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Technical Memorandum - DRAFT
Assessment of Groundwater Dependent Ecosystems for the Oxnard Subbasin Groundwater Sustainability Plan

INTRODUCTION

The Sustainable Groundwater Management Act (SGMA) requires agencies to identify and consider groundwater dependent ecosystems (GDEs) during the development of Groundwater Sustainability Plans (GSPs). The Fox Canyon Groundwater Management Agency's Technical Advisory Group (TAG) for the development of its GSPs formed an ad hoc committee, comprised TAG members from The Nature Conservancy, United Water Conservation District, and Calleguas Municipal Water District, to support the assessment of GDEs for the Fox Canyon Groundwater Sustainability Plans. The assessment coincided with development of a statewide GDE Guidance by The Nature Conservancy (TNC) to identify and consider GDEs under SGMA (Rohde et al., 2018). Thus, this GDE assessment served two purposes: 1) to aid in the development of the GDE Guidance and 2) serve as a case study of the utility of the guidance. This technical memorandum follows five steps laid out in the GDE Guidance:

I. Identify GDEs
II. Determine Potential Effects on GDEs
III. Consider GDEs when Establishing Sustainable Management Criteria
IV. Incorporate GDEs into the Monitoring Network
V. Identify Projects and Management Actions to Maintain or Improve GDEs.

I. Identify GDEs

Six groundwater dependent ecosystem (GDEs) were identified in the Oxnard Groundwater Subbasin: the lower Santa Clara River downstream of the Oxnard Forebay and upstream of the estuary, McGrath Lake, Ormond Beach wetlands, Mugu Lagoon, lower Calleguas Creek, and Revolon Slough GDEs (Figure 1). These six GDE located in the Oxnard Plain are connected to the shallow semi-perched aquifer. The semi-perched aquifer is recharged by local precipitation and agricultural return flows. The return flows and seawater intrusion result in marginal water quality (high TDS

and chloride). As a result, little to no pumping occurs in the semi-perched aquifer and the semi-perched aquifer is not a considered a managed or principal aquifer in the Oxnard Subbasin.

Mapping Basin GDEs from the Statewide Database of GDE Indicators

The GDEs were identified using an earlier version of the statewide database of GDE indicators (iGDE v0.3.1; TNC, 2017) and groundtruthed using local information to confirm whether or not a hydrologic connection to groundwater exists, as described in The Nature Conservancy's GDE Guidance (Step 1.1; Rohde et al., 2018). In the Oxnard Subbasin, the statewide database (Figure 2) of GDE indicators (iGDE database) is based on best available statewide data on phreatophytic vegetation, which are known to use groundwater (CCC, 2007; US NBVC, 2013; US FS, 2014) and wetlands identified in the National Wetland Inventory (US FWS, 2016).

The statewide iGDE database was assessed for the Oxnard subbasin boundary, and iGDEs found within that boundary were groundtruthed using aerial photos, local knowledge, and field verification (described below). The verified iGDEs were mapped and are presented in Figure 3. Because the statewide iGDE data relies on vegetative surveys conducted over multiple years, some of the mapped vegetation areas within the Oxnard subbasin have been developed (e.g., conversion into a parking lot or agricultural field) since the survey date; these iGDE areas were removed from further consideration and are noted on the map as "cultivated" or "developed". Some areas were determined to be incorrectly characterized as natural areas; these areas include the Saticoy, El Rio and Noble Spreading Grounds (listed as "spreading basins" in Figure 3), agricultural drainage channels, and the duck ponds northwest of Mugu Lagoon (listed as "artificial wetlands"). These were also removed from further consideration. McGrath Lake, a GDE that was not initially shown as an iGDE area in the statewide database, was added. This area is recognized as McGrath State Beach, a unique intersection of nine ecosystems, which have been characterized by a dependence on the Santa Clara River and the near surface groundwater system (ESA, 2003).

