

State of California  
Department of Water Resources  
Sustainable Groundwater Management Program  
Alternative Assessment Staff Report

Groundwater Basin Name: Coastal Plain of Orange County (Basin No. 8-001)  
Submitting Agency: Orange County Water District  
Recommendation: Approve  
Date Issued: July 17, 2019

---

## I. Summary

The Orange County Water District (OCWD), City of La Habra, and Irvine Ranch Water District (IRWD) (collectively referred to as Agencies) submitted an alternative (Coastal Basin Alternative or Alternative) to the Department of Water Resources (Department) for evaluation and assessment as provided by the Sustainable Groundwater Management Act (SGMA).<sup>1</sup> The Coastal Basin Alternative is based on an analysis of basin conditions that demonstrates the basin has operated within its sustainable yield over a period of at least 10 years.<sup>2</sup>

The OCWD was created in 1933 by the OCWD Act to protect surface water rights and manage the groundwater basin.<sup>3</sup> The OCWD Act was amended in 1954 giving OCWD authority to collect groundwater production records and a replenishment assessment fee from groundwater pumpers to purchase imported water for groundwater recharge.<sup>4</sup> The OCWD, in coordination with other agencies, has been managing the Coastal Plain of Orange County Groundwater Basin (Coastal Basin or Basin) and addressing water resources issues since the OCWD was established.<sup>5</sup> The Alternative documents evidence-based thresholds and implemented projects and management actions by the Agencies to address historical overdraft experienced in the early 1900s until the mid-1960s. The Coastal Basin Alternative demonstrates that the Agencies have a thorough understanding of groundwater conditions and sustainable management and have stabilized groundwater levels through active monitoring and management actions including purchasing land and water rights, ensuring a minimum amount of flow in the

---

<sup>1</sup> Water Code § 10720 *et seq.*

<sup>2</sup> Water Code § 10733.6(b)(3)

<sup>3</sup> Basin 8-1 Alternative, PDF p. 107

<sup>4</sup> Basin 8-1 Alternative, PDF p. 108

<sup>5</sup> Basin 8-1 Alternative, PDF pp. 107-109

Santa Ana River for Orange County, importing water, implementation of groundwater management programs, wastewater recycling, and artificial recharge.

After a review of the Alternative, other related documents, and consideration of public comments, Department staff find that the Alternative satisfies the objectives of SGMA and recommend approval of the Alternative. Department staff consider the information provided by the Agencies to be sufficient and credible to demonstrate the Basin has been operating within its sustainable yield for at least 10 years. In addition, staff have identified recommended actions that are designed to facilitate the Department's ongoing evaluation and assessment of the Plan including implementation and a determination of whether the Plan continues to satisfy the objectives of SGMA or adversely affects an adjacent basin.

The remainder of this assessment is organized as follows:

- **Section II. Review Principles** describes legal and other considerations regarding Department staff's assessment and evaluation of alternatives.
- **Section III. Alternative Materials** describes materials (i.e., plans, reports, data, and other information) submitted by the Agencies that, collectively, the Department staff considered as the Alternative.
- **Section IV. Required Conditions** describes whether the Alternative satisfies each of the four conditions required for the Department to review an alternative.
- **Section V. Alternative Contents** describes the information contained in the Alternative submittal.
- **Section VI. Assessment** describes Department staff's evaluation of the Alternative, whether it satisfies the objectives of SGMA, and, if applicable, describes recommended actions proposed for the first five-year update.

## II. Review Principles

The Agencies submitted an alternative based on an analysis of basin conditions to the Department for evaluation and assessment to determine whether it satisfies the objectives of SGMA for the Basin. To satisfy the objectives of SGMA, an alternative based on an analysis of basin conditions must demonstrate that the basin has been operated within its sustainable yield for a period of at least 10 years.<sup>6</sup> The SGMA definition of sustainable yield requires the avoidance of undesirable results.<sup>7</sup> As a result, an alternative based on an analysis of basin conditions must demonstrate that the submitting agency has an understanding of groundwater conditions that would cause undesirable results, as

---

<sup>6</sup> Water Code § 10733.6(b)(3)

<sup>7</sup> Water Code § 10721(w)

well as analysis in the alternative demonstrating the absence of undesirable results over a 10-year period.

An alternative, to be evaluated by the Department, must be submitted by the statutory deadline and be within a basin that complies with Part 2.11 of Division 6 of the Water Code.<sup>8</sup> The submitted alternative must also be complete and must cover the entire basin.<sup>9</sup> The GSP Regulations<sup>10</sup> require the Department to evaluate an Alternative “in accordance with Sections 355.2, 355.4(b), and Section 355.6, *as applicable*, to determine whether the Alternative complies with the objectives of the Act”.<sup>11</sup> The elements of the cited sections are not all applicable to alternatives. Some provisions apply to GSPs and alternatives alike, to alternatives only prospectively, or do not apply to alternatives at all.<sup>12</sup> Ultimately, the purpose of the evaluation is to determine whether an alternative satisfies the objectives of SGMA.<sup>13</sup> The agency must explain how the elements of an alternative are “functionally equivalent” to the elements of a GSP required by Articles 5 and 7 of the GSP Regulations and are sufficient to demonstrate the ability of an alternative to achieve the objectives of SGMA.<sup>14</sup> The explanation by the agency that elements of an alternative are functionally equivalent to elements of a GSP furthers the objective of demonstrating that an alternative satisfies the objectives of SGMA. Alternatives based on groundwater management plans or historical basin management practices that predate the passage of SGMA or adoption of GSP Regulations, although required to satisfy the objectives of SGMA, are not necessarily expected to conform to the precise format and content of a GSP. The Department’s assessment is thus focused on the ability of an alternative to satisfy the objectives of SGMA as demonstrated by information provided by the agency; it is not a determination of the degree to which an alternative matched the specific requirements of the GSP Regulations.

---

<sup>8</sup> Water Code § 10733.6(c)-(d)

<sup>9</sup> 23 CCR § 358.4(a)

<sup>10</sup> 23 CCR § 350 *et seq.*

<sup>11</sup> 23 CCR § 358.4(b) (emphasis added)

<sup>12</sup> Procedural requirements, including submissions by the agency, posting by the Department, and the public comment period, apply equally to plans and alternatives (23 CCR § 355.2(a)-(c)). The periodic review of Plans (23 CCR § 355.6(a)) applies to alternatives prospectively but does not apply to initial submissions. Other regulatory provisions are inapplicable to alternatives, including the two-year review period (23 CCR § 355.2(e)), which is based on the statutory time-frame that applies to Plans but not alternatives (Water Code § 10733.4(d)); the “incomplete” status that allows the agency to address “one or more deficiencies that preclude approval, but which may be capable of being corrected by the Agency in a timely manner” (23 CCR § 355.2(e)(2)), which applies to plans undergoing development, but not alternatives that purportedly satisfy the objectives of SGMA at the time of their submission (Water Code § 10733.6(a)); and, for the same reason, corrective actions to address deficiencies in plans (23 CCR § 355.4(a)(4)), which applies to plans developed after the adoption of SGMA, but is inapplicable to alternatives that predate SGMA.

<sup>13</sup> Water Code § 10733.6(a). The Department considers the regulatory language in 23 CCR § 358.2(d) (“complies with the objectives of [SGMA]”) to be equivalent to the statutory threshold upon which it is based.

<sup>14</sup> 23 CCR § 358.2(d)

When evaluating whether an alternative satisfies the objectives of SGMA and thus is likely to achieve the sustainability goal for the basin, staff reviews the information provided by and relied upon by the agency for sufficiency, credibility, and consistency with scientific and engineering professional standards of practice.<sup>15</sup> The Department's review considers whether there is a reasonable relationship between the information provided and the assumptions and conclusions made by the agency, whether sustainable management criteria and projects and management actions described in an alternative are commensurate with the level of understanding of the basin setting, and whether those projects and management actions are feasible and likely to prevent undesirable results.<sup>16</sup> Staff will recommend that an alternative be approved if staff believe, in light of these factors, that alternative has achieved or is likely to achieve the sustainability goal for the basin.<sup>17</sup>

An alternative based on a demonstration that the basin has operated within its sustainable yield over a period of at least 10 years may be approved based on information that demonstrates that objective criteria defining operating standards that governed groundwater management for the basin were established and consistently achieved. Even when staff review indicates that an alternative will satisfy the objective of SGMA, the Department may recommend actions to facilitate future evaluation of that alternative and to allow the Department to better evaluate whether an alternative adversely affects adjacent basins. DWR proposes that recommended actions be addressed by the submission date for the first periodic evaluation.

Staff assessment of an alternative involves the review of information presented by the agency, including models and assumptions, and an evaluation of that information based on scientific reasonableness. The assessment does not require Department staff to recalculate or reevaluate technical information provided in an alternative or to perform its own geologic or engineering analysis of that information. The staff recommendation to approve an alternative does not signify that Department staff, were they to exercise the professional judgment required to develop a plan for the basin, would make the same assumptions and interpretations as those contained in an alternative, but simply that Department staff has determined that the assumptions and interpretations relied upon by the submitting agency are supported by adequate, credible evidence, and are scientifically reasonable.

---

<sup>15</sup> 23 CCR § 351(h)

<sup>16</sup> 23 CCR § 355.4(b)(1), (3), and (5).

