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June 27, 2008

Mr. Brian Rakvica, P.E.
Nevada Division of Environmental Protection
2030 East Flamingo Road, Suite 230
Las Vegas, Nevada 89119-0818

Subject: Proposed Hydrostratigraphic Nomenclature – Black Mountain Industrial Complex and Common Areas

Dear Mr. Rakvica:

On May 7, 2008, the Nevada Department of Environmental Protection (NDEP) sent an email to the Black Mountain Industrial (BMI) Complex companies transmitting a proposal to establish common hydrogeologic nomenclature for use at the sites and in the common areas. Attached is the Tronox review and comments to that proposal. Tronox understands the complexity of the task and appreciates the opportunity to comment on the establishment of a common nomenclature. We look forward to future discussions on this important matter.

If you have any questions on our comments regarding this correspondence, please contact me at (702) 651-2234.

Sincerely,

Susan M. Crowley
Staff Environmental Specialist

Overnight Mail

Attachment: As stated
CC: See attached Distribution List

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Mack	Joel	Montrose Counsel			

Comments on the Proposed Stratigraphy and Hydrogeologic Nomenclature for the BMI Complex and Common Areas

On May 7, 2008, the Nevada Department of Environmental Protection (NDEP) sent an email to the Black Mountain Industrial (BMI) Complex companies transmitting a proposal to establish common hydrogeologic nomenclature for use at the sites and in the common areas. Tronox welcomes this proposal, though it believes modifications are needed to eliminate problems in hydrostratigraphic correlations laterally between site properties, and as the companies move downdip from the BMI complex.

Muddy Creek Formation

Plume's (1989) discussion of the geology and hydrogeology of the Las Vegas Valley (LVV) relied mostly on previous investigations. Citing Longwell and others (1965), he writes that the Muddy Creek formation (MC) of Miocene and Pliocene age occurs in Las Vegas Valley as valley-fill deposits that are coarse grained near mountain fronts and progressively finer grained toward the center of the valley. The Muddy Creek Formation has been recognized by numerous workers in several places in the LVV: (1) silt and silty clay northwest of Whitney Mesa (Bingler, 1977); (2) weakly bedded silt on the face of Whitney Mesa (Bingler, 1977); (3) interbedded gravel, sand, silt and clay south and west of Frenchman Mountain (Bingler, 1977; Bell and Smith, 1980); (4) a fanglomerate east of Henderson; (Bell and Smith, 1980); and (5) fine sandstone, siltstone and clay north of Sunrise Mountain (Longwell and others, 1965).

Maxey and Jameson (1948) wrote that "much of the material in these formations resembles playa-lake deposits". They used the word "formations", referring to MC sediments in all the basins they occur in; LVV being just one of them. None of the authors cited above, describe reworked or "transitional" MC in their discussions. During the interval between MC and Quaternary deposition there most certainly was erosion and reworking of MC, and depostion into the younger sediments. However, Tronox mapping has only found small, isolated occurrences of reworked MC in areas around Warm Spring Road.

According to Tronox mapping, the shallow MC valley-fill in the area from Lake Mead Parkway north to Las Vegas Wash (LVW) is comprised of the various facies of a large alluvial fan system (proximal fan, mid-fan and distal fan), shown on revised **Plate 1**, depositing into a large lake (lacustrine environment). The source area for this depositional system was the Spring Mountains to the west and the McCullough Range immediately to the south. Structure observed in the MC is probably related to deposition on an alluvial fan or inclined surface and/or tilting related to extensional faulting during the Tertiary Period.

The proximal fan facies, consisting of massive gravels, would have been eroded into bedrock and deposited in the confined canyons and at the head of the alluvial fans. This facies has not been recognized by Tronox in our investigations and was probably eroded as the mountain front receded. It is probable that the present-day cobble-to boulder-size Quaternary alluvial deposits (Qal) are reworked MC proximal fan facies.

The mid fan facies, consisting of alternating fine-gravel, sand and silt deposits was deposited along the mountain front where the flow became unconfined. This sedimentation type is composed of coarser grained braided stream sands and gravels and finer grained interfluvial silts, sandy and clayey silts with minor clay. This facies is mapped from Lake Mead Parkway northward to about Boulder Highway. Original dip of the beds must have been very gentle due to the fact that very little pebble and granule size material is seen north of Boulder Highway.

