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BEFORE THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

HEARING IN THE MATTER OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND UNITED STATES BUREAU OF RECLAMATION REQUEST FOR A CHANGE IN POINT OF DIVERSION FOR CALIFORNIA WATER FIX	TESTIMONY OF GWEN BUCHHOLZ (EXHIBIT DWR-80)

I, GWEN BUCHHOLZ, do hereby declare:

I am an expert and my expertise was established in DWR-32 and DWR-72 previously submitted in this hearing.

I. EFFECTS OF PROPOSED INTAKE, TUNNEL, AND FOREBAY FACILITIES ON GROUNDWATER RECHARGE

POTENTIAL ISSUES:

Placement of slurry walls around California WaterFix (CWF) intakes and forebays and installation of the tunnels between the intakes and forebays would reduce the subsurface movement of instream freshwater flows from the Sacramento and San Joaquin rivers and tributary water bodies which would affect groundwater recharge. These issues were discussed by:

- These issues were introduced by Dr. Steffen Mehl on behalf of Sacramento County Water Agency (SCWA) in Exhibit SCWA 4 and discussed at the State Water

Resources Control Board (SWRCB) hearing on October 26, 2016 [pages 126-135 and 230-232 of the transcript].

- Russell van Loben Sels on behalf of the Local Agencies of the North Delta (LAND) at the State Water Resources Control Board (SWRCB) hearing on November 10, 2016 [pages 50 - 51 of the transcript].
- Richard Elliot on behalf of LAND at the SWRCB hearing on November 10, 2016 [pages 62 – 65 of the transcript].
- Josef Tootle on behalf of LAND in written testimony (Exhibit LAND 35) and at the SWRCB hearing on November 10, 2016 [pages 78 – 98, 130 – 151, and 224- 235 of the transcript].
- Barbara Daly on behalf of North Delta CARES at the SWRCB hearing on December 13, 2016 [pages 176 – 184 and 216 - 220 of the transcript].
- Mark Pruner on behalf of North Delta CARES at the SWRCB hearing on December 13, 2016 [pages 222 - 229 of the transcript].

RESPONSE SUMMARY:

Based upon the preliminary hydrogeological assessment, groundwater recharge will not be impacted to any large extent. Groundwater wells near the proposed intakes include individual domestic and agricultural wells. The Sacramento County Water Agency, Zone 40, wells are located to the east of Interstate 5. The portion of the groundwater basin underlying Zone 40 and near the Sacramento River is recharged by a combination of water from the Sacramento River and groundwater flows from the areas located to the east of Interstate 5. Slurry walls would be constructed at Intakes 2, 3, and 5 along the Sacramento River, and would extend for less than 24 percent of the total length of the Sacramento River eastern bank between Intakes 2 and 5.

The mechanisms of groundwater recharge vary at each of the intakes, along the tunnel alignment, and at each of the forebays due to changes in geology and the presence of surface water bodies. In the northern portions of the alignment, soil characteristics are more favorable to groundwater recharge due to the presence of interspersed layers of sands, silty sands, and clays. Groundwater recharge potential becomes less south of Lambert Road due to the increased presence of clay soils. The tunnels would be located within the clay soils at depths below the more permeable soils; therefore, groundwater would continue to flow from the adjacent water bodies in the upper soil layers above the tunnel structures.

It also should be recognized that the BDCP/CWF EIR/EIS acknowledges that detailed hydrogeological analyses were not completed during the preparation of the EIR/EIS. As part of the environmental commitments of the project, thorough site investigations and desk studies would be conducted during design to identify the location of wells, depths of the wells and the depth to groundwater in the vicinity of the construction activities. Based upon the results of these studies, it is anticipated that monitoring wells would be installed prior to construction, and mitigation measures would be implemented if groundwater elevations declined due to the implementation of the proposed project.

1. GROUNDWATER RECHARGE EAST OF INTERSTATE 5

As presented in SCWA 4 and discussed in oral testimony, Dr. Steffen Mehl discussedthat the EIR/EIS did not address potential changes in groundwater east of Interstate 5 due to the operations of the CWF intakes; and that the operations of the CWF intakes would affect groundwater in that area. The assertions of Steffen Mehl are not supported by the evidence. Groundwater model results in the BDCP/CWF EIR/EIS, Figure 7-14, show that a maximum reduction of 5 feet in groundwater elevations along the Sacramento River would occur due to operations of five intakes under Alternative 1B and that the changes in groundwater elevations would not affect groundwater near Interstate 5. The results would be similar under the proposed Alternative 4A as can be determined by comparing the minimum Sacramento River flows under Alternatives 1B and 4A.

Groundwater conditions within the groundwater basin to the east of the intakes have been analyzed in several studies over the past 15 years, including the 2004

Sacramento County Water Agency Groundwater Management Plan, 2005 *Sacramento County Water Agency Zone 40 Water Supply Master Plan*, 2006 *Central Sacramento County Groundwater Management Plan*, and *Sacramento Central Groundwater Authority Basin Management Report 2009-2010*. Information in these studies describe that groundwater in the groundwater basin is recharged from rivers (Cosumnes, American, and Sacramento rivers), deep percolation of applied water, and subsurface flows along the Sierra Nevada foothills. Figure 2-16 of the 2006 *Central Sacramento County Groundwater Management Plan* indicate that the Sacramento River provides the smallest amount of groundwater recharge to the groundwater basin (see Attachment 1). The majority of the recharge occurs along the Cosumnes River and small streams that flow from Sierra Nevada foothills and from deep percolation of applied water. Information presented in the *Sacramento Central Groundwater Authority Basin Management Report 2009-2010* (Figures 4 through 7) show the groundwater elevation contours with the most recent contours shown in Figure 7 (see Attachment 2). Groundwater within an aquifer flows from higher elevations to lower elevations, and the rate of flow will increase along steeper elevation changes (e.g., areas with contour changes occurring with the least amount of horizontal space). Based upon the groundwater contours shown in Figure 7 of the *Sacramento Central Groundwater Authority Basin Management Report 2009-2010*, it appears that the lowest groundwater elevation occurs near Elk Grove, and groundwater primarily flows towards this portion of the groundwater basin from the east. Groundwater elevations near the Sacramento River appear to only be slightly higher than the lowest elevations near Elk Grove. This report also describes that groundwater elevations in these portions of the basin have recently been stable or have increased due to increased use of surface water in the area and fallowing of lands previously irrigated with groundwater.

