ICF Jones & Stokes
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October 14, 2008

Andrew Bell
District Engineer
Monterey Peninsula Water Management District
5 Harris Court, Building G
Monterey, CA 93940

Subject: Final Report, MPWMD 95-10 Project Implementation Feasibility

Dear Mr. Bell:

As specified in Amendment No. 1 to our Professional Services Agreement for the Monterey Peninsula Water Management District (MPWMD) 95-10 Project, ICF Jones & Stokes is submitting this letter and attachment as the Final Report for 95-10 Project implementation feasibility. Our staff and staff from Camp Dresser & McKee, Inc. (CDM) have pursued additional information on three critical implementation issues, each of which was discussed in our 95-10 Project Constraints Analysis (ICF Jones & Stokes and CDM 2008) submitted to MPWMD in August 2008. Our recommendations in that report were to collect additional information and have additional meetings with agencies regarding:

- Inter-basin Transfer of Water (Salinas and Seaside Basins)
- State Water Resources Control Board (SWRCB) Anti-degradation Policy
- Use of Fort Ord Dunes State Park for Well Sites

The conversations we had and the additional information we collected are summarized in the following paragraphs. A separate technical memorandum produced by CDM regarding groundwater aquifer boundaries in the project area is included as an attachment. References contained in this report are included as a second attachment.

Inter-basin Transfer of Water

The 95-10 Project Constraints Analysis pointed out that the Monterey County Water Resources Agency (MCWRA) has enabling legislation that prohibits the extraction and export of Salinas Basin groundwater to any location outside of the basin except Fort Ord (ICF Jones & Stokes and CDM 2008, page 14). Based on an initial meeting with MCWRA staff, it was determined that CDM should develop additional information on groundwater basin boundary conditions in the project area (see attachment) and meet again with MCWRA staff. A meeting with Curtis Weeks and Robert Johnson of MCWRA was conducted on October 2, 2008. The meeting was also

attended by Darby Fuerst and Joe Oliver of MPWMD, Ben Swann of CDM, and Mike Rushton of ICF Jones & Stokes. The information in the following paragraphs was developed by CDM as a summary of its groundwater boundary conditions investigation and the October 2, 2008 meeting.

Based on the review of available information, the Dune Sands boundary with the Seaside and Salinas Valley basins is not defined within the 95-10 Project study area. Information from groundwater studies of the shallow aquifer north of the 95-10 Project study area suggests that if a flow divide exists in the project area, it trends north to south, set back from the coast, with groundwater in areas near the coast flowing westward to Monterey Bay. The flow divides for the potable water bearing formations trend generally east-west in the study area and are affected by the basins' hydrogeology, stratigraphy, and effects of groundwater pumping with fluctuation over time.

All of the potential 95-10 Project well sites at former Fort Ord identified in the 95-10 Project Constraints Analysis are in areas with overlapping jurisdiction between MPWMD and MCWRA. In a meeting held with MCWRA staff on October 2, 2008, MCWRA recognized the overlapping jurisdictional and regulatory boundaries between the agencies based, in general, upon ambiguity and an oversimplified representation of the basins' boundary. The MCWRA stated general support for the 95-10 Project as defined, but emphasized that technical studies would be necessary to demonstrate that the project well locations would not extract water from the Salinas Basin.

An existing memorandum of agreement (MOA) between the two agencies gives MPWMD authority to regulate the management of the Seaside Basin within former Fort Ord. The MPWMD should work with MCWRA to develop an addendum to the MOA to define and monitor the Dune Sands aquifer at Fort Ord.

Groundwater production should be allowed to occur at locations that are close in proximity to Monterey Bay, that produce water from a shallow depth, and that have no demonstrated impact on potable aquifers of the Salinas or the Seaside Basins.

SWRCB Anti-degradation Policy

The SWRCB anti-degradation policy (Resolution No. 68-16) provides a mandate to maintain high quality in the waters of California. Any project that would reduce surface or groundwater quality below levels that existed at the time of enacting the policy (1968) would be in violation of the policy. On page 14 of the 95-10 Project Constraints Analysis, we speculated that projects completed in the Dune Sands aquifer might be exempt from this policy due to the aquifer's proximity to the ocean and its high salt content. However, the constraints report (ICF Jones & Stokes and CDM 2008, page 26) recommended that further discussions be undertaken with Regional Water Quality Control Board (RWQCB) and SWRCB staff to ascertain how the Dune

Sands aquifer might be treated relative to the deeper 180-foot aquifer along the southern Monterey Bay coast.

Subsequent conversations have been conducted with Mr. Ted Cobb, Assistant Chief Counsel with the SWRCB, Ms. Frances McChesney, Senior Staff Counsel with the SWRCB, and Mr. Matt Keeling, water resources engineer with the Central Coast RWQCB. In a conversation with Mr. Cobb on August 28, 2008, he indicated that the key questions regarding compliance with the anti-degradation policy related to what water body was in jeopardy and whether it had been assigned a beneficial use in the basin plan. Mr. Cobb also indicated that it would be useful to investigate whether exemptions from 68-16 might exist for projects with a public good that might override the need to protect groundwater quality. He suggested this be further investigated with RWQCB staff.

Subsequently, in a conversation with Mr. Keeling on September 29, 2008, it was determined that the Dune Sands aquifer had not been specifically assigned beneficial uses in the Central Coast basin plan. However, the basin plan states "Ground water throughout the Central Coastal Basin, except for that found in the Soda Lake Sub-basin, is suitable for agricultural water supply, municipal and domestic water supply, and industrial use." (State Water Resources Control Board 1994, page II-1) With these indirectly assigned beneficial uses, it is clear that the policy would apply to projects affecting the Dune Sands aquifer. The 180-foot aquifer, which is specifically identified as part of the Seaside groundwater basin in the basin plan (State Water Resources Control Board 1994, Table 3-8), is assigned these same beneficial uses. Mr. Keeling also indicated that the anti-degradation policy is not a "no-degradation" policy. Projects causing a decrease in groundwater quality would be judged on their individual merits.

In a telephone conversation with Ms. McChesney on October 14, 2008, she confirmed that the consistency of a project with the SWRCB anti-degradation policy would be based on evaluation of a specific project and the technical information developed regarding effects on groundwater. She indicated that some degradation of groundwater quality may be acceptable when a project provides an overriding benefit to the people of the state. Therefore, the 95-10 Project would be reviewed in light of the anti-degradation policy when the project and its potential effects were better defined.

Use of Fort Ord Dunes State Park for Well Sites

As part of our efforts to determine constraints to project development on former Fort Ord coastal land, we had conversations with Ken Gray of the California Department of Parks and Recreation (DPR). DPR is currently managing and will soon own former Fort Ord coastal lands now designated as Fort Ord Dunes State Park. The results of these conversations were reported in the 95-10 Project Constraints Analysis on page 9. No absolute constraints to the project were identified, but several issues were raised, including an informal policy to discourage construction of third-party infrastructure on state park land because of problems DPR has experienced in

recent years. It was suggested at that time we should meet with Mr. Matt Fuzie, the District Superintendent for DPR in the Monterey area.

A meeting was held with Matt Fuzie in the Monterey offices of DPR on September 19, 2008. The meeting was attended by Andrew Bell of MPWMD and Mike Rushton of ICF Jones & Stokes. We presented location and operation information regarding proposed groundwater extraction wells on areas intended for development in the Fort Ord Dunes State Park general plan. Mr. Fuzie indicated that DPR was generally not in support of constructing the project wells on park property, even on lands currently developed or proposed for development. However, he did not indicate that his opposition to the project was absolute. Any project brought before him in a formal manner would be judged on its merits. Mr. Fuzie went on to say that this type of project might receive more favorable consideration if it provided for a regional environmental or community benefit, or it in some way helped the DPR with the development of water and wastewater infrastructure needed to improve the park. At that time we mentioned the regional water supply benefit anticipated from the 95-10 Project, and the potential benefit to water quality and habitat conditions along the Carmel River expected by reducing water supply extractions from the river. The potential for jointly constructing pipelines to serve the 95-10 Project and the state park was also mentioned.

