California Energy Commission
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July 21, 2012

Commissioner Karen Douglas, Presiding Member
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: Hidden Hills Solar Electric Generation System: Comments by the Amargosa Conservancy on the California Energy Commission Preliminary Staff Assessment

Dear Commissioner Douglas:

The Amargosa Conservancy, with headquarters in Shoshone, California, is a non-profit conservation organization devoted to preserving the land, water and beauty of the Amargosa region. We appreciate the very open process that the Commission staff has conducted in addressing the Hidden Hills Solar Energy Generation System (HHSEGS), Application for Certification (AFC) and for providing ample opportunities to comment and sponsoring several local workshops where a wide range of views and opinions from the applicant, residents and organizations can be exchanged and fully aired.

As it is described in the PSA, the Amargosa Conservancy opposes the HHSEGS project. If the Commission were to approve the project, substantial mitigation, above and beyond what the PSA has recommended, would be necessary. We outline below our objections and concerns--as well as mitigation and other recommendations--for this massive $3 billion industrial facility that will be the bellwether of additional development.

We encourage the Commission and its staff to continue providing additional public workshops prior to and after the publication of the Final Staff Report. We believe that this project, if approved, will have very significant negative long-term effects on the natural communities in this region, and widely varying effects on the human population in two states.

I. Groundwater

Previous comment issues unresolved

The Conservancy has previously submitted extensive comments to the California Energy Commission (CEC) on detecting and averting effects from proposed groundwater pumping by the Hidden Hills Solar Energy Generation System (HHSEGS) from aquifers that are hydrologically connected to the Wild and Scenic Amargosa River and its groundwater-fed tributaries. Unfortunately, none of the issues our organization raised in those prior comments on groundwater use have been resolved. If anything, we have become even more concerned about proposed water use by this plant and by that of other utility-scale solar generation plants and the related regional development projects that are quite likely to follow in its wake.

Data absent

In particular, the data relevant to assessing groundwater impacts in this region are extremely limited, and the Applicant's repeated assurances that its long term pumping will have no off-site effects, based largely on guesswork rather than on collection and analysis of additional subsurface information, are distressingly dismissive of concerns raised by this organization, the BLM, and Inyo County, among others.

The Applicant's and the PSA's predictions unsupported

Applicant asserts that project pumping over the life of the project will not affect biological resources or wells beyond (or much beyond) its property boundaries, relying on scant geologic mapping, scattered, publicly undisclosed well logs, inadequate pump test data, and simplistic groundwater modeling. The latest assertions by Applicant's groundwater consultant are contained in a PowerPoint slideshow that was aired at the June Pahrump workshop. The slides speculatively propose one possible version of subsurface conditions to predict effects of HHSEGS pumping over a 25-year period, but add little or nothing to the real understanding of this complex system. Predictions are only as reliable as the data used to prepare the presentation; and it does not appear that any new information was obtained or used to buttress the very slim portfolio of available information. The PSA analysis uses the same sparse data and simplistic modeling techniques as the Applicant's consultants to predict the effects of the project's groundwater pumping.

Uncertainty

The key issue facing the CEC is what to do in the face of great uncertainty in the hydrogeologic properties of the area—and thus whether and how pumping impacts will propagate and affect off site resources.

Effects on the Wild and Scenic Amargosa River—Monitoring and Mitigation Required

One principal concern of the Conservancy is that groundwater pumping in the southern portion of the Pahrump Valley will affect the Wild and Scenic Amargosa River and its spring tributaries. Despite the fact that little pumping has occurred to date in the southern portion of the valley, water levels have been steadily dropping in most of the wells in this area from which data is available, apparently the result of pumping further north in the Pahrump Valley. The USGS regional groundwater flow model posits flow from the Spring Mountains through Pahrump Valley under the Nopah Range and through California Valley and thence into the Amargosa River. To us, this raises a serious unresolved issue of whether long term HHSEGS pumping will adversely affect the river and its tributaries. The solution, in the face of significant uncertainty, is to require clear and enforceable monitoring and mitigation conditions that will require reductions or cessation in pumping if monitoring predicts effects are likely to occur.

