- Pg 2-31, 2.3.2.5, – East Bay MUD and Contra Costa WD should have been lead agencies as this EIS/R document will inform them for their decision on if to approve this document and to participate in the water transfer program. 96
- Pg 2-31, 2.3.2.5, – "Transfers to East Bay MUD and Contra Costa WD are limited by available pumping capacity at the Freeport intake and Contra Costa WD's Delta intakes..." Water diverted at Freeport does not traverse the delta and does not contribute to south delta water quality or net delta outflows. 97
- Pg 2-34, 2.3.2.7, – "Buyers and sellers may negotiate transfers that last one year or multiple years." The project could result in some land being idled for 10 years straight. This could lead to land use designation changes fostering development or protected habitat. The possible long term impacts should be further analyzed. 98
- Pg 2-39, 2.5, – "While the alternatives would affect different resources in different ways, none of the alternatives are considered to be the environmentally superior alternative. There are no unavoidable significant impacts associated with the Proposed Action that would otherwise be avoided or substantially reduced by an alternative, and each of the alternatives has its own unique set of environmental impacts which, on balance, would be a "trade-off" of environmental impacts in selecting any one alternative over another." A number of significant impacts have been ignored and missed by the EIS/R analysis. the Proposed Action (Alternative 2) is not the environmentally superior alternative. 2.5, provides "Alternative 4 would reduce effects to groundwater levels, quality, and land subsidence." Any land subsidence from groundwater substitution is a significant impact. Alternative 2 includes groundwater substitution and land subsidence impacts, so alternative 4 is clearly environmentally superior. 99
- Pg 2-39, 2.5 – The project should have separated crop idling from crop switching in an alternative as they have very different impacts and operational requirements. Crop switch was proposed and screened as a separate conservation measure from crop idling. If crop switching were made a standalone alternative along with other conservation measures such as irrigation canal lining and leak repair, irrigation system water distribution uniformity and water efficiency improvements and irrigation scheduling water use efficiency improvements, there would have been an alternative which yielded real water for transfer, was flexible and immediate to implement. This combination of measures in an alternative would have yielded substantial water supplies with fewer environmental impacts of the other alternatives. 100
- Pg 2-40, Table 2-9, 3.2 – "Cropland idling transfers could result in increased deposition of sediment on water bodies." Some soils carry contaminants with them. This sediment deposition degrades water quality and beneficial uses. Any degradation of beneficial uses is 101

significant for compliance with the Central Valley Regional Water Quality Control Board Basin Plan. 101

- Pg 2-40, Table 2-9, 3.2 – "Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff." The EIS/R consistently lumps the description of effects of these two very different actions together. These are separate, mutually exclusive actions to implement on a piece of ground and they have very different impacts in type and magnitude. The EIS/R must separate the analysis of these two actions and disclose and mitigate their impacts separately. As an example, crop shifting would have very little erosional deposition in tributaries while crop idling may precipitate large and significant soil deposition and contamination to waterways. 102
- Pg 2-40, Table 2-9, 3.2 – "Cropland idling/shifting transfers could change the quantity of organic carbon in waterways." Again, the impacts of these two separate and different project actions have been lumped together to obscure the impacts of each – they are not the same. 103
- Pg 2-40, Table 2-9, 3.3 – "Groundwater substitution transfers could cause a reduction in groundwater levels in the Seller Service Area." and "Groundwater substitution transfers could cause subsidence in the Seller Service Area." Both were determined by the EIS/R to be a significant impact. The mitigation proposed by the EIS/R is to monitor the groundwater levels and subsidence. Monitoring something does not mitigate the impact of a project, only positive action like having a specific decision threshold for ceasing groundwater pumping activities would be a mitigation. There also needs to be a mitigation plan if groundwater levels do not recover or subsidence occurs even after cessation of groundwater pumping. 104
- Pg 2-45, Table 2-9, 3.9 – "Cropland idling water transfers could permanently or substantially decrease the amount of lands categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP." The EIS/R identifies the alternative 4 impact as significant and alternative 2 as LTS. Although alternative 2 includes groundwater substitution, there is no description in the alternatives which prohibits just as much crop idling in alternative 2 as in alternative 4 so both impacts are significant. If alternative 4 results in 177,000 acres of land being fallowed and alternative 2, because it includes groundwater substitution idles only 100,000 acres, the impact of alternative 2 is still significant even though it is less than alternative 4. 105
- Pg 2-45, Table 2-9, 3.9 – "Cropland idling water transfers could convert agricultural lands under the Williamson Act and other land resource programs to an incompatible use." Ther is no support for the LTS impact call when 177,000 acres of crops could be idled and nothing in the project precludes the same land being idled for all 10 years of the program? 10 years of crop idling and using the property for non-agricultural purposes is in direct conflict with the requirements of the Williamson Act. As the Proposed Project and alternatives are defined, the maximum impact to Williamson Act lands is 177,000 acres of crop idling on the same land for 10 years. This is a significant impact that must be mitigated and disclosed. 106
- Pg B-8, B.4.3.1.2 - "Transfer Operations and Priorities TOM uses an assumed priority for transfer mechanisms used to make water available under Project alternatives." This assumption is a fundamental flaw in the analysis of the impacts of the project. The alternatives clearly say that the sellers can transfer up to a limit amount. The project does not define in what priority or sequence those different sources for water for transfer would be implemented under the project. Operational problems with reservoirs or differences in snowpack in different basins could alter the sequence of implementation of the water transfer sources. As an example, if alfalfa prices were to go to levels that were unprofitable, many growers would first offer to switch to another crop and sell that water to the program. Although there is some rationale provided for the assumption used, the project may very well not operate that way at all in reality. The project must not be approved for operations that deviate from the assumptions used in the project analysis of impacts, otherwise the project has been permitted for impacts that were never analyzed mitigated or disclosed. 107
- Pg B-8, B.4.3.1.2, p1 - "TOM simulates the four transfer mechanisms in the following order: 108

- Groundwater substitution – for alternatives that include this mechanism
- Reservoir release
- Conserved water
- Crop idling – for alternatives that include this mechanism"

108

The TOM assumptions do not include crop shifting so the model assumptions were incomplete and incorrect to reflect the actions that were included in the alternatives.

- Pg B-9, Figure B-4 – The project is only using a 33 year period of record for hydrologic conditions. This truncated hydrologic period skews the impact analysis and fails to use the best available science of the readily available and industry standard utilized 83+ year period of record. The EIS/R must be revised using the best available science as NEPA and CEQA requires.

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- Pg B-9, B.4.3.1.2, – "Groundwater substitution transfers from the Sacramento Valley have the potential to create changes in stream-aquifer interaction that affect other parts of the water delivery system." Each tributary reach has unique surface and groundwater interactions. The EIS/R fails to disclose what the modeling assumptions were for the geographic distribution of the estimated groundwater transfers. If the groundwater is drawn from primarily adjacent to a single or limited set of tributaries then the groundwater surface water interactions and impacts would be more severe and focused. It appears the analysis assumed an even distribution of the estimated (with unsound rationale) amount of groundwater substitution across the whole north of Delta seller area. This error in modeling assumption causes the analysis to conclude much lower impacts that would occur within the range of operations the proposed project and alternatives.

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- Pg B-11, B.4.3.1.2 – "Changes in Delta inflow affect the CVP and SWP differently based on system conditions at the time and COA accounting." This is why we said in an earlier comment that the COA being out of date was a problem for this project that had to be addressed by updating the COA.

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- Pg B-15, B.4.3.1.5, – "Annual volumes were assumed to be made available on a monthly pattern based on the ETAW of rice, the assumed crop to be idled." This is a flawed assumption which leads to underestimating the impacts of the proposed project and alternatives. Rice has the highest ETAW at 3.3AF per acre of any of the crops proposed for idling. This assumption is in conflict with the reality of the program which would have a mix of idled crops with different and lower ETAW water consumption rates. This flawed analysis assumption will either lead to the project estimating that less number of acres will be fallowed to accomplish a given target amount of water for transfer or less water being made available for transfer with a given number of acres idled. Either way, the analysis assumption under-estimates the impacts of the project and the analysis must be revised and recirculated once this material analytical error is corrected.

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- Pg B-16, B.4.3.1.5, p4 – "Crop idling transfers offer the least flexibility of all transfer mechanisms. The decision to enter into crop idling transfers is typically made in spring months when there is still considerable uncertainty in the water supply forecast and the ability to convey water through the Delta." This is not true. In most years when water transfers are most desired are in years after the first year of a Dry or Critically Dry water year. In those cases when reservoir storage is down, although the exact amount of water allocation may not be announced until the spring, all of the buyers already know that they want to buy water. Each of the water transfer water sources suffer the same limitations on knowing the delta conditions ahead of time and their ability to convey water through the delta. This misperception on the part of the project in terms of the relative desirability of the water sources in the sequence in which water sources would be implemented in the project is

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flawed. In order to be conservative in identifying the types and magnitude of impacts from the proposed project, the EIS/R should have analyzed the range of actions that it desired to be permitted, not an undefined, unjustified and flawed rationale for generally how the program may or may not be implemented. In order to correct these flawed assumptions and allow a full range of operations as proposed by the project, the analysis needs to do a sensitivity analysis of doing the maximum amount of each water transfer type and in combination with other types. Only then will the potential impacts of the project be disclosed and properly mitigated. 113

- Pg B-16, B.4.3.1.5, – "Crop idling transfers make water available on the fixed schedule illustrated in Figure B-10. Therefore, transfer water made available in May and June, a total of 37 percent of the annual volume, can be lost or not diverted…" Some rice is not planted until the first of June, so the potential transfer loss in those cases is only 22% rather than the 37% as claimed in the EIS/R. 114
- Pg B-17, B.4.3.1.6, – "Analysis of the baseline CalSim II simulation of CVP and SWP operations was performed to identify potential opportunities to store both groundwater substitution and crop idling transfer water made available from April through June in upstream CVP and SWP reservoirs." Again, the analysis did not include the assumption of water transfer volumes from crop switching. 115
- Pg B-17, B.4.3.1.7, – "TOM simulates shifts in timing of Project water movement at SWP facilities by adjusting baseline Oroville releases and Banks pumping from July through September of some years. Logic in TOM adjusts Oroville releases and Banks pumping to create a more regular monthly pattern of available export capacity." The EIS/R stated that only Reclamation facilities and water transfers would be covered under this document and that any SWP operations in conjunction with this project would be subject to prior DWR approval and a separate environmental document. This analytical assumption seems to belie that EIS/R statement as the modeling assumptions clearly are counting on SWP operations to facilitate the water transfers covered under this environmental document. The EIS/R modeling assumptions must remove the assumption that SWP operations will be altered to facilitate these CVP water transfer operations. 116
- Pg B-17, B.4.3.1.8.1, – "East Bay MUD diverts both CVP Project water and transfer water at the Freeport Regional Water Project on the Sacramento River near Freeport." The water transferred by East Bay MUD through the CVP facilities is covered by the OCAP BOs water transfer provisions. The Freeport Regional Water Project facility is not part of the SWP or CVP that is covered under the OCAP BOs and therefore the ESA species impacts of transferring water through these facilities is not covered by an incidental take permit and must seek ESA consultation prior to implementation. 117
- Pg B-18, B.4.3.1.8.2, p1 – "Contra Costa WD diverts water under existing water rights, a CVP water service contract, and transfer water from multiple points of diversion in the Delta." The CCWD facilities are not part of the SWP or CVP that is covered under the OCAP BOs and therefore the ESA species impacts of transferring water through these facilities is not covered by an incidental take permit and must seek ESA consultation prior to implementation. 118
- Pg B-18, B.4.3.1.8.2 (this was a document numbering error, it should have been B.4.3.1.8.3), p1 – "Transfer water purchased by SLDMWA is conveyed through available export capacity at Jones and Banks pumping plants. Transfers from the Sacramento River assume a 20 percent carriage water adjustment to maintain Delta salinity. Transfers from Merced ID that enter the Delta from the San Joaquin River assume a ten percent carriage water adjustment." The EIS/R must disclose the basis and justification for these carriage water assumptions. 119

Under some conditions, the carriage water requirements to maintain delta water quality would have to be much higher, e.g. 30 or 40%. 119

- Pg B-18, B.4.3.1.8.2 (this was a document numbering error, it should have been B.4.3.1.8.3), p2 – "Additionally, water made available by Merced ID can be conveyed directly to SLDMWA member agencies through facilities that connect to Merced ID's internal conveyance system and facilities that join the lower San Joaquin River and the DMC without going through CVP/SWP export facilities." These facilities and operations are not covered under the OCAP BO operations or water transfer assumptions so these operations must seek separate ESA consultation with the fisheries agencies prior to implementation. 120
- Pg B-18, B.4.4 – The EIS/R must disclose its assumptions as to what projects they included as reasonably foreseeable. If they are elsewhere in the document, the mention of these assumptions should have included a reference as to what section that content could be found. In general this EIS/R is very poor at making the document reader friendly. 121
- Pg B-20, B.6.1, – "…they would need to complete individual NEPA and Endangered Species Act compliance for each transfer…" Buyers and sellers will need to complete ESA consultations anyway as the OCAP BOs only cover SWP and CVP water transfer activity and specifically exclude coverage of buyer and seller area impacts. 122
- Pg B-20, B.6.2, – "Alternative 2 includes transfers under all potential transfer measures: groundwater substitution, reservoir release, conserved water, and crop idling." Again, the assumptions leave out crop switching which has very different modeling implications to water use, savings and conveyance than crop idling. The current EIS/R modeling assumptions do not reflect all of the actions included in alternative 2 and the analysis must either be redone with the corrected assumptions or the description of and actions included in alternative 2 must drop crop switching as a component. 123
- Pg B-23, Figure B-14 and Pg B-28, B-24 - The EIS/R stated that only Reclamation facilities and water transfers would be covered under this document and that any SWP operations in conjunction with this project would be subject to prior DWR approval and a separate environmental document. This analytical assumption seems to belie that EIS/R statement as the modeling assumptions clearly are counting on SWP operations to facilitate the water transfers covered under this environmental document. The EIS/R modeling assumptions must remove the assumption that SWP operations will be altered to facilitate these CVP water transfer operations. 124
- Pg B-29, Figure B-27 – This figure demonstrates the point regarding project impacts on proportional flows at tributary confluences on salmonid homing and straying. The information to conduct the analysis of project impacts on straying is clearly available and yet the EIS/R did not conduct that analysis, disclose the impacts or mitigate the impacts. 125
- Pg B-66, Appendix B, attachment 1 – The 2005 level of development should not have been used in that the rest of the modeling updates were current up to January 2014. This out of date level of development assumption biased the analysis results as the 2014 level of demand is higher than it was in 2005. 126
- Pg B-66, Appendix B, attachment 1 – The Baseline Assumptions did not include implementation of the existing OCAP BO RPA requirements for restoration of subtidal and intertidal habitat and floodplain habitat. The subtidal and intertidal habitats have tidal exchange impacts to delta water quality and CVP/SWP operations that must be included in the modeling assumptions. These are reasonably foreseeable as they are current legal obligations of the CVP and SWP that are required to be implemented prior to 2015. Since the implementation deadline is so close, the location, design and operational characteristics must be thoroughly defined by now or DWR and Reclamation will not be compliant with the 127

BO requirements. The floodplain habitat restoration results in altered water quality and water consumption from evapotranspiration and changes in the tidal prism that must be accounted for in the modeling and impact analysis. The modeling assumptions must be revised and the analysis rerun to reflect these current legal obligations of the CVP and SWP under the OCAP BOs. 127

- Table C-17, p1 – "Although D-1641 specifies 14-day durations for mean daily chloride concentration, since most DSM2 boundary conditions are specified as monthly values, it is not sensible to account for this constraint herein." DSM2 reports data on 15 minute time increments, so the data from DSM2 is readily available to do the analysis to determine the frequency, duration and magnitude of exceedances of this water quality parameter as defined and required by D-1641. The EIS/R must use the best available science and this readily available DSM2 data to complete this study. The failure to use the best available is unsupportable.. The quantity of data available from DSM2 is why this data is always presented as exceedance graphs to show the frequency, duration and magnitude of water quality exceedances. Monthly averages of this data mean nothing and are obviously designed by the project to obscure the impacts of the project. The EIS/R must be revised to include exceedance plots of the full time series of data that is available from DSM2. This comment applies to all water quality evaluations done from DSM2 data. 128
- C.9 – p2 – "1. the daily minimum stage was calculated for all the Base and three Alternative from the 15-minute model output ; 2. daily change from Base stage was calculated (Daily Alternative Min Stage – Daily Base Min Stage) 3. monthly average stage was calculated from the results at step 2." So the analysis took two daily time step data sources and decided to water it down to a nice monthly average that is designed to hide all but extraordinary catastrophic impacts. Dewatering an ag intake does not have impacts on a monthly basis, it is an impact that occurs on a day by day basis. With the current analysis, the intakes could be dewatered by 6" for 20 of the 30 days of a month and then covered by 1' of water for the last 10 days and still show no impact. This analysis and any other used in the EIS/R that used daily source data and analyzed it at a monthly average for the impact assessment must be revised to reflect a best available science use of the full potential of the data sets for a daily impact analysis. 129
- C-48, p4 – The Proposed Project "…alternative sees the largest increases in EC when exports are the greatest, with Critical water years in July seeing the largest percent difference of 4.2% at the SWP location and 3.3 % at the CVP location." This is a very significant impact as the SWP and CVP are constantly in violation of these water quality parameters in Critical water years already. For the proposed project to make that violation worse by over 4% is a very significant impact that must be mitigated. 130
- D.3.6, p1 – "The distribution of aquifer properties across the Sacramento Valley is poorly understood. In certain areas with significant levels of groundwater production, the collection of aquifer test data and the measurement of historical groundwater-level trends in response to known groundwater production rates have provided valuable information on aquifer properties. However, in the majority of the valley, these data are not available." Yes, this may be true, but it also invalidates the use of modeling for predicting groundwater and surface water interactions. This model is not generally accepted for these types of analyses and its use for this kind of document and analysis in this geographic area is unprecedented. Peer review and supporting acceptable calibration is not apparent. 131
- Appendix D – The documentation fails to disclose the assumptions used in the model of how the groundwater substitution was geographically distributed or that the model used actual well locations that would be used under the Proposed Project and alternatives. Based on the 132

very generalized description of the data, we conclude that the model used an assumption of an average groundwater source usage distributed evenly across the seller areas. This assumption of course would have no relationship to reality or the impacts that would occur with implementing the project within the boundaries of how it was described. The generalized assumption of distributed groundwater well locations and demand would vastly underestimate the localized groundwater and surface water interaction impacts from the project that would be implemented such that those impacts were not uniformly distributed. The groundwater analysis in the EIS/R must be redone using an accepted model, with specific well locations and water demands. 132

- Figure D-4 – There are almost no well data points to characterize the hydraulic conductivity of the aquifer in the Feather River basin in which many seller areas were identified. These areas have almost no data to support the model analysis which render the results unreliable. 133

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Baseline Definitions

- The EIS/R No Action/Project assumptions were not consistent with the BDCP EIR/S and Reclamation Remand EIS. Since Reclamation is a lead agency for all of these projects and they are all on the CVP operations and they all occur over the same time period, it is an inexcusable inconsistency and bias in the outcomes of the analysis to have different baseline assumptions. Since the other documents have undergone public review already, this project's No Action/No Project assumptions must be revised to be consistent with these other documents, reanalyzed and revised, and then recirculated for public comment. 134

Impact Analysis Geographic Scope

- The geographic area included in the EIS/R impact assessment fails to include areas and tributaries downstream of drainage from water transfer recipient service areas. Transferred water will be applied to buyer areas and some of that water will result in runoff that will be carried downstream of those service areas. Those water transfer runoffs will alter flows and water quality in those downstream tributaries. Some of those downstream tributaries that should have been included in the EIS/R analysis, but were not, include (but are not limited to): San Joaquin River, Coyote Creek, Liaghs Creek, Pescadero Creek, Uva Creek, Stevens Creek, Beryessa Creek, Alameda Creek, Tassajara Creek, Walnut Creek, Marsh Creek, Kellog Creek, Lone Tree Creek, Hospital Creek, Corral Hallow Creek, Ingram Creek, Salido Creek, Crow Creek, Orestimba Creek, Garzas Creek, Quinto Creek, Romero Creek, Los Banos Creek and others. The San Joaquin River and several of these creeks are documented habitat for ESA species salmonids and therefore the lack of analysis of these ESA species impacts in the EIS/R is a particularly egregious omission. 135
- The geographic area included in the EIS/R impact assessment fails to include areas from the reservoirs involved in the project to the upstream first impassable fish barrier. Fluctuations of the reservoirs from project releases affect the ability for reservoir fish to forage and 136

spawn in the upstream tributaries. The project operations reduce reservoir cold and warmwater fisheries access and use of these upstream habitats from exposing sediment wedges in the tributaries at the interface with the reservoir and increasing the frequency and duration of impassable conditions for fish. Cold and warmwater fisheries are designated beneficial uses of water in the CV Basin Plan and therefore must be evaluated in a revised EIS/R. 136

- Both seller and buyer service areas are in unconfined groundwater basins. The impact area of groundwater resources, surface water interactions with groundwater, and fisheries and wildlife resources in the adjacent groundwater basins connected to these seller and buyer service areas must also be fully analyzed in the EIS/R. As the EIS/R stands, these extended impact areas in the interconnected groundwater basins are not identified, characterized, evaluated, quantified, mitigated or disclosed. This serious omission in the extent of the geographic area of impact from the project must be corrected in the revised EIS/R. 137

Impact Analysis Significance Criteria

- The EIR must use a full range of significance criteria which are consistent with Reclamation's use in other similar environmental documents. These similar environmental documents from which Reclamation should use the significance criteria include: Remand EIS, Shasta Enlargement, Sacramento Valley Water Management Plan (AKA Phase 8), CALFED, and BDCP. For this project to use anything less than the synthesis of the significance criteria from these recent and similar projects with Reclamation as the lead agency would be an inconsistent application of policy, procedure and science. The EIS/R impact analysis must be revised to address them missing impact criteria and thresholds. The revised EIS/R must be recirculated after addition of this material new information. 138

Permits Needed by the Project

- ESA Incidental Take Permit – Impacts from the selling and receiving water service areas are not covered by the OCAP BOs. They will require separate section 7 consultation (BA and BO). NMFS OCAP BO, pg729, p3 - "...this consultation does not address ESA section 7(a)(2) compliance for individual water supply contracts. Reclamation and DWR should consult with NMFS separately on their issuance of individual water supply contracts, including analysis of the effects of reduced water quality from agricultural and municipal return flows, contaminants, pesticides, altered aquatic ecosystems leading to the proliferation of non-native introduced species (*i.e.*, warm-water species), or the facilities or activities of parties to agreements with the U.S. that recognize a previous vested water right." The water transfers ESA species impacts in the seller and buyer service areas are not covered under the FWS or NMFS OCAP BOs and therefore a separate section 7 or 10 consultation for the water transfers for the seller and buyer service areas must be conducted and approved prior to the water transfers. 139
- Reclamation and DWR have not implemented the OCAP BO RPAs, so the CVP and SWP are not compliant with the terms of their current Incidental Take Permits (ITP). NMFS 140

specifically provides in the OCAP BO that if the agencies are not compliant with the terms of the OCAP BO RPAs that they will rescind their ITP. Since DWR and Reclamation are not compliant with the OCAP BO RPAs (see related comments), NMFS must rescind Reclamation and DWRs ITP and reinitiate ESA re-consultation. FWS and NMFS cannot approve the permits for the proposed water transfers until OCAP BO compliance is achieved. 140

- The project will require a 401 Clean Water Act certification to address all types of discharges that occur under the proposed project and alternatives. These discharges by the project which must be permitted include (but are not limited to): releases from each reservoir to each tributary involved in the transfers, leaks from conveyance used in the water transfers (e.g. California Aqueduct), discharge at the water transfer recipient service area, discharges of water used in the buyer service areas, discharge groundwater pumped for groundwater substitution, discharge of groundwater substituted water after use on the fields. These last categories of discharges from groundwater wells and drainage discharge of groundwater substituted fields represent new locations of discharges for the project that would not be covered under any 401 permits the SWP or CVP currently have (if they have any). 141
- The project will also need Air Quality permits for project impacts from (but not limited to): electrical load demand from groundwater pumping (this increased electrical load is not offset by not surface water pumping), changes in the timing and location of electrical generation from backing up water in reservoirs for transfer (the foregone generation must be replaced and the timing of the impacts are different), idling crops causes wind erosion and airborne particulate loads, operating equipment on fields receiving water from transfers in the buyer service areas are emissions that would not happen under the No Action/Project. All of these impacts are different from the conditions of the CVP and SWP without the project so these impacts are not covered by any current CVP or SWP air quality permits (if they have any). 142

Water Supply

- The EIS/R must be revised to evaluate the year to year potential geographic distribution of the sellers and to evaluate the worst case scenario of the distribution (or lack thereof) of the sellers. Since the EIS/R did not evaluate a worst case scenario for how the sales would be distributed, the project must not be approved or permitted for operations that would result in more geographically concentrated impacts than what was represented in the analytical assumptions in the EIS/R. The EIS/R assumed an average water transfer contribution from all seller areas for the available transfer capacity for each water year type. With these assumptions, the impacts are equally spread and are reduced in severity in any geographic location the most of any of the potential operational scenarios. The EIS/R should have conducted and disclosed some sensitivity analysis in which the extremes of operational scenarios were tested and evaluated for their environmental impacts. Several of these scenarios that represented the worst potential impacts from the project should have been fully evaluated. Only under that approach could the project be awarded permits that allow the full amount of water transfer proposed under a set of mitigations that would have addressed the impacts. The analysis took the most optimistic (and completely unrealistic) assumption of even geographic distribution water transfer operations and impacts, each of the identified seller areas should be only allowed to transfer the averaged amount of water that was actually analyzed in the EIS/R. Here is a description and analysis of 143

the critically flawed assumptions the impact analysis used in its impact analysis. The maximum proposed water transfer by the identified water sellers is 511,094AF. In all water years except Critical, Consecutive Dry, and Dry after Critical; the FWS OCAP BO says that the maximum transfer that can be conducted under the permitted conditions is 360,000AF. The EIS/R makes the erroneous assumption that the 360,000AF would be evenly distributed across the seller's area. In reality, the impacts would never be so perfectly distributed and reduced in their severity. The EIS/R should have tested a number of scenarios in which the transfer water was concentrated with various combinations of sellers. The EIS/R should have evaluated the impacts of all of the transfers coming from a single drainage basin under these limited subscription conditions, e.g. all from the Feather River or American River basin and none from the Sacramento River/Shasta drainage basin or visa versa. The scenario of all water transfers from one basin and none from another basin is very plausible as snowpack could favor one basin over another and make more or less water available for transfer or operational considerations of reservoirs in one basin vs. the other could make water storage much more feasible. The EIS/R should have evaluated at least two scenarios of different distribution of willing sellers. These are: all available sellers from the Sacramento and Feather River Service area with none from any of the other seller service areas and another scenario of all transfers being from Merced River, Delta, American River, Yuba River, and Feather River with none from the Sacramento River. 143

