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G3NO-2009-0006

January 29, 2009

U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Document Control Desk

DOCKET: No. 52-024

SUBJECT: Responses to NRC Verbal Requests Regarding Hydrology Related to the Environmental Review (GG3 COLA)

REFERENCES:

1. Entergy Operations, Inc. letter to NRC, *Application for Combined License for Grand Gulf Unit 3,* dated February 27, 2008 (ADAMS Accession No. ML080640433)

2. Entergy Operations, Inc. letter to NRC, *Grand Gulf Unit 3 and River Bend Station Unit 3 COLA Reviews,* dated January 9, 2009 (ADAMS Accession No. ML090130174)

Dear Sir or Madam:

In Reference 1, Entergy Operations, Inc. (Entergy) submitted an application for a combined license (COL) for Grand Gulf Nuclear Station (GGNS), Unit 3. In Reference 2, Entergy requested that the NRC suspend its activities related to the review of the GGNS Unit 3 COL application until further notice pending reevaluation of alternative technologies. The attached information is being provided to the NRC Staff, as requested, even though the COL application review has been suspended, to conclude certain aspects of the NRC's environmental review. As discussed in Reference 2, this supports the Staff's efforts to preserve work accomplished to the greatest extent practical.

On December 11, 2008, a conference call was held with the NRC Staff regarding the COLA Part 3, Environmental Report (ER). Specifically, the conference call pertained to the Staff's review of construction impacts associated with groundwater dewatering, as discussed in ER Sections 2.3 and 4.2. As a result of the discussion, the NRC requested additional information regarding the dewatering analyses input parameters. This letter provides the requested information in Attachment 1.

In addition, the NRC requested that any changes to the ER related to the discussion topics be provided in advance of the then-planned COLA revision submittal. Since the NRC review has been suspended, the planned COLA revision will not be submitted. However, to support NRC Staff review closure, this letter provides this requested information in Attachment 2. Specifically, draft markups of ER Sections 2.3.2.2, 4.2.2.2, 4.2.2.4, 5.2.2, and 6.3.2, and ER

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NRO

Tables 4.2-201, 4.2-202, and 5.2-201 (Sheet 2), are provided in Attachment 2, to reflect recently updated results of the groundwater dewatering analyses.

Should you have any questions, please contact me or Mr. Tom Williamson of my staff. Mr. Williamson may be reached as follows:

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This letter contains no new commitments.

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

Executed on January 29, 2009.

Sincerely,

WKH/ghd

Attachments: 1. Response to Request Regarding Dewatering Analyses
2. Proposed Changes to the COLA Part 3 Regarding Groundwater Drawdown

cc (email unless otherwise specified):

NRC

NRC Project Manager – Grand Gulf Unit 3 COLA
NRC Project Manager – North Anna Unit 3 COLA
NRC Director – Division of Construction Projects (Region II)
NRC Regional Administrator - Region IV
NRC Resident Inspectors' Office - GGNS

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Entergy

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ATTACHMENT 1

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RESPONSE TO REQUEST REGARDING DEWATERING ANALYSES

NRC Request for Information Regarding Dewatering Analyses

The following verbal request for information was made by the NRC staff during a conference call on December 11, 2008.

Provide an explanation of how the transmissivity values used in the Theis model analysis and the hydraulic conductivities and thicknesses used in the MODFLOW model analysis relate to each other. Discuss the general process used to arrive at the transmissivity, hydraulic conductivity, and aquifer thickness values used in both models for the dewatering analysis.

Entergy Response

Transmissivity is a property calculated from the hydraulic conductivity and the thickness of the layer for which that hydraulic conductivity is applicable using the equation:

$$T = Kt$$

where: T = transmissivity (ft^2/day),

K = hydraulic conductivity (ft/day), and

t = thickness of layer (ft).

The parameters are fully inter-convertible, meaning that given two, the third can be calculated. For the Theis numerical model, T is a direct input, while for the MODFLOW model, T can be calculated by the program from the direct inputs of K and the cell dimensions, depending on the layer package selected for use. The paragraphs below discuss the use of T in each model, separately.

Theis Model

The Theis model is a two-dimensional model with radial symmetry and horizontal flow that uses a single, domain-wide transmissivity value calculated as described above.

The hydraulic conductivity (K) values for the geologic materials within the dewatering zone were calculated from grain size analyses, pump test results, and published literature[1]. K values for the Lower Loess materials (i.e., clays and silts to fine sandy silts) were estimated to range from approximately 0.1 feet per day (ft/d) to 3 ft/d. The K values in the Upland Complex Alluvium (UCA) materials (i.e. silty fine to medium and coarse sands) were estimated to range from approximately 3 ft/d to 150 ft/d. The Upland Complex Old Alluvium (UCOA) materials (i.e., sandy gravel to gravel) are estimated to have a K value in the range of 280 ft/d to 2,800 ft/d. The K values for each formation are expected to exhibit a range of values consistent with the observed variability in lithology and texture.