<sup>17</sup> 23 CCR § 355.4(b)

### III. Alternative Materials

On behalf of the Agencies, the OCWD submitted an alternative based on an analysis of basin conditions demonstrating the Basin has operated within its sustainable yield over a period of at least 10 years, pursuant to Water Code Section 10733.6(b)(3). The Alternative thus relies primarily upon the following document:

- Basin 8-1 Alternative 2016 (Coastal Basin Alternative or Alternative)

The Agencies also submitted an Alternative Elements Guide, Annual Reports<sup>18</sup>, and a notice of exemption from the requirements of the California Environmental Quality Act. Other material submitted by the Agencies, correspondence, and other information provided to or relied upon by the Department have been posted on the Department's website.<sup>19</sup>

### IV. Required Conditions

An alternative, to be evaluated by the Department, must be submitted by the statutory deadline and be within a basin that complies with Part 2.11 of Division 6 of the Water Code.<sup>20</sup> The submitted alternative must also be complete and must cover the entire basin.<sup>21</sup>

#### A. Submission Deadline

SGMA requires that an alternative for a basin categorized as high- or medium-priority as of January 31, 2015, be submitted no later than January 1, 2017.<sup>22</sup>

On behalf of the Agencies, the OCWD submitted the Alternative on December 22, 2016, before the statutory deadline.

#### B. Part 2.11 (CASGEM) Compliance

SGMA requires that the Department assess whether an alternative is within a basin that is in compliance with Part 2.11 of Division 6 of the Water Code,<sup>23</sup> which requires that groundwater elevations in all groundwater basins be regularly and systematically

---

<sup>18</sup> The Annual Report is not part of the Alternative and was not reviewed by the Department for the purpose of approving the Alternative.

<sup>19</sup> <https://sgma.water.ca.gov/portal/#alt>

<sup>20</sup> Water Code § 10733.6

<sup>21</sup> 23 CCR § 358.4

<sup>22</sup> Water Code § 10733.6(c). Pursuant to Water Code § 10722.4(d), a different deadline applies to a basin that has been elevated from low- or very low-priority to high- or medium-priority after January 31, 2015.

<sup>23</sup> Water Code § 10733.6(d)

monitored and that groundwater elevation reports be submitted to the Department.<sup>24</sup> To manage its obligations under this law, the Department established the California Statewide Groundwater Elevation Monitoring (CASGEM) Program. The acronym CASGEM is used by the Department to denote both the program and the groundwater monitoring law.<sup>25</sup>

SGMA specifies that an alternative does not satisfy the objectives of SGMA if the basin is not in compliance with the requirements of CASGEM.<sup>26</sup> The Department confirmed that the Coastal Basin was in compliance with the requirements of CASGEM prior to evaluating the Alternative and confirmed that the Basin remained in compliance with CASGEM through the last reporting deadline prior to issuing this assessment.

### C. Completeness

GSP Regulations specify that the Department shall evaluate an alternative if that alternative is complete and includes the information required by SGMA and the GSP Regulations.<sup>27</sup> An alternative submitted pursuant to Water Code Section 10733.6(b)(3) must include an analysis demonstrating the basin has operated within its sustainable yield over a period of at least 10 years. That analysis must include a report prepared by a registered professional engineer or geologist who is licensed by the state, and be submitted under that engineer's or geologist's seal. The alternative must also include an explanation of how the elements of the alternative are functionally equivalent to the elements of a GSP required by Articles 5 and 7 of the GSP Regulations and are sufficient to demonstrate that the alternative has achieved or has the ability to achieve the objectives of SGMA.<sup>28</sup>

The Agencies submitted an analysis under the seal of licensed Professional Geologists and a licensed Professional Engineer along with an Alternative Elements Guide, which includes the Agency's explanation of how the elements of the Alternative are functionally equivalent to the elements of a GSP. Department staff found the Alternative to be complete and to contain the required information, sufficient to warrant an evaluation by the Department.

---

<sup>24</sup> Water Code § 10920 *et seq.*

<sup>25</sup> Stats.2009-2010, 7th Ex.Sess., c. 1 (S.B.6), § 1

<sup>26</sup> Water Code § 10733.6(d)

<sup>27</sup> 23 CCR § 358.4(a)(3)

<sup>28</sup> 23 CCR § 358.4(c)-(d)

## D. Basin Coverage

An alternative is required to cover the entire basin.<sup>29</sup> An alternative that is intended to cover the entire basin may be presumed to do so if the basin is fully contained within the jurisdictional boundaries of the submitting agency. However, an alternative submitted by an agency whose jurisdictional boundaries do not include all areas of the basin may nevertheless be found to effectively cover the entire basin. Because the intent of SGMA is to provide for the sustainable management of groundwater basins,<sup>30</sup> with sustainability defined as the management and use of groundwater that does not cause undesirable results,<sup>31</sup> an alternative effectively covers the entire basin if it results in groundwater management that avoids undesirable results. An alternative that cannot avoid undesirable results is not sustainably managing the basin even if the entire basin is within the jurisdiction of the managing agency, but an alternative that avoids undesirable results throughout the basin is sustainably managing that basin even if some part of the basin lies outside the jurisdiction of that agency.

The Alternative for the Coastal Basin is submitted on behalf of three agencies, the OCWD, City of La Habra, and IRWD, which collectively intend the Alternative to cover the entire Basin. None of the Agencies have jurisdiction over the entire Basin. The Alternative divides the Basin into four management areas (see map below). The largest of these is the OCWD Management Area, which coincides with the majority of the jurisdictional area of OCWD (small portion of jurisdiction extends into the Santa Ana Canyon Management Area). The OCWD Management Area covers approximately 89 percent of the Basin and accounts for approximately 98 percent of the total groundwater pumping in the Basin.<sup>32</sup> The other three management areas (La Habra-Brea, South East, and Santa Ana Canyon) are within the jurisdiction of multiple local agencies, including the City of La Habra and IRWD.<sup>33</sup> Based on the facts provided, Department staff find that the Alternative covers the entire Basin (see Figure 1, below).

---

<sup>29</sup> 23 CCR § 358.4(a)(4)

<sup>30</sup> Water Code § 10720.1(a)

<sup>31</sup> Water Code § 10721(v)

<sup>32</sup> Basin 8-1 Alternative, PDF p. 4, p. 8, p. 95, Figure 1-1

<sup>33</sup> Basin 8-1 Alternative, PDF p. 46, p. 48, p. 95, p. 317, p. 350, p. 351

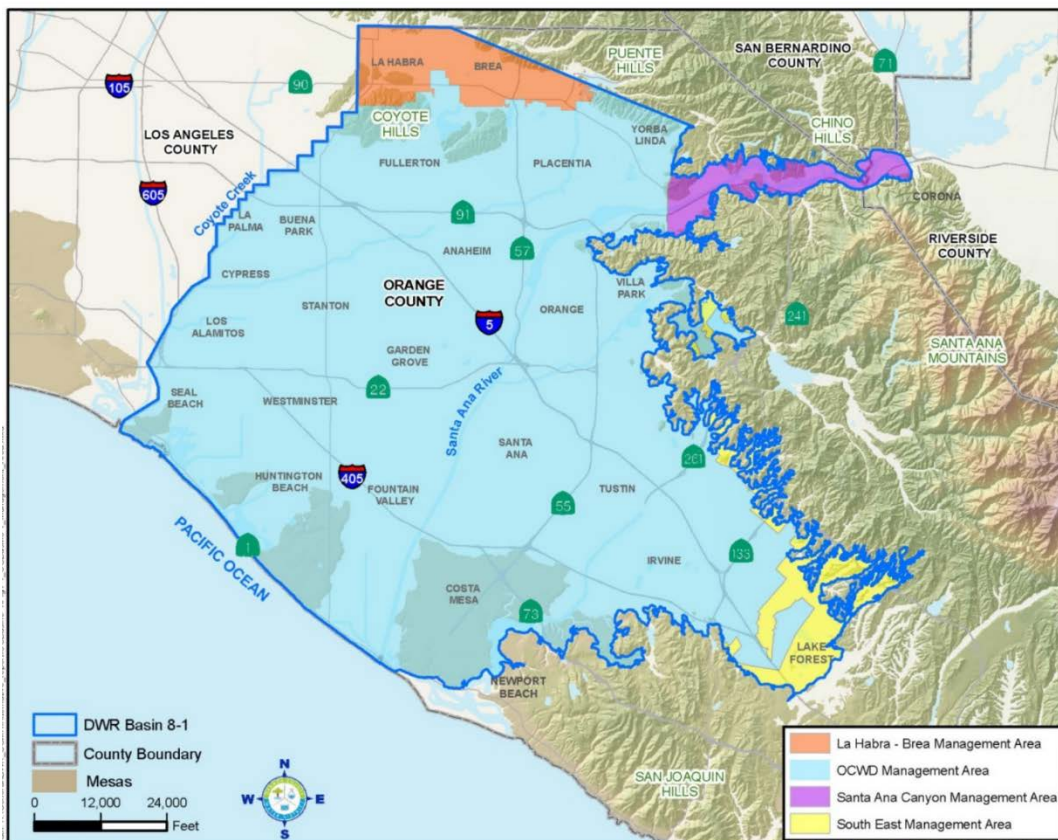


Figure 1. Basin 8-001 Management Areas

## V. Alternative Contents

GSP Regulations require the submitting agency to explain how the elements of an alternative are functionally equivalent to the elements of a GSP as required by Article 5 of the GSP regulations<sup>34</sup> and are sufficient to demonstrate the ability of the alternative to achieve the objectives of SGMA.<sup>35</sup>

As stated previously, alternatives based on historical basin management practices that predate the passage of SGMA or adoption of GSP Regulations, although required to satisfy the objectives of SGMA, are not necessarily expected to conform to the precise format and content of a GSP, and the criteria for adequacy of an alternative is whether the Department is able to determine that an alternative satisfies the objectives of SGMA. Department staff rely on the submitting agency's determination of functional equivalence of alternative elements to facilitate its evaluation and assessment of an alternative (see

<sup>34</sup> 23 CCR § 354-354.44

<sup>35</sup> 23 CCR § 358.2(d). The requirements pertaining to Article 7 of the GSP Regulations (23 CCR § 356-356.4) relate to annual reports and periodic evaluation and are not applicable to review of the initial alternative.