Amargosa effects could be rapid and significant

Although the PSA water supply analysis acknowledges that HHSEGS pumping might affect the Amargosa, it discounts that effect based on calculations of the length of time that the pumping effects might take to affect the river— using the same inadequate body of data discussed above. The attached analysis commissioned by the Nature Conservancy by Johnson Wright, Inc., hydrogeological consultants, posits other likely routes by which the HHSEGS pumping might well affect the river much more quickly and directly than the PSA analysis estimates. We believe that it is incumbent on the Applicant and the CEC to rule out these effects and to require mitigation (e.g., pumping cessation) if effects are predicted by water level declines in appropriately sited monitoring wells.

Longer term analysis required

The analyses by the Applicant and included in the PSA are limited to predicting effects of pumping for the first 30 years the plant will be operating. We believe this analysis period is far too short for two reasons: first, the plant will undoubtedly operate and pump groundwater far beyond the 30 year first period. Second, the effects of groundwater pumping usually propagate for long periods after pumping has stopped, and by the time that effects are detected in critical resources, it is too late. By the time recovery starts to occur after pumping ceases, water dependent life is often eliminated. Other analyses (e.g., the BLM environmental assessments of the Amargosa Valley solar plant and the Southern Nevada Water Authority's proposal to pump water from remote valleys to Las Vegas) have appropriately predicted effects over much longer terms—200 years or more. If that same standard were to be applied here, the likely effects on the Amargosa system would undoubtedly be apparent.

Monitoring and mitigation recommendations

The PSA proposes that Applicant install a single monitoring well between the project and California Valley, but would propose no mitigation conditions in the event that water level declines are detected. This is clearly inadequate. We suggest that at least three monitoring wells be located west of the project site, completed in the alluvial aquifer in the producing horizon from which the project will be pumping water. Moreover, to establish whether the HHSEGS pumping will affect the carbonate aquifer, at least one well should have a dual completion in the alluvial and carbonate aquifers. (We note that the BLM's recent comments on the PSA support installing monitoring wells penetrating the carbonate aquifer.) If future water level declines in these wells predict effects on the Wild and Scenic Amargosa River, pumping should cease or be curtailed; however, the Applicant should first be given a reasonable opportunity to demonstrate that the water level changes are not due to its operations.

With regard to the groundwater dependent resources, in an attempt to protect groundwater dependent resources, the PSA water supply and biological resources conditions would require mitigation in the form of a temporary pumping cessation; however, before groundwater pumping is modified or discontinued over the long-term, the PSA requires the CEC to meet the burden of satisfying three difficult conditions: a water level decline of .5 foot, that the health of water dependent vegetation had declined by 20%, and that these effects were not due to actions or conditions beyond the control of the Applicant. This is nearly an impossible burden, and enforcement would be extraordinarily expensive, difficult, and protracted even in the face of clear adverse changes. Moreover, by first requiring a demonstrable decline in the health of vegetation, remediation would very likely be too late to avert permanent harm to the target resources.

The Conservancy believes that declines in the water level in off-site monitoring wells sited to detect impending effects on key resources alone is a sufficient trigger for mitigation requirements, both for the groundwater dependent resources and the Amargosa River. In addition, vegetation effects should be included as a triggering condition as an independent basis for pumping reduction.

Mitigation burden of proof is key

In our view if a clear and easily enforceable groundwater level trigger is reached, the Applicant should have the burden of proof to establish that their operations are not the cause of the decline and, if the Applicant cannot meet this burden within a reasonable period time, groundwater pumping should cease.

Compensatory mitigation: purchase of water rights

Both the PSA and the Applicant propose compensatory mitigation for groundwater pumping by employing some (largely undefined) method to offset project water use on a 1:1 ratio. The Amargosa Conservancy supports such compensatory mitigation, but believes that the nature of the obligation as proposed in the PSA and by the Applicant poses significant issues and requires clarification and improvement.