The screens of the dewatering wells are planned to extend from 75 feet mean sea level (msl) (the typical water table in the vicinity of the excavation) to 50.5 feet msl for a total length of 24.5 ft in the saturated zone. From the general stratigrapy, the upper 10 feet of materials to

[1] Freeze and Cherry, Groundwater, Prentice Hall, 1979, p. 29

be dewatered are composed of the less permeable Lower Loess stratum, and the lower 14.5 feet of materials consist of the more permeable fine to coarse sands of the UCA.

The heterogeneous geologic conditions across the excavation dewatering area indicate variations of hydraulic conductivities are present throughout the dewatering zone. Upper and lower values of transmissivity for the dewatering zone for use in the Theis method numerical model were calculated to account for these variations, as discussed below.

- Upper transmissivity value – The dewatering zone includes about 10 feet of Lower loess with relatively low K values and about 14.5 feet of UCA with much higher K values as discussed previously. Using the upper end of the K range for the UCA of 150 ft/d would not be appropriate because the Lower loess with an upper K value of 3 ft/d comprises about 40 percent of the dewatering interval. The average of the mid-range values of both strata (39 ft/d) is considered too low because withdrawals from the dewatering wells will be dominated by the higher K values associated with the UCA. The mid-range K value for the UCA is about 75 ft/d. To approximate an effect of the Lower loess, a K value equal to 80 percent of the mid-range value of the UCA was selected - approximately 60 ft/d. To estimate an upper limit of the expected dewatering in the event more permeable materials are encountered, the K value was doubled to 120 ft/d. Using 24.5 feet as the aquifer thickness in the dewatering zone (the total screen interval for the dewatering wells), and a K value of 120 ft/d, an estimated transmissivity value of 3,000 ft^2/d was calculated for drawdown modeling purposes. This value is considered the upper bound of transmissivity for the materials that will be encountered in the excavation dewatering.
- Lower transmissivity value – For a lower value of transmissivity, an aquifer thickness of 15 feet (the portion of the screened interval of dewatering wells within the UCA) and a K value of 50 ft/d were used for the UCA to obtain a transmissivity of 750 ft^2/d.

<u>MODFLOW Model</u>

MODFLOW is a finite difference numerical approximation to a fully three-dimensional flow system. The area modeled is broken up into a large number of relatively small rectangular cells and flow is determined among these cells. Cell sizes and hydraulic conductivities can be varied throughout the grid. Because MODFLOW constructs the flow equations using cell-specific values, it uses cell-specific horizontal and vertical hydraulic conductivity values (designated K_h and K_v, respectively) and cell thickness values. In the model package used for the Grand Gulf Unit 3 dewatering analysis, values of T were not calculated.

The MODFLOW model area was divided vertically into 24 layers of equal thickness (5 feet each). These layers include, from top down, the Lower Loess, the UCA and the UCOA. Geologic information shows that the thickness of the UCOA varies across the site, being greatest in a paleochannel that passes under a portion of the western edge of the planned excavation. As a conservative measure, the maximum thickness of the UCOA was used throughout the model area. Calculations tend to overestimate the required pumping rate with this approach.

As noted earlier, review of lithologic descriptions of soil samples from borings taken in the vicinity of the planned excavation shows variations in lithology (and by inference, in hydraulic conductivities) within the area of interest. For the MODFLOW analysis, selections of horizontal hydraulic conductivities (K_h) were based on lithologic descriptions on the logs for 17 borings in the vicinity of the planned excavation. Guidelines for the selection of horizontal hydraulic conductivity based on lithology were taken from Freeze and Cherry[2]. Vertical hydraulic conductivities (K_v) were then assigned a value of $0.1K_h$ based on general practice described in Freeze and Cherry[3].

Proposed COLA Revision

None

[2] Freeze and Cherry, Groundwater, Prentice Hall, 1979, p. 29
[3] Freeze and Cherry, p. 32

ATTACHMENT 2

G3NO-2009-0006

PROPOSED CHANGES TO THE COLA PART 3 REGARDING GROUNDWATER DRAWDOWN

Markup of Grand Gulf COLA

The following markup is provided for information only.

The upper portion of the Catahoula Formation is impermeable (although thin sand lenses are encountered in the upper portion in some of the Unit 3 borings) and acts as a confining unit. Groundwater levels in wells screened in the Catahoula Formation have a higher potentiometric head than the level of the formation itself, indicating the water is under confined conditions. At well MW1009C, the water-bearing sand lens within the Catahoula Formation is separated from the Upland Complex by approximately 50 ft. of less permeable Catahoula Formation deposits. Pump tests did not result in impacts to the well screened within the Catahoula Formation when the well in the Upland Complex was being pumped. Because of the impermeable nature of the Catahoula Formation underlying the Upland Complex, no significant impacts are expected to the Catahoula Formation as a result of additional withdrawals from the Upland Complex.