Assessment, below). Although the exact components of a GSP are not required for an alternative, for organizational purposes the discussion of information contained in the Coastal Basin Alternative and related documents provided by the Agencies follows the elements of a GSP provided in Article 5 of the GSP Regulations. The reference to requirements of the GSP Regulations at the beginning of each section is to provide context regarding the nature of the element discussed but is not meant to define a strict standard applicable to alternatives.

## A. Administrative Information

GSP Regulations require that an alternative provide applicable information identifying the submitting agency, describing the plan area, and demonstrating the legal authority and ability of the submitting agency to develop and implement a plan for that area.<sup>36</sup>

The Coastal Basin Alternative provides detailed administrative information for the OCWD-managed portion of the basin, including a comprehensive executive summary, a description of the Basin area, and details related to the authority and financial ability to continue management and implementation of projects and management actions.<sup>37</sup> The Alternative also includes a description of engagement and communication activities related to groundwater management that have been conducted with the public, stakeholders, and agencies in neighboring basins.<sup>38</sup> OCWD's jurisdiction extends into the Santa Ana Canyon Management Area; therefore, the administrative information for OCWD also applies to that portion of the Basin. Within the South East Management Area, groundwater production only takes place within IRWD's jurisdiction; therefore, IRWD summarizes that management area and provides details regarding the related authority and financial ability to manage groundwater within their jurisdiction.<sup>39</sup> The Cities of La Habra and Brea manage the groundwater resources in the La Habra-Brea Management Area. The Alternative discusses the Cities' authority and the finance structure to fund groundwater projects.<sup>40</sup>

## B. Basin Setting

GSP Regulations require information about the physical setting and characteristics of the basin and current conditions of the basin, including a hydrogeologic conceptual model, a

---

<sup>36</sup> 23 CCR § 354.2-354.10

<sup>37</sup> Basin 8-1 Alternative, PDF pp. 111-116

<sup>38</sup> Basin 8-1 Alternative, PDF pp. 205-209

<sup>39</sup> Basin 8-1 Alternative, PDF p. 320

<sup>40</sup> Basin 8-1 Alternative, PDF pp. 49-50

description of historical and current groundwater conditions, and an assessment of the water budget.<sup>41</sup>

## 1. Hydrogeologic Conceptual Model

The GSP Regulations require a descriptive hydrogeologic conceptual model of the basin that includes a written description supported by cross sections and maps.<sup>42</sup>

The conceptual model described in the Alternative represents the Agencies' understanding of the geographic setting, regional geologic setting, structural setting, and other physical attributes of the Coastal Basin and its aquifers.<sup>43</sup> The conceptual model is based on studies conducted by the Department in the 1960s.<sup>44</sup> The Alternative describes the conceptual model graphically, with multiple cross sections, and through written descriptions of the physical and structural properties of the Basin, lateral basin boundaries, the principal aquifers and the primary uses of each aquifer, delineation of recharge areas, and the source and point of delivery of imported supplies. The Agencies describe three aquifer systems in the basin identified as the Shallow, Principal, and Deep Aquifers.<sup>45</sup> The Alternative also provides explanation of how information from the hydrogeologic conceptual model is then integrated into the development of the numerical model, which is used to calculate annual change in storage based on observed groundwater elevation data and conduct evaluations of proposed projects and operating scenarios.<sup>46</sup> The model includes the three aquifers in the Coastal Basin, covers nearly the entire Basin, and extends approximately three miles into the adjacent Central Groundwater Subbasin to provide more accurate modeling results.<sup>47</sup>

## 2. Groundwater Conditions

The GSP Regulations require a description of historical and current groundwater conditions in the basin that includes information related to groundwater elevations, groundwater storage, seawater intrusion, groundwater quality, subsidence, and interconnected surface water, as applicable. The Regulations also require an identification of groundwater dependent ecosystems.<sup>48</sup>

The Alternative presents extensive historical data and detailed information showing that the Coastal Basin has historically experienced declining groundwater levels, loss of

---

<sup>41</sup> 23 CCR § 354.12 et seq.

<sup>42</sup> 23 CCR § 354.14(a)

<sup>43</sup> Basin 8-1 Alternative, PDF pp. 16-20

<sup>44</sup> Basin 8-1 Alternative, PDF p. 18

<sup>45</sup> Basin 8-1 Alternative, PDF p. 18

<sup>46</sup> Basin 8-1 Alternative, PDF pp. 132-141

<sup>47</sup> Basin 8-1 Alternative, PDF pp. 132-133

<sup>48</sup> 23 CCR § 354.16

storage, and seawater intrusion as early as the 1920s. Problems associated with declining groundwater became critical when the groundwater in storage exceeded 500,000 acre-feet (AF) below full in 1956-1957.<sup>49</sup> Based on historical experience and knowledge of managing and monitoring the Basin, combined with numerical model simulations, OCWD determined that when the groundwater in storage drops below 500,000 AF below full, the Basin experiences an increased risk of seawater intrusion, inelastic land subsidence, depletion of groundwater in storage, some wells become inoperable due to low groundwater levels, higher costs to pump groundwater, and the potential for upwelling of lower quality groundwater from the Deep Aquifer.<sup>50</sup> The Alternative includes hydrographs with decades of groundwater level data. The estimated total groundwater storage capacity of the Coastal Basin is 66 million AF.<sup>51</sup> A chart showing decades of the volume of groundwater in storage in the Basin demonstrates that the Basin has been managed and maintained within its operating range for storage levels since the 1960s.<sup>52</sup>

The OCWD Management Area portion of the Alternative provides discussion, data, and figures regarding the water quality conditions for salinity, nitrate, contamination plumes, and the programs facilities in place to manage these issues.<sup>53</sup> The Alternative links land subsidence in the OCWD Management Area to development as early as 1898 and to oil extractions along the coast. Evidence of inelastic subsidence due to groundwater pumping has not been present in the Basin since the late 1950s, when OCWD began managing the basin to not exceed 500,000 AF below full.<sup>54</sup>

The Alternative describes seawater intrusion becoming a recognized issue by the 1920s due to declining groundwater levels and became a critical problem in the 1950s.<sup>55</sup> By the 1960s, seawater had intruded nearly four miles inland. The Basin is susceptible to seawater intrusion at four locations: Alamitos, Sunset, Bolsa, and Talbert Gaps (see Figure 2, below). Of the four locations, the Sunset Gap lacks a laterally extensive permeable shallow aquifer and is “considered to be a much lesser seawater intrusion threat.”<sup>56</sup> Seawater intrusion at the Bolsa Gap is largely restricted from migrating inland across the Bolsa-Fairview Fault and “...is not expected to be a threat to any active production wells or groundwater resources.”<sup>57</sup>

---

<sup>49</sup> Basin 8-1 Alternative, PDF pp. 107-109, pp. 202-203, p. 217

<sup>50</sup> Basin 8-1 Alternative, PDF p. 215

<sup>51</sup> Basin 8-1 Alternative, PDF p. 96

<sup>52</sup> Basin 8-1 Alternative, PDF p. 216

<sup>53</sup> Basin 8-1 Alternative, PDF p. 142

<sup>54</sup> Basin 8-1 Alternative, PDF pp. 147-148

<sup>55</sup> Basin 8-1 Alternative, PDF p. 202

<sup>56</sup> Basin 8-1 Alternative, PDF pp. 146-147, p. 245

<sup>57</sup> Basin 8-1 Alternative, PDF p. 249

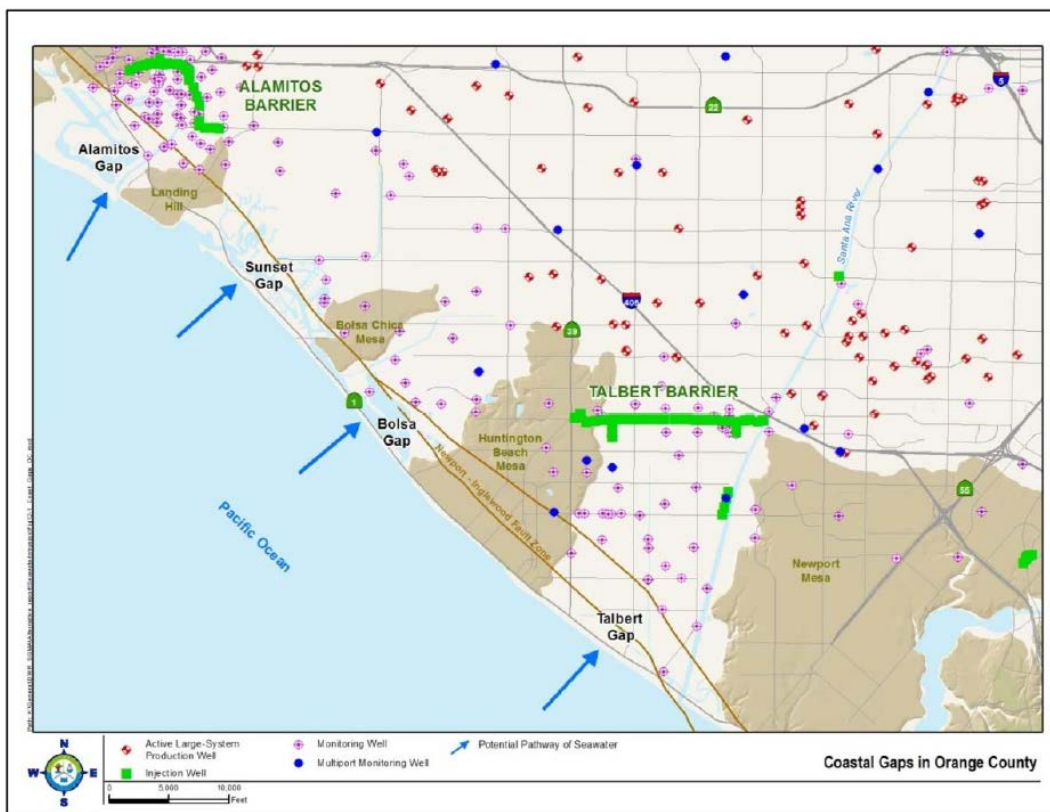


Figure 2. Coastal Gaps in Orange County

During the 1950s and 1960s, the OCWD slowed the seawater intrusion by recharging the Basin with imported Colorado River water. In 1965, the Alamos Seawater Intrusion Barrier, located at the boundary separating Los Angeles and Orange Counties, became operational. Through an interagency agreement developed in 1964, the Alamos Barrier has been operated, maintained, and monitored by the LACDPW. In 1975, the Talbert Seawater Intrusion Barrier began operation at the Talbert Gap, near the mouth of the Santa Ana River in Fountain Valley. The Talbert barrier injects recycled water that is blended with potable water and was the first permitted project of its kind in the United States.<sup>58</sup> The OCWD monitors the performance of the seawater intrusion barriers using the groundwater model, water quality constituents in monitoring wells, and protective groundwater elevations based on the Ghyben-Herzberg relation, which accounts for the density difference between saline and fresh groundwater and the amount of aquifer that is in contact with seawater.<sup>59</sup> The OCWD actively monitors the performance of the seawater intrusion barrier systems and has incrementally expanded the barrier system through time (see Projects and Management Actions below).