The offset obligation, if framed to require reduction of Pahrump Valley basin water use, should be limited to permanent retirement of active senior water rights with a long and documented history of steady use, located closest to the project site, approved by Nye County and the Nevada State Engineer—and in multiples of the proposed project use. Multiple retirements are necessary for compensation because of the fact that the Pahrump basin is grossly over allocated, so retirement of even senior active rights may well have no positive effect on reducing basin water use, even in the short run. Also, because offsetting rights may likely be available only in the distant northern section of the Pahrump Basin in Nevada, effective mitigation for impacts of project water use on nearby resources also justifies a higher ratio. Accordingly, we suggest at least a 4:1 permanent retirement ratio.

II. Alternatives

The PSA acknowledges that the project will have significant adverse impacts on the environment. Under such circumstances, California law requires that there be an analysis of alternatives to the project that would avoid or substantially reduce the impacts of the project. The alternatives analysis in the PSA is inadequate and should be significantly expanded.

The Final Staff Assessment should analyze alternative sources of water to supply the project in the event that trigger conditions require the cessation or reduction in groundwater pumping. In addition, the Commission should more seriously examine alternative locations such as Sandy Valley and other technologies such as solar PV and distributed generation. Alternative locations would avoid or substantially reduce the necessity to pump groundwater from an over allocated desert basin in which water resources are in secular decline because of pumping beyond sustainable amounts. Solar PV would eliminate the need for two 750 foot-high towers.

III. Cumulative Impacts

CEQA Guidelines define cumulative impacts as "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." (Cal. Code Regs., tit. 14, § 15355.) The Guideline continues: (a) "[t]he individual effects may be changes resulting from a single project or a number of separate projects" and (b) "[t]he cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time." (*Ibid*.)

The proposed natural gas pipeline and transmission line associated with the project are likely to draw and accommodate both additional electrical generation capacity as well as collateral development. The Hidden Hills plant is not only the first development, but it is also the proximate cause of additional economic activity in the Pahrump area that will require significant new water usage. Because the electrical and natural gas transmission lines associated with the project are subject to approval by the BLM and are being addressed in an EIS being prepared by the BLM, the PSA largely defers analysis of the cumulative impacts of the projects to the BLM. In its comment letter on the PSA, the BLM requests that the CEC conduct a more rigorous cumulative impact analysis. The Conservancy agrees with the BLM. The EIS is not currently available; thus, a complete cumulative impact analysis is not available to the CEC or to the public and the cumulative impacts of the project have not been fully assessed as required by law. In the absence of such an analysis, California law requires that the CEC conduct such an analysis and include it in the Final Staff Assessment.

We believe that the CEC is required to take a much more serious look at the potential, long term effects of all of the existing and allocated water rights in the Pahrump Valley basin and of the potential cumulative impacts of groundwater pumping by the project in combination with groundwater pumping by other reasonably foreseeable projects on the Amargosa River and on other groundwater dependent resources. While the PSA has included a short list of current and future projects, the list is not complete, and does not include other forms of water pumping and use (e.g., agricultural pumping).

IV. Cultural and Visual Resources

The HHSEGS plants, if built, will cause unacceptable changes in the character of our rural desert area. The massive 750 foot high towers, mirror fields and generation equipment will industrialize our area but provide little economic benefit for our small local California communities or Inyo County. The viewshed from the Old Spanish Trail Highway will be very substantially altered. The segment of Old Spanish Trial from the Spring Mountains through the Amargosa Canyon, a portion of which is documented to pass through or vary near the HHSEGS site, is one of the least disturbed and intact sections of any historic trail in the US southwest. Mule and wagon traces can still be easily seen, with the vistas yet unchanged and the rigors, solitude and grandeur of the trail imagined. Native American religious, burial and ceremonial sites and practices will be adversely affected. The obtrusiveness of 750 foot night-lighted towers will be ever apparent and will destroy dark sky views.