The distal fan facies, consisting of silt with minor sand and clay deposits, was deposited downgradient of the mid fan deposits. This sedimentation type is composed of finer grained interfluvial silts, sandy and clayey silts, and sandy and silty clay and minor finer grained braided stream sands. Within this facies and the mid fan facies above, "floating" sand to pea gravel size particles often occur suspended in the silt matrix. Such occurrences are indicative of sediment-choked debris flows and usually make up no more than 10 to 15 percent of the finer grained units. The distal fan facies is mapped from about Boulder Highway to about the Pittman Lateral.

The lacustrine facies, consisting of interbedded silt, sand and clay deposits on the south changing over to massive clay and evaporate deposits on the north, was deposited in a lake environment downgradient of the distal fan facies. In the vicinity of the Pittman Lateral the red and brown silts, clays and fine sands of the distal fan facies are interbedded with green and gray clays and gypsum beds of the lacustrine facies. Farther north, near LVW, massive lacustrine clays and evaporates are found to a depth of at least 1500 feet **(see Plate 1)**.

As the individual fans built up over time and coalesced, the distributaries and interfluves constantly changed position and pre-existing coarser grained sand units often became encapsulated within finer grained sediments. As such these sands became the aquifers and the silts and clays became the confining aquicludes and/or aquitards present today.

"Transitional" MC and Alluvium

As noted above, none of the authors dealing with the MC in LVV described "transitional" MC in any of their investigations. The proposed nomenclature document states that hydrologic investigations in the BMI areas have revealed the presence of a reworked "Transition Zone" of sediments between the base of the Qal and top of the MC. Tronox mapping from Lake Mead Parkway to LVW has found very little reworked MC. What has been observed are thin, isolated and discontinuous reddish brown silty fine grained sands with or without granules or fine pea gravel, and with or without pedogenic caliche nodules or layers. The word "transitional" means changing gradually over time or space. The reworked MC does not fit this definition and the use of the word "transitional' should be abandoned. If reworked MC is found in an area it probably occurs in depressions or alluvial channels eroded into the MC **(see Plate 2 for an example)** and should be described as "reworked" MC or, preferably, as part of the Qal, because a great deal of the alluvium is in fact "reworked" MC. In addition, if it exists at all in an area it is probably thin and should not be split out of the MC into a separate unit. Where Tronox has found reworked MC it has been saturated and is considered it to be part of the Qal.

Hydrogeologic Units

When a "stratigraphy" and a "hydrostratigraphy" are defined, the superposition of lithologic units needs to be foremost followed by divisions based on their associated hydraulic/geochemical conditions. Some of the designations in the proposed nomenclature do not appear to follow this logic and are discussed below.

(1) The UMCf-fg-"A", "B", "C" units are segregated by depth **(see Plate 2)**. Because of the relative uniformity of the fine-grain MC, the document author may have seen this as a necessity. Tronox is concerned though that "depth" has nothing to do with hydrostratigraphy. The site topography changes from south to north, and a "B" unit below the site, will not be the same "B" unit adjacent to the LVW. It would be preferable to segregate the units by lithology and hydrogeologic characteristics, not depth, as "depth" changes with variable topography.

(2) The document author proposes UMCf-cg for both the shallow coarse-grained Muddy Creek (unconfined) and the "deep" coarse-grained Muddy Creek (confined). There needs to be a designation (i.e. number added) to segregate these units, as leaving them the same will cause confusion. Whereas these sediments are derived from the same mountain front alluvial fan system they are stratigraphically and hydrologically different **(see revised Plate 1).**

(3) Whereas the original dip of the beds in the MC alluvial fan system was very gentle, tilting has occurred since deposition and this has been shown on revised **Plate 1**.

(4) The revised **Plate 1** and **Plate 2** shows the preferred naming of the geologic and hydrogeologic units. They are the following:

Proposed PES Geologic Names	Proposed Tronox Geologic Names
Qal	Qal
Qal/UMCf	Qal
UMCf-fg	MCf1, 2, 3, etc.
UMCf-cg	MCc1, 2, 3, etc.
	MCfu

The different numerical designations of the fine-grained deposits (MCf1, 2 and 3) and the coarse-grained deposits (MCc1, 2 and 3) are numbered downward and separate the distinct lithologic units. Note that units MCf3 and MCc3 have not been intersected by drilling and are only inferred. In cases where Qal sits directly on top of MCc1 the two can be distinguished on the basis of gravel size – the Qal almost always contains gravels with pebbles, cobbles and boulders whereas the MCc1 gravels generally contain only granule to pebble-size clasts.

