of 4,000 gpm. For sprinklered buildings, this demand may be reduced at the fire marshal's discretion. It has generally been our experience that incorporation of fire sprinklers can result in a 50% reduction in the required total fire flow. Assuming the use of sprinklered buildings and a 50% reduction in fire flow, the combined peak-day interior use plus fire flow demand is estimated at about 2,083 gpm. The fire flow demand calculations are shown in Figure 4.

Landscape Water Demand

Irrigation water is expected to be sourced from the new irrigation well on site and distributed via a dedicated piping system, and has therefore been calculated independently from the interior use demand. The preliminary land use plan includes approximately 78 acres of landscape area. A maximum irrigation water application rate of 0.186"/day has been estimated for the site based on typical local use in the month of July. This number assumes roughly 30% of the landscaped area will be planted with high water use plantings (approx. 10.5"/month in July), an additional 30% planted with medium use plantings (approx. 5.5"/month in July), with the remaining 40% planted with low water use plantings (approx. 1.9"/month in July). Assuming an irrigation window of 8 hours per day and a peak-hour factor of 2.0, a peak-hour application rate of 1,634 gpm is estimated during the peak month of July. These calculations are provided in Figure 4. The estimated annual landscape use for the project is 74.9 MG. The maximum applied water allowance, per the California Water Efficient Landscape Ordinance (AB1881), is 77.2 MG/year.

The estimated irrigation demand will need to be refined once more is known about the mix of plant types, and the demand may be reduced with the incorporation of lower water use plantings.



Recycled/Reclaimed Water

The existing water-supply infrastructure available to the site does not include a recycled/reclaimed water distribution system nor is a source for this water needed to service the demands of the project. However, the future landowners and users at the site may desire to utilize reclaimed water if and when it is made available. For this reason the applicant has designed infrastructure capable of receiving and internally distributing this potential future water supply.

Given that the predominant land-use planned for this site is office/R&D/industrial, it is not currently envisioned that the graywater and/or blackwater generated by these uses alone will be sufficient to economically justify onsite treatment and re-use. However, in the event that a particular user proves to be substantial producer of waste water, and it can be shown to be economically reclaimed and reused onsite, then a user-specific reclaimed water system may also be considered.