The Final Staff Assessment should more seriously examine alternative locations such as Sandy Valley and other technologies such as solar PV and distributed generation. Alternative locations and distributed generation would avoid the visual and cultural impacts of the project to the Amargosa region and solar PV would eliminate the need for the two 750 foot-high towers.

Respectfully submitted,

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Donna Lamm
Executive Director, Amargosa Conservancy

Date: July 17, 2012

To: Project File – JWI1305

From: Jon Philipp, Andy Zdon

Subject: Summary Memorandum - Review of Hydrogeologic Analysis, Proposed Hidden Hills Solar Electric Generating System Project, Inyo County, California

The following memorandum summarizes three previous documents prepared by Johnson Wright, Inc. (JWI), providing comments on hydrogeologic analyses conducted to evaluate the potential impacts to groundwater of the proposed Hidden Hills Solar Electric Generating System (HHSEGS). Based on the following assessment, the project applicant has not provided the requisite supplemental hydrogeologic knowledge regarding the site or surrounding areas to justify the conclusions its consultants have reached. Little is known about the subsurface in this area, and attempting to make general land management decisions based on "assumed understandings" of the groundwater system in the project area is not appropriate. Moreover, recent investigations in the Amargosa Basin indicate that the conceptual hydrogeologic model for the area may vary considerably from that which has has been long-held. For example, a recently installed monitoring well along the Amargosa River north of Shoshone, California suggests a considerably different relationship between the Amargosa River and groundwater flow beneath it at that point than previously believed. Additional hydrogeologic characterization is clearly needed to support a reasonable analysis of the potential impacts of the proposed project, and to provide the basis for sound land management decision-making. For example, a properly-run and documented aquifer test has not yet been completed at the site and should be conducted. As well, the hydrogeologic investigation conducted thus far has not established (and was not designed to evaluate) a disconnect between project pumping and flow in the federally-designated Amargosa Wild and Scenic River flow system.

Groundwater Modeling – Impact Analysis

As part of the Bright Source Energy August 2011 Application for Certification (AFC) for the Hidden Hills Solar Electric Generation System (HHSEGS), Cardno-Entrix (Entrix) authored two documents both titled 'Groundwater Modeling Technical Memorandum.' These two documents were included in the HHSEGS AFC as Appendix 5.15F (July 12, 2011) and Appendix 5.15G (July 20, 2011). The documents describe the results of a modeling exercise designed to predict the extent of groundwater drawdown in response to a range of potential short and long-term groundwater pumping scenarios at the HHSEGS site. A review of both documents shows that minimal site-specific hydrogeologic information was available, which necessitated the use of a very simplistic groundwater model that does not represent known hydrogeologic conditions (for example the presence of geologic structures such as faults and non-basin fill materials). At the time these documents were written, the applicant's aquifer testing on site-specific wells had not yet been conducted and the results of that testing were not available. The results of previous aquifer testing that were used in the analysis have not been presented and therefore the quality of that work which forms the basis of the analysis cannot be evaluated. There was an absence of site characterization by the applicant prior to the modeling analysis, and modeling was solely based on the sparse existing data for this part of the Pahrump Groundwater Basin. Thus, the results of the modeling have substantial uncertainty and the current model is inadequate as a predictive tool.

In general, the Appendices detail the modeled results of two primary scenarios:

1. The effect on the regional aquifer as a result of the planned pumping of 200 to 280 acre-feet per year (ac-ft/yr) during the two to three year construction period of the HHSEGS facility is detailed in Appendix 5.15F.
2. The effect on the regional aquifer as a result of the planned pumping of 140 ac-ft/yr during the 25 year lifespan of the HHSEGS facility is detailed in Appendix 5.15G.

The primary issue is the technical basis on which the model was built. In Appendix 5.15F, which focuses almost exclusively on modeling results, Entrix states, "The set-up and results of the original model were discussed in a previously submitted technical memorandum (dated July 3, 2011)." This July 3, 2011 memo was not included in the HHSEGS AFC and is not included in the list of documents related to the HHSEGS facility on the California Energy Commission (CEC) website. However, the Appendix 5.15G document does offer more information as to what was apparently relied upon to create the model used in both scenarios.