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Therefore, based upon the information presented in these reports, recharge in the groundwater basin that includes areas east of the Sacramento River, especially to the east of Interstate 5, would not be substantially affected by placement of slurry walls around the proposed Intakes.

2. GROUNDWATER RECHARGE ALONG THE SACRAMENTO RIVER NEAR THE PROPOSED INTAKES

As presented in LAND 35 prepared by Mr. Tootle and oral testimony presented by Mr. Tootle, Ms. Daly, Mr. Elliot, Mr. Pruner, and Mr. van Loeben Sels, it was discussed that operations of the CWF intakes would reduce groundwater recharge in the vicinity of the intakes due to installation of the slurry walls. These assertions, however, are contradicted by the evidence that the groundwater in the vicinity of the intakes would continue to be recharged by a combination of general groundwater flow within the groundwater basin primarily from the east towards the Sacramento River, groundwater flows from the Sacramento River, and deep percolation of applied irrigation water. As shown in Exhibit SWRCB 104, the slurry walls at the three intakes would represent less than 24 percent of the total Sacramento River bank between Intakes 2 and 5. Groundwater between the Sacramento River and Interstate 5 in the vicinity of the intakes is recharged by a combination of general groundwater flow within the groundwater basin primarily from the east towards the Sacramento River, groundwater flows from the Sacramento River, and deep percolation of applied irrigation water. Water appears to flow from the Sacramento River into the adjacent groundwater through permeable sands, silty sands, and sandy silt soils along the banks. Geotechnical borings in the vicinity of the intakes were completed by DWR, as reported in Exhibit DWR-212 figure 3-2a, p.52. Soils near Intakes 2, 3, and 5 within approximately 100 to 120 feet of the ground surface appear to consist of silty sands, poorly graded sands, and sandy silts. These soils generally allow groundwater to flow from the Sacramento River to the groundwater basin located to the east of the river. Soils at elevations below 120 feet generally become clays or clays interspersed with sandy silts, which would have less permeability for groundwater recharge. Although not included in the proposed project, soils near Intake 4 (located between Intakes 3 and 5) within the 100 feet of the ground surface consist of silty sands and clays, and therefore, are slightly less permeable than soils near the other intakes.

Similar soil conditions near Intakes 2, 3, and 5 also were discussed in Exhibit DWR 212 [pages 277-298, including Figure 6 on page 295]. Overall, it appears that soils between Intakes 2 and 5 would have good permeability for groundwater recharge within the first 100 feet of soil, and lower permeability below 100 to 120 feet.

3. POTENTIAL EFFECTS OF SLURRY WALL INSTALLATION AT THE PROPOSED INTAKES

The majority of the groundwater basin located to the east of the Sacramento River in the vicinity of the proposed intakes would be substantially recharged from surface waters and groundwater sources located to the east of Interstate 5. Groundwater between the Sacramento River and Interstate 5 in the vicinity of the intakes are recharged by a combination of groundwater flow from the east, from the Sacramento River, and deep percolation of applied irrigation water.

Intakes 2, 3, and 5 would include slurry walls that would extend along the Sacramento River bank. The length of these intake structures would be 1,969; 1,497; and 1,901 feet, respectively, between River Miles 41.1 and 36.8 (Exhibit SWRCB 104). The total length of intake facilities would represent approximately 5,367 feet, or less than 24 percent of the total Sacramento River bank between Intakes 2 and 5. The slurry wall would generally extend along the fish screen section of the intake and the areas where the fish screen connects to the levee. The slurry wall would not extend along the entire length of the relocated levee roadway, as shown in Exhibit DWR 212 [Figure 7 on page 296].

It is understood that the slurry walls would interrupt the flow of groundwater from the Sacramento River at the intake locations. However, the slurry walls between Intakes 2 and 3 and between Intakes 3 and 5 would be separated by more than 8,900 and 13,000 feet of Sacramento River bank, respectively.

Because groundwater levels near the Sacramento River appears to be higher than groundwater elevations east of the river (see Attachment 2), groundwater would tend to flow towards the east, including flowing around obstacles (e.g., slurry walls) to move towards the lowest groundwater elevations near Elk Grove. The soils along the Sacramento River bank between Intakes 2 and 5 appear to be relatively permeable, and it appears that groundwater would flow towards the east, including around the slurry walls, and continue to recharge the groundwater in the vicinity of the intakes.

As was discussed by Richard Elliot and Josef Tootle, Exhibit LAND 58 indicates that existing groundwater wells are located near Intakes 2 and 3. As discussed above and indicated in Exhibit DWR 212 [Figure 7 on page 296], the slurry walls are not anticipated to extend along the roadway modifications on either side of the intakes. Therefore, the slurry walls would not be located along the river bank to the west of Wells W1 through W12. The tunnels between Intakes 2 and 3 would be located at depths of 90 to 130 feet below the ground surface; and the soil conditions would primarily be characterized as loose to moderately dense sand to approximately 70 feet below the ground surface and underlain by stiff, moderate to high plasticity clay near Intake 2; and loose to moderately dense sand with interbedded loose/medium stiff sands and clays to approximately 100 feet below the ground surface and underlain by stiff, moderate to high plasticity clay near Intake 3. The groundwater recharge in these soil conditions would occur above the elevation of the top of tunnel either with or without the tunnel construction due to the presence of stiff, moderate to high plasticity clays located in the tunnel zone.

