



STATE OF NEVADA

Department of Conservation & Natural Resources

DIVISION OF ENVIRONMENTAL PROTECTION

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January 6, 2009

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Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Hydrogeologic and Lithologic Nomenclature Unification

Dear Sirs and Madam:

All of the parties listed above shall be referred to as “the Companies” for the purposes of this letter. The NDEP has been discussing the need to unify the hydrogeologic and lithologic nomenclature that is being used for the BMI Complex and Common Areas projects. The Companies often share wells and data and it is necessary to utilize the same nomenclature to provide transparency in Deliverables submitted to the Nevada Division of Environmental Protection (NDEP). In addition, NDEP maintains a regional database of soil and groundwater data. To maximize the usability of this database the nomenclature used to identify water-bearing zones and lithologic units needs to be consistent. The unified nomenclature is described in Attachment A. It is expected that all Deliverables submitted to the NDEP will utilize this nomenclature from this date forward.

NDEP will be editing the “all companies database” to reflect the nomenclature described in Attachment A.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

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BAR:s

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Attachment A

Hydrogeologic Nomenclature

NDEP understands that there are diverging opinions about geologic interpretations, however, we are not in disagreement regarding the water-bearing zones (WBZs). As noted above, it is expected that the simplified naming convention for the WBZs as described below will be used in all future Deliverables. The Companies can provide as much detail as they like about the lithologic details as a function of the CSM description in reports and in a separate column in the database. The lithologic nomenclature will be described below under a separate item.

There are three water-bearing zones that are of interest as follows:

1. The shallow zone - - this contains the saturated portions of the Quaternary Alluvium (Qal); Transitional (or reworked) Muddy Creek formation (xMCf) and the Upper Muddy Creek formation (UMCf) where the xMCf is missing.
 - a. It is noted that “what” this contains is largely determined by elevation and distance south from Las Vegas Wash. In some areas this water-bearing zone may contain the Qal, xMCf and UMCf. In other areas the UMCf may be the only portion that is saturated.
 - b. It is noted that some Companies disagree with the existence of the xMCf. NDEP has found the xMCf to be present over vast areas of the Sites and surrounding areas (over tens of square miles). Therefore, it is the NDEP’s opinion that this formation generally exists and failure to identify it is an interpretation issue.
 - c. It is noted that depending on geology the first portion of the UMCf may be fine grained (fg) or coarse grained (cg). It has been found that there are spatial relations with regards to this issue. Typically, as one progresses towards the southern boundary of the BMI Complex and Common Areas the fg portion of the UMCf “pinches out” and the first portion of the UMCf that is encountered is cg. It is noted that this is a geologic issue and does not change the fact that this is the “Shallow Zone” in those locations.
 - d. It is noted that the “bottom” of this first WBZ may be difficult to definitively identify, however, we believe that this is an issue that the field geologists and hydrogeologists are best suited to address.
 - e. It is noted that the NDEP believes that the entire column of soil (through all WBZs) is saturated and all of the WBZs are in some amount of communication with one another...therefore there truly is no “bottom”. As noted above, some interpretation is necessary to make practical decisions about well screening and data interpretation.
2. The Middle Zone
 - a. For the NDEP’s purposes we are calling this everything below the water table aquifer and above the “Deep Zone”. Generally, this zone starts at 90’ below ground surface (bgs) and extends to approximately 300’ bgs.

- b. It is acknowledged that this may include several fine grained and coarse grained zones, however, it is the opinion of the NDEP that this is a hydrogeologic distinction that could be made.
 - i. The utility of this distinction is not clear at this time as the UMCf-fg1 identified at a Site may not correspond in any way to the UMCf-fg1 discovered off-Site.
- c. It is noted that the connectivity (or lack thereof) of the waters encountered in this zone is largely undetermined.
- d. It is noted that a well could be screened in any part of this zone and yield water (sometime over a very long period of time). Generally, well screens are placed in zones with relatively higher sand contents (>20%) and some moisture.

3. The Deep Zone

- a. For the NDEP's purposes we are calling this the contiguous deep WBZ that is generally encountered in the 300-400' bgs range.
- b. In reference materials this is referred to as the "Shallow Confined Aquifer".

4. Challenges and Considerations

- a. Due to the variations in ground surface elevations it is very difficult to call out elevation ranges for each of these zones for the vast geography covered by the BMI Complex and Common Areas.
- b. Generally, at the present time the vertical hydraulic gradients of the WBZ are as follows:
 - i. Shallow Zone – down.
 - ii. Middle Zone – up or down relative to the Shallow Zone, however, the gradient is typically very slight relative to the Deep Zone. This gradient increases to be a stronger upward gradient the deeper the water is in the Middle Zone.
 - iii. Deep Zone – up to both the Middle Zone and Water Table Aquifer.
 - iv. It is noted that historically this may not have been the case.

Lithologic Nomenclature

Currently, the database field labeled as “Aquifer” contains information that NDEP would classify as “lithologic”. The problem is that different names are given for the same lithology. In addition, names are sometime given which are hydrogeologic and other times they are lithologic.

For example, what is defined as the “Shallow Zone” above is referred to in the existing database as follows:

- Alluvium
- ALL
- Alluvial
- Qal

This is unnecessarily confusing and creates unnecessary work for the Companies when they are trying to share data.

The lithologic nomenclature tags are as follows:

- “Qal” to represent the Quaternary Alluvium
- “xMCf” to represent the transitional Muddy Creek formation
- “UMCf” to represent the Upper Muddy Creek formation

It is noted that wells may cross these lithologies. Examples of acceptable entries are as follows:

- Qal/xMCf
- Qal/xMCf/UMCf
- xMCf/UMCf

In this manner, the number of different entries into the lithology column would be limited to six different entries.

It is noted that some of the Companies believe that additional information is needed regarding the UMCf. Specifically, the fine-grained (fg) versus coarse grained (cg) portions of the UMCf. If this information is to be provided in the database it needs to be in a separate field.

A conceptual or actual cross-section would be a helpful reference in each Deliverable.