In Appendix 5.15G, Entrix acknowledges that water for the HHSEGS facility will be pumped from the Basin-Fill aquifer and that, "in the project area, wells of 300-400 feet deep are likely sufficient to provide the required yields for the Project." A 1966 APT conducted in the vicinity of the proposed HHSEGS facility by Geotechnical Consultants estimated aquifer transmissivity to be 7,225 gallons per day per foot (gpd/ft). No additional details of the Geotechnical Consultants APT were included. Another similarly located APT performed in 2003 by Broadbent and Associates estimated the aquifer transmissivity to be 4,675 gpd/ft.

Entrix noted that the short duration of the Broadbent and Associates APT precluded obtaining reliable storage coefficient values or estimating leakance.

Entrix does not mention what model was used to simulate the various pumping scenarios. They understand that “several hydraulic aquifer coefficients and parameter are required when creating a groundwater model.” Entrix then acknowledges that “For this site only an approximate measurement of transmissivity is available. This lack of detailed aquifer property information constrains the modeling approach that can be employed to only a simplified model package that assumes homogeneous aquifer properties”. For the model, the transmissivity value of 7,225 gpd/ft was used. To represent a “typical semi-confined [aquifer] condition”, a storage coefficient of 0.01 was used. The analytical method used for calculating drawdown was Theis (1935), which is a confined aquifer solution. A regional groundwater gradient of 0.01, taken from groundwater surface maps, was applied to the model. In order to account for uncertainty in the one aquifer parameter Entrix had to work with, they ran each model scenario with a transmissivity of 7,225 gpd/ft, followed by runs with half that transmissivity value and with twice that transmissivity value, respectively. The model results can be seen in Appendix 5.15F and Appendix 5.15G in table format and graphically as nearly concentric circles of drawdown around the pumping center-- as would be expected from such a simple modeling approach.

The inherent simplicity of the model employed combined with the absence of site specific data (i.e. the only physical value used in the model was aquifer transmissivity derived from the Geotechnical Consultants APT) disconnects the model results from a reasonable simulation of existing conditions. The lack of site specific information then imposes no reliable constraints on the model; therefore, the model is not useful as a tool for predicting drawdown impacts related to any pumping scenarios.

The most important piece of missing information is the detailed geology under the HHSEGS site to the depth of proposed project production wells (the maximum depth Entrix believes a well would have to be drilled for adequate water to meet project needs is 400 feet, although applicant has recently suggested that deeper wells may be employed). This information could easily be obtained by supplemental drilling and collecting soil core data. Currently, neither the depth of the actual water bearing zone is known , nor if there are multiple water bearing zones. The water bearing zone materials are also unknown. Without APT-derived pumping test data, a primitive site conceptual model could still be prepared based on the soil core information, leading to some better informed assumptions as to what appropriate aquifer coefficients and parameters should be used in an analytical model. **Comments Regarding Aquifer Testing**

The March 2012 document titled 'Long-Term Aquifer Performance Test Report' (APT Report) by Entrix summarizes the design, implementation, analysis and conclusions of an aquifer performance test (APT) conducted at the future site of the HHSEGS. A thorough review of the document has revealed deficiencies in the design, implementation and analysis of the APT that question the conclusions reached by Entrix regarding the proposed HHSEGS long term project pumping impacts. The following paragraphs highlight the deficiencies,and their relevance to the Entrix conclusions.

In general, the biggest deficiency is the lack of a data-based conceptual site model of subsurface conditions. It is important to the proper design of an APT to identify the water bearing zones (aquifers) and the low permeability zones (aquitards) separating them. Entrix has compiled a narrative of regional geologic conditions based on previous investigations around other portions of Pahrump Valley and has made some assumptions as to what they believe geologic conditions are like under the HHSEGS site. In general, Entrix summarizes HHSEGS site conditions as follows:

> The HHSEGS site is underlain by Quaternary sediments, which form the primary water bearing units within the basin. Channel gravels become finer grained upward, becoming mudstone near the top of the sequence. The mudstones are overlain by silt and thin gravel beds. These deposits record a change from a fluvial and lacustrine condition during the most recent glacial cycle to the arid conditions found today (Flynn, et al 2006). The maximum thickness of the alluvium is at least 800 feet (DWR, 1964).

