This technical memorandum is a draft working document. It is undergoing agency review and is intended for discussion purposes. The proposed approach and findings have not been endorsed by any agency on the "20X2020 Team". It is expected that the information will be updated as the work progresses. The content of this and other technical memoranda will be used in the preparation of an overall report, and a draft of the overall report will be shared with the public. Please submit comments on this draft technical memorandum by September 22, 2008 to 2020comments@ccp.csus.edu

Public Draft Technical Memorandum

Task 2 – Determining Conservation Targets

September 5, 2008

This Technical Memorandum (TM) presents the interim and final conservation targets for achieving a 20 percent statewide per capita urban water use reduction by year 2020. This TM also discusses the applicability of the targets to each of the 10 hydrologic regions based on their specific demographic and economical structures.

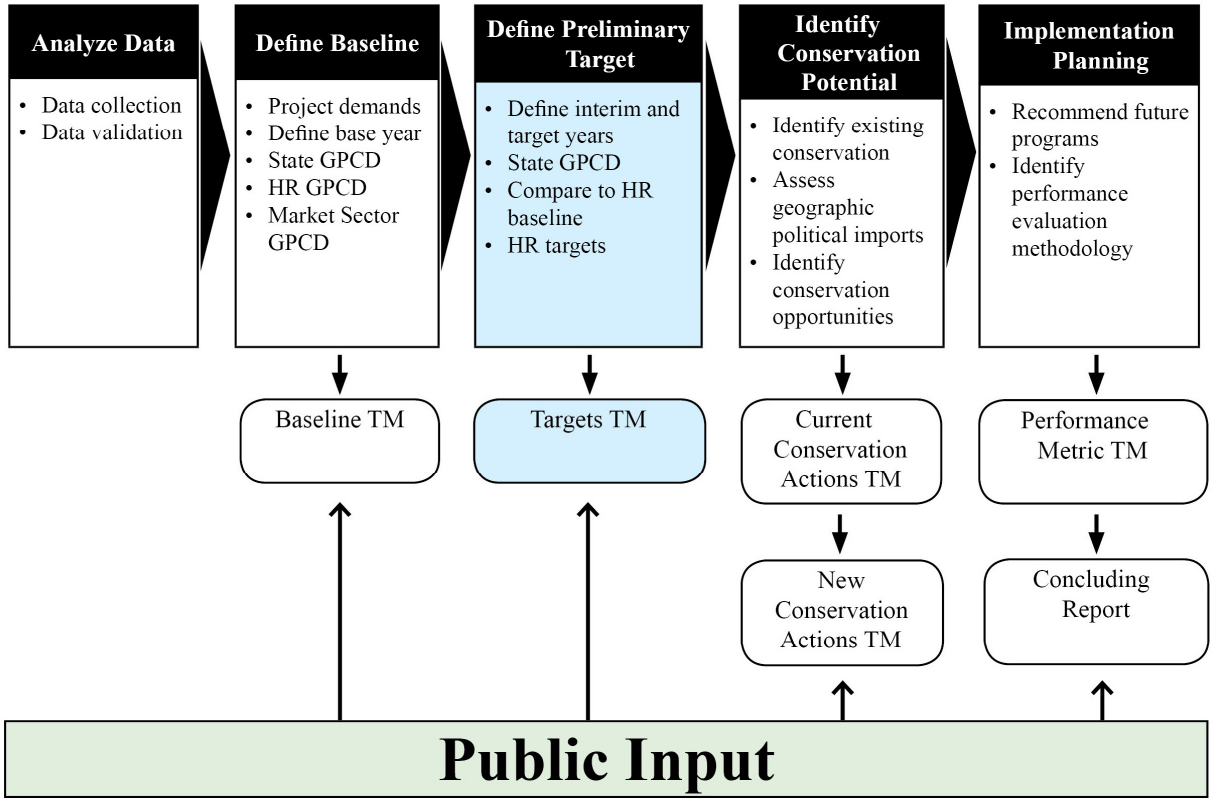
This TM is organized into the following sections:

1 Introduction

On February 28, 2008, Governor Schwarzenegger introduced a seven-part comprehensive plan for improving the Sacramento-San Joaquin Delta. As part of the plan, the Governor directed state agencies to prepare and implement a program to achieve a 20 percent reduction in statewide average per capita water use by year 2020 (20x2020 Program or Program). Several state agencies involved in water planning and management have joined together to form an agency team (20x2020 Team) to direct the development and implementation of the 20x2020 Program. The 20x2020 Team consists of five state agencies: Department of Water Resources (DWR), State Water Resources Control Board (SWRCB), California Energy Commission (CEC), Department of Public Health (DPH), and California Public Utilities Commission (CPUC). The US Bureau of Reclamation (USBR), a federal agency, is also participating on the team.

The 20x2020 Program is compatible with and further supports other California statewide water planning efforts such as the Delta Vision and the California Water Plan Update (Bulletin 160). These programs share the common goals of identifying and implementing strategies for sustainably managing the valuable water resources of California to support both its environmental and economic functions. Demand management and water conservation have been identified as priorities in each of these separate efforts. Legislative, regulatory and administrative agencies at the federal, state, regional and local levels are now focusing more actively on water conservation in a primary position for responding to California's current climate conditions and challenges for future water supply.

Figure 1-1: 20x2020 Program Development Process



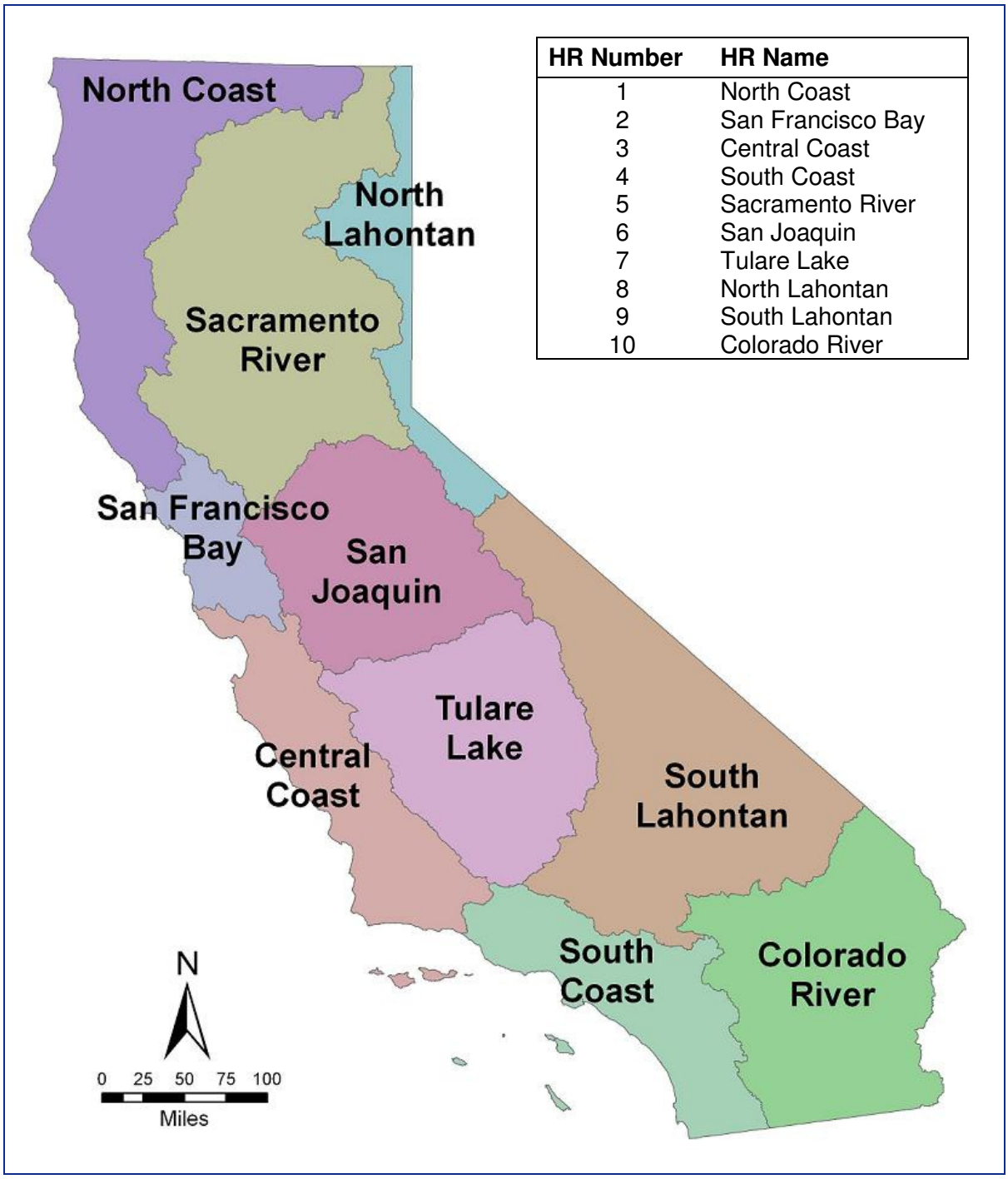
2 Program Scope and Scale

The scope and scale for determining the Program's conservation targets are consistent with the scope and scale developed for the baseline and presented in the Baseline TM. The conservation targets presented in this Targets TM are determined for a statewide average per capita reduction in **urban** water use, and then translated into **regional** levels in accordance with the 10 hydrologic regions (HRs) defined by DWR (Figure 2-1).

The results presented in this TM should be considered **preliminary**. The targets proposed in this TM were calculated from the baseline results, which were developed based on the 1995-2005 water use data of the DWR Public Water Systems Survey (PWSS) database. Section 4 of this TM discusses the general urban water use pattern of the 10 regions relative to their conservation targets and each region's potential to achieve the targets in light of existing conditions. The conservation targets proposed herein should be used solely for planning purposes and are not intended to support regulatory decisions.