The potential impact of withdrawal from the Upland Complex is discussed in Sections 4.2 and 5.2. Potential impact of withdrawal from the Mississippi River Alluvium, if needed, is also discussed in Sections 4.2 and 5.2.

Construction Requirements

NUREG-1817 Subsection 4.3.2 concludes that construction dewatering impacts would be small, temporary, and localized. Historic information on dewatering revealed that dewatering for construction of Unit 1 did not impact the regional water table (Reference 202). An evaluation of proposed dewatering for Unit 3 construction is provided in FSAR Subsection 2.5.4, and impacts are discussed in Subsection 4.2.2.2 of this report.

Construction dewatering is anticipated to pump about 420 gpm (most likely estimate) during excavations to construct Unit 3, based on most likely estimates of horizontal hydraulic conductivity for the Upland Complex. Dewatering is anticipated to extend over a period lasting about 2 years. This dewatering is necessary to achieve approximately 15 – 20 ft. of drawdown in the Upland Complex water table in the vicinity of the excavation. ~~The radius of influence (ROI) in the Upland Complex water table surrounding the excavation is estimated to extend to approximately 600 ft. from the excavation, with a predicted drawdown of essentially zero (about 1 in.) at that distance.~~

Additional groundwater wells are required for Unit 3 construction activities such as concrete batch plant operation, dust suppression, potable water, and sanitary needs.

The average and maximum construction water use estimates for Unit 3 are shown in Table 4.2-201. It is anticipated for construction activities to require a maximum of 115 gpm of water to supply concrete batch plant operation, dust suppression, makeup to fire protection tanks, and sanitary needs.

Water for construction of Unit 3 is expected to be provided by the withdrawal of groundwater from wells installed in the Upland Complex aquifer or the Mississippi River Alluvium, both of which overlie the Catahoula Formation. It is anticipated that one or two additional new wells are required to provide water for the concrete batch plant operation, dust suppression, and potable water supply for construction site workers. Installation of the new wells is anticipated in the Upland Complex in the vicinity of the existing three wells along the bluff area as described above for Unit 3 station operations, but may be sited within the Mississippi River Alluvium west of the

As discussed below, off-site impacts to groundwater users are not anticipated. However, the following potential impacts to groundwater use have been evaluated and are discussed in more detail below:

- The radius of influence (ROI) surrounding each potential groundwater withdrawal (i.e., existing Unit 1 potable wells along the bluff, new potable water wells, and excavation dewatering) has been evaluated considering potential overlapping drawdown effects.

- Upland Complex aquifer drawdown has been evaluated for dewatering impacts during construction that may reduce the groundwater available for the Unit 1 potable water wells needed for continued Unit 1 operations during Unit 3 construction.

- Unit 3 construction requires additional potable water capacity beyond that of the existing Unit 1 potable water wells. Upland Complex aquifer drawdown from dewatering during construction has been evaluated for potential impacts on the placement of new wells, in the vicinity of the Unit 1 wells, in the Upland Complex for construction water supplies.

- New wells installed in the Upland Complex to provide Unit 3 potable/sanitary water, concrete batch plant and dust suppression water, and miscellaneous water needs may reduce the water available for the existing Unit 1 water wells, if installed close enough to cause an overlapping drawdown. Conversely, Unit 1 well drawdown of the Upland Complex aquifer may restrict siting of new water wells to support Unit 3 construction.

- Relocation of potable water wells west of the bluffs in the Mississippi River Alluvium aquifer has been evaluated for impacts.

- The combined drawdown of the Upland Complex has been evaluated for impact to off-site uses from Unit 3 potable well operation during construction, or to the underlying Catahoula Formation.

Dewatering Impacts on Unit 1 Wells

NUREG-1817, Subsection 4.3.2 concludes that construction dewatering impacts would be SMALL, temporary, and localized. Historic information on dewatering revealed that dewatering for construction of Unit 1 did not impact the regional water table (Reference 201). An evaluation of dewatering for Unit 3 is provided in FSAR Subsection 2.5.4.