Out of necessity, in the lower distal fan and lacustrine facies where no marker beds exist, it will be necessary to lump the fine-grained MC into an undifferentiated unit (MCfu) which is equivalent to the MCf1, MCf2 and MCf3 units of the mid fan facies

Proposed PES Hydrogeologic Names	Proposed Tronox Hydrogeologic Names
Qal	Qal
UMCf-cg	Qal/MCc1
UMCf-fg-A, B, C	MCf1
UMCf-cg	MCc2

References

Bell, J. W. and Smith, E. I., 1980, Geologic Mao of the Henderson Quadrangle, Nevada: Nevada Bureau of Mines and Geology, Map 67.

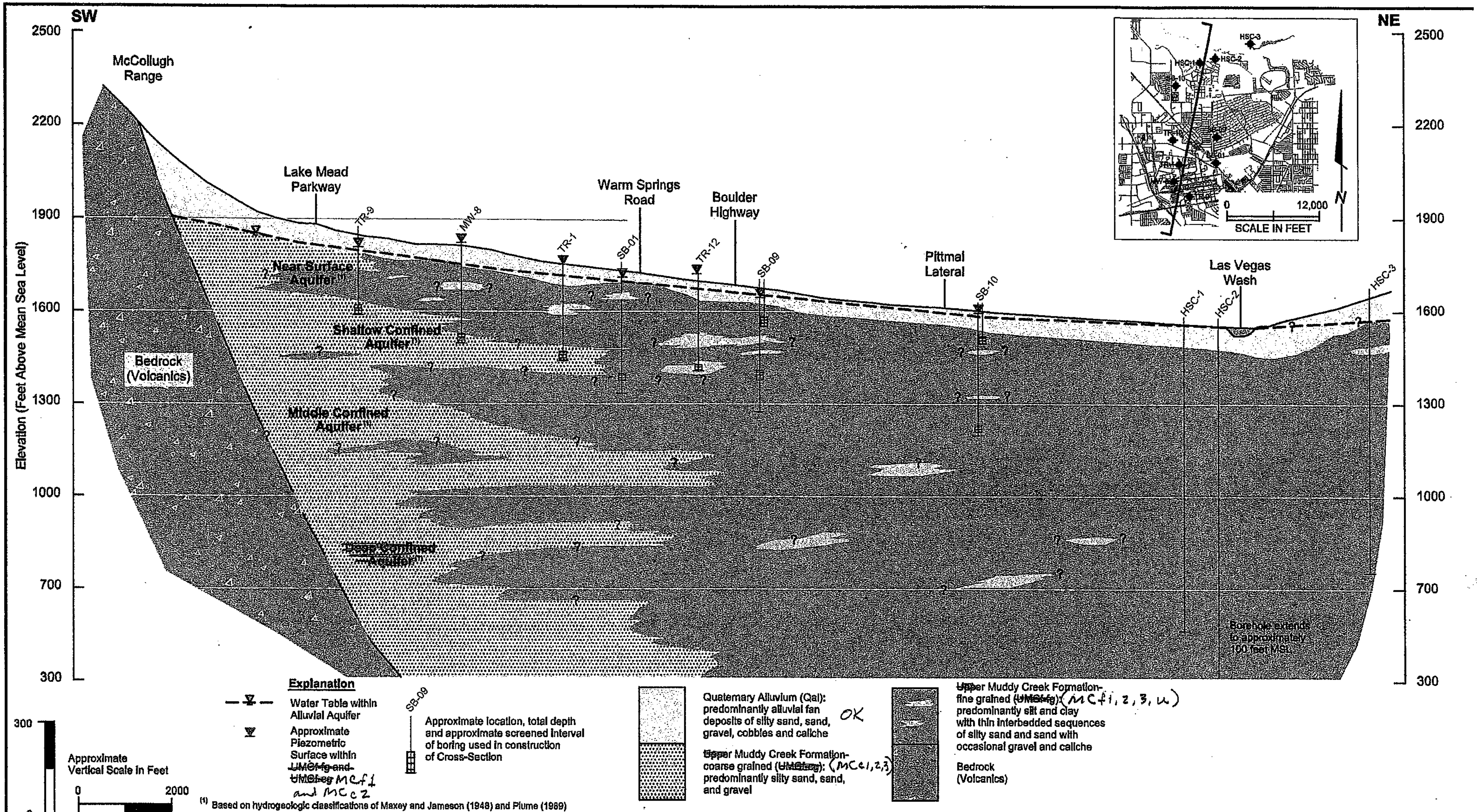
Bingler, e. C., 1977, Geologic Map, Las Vegas SE Quadrangle: Nevada Bureau of Mines and Geology Urban Maps Series, las Vegas SE Folio, Map 3Ag.