The hydrologic connection of the iGDE areas to groundwater was assessed using an initial screening worksheet provided in the GDE Guidance Document (Worksheet 1). All iGDEs met the initial screening criteria for having a hydrologic connection to groundwater. The remaining ground-truthed iGDEs were consolidated into six different GDE units based on the proximity of the iGDE areas to dominant surface water features and association to the same hydrogeologic formations (Figure 4). A hydrologic and ecological assessment of the iGDE areas along the lower Santa Clara River located above Highway 101 in the Forebay led to its removal as a GDE (described below in the "Characterizing GDE Conditions" section). The Forebay is

defined by the lack of the confining clay cap and overlying semi-perched aquifer present along the coastal area of the Oxnard basin (Figure 1). The Oxnard Aquifer is unconfined in this area and found at deeper depths. The Santa Clara River upstream of Highway 101 has always been intermittent, and the river is a losing reach given the deeper groundwater levels. Due to the lack of groundwater-fed summer baseflow, there has historically been a corresponding lack of riparian vegetation (Beller et al., 2011). Under current conditions, assessment of the depth to groundwater along this portion of the Santa Clara River indicates that the groundwater levels are quite variable, ranging between 20 and 115 feet below ground surface, with shallower groundwater levels typically associated with wetter years followed by multiple years of much deeper groundwater levels (Figure 5). Proximity to recharge activities at the Saticoy, El Rio and Noble Spreading Grounds also may influence depth to groundwater. The current sparse riparian vegetation in a predominantly sandy riverwash; however, it is possible that those vegetation patches are accessing small perched lenses of shallow groundwater. During wet years with high river flows, vegetation in this reach is subject to a high level of scour. As depth to groundwater increases following wet years (Figure 5), vegetation attempting to re-establish following scour events would have insufficient root depth to access the deeper groundwater. Thus, the variable, deep groundwater levels and the sparse riparian vegetation in the channel typical of this reach led to the conclusion of the lack of groundwater connection to this stretch of the Santa Clara River riparian habitat.

Characterize GDE Condition

Descriptions of the hydrologic and ecological conditions for each GDE are below, following The Nature Conservancy's GDE Guidance (Step 1.2; Rohde et al., 2018).

Lower Santa Clara River GDE

Hydrologic Condition

The lower Santa Clara River downstream of Highway 101, marked by boundary of the Forebay and Oxnard Plain (Figure 1), has historically been a perennial stretch of the Santa Clara River with extensive historical riparian willow-cottonwood forest and freshwater wetland complex, both of which were supported during the dry summer with groundwater (Beller et al., 2011). Based on studies over the past 20 years, the direction of groundwater flow between the semi-perched aquifer and the lower Santa Clara River, its estuary and nearby McGrath Lake, is dependent upon tidal conditions, river stage and recharge rates due to agricultural irrigation (Stillwater Sciences, 2016). Groundwater levels from wells in the vicinity of the lower Santa Clara River GDE generally range between 7 and 11 feet below ground surface (bgs) (Figure 6). The years 2006 to 2015 represent a dry period of record, where the latter 5 years

(2011-2016) representing drought climatic conditions. The levels have been relatively constant across the 10 years of available monitoring in well 02N22W30A03S. A typical seasonal variation of 2 feet is shown in the groundwater depth data from well GW-04. The groundwater depths are within the range considered necessary for juvenile establishment (< 10 feet) and mature vegetation growth (<20 feet) (Stillwater Sciences, 2016).

This reach of the Santa Clara River is generally considered a gaining reach (Stillwater Science, 2016), although the reach is often dry during summer dry periods. Streamflow records from Station 723 at Victoria Avenue (2008-2015) indicate summer dry season flows less than 0.5 cfs (for 2008, 2009, 2011) to no flow. Low flow conditions may occur more often than recorded, as Station 723 was designed and calibrated as a peak-flow flood-control gage. A water balance assessment conducted by Stillwater Sciences (2011) for the Santa Clara River Estuary for water year 2010 provides some quantification of current hydrologic conditions; although it should be noted the estuary itself is located in the Mound Groundwater Basin and includes components such as the VWRF effluent. Stillwater Sciences (2011) found that for the fall/winter period, groundwater was estimated to contribute approximately 15 percent of the inflow volume, which itself was dominated by Santa Clara River inflow (45% of the total volume) and Ventura Water Reclamation Facility (RFWF) effluent (35% including groundwater flow via the VFWF Wildlife Ponds). For summer/spring 2010 period, the groundwater contribution was estimated at 10 percent, with majority from the VWRF. For this reach of the Santa Clara River upstream of the estuary, groundwater provides the dry summer baseflow, if it exists, and is a quarter of the winter flow, based on the 2010 water year assessment.