The summary suggests variable subsurface conditions ranging from mudstones, which would likely act as an aquitard, to gravel beds, which would likely act as an aquifer. However, no HHSEGS site specific information has been collected below a depth of 200-feet below ground surface (bgs), which was done during the installation of the observation wells Entrix used for the APT. In short, knowledge was lacking regarding site specific conditions below that depth when the APT was designed, run and analyzed.

The pumping wells used during the APT were wells already in existence on the HHSEGS site, including the Orchard Well and Well #3. Well #3 was evaluated using a down-hole camera. This well was found to be cased to a depth of 790-feet bgs and open hole from 790 to 970-feet bgs, which indicates that; 1) water is being drawn from a depth of 790-feet or greater and 2) the surrounding formation from 790-feet bgs and below is lithified enough to not collapse on itself in the absence of a well screen. The Orchard well was only evaluated for total depth, which remains unknown as the device used to measure total depth was not long enough. Thus, one of the pumping wells has an inlet below 790-feet bgs while the inlet of the other pumped well is unknown. In both cases, the boring logs for the pumped wells were not included in the APT Report, so the assumption is they were not made available to Entrix. Accordingly, geologic conditions in and surrounding the pumping wells are unknown. In contrast to the pumping wells, the observation wells were installed to a shallower depth of 200-feet bgs. With the partial exception of well MW-6, all of the observation wells were screened within clay and silt formations which are generally considered aquitard material rather than aquifer material. In short, the Entrix APT pumping wells are in unknown geologic formations (potentially lithified) and, in the case of the Orchard Well, the pumping inlet is at an unknown depth, while the observation wells are set many hundreds of feet shallower in geologic formations generally more akin to aquitard material.

Entrix encountered several difficulties during the data collection phase of the APT. The most significant was the premature end to the APT when the pumping equipment in Well #3 fell to the bottom of the well. In general, the longer the duration of the APT, the better and more informative the results, as the cone of depression will continue to expand as pumping continues. The foreshortening of the test introduces additional uncertainty to the test results, especially when using the results to make long term predictions related to water availability.

Other issues surrounding the Entrix data collection efforts related to the APT which have to potential to add uncertainty to the APT results include:

1. Something happened to the transducer in pumping Well #3 50 minutes into the test. There is a nearly two hour gap in data collection from 50 minutes into the test to 2 hours and 40 minutes into the test.
2. Manual depth to water measurements in the pumping Orchard Well do not match the data collected by the transducer. At some points, the difference is as much as five feet.
3. It seems as if there were only four data points collected from observation well MW-1 during the first 5 hours and 42 minutes of the test. It also seems that drawdown was ‘zeroed’ at 5 hours and 42 minutes into the test.
4. It seems as if there was only four data points collected from observation well MW-2 during the first 5 hours and 39 minutes of the test. It also seems that drawdown was ‘zeroed’ at 5 hours and 39 minutes into the test.
5. There are only two manually collected data points from observation well MW-6 during pumping portion of the APT.

6. A seemingly arbitrary ‘zero’ point was chosen for the transducer data collected from Stump Springs. Although this method would still show a response in the monitoring well, this is another example of how the field work conducted during the APT varies from standard water resource investigation techniques and adds concern to the data collection efforts. Future aquifer testing should be conducted with independent oversight.