- The EIS/R does not analyze the impacts of the proposed project and alternatives on other existing long-term (e.g. YCWA Lower Yuba River Accord) or year-to-year water transfer opportunities. The proposed project and alternatives preclude or significantly reduce the amount of potentially available excess CVP and SWP capacity for other long- and short-term water transfers which compete to use these same CVP and SWP facilities. Some of the Lower Yuba River Accord water transfers are for environmental objectives. Some or all of these transfers may not occur under the proposed project or alternatives. This is unknown because the EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose the impacts to these other water transfers. This omission is a material deficiency of this EIS/R document which must be revised and recirculated. 144
- The EIS/R proposed "paper water accounting" as the basis for some of its analysis. As an example, the project description says that "These agencies... would use the water diverted from the San Joaquin River in exchange for their CVP water from the Delta-Mendota Canal." (EIS/R page 2-25, p3). The impacts of the other 4 proposed conveyance routes and operations are very different from the foregone diversions of these other water districts in favor of the proposed San Joaquin River diversion impacts. The different impacts of these different proposed modes of accomplishing this Merced ID water transfer were not analyzed, mitigated or disclosed in the EIS/R. These material omissions and deficiencies in the EIS/R must be corrected in the revised and recirculated EIS/R. 145
- If the transferred water is allegedly conserved and does not result from and is limited to an actual reduction in consumptive use (which will vary with the climate) it could reduce runoff to surface flow and percolation to recharge the groundwater. 146
- Is water transferred from outside of basin? E.g. Feather River basin surface water rights transferred, but delivered from Shasta? 147
- Operational assumptions for reservoir storage for water transfer failed to take into account operational changes required by the OCAP BO RPAs for fish passage at Shasta, Folsom and New Melones. 148

- The EIS/R analysis should be specific on the operations and impacts for each water transfer in order to justify project-level permits required for implementation of the project. The level of specificity of the current EIS/R is only at a programmatic level of detail so the project should be subject to additional project level impact analysis prior to implementation each year. 149
- The EIS/R analysis should be specific on the operations and impacts for each water transfer and cumulatively for year to year for the project and in combination with all current and other reasonably foreseeable projects, e.g. Lower Yuba River Accord water transfers. 150
- Each river, stream and location has different geology and hydrology. The EIS/R analysis did not incorporate analysis of all potential operational scenarios that could occur under the range of operations and conditions included in the project description. The project should only be permitted for the operations and conditions analyzed, mitigated and disclosed in the EIS/R, not on the range proposed that were not addressed in the analysis. 151
- Water transfers from this project result in discouragement of investment in water conservation or adaptation of water users to more sustainable water uses in the Buyer Service areas. If you can buy water cheaper than the cost of implementing water conservation to achieve an equal amount of water supply then you will always choose the cheaper option of buying the water. This is also why desalination projects or other new water or major conservation efforts (e.g. fixing all the water conveyance leaks) will never occur until all the cheaper water that exists is purchased and transferred. This project and others like it, result in a California that will continue to take water from each other until there is no more water to take before it makes any meaningful investment in water conservation, alternative water supplies, and changes in lifestyle related to water use (hundreds of golf courses in the desert) and water allocation. The BDCP does not count as a project to create new water as this project claims that it "won't divert any more water than current operations" and the real purpose of that project is to just facilitate the transfer of water from a poorer Northern California to a richer Southern California. 152
- CVP and SWP operations are often constrained by net delta outflow requirements. The Net Delta Outflow Index (NDOI) that the SWP and CVP are currently using is grossly over-reporting net delta outflow. "While the NDOI is, at best, an estimate of Delta outflow, there are stations that accurately measure actual Delta outflow. The United States Geological Survey (USGS) has established a series of stations in the Delta to measure flow and water quality parameters." "Four of the USGS gauging stations... accurately measure Net Delta Outflow (NDO)." ("*The Case of the Missing Delta Outflow*", California Sportfishing Protection Alliance) DWR's own analysis of NDOI ("Dayflow") estimates vs. the new more accurate USGS gage measurements indicates that the "Dayflow under estimates flow during wet periods and over estimates flow during dry periods." (http://www.water.ca.gov/dayflow/docs/2013_Comments.pdf) This DWR report means that during the majority of the CVP and SWP diversion season (spring through fall), the operations systematically over estimate NDOI and systematically divert more water from the south delta than regulatory operational constraints would allow if NDO was correctly accounted for. As a result of this over-estimation of net delta outflows and the resulting lack of operational constraint, Reclamation and DWR's evaluation of available excess capacity for water transfers for this project will result in more capacity being identified as available as actually would exist if 153

the delta net outflows were being accurately measured. The EIS/R must include an evaluation of the accuracy of the Delta Net Outflow Index accuracy and an adjustment for the water transfer delivery quantities that would result from correctly adhering to the operational constraints of the CVP and SWP from Delta Net Outflow Index requirements. This regular exceedance of regulatory constraints on the CVP and SWP operations must be evaluated in this EIS/R and water transfer amounts included in the project must be limited to amounts that would not result in the CVP and SWP violation of net delta outflow requirements. This over estimation of net delta outflow also results in insufficient carriage water being pulled out of the water transfers to maintain delta water quality and CVP/SWP operational compliance with the OCAP Biological Opinions and the Reclamation Remand court order. 153

- Coordinated CVP/SWP operations, funding and water deliveries are based on the COA. The COA is grossly out of date and has not been updated since 1986. COA determines the proportional distribution of available water supplies and operations. If the COA were updated, the amount and locations of excess capacity in the SWP and CVP system would change. This project must include an update to the COA as part of the scope or the actual amount of conveyance capacity available for transfers cannot be determined. 154

Water Rights

- Water rights were not addressed at all in the ES impact summary table. 155
- In 2014, some federal water contractor's had stored some water from the previous year for later release at Reclamation's Friant facility. Due to the drought conditions and lack of available water supply in 2014, Reclamation decided to deliver that water contractor stored water to the Exchange Contractors to fulfill their other standing obligations to the Exchange Contractors rather than to the water agencies that stored their water in Friant. The EIS/R does not address this potential scenario in released water from reservoirs or the "backed up" water operations of the Proposed Project or alternatives. As a very similar scenario example for the Proposed Project or alternatives, water stored in Friant for Merced Irrigation District that was held back specifically for a water transfer could be hijacked by Reclamation to service the Exchange Contractors instead. This scenario could easily occur on the other dams with backed up water released to fulfill minimum flow or senior water rights holders on the downstream tributaries rather than for the project water transfers. Again, there is a difference in the timing and location of impacts for when the water is released and where it is used for the project or for other obligations. Without the project, the backed up water would not have existed so there would not be the impacts of releasing that water to fulfill these other obligations. The difference in release timing and location of use create impacts that the EIS/R did not identify, characterize, evaluate, quantify, mitigate or disclose. 156
- When downstream senior water right holder settlement agreement (settlement contractors, e.g. Shasta - Tehama and GCID; Oroville – WCWD, BWGWD, Richvale, etc.) water supply is released from storage for transfer to the water buyers under the Proposed Project and alternatives, it may include natural flow water or stored water which is in violation of permit 157

terms and conditions from their Settlement Agreements. The water rights that the settlement contractors have under the settlement agreement are not the same as their original pre-1914or riparian water right so they should not have the senior water right status for the water transfer. Since they do not have this senior water right status, these actions must not be allowed to affect parties with more senior water rights. All water transfers must be subject to water rights priorities. The EIS/R is deficient as it did not correctly differentiate the water rights level of the settlement contractors and allowed these water transfers to impact the water rights (water quality) of more senior water rights holders. 157

- The analysis should cover the requirement or recognition that no water can be exported from the Delta by the projects unless the Delta is first provided an adequate supply (WC 12200 etseq.) and to the extent the transfer is dependent on the water rights of the SWP or CVP the water can be recaptured to serve needs in the watersheds of origin (WC 11460 etseq.). 158
- Reclamation and DWR water rights are subordinate to senior rights and conditioned on compliance with statutory requirements as well as permit conditions. The CVP and SWPs post-1914 water rights are junior to most in-Delta water rights and, as a result, the project has no right to divert the natural flows within the Delta if there is not enough natural flows through the Delta to satisfy in-Delta pre-1914 appropriative rights. The CVP and SWP, as junior water rights holders, are also not allowed to impair the water quality of the senior water rights holders from the operational impacts of their diversions. Reclamation and DWR, through their CVP and SWP operations, consistently violate these water quality standards and impact the beneficial uses of water for agricultural use of the senior water rights holders in the delta. 159
- The SWRCB cannot certify or issue permits on a project which knowingly and consistently violates state surface water rights and the addition of these water transfers under the Proposed Project and alternatives would only exacerbate the frequency, magnitude and duration of these violations. Area of Origin Statutes were enacted during the years when California's two largest water projects, the Central Valley Project and State Water Project, were being developed to protect local Northern California supplies from being depleted as a result of the projects. County of origin statutes provide for the reservation of water supplies for counties in which the water originates when, in the judgment of the State Water Resources Control Board, an application for the assignment or release from priority of State water right filings will deprive the county of water necessary for its present and future development. Watershed protection statutes are provisions which require that the construction and operation of elements of the Federal Central Valley Project and the State Water Project not deprive the watershed, or area where water originates, or immediately adjacent areas which can be conveniently supplied with water, of the prior right to water reasonably required to supply the present or future beneficial needs of the watershed area or any of its inhabitants or property owners. The addition of these water transfers under the Proposed Project and alternatives would only exacerbate the area of origin conflicts. 160

- The Delta Protection Act, enacted in 1959 (not to be confused with the Delta Protection Act of 1992, which relates to land use), declares that the maintenance of an adequate water supply in the Delta--to maintain and expand agriculture, industry, urban, and recreational development in the Delta area and provide a common source of fresh water for export to areas of water deficiency--is necessary for the peace, health, safety, and welfare of the people of the State, subject to the County of Origin and Watershed Protection laws. The act requires the State Water Project and the federal CVP to provide an adequate water supply for water users in the Delta through salinity control or through substitute supplies in lieu of salinity control. The addition of these water transfers under the Proposed Project and alternatives would only exacerbate the water supply conflicts addressed under the Act. 161
- In 1984, additional area of origin protections were enacted covering the Sacramento, Mokelumne, Calaveras, and San Joaquin rivers; the combined Truckee, Carson, and Walker rivers; and Mono Lake. The protections prohibit the export of ground water from the combined Sacramento River and Sacramento-San Joaquin Delta basins, unless the export is in compliance with local ground water plans. Also, Water Code Section 1245 holds municipalities liable for economic damages resulting from their diversion of water from a watershed." (http://www.waterplan.water.ca.gov/previous/b160-93/b160-93v1/ifrmwk.cfm) The addition of these water transfers under the Proposed Project and alternatives would only exacerbate the water supply and groundwater conflicts addressed under the water code. 162
- Reclamation is not compliant with their junior water rights requirements as the CVP operations frequently exceed Delta water quality requirements in violation of the Delta Protection Act of 1959. Transfers of water supplies through the CVP or SWP from conjunctive use of groundwater substitution for surface water supplies are not consistent with local groundwater plans. Water contractors supplied through the SWP are liable for any direct or indirect damages from diverting water from a watershed. These damages may include injury, damage, destruction or decrease in value of any such property, business, trade, profession or occupation resulting from or caused by the taking of any such lands or waters, or by the taking, diverting or transporting of water from such watershed. (Water Code 1245) The addition of these water transfers under the Proposed Project and alternatives would only exacerbate the water quality impacts addressed under the Act. 163
- The Proposed Project and alternatives must consider the water supply, water rights, water quality impairments and other water beneficial use impacts associated with the water transfers of south delta water. The conditions of waters in the delta including direction of flows, water quality and impacts to agriculture, drinking water supplies and fisheries resources are a direct consequence of the CVP and SWP south delta facilities water diversions. 164

Water Quality

- The sellers identified are mostly water districts. When water districts transfer water they typically rotate the fallowed lands from year to year so not the same land or owners are participating from year to year. The EIS/R just assumes there will be some even distribution of the fallowed fields across a water district. They do put some constraints on adjacency to wildlife refuges, but other than that, the fallowing could occur in any location or in any combination of locations or concentrations. By not having specific locations or a very specific rule set about how fallowed fields can be distributed within a water district, the 165

analysis of the impacts from field fallowing is at a programmatic level of detail, not a project site specific level of detail. The rules for how fallowed fields are distributed in a water district are not specific enough to allow detailed analysis of impacts such as reduced ag drainage return flows and resulting drainage flows and water quality impacts. The EIS/R must be revised such that project specific levels of detail on the impacts of field fallowing are conducted. Although the agencies can approve a programmatic EIS/R, this project, because of its lack of project-level analysis of impacts, must have a subsequent environmental analysis prior to implementation. 165

- Each groundwater basin and sub-basin area has different water quality, e.g. south of Sutter Buttes has higher saline groundwater than farther to the north. Different depth groundwater aquifers can have different water quality. The differences in groundwater quality that would be substituted for surface water supplies and the specific differences in the water quality of discharge water from the conjunctive use properties in the project are not characterized, evaluated, quantified, mitigated or disclosed in the EIS/R. This material omission of groundwater substitution water quality impacts on surface and groundwater quality must be addressed in a revised and recirculated EIS/R. 166
- Ag drainage water quality is lower in the areas of groundwater substitution than if their surface water supplies were utilized. As an example of the impact of the project, groundwater is higher in dissolved minerals (TDS) than surface water. High dissolved minerals in water can have significant adverse impacts on development of juvenile salmonids that occur in the tributary reaches where the proposed project surface water quality degradations would occur from groundwater substitutions. The Sacramento Valley Regional Water Plan (AKA Phase 8) identified and addressed those impacts in their project's conjunctive use analysis, but this project EIS/R did not even though Reclamation was a lead agency on both projects and both involve conjunctive use. 167
- The EIS/R also failed to evaluate the impact of fallowed fields on reduced ag return flow volumes and increased contaminant loads which could exceed the discharge permits tolerances, e.g. water temperature difference, TDS, DO, nutrient loading, DOC, ECw, contaminant metals (Hg, Se, Pb, Fe) other (diaznon, DDT, chlorpyrifos, etc.) of the water and reclamation districts. This is a material omission and deficiency of the EIS/R which must be corrected in the revised EIS/R prior to recirculation. 168
- The Proposed Project and alternatives will result in water quality impacts to delta and other beneficial uses which were not fully addressed in the EIS/R. 169
- The Proposed Project and alternatives idling of fields will result wind erosion of soils which will be deposited into tributaries which will degrade water quality of those tributaries with the associated contaminant loads. The contaminant loads from fallowed field wind and water erosion into surface water tributaries was not fully addressed in the EIS/R because the location and number of fields was not defined by the Proposed Project and alternatives. This significant impact must be more specifically analyzed for the field locations, number and distribution and the significant impacts to surface water quality mitigated and disclosed. 170

- Water quality impacts vary greatly depending on the tributary and groundwater substituted, e.g. Berryessa and Putah Creek flow transfers would mobilize a disproportionate amount of Hg. Transfers from Friant to Westlands would mobilize a disproportionate amount of Se. Both of these project impacts are not fully addressed in the EIS/R. This significant impact must be more specifically analyzed for the tributary locations, timing of substitution and transfer, and volume of those transfers and the significant impacts to surface water quality for the project mitigated and disclosed. 171

Groundwater

- If the transferred water is based on an actual reduction in consumptive use (which will vary with the climate)' it will reduce runoff to surface flow and percolation to recharge the groundwater. As an example, ag irrigation quantities include a component for leaching salts below the plant root system. The leaching component of irrigation water contributes to groundwater recharge. In the case of proposed project idling of fields or crop switching to lower water use crops, that irrigation leaching component contribution to groundwater recharge is significantly reduced or eliminated all together. The EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose this significant impact from the Proposed Project and alternatives. This material omission in the analysis of the EIS/R must be rectified and submitted for public review in a recirculated document. 172
- Groundwater drawdown affects of the proposed project and alternatives on adjacent groundwater wells and changes in direction or magnitude of groundwater hydraulic gradient on contribution to surface water flows was not addressed in the EIS/R. The EIS/R Regional Economics section identified "Groundwater substitution transfers could increase groundwater pumping costs for water users in areas where groundwater levels decline as a result of the transfer." as an adverse project impact. Obviously the groundwater section missed this impact, which is a significant impact and must be mitigated. 173
- Subsidence impacts from groundwater drawdown in the seller service area as a result of the project were not addressed in the EIS/R. The EIS/R only addressed the reduction of groundwater subsidence in the buyer's service area as a benefit. Since groundwater substitution in the sellers area is a significant component to the source of water for transfer, the one sided and biased EIS/R analysis where the beneficial impact is disclosed, but the significant adverse impact is ignored and goes unmitigated and disclosed, There is an egregious violation of the requirements and intent of NEPA and CEQA. 174
- The amount of groundwater substitution/transfer cannot be greater than the maximum sustainable yield or groundwater aquifer collapse occurs. The Proposed Project does not provide operational limits and the EIS/R analysis does not determine how much water can be sustainably withdrawn from groundwater aquifers without risk of collapsing them. The Proposed Project does not define how much groundwater substitution would occur in each seller area from year to year. With both of these critical information components missing in order to ensure protection of the groundwater aquifers, the EIS/R document is deficient and must be revised to correct these omissions. In order to avoid and mitigate the significant impact of the project on groundwater subsidence, the project must include an alternative 175

for a sustainable rate of groundwater withdrawal and/or propose the sustainable rate of groundwater withdrawal as a mitigation of the impacts of the current Proposed Project and alternatives. This "sustainable groundwater alternative" extraction and transfer amount can be calculated for each seller service area groundwater basin using the following generalized methodology. First, determine the current size (TAF) and annual groundwater recharge for each groundwater basin for the 82 year period of hydrologic record. Second, determine the safe and sustainable annual quantity of groundwater yield (including maximum rate of groundwater withdrawal without collapsing water bearing strata) in each basin. Now add the groundwater basin (with size, recharge rates and maximum sustainable rates of withdrawals) as a "reservoir" for each groundwater basin and seller service area to CALSIM (or in a post processing module for analyzing CALSIM results). Next, using the 82 year period of record and the CALSIM model, optimize the amount of seller area water deliveries for each groundwater basin area. Determine the amount of groundwater extraction for transfer that does not accrue into an over-draft of the groundwater basin at any time during the 82 year period of record. The maximum groundwater substitution amount that does not result in over-drafting the groundwater in any year in the 82 year hydrologic period of record will be the maximum contract delivery amount for that groundwater basin and seller service area for use in the "sustainable groundwater" EIS/R alternative or as a mitigation for the significant groundwater aquifer collapse impacts of the Proposed Project. The EIS/R also fails to identify impacts to infrastructure (roads and bridge structural integrity and safety, canal capacity and structural integrity and safety), and other resources (such as surface water drainage) that occur from groundwater withdrawal caused ground level subsidence. 175

Geology and Soils

- The EIS/R evaluated the potential loss of top soil from fallowing, but did not address the different soil erosion potentials that occur in different seller areas. The EIS/R analysis must be revised to reflect the site specific soil erosion characteristics at the seller areas; otherwise the analysis is programmatic rather than project specific and would require subsequent environmental analysis prior to implementation of the project. 176
- The EIS/R did not address salt accumulation and resulting reductions on soil productivity from the water transfers on the buyer areas. The EIS/R analysis must be revised to reflect the continued and increased salt accumulation of soils and reduced soil productivity from the proposed water transfers. 177
- Water released from CVP or SWP facilities for water transfers is on top of the water that would have been released in the No Action/No Project. Most of the water transfer releases of the Proposed Project will be on top of higher natural flows so that less carriage water is required and water diversion yields of the transferred water will be highest at the south delta pumps. This extra flow increment of the transferred water on top of the flows that would be there under the No Action/No Project will result in increased erosion of banks in the tributary reaches below the dams. As an example of this impact, see DWRs settlement agreement and 178

compensation to Emerald Farms on the lower Feather River from increased erosion from the SWP operations. These flow related impacts to bank erosion are a real impact of the Proposed Project and alternatives. The EIS/R failed to analyze these identify, characterize, evaluate, quantify, mitigate or disclose these impacts. 178

Air Quality

- The EIS/R identifies a benefit from the reduction of emissions from farm equipment that would not be operated on fallowed water seller fields, but does not address the increase in emissions from farm equipment being operated on buyers fields that would have otherwise been fallowed. This shifting of air quality impacts from farm equipment operations from northern California to the southern central valley is a significant impact as the northern counties generally do not have a problem meeting their air quality attainment requirements and the bay area and southern central valley counties are constantly in violation of their air quality attainment requirements. The EIS/R identification of a beneficial impact while ignoring the more than offsetting corollary significant impact demonstrates the one sided biased nature of the impact assessment. The EIS/R must be revised to disclose and mitigate the air quality impacts of the farm equipment operated in the buyers area under the proposed project which would not occur under the No Action/No Project. 179
- The EIS/R claims that dust from fallowing fields is an overall benefit because there is no tilling and harvest associated dust. This analysis and conclusion is completely biased and is not supportable. Much more soil is eroded from a field that is fallowed and bare of all vegetation all year as compared to a field that is tilled and harvested. This impact is not a benefit, it is a significant impact that must be mitigated. 180
- Increased air pollution from increased groundwater and other pumping (e.g. CVP/SWP lift pumps and groundwater pumps) under the proposed project is a significant impact, not a less than significant impact as the EIS/R determined. This significant impact must be mitigated. 181

Climate Change

- The EIS/R is analysis is fundamentally flawed because the future project condition to 2024 did not include sea level rise, precipitation or other climate change impact assumptions. NEPA requires the end condition of the project period to be analyzed, in this case 2024. The BDCP has incorporated climate change in its analysis of conditions in 2025, so this EIS/Rs omission of climate change for 2024 is a serious inconsistency in how climate change is addressed between these two similar projects. Reclamation is a lead agency on both projects, both projects cover the same water systems and geographic areas and resources; and yet the BDCP addresses climate change in 2025 and this EIS/R does not for 2024. NEPA guidance and specifically USACE and EPA in their analytical requirements for a 401 permit, require consideration of climate change. Department of Interior, USACE and EPA all have specific methods and assumptions which are required to be utilized in an EIS. The project failed to incorporate these methods and assumptions. This EIS/R must be revised to incorporate climate change assumptions in its Proposed Project, Alternatives and No 182

Action/No Project assumptions. A 401 permit for this project must not be issued without analysis that includes climate change that is consistent with Department of Interior, USACE and EPA analytical method requirements and assumptions. 182

- Fallowed fields do not transpire so the cooling effect of the growing crops would not occur in acres fallowed from the implementation of the proposed project or alternatives which include crop idling. Some publications have speculated that the central valley is 10+°F cooler in the summer due to crop irrigation as compared to non-irrigation of the current irrigated acres. The fallowing of crop acres from the project would have similar impacts as those widely recognized for urban heat island effects. The EIS/R is deficient as it did not identify, characterize, evaluate, quantify, mitigate or disclose these impacts and it must be revised to address these omissions. 183
- Greenhouse gas emissions from increased groundwater and other pumping (e.g. CVP/SWP lift pumps and groundwater pumps) is a significant impact, not a less than significant impact as the EIS/R determined. This significant impact must be mitigated. 184

Aquatic Resources

- Increased deliveries of CVP/SWP south of delta service areas of Sacramento Valley basin water supply increases the proportion of "foreign basin" introduction of water and drainage water to the tributaries downstream of the water transfer receiving service areas. The water transfers under the proposed project increases the proportion of foreign basin water into the tributaries downstream of the service areas receiving these transfer waters. The out of basin water has a different signature as a homing cue for anadromous fish, especially salmonids. False attraction of migrating fish from out of basin water is well documented in published literature and is a major problem with central valley salmonid reproductive survival rates and genetic introgression which is a direct threat to the species diversity and viability. The proposed project is particularly problematic for increasing salmonid straying from out of basin water transfers in that the years where the proposed project water transfers are anticipated to be most active are the years where otherwise the CVP/SWP would have the lowest operational impacts on out of basin caused salmonid straying and genetic introgression. As an example, in 2014, CVP and SWP deliveries to the agricultural users that are the proposed project recipients of the water transfers, their 2014 water deliveries from the CVP and SWP were 0%. This means that in 2014 there would have been no straying and genetic introgression from out of basin transfers from these areas for the San Joaquin River and the South San Francisco Bay and their tributaries. With the proposed project, the out of basin transfers would occur on years of low and no CVP and SWP deliveries which will result in an increase in the proportion of out of basin water in the downstream drainage tributaries and in the rate of salmonid straying, associated mortalities and loss of fecundity and genetic introgression impacts on the species genetic integrity and diversity as compared to the No Action/No Project condition. In the case of years with 0% CVP/SWP water deliveries, to go from zero straying impact from the CVP/SWP operations under the No Action/No Project condition to some increased amount of straying impact is 185

an increase of infinity percent as compared to the baseline condition that occurs without the project water transfers. The EIS/R failed to identify, evaluate, quantify, mitigate or disclose this impact. 185

- The EIS/R must be revised to evaluate the year to year potential geographic distribution of the sellers and to evaluate the worst case scenario of the distribution (or lack thereof) of the sellers. Since the EIS/R did not evaluate a worst case scenario for how the sales would be distributed, the project must not be approved or permitted for operations that would result in more geographically concentrated impacts than what was represented in the analytical assumptions in the EIS/R. The EIS/R assumed an average water transfer contribution from all seller areas for the available transfer capacity for each water year type. The EIS/R average geographic distribution of water seller assumption for the impact analysis is actually the best case scenario for the least impacts as the impacts are equally spread and are reduced in severity in any geographic location the most of any of the potential operational scenario. Any other scenario of seller distribution would result more significant impacts than the average seller distribution assumption used in the EIS/R analysis. The EIS/R should have conducted and disclosed some sensitivity analysis in which the extremes of operational scenarios were tested and evaluated for their environmental impacts. Several of these scenarios that represented the worst potential impacts from the project should have then been fully evaluated to disclose the range of impacts that could or would be precipitated by implementing the proposed project. Only under that "bookend" of worst case scenarios analytical approach should the project be awarded permits that allow the full amount of water transfer proposed with a full set of mitigations to cover the worst case scenarios that would address these impacts. The current EIS/R analysis took the most optimistic (and completely unrealistic) assumption of an evenly distributed geographic spread of water transfer operations and impacts. Under the current set of analysis assumption that assumes only average seller water allocation in the transfers, each of the identified seller areas should be only allowed to transfer the averaged amount of water that was actually analyzed in the EIS/R. Any more water than that allowed under the operations would precipitate impacts that were not analyzed, mitigated or disclosed. Here is a description and analysis of the current critically flawed analytical assumptions the EIS/R used in its impact analysis. The maximum proposed water transfer by the identified water sellers is 511,094AF. In all water years except Critical, Consecutive Dry, and Dry after Critical; the FWS OCAP BO says that the maximum transfer that can be conducted under the permitted conditions is 360,000AF (see related comments). The EIS/R makes the erroneous assumption that the 360,000AF would be evenly distributed across the seller's area. In reality, the impacts would never be so perfectly distributed and reduced in their severity. The EIS/R should have, as described earlier in this comment, tested a number of scenarios in which the transfer water was concentrated with various combinations of sellers. The EIS/R should have evaluated the impacts of all of the transfers coming from a single drainage basin under these limited subscription conditions, e.g. all from the Feather River or American River basin and none from the Sacramento River/Shasta drainage basin and visa versa. The scenario of all water transfers from one basin and none from another basin is very plausible as snowpack could favor one basin over another and make more or less water available for transfer or operational considerations of reservoirs in one basin vs. the other could make water storage much more or much less feasible. The EIS/R should have evaluated at least two scenarios of different distribution of willing sellers. These are: all available sellers from the Sacramento and Feather River Service area with none from any of the other seller service areas and 186

another scenario of all transfers being from Merced River, Delta, American River, Yuba River, and Feather River with none from the Sacramento River. To analyze the salmonid straying effects of the project (see related comments), these scenarios should have also included maximum differences in flow contributions from different operational scenarios for each tributary confluence. At the minimum, these should have included max operations on the Sacramento and no operations on the Feather River and Yuba (and visa versa), max operations on the Feather River and none on the Yuba (and visa versa), max operations on the Sacramento, Feather and Yuba rivers and none on the American (and visa versa). The concept proposed by the project of "backed up water" (see related comments) where water is released earlier in one tributary (e.g. Feather River), water is stored in another tributary basin (e.g. Shasta) and then released later in the other tributary (e.g. Sacramento River) has many more complex flow and water temperature impacts than just the raw number of acre feet in the transfer would indicate by just considering the "upper limits" of transfers as presented in the EIS/R Table 2-5. In the case of "backed up water", the flow impacts on proportional flows at a tributary confluence are doubled. Under the backed up water operational scenario of the proposed project operations, all of the water identified by willing sellers in the Feather and Yuba River and could be released earlier than they otherwise would have in lieu of releases that would have occurred from Shasta. This results in an increase of Feather River flows and a relative decrease in Sacramento River flows at the confluence of the rivers. This is a 2x change in proportional flows at the tributary confluence (e.g. Feather and Sacramento River confluence) (+90,000AF in the Feather River and -90,000AF in the Sacramento River) as compared to the No Action/No Project during the release period. The proposed project does not define when or how short a time period a backed up water transfer could occur (presumably limited by available excess capacity for transfer), but in the absence of supported assumptions provided by the EIS/R we must assume the worst case period of time and volumes so as to be protective of the endangered fisheries species resources. If the analysis does not specify when, where and how these reservoir backup water transfers would occur, the agencies must assume the worst case scenario and limit the project permitted operations accordingly to assure ESA fish protections. Without these potential flow and temperature change analyses at the confluences of the salmonid migratory tributary confluences, the potential impacts of the range of operations that the project has proposed have not been evaluated, quantified, mitigated or disclosed. The EIS/R is deficient for the lack of this analysis which must be rectified when the document is revised and recirculated. 186

