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CP-201001161
Log # TXNB-10060

Ref. # 10 CFR 52

August 26, 2010

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555
ATTN: David B. Matthews, Director
Division of New Reactor Licensing

SUBJECT: COMANCHE PEAK NUCLEAR POWER PLANT, UNITS 3 AND 4
DOCKET NUMBERS 52-034 AND 52-035
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION NO. 4312 AND 4314

Dear Sir:

Luminant Generation Company LLC (Luminant) submits herein the response to Request for Additional Information (RAI) No. 4312 and 4314 for the Combined License Application for Comanche Peak Nuclear Power Plant Units 3 and 4. The RAIs involve site flooding and groundwater.

The Final Safety Analysis Report pages affected by the response are listed in Attachment 3 and provided on the enclosed CD. Distribution addressees will receive Attachment 3 electronically. Should you have any questions regarding this response, please contact Don Woodlan (254-897-6887, Donald.Woodlan@luminant.com) or me.

There are no commitments in this letter.

I state under penalty of perjury that the foregoing is true and correct.

Executed on August 26, 2010.

Sincerely,

Luminant Generation Company LLC

Donald R. Woodlan for

Rafael Flores

Attachments: 1. Response to Request for Additional Information No. 4312 (CP RAI #144)
2. Response to Request for Additional Information No. 4314 (CP RAI #147)
3. Revised Final Safety Analysis Report Pages on the Enclosed CD

D090
NRO

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# Attachment 1

## Response to Request for Additional Information No. 4312 (CP RAI #144)

# RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4312 (CP RAI #144)**

**SRP SECTION: 02.04.05 - Probable Maximum Surge and Seiche Flooding**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.05-6**

NUREG-0800, Standard Review Plan (SRP), Section 2.4.5, 'Probable Maximum Surge and Seiche Flooding,' establishes criteria that the NRC staff intends to use to evaluate whether an Applicant meets the NRC's regulations.

The NRC staff issued RAI ID 3667 (RAI 112) Question Number 14256 (02.04.05-3), in which the NRC staff asked "Provide discussion to clarify the assumptions made and the risk thresholds used to eliminate from consideration the seiche hazard to the site. Provide a quantitative characterization of the term "rare" as used in reference to USACE geologic hazard evaluations of seiche wave risk."

The Applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The NRC staff reviewed the response and the related revisions contained in UTR #4.

The NRC staff determined that the Applicant has not adequately analyzed or reported the potential for landslide-induced seiche in Squaw Creek Reservoir. The Applicant cites slope stability analysis in COL Part 2 FSAR Section 2.5.5 as indicating that "landslide-induced waves are not plausible for the Squaw Creek Reservoir."

The NRC staff also determined that the slope stability analysis in COL Part 2 FSAR Section 2.5.5 is limited in scope to the subsurface of the power block and ultimate heat sink equipment portions of the proposed site. It does not consider the entire shoreline of Squaw Creek Reservoir, nor does it consider the submerged slopes of the reservoir banks or any submerged accumulation of sediment that may exhibit slope failure within the reservoir.

In order to make its safety determination based on the use of appropriate quantitative and technical analyses and consideration of all mechanisms that could result in a conservative estimate, the staff requests that, that the Applicant include in the FSAR a conceptual model and analysis of landslide-induced seiche within Squaw Creek Reservoir and analyze the effect of such seiche on the design basis flood.

This is supplemental RAI 2.4.5-02-S-a.

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**ANSWER:**

The available past aerial photographs and images of the site do not show any features suggesting the presence of past landslides or slope failures along the shoreline slopes of the Squaw Creek Reservoir (SCR).

In order to perform an engineering evaluation of the SCR shoreline slopes, available USGS topographic data for both pre- and post-construction were studied, and 10 critical sections were selected to represent the overall condition of the SCR shoreline slopes. The selection of the sample sections along the SCR shoreline slopes was based on the slope height, slope gradient, and location. In general, the selected sections have heights ranging between 80 ft and 150 ft, and gradients ranging between 30H:1V (~2°) and 3H:1V (~18°), indicating fairly flat slopes along the SCR shorelines.

The subsurface materials that are relevant to the stability of the SCR shoreline slopes include residual soils and the Glen Rose Formation bedrock. The Glen Rose Formation within the depth of interest consists of interbedded limestone and shale. The thickness of the residual soils may range from a few feet to a few tens of feet. Details of the geology and characteristics of the subsurface materials of the SCR area are discussed in FSAR Section 2.5.

Because of the uniform geology of the site and relatively flat-lying stratigraphy of the Glen Rose Formation, the subsurface materials for the selected sections are assumed to be similar to those of the CPNPP Units 3 and 4 site, as described in FSAR Subsection 2.5.5. The thickness of the residual soils within the sections was selected based on an El. 833 ft for the top of the Glen Rose Formation engineering Layer A, which is an average value obtained from all the field exploration data for the CPNPP Units 3 and 4 site. As a conservative subsurface model, all material strength properties were assumed based on lower-bound values similar to the CPNPP site, as discussed in FSAR Subsection 2.5.5 and shown in Table 2.5.5-202. The selected SCR shoreline slopes were analyzed using the conventional two-dimensional limit-equilibrium for both the static and seismic loading conditions. For seismic loading, a PGA value of 0.10g was used for both the horizontal and vertical components. For the vertical component, both the positive and negative directions were utilized, and whichever resulted in a lower factor of safety was selected as the controlling condition. The slope stability analyses of the SCR shoreline slopes indicate acceptable static long-term and pseudo-static factors of safety with values greater than 1.5 and 1.1, respectively. In order to consider the potential effect of the SCR water level fluctuations (from its maximum El. 783 ft at the spillway level to the minimum level of El. 770 ft), the sections were conservatively modeled as a rapid drawdown condition and stability analyses were performed assuming the very conservative condition that the SCR water level is instantaneously lowered from its highest level of El. 783 ft to the lowest level of El. 770 ft. Results of the slope stability analyses for the conservative condition of rapid drawdown are all acceptable.

In order to investigate the potential for variability of the subsurface material layering, an additional extremely conservative worst case scenario model was also considered, with the assumption that all subsurface materials consist of soils with lower-bound effective strength properties. This model is overly conservative and is not considered to be a realistic model. However, it is only considered as a parameter study to check the sensitivity of potential variation of the subsurface material layering. The results of stability analyses using this worst case scenario model also indicate acceptable factors of safety. Therefore, the state of the stability of the SCR shoreline slopes is not considered to be sensitive to potential variability of subsurface materials layering and thicknesses.

The stability analyses described above demonstrate that the SCR shoreline slopes are stable and no instability or landslide-induced seiches or waves are expected.

Impact on R-COLA

See attached marked-up FSAR Revision 1 pages 2.4-56 and 2.4-57; new pages 2.4-165, 2.4-166, 2.4-167, 2.4-168, 2.4-169; and new Figures 2.4.5-201 and 2.4.5-202.

Impact on DCD

None.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4312 (CP RAI #144)**

**SRP SECTION: 02.04.05 - Probable Maximum Surge and Seiche Flooding**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.05-7**

NUREG-0800, Standard Review Plan (SRP), Section 2.4.5, 'Probable Maximum Surge and Seiche Flooding,' establishes criteria that the NRC staff intends to use to evaluate whether an Applicant meets the NRC's regulations.

The NRC staff issued RAI ID 3667 (RAI 112) Question Number 14256 (02.04.05-3), in which the NRC staff asked "Provide discussion to clarify the assumptions made and the risk thresholds used to eliminate from consideration the seiche hazard to the site. Provide a quantitative characterization of the term "rare" as used in reference to USACE geologic hazard evaluations of seiche wave risk."

The Applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The NRC staff reviewed the response and the related revisions contained in UTR #4.

The NRC staff has determined that the Applicant has not defined the term "rare", either in the context of the referenced USACE geologic hazard evaluation or in the context of risk that an extreme seiche would increase the design basis flood for the proposed site.

In order to avoid ambiguity from the usage of generic and overly qualitative terms and base safety determinations on appropriate consideration of relevant mechanisms that could result in conservative estimates, the NRC staff requests that the Applicant define the term "rare" and quantify the risk to the site.

This is supplemental RAI 2.4.5-02-S-b.

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**ANSWER:**

In its response to Question 02.04.05-3, Luminant quoted directly from the U.S. Army Corps of Engineers (USACE) publication "Seismic Design for Buildings," TI 809-04, which did not explain its usage of the word "rare." Rather than provide a definition that might not clearly convey what the USACE meant, Luminant has provided a discussion below and in the FSAR regarding the risk of a seiche on Squaw Creek Reservoir (SCR).

The risk of the occurrence of seismic seiches greater than about 5 ft in height at the SCR site is considered very low because a comprehensive study by Barberopoulou (2006, 2007) found that Lake Union, Washington, a site with geometry, geology, and seismicity conditions that are much more favorable for seismic seiche development, indicated a maximum seismic seiche height of about 5 ft. Lake Union is therefore considered to be a conservative bounding case for SCR, and maximum seismic seiche heights at the SCR location are not expected to exceed those for Lake Union. The CPNPP Units 3 and 4 site finish grade elevation of 822 ft provides an approximately 28-foot margin over the maximum SCR water level during the PMF event (793.66 ft), which is significantly larger than the expected maximum seismic seiche height of 5 ft.