A tunnel extends from Intake 3 to the Intermediate Forebay at depths of 80 to 120 feet below the ground surface, as described in the *Delta Habitat Conservation & Conveyance Program - Conceptual Engineering Report, Volume 2*. Exhibit SCWA 1 shows two community wells in Hood located to the west and to the east of the tunnel. Soils near Intake 3 and Intake 4 to the north and south of Hood would consist of silty sand and lean clay layers interspersed with clays and poorly graded sand to 100 to 120 feet below the ground surface, as described in the 2013 *2009 Through 2012*

Geotechnical Data Report, Pipeline/Tunnel Option. The soil boring to the north of Hood indicated silty sand between 100 to 120 feet below the ground surface underlain by clay; and the soil boring to the south of Hood indicated lean clay and silty sand between approximately 110 and 135 feet below the ground surface underlain by sand. The Well "W-20" in Exhibit SCWA 1 is shown as having a screen between 122 and 132 feet below the ground surface and a well depth to 340 feet below the ground surface. The soils in this area appear to have interspersed silty sand, sand, lean clay, and fat clay. In general, it appears that the upper soils above 100 feet below the ground surface are more permeable and would generally allow groundwater to flow from the Sacramento River to the east of the river above the tunnel structure or immediately below the tunnel structure.

As described above, thorough site investigations and desk studies would be conducted during design to identify the location of wells, depths of the wells and the depth to groundwater in the vicinity of the construction activities. Based upon the results of these studies, it is anticipated that monitoring wells would be installed prior to construction, and mitigation measures would be implemented if groundwater elevations declined due to the implementation of the proposed project.

4. GROUNDWATER RECHARGE ALONG THE TUNNEL ALIGNMENT AND AT THE INTERMEDIATE FOREBAY

As presented in LAND 35 prepared by Mr. Tootle and oral testimony presented by Mr. Tootle, it was discussed that installation of the CWF tunnels and the Intermediate Forebay would reduce groundwater recharge in the vicinity of the tunnels and the Intermediate Forebay. These assertions, however, are contradicted by the evidence that the groundwater in the vicinity of the tunnels and the Intermediate Forebay would continue to be recharged from adjacent water bodies.

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5. TUNNEL ALLIGNMENT BETWEEN INTAKE 5 AND THE INTERMIDATE FOREBAY AND THE INTERMIDATE FOREBAY

The tunnel alignment between Intake 5 and the Intermediate Forebay is located to the east of Snodgrass Slough. Water appears to flow from Snodgrass Slough and North Fork Mokelumne River into the groundwater adjacent to these water bodies, as presented in the 2010 *Sacramento County General Plan Update, Final Environmental Impact Report* (see Attachment 3).

Soils near Intake 5 to the first tunnel shaft location (south of Lambert Road) consist of silty sands, poorly graded sands, and sandy silts within approximately 100 to 120 feet of the ground surface based upon information from geotechnical borings in the vicinity of the intakes completed by DWR, as reported in the 2013 *2009 Through 2012 Geotechnical Data Report, Pipeline/Tunnel Option*. These soils generally allow groundwater to flow from the Sacramento River to the groundwater basin located to the east of the river. Soils at elevations below 120 feet generally become clays or clays interspersed with sandy silts which would have less permeability for groundwater recharge. The tunnels would be located within the clay soils at depths below the more permeable silty sands, poorly graded sands, and sandy silts; therefore, groundwater would continue to flow from the Sacramento River in the upper soil layers above the tunnel structures.

Soils between Lambert Road and the Intermediate Forebay appear to be primarily clay loams and sandy clay loams with interspersed areas of silt loams and clay. The proportion of clays increase along the alignment towards the Intermediate Forebay. This information is based on soils information included in the Soil Conservation Service *Soil Survey, Sacramento County, California* because there were no specific geotechnical surveys conducted along this portion of the alignment. Due to the presence of clay loams and clay, there is less groundwater recharge from Snodgrass Slough than in other portions of the alignment with more permeable soils. However, the tunnels would be located at depths below the clay loams that do allow the groundwater flow.

Therefore, groundwater recharge is anticipated to continue to flow in the clay loams from Snodgrass Slough in the upper layers above the tunnel structure.

The Intermediate Forebay is located in an area with low groundwater recharge potential (see Attachment 3). Currently, minimal groundwater recharge appears to occur to the west of the Intermediate Forebay from Snodgrass Slough. In this area, it appears that although groundwater recharge is minimal, the majority of the recharge is related to flows from the Cosumnes River and North Fork Mokelumne River. Slurry walls around the Intermediate Forebay (located north of Twin Cities Road) would extend into the less permeable clay soils to reduce groundwater impacts during construction and operations on adjacent groundwater. The slurry walls would reduce flow of groundwater from Snodgrass Slough to areas located to the east of the Intermediate Forebay. However, it appears that the groundwater recharge rate would be low and groundwater would continue to flow into the area from the Cosumnes River and North Fork Mokelumne River. Therefore, slurry walls would have minimal effect on groundwater recharge in the vicinity of the Intermediate Forebay.

6. TUNNEL ALLIGNMENT BETWEEN THE INTERMIDATE FOREBAY TO THE NORTH FORK MOKELUMNE RIVER

Soils along the tunnel alignment downstream of the Intermediate Forebay transition from less permeable clay loams and sandy clay loams with interspersed areas of silt loams and clay to soils characterized by clay loams and silty clay loams with sandy loams and loams near the rivers based on soil information included in the Soil Conservation Service *Soil Survey, Sacramento County, California*. Clay soils are present at lower depths. Groundwater recharge appears to occur in this area from the Cosumnes River and North Fork Mokelumne River (see Attachment 3). The tunnels would be located in the clay soils below the loam soils. Groundwater recharge would continue in the upper soil layers above the tunnel structures.