- The Terrestrial species impact analysis determined that "Groundwater substitution could reduce stream flows supporting natural communities in small streams" was a significant impact for alternatives 2 and 3. If groundwater impacts on streams can be significant for terrestrial species, how can it not be significant for aquatic species? The EIS/R must be revised to correct this impact call omission in the aquatic species section. 187

- Vegetation removal from Bouldin Island was required for a water transfer to Semitropic Water District in 2014. The herbicide application resulted in the damage to 10s of thousands of acres of agricultural crops and wildlife habitat. Since Bouldin Island is in the very middle of the delta, the herbicide spray drift that impacted terrestrial habitat would have also have to have contaminated hundreds of acres of aquatic habitat. In this case the aquatic habitat damaged included designated critical habitat for San Joaquin steelhead and Chinook salmon, green sturgeon, delta smelt and other special status species. Previous 188

water transfers have proven that this is a real risk of this type of project and these risks must be evaluated. The EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose these very real potential impacts of the proposed project. The EIS/R must be revised and recirculated to address these material omissions and deficiencies in the document. 188

Wildlife

- The sellers identified are mostly water districts. When water districts transfer water they typically rotate the fallowed lands from year to year so not the same fields or owners are participating from year to year. The EIS/R just assumes there will be some even distribution of the fallowed fields across a water district. They do put some constraints on adjacency to wildlife refuges, but other than that, the fallowing could occur in any location or in any combination of locations or concentrations. By not having specific locations or a very specific rule set about how fallowed fields can be distributed within a water district, the analysis of the impacts from field fallowing is at a programmatic level of detail, not a project site specific level of detail. The rules for how fallowed field are distributed in a water district are not specific enough to allow detailed analysis of impacts. The lack of specificity of the location and distribution of fields also does not allow for impact analysis to wildlife. There are some vague assurances from the project about not disrupting habitat corridors, but they do not say how this would be determined, what threshold of disruption is acceptable or unacceptable. A single fallowed field is disruptive to habitat connectivity by itself, is that too much? How about two adjacent fields fallowed, too much or OK? How about 3 contiguous fields or 30 contiguous fields? The EIS/R assurances to not disrupt habitat are so vague that these questions cannot be answered and therefore these assurances by the project are meaningless. The EIS/R must be revised such that project specific levels of detail on the impacts of field fallowing are conducted. Although the agencies can approve a programmatic EIS/R, this project, because of its lack of project-level analysis of impacts, must have a subsequent environmental analysis prior to implementation. 189
- Farmed fields contribute wildlife habitat values for foraging, refuge, and mating. Fallowed bare ground impacts wildlife by altering habitat values and uses and overall provides lower habitat value than a cultivated field, e.g. no flooded rice when fallowed. Loss of habitat on the international flyway, which the seller areas are in a core area of, impact the United States compliance with the International Migratory Bird Treaty which was not addressed in the EIS/R. 190
- Southern Central Valley land that has been fallowed and is put back into production due to a water transfer will destroy the habitat values that have been created while the field was fallowed. Some of the species that move into fallowed fields that would have their habitat destroyed by putting the field back into production by the water made available by the water transfers include giant garter snake, tiger salamander, Alameda whip snake, San Joaquin kit fox, San Joaquin kangaroo rat, and others. The project failed to quantify and mitigate these impacts. 191

- If a field is fallowed for up to 10 years under the Proposed Project, habitat values will be created. The project fails mitigate for the destruction of these created habitat values that will occur at the end of the project period when these lands are put back into production. 192
- Vegetation removal from Bouldin Island was required for a water transfer to Semitropic Water District in 2014. The application of herbicide for vegetation removal resulted in the damage to 10s of thousands of acres of agricultural crops and wildlife habitat. In this case the habitat damage included critical habitat for giant garter snake, riparian brush rabbit and rat, tiger salamander, greater sandhill crane, San Joaquin steelhead and Chinook salmon, green sturgeon, delta smelt and other special status species. This spray drift damage has been well documented and publicized (http://wineindustryinsight.com/?p=54211, http://www.winebusiness.com/blog/?go=getBlogEntry&dataId=135322, http://www.lodinews.com/news/article_3c58d352-f196-11e3-8efa-0019bb2963f4.html, http://rivernewsherald.org/articles2014/bouldin_8-6-2014.html). Bouldin Island is only 5,900 acres. The proposed project could idle as much as 177,000 acres in a year if it utilized its maximum transfer capacity covered under the EIS/R using mostly the crop idling strategy component of its proposed project water conservation. If the transfers were maximized for the 10 year project period and utilized mostly crop idling as its water conservation strategy then over the 10 year project period, there would be as many as 1,770,000 acres that required herbicide treatment. If only 1% of the herbicide treatments for the proposed project water transfers go as badly as the Bouldin Island water transfer, the impact of these water transfers could damage 100s of thousands of acres of wildlife habitat. Previous water transfers have proven that this is a real risk of this type of project and these risks must be evaluated. The EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose these very real potential impacts of the proposed project. The EIS/R must be revised and recirculated to address these material omissions and deficiencies in the document. 193

Land Use and Agriculture

- Improved irrigation management and scheduling as a water conservation measure should have been included as a component to some of the alternatives. 194
- The timing and method of vegetation removal was not adequately defined in the EIS/R to ensure water conservation. As an example a previous comment alluded to, Bouldin Island vegetation management was very late, so much of what was supposed to be conserved was not. The EIS/R has failed to provide descriptions, process, monitoring and contingency plans to guarantee idled crop land does not continue to transpire and use water that was supposed to be conserved. 195
- Long term transfers conflict with Williamson Act conservation as long term fallowed ground with no vegetation is no longer agriculture. 196
- Transfers include water conserved from "crop shifting". If a grower was to plant alfalfa (very water consumptive use intensive) and then they say they will take that crop out and plant winter wheat instead and sell the water that was "saved" by not continuing to grow the water use intensive crop, it opens the whole project to gaming and false water savings. 197

- "Cropland idling water transfers could permanently or substantially decrease the amount of lands categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP." was determined in the EIS/R to be a Less Than Significant impact for alternative 2. This is an error as irrigation of the land is a core requirement of the definition of "prime farmland". The proposed project and alternatives take irrigation water away from as much as 177,000 acres in any alternative that includes land fallowing. Alternative 2 includes land fallowing, so it is a significant impact. Alternative 2 may have less of this impact than alternative 4, but it is still significant and must be mitigated. 198
    - The EIS/R fails to identify increased weed pressure on properties adjacent to fallowed fields. This results in additional herbicide applications being required, which has environmental impacts and costs for the adjacent land owner. The EIS/R must be revised to identify, characterize, evaluate, quantify, mitigate and disclose this impact. 199
    - Native grasses and herbaceous plants are slow to colonize highly disturbed soils such as idled agricultural fields so the idled fields are primarily initially colonized by exotic and invasive weed species. The EIS/R failed to identify that the proposed project and alternatives operations would increase weed pressure of exotic and invasive plant species. These exotic and invasive plants also alter habitat value for foraging and refuge for wildlife. 200
    - The EIS/R failed to analyze proposed project impacts on the suitability of water temperatures for agricultural irrigation beneficial uses. The proposed project increased reservoir releases and tributary flows which result in reduced water temperatures farther downstream which in turn results in increased coldwater impacts on crops. DWR's Oroville Facilities reached a settlement agreement with the water districts which are affected by water temperatures being too cold for crop production. The settlement agreement has resulted in more than a million dollars per year in compensation to the affected growers. The proposed project operations at Oroville would add to these impacts. Similarly, cold water affects from releases from Shasta reservoir for the project, could precipitate impacts for growers that divert water at TCID and GCID. The EIS/R failed to identify, evaluate, quantify, mitigate or disclose coldwater affect impacts to agricultural irrigation beneficial uses resulting from the Proposed Project or alternatives. 201
    - The water transfers must be restricted to avoid inducement of more permanent demand such as conversion of annual crops to permanent crops in the buyer service areas. The EIS/R failed to addressed the impacts of the water transfers in conversion of crop land to permanent crops and development of permanent demand as a result of the project. 202
    - Fields adjacent and downwind of fallowed fields have yield losses from hot dry and dusty air being blown from the bare fields. This impact was not addressed in the EIS/R. 203
    - Vegetation removal from Bouldin Island was required for a water transfer to Semitropic Water District in 2014. The herbicide application resulted in the damage to 10s of thousands of acres of agricultural crops. In this case the crop damage included large portions of the Lodi wine grape district. This spray drift damage has been well documented and publicized (http://wineindustryinsight.com/?p=54211, http://www.winebusiness.com/blog/?go=getBlogEntry&dataId=135322, 204

http://www.lodinews.com/news/article_3c58d352-f196-11e3-8efa-0019bb2963f4.html, http://rivernewsherald.org/articles2014/bouldin_8-6-2014.html) and is estimated to have caused as much as $1Billion in damages. Bouldin Island is only 5,900 acres. The proposed project could idle as much as 177,000 acres in a year if it utilized its maximum transfer capacity covered under the EIS/R using mostly the crop idling strategy component of its proposed project water conservation. If the transfers were maximized for the 10 year project period and utilized mostly crop idling as its water conservation strategy then over the 10 year project period, there would be as many as 1,770,000 acres that required herbicide treatment. If only 1% of the herbicide treatments for the proposed project water transfers go as badly as the Bouldin Island water transfer, the impact of these water transfers could be $3 Billion in damages. If you look at the amount of herbicide damage claims associated with water transfer vegetation removal to date, you will find the damage rate is well above 1%. Just talk to some Forensic Agronomists in California that deal with these types herbicide drift cases (e.g. Rush Markroft, Whaley and Stienberg, Bahme and Associates) to get a realistic rate of damages which occur. DWR has a particularly bad track record (probably among the worst in the state when compared to the amount of damages vs. the number of herbicide applied acres) when it comes to damages to third parties from herbicide applications. If the project claims that some or most of the water conservation will not come from crop idling that require herbicide spray weed control, then they must define these limits and analyze and disclose them in the EIS/R. Previous water transfers have proven that herbicide spray drift is a real risk of this type of project and these risks must be evaluated. The EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose these very real potential impacts of the proposed project. The EIS/R must be revised and recirculated to address these material omissions and deficiencies in the document.

204

Cultural

- The impact criteria for cultural resources are incorrect. It is not an impact only if the reservoir levels are drawn down below historical levels, it is an impact if the reservoir drawdown from proposed project and alternatives operations that result in an increase of the frequency and magnitude of archaeological site exposure within the fluctuation zone of the reservoirs. Any increase in the frequency or magnitude of exposure of cultural or archaeological resources is a significant impact of the project. As an example of a correct impact criteria for this resource in a similar environmental document, see the Cultural Resources reports from the California Department of Water Resources Oroville Facilities Relicensing.

205

Recreation

- The impact calls related to reservoir recreation are incorrect. If the proposed project or alternatives result in an increase in the frequency or earlier calendar date of boat ramp dewatering, then the impact is significant and must be mitigated. As an example of a correct impact criteria for this resource in a similar environmental document, see the Recreation

206

Resources reports from the California Department of Water Resources Oroville Facilities Relicensing. 206

Power

- The EIS/R misses the main impact of the proposed project and alternatives 2 and 4 in the impact of increased energy demand from groundwater pumping and from groundwater level drawdown. The amount of groundwater pumping the project can create definitely could be a significant impact to power resources in northern California, especially with power transmission line capacity constraints in the areas where the groundwater power demand can be anticipated. Additionally, "backed up reservoir" water transfers which are include in the proposed project and all alternatives alter the timing and location (see related comments) of hydroelectric power generation associated with these releases as compared to the No Action/No Project. The EIS/R failed to consider these power generation timing and location, changes in location and timing of power consumption and constraints and impacts on power transmission from the proposed project and alternatives. The EIS/R must be revised to correct these omissions and propose mitigations for these undisclosed significant impacts. 207

Flood Control

- The impact calls relative to project impacts on reservoir storage are flawed. Reservoirs are multipurpose, including flood control and water supply. Flood control comes first in terms of overriding operations as adequate flood control reserve must be managed in the flood control season. If the reservoirs are lower due to proposed project operations, there is no impact to flood control operations as flood control reserve releases are less likely to be triggered and therefore the project has no impact. If flood control reserve releases are activated when the reservoir is fuller due to proposed project operations, the water stored by the project will be spilled first. 208

Regional Economics

- "Water transfers from idling alfalfa could increase costs for dairy and other livestock feed." This impact category misses the fact that alfalfa would be one of the primary crops not grown in the component of the proposed project for "crop shifting". When rotation away from water use intensive forage crops in crop shifting is added to the loss of these crop acres in the fallowing part of the proposed project and alternatives, the impact to forage supplies and feed prices to local dairies the impacts could be significant. 209
- The EIS/R does not disclose if the water transfers are paying proportionate fees for conveyance as the water districts that are paying for the SWP and CVP facilities construction and operations. 210
- Vegetation removal from Bouldin Island was required for a water transfer in 2014. The use of an unregistered combination of herbicides and misapplication of them has resulted in the damage to 10s of thousands of acres of agricultural crops. In this case the habitat damage 211

included critical habitat for giant garter snake, riparian brush rabbit and rat, tiger salamander, greater sandhill crane, San Joaquin steelhead and Chinook salmon, green sturgeon, delta smelt and other special status species. This spray drift damage has been well documented and publicized (http://wineindustryinsight.com/?p=54211, http://www.winebusiness.com/blog/?go=getBlogEntry&dataId=135322, http://www.lodinews.com/news/article_3c58d352-f196-11e3-8efa-0019bb2963f4.html, http://rivernewsherald.org/articles2014/bouldin_8-6-2014.html) and is estimated to have caused as much as $1Billion in damages. Bouldin Island is only 5,900 acres. The proposed project could idle as much as 177,000 acres in a year if it utilized its maximum transfer capacity covered under the EIS/R using mostly the crop idling strategy component of its proposed project water conservation. If the transfers were maximized for the 10 year project period and utilized mostly crop idling as its water conservation strategy then over the 10 year project period, there would be as many as 1,770,000 acres that required herbicide treatment. If only 1% of the herbicide treatments for the proposed project water transfers go as badly as the Bouldin Island water transfer, the impact of these water transfers could be $3 Billion in damages. Previous water transfers have proven that this is a real risk of this type of project and these risks must be evaluated and $3 billion in damages to the crops in the seller service areas from the project is a substantial impact to the agricultural industry and local economies that the EIS/R failed to evaluate. The EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose these very real potential impacts of the proposed project. The EIS/R must be revised and recirculated to address these material omissions and deficiencies in the document. 211

Environmental Justice

- Fallowed ground and shifting to lower water use intensive crops which are typically less labor intensive than more water intensive crops has significant impacts on disadvantaged local communities, employment opportunities, the working poor, and minority farm workers. Regional economics identifies that 500 people would lose their jobs in the water sellers area from fallowing and crop shifting. The vast majority of these people would be minorities. The EIS/R impact call of "No disproportionately high or adverse effect" is not only incorrect, it is not even a proper NEPA or CEQA impact call. 212

Growth inducement

- Growth inducement was not a section included in the ES summary. Growth inducement consideration is a NEPA requirement. 213
- These water transfers result in an increase of the economic disparity between the value of water used for agriculture vs. M&I uses. M&I water uses can justify costs in excess of a thousand $ per acre foot. Almost no crops can be economically grown at a comparable cost to the values that can be justified for M&I uses. The proposed project water transfers inducement creation of permanent demand such as for industrial, urban, commercial or permanent crop use because those water uses can always afford to pay more than the value of the water if it were used for normal row crop production. Therefore, creation of this long 214

term water transfer opportunity from the project has significant growth inducement impact from permanent shifting of water use location and beneficial use that must be evaluated, quantified, mitigated and disclosed by the project. The EIS/R must not be approved until these material deficiencies in how it addresses growth inducing impacts are rectified. 214

- Long-term transfers resulting from this project encourage reliance on this water supply. Annual transfers as an alternative for comparison do not. This difference in growth inducement must be evaluated. 215

Cumulative

- The EIS/R analysis must be specific as to each transfer and cumulatively. This cumulative analysis must be in conjunction with single year water transfers and other long-term transfers such as the Lower Yuba River Accord. 216

December 1, 2014

BY U.S. MAIL AND EMAIL
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Re: State Water Contractors' Comments on Draft Environmental Impact Statement/Environmental Impact Report for Long-Term Water Transfers

Dear Mr. Hubbard and Ms. Mizuno:

The State Water Contractors ("SWC") appreciate the opportunity to review and comment on the Draft Environmental Impact Statement/Environmental Impact Report ("EIS/EIR") prepared by the Bureau of Reclamation ("Reclamation") and the San Luis & Delta-Mendota Water Authority ("SLDMWA") for the proposed Long-Term Water Transfers Project (the "Project"). The SWC understand that Reclamation is serving as the lead agency under the National Environmental Policy Act ("NEPA") and that SLDMWA is serving as the lead agency under the California Environmental Quality Act ("CEQA"). These comments are provided by the SWC for both NEPA and CEQA. 1

As Reclamation and SLDMWA know, the SWC is a nonprofit mutual benefit corporation that represents and protects the common interests of its 27 members[1] in California's State Water Project ("SWP"). Collectively, the SWC member agencies utilize the SWP and other facilities to deliver water to more than 26 million residents throughout the state and to more than 750,000 acres of agricultural lands. Hence, the SWC have an interest in any project that may impact SWP water supplies.

[1] The SWC members agencies are: Alameda County Flood Control and Water Conservation District Zone 7; Alameda County Water District; Antelope Valley-East Kern Water Agency; Casitas Municipal Water District; Castaic Lake Water Agency; Central Coastal Water Authority; City of Yuba City; Coachella Valley Water District; County of Kings; Crestline-Lake Arrowhead Water Agency; Desert Water Agency; Dudley Ridge Water District; Empire-West Side Irrigation District; Kern County Water Agency; Littlerock Creek Irrigation District; Metropolitan Water District of Southern California; Mojave Water Agency; Napa County Flood Control and Water Conservation District; Oak Flat Water District; Palmdale Water District; San Bernardino Valley Municipal Water District; San Gabriel Valley Municipal Water District; San Gorgonio Pass Water Agency; San Luis Obispo County Flood Control & Water Conservation District; Santa Clara Valley Water District; Solano County Water Agency; and Tulare Lake Basin Water Storage District.

As described in the EIS/EIR, the Project covers a 10-year period (2015 through 2024) during which water could be transferred between willing sellers and buyers through groundwater substitution, reservoir release, conservation, and other mechanisms. More specifically, the Project would allow Central Valley Project ("CVP") contractors in areas south of the Delta or in the San Francisco Bay area to purchase transferred water. The transferred water would be conveyed to the purchasers by the sellers through the Delta using existing CVP or SWP facilities and pumps. 1

After reviewing the EIS/EIR, the SWC have several questions regarding the Project and its environmental analysis. Accordingly, the SWC respectfully request that Reclamation and SLDMWA provide further discussion regarding the items identified below in order to more fully comply with NEPA, CEQA, and those laws' respective public disclosure and analysis requirements. Specifically, the SWC's questions relate primarily to the analysis of, and mitigation for, potential impacts associated with the Project's groundwater substitution and reservoir re-operation elements.

1. The SWC request that Reclamation and SLDMWA clarify the criteria for assessing the magnitude of impacts.

Based on the SWC's review of the EIS/EIR, it is unclear how thresholds of significance or magnitudes of impacts were utilized to determine whether the Project would result in significant impacts to water supplies. The SWC request that the EIS/EIR be clarified to identify with greater specificity how thresholds were applied in both the groundwater substitution and reservoir re-operation contexts, and what specific magnitude of impacts were used when arriving at a significance conclusion. 2

Similarly, when determining whether the Project would result in significant impacts to groundwater resources as a result of groundwater substitution, the EIS/EIR asks whether the Project would cause "[a] net reduction in groundwater levels that would result in adverse environmental effects or effects to non-transferring parties." (EIS/EIR, p. 3.3-61). Thus, the threshold suggests that <u>any</u> net reduction in groundwater levels or <u>any</u> effect to non-transferring parties (regardless how small) may be significant. The SWC request that the EIS/EIR more clearly identify what standard/magnitude of impact was used for assessing significance. Similarly, the threshold asks whether the Project would result in "adverse environmental effects." The SWC's request clarification regarding how "adverse environmental effects" were assessed and what magnitude of impact was used when reaching the significance conclusions in the EIS/EIR. 3

Finally, the EIS/EIR could avoid ambiguities by answering the following questions. Is <u>any</u> amount of "permanent land subsidence" considered significant, and how did Reclamation and SLDMWA determine whether "significant groundwater level declines" would occur in the first instance? (See second threshold at EIS/EIR, p. 3.3-61; see also third threshold which appears to be incomplete at EIS/EIR, p. 3.3-61). The SWC request that the EIS/EIR be clarified to more specifically identify how Reclamation and SLDMWA determined the significance/magnitude of Project impacts. 4

2. The SWC request that Reclamation and SLDMWA expand the analysis of impacts and also clarify the "Environmental Commitments" and Project features that are relied upon to prevent impacts from arising.

a. *<u>The SWC request a further elaboration on the Project's impacts on water supply and surface/groundwater interactions</u>*

The discussion of water supply impacts and surface/groundwater interaction confirms the Project's groundwater substitutions will cause reduced Delta Pumping Station exports on an annual basis. (EIS/EIR, p. 3.1-17). However, it is unclear how those reductions were calculated or during which 5

specific months of the year they are likely to arise. As the EIS/EIR notes, the Biological Opinions ("BiOps") applicable to the Coordinated Operations of the CVP and SWP typically limit the bulk of Delta exports to the months of July through September. (EIS/EIR, pp. ES-9, 1-11). Accordingly, if Project-induced reductions in exports are all concentrated within a narrow-window (particularly during summertime peak exports), the overall impact on water supply may be disproportionately large. The SWC request clarification regarding what month(s) reductions in exports are likely to occur and what impacts to water supply exports may result. 5

Similarly, the SWC request further discussion regarding the groundwater substitutions. Specifically, the SWC request explanation of which specific surface flows are likely to see the largest flow reductions; when those flow reductions are most likely to manifest; and what the magnitude of those reduced volumes may be. As the EIR acknowledges throughout Section 3.3, the geographic area covered by the Project is large and it hosts a wide variety of hydrological and geologic conditions (annual rainfall, volume of groundwater basin, depth to groundwater, etc.). These varying conditions presumably make certain surface flows more vulnerable to the effects of groundwater substitution impacts than others. (See EIS/EIR, p. 3.1-16 [Figure 3.1-2]). Thus, the EIS/EIR should provide a stream-by-stream discussion of whether flow reductions are likely; when those reductions are likely to arise; and what the magnitude of those reductions may be. As described below, mitigation could then be tailored to more specifically address those impacts. 6

The EIS/EIR also confirms that reservoir re-operations will cause a drawdown in reservoir levels. (EIS/EIR, p. 3.1-19). It is anticipated that this drawdown volume would, over time, be replaced by water that would otherwise flow downstream. (EIS/EIR, p. 3.1-18). However, and again as the EIS/EIR alludes to, there are certain flow and salinity requirements arising from the BiOps that regulate Delta exports. If water that would normally flow downstream and assist in meeting BiOp requirements is now withheld in upstream reservoirs (for example, flows that would normally enter the Delta from the San Joaquin River), that could reduce the SWC's ability to export water from the Delta, an impact that should be described in greater specificity in the EIS/EIR. 7

The EIS/EIR also states that reservoir re-operations may result in reservoir drawdowns that require more than one season to refill. (EIS/EIR, p. ES-11). It is unclear how refill would occur, if at all, in periods of multiple drought years akin to the drought conditions that exist today. Ultimately, the SWC request that the EIS/EIR discuss in greater detail how compliance with the BiOps' flow requirements, water quality requirements (such as salinity targets), and release timing requirements would be affected by reservoir re-operations. 8

With regard to cumulative impacts, the SWC request clarification of the discussion regarding groundwater substitution and reservoir re-operation. The EIS/EIR confirms that the cumulative effects analysis spans a ten year period (2014-2024). (EIS/EIR, p. 3.3-91). However, elsewhere the EIS/EIR states that residual reservoir drawdowns and stream flow effects may linger for more than one season, potentially even after any transfers have been completed. The SWC request further discussion to confirm that the Project's impacts have been captured, including those impacts that may remain even after the 10-year transfer period has concluded. Additionally, it is unclear how the cumulative impacts analysis accounts for the combined pressures of existing CVP and SWP operations, the ongoing drought, the potential effects of BiOps, and other projects. The SWC request that an expanded discussion of those issues be provided. 9

b. *The SWC request that "Environmental Commitments" and Project features be further specified*. 10

The EIS/EIR puts forward a number of measures intended to prevent water supply impacts from occurring. The SWC appreciate those efforts, and agree that proactive management is appropriate to prevent impacts from arising. However, the SWC believe that the proposal could be improved with more specific details of those measures specified as part of the current EIS/EIR process.

As one example, all transfers (including both groundwater substitution and reservoir re-operation) are subject to a "carriage water" requirement that is aimed at maintaining water quality in the Delta. (EIS/EIR, p. 2-29). It is unclear if this carriage water factors is intended to be duplicative of the stream flow depletion requirement imposed by Mitigation Measure WS-1, or if the carriage water concept is an entirely separate and distinct requirement. 10

As another example, the EIS/EIR states that all reservoir re-operation transfers would be subject to a "refill agreement" between the seller and Reclamation to prevent impacts to downstream users. (EIS/EIR, p. 2-11). However, it is unclear how quickly refill would be required or how such an agreement would be enforced. Likewise, the EIS/EIR states that the refill agreements would require refill of reservoirs only when it would not adversely affect downstream water users." (EIS/EIR, p. 3.1-19). It is unclear to the SWC what standards apply for making that determination and which party (the seller, the buyer, the downstream water user, or DWR/Reclamation) would have the burden to prove or disprove any adverse impact. The SWC request clarification of the specific performance standards and enforcement mechanisms for the refill agreements, such as withholding water to refill reservoirs only occurs during times when Delta water exports are not occurring. 11

The EIS/EIR also confirms that Delta water quality may be adversely impacted by reduced flows or changed timing of flows. Thus, "Reclamation and DWR would need to either decrease Delta exports or release additional flow from upstream reservoirs to meet flow or water quality standards." (EIS/EIR, p. 3.1-16). The SWC request further details on how this Reclamation/DWR process would be implemented; which entity would bear responsibility for documenting the decision; and what factors Reclamation and DWR anticipate applying in deciding whether to cut water supply exports or release upstream reservoir volumes. Similarly, the SWC request elaboration on whether upstream reservoir volumes are likely to be available, particularly as the EIS/EIR elsewhere confirms that total reservoir volume is likely to decrease for more than one season at a time. (See EIS/EIR, p. ES-11). 12

Finally, the EIS/EIR states that transferred water would only be used to meet existing needs and not future or expanded needs. (EIS/EIR, pp. ES-1, 1-1). The SWC request elaboration on how this Project feature will be monitored to ensure that no unanticipated impacts will arise. 13

3. **The SWC request that Reclamation and SLDMWA clarify the mitigation to ensure performance with specific criteria**.