The proposed regional targets may not translate well into targets for individual water suppliers. It is understood that water use patterns among individual suppliers within the same region may vary substantially. Local water suppliers should attempt to refine the data to fit the local setting. The methodology developed for this regional analysis should be combined with local data to obtain the most accurate estimates of quantifiable conservation potential. It is assumed that developing reasonable regional and local targets will require an iterative and dynamic process, of which the preliminary analysis and targets provided in this TM are merely a first step.

Figure 2-1 California Hydrologic Regions (HR)



HR Number	HR Name
1	North Coast
2	San Francisco Bay
3	Central Coast
4	South Coast
5	Sacramento River
6	San Joaquin
7	Tulare Lake
8	North Lahontan
9	South Lahontan
10	Colorado River

3 Methodology of Determining Conservation Targets

Conservation targets were determined by translating the overall statewide reduction target into 10 individual targets for each HR. This section details the step-by-step methodology used to determine those targets.

Establishing Interim Year and Final Year

The Governor has defined Year 2020 as the final year for the State to achieve a 20 percent reduction in statewide average per capita water use. In order for the 20x2020 Team and individual water suppliers to assess the progress of achieving the Governor's goal, Year 2015 was defined to be the interim year for this Program. Year 2015 was selected because it allows enough time (seven years, from 2008 to 2015) for water suppliers to start incorporating conservation targets and associated water use reduction programs into local planning efforts. There is also some time afterwards (five years, from 2015 to 2020) for suppliers to evaluate program effectiveness and adjust their approach if necessary.

Establishing a Statewide Interim Target and Final Target

The conservation targets for the interim year (2015) and the final year (2020) are not linear interpolations between the baseline and the final goal. An introductory conservation target of 10 percent reduction from the baseline was proposed to allow time for water entities to incorporate the Program goals into their planning activities. A conservation target of 20 percent reduction from the baseline was defined for Year 2020, by which time all entities are expected to have implemented the conservation programs necessary to achieve their assigned conservation targets.

The statewide baseline water use value, expressed in gallons per capita per day (GPCD)), is **192 GPCD**[1]. The corresponding statewide targets are:

- Interim Statewide Target = 192 GPCD – 10% = **173 GPCD**
- Final Statewide Target = 192 GPCD – 20% = **154 GPCD**

Determining Regional Conservation Targets

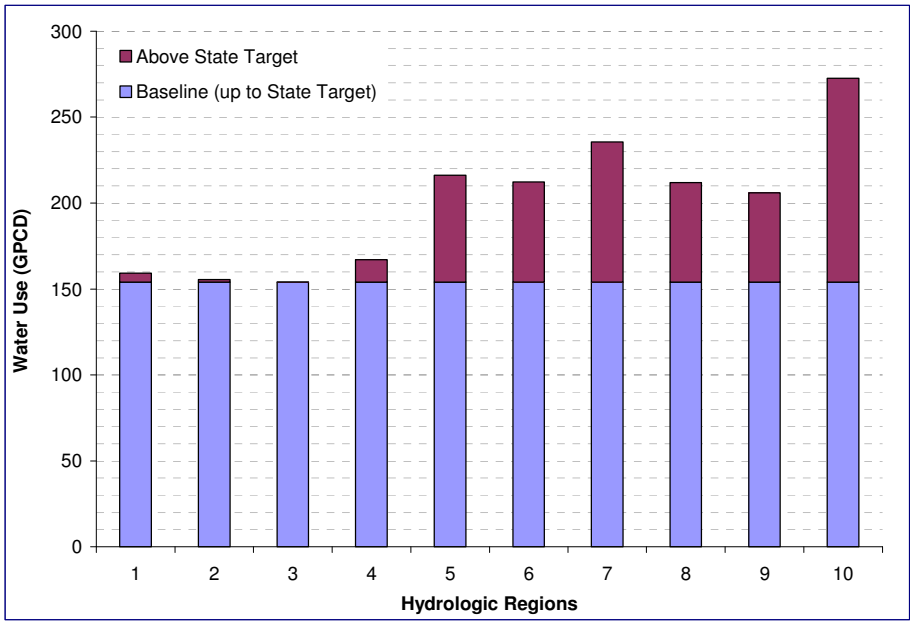
The interim year (2015) and final year (2020) conservation targets were defined for the State as a whole, and then adjusted for each region based on the regional baseline values provided in the Baseline TM. The baseline values, having been calculated using validated water use data from water suppliers of each region, already reflect some level of variation in evapotranspiration (ET) and conservation program implementation between regions. For example, the San Francisco Bay and the Central Coast HRs (which are both located along the Pacific coast, have relatively low ET rates, and well-established conservation histories) demonstrate much lower baseline values than inland regions such as the Tulare Lake and South Lahontan. Figure 3-1 summarizes the baseline GPCD values for each region and illustrates the amount that they are above the statewide target of 154 GPCD.

The differences in regional per capita values illustrated in Figure 3-1 demonstrate an equity issue that arises if the 20 percent reduction is applied across the state. Many water suppliers are already below the statewide target of 154 GPCD. In effect they have met the goal, before the program starts. In addition, a water supplier with per capita consumption of 100 GPCD reduced to 80 GPCD is supplying a fraction of the water to each customer compared to a water supplier which starts at 250 GPCD, and reduces by 50 GPCD. In order to balance these issues, and achieve conservation from every Region in the state, the "balancing" approach recognizes those who are already below the 154 GPCD target by expecting them to maintain this level of consumption. All water suppliers within Regions 1 through 4 would be expected to reduce to a maximum of 154 GPCD resulting in Regional GPCD value or lower. Figure 3-2 below

[1] Baseline TM, section 4.1.

illustrates the eventual results of this reduction. Since the water suppliers in Regions 1 through 4 have then reduced overall GPCD to below 154, Regions 5 through 10 would be able to decrease the severity of the reductions required to more realistic and achievable targets. Regions 5 through 10 would still need to reduce by more than 20 percent, but with a more achievable target than the statewide 154 GPCD. It should be emphasized that although regions with baseline values significantly above the 154 GPCD level are expected to conserve more, ***all*** regions are responsible for contributing some level of water conservation in order to help the State achieve the target of 154 GPCD. Together, Regions 1 through 10 would be able to contribute for the state as a whole to meet the 20 percent reduction target.

Figure 3-1: Regional Baseline GPCD above 2020 Statewide Final Target



HR	HR Name
1	North Coast
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4	South Coast
5	Sacramento River
6	San Joaquin
7	Tulare Lake
8	North Lahontan
9	South Lahontan
10	Colorado River

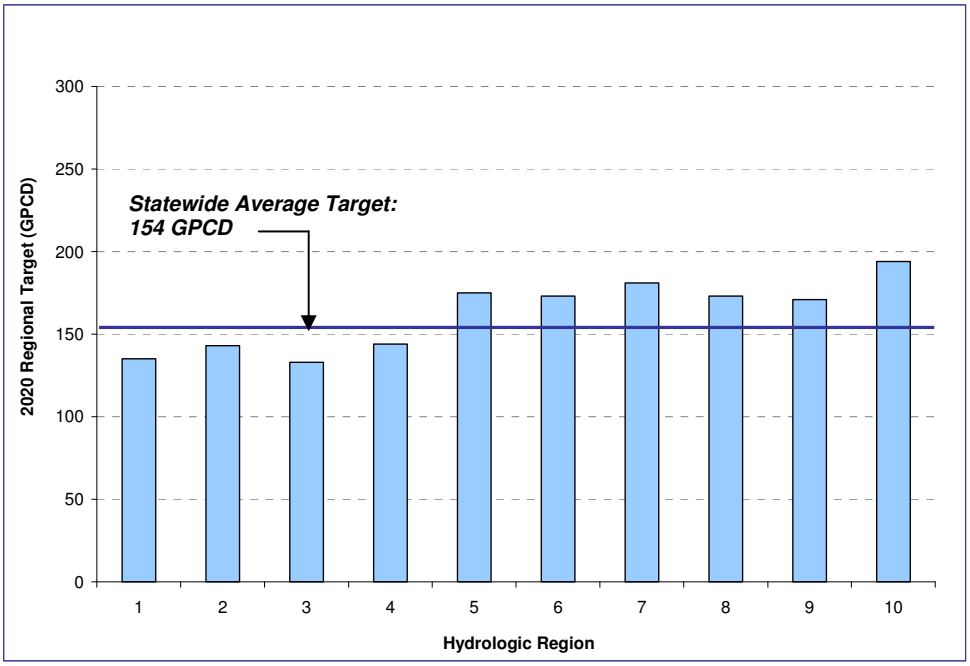
As shown in Figure 3-1, Regions 5 through 10 demonstrate a higher state GPCD exceedance than the other regions. One of the main drivers for such high values is the higher ET rates in these regions. In order to determine a reasonable conservation target for Regions 5 through 10 without overburdening Regions 1 through 4, a balanced target was assigned.

Using the regions' baseline values as guidance, it is expected that water suppliers within Regions 1 through 4 would be able to maintain or further reduce their water use to below 154 GPCD by year 2020. Under this expectation, these regions would be able to achieve a regional target GPCD at lower than the statewide GPCD levels. This amount of projected savings achieved by Regions 1 through 4 can be distributed among Regions 5 through 10 (again, using the regions' baseline values as guidance) to decrease the severity of the reductions required to more realistic and achievable targets. Table 3-1 and Figure 3-2 summarizes the proposed targets for each region. A detailed step-by-step explanation of this process is included in Appendix A.