Entrix used the commercially available software package Aqtesolv to analyze their APT data. According to Section 5.2 of the APT Report, Entrix used Aqtesolv to fit each observation well’s time vs. drawdown curve “to the appropriate type curve” to determine aquifer properties. Although not explicitly stated, this suggests that multiple solutions were tried until a best fit was encountered. In all cases, the best curve fits were from the family of curves used to describe leaky aquifers: Entrix specifically called out both a Hantush-Jacob solution curve and a Neuman-Witherspoon solution curve for specific data sets. Both of these solutions specifically describe a situation where the aquifer being tested resides beneath another aquifer separated by an aquitard. The solutions take into account water sourced from both the pumped aquifer and from water leaking though the aquitard to the pumped aquifer from the aquifer above.

Despite the fact that the solution curves fit the data generated by the recorders in the observation wells, due to the lack of subsurface information, the geologic situation the solution curves solve for has not been established at the HHSEGS site. It should also be noted that Entrix assumed a 1000-foot aquifer thickness in their solutions, which may be contradictory with the leaky aquifer concept, and suggests the pumping well and the observation wells are all in one continuous water bearing formation. If this situation is true, an unconfined aquifer solution may be more appropriate for the data. Finally, one primary caveat related to the curve fit aquifer solutions is that the pumping well fully penetrates the aquifer and that flow to the pumping well is horizontal. This cannot be true, assuming that Entrix’s 1000-foot aquifer thickness is valid, which would introduce additional error to the analysis. In short, there is a lack of information about the local geology or depths to aquifers and aquitards, a significant difference between the depth of the pumping wells and the depth of the observation wells, and a seemingly arbitrary application of aquifer test solution curves and aquifer thickness values.

In summary, there are significant deficiencies related to the design, implementation, and analysis of the APT conducted at the HHSEGS site. The most critical is that there is an absence of knowledge of local geologic and hydrologic conditions from which to design a successful test. Entrix designed their APT with no local knowledge of the subsurface below

200-feet bgs, used pumping wells installed into unknown formations and at unknown depths, and used observation wells that were between 300 and nearly 800 feet vertically offset from the pumping wells, and which does not follow standard practice. Any conclusions drawn from such a test are suspect. Additional concerns regarding the collection of data, the duration of the APT, and the way the data were analyzed only add to the uncertainty of the APT results.

California Energy Commission (CEC) Preliminary Staff Assessment (PSA)

The PSA for the HHSEGS was released by the CEC during May 2012. The Water Supply section of the PSA (Section 4.15) addresses potential impacts on groundwater resources by the proposed HHSEGS, including impacts to the Amargosa River. In the summary of conclusions for the Water Supply section, the PSA states "The proposed HHSEGS project would not be expected to have a measureable impact on the Amargosa River or its tributaries." JWI believes there is an insufficient technical basis to support this statement.

In general, there is a scarcity of data related to the hydrology of the southern Pahrump Valley, California Valley, Chicago Valley and the Amargosa River. Also poorly understood are the groundwater interconnections between these aforementioned areas. Data supplied by the applicant has not increased the base of knowledge.

The applicant has attempted to quantify the effects of direct groundwater impacts related to the proposed pumping at the HHSEGS site via two methods. The first method was the use of a simple analytical groundwater model to show the cone of depression likely resulting from 25 years of project pumping. The available data for use in the model was limited to a value for aquifer transmissivity derived from a 1966 aquifer performance test (APT) conducted near the HHSEGS site. All other aquifer parameters were assumed values. The resulting cone of depression extended into the Nopah Range suggesting impacts might extend into California Valley (which is hydrologically linked to the Amargosa River), but not as far as the Amargosa River itself. The second method used by the applicant was to conduct an APT at the HHSEGS site using two pumping wells and an array of monitoring wells. The results of the applicant's APT suggested that the cone of groundwater depression resulting from 25 years of project pumping might not extend past the HHSEGS site boundaries. As described earlier, these results are suspect based on significant concerns related to the applicant's design, implementation and analysis of their APT. Further, it is not appropriate to use an APT to make long-term conclusions regarding impacts. An APT solely allows for the evaluation of hydraulic characteristics which are then used as input in a subsequent analysis to evaluate long-term impacts. In summary, the applicant's APT and modeling efforts have not added to the understanding of the groundwater flow system at the HHSEGS site or in the surrounding areas.