Ecological Condition

The lower Santa Clara River GDE (located downstream of Highway 101 and upstream of the estuary) is comprised of approximately 1,300 acres of aquatic habitat, in-channel wetland, and a range of willow-cottonwood riparian forest patches with mulefat and willow scrub, and invasive Arundo donax within the 1,000 to 1,500 foot-wide leveed lower Santa Clara River corridor. Arroyo willow and black cottonwood are focal phreatophytic species for the riparian forests of the Santa Clara River and preferentially occur in reaches with shallow groundwater, which provide a reliable summer source of water (Stillwater, 2016a). The GDE is located in the floodplain of the lower Santa Clara River, which undergoes substantial transformations in vegetation composition and distribution due to the dynamic nature of the river flows during winter. For example, the January and February 2005 winter floods scoured the active channel and floodplain terraces down to bare riverwash. By 2009, colonization by herbaceous vegetation transformed the floodplain to a willow, cottonwood and arundo riparian forest (Stillwater Sciences, 2011). This successional pattern is typical of southern California rivers (Stillwater, 2016a).

The lower Santa Clara River GDE has high ecological value, since it supports a rich community of species including habitat for the state and federally listed endangered least Bell's vireo and salt marsh bird's beak; critical habitat for the state and federally- listed southwestern willow flycatcher and federally listed threatened western snowy plover. The river is also critical habitat for the federally listed endangered Southern California steelhead and federally- listed endangered tidewater goby. The area is listed as an Audubon California Important Bird Area, 1,200 acres of wetlands are listed in the National Wetland Inventory, and the RWQCB listed beneficial uses include: Wildlife Habitat (WILD), Rare, Threatened, or Endangered Species (RARE), Migration of Aquatic Organisms (MIGR), Spawning, Reproduction, and/or Early Development (SPWN), and Wetlands (WET). An ecological inventory is provided in Worksheet 2 available from Rohde et al., 2018.

McGrath Lake GDE

Hydrologic Condition

McGrath Lake GDE is hydrologically connected to freshwater, estuarine, and groundwater sources. Locally, a clay layer ranging between 3 and 8 feet msl in the semi-perched aquifer causes surface sources to remain perched near the surface (ESA, 2003). This shallow groundwater is expressed at the surface at McGrath Lake, with recharge rates supplied by agricultural irrigation. McGrath Lake is pumped to reduce the flooding of agricultural fields adjacent to the lake (due to agricultural irrigation and naturally-high groundwater levels), with normal operational water surface elevations maintained between 2.7 and 3.6 feet above mean sea level (Stillwater Sciences, 2011). Groundwater flows toward the Santa Clara River during open-mouth conditions and towards McGrath Lake when the Santa Clara River estuary fills following mouth closure (Stillwater Sciences, 2011). As measured since 2009, depths to groundwater around the McGrath Lake GDE range between ground surface and 10 feet bgs, depending on the well (Figure 7). Given management of McGrath Lake, inter-annual variations are relatively constant, with seasonal variations around 5 feet.

Ecological Condition

The McGrath Lake GDE has a high ecological value and includes a wide range of hydrologically dependent ecosystems: a coastal freshwater back-dune lake, arroyo willow riparian forest, freshwater emergent marsh, saline emergent marsh covering approximately 280 acres extending southward from the Santa Clara River estuary through McGrath and Mandalay State Beach Parks to Wooley Road (note the estuary itself is not included as it is not in the Oxnard Groundwater Subbasin). The McGrath Lake GDE supports a wide range of habitats for many species, including critical habitat for the endangered plant species Ventura marsh milk-vetch, Southwestern

willow flycatcher, and tidewater goby. Many special status bird species, including the federally listed threatened western snowy plover and the state and federally listed endangered California least tern, are known or have the potential to occur in the McGrath Lake GDE (see Worksheet 2 for an ecological inventory of McGrath Lake GDE). The GDE is partially protected as McGrath and Mandalay State Beaches (85 acres); 197 acres are delineated as wetlands in the National Wetland Inventory. In addition, the RWQCB lists beneficial uses as WILD, RARE, WET, and estuarine habitat (EST).