Here – separate and apart from the "Environmental Commitments" and Project feature concerns addressed above – the SWC believe Mitigation Measure WS-1 requires the implementation of a stream flow depletion factor, which will be developed at a future date and subject to change, and which will be designed to offset any water supply impacts and prevent conflict with the "no injury" rule that may otherwise arise from groundwater substitution transfers. (EIS/EIR, p. 3.1-21). However, measure WS-1 does not identify what <u>specific</u> minimum depletion factor would be required. Instead, it appears that this decision is left largely to DWR and Reclamation's future discretion. The SWC request further elaboration on how this factor would be developed and enforced, and the SWC recommend that a minimum stream flow depletion factor percentage be established now as part of the current EIS/EIR process. 14

Likewise, measure WS-1 provides that the stream flow depletion factor will be established "in consultation with buyers and sellers." (EIS/EIR, p. 3.1-21). However, many of the entities that may suffer injury as a result of any approved transfer are actually downstream water recipients that are neither the buyer nor the seller in the transfer. Thus, the SWC request that measure WS-1 be modified to state that any depletion factor will only be established in consultation with buyers, seller, and other potentially affected parties. 15

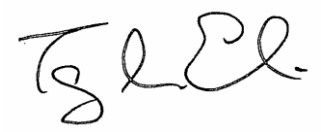
Further, measure WS-1 states that no water transfer will be approved if it violates the "no injury rule." (EIS/EIR, p. 3.1-21). The SWC request that the Mitigation Measure be revised to elaborate on who bears the burden of proving/disproving injury, and what information would be relevant to that determination. 16

Similarly, the SWC request that Mitigation Measure GW-1 be revised to further explain how long-term decreases in surface flows will be prevented or mitigated. As set forth above, the EIS/EIR confirms that surface flows may decrease as a result of increased groundwater pumping. The EIS/EIR confirms that surface flows may experience some decrease over baseline conditions as groundwater basins subsequently recharge. Without further details, it appears that surface water flows may be decreased for a period of 10+ continuous years as transfers result in an ongoing tradeoff between groundwater pumping and groundwater recharge (both of which would reduce flows in surface stream). Thus, the SWC would appreciate further explanation of how Mitigation Measure GW-1 will prevent that long-term reduction in surface flows from occurring. One recommendation is to provide a body-by-body performance standard that states how much reduction in surface water flows would be allowed and over what time period in order to assure that no significant impacts result. 17

In conclusion, the SWC thank Reclamation and the SLDMWA for the opportunity to review and comment upon the EIS/EIR. The SWC appreciate the Project's overall goal of increasing flexibility and reliability with regard to management of CVP water supplies. However, the SWC do request that Reclamation and SLDMWA expand on the issues identified above in order to comply with CEQA and NEPA. SWC believe it is necessary to provide a fuller and more complete environmental analysis under NEPA and CEQA to help ensure that the Project does not provide a benefit to certain water providers to the potential detriment of others.

Should you have any questions, please do not hesitate to contact me at (916) 447-7357 ext. 203.

Sincerely,



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Re: Comments on Draft EIS/EIR on Proposed Long-Term Water Transfers

Dear Mr. Hubbard and Ms. Mizuno:

The County of Yolo ("County") submits this letter to provide its initial comments on the Long Term Water Transfers Draft Environmental Impact Statement/Environmental Impact Report ("Draft EIS/EIR"). The County is continuing to review the Draft EIS and may submit further comments in early 2015.

Altogether, the Executive Summary of the Draft EIS/EIR indicates that up to 86,000 acre-feet of surface water could be transferred each year from 2015 through 2024 from properties within Yolo County to buyers in the San Luis & Delta-Mendota Water Agency ("SLDMA") service area, as well as the Contra Costa Water District and East Bay Municipal Utility District. The County's comments focus on proposed transfers within Yolo County and, in particular, on the potential transfer of up to 35,000 acre-feet annually ("af/yr") from Conaway Ranch. Notwithstanding this letter's focus on transfers from Yolo County, however, the following comments apply equally to other proposed transfers and the Draft EIS/EIR generally. 1

1. General Comments.

As an overall matter, the County disagrees with the conclusion that Alternative 2 (the "Proposed Action" analyzed in the Draft EIS/EIR) will not have any significant, unavoidable adverse effects. Even considering the "environmental commitments" described in Chapter 2 of the Draft EIR/EIS, it is objectively unreasonable to conclude that the potential transfer of slightly over 500,000 af/yr and associated groundwater substitutions, cropland idling, and other measures within the selling areas will somehow not cause any significant, unavoidable adverse effects. There are a host of specific reasons why this conclusion is inappropriate, including an overreliance on assumptions that lack a sound evidentiary basis and other factors discussed in the following section of this letter. 2

Altogether, these analytical flaws distort the comparison of the Proposed Action to other alternatives that could reduce environmental effects associated with cropland idling (Alternative 3) and groundwater substitutions (Alternative 4). The deficient analysis of the Proposed Action's environmental effects compromises the analysis of Alternatives 3 and 4, as well as the ultimate conclusion that those alternatives are not "environmentally superior" 3

to the Proposed Action. The timeframe for analysis—a ten-year period between 2015 and 2024—is also artificial and appears to have been contrived for the purpose of environmental analysis, independent of any proposed transactions or other relevant factors. A shorter transactional timeframe (such as five years) should be used to ensure that environmental effects are appropriately studied as they become apparent, rather than dismissed several years from now by virtue of the inappropriate use of a ten-year period in the Draft EIS/EIR. 3 4

These fundamental flaws in the Draft EIS/EIR are alone sufficient to support revising the document in several respects, as noted more specifically below. The Draft EIS/EIR should also be recirculated for further public review after these deficiencies are addressed. 5

2. Issue-Specific Comments.

The County's specific comments fall into three categories: (A) subsidence and public safety; (B) agricultural and economic impacts; (C) impacts on terrestrial species, including migratory waterfowl.

A. Subsidence and Public Safety.

The Draft EIS/EIR fails (albeit understandably) to consider recent information relating to subsidence on the Conaway Ranch during the Summer of 2014. A copy of the report on subsidence produced by MBK Engineers on November 12, 2014 is attached hereto. As that report documents, portions of the Conaway Ranch subsided by up to 17 centimeters (6.5 inches) in a three-month period. That three-month period coincided with the transfer of about 25,000 af of surface water to the Tehama-Colusa Canal Authority via groundwater substitution. 6

The County acknowledges that it is not possible to determine the relative contribution of increased groundwater pumping and the fallowing of thousands of acres of farmland on Conaway Ranch to the observed subsidence. However, the overall circumstances support a serious concern that further surface water transfers will cause or contribute to similar effects if up to 35,000 af/year is transferred from Conaway Ranch in the future (in addition to 10,000 af/year that Conaway Preservation Group is contractually obligated to deliver to local cities). This concern is particularly acute because the Yolo Bypass passes through Conaway Ranch. The levees of the Yolo Bypass are already known to suffer from various deficiencies, as documented in the Draft EIR for the Central Valley Flood Protection Plan in 2012 and numerous other public documents. Subsidence can further compromise levee integrity (Draft EIS/EIR at p. 3.3-28) and, in turn, increase public safety risks within Yolo County. 7

Further analysis is required in the Draft EIS/EIR to determine the potential magnitude of such effects and, in addition, to enable proper consideration of the findings required for surface water transfers by Water Code § 1745.10 (relating to conditions of long-term overdraft in affected groundwater basins). These are serious concerns that deserve specific attention in the Draft EIS/EIR, which should be recirculated after it is revised to include a discussion of the new information available on subsidence within the Conaway Ranch. The potential for adverse short-term subsidence effects should also be considered, as even subsidence of a limited duration could impact levee integrity and increase public safety risks (as well as the environmental consequences of large-scale inundation of urban areas if the Yolo Bypass levees fail). 8

In addition, Mitigation Measure GW-1 (Monitoring Program and Mitigation Plans) is legally inadequate. By its own terms, it applies only if "substantial adverse impacts" are determined to occur as a consequence of increased groundwater pumping due to surface water transfers. (Draft EIS/EIR at p. 3.3-90.) It assumes, without any apparent basis, that such "substantial adverse impacts" are entirely reversible and can be reduced to a less than significant level through mitigation plans backed by "financial assurances." Much more is needed to explain the conclusion that such mitigation plans will be effective, that adequate financial assurances can be provided (particularly for impacts on major public infrastructure such as levees), and that Mitigation Measure GW-1 is otherwise sufficient in all instances to reduce even the short-term adverse effects of subsidence and other effects of groundwater pumping to a less than significant level. Additionally, the Draft EIS/EIR should study mitigation measures (or project alternatives) that include common-sense approaches such as lower levels of transfers and/or related groundwater pumping. 9

B. Agricultural and Economic Impacts.

The Executive Summary of the Draft EIS/EIR explains that the proposed transfers are primarily intended is to support agriculture within SLDMA boundaries. Ironically however, all of the identified drawbacks of the "no action alternative" in the Draft EIS/EIR--increased groundwater pumping, cropland idling, and land retirement within the SLDMA--could occur within the selling areas if the transfers proceed. These effects range from minor to significant, as explained in Chapter 3.9 of the document. 10

Despite this, the Draft EIS/EIR does not contain sufficient mitigation measures or other constraints upon the proposed transfers to ensure that the adverse effects of water shortages are not simply transferred from the SLDMA to the selling areas. There is no legal or practical reason why this should be so. For instance, the Draft EIR/EIS could easily contain safeguards that limit transfers to the extent necessary to avoid environmentally and/or economically significant effects on groundwater pumping, cropland idling, and land retirement within the selling areas. Such mitigation measures (or project alternatives) should be included for consideration in a recirculated version of the Draft EIS/EIR. More detailed consideration of the potential for Alternatives 3 and 4 to reduce such effects should also be included in the recirculated document. 11

The Draft EIS/EIR also takes an inappropriately narrow view of "agricultural impacts." It focuses largely on whether cropland idling and changes in cropping patterns will "substantially decrease" the amount of affected farmland designated Prime Farmland, Farmland of Statewide Importance, or Unique Farmland during the limited term of the transfer program studied in the Draft EIS/EIR. This impact is deemed less than significant under Alternative 2, primarily because cropland idling will be for relatively short periods of time during the ten-year duration of the studied transfers. 12

This analytical approach is flawed because the water transfers facilitated by the Draft EIS/EIR will lead to continued demand (post-2024) for additional water transfers to support agricultural, municipal, and industrial uses within the boundaries of the SLDMA and other purchasing entities. For this reason, the ten-year term of the environmental analysis is entirely artificial. It has no connection to real-world demands, which will extend long past 2024, nor does it have any apparent connection to legal or other characteristics of the proposed transfers. A short-term view of the environmental and economic effects of creating a water transfer program is therefore inappropriate because it can be seen with reasonable certainty that, analogous to the growth-inducing effects of urban development projects, the demand for such transfers will continue beyond the limited life of the program. The Draft EIS/EIR should be revised to account for the basic reality that water transfers will lead to (and likely increase the demand for) more water transfers, well beyond the ten-year period of the analysis. 13

Finally, the potential adverse economic impacts of the proposed transfers are considerable, particularly within Yolo, Colusa, and Glenn Counties. The Draft EIS/EIR notes that, among other things, over 40,000 acres in rice land alone in the Sacramento Region may not be farmed due to the potential water transfers. In those three counties alone, up to 362 jobs may be lost and the projected declines in labor income and economic output are $11.1 million and $45.46 million, respectively. 14

These economic effects (and the related potential for indirect environmental effects) deserve considerably more analysis. To use one example, the potential decline of rice cultivation in the Yolo Bypass due to water transfers, ecosystem restoration, and other projects (which should be included in an analysis of cumulative impacts) could lead to a “tipping point”—meaning that rice cultivation ceases to be commercially viable even on unaffected lands throughout the County—due to a decline in rice volumes, the resulting closure of local rice mills, and the eventual rise of unit processing costs to unacceptable levels. None of this appears to have received meaningful consideration in the Draft EIS/EIR. 15

C. Impacts on Terrestrial Species, Including Migratory Waterfowl.

The Draft EIS/EIS concludes that potential adverse effects on habitat availability and suitability for terrestrial species due to cropland idling/shifting under Alternatives 2 and 4 would be less than significant. This is simply wrong, particularly (though not only) for species that depend on flooded agricultural fields and associated irrigation waterways. Not only does this analytical shortcoming render the Draft EIS/EIR deficient under the California Environmental Quality Act (“CEQA”) and the National Environmental Policy Act (“NEPA”), it also calls into 16

question whether the proposed transfers meet the requirements of the Central Valley Project Improvement Act of 1992 (which prohibits water transfers will adversely affect water supplies for fish and wildlife) and similar provisions of the California Water Code (e.g., Cal. Water Code §§ 1725 and 1736). 16

For the giant garter snake, the analysis of these issues in the Draft EIS/EIR is particularly deficient. The analysis at pp. 3-8.68 through 3-8.70 is highly general and simply states the obvious (i.e., that some individual members of the species will be subject to increased predation and other risks due to habitat displacement) before concluding that impacts are unlikely to be significant. The conclusion appears to be nothing more than speculation. 17

Also, the "environmental commitments" described at p. 2-29 are unlikely to be sufficient to protect giant garter snake populations in Yolo County. The commitments primarily limit restrictions on transfers from fields "abutting or immediately adjacent to" the "land side" of the Toe Drain along Willow Slough and Willow Slough Bypass in Yolo County. (Draft EIS/EIS at p. 2-29.) This very narrow restriction that fails to fully account for the wide distribution of the giant garter snake across parcels not immediately adjacent to the Toe Drain. Accordingly, the Draft EIS/EIR does not sufficiently explain how this restriction supports a conclusion that impacts will be less than significant. 18

Similarly troubling is the complete absence of any analysis of the potential effects of the proposed water transfers on the Swainson's hawk or migratory waterfowl. Numerous passages in Chapter 3-8 indicate that the authors of the Draft EIS/EIR understand that agricultural fields and natural communities affected by the proposed transfers currently support abundant Swainson's hawk and migratory waterfowl populations. Despite this, however, there is no meaningful analysis of potential impacts on the Swainson's hawk or migratory waterfowl. Effects resulting from the fallowing of fields--and for migratory waterfowl, particularly the loss of up to 40,000 in rice annually--need to be analyzed carefully in the Draft EIS/EIR. 19

* * *

Overall, as this letter describes, the Draft EIS/EIR needs significant revisions and recirculation to meet the requirements of CEQA and NEPA. The County requests notice of any hearings or other public discussions of the Draft EIS/EIR or the water transfers studied therein, as well as copies of any documents subsequently produced under CEQA or NEPA for the proposed transfers. Such notice is required by CEQA, as the County is a "responsible agency" within the meaning of that statute. As noted above, the County is continuing to review the Draft EIS and may submit further comments in early 2014. 20

Very truly yours,

Patrick S. Blacklock
Yolo County Administrator

Enclosure

cc: Yolo County Board of Supervisors

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Water Resources • Flood Control • Water Rights

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November 12, 2014

Richard Woodley
U.S. Bureau of Reclamation
2800 Cottage Way
Sacramento, CA 95821

Subject: Conaway Preservation Group 2014 Water Transfer
Second Land Subsidence Report

Dear Mr. Woodley:

On behalf of Conaway Preservation Group (CPG), the purpose of this letter is to provide the enclosed Survey Control Project Report (Report) requested pursuant to Paragraph 16 of the Agreement Among the United States, CPG, and the Tehama-Colusa Canal Authority to Provide for Additional Water from the Central Valley Project for 2014, dated May 19, 2014 (Agreement). The Report details the results of a land subsidence monitoring survey conducted at the end of the 2014 irrigation season for CPG by Frame Surveying & Mapping in accordance with the approach identified in Exhibit E to the Agreement. The Report includes a comparison of the survey results with the initial land subsidence survey results transmitted to your office by letter dated August 28, 2014. A third land subsidence monitoring survey will be conducted prior to the start of the 2015 irrigation season; and following that survey, the results will be documented in a report to be provided in a future update pursuant to Exhibit E.

Please call if you have any questions or require additional information.

Sincerely,
MBK ENGINEERS

Darren Cordova

Enclosures
cc: Robert Thomas, Conaway Preservation Group
Regina Cherovsky, Conaway Preservation Group
Mike Hall, Conaway Preservation Group
Andrew Hitchings, Somach, Simmons & Dunn
Tim Durbin, Tim J. Durbin, Inc.
Jim Frame, Frame Surveying & Mapping
Jeff Sutton, Tehama-Colusa Canal Authority
Sheri Looper, U.S. Bureau of Reclamation
Stanley Parrott, U.S. Bureau of Reclamation
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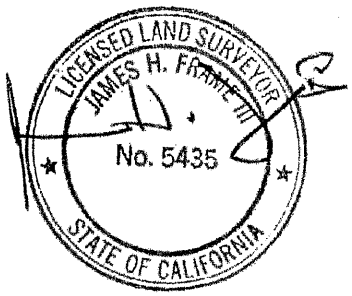

SURVEY CONTROL PROJECT REPORT

CONAWAY RANCH LAND SUBSIDENCE MONITORING
SEPTEMBER, 2014 MONITORING EVENT

PURPOSE

This report describes the results of the second monitoring event of the Conaway Ranch subsidence monitoring project. The initial (baseline) measurements were described in a June, 2014 report, which is a companion document to this report.

EXECUTIVE SUMMARY

Of the 10 monitoring stations within the immediate project area, measurable subsidence was detected at 6 of the stations. The measured subsidence ranged from 5 cm to 17 cm, with the largest value found at station SM10, which is located near the ranch headquarters and also near the DWR extensometer. Estimated measurement accuracy is 2 cm. See Appendix A for a graphical approximation of subsidence distribution.

MONITORING EVENT DESIGN

As with the June measurements, the September monitoring event consisted of 30-minute minimum GPS observation sessions at all monitored stations. OPUS Projects was used to establish current ellipsoid heights at 8 stations in and near the project area.

The only terrestrial measurement in the September event was a trig leveling check between SM10 and the nearby EX11, which was performed in response to the relatively large movement detected at SM10. It was determined that EX11 had subsided 0.016 m less than SM10. The June measurements to FERR and CONA were made to tie the project to the Yolo Subsidence Network, but aren't considered necessary to the ongoing monitoring effort.

DATA PROCESSING AND ADJUSTMENT

Substantially duplicating the process followed in June, GPS data files greater than 2 hours in length were processed in OPUS Projects, and the resulting adjustment again constrained stations LNC2, P267, P268 and SACR. The ellipsoid heights of the constraining stations showed very little change between the June and September events – 5 mm or less – validating the selection of these stations as stable vertical constraints.

TABLE E			
STATION POSITIONS - CCS83 US SURVEY FEET			
STATION	NORTHING	EASTING	ELEVATION
1031	2008599.383	6644606.877	33.236
CAST	1967456.543	6663504.495	17.005
COD1	1977287.674	6659463.132	21.206
COY1	1977246.445	6649648.950	27.478
CR27	1987259.421	6648517.853	29.651
EX11	1997336.718	6656626.527	24.513
P268	1934465.509	6662900.456	25.804
P271	2001341.660	6643182.771	42.554
RIVE	1997860.863	6683832.685	39.235
S16A	2008423.129	6663149.765	27.723
SM08	1987046.351	6662905.689	21.206
SM09	1988144.768	6673466.416	18.500
SM10	1997409.582	6656970.177	30.939
SM11	2006681.702	6655241.391	23.129
UCD1	1957204.975	6632828.912	102.613

HEIGHT COMPARISONS, SEPTEMBER 2014 – JUNE 2014

Table F below shows the difference in station height between the September and June 2014 monitoring events. A negative delta value indicates that a station has subsided.

These values constitute the data from which the subsidence contours shown in Appendix A were developed. Reiterating the cautionary note from Appendix A, these contours are based on interpolating between the very sparse data points available from the survey. While they are useful for showing in broad strokes the distribution of subsidence, they are not to be regarded as accurate except in the immediate vicinity of the individual monitoring stations.

TABLE C			
GEOGRAPHIC STATION POSITIONS			
STATION	LATITUDE	LONGITUDE	ELLIP HT (M)
1031	38-40-38.146911	121-42-34.079974	-20.568
CAST	38-33-50.779180	121-38-37.806580	-25.807
COD1	38-35-28.114860	121-39-28.223014	-24.459
COY1	38-35-28.054244	121-41-31.836450	-22.597
CR27	38-37-07.071749	121-41-45.661002	-21.847
EX11	38-38-46.406630	121-40-03.026719	-23.288
P268	38-28-24.681149	121-38-47.027881	-23.431
P271	38-39-26.447882	121-42-52.326075	-17.804
RIVE	38-38-50.462947	121-34-20.065279	-18.774
S16A	38-40-35.753116	121-38-40.255181	-22.202
SM08	38-37-04.450378	121-38-44.384113	-24.364
SM09	38-37-14.880094	121-36-31.260494	-25.163
SM10	38-38-47.114446	121-39-58.691662	-21.328
SM11	38-40-18.832764	121-40-20.061430	-23.630
UCD1	38-32-10.449924	121-45-04.379784	0.014

TABLE D			
STATION POSITIONS - CCS83 Meters			
STATION	NORTHING	EASTING	ELEVATION
1031	612222.316	2025280.227	10.131
CAST	599681.954	2031040.232	5.183
COD1	602678.488	2029808.422	6.464
COY1	602665.922	2026817.054	8.375
CR27	605717.883	2026472.295	9.038
EX11	608789.449	2028943.823	7.472
P268	589626.267	2030856.121	7.865
P271	610010.158	2024846.158	12.971
RIVE	608949.209	2037236.277	11.959
S16A	612168.594	2030932.110	8.450
SM08	605652.939	2030857.716	6.464
SM09	605987.737	2034076.632	5.639
SM10	608811.658	2029048.568	9.430
SM11	611637.806	2028521.633	7.050
UCD1	596557.269	2021690.296	31.277

accurate depiction of the distribution of that subsidence. If a more precise model of subsidence distribution is desired, the network of monitoring points will need to be densified. This can be accomplished by supplementing the rigorous static GPS network with infill measurements captured by means of more rapid – though slightly less accurate – GPS techniques.

TABLE F			
ORTHOMETRIC HEIGHT COMPARISONS			
SEPTEMBER 2014 - JUNE 2014 (METERS)			
STATION	09/2014	06/2014	Δ ELEVATION
1031	10.131	10.183	-0.053
CAST	5.183	5.170	0.013
COD1	6.464	6.475	-0.012
COY1	8.375	8.414	-0.039
CR27	9.038	9.125	-0.087
EX11	7.472	7.628	-0.156
P268	7.865	7.867	-0.002
P271	12.971	13.023	-0.053
RIVE	11.959	11.983	-0.024
S16A	8.450	8.445	0.004
SM08	6.464	6.471	-0.007
SM09	5.639	5.628	0.011
SM10	9.430	9.602	-0.172
SM11	7.050	7.121	-0.071
UCD1	31.276	31.295	-0.019

DWR EXTENSOMETER DATA, SEPTEMBER – JUNE 2014

Data from the Conaway Extensometer is available at

http://www.water.ca.gov/waterdatalibrary/docs/Hydstra/docs/09N03E08C004M/POR/GROUND_SURFACE_DISPLACEMENT_POINT_DATA.CSV

This data indicates that between June 10, 2014 and September 4, 2014 the ground surface was displaced downward 0.12 m (0.42 foot) at the extensometer site. This substantially corroborates the change in elevation shown in Table F above.

SUMMARY

The orthometric height values determined by this survey have an estimated accuracy of +/- 2 cm at the 95% confidence level. Although many of the 95% error estimates for heights shown in the Star*Net adjustment report (see Appendix D) are smaller by a magnitude, empirical evidence has demonstrated that GPS height transfer is not reliably accurate at that level.