Conclusions and Recommendations

ICF Jones & Stokes and CDM staff believe, based on the additional coordination and data collection summarized above, there continue to be significant potential constraints to implementation of the 95-10 Project along the southern edge of Monterey Bay. These significant constraints were originally documented and reported to MPWMD in the 95-10 Project Constraints Analysis (ICF Jones & Stokes and CDM 2008). However, after further investigating the issues surrounding inter-basin transfer of water from the Salinas Basin, the SWRCB anti-degradation policy, and the use of DPR lands for well sites, we conclude that there remain no issues that should be considered insurmountable roadblocks to the 95-10 Project at this point in the planning process. Many potential constraints in the areas of engineering feasibility and policy or regulatory restrictions can only be completely known through further field studies and development and evaluation of a specific project.

CDM recommends, should the MPWMD wish to proceed with Phase 2 of the 95-10 Project, that field investigations are undertaken to better define the Dune Sands aquifer within the project area, and that the potential for impacts on the Salinas and Seaside Basins from Dune Sands aquifer production be assessed. CDM also recommends that outfall brine characterization studies be undertaken to clearly identify potential ocean resource impacts from disposing of desalination brine through the Monterey Regional Water Pollution Control Agency outfall into Monterey Bay.

ICF Jones & Stokes further recommends that Phase 3 of the effort, completion of a CEQA review of the project, is placed on hold pending the results of the Phase 2 engineering investigations.

We look forward to reporting the results of this most recent investigation of potential 95-10 Project constraints to your Board of Directors. Please feel free to call with any questions or concerns regarding this progress report.

Sincerely,

Michael D. Rushton

Michael D. Rushton
Principal

Attachment

cc: Polly Boissevain, Camp Dresser & McKee, Inc.
Ben Swann, Camp Dresser & McKee, Inc.

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References

MPWMD Progress Report, 95-10 Project Implementation Feasibility

Printed References

ICF Jones & Stokes and Camp Dresser & McKee, Inc. 2008. *95-10 Project Constraints Analysis.* Sacramento, CA. Prepared for Monterey Peninsula Water Management District, Monterey, CA.

State Water Resources Control Board. 1968. *Resolution 68-16, Statement of Policy with Respect to Maintaining High Quality Waters in California.* State Water Resources Control Board, Sacramento, CA.

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Personal Communications

Cobb, Theodore. Assistant Chief Counsel, State Water Resources Control Board, Sacramento, CA. August 28, 2008 – telephone conversation.

Fuzie, Matthew. Monterey District Superintendent, California Department of Parks and Recreation, Monterey, CA. September 19, 2008 – meeting.

Keeling, Matthew. Engineer, Regional Water Quality Control Board, Central Coast Region, San Luis Obispo, CA. September 29, 2008 – telephone conversation.

McChesney, Frances. Senior Staff Counsel, State Water Resources Control Board, Sacramento, CA. October 14, 2008 – telephone conversation.

CDM

Technical Memorandum

To: *Mike Rushton, ICF Jones and Stokes*

From: *Ben Swann, R.G., C.Hg., Camp Dresser & McKee, Inc.*
Polly Boissevain, P.E., Camp Dresser & McKee, Inc.

Date: *October 13, 2008*

Subject: *Dune Sands Aquifer Characteristics- Salinas Valley and Seaside Groundwater Basins*

This technical memorandum (TM) examines the physical nature and regulatory status of the saturated Dune Sands aquifer in the Monterey coastal plain relative to its hydrogeologic connection to the Seaside and Salinas Valley Groundwater Basins. This work was undertaken following the completion of the *95-10 Project Constraints Analysis, August 2008* for the Monterey Peninsula Water Management District (MPWMD). The constraints analysis was developed jointly by Camp Dresser & McKee Inc. (CDM) and ICF Jones & Stokes to identify potential seawater extraction well locations in the District's service area to provide desalination feed water to meet the State Water Resources Control Board's 95-10 Order to reduce surface water withdrawals from the Carmel River.

An important constraint identified in the Constraints Analysis Report is the regulatory status of the Dune Sands aquifer in the near-shore coastal plain extending from the City of Seaside north through former Fort Ord. This hydrogeologic unit is brackish to salty and under hydraulic influence by ocean water. The MPWMD desires to extract water from the Dune Sands aquifer for the 95-10 Project. The general location of the 95-10 Project area is shown in Figure 1. The specific regulatory issue identified in the Constraints Analysis Report is whether the Dune Sands aquifer underlying former Fort Ord is part of the Salinas Valley Basin or the Seaside Basin. Chapter 52-21 of the Monterey County Water Resources Agency (MCWRA) enabling legislation specifically prohibits the extraction and export of groundwater outside of the Salinas Basin except for use at Fort Ord. Discussions with MCWRA during development of the Constraints Analysis Report indicated that a project extracting from the Dune Sands formation within the Salinas Basin could incur a considerably lengthy implementation timeline to address the Chapter 52-21 policy.

This memo explores the regulatory and hydrogeologic relationship of the Dune Sands relative to the Salinas Valley Groundwater Basin and Seaside Groundwater Basin. The memo reviews the:

1) Dune Sand aquifer and its relationship to the Seaside and Salinas Valley Basin potable groundwater aquifers;

2) Physical boundaries defined for the Seaside and Salinas Valley basins; and,

3) Regulatory and jurisdictional boundaries as they relate to the Seaside and Salinas Valley basins.

The memo concludes with findings and recommendations with regard to the Dunes Sands aquifer boundaries.

TM Summary

Based on the review of available information, the Dune Sands boundary with the Seaside and Salinas Valley basins is not defined within the 95-10 Project study area. Information from groundwater studies of the shallow aquifer north of the 95-10 Project study area suggests that if a flow divide exists in the project area, it trends north to south, set back from the coast, with groundwater in areas near the coast flowing westward to Monterey Bay. The flow divides for the potable water bearing formations trend generally east-west in the study area and are affected by the basins' hydrogeology, stratigraphy, and effects of groundwater pumping with fluctuation over time.

Potential 95-10 Project well sites at former Fort Ord identified in the 95-10 Constraints Analysis are all in areas with overlapping jurisdiction between MPWMD and MCWRA. In a meeting held with MCWRA staff on October 2, 2008, MCWRA recognized the overlapping jurisdictional and regulatory boundaries between the agencies based, in general, upon ambiguity and an oversimplified representation of the basins' boundary. The MCWRA stated general support for the 95-10 Project as defined, but emphasized that technical studies would be necessary to demonstrate that the project well locations would not extract water from the Salinas Valley Groundwater Basin.

An existing memorandum of agreement (MOA) between the two agencies gives MPWMD authority to regulate the management of the Seaside Basin within former Fort Ord. The MPWMD should work with MCWRA to develop an addendum to the MOA to define and monitor the Dune Sands Aquifer at Fort Ord.

Groundwater production should be allowed to occur at locations that are close in proximity to Monterey Bay, that produce water from a shallow depth, and that have no demonstrated impact on potable aquifers of the Salinas or the Seaside basins. CDM recommends that, should the MPWMD wish to proceed with Phase 2 of the 95-10 Project, field investigations be undertaken to better define the Dune Sands aquifer within the project area, and assess the potential for impacts on the Salinas Valley and Seaside basins from Dune Sands aquifer production.

Seaside and Salinas Basin Groundwater Aquifers

This section provides a brief overview of the hydrogeologic units used for potable supply in both the Salinas Valley and Seaside Groundwater Basins and the non-potable Dune Sand aquifer.

Potable Aquifers of Salinas and Seaside Groundwater Basins

The two principal aquifers in the Seaside Basin are the Paso Robles Formation and the Santa Margarita Sandstone. The shallower Paso Robles Formation is encountered in the Seaside area at depths shallower that 100 feet but deepen to the north as the formation dips northward and thickens (See geologic cross section Figure 2). The Santa Margarita Sandstone is the deeper water bearing unit which has been both faulted and folded by geologic activity south of the city of Seaside. Consequently, its depth is variable but is generally greater than 400 feet. The Santa Margarita Sandstone either terminates or grades into the Lower Purisima Formation north of the City of Seaside.

The Salinas Valley Basin aquifers are designated based upon the depth at which the aquifer units are encountered. There are three designated aquifers in the Salinas Valley Basin, the 180-Foot Aquifer (Upper and Lower) , the 400-Foot Aquifer and the Deep Aquifer (all aquifers below the 400-Foot Aquifer). The Salinas Valley Aquitard overlies the 180-Foot Aquifer throughout most of the coastal part of the Salinas Valley creating a confined aquifer condition and separation of the 180-Foot Aquifer from direct surface water infiltration.