In order to determine if groundwater pumping at the proposed HHSEGS site might have an impact on the Amargosa River, the PSA used a model similar to the applicant's model to show the possible cone of depression resulting from 30 years of project pumping. Using a range of values for aquifer parameters based on the CEC Staff's best estimates, groundwater surfaces were generated for 30 years of proposed project pumping at the HHSEGS site. The resulting cone of depression extended into both Chicago Valley and California Valley. While these assumed drawdowns did not directly intersect the Amargosa River, the project pumping could potentially affect groundwater levels in these valleys that have a defined connection with the Amargosa River.

The PSA also utilized the existing dataset to make general statements about regional groundwater flow. Regarding regional flow from the HHSEGS site, they state,

> "Although a map of the potentiometric surface constructed from available water level data suggests that groundwater in Pahrump [Valley] has a southwesterly flow direction, limited data is available to suggest that groundwater flow in the southern portion of the Pahrump Valley would discharge at the Amargosa River. Potentiometric contours suggest the possibility that groundwater that could be captured by the proposed HHSEGS site has a flow path that may not intersect the river, but would instead flow to the south."

There is no significant data to support or refute the scenario suggested by the above paragraph. The PSA acknowledges this lack of information in the next paragraph by stating,

> "…that flow from the Pahrump Valley, to Chicago Valley, to the Amargosa River could be limited, based on preliminary geochemistry data (ARM 2011a). Unfortunately very few wells exist in between the proposed project and the Amargosa River, which would help to identify flow paths and potential discharge to the Amargosa River."

The PSA is entirely correct in acknowledging the lack of adequate subsurface data supporting or refuting groundwater flow connections between the HHSEGS site and the Amargosa River through the intervening valleys. Impact(s) to the Amargosa River related to project pumping cannot and should not be discounted.

Finally, the PSA performed a travel time calculation for groundwater flowing between the HHSEGS site and the Amargosa River assuming a direct connection. Assuming a travel distance of 20 miles, a hydraulic conductivity (K) value of 1 foot per day (ft/d), a porosity of 0.2 and a gradient based on the difference in groundwater elevation between the site and the river, the calculated groundwater travel time was over 3,000 years. Increasing K to 15 ft/d reduced the travel time to 214 years. These calculations do not reflect the potential for the actual groundwater flow path between the HHSEGS site and the Amargosa River (assuming it exists) to significantly reduce those travel times. For instance, Willow Creek Wash, located at the southern end of California Valley, is a very narrow canyon filled with very recent and unconsolidated alluvium though which groundwater could potentially travel at much higher velocities than those calculated in the PSA. Additionally, the water flowing in this wash often becomes surface flow in the China Ranch area and often remains so all the way to the confluence with the Wild and Scenic Amargosa River. Both of these flow properties would have the effect of shortening the groundwater travel time from the HHSEGS site to the Amargosa River. Groundwater flow system specifics are not accounted for in the PSA travel time calculations due to lack of data, and thus should not be discounted by assuming “no effect.”

More critically, the travel time for a particle of water to reach the Amargosa River from Pahrump Valley has little relationship to hydraulic effects, which can be transmitted nearly instantaneously over long distances within a confined aquifer. The result is that an estimate of travel time from Pahrump Valley is not a conservative assessment of potential effects to the Amargosa River.

In conclusion, the applicant has not substantially added to the needed body of hydrogeologic knowledge regarding the site or the surrounding areas. Additionally, the CEC PSA forms conclusions about the potential for the HHSEGS project to impact flows in the Amargosa River based on an inadequate base of knowledge about the local and regional flow systems. Falling back on ‘assumed understandings’ about the system is not appropriate based on recent drilling along the Amargosa River which altered 50+ years of one ‘assumed understanding’ regarding the relationship between the Amargosa River and the underlying groundwater. Ultimately, additional data points, most significantly monitoring wells both at the HHSEGS site and along suspected flow paths to the Amargosa River, will be needed to answer the question of connectivity.