The results of this survey document land subsidence on the Conaway Ranch that occurred during the Summer 2014 season. However, the nature of the monitoring network does not permit

APPENDIX B - OPUS PROJECTS NETWORK ADJUSTMENT REPORT

NGS OPUS-PROJECTS NETWORK ADJUSTMENT REPORT
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All coordinate accuracies reported here are 1 times the formal uncertainties from the solution. For additional information: geodesy.noaa.gov/OPUS/Using_OPUS-Projects.html#accuracy

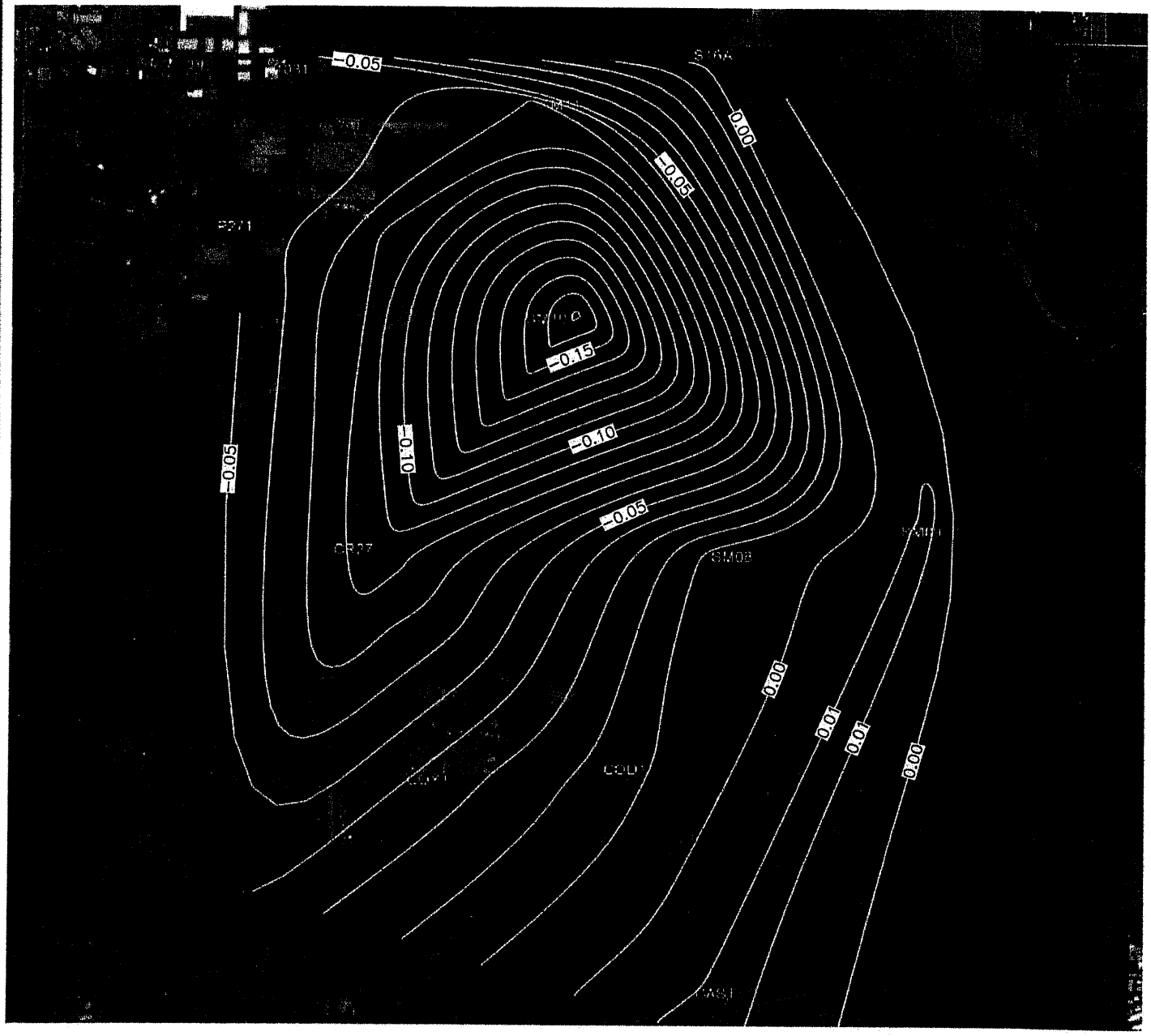
These positions were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

SUBMITTED BY:	jhframe
SOLUTION FILE NAME:	network-network-20140907-LNC2-P267-P2.sum
SOLUTION SOFTWARE:	GPSCOM(1210.24)
SOLUTION DATE:	2014-09-07T20:06:48 UTC
STANDARD ERROR OF UNIT WEIGHT:	0.500
TOTAL NUMBER OF OBSERVATIONS:	829229
TOTAL NUMBER OF MARKS:	16
NUMBER OF CONSTRAINED MARKS:	4
START TIME:	2014-09-03T00:00:00 GPS
STOP TIME:	2014-09-04T23:59:30 GPS
FREQUENCY:	L1-ONLY TO ION-FREE [BY BASELINE LENGTH]
OBSERVATION INTERVAL:	30 s
ELEVATION CUTOFF:	15 deg
TROPO INTERVAL:	1800 s [STEP-OFFSET PARAMETERIZATION]
DD CORRELATIONS:	ON

INCLUDED SOLUTION	RMS	SOFTWARE	RUN DATE
1) 2014-246 A	1.1 cm	GPSCOM(1210.24)	2014-09-07T19:41 UTC
2) 2014-246 B	1.3 cm	page5(1404.11)	2014-09-07T18:54 UTC
3) 2014-247 A	0.9 cm	GPSCOM(1210.24)	2014-09-07T19:30 UTC
4) 2014-247 B	0.9 cm	GPSCOM(1210.24)	2014-09-07T19:35 UTC

BASELINE	LENGTH	RMS	OBS	OMITTED	FIXED	IN SOLUTION(S)
1031-p271	2.254 km	0.4 cm	1566	0.4%	100.0%	1
coy1-cod1	2.992 km	0.5 cm	6924	2.5%	100.0%	2, 3, 4
sm08-cod1	3.154 km	0.6 cm	6951	4.4%	100.0%	2, 3, 4
sm10-sm08	3.640 km	0.6 cm	14526	3.6%	96.9%	1, 2, 3, 4
s16a-sm10	3.849 km	0.5 cm	3397	0.8%	100.0%	1, 4
p271-sm10	4.370 km	0.8 cm	17341	2.2%	100.0%	1, 2, 3, 4
sm08-coy1	5.025 km	0.6 cm	6216	1.4%	100.0%	3, 4
sm10-1031	5.083 km	0.6 cm	1565	0.5%	100.0%	1
s16a-1031	5.652 km	0.5 cm	957	2.6%	100.0%	1
s16a-p271	6.458 km	0.5 cm	1915	0.9%	100.0%	4
sm08-s16a	6.516 km	0.7 cm	3741	2.1%	100.0%	1, 4
coy1-sm10	6.539 km	0.6 cm	6300	0.5%	100.0%	3, 4
sm08-p271	7.425 km	0.9 cm	6409	2.5%	100.0%	1
coy1-p271	7.604 km	0.7 cm	6274	1.0%	100.0%	3, 4
ucd1-coy1	7.975 km	0.9 cm	6270	0.3%	100.0%	3, 4
ucd1-cod1	10.168 km	0.7 cm	2157	3.8%	100.0%	2
ucd1-p268	11.492 km	1.0 cm	57113	0.3%	100.0%	1, 3, 4
ucd1-sm08	12.915 km	1.0 cm	6361	2.5%	100.0%	1
p268-cod1	13.095 km	0.9 cm	7111	2.2%	100.0%	2, 3, 4
coy1-p268	13.651 km	0.9 cm	6310	0.3%	100.0%	3, 4
p271-ucd1	13.819 km	0.9 cm	56921	0.7%	98.8%	1, 3, 4

APPENDIX A



NOTES

1. SUBSIDENCE VALUES REPRESENT MOVEMENT DETECTED BETWEEN JUNE 10, 2014 AND SEPTEMBER 4, 2014.

2. CONTOUR LINES SHOWN WERE DERIVED FROM SPARSE DATA AND ARE INTENDED TO DEPICT APPROXIMATE SUBSIDENCE DISTRIBUTION ONLY EXCEPT IN THE IMMEDIATE VICINITY OF MONITORING STATIONS.

3. ABSOLUTE VALUES SMALLER THAN 0.02 METER ARE NOT CONSIDERED SIGNIFICANT DUE TO THE LIMITS OF THE MEASURSUREMENT TECHNOLOGY.

FRAME SURVEYING & MAPPING
609 A STREET DAVIS, CA 95616
530.756.8584 (v&f) jhframe@dcn.org
1037-001

SUBSIDENCE CONTOURS

CONAWAY RANCH SUBSIDENCE MONITORING EVENT
SEPTEMBER, 2014 SCALE: 1"= 2000'
SUBSIDENCE VALUES SHOWN IN METERS

APPENDIX B – OPUS PROJECTS NETWORK ADJUSTMENT REPORT

++
UNCONSTRAINED MARKS
++

MARK: 1031 (1031 1)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6730)	
X:	-2620586.835 m	0.002 m	-2620587.718 m	0.002 m
Y:	-4241524.000 m	0.002 m	-4241522.693 m	0.002 m
Z:	3964397.371 m	0.002 m	3964397.344 m	0.002 m
LAT:	38 40 38.14700	0.001 m	38 40 38.15946	0.001 m
E LON:	238 17 25.92000	0.001 m	238 17 25.86048	0.001 m
W LON:	121 42 34.08000	0.001 m	121 42 34.13952	0.001 m
EL HGT:	-20.585 m	0.002 m	-21.108 m	0.002 m
ORTHO HGT:	10.113 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4281753.255 m	612222.319 m
EASTING (X)	612257.527 m	2025280.226 m
CONVERGENCE	0.80658090 deg	0.18317207 deg
POINT SCALE	0.99975518	0.99993980
COMBINED FACTOR	0.99975841	0.99994303

US NATIONAL GRID DESIGNATOR: 10SFH1225781753 (NAD 83)

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MARK: casr (casr a 1)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6726)	
X:	-2705828.432 m	0.001 m	-2705829.321 m	0.001 m
Y:	-4207167.175 m	0.002 m	-4207165.810 m	0.002 m
Z:	3943880.560 m	0.002 m	3943880.595 m	0.002 m
LAT:	38 26 26.41470	0.001 m	38 26 26.42904	0.001 m
E LON:	237 15 10.83511	0.001 m	237 15 10.77384	0.001 m
W LON:	122 44 49.16489	0.001 m	122 44 49.22616	0.001 m
EL HGT:	11.968 m	0.002 m	11.467 m	0.002 m
ORTHO HGT:	43.427 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4254740.503 m	586187.630 m
EASTING (X)	522080.014 m	1934786.767 m
CONVERGENCE	0.15729779 deg	-0.47095370 deg
POINT SCALE	0.99960600	0.99997739
COMBINED FACTOR	0.99960412	0.99997551

US NATIONAL GRID DESIGNATOR: 10SEH2208054740 (NAD 83)

APPENDIX B - OPUS PROJECTS NETWORK ADJUSTMENT REPORT

p268-sm08	16.027 km	1.1 cm	17523	3.3%	100.0%	1, 3, 4
ucd1-p267	18.412 km	1.0 cm	56766	1.0%	100.0%	1, 3, 4
p268-p267	18.585 km	0.9 cm	76118	0.8%	100.0%	1, 2, 3, 4
sacr-lnc2	21.262 km	1.5 cm	35562	3.2%	100.0%	1, 2
s16a-sacr	25.379 km	1.2 cm	1974	3.9%	100.0%	1
sm08-sacr	25.707 km	1.6 cm	11738	3.9%	88.9%	1, 2
lnc2-s16a	31.759 km	0.9 cm	4209	0.8%	100.0%	1, 4
p268-sacr	32.469 km	1.4 cm	17971	2.2%	94.3%	1
lnc2-sm10	35.312 km	1.1 cm	6534	2.5%	100.0%	3
lnc2-sm08	36.090 km	1.1 cm	11122	3.3%	100.0%	3, 4
p271-lnc2	37.975 km	0.9 cm	37938	0.8%	96.3%	3, 4
p267-p261	42.752 km	0.9 cm	37922	1.0%	100.0%	3, 4
p268-lnc2	48.759 km	0.9 cm	38122	0.3%	100.0%	3, 4
p261-ucd1	58.923 km	1.0 cm	37904	0.4%	100.0%	3, 4
lnc2-cho5	70.520 km	1.0 cm	18787	1.3%	96.6%	1
p271-p261	71.169 km	0.9 cm	38068	0.5%	98.2%	3, 4
p267-casr	80.959 km	1.1 cm	18714	1.6%	98.4%	1
p267-s300	82.582 km	0.9 cm	18896	0.7%	98.1%	1
1031-cho5	83.947 km	0.8 cm	1542	1.8%	100.0%	1
cho5-s16a	83.951 km	1.0 cm	2304	0.7%	100.0%	1
casr-ucd1	87.522 km	1.2 cm	18719	1.0%	95.1%	1
s300-p268	89.915 km	0.9 cm	18999	0.3%	100.0%	1
p271-casr	93.160 km	1.2 cm	18686	1.8%	100.0%	1
casr-1031	94.167 km	1.3 cm	1551	0.3%	100.0%	1
sacr-s300	111.173 km	1.4 cm	17897	1.9%	98.4%	1
casr-s300	135.166 km	1.2 cm	18823	0.4%	92.7%	1
cho5-casr	144.661 km	1.3 cm	18515	2.5%	95.7%	1

APPENDIX B – OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK: coy1 (coy1 1)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6757)	
X:	-2622442.280 m	0.001 m	-2622443.163 m	0.001 m
Y:	-4247392.981 m	0.002 m	-4247391.673 m	0.002 m
Z:	3956926.861 m	0.002 m	3956926.834 m	0.002 m
LAT:	38 35 28.05426	0.001 m	38 35 28.06670	0.001 m
E LON:	238 18 28.16354	0.001 m	238 18 28.10409	0.001 m
W LON:	121 41 31.83646	0.001 m	121 41 31.89591	0.001 m
EL HGT:	-22.598 m	0.002 m	-23.122 m	0.002 m
ORTHO HGT:	8.375 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4272215.915 m	602665.922 m
EASTING (X)	613897.797 m	2026817.053 m
CONVERGENCE	0.81585354 deg	0.19407278 deg
POINT SCALE	0.99975975	0.99995154
COMBINED FACTOR	0.99976329	0.99995509

US NATIONAL GRID DESIGNATOR: 10SFH1389772215 (NAD 83)

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MARK: p261 (p261 a 4)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6753)	
X:	-2677432.147 m	0.001 m	-2677433.022 m	0.001 m
Y:	-4248807.523 m	0.002 m	-4248806.186 m	0.002 m
Z:	3918882.060 m	0.002 m	3918882.053 m	0.002 m
LAT:	38 09 10.64359	0.001 m	38 09 10.65673	0.001 m
E LON:	237 46 56.91143	0.001 m	237 46 56.85175	0.001 m
W LON:	122 13 03.08857	0.001 m	122 13 03.14825	0.001 m
EL HGT:	118.692 m	0.002 m	118.166 m	0.002 m
ORTHO HGT:	150.561 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4223075.294 m	554005.247 m
EASTING (X)	568556.824 m	1980933.176 m
CONVERGENCE	0.48340313 deg	-0.13714237 deg
POINT SCALE	0.99965788	1.00004578
COMBINED FACTOR	0.99963926	1.00002716

US NATIONAL GRID DESIGNATOR: 10SEH6855623075 (NAD 83)

APPENDIX B – OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK: cho5 (cho5 a 2)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6726)	
X:	-2589569.372 m	0.001 m	-2589570.258 m	0.001 m
Y:	-4198613.275 m	0.002 m	-4198611.980 m	0.002 m
Z:	4029540.481 m	0.002 m	4029540.456 m	0.002 m
LAT:	39 25 57.48598	0.001 m	39 25 57.49848	0.001 m
E LON:	238 20 06.18724	0.001 m	238 20 06.12729	0.001 m
W LON:	121 39 53.81276	0.001 m	121 39 53.87271	0.001 m
EL HGT:	17.098 m	0.002 m	16.590 m	0.002 m
ORTHO HGT:	45.334 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4365638.688 m	696087.317 m
EASTING (X)	614899.215 m	2028844.773 m
CONVERGENCE	0.84807839 deg	0.21123968 deg
POINT SCALE	0.99976254	0.99993307
COMBINED FACTOR	0.99975986	0.99993039

US NATIONAL GRID DESIGNATOR: 10SFJ1489965638 (NAD 83)

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MARK: cod1 (cod1 1)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6751)	
X:	-2619894.992 m	0.002 m	-2619895.875 m	0.002 m
Y:	-4248961.603 m	0.002 m	-4248960.295 m	0.002 m
Z:	3956927.160 m	0.002 m	3956927.132 m	0.002 m
LAT:	38 35 28.11487	0.001 m	38 35 28.12732	0.001 m
E LON:	238 20 31.77700	0.001 m	238 20 31.71758	0.001 m
W LON:	121 39 28.22300	0.001 m	121 39 28.28242	0.001 m
EL HGT:	-24.460 m	0.002 m	-24.986 m	0.002 m
ORTHO HGT:	6.463 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4272260.928 m	602678.489 m
EASTING (X)	616888.293 m	2029808.422 m
CONVERGENCE	0.83727898 deg	0.21572122 deg
POINT SCALE	0.99976825	0.99995153
COMBINED FACTOR	0.99977209	0.99995537

US NATIONAL GRID DESIGNATOR: 10SFH1688872260 (NAD 83)

APPENDIX B – OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK: s300 (s300 a 3)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6726)	
X:	-2645886.543 m	0.001 m	-2645887.420 m	0.001 m
Y:	-4307856.961 m	0.002 m	-4307855.641 m	0.002 m
Z:	3876512.196 m	0.002 m	3876512.164 m	0.002 m
LAT:	37 39 59.41374	0.001 m	37 39 59.42610	0.001 m
E LON:	238 26 30.28629	0.001 m	238 26 30.22763	0.001 m
W LON:	121 33 29.71371	0.001 m	121 33 29.77237	0.001 m
EL HGT:	496.304 m	0.002 m	495.757 m	0.002 m
ORTHO HGT:	528.063 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0403 CA 3)
NORTHING (Y)	4169791.690 m	629987.304 m
EASTING (X)	627155.978 m	1906640.117 m
CONVERGENCE	0.88111774 deg	-0.64789689 deg
POINT SCALE	0.99979915	0.99993026
COMBINED FACTOR	0.99972129	0.99985239

US NATIONAL GRID DESIGNATOR: 10SFG2715569791 (NAD 83)

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MARK: sm08 (sm08 1)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6747)	
X:	-2618019.472 m	0.001 m	-2618020.355 m	0.001 m
Y:	-4247940.539 m	0.002 m	-4247939.231 m	0.002 m
Z:	3959248.615 m	0.002 m	3959248.587 m	0.002 m
LAT:	38 37 04.45037	0.001 m	38 37 04.46284	0.001 m
E LON:	238 21 15.61592	0.001 m	238 21 15.55649	0.001 m
W LON:	121 38 44.38408	0.001 m	121 38 44.44351	0.001 m
EL HGT:	-24.366 m	0.002 m	-24.892 m	0.002 m
ORTHO HGT:	6.462 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4275246.053 m	605652.939 m
EASTING (X)	617905.065 m	2030857.717 m
CONVERGENCE	0.84537168 deg	0.22339874 deg
POINT SCALE	0.99977119	0.99994765
COMBINED FACTOR	0.99977501	0.99995147

US NATIONAL GRID DESIGNATOR: 10SFH1790575246 (NAD 83)

APPENDIX B – OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK: p271 (p271 a 3)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6747)	
X:	-2621689.337 m	0.001 m	-2621690.215 m	0.001 m
Y:	-4242469.113 m	0.002 m	-4242467.793 m	0.002 m
Z:	3962672.872 m	0.002 m	3962672.829 m	0.002 m
LAT:	38 39 26.44791	0.001 m	38 39 26.46021	0.001 m
E LON:	238 17 07.67390	0.001 m	238 17 07.61429	0.001 m
W LON:	121 42 52.32610	0.001 m	121 42 52.38571	0.001 m
EL HGT:	-17.798 m	0.002 m	-18.342 m	0.002 m
ORTHO HGT:	12.977 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4279536.917 m	610010.159 m
EASTING (X)	611847.624 m	2024846.158 m
CONVERGENCE	0.80306366 deg	0.17997663 deg
POINT SCALE	0.99975405	0.99994232
COMBINED FACTOR	0.99975684	0.99994511

US NATIONAL GRID DESIGNATOR: 10SFH1184779536 (NAD 83)

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MARK: s16a (s16a 1)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6744)	
X:	-2615800.438 m	0.002 m	-2615801.321 m	0.002 m
Y:	-4244530.207 m	0.002 m	-4244528.900 m	0.002 m
Z:	3964338.733 m	0.002 m	3964338.706 m	0.002 m
LAT:	38 40 35.75313	0.001 m	38 40 35.76560	0.001 m
E LON:	238 21 19.74482	0.001 m	238 21 19.68534	0.001 m
W LON:	121 38 40.25518	0.001 m	121 38 40.31466	0.001 m
EL HGT:	-22.202 m	0.002 m	-22.726 m	0.002 m
ORTHO HGT:	8.450 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4281761.009 m	612168.595 m
EASTING (X)	617908.663 m	2030932.110 m
CONVERGENCE	0.84717221 deg	0.22412183 deg
POINT SCALE	0.99977120	0.99993988
COMBINED FACTOR	0.99977468	0.99994336

US NATIONAL GRID DESIGNATOR: 10SFH1790881761 (NAD 83)

APPENDIX B – OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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CONSTRAINED MARKS
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MARK: lnc2 (lnc2 a 2)
CONSTRAIN: 3-D NORMAL
ADJUST X: -0.007m (0.001m) Y: -0.008m (0.002m) Z: 0.008m (0.002m)
ADJUST N: -0.000m (0.001m) E: -0.002m (0.001m) H: 0.013m (0.001m)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6744)	
X:	-2587855.575 m	0.001 m	-2587856.456 m	0.001 m
Y:	-4247830.084 m	0.002 m	-4247828.780 m	0.002 m
Z:	3979063.991 m	0.002 m	3979063.961 m	0.002 m
LAT:	38 50 47.41586	0.001 m	38 50 47.42845	0.001 m
E LON:	238 38 58.07306	0.001 m	238 38 58.01373	0.001 m
W LON:	121 21 01.92694	0.001 m	121 21 01.98627	0.001 m
EL HGT:	6.394 m	0.001 m	5.865 m	0.001 m
ORTHO HGT:	36.400 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4301035.814 m	631169.703 m
EASTING (X)	643142.392 m	2056377.344 m
CONVERGENCE	1.03477945 deg	0.40946695 deg
POINT SCALE	0.99985231	0.99992327
COMBINED FACTOR	0.99985131	0.99992227

US NATIONAL GRID DESIGNATOR: 10SFJ4314201035 (NAD 83)

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MARK: p267 (p267 a 1)
CONSTRAIN: 3-D NORMAL
ADJUST X: 0.015m (0.001m) Y: 0.010m (0.002m) Z: -0.003m (0.002m)
ADJUST N: 0.008m (0.001m) E: 0.007m (0.001m) H: -0.015m (0.001m)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6741)	
X:	-2639830.530 m	0.001 m	-2639831.415 m	0.001 m
Y:	-4253760.634 m	0.002 m	-4253759.322 m	0.002 m
Z:	3938614.254 m	0.002 m	3938614.228 m	0.002 m
LAT:	38 22 49.19452	0.001 m	38 22 49.20691	0.001 m
E LON:	238 10 36.40911	0.001 m	238 10 36.34962	0.001 m
W LON:	121 49 23.59089	0.001 m	121 49 23.65038	0.001 m
EL HGT:	-16.983 m	0.001 m	-17.508 m	0.001 m
ORTHO HGT:	14.863 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4248670.398 m	579236.868 m
EASTING (X)	602783.963 m	2015446.347 m
CONVERGENCE	0.73070178 deg	0.11145439 deg
POINT SCALE	0.99973010	0.99998968
COMBINED FACTOR	0.99973276	0.99999234

US NATIONAL GRID DESIGNATOR: 10SFH0278348670 (NAD 83)

APPENDIX B – OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK: sm10 (sm10 1)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6754)	
X:	-2618513.325 m	0.001 m	-2618514.209 m	0.001 m
Y:	-4245316.972 m	0.002 m	-4245315.665 m	0.002 m
Z:	3961723.467 m	0.002 m	3961723.439 m	0.002 m
LAT:	38 38 47.11448	0.001 m	38 38 47.12692	0.001 m
E LON:	238 20 01.30834	0.001 m	238 20 01.24887	0.001 m
W LON:	121 39 58.69166	0.001 m	121 39 58.75113	0.001 m
EL HGT:	-21.329 m	0.002 m	-21.853 m	0.002 m
ORTHO HGT:	9.429 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4278384.382 m	608811.659 m
EASTING (X)	616062.043 m	2029048.568 m
CONVERGENCE	0.83300330 deg	0.21038524 deg
POINT SCALE	0.99976588	0.99994375
COMBINED FACTOR	0.99976923	0.99994710

US NATIONAL GRID DESIGNATOR: 10SFH1606278384 (NAD 83)

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MARK: ucd1 (ucd1 1)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6744)	
X:	-2628825.708 m	0.001 m	-2628826.591 m	0.001 m
Y:	-4247933.423 m	0.002 m	-4247932.114 m	0.002 m
Z:	3952176.600 m	0.002 m	3952176.573 m	0.002 m
LAT:	38 32 10.44989	0.001 m	38 32 10.46230	0.001 m
E LON:	238 14 55.62017	0.001 m	238 14 55.56071	0.001 m
W LON:	121 45 04.37983	0.001 m	121 45 04.43929	0.001 m
EL HGT:	0.014 m	0.001 m	-0.510 m	0.001 m
ORTHO HGT:	31.276 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4266053.262 m	596557.268 m
EASTING (X)	608838.628 m	2021690.295 m
CONVERGENCE	0.77808018 deg	0.15685004 deg
POINT SCALE	0.99974588	0.99996018
COMBINED FACTOR	0.99974588	0.99996018

US NATIONAL GRID DESIGNATOR: 10SFH0883866053 (NAD 83)

APPENDIX C - MINIMALLY-CONSTRAINED GPS ADJUSTMENT REPORT

Project Information		**Coordinate System**	
Name:	C:\Projects\1037-001 \1037-001-201409.vce	Name:	US State Plane 1983
Size:	902 KB	Datum:	NAD 1983 (Conus)
Modified:	9/7/2014 5:44:03 PM (UTC:-7)	Zone:	California Zone 2 0402
Time zone:	Pacific Standard Time	Geoid:	GEOID12A
Reference number:		Vertical datum:	
Description:			

Network Adjustment Report

Adjustment Settings

Set-Up Errors

GNSS

Error in Height of Antenna: 0.000 m

Centering Error: 0.000 m

Covariance Display

Horizontal:

Propagated Linear Error [E]: U.S.

Constant Term [C]: 0.000 m

Scale on Linear Error [S]: 1.960

Three-Dimensional

Propagated Linear Error [E]: U.S.

Constant Term [C]: 0.000 m

Scale on Linear Error [S]: 1.960

Adjustment Statistics

Number of Iterations for Successful Adjustment: 2

Network Reference Factor: 1.00

Chi Square Test (95%): Passed

APPENDIX B – OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK: p268 (p268 a 1)
CONSTRAIN: 3-D NORMAL
ADJUST X: -0.004m (0.001m) Y: 0.015m (0.002m) Z: -0.007m (0.002m)
ADJUST N: 0.001m (0.001m) E: -0.011m (0.001m) H: -0.013m (0.001m)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6742)	
X:	-2623314.307 m	0.001 m	-2623315.190 m	0.001 m
Y:	-4256409.676 m	0.002 m	-4256408.366 m	0.002 m
Z:	3946714.191 m	0.002 m	3946714.163 m	0.002 m
LAT:	38 28 24.68109	0.001 m	38 28 24.69352	0.001 m
E LON:	238 21 12.97215	0.001 m	238 21 12.91279	0.001 m
W LON:	121 38 47.02785	0.001 m	121 38 47.08721	0.001 m
EL HGT:	-23.431 m	0.001 m	-23.958 m	0.001 m
ORTHO HGT:	7.865 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4259223.306 m	589626.265 m
EASTING (X)	618077.039 m	2030856.122 m
CONVERGENCE	0.84224552 deg	0.22293573 deg
POINT SCALE	0.99977170	0.99997117
COMBINED FACTOR	0.99977538	0.99997485

US NATIONAL GRID DESIGNATOR: 10SFH1807759223 (NAD 83)

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MARK: sacr (sacr a 1)
CONSTRAIN: 3-D NORMAL
ADJUST X: 0.004m (0.001m) Y: -0.018m (0.002m) Z: 0.009m (0.002m)
ADJUST N: -0.001m (0.001m) E: 0.013m (0.001m) H: 0.016m (0.002m)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6727)	
X:	-2595053.373 m	0.001 m	-2595054.254 m	0.001 m
Y:	-4259028.374 m	0.002 m	-4259027.067 m	0.002 m
Z:	3962484.552 m	0.002 m	3962484.523 m	0.002 m
LAT:	38 39 17.97126	0.001 m	38 39 17.98386	0.001 m
E LON:	238 38 44.80724	0.001 m	238 38 44.74800	0.001 m
W LON:	121 21 15.19276	0.001 m	121 21 15.25200	0.001 m
EL HGT:	7.491 m	0.002 m	6.960 m	0.002 m
ORTHO HGT:	37.958 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES UTM (Zone 10)	STATE PLANE COORDINATES SPC (0402 CA 2)
NORTHING (Y)	4279776.701 m	609909.476 m
EASTING (X)	643204.819 m	2056208.536 m
CONVERGENCE	1.02817703 deg	0.40714371 deg
POINT SCALE	0.99985254	0.99994262
COMBINED FACTOR	0.99985136	0.99994144

US NATIONAL GRID DESIGNATOR: 10SFH4320479776 (NAD 83)

ID	(Meter)	(Meter)	(Meter)	(Meter)	(Meter)	(Meter)	
1031	2025278.783	0.002	612222.692	0.002	9.603	0.012	
CAST	2031038.789	0.002	599682.330	0.003	4.670	0.015	
COD1	2029806.978	0.002	602678.863	0.002	5.965	0.013	
COY1	2026815.610	0.002	602666.297	0.002	7.865	0.011	
CR27	2026470.851	0.002	605718.258	0.002	8.521	0.019	
P268	2030854.677	0.003	589626.646	0.002	7.335	0.011	
P271	2024844.715	?	610010.534	?	12.433	?	LLh
RIVE	2037234.834	0.004	608949.583	0.004	11.464	0.026	
S16A	2030930.667	0.002	612168.968	0.002	7.933	0.013	
SM08	2030856.272	0.002	605653.314	0.002	5.959	0.010	
SM09	2034075.188	0.003	605988.111	0.003	5.125	0.017	
SM10	2029047.124	0.002	608812.032	0.002	8.913	0.008	
SM11	2028520.190	0.002	611638.181	0.002	6.534	0.013	
UCD1	2021688.853	0.002	596557.647	0.001	30.744	0.008	

Adjusted Geodetic Coordinates

Point ID	Latitude	Longitude	Height (Meter)	Height Error (Meter)	Constraint
1031	N38°40'38.15923"	W121°42'34.13964"	-21.096	0.012	
CAST	N38°33'50.79156"	W121°38'37.86615"	-26.319	0.015	
COD1	N38°35'28.12719"	W121°39'28.28263"	-24.958	0.013	

Precision Confidence Level: 95%
Degrees of Freedom: 141

Post Processed Vector Statistics

Reference Factor: 1.00
Redundancy Number: 141.00
A Priori Scalar: 1.57

Control Coordinate Comparisons

Values shown are control coordinates minus adjusted coordinates.