The correlation between aquifers in the Seaside and Salinas Valley basins is complicated by the northward dip of all of the geologic units, the northward termination of the Santa Margarita Sandstone, and the presence of Salinas River alluvial deposits which likely constitute part of the 180-Foot Aquifer in the Salinas Valley. Nonetheless, stratigraphic and potentiometric head investigations have shown a correlation between the aquifers of both basins. (Watermaster, 2008). The cross section in Figure 2 shows the general interpretation of the extension of the Seaside Basin geologic units into the Salinas Valley basin.

Dune Sands

The Aromas Sand and the dune sands (collectively referred to in this TM as the Dune Sands) are extensive in the 95-10 Project study area from Seaside north through Ford Ord. The Dune Sands are in direct communication with the ocean and in the 95-10 Project study area are thought to be saturated only at the coastal margin. The Dune Sands have a very high potential to withdraw ocean water from the coastal margin as demonstrated by production wells in Sand City with yields exceeding 500 gallons per minute (gpm) (CDM, 2008).

Withdrawal of ocean water from the Dune Sands in the Seaside Basin and the Salinas Valley Basin have the potential to impact the Paso Robles Formation and 180-Foot Aquifer if water is extracted too far inland. In the 95-10 Project study area, a lower permeable silt/clay unit has been identified separating the Dune Sands from the Paso Robles Formation at a depth of approximately 50-75 feet below sea level. In close proximity to the beach, this unit appears continuous from Sand City through Fort Ord and provides a barrier between the underlying Paso Robles Formation. There is less geologic data on this unit to the east and consequently, its inland (greater than 400 feet from the ocean) continuity is not known. (CDM, 2008)

The largest body of work compiled on the Dune Sands aquifer was conducted north of the 95-10 Project study area at the Fort Ord Sites 2 and 12 groundwater monitoring and cleanup in the Salinas Valley Groundwater Basin. In this area, the Dune Sand Aquifer of the Seaside Basin correlates to the A-Aquifer and the unconfined portion of the Upper 180-Foot Aquifer.

The shallow hydrostratigraphic units defined in these studies included (from shallow to deep) the A-Aquifer, Salinas Valley Aquitard , and the Upper 180-Foot Aquifer. Groundwater within the A-Aquifer is unconfined, non-potable, perched on the Salinas Valley Aquitard , and generally flows west and east along a northeast-trending groundwater divide located approximately 2.5 miles from the ocean (See Figure 3 Groundwater Elevations for the A-Aquifer and Upper 180-Foot Aquifer and Figure 4 Cross-section A- A'). The groundwater divide is largely controlled by the underlying Salinas Valley Aquitard. Groundwater flowing east of the A-Aquifer divide eventually discharges into the Salinas River. Groundwater flowing west of the A-Aquifer groundwater divide flows toward the western edge of the Salinas Valley Aquitard where it enters the unconfined portion of the Upper 180-Foot Aquifer. Groundwater within the unconfined portion of the Upper 180-Foot Aquifer flows west and discharges into Monterey Bay. (MACTEC, 2008).

Seaside Basin and Salinas Valley Basin Physical Boundaries

The Salinas Valley and the Seaside Basins' shared groundwater boundary is represented by a flow divide. Groundwater north of the divide flows to the Salinas Valley Basin and groundwater to the south flows to the Seaside Basin. The approximate flow divide between the Salinas Valley and the Seaside Basins is depicted in Figures 5 and 6 for the Paso Robles Formation and the Santa Margarita Sandstone, respectively. The flow divides are influenced by pumping in both basins and can change over time as a function of pumping rates and locations. Both basin boundaries are represented as a wide zone in Figures 5 and 6 to represent the temporal variability of this flow divide.

The Dune Sands aquifer has not been mapped relative to the Seaside Basin. Because the Dune Sands are in direct hydraulic communication with the ocean, are recharged by local rainfall, and not under the influence of local pumping, the direction of groundwater flow in 95-10 Project study area is anticipated to be west/ northwest toward the Monterey Bay. This

general flow direction is supported by work at Sites 2 and 12 as discussed above and illustrated in groundwater contours shown in Figure 3.

The city of Sand City plans to initiate a brackish water extraction program from the Dune Sands aquifer for desalination feed water in Sand City. This project will develop a localized groundwater depression and associated flow divide drawing in both ocean and brackish water from the coastal plain. Flow testing of extraction wells has shown that withdrawal of the brackish water from the Dune Sands does not impact the Paso Robles Formation of the Seaside Basin (Feeney, pers comm.). As Sand City develops this desalination project, a greater understanding of the flow conditions of the Dune Sands aquifer will be developed with additional monitoring and pumping data.

Regulatory and Jurisdictional Boundaries and their Relationship to the Seaside and Salinas Basins

The flow divide boundary between the Seaside Basin and the Salinas Valley Basin has created the opportunity for conflicting interpretation of regulatory and institutional jurisdictions. These overlapping interpretations of jurisdiction include:

1. **Seaside Basin adjudication decision used the Paso Robles flow divide to define the Seaside Basin**. The Seaside Groundwater Basin was defined in the court adjudication decision (*California American Water v. City of Seaside, et al. , Case M66343)* as bounded by the Pacific Ocean on the west and the Salinas Valley on the north, the Toro Peak on the east and Highways 68 and 218 on the south. The decision included a map of the Seaside Basin consistent with the basin boundary depicted in Figure 5 which represents the Salinas Valley and Seaside Basins' flow divide as that of the Paso Robles Formation.

   The adjudication decision did not address the different hydrogeologic flow régime caused by pumping from the deeper 400-Foot Aquifer and the Santa Margarita Sandstone. This flow divide is shifted significantly north of the Paso Robles flow divide and into what is geographically designated as the Salinas Valley Groundwater Basin.

   Relative to the Dune Sands aquifer, the adjudication decision specified the right to Sand City to produce brackish water from the Dune Sands for desalination so long as the extraction does not result in a material injury to the Seaside Basin. In so ruling, the adjudication decision clearly recognized a distinction between the Dune Sands and the potable groundwater aquifers (Paso Robles Formation and Santa Margarita Sandstone) of the Seaside Basin. The decision does not limit the production of seawater from the Seaside Basin to the extent that it does not adversely affect Seaside Basin water resources (Laredo, 2006).

2. **Monterey County Water Resources Agency (MCWRA) boundary and studies overlap with the Seaside Basin adjudication boundary**. The Monterey County Water Resources Act codifies the responsibilities and scope of authority for the MCWRA. The MCWRA is granted specific responsibility in the act to protect the groundwater resources of the Salinas Valley Groundwater Basin. However, the act does not specify the geographic, hydrologic, or hydrogeologic boundaries of the basin. The Agency's Zone 2C boundary is consistent with the former Fort Ord property and includes a portion of the adjudicated Seaside Basin boundary (see Figure 7). Further, the Agency's groundwater model for the Salinas Valley Groundwater Basin includes most of the Seaside Groundwater Basin in the model domain (see Figure 8).

3. **Monterey Peninsula Water Management District boundary includes significant portions of Fort Ord and is different than the adjudication order.** The District's boundary differs from the adjudication order and the MCWRA's boundary at Fort Ord, potentially creating complexity in developing new water management programs to protect the Seaside Basin. The Monterey County Water Resources Act specifies that the Agency and the District will make a "good faith effort" to develop a memorandum of agreement (MOA) in the overlapping jurisdictional areas. This MOA dated December 15, 1991 and Addendum 1 dated September 28, 1992 did not define the specific boundaries of the Seaside and Salinas Valley Groundwater Basins and predate the most current understanding of the basins as depicted in Figures 5 and 6 and the adjudication decision.

4. **California Department of Water Resources depicts a larger Seaside Basin.** The current depiction of the Seaside Basin boundary differs from the boundary used by the California Department of Water Resources in its mapping of California groundwater basins for Bulletin 118 (DWR, 2004). DWR has interpreted the Seaside Basin as extending north to include all of Fort Ord and the city of Marina.