Longwell, C. R., Pampeyan, E. H., Bowyer, Ben, and Roberts, R. J., 1965, Geology and Mineral Deposits of Clark County, Nevada: Nevada Bureau of Mines Bulletin 62, 217 p.

Maxey, G. B., and Jameson, C.H., 1948, Geology and Water Resources of Las Vegas, Pahrump, and Indian Springs Valleys, Clark and Nye Counties, Nevada: Nevada State Engineering, Water Resources Bulletin 5, 121p.

Plume, R.W., 1989, Ground-Water Conditions in Las Vegas Valley, Clark County, Nevada: Part 1. Hydrologic Framework: U.S. Geological Survey Water-Supply Paper 2320-A, 14p.

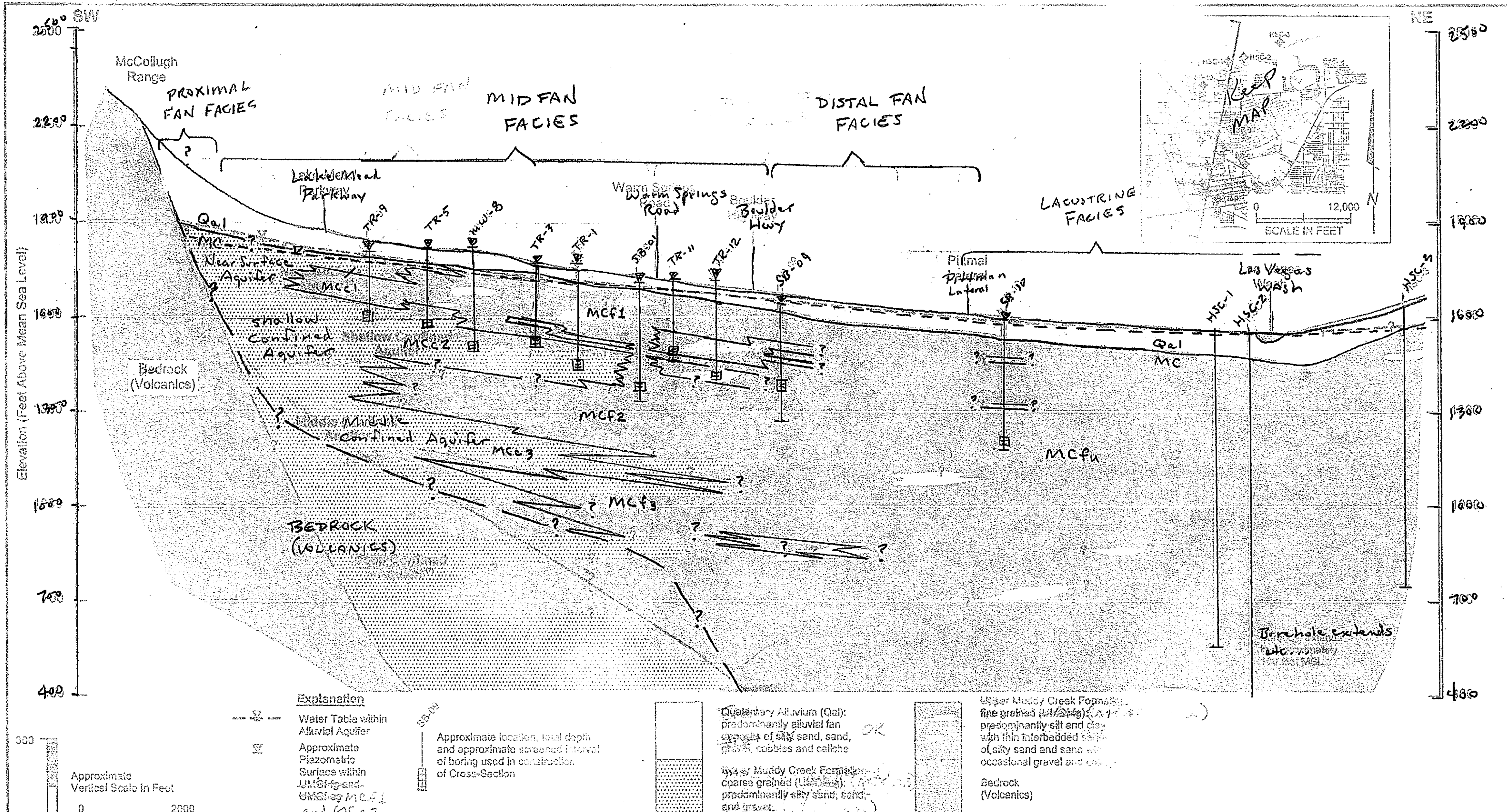
Plate 1 Comments



(1) Based on hydrogeologic classifications of Maxey and Jameson (1948) and Plume (1989)