Table 3-1: Proposed Regional GPCD for Regions 1 through 10

Hydrologic Region	1	2	3	4	5	6	7	8	9	10
Baseline GPCD	165	157	154	180	253	248	285	243	237	346
Target GPCD	135	143	133	144	175	173	181	173	171	194
Reduction (%)	18%	9%	14%	20%	42%	38%	47%	39%	36%	57%

Figure 3-2: Proposed Regional GPCD Balanced Targets



HR	HR Name
1	North Coast
2	San Francisco Bay
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5	Sacramento River
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10	Colorado River

Geographic and Socioeconomic Factors

The methodology of determining conservation targets should, ideally, also incorporate geographic and socioeconomic factors of a region that may have an impact on water demand and conservation potential. However, in the absence of quantifiable data, the impacts of these factors are acknowledged below but are excluded from the calculation of the targets at this time. To this end, it is recognized that the targets do not necessarily reflect the complex water use patterns defined by the demographic and economic compositions of each region.

- **Climate.** Inland valleys which possess a relatively warm and dry climate inherit a higher ET rate than those of coastal areas with mostly foggy and cool climates. A high ET rate usually leads to higher irrigation demand, but the conservation potential impacted by climate is usually complicated by other factors:
    - The conservation status of a region with high ET can affect how much more conservation can be achieved. Regions with high ET rates reveal great conservation potential for outdoor savings with Best Management Practices (BMPs) such as water-smart plants and drip irrigation systems.
    - Land-use patterns also determine how feasible conservation is in regions with high ET rates. Irrigation demand usually depends on two factors: what plants are grown and how

they are irrigated. Modifications to irrigation systems and plant selections could be more difficult in established urban areas than in new developments, and so growth could sometimes help increase conservation potential on a per capita basis. However, some water suppliers have also reported that new developments are actually using more water than established neighborhoods due to plant selection (turf) and other water features.

- **Climate Change.** It is expected that some areas may experience increased rainfall while others experience extended dry periods due to climate change. These may induce changes in water use patterns and user behavior. But because climate change impacts will develop gradually, it is unlikely that is will impose a significant impact by year 2020.
- **Urban Densities**. The combination of high ET rates and low urban density often reveals significant opportunities for urban water savings. For example, single family houses and CII buildings in areas with low urban densities tend to have larger landscapes and lawns which use more water than smaller landscapes in areas with higher urban densities. Areas with more single family users, coupled with high ET rates, present a significant opportunity for water savings through residential outdoor use BMPs.
- **Growth Trends.** Research and studies conducted in the past have not specifically justified the relationship between projected population growth and projected GPCD values. Because GPCD is a function of population itself, it is proposed to assume that GPCD is relatively insensitive to changes in population, while likely to react more closely to changes in other demographic and socioeconomic factors. It should be recognized, however, that growth trends can affect penetration estimates for plumbing codes and the applicability of other BMPs that are oriented to retrofits and new developments. Areas of new growth present greater opportunity to incorporate new technology or water conservation devices (that will decrease per capita use) than do older, established urban areas. However, as previously stated, some water suppliers have also reported that new developments are actually using more water than established neighborhoods due to plant selection (turf) and other water features.
- **Water Use Market Sectors**. Each region has a unique mix of water-use market sectors. The amount of water use and the conservation potential of each sector can vary significantly. For example, SFR outdoor irrigation demand can be more easily reduced with simple BMPs, whereas unreported water (URW) use due to aged system pipelines is sometimes more challenging to reduce due to limited labor and financial resources of many water entities. There are also major regional differences in the proportion of use in the commercial and industrial market sectors, and these sectors may have a significant influence on the ability of a region to meet the targets. For example, if a region supplies a large percentage of their water to a small number of industrial users that can use recycled water in lieu of potable supplies, there is an opportunity for further fresh water demand reductions. These sectors also represent a great uncertainty in estimating the conservation potential of a region.
- **Status of BMP Implementation**. Regions with lower BMP implementation status may have larger conservation potential than regions with better status. Regions that have implemented conservation savings measures that go beyond current BMPs may have already lowered their GPCD values since the Base Year, and further reductions may be more challenging. Likewise, some of the more innovative conservation measures and technologies which have been identified may be more applicable in one region than another.
- **Socioeconomic Factors**. Socioeconomic factors may also influence water use within a region. For example, more affluent communities may be less influenced by conservation tiered water rates, while economically disadvantaged communities may not be able to afford to implement certain conservation measures.

4 Results

Interim and final GPCD targets have been calculated for each of the 10 hydrologic regions, followed by a brief discussion of the demographics and socioeconomics of the region that may impact its potential in achieving the targets.

4.1 Statewide Summary

The statewide baseline GPCD value is **192** GPCD. The corresponding statewide targets are:

- Interim Statewide Target = $192\ \text{GPCD} \times 90\% = 173\ \text{GPCD}$
- Final Statewide Target = $192\ \text{GPCD} \times 80\% = 154\ \text{GPCD}$

For regions that have a baseline GPCD value already below the final target of 154 GPCD, the interim and final GPCD targets remain at 154 GPCD for the region and each individual utility, with the interim target calculated to be the average between the baseline and the final target values. For regions which have a baseline GPCD value above the final targets, the final target is determined by the balancing adjustment described in Section 3, with the interim target calculated to be the average between the baseline and the final target values.

Table 4-1 summarizes the interim and final targets for each region. If the targets shown in Table 4-1 for each region are reached, then the state target will be met. As the targets are modified and refined as a part of this iterative process, there will need to be repeated checks to ensure that the changes to individual regional targets will still combine to meet the overall interim and final state targets of 173 GPCD and 154 GPCD, respectively.

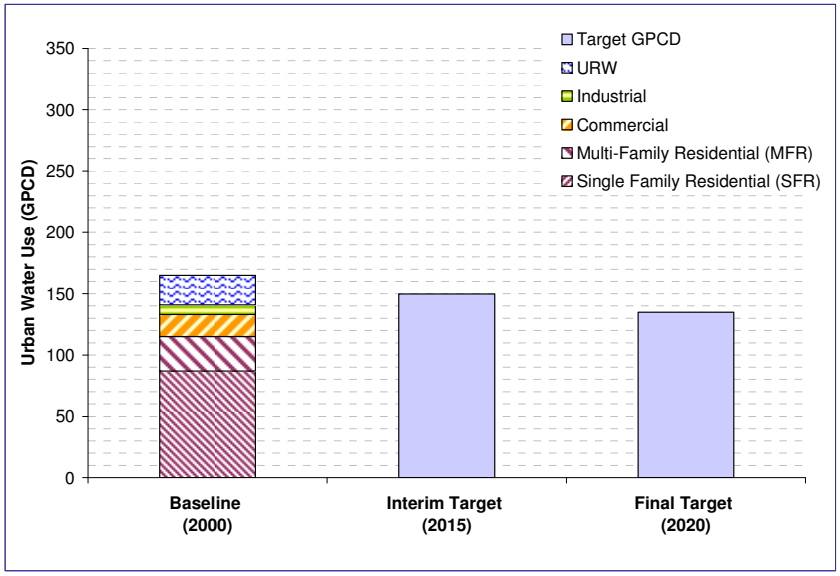
Table 4-1: Regional Interim and Final Conservation Targets

Hydrologic Region	1	2	3	4	5	6	7	8	9	10
Current GPCD from baseline database	165	157	154	180	253	248	285	248	237	346
Feasible Interim (2015) Target	159	156	154	167	216	212	236	212	206	273
Feasible Final (2020) target	135	143	133	144	175	174	182	173	172	195

4.2 North Coast Hydrologic Region (Region 1)

The North Coast Region (Region 1) is one of the least urbanized regions in California with more than 98 percent of the land covered by forests and rangelands, and only the remaining 2 percent dedicated to agriculture and urban use. The majority of the region's approximately 640,000 people live within an urban corridor along the Russian River Valley. About 2 percent of the total land area in the region is irrigated. The area is also home to some water-intensive industries such as paper mills. Figure 4-1 summarizes the baseline, interim target, and final target GPCD values of this region.

Figure 4-1: Region 1 Urban Water Conservation Targets



With a baseline urban water use value of 165 GPCD, the region is currently using water at rates lower than the statewide interim target and is just slightly above the final target. It is feasible for the region to further reduce its urban water use to meet the final target of **135 GPCD** by 2020.

Geographic and Socioeconomic Variables

The population of the region is expected to increase to approximately 730,000 by 2015 and to 760,000 by 2020. It is expected that the majority of the growth will occur in the Russian River Valley due to its proximity to the San Francisco Bay metropolitan area. Land previously dedicated to orchard crops in the area will also continue a current trend of conversion to more urban or rural-residential land uses as well as higher water using crops and vineyards. As such, water use activities in the residential sector are expected to increase slightly. Many of the rural areas to the north are sparsely populated and therefore resource limited. These areas may have some difficulty in affording typical conservation device programs for both agencies providing rebates and customers purchasing devices.

While the region has the lowest ET range in the state, there is still a need for summertime irrigation. Since the area receives relatively minimal winter snow, snowpack supplies are unavailable and supplies are highly seasonable. The maintenance of environmental flows for both recreational and fishery industries is critical and is also providing flow requirements that can only be met through reducing freshwater flow consumption.

Feasibility of Achieving the Targets

Because of the increasing demands placed upon increasingly limited supplies available for urban use, the region has experienced significant water shortage issues. Many water suppliers in this region have implemented major conservation programs in light of potential shortages due to drought, low supply reservoir levels, and system capacity constraints. As a result, there would be a lower level of BMP-related conservation reductions that could occur on top of what is already being implemented on an ongoing basis. Other regions in the area have such low populations that any reduction in water use would provide little impact on meeting a statewide target.