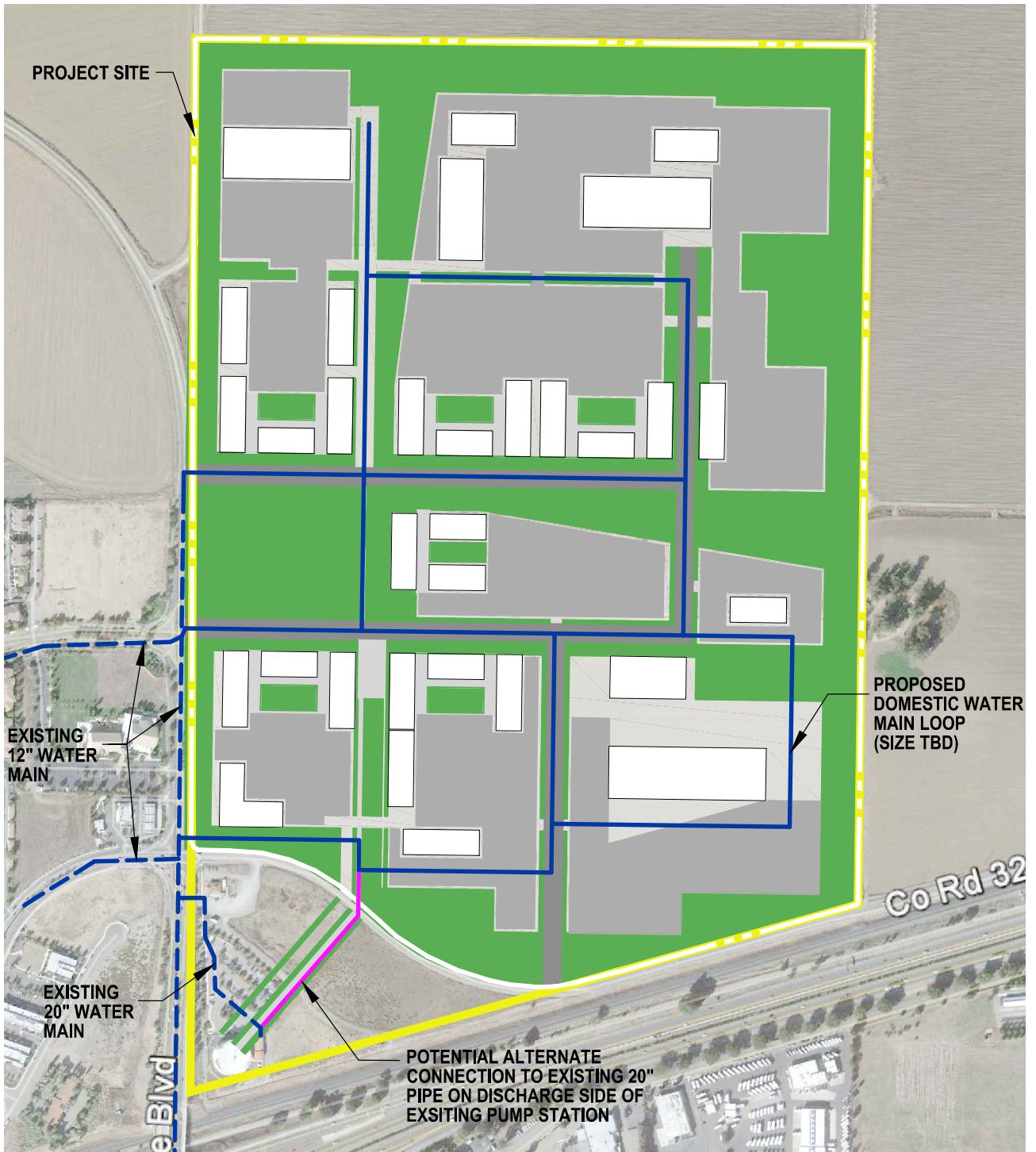
The applicant is aware of the City's Integrated Water Resource Study identifying recycled water as a long-term component of the City's water supply plan. If the City eventually delivers tertiary-treated effluent (recycled water) from the City's Wastewater Treatment Plant to areas of the City in the vicinity of the project site, the applicant may then be able to use recycled water for some project uses, such as irrigation, and possibly industrial process water, although no potential process water users have been identified at this time. In recognition of the City's strong desire to make recycled water available, two potential points of connection to a future reclaimed water supply are shown in Figure 3.

The installation of offsite infrastructure to connect to the City's Wastewater Treatment Plant is not proposed as part of the Project. The future use of reclaimed water at the project site will be dependent upon the City's ability to produce and deliver such water to the vicinity of the project site. The City would be responsible for conducting an independent CEQA analysis on the production and delivery of a tertiary treated water supply back to the City for use.

Phase 1 Improvements

Preliminary phasing has been proposed for the project. Phase 1A and 1B include approximately 460,000 sf. of manufacturing space, 100,000 sf. of retail space and 40,000 sf. of office space. This portion of the development is estimated to generate an interior use peak day demand of 25 gpm and peak hour demand of 44 gpm, resulting in a combined peak-day interior use plus fire flow demand of 2,025 gpm (assuming 50% fire flow credit for sprinklers). The estimated annual interior use for Phase 1 is 13.1 MG. The associated landscaped areas for Phase 1A and 1B is approximately 12.6 acres, with an estimated peak hour application rate of 265 gpm in the peak summer months. The estimated annual landscape use for Phase 1 is 12.1 MG. Refer to Figure 5 for Phase 1 interior use and landscape use calculations. The maximum applied water allowance, per the California Water Efficient Landscape Ordinance (AB1881), is 12.5 MG/year.



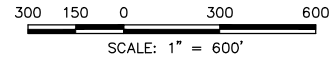


LEGEND

- PROPOSED BUILDING
- PROPOSED PARKING
- PROPOSED ROAD
- PROPOSED PAVED OPEN SPACE
- PROPOSED GREEN SPACE

NOTES:

1. SITE AERIAL IMAGERY TAKEN IN 2012 AND WAS ACQUIRED FEBRUARY 14, 2012 FROM GOOGLE EARTH PRO.



| | |
|----------|----------|
| DESIGNED | ML |
| DRAWN | KM |
| CHECKED | ML |
| DATE: | 11/14/14 |
| JOB No: | 1239.04 |