Seismic seiching is a recurrent phenomenon in areas with high seismic activities and mainly depends on factors such as frequency and magnitude of the excitation, depth and geometry of the water body, and the sediment properties surrounding the water body (McGarr, 1968, Barberopoulou, 2006). The height of a seiche is directly proportional to the horizontal seismic surface wave acceleration in the period range of about 5 to 15 seconds and the square root of the depth of the water body. It is also roughly proportional to the thickness of low-rigidity or soft sediments because soft sediments tend to amplify the seismic acceleration. Long, linear shorelines of the water bodies are also found to have one of the largest contributions to the height of the seiche.

Lake Union is located in Seattle, Washington, an area with frequent seismic activity. It is roughly rectangular in shape, with dimensions of about 5000 ft by 8500 ft, and depths ranging between about 20 ft and 50 ft. The subsurface materials in the Seattle and Lake Union area consist of very thick low-density, low-rigidity, unconsolidated sediments. Barberopoulou's study considered several large local and distant earthquakes, as well as synthetic excitations. He also analyzed the response of a rectangular basin with variable depths of up to 164 feet. For the worst case of a 164-foot depth, the estimated maximum seiche height is about 12 feet.

The SCR is roughly triangular in shape, with a length of about 22,000 ft, and a width ranging between about 1500 ft and 5000 ft. The reservoir shorelines are irregular in shape and the reservoir depth generally ranges between 20 ft and 75 ft, with the exception of the area immediately behind the dam, where the depth increases to about 120 ft. The subsurface material in the general SCR area consists of Glenn Rose Formation, with a very minimal amount of low-rigidity alluvium deposit.

Seismic seiches resulting from the 1964 Alaska Earthquake (M 9.2) were also recorded at more than 850 surface water gaging stations within lakes, reservoirs, ponds, or rivers in North America (McGarr and Vorhis, 1968). The maximum measured seiche was about 2 feet, with the densest occurrence in areas with thickest alluvium or low-rigidity sediments. Although this information can not be construed to be a complete representation of all past seismic seiche occurrences, the lack of any measured seiche greater than 2 feet during such a significant seismic event further supports the conclusion that seismic seiches greater than 5 ft in height are not expected the SCR site.

<u>References:</u>

McGarr, A., and R.C. Vorhis (1968), Seismic Seiches from the March 1964 Alaska Earthquake, U.S. Geological Survey Professional Paper 544-E.

Barberopoulou, A. (2006), Investigating the damage potential of seismic seiche: a case study of the Puget Lowland, Ph.D. Thesis, University of Washington.

Barberopoulou, A. (2008), A Seiche Hazard Study for Lake Union, Seattle, Washington, Bulletin of the Seismological Society of America, Vol. 98, No. 4.

Impact on R-COLA

See attached marked-up FSAR Revision 1 pages 2.4-55 and 2.4-107.

Impact on DCD

None.

# Attachment 2

## Response to Request for Additional Information No. 4314 (CP RAI #147)

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4314 (CP RAI #147)**

**SRP SECTION: 02.04.12 - Groundwater**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.12-8**

NUREG-0800, Standard Review Plan (SRP), Chapter 2.4.12, 'Groundwater,' establishes criteria that the NRC staff intends to use to evaluate whether an applicant meets the NRC's regulations.

By letter dated October 2, 2009, the NRC staff issued RAI ID 3672 (RAI No. 114) Question Number 14266 (02.04.12-1), in which the NRC staff asked, "Provide a description of the process followed to determine the conceptual models subsequently used to establish subsurface site characteristics related to groundwater to ensure that the most conservative of plausible conceptual models have been identified."

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The NRC staff has reviewed the response and has determined that additional information is needed in order to complete its review.

The staff determined that an adequate description of the processes used to develop conservative conceptual models used subsequently in the accidental release evaluations was not sufficiently provided in the RAI response. The information provided in the response has numerous assumptions and lacked adequate conceptual description, data, and analyses to characterize the site alterations and how these alterations affect the hydrologic processes at the site. For example, it is assumed that there will not be any shallow groundwater at the site after construction is completed because the A and B zones will be entirely removed and the surface water drainage system will be designed to prevent subsurface infiltration.

Also, the NRC staff disagrees with a statement, which was made intermittently throughout the RAI responses and the combined license application, Revision 1 Part 2 FSAR, that groundwater within the Glen Rose Formation is "not real groundwater". This statement is unsupported since on the basis of data presented, the NRC staff asserts that the Glen Rose Formation is indeed a groundwater bearing perched aquifer.

In order to make its safety determination based on adequate characterization of the site, the NRC staff requests that the applicant provide the information below. The responses should follow guidance related to the analysis of groundwater related hazards through compliance with this and the accompanying RAIs.

1. Provide adequate conceptual and site specific information on how the surface water and groundwater flow system is expected to change after Comanche Peak Nuclear Power Plant, Units 3 and 4 are constructed.

2. Provide an adequate site conceptual model supported by data, analyses and construction design information to support the conclusions presented.

This is supplemental RAI 2.4.12-00-S.

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**ANSWER:**

The information requested in this question is discussed in detail in the responses to Questions 02.04.12-9, 02.04.12-10, and 02.04.12-13. Information and analysis discussed in those responses will explain changes in groundwater flow patterns following construction of CPNPP Units 3 and 4.

Impact on R-COLA

None.

Impact on DCD

None.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4314 (CP RAI #147)**

**SRP SECTION: 02.04.12 - Groundwater**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.12-9**

NUREG-0800, Standard Review Plan (SRP), Chapter 2.4.12, 'Groundwater,' establishes criteria that staff intends to use to evaluate whether an applicant meets the NRC's regulations.

By letter dated October 2, 2009, the NRC staff issued RAI ID 3672 (RAI No. 114) Question Number 14267 (02.04.12-2), in which the NRC staff asked "The CPNPP Units 1 and 2 FSAR states that alterations related to construction increased groundwater levels onsite. In order to understand the effect of construction of Units 3 and 4 on the hydrologic characteristics of the subsurface, plausible groundwater pathways, and site groundwater levels, Luminant is requested to provide a detailed description of the location and extent of planned construction activities including: excavation of regolith/undifferentiated fill and bedrock, the placement of engineered fill and the addition of engineered features (such as drainage ditches, parking lots, roads, etc.). Additionally, please evaluate and discuss the impact of these changes on site hydrologic processes such as infiltration, surface runoff, groundwater levels, hydraulic gradients and flow paths."

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The NRC staff has reviewed the response and has determined that additional information is needed in order to complete its review.

The staff acknowledges that the additional information provided in the response partially satisfies the information need with regard to the post-construction site conditions. However, the information provided did not incorporate adequate description of the location and extent of planned construction activities including: excavation of regolith, undifferentiated fill and bedrock, the placement of engineered fill and the addition of engineered features (such as drainage ditches, subsurface drains, parking lots, roads, etc.)

The NRC staff provides the following examples that demonstrate some of the inadequacies in the description and level of details provided within the response.

1) The applicant stated that there will not be any shallow groundwater at the site after construction is completed because the A and B zones will be removed and the surface water drainage system will be designed to prevent subsurface infiltration and preclude buildup near plant foundations. However, these statements are not sufficient to illustrate that the system will function as designed and to establish a

maximum operational groundwater level and ensure compliance with the US-APWR design parameter groundwater level. In fact, Section 2.4.13 of the FSAR for Units 1 and 2 states that construction activities actually created areas where water levels were elevated due the placement of permeable fill materials. The data and evaluations presented are not adequate and of sufficient detail to show that this will not occur at the Units 3 and 4 site. For example, Figures 2.4.12-213 and 2.4.12-214 show new fill around many of the new structures but it is not clear how and if this new fill will be drained and what post-construction groundwater and surface water conditions (flow and levels) will be like.

2) The water level hydrographs from B-zone monitoring wells MW1201b (middle of Unit 4) and MW1207b (just north of Unit 3) have water level elevations of over 830 ft. The screened interval for these wells extends to elevations of 808 ft and 803 ft, respectively, which is well below the 822 ft site grade. This suggests that at least some portion of the water bearing B-zone could remain after the site grading is completed. The applicant has stated that it will all be removed.

In order to make its safety determination based on adequate characterization of the site that depicts the post-construction scenario adequately, the NRC staff requests that the applicant provide the following information.

1) A qualitative description of the construction related impacts that could affect site hydrology including maps at a legible scale, sufficiently detailed engineering design information on drainage systems and a description of conservative measurements or estimates of hydrologic parameters. This information should be of sufficient detail to support an analysis of the impact of site modifications on site hydrologic processes such as infiltration, surface runoff, groundwater levels, hydraulic gradients and flow paths.

2) A conservative quantitative analysis that demonstrates that the estimated maximum operational groundwater level complies with the US-APWR Design Certification Document.

This is supplemental RAI 2.4.12-01-S.

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**ANSWER:**

Pre-Construction Conditions

In general, the groundwater A-zone wells are completed above the top of bedrock in the soil or undifferentiated swale fill material (existing fill), the groundwater B-zone wells are completed in the engineering layer "A" (upper weathered Glen Rose Formation), and the groundwater C-zone wells are completed in the engineering layer "C" (competent, non-weathered Glen Rose Formation).

