INDIAN WELLS VALLEY GROUNDWATER AUTHORITY TECHNICAL ADVISORY COMMITTEE

Indian Wells Valley Water District 500 W. Ridgecrest Blvd. Ridgecrest, CA 93555

A G E N D A

Thursday, April 5th, 2018, Time 1:00 p.m.

In compliance with the Americans with Disabilities Act, if you are a disabled person and you need a disability-related modification or accommodation to participate in this meeting, please contact Ronald Strand at (760) 499-5002. Requests must be made as early as possible and at least one full business day before the start of the meeting. Documents and material relating to an open session agenda items that are provided to the IWVGA TAC Committee prior to a regular meeting will be available for public inspection and copying at Indian Wells Valley Water District, 500 W. Ridgecrest Blvd, Ridgecrest, CA 93555, or online at www.co.kern.ca.us/groundwater/.

Statements from the Public

The public will be allowed to address the Committee during Public Comments about subjects within the jurisdiction of the IWVGA Technical Advisory Committee and that are NOT on the agenda. No action may be taken on off-agenda items unless authorized by law. Questions posed to the Committee may be answered after the meeting or at future meeting. Dialog or extended discussion between the public and the Committee or staff will be limited in accordance with the Brown Act. The Public Comments portion of the meeting shall be limited to three (3) minutes per speaker. Each person is limited to one comment during Public Comments. Legal representatives are available for information regarding the Brown Act and will be present for comments if needed.

All remarks and questions should be addressed to the Committee as a whole and not to any individual member or staff. There will be time after each action item on the agenda to receive comments from the public. Again each speaker will be limited to three (3) minutes. Speakers should be brief and limit their comments to the specific subject being discussed. Persons will be limited to one comment per person unless directed by the Chair.

1. **CALL TO ORDER**

2. **PUBLIC COMMENTS**
   This time is reserved for the public to address the Committee about matters NOT on the agenda. No action will be taken on non-agenda items unless authorized by law. Comments are limited to three minutes per person.

3. **APPROVAL OF PREVIOUS MEETING MINUTES**
   a. March 1st TAC meeting.

4. **ADMINISTRATIVE ISSUES**
   a. TAC - Ethics Training and Form 700 Status.

5. TAC DISCUSSION OF GSP PRIORITY PROJECTS/TASKS

a. Prop 1 Grant Funding Update
b. Model Update Report (Jean Moran by phone, Attachments to Agenda – 5)
    i) Status/Schedule
    ii) Responses to Comments
    iii) Data Gaps
c. Recycled Water Opportunities – Presentation No.2 (Meeting report provided in advance)
d. Alernative/Imported Water Opportunities – Presentation No.2 (Meeting report provided in advance)
e. TAC Input - Reporting of Pumping w/o Meter (Verbal)
f. TAC Input - Identification of Potential Wells/Owners Subject to Pumping Assessment (Verbal)
g. Prop 1 Grant – Category 1 (SDAC) Project
    i) Review of RFP – Water Conservation Consultant
    ii) Contract Options (Attachments to Agenda - RFP)
h. Comments Received by WRM from TAC (Attachments to Agenda - 3)

6. FUTURE AGENDA ITEMS SCHEDULE

This time is reserved to inform the Committee of any items that are anticipated to be on the next agenda. No action may be taken unless authorized by law and public comments are limited to three minutes per person.

a. PAS Items for May
    i) Imported Water Opportunities
    ii) Recycled Water Opportunities
    iii) Data Gaps: Monitoring Wells and Aquifer Tests
    iv) Category 1: Leak Detection

7. FUTURE TAC MEETING DATES

a. First Thursday of each month at 1pm as listed.
    i) July 5th – Holiday week may change date
    ii) August 2nd, September 6th, October 4th, November 1st, December 6th

8. COMMITTEE MEMBER ANNOUNCEMENTS OR COMMENTS

9. ADJOURN

Indian Wells Valley Model Status

April 5, 2018

IWV-TAC Meeting

Modeling Schedule (T)

changes are underlined

Direct Model Item for the GSP	Start	Presentation / Submittal
Response to Comments re: Draft Model Review (Dec 2017 TAC) Water Budget (Feb 2018 TAC)	Dec 2017 Feb 2018	April TAC April TAC
IWV Basin Model: Model Update and Calibration TAC Model Workshops re: Historical & Baseline Recharge and Pumping Historical Calibration Historical Model Run and Water Budget	*Apr 2018*	 Jun 2018 wrkshp *Aug 2018 wrkshp* Sep 2018 TAC mtg
MODEL: Baseline through 2070 Baseline Model Assumptions and Water Budget Baseline Model Run and Water Budget	Sep 2018	 Oct 2018 TAC mtg Dec 2018 TAC mtg
MODEL: (4) Sustainable Management Alternatives through 2070 Monthly TAC discussion of Model Alternatives and Model Results	Nov 2018	Feb 2019
MODEL: Transport and Land Subsidence Analysis	Feb 2019	May 2019

Response to Comments Matrix re: Review of Indian Wells Valley Groundwater Basin Model Review

This response to comments matrix refers to:

Document: *Draft Review of the Indian Wells Valley Groundwater Basin Model*, December 6, 2017 by Stetson Engineers Inc.

Presentation *Indian Wells Valley Numerical Groundwater Model Review* presented at December 6, 2017 IWV-TAC meeting

Commenters: Indian Wells Valley Technical Advisory Committee (IWV-TAC) members

#	Comment	Response
A. Earl Wilson (Received 12/22/2017)		
1	Not clear if this study is in support of a "Conceptual" or a "Flow" model.	This review is of the numerical flow model.
2	DWR acceptance of the PEST (Parameter Estimation) software (Doherty and Hunt, 2010) as opposed to "MODFLOW" the traditionally accepted standard for this type of modeling.	DRI uses USGS's MODFLOW code for the flow model. The PEST software was used as a calibration tool for the MODFLOW code.
3	Not clear how the base line data is being normalized w/o actual data 1922 thru 1940 -`50s.	We will ask DRI to clarify this when they are under contract.
4	Not clear how variability in historical climate is being determined.	The historical climate was simulated as average annual natural recharge (constant 7,665 AF each year). Model calibration and scenarios simulated for the GSP will incorporate seasonal natural recharge that is varied by hydrologic condition to meet GSP requirements.
5	Figure 9. Calibrated hydraulic conductivity field (layers 1 – 3). There are 5 layers shown.	Figure 9 shows the hydraulic conductivity (K) distribution in the top three layers. There are 5 K values shown in the legend. For clarification, there are 6 layers (Figure 19 (DRI, 2016) and Page 5 (DRI, 2017). Layers 4, 5, and 6 have the same K values. The K values for the lower three layers were 0.03 feet/day in El Paso Valley, and 1 feet/day in Indian Wells Valley (DRI, 2017, page 5).
6	Appendix A – "Y" values should be consistent in feet elevation on all the graphs i.e. 10ft/tick marks. Least Square (R2) should be shown individually on each graph. Aquifer screening would be helpful information. Missing data for DTW after 2010 in some graphs. Are these wells in "OFF" status, abandoned or just not monitored?	These graphs were constructed with available data. We will need to check the data gaps in time series to see why some of the data stops at 2010. The target measured groundwater level data will be updated for the GSP modeling effort. We will request DRI to reformat model output for the GSP calibration and scenarios to have consistent x- and y-axis, calibration statistics, and well perforation intervals.

#	Comment	Response
B. Don Decker (Received 12/18/2017)		
1	The suggested modeling changes/improvements on page 3 of ref 1 [Stetson's Draft Model Review] are appropriate and useful to the GSP but are incomplete in several critical aspects. a) The modeled basin water balance has an incomplete out-of-date basis. The recent modeling improvements do not revise the estimated playa discharge which is undoubtedly substantially lower at present than earlier much wetter climate estimates. It is essential that the DRI model incorporate modern day playa characteristics. Hopefully the next DRI iteration could incorporate an onsite evaluation using modern geophysical methods. b) An additional omission in virtually all recent modeling is the discovery reported in the AB303 Final Report (ref 6 [*Installation and Implementation of a Comprehensive Groundwater Monitoring Program for the IWV*]) that groundwater in virtually all of the basin storage is Pleistocene in age. This documented discovery clearly has a huge implication for estimates of recharge. c) Poor quality water underlies much of the North Brown Rd sub basin. Other areas including the south Brown Rd sub basin (sometimes called the southwest) have poor water either below or adjacent to existing production areas. It is very important to realize that even in many valley wells with good water production, zones of poor water occur as is disclosed in those wells for which elogs are available. This poor water can and is already limiting the available higher quality groundwater being pumped in some areas. These circumstances will not impact present flow modeling but will certainly have a strong impact on calculations related to quantities of potable water in storage. See reference 7 for more detail (BoR wells 2, NR 1 and 2 [BoR, 1993; *IWV Groundwater Report vol II]*).	We will ask DRI to reconsider the estimated playa evapotranspiration discharge, groundwater isotopic age, and poor/high groundwater quality distribution as they revise and recalibrate the flow model. Salinity modeling of preferred alternatives will need to incorporate the TDS distribution to correctly evaluate the available water resources within the basin. These elements will be included in determining the basin water budgets and available water resources.

#	Comment	Response
2	The first DRI model iteration released for Navy and public review (ref 4 [DRI, 2016 model report]) was based on a model optimization of groundwater level (head) rates of change in time. This optimization was quite successful in its stated purpose but resulted in large residual discrepancies in head. The second updated model release (ref 5 [DRI, 2017 draft model update]), was optimized for head and the model is now far more useful as a predictive tool both for head and its time rate of change. The second model attempts at describing the hydrological effects of the sw groundwater barrier are also a substantial improvement. However, it appears that the model still incorporates excessive "El Paso Basin" and Sierra Front recharge components.	Recharge estimates will be evaluated in the GSP model update.
3	The assumed excessive playa discharge in the DRI model is clearly evident in the systematic residual discrepancies demonstrated in Fig 11 of the latest DRI report (ref 5 [DRI, 2017 DRI draft model update). Notice the clear e-w bias in the sign and magnitude of the head residuals. There is excess water represented in the western zone and not enough in the eastern zone- especially prominent in the playa vicinity. These discrepancies will become even more pronounced as water production declines when reduced consumption requirements are implemented for sustainability. These discrepancies can be repaired by reducing the Sierra Front and El Paso sub basin recharge and reducing the playa discharge as assumed in the model. The water balance can be substantially corrected and this correction will be critical to the definition the actual sustained yield.	We will ask DRI to evaluate the east-west zonation that may be caused by too much recharge in the west and too much evapotranspiration at the playa. This topic will also be discussed at both Model Workshops.
4	For some reason, measured head from monitoring well BoR #5 (ref 7 [BoR, 1993]) is apparently being left out of the model (not shown on the map of calibration wells). This BoR well was specifically located to look at mountain front recharge, which by direct inference from water level data from this well and NR #1 and 2, is very small in the greater vicinity (ref 7). There is no evident seasonal fluctuation in the water levels of the piezometers of BoR #5. The wells showing seasonal fluctuation are wells near existing major production. The basin seasonal demands are reasonably well documented in the biannual Kern County Water Agency measured water levels. The approximately 170 wells involved are distributed in the productive and recharge areas of the basin. The Stetson review makes no reference to this 30 + year data set (ref 8 [KCWA biannual well survey]).	The database that is used for the groundwater level calibration targets will be reviewed with DRI and presented at the Model Workshop with a summary to the TAC. The historical record and seasonal pumping signature of BoR #5 will be incorporated into the model calibration.

#	Comment	Response
5	The Stetson review makes some emphasis on mountain front recharge as evidenced by surface flow from the major canyons. Except for Grapevine and Sand Canyons, there is only minimal surface flow even in the spring of wet years. The flows in Grapevine and Sand Canyons as measured by weir observations are very small except in wetter years and even then is typically no more than 1,000 af.	Noted. This will be evaluated and incorporated into the conceptual model.
6	The DRI model update is capable of sufficiently accurate head predictions to be used "as is" over most of the productive area of the basin in our present severely overdrafted mode. However, in the future when consumption is reduced to lower levels to attempt to reach sustainability, the present model is likely to show increasing residual errors as a result of excess estimated recharge and playa discharge.	See response to Decker #3 above.
7	It remains to be seen whether the ongoing USGS recharge study will provide useful new recharge/discharge estimates. This reservation comes from the admitted emphasis on surface water recharge and very little concern for subsurface components including playa discharge. Lack of familiarity with the basin is a potentially serious limitation.	Noted. The USGS Recharge study is expected to come out in May 2018. We will review it at that time.
C. Kennedy/Jenks – Eddy Teasdale (Received 12/22/2017)		
1	General Comment: The TM appears to provide a fair characterization and summary of the groundwater flow model architecture, model inputs, calibration and future use. However, the DRI model was developed specifically for NAWS and not in a transparent manner that included feedback from individual stakeholder groups within the Indian Wells Groundwater Basin during its development. For that reason, our review is limited to commenting on the TM, and we reserve further evaluation and comments as the actual model and further relevant data become available.	Noted. We are planning two ad hoc model workshops to make the historical calibration model more transparent. Summary notes will be presented at the TAC meeting following the model workshops. Sustainable management scenarios, salinity analysis, and subsidence evaluation will be presented at TAC meetings (see Plan of Action Milestones (POAM) and Potential Action Schedule (PAS)).