CITY OF DAMS

**MACE RANCH INNOVATION CENTER
UTILITIES - DOMESTIC WATER
FIGURE 1**

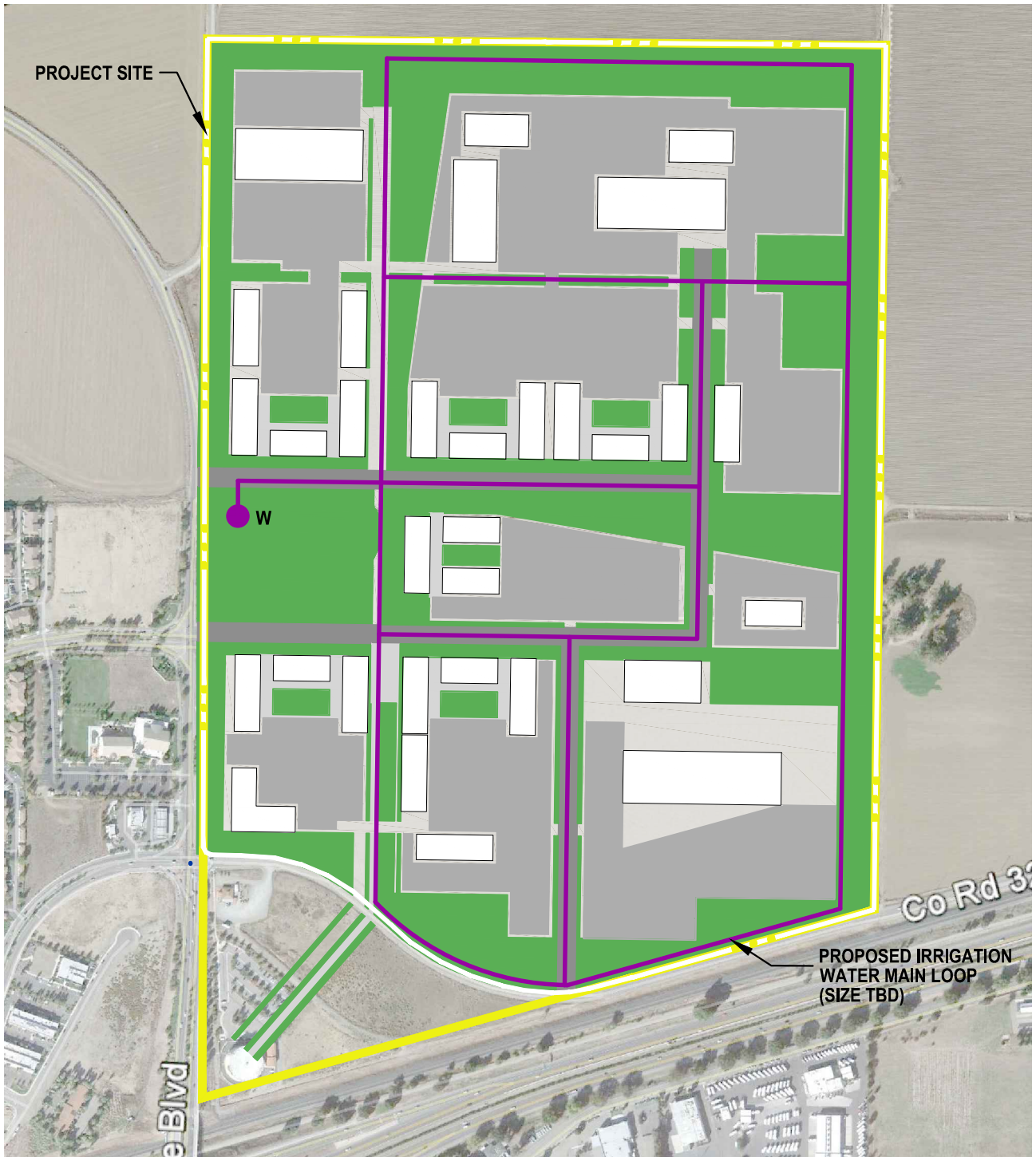
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| <p style="text-align: center;">■ Sacramento Office</p> <p style="text-align: center;">2120 20th Street, Suite Three Sacramento, CA 95818 (916) 455-2026</p> | <p style="text-align: center;">■ Davis Office</p> <p style="text-align: center;">2340 Spafford Street, Suite 200 Davis, CA 95618 (530) 758-2026</p> |
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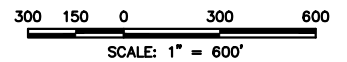