Construction dewatering is anticipated to pump about 420 gpm (most likely estimate) during excavations to construct Unit 3, based on most likely estimates of horizontal hydraulic conductivity for the Upland Complex. Dewatering is anticipated to extend over a period lasting up to about two years. Dewatering is necessary to achieve approximately 15 – 20 ft. of drawdown in the Upland Complex water table in the area of the excavation. The ROI in the Upland Complex water table surrounding the excavation is estimated to extend to approximately 600 ft. from the excavation, with a predicted drawdown of essentially zero (about 1 in.) at that distance. Construction dewatering has the potential to reduce the available groundwater yield of the existing three Unit 1 potable water wells. The overlapping drawdown due to additional Unit 3 wells installed along the bluff combined with the dewatering drawdown in the Upland Complex is expected to have the potential to further reduce available potable water supply for Unit 1.

Based upon the estimated drawdown due to construction dewatering, Unit 1 can continue to use its existing wells, although maximum potential yield will be reduced. During Unit 1 outages that coincide with the Unit 3 dewatering, additional potable water supply may be required. This water will be provided either from the additional wells along the area of the bluff west of the Unit 3 construction, or from the Mississippi River Alluvium.

Potential Impacts from Groundwater Well Withdrawal

It is anticipated that additional potable water will be needed during construction of Unit 3. The preferred siting of new groundwater wells is along the bluff between the planned concrete batch plant and the existing ESC building. Withdrawal in this location has been evaluated for potential adverse impact to the existing Unit 1 wells. The evaluation developed estimates of the potential ROI and drawdown cones of depression for new and existing wells to determine Upland Complex aquifer groundwater availability and impacts. Overlapping ROI of a well with the ROI of other wells is considered acceptable if the combined drawdown does not exceed desired yield for total needs. Table 4.2-202 provides a summary of the ROI calculated for a defined pumping rate of up to 200 gpm at a well pumping in the Upland Complex. A transmissivity of 12,300 ft^2/day has been used based on a pump test completed during the COL investigations in the sand and gravel unit at the base of the Upland Complex, as described in Section 2.3.

Based on the results of a well siting study, placement of one or two new groundwater supply wells along the bluff area pumping from the Upland Complex aquifer is feasible. Excavation dewatering for Unit 3 construction is expected to cause a drawdown that maywill overlap the Unit 1 water wells, but not so much as to preclude their continued use. Dewatering will also reduce the yield of any new wells installed along the bluff area. The actual drawdown during dewatering will be monitored. Monitoring of drawdown during construction is described in Section 6.3.

Based on estimates of needed pumping rates and ROI surrounding on-site wells, the only potential impact to identified groundwater users during construction activities is to Unit 1 potable water wells. The ROI due to groundwater withdrawals does not extend beyond the GGNS property boundaries. The radius of the cone of depression around a new Unit 3 well during the two year period of construction dewatering could extend greater than 5000 feet around the well. However, the anticipated drawdown at 3500 feet from the well would be less than 0.5 foot. (If Unit 3 well installation occurs on the bluffs, the property boundary would be approximately 3500 feet away.) While continuous pumping at the maximum anticipated Unit 3 wells flow rate (albeit an unlikely scenario) might result in a small drawdown at the property line from the cone of depression, drawdown would be minimal, if detectable.

The Upland Complex shows indications of braided-stream channel deposition, resulting in varying thicknesses of sand and gravel deposits. There is a potential that adequate well spacing cannot be achieved for all the required water wells needed during construction due to this depositional heterogeneity. Therefore, actual well installation and placement is dependent upon confirmation that the thickness and aquifer characteristics of the Upland Complex at the sites selected for the new water well installation are appropriate to supply adequate volumes of water for construction.

If necessary, wells for Unit 3 construction can be placed in the Mississippi River Alluvium aquifer. If necessary, potable water may be withdrawn from the Upland Complex, and water for the concrete batch plant and dust suppression can be pumped from the Mississippi River Alluvium aquifer. Evaluation of potential impacts of groundwater withdrawal from the alluvium west of the bluffs at the GGNS site has been completed at an assumed pumping rate of 200 gpm, and using an average transmissivity of 12,300 ft^2/day. Aquifer test transmissivity results for the Mississippi River alluvial sediments range from 21,500 to 163,500 gpd/ft, as reported in the Unit 1 UFSAR Table 2.4B-1. Therefore, the transmissivity value of 91,974 gpd/ft (12,300 ft^2/day) used in the Upland Complex evaluation is also applicable for the Mississippi River Alluvium, and thus the groundwater withdrawal impacts are anticipated to be similar.

The potential availability of groundwater in the Mississippi River Alluvium aquifer is less likely to be affected by construction dewatering. Because the radius of drawdown does not extendis minimal beyond the GGNS property boundaries, there are no nearby withdrawals of groundwater from the Mississippi River Alluvium aquifer, and flow of groundwater in the alluvium is toward the river, no impact to off-site users is anticipated. Table 4.2-202 provides support for this determination. Based on evaluations of groundwater availability in the Mississippi River Alluvium aquifer, relocation of some or all of the potable water supply wells to the Mississippi River Alluvium is feasible; although, water quality may not be as good due to bacteria, low dissolved oxygen, and increased dissolved solids. If used for potable water, additional treatment may be required for water pumped from the Mississippi River Alluvium aquifer.