<sup>58</sup> Basin 8-1 Alternative, PDF pp. 108-109, p. 146

<sup>59</sup> Basin 8-1 Alternative, PDF pp. 235-245

The Alternative states that groundwater-dependent ecosystems and interconnected systems are not present in the OCWD Management Area because there are no surface water bodies that are dependent on groundwater and the majority of the Santa Ana River is concrete-lined and where not lined, the river is a losing reach with engineered facilities to infiltrate surface water into the groundwater basin.<sup>60</sup>

For the La Habra-Brea Management Area, the Alternative provides hydrographs up until 2011.<sup>61</sup> The estimated total groundwater storage capacity is 55,000 AF.<sup>62</sup> A summary of water quality minimum, maximum, and average concentrations for a limited list of constituents in this management area from 1927 to 1977 is provided in a tabular form, and water quality monitoring is reported to the designated agencies.<sup>63</sup> The Alternative states that minimal land surface changes have occurred in the Basin, but there is no evidence that any structural damage has occurred. The Alternative also states that based on United States Geological Survey (USGS) studies published in 2001 and 2003,<sup>64</sup> the La Habra-Brea Management Area has not experienced historical or current subsidence associated with groundwater pumping. The Alternative describes the major creeks in the Coyote Creek Watershed within the La Habra-Brea Management Area. The Alternative states that groundwater production is not anticipated to impact surface waters and local habitats because production occurs in the confined San Pedro aquifer, which is about 140 feet below ground surface, which is significantly deeper than the perched alluvial aquifer where groundwater is about 30 feet below ground surface. However, there is no mention of whether or not groundwater-dependent ecosystems exist.<sup>65</sup>

The South East Management Area chapter of the Alternative provides groundwater level data from 1991-2001 and 2013-2015 collected by IRWD, the only Agency that pumps groundwater in that area.<sup>66</sup> The average groundwater production in this management area is 125 AF per year,<sup>67</sup> and the estimated total storage capacity is 350,000 AF.<sup>68</sup> The water quality in this management area contains elevated levels of iron, manganese, and total dissolved solids (TDS). The most recent data is from 2011-2015 for one well and reports the average concentrations for arsenic, manganese, and TDS.<sup>69</sup> No known land subsidence has been reported for this area. Two real-time survey stations within the Orange County Real Time Network (OCRTN) monitor land surface changes near the

---

<sup>60</sup> Basin 8-1 Alternative, PDF p. 149

<sup>61</sup> Basin 8-1 Alternative, PDF p. 57

<sup>62</sup> Basin 8-1 Alternative, PDF p. 58

<sup>63</sup> Basin 8-1 Alternative, PDF p. 58

<sup>64</sup> Basin 8-1 Alternative, PDF p. 59, p. 83

<sup>65</sup> Basin 8-1 Alternative, PDF p. 59

<sup>66</sup> Basin 8-1 Alternative, PDF p. 318, p. 325

<sup>67</sup> Basin 8-1 Alternative, PDF p. 326

<sup>68</sup> Basin 8-1 Alternative, PDF p. 328

<sup>69</sup> Basin 8-1 Alternative, PDF p. 329

South East Management Area; one station is immediately adjacent to, and another is within, the South East Management Area.<sup>70</sup>

The South East Management Area portion of the Alternative discusses the intermittent flow in the Serrano Creek, which only flows after storms, and the absence of groundwater-dependent ecosystems.<sup>71</sup> There is no discussion of whether or not there are interconnections between groundwater and surface water in the South East Management Area.

For the Santa Ana Management Area, the Alternative provides water level data from 1991 to about 2016.<sup>72</sup> The average groundwater production in this area is 1,839 AF per year.<sup>73</sup> Average water quality data for constituents ranging between 1969-2016 within the management area is provided in tabular form.<sup>74</sup> Subsidence is not experienced and is considered unlikely due to stable groundwater levels, de minimis groundwater production, and the presence of shale and sandstone bedrock underlying a thin alluvial aquifer primarily composed of sand and gravel.<sup>75</sup>

Within the Santa Ana Canyon Management Area, the Alternative states that groundwater production has little to no impact on groundwater-dependent ecosystems because groundwater is consistently 20-30 feet below the ground surface and the surface water flow through the canyon is significantly greater than the groundwater production.<sup>76</sup> The maximum groundwater production in the Santa Ana Canyon is 2,230 AF per year, and the minimum surface water flow is 55,300 AF per year.<sup>77</sup> The Alternative states that the surface water and groundwater in the stretch of the Santa Ana River in the Santa Ana Canyon is in equilibrium based on available stream gage and groundwater level data, even though some infiltration may occur due to minor groundwater pumping.<sup>78</sup> The Alternative states that based on monitoring, there are no depletions of interconnected surface water that will cause significant and unreasonable impacts on beneficial users of surface water; however, the monitoring data are not provided.<sup>79</sup>

---

<sup>70</sup> Basin 8-1 Alternative, PDF pp. 253-254

<sup>71</sup> Basin 8-1 Alternative, PDF p. 329

<sup>72</sup> Basin 8-1 Alternative, PDF p. 364

<sup>73</sup> Basin 8-1 Alternative, PDF p. 366

<sup>74</sup> Basin 8-1 Alternative, PDF p. 368

<sup>75</sup> Basin 8-1 Alternative, PDF p. 369

<sup>76</sup> Basin 8-1 Alternative, PDF p. 369

<sup>77</sup> Basin 8-1 Alternative, PDF p. 373

<sup>78</sup> Basin 8-1 Alternative, PDF p. 148

<sup>79</sup> Basin 8-1 Alternative, PDF p. 9

### 3. Water Budget

GSP Regulations require a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored, as applicable.<sup>80</sup>

The Alternative includes a water budget for the OCWD Management Area, which aided the development of the numerical model that was used to model the subsurface flows and the change in groundwater storage through time.<sup>81</sup> The water budget for the OCWD Management Area details the amount of inflow and outflow, including production and recharge, for a dry, average, and wet year. The Basin is managed based on the annual change in volume and the total volume of groundwater in storage and is not operated on an annual safe-yield basis.<sup>82</sup> Therefore, OCWD maintains an extensive database of the annual changes in volume and total volume of groundwater in storage. Water budgets are also presented for the Santa Ana Canyon<sup>83</sup> and South East<sup>84</sup> Management Areas as tabular data calculated using the numerical model for the OCWD Management Area. The water budget for the Santa Ana Canyon Management Area tabulates the 10-year-average inflows and outflows, including production and evapotranspiration, and provides the maximum and minimum of each component for the 10-year period. A simple water balance was calculated for the South East Management Area based on measured groundwater production and the subsurface flow calculated by the numerical model for the OCWD Management Area. The Alternative provided the groundwater production values between 2011-2015 for the La Habra-Brea Management Area.<sup>85</sup> A water budget was not provided for the La Habra-Brea Management Area, but the Alternative does provide the safe yield, which is approximately 4,500 AF per year.<sup>86</sup>

### 4. Management Areas

GSP Regulations authorize, but do not require, an agency to define one or more management areas within a basin if the agency has determined that creation of management areas will facilitate implementation of the GSP.<sup>87</sup>

The Alternative appears to convey that because no single agency has jurisdiction over the entire Coastal Basin and because SGMA requires the entire Coastal Basin be covered

---

<sup>80</sup> 23 CCR § 354.18

<sup>81</sup> Basin 8-1 Alternative, PDF p. 151

<sup>82</sup> Basin 8-1 Alternative, PDF p. 151

<sup>83</sup> Basin 8-1 Alternative, PDF p. 370

<sup>84</sup> Basin 8-1 Alternative, PDF p. 330

<sup>85</sup> Basin 8-1 Alternative, PDF p. 54

<sup>86</sup> Basin 8-1 Alternative, PDF p. 61

<sup>87</sup> 23 CCR § 354.20

by the Alternative, the Basin and the Alternative are divided into four management areas, the La Habra-Brea Management Area, OCWD Management Area, South East Management Area, and Santa Ana Canyon Management Area (see map under Basin Coverage, above).<sup>88</sup> Each management area's general hydrology, water demand, monitoring, and managing entities are discussed in the Alternative. The Alternative states that although the four management areas are described separately, "it is important to understand that actual 'management' is not as distinct, and existing collaborative efforts between agencies in managing groundwater resources will continue."<sup>89</sup>

OCWD has complete jurisdiction within the OCWD Management Area and has jurisdiction in a portion of the Santa Ana Canyon Management Area. While other jurisdictions exist within the Santa Ana Canyon Management Area, the area is managed according to how OCWD manages within its jurisdiction and the performance-tracking metrics in the OCWD Management Area. OCWD owns the rights to all of the water in the Santa Ana River released from Prado Dam.<sup>90</sup>

The South East Management Area includes a variety of agency jurisdictions; however, IRWD is the only agency that produces groundwater, and IRWD states that it will manage the area per OCWD's objective standards.