Hydrographs of the monitoring wells installed in the vicinity of the power blocks confirm the water levels in the groundwater C-zone are consistently dry or exhibit very slow infiltration of groundwater from the formation into the well. With the currently available data, the maximum groundwater level in a groundwater C-zone zone well is 802.28 ft msl (MW-1207c; 5/28/08). This well has shown an average increase in water level of 1.36 ft/month without reaching an equilibrium condition as of the final gauging event. Similar analysis can be made for other groundwater C-zone wells and groundwater B-zone wells from the hydrographs.

It is apparent that perched water within the overlying regolith (groundwater A-zone) is recharging (via infiltration) water within the groundwater B-zone and possibly the groundwater C-zone. Perched groundwater levels within the soil (groundwater A-zone) near the power blocks are measured between approximately 828 and 859 ft msl, and groundwater B-zone wells, which exhibit equilibrium conditions, range from approximately 820 to 833 ft msl, further supporting slow infiltration.

While the connection mechanisms (bedding plains, weathered zones, and other related mechanisms) allowing infiltration are very small, they do exist and will transmit groundwater from recharge areas into the weathered portions of the engineering layer "A", which can be transmitted to the foundation fill, although very slowly.

Construction-Related Impacts and Maximum Operational Groundwater Level

Soils and the upper surface of engineering layer "A" will be removed from the entire plant site, with cut backs surrounding the site to the south and west as illustrated in both FSAR Figures 2.4.2-202 and 2.5.5-204. At the base of the grading cut backs, a trench drain will be installed to divert water (stormwater or groundwater seepage) away from the site to the stormwater collection ponds to the east and west of the plants. Additional drainage swales will be installed throughout the site to drain stormwater away from the buildings.

Once the soils (groundwater A-zone) are removed from the site, a topographically higher soil horizon will remain to the south and west of the power block areas. Although this higher soil horizon may provide a recharge source for those portions of the engineering layer "A" that remain surrounding the engineered fill within the plant site, the final site grading and drainage plan, illustrated in both FSAR Figures 2.4.2-202 and 2.5.5-204, shows the base of the drainage system along the southern and western boundaries of the plant site to be less than 820 ft msl. The northern and eastern boundaries of the site slope directly from the plant grade level of 822 ft msl towards Squaw Creek Reservoir (SCR), with normal pool elevation at 775 ft msl, or the stormwater holding ponds, with elevations at approximately 800 ft msl. This relationship is also depicted in Figure 1-1.

Groundwater recharge from the remaining soils into engineering layer "A" and the engineered fill surrounding the embedded portions of Units 3 and 4 is constrained by the base of the trench drain. With the exception of small amounts of landscaping, no soils would remain in the plant site which would be capable of recharging the remaining engineering layer "A". Site drainage is designed to remove stormwater with no pooling, thus preventing areas of recharge within the plant site.

Based on the interception of infiltrating perched groundwater or stormwater by the site drainage system, the maximum groundwater potentiometric surface at the site would be found at the base of the trench drain along the southern and western cut banks, equivalent to a maximum elevation of 820 ft msl. No constraining boundaries exist on the northern and eastern plant boundaries prior to the lower pool elevations of SCR. One retaining wall is to be constructed along the shore of SCR north of the Unit 3 UHS basins; however, the retaining wall is of limited extent and the top of the retaining wall is approximately 800 ft msl, well below the DCD maximum groundwater elevation. Two stormwater retention basins are also to be constructed to the east of Unit 3 and the west of Unit 4; however, the overflow elevations will be less than 810 ft msl, preventing accumulated stormwater from recharging the subsurface groundwater above the DCD maximum groundwater elevation.

Based on the lack of a constraining boundary or infiltration source above the DCD maximum groundwater elevation, the groundwater potentiometric surface will exhibit a lowering gradient towards SCR; therefore, the groundwater level from seepage into the fill material surrounding the power block embedment will not exceed a maximum of 820 ft msl, and should be less due to the gradient towards SCR.

Determination of the exact maximum groundwater elevation at the power block locations will be difficult, if not impossible, to calculate. However, based on the above discussion, use of the constrained maximum groundwater elevation at the cut back trench drain base (maximum 820 ft msl) between 300 feet (west) to 700 feet (south) from CPNPP Units 3 and 4 and the removal of recharge sources in the plant location (groundwater A-zone) conservatively proves the groundwater levels at the power block embedded foundations will not exceed the DCD required maximum groundwater elevation of 1 ft below the site grade elevation (822 ft msl).

Groundwater conditions described in FSAR Subsection 2.5.1.2.5.5 have been revised to ensure consistency with the model described herein.

Attachment

Figure 1-1 Cross-Section Location Map

Impact on R-COLA

See attached marked-up FSAR Revision 1 pages 2.4-75, 2.4-76, 2.4-77, 2.4-78, 2.4-80, 2.4-81, 2.4-82, 2.4-83, 2.4-84, 2.4-85, 2.4-87, 2.4-216, 2.4-217, 2.4-218, 2.4-219, 2.4-220, Figures 2.4.12-210 (Sht 1-12), 2.4.12-212, 2.4.12-213, 2.4.12-214, page 2.5-58, and Figure 2.5.5-204.

Impact on DCD

None.

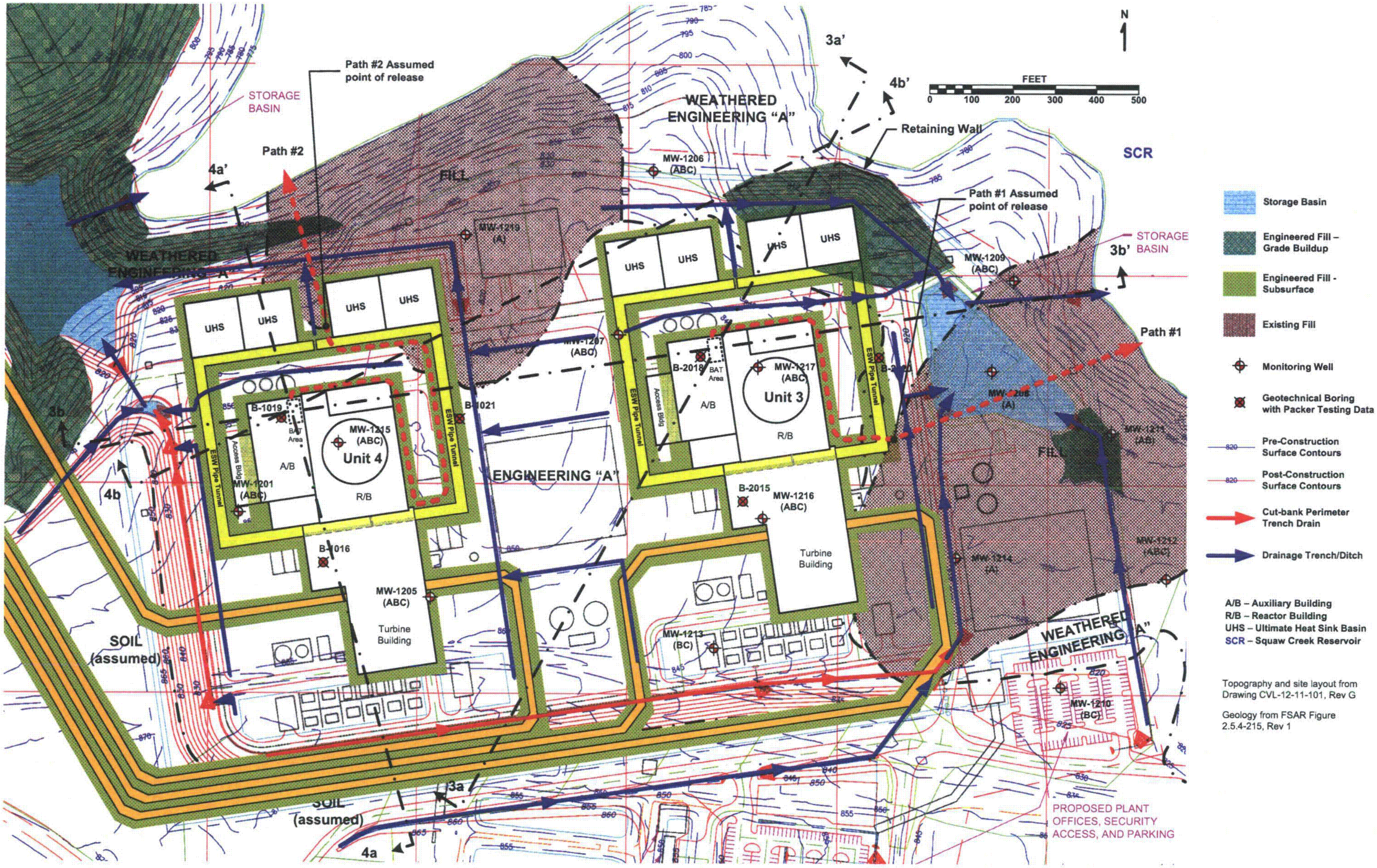


**Figure 1-1 Cross-Section Location Map**

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4314 (CP RAI #147)**

**SRP SECTION: 02.04.12 - Groundwater**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.12-10**

NUREG-0800, Standard Review Plan (SRP), Chapter 2.4.12, 'Groundwater,' establishes criteria that the NRC staff intends to use to evaluate whether an applicant meets the NRC's regulations.