#	Comment	Response
2	**Stetson Recommendations** – TM Section 5 (Bullet #1): "Use the NAWS numerical groundwater flow model for development, implementation, and performance of the IWV GSP" **Kennedy/Jenks Response:** -The current model structure (i.e. grid spacing, boundary conditions) as represented in the TM appear to be defensible; however, the lithological data as presented in its current form is not physically based. Should the IWVGA elect to use the current model structure, it is imperative that results from the recent SkyTEM investigation (hydrostratigraphic analysis and water quality interpolations) and USGS recharge study be incorporated into the groundwater model. Once this detailed information has been incorporated, subsequent model calibration and verification will be necessary for both the numerical flow and transport models. -Kennedy/Jenks recommends that a modeling advisory panel, such as the TAC or a TAC ad hoc subcommittee, be developed to ensure essential technical quality, transparency and future elements for the groundwater modeling are developed through a collaborative process. Kennedy/Jenks requests to participate on such a panel and in that process. -During initial working group meetings of the modeling advisory panel, the principal modeler should conduct a hands-on workshop with the panel to demonstrate operation and modification of the model. Workshop topics should include discussion on at least the following items: Model assumptions, model components and structure, aquifer parameters, recharge parameters, water balance, discussion and definition of model calibration targets, process for evaluation of steady-state and transient calibration criteria, sensitivity and uncertainty analysis, predictive simulations These modeling advisory panel workshops, along with frequent communication and interaction throughout the project, should provide members with the knowledge and confidence needed to better understand current and future modeling efforts, which will be key to developing GSP related metrics and toward the ultimate goal of achieving sustainability in the basin.	The ad hoc Model Workshops were proposed during the February 1, 2018 TAC meeting, and committee members were volunteered at that time.

#	Comment	Response
3	**Stetson Recommendations** – TM Section 5 (Bullet #4): "Request a logistical exception for DWR model review to fulfill CCR 352.4(g) requirements" **Kennedy/Jenks Response:** The meaning and reasoning for this recommendation is not clear. We request that Stetson provide clarification. Kennedy/Jenks understands that certain data utilized in the NAWS model may be confidential; however, as part of the GSP process, the model must be transparent to all parties. To respect NAWS and other party confidentiality as appropriate, perhaps certain key elements could be redacted or protected. As detailed above, the modeling advisory panel could be tasked with developing a process to allow for confidentially, but also allowing for transparency.	The model is the property of the Navy, and they have requested that the numerical model files not be released to the public. The Navy has provided a cooperative effort to supply the needed files and meetings for Stetson's model evaluation and review.
D. Scott O'Neil (Received 12/20/2017 and 12/22/2017)		
1	I read and studied your report on the DRI model and have no detailed comments. I think your review appeared thorough and competent. I didn't quite understand where or how you got the new information on the fault structure at the mouth of El Paso area of the model. That said it seems you are able to update that section of the model. I also think we need to be fairly proactive in getting a response and plan from the Navy regarding the new work that DRI needs to do. If not pressured this could take a fairly long time as they have not budgeted nor asked DRI for a bid (cost and schedule) on the needed work. Furthermore it could take a while to get the contract mod in place. This is something the NAWS has not planned for. If you need the TAC or GA to engage, I recommend you do not procrastinate. We need to get the plan definitized and agreed to by all parties involved ASAP.	The new fault information was from field mapping by a DRI geologist. There is not a formal report at this time. The Navy is still working with contracting and plans to have DRI start the update 'soon'. However, no firm date has been given at this time. Some Prop 1 funding has been requested for DRI participation in the GSP process. We are following up with both the Navy and DWR to contract DRI to perform the modeling tasks for the GSP. We will update the TAC on the progress of DRI work at their monthly meetings.
2	Upon thinking a little more on the model assessment...I think it behooves us to fully understand the quality of the wells we use in calibrating the model. To this end, a few questions arise in my mind. Are the wells used in the calibration quality wells? Do they meet the DWP standards for such wells? Do we have a good strategy that guides us to use and value the info/data we have properly? For example is there adequate separation between wells? Are the structural characteristics of the wells such that the info/data received is trustworthy? Do we have an adequate set of monitoring wells in all areas where we need the model to be accurate? If so I'd like to understand the criteria and the methodology used to arrive at that conclusion? If not what needs to be done to correct the situation? I think this is too important of an area for us not to understand thoroughly.	Yes, the vertical and horizontal spatial distribution and quality of the monitoring well data that is used to calibrate the well is important. The database that will be used for the groundwater level calibration targets will be reviewed and a methodology to evaluate and rank the data will be developed. This approach will be presented at one of the Model Workshop with a summary to the TAC.

#	Comment	Response
E. Wade Major (Received 12/22/2017)		
1	I have only one comment for the DRI model review that is an amplification of one of your Recommendations: **5 RECOMMENDATIONS** Use the NAWS numerical groundwater model for development, implementation, and performance of the IWV GSP. • Update and re-calibrate the existing model to include the comments addressed in this review and GSP Emergency Regulations. • Review and incorporate findings from the U.S. Geological Survey Recharge Study, Salt and Nutrient Management Plan, and Brackish Water Study as these data become available. • Request a logistical exception for DWR model review to fulfill CCR §352.4(g) requirements • Collaboratively integrate NAWS/DRI model findings, recommendations, and analysis into IWVGA and IWV-TAC working groups/meetings to address the requirements for GSP development and implementation. Our focus in the Brackish Water Study is finding out, as best we can, the actual distribution of TDS both laterally and vertically so we can then run a number of different extraction feasibility scenarios. The DRI model inputs known TDS values where they are available, but then uses Control Points for where TDS concentrations are unknown. See the two JPGs attached that are extracts from the DRI report included in one of our figures. You can see from the graphics that many assumptions are made regarding TDS in the southeastern, northern, northeastern, and eastern portions of the Basin. Our group would like to see those Control Points turned into actual measurements for use in the model. We are endeavoring, within our scope of work, to try and fill some of those gaps. We would like to see the water quality module, specific to TDS, within the DRI model updated and improved on the basis of what you have suggested in your Recommendation #3.	The brackish water study will provide valuable spatial data and conceptual understanding of the TDS distribution within the basin. It promises to improve our understanding and management of the basin as we move through the next couple of years in developing the GSP. It is our intent to be collaborative with the Brackish Water Groundwater Group (BWGG) where feasible within the GSP timeline. The POAM shows salinity transport modeling for the GSP starting after the historical calibration and sustainable management scenarios (starting in February 2019). This schedule should interface well with salinity data developed by the BWGG.

#	Comment	Response
F. Stephan Bork (Received 2/28/2018)		
1	Per the discussion between you, CDR Longbottom and myself on January 4, you made it clear the following three model updates are essential for developing the GSP (from the DRAFT model review dated 12/6/2017): * Develop stress periods for two planning horizons - 20 years for achieving the sustainability goal (operating the basin within the sustainable yield), and 50 years for maintaining sustainable aquifer conditions. * Incorporate variable hydrologic conditions, and seasonal fluxes (seasonal or monthly stress periods). * Calibrate the transient model to measured groundwater levels, stream gages, rate of drawdown, and sub-regional water budget elements.	Yes, this is from page 3 of the December 6, 2017 Draft Model Review.
2	In addition to those three primary requirements, you made several other recommendations in the Attachment A review elements, in particular elements #10 (Discretization) and #11 (Hydraulic Properties). Considering the short timeframe to prepare the GSP and the extensive effort that would be required to make the additional updates, the Navy would like to know if any of those additional requirements could be considered 'required' by DWR policy or guidance or if they fall into the category of 'recommended but not essential.'	These additional recommendations for model improvements are not required by GSP Emergency Regulations. These comments provide recommendations to improve the model or identify modeling elements to consider as the model is updated, as stated in Section 2 of the December 6, 2017 Draft Model Review.

Concerns:

Not clear if this study is in support of a "Conceptual" or a "Flow" model.

DWR acceptance of the PEST (Parameter Estimation) software (Doherty and Hunt, 2010) as opposed to "MODFLOW" the traditionally accepted standard for this type of modeling.

Presentation:

Not clear how the base line data is being normalized w/o actual data 1922 thru 1940 -`50s.

Not clear how variability in historical climate is being determined.

Figure 9. Calibrated hydraulic conductivity field **(layers 1 – 3).** ***There are 5 layers shown.***

Appendix A:

"Y" values should be consistent in feet elevation on all the graphs i.e. 10ft/tick marks.

Least Square (R2) should be shown individually on each graph.

Aquifer screening would be helpful information.

Missing data for DTW after 2010 in some graphs. ***Are these wells in "OFF" status, abandoned or just not monitored?***

Earl Wilson
IWV-GA TAC Member

12/11/2017

To: Jean Moran, Stetson Engineers
From: Don Decker, IWVGA TAC member
Subj: Summary of my review of the Stetson Engineers draft analysis of the DRI Groundwater Model dated December 6, 2017
Ref: 1. Stetson Engineers draft Review of the Indian Wells Valley Groundwater Basin Model "Groundwater Resource Sustainability: Modeling Evaluation for the Naval Air Weapons Station, China Lake, CA" by the Desert Research Institute, September 2017.

2. F. Kunkel and G. H. Chase, "Geology and Ground Water in Indian Wells Valley, California", January 1969, USGS Open File Report

3. "Technical Justification for Beneficial Use Changes for Groundwater in Salt Wells Valley and Shallow Groundwater in Eastern Indian Wells Valley", Naval Air Weapons Station China Lake, California, by TriEcoTt, May 25, 2012

4. "Groundwater Resource Sustainability: Modeling Evaluation" for the Naval Air Weapons Station, China Lake, California, NAWCWD-TP-8811 by the Desert Research Institute, September 2016
5. Model Update NAWCWD-TP-8811, by the Desert Research Institute, September 2017
6. AB 303 Final Report, "Installation and Implementation of a Comprehensive Groundwater Monitoring Program for the Indian Wells Valley, California", March 2006.
7. US Bureau of Reclamation, "IWV Groundwater Report vol II", December 1993
8. Kern County Water Agency biannual IWV well survey, summarized in the KCWA Annual Water Report.

Background:

1) In addition to reviewing both the original DRI IWV Basin model (ref 4), I also reviewed the model update (ref 5) and the earlier paper by Kunkel and Chase, (ref 2) and a series of reports done for the Navy by TetraTech et al, summarized in reference 3.
2) Although the intended purpose of this note is specifically addressing ref 1, this reviewer is taking the liberty to comment on the DRI effort itself. This report is coming from a physicist with 50+ years of geophysical/geology/hydrology experience with the IWV and other desert basins.
3) I find the topics covered and the level of detail incorporated in the referenced Stetson Engineers report (ref 1) adequate to support its stated purpose in reviewing the DRI digital groundwater model (ref 3 and 4) for the purpose of supporting the development, implementation, and performance of the IWVGA Sustainability Plan. I approve the Stetson Engineers recommendations in section 5, p6, of the Stetson analysis. Subsequent comments below although critical in nature are not intended to negate this statement but rather to provide suggestions for important improvement in the DRI model.