CDM, ICF Jones and Stokes, and MPWMD staff (Darby Fuerst and Joe Oliver) met with the MCWRA on October 2, 2008 to discuss the 95-10 Project and the jurisdictional issues in the 95-10 Project area that could delay or prohibit the project from proceeding. MCWRA staff (Robert Johnson, Chief of Water Resources Planning and Curtis Weeks, General Manager) recognized the overlapping jurisdictional and regulatory boundaries between the agencies based, in general, upon ambiguity and an oversimplified representation of the basins' boundary as discussed above. The MCWRA generally supported the 95-10 Project and Dune Sands extraction as a mechanism to help resolve the 95-10 Order. It was further stated that for the MCWMA to support the project it would need to be in close proximity to the coast, drawing from the shallow Dune Sands aquifer, and importantly could be proven though technical studies that the project would not extract water from the Salinas Valley Groundwater Basin.

Findings and Recommendations Regarding Dune Sand Boundary

The following important points were identified based on the review of available information on the boundary of the Dune Sands aquifer.

1. Based on available data, there is no defined or discernable Dune Sand aquifer flow divide boundary separating the Salinas Valley and Seaside Groundwater Basins. Information from Sites 2 and 12 at former Fort Ord to the north of the 95-10 Project area indicates that in the Salinas Valley Basin, the corresponding A-Aquifer flow divide trends north to south along the coast with eastward inland flow to the Salinas River and the westward movement of seasonally recharged shallow groundwater to the ocean (see Figure 3). In the 95-10 Project area, there may not be a defined flow divide between the two basins, as seasonally recharged groundwater is thought to flow only west towards the Monterey Bay.

2. Defining the basins' flow divide, and consequently the basins themselves, is complicated by the complex hydrogeology, stratigraphy, and separate aquifer nomenclature used in both basins for interconnected water bearing units (see Figure 4). Additionally, the flow divides have fluctuated over time and will continue to do so in the future from the effect of changing groundwater pumping.

3. The MOA between MCWMA and the MPWMD does not reflect the most recent technical data on the Salinas Valley and the Seaside Basins' boundary. The Seaside Basin adjudication decision has defined the Paso Robles Formation flow divide as the basins' boundary. This definition appears overly simplistic given that the Santa Margarita Sandstone's flow divide is shifted significantly north of the Paso Robles formation flow divide and the Dune Sands aquifer is not affected by potable aquifer pumping in the Seaside Basin or the Salinas Valley Basin.

Recommendations

The 95-10 Project Constraints Analysis identified several well locations at Former Fort Ord where seawater could potentially be extracted from the Dune Sands aquifer. All of these extraction well locations are in areas of overlapping jurisdiction between MPWMD and the MCWRA. The boundary of the Seaside Basin and the Salinas Valley Basin is represented by a flow divide for the potable aquifer units. The Dune Sands aquifer likely does not have a definable flow divide between the two basins similar to that of the Paso Robles Formation (e.g. a flow divide created by pumping in each basin). Information collected as part of this study from Sites 2 and 12 to the north of the 95-10 Project study area suggests that if a flow divide exists within the 95-10 Project study area, the flow divide trends approximately north/south paralleling the beach and represents the discharge of seasonally recharged water in the coastal plain to the Monterey Bay.

Seawater production should be allowed to occur at those 95-10 Project well locations that: 1.) Are in close proximity to the Monterey Bay, 2.) Produce water from a shallow depth (less than 50 feet below sea level), 3.) Are geographically within the MPWMD's boundary, and 4.) Will have no negative effect on the potable water aquifers of either the Salinas Valley or the Seaside Basins.

As sea water extraction programs become a more important alternative of the water supply options to resolve the 95-10 Order, the MPWMD and the MCWRA should consider developing a joint agreement to define and monitor the Dune Sands Aquifer at Fort Ord.

The MPWMD and the MCWRA MOA Addendum 1 specifies that the MPWMD "shall have exclusive authority to regulate the management of the Seaside Basin within the present Fort Ord boundaries, and that the MCWRA will comply with any such ordinance enacted by MPWMD." Given the overlapping regulatory boundaries and ambiguity in the hydrogeologic boundary of the basins at Fort Ord, the MPWMD and the MCWRA could use the MOA addenda mechanism to regulate the extraction of seawater from the coastal plain at former Fort Ord.

The following technical studies should be undertaken at the identified 95-10 Project well locations to aid in understanding the hydrogeology and demonstrate whether there are potential effects that pumping could induce on the potable aquifers in the Salinas Valley and Seaside Basins. These studies would be needed to confirm project viability (i.e. project does not impact potable aquifers in the Salinas Valley and Seaside Basins) and are recommended to be performed as part of a 95-10 Project Phase 2 field investigation program.

1. Extended Dune Sands aquifer pump testing and monitoring of flow, water levels, and salt content to understand yield and groundwater flow influences on the two basins.

2. Exploratory borings to identify and confirm the extent of the low permeable silt/clay unit overlying the Paso Robles Formation and the relationship of this unit to the Salinas Valley Aquitard.

References

ICF Jones and Stokes and Camp Dresser & McKee Inc. 2008. *95-10 Project Constraints Analysis, August 2008.* Sacramento, CA. Prepared for MPWMD, Monterey, CA.

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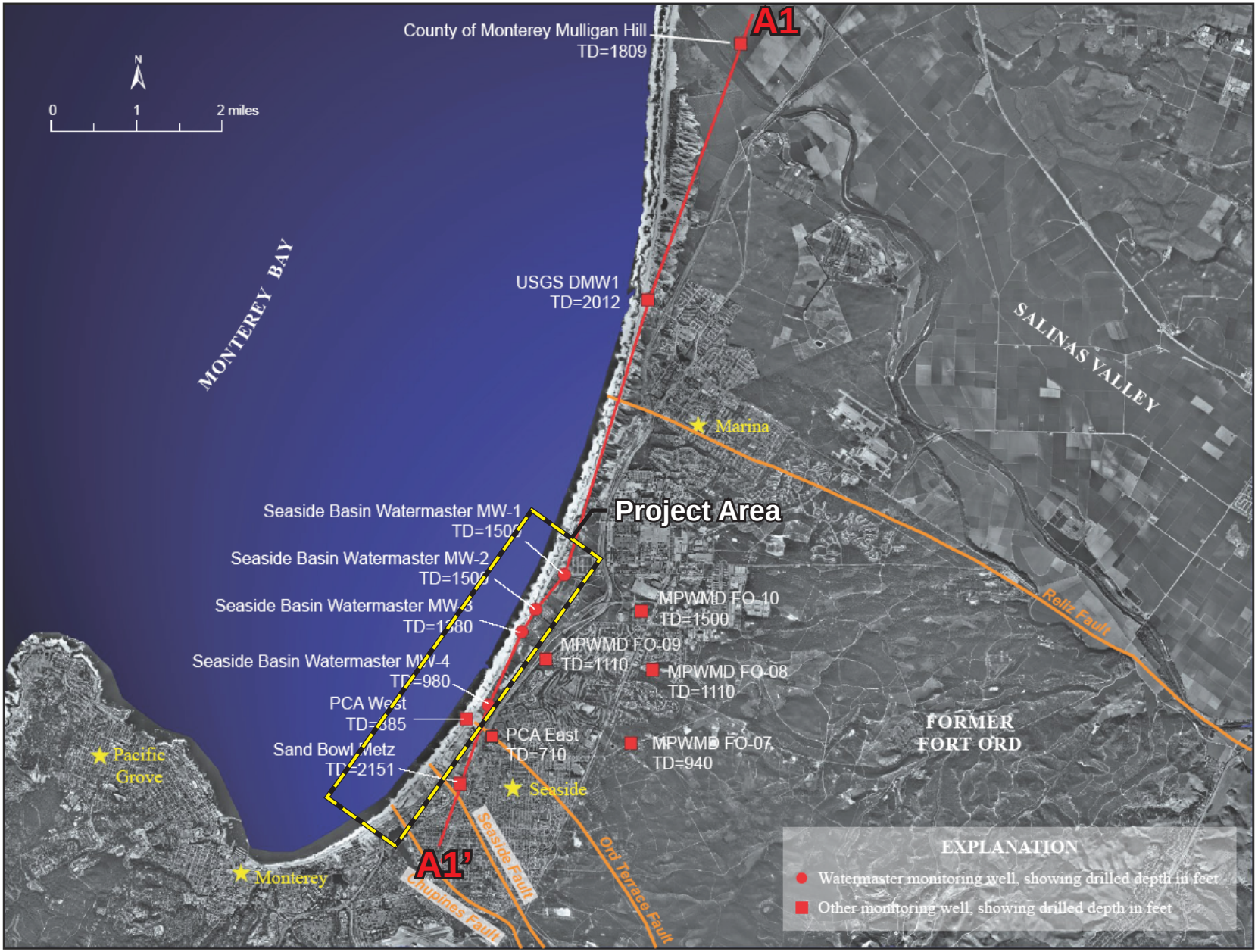