LEGEND

- PROPOSED BUILDING
- PROPOSED PARKING
- PROPOSED ROAD
- PROPOSED PAVED OPEN SPACE
- PROPOSED GREEN SPACE
- POSSIBLE LOCATION FOR NEW IRRIGATION WELL, OR CONNECTION TO EXISTING IRRIGATION WELL

NOTES:

1. SITE AERIAL IMAGERY TAKEN IN 2012 AND WAS ACQUIRED FEBRUARY 14, 2012 FROM GOOGLE EARTH PRO.



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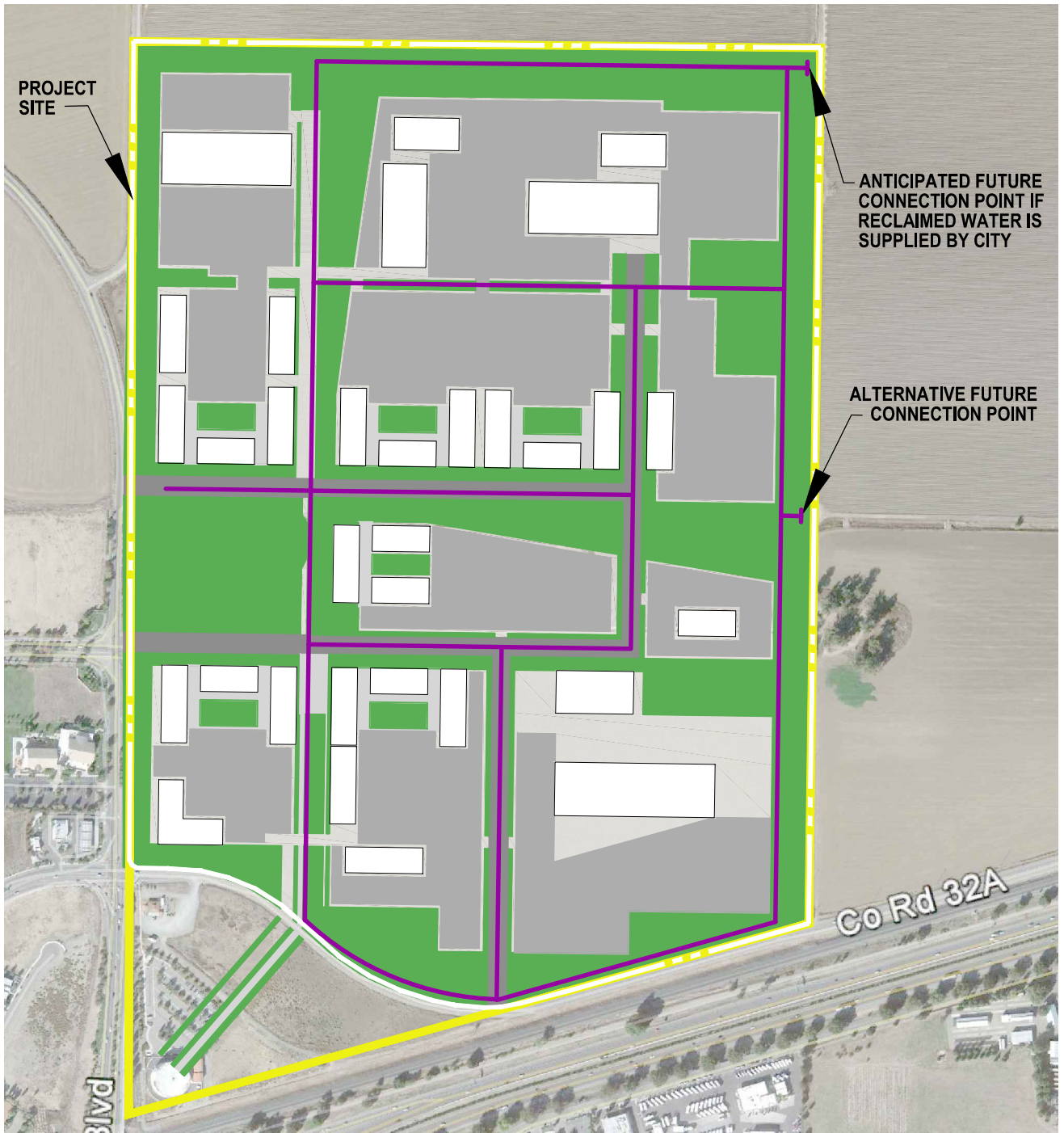
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**MACE RANCH INNOVATION CENTER
IRRIGATION WATER
FIGURE 2**