Conclusions Related to Potential Groundwater Withdrawal Impacts

Water rights and allocations of groundwater are regulated by the Mississippi Department of Environmental Quality (MDEQ) Regulation LW-2 (Reference 202). Because potable and sanitary water for station construction and operations is provided by groundwater resources, the demand, supply, and impact of additional groundwater withdrawal has been evaluated. The impacts of construction dewatering have also been evaluated to consider the potential impact on both the existing Unit 1 water supply wells, and those proposed for Unit 3 construction. The results of that evaluation indicate that it is feasible to obtain satisfactory quantities of groundwater for Unit 3 construction without adversely affecting Unit 1 station operations, and therefore the impact to Unit 1 operations is expected to be SMALL.

The existing Unit 1 groundwater withdrawals are regulated by a groundwater allocation permit program by the MDEQ. These permits are MS-GW 14989 and 15026. The Unit 1 MDEQ permits were granted considering their identified potential impact on other uses in the area, and considering those withdrawals in the recharge area of the underlying Catahoula Formation. The ESP ER states the existing wells are completed in the Catahoula Formation. This conclusion was based on a review of the MDEQ permits at the time of the ESP Application. As discussed above, a refined site conceptual model revealed that the existing water wells providing potable water for Unit 1 operations are actually completed in the Upland Complex, and not the underlying Catahoula Formation. As stated in Subsection 2.3.3.2, the MDEQ has recognized and concurs that the Unit 1 potable water wells are not screened in the Catahoula Formation. The existing wells are considered to have SMALL or negligible impact on the Catahoula Formation.

MDEQ has been contacted regarding the anticipated withdrawals for Unit 3 construction, and those anticipated for combined Unit 3 and Unit 1 operations. Groundwater withdrawal at the site is in accordance with applicable MDEQ groundwater use and protection regulations (see

Reference 202 and 203). Necessary permits will be obtained from MDEQ prior to installation of groundwater withdrawal wells.

Construction activities resulting in utilization of water include potable water supply, water for the concrete batch plant operations, dust suppression, and sanitary water needs. The potential impact to water use is limited to on-site withdrawals, as the ~~ROI surrounding~~amount of drawdown resulting from all withdrawals during construction is ~~not~~ expected to ~~extend~~be minimal (less than 0.5 foot) beyond the GGNS site property boundaries. Additional pump tests were performed during the COL investigations to develop additional information on Upland Complex aquifer thicknesses and aquifer characteristics such as flow, transmissivity, hydraulic conductivity, potential yield, and drawdown resulting from withdrawals. Based on available information, the installation of additional wells installed in the Upland Complex aquifer is not anticipated to adversely impact off-site users. Because of the impermeable nature of the Catahoula Formation underlying the Upland Complex, no significant impacts are expected to the Catahoula Formation as a result of additional withdrawals from the Upland Complex. Therefore, the impact on the Catahoula Formation is SMALL. Mitigation measures are not necessary.

Water-Use and Potentially Affected Federal Projects

The Applicant is participating in a Department of Energy (DOE) government/industry cost-shared project and is receiving funds in support of this COL application process. As a project that is receiving federal financial assistance and that has the potential to contaminate a designated sole source aquifer, GGNS is subject to review by the Environmental Protection Agency (EPA).

The U.S. Department of Agriculture (USDA) Rural Development Office (Mississippi Office) initially screens such projects before referring them to the EPA Sole Source Aquifer Program. Consultation with the USDA was completed during COL application development. Based on anticipated consultation responses with the USDA and EPA, the dewatering and other groundwater withdrawals are expected to have a SMALL impact on the Catahoula. During construction of the new facility, appropriate measures applicable under the Clean Water Act (such as Spill Protection, Control, and Countermeasures (SPCC) Plan implementation) are expected to be taken to prevent the introduction of contaminants into the Catahoula Formation and the Southern Hills Regional Sole Source Aquifer.

No other federal projects have been identified that have an impact, from a water-use standpoint, on the construction of Unit 3 or overall operations of GGNS. The construction of Unit 3 is not expected to have an impact on any federal projects.

4.2.2.3 Aquatic Biota and Wetlands

Groundwater use in the Mississippi River Alluvium aquifer is not expected to have an adverse impact on aquatic or terrestrial ecological communities. Section 4.3 provides information relating to ecological effects associated with construction of the new facility.