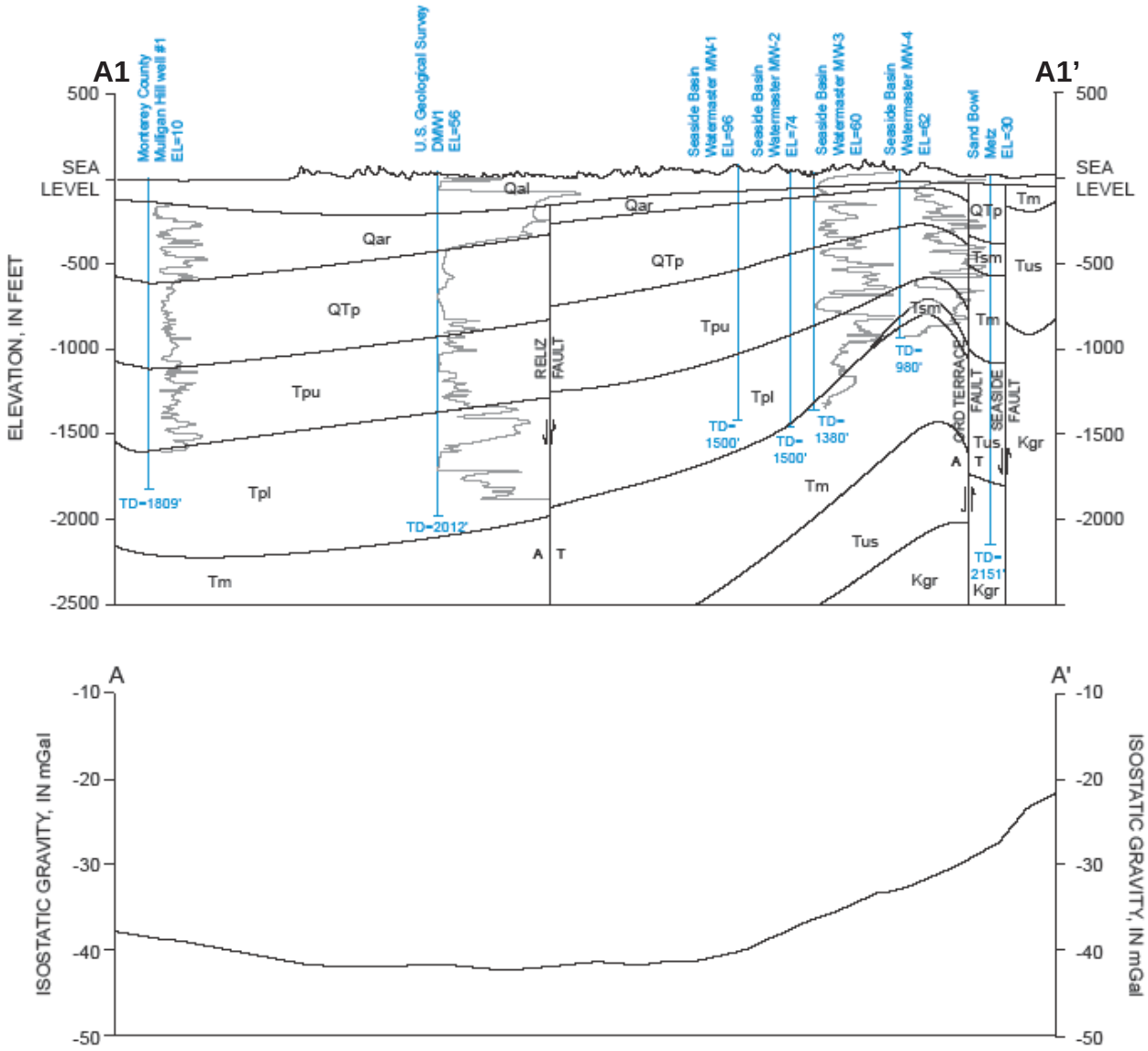
Orthophoto base from HJW (1999), 1:36,000 scale imagery

Source: Feeney (2007)

W:\ENGINEER\Boissevain\Monterey White Paper\Figure 1 - General Site Location and X-Section.ai 10/07/08 JJT

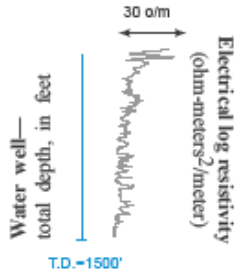
Figure 1

General Site Location and Cross Section A-A' Location



EXPLANATION

Qal	Alluvium (Holocene)
Qar	Aromas Sand (Pleistocene)
QTp	Paso Robles Formation (Pleistocene-Pliocene?)
Tp	Purisima Formation (Pliocene), subdivided into upper unit (Tpu) and lower unit (Tpl)
Tsm	Santa Margarita Sandstone (late Miocene)
Tm	Monterey Formation (middle Miocene)
Tus	Unnamed sandstone (middle Miocene)
Kgr	Granitic rocks (late Cretaceous)
———	Fault, half arrows show direction of vertical separation; A indicates horizontal movement away from viewer, T indicates movement toward viewer
———	Contact