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(916) 455-2026 (530) 758-2026

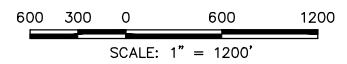
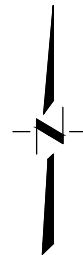


LEGEND

| | | | |
|---|----------------------|---|---------------------------|
|  | PROPOSED BUILDING |  | PROPOSED ROAD |
|  | PROPOSED PARKING |  | PROPOSED PAVED OPEN SPACE |
|  | PROPOSED GREEN SPACE | | |

NOTES:

1. SITE AERIAL IMAGERY TAKEN IN 2014 AND WAS ACQUIRED JUNE 10, 2014 FROM GOOGLE EARTH PRO.



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| DATE: | 12/10/14 |
| JOB No: | 1239.04 |

**MACE RANCH INNOVATION CENTER
POTENTIAL RECLAIMED WATER SUPPLY
FIGURE 3**

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FIGURE 4

**Mace Ranch Innovation Center
Preliminary Water Demands**

Prepared by Cunningham Engineering Corporation
11/20/14 Revised 12/12/14

| | Floor Area (SF) | Population Ratio (person/sf) | Sewered Population Employee (person) | Sewered Population Other (person) | Per Person ADD (gpd) | Total ADD (gpd) |
|--------------------------|--------------------|-------------------------------------|---|--|----------------------------|-------------------------------------|
| RD/Office | 1,510,000 | 0.0024 | 3,553 | | 15 | 53,294 |
| Manuf. | 884,000 | 0.0024 | 2,080 | | 15 | 31,200 |
| Hotel | 160,000 | | 50 | | 15 | 750 |
| Guest Rooms | | | | 150 | 44 | 6,600 |
| Convention | 50,000 | 0.0133 | | 667 | 15 | 10,000 |
| Retail | 100,000 | 0.0020 | 200 | | 15 | 3,000 |
| Sales | 80,000 | 0.0444 | | 3,556 | 2 | 7,111 |
| Café | 4,000 | 0.1000 | | 400 | 2 | 800 |
| Fitness | 16,000 | 0.0100 | | 160 | 44 | 7,040 |
| | 2,654,000 | | 5883 | 4932 | | 119,795 |
| | | | PD/AD= 1.0 | | | PH/AD= 1.8 |
| | | Avg day Demand (gpd) | | Peak Day Demand (gpd) | | Peak Hr Demand (gpm) |
| INSIDE USE TOTALS | | 119,795 | 83 | 119,795 | 83 | 150 |

| | Fire Flow (gpm) | Duration (hrs) |
|-------------------------|--|-------------------|
| Residential/hospitality | 3,500 | 3 |
| Industrial | 4,000 | 4 |
| | PEAK DAY PLUS 50% OF LARGEST FIRE FLOW (gpm) = 2,083 | |
| | PEAK DAY PLUS 100% OF LARGEST FIRE FLOW (gpm) = 4,083 | |

| Project Area (acres) | Percent Landscape (%) | Landscape Area (acres) | Peak day Application (in/day) | Peak day Application (gpd) | Irrigation Window (hrs/day) | Peak day Applic rate (gpm) | Assumed PH/PD= 2.0 | Peak Hr Applic rate (gpm) |
|----------------------------|-----------------------------|------------------------------|-------------------------------------|----------------------------------|-----------------------------------|----------------------------------|--------------------------|---------------------------------|
| 211 | 37% | 77.8 | 0.186 | 392,213 | 8 | 817 | | 1634 |

| | | |
|--|--|---|
| | Total Annual Use 74,906,333 GAL/YR | Maximum Applied Water Allowance 77,217,636 GAL/YR |
|--|--|---|