The La Habra-Brea Management Area is outside the jurisdiction of OCWD. The City of La Habra is the established Groundwater Sustainability Agency (GSA) in the La Habra-Brea Management Area. The Alternative states that the City of La Habra adopted a resolution to modify the Coastal Basin, as defined in the Department's Bulletin 118, to establish a separate basin, locally referred to as the La Habra Groundwater Basin (La Habra Basin), that matches the City's jurisdictional boundary and GSA boundary.<sup>91</sup> As the GSA, the City of La Habra GSA intends to manage the La Habra Basin and provide additional detail for components, such as a water budget, objective standards, defining and avoiding undesirable results, and the monitoring program, in a GSP by January 2020.<sup>92</sup> In 2016, the Department received a request by the City of La Habra to modify the Coastal Basin; however, the application was incomplete, and the request to modify the Basin was not approved by the Department. During the 2018 basin boundary modification period, the Department did not receive a request from any agency to modify the Coastal Basin.

---

<sup>88</sup> Basin 8-1 Alternative, PDF p. 4

<sup>89</sup> Basin 8-1 Alternative, PDF p. 4

<sup>90</sup> Basin 8-1 Alternative, PDF p. 4

<sup>91</sup> Basin 8-1 Alternative, PDF p. 51

<sup>92</sup> Basin 8-1 Alternative, PDF p. 47



## C. Sustainable Management Criteria

GSP Regulations require a sustainability goal that defines conditions that constitute sustainable groundwater management for the basin, the characterization of undesirable results, and establishment of minimum thresholds and measurable objectives for each applicable sustainability indicator, as appropriate.<sup>93</sup>

### 1. Sustainability Goal

GSP Regulations require that sustainable management criteria include a sustainability goal that culminates in the absence of undesirable results within the appropriate timeframe, and includes a description of the sustainability goal, describes information used to establish the goal for the basin, describes measures that will be implemented to ensure the basin operates within its sustainable yield, and contains an explanation of how the sustainability goal will be met.<sup>94</sup> The sustainability goal for an alternative based on an analysis of basin conditions represents the criteria that allowed the basin to be operated within its sustainable yield for a period of at least 10 years, which includes the avoidance of undesirable results.<sup>95</sup>

The Coastal Basin Alternative describes the sustainability goal separately for each of the four management areas, although the goals are essentially identical and consistent for three of the management areas (OCWD, Santa Ana Canyon, and South East). The Alternative describes the sustainability goal for the OCWD Management Area as continuing to manage the groundwater basin to prevent conditions that would lead to significant and unreasonable undesirable results.<sup>96</sup> The South East Management Area and the Santa Ana Canyon Management Area are generally consistent with the approach of OCWD, emphasizing monitoring and maintenance of existing conditions to avoid undesirable results.<sup>97</sup> The La Habra-Brea Management Area is consistent with the other areas, except that the City of La Habra GSA intends to develop its own GSP to manage that portion of the Basin.<sup>98</sup>

### 2. Sustainability Indicators

GSP Regulations specify that an agency define conditions that constitute sustainable groundwater management for a basin, including the characterization of undesirable

---

<sup>93</sup> 23 CCR § 354.22

<sup>94</sup> 23 CCR § 354.24. For an alternative based on a demonstration of 10 years of sustainable management, the sustainability goal, or its functional equivalent, would have been developed at some previous time during basin management, and its goals met by the time the Alternative was submitted to the Department.

<sup>95</sup> Water Code § 10721(w)

<sup>96</sup> Basin 8-1 Alternative, PDF p. 8, p. 210

<sup>97</sup> Basin 8-1 Alternative, PDF p. 335, p. 380

<sup>98</sup> Basin 8-1 Alternative, PDF p. 69

results and the establishment of minimum thresholds and measurable objectives for each applicable sustainability indicator.<sup>99</sup>

Sustainability indicators are defined as any of the effects caused by groundwater conditions occurring throughout the basin that, *when significant and unreasonable*, cause undesirable results.<sup>100</sup> Sustainability indicators thus correspond with the six undesirable results – chronic lowering of groundwater levels indicating a depletion of supply if continued over the planning and implementation horizon, reduction of groundwater storage, seawater intrusion, degraded water quality, including the migration of contaminant plumes that impair water supplies, land subsidence that substantially interferes with surface land uses, and depletions of interconnected surface water that have adverse impacts on beneficial uses of the surface water<sup>101</sup> – but refer to groundwater conditions that are not, in and of themselves, significant and unreasonable. Rather, sustainability indicators refer to the effects caused by changing groundwater conditions that are monitored, and for which criteria in the form of minimum thresholds are established by the agency to define when the effect becomes significant and unreasonable, producing an undesirable result.

This section thus consolidates three facets of sustainable management criteria: undesirable results, minimum thresholds, and measurable objectives. Information pertaining to the processes and criteria relied upon to define undesirable results applicable to the basin, as quantified through the establishment of minimum thresholds, are addressed for each sustainability indicator. However, a submitting agency is not required to establish criteria for undesirable results that the agency can demonstrate are not present and are not likely to occur in a basin.<sup>102</sup>

The Alternative focuses on groundwater storage, which is the primary threshold by which the Agencies determine the successful operation of the basin. According to the Alternative, the Agencies avoid other undesirable results by maintaining an operating range of a full aquifer system to 500,000 AF below full.<sup>103</sup> Because the Agencies consider the Basin to have been managed sustainably for years, meaning that undesirable results are not present and are not likely to occur, establishment of measurable objectives and interim milestones are not regarded as a necessary component for this type of alternative.<sup>104</sup>

---

<sup>99</sup> 23 CCR § 354.22

<sup>100</sup> 23 CCR § 351(ah)

<sup>101</sup> Water Code § 10721(x)

<sup>102</sup> 23 CCR § 354.26(d)

<sup>103</sup> Basin 8-1 Alternative, PDF p. 215

<sup>104</sup> Alternative Elements Guide

### *a. Chronic Lowering of Groundwater Levels*

GSP Regulations specify that the minimum threshold for chronic lowering of groundwater levels be based on groundwater elevations indicating a depletion of supply that may lead to undesirable results.<sup>105</sup>

Groundwater levels are measured through a network of monitoring wells in each management area (see Monitoring Networks, below). The groundwater level data collected from the monitoring wells in the OCWD Management Area are used to calculate the groundwater in storage for the entire Coastal Basin annually. The Basin is managed to maintain storage levels at or above the threshold of 500,000 AF below full conditions that has been determined by the OCWD to prevent undesirable results in the Basin.<sup>106</sup> The Agencies have not set a minimum threshold for groundwater levels at any particular monitoring well. Instead, groundwater level data are used to create groundwater elevation maps, which are used to calculate the annual volume of groundwater in storage and the total groundwater in storage. "GIS mapping is used to multiply the water level changes by a grid of aquifer storage coefficients from OCWD's calibrated groundwater flow model, [which] results in a storage change volume for each of the three aquifer layers which are totaled to provide a net annual storage change for the basin."<sup>107</sup> The Alternative states that "the estimated historical minimum storage level of 500,000 AF to 700,000 AF below full condition occurred in 1956-57."<sup>108</sup> The groundwater model indicates a higher potential for adverse impacts related to seawater intrusion, production wells, and land subsidence if the groundwater in storage declined to 700,000 AF below full condition.<sup>109</sup>

The groundwater production in the OCWD Management Area accounts for about 98 percent of the groundwater that is extracted from the Basin each year, and the basin model used by the OCWD to calculate the volume of groundwater in storage covers nearly the entire basin.<sup>110</sup>

### *b. Reduction of Groundwater Storage*

GSP Regulations specify that the minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results.<sup>111</sup>

---

<sup>105</sup> 23 CCR § 354.28(c)(1)

<sup>106</sup> Basin 8-1 Alternative, PDF p. 214

<sup>107</sup> Basin 8-1 Alternative, PDF p. 212

<sup>108</sup> Basin 8-1 Alternative, PDF p. 217

<sup>109</sup> Basin 8-1 Alternative, PDF p. 215, p. 216

<sup>110</sup> Basin 8-1 Alternative, PDF pp. 132-133

<sup>111</sup> 23 CCR § 354.28(c)(2)

The Coastal Basin is managed based on the volume of groundwater in storage. The maximum groundwater storage capacity of the basin is estimated to be 66 million AF.<sup>112</sup> Although the specific yield of the Basin is 38 million AF, the OCWD has established an operating range for the Basin of 500,000 AF below full condition based on empirical evidence that adverse impacts such as seawater intrusion, land subsidence, lowering of groundwater levels, and reduction in storage occur at lower storage conditions.<sup>113</sup> The Alternative states that the significant and unreasonable impacts incrementally increase as the groundwater in storage falls more than 500,000 AF below full condition, but that a reduction of up to 700,000 AF below full condition is acceptable during an extreme emergency.<sup>114</sup>

The annual change in groundwater in storage is calculated using groundwater elevation data, and the result is checked against the annual water budget, which accounts for all production, measured recharge, and estimated unmeasured recharge.<sup>115</sup> The groundwater in storage from 1959 to 2016 presented in the Alternative demonstrate that OCWD has managed the basin within its operating range since the early 1960s.<sup>116</sup>