It is noted that Exhibit LAND 59 presents approximate locations of wells in Walnut Grove along the Delta Cross Channel Slough, near Snodgrass Slough and the North

Mokelumne River, and along the Mokelumne River on New Hope Tract. All of these wells are located along waterways that would not be occluded by the construction of the tunnel structure approximately 110 feet below the ground surface in this part of the alignment. Therefore, it is anticipated that groundwater recharge would continue from the adjacent waterways into the groundwater used for water supplies.

7. TUNNEL ALIGNMENT BETWEEN NORTH FORK MOKELUMNE RIVER AND POTATO SLOUGH

The tunnel alignment between the North Fork Mokelumne River and Potato Slough is located along Staten and Bouldin islands. This area was identified in the 2009 *San Joaquin County General Plan, Public Review Draft Background Report* (Attachment 4) as an area of poorly drained soils with low recharge potential. The soils are characterized as mucky clay loam, silty clay loam, and clay underlain by peat as presented in Soil Conservation Service *Soil Survey, San Joaquin County, California*. Soils near the waterways that surround these islands are characterized by silt loam and silty clay loam underlain by peat. Staten Island is surrounded by the South Fork Mokelumne River and North Fork Mokelumne River, and Bouldin Island is surrounded by South Fork Mokelumne River, Mokelumne River, Potato Slough, and Little Potato Slough. Although groundwater recharge rates are low, groundwater would continue to flow from these water bodies to the groundwater on both sides of the tunnel alignment.

8. TUNNEL ALIGNMENT BETWEEN POTATO SLOUGH AND CLIFTON COURT FOREBAY

Soils along the tunnel alignment between Potato Slough and Clifton Court Forebay are primarily clay soils along Venice, Mandeville, Bacon, Woodward, and Victoria islands as indicated by geotechnical borings in the vicinity of the intakes, that were completed by DWR, as reported in the 2013 *2009 Through 2012 Geotechnical Data Report, Pipeline/Tunnel Option*. This area was identified in the 2009 *San Joaquin County General Plan, Public Review Draft Background Report* (Attachment 4) as an area of poorly drained soils with low recharge potential. The islands are surrounded by Old

River, San Joaquin River, Middle River and connecting waterways between Old and Middle rivers. Although groundwater recharge rates are low, groundwater would continue to flow from these water bodies to the groundwater on both sides of the tunnel alignment.

It is noted that Exhibit LAND 59 presents approximate locations of wells on the east sides of Mandeville and Bacon islands between Middle River and the tunnel alignment, on the west side of Bacon Island between Old River and the tunnel alignment, and on Jones Tract which does not include the tunnel alignment. All of these wells are located along waterways that would not be occluded by the construction of the tunnel structure approximately 110 feet below the ground surface in this part of the alignment. Therefore, it is anticipated that groundwater recharge would continue from the adjacent waterways into the groundwater used for water supplies.

Clifton Court Forebay is located in an area with clay soils with low groundwater recharge potential. The proposed forebay modifications would extend throughout the entire Clifton Court Tract. Groundwater recharge would continue to occur on adjacent tracts of land that are located across Old River, Italian Slough, and West Canal. Therefore, slurry walls placed around Clifton Court Forebay would have minimal effect on groundwater recharge in the vicinity of the forebay.