Point ID	ΔEasting (Meter)	ΔNorthing (Meter)	ΔElevation (Meter)	ΔHeight (Meter)
1031	0.003	0.007	?	-0.012
COD1	0.005	0.004	?	-0.028
COY1	0.003	0.004	?	-0.014
S16A	0.004	0.006	?	-0.007
SM08	0.006	0.004	?	-0.023
SM10	0.004	0.006	?	-0.008
UCD1	0.000	0.000	?	0.008

Control Point Constraints

Point ID	Type	East σ (Meter)	North σ (Meter)	Height σ (Meter)	Elevation σ (Meter)
P271	Global	Fixed	Fixed	Fixed	
Fixed = 0.000001(Meter)					

Adjusted Grid Coordinates

Point	Easting	Easting Error	Northing	Northing Error	Elevation	Elevation Error	Constraint

Error Ellipse Components

Point ID	Semi-major axis (Meter)	Semi-minor axis (Meter)	Azimuth
1031	0.003	0.002	2°
CAST	0.003	0.003	25°
COD1	0.003	0.003	46°
COY1	0.003	0.002	54°
CR27	0.003	0.003	50°
P268	0.004	0.002	85°
RIVE	0.006	0.004	50°
S16A	0.003	0.003	9°
SM08	0.003	0.002	49°
SM09	0.004	0.003	40°
SM10	0.002	0.002	29°
SM11	0.003	0.002	180°
UCD1	0.002	0.002	84°

Adjusted GPS Observations

Observation ID		Observation	A-posteriori Error	Residual	Standardized Residual
P271 --> SM10 (PV45)	Az.	106°05'53"	0.078 sec	-0.053 sec	-0.374
	ΔHt.	-3.503 m	0.008 m	-0.036 m	-4.824
	Ellip Dist.	4370.220 m	0.002 m	0.002 m	1.044
SM10 --> SM08 (PV22)	Az.	150°24'31"	0.099 sec	0.127 sec	1.269
	ΔHt.	-3.024 m	0.009 m	-0.034 m	-4.145
	Ellip Dist.	3640.323 m	0.002 m	0.001 m	0.248
SM08 --> COY1 (PV11)	Az.	233°45'00"	0.068 sec	-0.037 sec	-0.480
	ΔHt.	1.761 m	0.011 m	-0.032 m	-2.774
	Ellip Dist.	5025.113 m	0.002 m	0.003 m	1.025
SM10 --> SM08 (PV74)	Az.	150°24'31"	0.099 sec	-0.109 sec	-0.907
	ΔHt.	-3.024 m	0.009 m	0.015 m	2.002

COY1	N38°35'28.06656"	W121°41'31.89604"	-23.108	0.011	
CR27	N38°37'07.08407"	W121°41'45.72062"	-22.363	0.019	
P268	N38°28'24.69364"	W121°38'47.08739"	-23.961	0.011	
P271	N38°39'26.46021"	W121°42'52.38571"	-18.342	?	LLh
RIVE	N38°38'50.47531"	W121°34'20.12486"	-19.269	0.026	
S16A	N38°40'35.76543"	W121°38'40.31483"	-22.719	0.013	
SM08	N38°37'04.46272"	W121°38'44.44375"	-24.869	0.010	
SM09	N38°37'14.89242"	W121°36'31.32010"	-25.676	0.017	
SM10	N38°38'47.12675"	W121°39'58.75130"	-21.845	0.008	
SM11	N38°40'18.84508"	W121°40'20.12109"	-24.146	0.013	
UCD1	N38°32'10.46230"	W121°45'04.43930"	-0.518	0.008	

Adjusted ECEF Coordinates

Point ID	X (Meter)	X Error (Meter)	Y (Meter)	Y Error (Meter)	Z (Meter)	Z Error (Meter)	3D Error (Meter)	Constraint
1031	-2620587.728	0.005	-4241522.703	0.008	3964397.346	0.008	0.013	
CAST	-2619838.599	0.007	-4251192.973	0.010	3954579.934	0.009	0.015	
COD1	-2619895.892	0.006	-4248960.313	0.009	3956927.146	0.009	0.014	
COY1	-2622443.173	0.005	-4247391.683	0.008	3956926.840	0.007	0.011	
CR27	-2621727.204	0.008	-4245595.486	0.013	3959313.317	0.012	0.019	
P268	-2623315.192	0.005	-4256408.360	0.008	3946714.164	0.007	0.012	
P271	-2621690.215	?	-4242467.792	?	3962672.829	?	?	LLh
RIVE	-2611508.416	0.011	-4249555.556	0.018	3961805.692	0.017	0.027	
S16A	-2615801.329	0.006	-4244528.905	0.009	3964338.705	0.009	0.014	
SM08	-2618020.370	0.005	-4247939.245	0.007	3959248.599	0.007	0.011	
SM09	-2615172.663	0.007	-4249456.549	0.011	3959499.368	0.011	0.017	
SM10	-2618514.217	0.004	-4245315.671	0.006	3961723.440	0.005	0.009	
SM11	-2618025.447	0.006	-4243539.221	0.008	3963930.476	0.008	0.013	
UCD1	-2628826.589	0.004	-4247932.109	0.005	3952176.568	0.005	0.008	

	ΔHt.	-3.024 m	0.009 m	-0.014 m	-1.617
	Ellip Dist.	3640.323 m	0.002 m	-0.002 m	-1.329
COY1 --> CR27 (PV59)	**Az.**	353°44'57"	0.164 sec	0.004 sec	0.029
	ΔHt.	0.744 m	0.018 m	0.012 m	0.620
	Ellip Dist.	3071.527 m	0.002 m	0.003 m	1.598
P271 --> 1031 (PV55)	**Az.**	11°16'53"	0.158 sec	-0.053 sec	-0.584
	ΔHt.	-2.754 m	0.012 m	0.016 m	1.588
	Ellip Dist.	2254.475 m	0.002 m	-0.001 m	-0.381
UCD1 --> P268 (PV123)	**Az.**	127°15'11"	0.033 sec	-0.004 sec	-0.207
	ΔHt.	-23.443 m	0.009 m	0.008 m	1.587
	Ellip Dist.	11491.744 m	0.002 m	0.000 m	0.300
S16A --> RIVE (PV61)	**Az.**	117°16'36"	0.122 sec	0.156 sec	1.374
	ΔHt.	3.451 m	0.025 m	-0.025 m	-1.137
	Ellip Dist.	7079.040 m	0.003 m	-0.006 m	-1.578
P271 --> SM11 (PV44)	**Az.**	66°17'40"	0.111 sec	-0.016 sec	-0.112
	ΔHt.	-5.804 m	0.013 m	0.031 m	1.566
	Ellip Dist.	4019.980 m	0.002 m	-0.002 m	-0.650
UCD1 --> CAST (PV41)	**Az.**	71°40'41"	0.050 sec	-0.016 sec	-0.298
	ΔHt.	-25.801 m	0.015 m	0.004 m	0.209
	Ellip Dist.	9858.657 m	0.002 m	0.005 m	1.543
SM08 --> CAST (PV13)	**Az.**	178°28'21"	0.075 sec	-0.006 sec	-0.057
	ΔHt.	-1.450 m	0.014 m	-0.026 m	-1.526
	Ellip Dist.	5974.062 m	0.002 m	0.003 m	0.939
COY1 --> CR27 (PV4)	**Az.**	353°44'57"	0.164 sec	-0.143 sec	-0.655
	ΔHt.	0.744 m	0.018 m	-0.029 m	-1.482
	Ellip Dist.	3071.527 m	0.002 m	0.001 m	0.443
SM08 --> CR27 (PV10)	**Az.**	271°04'18"	0.110 sec	-0.249 sec	-1.445
	ΔHt.	2.506 m	0.018 m	-0.007 m	-0.153
	Ellip Dist.	4386.131 m	0.002 m	0.001 m	0.225
UCD1 --> COY1 (PV39)	**Az.**	40°09'45"	0.051 sec	0.008 sec	0.151
	ΔHt.	-22.590 m	0.012 m	-0.002 m	-0.147
	Ellip Dist.	7975.266 m	0.002 m	0.005 m	1.418

	Ellip Dist.	3640.323 m	0.002 m	0.003 m	2.619
P271 --> SM10 (PV46)	**Az.**	106°05'53"	0.078 sec	-0.039 sec	-0.401
	ΔHt.	-3.503 m	0.008 m	-0.022 m	-2.389
	Ellip Dist.	4370.220 m	0.002 m	0.000 m	0.025
P271 --> SM10 (PV87)	**Az.**	106°05'53"	0.078 sec	0.052 sec	0.774
	ΔHt.	-3.503 m	0.008 m	0.018 m	2.326
	Ellip Dist.	4370.220 m	0.002 m	0.001 m	0.429
SM10 --> S16A (PV19)	**Az.**	29°30'24"	0.104 sec	-0.019 sec	-0.200
	ΔHt.	-0.874 m	0.012 m	-0.022 m	-2.170
	Ellip Dist.	3849.477 m	0.002 m	0.001 m	0.548
UCD1 --> CAST (PV107)	**Az.**	71°40'41"	0.050 sec	-0.075 sec	-0.914
	ΔHt.	-25.801 m	0.015 m	0.033 m	1.287
	Ellip Dist.	9858.657 m	0.002 m	-0.006 m	-2.101
COY1 --> CAST (PV3)	**Az.**	125°26'17"	0.096 sec	-0.018 sec	-0.152
	ΔHt.	-3.211 m	0.014 m	-0.022 m	-1.334
	Ellip Dist.	5171.245 m	0.002 m	0.006 m	2.021
UCD1 --> P271 (PV97)	**Az.**	13°21'33"	0.029 sec	-0.007 sec	-0.349
	ΔHt.	-17.824 m	0.008 m	-0.009 m	-1.988
	Ellip Dist.	13818.769 m	0.001 m	0.000 m	-0.446
S16A --> 1031 (PV62)	**Az.**	270°46'07"	0.098 sec	-0.004 sec	-0.032
	ΔHt.	1.624 m	0.015 m	-0.033 m	-1.938
	Ellip Dist.	5652.479 m	0.002 m	-0.002 m	-0.696
P271 --> COY1 (PV93)	**Az.**	165°09'29"	0.059 sec	0.032 sec	0.378
	ΔHt.	-4.766 m	0.011 m	0.028 m	1.795
	Ellip Dist.	7604.498 m	0.002 m	0.000 m	-0.158
UCD1 --> COY1 (PV105)	**Az.**	40°09'45"	0.051 sec	-0.013 sec	-0.201
	ΔHt.	-22.590 m	0.012 m	0.027 m	1.735
	Ellip Dist.	7975.266 m	0.002 m	0.001 m	0.335
P268 --> CAST (PV120)	**Az.**	1°16'19"	0.057 sec	0.003 sec	0.054
	ΔHt.	-2.358 m	0.016 m	0.045 m	1.701
	Ellip Dist.	10057.739 m	0.003 m	-0.003 m	-0.666
SM10 --> SM08 (PV18)	**Az.**	150°24'31"	0.099 sec	-0.085 sec	-0.981

	Ellip Dist.	2468.373 m	0.002 m	0.000 m	0.174
COY1 --> COD1 (PV57)	**Az.**	89°57'13"	0.136 sec	-0.029 sec	-0.253
	ΔHt.	-1.851 m	0.011 m	-0.009 m	-0.962
	Ellip Dist.	2991.539 m	0.002 m	0.001 m	0.394
SM08 --> SM09 (PV15)	**Az.**	84°17'08"	0.189 sec	0.019 sec	0.142
	ΔHt.	-0.807 m	0.014 m	0.022 m	0.961
	Ellip Dist.	3236.451 m	0.003 m	0.000 m	0.156
1031 --> SM11 (PV85)	**Az.**	100°24'19"	0.152 sec	0.045 sec	0.286
	ΔHt.	-3.051 m	0.014 m	-0.011 m	-0.920
	Ellip Dist.	3293.883 m	0.002 m	0.000 m	0.104
SM08 --> COD1 (PV12)	**Az.**	199°39'17"	0.117 sec	0.077 sec	0.919
	ΔHt.	-0.089 m	0.012 m	0.002 m	0.224
	Ellip Dist.	3154.264 m	0.002 m	0.001 m	0.775
COD1 --> CAST (PV1)	**Az.**	157°52'09"	0.142 sec	-0.073 sec	-0.541
	ΔHt.	-1.361 m	0.014 m	0.008 m	0.454
	Ellip Dist.	3239.991 m	0.002 m	0.002 m	0.901
SM10 --> SM11 (PV27)	**Az.**	349°38'56"	0.129 sec	0.026 sec	0.216
	ΔHt.	-2.301 m	0.012 m	0.014 m	0.889
	Ellip Dist.	2875.019 m	0.002 m	-0.002 m	-0.731
SM08 --> CR27 (PV65)	**Az.**	271°04'18"	0.110 sec	0.001 sec	0.006
	ΔHt.	2.506 m	0.018 m	-0.017 m	-0.872
	Ellip Dist.	4386.131 m	0.002 m	-0.002 m	-0.873
SM08 --> CAST (PV68)	**Az.**	178°28'21"	0.075 sec	0.018 sec	0.212
	ΔHt.	-1.450 m	0.014 m	0.002 m	0.075
	Ellip Dist.	5974.062 m	0.002 m	-0.003 m	-0.834
1031 --> SM11 (PV30)	**Az.**	100°24'19"	0.152 sec	-0.014 sec	-0.092
	ΔHt.	-3.051 m	0.014 m	0.014 m	0.826
	Ellip Dist.	3293.883 m	0.002 m	0.000 m	-0.263
S16A --> RIVE (PV6)	**Az.**	117°16'36"	0.122 sec	-0.019 sec	-0.158
	ΔHt.	3.451 m	0.025 m	0.023 m	0.787
	Ellip Dist.	7079.040 m	0.003 m	-0.002 m	-0.817
S16A --> 1031 (PV7)	**Az.**	270°46'07"	0.098 sec	-0.008 sec	-0.061

SM09 --> RIVE (PV17)	**Az.**	47°06'04"	0.132 sec	0.046 sec	0.457
	ΔHt.	6.408 m	0.024 m	-0.007 m	-0.274
	Ellip Dist.	4330.789 m	0.004 m	0.004 m	1.389
COD1 --> CAST (PV56)	**Az.**	157°52'09"	0.142 sec	0.002 sec	0.018
	ΔHt.	-1.361 m	0.014 m	-0.017 m	-1.304
	Ellip Dist.	3239.991 m	0.002 m	-0.001 m	-0.553
COY1 --> COD1 (PV2)	**Az.**	89°57'13"	0.136 sec	-0.045 sec	-0.383
	ΔHt.	-1.851 m	0.011 m	0.013 m	1.281
	Ellip Dist.	2991.539 m	0.002 m	0.001 m	0.775
SM08 --> COD1 (PV67)	**Az.**	199°39'17"	0.117 sec	-0.079 sec	-0.702
	ΔHt.	-0.089 m	0.012 m	-0.011 m	-1.172
	Ellip Dist.	3154.264 m	0.002 m	-0.001 m	-0.642
SM10 --> SM11 (PV82)	**Az.**	349°38'56"	0.129 sec	0.036 sec	0.260
	ΔHt.	-2.301 m	0.012 m	-0.014 m	-1.135
	Ellip Dist.	2875.019 m	0.002 m	0.000 m	-0.059
S16A --> SM09 (PV16)	**Az.**	153°15'34"	0.098 sec	0.001 sec	0.010
	ΔHt.	-2.957 m	0.018 m	-0.024 m	-1.129
	Ellip Dist.	6935.160 m	0.003 m	-0.001 m	-0.472
UCD1 --> P268 (PV109)	**Az.**	127°15'11"	0.033 sec	0.002 sec	0.091
	ΔHt.	-23.443 m	0.009 m	-0.005 m	-1.077
	Ellip Dist.	11491.744 m	0.002 m	0.000 m	0.244
SM10 --> S16A (PV75)	**Az.**	29°30'24"	0.104 sec	-0.012 sec	-0.115
	ΔHt.	-0.874 m	0.012 m	0.002 m	0.171
	Ellip Dist.	3849.477 m	0.002 m	0.003 m	1.030
SM10 --> CR27 (PV77)	**Az.**	219°59'43"	0.117 sec	-0.013 sec	-0.119
	ΔHt.	-0.518 m	0.019 m	0.022 m	0.977
	Ellip Dist.	4026.212 m	0.003 m	-0.001 m	-0.399
COY1 --> CAST (PV58)	**Az.**	125°26'17"	0.096 sec	0.010 sec	0.080
	ΔHt.	-3.211 m	0.014 m	0.011 m	0.474
	Ellip Dist.	5171.245 m	0.002 m	-0.003 m	-0.970
S16A --> SM11 (PV84)	**Az.**	257°48'20"	0.191 sec	0.025 sec	0.146
	ΔHt.	-1.427 m	0.013 m	-0.011 m	-0.963

P271 --> COY1 (PV52)	Az.	165°09'29"	0.059 sec	-0.031 sec	-0.376
	ΔHt.	-4.766 m	0.011 m	0.001 m	0.099
	Ellip Dist.	7604.498 m	0.002 m	0.000 m	0.028
P271 --> CR27 (PV92)	Az.	159°25'51"	0.110 sec	0.016 sec	0.175
	ΔHt.	-4.021 m	0.019 m	0.002 m	0.131
	Ellip Dist.	4590.237 m	0.002 m	0.001 m	0.260
SM10 --> SM09 (PV73)	Az.	119°31'50"	0.120 sec	0.007 sec	0.034
	ΔHt.	-3.831 m	0.016 m	0.002 m	0.043
	Ellip Dist.	5767.112 m	0.003 m	0.001 m	0.095

Covariance Terms

From Point	To Point		Components	A-posteriori Error	Horiz. Precision (Ratio)	3D Precision (Ratio)
1031	P271	Az.	191°17'05"	0.157 sec	1 : 1057493	1 : 1057519
		ΔHt.	2.754 m	0.012 m		
		ΔElev.	2.830 m	0.012 m		
		Ellip Dist.	2254.475 m	0.002 m		
1031	S16A	Az.	90°43'41"	0.098 sec	1 : 2552733	1 : 2552187
		ΔHt.	-1.624 m	0.015 m		
		ΔElev.	-1.670 m	0.015 m		
		Ellip Dist.	5652.479 m	0.002 m		
1031	SM11	Az.	100°24'19"	0.153 sec	1 : 1653677	1 : 1651496
		ΔHt.	-3.051 m	0.014 m		
		ΔElev.	-3.069 m	0.014 m		
		Ellip Dist.	3293.883 m	0.002 m		
CAST	COD1	Az.	337°52'41"	0.142 sec	1 : 1340853	1 : 1339734
		ΔHt.	1.361 m	0.014 m		
		ΔElev.	1.294 m	0.014 m		
		Ellip Dist.	3239.991 m	0.002 m		
CAST	COY1	Az.	305°28'06"	0.096 sec	1 : 2395191	1 : 2392920
		ΔHt.	3.211 m	0.014 m		

	ΔHt.	1.624 m	0.015 m	-0.003 m	-0.119
	Ellip Dist.	5652.479 m	0.002 m	-0.002 m	-0.694
SM08 --> SM09 (PV70)	**Az.**	84°17'08"	0.189 sec	0.077 sec	0.364
	ΔHt.	-0.807 m	0.014 m	-0.001 m	-0.228
	Ellip Dist.	3236.451 m	0.003 m	0.002 m	0.693
P271 --> CR27 (PV51)	**Az.**	159°25'51"	0.110 sec	-0.014 sec	-0.067
	ΔHt.	-4.021 m	0.019 m	0.031 m	0.690
	Ellip Dist.	4590.237 m	0.002 m	0.001 m	0.213
P271 --> SM11 (PV86)	**Az.**	66°17'40"	0.111 sec	0.032 sec	0.211
	ΔHt.	-5.804 m	0.013 m	0.002 m	0.171
	Ellip Dist.	4019.980 m	0.002 m	-0.002 m	-0.657
UCD1 --> P271 (PV43)	**Az.**	13°21'33"	0.029 sec	0.004 sec	0.211
	ΔHt.	-17.824 m	0.008 m	0.003 m	0.608
	Ellip Dist.	13818.769 m	0.001 m	0.000 m	-0.437
SM08 --> COY1 (PV66)	**Az.**	233°45'00"	0.068 sec	-0.037 sec	-0.435
	ΔHt.	1.761 m	0.011 m	-0.006 m	-0.410
	Ellip Dist.	5025.113 m	0.002 m	-0.002 m	-0.583
SM09 --> RIVE (PV72)	**Az.**	47°06'04"	0.132 sec	0.047 sec	0.561
	ΔHt.	6.408 m	0.024 m	-0.005 m	-0.373
	Ellip Dist.	4330.789 m	0.004 m	-0.002 m	-0.560
S16A --> SM11 (PV29)	**Az.**	257°48'20"	0.191 sec	-0.032 sec	-0.195
	ΔHt.	-1.427 m	0.013 m	0.007 m	0.493
	Ellip Dist.	2468.373 m	0.002 m	-0.001 m	-0.382
P268 --> CAST (PV134)	**Az.**	1°16'19"	0.057 sec	0.030 sec	0.472
	ΔHt.	-2.358 m	0.016 m	-0.004 m	-0.218
	Ellip Dist.	10057.739 m	0.003 m	-0.001 m	-0.245
P271 --> 1031 (PV96)	**Az.**	11°16'53"	0.158 sec	-0.024 sec	-0.182
	ΔHt.	-2.754 m	0.012 m	-0.003 m	-0.349
	Ellip Dist.	2254.475 m	0.002 m	-0.001 m	-0.446
S16A --> SM09 (PV71)	**Az.**	153°15'34"	0.098 sec	0.091 sec	0.391
	ΔHt.	-2.957 m	0.018 m	-0.006 m	-0.122
	Ellip Dist.	6935.160 m	0.003 m	0.001 m	0.189

COY1	UCD1	**Az.**	220°11'58"	0.051 sec	1 : 3412861	1 : 3411619
		ΔHt.	22.590 m	0.012 m		
		ΔElev.	22.879 m	0.012 m		
		Ellip Dist.	7975.266 m	0.002 m		
CR27	P271	**Az.**	339°26'32"	0.110 sec	1 : 2014188	1 : 2015173
		ΔHt.	4.021 m	0.019 m		
		ΔElev.	3.912 m	0.019 m		
		Ellip Dist.	4590.237 m	0.002 m		
CR27	SM08	**Az.**	91°02'25"	0.110 sec	1 : 1837654	1 : 1839212
		ΔHt.	-2.506 m	0.018 m		
		ΔElev.	-2.562 m	0.018 m		
		Ellip Dist.	4386.131 m	0.002 m		
CR27	SM10	**Az.**	39°58'37"	0.117 sec	1 : 1578617	1 : 1578491
		ΔHt.	0.518 m	0.019 m		
		ΔElev.	0.392 m	0.019 m		
		Ellip Dist.	4026.212 m	0.003 m		
RIVE	S16A	**Az.**	297°19'18"	0.122 sec	1 : 2116031	1 : 2118405
		ΔHt.	-3.451 m	0.025 m		
		ΔElev.	-3.532 m	0.025 m		
		Ellip Dist.	7079.040 m	0.003 m		
RIVE	SM09	**Az.**	227°07'26"	0.132 sec	1 : 1055317	1 : 1054019
		ΔHt.	-6.408 m	0.024 m		
		ΔElev.	-6.339 m	0.024 m		
		Ellip Dist.	4330.789 m	0.004 m		
S16A	SM09	**Az.**	153°15'34"	0.098 sec	1 : 2574971	1 : 2573056
		ΔHt.	-2.957 m	0.018 m		
		ΔElev.	-2.807 m	0.018 m		
		Ellip Dist.	6935.160 m	0.003 m		
S16A	SM10	**Az.**	209°31'13"	0.103 sec	1 : 1726658	1 : 1727353
		ΔHt.	0.874 m	0.012 m		
		ΔElev.	0.980 m	0.012 m		
		Ellip Dist.	3849.477 m	0.002 m		
S16A	SM11	**Az.**	257°48'20"	0.191 sec	1 : 1312698	1 : 1313696
		ΔHt.	-1.427 m	0.013 m		

		ΔElev.	3.195 m	0.014 m		
		Ellip Dist.	5171.245 m	0.002 m		
CAST	P268	**Az.**	181°16'24"	0.057 sec	1 : 3773990	1 : 3772785
		ΔHt.	2.358 m	0.016 m		
		ΔElev.	2.665 m	0.016 m		
		Ellip Dist.	10057.739 m	0.003 m		
CAST	SM08	**Az.**	358°28'25"	0.075 sec	1 : 2408874	1 : 2408166
		ΔHt.	1.450 m	0.014 m		
		ΔElev.	1.289 m	0.014 m		
		Ellip Dist.	5974.062 m	0.002 m		
CAST	UCD1	**Az.**	251°44'42"	0.050 sec	1 : 4123090	1 : 4118443
		ΔHt.	25.801 m	0.015 m		
		ΔElev.	26.074 m	0.015 m		
		Ellip Dist.	9858.657 m	0.002 m		
COD1	COY1	**Az.**	269°58'30"	0.136 sec	1 : 1527228	1 : 1528903
		ΔHt.	1.851 m	0.011 m		
		ΔElev.	1.901 m	0.011 m		
		Ellip Dist.	2991.539 m	0.002 m		
COD1	SM08	**Az.**	19°38'49"	0.116 sec	1 : 1461741	1 : 1460875
		ΔHt.	0.089 m	0.012 m		
		ΔElev.	-0.006 m	0.012 m		
		Ellip Dist.	3154.264 m	0.002 m		
COY1	CR27	**Az.**	353°44'57"	0.163 sec	1 : 1317734	1 : 1317312
		ΔHt.	0.744 m	0.018 m		
		ΔElev.	0.656 m	0.018 m		
		Ellip Dist.	3071.527 m	0.002 m		
COY1	P271	**Az.**	345°10'19"	0.059 sec	1 : 4083332	1 : 4081238
		ΔHt.	4.766 m	0.011 m		
		ΔElev.	4.568 m	0.011 m		
		Ellip Dist.	7604.498 m	0.002 m		
COY1	SM08	**Az.**	53°43'15"	0.068 sec	1 : 2385709	1 : 2386218
		ΔHt.	-1.761 m	0.011 m		
		ΔElev.	-1.906 m	0.011 m		
		Ellip Dist.	5025.113 m	0.002 m		

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		ΔElev.	-1.399 m	0.013 m		
		Ellip Dist.	2468.373 m	0.002 m		
SM08	SM09	**Az.**	84°17'08"	0.189 sec	1 : 1086141	1 : 1087567
		ΔHt.	-0.807 m	0.014 m		
		ΔElev.	-0.834 m	0.014 m		
		Ellip Dist.	3236.451 m	0.003 m		
SM08	SM10	**Az.**	330°25'17"	0.099 sec	1 : 2290748	1 : 2290777
		ΔHt.	3.024 m	0.009 m		
		ΔElev.	2.954 m	0.009 m		
		Ellip Dist.	3640.323 m	0.002 m		
SM09	SM10	**Az.**	299°33'59"	0.120 sec	1 : 2173531	1 : 2175731
		ΔHt.	3.831 m	0.016 m		
		ΔElev.	3.787 m	0.016 m		
		Ellip Dist.	5767.112 m	0.003 m		
SM10	P271	**Az.**	286°07'41"	0.078 sec	1 : 2798098	1 : 2798632
		ΔHt.	3.503 m	0.008 m		
		ΔElev.	3.520 m	0.008 m		
		Ellip Dist.	4370.220 m	0.002 m		
SM10	SM11	**Az.**	349°38'56"	0.129 sec	1 : 1335421	1 : 1335663
		ΔHt.	-2.301 m	0.012 m		
		ΔElev.	-2.379 m	0.012 m		
		Ellip Dist.	2875.019 m	0.002 m		
SM11	P271	**Az.**	246°19'15"	0.111 sec	1 : 2111126	1 : 2110872
		ΔHt.	5.804 m	0.013 m		
		ΔElev.	5.899 m	0.013 m		
		Ellip Dist.	4019.980 m	0.002 m		
UCD1	P268	**Az.**	127°15'11"	0.033 sec	1 : 5969252	1 : 5977614
		ΔHt.	-23.443 m	0.009 m		
		ΔElev.	-23.409 m	0.009 m		
		Ellip Dist.	11491.744 m	0.002 m		
UCD1	P271	**Az.**	13°21'33"	0.029 sec	1 : 9593411	1 : 9578680
		ΔHt.	-17.824 m	0.008 m		
		ΔElev.	-18.311 m	0.008 m		
		Ellip Dist.	13818.769 m	0.001 m		

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Summary of Unadjusted Input Observations

Number of Entered Stations (Meters) = 10
(Elevations Marked with (*) are Ellipsoid Heights)

Partially Fixed	N StdErr	E StdErr	Elev StdErr	Description
15	608777.2764 0.0100	2029032.5965 0.0100	10.8178 FREE	CONTROL
16	608797.8742	2028884.0119	10.0000	CONTROL AZ
MARK	FREE	FREE	FIXED	

Partially Fixed	Latitude N-StdErr	Longitude E-StdErr	Elev StdErr	Description
UCD1	38-32-10.449890 0.0010	121-45-04.379830 0.0010	0.0140* 0.0010	UCD1
P268	38-28-24.681090 0.0010	121-38-47.027850 0.0010	-23.4310* 0.0010	P268
P271	38-39-26.447910 0.0010	121-42-52.326100 0.0010	-17.7980* 0.0020	P271
COD1	38-35-28.114870 0.0010	121-39-28.223000 0.0010	-24.4600* 0.0020	COD1
COY1	38-35-28.054260 0.0010	121-41-31.836460 0.0010	-22.5980* 0.0020	COY1
S16A	38-40-35.753130 0.0010	121-38-40.255180 0.0010	-22.2020* 0.0020	S16A
SMO8	38-37-04.450370 0.0010	121-38-44.384080 0.0010	-24.3660* 0.0020	SMO8
SM10	38-38-47.114480 0.0010	121-39-58.691660 0.0010	-21.3290* 0.0020	SM10

Number of Measured Angle Observations (DMS) = 2

From	At	To	Angle	StdErr	t-T
16	15	EX11	0-00-01.00	4.76	-0.00
16	15	SM10	107-06-31.00	12.67	-0.02

Number of Measured Distance Observations (Meters) = 3

From	To	Distance	StdErr	HI	HT	Comb Grid	Type
15	16	121.9202	FIXED	0.000	0.000	0.9999470	S
15	EX11	89.6510	0.0031	1.524	2.121	0.9999472	S
15	SM10	37.9205	0.0030	1.524	2.121	0.9999470	S

Number of Zenith Observations (DMS) = 2

From	To	Zenith	StdErr	HI	HT
15	EX11	91-45-28.00	5.35	1.524	2.121
15	SM10	91-11-33.00	11.89	1.524	2.121

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Note: In order to effectively incorporate the trigonometric leveling data, approximate positions for the instrument and backsight stations were determined in order to provide the adjustment engine with adequate seed data. This pertains to stations 15 and 16 referenced in the adjustment report. These station were ephemeral and are not marked on the ground.