The OCWD has used a financially-driven management strategy locally referred to as the Basin Production Percentage as a technique to manage private groundwater production. The Basin Production Percentage is set after OCWD evaluates groundwater storage conditions, availability of recharge water supplies, and basin management objectives. The goal of the Basin Production Percentage approach is to encourage groundwater producers to pump sustainably over the long term, reduce the overall water supply cost, and financially discourage production, via higher replenishment assessment fees, above the sustainable range.<sup>117</sup> The OCWD uses 500,000 AF below full as the minimum threshold to avoid undesirable results; if groundwater in storage exceeds 500,000 AF below full, there is an increased likelihood of undesirable results including seawater intrusion, land subsidence, reduction of water in storage, some wells becoming inoperable, increased costs to pump groundwater, and potential for upwelling of lower quality amber-colored groundwater from the Deep Aquifer.<sup>118</sup>

---

<sup>112</sup> Basin 8-1 Alternative, PDF p. 23

<sup>113</sup> Basin 8-1 Alternative, PDF p. 102, pp. 107-109, p. 215

<sup>114</sup> Basin 8-1 Alternative, PDF p. 215

<sup>115</sup> Basin 8-1 Alternative, PDF p. 103

<sup>116</sup> Basin 8-1 Alternative, PDF p. 216

<sup>117</sup> Basin 8-1 Alternative, PDF pp. 218-221

<sup>118</sup> Basin 8-1 Alternative, PDF p. 215

### *c. Seawater Intrusion*

GSP Regulations specify that the minimum threshold for seawater intrusion be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results.<sup>119</sup>

The Alternative states that an undesirable result of seawater intrusion would be the shutdown of active production wells due to seawater-derived salinity and loss of a significant amount of basin storage due to seawater-derived salinity.<sup>120</sup> Also, as the Alternative explains in the analysis of groundwater storage for the basin, if groundwater in storage drops more than 500,000 AF below full condition, there would be increased risk of seawater intrusion.<sup>121</sup>

Seawater intrusion is of concern only to the OCWD Management Area, as the other management areas are located inland.<sup>122</sup> Seawater intrusion in the Basin began in the 1920s due to unrestricted pumping and gradually moved inland, becoming a critical problem in the 1950s.<sup>123</sup> The USGS and the Department investigated seawater intrusion along the coast in the 1950s and 1960s.<sup>124</sup> “OCWD regularly reviews hydrogeologic data, including water quality data, [from 425 monitoring and production wells] to evaluate the extent of seawater intrusion.”<sup>125</sup> The Alternative explains that seawater intrusion was halted, and significant and unreasonable seawater intrusion is not actively occurring due to OCWD’s management programs.

As mentioned above, the Alternative states OCWD’s management of seawater intrusion is implemented through a comprehensive program that includes operating seawater intrusion barriers using recycled water, monitoring and evaluating barrier performance, monitoring and evaluating susceptible coastal areas, and coastal groundwater management.<sup>126</sup> The Alternative describes OCWD’s decades of operation of the different seawater intrusion barriers and the associated monitoring for intrusion and barrier performance<sup>127</sup> and states that “significant and unreasonable seawater intrusion seawater intrusion is not present and not anticipated to occur in the future in the OCWD

---

<sup>119</sup> 23 CCR § 354.28(c)(3)

<sup>120</sup> Basin 8-1 Alternative, PDF p. 252

<sup>121</sup> Basin 8-1 Alternative, PDF p. 215

<sup>122</sup> Basin 8-1 Alternative, PDF, Figure 1-1

<sup>123</sup> Basin 8-1 Alternative, PDF p. 202

<sup>124</sup> Basin 8-1 Alternative, PDF p. 124

<sup>125</sup> Basin 8-1 Alternative, PDF p. 147, p. 160

<sup>126</sup> Basin 8-1 Alternative, PDF p. 104

<sup>127</sup> Basin 8-1 Alternative, PDF pp. 107-109, pp. 235-252

Management Area due to OCWD's management programs."<sup>128</sup> The Alternative includes cross-sections and contour maps showing chloride concentrations.<sup>129</sup>

#### *d. Degraded Water Quality*

GSP Regulations specify that the minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agencies that may lead to undesirable results.<sup>130</sup>

The Alternative provides a description of water quality issues related to plumes of volatile organic compounds, methyl tertiary-butyl ether, and high levels of nitrates and total dissolved solids. Each of these water quality issues have associated remediation programs<sup>131</sup> that are described in the Alternative and coordinated with the groundwater management actions of the Agencies; however, these sites are overseen by other agencies. The monitoring of water quality issues is discussed in the *Monitoring Networks* section, below. The minimum threshold for the water quality sustainability indicator is defined in the Alternative as exceedances of maximum contaminant levels or other applicable regulatory limits that are directly attributable to groundwater management actions in the OCWD Management Area that prevents the use of groundwater for its designated beneficial uses.<sup>132</sup>

The Alternative describes amber-colored water from the Deep Aquifer. The groundwater is in contact with ancient buried plant and wood material that results in the high-quality groundwater having a sulfur odor and being amber-colored. Two facilities treat this groundwater using nano-filtration technology.<sup>133</sup> By maintaining the groundwater in storage above 500,000 AF below full condition, the potential for upwelling of amber-colored groundwater is reduced.<sup>134</sup>

#### *e. Land Subsidence*

GSP Regulations specify that the minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results.<sup>135</sup>

---

<sup>128</sup> Basin 8-1 Alternative, PDF p. 104

<sup>129</sup> Basin 8-1 Alternative, PDF pp. 235-250

<sup>130</sup> 23 CCR § 354.28(c)(4)

<sup>131</sup> Basin 8-1 Alternative, PDF pp. 186-193

<sup>132</sup> Basin 8-1 Alternative, PDF p. 234

<sup>133</sup> Basin 8-1 Alternative, PDF pp. 232-233

<sup>134</sup> Basin 8-1 Alternative, PDF p. 215

<sup>135</sup> 23 CCR § 354.28(c)(5)

Based on interferometric synthetic aperture radar data and data collected by the Orange County Surveyor, the Alternative states that there is “no evidence of continuing irreversible land subsidence, nor is there evidence that land subsidence has interfered with surface uses” since 2002.<sup>136</sup> The Alternative recognizes elastic and reversible ground movement and provides monitoring data from 2002 to 2014, showing “a consistent pattern of the ground surface rising and falling in tandem with groundwater levels and overall changes in basin groundwater storage.”<sup>137</sup> This elastic land subsidence is correlated with the changes in groundwater levels and groundwater in storage.<sup>138</sup>

The surveyor measures the land elevation and maintains a network of real-time GPS reference stations that monitor horizontal and vertical movement in Orange County. OCWD reviews this data annually. The Alternative discusses that with the use of groundwater storage as a proxy, if groundwater in storage does not drop more than 500,000 AF below full for an extended period of time, the Basin will not experience undesirable results associated with inelastic land subsidence.

#### *f. Depletions of Interconnected Surface Water*

GSP Regulations specify that the minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results.<sup>139</sup>

Within the OCWD Management Area, depletions of interconnected surface water do not exist because much of the Santa Ana River is concrete-lined or is a losing reach with engineering facilities to infiltrate surface water into the groundwater basin.<sup>140</sup> The La Habra-Brea Management Area states that groundwater is pumped from the confined San Pedro aquifer, with a depth to groundwater of about 140 feet in the year 2000; therefore, groundwater production is not anticipated to impact surface waters or local habitats.<sup>141</sup> No updated groundwater levels are provided. The South East Management Area does not manage depletions of interconnected surface water because streams and creeks are ephemeral.<sup>142</sup>

For the stretch of the Santa Ana River in the OCWD Management Area (see Figure 3, modified map below), the Alternative states that while the Santa Ana River is known to be a losing reach, “there is no evidence that changes in groundwater levels have had an

---

<sup>136</sup> Basin 8-1 Alternative, PDF pp. 253-254

<sup>137</sup> Basin 8-1 Alternative, PDF pp. 253-255

<sup>138</sup> Basin 8-1 Alternative, PDF p. 254

<sup>139</sup> 23 CCR § 354.28(c)(6)

<sup>140</sup> Basin 8-1 Alternative, PDF p. 148

<sup>141</sup> Basin 8-1 Alternative, PDF p. 79

<sup>142</sup> Basin 8-1 Alternative, PDF p. 341

impact on flows in the Santa Ana River from Imperial Highway to 17th Street in Santa Ana.”<sup>143</sup> Prado Dam is located above the Santa Ana Canyon, and the river is dependent on water releases from the flow-through dam. Within the Santa Ana Canyon Management Area section, the Alternative states that the flow of surface water dwarfs the groundwater production. Thus, “groundwater production has a de minimis impact on groundwater conditions and the flows of surface water through the canyon” with little to no impact of groundwater-dependent ecosystems or depletion of interconnected surface water.<sup>144</sup> However, the Alternative states that “...some infiltration may occur due to minor groundwater pumping in the Santa Ana Canyon Management Area[,]” but the river “is generally considered to be in equilibrium between surface water and groundwater based on available stream gage and groundwater level data.”<sup>145</sup>



Figure 3. Groundwater Replenishment System

## D. Monitoring Networks

GSP Regulations require that each basin be monitored, and that a monitoring network include monitoring objectives, monitoring protocols, and data reporting requirements be developed that shall promote the collection of data of sufficient quality, frequency, and

<sup>143</sup> Basin 8-1 Alternative, PDF p. 257

<sup>144</sup> Basin 8-1 Alternative, PDF p. 369

<sup>145</sup> Basin 8-1 Alternative, PDF p. 148



distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions.<sup>146</sup>

The Alternative discusses the monitoring network for each management area the Basin. The OCWD monitoring network is the most extensive network in the Basin and covers the OCWD Management Area and the Santa Ana Canyon Management Area. OCWD monitors the Basin by collecting data from the following wells: monitoring wells, production wells, irrigation and industrial wells, injection wells, mid-basin injection wells, seawater intrusion monitoring wells, Title 22 compliance monitoring wells, North Basin Groundwater Protection Program wells, South Basin Groundwater Protection Program wells, and CASGEM monitoring program wells. A list of wells, the owners, and which program each well participates in is included in the Alternative.<sup>147</sup> The OCWD monitors groundwater levels in more than 1,000 individual measuring points in about 400 monitoring wells on a monthly or bimonthly frequency.<sup>148</sup>