This Conceptual Hydrogeologic Cross Section is based upon the predominant type of deposits common to each hydrogeologic unit, and does not illustrate the heterogeneous or thin interbedded nature of sediments that are present within these hydrogeologic units.

This Conceptual Hydrogeologic Cross Section has been prepared for the express purpose of developing common hydrogeologic nomenclature (further described on Plate 2) throughout the BMI areas. The boring logs cited herein are believed to be accurately represented.

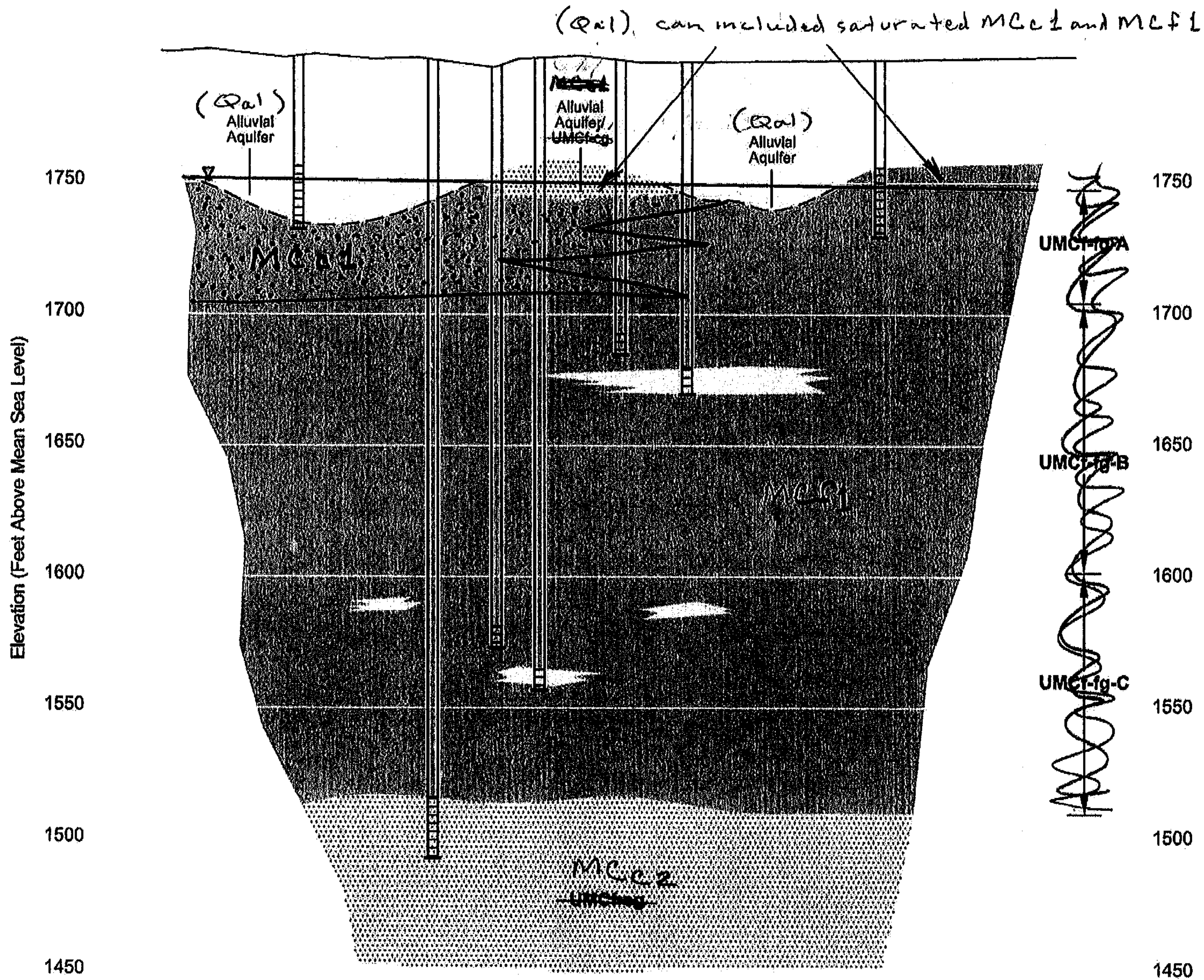


(1) Based on hydrogeologic classifications of Maxey and Jameson (1948) and Plume (1989)

This Conceptual Hydrogeologic Cross Section is based upon the predominant type of deposits common to each hydrogeologic unit, and does not illustrate the heterogeneous or thin interbedded nature of sediments that are present within these hydrogeologic units.