Summary of Files Used and Option Settings

Project Folder and Data Files

Project Name	1037-001-201409
Project Folder	C:\STAR
Data File List	1. 1037-001-201409.dat
	2. 1037-001-201409.gps

Project Option Settings

STAR*NET Run Mode	: Adjust with Error Propagation
Type of Adjustment	: 3D
Project Units	: Meters; DMS
Coordinate System	: Lambert NAD83; CA Zone 2 0402
Geoid Height Model	: GEOID12A-5.GHT
Longitude Sign Convention	: Positive West
Input/Output Coordinate Order	: North-East
Angle Data Station Order	: From-At-To
Distance/Vertical Data Type	: Slope/Zenith
Convergence Limit; Max Iterations	: 0.010000; 99
Default Coefficient of Refraction	: 0.070000
Create Coordinate File	: Yes
Create Geodetic Position File	: Yes
Create Ground Scale Coordinate File	: No
Create Dump File	: No
GPS Vector Standard Error Factors	: 1.9600
GPS Vector Centering (Meters)	: 0.00100
GPS Vector Transformations	: None

Company Library Instrument TCRA1102
Note: Leica TCRA1102plus Robot

Distances (Constant)	:	0.002012 Meters
Distances (PPM)	:	2.000000
Angles	:	2.000000 Seconds
Directions	:	2.000000 Seconds
Azimuths & Bearings	:	2.000000 Seconds
Zeniths	:	2.000000 Seconds
Elevation Differences (Constant)	:	0.001524 Meters
Elevation Differences (PPM)	:	0.000000
Differential Levels	:	0.002403 Meters / Km
Centering Error Instrument	:	0.001524 Meters
Centering Error Target	:	0.001524 Meters
Centering Error Vertical	:	0.001524 Meters

(V14 PostProcessed 03-SEP-2014 19:22:14.0 1037-001-201409.asc)			
COY1	2547.2854	0.0060	0.8504
COD1	-1568.6208	0.0097	-0.8142
	0.2983	0.0099	-0.9366
(V15 PostProcessed 04-SEP-2014 15:27:29.0 1037-001-201409.asc)			
COY1	2547.2770	0.0065	0.8404
COD1	-1568.6355	0.0092	-0.8049
	0.3121	0.0086	-0.9157
(V16 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)			
COY1	2604.5800	0.0133	0.9524
CAST	-3801.2848	0.0202	-0.9250
	-2346.9131	0.0184	-0.9437
(V17 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)			
COY1	2604.5616	0.0102	0.8826
CAST	-3801.2998	0.0140	-0.8777
	-2346.8893	0.0151	-0.9073
(V18 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)			
COY1	715.9736	0.0121	0.9492
CR27	1796.2033	0.0180	-0.9334
	2386.4675	0.0168	-0.9689
(V19 PostProcessed 03-SEP-2014 21:14:44.0 1037-001-201409.asc)			
COY1	715.9592	0.0102	0.8935
CR27	1796.1763	0.0196	-0.8967
	2386.4945	0.0164	-0.9413
(V20 PostProcessed 03-SEP-2014 15:05:29.0 1037-001-201409.asc)			
1031	2562.2871	0.0102	0.9425
SM11	-2016.5094	0.0153	-0.9188
	-466.8788	0.0140	-0.9408
(V21 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)			
1031	2562.2768	0.0079	0.8726
SM11	-2016.5252	0.0116	-0.8632
	-466.8624	0.0121	-0.8995
(V22 PostProcessed 04-SEP-2014 14:06:29.0 1037-001-201409.asc)			
SM10	493.8504	0.0050	0.6902
SM08	-2623.5621	0.0075	-0.7181
	-2474.8491	0.0070	-0.9094
(V23 PostProcessed 03-SEP-2014 18:54:29.0 1037-001-201409.asc)			
SM10	493.8347	0.0051	0.7938
SM08	-2623.5967	0.0086	-0.7315
	-2474.8189	0.0078	-0.7422
(V24 PostProcessed 03-SEP-2014 14:11:29.0 1037-001-201409.asc)			
SM10	493.8397	0.0060	0.8761
SM08	-2623.5852	0.0085	-0.8403
	-2474.8345	0.0078	-0.8801
(V25 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)			
SM10	3341.5544	0.0190	0.9476
SM09	-4140.8760	0.0454	-0.9398
	-2224.0729	0.0390	-0.9803
(V26 PostProcessed 03-SEP-2014 15:05:29.0 1037-001-201409.asc)			
SM10	488.7758	0.0093	0.9400
SM11	1776.4598	0.0139	-0.9163
	2207.0288	0.0128	-0.9392
(V27 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)			
SM10	488.7640	0.0078	0.8854
SM11	1776.4406	0.0111	-0.8866
	2207.0449	0.0120	-0.9117

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Number of GPS Vector Observations (Meters) = 60

From To	DeltaX DeltaY DeltaZ	StdErrX StdErrY StdErrZ	CorrelXY CorrelXZ CorrelYZ
(V1 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)			
P271	-752.9454	0.0096	0.8572
COY1	-4923.8725	0.0144	-0.8403
	-5746.0067	0.0129	-0.9366
(V2 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)			
P271	-752.9585	0.0077	0.8068
COY1	-4923.8892	0.0119	-0.7546
	-5745.9901	0.0119	-0.9140
(V3 PostProcessed 03-SEP-2014 21:14:44.0 1037-001-201409.asc)			
P271	-36.9762	0.0203	0.9595
CR27	-3127.6721	0.0414	-0.9651
	-3359.5302	0.0347	-0.9799
(V4 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)			
P271	-36.9872	0.0109	0.9386
CR27	-3127.6915	0.0178	-0.9311
	-3359.5126	0.0164	-0.9652
(V5 PostProcessed 03-SEP-2014 14:32:29.0 1037-001-201409.asc)			
P271	1102.4947	0.0069	0.9266
1031	945.1001	0.0101	-0.8967
	1724.5077	0.0090	-0.9279
(V6 PostProcessed 04-SEP-2014 19:09:29.0 1037-001-201409.asc)			
P271	1102.4868	0.0059	0.8670
1031	945.0878	0.0086	-0.8554
	1724.5196	0.0089	-0.8984
(V7 PostProcessed 04-SEP-2014 13:46:59.0 1037-001-201409.asc)			
P271	3176.0059	0.0050	0.6951
SM10	-2847.8650	0.0080	-0.7264
	-949.3992	0.0073	-0.9107
(V8 PostProcessed 03-SEP-2014 18:54:29.0 1037-001-201409.asc)			
P271	3175.9814	0.0049	0.7317
SM10	-2847.9006	0.0080	-0.6591
	-949.3669	0.0074	-0.6651
(V9 PostProcessed 03-SEP-2014 14:11:29.0 1037-001-201409.asc)			
P271	3175.9888	0.0061	0.8707
SM10	-2847.8932	0.0088	-0.8237
	-949.3755	0.0081	-0.8704
(V10 PostProcessed 03-SEP-2014 15:05:29.0 1037-001-201409.asc)			
P271	3664.7827	0.0117	0.9458
SM11	-1071.4086	0.0175	-0.9222
	1257.6282	0.0161	-0.9429
(V11 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)			
P271	3664.7711	0.0086	0.8781
SM11	-1071.4269	0.0128	-0.8669
	1257.6467	0.0133	-0.9039
(V12 PostProcessed 03-SEP-2014 23:59:44.0 1037-001-201409.asc)			
P271	-7136.3762	0.0041	0.7048
UCD1	-5464.3203	0.0058	-0.7371
	-10496.2575	0.0052	-0.8683
(V13 PostProcessed 02-SEP-2014 23:59:44.0 1037-001-201409.asc)			
P271	-7136.3806	0.0040	0.6686
UCD1	-5464.3285	0.0054	-0.7259
	-10496.2503	0.0049	-0.8473

(V42 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)			
SMO8	-4422.8140	0.0069	0.8125
COY1	547.5408	0.0108	-0.7640
	-2321.7369	0.0110	-0.9201
(V43 PostProcessed 03-SEP-2014 19:22:14.0 1037-001-201409.asc)			
SMO8	-1875.5191	0.0061	0.8700
COD1	-1021.0666	0.0098	-0.8321
	-2321.4527	0.0100	-0.9349
(V44 PostProcessed 04-SEP-2014 15:27:29.0 1037-001-201409.asc)			
SMO8	-1875.5279	0.0068	0.8490
COD1	-1021.0749	0.0096	-0.8110
	-2321.4456	0.0089	-0.9174
(V45 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)			
SMO8	-1818.2287	0.0137	0.9509
CAST	-3253.7289	0.0210	-0.9212
	-4668.6679	0.0190	-0.9414
(V46 PostProcessed 03-SEP-2014 19:18:14.0 1037-001-201409.asc)			
SMO8	-1818.2387	0.0106	0.8813
CAST	-3253.7435	0.0145	-0.8756
	-4668.6457	0.0157	-0.9062
(V47 PostProcessed 03-SEP-2014 17:11:44.0 1037-001-201409.asc)			
SMO8	2847.7158	0.0133	0.9484
SMO9	-1517.2889	0.0198	-0.9268
	250.7560	0.0184	-0.9711
(V48 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)			
SMO8	2847.7052	0.0056	0.6116
SMO9	-1517.3030	0.0080	-0.4736
	250.7710	0.0095	-0.7819
(V49 PostProcessed 03-SEP-2014 17:05:29.0 1037-001-201409.asc)			
S16A	4292.9231	0.0180	0.9434
RIVE	-5026.6381	0.0260	-0.9171
	-2533.0286	0.0243	-0.9685
(V50 PostProcessed 04-SEP-2014 21:14:44.0 1037-001-201409.asc)			
S16A	4292.9099	0.0114	0.8342
RIVE	-5026.6715	0.0230	-0.8259
	-2532.9959	0.0210	-0.9687
(V51 PostProcessed 03-SEP-2014 15:12:29.0 1037-001-201409.asc)			
S16A	-4786.4011	0.0139	0.9489
1031	3006.2012	0.0209	-0.9268
	58.6424	0.0192	-0.9429
(V52 PostProcessed 04-SEP-2014 19:21:29.0 1037-001-201409.asc)			
S16A	-4786.4137	0.0107	0.8819
1031	3006.1814	0.0146	-0.8793
	58.6612	0.0161	-0.9070
(V53 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)			
S16A	628.6664	0.0203	0.9486
SMO9	-4927.6479	0.0486	-0.9408
	-4839.3318	0.0417	-0.9807
(V54 PostProcessed 03-SEP-2014 17:11:44.0 1037-001-201409.asc)			
S16A	628.6564	0.0116	0.9211
SMO9	-4927.6607	0.0201	-0.8980
	-4839.3232	0.0186	-0.9624
(V55 PostProcessed 04-SEP-2014 19:21:29.0 1037-001-201409.asc)			
S16A	-2712.8863	0.0072	0.8236
SM10	-786.7665	0.0125	-0.7790
	-2615.2619	0.0129	-0.9360

(V28 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)			
SM10	-3212.9788	0.0139	0.9485
CR27	-279.8002	0.0206	-0.9317
	-2410.1374	0.0194	-0.9685
(V29 PostProcessed 03-SEP-2014 15:12:29.0 1037-001-201409.asc)			
SM11	2224.1149	0.0087	0.9387
S16A	-989.6889	0.0130	-0.9162
	408.2336	0.0120	-0.9374
(V30 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)			
SM11	2224.1034	0.0072	0.8861
S16A	-989.7031	0.0102	-0.8874
	408.2518	0.0110	-0.9131
(V31 PostProcessed 02-SEP-2014 23:59:44.0 1037-001-201409.asc)			
UCD1	5511.3999	0.0042	0.6963
P268	-8476.2458	0.0059	-0.7509
	-5462.4091	0.0053	-0.8662
(V32 PostProcessed 03-SEP-2014 23:59:44.0 1037-001-201409.asc)			
UCD1	5511.3951	0.0040	0.6703
P268	-8476.2542	0.0056	-0.7107
	-5462.4011	0.0050	-0.8494
(V33 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)			
UCD1	6383.4259	0.0097	0.8587
COY1	540.4438	0.0145	-0.8420
	4750.2535	0.0130	-0.9373
(V34 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)			
UCD1	6383.4106	0.0078	0.8154
COY1	540.4248	0.0123	-0.7643
	4750.2699	0.0125	-0.9217
(V35 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)			
UCD1	8988.0084	0.0149	0.9521
CAST	-3260.8461	0.0229	-0.9223
	2403.3439	0.0208	-0.9421
(V36 PostProcessed 03-SEP-2014 19:18:14.0 1037-001-201409.asc)			
UCD1	8987.9863	0.0111	0.8819
CAST	-3260.8604	0.0156	-0.8757
	2403.3619	0.0153	-0.9377
(V37 PostProcessed 03-SEP-2014 19:22:14.0 1037-001-201409.asc)			
COD1	57.2949	0.0105	0.9256
CAST	-2232.6530	0.0150	-0.9247
	-2347.2158	0.0159	-0.9419
(V38 PostProcessed 04-SEP-2014 15:27:29.0 1037-001-201409.asc)			
COD1	57.2859	0.0083	0.9145
CAST	-2232.6724	0.0126	-0.8701
	-2347.2029	0.0117	-0.8995
(V39 PostProcessed 03-SEP-2014 21:14:44.0 1037-001-201409.asc)			
SM08	-3706.8335	0.0196	0.9591
CR27	2343.7568	0.0399	-0.9646
	64.7268	0.0334	-0.9796
(V40 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)			
SM08	-3706.8425	0.0124	0.9315
CR27	2343.7488	0.0183	-0.9157
	64.7293	0.0167	-0.9674
(V41 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)			
SM08	-4422.8070	0.0086	0.8601
COY1	547.5590	0.0128	-0.8409
	-2321.7556	0.0114	-0.9342

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Adjustment Statistical Summary

Iterations	=	4
Number of Stations	=	17
Number of Observations	=	213
Number of Unknowns	=	50
Number of Redundant Obs	=	163

Observation	Count	Sum Squares of StdRes	Error Factor
Coordinates	26	21.798	1.047
Angles	2	0.000	0.000
Distances	3	0.000	0.006
Zeniths	2	0.000	0.000
GPS Deltas	180	154.960	1.061
Total	213	176.758	1.041

The Chi-Square Test at 5.00% Level Passed
Lower/Upper Bounds (0.891/1.108)

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

(V56 PostProcessed 03-SEP-2014 15:12:29.0 1037-001-201409.asc)			
S16A	-2712.8948	0.0070	0.8909
SM10	-786.7763	0.0103	-0.8603
	-2615.2551	0.0095	-0.8868
(V57 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)			
P268	3476.6114	0.0152	0.9531
CAST	5215.4185	0.0233	-0.9239
	7865.7445	0.0211	-0.9431
(V58 PostProcessed 03-SEP-2014 19:18:14.0 1037-001-201409.asc)			
P268	3476.5897	0.0119	0.8956
CAST	5215.3857	0.0169	-0.8890
	7865.7733	0.0163	-0.9442
(V59 PostProcessed 03-SEP-2014 17:11:44.0 1037-001-201409.asc)			
RIVE	-3664.2397	0.0159	0.9502
SM09	99.0115	0.0236	-0.9285
	-2306.3269	0.0220	-0.9724
(V60 PostProcessed 04-SEP-2014 21:14:44.0 1037-001-201409.asc)			
RIVE	-3664.2659	0.0095	0.8675
SM09	98.9699	0.0164	-0.8395
	-2306.2899	0.0156	-0.9609

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Convergence Angles (DMS) and Grid Factors at Stations
(Grid Azimuth = Geodetic Azimuth - Convergence)
(Elevation Factor Includes a Geoid Height Correction at Each Station))

Station	Convergence Angle	------- Factors ------- Scale	x Elevation	= Combined
UCD1	0-09-24.66	0.99996018	1.00000000	0.99996018
P268	0-13-22.57	0.99997117	1.00000368	0.99997484
P271	0-10-47.92	0.99994232	1.00000279	0.99994511
COD1	0-12-56.60	0.99995153	1.00000384	0.99995537
COY1	0-11-38.66	0.99995154	1.00000355	0.99995508
S16A	0-13-26.84	0.99993988	1.00000348	0.99994337
SM08	0-13-24.24	0.99994765	1.00000382	0.99995147
SM10	0-12-37.39	0.99994375	1.00000335	0.99994709
15	0-12-36.97	0.99994379	1.00000313	0.99994692
16	0-12-33.82	0.99994377	1.00000326	0.99994702
EX11	0-12-34.65	0.99994377	1.00000365	0.99994743
CR27	0-11-29.95	0.99994755	1.00000343	0.99995097
1031	0-10-59.42	0.99993980	1.00000323	0.99994303
SM11	0-12-23.91	0.99994047	1.00000371	0.99994418
CAST	0-13-28.38	0.99995568	1.00000405	0.99995973
SM09	0-14-48.17	0.99994724	1.00000395	0.99995119
RIVE	0-16-10.88	0.99994362	1.00000295	0.99994657
Project Averages:	0-12-37.94	0.99994786	1.00000329	0.99995115

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Adjusted Station Information

Adjusted Coordinates (Meters)

Station	N	E	Elev	Description
UCD1	596557.2693	2021690.2957	31.2765	UCD1
P268	589626.2665	2030856.1207	7.8651	P268
P271	610010.1580	2024846.1584	12.9705	P271
COD1	602678.4883	2029808.4221	6.4637	COD1
COY1	602665.9217	2026817.0537	8.3753	COY1
S16A	612168.5942	2030932.1104	8.4498	S16A
SMO8	605652.9391	2030857.7158	6.4636	SMO8
SM10	608811.6582	2029048.5679	9.4302	SM10
15	608777.2764	2029032.5965	10.8179	CONTROL
16	608793.8378	2028911.8157	10.0000	CONTROL AZ MARK
EX11	608789.4494	2028943.8232	7.4716	EX11
CR27	605717.8829	2026472.2946	9.0378	
1031	612222.3164	2025280.2267	10.1305	
SM11	611637.8060	2028521.6330	7.0497	
CAST	599681.9537	2031040.2322	5.1830	
SMO9	605987.7372	2034076.6317	5.6389	
RIVE	608949.2090	2037236.2768	11.9588	

Adjusted Positions and Ellipsoid Heights (Meters)

Station	Latitude	Longitude	Ellip Ht	Geoid Ht
UCD1	38-32-10.449924	121-45-04.379784	0.0144	-31.2621
P268	38-28-24.681149	121-38-47.027881	-23.4309	-31.2960
P271	38-39-26.447882	121-42-52.326075	-17.8044	-30.7749
COD1	38-35-28.114860	121-39-28.223014	-24.4590	-30.9227
COY1	38-35-28.054244	121-41-31.836450	-22.5974	-30.9728
S16A	38-40-35.753116	121-38-40.255181	-22.2021	-30.6520
SMO8	38-37-04.450378	121-38-44.384113	-24.3643	-30.8279
SM10	38-38-47.114446	121-39-58.691662	-21.3277	-30.7579
15	38-38-46.001294	121-39-59.357372	-19.9412	-30.7590
16	38-38-46.552748	121-40-04.349716	-20.7598	-30.7598
EX11	38-38-46.406630	121-40-03.026719	-23.2880	-30.7596
CR27	38-37-07.071749	121-41-45.661002	-21.8468	-30.8845
1031	38-40-38.146911	121-42-34.079974	-20.5680	-30.6985
SM11	38-40-18.832764	121-40-20.061430	-23.6302	-30.6799
CAST	38-33-50.779180	121-38-37.806580	-25.8065	-30.9894
SMO9	38-37-14.880094	121-36-31.260494	-25.1625	-30.8014
RIVE	38-38-50.462947	121-34-20.065279	-18.7741	-30.7330
			Average:	-30.8548

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Adjusted GPS Vector Observations (Meters)

From To	Component	Adj Value	Residual	StdErr	StdRes
(V1 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)					
P271	Delta-N	-7350.7564	0.0002	0.0037	0.1
COY1	Delta-E	1947.9035	-0.0007	0.0043	0.2
	Delta-U	-9.3378	-0.0001	0.0208	0.0
	Length	7604.4747			
(V2 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)					
P271	Delta-N	-7350.7564	0.0004	0.0040	0.1
COY1	Delta-E	1947.9035	0.0017	0.0040	0.4
	Delta-U	-9.3378	-0.0270	0.0176	1.5
	Length	7604.4747			
(V3 PostProcessed 03-SEP-2014 21:14:44.0 1037-001-201409.asc)					
P271	Delta-N	-4297.5852	-0.0005	0.0052	0.1
CR27	Delta-E	1612.7244	0.0012	0.0071	0.2
	Delta-U	-5.6979	0.0092	0.0570	0.2
	Length	4590.2234			
(V4 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)					
P271	Delta-N	-4297.5852	-0.0003	0.0033	0.1
CR27	Delta-E	1612.7244	0.0004	0.0033	0.1
	Delta-U	-5.6979	-0.0192	0.0261	0.7
	Length	4590.2234			
(V5 PostProcessed 03-SEP-2014 14:32:29.0 1037-001-201409.asc)					
P271	Delta-N	2210.9071	0.0003	0.0027	0.1
1031	Delta-E	441.0401	-0.0004	0.0022	0.2
	Delta-U	-3.1631	0.0063	0.0148	0.4
	Length	2254.4703			
(V6 PostProcessed 04-SEP-2014 19:09:29.0 1037-001-201409.asc)					
P271	Delta-N	2210.9071	0.0001	0.0028	0.0
1031	Delta-E	441.0401	-0.0001	0.0025	0.1
	Delta-U	-3.1631	-0.0126	0.0131	1.0
	Length	2254.4703			
(V7 PostProcessed 04-SEP-2014 13:46:59.0 1037-001-201409.asc)					
P271	Delta-N	-1211.7696	0.0003	0.0023	0.1
SM10	Delta-E	4198.8460	0.0014	0.0033	0.4
	Delta-U	-5.0190	-0.0029	0.0112	0.3
	Length	4370.2080			
(V8 PostProcessed 03-SEP-2014 18:54:29.0 1037-001-201409.asc)					
P271	Delta-N	-1211.7696	0.0021	0.0044	0.5
SM10	Delta-E	4198.8460	0.0035	0.0031	1.1
	Delta-U	-5.0190	-0.0567	0.0107	5.3*
	Length	4370.2080			
(V9 PostProcessed 03-SEP-2014 14:11:29.0 1037-001-201409.asc)					
P271	Delta-N	-1211.7696	0.0024	0.0031	0.8
SM10	Delta-E	4198.8460	0.0011	0.0025	0.4
	Delta-U	-5.0190	-0.0434	0.0128	3.4*
	Length	4370.2080			
(V10 PostProcessed 03-SEP-2014 15:05:29.0 1037-001-201409.asc)					
P271	Delta-N	1616.1754	0.0009	0.0042	0.2
SM11	Delta-E	3680.7745	-0.0008	0.0032	0.2
	Delta-U	-7.0918	0.0088	0.0259	0.3
	Length	4019.9719			
(V11 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)					
P271	Delta-N	1616.1754	-0.0000	0.0042	0.0
SM11	Delta-E	3680.7745	-0.0005	0.0035	0.1

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Adjusted Observations and Residuals

Adjusted Coordinate Observations (Meters)
(Stations with Partially Fixed Coordinate Components)
(Elevations Marked with (*) are Ellipsoid Heights)