Review:

1) The suggested modeling changes/improvements on page 3 of ref 1 are appropriate and useful to the GSP but are incomplete in several critical aspects. a) The modeled basin water balance has an incomplete out -of -date basis. The recent modeling improvements do not revise the estimated playa discharge which is undoubtedly substantially lower at present than earlier much wetter climate estimates. It is essential that the DRI model incorporate modern day playa characteristics. Hopefully the next DRI iteration could incorporate an onsite evaluation using modern geophysical methods. b) An additional omission in virtually all recent modeling is the discovery reported in the AB303 Final Report (ref 6) that groundwater in virtually all of the basin storage is Pleistocene in age. This documented discovery clearly has a huge implication for estimates of recharge. c) Poor quality water underlies much of the North Brown Rd sub basin. Other areas including the south Brown Rd sub basin (sometimes called the southwest) have poor

water either below or adjacent to existing production areas. It is very important to realize that even in many valley wells with good water production, zones of poor water occur as is disclosed in those wells for which elogs are available. This poor water can and is already limiting the available higher quality groundwater being pumped in some areas. These circumstances will not impact present flow modeling but will certainly have a strong impact on calculations related to quantities of potable water in storage. See reference 7 for more detail (BoR wells 2, NR 1 and 2).
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2) The first DRI model iteration released for Navy and public review (ref 4) was based on a model optimization of groundwater level (head) rates of change in time. This optimization was quite successful in its stated purpose but resulted in large residual discrepancies in head. The second updated model release (ref 5), was optimized for head and the model is now far more useful as a predictive tool both for head and its time rate of change. The second model attempts at describing the hydrological effects of the sw groundwater barrier are also a substantial improvement. However, it appears that the model still incorporates excessive "El Paso Basin" and Sierra Front recharge components.
3) The assumed excessive playa discharge in the DRI model is clearly evident in the systematic residual discrepancies demonstrated in Fig 11 of the latest DRI report (ref 5). Notice the clear e-w bias in the sign and magnitude of the head residuals. There is excess water represented in the western zone and not enough in the eastern zone- especially prominent in the playa vicinity. These discrepancies will become even more pronounced as water production declines when reduced consumption requirements are implemented for sustainability. These discrepancies can be repaired by reducing the Sierra Front and El Paso sub basin recharge and reducing the playa discharge as assumed in the model. The water balance can be substantially corrected and this correction will be critical to the definition the actual sustained yield.
4) For some reason, measured head from monitoring well BoR #5 (ref 7) is apparently being left out of the model (not shown on the map of calibration wells). This BoR well was specifically located to look at mountain front recharge, which by direct inference from water level data from this well and NR #1 and 2, is very small in the greater vicinity (ref 7). There is no evident seasonal fluctuation in the water levels of the piezometers of BoR #5. The wells showing seasonal fluctuation are wells near existing major production. The basin seasonal demands are reasonably well documented in the biannual Kern County Water Agency measured water levels. The approximately 170 wells involved are distributed in the productive and recharge areas of the basin. The Stetson review makes no reference to this 30 + year data set (ref 8).
5) The Stetson review makes some emphasis on mountain front recharge as evidenced by surface flow from the major canyons. Except for Grapevine and Sand Canyons, there is only minimal surface flow even in the spring of wet years. The flows in Grapevine and Sand Canyons as measured by weir observations are very small except in wetter years and even then is typically no more than 1,000 af.
6) The DRI model update is capable of sufficiently accurate head predictions to be used "as is" over most of the *productive* area of the basin in our present severely overdrafted mode. However, in the future when consumption is reduced to lower levels to attempt to reach sustainability, the present model is likely to show increasing residual errors as a result of excess estimated recharge and playa discharge.
7) It remains to be seen whether the ongoing USGS recharge study will provide useful new recharge/discharge estimates. This reservation comes from the admitted emphasis on surface water recharge and very little concern for subsurface components including playa discharge. Lack of familiarity with the basin is a potentially serious limitation.

Signed, Dr Don Decker, IWV GA TAC member

Kennedy/Jenks Consultants
Engineers & Scientists
10850 Gold Center Drive, Suite 350
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916-858-2700

22 December 2017

Jean Moran, PG, CHG
jeanm@stetsonengineers.com.

Subject:

Review of the Indian Wells Valley Groundwater Basin Model Technical Memorandum Draft, Prepared by Stetson Engineers, Inc. for Indian Wells Valley Groundwater Authority

Dear Ms. Moran:

Kennedy/Jenks has reviewed the December 6, 2017 Technical Memorandum (TM) prepared by Stetson Engineers, Inc. (Stetson) for the Indian Wells Valley Groundwater Authority (IWVGA), entitled "DRAFT Review of the Indian Wells Valley Groundwater Basin Model documented in *Groundwater Resource Sustainability: Modeling Evaluation for the Naval Air Weapons Station, China Lake, California,* by Desert Research Institute, September 2016 for Naval Air Warfare Center Weapons Division". As a member of the IWVGA Technical Advisory Committee (TAC), I am providing my comments directly to you in response to your email of December 19, 2017, with the understanding that discussion of the TM will occur in a scheduled TAC meeting in accordance with the requirements of the Brown Act.

This letter provides comments on the key components of the TM as it applies to two overreaching concepts:

1. Stetson's TM has been prepared to help the IWVGA decide whether the current model is scientifically defensible and appropriate to help support GSP development and future groundwater management decisions such as:

    a. Estimating the magnitude and extent (areally and vertically) of groundwater level changes during seasonal groundwater pumping
    b. Estimating groundwater pumping impacts
    c. Interpreting pumping impacts on shallow groundwater
    d. Interpreting potential subsidence resulting from estimated groundwater level changes
    e. Interpreting potential effects of groundwater level changes on local groundwater flow directions
    f. Estimating overall groundwater basin response to future recharge projects.

2. Stetson's TM has been prepared to develop an opinion of whether the model is capable of satisfying objectives stated in the model documentation.

General Comments on the TM

The TM appears to provide a fair characterization and summary of the groundwater flow model architecture, model inputs, calibration and future use. However, the DRI model was developed specifically for NAWS and not in a transparent manner that included feedback from individual stakeholder groups within the Indian Wells Groundwater Basin during its development. For that reason, our review is limited to commenting on the TM, and we reserve further evaluation and comments as the actual model and further relevant data become available.

Detailed discussion of Key TM Components

1 – Stetson Recommendations – TM Section 5 (Bullet #1):

"Use the NAWS numerical groundwater flow model for development, implementation, and performance of the IWV GSP"

Kennedy/Jenks Response

- The current model structure (i.e. grid spacing, boundary conditions) as represented in the TM appear to be defensible; however, the lithological data as presented in its current form is not physically based. Should the IWVGA elect to use the current model structure, it is imperative that results from the recent SkyTEM investigation (hydrostratigraphic analysis and water quality interpolations) and USGS recharge study be incorporated into the groundwater model. Once this detailed information has been incorporated, subsequent model calibration and verification will be necessary for both the numerical flow and transport models.

- Kennedy/Jenks recommends that a modeling advisory panel, such as the TAC or a TAC ad hoc subcommittee, be developed to ensure essential technical quality, transparency and future elements for the groundwater modeling are developed through a collaborative process. Kennedy/Jenks requests to participate on such a panel and in that process.

- During initial working group meetings of the modeling advisory panel, the principal modeler should conduct a hands-on workshop with the panel to demonstrate operation and modification of the model. Workshop topics should include discussion on at least the following items:

    - Model assumptions
    - Model components and structure
    - Aquifer parameters
    - Recharge parameters

- Water balance
- Discussion and definition of model calibration targets
- Process for evaluation of steady-state and transient calibration criteria
- Sensitivity and uncertainty analysis
- Predictive simulations

These modeling advisory panel workshops, along with frequent communication and interaction throughout the project, should provide members with the knowledge and confidence needed to better understand current and future modeling efforts, which will be key to developing GSP related metrics and toward the ultimate goal of achieving sustainability in the basin.

2 – Stetson Recommendations – TM Section 5 (Bullet #4):

"Request a logistical exception for DWR model review to fulfill CCR 352.4(g) requirements"

Kennedy/Jenks Response

- The meaning and reasoning for this recommendation is not clear. We request that Stetson provide clarification.
- Kennedy/Jenks understands that certain data utilized in the NAWS model may be confidential; however, as part of the GSP process, the model must be transparent to all parties. To respect NAWS and other party confidentiality as appropriate, perhaps certain key elements could be redacted or protected. As detailed above, the modeling advisory panel could be tasked with developing a process to allow for confidentially, but also allowing for transparency.

In conclusion, Kennedy/Jenks appreciates the efforts of Stetson in the developing the TM, and giving vested stakeholders an opportunity to provide comments and recommendations as stated in this correspondence. We appreciate your consideration and look forward to working with you to finalize the review of the TM and in future groundwater sustainability planning related tasks.

Very truly yours,

Eddy Teasdale, PG, CHG
Senior Hydrogeologist

From:	Jean Moran
To:	Jean Moran
Subject:	FW: TAC Model Review
Date:	Thursday, March 29, 2018 7:53:22 AM

From: Scott O'Neil <mrscottoneil@gmail.com>
Sent: Friday, December 22, 2017 6:53 AM
To: Jean Moran <jeanm@stetsonengineers.com>; Heather Steele <heathers@stetsonengineers.com>
Subject: Re: TAC Model Review

Upon thinking a little more on the model assessment...I think it behooves us to fully understand the quality fo the wells we use in calibrating the model. To this end, a few questions arise in my mind. Are the wells used in the calibration quality wells? Do they meet the DWP standards for such wells? Do we have a good strategy that guides us to use and value the info/data we have properly? For example is there adequate separation between wells? Are the structural characteristics of the wells such that the info/data received is trustworthy? Do we have an adequate set of monitoring wells in all areas where we need the model to be accurate? If so I'd like to understand the criteria and the methodology used to arrive at that conclusion? If not what needs to be done to correct the situation? I think this is too important of an area for us not to understand thoroughly. Happy Holidays! VR, Scott

On Wed, Dec 20, 2017 at 11:47 AM, Scott O'Neil <mrscottoneil@gmail.com> wrote:

> Jean, Heather, I read and studied your report on the DRI model and have no detailed comments. I think your review appeared thorough and competent. I didn't quite understand where or how you got the new information on the fault structure at the mouth of El Paso area of the model. That said it seems you are able to update that section of the model. I also think we need to be fairly proactive in getting a response and plan from the Navy regarding the new work that DRI needs to do. If not pressured this could take a fairly long time as they have not budgeted nor asked DRI for a bid (cost and schedule) on the needed work. Furthermore it could take a while to get the contract mod in place. This is something the NAWS has not planned for. If you need the TAC or GA to engage, I recommend you do not procrastinate. We need to get the plan definitized and agreed to by all parties involved ASAP. Happy holiday! Vr, Scott
>
> Scott O'Neil
> TAC member

From: Wade Major <wade.major@aquilogic.com>
Sent: Friday, December 22, 2017 8:26 AM
To: Jean Moran
Subject: Comments On Review Of DRI Model
Attachments: TDS Control Points.JPG; TDS Control Points Legend.JPG

Hi Jean,

I have only one comment for the DRI model review that is an amplification of one of your Recommendations:

5 RECOMMENDATIONS
- *Use the NAWS numerical groundwater model for development, implementation, and performance of the IWV GSP.*
- *Update and re-calibrate the existing model to include the comments addressed in this review and GSP Emergency Regulations.*
- *Review and incorporate findings from the U.S. Geological Survey Recharge Study, Salt and Nutrient Management Plan, and Brackish Water Study as these data become available.*
- *Request a logistical exception for DWR model review to fulfill CCR §352.4(g) requirements*
- *Collaboratively integrate NAWS/DRI model findings, recommendations, and analysis into IWVGA and IWV-TAC working groups/meetings to address the requirements for GSP development and implementation.*