By letter dated October 2, 2009, the NRC staff issued RAI ID 3672 (RAI No. 114), Question Number 14268 (02.04.12-3), in which the NRC staff asked "In accordance with 10 CFR 52.79(a) provide illustrations of cross-sections through the centerline of each proposed reactor area which present the post-construction site configuration, hydrogeological units beneath the site (including the Twin Mountains Formation and bedrock transition zone found in the Glen Rose), monitoring wells and borings used as control points and probable directions of groundwater movement. Also provide maps displaying post-construction site features and conceptualize post-construction groundwater conditions."

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The NRC staff has reviewed the response and has determined that additional information is needed in order to complete its review.

The staff acknowledges that cross-sections were included in the applicant's response as Figures 2.4.12-213 and 2.4.12-214 and Figures 2.5.4-209 through 211. While these cross-sections contain useful and related information they do not satisfy the intent of the original RAI, which was to illustrate the post-construction conceptual site configuration by incorporating description of conceptual hydrologic conditions (such as groundwater levels, flow directions, etc.) and site hydrogeology with associated well or boring control points through the Twin Mountains Formation on one set of cross-sections.

Information provided in the cross-sections does not clearly show the anticipated surface and groundwater conditions. The flowpaths presented in these cross-sections are simple straight lines with little documentation or maps to support the selection of these specific pathways as the most probable result of post-construction conditions. The interaction between surface water and groundwater is important and there are insufficient details on expected interactions post-construction.

In order to make its safety determination based on adequate characterization of the site, the NRC staff requests that the applicant provide cross-sections through the centerline of each proposed reactor area which present on the same figure the post-construction site configuration, hydrogeological units beneath the site (including the Twin Mountains Formation and bedrock transition zone found in the Glen Rose), monitoring wells and borings used as control points and probable directions of groundwater movement. Also provide maps displaying post-construction site features and conceptualize post-construction groundwater conditions.

This is supplemental RAI 2.4.12-02-S.

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**ANSWER:**

Figures 1-2 through 1-5 provide the requested information. The cross-sections are defined on Figure 1-1 attached to the response to Question 02.04.12-9 above

Reference

Grading and Drainage Plan, Drawing CVL-12-11-101, Rev G.

Attachments

Figure 1-2 Cross-Section 3a

Figure 1-3 Cross-Section 3b

Figure 1-4 Cross-Section 4a

Figure 1-5 Cross-Section 4b

Impact on R-COLA

None.

Impact on DCD

None.