Station	Component	Adj Coordinate	Residual	StdErr	StdRes
UCD1	N	596557.2693	0.0011	0.0010	1.1
	E	2021690.2957	0.0011	0.0010	1.1
	Elev	0.0144*	0.0004	0.0010	0.4
P268	N	589626.2665	0.0018	0.0010	1.8
	E	2030856.1207	-0.0008	0.0010	0.8
	Elev	-23.4309*	0.0001	0.0010	0.1
P271	N	610010.1580	-0.0008	0.0010	0.8
	E	2024846.1584	0.0006	0.0010	0.6
	Elev	-17.8044*	-0.0064	0.0020	3.2*
COD1	N	602678.4883	-0.0003	0.0010	0.3
	E	2029808.4221	-0.0003	0.0010	0.3
	Elev	-24.4590*	0.0010	0.0020	0.5
COY1	N	602665.9217	-0.0005	0.0010	0.5
	E	2026817.0537	0.0002	0.0010	0.2
	Elev	-22.5974*	0.0006	0.0020	0.3
S16A	N	612168.5942	-0.0004	0.0010	0.4
	E	2030932.1104	-0.0000	0.0010	0.0
	Elev	-22.2021*	-0.0001	0.0020	0.1
SMO8	N	605652.9391	0.0003	0.0010	0.3
	E	2030857.7158	-0.0008	0.0010	0.8
	Elev	-24.3643*	0.0017	0.0020	0.8
SM1O	N	608811.6582	-0.0010	0.0010	1.0
	E	2029048.5679	-0.0000	0.0010	0.0
	Elev	-21.3277*	0.0013	0.0020	0.7
15	N	608777.2764	0.0000	0.0100	0.0
	E	2029032.5965	0.0000	0.0100	0.0

Adjusted Measured Angle Observations (DMS)

From	At	To	Angle	Residual	StdErr	StdRes
16	15	EX11	0-00-01.00	0-00-00.00	4.76	0.0
16	15	SM1O	107-06-31.00	0-00-00.00	12.67	0.0

Adjusted Measured Distance Observations (Meters)

From	To	Distance	Residual	StdErr	StdRes
15	16	121.9202	-0.0000	FIXED	0.0
15	EX11	89.6510	0.0000	0.0031	0.0
15	SM1O	37.9206	0.0000	0.0030	0.0

Adjusted Zenith Observations (DMS)

From	To	Zenith	Residual	StdErr	StdRes
15	EX11	91-45-28.00	0-00-00.00	5.35	0.0
15	SM1O	91-11-33.00	-0-00-00.00	11.89	0.0

(V23 PostProcessed 03-SEP-2014 18:54:29.0 1037-001-201409.asc)					
SM10	Delta-N	-3165.5026	-0.0029	0.0041	0.7
SM08	Delta-E	1797.6244	-0.0008	0.0029	0.3
	Delta-U	-4.0774	-0.0471	0.0117	4.0*
	Length	3640.3127			
(V24 PostProcessed 03-SEP-2014 14:11:29.0 1037-001-201409.asc)					
SM10	Delta-N	-3165.5026	0.0015	0.0029	0.5
SM08	Delta-E	1797.6244	0.0010	0.0025	0.4
	Delta-U	-4.0774	-0.0277	0.0125	2.2
	Length	3640.3127			
(V25 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)					
SM10	Delta-N	-2842.5232	-0.0007	0.0060	0.1
SM09	Delta-E	5017.9052	0.0008	0.0100	0.1
	Delta-U	-6.4414	-0.0030	0.0617	0.0
	Length	5767.0922			
(V26 PostProcessed 03-SEP-2014 15:05:29.0 1037-001-201409.asc)					
SM10	Delta-N	2828.2165	-0.0020	0.0034	0.6
SM11	Delta-E	-516.5828	0.0005	0.0027	0.2
	Delta-U	-2.9522	0.0126	0.0206	0.6
	Length	2875.0087			
(V27 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)					
SM10	Delta-N	2828.2165	-0.0005	0.0035	0.1
SM11	Delta-E	-516.5828	0.0005	0.0031	0.2
	Delta-U	-2.9522	-0.0150	0.0175	0.9
	Length	2875.0087			
(V28 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)					
SM10	Delta-N	-3084.4557	-0.0005	0.0039	0.1
CR27	Delta-E	-2587.7428	0.0007	0.0038	0.2
	Delta-U	-1.7913	0.0220	0.0311	0.7
	Length	4026.1996			
(V29 PostProcessed 03-SEP-2014 15:12:29.0 1037-001-201409.asc)					
SM11	Delta-N	522.1173	0.0010	0.0032	0.3
S16A	Delta-E	2412.5126	-0.0005	0.0025	0.2
	Delta-U	0.9510	-0.0062	0.0192	0.3
	Length	2468.3647			
(V30 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)					
SM11	Delta-N	522.1173	-0.0019	0.0032	0.6
S16A	Delta-E	2412.5126	0.0018	0.0028	0.6
	Delta-U	0.9510	-0.0317	0.0161	2.0
	Length	2468.3647			
(V31 PostProcessed 02-SEP-2014 23:59:44.0 1037-001-201409.asc)					
UCD1	Delta-N	-6956.3437	-0.0027	0.0020	1.4
P268	Delta-E	9147.0438	0.0026	0.0026	1.0
	Delta-U	-33.7999	0.0033	0.0083	0.4
	Length	11491.7479			
(V32 PostProcessed 03-SEP-2014 23:59:44.0 1037-001-201409.asc)					
UCD1	Delta-N	-6956.3437	-0.0029	0.0020	1.5
P268	Delta-E	9147.0438	0.0023	0.0026	0.9
	Delta-U	-33.7999	-0.0093	0.0078	1.2
	Length	11491.7479			
(V33 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)					
UCD1	Delta-N	6094.8219	0.0042	0.0037	1.2
COY1	Delta-E	5143.6920	0.0017	0.0043	0.4
	Delta-U	-27.6034	0.0045	0.0210	0.2
	Length	7975.2858			

	Delta-U	-7.0918	-0.0197	0.0197	1.0
	Length	4019.9719			
(V12 PostProcessed	03-SEP-2014 23:59:44.0 1037-001-201409.asc)				
P271	Delta-N	-13443.5655	-0.0024	0.0020	1.2
UCD1	Delta-E	-3198.2322	-0.0003	0.0025	0.1
	Delta-U	2.8103	-0.0110	0.0082	1.3
	Length	13818.7608			
(V13 PostProcessed	02-SEP-2014 23:59:44.0 1037-001-201409.asc)				
P271	Delta-N	-13443.5655	-0.0022	0.0019	1.2
UCD1	Delta-E	-3198.2322	-0.0009	0.0026	0.3
	Delta-U	2.8103	-0.0228	0.0076	3.0
	Length	13818.7608			
(V14 PostProcessed	03-SEP-2014 19:22:14.0 1037-001-201409.asc)				
COY1	Delta-N	2.4283	0.0008	0.0028	0.3
COD1	Delta-E	2991.5273	0.0023	0.0028	0.8
	Delta-U	-2.5622	0.0013	0.0146	0.1
	Length	2991.5294			
(V15 PostProcessed	04-SEP-2014 15:27:29.0 1037-001-201409.asc)				
COY1	Delta-N	2.4283	0.0006	0.0028	0.2
COD1	Delta-E	2991.5273	0.0017	0.0030	0.6
	Delta-U	-2.5622	-0.0206	0.0136	1.5
	Length	2991.5294			
(V16 PostProcessed	04-SEP-2014 15:14:29.0 1037-001-201409.asc)				
COY1	Delta-N	-2998.3944	-0.0002	0.0048	0.0
CAST	Delta-E	4213.2164	-0.0018	0.0034	0.5
	Delta-U	-5.3056	0.0121	0.0299	0.4
	Length	5171.2271			
(V17 PostProcessed	03-SEP-2014 19:18:44.0 1037-001-201409.asc)				
COY1	Delta-N	-2998.3944	-0.0048	0.0046	1.0
CAST	Delta-E	4213.2164	0.0059	0.0041	1.5
	Delta-U	-5.3056	-0.0203	0.0221	0.9
	Length	5171.2271			
(V18 PostProcessed	04-SEP-2014 17:13:59.0 1037-001-201409.asc)				
COY1	Delta-N	3053.2549	0.0034	0.0033	1.0
CR27	Delta-E	-334.4359	-0.0003	0.0032	0.1
	Delta-U	0.0090	0.0187	0.0271	0.7
	Length	3071.5163			
(V19 PostProcessed	03-SEP-2014 21:14:44.0 1037-001-201409.asc)				
COY1	Delta-N	3053.2549	0.0014	0.0042	0.3
CR27	Delta-E	-334.4359	-0.0023	0.0047	0.5
	Delta-U	0.0090	-0.0220	0.0268	0.8
	Length	3071.5163			
(V20 PostProcessed	03-SEP-2014 15:05:29.0 1037-001-201409.asc)				
1031	Delta-N	-594.9093	0.0007	0.0037	0.2
SM11	Delta-E	3239.7019	0.0000	0.0029	0.0
	Delta-U	-3.9117	0.0013	0.0226	0.1
	Length	3293.8732			
(V21 PostProcessed	04-SEP-2014 19:25:29.0 1037-001-201409.asc)				
1031	Delta-N	-594.9093	-0.0003	0.0038	0.1
SM11	Delta-E	3239.7019	0.0005	0.0033	0.2
	Delta-U	-3.9117	-0.0237	0.0178	1.3
	Length	3293.8732			
(V22 PostProcessed	04-SEP-2014 14:06:29.0 1037-001-201409.asc)				
SM10	Delta-N	-3165.5026	-0.0028	0.0022	1.3
SM08	Delta-E	1797.6244	0.0040	0.0032	1.2
	Delta-U	-4.0774	0.0012	0.0107	0.1
	Length	3640.3127			

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(V45 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)					
SMO8	Delta-N	-5971.9156	0.0013	0.0051	0.3
CAST	Delta-E	159.2403	-0.0012	0.0036	0.3
	Delta-U	-4.2478	0.0094	0.0308	0.3
	Length	5974.0398			
(V46 PostProcessed 03-SEP-2014 19:18:14.0 1037-001-201409.asc)					
SMO8	Delta-N	-5971.9156	-0.0050	0.0048	1.0
CAST	Delta-E	159.2403	-0.0004	0.0043	0.1
	Delta-U	-4.2478	-0.0183	0.0230	0.8
	Length	5974.0398			
(V47 PostProcessed 03-SEP-2014 17:11:44.0 1037-001-201409.asc)					
SMO8	Delta-N	322.2540	0.0008	0.0037	0.2
SMO9	Delta-E	3220.3539	-0.0001	0.0036	0.0
	Delta-U	-1.6183	0.0299	0.0297	1.0
	Length	3236.4378			
(V48 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)					
SMO8	Delta-N	322.2540	0.0001	0.0049	0.0
SMO9	Delta-E	3220.3539	0.0016	0.0040	0.4
	Delta-U	-1.6183	0.0068	0.0121	0.6
	Length	3236.4378			
(V49 PostProcessed 03-SEP-2014 17:05:29.0 1037-001-201409.asc)					
S16A	Delta-N	-3244.2216	0.0009	0.0051	0.2
RIVE	Delta-E	6291.8603	-0.0022	0.0051	0.4
	Delta-U	-0.4987	-0.0019	0.0392	0.0
	Length	7079.0169			
(V50 PostProcessed 04-SEP-2014 21:14:44.0 1037-001-201409.asc)					
S16A	Delta-N	-3244.2216	-0.0026	0.0043	0.6
RIVE	Delta-E	6291.8603	-0.0085	0.0067	1.3
	Delta-U	-0.4987	-0.0499	0.0322	1.6
	Length	7079.0169			
(V51 PostProcessed 03-SEP-2014 15:12:29.0 1037-001-201409.asc)					
S16A	Delta-N	75.8166	-0.0014	0.0049	0.3
1031	Delta-E	-5651.9516	0.0012	0.0038	0.3
	Delta-U	-0.8673	0.0090	0.0310	0.3
	Length	5652.4602			
(V52 PostProcessed 04-SEP-2014 19:21:29.0 1037-001-201409.asc)					
S16A	Delta-N	75.8166	-0.0014	0.0049	0.3
1031	Delta-E	-5651.9516	0.0016	0.0043	0.4
	Delta-U	-0.8673	-0.0211	0.0233	0.9
	Length	5652.4602			
(V53 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)					
S16A	Delta-N	-6193.4399	-0.0027	0.0064	0.4
SMO9	Delta-E	3120.4721	-0.0020	0.0106	0.2
	Delta-U	-6.7382	-0.0112	0.0660	0.2
	Length	6935.1344			
(V54 PostProcessed 03-SEP-2014 17:11:44.0 1037-001-201409.asc)					
S16A	Delta-N	-6193.4399	0.0006	0.0041	0.2
SMO9	Delta-E	3120.4721	-0.0002	0.0041	0.0
	Delta-U	-6.7382	-0.0291	0.0292	1.0
	Length	6935.1344			
(V55 PostProcessed 04-SEP-2014 19:21:29.0 1037-001-201409.asc)					
S16A	Delta-N	-3349.7281	-0.0032	0.0038	0.8
SM10	Delta-E	-1896.7596	-0.0014	0.0038	0.4
	Delta-U	-0.2893	-0.0020	0.0186	0.1
	Length	3849.4643			

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(V34 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)					
UCD1	Delta-N	6094.8219	0.0065	0.0040	1.6
COY1	Delta-E	5143.6920	0.0047	0.0040	1.2
	Delta-U	-27.6034	-0.0246	0.0183	1.3
	Length	7975.2858			
(V35 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)					
UCD1	Delta-N	3099.1291	0.0032	0.0055	0.6
CAST	Delta-E	9358.8291	-0.0049	0.0039	1.3
	Delta-U	-33.4332	0.0121	0.0337	0.4
	Length	9858.6714			
(V36 PostProcessed 03-SEP-2014 19:18:14.0 1037-001-201409.asc)					
UCD1	Delta-N	3099.1291	0.0040	0.0040	1.0
CAST	Delta-E	9358.8291	0.0063	0.0045	1.4
	Delta-U	-33.4332	-0.0178	0.0238	0.7
	Length	9858.6714			
(V37 PostProcessed 03-SEP-2014 19:22:14.0 1037-001-201409.asc)					
COD1	Delta-N	-3001.2791	-0.0035	0.0039	0.9
CAST	Delta-E	1220.5684	0.0014	0.0034	0.4
	Delta-U	-2.1722	0.0210	0.0237	0.9
	Length	3239.9797			
(V38 PostProcessed 04-SEP-2014 15:27:29.0 1037-001-201409.asc)					
COD1	Delta-N	-3001.2791	-0.0004	0.0040	0.1
CAST	Delta-E	1220.5684	-0.0011	0.0029	0.4
	Delta-U	-2.1722	-0.0036	0.0185	0.2
	Length	3239.9797			
(V39 PostProcessed 03-SEP-2014 21:14:44.0 1037-001-201409.asc)					
SMO8	Delta-N	82.0340	-0.0054	0.0051	1.1
CR27	Delta-E	-4385.3494	-0.0023	0.0068	0.3
	Delta-U	1.0114	0.0062	0.0549	0.1
	Length	4386.1167			
(V40 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)					
SMO8	Delta-N	82.0340	-0.0001	0.0035	0.0
CR27	Delta-E	-4385.3494	0.0011	0.0038	0.3
	Delta-U	1.0114	-0.0043	0.0272	0.2
	Length	4386.1167			
(V41 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)					
SMO8	Delta-N	-2971.3896	-0.0001	0.0033	0.0
COY1	Delta-E	-4052.4597	0.0008	0.0038	0.2
	Delta-U	-0.2129	0.0006	0.0185	0.0
	Length	5025.0956			
(V42 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)					
SMO8	Delta-N	-2971.3896	-0.0027	0.0035	0.8
COY1	Delta-E	-4052.4597	-0.0028	0.0035	0.8
	Delta-U	-0.2129	-0.0261	0.0161	1.6
	Length	5025.0956			
(V43 PostProcessed 03-SEP-2014 19:22:14.0 1037-001-201409.asc)					
SMO8	Delta-N	-2970.4759	-0.0011	0.0029	0.4
COD1	Delta-E	-1060.9306	-0.0016	0.0026	0.6
	Delta-U	-0.8765	-0.0032	0.0147	0.2
	Length	3154.2513			
(V44 PostProcessed 04-SEP-2014 15:27:29.0 1037-001-201409.asc)					
SMO8	Delta-N	-2970.4759	0.0006	0.0029	0.2
COD1	Delta-E	-1060.9306	0.0016	0.0031	0.5
	Delta-U	-0.8765	-0.0168	0.0142	1.2
	Length	3154.2513			

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Adjusted Bearings (DMS) and Horizontal Distances (Meters)

(Relative Confidence of Bearing is in Seconds)

From	To	Grid Bearing	Grid Dist Grnd Dist	95% RelConfidence Brg	 Dist	 PPM
15	16	N82-11-32.53W	121.9110 121.9175	137.07	0.0000	0.3822
15	EX11	N82-11-31.54W	89.6041 89.6088	137.57	0.0075	83.9499
15	SM10	N24-54-58.45E	37.9103 37.9123	133.52	0.0070	185.6037
1031	P271	S11-06-05.39W	2254.3425 2254.4686	0.29	0.0036	1.6145
1031	S16A	S89-27-19.47E	5652.1390 5652.4599	0.14	0.0034	0.6095
1031	SM11	S79-46-40.53E	3293.6860 3293.8718	0.26	0.0035	1.0720
CAST	COD1	N22-20-47.39W	3239.8419 3239.9794	0.21	0.0037	1.1303
CAST	COY1	N54-45-22.14W	5171.0059 5171.2261	0.15	0.0034	0.6576
CAST	P268	S01-02-56.12W	10057.3726 10057.7026	0.07	0.0039	0.3829
CAST	SM08	N01-45-02.98W	5973.7742 5974.0396	0.11	0.0038	0.6324
CAST	UCD1	S71-31-14.62W	9858.2435 9858.6375	0.08	0.0034	0.3470
COD1	COY1	S89-45-33.50W	2991.3948 2991.5288	0.17	0.0024	0.8089
COD1	SM08	N19-25-52.52E	3154.1044 3154.2513	0.15	0.0025	0.7853
COY1	CR27	N06-26-41.96W	3071.3720 3071.5163	0.26	0.0037	1.2135
COY1	P271	N15-01-18.95W	7604.0933 7604.4731	0.07	0.0023	0.3024
COY1	SM08	N53-31-36.20E	5024.8605 5025.0953	0.09	0.0025	0.4882
COY1	UCD1	S40-00-19.61W	7974.9157 7975.2537	0.06	0.0025	0.3151
CR27	P271	N20-44-57.42W	4589.9831 4590.2216	0.17	0.0037	0.8041
CR27	SM08	S89-09-05.64E	4385.9021 4386.1160	0.18	0.0038	0.8756
CR27	SM10	N39-47-06.34E	4025.9943 4026.1995	0.19	0.0040	0.9924
P268	UCD1	N52-54-15.12W	11491.3510 11491.7240	0.04	0.0024	0.2103
P271	SM10	S74-04-55.91E	4369.9711 4370.2066	0.10	0.0021	0.4894
P271	SM11	N66-06-51.52E	4019.7452 4019.9677	0.17	0.0030	0.7536
P271	UCD1	S13-12-07.50W	13818.0926 13818.7493	0.03	0.0021	0.1550
RIVE	S16A	N62-56-51.72W	7078.6267 7079.0161	0.20	0.0055	0.7776
RIVE	SM09	S46-51-15.57W	4330.5511	0.22	0.0067	1.5371

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(V56	PostProcessed	03-SEP-2014	15:12:29.0	1037-001-201409.asc)		
S16A		Delta-N	-3349.7281	-0.0005	0.0034	0.1
SM10		Delta-E	-1896.7596	0.0007	0.0027	0.2
		Delta-U	-0.2893	-0.0163	0.0151	1.1
		Length	3849.4643			
(V57	PostProcessed	04-SEP-2014	15:14:29.0	1037-001-201409.asc)		
P268		Delta-N	10055.2196	0.0017	0.0055	0.3
CAST		Delta-E	223.2452	-0.0002	0.0039	0.1
		Delta-U	-10.3280	0.0278	0.0343	0.8
		Length	10057.7028			
(V58	PostProcessed	03-SEP-2014	19:18:14.0	1037-001-201409.asc)		
P268		Delta-N	10055.2196	0.0036	0.0041	0.9
CAST		Delta-E	223.2452	0.0011	0.0045	0.2
		Delta-U	-10.3280	-0.0209	0.0256	0.8
		Length	10057.7028			
(V59	PostProcessed	03-SEP-2014	17:11:44.0	1037-001-201409.asc)		
RIVE		Delta-N	-2946.7218	-0.0020	0.0043	0.5
SM09		Delta-E	-3173.7044	-0.0031	0.0043	0.7
		Delta-U	-7.8596	0.0267	0.0355	0.8
		Length	4330.7772			
(V60	PostProcessed	04-SEP-2014	21:14:44.0	1037-001-201409.asc)		
RIVE		Delta-N	-2946.7218	-0.0002	0.0037	0.0
SM09		Delta-E	-3173.7044	-0.0026	0.0043	0.6
		Delta-U	-7.8596	-0.0348	0.0239	1.5
		Length	4330.7772			

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Error Propagation

Station Coordinate Standard Deviations (Meters)

Station	N	E	Elev
UCD1	0.000718	0.000771	0.000968
P268	0.000829	0.000867	0.000984
P271	0.000703	0.000721	0.001779
COD1	0.000809	0.000802	0.001914
COY1	0.000749	0.000756	0.001882
S16A	0.000850	0.000821	0.001937
SMO8	0.000731	0.000728	0.001844
SM10	0.000728	0.000716	0.001808
15	0.004991	0.009154	0.002838
16	0.036994	0.004977	0.000000
EX11	0.028416	0.006769	0.003668
CR27	0.001499	0.001520	0.011151
1031	0.001556	0.001354	0.007579
SM11	0.001393	0.001203	0.007017
CAST	0.001463	0.001255	0.007831
SMO9	0.001940	0.001902	0.009146
RIVE	0.002461	0.002671	0.015661

Station Coordinate Error Ellipses (Meters)
Confidence Region = 95%

Station	Semi-Major Axis	Semi-Minor Axis	Azimuth of Major Axis	Elev
UCD1	0.001891	0.001754	79-43	0.001898
P268	0.002122	0.002027	84-26	0.001929
P271	0.001770	0.001715	70-44	0.003487
COD1	0.002030	0.001912	40-17	0.003751
COY1	0.001913	0.001770	48-24	0.003688
S16A	0.002085	0.002005	13-58	0.003797
SMO8	0.001832	0.001737	42-42	0.003614
SM10	0.001786	0.001747	20-55	0.003544
15	0.024477	0.007223	114-55	0.005562
16	0.091157	0.006216	173-23	0.000000
EX11	0.070845	0.009660	168-56	0.007190
CR27	0.003825	0.003559	50-39	0.021856
1031	0.003809	0.003313	179-32	0.014854
SM11	0.003412	0.002942	174-53	0.013754
CAST	0.003581	0.003072	1-43	0.015349
SMO9	0.005241	0.004095	42-39	0.017925
RIVE	0.007201	0.005213	52-34	0.030694

			4330.7724			
S16A	SM09	S26-57-53.25E	6934.7680	0.15	0.0042	0.6104
			6935.1338			
S16A	SM10	S29-17-46.82W	3849.2533	0.13	0.0025	0.6465
			3849.4642			
S16A	SM11	S77-34-53.86W	2468.2255	0.29	0.0030	1.2100
			2468.3643			
SM08	SM09	N84-03-43.34E	3236.2802	0.30	0.0047	1.4669
			3236.4377			
SM08	SM10	N29-48-06.51W	3640.1268	0.13	0.0022	0.5970
			3640.3114			
SM09	SM10	N60-40-48.16W	5766.7977	0.19	0.0043	0.7476
			5767.0909			
SM10	SM11	N10-33-41.47W	2874.8515	0.21	0.0035	1.2037
			2875.0078			

The OPUS Projects adjustment produced a SEUW of 0.500, which is in the middle of the acceptable range. The OPUS Projects adjustment report is attached as Appendix B.

Following the OPUS Projects adjustment, GPS data taken at 14 stations (including the CORS P268, P271 and UCD1) was processed in Trimble Business Center (TBC) v2.81 using precise orbits and NGS absolute antenna models. This was done primarily to produce vector data for use in a combined GPS-terrestrial adjustment using Star*Net v6.0. However, a minimally-constrained adjustment of the GPS data was performed in TBC to ensure data quality. This adjustment produced a SEUW of 1.96, indicating that the accuracy of the data is somewhat lower than predicted by the baseline processor. However, the Trimble baseline processor is known to be optimistic, and this value is acceptable for the project. (Note that the acceptable SEUW range for OPUS Projects is based on a different set of parameters and is not directly comparable to the SEUW value produced by TBC.) The minimally-constrained adjustment report is attached as Appendix C.

The adjusted positions from the OPUS Projects adjustment for the 8 stations closest to the project area were used as constraints in the Star*Net adjustment, using the standard errors for these station positions (latitude, longitude and ellipsoid height) as reported by OPUS Projects. This adjustment incorporated both GPS and terrestrial measurements, and produced a SEUW of 1.041 after scaling the GPS vector standard errors by the SEUW of the TBC adjustment (1.96).

A high-resolution hybrid geoid model (GEOID12A) produced by NGS was applied during the adjustment to produce NAVD88 orthometric heights (elevations).

The final positions from the Star*Net adjustment are shown in the tables below. Values are shown in geographic format with ellipsoid height in meters (Table C), California Coordinate System of 1983 (CCS83) meters (Table D) and CCS83 feet (Table E). The complete Star*Net adjustment report is attached as Appendix D. Note that there is no Table A or Table B so that table designations remain consistent between this report and the June report, and that Tables C, D and E do not include positions for LNC2, P267, PLSB and SACR, as these were not used in the Star*Net adjustment.

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Relative Error Ellipses (Meters)
Confidence Region = 95%

Stations From	To	Semi-Major Axis	Semi-Minor Axis	Azimuth of Major Axis	Vertical
15	16	0.081014	0.000047	7-48	0.005562
15	EX11	0.059760	0.007522	7-48	0.004557
15	SM10	0.024540	0.007036	114-55	0.004286
1031	P271	0.003658	0.003127	0-02	0.014715
1031	S16A	0.003973	0.003444	178-55	0.015068
1031	SM11	0.004163	0.003494	177-12	0.017284
CAST	COD1	0.003747	0.003223	2-13	0.015519
CAST	COY1	0.003764	0.003266	4-48	0.015591
CAST	P268	0.003852	0.003465	5-07	0.015433
CAST	SMO8	0.003782	0.003276	3-48	0.015594
CAST	UCD1	0.003752	0.003350	5-44	0.015425
COD1	COY1	0.002545	0.002289	44-36	0.005147
COD1	SMO8	0.002507	0.002280	41-18	0.005105
COY1	CR27	0.003926	0.003630	49-13	0.021921
COY1	P271	0.002457	0.002277	54-32	0.005017
COY1	SMO8	0.002456	0.002228	46-59	0.005082
COY1	UCD1	0.002539	0.002325	60-40	0.004127
CR27	P271	0.003911	0.003669	52-06	0.021986
CR27	SMO8	0.003958	0.003652	51-55	0.021996
CR27	SM10	0.004001	0.003713	47-39	0.022040
P268	UCD1	0.002540	0.002258	84-57	0.002665
P271	SM10	0.002185	0.002136	27-50	0.004761
P271	SM11	0.003456	0.002970	175-52	0.013864
P271	UCD1	0.002349	0.002109	81-59	0.003876
RIVE	S16A	0.007083	0.005049	53-13	0.030667
RIVE	SMO9	0.006669	0.004690	51-44	0.029732
S16A	SMO9	0.005229	0.004095	43-45	0.018131
S16A	SM10	0.002499	0.002356	13-38	0.005093
S16A	SM11	0.003473	0.002978	174-49	0.013871
SMO8	SMO9	0.005252	0.004060	41-40	0.017762
SMO8	SM10	0.002247	0.002160	37-10	0.004856
SMO9	SM10	0.005356	0.004249	42-15	0.018191
SM10	SM11	0.003465	0.002977	175-32	0.013910