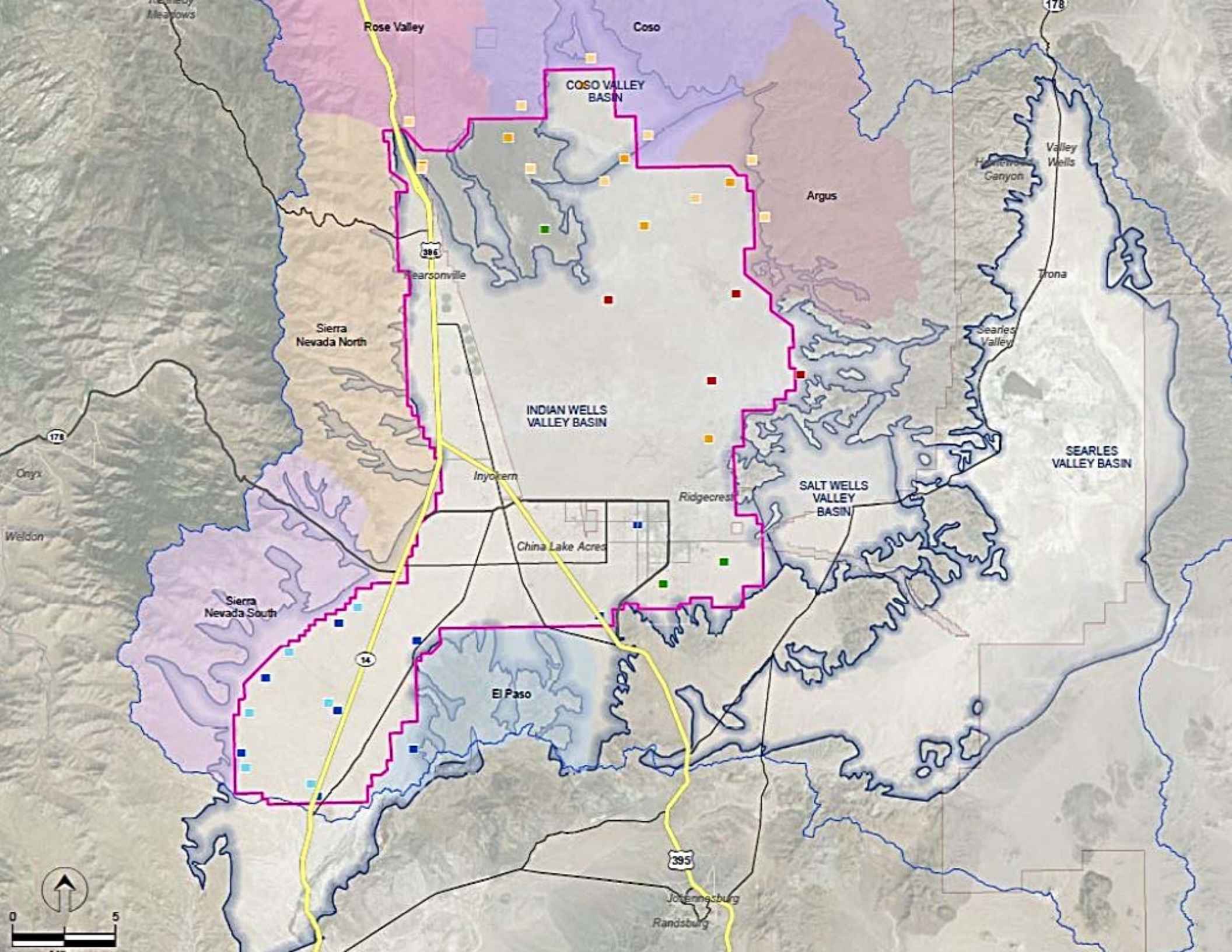
Our focus in the Brackish Water Study is finding out, as best we can, the actual distribution of TDS both laterally and vertically so we can then run a number of different extraction feasibility scenarios. The DRI model inputs known TDS values where they are available, but then uses Control Points for where TDS concentrations are unknown. See the two JPGs attached that are extracts from the DRI report included in one of our figures. You can see from the graphics that many assumptions are made regarding TDS in the southeastern, northern, northeastern, and eastern portions of the Basin. Our group would like to see those Control Points turned into actual measurements for use in the model. We are endeavoring, within our scope of work, to try and fill some of those gaps. We would like to see the water quality module, specific to TDS, within the DRI model updated and improved on the basis of what you have suggested in your Recommendation #3.

Hope this helps.

I hope you have a great holiday season!

Sincerely,
W.

Wade Major, MEng, MBA, PE
Senior Consultant
aquilogic, Inc.
Tel.: +1.714.336.2996
Email: wade.major@aquilogic.com
Web: www.aquilogic.com


Rose Valley
Coso
COSO VALLEY BASIN
Argus
Valley Wells
Trona
Searles Valley
SEARLES VALLEY BASIN
Pearsonville
386
Sierra Nevada North
INDIAN WELLS VALLEY BASIN
Inyokern
Ridgecrest
SALT WELLS VALLEY BASIN
China Lake Acres
178
Onyx
Weldon
Sierra Nevada South
14
El Paso
395
Johannesburg
Randsburg
0
5

TDS Points - Shallow (mg/L) (Round for measured value. Square for control point)

- 0 - 500
- 500 - 1,000
- 1,000 - 5,000
- > 5,000

TDS Points - Deep (mg/L) (Round for measured value. Square for control point)

- 0 - 500
- 500 - 1,000
- 1,000 - 5,000
- > 5,000

From: Jean Moran
To: Jean Moran
Subject: FW: GSP DRI/Navy Modeling
Date: Thursday, March 29, 2018 7:42:32 AM

-----Original Message-----
From: Bork, Stephan A CIV NAVFACSW, Requirements Branch <stephan.bork@navy.mil>
Sent: Wednesday, February 28, 2018 5:44 PM
To: Jean Moran <jeanm@stetsonengineers.com>
Cc: Heather Steele <heathers@stetsonengineers.com>; Longbottom, Brian J CDR NAVFAC SW, CHLK <brian.longbottom@navy.mil>; Bork, Stephan A CIV NAVFACSW, Requirements Branch <stephan.bork@navy.mil>
Subject: RE: GSP DRI/Navy Modeling

Jean,
No, I had not sent comments yet but am provided them below now.

Per the discussion between you, CDR Longbottom and myself on January 4, you made it clear the following three model updates are essential for developing the GSP (from the DRAFT model review dated 12/6/2017):

* Develop stress periods for two planning horizons - 20 years for achieving the sustainability goal (operating the basin within the sustainable yield), and 50 years for maintaining sustainable aquifer conditions.
* Incorporate variable hydrologic conditions, and seasonal fluxes (seasonal or monthly stress periods).
* Calibrate the transient model to measured groundwater levels, stream gages, rate of drawdown, and sub-regional water budget elements.

In addition to those three primary requirements, you made several other recommendations in the Attachment A review elements, in particular elements #10 (Discretization) and #11 (Hydraulic Properties). Considering the short timeframe to prepare the GSP and the extensive effort that would be required to make the additional updates, the Navy would like to know if any of those additional requirements could be considered 'required' by DWR policy or guidance or if they fall into the category of 'recommended but not essential.'

We look forward to your response.
Thank you,
Stephan

Stephan A. Bork, PG, CEG, CHG
Geologist - Water Quality Program
NAVFAC-SW
NAWS China Lake, Environmental Management Division
760-939-2167

Response to Comments Matrix re: Initial Water Budget Presentation (February 1, 2018)

This response to comments matrix refers to:

Presentation *Initial Water Budget* presented at February 1, 2018 IWV-TAC meeting

Commenters: Indian Wells Valley Technical Advisory Committee (IWV-TAC) members

#	Comment	Response
A. Don Decker (Received February 23, 2017, 3/1/2018)		
1	Here is a short bibliography of IWV Basin hydrology and geology papers that document to the comments [below]. These very important papers are in chronological order and have notes associated with each entry summarizing the important contents. [*note: this comment was presented last and was moved to first to preserve the comment numbering related to the water budget. See attached comments to review the list of 10 recommended documents*]	Thank you for compiling the list of major documents pertaining to this topic. They form the basis of the conceptual model of the Indian Wells Valley water budget, and the occurrence and movement of water within the basin.
2	There is very little mention and no data concerning Basin natural discharge in the TAC discussion on Water Balance. This is a serious omission as there can be no "balance" discussion without a careful consideration of Basin discharge.	This first discussion on the water budget was a broad overview meant to introduce terms and concepts. Yes, the natural discharge is important and was indicated by 'Playa Evaporation' and 'Phreatophyte Evapotranspiration' (ET) on the Water Budget Elements Table (slide 5). This will be further discussed as we develop the historical and sustainable management water budgets for the basin.
3	There is no mention in the TAC discussion of the DRI Flow Model Report and its Water Balance considerations. This Report has an excellent documented section on Basin Water Balance, including Playa discharge (ref 9, pp 6 to 21). It is instructive to read pp15 and 23 of this Report.	Yes, DRI did extensive analysis on the playa discharge. The volume of playa evaporation and ET will be affected by the groundwater levels within the basin.
4	There has been an essential chart missing from TAC/Stetson documentation that summarizes the *techniques* used to derive the recharge and natural discharge values specific to the studies listed. Many studies have assumed recharge values from previous studies going back decades. The similarity in numbers thus does not mean agreement in the various papers.	This needs to be further developed and will be discussed with respect to recharge assumptions at the first ad hoc model workshop.

#	Comment	Response
5	There has been no mention anywhere of the issue I brought up at the November 17'th GA meeting that the USGS "recharge" numbers do not relate directly to the water actually entering the aquifer. As you recall, Ms. Lori Flint responded to my comment quickly and agreed with my statement. The USGS study is a surface water study with a presently poorly documented correction for surface losses by evaporation and by transpiration. No evaluation or even mention of the Playa discharge is made in their work. This is a very serious omission as there is no "water balance" attempted in spite of the words being used. It is also a serious mistake not to incorporate the very latest DRI Water Balance results (ref 9 p 6 to 21).	Similar to the last comment, this needs to be further developed and will be discussed with respect to recharge assumptions at the first ad hoc model workshop. We will present simulated water budgets to the TAC as the historical model is calibrated.
6	There are very strong reasons to suspect many of the entries in the USGS recharge table, even beyond the criticism I have already offered. **A)** The recharge from the Coso volcanic area that may flow into the Basin to the south is cut by the Little Lake fault with unknown consequences. There is also no reason to suspect that the massive flows of extrusive lava in the Cosos are somehow more porous as claimed. **B)** There is no evidence for significant Argus recharge that would end up at the CL Playa. Age dating of Playa waters indicates Pleistocene age (not modern recharge water). (ref 7, fig **C)** The El Paso Basin recharge is largely cut off by the El Paso fault and the relatively stable groundwater levels in the El Paso Basin are indicative of a very low recharge into that Basin. (see BoR well 1 water level data from the KCWA). **D)** There is also no evidence from DRI flow modeling of such a recharge (ref 9 p 27). There is also no evidence of Valley floor recharge. **E)** The main Sierra front recharge is also suspect. The line of wells starting at Bureau of Reclamation well No 5 at the base of the Sierras and extending east all the way to the Playa vicinity shows no evidence of Sierra recharge flow (ref 7, Fig 3-5). at the base of the Sierras and extending east all the way to the Playa vicinity shows no evidence of Sierra recharge flow (ref 7, Fig 3-5).	Noted. We will review the final document when it comes out in May 2018 and use your comments to evaluate the results during this review.

#	Comment	Response
7	In many papers, the CL Playa natural discharge is estimated to be far larger than is commonly appreciated. Correcting the Water Balance in the DRI modeled Playa discharge will result in a stunning reduction in the quantity of sustainable groundwater (ref 9 p 23).	Noted. This comment will be passed on to DRI modeler. Also, playa discharge will be discussed during historical model calibration at the ad hoc model workshop.
8	It has been very well documented with modern isotopic age dating methods that virtually all of the groundwater we are pumping in the IWV Basin is Pleistocene in age (ref 8, p21 and following). This means simply that we are "mining" old water and that the recharge that we calculate is not evident except in the extreme NW -that area is likely receiving subsurface water from Rose Valley. This old water /recharge discrepancy must be brought to this discussion and reconciled. After having brought this up, I do not see any path to resolve the discrepancy except to admit we have very little natural recharge in modern times.	Noted. Historical isotope data will be evaluated for determining recharge rates.
9	The establishment of baseline water levels in the IWV Basin has a far stronger psychological component than technical. Water levels have continuously declined in all productive areas of the basin for 100 years. Most of the Basin water production has occurred since 1960. Well level declines have never been reversed even in the wettest years. There is no year that is identified by some characteristic that stands out. Wells have been drying out and thus failing for a very long time and the failure rate has gone up just as rates of decline have also. The baseline year to be selected is not necessarily the same as the year to which the Basin water levels will be restored. Restoration is far more complicated as many of the more seriously depleted well field areas have declined 150' and more. As an arbitrary baseline date, I suggest January 1960, since we have substantial high quality well data from that time and forward.	The trend in groundwater levels has been the reason why this basin has been assigned as overdraft. The baseline water level will need to be assigned as a reference point for development of the GSP sustainable management alternatives.
10	As interesting as they are, historic rainfall data are not as useful as it would seem. Data from stations at elevations high enough to actually produce recharge water are few and intermittent. There is little to no evidence in any well in the productive areas of the Basin for increases in water levels following wetter years. There is also no evidence that precipitation on the Valley floor can reach the groundwater. All of this is consistent with the majority of the groundwater in the productive areas of the IWV Basin being Pleistocene in age.	The cumulative departure from mean graph was used to illustrate the concepts of hydrologic conditions and balanced hydrologic periods that are used in determining water budgets. These concepts will be used in the GSP.