SCALE

10000 feet

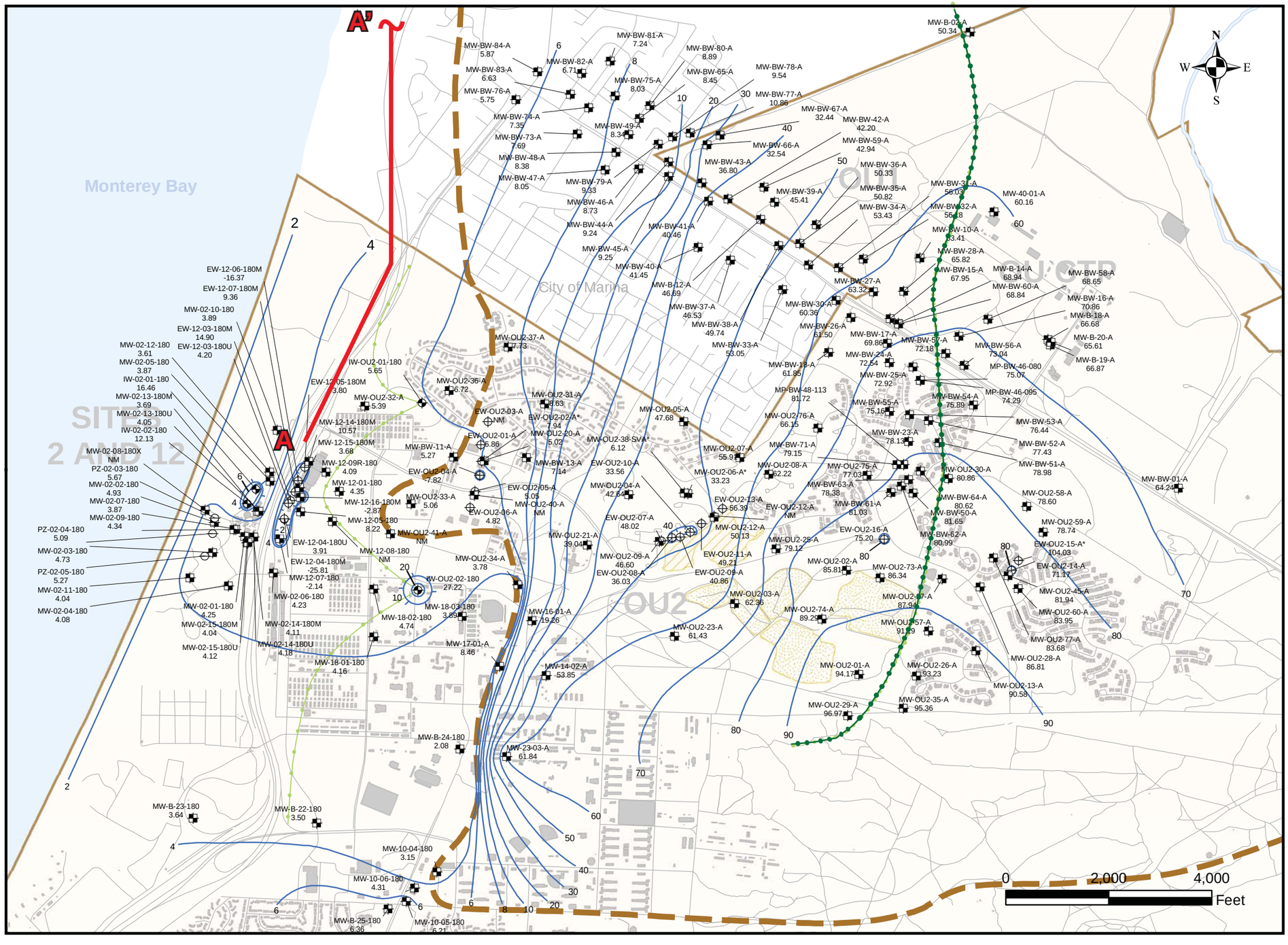
Vertical exaggeration = 10X

1000 feet

Geologic data modified from Rosenberg and Feeney (2003), *in* **Deep aquifer investigative study (WRIME, 2003,** cross section **A–A')**
Gravity data from USGS Open-File Report OF 02-373 (Langenheim and others, 2002)
Topography from USGS National Elevation Dataset (30-m resolution).

W:\ENGINEER\Boissevain\Monterey White Paper\Figure 2 - Basin Cross Section.ai 10/07/08 JJT

Figure 2
Basin Cross Section



Explanation

- Monitoring Well
- Piezometer
- Remediation Extraction Well
- Remediation Injection Well
- Approximate edge of Fort Ord-Salinas Valley Aquitard Boundary, queried where uncertain
- Facilities
- Approximate location of a Groundwater Divide
- Approximate outline of former Fort Ord Landfill Cell A
- Approximate extent of Fort Ord Landfills, HLA, January 5, 1995
- Roads
- Former Fort Ord Boundary
- 60 — Groundwater elevation contour (in feet above or below mean sea level, contour interval 2 or 10 feet)
- NM — Water level not measured this quarter
- * — Water level not used for contouring
- MW-BW-38-A 49.74 — Station ID and Water-level elevation (in feet above or below mean sea level)

Base map received from US Army Corps of Engineers March 10, 2008

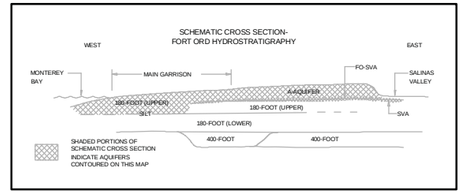
NOTES:

(1) WATER LEVELS IN MONITORING WELLS WERE MEASURED ON DECEMBER 3-7 AND 10, 2007.

(2) WATER LEVELS IN PIEZOMETERS WERE MEASURED ON DECEMBER 4, 2007.

(3) WATER LEVELS IN EXTRACTION AND INJECTION WELLS WERE MEASURED BY AHTNA GOVERNMENT SERVICES ON DECEMBER 11 AND 24, 2007.

(4) GROUNDWATER ELEVATION CONTOURS ARE BASED ON ONE INTERPRETATION OF THE DATA THAT WERE AVAILABLE AT THE TIME THIS REPORT WAS PREPARED; OTHER INTERPRETATIONS MAY BE POSSIBLE.

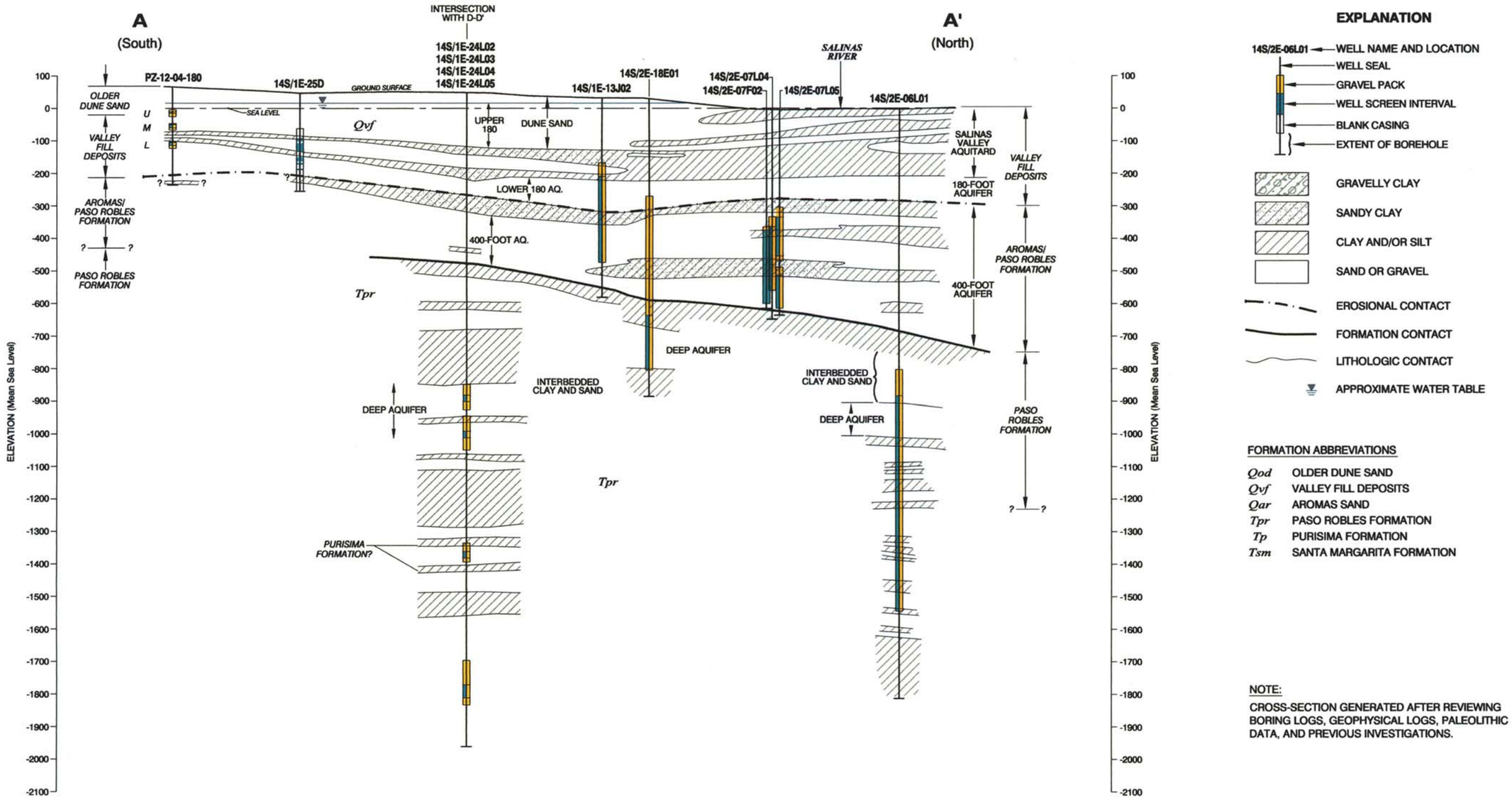


Source: MACTEC (2007)

W:\ENGINEER\Boissevain\Monterey White Paper\Figure 3 - Salinas Valley A-Aquifer and Upper 180-Ft Aquifer Flow Divides.ai 10/07/08 JJT

Figure 3

Salinas Valley A-Aquifer and Upper 180-Ft Aquifer Flow Divides



EXPLANATION

FORMATION ABBREVIATIONS

Qod	OLDER DUNE SAND
Qvf	VALLEY FILL DEPOSITS
Qar	AROMAS SAND
Tpr	PASO ROBLES FORMATION
Tp	PURISIMA FORMATION
Tsm	SANTA MARGARITA FORMATION