4.2.2.4 Water-Use Impact Conclusion

~~The area of impact due to~~ Unit 3 construction water use ~~is limited to the site property and~~ is not expected to affect off-site water use or water users. All of the potential water use impacts in

TABLE 4.2-201
WATER UTILIZATION DURING CONSTRUCTION

	Construction Water Source							
	ESP Stage Estimates[1]				COL Stage Estimates[2]			
Construction Activity	Mississippi River/ Alluvium Groundwater Use	Surface Water Use	Groundwater Use – Catahoula Formation	Groundwater Use – Upland Complex	Mississippi River/ Alluvium Groundwater Use	Surface Water Use	Groundwater Use – Catahoula Formation	Groundwater Use – Upland Complex (Average)
Concrete Batch Plant Operations, Dust Suppression, Testing	None	None	350 gpm	None	May be Option	None	None	56 gpm[3]
Potable/Sanitary Use	None	None	7 gpm	None	May be Option	None	None	35 gpm[3,4]
Power Block Construction Dewatering	None. Only the Upland Complex will require dewatering.	None. No surface water overlies dewatering area.	None. Excavation will not extend to depth of the Catahoula.	Estimated Similar to Unit 1	None. Only the Upland Complex will require dewatering.	None. No surface water overlies dewatering area.	None	420 gpm
Unit 1 Cooling Water Utilization	21,332 gpm	None	None. Unit 1 does not withdraw water from the Catahoula.	None. Unit 1 withdraws water from Ranney wells in Mississippi River Alluvium.	21,332 gpm	None	None	None. Unit 1 withdraws water from Ranney wells in Mississippi River Alluvium.
Unit 1 Potable/Sanitary Water	None	None	~~122~~112 gpm	None	May be Option	None	None	~~122~~112 gpm

1. SERI ESP Application, SSAR Section 2.4.12, ESP ER Section 4.2; SSAR Table 1.3-1 (above quantities do not include demineralization & fire protection water)
2. All utilization rates are average
3. Based on estimates for 50 weeks per year, 5 days per week, 24-hour days. Maximum water use is assumed to be approximately 125% of average use.
4. See also Table 2.3-204.

TABLE 4.2-202
ESTIMATED WITHDRAWAL IMPACT

	Potential Impacts To On-site Use			Potential Impacts if Potable Water Wells Relocated to Mississippi River Alluvium[3]		
Groundwater Withdrawals During Construction	Formation of Use	Anticipated Drawdown	Potential Radius of Influence	Formation of Use	Anticipated Drawdown	Potential Radius of Influence
~~Concrete Batch Plant~~Construction Use[1]	Upland Complex	~~3~~4.5 ft.	~~200 ft.~~Less than 0.5 ft. drawdown at 3500 ft.	Mississippi River Alluvium	~~3~~4.5 ft.	~~200 ft.~~Less than 0.5 ft. drawdown at 3500 ft.
~~Potable/Sanitary and Miscellaneous Use[1]~~	~~Upland Complex~~	~~3 ft.~~	~~200 ft.~~	~~Mississippi River Alluvium~~	~~3 ft.~~	~~200 ft.~~
Dewatering[2]	Upland Complex	15–20 ft.	~~600 ft.~~Approx. 12.1 ft. drawdown at Unit 1 potable well location (600 ft. from dewatering location)	Upland Complex	~~NA[3]~~15-20 ft.	~~NA~~Approx. 12.1 ft. drawdown at Unit 1 potable well location (600 ft. from dewatering location)
~~Unit 1 Potable/Sanitary/Fire Protection Use~~	~~Upland Complex~~	~~Unknown[4]~~	~~<200 ft.~~	~~Relocated to Mississippi River Alluvium~~	~~2 ft.~~	~~200 ft.~~
Unit 1 Cooling/Service Water Use	Mississippi River Alluvium	NR	NR	Mississippi River Alluvium	NR	NR

NOTES:

1. Assumes a conservative maximum pumping rate of 200 gpm (see Subsection 2.3.2.2)
2. Assumes dewatering rate of 420 gpm

3. Based on Mississippi River Alluvium transmissivity results reported in the Unit 1 UFSAR Table 2.4B-1, groundwater withdrawal impacts are anticipated to be similar to those in the Upland Complex.

~~3. If potable water wells are moved to the Mississippi River Alluvium, dewatering in the Upland Complex on the bluffs will have no impacts on the potable water wells.~~

~~4. While some information is available for Unit 1 potable water wells, specific data related to drawdown is currently unavailable.~~

NR – Not relevant to evaluation, since radial wells are in direct communication with river.

the intake structure and are to be positioned below the predicted extreme low water river level. The base of the intake screens is designed to be placed at an elevation above the dredged base of the embayment to minimize the uptake of aquatic biota and river debris. Riprap, or other appropriate means, is planned to be used to stabilize the banks of the embayment and the river shoreline around the embayment. Dredging of the embayment for maintenance of the embayment depth and configuration is expected to be necessary on a periodic basis. Spoils dredged from the embayment are to be disposed in a manner satisfactory to the U.S. Army Corps of Engineers and the Mississippi Department of Environmental Quality (MDEQ), and according to applicable permits. Potential alterations to aquatic ecosystems as a result of plant water intake and discharge systems are discussed in Section 5.3.