#	Comment	Response
B. Eddy Teasdale, Luhdorff & Scalmanini (Received 2/22/2018)		
1	*Initial Comments on Topic Number 1 – Water Budget* A methodology should be developed and agreed upon for how measurements of all groundwater extraction volumes will be calculated, recorded, stored and reported, and to whom.	Yes, this is currently being worked on at the GA board level.
2	The Cooperative Groundwater Management Group has tabulated historical groundwater pumping data back to 1975. To the extent that data is relied upon, the quality control and assurance of that data collection and calculation process should be reviewed and updated where data gaps and data overlap appear to exist, for example: o Indian Wells Valley Water District (IWVWD) (which acquired lands and/or pumping from other entities listed on the chart) o Naval Air Weapons Station – China Lake (as to conservation efforts listed in the footnotes) o Orchards, Private Wells, and various ranches where the data, as currently presented, includes overlap as described in part in the footnotes.	We will verify that DRI has the most recent pumping data and summarize the assumptions / certainty of the 'best' available data. The tentative agenda topic for the first ad hoc model workshop will be to discuss assumptions with respect to pumping data. A summary of the workshop will be presented to the TAC.
3	To account for diverse conditions and water users in the basin, discussion should occur, and decisions should be made as to the appropriateness of developing or utilizing basin management areas within the context of the water budget. o GSP Regulations define a management area as, "an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors" (Section 351). o Individual management areas must be coordinated to achieve a basin's overall sustainability goal.	Incorporating management areas is still being evaluated. This will be discussed during future TAC meetings during sustainable criteria and water budget PAS topics.

#	Comment	Response
4	Groundwater model utilization to support basin water budget. o As described in DWR's Groundwater Modeling BMP, the development and use of groundwater model in support of a GSP should promote transparency, coordination and data sharing. Greater transparency and TAC engagement is necessary to achieve "buy-in" on current groundwater modeling efforts in the Indian Wells Valley. We reiterate a previous recommendation that a TAC model review panel be established to peer-review the current groundwater flow and transport model. At the March TAC meeting, dates and times for a TAC model review panel workshop should be established, and individual workshop participants identified. Participants should also include the Desert Research Institute (DRI). I also request to be on the panel. o Develop annual change in storage volumes utilizing both analytical and numerical methodologies and evaluate the similarities and differences between the methods. o Discuss how climate models, land use and growth production will be incorporated into future model scenarios.	Two ad hoc model workshops with summary reports to the TAC were discussed at the March 1st 2018 TAC meeting. You were volunteered for the model workshops. We are currently working on the contract, costs, and schedule with DRI for presenting at and participating in these workshops and key TAC meetings. We will also provide an analytical analysis to evaluate changes in storage within the basin. Future baseline discussions are planned with the TAC that will include the assumptions for projected changes in land use and population. We will also discuss regional climate change projections that have been estimated for different areas within California.
C. Tim Parker, Parker Groundwater (Received 2/22/2018)		
1	The Water Budget terms used in the DWR BMP should be applied to the WRM Water Budget – for example, 'infiltration from precipitation, applied water" ETC.	Noted, we will be consistent with DWR terms.
2	The Water budget "shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions"	This will be developed through the GSP modeling process and be included into the water budget presentations as model simulations are reviewed by the TAC.
3	A diagram should accompany the Water Budget Elements for illustration purposes	Diagrams help illustrate the water budget and changes in storage. This will be developed as we get further along into quantifying the water budget.
4	There should be both analytical and numerical approaches to the water budget estimate	We will also provide an analytical analysis to estimate the water budget and evaluate changes in storage within the basin.

#	Comment	Response
5	Recharge should be based on the best available information and science – which based on the literature and recent work should turn out to be the USGS Recharge Study using the Basin Characterization Model – uncertainty should be applied to bracket final results – additionally, a careful assessment of the assumptions that went into the BCM should be conducted and used to qualify the results as necessary and appropriate.	Agreed. We plan to evaluate the USGS Recharge Study when it becomes available in May 2018.
6	For the numerical model, uncertainty analysis should be incorporated	Yes, uncertainty analysis will be incorporated for the modeling analysis.
7	Water budget elements – it would be helpful in terms of process and understanding of uncertainty, to begin to identify data gaps and level of uncertainty in the list of Water budget Elements, and what is needed to fill those data gaps – for example, what is the level of uncertainty for estimation of precipitation basinwide. Should basinwide precipitation be used instead of the NOAA station in the unnumbered slide "Water Year Type, Hydrologic Periods"? i.e., is this appropriate for the baseline? What is being used in the USGS Recharge Study for precipitation? And what is being used for the Baseline Model for precipitation?	Uncertainty of different water budget terms will be discussed for the GSP.
8	Cumulative departure from mean can be misleading and should be qualified in narrative terms	It will be qualified for the GSP in determining the 'balanced' hydrologic period for the future baseline and management scenarios.

#	Comment	Response
D. Scott O'Neil (Received 2/23/2018)		
1	…. I will be very interested in our efforts to determine the quality and adequacy of the data we are going to use to calibrate the model that will be used to assess the state of our basin and its future viability. Personally, I think many of the wells we have data on are inadequate for this purpose and I also generally think that we have gaps in this data, particularly in the west and souths sides of the basin. I think we may have to find the means to bolster this database (i.e., drill some more monitoring wells). We need to be careful to ensure that the data we use is unreliable...not influenced by recent pumping activity, etc. The analysis to determine the quality and adequacy of our data is a critical task and it needs to be accomplished with a "fresh set of eyes" (i.e., underpinned by a critical assessment of the data we have and unbiased by old paradigms and/or conclusions). Any gaps or weaknesses in our database need to be identified with recommendation made to mitigate these gaps.	The uncertainty in the data will be described in the GSP. The existing data is a starting point. A monitoring program will be developed to address data needs and collection for sustainably managing the IWV basin through the GSP process. It is expected that the distribution and quality of monitored data will be improved as the GSP review process proceeds through SIGMA's reporting/review process.
2	I think the water budget elements as proposed are good.	The budget will be refined as we move forward with the modeling task.

Comments and Recommendations for the GA TAC Water Balance Discussion

From Dr. Don Decker 3/1/2018

Summary comments:

1. **The IWV Basin, California 6-54, is without any doubt in CRITICAL OVERDRAFT**. The unambiguous evidence for this fact comes from the consistent steady decline in water levels in all *productive* areas of the Basin over a period of many decades. **The loss of water in storage that this decline indicates is the very definition of overdraft.** The long- term steady declines emphasize the critical nature of this loss. (ref 6, p ES 1))

   The first serious attempt to bring imported water into the Basin was in the 1919 time period. If we assume the modern Basin recharge is 7600 ac-ft/yr, the sustainability shortfall with present day pumping is about 20,000 ac-ft/yr. However, there is incontrovertible evidence that we are pumping (mining) "fossil" water almost everywhere in the Basin. (ref 8, p21 and following, ref 7 Fig 2-3) This means that the shortfall is even greater than 20,000 ac-ft/yr. **An accurate shortfall calculation would come as a result of an iterative, carefully optimized basin flow model that by its nature incorporates a water balance component.**
2. There is very little mention and no data concerning Basin natural discharge in the TAC discussion on Water Balance. **This is a serious omission as there can be no "balance" discussion without a careful consideration of Basin discharge.**
3. There is no mention in the TAC discussion of the DRI Flow Model Report and its Water Balance considerations. **This Report has an excellent documented section on Basin Water Balance, including Playa discharge (ref 9, pp 6 to 21).** It is instructive to read pp15 and 23 of this Report.
4. **There has been an essential chart missing from TAC/Stetson documentation that summarizes the *techniques* used to derive the recharge and natural discharge values specific to the studies listed.** Many studies have assumed recharge values from previous studies going back decades. **The similarity in numbers thus does not mean agreement in the various papers.**
5. **There has been no mention anywhere of the issue I brought up at the November 17'th GA meeting that the USGS "recharge" numbers do not relate directly to the water actually entering the aquifer**. As you recall, Ms.Lori Flint responded to my comment quickly and agreed with my statement. The USGS study is a surface water study with a presently poorly documented correction for surface losses by evaporation and by transpiration. No evaluation or even mention of the Playa discharge is made in their work. **This is a very serious omission as there is no "water balance" attempted in spite of the words being used.** It is also a serious mistake not to incorporate the very latest DRI Water Balance results (ref 9 p 6 to 21).
6. **There are very strong reasons to suspect many of the entries in the USGS recharge table, even beyond the criticism I have already offered.** A) The recharge from the Coso volcanic area that may flow into the Basin to the south is cut by the Little Lake fault with unknown consequences. There is also no reason to suspect that the massive flows of extrusive lava in the Cosos are somehow more porous as claimed. B) There is no evidence for significant Argus recharge that would end up at the CL Playa. Age dating of Playa waters indicates Pleistocene age (not modern recharge water). (ref 7, fig C) The El Paso Basin recharge is largely cut off by the El Paso fault and the relatively stable groundwater levels in the El Paso Basin are indicative of a very low recharge into that Basin. (see BoR well 1 water level data from the KCWA). D) There is also no evidence from DRI flow modeling of such a recharge (ref 9 p 27). There is also no evidence of Valley floor recharge. E) The main Sierra front recharge is also suspect. The line of wells starting at Bureau of Reclamation well No 5

at the base of the Sierras and extending east all the way to the Playa vicinity shows no evidence of Sierra recharge flow (ref 7, Fig 3-5).

7. **In many papers, the CL Playa natural discharge is estimated to be far larger than is commonly appreciated. Correcting the Water Balance in the DRI modeled Playa discharge will result in a stunning reduction in the quantity of sustainable groundwater (ref 9 p 23).**
8. **It has been very well documented with modern isotopic age dating methods that virtually all of the groundwater we are pumping in the IWV Basin is Pleistocene in age (ref 8, p21 and following).** This means simply that we are "mining" old water and that the recharge that we calculate is not evident except in the extreme NW -that area is likely receiving subsurface water from Rose Valley. **This old water /recharge discrepancy must be brought to this discussion and reconciled.** After having brought this up, I do not see any path to resolve the discrepancy except to admit we have very little natural recharge in modern times.
9. **The establishment of baseline water levels in the IWV Basin has a far stronger psychological component than technical.** Water levels have continuously declined in all productive areas of the basin for 100 years. Most of the Basin water production has occurred since 1960. Well level declines have never been reversed even in the wettest years. **There is no year that is identified by some characteristic that stands out.** Wells have been drying out and thus failing for a very long time and the failure rate has gone up just as rates of decline have also. **The baseline year to be selected is not necessarily the same as the year to which the Basin water levels will be restored.** Restoration is far more complicated as many of the more seriously depleted well field areas have declined 150' and more. **As an arbitrary baseline date, I suggest January 1960, since we have substantial high quality well data from that time and forward.**
10. **As interesting as they are, historic rainfall data are not as useful as it would seem. Data from stations at elevations high enough to actually produce recharge water are few and intermittent. There is little to no evidence in any well in the productive areas of the Basin for increases in water levels following wetter years.** There is also no evidence that precipitation on the Valley floor can reach the groundwater. All of this is consistent with the majority of the groundwater in the productive areas of the IWV Basin being Pleistocene in age.
11. **The KCWA groundwater absolute elevation contour maps year-by-year are instructive. However, an *elevation change* map is far more useful for many purposes and has been offered by the Agency only in a draft form. The last change map ended in Spring 2008**. It would be very valuable if the Agency or other entity could produce an up to date edition of these maps that would include the years since the large increase in agricultural pumping. This could be an ongoing DRI effort if the Agency were to decline the task.
12. **The KCWA well level data is collected by professionals and the subsequent maintenance of records and analysis is likewise accomplished. The well measurements are following USGS guidelines. The criticisms of this database and the persistent vague claims of data gaps are largely unwarranted.** There is no doubt that additional select monitoring wells could add to our basin understanding. **However, with the database in its present form, adequate data exists to properly model the basin and to thus predict future well levels, and some of the deleterious effects (water quality deterioration and subsidence) of continued pumping.** There are three Basin areas with potential poor outcomes from continued pumping that could benefit from additional exploration: 1) the poor water zone under much of N brown Rd, (ref 4 NR 1 & 2, BoR well 6,10) 2) The poor water areas in the SW (ref 4, BoR well 3) and 3) exploration of the El Paso fault zone (ref 4, BoR well 1 and 2).

Here is a short bibliography of IWV Basin hydrology and geology papers that document the comments above. These very important papers are in chronological order and have notes associated with each entry summarizing the important contents.