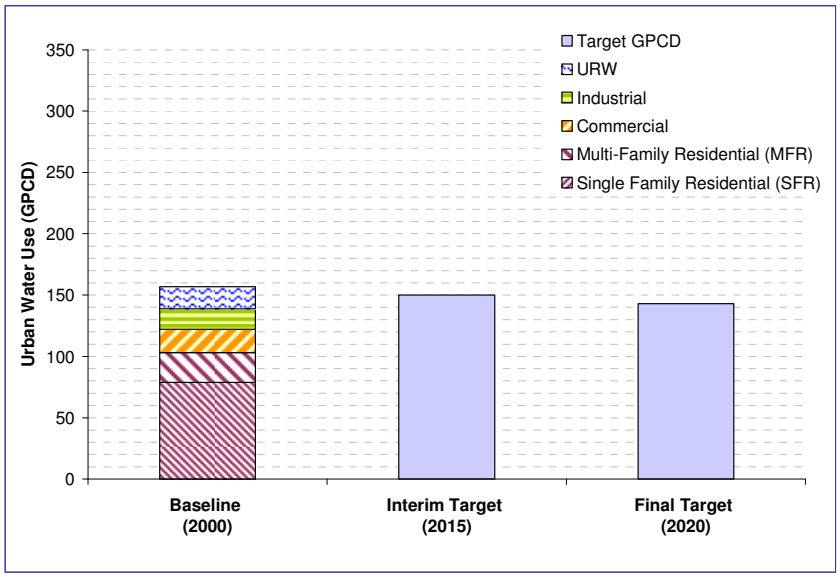
Given water quality driven wastewater treatment plant discharge permit limitations, the treatment of wastewater effluent to Title 22 tertiary standards is increasing which will result in larger supplies of non-potable local supplies to offset fresh water demand in the region. As the population and density of certain areas in the region increase, the unit cost of recycled water supplies will decrease as well, making recycled water projects more cost-effective to implement.

It is anticipated that conservation measures will become increasingly important to solve anticipated water shortfalls within the region. This coupled with increased pressures and/or incentives to export for use in areas such as the Bay Area and the Central Valley will motivate even further reductions in GPCD water use of this region. This region demonstrates a very high potential in achieving the regional target of 135 GPCD by 2020.

4.3 San Francisco Bay Hydrologic Region (Region 2)

The San Francisco Bay Hydrologic Region (Region 2) is a highly urbanized region and is expected to continue to grow in population and expand in economic activities. Most water suppliers of this region have already established a long history of water conservation activities and have achieved significant water savings. Figure 4-2 summarizes the baseline, interim target, and final target GPCD values of this region.

Figure 4-2: Region 2 Urban Water Conservation Targets



With a baseline urban water use value of 157 GPCD, the region is currently using water at rates lower than the statewide interim target and is at the margin of meeting the final target. It is feasible for the region to meet the final target of **143 GPCD** by 2020.

Geographic and Socioeconomic Variables

Region 2 is expected to experience a continuous steady population growth, possibly reaching more than 7 million people by Year 2020. Urban density is likely to increase in metropolitan areas such as San Francisco, Oakland, and San Jose. Because these areas are already highly urbanized, it is likely that the population growth will predominantly expand the water use activities of multi-family residential (MFR) and institutional (such as universities and hospitals) sectors.

The potential change in the water use GPCD value as a result of this is unlikely to be significant compared to a change in other water use sectors, such as SFR outdoor water use. It appears that Region 2 could feasibly maintain and further reduce its water use to below 154 GPCD.

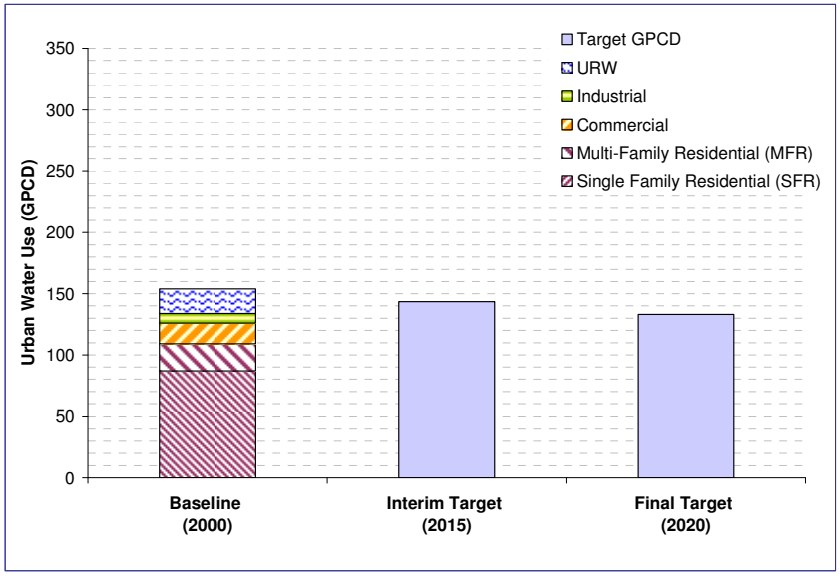
Feasibility of Achieving the Targets

Coastal areas such as San Francisco and San Mateo counties would be more successful in achieving water conservation targets by reducing water use of their commercial and industrial sectors. Inland valleys would find it easier to achieve their water conservation targets through irrigation conservation programs reducing both residential and landscape irrigation. Further conservation achievable through new BMP measures such as dual-flush toilet replacement incentive program and dual-plumbing homes will be evaluated in later tasks (Tasks 4 and 5: Conservation Savings through Current and New Actions) of this Program.

4.4 Central Coast Hydrologic Region (Region 3)

Region 3 covers approximately 7.25 million acres of land and is home to 1.5 million people (four percent of the total California population). According to the California Water Plan Update 2005, per capita urban water use in many parts of this region remains at or below urban usage levels from the late 1980s. This low GPCD value is partially attributed by the aggressive use of water conservation programs and mandatory water use reductions during the multi-year droughts from 1987 through 1992. Figure 4-3 summarizes the baseline, interim target, and final target GPCD values of this region.

Figure 4-3: Region 3 Urban Water Conservation Targets



With a baseline urban water use value of 154 GPCD, the region is already meeting the final target. The potential of this region to maintain its baseline GPCD and possibly reduce it further to meet the final target of **133 GPCD** by 2020 is evaluated based on the following variables.

Geographic and Socioeconomic Variables

Population projection by the Department of Finance reveals that this region is expected to add another 220,000 people by 2020. As a result of the population growth and the trend of urban density of this region, there is potential for expanded water use activities in single family residential and CII sectors, both of which are likely to noticeably increase the GPCD value for the region.

Feasibility of Achieving the Targets

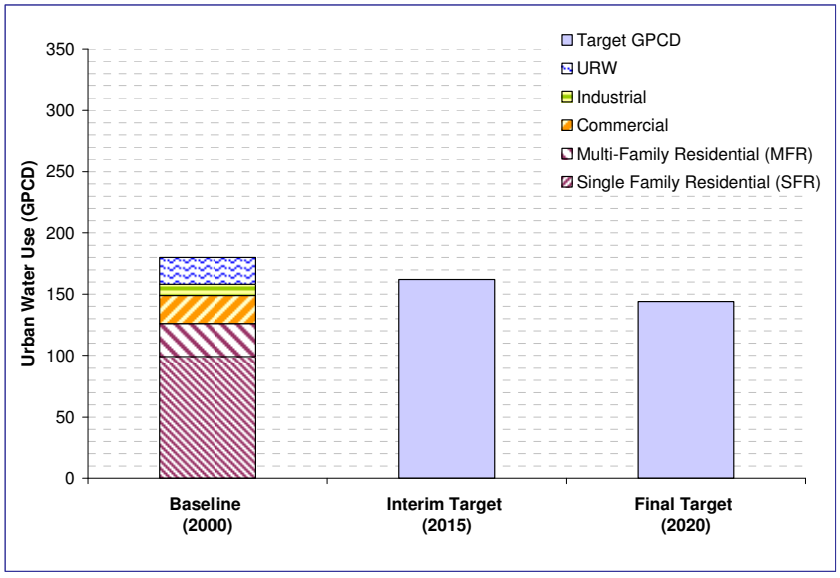
Because the region is already meeting the statewide target, it is encouraged to maintain its ongoing conservation efforts and continue to seek opportunities to further reduce GPCD values whenever feasible. It is acknowledged that this region is challenged by its dependence on groundwater and continues to look at alternative sources in conjunction with its aggressive water conservation programs. It is possible that more recycled water would be used in this region to offset potable water use for irrigation and construction activities, thus offsetting the potential GPCD increase due to population growth or even further reducing the GPCD value for this region below the final conservation target.

4.5 South Coast Hydrologic Region (Region 4)

The South Coast Hydrologic Region (Region 4) has a population totaling over 18.2 million people (2000 census). The fastest growing portion of the region is that known as the Inland Empire, which includes the inland valleys of Riverside and San Bernardino counties. The region contains seven of the state's fastest-growing metropolitan areas. The city of Los Angeles is the state's biggest city. Its population grew from 3,486,000 in 1990, to 3,645,000 in 2000. In 2000, the city of San Diego was America's seventh largest city, and California's second largest, with 1,223,000 people.

Figure 4-4 summarizes the baseline, interim target, and final target GPCD values of this region.

Figure 4-4: Region 4 Urban Water Conservation Targets



With a baseline urban water use value of 180 GPCD, the region appears to be in a good position to meet the interim target of 174 GPCD and will need to continue to implement aggressive conservation measures to meet the final target of **144 GPCD**. Additional information on the region's ability to reduce its baseline GPCD to meet the 2015 and 2020 targets is discussed below.

Geographic and Socioeconomic Variables

Since 2000, the population of the region has continued to grow at a steady rate. In 2015, the region's population is projected to exceed 21.5 million, and in 2020, it is projected to exceed 22.5 million. The areas of growth will continue to be outward and away from the major urban centers into previously undeveloped areas. New construction in those areas will benefit from past plumbing code changes and the use of water efficient landscape to achieve lower GPCD totals. Most water suppliers in the region are signatories to the BMPs and have achieved a high level of BMP implementation. In addition, implementation of measures that go beyond the BMPs are common throughout the region and are reflected in the GPCD for the region.