Ormond Beach GDE

Hydrologic Condition

The Ormond Beach GDE is hydrologically connected to the semi-perched aquifer. Shallow groundwater elevations are influenced by rainfall, tidal events and the surface water elevations of the surface water features such as the agricultural drains and flood control channels Tšumaš (Chumash) Creek (formerly, J Street Drain), Ormond Lagoon Waterway (formerly, the Oxnard Industrial Drain) and Hueneme Drain. Depth to groundwater ranges between 2 and 15 feet bgs in well 01N22W27C04S over the 25-year well record. Levels vary seasonally but are relatively constant across the wetter period (pre-2006); more variation and lower groundwater levels are observed during the drier climatic period (2006-2015). Three other wells located near the Ormond Beach GDE indicate groundwater levels across the Ormond Beach GDE are even shallower, ranging between ground surface and 4 feet bgs, with seasonal variations between 2 to 4 feet (Figure 8).

Ecological Condition

The Ormond Beach GDE is considered to have high ecological value and is comprised of approximately 210 acres of southern coastal salt marsh and coastal freshwater/brackish marsh that are currently in isolated patches of low quality condition (WRA, 2003). These remnant wetlands have been drained, filled, and degraded by past industrial and agricultural use. The Nature Conservancy owns 129 acres of these wetlands. The Ormond Beach GDE is part of a larger 1,500 acre coastal dune – marsh system of dunes, lakes, lagoons, salt and freshwater marshes and is considered to be the most important wetlands restoration project in southern California (CCC, 2010). The area hosts over 200 migratory bird species; more shorebird species are known to use Ormond Beach than any other site in Ventura County. Ormond Beach is located on the Pacific Flyway, is an e-Bird International Hot Spot and is listed as critical habitat for tidewater goby and Western snowy plover. Twenty-seven (27) special status plant species and 42 special status wildlife species have documented presence or a moderate or high potential to occur within the Ormond Beach wetlands GDE including Endangered Belding's Savannah Sparrow, Salt Marsh Bird's-Beak, Least Bell's Vireo, Light-Footed Clapper Rail, Western snowy

plover and California least tern (WRA, 2007) (see Worksheet 2 for an ecological inventory of Ormond Beach GDE). The biological significance of the area is recognized by all 14 federal and state resource agencies participating in the Southern California Wetlands Recovery Project and the County of Ventura and the City of Oxnard (CCC, 2017). RWQCB beneficial uses include WILD, RARE, WET, and EST.

Mugu Lagoon GDE

Hydrologic Condition

The water table of the semi-perched aquifer varies between ground surface and 6 feet below ground surface across Mugu Lagoon GDE (see Figure 9). The figures present the estimated depths to groundwater in the GDE, based on interpolation of water elevation data from representative wells at Point Mugu Naval Base to reference point locations within the Mugu Lagoon GDE. Based on data from well MW6-6A, groundwater levels have varied over a narrow range of less than three feet across the 20-year record; the trend is relatively flat. Data from well S35MW8 does have a decreasing trend; the data record starts in 2010 through 2016, which corresponds to the recent drought period. Hydrogeologic investigations across Point Mugu Naval Base indicate the semi-perched aquifer is still separated in this area from the Oxnard aquifer by discontinuous clay layers (TtEMI, 2003). Mugu Lagoon receives groundwater discharge from the semi-perched aquifer along with freshwater from Calleguas Creek, the drainage ditches, primarily Oxnard Drainage Ditch No. 2, and salt water from tidal fluctuations. The semi-perched aquifer is also affected by seawater intrusion and tidal influence (TtEMI, 2003). The upper 20 feet of the semi-perched aquifer overlies a saltwater wedge (TtEMI, 2003). Aquatic life and bird species, including the light-footed clapper rail, in Mugu Lagoon has been impacted by pollutants (primarily pesticides) from nonpoint sources (RWQCB, 2016). The high TDS and chloride levels are attributed to sea water intrusion in this area (TtEMI, 2003).