1. *Lee, C.H., 1912. Groundwater resources of the Indian Wells valley California, California State conservation Commission Report pp 403-429.*
   This *is* the earliest paper concerning the hydrology of the IWV Basin. This Report was stimulated by the declining water well levels with even the early limited Basin farming . This Report led to a formal attempt to bring imported water into the Basin within the decade. The main promoter in these early days was the Inyo and Kern Land and Farming Co.
2. *Kunkel,F, and G.H.Chase, 1969. Geology and groundwater in the Indian Wells Valley, California, USGS Open File Report.*
   This paper contains a reasonably complete geologic model of the Basin. This paper also identifies the groundwater barrier in the SW that substantially cuts off recharge from the El Paso subBasin, that is sometimes called the El Paso North fault.
3. *Dutcher, L.C,. and W.R. Moyle Jr., 1973. Geologic and Hydrologic Features of the Indian Wells Valley California, USGS Water Supply Paper 2007.*
   Dutcher amd Moyle estimated that the total recoverable potable water in storage in the IWV basin was about 2,000,000 ac-ft. :This quantity was based on 1920 levels as a starting point and a 200 ft permissible drop in water levels as an end point. A slightly lower value, 1,800,000 ac-ft was obtained in the Bureau of Reclamation Study, as a result of a better understanding of the areas of non-potable water.
4. *U.S. Bureau of Reclamation, 1993. Indian Wells Valley groundwater project, USBR Technical Report Vol I and II.*
   As an integral part of this comprehensive study, ten deep 2000' wells were drilled and carefully logged and then equipped with piezometers (maximum of 4 each per bore). Each piezometer terminated in a sealed off screened section. These zones were chosen to sample the higher quality water found at depth. The Report also contains summaries of the very deep (7,500') Basin wells drilled and studied under the auspices of the Navy Geothermal Office.
5. *Monastero, F., J. Walker, A Katzenstein, and A. Sabin, 2002. Neogene evolution of the Indian Wells valley, East Central California, Geological Society of America, Memoir 195.*
   At almost the same time (early 1990's), a series of deep seismic surveys of the IWV were conducted by the same Geothermal Office. A Paper describing this work was not published until 2002. The geologic sections published in this paper are supported by both deep well coring and drill cutting analysis but also deep seismic refraction studies. This paper further destroys the early suggestions of a complicated aquifer geology that somehow supported deep zones of recharge flow from the Kern Plateau.
6. *Todd Engineers, 2014. Indian Wells valley Resource Opportunity Plan- Water Availability and Conservation Report Kern County Planning and Community Development Department.*
   This paper is an accurate summary of basin geology and hydrology taken from the published literature with some update for the additional modern large scale farming on N Brown Rd. It also provides an excellent summary of the magnitude of the Basin groundwater supply shortfall and measures required to overcome the shortfall.
7. *TriEcoTt, joint venture 2012. Technical justification for beneficial use changes for groundwater in Salt Wells Valley and shallow groundwater in eastern Indian Wells Valley. Prepared for the US Navy Naval Facilities Engineering Command, San Diego, California.*
   This report summarizes work started in the 1990's as a survey of the groundwater in the

greater vicinity of the CL Playa,. It involved hundreds of carefully drilled and characterized small bore wells by TetraTech EM and associates. A specific finding is that the deeper main aquifer is no longer hydraulically connected to the shallow aquifer that is discharging at the Playa. The paper also presents Pleistocene age dates for Playa water..

8. *AB 303 Final Report, March 2008. State of California*
   The AB 303 Final Report contains sections exploring and analyzing the assumed primary Sierra recharge zones to the west and sw. A careful analysis of claims made by Thyne and Gillespie, et al, concludes that errors in interpretation of the available data employed in their study were so severe as to negate any conclusions of high recharge coming into the Basin from the sw. The AB303 Report also summarizes many sets of isotopic age dating of groundwater samples at many locations and by inspection one can conclude that all of the water being pumped in the *productive* parts of the Basin is Pleistocene in age. A very important paper to read and understand.
9. *Desert Research Institute, 2016. Groundwater sustainability: modeling evaluation for the Naval Air Weapons Station, China lake, California. NAWCWD TP 8811.*
   The MODFLOW based Groundwater Flow Model conducted by the Desert Research Institute (University of Nevada) for the Department of the Navy at China Lake is available as a Technical Publication. **This model is by far the most up to date and accurate flow model of the Basin.** It is being actively updated as additional findings are available and will ultimately be used to evaluate proposed sustainability plans.

February 22, 2018
File No. 18-1-021

Sent Via E-mail: JeanM@stetsonengineers.com

Ms. Jena Moran, P.G., C.HG
Senior Hydrogeologist
Stetson Engineers Inc.
785 Grand Avenue, Suite 202
Carlsbad, CA 92408

SUBJECT: Indian Wells Valley Groundwater Authority Technical Advisory Committee Member Initial Comments on Water Budget Elements and Initial Groundwater Levels

Dear Ms. Moran:

This letter is submitted in response to the Indian Wells Valley Groundwater Authority (GA) Water Resources Manager Discussion Overview memorandum to the GA Technical Advisory Group (TAC) members, dated February 1, 2018, which was provided for the TAC February meeting. As indicated in that memorandum, Stetson Engineers requested TAC members to provide written initial comments on: (1) Water Budget; (2) Initial Groundwater Levels; and (3) specific Water Resources Manager Questions for TAC Members. We appreciate the opportunity to provide preliminary comments on these subjects to lay groundwork for the next several TAC meetings, and we look forward to developing a process to reach technical consensus as we move forward through the GSP process. Our comments are itemized below based on the three discussion topics outlined in the February 1, 2018 memorandum provided by Stetson Engineers.

Discussion Topic Number 1 - Water Budget

A water budget is defined by SGMA as an accounting of the total groundwater and surface water entering and leaving the basin including the changes in the amount of water stored. Water budgets should be developed based on accepted scientific practices as documented in DWR's Water Budget Best Management Practices. The water budget should be developed based upon best available data, information and science. Water budgets and base period analysis should be arrived at through consensus among the TAC and with the Water Resources Manager. As they are developed, water budgets should be compared to the water budgets from previous studies to evaluate whether the modeling tools produce similar water budget estimates. In accordance with GSP regulations, the evaluation of a base period representing average conditions and for the analysis of sustainable yield should also be derived through TAC and Water Resources Manager consensus.

Historical water budget information should be a primary basis for estimating future baseline conditions of hydrology, water demand and groundwater supply reliability over the 50-year GSP planning and implementation horizon. Historical precipitation, evapotranspiration information should be developed based on best available science and information, and used in developing future baseline hydrology

conditions. The uncertainty associated with climate change should be considered and addressed, including through evaluation of climate change scenarios provided by DWR and reliable local data. Per GSP regulations, the most recent land use, evapotranspiration, and crop coefficient information should be evaluated for baseline conditions for estimating future water demands with consideration given to future water demand uncertainty associated with projected changes in local land use planning, and population growth. Likewise, the most recent water supply information should be evaluated for baseline conditions for estimating future surface water supply incorporating the historical surface water supply reliability with consideration given to projected changes in local land use planning and population growth. The projected water budget accounting should also include estimated changes in the projected water budget resulting from planned implementation of the selected projects and should be used to quantify the estimated future baseline conditions of supply, demand, and aquifer response to GSP implementation. The projected water budget assessment in the GSP should also evaluate and identify the level of uncertainty in the projected water budget estimate.

Initial Comments on Topic Number 1 – Water Budget

- A methodology should be developed and agreed upon for how measurements of all groundwater extraction volumes will be calculated, recorded, stored and reported, and to whom.
- The Cooperative Groundwater Management Group has tabulated historical groundwater pumping data back to 1975. To the extent that data is relied upon, the quality control and assurance of that data collection and calculation process should be reviewed and updated where data gaps and data overlap appear to exist, for example:
    - Indian Wells Valley Water District (IWVWD) (which acquired lands and/or pumping from other entities listed on the chart)
    - Naval Air Weapons Station – China Lake (as to conservation efforts listed in the footnotes)
    - Orchards, Private Wells, and various ranches where the data, as currently presented, includes overlap as described in part in the footnotes.
- To account for diverse conditions and water users in the basin, discussion should occur, and decisions should be made as to the appropriateness of developing or utilizing basin management areas within the context of the water budget.
    - GSP Regulations define a management area as, “an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors” (Section 351).
    - Individual management areas must be coordinated to achieve a basin’s overall sustainability goal.
- Groundwater model utilization to support basin water budget.
    - As described in DWR’s Groundwater Modeling BMP, the development and use of groundwater model in support of a GSP should promote transparency, coordination and data sharing.

Greater transparency and TAC engagement is necessary to achieve "buy-in" on current groundwater modeling efforts in the Indian Wells Valley. We reiterate a previous recommendation that a TAC model review panel be established to peer-review the current groundwater flow and transport model. At the March TAC meeting, dates and times for a TAC model review panel workshop should be established, and individual workshop participants identified. Participants should also include the Desert Research Institute (DRI). I also request to be on the panel.

- Develop annual change in storage volumes utilizing both analytical and numerical methodologies and evaluate the similarities and differences between the methods.
- Discuss how climate models, land use and growth production will be incorporated into future model scenarios.

Discussion Topic Number 2 - Initial Groundwater Levels

Through GSP development, gaps in available monitoring data including for groundwater levels, and groundwater quality, should be determined. In addition, potential approaches for filling the gaps, including incorporation of existing wells into GSP monitoring activities, and for construction of new monitoring wells should occur. The GSP groundwater monitoring network should be developed using existing and new infrastructure and coordinated with other GSP efforts including but not limited to:

1) Regular groundwater level collections (e.g., CASGEM, DWR, USGS, local entities);
2) Regular groundwater quality testing required by the California Division of Drinking Water for public supply wells;
3) Project- or industry-specific groundwater quality data collection required by the Regional Water Quality Control Board for regulated facilities (e.g., contamination sites);
4) Existing wells that can be added to the monitoring network; and
5) New dedicated monitoring well installations

Groundwater elevation data, groundwater contour maps, and hydrographs prepared as part of the development of the Hydrogeologic Conceptual Model should be evaluated further in terms of sustainability goals, minimum thresholds, measurable objectives, and sustainable yield. Similarly, the amount of groundwater storage and groundwater storage capacity should be determined relative to sustainability criteria and sustainable yield.

Initial Comments on Topic Number 2 – Initial Groundwater Levels

- Well location names utilized to construct the contour maps references on PLATE7-IWV-GW DEPTH Spring 2015 and PLATE8-IWV-GW ELEV Spring 2015 should be posted on the applicable figure.
- Interpolation and contouring methodologies should be described and discussed.
- TDS values should be considered in contouring as an analogy for evaluating groundwater flow patterns.

- Well information such as depth, well type (production or monitoring well) should be defined within the figure legend.
- Groundwater elevation and change in groundwater elevation figures for both shallow and deep wells should be created and evaluated.
- Groundwater elevation hydrographs for each well should also be posted within the figure to help facilitate future discussions regarding base period selection.
- All available groundwater elevation data (contour maps and hydrographs) should be incorporated into the IWV DMS platform to help facilitate development of future measurable threshold and measurable objective discussion topics.
- It is crucial that groundwater level information will be considered in the establishment of minimum thresholds and measurable objectives for IWV to consider as part of the development of the GSP. Per GSP regulation 354.28, minimum thresholds need to be established for each sustainability indicator at each monitoring site. Exceedance of a minimum threshold is presumed to cause undesirable results. The development of a minimum threshold that is unique to each monitoring facility allows the GSA to utilize historical data in establishing those thresholds that are representative of the monitoring facility location in the basin. The level of effort involved in this task could be significant and depends on the number of existing facilities agreed upon for monitoring of the sustainability indicators that are identified. Although this task may involve a substantial effort in the short term, the long-term benefits for groundwater management in IWV will be pronounced and more accurately account for historical variations and conditions. The recommended minimum thresholds should focus on sustainability indicators and be consistent with the GSP regulations.
- Review and develop a revised GSP applicable monitoring program (as compared to data gaps present in the historical data record conducted as part of the existing scope of work) and identify data gaps related to current monitoring of the sustainability indicators listed below. The review should include frequency of monitoring, monitoring facility locations, and types of data collected. The results of the review should be documented in a monitoring network plan that will focus on the following sustainability indicators that are relevant to:

    - Land Subsidence
    - Chronic Lowering of Groundwater Levels
    - Reduction of Groundwater Storage
    - Degraded Water Quality

- The monitoring network plan should include recommendations for augmentation, as appropriate, of the current monitoring program to ensure compliance with GSP regulations and address data gaps as presented in Article 5, Subarticle 4 of the GSP regulations and how uncertainty in monitoring will be addressed.

Discussion Topic Number 3 - Water Resources Manager Questions for TAC Members Regarding Overdraft as related to future sustainable yield discussion

"Sustainable Yield" is defined as the maximum quantity of water, calculated over a base period representative of long-term conditions in a basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result. As such, the sustainable yield translates to the amount of groundwater pumping that can be sustained without producing significant and unreasonable declines in groundwater storage or other undesirable results. There are three primary methods for estimating sustainable yield: 1) using water budgets; 2) performing change in groundwater storage calculations; and 3) using a groundwater flow model.

The first method looks at water budget components over a balanced hydrologic period in a basin to determine if pumping results in long-term declines in groundwater storage (as determined annually from the balance of total inflows and outflows) or if other sustainability indicator thresholds are being exceeded. Long-term storage decline and/or exceeding other sustainability indicators may indicate a need for specific projects/management actions to meet the basin sustainable yield.