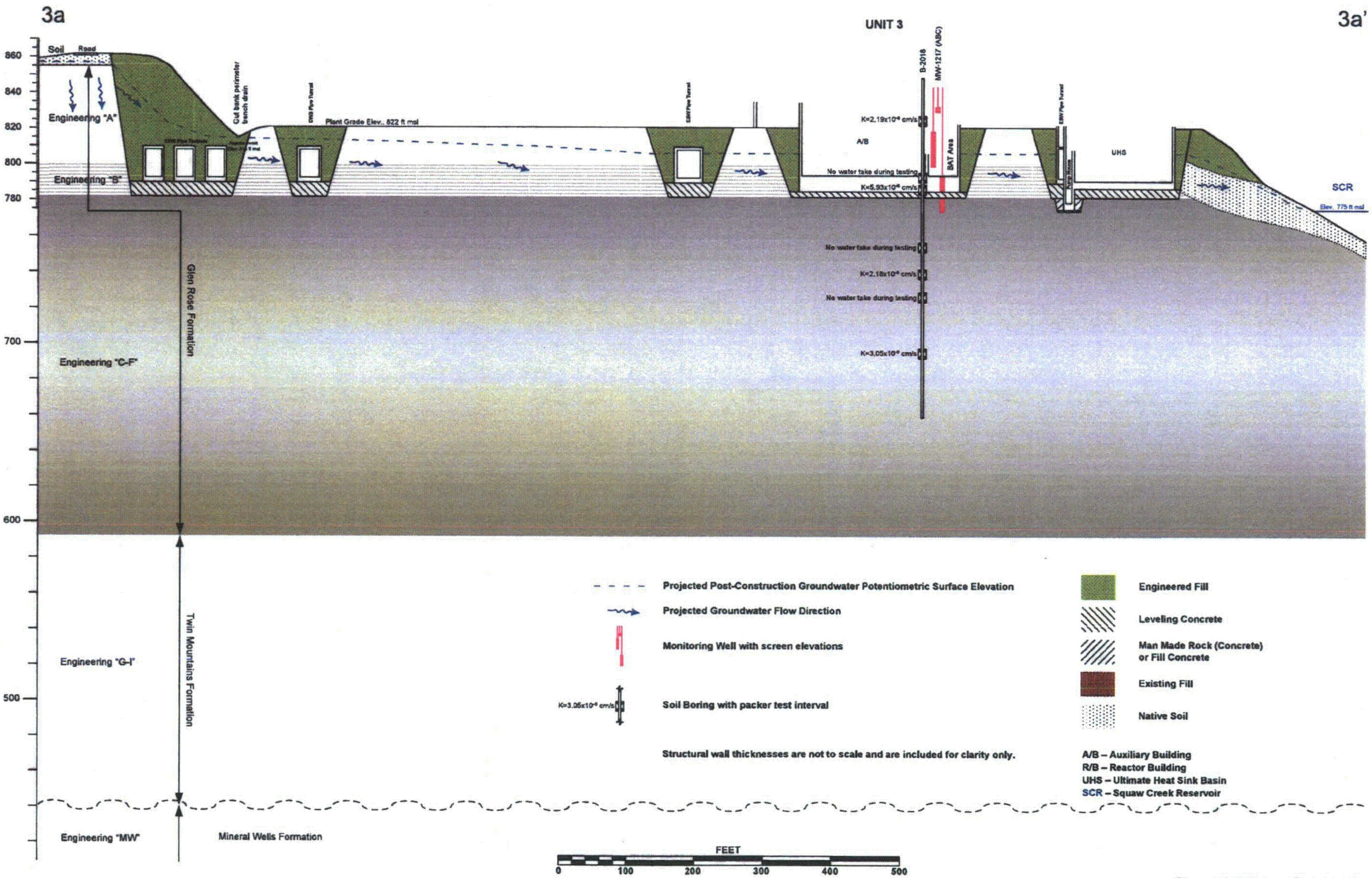


**Figure 1-2 Cross-Section 3a**

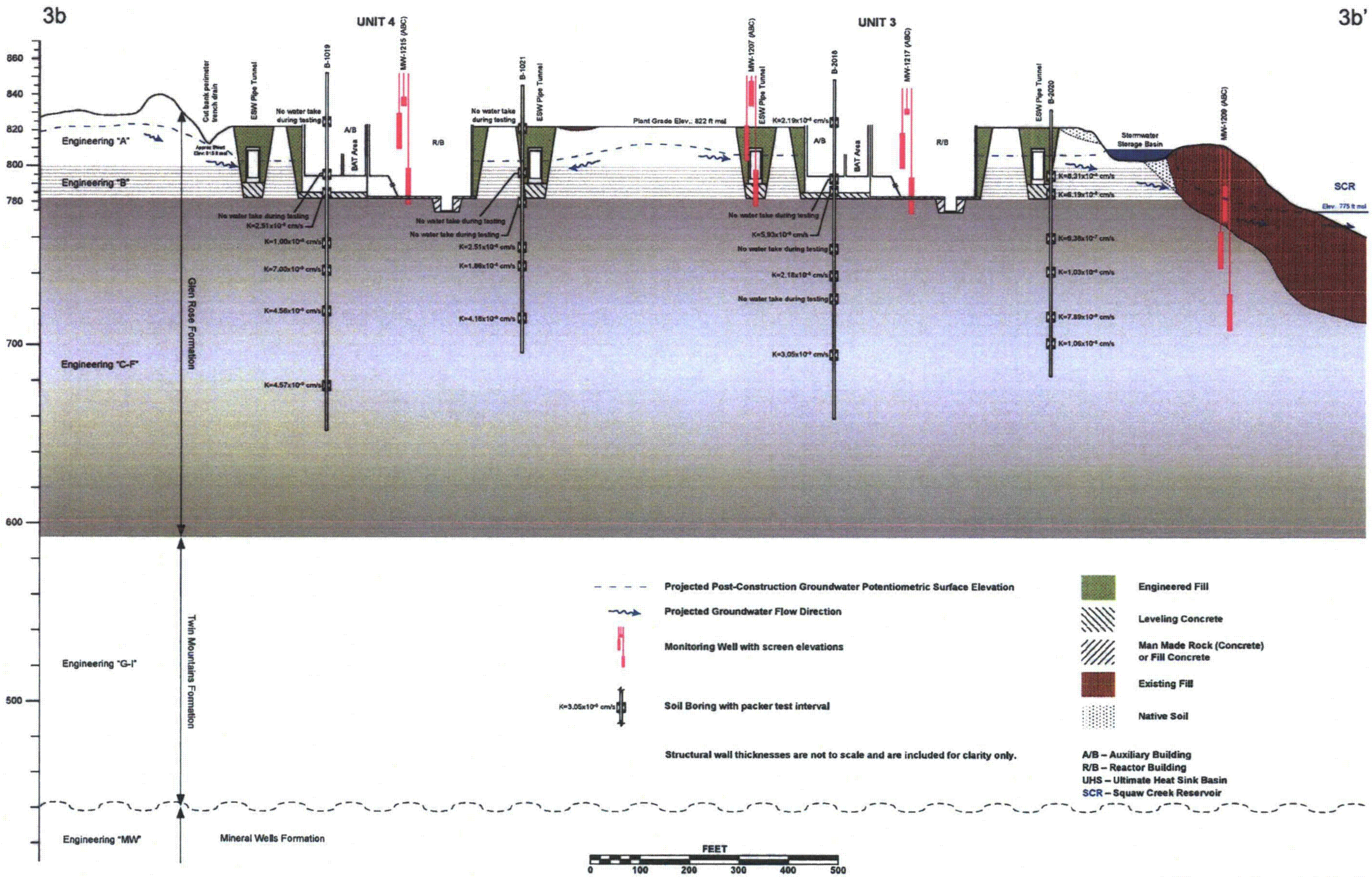


**Figure 1-3 Cross-Section 3b**

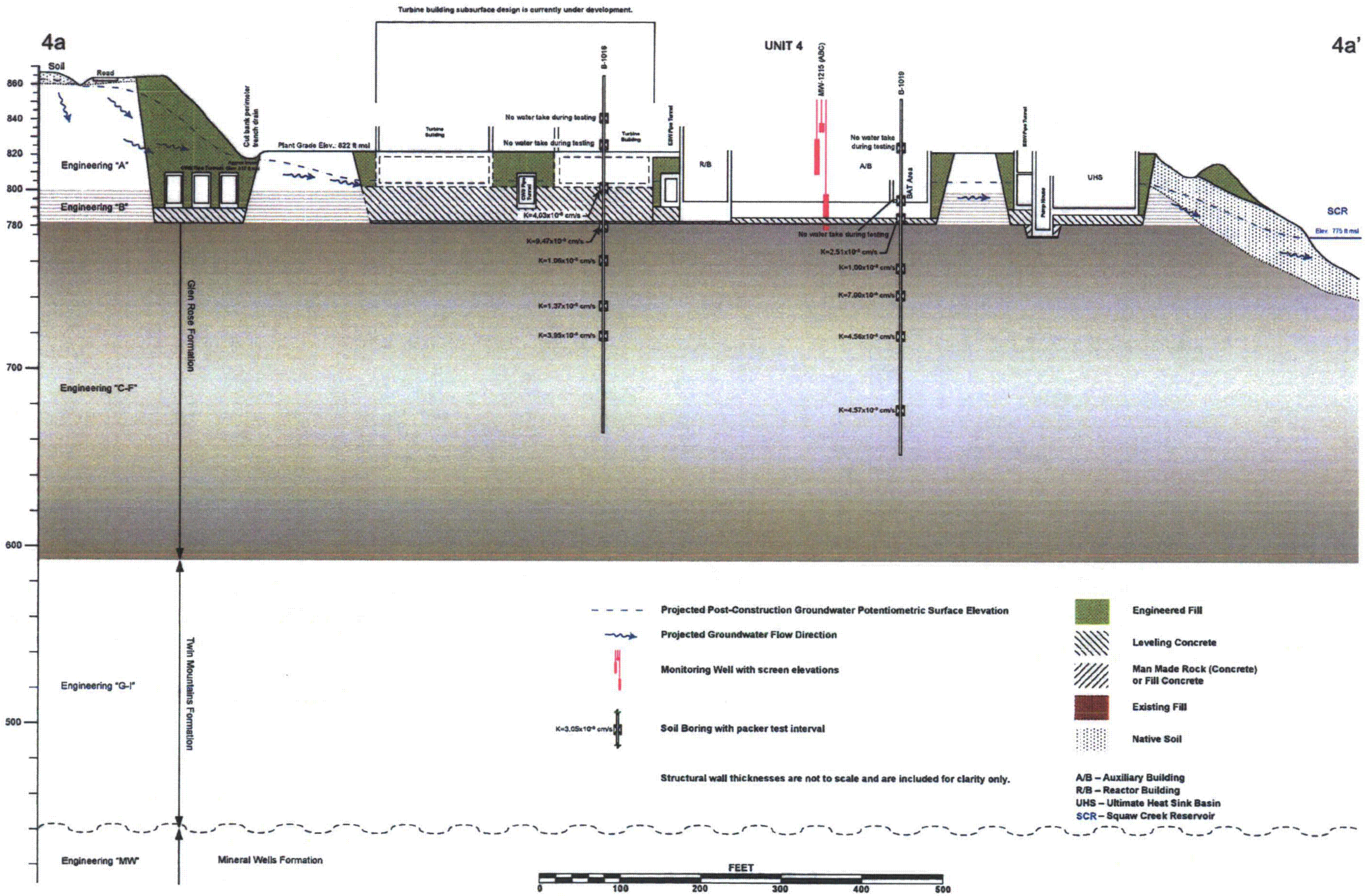


Figure 1-4 Cross-Section 4a

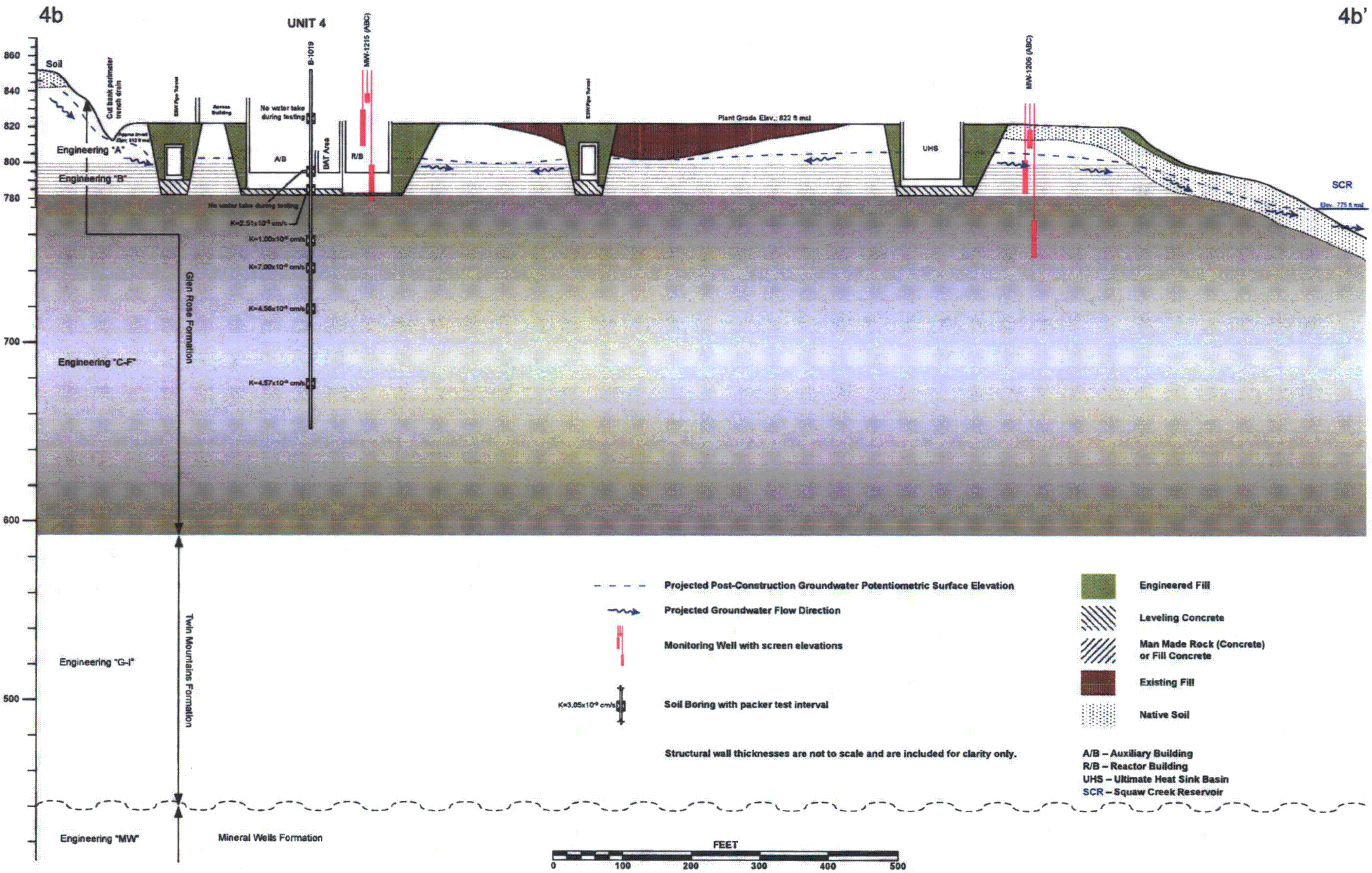


**Figure 1-5 Cross-Section 4b**

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4314 (CP RAI #147)**

**SRP SECTION: 02.04.12 - Groundwater**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.12-11**

NUREG-0800, Standard Review Plan (SRP), Chapter 2.4.12, 'Groundwater,' establishes criteria that the NRC staff intends to use to evaluate whether an applicant meets the NRC's regulations.

By letter dated October 2, 2009, the NRC staff issued RAI ID 3672 (RAI No. 114), Question Number 14269 (02.04.12-4), in which the NRC staff asked "In order to understand impacts of seasonality and climatic fluctuations on aquifers beneath and in the vicinity of the site, the Applicant is requested to provide the following information: (a) Explain or discuss any trends or fluctuations in data from onsite monitoring wells, which will be displayed on the revised hydrographs submitted as part of the Applicant's response to Environmental RAI HYD-06; (b) Correlate data from onsite monitoring wells to monitoring data from area wells with longer records, and provide a discussion of any apparent seasonal and climatic trends and aquifer response to historic precipitation conditions; and (c) Identify current precipitation conditions at the site (i.e., wet, normal or drought conditions) and evaluate and discuss the effect that long-term wet and dry periods will have on the post-construction groundwater conditions and compliance with the design criteria maximum groundwater level."