Ecological Condition

Mugu Lagoon GDE is considered to have high ecological value and is comprised of approximately 5,900 acres of wetlands, representing the largest salt marsh estuary in Southern California as delineated in the National Wetland Inventory. The GDE provides habitat for hundreds of thousands of seasonal waterfowl and shorebirds (American Bird Conservancy, 2003). Endangered species dependent on this habitat include Belding's Savannah Sparrow, Salt Marsh Bird's-Beak, Least Bell's Vireo, Light-Footed Clapper Rail, Western snowy plover, California least tern, amongst others. Mugu Lagoon has many designated habitats, including Wetland of Regional Importance in the Western Hemisphere Shorebird Reserve Network; Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC) for Pacific Coast Groundfish and Coastal Pelagic Species in the nearshore marine and estuarine

habitats, and is part of the Laguna Point to Latigo Point Area of Special Biological Significance (see Worksheet 2 for an ecological inventory of Mugu Lagoon GDE). The Regional Water Quality Control Board (RWQCB) beneficial uses listed for WILD, RARE, WET, EST, MIGR, SPWN, Marine Habitat (MAR), Preservation of Biological Habitats of Special Significance (BIOL), and Shellfish Harvesting (SHELL).

Lower Calleguas Creek GDE

Hydrologic Condition

The GDE overlies the semi-perched aquifer. Historically, Calleguas Creek was an intermittent creek on the Oxnard Plain without a defined channel (Beller et al., 2011). Currently, the channel invert (i.e., channel bottom) of Calleguas Creek is approximately 4 to 5 feet above the surrounding grade, (Tony Chen, 2017). The channel has been separated from the adjacent floodplain since the 1960s by a riprap and earthen levee countersunk about 3 feet below the surrounding grade. Thus, Calleguas Creek is a losing reach in the Oxnard Plain. Lower Calleguas Creek maintains a perennial streamflow due to a combination of wastewater effluent and pumped tile drain discharge from adjacent agricultural fields, with the addition of natural precipitation and stormwater runoff during winter months. The pumped tile drain discharge from adjacent agricultural fields. The tile drain source is typically a combination of perched groundwater, irrigation return flow, local precipitation, and water that has seeped through the levees driven by the head differential between the Calleguas Creek and the adjacent grade. Groundwater elevations at semi-perched aquifer monitoring wells (located approximately one mile to the southwest at Point Mugu Naval Base) indicate typical groundwater elevations range from -1 to 6 ft MSL. Extrapolated depths to groundwater at the downstream end of the Calleguas Creek GDE, at approximately 12 ft MSL, are between 6 to 13 feet bgs. The extrapolated groundwater depths indicate the potential for the riparian vegetation to access shallow groundwater.

Ecological Condition

The lower Calleguas Creek GDE is considered to have a low ecological value and is comprised of approximately 150 acres of aquatic habitat and surrounding mulefat and willow riparian forest within a narrow 350 to 400 foot-wide leveed lower Calleguas Creek corridor. Riparian and wetland plant communities represent less than 3 percent of the watershed, which is below the statewide average of 10 percent. In the Calleguas Creek GDE, only 6 acres are delineated as wetlands in the National Wetland Inventory. Three native special status species, arroyo chub, two-striped gartersnake and least Bell's vireo, has been found in the lower Callegaus Creek GDE. The RWQCB listed beneficial uses for Reach 2 (Potrero Road to the estuary) include: WILD, RARE, WET, WARM and COLD habitat. An ecological inventory is provided in Worksheet 2.

Revolon Slough GDE

Hydrologic Condition
The GDE overlies the semi-perched aquifer. Streamflow in lower Revolon Slough is considered to be a combination of agricultural return flow, and precipitation and stormwater runoff; the degree of groundwater recharge and/or discharge has not been studied. Groundwater elevation (depth-to-groundwater) data is not available for this area. Groundwater elevations at semi-perched aquifer monitoring wells located approximately one mile to the southwest at Point Mugu Naval Base indicate typical groundwater elevations range from -1 to 6 ft MSL. Extrapolated depths to groundwater at the downstream end of the Revolon Slough GDE would be between 9 to 16 feet bgs. The extrapolated groundwater depths indicate the potential for the riparian vegetation to access shallow groundwater.