The second method involves looking at changes in the measured groundwater elevations over specific time periods and relating that to changes in groundwater storage over time. An effective way of assessing the change in storage under this method is to utilize groundwater elevation surfaces during spring, when much of the winter recharge has occurred and basin pumping is typically at a minimum, and to compare these spring water levels from year to year. Changes in groundwater storage can be translated to volumes of water lost or gained from year to year in this manner. These changes in groundwater storage over the long-term (or at least multiple years) can then be compared to pumping amounts over the same time periods to determine which time periods resulted in stable conditions when no net depletion of storage occurred (or how much storage was lost compared to total pumping).

The third method involves utilizing a groundwater flow model. The flow model would be the most robust tool to determine sustainable yield, as various management actions and groundwater pumping model inputs can be altered and effects on groundwater storage, streamflow contributions, and subsurface lateral flows can be simulated. The testing of various combinations of management actions/projects and different amounts of groundwater pumping and the evaluation of simulated effects on groundwater storage, streamflow contributions, and subsurface lateral flows would lead to an estimate of sustainable yield. See comments on Topic Number 1 regarding recommendations for establishing a model review panel.

Comments on Topic Number 3 - Specific Water Resources Manager Questions for TAC Members

The Water Resources Manager's February 1 memorandum asked TAC members to provide comments on two questions: (1) "Is there TAC agreement the basin is over drafted?" (2) "Are there additional studies and/or resources the TAC believes should be considered during the development of the Hydrogeological Conceptual Model?"

GSP Regulation 354.18(b) provides that a water budget shall quantify the following, either through direct measurements or estimates based on data:

> (1) Total surface water entering and leaving a basin by water source type.
>
> (2) Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.
>
> (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.
>
> (4) The change in the annual volume of groundwater in storage between seasonal high conditions.
>
> (5) If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.
>
> (6) The water year type associated with the annual supply, demand, and change in groundwater stored.
>
> (7) An estimate of sustainable yield for the basin.

Bulletin 118, Update 1980 defines a groundwater basin as being *subject to critical conditions of overdraft* "when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts." It further states that "the adverse impacts do not necessarily occur throughout the entire basin; in fact, water levels may be rising in one portion of the basin, or in one aquifer, even though the basin is in overdraft or subject to critical conditions of overdraft."

Bulletin 118, Update 2003, describes *groundwater overdraft* as a "condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions." It states further that "despite its common usage, the term overdraft has been the subject of debate for many years. Groundwater management is a local responsibility, therefore, the decision whether a basin is in a condition of overdraft is the responsibility of the local groundwater or water management agency."

Under SGMA, all high- or medium-priority basins that have been designated in Bulletin 118 as basins that are *subject to critical conditions of overdraft* must be managed under a GSP by January 31, 2020. Bulletin 118 has identified the IWV basin as one of twenty-one basins in California that are *subject to critical conditions of overdraft*.

First Question: Is there TAC agreement the basin is over drafted? If so, by how much?

- Based upon current and available data and DWR's designation of the IWV basin as a basin that is subject to critical conditions of overdraft, the IWV groundwater basin does presently appear to be experiencing overdraft.
- The *extent* of overdraft, however, requires further analysis and the collection, compilation and evaluation of relevant data, including the elements required by GSP regulation 354.18(b) set forth above. Studies currently underway (e.g. USGS recharge study) will further refine the analysis. As described in Topics 1 and 2 above, more and better refined data is needed for each water budget element, which will be used to define and estimate historic, current and projected potential overdraft.

Second Question: Are there additional studies and/or resources the TAC believes should be considered during the development of the Hydrogeological Conceptual Model?

- Ongoing SkyTEM hydrostratigraphic and water quality data should be incorporated into the refined HCM.
- DRI November 17, 2017 Technical Memorandum detailing updates to the Indian Wells Valley Groundwater model since the 2016 model update.
- Sandia Report (SAND2016-8930) – Frontier Observatory for Research in the Geothermal Energy: Phase 1 Topical Report West Flank of Coso, CA.
- Work with the TAC to create a comprehensive bibliography list of all reference documents and highlight why selected studies are or are not to be utilized (ex. Todd Report).
- When applicable, define the methodology of how extraction and recharge estimates are derived (i.e. directly measured versus equation derived) in prior reports.

Thank you for considering our initial comments and recommendations. We look forward to working with you to further define, develop and produce the Groundwater Sustainability Plan in Indian Wells Valley.

Sincerely,

LUHDORFF & SCALMANINI ENGINEERS

Eddy Teasdale, P.G., C.HG
Senior Hydrogeologist

Technical Memorandum February 22, 2018

To: Heather Steele, Stetson Engineers

From: Timothy K. Parker, PG, CEG, CHG, Parker Groundwater/ Consulting Hydrogeologist for Indian Wells Valley Water District

CC: Don Zdeba, Indian Wells Valley Water District

Subject: TAC Comments on Initial Groundwater levels for Baseline Model Runs, Water Budget Elements, and Responses to WRM Questions

Below are my comments on initial groundwater levels for baseline model runs, water budget elements, and answers o the WRM questions.

Initial Groundwater Levels:

- I believe the groundwater depth and level maps Plate 7 and Plate 8, respectively, are from Kern County Water Agency – it would be helpful to hear from KCWA the specific process of how the contour lines were generated
- With the "strong legal" emphasis by the WRM, IWVGA Board and Legal Staff on using products developed by the WRM so that everything is legally defensible, is the WRM going to generate new groundwater depth and elevation maps for the baseline based on the wells WRM selects to be used in managing the basin?
- For the existing Plate 7&8 to be more useful, the groundwater basin boundary and other pertinent geographic features such as well symbol and data from the wells should be added to better show relative location and source of the data
- If Plates 7&8 are going to be viewed by the general public, it may also be useful to do use color infill and groundwater flow direction arrows to help explain to laypeople what the contour lines mean
- What will be used to define the base of groundwater in storage for future baseline and sustainable management model runs?

Future Baseline Model to be used to (modified):

- Evaluate GSP potential projects (alternatives) and management actions
- 50-year historical hydrology (data permitting)
- Project water demands based on past, current and future land uses
- Note that TAC will need to discuss assumptions for projected changes in local land use planning, population growth, and climate for the 50-year planning horizon

Water Budget

- The Water Budget terms used in the DWR BMP should be applied to the WRM Water Budget – for example, 'infiltration from precipitation, applied water" ETC.
- The Water budget "shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions"

- A diagram should accompany the Water Budget Elements for illustration purposes
- There should be both analytical and numerical approaches to the water budget estimate
- Recharge should be based on the best available information and science – which based on the literature and recent work should turn out to be the USGS Recharge Study using the Basin Characterization Model – uncertainty should be applied to bracket final results – additionally, a careful assessment of the assumptions that went into the BCM should be conducted and used to qualify the results as necessary and appropriate
- For the numerical model, uncertainty analysis should be incorporated
- Water budget elements – it would be helpful in terms of process and understanding of uncertainty, to begin to identify data gaps and level of uncertainty in the list of Water budget Elements, and what is needed to fill those data gaps – for example, what is the level of uncertainty for estimation of precipitation basinwide. Should basinwide precipitation be used instead of the NOAA station in the unnumbered slide "Water Year Type, Hydrologic Periods"? i.e., is this appropriate for the baseline? What is being used in the USGS Recharge Study for precipitation? And what is being used for the Baseline Model for precipitation?
- Cumulative departure from mean can be misleading and should be qualified in narrative terms

Water Resources Manager Question:

- Is there TAC agreement the basin is overdraft?
  - The basin is currently unsustainable -
- If so, by how much?
  - That is for the WRM to determine – I think we all agree it is considerable
  - I prefer not to speculate but instead use better science through the development of this GSP and associated tools including the model to estimate the overdraft
- Are there additional studies and/or resources the TAC believes should be considered during the development of the Hydrogeologic Conceptual Model?
  - The main thing is to consider is to bring in, respect and incorporate all the existing data in the HCM development
  - Additional information that would be useful include:
    - Flux of recharge coming into and leaving the basin from mountain fronts and basin boundaries
    - Depth of fresh water in the basin and distribution of brackish water
    - Improved information on distribution of aquifer and aquitard bodies and interconnection between shallow and deep system
    - Distribution and characteristics of faults (barrier, conduit)
    - Pumping volumes and distribution (domestic large plots with many trees, industry and agriculture)

From:	Heather Steele
To:	Jean Moran; Jeff Helsley; Steve Johnson
Subject:	FW: TAC member comments
Date:	Friday, February 23, 2018 8:19:47 AM

Below are additional comments.

From: Scott O'Neil [mailto:mrscottoneil@gmail.com]
Sent: Friday, February 23, 2018 7:01 AM
To: Heather Steele <heathers@stetsonengineers.com>
Subject: TAC member comments

Good morning Heather...this was due last night so I'm a tad late in my response. I do apologize.

1. regarding the state of the IWV Basin and initial groundwater levels. I generally agree that the IWV basin is in trouble but I do think there needs to be a comprehensive data driven assessment to validate this. I will be very interested in our efforts to determine the quality and adequacy of the data we are going to use to calibrate the model that will be used to assess the state of our basin and its future viability. Personally, I think many of the wells we have data on are inadequate for this purpose and I also generally think that we have gaps in this data, particularly in the west and souths sides of the basin. I think we may have to find the means to bolster this database (i.e., drill some more monitoring wells). We need to be careful to ensure that the data we use is unreliable...not influenced by recent pumping activity, etc. The analysis to determine the quality and adequacy of our data is a critical task and it needs to be accomplished with a "fresh set of eyes" (i.e., underpinned by a critical assessment of the data we have and unbiased by old paradigms and/or conclusions). Any gaps or weaknesses in our database need to be identified with recommendation made to mitigate these gaps.

2. I think the water budget elements as proposed are good.

vr, scott

STETSON ENGINEERS INC.

861 Village Oaks Drive, Suite 100 • Covina , California 91724
Phone: (626) 967-6202 • FAX: (626) 331-7065 • Web site: www.stetsonengineers.com

Northern California • Southern California • Arizona • Colorado

Reply to: Covina

Memorandum

TO: **Indian Wells Valley Groundwater Authority**
Technical Advisory Committee (TAC)

FROM: **Stetson Engineers Inc.**

SUBJECT: **Request for Proposal Residential and Commercial Rebate Program**

JOB NO.: **2652**

DATE: **March 29, 2018**

The Proposition 1 grant funding application submitted for the Indian Wells Valley Groundwater Authority under the California Department of Water Resources Sustainable Groundwater Planning grant program included two projects for Severely Disadvantaged Communities. One of these projects was the Indian Wells Valley Groundwater Basin Water Conservation Rebate Program. This program is intended to be pilot program to determine if water conservation programs in the SDACs are effective and to evaluate whether such programs should be included in the management actions for the Groundwater Sustainability Plan. The attached draft Request for Proposal (RFP) to obtain a contractor to conduct a Residential and Commercial Rebates Program was prepared in accordance with the Prop 1 grant application workplan and is provided for your review and comment.

J:\Jobs\2652 IWVGA\Rebates RFP Transmittal 3-29-18.docx

REQUEST FOR PROPOSALS

Residential and Commercial Rebates Program

May 2018

Proposal Submission Deadline:

May ___, 2018 – 3:00 PM PT

Make all inquiries and send all questions to:
Karen Brunelle, Stetson Engineers Inc.
861 S. Village Oaks Drive, Suite 100, Covina, CA 91724
Telephone: 626-967-6202
E-mail: karenb@stetsonengineers.com

Table of Contents

Attachments

I. Introduction

Indian Wells Valley Groundwater Authority (IWVGA) is requesting proposals for residential and commercial rebate program administration from qualified firms. IWVGA intends to issue a contract for these services that would end by December 2019. The rebate program will benefit the Severely Disadvantaged Communities (SDACs) of Inyokern and China Lake Acres in the Indian Wells Valley groundwater basin and could ultimately expand into other SDACs in the Indian Wells Valley groundwater basin area. This document outlines the requirements and minimum qualifications, selection process, and documentation necessary to submit a Proposal.