ATTACHMENT 1 – FIGURE 2-16 IN THE 2006
CENTRAL SACRAMENTO COUNTY GROUNDWATER MANAGEMENT PLAN

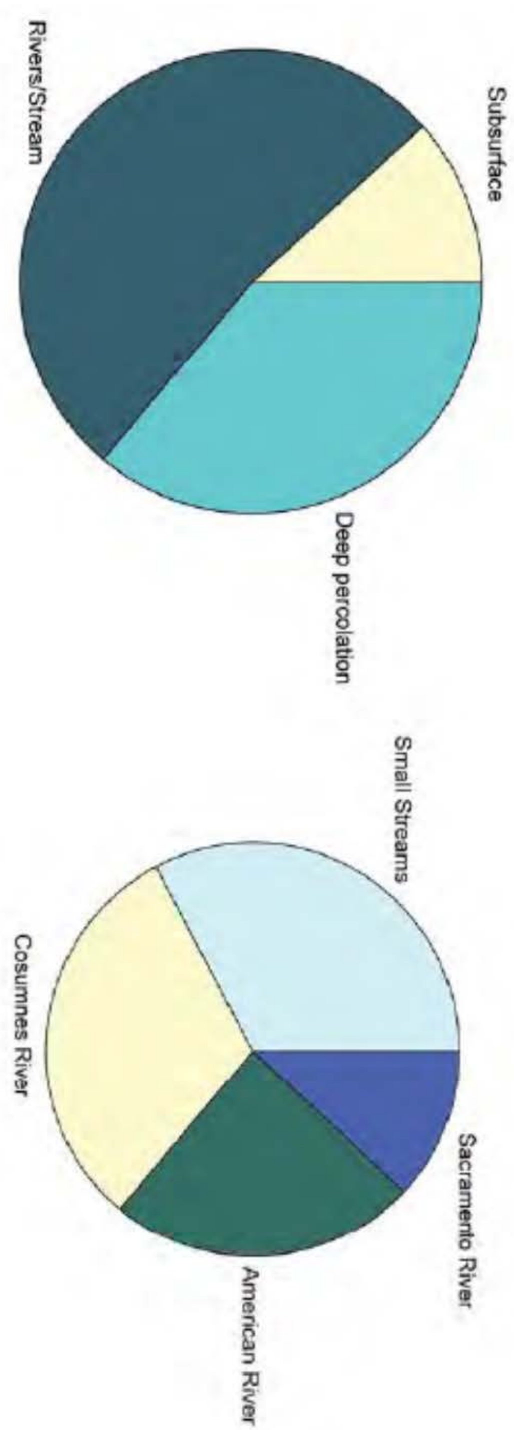


Figure 2-16. Central Basin Recharge Sources

2-26