Ecological Condition
The Revolon Slough GDE is comprised of around 25 acres of aquatic habitat and surrounding willow riparian forest within a narrow 100 to 200 foot-wide corridor between Wood Road and Calleguas Creek. This section of Revolon Slough is soft-bottom, rip-rap lined waterway that flows through agricultural fields (RWQCB, 2007). The lower mile to mile and a half of the slough above Las Posas Road appears to be tidally influenced by inflows from Mugu Lagoon. Revolon Slough flows into Mugu Lagoon in a channel that runs parallel to Calleguas Creek near Pacific Coast Highway. In the Revolon Slough GDE, only 2 acres are delineated as wetlands in the National Wetland Inventory. Two native special status species, arroyo chub and least Bell's vireo, has been found in Revolon Slough. The RWQCB listed beneficial uses include: WILD, WET, and WARM habitat. The riparian habitat is considered to have low ecological value given the limited extent adjacent to the waterway and poor ecological quality. An ecological inventory is listed in Worksheet 2.

II. Determine Potential Effects on GDEs

SGMA requires agencies to describe potential effects on GDEs (a beneficial use and user of groundwater) that may occur or are occurring from the six groundwater conditions being used to evaluate sustainability (GSP Regulations §354.26(b)(3)). The sustainability indictors that could have a direct impact on GDEs are: chronic lowering of groundwater levels, degraded water quality, and depletions of interconnected surface water. Following The Nature Conservancy's GDE Guidance (Step 2; Rohde et al., 2018), potential effects on Oxnard GDEs are evaluated using hydrologic and biological data. The step concludes with an assessment of the GDE

susceptibility (i.e., high, moderate, or low) to current and future groundwater conditions.

This step assumes that if there are little-to-no changes in groundwater conditions from consistent baseline conditions then the corresponding groundwater condition will have little-to-know impact on a GDE. Groundwater elevation (depth-to-groundwater) hydrologic data are used to assess potential effects on GDEs caused by changes in groundwater levels and interconnected surface water. Two remote sensing indices – Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) – derived from Landsat imagery from each GDE were used as biological data.

Chronic Lowering of Groundwater Levels / Depletions of Interconnected Surface Water

Four of the GDEs located on the semi-perched aquifer have representative depth to groundwater data in the vicinity of the GDE to provide an assessment of groundwater levels and interconnected surface water, where groundwater levels are used as a proxy metric. As shown in Figures 6 – 9, the depth to groundwater data present a relatively constant interannual trend for these GDEs. The specific depths to groundwater for each GDE are discussed above in Section I and the baseline averages and ranges are listed in Worksheet 3.

The Ormond Beach GDE groundwater data includes one well with a 25-year record that encompasses the majority of the baseline period. The lower Santa Clara River and Mugu Lagoon GDEs include wells with a 10- and 15-year baseline periods. The well data for McGrath Lake GDE extends only for 6 years; however, its limited record is not considered a significant data gap given that management of the lake water levels to address drainage of nearby agricultural fields has been ongoing since at least 1979 (ESA, 2003). The Mugu Lagoon GDE groundwater data includes one well with a 20-year record that encompasses the majority of the baseline period. No groundwater data are available for Revolon Slough or Calleguas Creek GDEs; it is expected that the conditions would be similar to those at the other GDEs given the minimal use of the semi-perched aquifer for water supply. The overall depth to groundwater data indicate little-to-no changes in in groundwater levels from baseline conditions, which is translated as having little-to-no impact on the GDEs. This is not surprising, given that there is only minimal groundwater utilization of the semi-perched aquifer for water supply purposes. The only known active management is the pumping of McGrath Lake to reduce drainage and flooding problems on adjacent agricultural fields. Therefore, the Oxnard Plain GDEs are all considered to be at low risk of any adverse impact.

To further investigate whether potential effects on the Arroyo-Simi Las Posas GDE caused by changes in groundwater levels exist, two remote sensing vegetation metrics, Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI), associated with vegetation chlorophyll and moisture content, and provide an indirect metric of growth and water stress, were examined using The Nature Conservancy's GDE Pulse (Klausmeyer et al., 2019). Figures 10-15 present spatial maps of average summer NDVI and NDMI values for the six GDEs, with time series graphs from 1985 to 2018 for specific GDE polygons selected for their proximity to nearby shallow wells. General conclusions from reviewing the data are that there are not significant trends that can be identified across entire GDEs (i.e., there is variability between GDE polygons within a GDE) nor that there is a clear correlation between the vegetation metrics and the groundwater data.