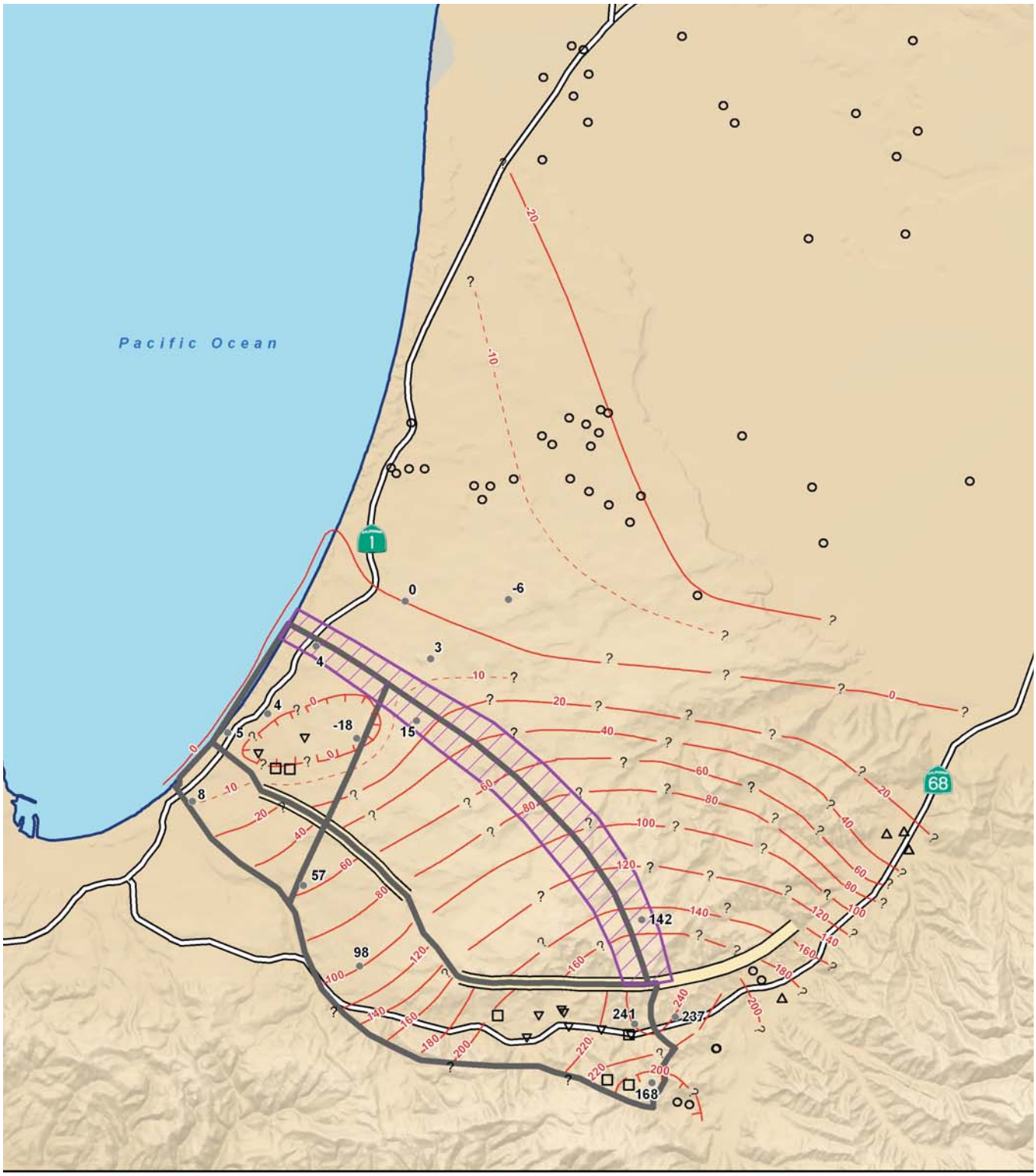
NOTE:

CROSS-SECTION GENERATED AFTER REVIEWING BORING LOGS, GEOPHYSICAL LOGS, PALEOLITHIC DATA, AND PREVIOUS INVESTIGATIONS.

Source: Harding ESE (2000) a MACTEC Company

W:\ENGINEER\Boissevain\Monterey White Paper\Figure 4 - Salinas Valley A-Aquifer X-Section.ai 10/07/08 JJT

Figure 4
Salinas Valley A-Aquifer Cross Section



Source: HydroMetrics, RBF Consulting GIS (2006)

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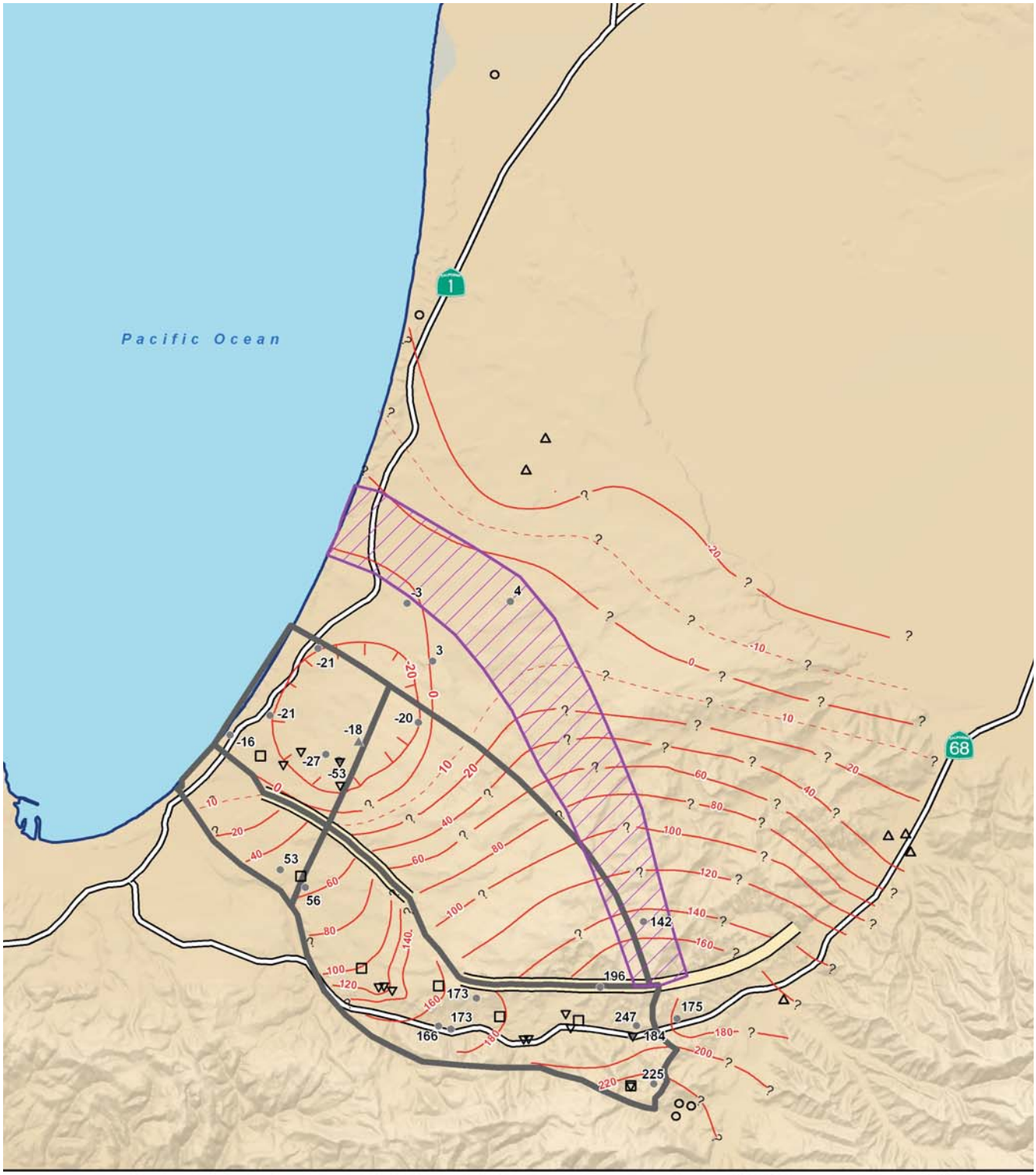
Figure 5
Paso Robles Flow Divide