ATTACHMENT 2 – FIGURE 7 IN THE SACRAMENTO CENTRAL GROUNDWATER AUTHORITY BASIN MANAGEMENT REPORT 2009-2010

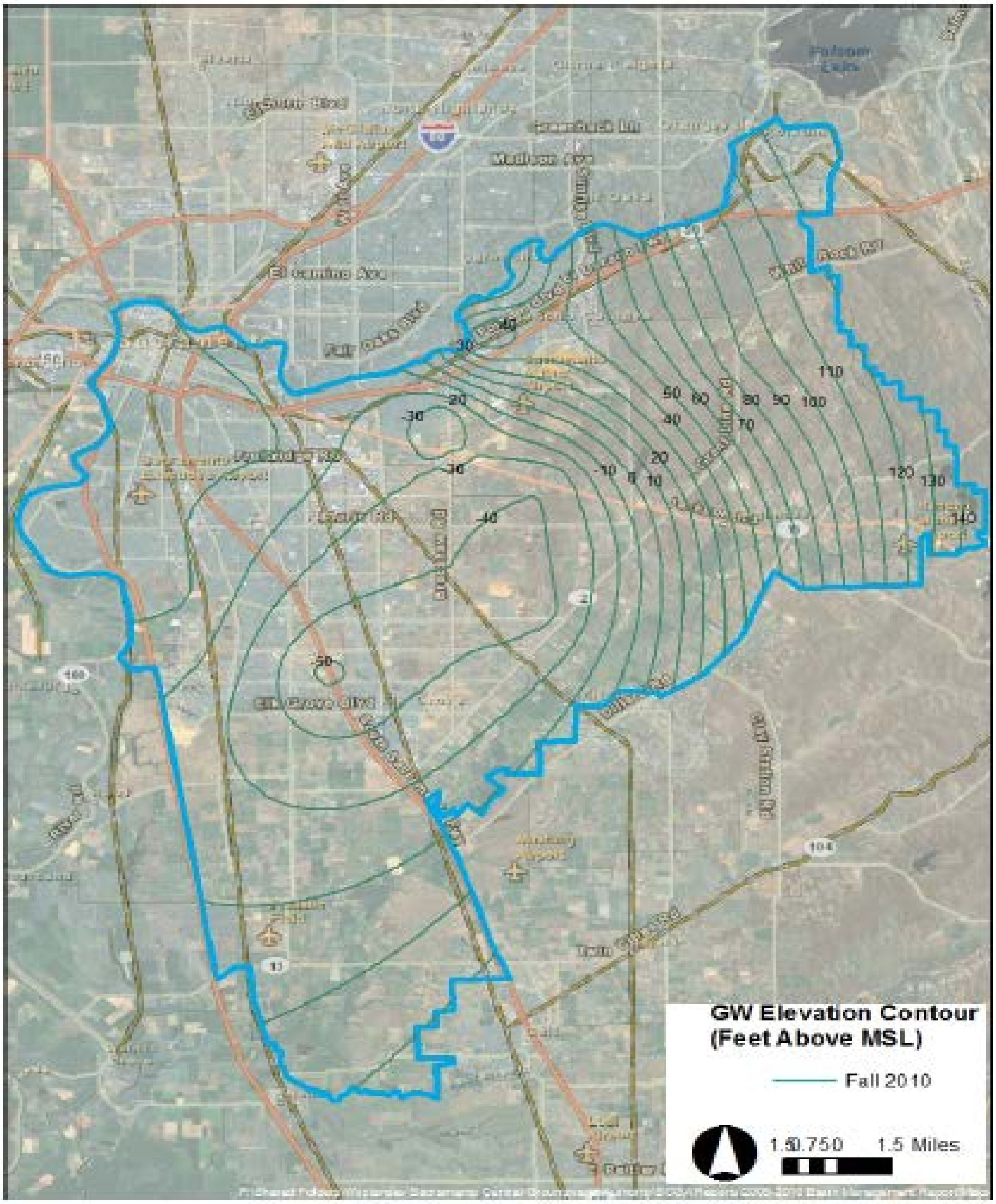


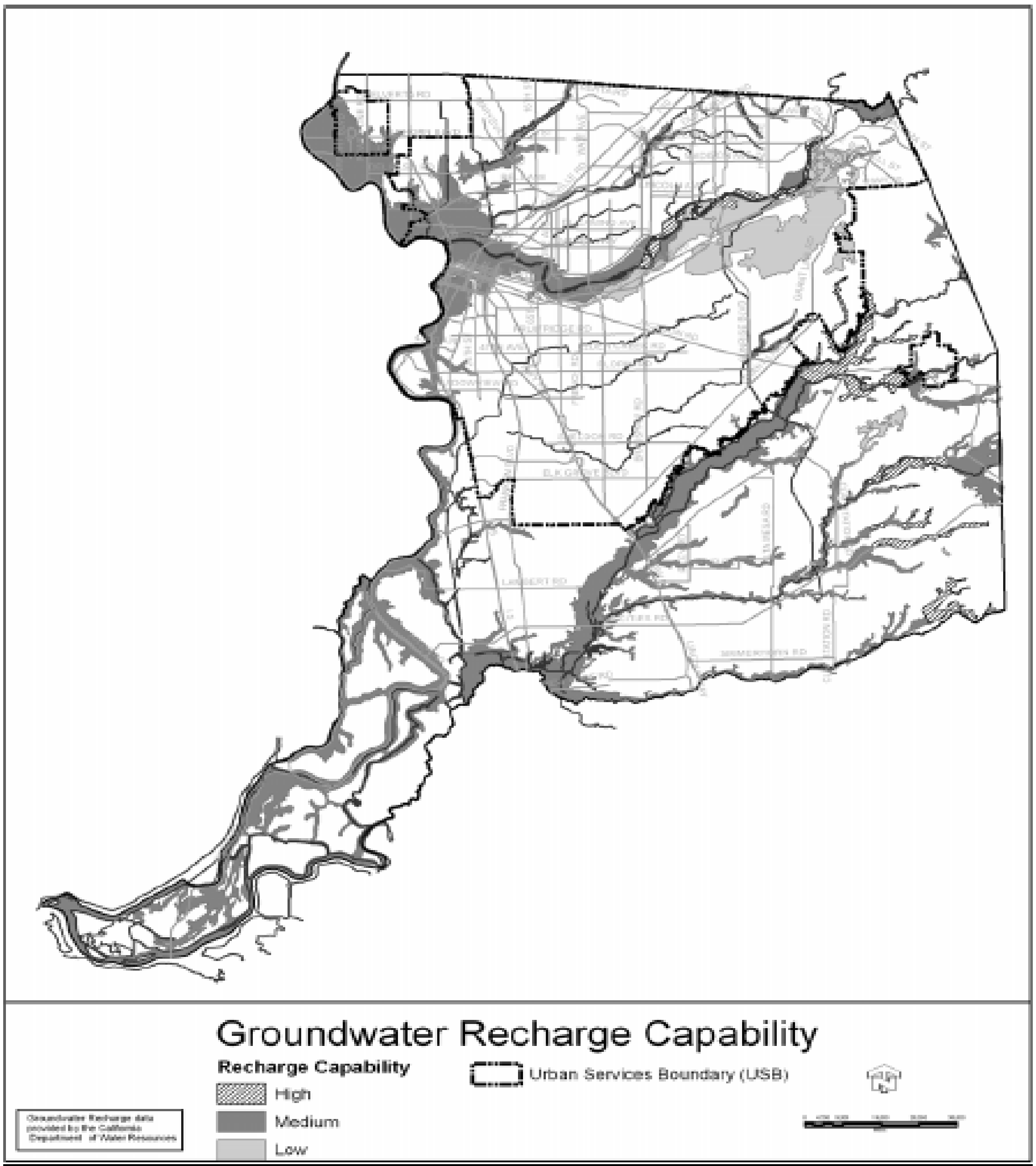
Figure 7 Fall 2010 Groundwater Elevation Contour Map