Feasibility of Achieving the Targets

Looking to the future, a significant portion of the region's savings potential is from outdoor water savings and commercial, industrial, and institutional water savings. The outdoor water savings can be achieved through the installation of water efficient landscape and improved irrigation practices. Inland communities in zones with higher ETs offer more savings potential from water efficient landscape and

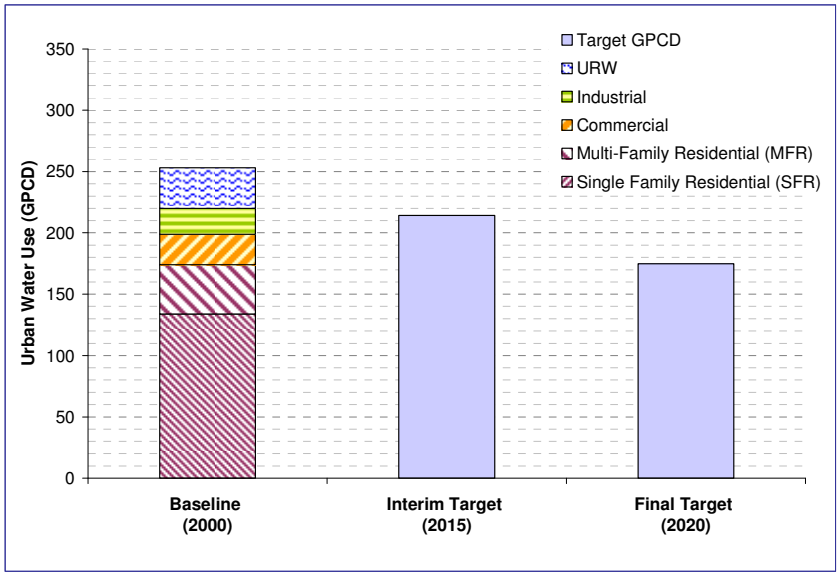
improved irrigation practices than coastal communities in zones with lower ETs and less landscaped area. Commercial, industrial, and institutional water savings are possible through process improvements and hardware retrofits. Plumbing code changes, tiered rate structures, and programs to reduce unaccounted for water losses could also generate significant water savings in the region. With a baseline level of 180 GPCD, the region is in a good position to meet the 2015 target of 167 GPCD. The challenge will be to meet the 2020 target of 144 GPCD without aggressive outdoor conservation programs given the higher ET rates in this region.

4.6 Sacramento River Hydrologic Region (Region 5)

The Sacramento River Hydrologic Region (Region 5) is composed of predominantly rural counties in the north coupled with rapidly growing urban areas in the south. While a few of the larger cities in the region divert most of their water from the larger rivers, the principal source of water for most of the communities is groundwater. Many water suppliers in this region have just recently begun the installation of water meters for their residential customers. Because of the combination of lack of information regarding water use, low water rates, and the perception of ample water supplies, this region has not been as aggressive in adopting water use efficiency programs as other areas of the state.

Figure 4-5 summarizes the baseline, interim target, and final target GPCD values of this region.

Figure 4-5: Region 5 Urban Water Conservation Targets



With a baseline urban water use value of 253 GPCD, the region faces significant challenges in meeting the interim target of 206 GPCD and the final target of **175** GPCD. The potential of this region to meet the targets is evaluated and discussed below.

Geographic and Socioeconomic Variables

The Sacramento River Region's population totaled more than 2.5 million people in 2000. The fastest-growing portion of the region is in the south, including Sacramento, Placer, El Dorado, and Yolo counties. Since 2000, the population of the region has grown at a rapid rate. In 2015, the region's population is projected to exceed 3.3 million people; and in 2020, it is projected to exceed 3.6 million.

Feasibility of Achieving the Targets

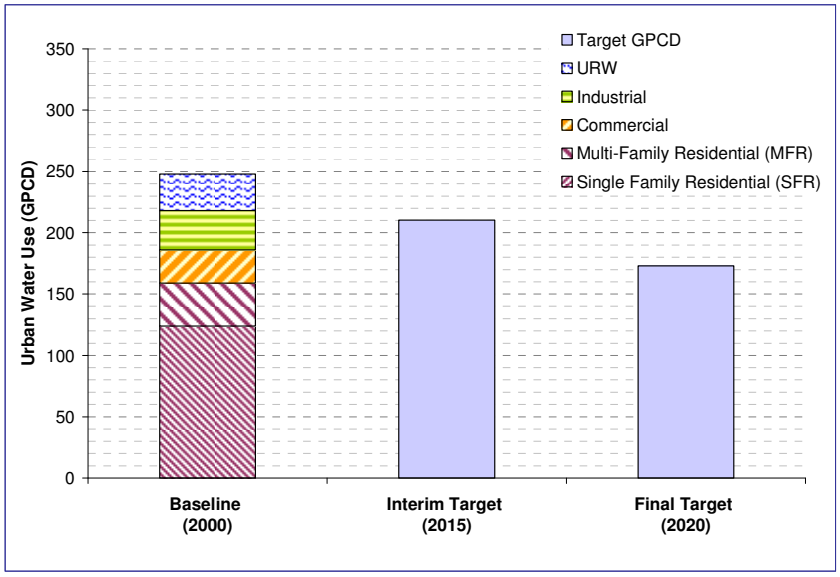
Achieving the 2020 target would be an enormous task in this region. The expedited installation of meters and establishing water conserving rate structures would go a long way toward meeting the target. Increased landscape water conservation efforts (through improved irrigation efficiency, limiting irrigated area, selecting low water using plants in new developments, etc.) in this region where ET values are high and lots are generally large would also contribute substantially toward meeting the target. However, the cost effectiveness of these measures may not justify implementation at existing water rates in the region.

4.7 San Joaquin River Hydrologic Region (Region 6)

The San Joaquin River Hydrologic Region (Region 6) is one of the most quickly growing regions of the state. Agricultural land in the valley floor areas is being challenged by rapidly growing urban areas. Public lands account for one-third of the region's total land area. Urban water use accounts for less than five percent of the total applied water in the region.

Figure 4-6 summarizes the baseline, interim target, and final target GPCD values of this region.

Figure 4-6: Region 6 Urban Water Conservation Targets



With a baseline urban water use value of 248 GPCD, the region faces significant challenges in meeting the interim target of 209 GPCD and the final target of **174 GPCD**. The potential of this region to meet the targets is evaluated and discussed below.

Geographic and Socioeconomic Variables

The San Joaquin River Region's population totaled 1.7 million people in 2000. The fastest-growing portion of the region is in the counties of San Joaquin, Stanislaus, Merced, Contra Costa, and Madera. Spill-over growth is occurring as people move from the Bay Area to more affordable communities in the Central Valley. Since 2000, the population of the region has continued to grow at a rapid rate. In 2015, the region's population is projected to exceed 2.5 million people; and in 2020, it is projected to exceed 2.7 million.

Feasibility of Achieving the Targets

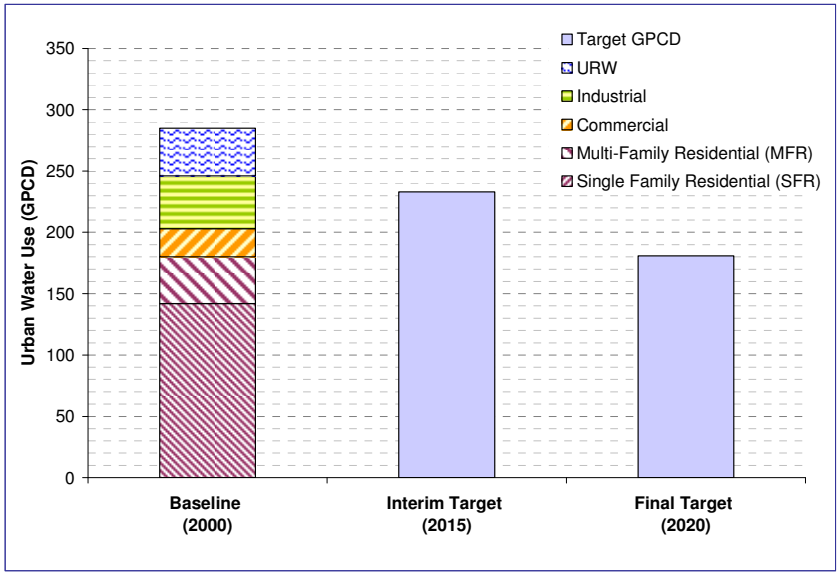
Achieving the 2020 target would be challenging in this region. The expedited installation of meters and establishing water conserving rate structures would go a long way toward meeting the target. Increased landscape water conservation efforts (through improved irrigation efficiency, limiting irrigated area, selecting low water using plants in new developments, etc.) in this region where ET values are high and lots are generally large would also contribute substantially toward meeting the target. However, the cost effectiveness of these measures may not justify implementation at existing water rates in the region.

4.8 Tulare Lake Hydrologic Region (Region 7)

The Tulare Lake Hydrologic Region (Region 7) is an important agricultural area with a high population growth rate. Urban water use accounts for less than five percent of the total applied water in the region. The four main rivers that flow out of the Sierra Nevada provide most of the surface water to the region. Groundwater has also been an important source for both urban and agricultural uses, accounting for 33 percent of the region's total annual supply.

Figure 4-7 summarizes the baseline, interim target, and final target GPCD values of this region.

Figure 4-7: Region 7 Urban Water Conservation Targets



With a baseline urban water use value of 285 GPCD, the region faces significant challenges in meeting the interim target of 229 GPCD and the final target of **182 GPCD**. The potential of this region to meet the targets is evaluated and discussed below.

Geographic and Socioeconomic Variables

The Tulare Lake Region's population totaled more than 1.8 million people in 2000. The fastest-growing portion of the region is in the larger urban areas of Fresno, Clovis, Visalia, and Bakersfield. Since 2000, the population of the region has continued to grow. Additional growth is occurring as people move from the Los Angeles area to more affordable communities in the Central Valley In 2015, the region's population is projected to exceed 2.6 million people; and in 2020, it is projected to exceed 2.9 million.