Degraded Water Quality

The semi-perched aquifer is recharged by local precipitation and agricultural return flows. The return flows and seawater intrusion result in marginal water quality (high TDS and chloride). The Los Angeles Regional Water Quality Control Board established water quality objectives for nitrate, chloride, sulfate and TDS for groundwater for perched aquifer (RWQCB, 2014). Water quality is highly variable in the semi-perched aquifer (UWCD 1999). These water quality parameters can result in high salinity soils, which can negatively affect establishment and growth rate of riparian species (Briggs, 1995). Typically, annual spring floods will remove excess salts within the riparian zone. There is no current site-specific understanding of the soil conditions nor of any ecological impacts on the riparian species in the GDEs. Similar negative impacts may occur for the freshwater lake and wetlands, and associated vegetation. While this is an acknowledged data gap, water quality is not considered further as a factor for evaluating the GDEs given the scope of the GSP is on aquifers managed by the Fox Canyon Groundwater Management Agency.

Classify GDE Susceptibility

Following the GDE Guidance, first the susceptibility of the GDE to potential effects from each groundwater condition for current groundwater conditions is assessed. Under current conditions, the Oxnard Subbasin GDEs can be classified as having a Low Susceptibility[1] to changing groundwater levels since there is little-to-no impact

[1] The GDE Guidance classifies how susceptible a GDE unit is to changing groundwater conditions using the hydrological data gathered and the following descriptions: (1) High Susceptibility if current groundwater conditions within a GDE fall outside the baseline range; (2) Moderate Susceptibility if groundwater conditions within a GDE currently fall within the baseline range, but future changes are likely to cause groundwater conditions to fall outside the baseline range; and (3) Low Susceptibility if groundwater conditions fall within the baseline range and no future changes in groundwater conditions are likely to occur.

to the GDE under current conditions. Next, if there is little-to-no impact to the GDE, SGMA requires assessing risks for future adverse impacts (in the next five years or longer). As the semi-perched aquifer is generally not now nor is it projected to be utilized for water supply purposes, there is little risk for future adverse impacts. Therefore, the GDE is classified as Low Susceptibility to changing groundwater changes because there are currently little-to-no changes in in the current period compared with baseline period and a low likelihood of future changes in the next five years. This may change if there is future utilization of the semi-perched aquifer.

III. Consider GDEs When Establishing Sustainable Management Criteria

Set the Sustainability Goal

The GDE Guidance recommends that the sustainability goal include the specific goal of protection of the environmental beneficial user – that is, maintaining the Oxnard Subbasin GDEs. The GDEs are currently in stable baseline conditions with the relatively constant groundwater levels in the semi-perched aquifer.

However, given that the semi-perched aquifer is not managed or utilized for water supply and the Oxnard Subbasin GDEs, while important, are not considered to be at risk under current or expected future conditions, no management actions are currently necessary to bring any of six undesirable results into sustainable conditions. Therefore, while one could argue for inclusion of sustainable management criteria at this time, it is also appropriate to not include them in this initial GSP. In the future if changes in utilization or management of the semi-perched aquifer occur, sustainable management criteria will need to be defined and included in the GSP update. This determination should be reassessed at every 5-year update to the Oxnard Subbasin Groundwater Sustainability Plan.

Set Minimum Thresholds for Sustainability Indicators

No minimum thresholds are considered necessary for the GDEs at this time.

Establish Measurable Objectives and Interim Milestones

No measurable objectives and interim milestones are considered necessary for the GDEs at this time.

IV. Incorporate GDEs into the Monitoring Network

We recommend continued monitoring of depth to groundwater for the GDEs to provide a record of baseline conditions, and to assess whether changes in hydrographic conditions occur in the future. Many of the wells identified in Section I are sampled regularly as part of existing monitoring programs; these are recommended to be included in the 5-year Groundwater Sustainability Plan updates.

V. Identify Projects and Management Actions to Maintain or Improve Conditions in GDEs

No groundwater management actions or projects to maintain or enhance GDEs are being considered at this time.

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