ATTACHMENT 3 – PLATE WS-3 IN THE 2010

SACRAMENTO COUNTY GENERAL PLAN UPDATE, FINAL ENVIRONMENTAL IMPACT REPORT

6 - WATER SUPPLY

Plate WS-3 Groundwater Recharge Capability Map



Sacramento County General Plan Update *6-55* *02-GPB-0105*

ATTACHMENT 4 – FIGURE 10-6 IN THE 2009

SAN JOAQUIN COUNTY GENERAL PLAN, PUBLIC REVIEW DRAFT BACKGROUND REPORT

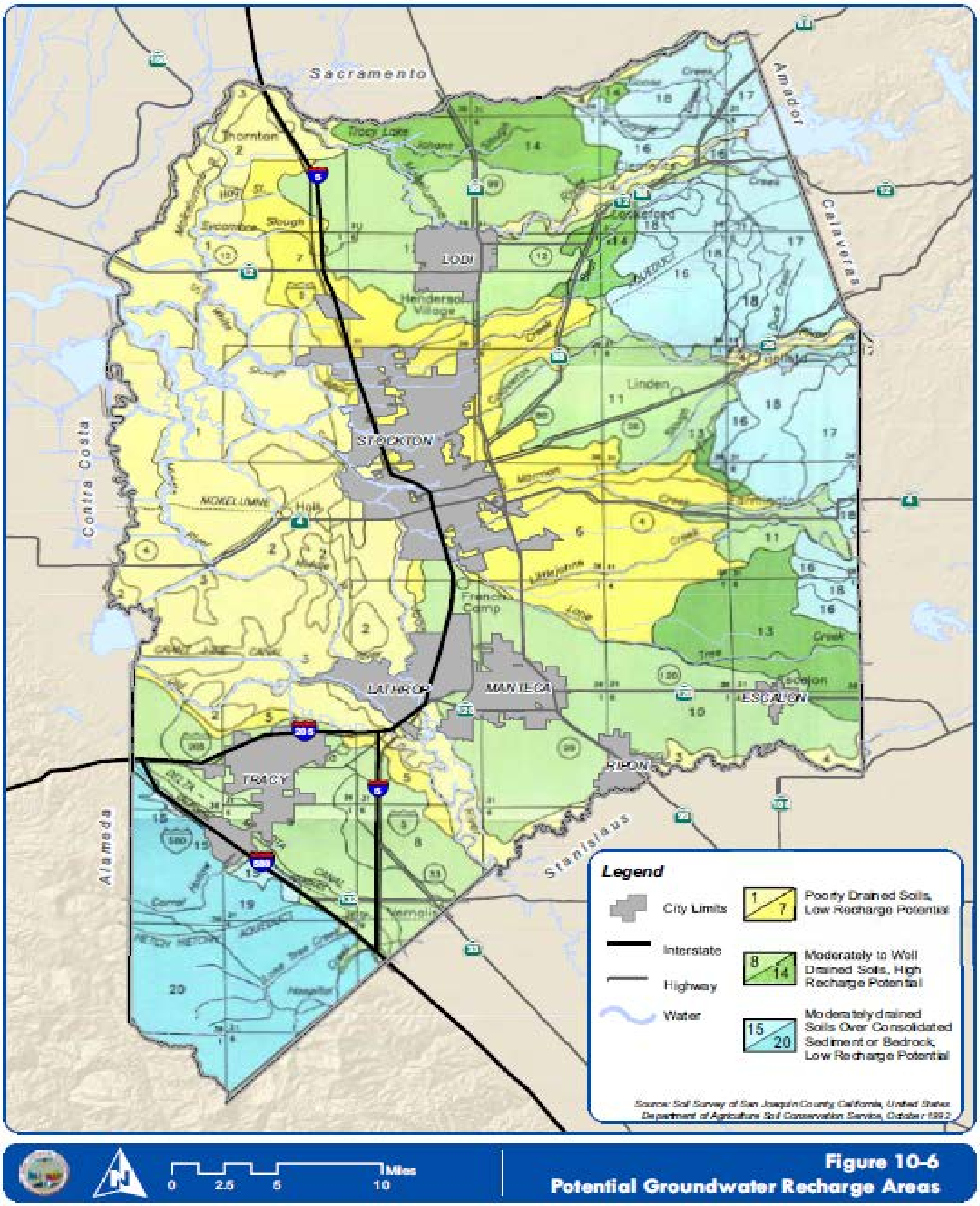
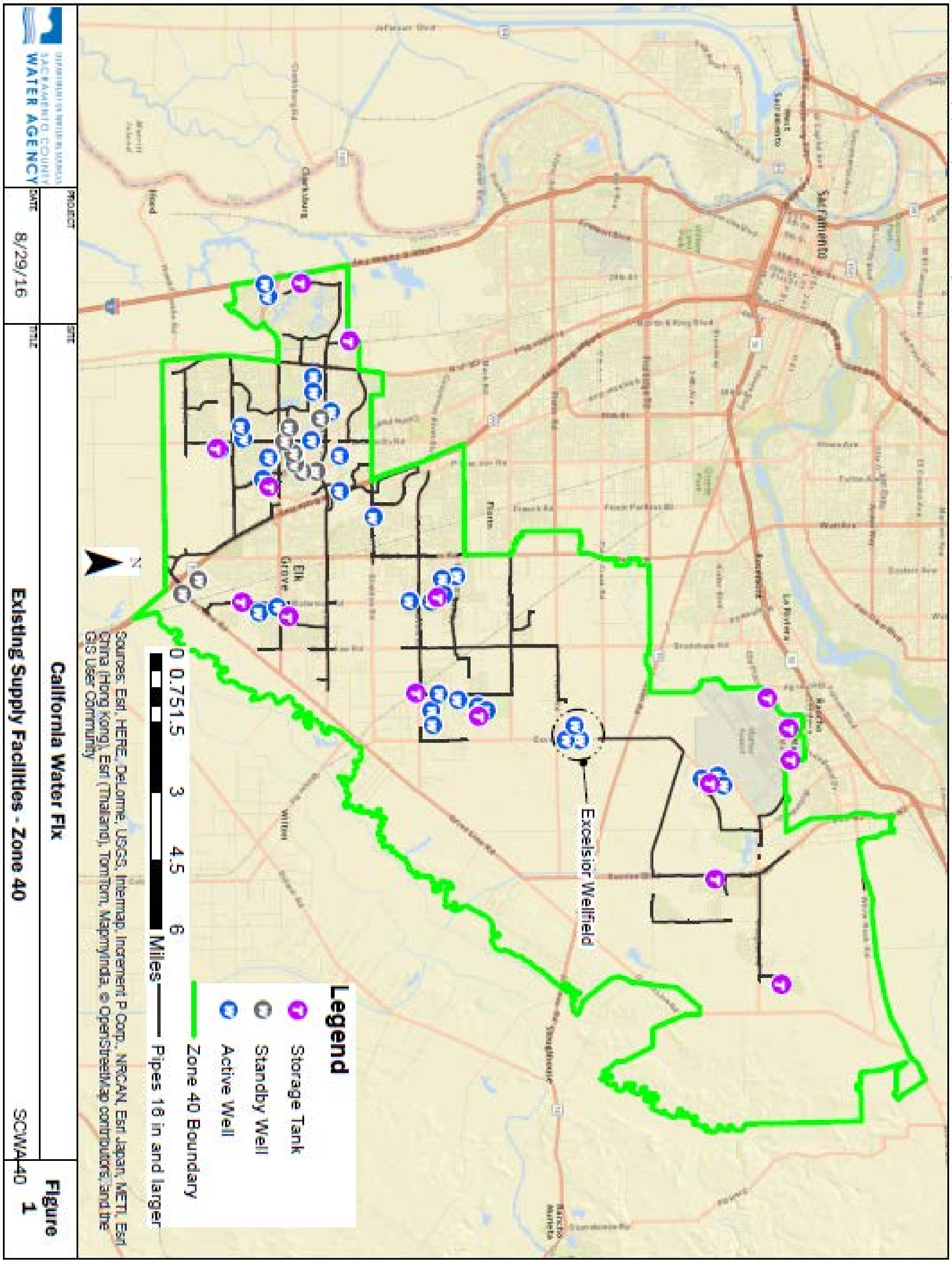


Figure 10-6
Potential Groundwater Recharge Areas

ATTACHMENT 5 – SWRCB EXHIBIT “SCWA 40”



II. EFFECTS OF PROPOSED INTAKE AND CONVEYANCE FACILITIES ON GROUNDWATER IN SACRAMENTO COUNTY WATER AGENCY, ZONE 40 SERVICE AREA

POTENTIAL ISSUES:

Operation of California WaterFix (CWF) Intakes would reduce instream freshwater flows from the Sacramento River which would affect groundwater supplies used by Sacramento County Water Agency (SCWA), Zone 40 Service Area (Zone 40). These issues were introduced in Exhibit SCWA 4 and discussed by Dr. Steffen Mehl on behalf of Zone 40 at the State Water Resources Control Board (SWRCB) hearing on October 26, 2016 [pages 126-135 and 230-232 of the transcript].