Feasibility of Achieving the Targets

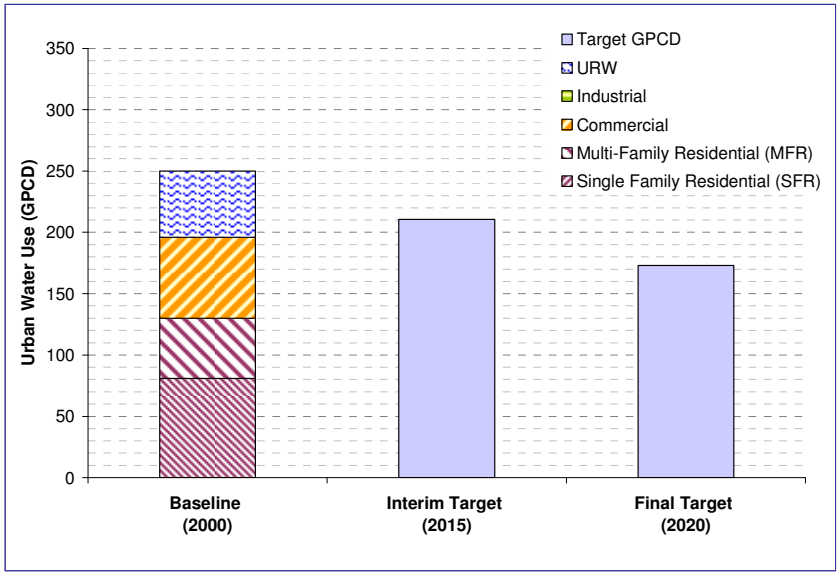
Achieving the 2020 target would be difficult in this region. Expeditiously installing meters and charging by volume would go a long way toward meeting the target. Increased landscape water conservation efforts in this region where ET values are high and lots are generally large would also contribute substantially toward meeting the target.

4.9 North Lahontan Hydrologic Region (Region 8)

The North Lahontan Hydrologic Region (Region 8) is home to less than one percent of California's population. High desert with flat valleys characterizes the northern portion of the region, with the eastern slopes of the Sierra Nevada dominating the central and southern portions. Most locally developed water supplies are from groundwater or small surface water diversions, and most of the region is chronically short of water.

Figure 4-8 summarizes the baseline, interim target, and final target GPCD values of this region.

Figure 4-8: Region 8 Urban Water Conservation Targets



Geographic and Socioeconomic Variables

The North Lahontan Region's population totaled over 98,000 people in 2000. The cities of South Lake Tahoe and Truckee have the largest permanent populations. Since 2000, the population of the region has continued to grow at a relatively slow rate. In 2015, the region's population is projected to exceed 114,000 people, and in 2020, it is projected to exceed 119,000.

Feasibility of Achieving the Targets

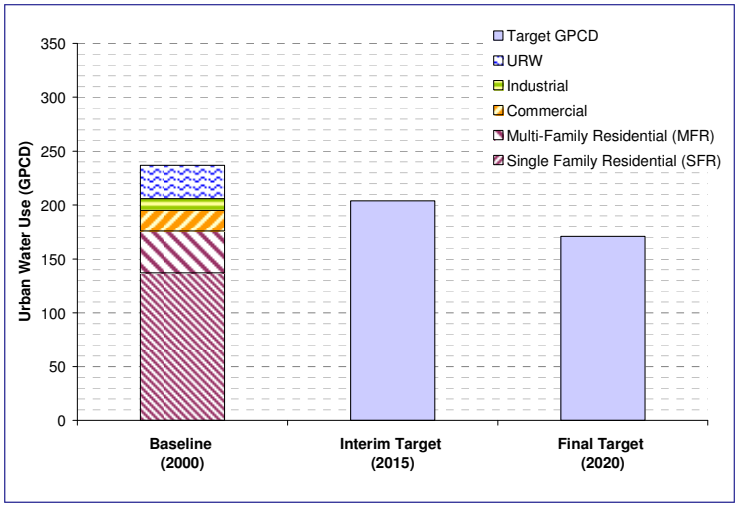
Achieving the 2020 target would be problematic in this region due to the small urban population base and high level of tourist activity.

4.10 South Lahontan Hydrologic Region (Region 9)

The South Lahontan Hydrologic Region's population totaled approximately 722,000 people in 2000. Of that total, nearly 450,000 people live in the southern portion of the region in the areas of Antelope, Apple, and Victor valleys. The cities of Palmdale and Lancaster were among the fastest-growing cities in the state in the 1990s, and population growth is projected to continue over the next 25 years. In 2015, the region's population is projected to exceed 1.1 million; and in 2020, it is projected to exceed 1.3 million. Other areas of the region that have experienced significant growth are the cities of Barstow and Ridgecrest. The rest of the region is rural and generally consists of widely scattered small towns with populations of less than 8,000. Much of the land in the region remains undeveloped and is under protected or managed status for various purposes.

Figure 4-9 summarizes the baseline (for detail GPCD values of each water sector please refer to the Baseline TM), interim target, and final target GPCD values of this region.

Figure 4-9: Region 9 Urban Water Conservation Targets



Additional information on the region's ability to reduce its baseline GPCD to meet the 2015 and 2020 targets is discussed below.

Geographic and Socioeconomic Variables

New construction in the southern area of the region will benefit from past plumbing code changes and the use of water efficient landscape to achieve lower GPCD totals. Several of the water suppliers in the region are signatories to the BMPs, which also drives down GPCD totals through water conservation program implementation.

Feasibility of Achieving the Targets

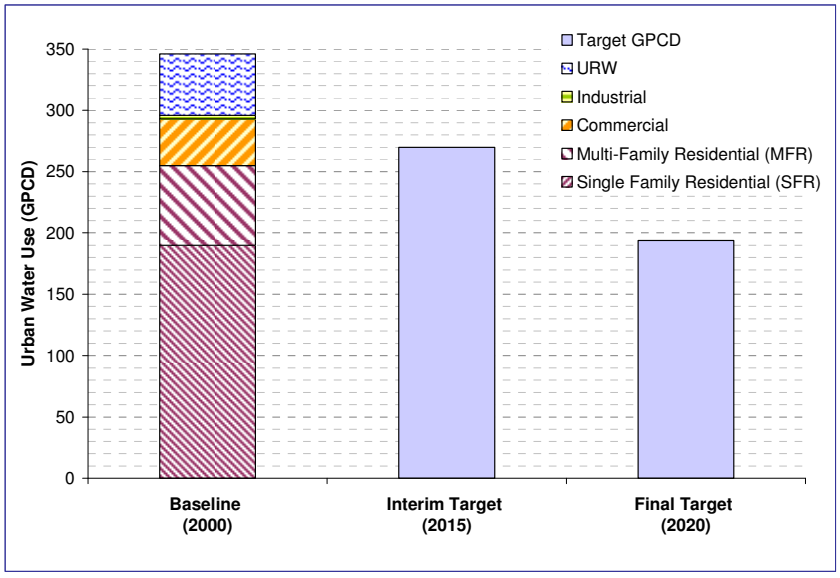
Looking to the future, the majority of the region's savings potential is from outdoor water savings and commercial, industrial, and institutional water savings. Outdoor water savings can be achieved through the installation of water efficient landscape and improved irrigation practices. The region crosses several high ET zones, making outdoor water savings potential significant. Commercial, industrial, and institutional water use savings are possible through process improvements and hardware retrofits. Plumbing code changes, tiered rate structures, and programs to reduce unaccounted for water losses could also account for significant water savings in the region. Despite this water savings potential, with a baseline level of 237 GPCD, the region will likely find it impossible to meet the 2020 target of **172 GPC**D.

4.11 Colorado River Hydrologic Region (Region 10)

The Colorado River Region's population totaled approximately 604,000 people in 2000, which represented an increase of 31 percent from the 1990 population. By 2015, the region's population is projected to increase to more than 1 million; and by 2020, it is projected to reach nearly 1.2 million. More than half of the region's population currently resides in the Coachella Valley, with the remainder of the population in the Imperial Valley and in the corridor between the cities of Yucca Valley and Twentynine Palms.

Figure 4-10 summarizes the baseline, interim target, and final target GPCD values of this region.

Figure 4-10: Region 10 Urban Water Conservation Targets



Additional information on the region's ability to reduce its baseline GPCD to meet the 2015 and 2020 targets is discussed below.

Geographic and Socioeconomic Variables

New construction in the developing areas of the region will benefit from past plumbing code changes and the use of water-efficient landscape to reduce GPCD totals. Several of the water suppliers in the region are signatories to the BMPs, which also drives down GPCD totals through the implementation of water conservation programs.

Feasibility of Achieving the Targets

Looking to the future, the region's potential to save water is dependent on its ability to reduce outdoor water use. Savings can be achieved through the installation of water efficient landscape and improved irrigation practices. The region is hot and dry and crosses several high ET zones, making outdoor water savings a potentially effective way to significantly lower the region's GPCD if the appropriate water conservation programs are implemented. Reducing unaccounted for water losses could also reduce the region's GPCD total. However, even with a significant reduction in outdoor water use, given the region's baseline level of 346 GPCD, a reduction to **195 GPCD** by 2020 will require an aggressive water conservation effort including landscape conversions; enforcing ordinances restricting water waste; and tiered water rates as well as implementation of the entire BMP portfolio.

5 Conclusions and Recommendations

As previously stated, the results presented in the analysis should be considered as **preliminary**. As more data become available in the future and further data validation is completed, the baseline values and the targets for each region will need to be refined. The conservation targets proposed herein should be used solely for planning purposes and are not intended to support regulatory decisions.

It is understood that water use patterns among individual entities within the same region may vary substantially, and that the proposed regional targets may not translate well into individual water entity targets. Local water entities should attempt to refine the baseline data and target to fit the local setting. The methodology developed for this regional analysis should be combined with local entity data to obtain the most accurate estimates of quantifiable conservation potential.