Based upon the above information, potential impacts to surface water as a result of Unit 3 operations water use are judged to be SMALL.

Groundwater

Effects of groundwater withdrawal on the Catahoula Formation are considered unresolved in NUREG-1817 Subsection 5.3.2. The NRC staff states that because of the limited number of borings, hydraulic conductivity measurements, and long-term pump tests in this portion of the aquifer that are available in the vicinity of Unit 3, the staff was unable to assess reliably the impact of a significant increase in the groundwater withdrawal from the Catahoula Formation at the Grand Gulf ESP site. The following discussions provide information to address this unresolved issue.

Unit 1 currently uses three groundwater wells, completed in the Upland Complex (Subsection 2.3.2.2 indicates this as a correction to errors in the ESP ER concerning the Catahoula Formation), for general site needs, which include potable and sanitary water systems, air conditioning, and landscape maintenance. Unit 1 uses two of the wells on a routine basis and reserves the third as a backup water supply well. As discussed in Sections 2.3 and 3.3, Unit 3 also does not require groundwater withdrawal from the Catahoula Formation.

Additional aquifer characterization studies have been conducted to evaluate water use impacts resulting from to groundwater withdrawals from the Upland Complex, the Mississippi River Alluvium, or both. Groundwater hydrologic characteristics are discussed in Section 2.3. New Unit 3 water wells in the Upland Complex, overlying the Catahoula Formation, are planned to supply only potable and sanitary water systems. Other water requirements for Unit 3, such as makeup water for the cooling systems and water for the fire protection system, are to be obtained from Mississippi River. Based on estimates of pumping rates and radii of influence around Unit 3 wells, the only potential impact to identified groundwater users during operation of Unit 3 is to Unit 1 potable water wells. ~~The radius of impact due to groundwater withdrawals does not extend beyond the GGNS property boundaries.~~ The estimated drawdown at the GGNS property boundary (about 3500 feet away) would be approximately 1 foot, using the maximum Unit 3 well flow (200 gpm) and after an extended pumping period of 10,000 days, without recharge to the aquifer and assuming wells in the Upland Complex. This amount of drawdown would have minimal impact on offsite groundwater users, even if a new potable water well were to be installed by an adjacent property owner at the GGNS property boundary.

The average demand for potable water for Unit 3 operations is approximately 35 gpm, as discussed in Subsection 2.3.2.2. Using this average pumping rate, the resulting drawdown at the GGNS property boundary would be expected to be about 0.2 foot after an extended pumping period of 10,000 days. Based upon recent hydrological studies, increased groundwater withdrawal from the Upland Complex and/or Mississippi River Alluvium have only SMALL and localized impact on these two aquifers. These withdrawals are expected to have a negligible effect on the underlying Catahoula Formation.

The NRC staff indicated in NUREG-1817, Subsection 5.3.2 that there would be no anticipated effects on the alluvial aquifer as no new wells were proposed in that aquifer system. One or two new wells are planned to supply the construction and operation needs of Unit 3. The new wells are anticipated to be installed in the Upland Complex in the vicinity of the existing three wells along the bluff area, but may be sited within the Mississippi River Alluvium west of the bluff if adequate aquifer thickness is not available in the Upland Complex. Plant operation plans do not require groundwater withdrawal from the Catahoula Formation. Unit 3 will require a monthly average flow of 35 gpm (see Figure 3.3-201) and a maximum flow of 200 gpm to supply potable and sanitary systems. Water use requirements for construction activities are discussed in Section 4.2. Some overlap in use requirements is possible during the transition period from construction to operation. However, maximum uses should remain within the bounds discussed here and in Section 4.2.

Unit 3 is designed to use surface water for all water requirements except the potable and sanitary systems. This usage reduces the need for groundwater withdrawals and minimizes potential impacts to groundwater sources.

Water use effects upon groundwater users of water from local aquifers as a result of withdrawals from the Upland Complex aquifer system are anticipated to be SMALL.

5.2.3 WATER QUALITY IMPACTS

The information for this section is provided in Section 5.2 of the ESP ER, and associated impacts are not fully resolved in NUREG-1817 Subsection 5.3.3. The following supplemental information is provided to resolve this issue.