NOTES

- 1 Population Ratios for RD/Office and Retail obtained from BAE Urban Economics Report, dated December 2014. Ratios for other uses derived from California Uniform Building Code Occupancy Levels and City of Davis Standards. Convention center ratios have been reduced to 20% of maximum occupancy with the assumption that maximum capacity events do not occur on a daily basis. Retail uses assume occupancy at any given time is 50% of maximum occupancy. Retail sales occupancy is based on 1/60 persons per sqft at any given time with a population turnover of 8 per day. It is also assumed that costumers will occupy 1/3 of the total floor area with remaining area dedicated to product storage, display, and employee spaces. Retail Cafe use assumes 1/30 persons per sqft at any given time with a population turnover of 3 peak times per day. Retail fitness assumes 1/100 persons per sqft at any given time. No turnover factor has been applied, assuming only a fraction of users will be using facilities at the rate of 44 gpd.
- 2 For preliminary planning purposes, it is assumed that inside water use is equivalent to sewer use.
- 3 Per person ADD based on City standard sewer unit generation rates, with a 20% reduction applied for Hotel Guest Room and Retail-Fitness uses, based on the CALGreen building code requirements for low-flow interior plumbing fixtures.
- 4 Peaking factor for Peak Day domestic water use is assumed to be 1.0. Inside use is expected to remain substantially consistent year round.
- 5 Peaking factor for Peak Hour domestic water use is assumed to be 1.8 per City of Davis standards.
- 6 Irrigation water use based on historical local use in the month of July. Project assumes approximatly 30% high water use (0.35"/day), 30% medium water use (0.18"/day), and 40% low water use (0.06"/day) plantings for an average use of 0.186"/day or 5.57"/month.
- 7 "Hotel - Guest Rooms" space is estimated based on 150 rooms.
- 8 See attached Water Efficiency Calculations for annual use and maximum water allowance.

FIGURE 5

Mace Ranch Innovation Center
Preliminary Water Demands - PHASE 1

Prepared by Cunningham Engineering Corporation
 11/20/14 Revised 12/12/14

| Domestic Water Demand- PHASE 1 | | | | | | |
|---------------------------------------|-----------------|------------------------------|--------------------------------------|-----------------------------------|----------------------|-----------------|
| | Floor Area (SF) | Population Ratio (person/sf) | Sewered Population Employee (person) | Sewered Population Other (person) | Per Person ADD (gpd) | Total ADD (gpd) |
| RD/Office | 40,000 | 0.0024 | 94 | | 15 | 1,412 |
| Manuf. | 460,000 | 0.0024 | 1,082 | | 15 | 16,235 |
| Retail | 100,000 | 0.0020 | 200 | | 15 | 3,000 |
| Sales | 80,000 | 0.0444 | | 3,556 | 2 | 7,111 |
| Café | 4,000 | 0.1000 | | 400 | 2 | 800 |
| Fitness | 16,000 | 0.0100 | | 160 | 44 | 7,040 |
| | 600,000 | | 1376 | 4116 | | 35,598 |
| | | | | PD/AD= | | PH/AD= |
| | | | | 1.0 | | 1.8 |
| | | Avg Day Demand (gpd) | Peak Day Demand (gpd) | Peak Hr Demand (gpm) | | |
| INSIDE USE TOTALS | 35,598 | 25 | 35,598 | 25 | 44 | |

| Fire Flows - PHASE 1 | | |
|-----------------------------|--|----------------|
| | Fire Flow (gpm) | Duration (hrs) |
| Residential/hospitality | 3,500 | 3 |
| Industrial | 4,000 | 4 |
| | PEAK DAY PLUS 50% OF LARGEST FIRE FLOW (gpm) = 2,025 | |
| | PEAK DAY PLUS 100% OF LARGEST FIRE FLOW (gpm) = 4,025 | |

| Irrigation- Peak Hour - PHASE 1 | | | | | | | | |
|--|-----------------------|------------------------|-------------------------------|----------------------------|-----------------------------|----------------------------|----------------|---------------------------|
| Project Area (acres) | Percent Landscape (%) | Landscape Area (acres) | Peak day Application (in/day) | Peak day Application (gpd) | Irrigation Window (hrs/day) | Peak day Applic rate (gpm) | Assumed PH/PD= | Peak Hr Applic rate (gpm) |
| 40.9 | 31% | 12.6 | 0.186 | 63,520 | 8 | 132 | 2.0 | 265 |

| Irrigation - Annual Use - PHASE 1 | |
|--|---------------------------------|
| Total Annual Use | Maximum Applied Water Allowance |
| 12,131,374 GAL/YR | 12,505,684 GAL/YR |

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- 7 "Hotel - Guest Rooms" space is estimated based on 150 rooms.
- 8 See attached Water Efficiency Calculations for annual use and maximum water allowance.