RESPONSE SUMMARY:

As described below, testimony presented to the SWRCB and reports prepared by Sacramento County water agencies indicate that the Zone 40 wells are located to the east of Interstate 5, and that the aquifer with the Zone 40 wells is primarily recharged from water flowing from the Sierra Nevada foothills located to the east of Zone 40. Model results presented in the Bay Delta Conservation Plan/California WaterFix Environmental Impact Report/Environmental Impact Statement (BDCP/CWF EIR/EIS) indicate that operations of the proposed CWF intakes under Alternative 1 would not affect the groundwater aquifer located to the east of Interstate 5.

1. GROUNDWATER RECHARGE OF ZONE 40 WELLS

As presented in SCWA 4 and discussed in oral testimony, Dr. Steffen Mehl discussed that the EIR/EIS did not address potential changes in groundwater due to the operations of the CWF intakes; and that the operations of the CWF intakes would affect groundwater in Zone 40. The assertions of Steffen Mehl are not supported by the evidence. Groundwater model results in the BDCP/CWF EIR/EIS, Figure 7-14, show that a maximum reduction of 5 feet in groundwater elevations along the Sacramento River would occur due to operations of five intakes under Alternative 1B and that the changes in groundwater elevations would not affect groundwater near Interstate 5 which is the western boundary of Zone 40. The results would be similar under the proposed Alternative 4A as can be determined by comparing the minimum Sacramento River flows under Alternatives 1B and 4A.

Zone 40 serves a portion of Sacramento County located south of the American River and north of the Cosumnes River with the most-western boundary that extends to Interstate 5 and eastern boundary that extends to the edge of the foothills located to the west of the Sacramento County line (see Exhibit SCWA 40 submitted to the SWRCB, included as Attachment 5 to this paper).

Groundwater conditions within Zone 40 have been analyzed in several studies over the past 15 years, including the 2004 *Sacramento County Water Agency Groundwater Management Plan*, 2005 *Sacramento County Water Agency Zone 40 Water Supply Master Plan*, 2006 *Central Sacramento County Groundwater Management Plan*, and *Sacramento Central Groundwater Authority Basin Management Report 2009-2010*. Information in these studies describe that groundwater in the groundwater basin that includes Zone 40 is recharged from rivers (Cosumnes, American, and Sacramento rivers), deep percolation of applied water, and subsurface flows along the Sierra Nevada foothills. Figure 2-16 of the 2006 *Central Sacramento County Groundwater Management Plan* indicate that Sacramento River provides the smallest amount of groundwater recharge to the groundwater basin (see Attachment 1). The majority of the recharge occurs along the Cosumnes River and small streams that flow from Sierra Nevada foothills and from deep percolation of applied water.

Information presented in the *Sacramento Central Groundwater Authority Basin Management Report 2009-2010* (Figures 4 through 7) show the groundwater elevation contours with the most recent contours shown in Figure 7 (see Attachment 2). Groundwater within an aquifer flows from higher elevations to lower elevations, and the rate of flow will increase along steeper elevation changes (e.g., areas with contour changes occurring with the least amount of horizontal space). Based upon the groundwater contours shown in Figure 7 of the *Sacramento Central Groundwater*

Authority Basin Management Report 2009-2010, it appears that the lowest groundwater elevation occurs near Elk Grove, located within Zone 40, and groundwater primarily flows towards this portion of Zone 40 from the east. Groundwater elevations near the Sacramento River appear to only be slightly higher than groundwater in Zone 40 (located to the east of Interstate 5). This report also describes that groundwater elevations in the portions of the basin that includes Zone 40 have recently been stable or have increased due to increased use of surface water in the area and fallowing of lands previously irrigated with groundwater.

Therefore, based upon the information presented in these reports, recharge in the groundwater basin that includes Zone 40 appears is not substantially affected by recharge from the Sacramento River.

This conclusion is consistent with the modeling results presented in the BDCP/CWF EIR/EIS, Figure 7-14. This figure presents the anticipated maximum reduction in groundwater elevations along the Sacramento River due to operations of five intakes under Alternative 1B. The results indicate that groundwater adjacent to the Sacramento River between Intake 1 and Rio Vista would decline up to 5 feet during drier months when the Sacramento River elevations would be at the lowest elevations. The changes in groundwater elevations would not extend to Interstate 5, and would not affect wells in Zone 40. It should be noted that Figure 7-14 provides results for operations of Intakes 1 through 5 under Alternative 1B. However, the results would be similar under the proposed Alternative 4A as can be determined by comparing the minimum Sacramento River flows under Alternatives 1 and 4A. As shown in Appendix 5A, Section C of the BDCP/CWF EIR/EIS, changes in Sacramento River monthly flows downstream of the North Delta Diversions as compared to the No Action Alternative are similar for the evaluation of Alternative 1B and Alternative 4A (see Tables C-21-14 and C-60-6, respectively).

Overall, based upon information prepared for Zone 40 groundwater conditions and results from groundwater monitoring presented in the BDCP/CWF EIR/EIS, it does not appear that operations of the North Delta Diversions would substantially affect groundwater recharge in Zone 40.

It also should be recognized that the BDCP/CWF EIR/EIS acknowledges that detailed hydrogeological analyses were not completed during the preparation of the EIR/EIS. As part of the environmental commitments of the project, thorough site investigations and desk studies would be conducted during design to identify the location of wells, depths of the wells and the depth to groundwater in the vicinity of the construction activities. Based upon the results of these studies, it is anticipated that monitoring wells would be installed prior to construction.

Executed on this 22 day of March, 2017 in Sacramento, California.

GWEN BUCHHOLZ