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The NRC staff has reviewed the response and has determined that additional information is needed in order to complete its review.

The staff determined that the applicant's response does not adequately address parts (b) and (c) of the RAI. As presented in the RAI response to part (b), it was determined during the site audit that due to the location of Squaw Creek Reservoir to the north, east and south-east of the site, data from offsite wells within the Glen Rose Formation would not likely be helpful in confirming flow directions in the vicinity of the site. However, an evaluation of groundwater level trends in any nearby offsite wells which may exist is still needed to better understand the response of the aquifer to long-term hydro-climatic stresses such as changes in precipitation and evapotranspiration.

In response to part (c) the applicant asserted that long term climatic changes would have minimal effect due to the limited number of wells exhibiting seasonal and long-term fluctuations and the planned removal of a large portion of the Glen Rose Formation. The staff agrees that aquifer response to precipitation may not be seen in all wells in the Glen Rose Formation. However, fluctuations of several feet are observed in several wells. The staff also understands that a large portion of the Glen Rose Formation near the site will be removed. However, the extent of this removal is not clear to the staff and it appears that after removal, water-bearing portions of the Glen Rose Formation may be left intact in the vicinity of the site.

In order to make its safety determination based on adequate characterization of the site and description of the hydrologic causal mechanisms that govern groundwater flow processes at the site, the NRC staff requests that the applicant provide the following information.

1) Discussion on long-term groundwater trends based on data from nearby wells with longer periods of monitoring

2) Description of how current precipitation conditions relate to normal or extreme precipitation conditions (wet, normal, and dry).

3) Description of impacts of groundwater level fluctuations due to changes in precipitation conditions on the maximum operational groundwater level determined in response to RAI 2.4.12-01-S.

This is supplemental RAI 2.4.12-03-S-a.

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**ANSWER:**

1) Longer periods of data do not exist from regional Glen Rose formation wells. Wells with longer periods of monitoring are in a distinctly different groundwater regime (overlain by the Paluxy) and are not correlatable for comparison to groundwater conditions at the CPNPP site. Groundwater levels are prevented from exceeding DCD limits by the grading plan and post-construction site modifications.

2) During the monitoring period (2006-2008), the area was considered to be near normal to wet according to the NOAA Historic Palmer Drought Indices. The area has remained near normal precipitation with the occasional, normal summer moderate drought conditions. Table 1 summarizes the NOAA data.

3) The only wells that show any effect due to precipitation are the groundwater A-zone wells, which will be entirely removed within the plant area. In addition, the maximum groundwater accumulation within the underlying formations will be controlled by the post-construction grading plan (see response to Question 02.04.12-9 above).

<u>Reference</u>

NOAA National Climactic Data Center, Historic Palmer Drought Indices, Website, http://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers.php, accessed July 27, 2010.

<u>Attachment</u>

Table 1 Summary of NOAA Palmer Modified Drought Index Data

<u>Impact on R-COLA</u>

None.

<u>Impact on DCD</u>

None.

Table 1 Summary of NOAA Palmer Modified Drought Index Data

| Month Year | Severe Drought -3.00 to -3.99 | Moderate Drought -2.00 to -2.99 | Mid-Range -1.99 to +1.99 | Moderately Moist +2.00 to +2.99 | Very Moist +3.00 to +3.99 | Extremely Moist +4.00 and above |
|---|---|---|---|---|---|---|
| Nov-06 | X | | | | | |
| Dec-06 | X | | | | | |
| Jan-07 | | | X | | | |
| Feb-07 | | X | | | | |
| Mar-07 | | | X | | | |
| Apr-07 | | | X | | | |
| May-07 | | | | X | | |
| Jun-07 | | | | | | X |
| Jul-07 | | | | | | X |
| Aug-07 | | | | | | X |
| Sep-07 | | | | | | X |
| Oct-07 | | | | | | X |
| Nov-07 | | | | | X | |
| Dec-07 | | | X | | | |
| Jan-08 | | | X | | | |
| Feb-08 | | | X | | | |
| Mar-08 | | | X | | | |
| Apr-08 | | | X | | | |
| May-08 | | | X | | | |
| Jun-08 | | | X | | | |
| Jul-08 | | | X | | | |
| Aug-08 | | | X | | | |
| Sep-08 | | | X | | | |
| Oct-08 | | | X | | | |

| Month Year | Severe Drought -3.00 to -3.99 | Moderate Drought -2.00 to -2.99 | Mid-Range -1.99 to +1.99 | Moderately Moist +2.00 to +2.99 | Very Moist +3.00 to +3.99 | Extremely Moist +4.00 and above |
|---|---|---|---|---|---|---|
| Nov-08 | | | X | | | |
| Dec-08 | | X | | | | |
| Jan-09 | X | | | | | |
| Feb-09 | X | | | | | |
| Mar-09 | X | | | | | |
| Apr-09 | | X | | | | |
| May-09 | | X | | | | |
| Jun-09 | | X | | | | |
| Jul-09 | | X | | | | |
| Aug-09 | | X | | | | |
| Sep-09 | | X | | | | |
| Oct-09 | | | X | | | |
| Nov-09 | | | | X | | |
| Dec-09 | | | | | X | |
| Jan-10 | | | | | X | |
| Feb-10 | | | | | X | |
| Mar-10 | | | | | X | |
| Apr-10 | | | | | X | |
| May-10 | | | | X | | |
| Jun-10 | | | X | | | |
| Jul-10 | | | X | | | |

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4314 (CP RAI #147)**

**SRP SECTION: 02.04.12 - Groundwater**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.12-12**

NUREG-0800, Standard Review Plan (SRP), Chapter 2.4.12, 'Groundwater,' establishes criteria that the NRC staff intends to use to evaluate whether an applicant meets the NRC's regulations.

By letter dated October 2, 2009, the NRC staff issued RAI ID 3672 (RAI No. 114), Question Number 14269 (02.04.12-4), in which the NRC staff asked "In order to understand impacts of seasonality and climatic fluctuations on aquifers beneath and in the vicinity of the site, Luminant is requested to provide the following information: (a) Explain or discuss any trends or fluctuations in data from onsite monitoring wells, which will be displayed on the revised hydrographs submitted as part of Luminant's response to Environmental RAI HYD-06; (b) Correlate data from onsite monitoring wells to monitoring data from area wells with longer records, and provide a discussion of any apparent seasonal and climatic trends and aquifer response to historic precipitation conditions; and (c) Identify current precipitation conditions at the site (i.e., wet, normal or drought conditions) and evaluate and discuss the effect that long-term wet and dry periods will have on the post-construction groundwater conditions and compliance with the design criteria maximum groundwater level."

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The NRC staff has reviewed the response and has determined that additional information is needed in order to complete its review.

The NRC staff determined that the hydrographs with rainfall data provided by the applicant's response do not provide adequate information to determine whether the data demonstrates equilibrium conditions since water levels in some wells are still increasing.

In order to make its safety determinations based on the most current and reliable information, the staff requests that the applicant provide updated hydrographs with more recent data.

This is supplemental RAI 2.4.12-03-S-b.

---

**ANSWER:**

Eighteen months of groundwater gauging data for the on-site monitoring wells has been provided. No further data collection was performed for the on-site groundwater monitoring wells.

Historical on-site water levels are discussed in FSAR Subsection 2.4.12.2.3, which emphasizes the general lack of reliable groundwater found during construction activities at CPNPP Units 1 and 2. None of the onsite monitoring wells with the exception of some soil (groundwater A-zone) wells, shows a correlation with rainfall data collected from the Opossum Hollow rain gage. Additional and more recent data would not provide any useful information as it has already been shown that the wells do not respond to climatic changes.

Currently, the only wells that show any effect due to precipitation are the groundwater A-zone wells. These wells will be entirely removed and maximum groundwater accumulation within the underlying formations will be controlled by the post-construction grading plan.

Impact on R-COLA

None.

Impact on DCD

None.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4314 (CP RAI #147)**

**SRP SECTION: 02.04.12 - Groundwater**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.12-13**

NUREG-0800, Standard Review Plan (SRP), Chapter 2.4.12, 'Groundwater,' establishes criteria that the NRC staff intends to use to evaluate whether an applicant meets the NRC's regulations.

By letter dated October 2, 2009, the NRC staff issued RAI ID 3672 (RAI No. 114), Question Number 14270 (02.04.12-5), in which the NRC staff asked "The four groundwater flow paths and related travel time scenarios presented in FSAR Section 2.4.12.3 are based on current site conditions. To demonstrate compliance with 10 CFR 100.20(c), which requires consideration of site characteristics which may affect flow and transport, please evaluate the applicability of these flowpaths in a post-construction setting and provide a revised description of the most conservative, plausible post-construction flowpaths, if needed."

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The NRC staff has reviewed the response and has determined that additional information is needed in order to complete its review.