It is also recommended that the methodology presented in this TM be periodically revisited to determine the potential for developing more refined estimates and entity-specific conservation targets that can be quantified and incorporate the geographic and socioeconomic factors associated with conservation potentials but were not able to directly considered in this TM.

6 References

- California Water Plan Update 2005, Department of Water Resources
- Bulletin 118, California's Groundwater, Update 2003, Department of Water Resources
- Department of Water Resource Public Water Systems Survey (PWSS) Database
- California Department of Finance Population Projection Database

Appendix A – Regional Targets Determination Process

Regions 1 through 4, which are currently below or meeting the statewide target (154 GPCD) are expected to maintain or further reduce their GPCD values. Regions 5 through 10, limited by the high ET rates, are expected to find it more challenging to meet the statewide target. To ensure that the regional targets can be reasonably achieved by all regions such that the state as a whole can meet the 20 percent reduction target, a "balancing" process is performed to assign each region with an appropriate regional target. The methodology ensures that the contribution can be reasonably achieved by Regions 1 through 4, and it is also appropriately assigned to Regions 5 through 10 such that the state as a whole can meet the 20 percent reduction target. A detailed step-by-step explanation is provided below.

Step 1:
Determine the Available Savings from Regions 1 through 4

This step determines the amount of water (in volume per year) that could be contributed by Regions 1 through 4 to reduce the overall state demand in year 2020.

Step 1A – Project 2020 water use, assuming regions would adopt statewide target

Assuming that Regions 1 through 4 would adopt the statewide target of 154 GPCD, then the amount of water (in volume) that each region would be using in 2020 can be calculated by equation A-1. The results for each region are summarized in Table A-1 on page 2:

Eq. A-1: $$\text{Water Use}_{2020} = \text{Population}_{2020} \times 154\,\text{GPCD} \times 365\text{d/yr}$$

For example, Region 1 is projected to reach a population of 763,296 in year 2020[1]; the total volume of water that Region 1 would use under this assumption is:

Example A-1: $$\text{Water Use}_{2020} = 763{,}296 \times 154 \times 365 = 4.28 \times 10^{10}\,\text{gal/yr}$$

Similar calculations are performed for Regions 2 through 4. Table A-1 summarizes the projected water use (in volume) for Regions 1 through 4.

Table A-1: Projected Water Use (Volume)

HR	1	2	3	4
Water Use$_{2020}$ (10^{10} gal/yr)	4.28	39.46	9.64	126.35

Step 1B – Revise 2020 water use, assuming regions would apply further conservation efforts

Review of the PWSS database and the baseline value of all regions reveal that water suppliers in Regions 1 through 4 generally demonstrate lower GPCD baseline values than water suppliers in Regions 5 through 10. This is partially attributed by the low ET rates in these regions, as well as their ongoing pro-active roles in water conservation efforts. As such, it is expected that Regions 1 through 4 would be able to maintain or further reduce their GPCD.

Assuming that water suppliers within Regions 1 through 4 that currently have baseline values above the 154 GPCD target will make an effort to reduce their water use to 154 GPCD by year 2020, and the water suppliers that are now at or below 154 GPCD will make an effort to stay at their current levels, then the overall regional GPCD values in 2020 for these regions would

[1] Population projection provided by Department of Finance

become lower than the statewide target of 154 GPCD. Table A-2 summarizes the regional target GPCD values for Regions 1 through 4 calculated under this assumption.

Table A-2: 2020 Target GPCD for Regions 1 through 4

HR	1	2	3	4
$GPCD_{2020}$[2]	135	143	133	144

Step 1C: Calculate the savings from Regions 1 through 4

Building upon the assumption in Step 1B, Regions 1 through 4 would be able to contribute a certain amount of water ("savings") that could be credited towards other regions so that the state as a whole would be able to achieve a 20 percent reduction in 2020.

The total available savings (in volume) from Regions 1 through 4 in year 2020 can be calculated by equation A-2:

Eq. A-2: $$\text{Water Use}_{2020,\text{ revised}} = \text{Population}_{2020} \times \text{GPCD}_{2020} \times 365\text{d/yr}$$

For example, according to Table A-2, Region 1 is expected to have a GPCD of 135 in 2020 under the assumption in Step 1B. With the projected population of 763,296 in 2020, the total volume of water that Region 1 would be using in 2020 is:

Example A-2: $$\text{Water Use}_{2020,\text{ revised}} = 763296 \times 135 \times 365 = 3.77\text{x}10^{10}\text{ gal/yr}$$

Similar calculations are performed for Regions 2 through 4. Table A-3 summarizes the calculated water use for Regions 1 through 4.

Table A-3: Projected Water Use (gal/yr) for Regions 1 through 4

HR	1	2	3	4
$\text{Water Use}_{2020,\text{ revised}}$ (10^{10} gal/yr)	3.77	3.68	8.35	1.18

The differences between the numbers generated by equations A-1 and A-2 represent the savings that each region can achieve:

Eq. A-3: $$\text{Savings} = \text{WaterUse}_{2020} - \text{Water Use}_{2020,\text{ revised}}$$

For example, Region 1 would be able to contribute a saving of:

Example A-3: $$\text{Savings} = 4.57 \times 10^{10} - 3.77 \times 10^{10} = 0.51 \times 10^{10}\text{ gal/yr}$$

Similar calculations are performed for Regions 2 through 4. Table A-4 summarizes the calculated savings from Regions 1 through 4:

[2] Adjustments were made on raw data from the Public Water Systems Survey (PWSS) database: water suppliers that have total system GPCD values above 154 GPCD were reduced to 154, and water suppliers that have total system GPCD values at or below 154 GPCD stayed as-is. The adjusted data resulted in the regional GPCD values presented here.

Table A-4: Savings (gal/yr) from Regions 1 through 4

HR	1	2	3	4
Savings (in 10^{10} gal/yr)	0.51	2.67	1.29	7.90

The total water savings achieved by Regions 1 through 4 would be:

Eq. A-4: $$\text{Savings} = \sum_{HR=1}^{4} \text{Savings}_{\text{HR}} = 12.4 \times 10^{10}\,\text{gal/yr} = 379{,}560\,\text{acre - ft}$$

Step 2: Distribute the Savings to Regions 5 through 10

This step shows how the savings achieved by Regions 1 through 4 would be distributed to Regions 5 through 10 to allow these regions to achieve a realistic reduction target.

Step 2A – Project 2020 water use, assuming Regions 5-10 apply further conservation

Applying the same assumption as described in Step 1B for Regions 1 through 4 (i.e., assuming that within Regions 5 through 10, water suppliers that currently have their baseline values above the 154 GPCD target would make an effort to reduce their water use to 154 GPCD by year 2020, and the water suppliers that are now at or below 154 GPCD would make an effort to stay at their current water use) then the overall regional GPCD values in 2020 for these regions would become lower than the statewide target of 154 GPCD. Table A-2 summarizes the regional target GPCD values for Regions 5 through 10 calculated under this assumption.

Table A-5: Projected GPCD for Regions 5 through 10

HR	5	6	7	8	9	10
Target GPCD[3]	146	153	150	149	151	150

Note that the target GPCD derived from the above assumption presents a very difficult challenge for Regions 5 through 10 given the high baseline values they currently have. Therefore, an "allowance" is assigned to each region so that they would still need to reduce their water use by a large amount, but within an achievable range, as described in Step 2B.

Step 2B: Recognize the conservation limits of Regions 5 through 10

The baseline values of Regions 5 through 10 reflect, to some extent, high water use due to the high ET rates in the inland areas. To account for the challenges these regions face in reducing their per capita water use, an "allowance" above the statewide target should be permitted to each of these regions. The allowance is determined by the percentage of how much this region's baseline is above the statewide target ("exceedance") as compared to that of other regions.

Figure A-1 illustrates the baseline GPCD of Regions 5 through 10 that are exceeding the statewide target of 154 GPCD (i.e., the red portion of the bars in Figure 1, calculated by equation A-5). The numbers are summarized in Table A-5.

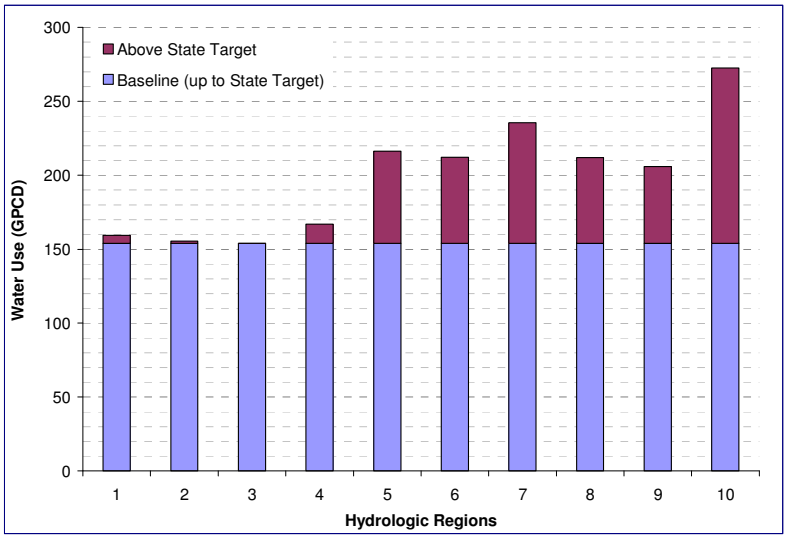
[3] Adjustments were made on raw data from the PWSS database: water suppliers that have total system GPCD values above 154 GPCD were reduced to 154, and water suppliers that have total system GPCD values at or below 154 GPCD stayed as-is. The adjusted data resulted in the regional GPCD values presented here.