A. Background

The Indian Wells Valley groundwater basin is located east of the southern Sierra Nevada Range in southern California with an area of approximately 382,000 acres underlying portions of Inyo, Kern, and San Bernardino Counties. The Indian Wells Valley groundwater basin is identified by the Department of Water Resources (DWR) as Basin 6-54 in Bulletin No. 118. In July 2016, the IWVGA was formed through a Joint Exercise of Powers Agreement for the purpose of forming a Groundwater Sustainability Agency (GSA) to manage the Indian Wells Valley groundwater basin and to implement Sustainable Groundwater Management Act (SGMA) requirements, including the development of the Groundwater Sustainability Plan (GSP). The IWVGA consists of the following voting member agencies:

1. City of Ridgecrest (a public agency)
2. Indian Wells Valley Water District (a public utility)
3. County of Kern (a public agency)
4. County of Inyo (a public agency)
5. County of San Bernardino (a public agency)

along with the United States Department of the Interior Bureau of Land Management and the United States Navy, Naval Air Weapons Station China Lake as non-voting associate members.

B. Purpose of the Request

IWVGA is looking for a firm, hereafter known as the Program Administrator (PA), to provide an IWVGA-branded, user-friendly online marketplace for residential and commercial customers to find products that qualify for IWVGA's rebates and access the rebate application. The PA will also manage rebate submission, verification, processing, payment, and reporting of information back to IWVGA. The rebate offerings shall include washing machines, dishwashers, high-efficiency toilets and waterless urinals. IWVGA expects to receive 300-500 applications in the first year of operation.

II. Scope of Services

Attachment A is the Scope of Services listing major work tasks that may be requested.

III. Proposal Format

A. RFP Manager

All questions and correspondence regarding the proposal documents and proposal should be directed in writing referencing “IWVGA Residential and Commercial Rebates Program” to:

Stetson Engineers Inc.
861 S. Village Oaks Drive, Suite 100
Covina, CA 91724
Attention: Karen Brunelle
Phone: 626-967-6202
E-Mail: karenb@stetsonengineers.com

Pre-proposal questions will be accepted via email no later than 3:00 p.m. on Monday, May 14, 2018. All questions received will be answered electronically via email to all participating Proposers. All Proposers interested in submitting a proposal must email their intention by May 14, 2018, to guarantee receipt of IWVGA’s answers to all pre-proposal questions. Proposers must also acknowledge receipt of pre-proposal clarifications in their proposal.

B. Timetable

Responses to this Request for Proposal (RFP) with sealed proposals are due and must be received in Stetson Engineers’ Office, 861 S. Village Oaks Drive, Suite 100, Covina, CA 91724, no later than 3:00p.m., Pacific Time, on Thursday, May 31, 2018. No proposals shall be accepted after that time. IWVGA assumes no responsibility for delays caused by delivery service. Postmarking by the due date will not substitute for actual receipt. Hand delivery before the deadline is recommended. Proposals received after the time and date listed above shall be returned to the proposer unopened.

The following schedule has been established for this RFP:

RFP Release Date	Tuesday, May 1, 2018
Proposers Submittal of Interest/Pre-Proposal Questions Due	Monday, May 14, 2018
Proposals Due	Thursday, May 31, 2018
Interviews Scheduled	Week of June 18, 2018
Consultant Selected	Tuesday, July 3, 2018
Final Contract Negotiations	Tuesday, July 10, 2018
IWVGA Board Approval of Contract	Monday, July 16, 2018
Projected Contract Start Date	Thursday, July 19, 2018

C. Proposal Submission Instructions

All proposals must meet the content requirements and format guidelines listed below in the “Proposal Content Guidelines” section. The complete proposal shall be submitted by the due date in a sealed envelope marked “PROPOSAL FOR IWVGA Residential and Commercial Rebates Program". A total of two (2) complete double-sided copies on paper containing a minimum of 20% post-consumer recycled

content and one (1) electronic copy of the proposal. Proposals must be submitted in a sealed envelope, which details the business name, business address and contact person of the respondent. Responses must be addressed to the attention of Karen Brunelle, Stetson Engineers Inc.

D. Proposal Content Guidelines

Proposals must be submitted with all documents required by this Request for Proposal. Proposals not submitted with all the required information may be considered incomplete and rejected by IWVGA. Proposals may be rejected if they show any alterations of form, additions not called for, conditional or alternative proposals, incomplete proposals, erasures, or irregularities of any kind. Any statement or qualification in proposal form, or attached to, or included therewith, serving to qualify proposal, or containing conflicting statements, or otherwise rendering proposal ambiguous or uncertain, will disqualify the proposal. IWVGA reserves the rights to reject any or all proposals.

1. Introduction

Proposals should include the following:

a) A letter of introduction briefly describing an understanding of the requested scope of work and qualifications to undertake this work such as experience in providing like services, background of the firm(s) including and resumes of the principals involved.
b) Additional material such as brochures and photos, promotional material, references, and supplemental graphics, applicable to the content of the proposal.
c) Signature by an individual authorized by the firm or partnership to bind the firm or partnership to the proposal.

2. Project Team

a) Prime team members: Name of entity submitting the proposal, its mailing address, telephone number, facsimile number, email address, the name of contact individual as well as the signature of principal/owner/officer in case of joint venture or other. Describe business and background, including the size, location, capacity, type of firm, and year established.
b) If applicable, subcontractors: List subcontractors with individual addresses, telephone numbers, facsimile numbers, email addresses, and areas of expertise.
c) Briefly describe the project responsibility of each team member.

3. Project Personnel

Description of organization, management, and team members. Provide a description of the PA's organization and a work plan that identifies the personnel to be assigned to each task. The organization description should clearly identify the project manager and the day-to-day contact person for the project. Contract terms will not permit substitution of lead personnel without prior approval by IWVGA. Description of qualifications of the professional personnel to be employed with a summary of similar works performed and a resume for each professional.

4. References, Related Experience and Examples of Work

Provide at least three client references (contact name, title, company name, address, phone number, and e-mail address) for relevant work. Specify the client, location, type of work, implementation results or status, examples of work, and other relevant information as needed.

Provide a minimum of two examples of similar solutions the PA has deployed for other utilities (web address). When components of the tool are inaccessible due to the need for a login, account number, or address, provide screen shots of the customer interface screens.

5. Additional Documents Required

In addition to the information required in the previous sections, the response must include the following:

a) A statement that the firm is financially sound and has financial resources sufficient to successfully execute the contract.

6. Fee Schedule

Provide fee structure and schedule for the included services. Include year one and subsequent years, if there is an initial service setup fee. Provide an itemized fee list in the proposal. If needed, assume 400 rebates processed per year.

7. Contract

Comments and exceptions, if any, to IWVGA's standard contractor agreement and insurance requirements should be noted. It is understood that prospective consultants have reviewed the agreements (Attachment B) and will take exception only to those items identified in the proposals. If there are any concerns or proposed exceptions requested to the standard contractor agreement, these issues are to be discussed at the time of the interview.

IV. Selection Process

A. Qualifications

All proposals received by the due date will be evaluated by IWVGA. Only information which is received in response the RFP and input from references will be evaluated. IWVGA will judge responses of each proposing firm in several critical areas.

The selection process shall proceed as follows:

1. Based upon the submitted written responses to this RFP, the IWVGA selection panel shall select up to three Program Administrators to interview.

2. At the interview, the selection panel will expect the PA to give a presentation of the proposed solution with a software demonstration, if applicable. The project manager/main contact for this

program must be present for the interview/presentation. The presentation will be followed by a question and answer period by the selection team. IWVGA will conduct interviews by conference call and screen sharing, and/or in face-to-face meetings based on the availability of the Proposer selected for interviews. IWVGA reserves the right to reject any and all proposals at its discretion, thus not awarding the contract to any firm. IWVGA reserves the right to modify this RFP or the criteria for selection in any manner, to cancel this RFP, or to reject any one or more or all submittals.

IWVGA retains sole discretion to evaluate proposals and make an award to the Proposer that IWVGA deems to have the most responsive proposal. IWVGA reserves the right to invite the top candidate(s) for an oral interview, or to request additional clarifying information. The firm with the highest rating may be invited to negotiate a final agreement. If an agreement is not reached, negotiations may be terminated and commenced with the next most qualified firm. The recommendation of IWVGA shall be submitted to the IWVGA Board for award of contract.

Upon the approval of the IWVGA Board, IWVGA will issue the Notice of Award and deliver the signed contract to the awarded Proposer.

B. Selection Criteria

IWVGA will select the most qualified proposal based on the following factors.

1. Relevant qualifications and experience for comparable implementation and operation of energy efficiency rebate programs.

2. Conceptual and proposed solutions and past performance on comparable engagements, including ease-of-use for residential and commercial customers for other utilities and website appearance.

3. Ability to provide services outlined in the Request for Proposal and demonstration an understanding of IWVGA's needs.

4. Total Program Cost, while not determinative, may be considered in the selection process. The selected firm will be expected to maintain the proposed billing rates throughout the term of the contract.

5. Willingness to Comply with the Proposed Agreement Terms. A sample agreement is attached as Attachment B. Proposals will be rated based on the exceptions taken to the proposed contract.

V. Conditions of Request

A. General Conditions

IWVGA reserves the right to cancel or reject all or a portion or portions of the request for proposals without notice. Further, IWVGA makes no representations that any agreement will be awarded to any organization submitting a proposal. IWVGA reserves the right to reject any and all proposals submitted in response to this request or any addenda thereto. Any changes to the proposal requirements will be made by written addendum.

B. Limitations

All reports and pertinent data or materials shall be the sole property of the IWVGA, and may not be used or reproduced in any form without the explicit written permission of IWVGA. IWVGA reserves the right to extend the time allotted for the proposal, to verbally examine the Proposer in person, request copies of previous work prepared by the consultant, and to request a best and final offer, should IWVGA deem that it is in its best interests to do so.

This RFP does not commit IWVGA to award a contract, or to pay any costs incurred in the preparation of the proposal. IWVGA reserves the right to accept or reject any or all proposals received as a result of this request, to negotiate with any qualified consultant, or to cancel this request in part or in its entirety. IWVGA may require the selected consultant to participate in negotiations and to submit such technical, price, or other revisions of their proposals as may result from negotiations. IWVGA reserves the right to negotiate all final terms and conditions of any contract entered into.

C. Liability of Costs and Responsibility

IWVGA shall not be liable for any costs incurred in response to this request for proposals. All costs shall be borne by the person or organization responding to the request. Proposers are liable for all errors and omissions contained in their proposals. The person or organization responding to the request shall hold IWVGA harmless from any and all liability, claim or expense whatsoever incurred by or on behalf of that person or organization. All submitted material becomes the property of IWVGA.

The selected PA will be required to assume responsibility for all services offered in the proposal whether or not they possess them within their organization. The selected PA will be the sole point of contact with regard to contractual matters, including payment of any and all charges resulting from the contract.

D. Validity

The proposer agrees to be bound by its proposal for a period of ninety (90) days commencing May 31, 2018, during which time IWVGA may request clarification or correction of the proposal for the purpose of evaluation. Amendments or clarifications shall not affect the remainder of the proposal, but only that portion so amended or clarified.

E. Standard Contractor Agreement

A sample contractor agreement has been provided in Attachments B for the proposer's review and comment. If a proposer wishes to take exception to any of the terms and conditions contained in the standard contractor agreement, these should be identified specifically; otherwise it will be assumed that the proposer is willing to enter into the agreement as it is written. Failure to identify contractual issues of dispute can later be the basis for IWVGA disqualifying a proposer.

Any exceptions to terms, conditions, or other requirements must be clearly stated. Otherwise, IWVGA will consider that all items offered are in strict compliance with the RFP, and the successful proposer will be responsible for compliance. IWVGA will consider such exceptions as part of the evaluation process

which may constitute the sole grounds for rejection of the proposal. The contractor agreement will not be executed by IWVGA without first being signed by the proposer.

F. Permits and Licenses

Proposer, and all of proposer's subcontractor, at its and/or their sole expense, shall obtain and maintain during the term of any agreement, all appropriate permits, certificates and licenses including, but not limited to, a City Business License which will be required in connection with the performance of services hereunder.

G. Oral and Written Explanations

IWVGA shall not be bound by oral explanations or instructions given at any time during the process or after the award. Oral explanations given during the review process and after award become binding when confirmed in writing by an authorized IWVGA official. Written responses to question(s) asked by one proposer will be provided to all proposers who received Requests for Proposals.

H. Proposer's Representative

The person signing the proposal must be a legal representative of the firm authorized to bind the firm to an agreement in the event of the award.

I. Deliverables

Deliverables depend upon the task assigned. In general, 2 copies of administrative draft reports are required upon completion of each task. Following approval by the staff, 3 copies of each final report are required. One unbound copy of each final document and an electronic file containing all final documents and all information are to be provided. The consultant will develop a system to assemble, organize, store and utilize data in an electronic format. At the outset of the agreement, the consultant will submit a description of the software to be used in preparation of the reports and graphics.

J. Insurance

General Liability, Automobile, Professional Liability, and Worker's compensation insurance are required in the amount set forth in the attached sample contractor agreement.