The staff noted that groundwater levels in wells MW-1200b and MW-1202B are labeled as anomalous on Figures 2.4.12-210 sheets 6 through 8. However, Table 2.4.12-209 shows that the water levels measured in the wells were relatively consistent throughout the period of monitoring. The information lacks adequate description of why the values from these wells are considered anomalous and not included as part of the potentiometric contouring on Figures 2.4.12-210. If included, the data could indicate that water levels within B-zone are lower to the west of the Unit 4 reactor site and that groundwater may flow from Unit 4 to the west.

The NRC staff also noted that the four flowpaths currently presented in the FSAR represent the shortest straight line from the proposed Units to SCR. As a result, the resultant flowpaths may not be realistically representative of the post-construction environment.

In order to make its safety determination based on information that adequately demonstrates conservatism and consideration of the post-construction conditions at the site, the staff requests that flowpaths be based upon post-construction site conditions, as determined in the analyses performed in response to RAI 2.4.12-01. In addition, if the anomalous nature of the water level measurements from wells MW-1200b and MW-1202b cannot be adequately explained, the staff requests that the applicant evaluate the potential of flowpaths to the west away from Unit 4.

This is supplemental RAI 2.4.12-04-S.

---

**ANSWER:**

During evaluation of groundwater flow pathways following construction of CPNPP Units 3 and 4, it was determined that engineered fill placement surrounding the reactor building, auxiliary building, essential service water pipe tunnels, and ultimate heat sink basins was in connection with areas of existing fill to the east of Unit 3 and north of Unit 4. Therefore, groundwater flow pathways were evaluated using the engineered fill instead of the low hydraulic conductivity Glen Rose Limestone. Because the properties of the engineered fill to be used during construction are unknown, it has been conservatively assumed that any groundwater reaching the engineered fill would be transported instantly to the nearest engineered fill/existing fill interface, where it would then flow through the existing fill to SCR. See Figure 1-1 provided with the response to Question 02.04.12-9 above.

Hydrographs of groundwater B-zone wells MW-1200b and MW-1202b show a slow, steady rise in level following installation. These wells are clearly not in equilibrium with the surrounding groundwater and cannot be used to make groundwater gradient judgment.

Reference

Grading and Drainage Plan, Drawing CVL-12-11-101, Rev G.

Impact on R-COLA

See attached marked-up FSAR Revision 1 pages 2.4-75, 2.4-76,2.4- 77, 2.4-78, 2.4-80, 2.4-81, 2.4-82, 2.4-83, 2.4-84, 2.4-85, 2.4-87, 2.4-216, 2.4-217, 2.4-218, 2.4-219, 2.4-220, and Figures 2.4.12-210 (Sht 1-12), 2.4.12-212, 2.4.12-213, and 2.4.12-214.

Impact on DCD

None.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4314 (CP RAI #147)**

**SRP SECTION: 02.04.12 - Groundwater**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.12-14**

NUREG-0800, Standard Review Plan (SRP), Chapter 2.4.12, 'Groundwater,' establishes criteria that the NRC staff intends to use to evaluate whether an applicant meets the NRC's regulations.

By letter dated October 2, 2009, the NRC staff issued RAI ID 3672 (RAI No. 114), Question Number 14271 (02.04.12-6), in which the NRC staff asked "To satisfy 10 CFR 100.20(c) as it relates to evaluating site characteristics important to hydrology, explain how the parameters selected for travel time calculations conservatively represent parameters which may be expected along post-construction flowpaths. Specifically: (a) Present the range of effective porosities in hydrologic units along potential flowpaths including engineered fill, and describe why lower measured values presented in Chapter 2.5 of the FSAR were not used; (b) Discuss how averaging of literature values for the effective porosity of the regolith and bedrock (from Reference 2.4-261 of the FSAR), and the use of total porosity in the undifferentiated fill demonstrate conservatism; and (c) Explain the rationale behind the use of hydraulic conductivity values which are less than the highest values determined through onsite aquifer testing."

The applicant responded in document CP-200901564-Log No TXNB-09067- (ML093230704) executed on November 13, 2009. The NRC staff has reviewed the response and has determined that additional information is needed in order to complete its review.

The NRC staff acknowledges that in response to parts (a) and (b) of the RAI question, the applicant has revised the calculations and used a porosity of 11.9% for the C-zone limestone. However, in Section 2.5 of the FSAR it is estimated that the limestone beds at the site have an average "total" porosity of 11.9%. Effective porosity would be substantially lower than 11.9% especially since average moisture content of the limestone reported in Section 2.5 was only 5%. Therefore, Staff finds that the Applicant's assumption of an effective porosity of 11.9% to be not conservative for the C-zone limestone.

In order to make its safety determination based on consideration of conservative estimates for parameters that govern the hydrologic processes at the site, the staff requests that the applicant use more conservative assumptions for effective porosity for the lateral and vertical migration scenarios or provide additional justification for the conservatism of existing assumptions.

This is supplemental RAI 2.4.12-05-S-a.

---

**ANSWER:**

Porosity values for the shallow bedrock are discussed in FSAR Subsection 2.4.12.2.5.1, which states that "total porosity" values were used. Porosity values of the limestone were determined by specific gravity and dry weight analysis, resulting in the determination of the average 11.9 percent porosity.

Tables 2.5.4-209 and 2.5.4-210 present the moisture content for various materials in the borings performed at the CPNPP site. Shale is listed as 15.0 +/- 3.9 percent (average), limestone/shale is 11.8 +/- 2.6 percent, and limestone is 4.7 +/- 2.2 percent. Formation effective porosity was not measured and is difficult to determine within a fractured rock system due to limited size of the samples collected for analysis. Samples analyzed in the laboratory tend to favor primary porosity values rather than secondary porosities, where the majority of the groundwater movement will occur.

A porosity value of 11.9 percent has been used as a measured value of "formation porosity," i.e., the porosity of the joints, small fractures, bedding planes, and other non-primary (intergranular) porosity mechanisms. This was an "average" value and is assumed to be a conservative estimate of the formation porosity and groundwater pathways.

Following the re-evaluation of groundwater pathways due to placement of engineered fill, this value of porosity will not be used for the pathway analysis.

Vertical migration pathways are considered improbable due to the thickness and extremely low hydraulic conductivity of the lower Glen Rose limestone.

Packer tests in the power block areas show low hydraulic conductivities ($10^{-8}$ to $10^{-9}$ cm/sec range, or no water takes) from plant grade elevation (822 ft msl) to 677 ft msl (FSAR Table 2.5.4-206). Select packer test locations are depicted on Figures 1-2 though 1-5 included in the response to Question 02.04.12-10 above.

In addition, Units 1 and 2 utilized diffusion for contaminant movement through the bedrock and assumed no groundwater transport. Based on the higher assumed hydraulic conductivity of the fill materials, it is assumed that any release from Units 3 and 4 will travel horizontally through the fill material and not vertically through the bedrock. Thus the horizontal pathways will produce faster travel times and be the more conservative scenario.

<u>Impact on R-COLA</u>

See attached marked-up FSAR Revision 1 pages 2.4-75, 2.4-76,2.4- 77, 2.4-78, 2.4-80, 2.4-81, 2.4-82, 2.4-83, 2.4-84, 2.4-85, 2.4-87, 2.4-216, 2.4-217, 2.4-218, 2.4-219, 2.4-220, and Figures 2.4.12-210 (Sht 1-12), 2.4.12-212, 2.4.12-213, and 2.4.12-214.

<u>Impact on DCD</u>

None.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4314 (CP RAI #147)**

**SRP SECTION: 02.04.12 - Groundwater**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.12-15**

NUREG-0800, Standard Review Plan (SRP), Chapter 2.4.12, 'Groundwater,' establishes criteria that the NRC staff intends to use to evaluate whether an applicant meets the NRC's regulations.

By letter dated October 2, 2009, the NRC staff issued RAI ID 3672 (RAI No. 114), Question Number 14271 (02.04.12-6), in which the NRC staff asked "To satisfy 10 CFR 100.20(c) as it relates to evaluating site characteristics important to hydrology, explain how the parameters selected for travel time calculations conservatively represent parameters which may be expected along post-construction flowpaths. Specifically: (a) Present the range of effective porosities in hydrologic units along potential flowpaths including engineered fill, and describe why lower measured values presented in Chapter 2.5 of the FSAR were not used; (b) Discuss how averaging of literature values for the effective porosity of the regolith and bedrock (from Reference 2.4-261 of the FSAR), and the use of total porosity in the undifferentiated fill demonstrate conservatism; and (c) Explain the rationale behind the use of hydraulic conductivity values which are less than the highest values determined through onsite aquifer testing."

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The NRC staff has reviewed the response and has determined that additional information is needed in order to complete its review.

The NRC staff noted that the applicant's response to part (c) of the RAI reports that the hydraulic conductivity used for the horizontal flowpath was $1.37 \times 10^{-5}$ cm/sec which is representative for the C-zone. If there is B-zone remaining after excavation is completed, a more conservative hydraulic conductivity value is warranted to be used for the remaining zone.

In order to make its safety determination based on consideration of current and correct information, the staff requests that the applicant confirm the existence of any remaining B-zone after excavation and discuss the selection of conservative post-construction porosities and hydraulic conductivities for the C-zone and B-zone.

This is supplemental RAI 2.4.12-05-S-b.

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**ANSWER:**

1. FSAR Subsection 2.4.12.3.1 states that the highest hydraulic conductivity measured at the site ($1.37 \times 10^{-5}$ cm/s) was used for the pathway analysis. This hydraulic conductivity was measured from MW-1217b, a groundwater B-Zone well completed in engineering layer "A", and was the highest measure hydraulic conductivity measured within the Glen Rose Limestone.