With the data collected within the OCWD jurisdiction, groundwater levels are used to create groundwater elevation contour maps for each aquifer, which are used to determine the annual change and total change of groundwater in storage. Determining the annual change and total change in storage allows the OCWD to implement management actions and maintain the Basin within its operating range.<sup>149</sup>

The La Habra-Brea Management Area monitors for groundwater elevation and water quality. A map showing the location of monitoring wells within the management area is provided; however, the monitoring program is not clearly explained. The La Habra-Brea Management Area includes groundwater level data for about eight wells.<sup>150</sup> The Alternative states that the City of La Habra has measured groundwater elevations in its production wells since 2008, the most recent data was from about 2011.<sup>151</sup> The Alternative states that the City's monitoring program will be governed by its GSP, which is anticipated to be completed by January 2020.<sup>152</sup>

IRWD monitors the wells in the South East Management Area for groundwater levels and water quality on a monthly basis. The monitoring network consists of six wells.<sup>153</sup>

OCWD adopted the Groundwater Quality Protection Policy in 1987, which includes the maintenance of surface water and groundwater quality monitoring programs, the

---

<sup>146</sup> 23 CCR § 354.32

<sup>147</sup> Basin 8-1 Alternative, PDF p. 275

<sup>148</sup> Basin 8-1 Alternative, PDF p. 161, p. 211

<sup>149</sup> Basin 8-1 Alternative, PDF p. 120, p. 222

<sup>150</sup> Basin 8-1 Alternative, PDF pp. 55-57, p. 62

<sup>151</sup> Basin 8-1 Alternative, PDF pp. 55-57

<sup>152</sup> Basin 8-1 Alternative, PDF p. 47, p. 62

<sup>153</sup> Basin 8-1 Alternative, PDF p. 318

monitoring well network and data management system, and assisting regulatory agencies in remediating contaminated sites.<sup>154</sup> OCWD also monitors for seawater intrusion barrier performance and determines if the barriers are preventing seawater intrusion.<sup>155</sup> Historical data is stored utilizing the Water Resources Management System.<sup>156</sup>

The Alternative indicates that more than 425 monitoring and production wells are sampled semi-annually for more than 100 water quality constituents.<sup>157</sup> The discussion regarding the monitoring and production wells that are tested for water quality in the La Habra-Brea, Southeast, and Santa Ana Canyon Management Areas are available in the respective management area sections of the Alternative. All of the Agencies sample the wells pursuant to Title 22 of the California Code of Regulations and use the maximum contaminant levels regulated by the State Water Resources Control Board Division of Drinking Water for the minimum thresholds. The Alternative discusses the sampling protocol in the OCWD Management Area; if a detection of an organic compound occurs at a well for the first time, the well will be resampled to confirm the presence of the constituent. If the constituent is confirmed, then the sampling frequency will increase for that well.<sup>158</sup>

In addition to overseeing the OCWD monitoring network, the OCWD collaborates with the LACDPW to operate the jointly owned Alamitos Seawater Intrusion Barrier. The LACDPW operates, maintains, and samples the Alamitos Barrier monitoring wells and injection well, including the wells owned by OCWD located in Orange County. The operational costs and data are shared between the two agencies.<sup>159</sup>

In regard to monitoring ground surface elevation, the Orange County Surveyor (Surveyor) maintains more than 1,500 elevation benchmarks throughout Orange County and periodically surveys the benchmarks. The Surveyor also maintains a network of continuously operating survey stations that measure and record data in real-time. InSAR data and Surveyor data from about 1993 to 2014 show elastic ground movement that correlates rises and declines with the available groundwater storage space.<sup>160</sup>

## E. Projects and Management Actions

GSP Regulations require a description of the projects and management actions the submitting agency has determined will achieve the sustainability goal for the basin,

---

<sup>154</sup> Basin 8-1 Alternative, PDF p. 100

<sup>155</sup> Basin 8-1 Alternative, PDF p. 251

<sup>156</sup> Basin 8-1 Alternative, PDF p. 134

<sup>157</sup> Basin 8-1 Alternative, PDF p. 169

<sup>158</sup> Basin 8-1 Alternative, PDF p. 104

<sup>159</sup> Basin 8-1 Alternative, PDF p. 173

<sup>160</sup> Basin 8-1 Alternative, PDF pp. 253-255

including projects and management actions to respond to changing conditions in the basin.<sup>161</sup>

The Alternative describes several projects and management actions, such as the seawater intrusion barriers, recycled water projects, recharge projects, and the acquisition of water rights and property, that were implemented by OCWD to stop undesirable results associated with excessive groundwater production, which included lowering groundwater levels, reduction of groundwater storage, and seawater intrusion. The Alternative demonstrates that with the implementation of these projects and actions, the Agencies have operated the Basin since the early 1960s to be within the management goal for the Basin, which is between a full condition and 500,000 AF below full, without experiencing undesirable results.<sup>162</sup>

Through decades of management and project implementation, the OCWD developed an aquifer recharge program, a water recycling program that can produce up to 100 million gallons of high-quality water every day, an extensive monitoring program, constructed seawater intrusion barriers, and doubled the volume of groundwater production while avoiding undesirable results.<sup>163</sup> The Alternative states that the existing sea water intrusion barriers, recycled water projects, and recharge projects are ongoing projects expected to continue to facilitate meeting the water demand of the beneficial uses and users of groundwater while operating within the sustainable yield.<sup>164</sup>

The OCWD also collaborates with local water managers; the seawater intrusion barrier at the Alamitos Gap is jointly owned by OCWD and the Los Angeles County Department of Public Works (LACDPW), an agency in an adjacent groundwater basin and county; the LACDPW operates and maintains the Alamitos Barrier, but receives funding from the OCWD for some of the water that is injected. Through an interagency agreement since 1964, “the operational costs and data are shared between the two agencies with a joint report on the status of the barrier prepared on an annual basis.”<sup>165</sup> Both seawater intrusion barrier barriers have been expanded from their initial implementation to include more injection well sites.<sup>166</sup> The Alamitos Gap began operation in 1965 with 14 injection wells and now includes 41 injection wells<sup>167</sup>. The Alamitos Barrier is undergoing a \$15

---

<sup>161</sup> 23 CCR § 354.44

<sup>162</sup> Basin 8-1 Alternative, PDF pp. 107-109, p. 216

<sup>163</sup> Basin 8-1 Alternative, PDF pp. 101-102

<sup>164</sup> Basin 8-1 Alternative, PDF p. 210

<sup>165</sup> Basin 8-1 Alternative, PDF p. 173

<sup>166</sup> Basin 8-1 Alternative, PDF p. 203

<sup>167</sup> Basin 8-1 Alternative, PDF p. 204

million improvement of 17 injection wells and six monitoring wells.<sup>168</sup> The Talbert Gap began operation with 23 barrier wells and now consists of 36 injection wells.<sup>169</sup>

## IV. Assessment

The following describes the evaluation and assessment of the Alternative for the Coastal Plain of Orange County Basin as determined by Department staff. In undertaking this assessment, Department staff did not conduct geologic or engineering studies, although Department staff may have relied on publicly available geologic or engineering or other technical information to verify claims or assumptions presented in the Alternative.<sup>170</sup> As discussed above, Department staff have determined that the Coastal Basin Alternative satisfied the conditions for submission of an alternative.<sup>171</sup> The Alternative was submitted within the statutory period, the Coastal Basin was found to be in compliance with the reporting requirements of CASGEM, and staff find the Alternative to be complete and to cover the entire Basin (see Required Conditions, above). Based on its evaluation and assessment of the Coastal Basin Alternative, as discussed below, Department staff have determined that the Alternative satisfies the objectives of SGMA.<sup>172</sup>

### A. Evaluation of Alternative Contents

The Agencies document their authority to manage groundwater within their statutory boundaries within each management area of the Coastal Basin. The Alternative asserts the Agencies legal authorities and recounts their ability to finance projects and management actions, which have been implemented and demonstrate the Basin has been operating within the sustainable yield of the basin for at least 10 years. Similar to the historical and ongoing groundwater management actions and projects, the Alternative was developed through a process that included participation from a wide range of interests representing various beneficial uses and users of groundwater.

The hydrogeologic conceptual model is consistent with the Department staff's understanding of the geology of the Basin, has reasonably characterized surface water and groundwater systems, and has relied upon the best available information. The Alternative demonstrates that the Agencies have an extensive understanding of the Basin hydrogeology and utilize this knowledge to set sustainability goals and sustainably manage the Basin.

---

<sup>168</sup> Basin 8-1 Alternative, PDF p. 244

<sup>169</sup> Basin 8-1 Alternative, PDF pp. 203-204

<sup>170</sup> Instances where the Department review relied upon publicly available data that was not part of the Alternative are specifically noted in the assessment.

<sup>171</sup> 23 CCR § 358.4(a)

<sup>172</sup> Water Code § 10733.6(a); 23 CCR § 358.4(b)

Department staff find the overall description of groundwater conditions to be thorough and reasonable and to be based on an appropriate level of detail and range of data distribution points in the Basin. The groundwater conditions described are consistent with the hydrogeologic conceptual model for the Basin. However, the discussions regarding the effects of pumping on the interconnected surface water and groundwater in the La Habra-Brea and Santa Ana Canyon Management Areas are not clear and should be clarified. No explanation is provided for whether the surface water bodies in the La Habra-Brea Management Area are interconnected with the groundwater aquifers, nor does the Alternative discuss the presence or absence of groundwater-dependent ecosystems in the La Habra-Brea Management Area. Given the statements in the Santa Ana Canyon and OCWD Management Areas, surface water and groundwater interaction does exist.<sup>173</sup> The Alternative indicates that stream gage data and groundwater level data exist for the Santa Ana Canyon, but the Alternative does not provide a summary of the stream gage data and groundwater level data that were used to determine that groundwater production has a de minimis effect on the groundwater-surface water interaction, nor describes what is the rationale for what constitutes a de minimis impact and what the de minimis impacts are. The Agencies' understanding of the basin setting is adequate for the approval of the Alternative; however, the Agencies should clarify the discussion regarding depletions of interconnected surface water and groundwater related to basin setting (see Recommended Action 1).