Source: HydroMetrics, RBF Consulting GIS (2006)

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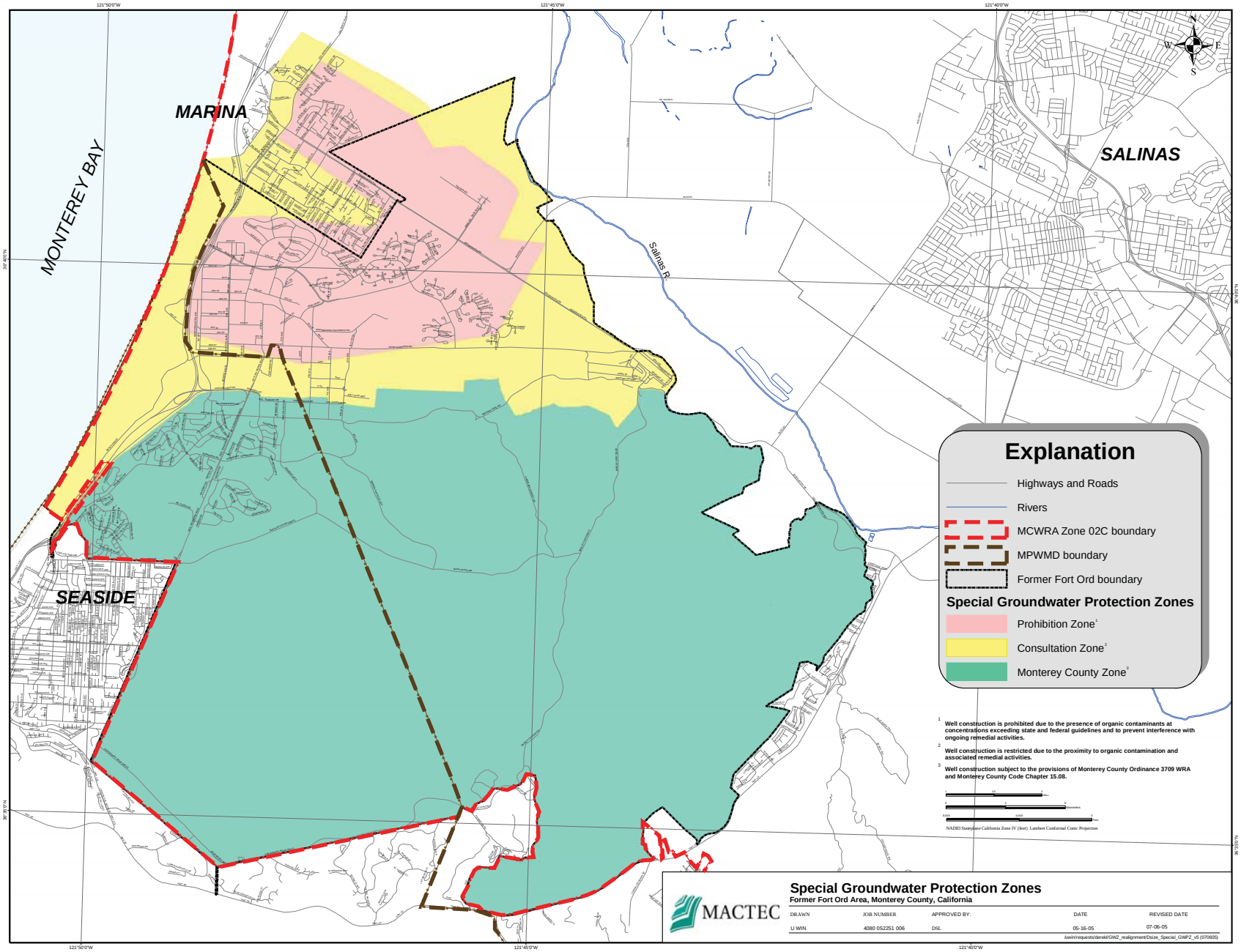
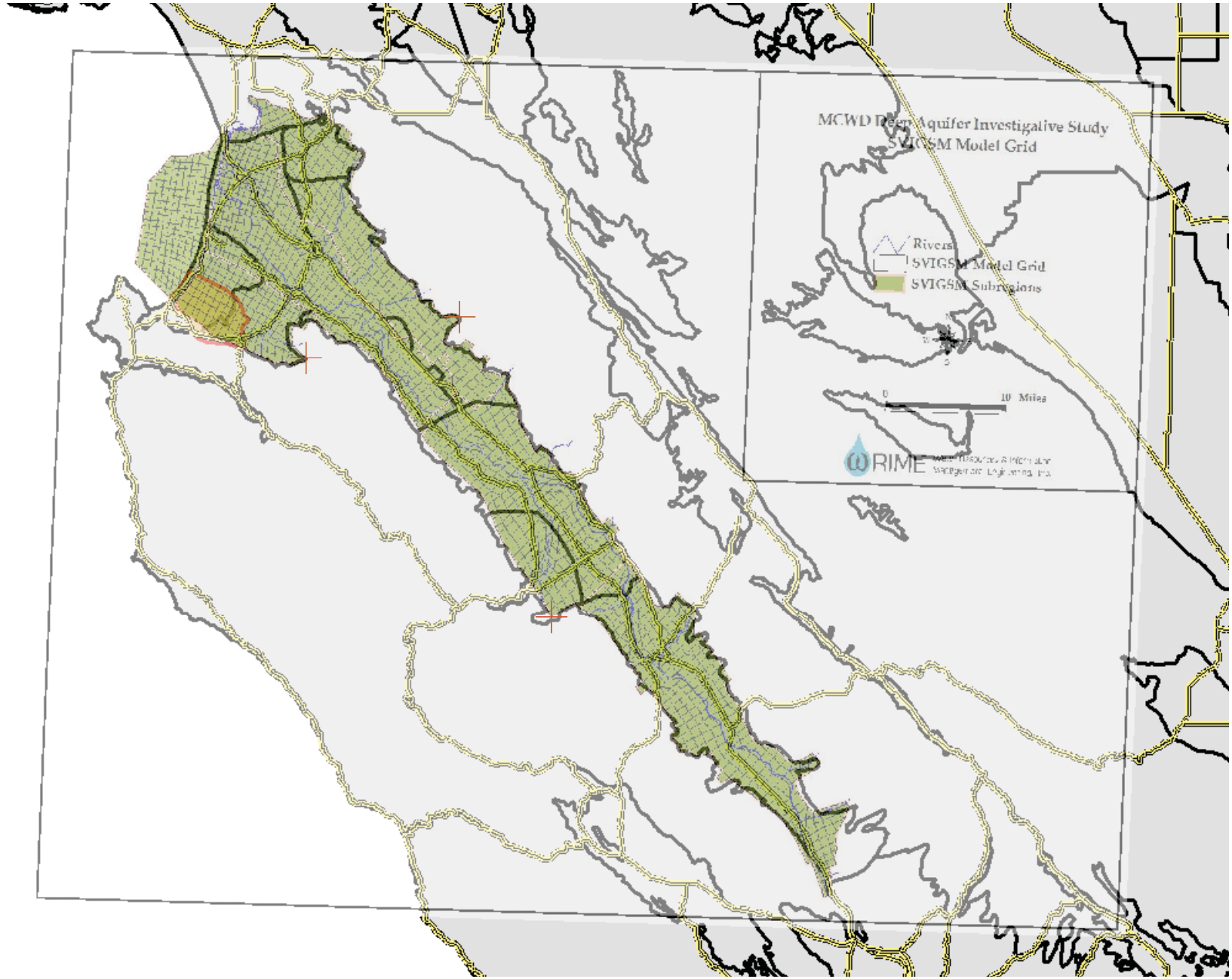
Figure 6
Santa Margarita Flow Divide



Source: MACTEC (2005)

W:\ENGINEER\Boissevain\Monterey White Paper\Figure 7 - MCWRA and MPWMD Boundaries on Former Fort Ord.ai 10/07/08 JJT

Figure 7
MCWRA and MPWMD Boundaries on Former Fort Ord



Source: WRIME

W:\ENGINEER\Boissevain\Monterey White Paper\Figure 8 - Salinas Valley IGSM Model Domain.ai 10/07/08 JJT

Figure 8
Salinas Valley IGSM Model Domain