This Conceptual Hydrogeologic Cross Section has been prepared for the express purpose of developing common hydrogeologic nomenclature (further described on Plate 2) throughout the BMI areas. The boring logs cited herein are believed to be accurately represented.

Plate 2 Comments



This Generalized Hydrogeologic Framework is based upon the predominant type of deposits common to each hydrogeologic unit, and does not illustrate the heterogeneous or thin interbedded nature of sediments that are present within these hydrogeologic units. The Generalized Hydrogeologic Framework is solely conceptualized and prepared for the express purpose of developing common hydrogeologic nomenclature throughout the BMI areas. As such, the view can be conceptualized as trending either north to south, or east to west.

PLATE 2

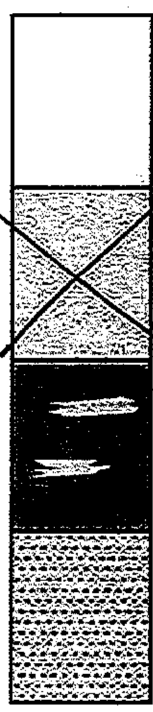
EXPLANATION

Groundwater Potentiometric Surface

Base of Alluvial Aquifer

Typical Groundwater Monitoring Well with Screened Interval

Geologic Units



Quaternary Alluvium (Qal): predominantly alluvial fan deposits of silty sand, sand, gravel, cobbles and caliche

Transition Zone of Qal/UMCf: predominantly silt and clay intercalated with sand, gravel and/or caliche

Upper Muddy Creek Formation - fine grained (UMCf-fg): MCf 1, 2, 3, etc. predominantly silt and clay with thin interbedded sequences of silty sand and sand with occasional gravel and caliche

Upper Muddy Creek Formation - coarse grained (UMCf-cg): MCc 1, 2, 3, etc. predominantly silty sand, sand, and gravel

Hydrogeologic Units

MCf 1 Near-Surface Aquifers of Maxey and Jameson (1948) and Plume (1989)	**Alluvial Aquifer (Qal):** For the purpose of developing common nomenclature throughout the BMI areas, saturated deposits within Qal and reworked MC and/or Transition Zone (typically exhibits unconfined conditions). Can include saturated deposits of MCc1 **Alluvial Aquifer (UMCf-cg):** For the purpose of developing common nomenclature throughout the BMI areas, at locations along mountain fronts (e.g. adjacent to Lake Mead Parkway) where Qal deposits are immediately underlain by saturated deposits of UMCf-cg MCc1 (typically exhibits unconfined conditions), or saturated deposits of MCf 1 further north (typically exhibit unconfined conditions. **UMCf-fg-A:** For the purpose of developing common nomenclature throughout the BMI areas, where applicable the UMCf-fg-A MCf 1 is projected as saturated UMCf-fg deposits within the approximate upper 50 feet of UMCf-fg (typically exhibits semi-confined or unconfined conditions). confined, **UMCf-fg-B:** For the purpose of developing common nomenclature throughout the BMI areas, where applicable the UMCf-fg-B is projected as the zone of saturated UMCf-fg deposits that range from approximately 50 to 150 feet below the top of UMCf-fg (typically exhibits semi-confined or confined conditions). **UMCf-fg-C:** For the purpose of developing common nomenclature throughout the BMI areas, where applicable the UMCf-fg-C is projected as the zone of saturated UMCf-fg deposits that range from approximately 150 to 350 feet below the top of UMCf-fg and above the UMCf-cg (typically exhibits semi-confined or confined conditions). In general, this zone represents the maximum depth of groundwater monitoring wells completed throughout the BMI areas.
Shallow Confined Aquifer of Maxey and Jameson (1948) and Plume (1989)	MCc2 MCc2 **UMCf-cg:** Saturated sediments within UMCf-cg (typically exhibits confined conditions)