Surface Water

Unit 1 currently discharges various waste streams to surface water under an existing NPDES permit. There are three primary outfall locations covered by permit (see ESP ER Figure 2.3-12). Each of these primary locations is, in turn, supplied by other minor outfalls. Outfall 001 includes flow from the Unit 1 cooling towers, standby service water, treated low volume wastewater, and treated liquid radwaste water. Outfall 007 includes miscellaneous waste waters discharged into Sediment Basin B. Outfall 010 includes total facility treated sanitary waste water discharged to Sediment Basin A. Outfall 013 includes treated effluent from Sediment Basin A, that enters Stream A, and then flows into Hamilton Lake. This includes flow from Outfall 010. Outfall 014 includes treated effluent from Sediment Basin B that enters Stream B, and then flows into Hamilton Lake. This includes flow from Outfall 007 and stormwater runoff.

TABLE 5.2-201 (Sheet 2 of 2)
OPERATIONAL IMPACTS OF UNIT 3 ON WATER USERS

Water body affected by operation	Operational Activity	Water Use / User	Potential Effects on Water Users	Impact Level / Mitigation
Groundwater				
1. Upland Complex	Pumping to Meet Operational Needs	A. Unit 1	Loss of water availability for Unit 1 potable water wells	**SMALL.** **Mitigation** – GGNS plans to install up to two new wells to help supply operational needs of the new unit. This, plus the site's existing well capacity should minimize water availability effects.
		B. Off-site Users	Loss of water availability	**SMALL.** **Mitigation** – None. Based upon aquifer characterization studies, effects of operational water use are expected to be localized. Impacts to Ooff-site water users would be ~~unaffected~~minimal.
2. Catahoula Formation	Pumping to Meet Operational Needs	A. Unit 1	Loss of water availability for existing water wells	**Minimal.** Currently not pumping from Catahoula Formation. **Mitigation** – GGNS plans to install up to two new wells in the Upland Complex or the Mississippi River Alluvium to help supply operational needs of the new unit.
		B. Off-site Users	Loss of water quality as a result of upwelling from deeper, lower quality zones.	**SMALL.** Aquifer characterization studies have shown the likelihood of water quality deteriorization in the Catahoula Formation as a result of operational pumping from the Upland Complex is small. **Mitigation** – GGNS is not withdrawing water from the Catahoula, nor does it have plans to do so in the future.
			Loss of water availability	**Minimal.** Based upon aquifer characterization studies, effects of operational pumping from the Upland Complex are expected to be localized. Off-site water users of Catahoula Formation waters should remain unaffected.

cessation of dewatering. Water quality sampling from the wells and piezometers is not necessary. Monitoring of the COL monitoring wells in the top of the Catahoula Formation can be included, but is not considered necessary.

Construction dewatering in the Upland Complex is not expected to have any adverse impactsinfluence on water levelsoff-site water uses in the Mississippi River Alluvium. For this reason, monitoring of groundwater in the Mississippi River Alluvium is not considered to be necessary, even if groundwater withdrawal from the Mississippi River Alluvium aquifer is necessary to support Unit 3 construction or to provide alternate supplies of potable water for Unit 1 operations. Water quality is monitored in accordance with U.S. Environmental Protection Agency (EPA) and MDEQ public water system requirements, and in accordance with applicable well permits.

As noted above, all existing Unit 1 monitoring programs applicable at the time of Unit 3 construction are assumed to continue during construction, modified as necessary considering pre-operational monitoring for Unit 3, and for initiation of Unit 3 operations.

Surface Water

The NRC staff found that continuation of the existing monitoring program provides an adequate hydrological monitoring program (NUREG-1817, Subsection 2.6.1.3).

Standard engineering stormwater management practices and monitoring pursuant to the site's NPDES stormwater management program provide adequate monitoring of hydrological impacts to surface water.

Construction of off-site transmission line ROW utilizes engineering design incorporating standard practice for avoidance of construction in streams and wetland areas to minimize impacts due to hydrological alterations or to water quality. Construction of ROW is completed using stormwater best management practices and monitoring in conjunction with required MDEQ stormwater permits to provide adequate monitoring of off-site hydrological impact to surface water. CWA Section 404 permits are also acquired as necessary for ROW construction incorporating appropriate monitoring and mitigation to minimize construction impacts where avoidance is not possible.

NUREG-1817, Subsection 4.3.3 states that potential impacts to the Mississippi River from dredging for construction of intake and discharge structures would be negligible. Minimization of sediment dislocation and transport is controlled by implementation of engineering controls and construction sequencing. The nearest surface water intake is the Southeast Wood Fiber located 0.8 mi. downstream. That withdrawal is not used for potable water. No potable water intakes are located within 100 mi. downstream of GGNS. Therefore, monitoring of surface water is not necessary during dredging other than as required in accordance with Section 404 of the CWA permits for the project.