2. The discussion of hydraulic conductivity values in the FSAR and the RAI response do not state that the hydraulic conductivity is from the engineering layer "C" zone of the Glen Rose. It is measured in the upper Glen Rose (groundwater B-Zone) with higher hydraulic conductivities than the engineering layer "C" zone. As stated in the FSAR and used in the postulated accident analysis, the hydraulic conductivity is the highest measured on site, and will be conservative for the postulated release flow path through the engineering layer "C" zone.

3. Based on the response to Question 2.4.12-13 above, the hydraulic conductivity of the Glen Rose Limestone will no longer be used in the pathway analysis, as it is assumed that groundwater will preferentially flow through the engineered fill and existing fill prior to release in SCR. Pathway analysis calculations have been revised to use the hydraulic conductivity of the existing fill.

Impact on R-COLA

See attached marked-up FSAR Revision 1 pages 2.4-75, 2.4-76,2.4- 77, 2.4-78, 2.4-80, 2.4-81, 2.4-82, 2.4-83, 2.4-84, 2.4-85, 2.4-87, 2.4-216, 2.4-217, 2.4-218, 2.4-219, 2.4-220, and Figures 2.4.12-210 (Sht 1-12), 2.4.12-212, 2.4.12-213, and 2.4.12-214.

Impact on DCD

None.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4314 (CP RAI #147)**

**SRP SECTION: 02.04.12 - Groundwater**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.12-16**

NUREG-0800, Standard Review Plan (SRP), Chapter 2.4.12, 'Groundwater,' establishes criteria that the NRC staff intends to use to evaluate whether an applicant meets the NRC's regulations.

By letter dated October 2, 2009, the NRC staff issued RAI ID 3672 (RAI No. 114), Question Number 14271 which asked "To satisfy 10 CFR 100.20(c) as it relates to evaluating site characteristics important to hydrology, explain how the parameters selected for travel time calculations conservatively represent parameters which may be expected along post-construction flowpaths. Specifically: (a) Present the range of effective porosities in hydrologic units along potential flowpaths including engineered fill, and describe why lower measured values presented in Chapter 2.5 of the FSAR were not used; (b) Discuss how averaging of literature values for the effective porosity of the regolith and bedrock (from Reference 2.4-261 of the FSAR), and the use of total porosity in the undifferentiated fill demonstrate conservatism; and (c) Explain the rationale behind the use of hydraulic conductivity values which are less than the highest values determined through onsite aquifer testing."

The applicant responded in document CP-200901564-Log No TXNB-09067-ML093230704 executed on November 13, 2009. The NRC staff has reviewed the response and has determined that additional information is needed in order to complete its review.

During the review of groundwater velocity and travel time calculations presented in Table 2.4.211, the staff found several items that made it impossible to reproduce the velocities and travel times results for each pathway using the parameters and assumptions presented in the FSAR. The items identified are explained as follows:

a) Using the Applicant's assumptions provided in Table 2.4.12-211, the staff performed a confirmatory analyses for travel time and velocity. The staff was not able to recreate velocities and travel times reported by the Applicant in Table 2.4.12-211.

b) In Table 2.4.12-211, the water levels reported from wells MW-1217a (Scenario 1, Pathway 3a) and MW-1215a (Scenario 2, Pathway 4a) are incorrect. The values are actually the same as the values reported for wells MW-1217b and MW-1215b, respectively.

c) Table 2.4.12-211 and Section 2.4.12.3.1 (page 2.4-57) report that a hydraulic conductivity value of 1.37x10-5 cm/sec was used in the travel time calculations. However, in Section 2.4.12.3 (page 2.4-56) the upper value for hydraulic conductivity within the shallow bedrock is reported as $1.037 \times 10^{-5}$ cm/sec.

In order to make its safety determination based on current, correct, and conservative estimates of parameters that govern the hydrologic processes at the site, the staff requests the following information.

1) Pursuant to issue (a), document all parameter values used in the calculations (including the path length for each scenario), and, if necessary revise the FSAR to include corrected results.
2) Pursuant to issue (b), correct either the well names or the starting head values for the calculation and revise the calculation as appropriate.
3) Pursuant to issue (c) determine which of these values is correct and revise the calculation as appropriate.

This is supplemental RAI 2.4.12-05-S-c.

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**ANSWER:**

Typographical errors were discovered In FSAR Table 2.4.12-211 and Subsection 2.4.12.3. The table has been revised to show parameters and calculations for the anticipated fill transport of groundwater based on the re-evaluation of flow pathways described in the response to Question 02.04.12-13 above. FSAR Subsection 2.4.12.3 has been revised to discuss the current pathway analysis as described in the responses to Questions 02.04.12-9, -13, -14, and -15 above.

Impact on R-COLA

None.

Impact on DCD

None.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**Comanche Peak, Units 3 and 4**

**Luminant Generation Company LLC**

**Docket Nos. 52-034 and 52-035**

**RAI NO.: 4314 (CP RAI #147)**

**SRP SECTION: 02.04.12 - Groundwater**

**QUESTIONS for Hydrologic Engineering Branch (RHEB)**

**DATE OF RAI ISSUE: 2/26/2010**

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**QUESTION NO.: 02.04.12-17**

NUREG-0800, Standard Review Plan (SRP), Chapter 2.4.12, 'Groundwater,' establishes criteria that the NRC staff intends to use to evaluate whether an applicant meets the NRC's regulations.

By letter dated October 2, 2009, the NRC staff issued RAI ID 3672 (RAI No. 114), Question Number 14272 (02.04.12-7), in which the NRC staff asked "Section 2.4.12.2.5 of the Update Tracking Report, Rev. 0, dated April 2, 2009, 'Technical Correction Version' of the FSAR dated March 31, 2009 states that the undifferentiated fill, regolith and the shallow Glen Rose Formation which generally coincide with monitoring well zones "a" and "b", will be removed during construction in the power block area. Despite this excavation, it appears that groundwater bearing portions of these formations with water levels, inferred to be above the design maximum groundwater level (on Figures 2.4.12-210 of the FSAR), will be left in place after construction. In accordance with 10 CFR 100.21(d) demonstrate that the maximum operational groundwater level will comply with the design maximum groundwater level."

The applicant responded in document CP-200901564-Log No TXNB-09067-ML093230704 executed on November 13, 2009. The NRC staff has reviewed the response and has determined that additional information is needed in order to complete its review.

The staff disagrees with the applicant's assertion that there will be no groundwater at the site during the post-construction phase. Data from Units 1 and 2 show that construction activities can create areas where water levels are elevated due the placement of permeable fill materials. Figures 2.4.12-213 and 2.4.12-214 show new fill around many of the new structures, but it is not clear how and if this new fill will be drained and what the details will be for post-construction groundwater and surface water conditions (flow and levels). Seasonal trends in groundwater elevation related to seasonal rainfall recharge are obvious with as much as 10 ft of variation between wet and dry seasons in the A-zone and 5 ft in the B-zone (which will not be entirely excavated during construction).

In order to make its safety determination based on site configuration that reflects the engineered fill materials and changes to the onsite hydrologic processes, the NRC staff requests that the applicant provide a conservative analysis of maximum operational groundwater level that takes into account the removal of portions of Zone-B and takes into account the fact that the area surrounding the excavated and backfilled area of the site still has the potential for lateral inflow. The analyses should include an evaluation of any surface and subsurface drainage systems that will be implemented to maintain groundwater levels below the Design Control Document design criteria.

This is supplemental RAI 2.4.12-06-S.

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**ANSWER:**

This question is answered in the responses to Questions 02.04.12-9 and 02.04.12-13 above. Re-evaluation of groundwater flow in engineered fill material and limiting conditions provided by the trench drain system will maintain groundwater levels below the DCD design criteria.

Impact on R-COLA

None.

Impact on DCD

None.

# Attachment 3

## Revised Final Safety Analysis Report Pages on the Enclosed CD

| | | | | |
|---|---|---|---|---|
| 2.4-55 | 2.4-82 | 2.4-168 | Figure 2.4.12-210 Sh 1 | Figure 2.4.12-210 Sh 10 |
| 2.4-56 | 2.4-83 | 2.4-169 | Figure 2.4.12-210 Sh 2 | Figure 2.4.12-210 Sh 11 |
| 2.4-57 | 2.4-84 | 2.4-216 | Figure 2.4.12-210 Sh 3 | Figure 2.4.12-210 Sh 12 |
| 2.4-75 | 2.4-85 | 2.4-217 | Figure 2.4.12-210 Sh 4 | Figure 2.4.12-212 |
| 2.4-76 | 2.4-87 | 2.4-218 | Figure 2.4.12-210 Sh 5 | Figure 2.4.12-213 |
| 2.4-77 | 2.4-107 | 2.4-219 | Figure 2.4.12-210 Sh 6 | Figure 2.4.12-214 |
| 2.4-78 | 2.4-165 | 2.4-220 | Figure 2.4.12-210 Sh 7 | 2.5-58 |
| 2.4-80 | 2.4-166 | Figure 2.4.5-201 | Figure 2.4.12-210 Sh 8 | Figure 2.5.5-204 |
| 2.4-81 | 2.4-167 | Figure 2.4.5-202 | Figure 2.4.12-210 Sh 9 | |