Eq. A-5: $$\text{Exceedance}_{HR} = \text{GPCD}_{2000} - \text{GPCD}_{State}$$

Table A-5: GPCD Exceeding Statewide Target

HR	1	2	3	4	5	6	7	8	9	10
$GPCD_{2000}$[4]	165	157	154	180	253	248	285	243	237	346
$GPCD_{State}$[5]	154	154	154	154	154	154	154	154	154	154
Exceedance	11	3	0	26	99	94	131	89	83	192

Figure A-1: Regional Baseline GPCD above 2020 Statewide Target



HR	HR Name
1	North Coast
2	San Francisco Bay
3	Central Coast
4	South Coast
5	Sacramento River
6	San Joaquin
7	Tulare Lake
8	North Lahontan
9	South Lahontan
10	Colorado River

The total exceedance (total of red portion) would be:

Eq. A-6: $$\text{Total Exceedance} = \sum_{HR=1}^{10} \text{Exceedance}_{HR} = 728\ \text{GPCD}$$

Based on how much Regions 5 through 10 are currently above the 154 goal (the red portion in Figure A-1), equation A-7 calculates how the exceedance for each region compares to the exceedance of the entire state (in percent). This percentage represents how "severe" the conservation limits are for this region when compared with other regions.

Eq. A-7: $$\text{Exceedance}_{HR,\%} = \frac{\text{Exceedance}_{HR}}{\text{Total Exceedance}} \times 100\%$$

For example, Region 5 will have an exceedance of:

[4] PWSS database, 1995-2005. See Baseline TM, sections 4.1 – 4.11
[5] PWSS database, 1995-2005. See Baseline TM, section 4.1.

Example A-4: $\text{Exceedance}_{HR,\%} = \frac{\text{Exceedance}_{HR}}{\text{Total Exceedance}} = \frac{99}{728} = 13.6\%$

Similar calculations are performed for Regions 6 through 10. Table A-6 summarizes the exceedance for Regions 5 through 10.

Table A-6: Regional Exceedance for Regions 5 through 10

Hydrologic Region	5	6	7	8	9	10
Baseline GPCD [6]	253	248	285	248	237	346
Exceedance $_{HR}$ [7]	99	94	131	94	83	194
Exceeding $_{HR,\%}$ [8]	14%	13%	18%	12%	11%	26%

Step 2C: Assign realistic targets to Regions 5 through 10

The savings achieved by Regions 1 through 4 (Step 1C, equation A-4) could then be distributed among Regions 5 through 10 by preserving the same percentage for each region. This percentage, which was generated based on the total exceedance of all regions (Step 2A, equations A-6 and A-7), is now generated based on only this region's exceedance above the statewide target (equation A-8).

Eq. A-8: $\text{GPCD}_{2020,\text{revised}} = \left(1 + \text{Exceedance}_{HR,\%}\right) \times 154$

For example, Region 5 will now have a new target GPCD of:

Example A-5: $\text{Target GPCD} = \left(1 + 13.6\%\right) \times 154 = 175$

Similar calculations are performed for Regions 6 through 10. Table A-7 summarizes the adjusted targets for Regions 5 through 10.

Table A-7: Adjusted Regional GPCD Targets for Regions 5 through 10

Hydrologic Region	5	6	7	8	9	10
Exceeding $_{HR,\%}$ [9]	14%	13%	18%	12%	11%	26%
$\text{GPCD}_{2020,\text{revised}}$	175	174	182	173	172	195

Step 3: Validate the Statewide Target

The final step in this process is to verify if the statewide target of 154 GPCD could be met with the revised targets assigned to each region per Steps 1B and 2C (Tables A-2 and A-7).

To verify this, the following condition needs to be met:

[6] PWSS database, 1995-2005. Se Baseline TM, section 4.
[7] Equation A-5
[8] Equation A-7
[9] Equation A-7

Eq. A-9: $$\sum_{HR=1}^{4} \text{Savings}_{HR} = \sum_{HR=5}^{10} \text{Allowance}_{HR}$$

Total "savings" from Regions 1 through 4 is 12.4×10^{10} gal/yr (equation A-4).
Total "allowance" from Regions 5 through 10 needs to be calculated by the following equation:

Eq. A-10: $$\text{Allowance}_{HR} = \text{WaterUse}_{2020} - \text{WaterUse}_{2020,\text{ revised}}$$
$$\text{Allowance}_{HR} = \left(\text{GPCD}_{2020,\text{ revised}} - \text{GPCD}_{2020}\right)\times \text{Population}_{2020} \times 365\text{d/yr}$$

Table A-8 summarizes the total water needs for Regions 5 through 10.

Table A-8: Water Needs for Regions 5 through 10

HR	5	6	7	8	9	10	Total
GPCD_{2020}[10]	146	153	150	149	151	146	NA
$\text{GPCD}_{2020,\text{ revised}}$	175	174	182	173	172	195	NA
Population_{2020}[11]	3631063	2795598	2961357	119832	1376567	1193284	NA
Water Use$_{2020}$ (10^{10}gal/yr)	3.89	2.15	3.40	0.10	1.03	1.94	**12.51**

The above table shows that there is slightly more water needed (12.5×10^{10} gal/yr) for Regions 5 through 10 than there is "available" water to distribute (12.4×10^{10} gal/yr) from Regions 1 through 4.

An iterative process is performed by multiplying the GPCD by a factor "C", as shown in equation A-11, until the condition in equation A-9 is met.

Eq. A-11: $$\text{GPCD}_{2020,\text{ revised}} = \left[154 + \text{Exceedance}(\%)\right]\times C$$

After several iterations, C is determined to be 0.99813.

The final revised GPCD values for Regions 5 through 10 are presented in Table A-9:

Table A-9: Final Regional GPCD Targets for Regions 5 through 10

HR	5	6	7	8	9	10
$\text{GPCD}_{2020,\text{revised}}$	175	173	181	173	171	194

Conclusion

Table A-10 and Figure A-2 summarize the proposed regional GPCD target values, and reduction (in percent) from the baseline values, for all regions.

[10] Table A-5
[11] Population project data provided by Department of Finance

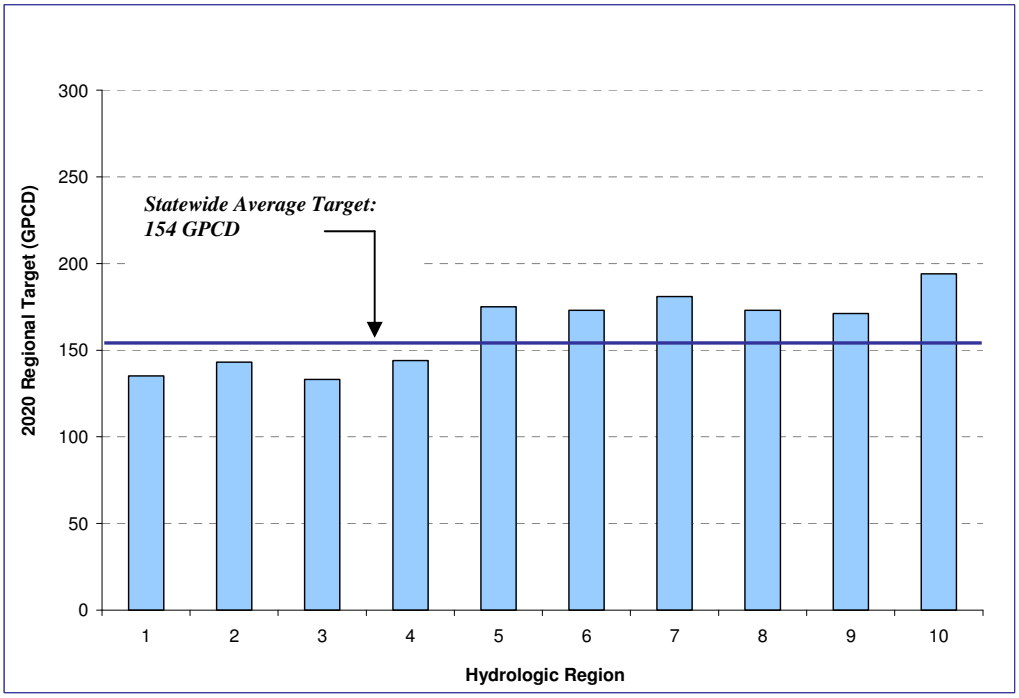
Reduction is calculated as follow:

Eq. A-12: $$\text{Reduction} = \frac{\text{GPCD}_{2020} - \text{GPCD}_{2000}}{\text{GPCD}_{2000}} \times 100\%$$

Table A-10: Proposed Regional GPCD Targets for Regions 1 through 10

HR	1	2	3	4	5	6	7	8	9	10
$GPCD_{2000}$[12]	165	157	154	180	253	248	285	248	237	346
$GPCD_{2020, revised}$[13]	135	143	133	144	175	173	181	173	171	194
Reduction (%)	18%	9%	14%	20%	42%	38%	47%	39%	36%	57%

Figure A-2: Proposed Regional GPCD Balanced Targets



HR	HR Name
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4	South Coast
5	Sacramento River
6	San Joaquin
7	Tulare Lake
8	North Lahontan
9	South Lahontan
10	Colorado River

[12] Baseline GPCD values developed from the PWSS database
[13] Tables A-2 and A-9

Appendix B – Abbreviations and Acronyms

ABBREVIATIONS & ACRONYMS

BMP	Best Management Practice
CEC	California Energy Commission
CII	Commercial, Industrial, Institutional
CPUC	California Public Utilities Commission
CUWCC	California Urban Water Conservation Council
DOF	Department of Finance
DPH	Department of Public Health
DWR	Department of Water Resources
ET	Evapotranspiration
GPCD	Gallons per capita per day
HR	Hydrologic Region
LWUP	Land and Water Use Program
MRF	Multi-Family Residential
PWSS	Public Water Systems Survey
SFR	Single Family Residential
SWRCB	State Water Resources Control Board
TM	Technical Memorandum
URW	Unreported Water
USBR	U.S. Bureau of Reclamation