The Alternative presentation of the water budget meets the intent of the requirements of SGMA and the GSP Regulations. Because the Alternative discusses the Agencies operating within the sustainable yield for more than 10 years, a projected water budget is not required for the Department staff to make its determination. Although the water budget does not account for the groundwater production in the La Habra-Brea Management Area, the Department staff determined that the Alternative provided enough information for staff to evaluate the Basin's sustainability because approximately 98 percent of the Basin's groundwater production is from the OCWD Management area.<sup>174</sup> The Agencies' understanding of the basin setting is adequate for the approval of the Alternative; however, the Agencies should better describe and quantify the use of groundwater in the La Habra-Brea Management Area and the relationship to the rest of the Basin (see Recommended Action 2).

Because the OCWD Management Area covers 89% of the land overlying the Basin and accounts for 98% of the groundwater production, the lack of management activities and deficiencies within the Alternative for the other management areas did not prevent the Department staff from determining the Basin's sustainability at this time. The Alternative

---

<sup>173</sup> Basin 8-1 Alternative, PDF p. 148, p. 369

<sup>174</sup> Basin 8-1 Alternative, PDF p. 8

did not clearly explain the rationale for the creation or use of management areas or how the creation of management areas will facilitate implementation of the Alternative.<sup>175</sup> However, the Alternative implies that management areas were created to comply with the SGMA requirement that the entire basin be covered because no single agency had jurisdiction over the entire Basin.<sup>176</sup> The Alternative states that the City of La Habra intends to prepare a GSP for the La Habra-Brea Management Area by 2020 for the La Habra Basin. The information in the Alternative for the La Habra-Brea Management Area lacks clarity and detail regarding the beneficial uses and users of water, the water budget, sustainable management criteria, monitoring network, and data gaps. The Agencies should address the discrepancies related to basin setting (see Recommended Action 3).

While each of the management areas identified a sustainability goal which are collectively similar in nature, it should be noted that a single sustainability goal, along with the undesirable results, are intended to be established for the entire basin.

The use of groundwater in storage as a proxy for the minimum thresholds and avoidance of undesirable results for the sustainability indicators appears reasonable. The groundwater elevations used to calculate the groundwater in storage are routinely measured at an acceptable frequency; however, the wells that are used to create the groundwater elevation contours and used to determine the volume of groundwater in storage are not explicitly discussed in the Alternative. The Alternative demonstrates that the Basin has been operated sustainably for at least 10 years and that it will likely continue to be operated sustainably based on the description of OCWD's management program, which assesses the current storage, projected supply needs, and estimated water available for recharge including surface water, natural recharge, and recycled water. The Agencies' understanding of undesirable results and minimum thresholds is adequate for the approval of the Alternative; however, the Alternative contains vague language regarding the onset of undesirable results when exceeding the minimum threshold. The Alternative states that "on a short-term basis, the basin can be operated [more than 500,000 AF below full condition] in an emergency"<sup>177</sup> and that "...[a] reduction of up to 700,000 AF of groundwater in storage is only considered acceptable during an extreme emergency..."<sup>178</sup> The Agencies should provide a technical justification and quantification of the timing related to this sustainable management criteria (see Recommended Action 4).

The Agencies have decades of experience facilitating and operating seawater intrusion barriers, including the development and implementation of the groundwater quality

---

<sup>175</sup> 23 CCR § 354.20

<sup>176</sup> Basin 8-1 Alternative, PDF p. 4

<sup>177</sup> Basin 8-1 Alternative, PDF p. 154

<sup>178</sup> Basin 8-1 Alternative, PDF p. 215

monitoring network and protocols, which demonstrates that the Agencies have satisfied the objectives of SGMA with regard to seawater intrusion. With collaborative management and assistance from agencies overlying the Basin and adjacent basins, the Alternative demonstrates with the seawater intrusion barrier and water treatment projects, the Agencies can "...sustainably manage groundwater conditions in the basin in order to prevent significant and unreasonable seawater intrusion."<sup>179</sup>

Given the Agencies' extensive water quality programs, monitoring, sampling pursuant to Title 22 requirements, historical remediation experience, and utilizing the Basin within its operating range, the Basin has not experienced undesirable results associated with water quality, including the upwelling of amber-colored water.

For the Santa Ana Canyon, the Alternative seems to convey that if groundwater pumping does cause increased surface water infiltration, the impact has a de minimis effect due to the high volume of surface water released from Prado Dam in comparison with the minor pumping. However, the Alternative contains conflicting language, which results in confusion and ambiguity regarding the interconnectedness of surface water and groundwater and whether stream depletions occur and are affected by groundwater pumping. The OCWD's contention appears reasonable based on the Santa Ana River's dependency on the controlled releases of water from Prado Dam, and given that the Santa Ana Canyon Management Area represents approximately 0.6 percent of the entire Basin's groundwater production and 3 percent of the land area, making it unlikely that the Basin would experience undesirable results related to groundwater depletions impacting surface water. The lack of more specific information does not limit Department staff's ability to determine the Basin's sustainability; however, the de minimis impact should be clarified and quantified (see Recommended Action 1).

The monitoring network provides a comprehensive network of wells and other measuring methods to evaluate the sustainability indicators. The OCWD maintains decades of monitoring results and demonstrates detailed knowledge and understanding of the Basin. The Agencies actively monitor for changes in groundwater conditions and use the monitoring data to manage the Basin sustainably. The Agencies intend to continue sustainable management and to report monitoring data as required by SGMA.<sup>180</sup> While the following did not prevent Department staff from making a determination, it is noted that the La Habra-Brea Management Area monitoring network lacks detail. The La Habra-Brea monitoring wells do not provide well construction information to specifically identify the aquifer being measured; and water level measurements are collected from wells under pumping conditions or under the influence of nearby operating pumps affecting the

---

<sup>179</sup> Basin 8-1 Alternative, PDF p. 235

<sup>180</sup> Basin 8-1 Alternative, PDF p. 3

understanding of static groundwater conditions. The Alternative mentions that part of their monitoring network include three wells reported by the Department; for clarification, the Department has not and does not monitor the wells mentioned in the Alternative; the Department formerly compiled groundwater information for these wells but has not done so since about 2010.<sup>181</sup> The three wells are in CASGEM; however, two of the three wells do not have groundwater elevation data in CASGEM; only one well has groundwater elevation data reported by the OCWD. No hydrographs with data more recent than about 2010 were provided for the La Habra-Brea Management Area, which coincides with the year that the Department stopped manually compiling groundwater elevation data. The age of the groundwater elevation data and the timing of when data became unavailable<sup>182</sup> for the La Habra-Brea Management Area suggests that monitoring is not active and not comprehensive (see Recommended Action 3).

Although the description of future Projects and Management actions are not required for this type of analysis, the Alternative demonstrated that through the historical implementation of projects and management actions, the Basin has reached a locally-defined level of sustainability and is operating to a sustainable yield. Many of the implemented projects are ongoing and expected to continue.

The Agencies within the Coastal Basin have mitigated overdraft and managed seawater intrusion, which is consistent with Water Code Section 106.3, which establishes the state policy that “every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.” The Alternative states that, apart from a small stretch of the Santa Ana River in the Santa Ana Canyon Management Area part of the basin, in which releases from surface water storage recharge the aquifer, no interconnected streams are present in the Basin. Therefore, Department staff consider the Alternative to not affect public trust resources. Although Department staff do not consider the extent of interconnected surface water to be significant, or there to be a reasonable risk that undesirable results related to interconnected surface water could results from current groundwater management practices, quantification of surface-groundwater relations is recommended (see Recommended Action 1).

## B. Recommended Actions

The following recommended actions include information that the District may wish to include in the first five-year update of the Alternative to facilitate the Department’s ongoing

---

<sup>181</sup> Basin 8-1 Alternative, PDF p. 62

<sup>182</sup> Basin 8-1 Alternative, PDF pp. 56-57



evaluation and assessment of the Alternative as well as recommendations for improvements to the Alternative.

### Recommended Action 1.

Staff recommend the Agencies clarify the basis for the determination that depletions of interconnected surface water in the Santa Ana Canyon Management Area are de minimis, while considering the volume of pumping, the extent of the interconnection between groundwater and surface water, and the beneficial users of the surface water. Staff recommend clarifying whether surface water bodies in the La Habra-Brea Management Area are interconnected with groundwater and whether groundwater-dependent ecosystems exist within the Santa Ana Canyon and La Habra Management Areas.

### Recommended Action 2.

Staff recommend a basin-wide water budget utilizing inflow and outflow information from each management area or a water budget for each management area be provided in accordance with the GSP regulations (CCR 23 Section 354.18).

### Recommended Action 3.

Staff recommend that the Agencies provide the agreements among the different jurisdictions which commit the Agencies to conduct monitoring and implement the Alternative within their management areas. If no GSP is developed for the La Habra-Brea Management Area, the next Alternative update should provide additional explanation and quantification of the management approaches, sustainable management criteria, and evidence for the presence or absence of undesirable results for the La Habra-Brea Management Area.

### Recommended Action 4.

Staff recommend the Agencies explain the timeframe that the Basin can safely operate, without experiencing undesirable results, after exceeding 500,000 AF below full conditions (23 CCR Section 354.26(b)(2)) and clarify the wells used to calculate the change in groundwater in storage and the overall groundwater in storage.