

MEMO

State of Idaho

Department of Water Resources

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Date: August 27, 2007

To: Dan Nelson, Western Region

From: Dennis Owsley^{DO}, Hydrology Section, State Office

Reviewed By: Sean Vincent^{SV}, Hydrology Section Manager

Subject: Boise State University Application for Permit for Cooling

A request for analysis was submitted to the Hydrology Section at the State Office for the subject application. The applicant is proposing to divert 0.42 cfs (190 gpm) of ground water for cooling purposes in three buildings on the Boise campus. One existing 10" well is proposed to provide water for the cooling system from the intermediate aquifer. The water will be discharged to the Boise River once it cycles through the cooling system. The proposed use is characterized as non-consumptive in the June 20, 2007 letter prepared in support of the permit application (SPF, 2007).

Questions to be addressed:

Application will mitigate the river, but will it mitigate the ground water being diverted? Is there a reasonable communication between the river and the aquifer at this location?

Response:

The two questions to be addressed can be answered together because the amount of ground water mitigation will be directly related to the hydraulic connection between the aquifer and the river on the BSU campus. To attempt to answer the questions presented, the following summary of the hydrogeologic conditions of the area is presented based upon a review of the application packet and related documents

GEOLOGY

The subject well is located approximately 1,000 feet south of the Boise River. The well is screened between 163 to 173 feet below ground surface (bgs) across a contact between a sandy shale and a coarse sand unit. It appears that the producing zone is a sand unit encountered at a depth of 170 feet bgs.

The driller's log provides a summary of the lithologic units encountered when drilling the well. The upper 30 feet of the subsurface is composed of gravel and top soil overlying a 60-foot thick saturated sand unit. This saturated sand unit represents the shallow aquifer and is separated from the intermediate aquifer system by the 80-foot thick sequence of clay and shale. Below the clay and shale units lies the sand unit that represents the intermediate aquifer. The individual sand, gravel, and clay units of the area appear to be laterally discontinuous, as shown in Figure 1.

HYDROGEOLOGY

The static water level at the time of the completion of the well was 20 feet bgs, approximately five feet lower than the bottom of the Boise River channel. The rise of the water column above the top of the aquifer elevation indicates the aquifer is semi-to fully-confined (SPF Engineering, 2007). The confining layer appears to be the 80+ feet of clay and sandy shale overlying the producing sand unit. Based on previous studies, it appears the confining layers will restrict vertical movement. According to Petrich (2004), "while individual clay layers are not necessarily areally extensive, multiple clay layers in aggregate form effective barriers to vertical ground water movement".

However, it has been shown that the river is in hydraulic communication with the shallow aquifer and gaining and losing reaches of the river have been identified from Lucky Peak to the Snake River (Urban, 2000; USBR, 2007; Petrich, 2004). The particular reach associated with the location of this well has been shown to be a losing reach (Urban, 2000).

The recharge area for the intermediate aquifer has not been delineated, but recharge is most likely to occur where the restrictive clay layers are absent and the producing sand zone is in hydraulic communication with the overlying surface water features and aquifers. Recharge sources likely include leakage from the Boise River, leakage from overlying aquifers, canal losses, underflow from adjacent aquifers, and infiltration from irrigated agricultural lands (Petrich, 2004).

Adequate data does not exist to evaluate the hydraulic communication between the Boise River and the intermediate aquifer in this area. Determination of surface water/ground water interaction requires comparison of trends in the stage of the Boise River and water levels in the producing zone. The necessary monitoring data currently does not exist for this reach of the river.

Figure 1 in the June 20, 2007 report from SPF Engineering summarizes water levels from a multi-level ground water piezometer nest located east of the BSU well, near the Boise River. As shown in the figure, water levels in the late summer of 2002, 2003, 2005, and 2006 are rising in the intermediate zone. This rise in water level in the late summer is also shown in the deeper zones, indicating a hydraulic connection between the deeper and intermediate zones. The shallow aquifer levels during the

An attachment to the June 20 report from SPF Engineering is a report prepared by Keith Anderson in August of 1963. This 1963 report summarizes well interference on the BSU campus from pumping the Liberal Arts well (well associated with this application), the Library well, and the Student Union well. All three of these wells are completed on the BSU campus at similar depths. The results show that pumping each of the wells induces significant drawdown in the other two wells. These results indicate that the wells are hydraulically connected with low transmissivity properties. Therefore, impacts to any other wells completed in this intermediate aquifer will occur by pumping the well in this application.

CONCLUSIONS

The ground water being diverted in this application is from the intermediate aquifer at a depth of approximately 170 feet bgs. Hydraulic connection of the producing zone to the overlying shallow aquifer has not been shown. Based on the existence of over 80 feet of low permeable unsaturated clay and shale separate the shallow aquifer system from this intermediate aquifer, the degree of hydraulic communication between the two aquifers is minimal.

The shallow aquifer receives the water lost from the river; however, the degree of hydraulic connection to the intermediate and deeper aquifers is unknown. The water used in this application does not fully mitigate the intermediate aquifer in the area of impact. Without full mitigation, pumping of the proposed well will lower the static water level in nearby wells completed in the intermediate sand aquifer.

References

- Petrich, C., 2004. Simulation of Ground Water Flow in the Lower Boise River Basin. Idaho Water Resources Research Institute and the Idaho Department of Water Resources Research Report IWRRRI-2004-02
- SPF Water Engineering, LLC, 2007. Correspondence dated June 20, 2007 to Dan Nelson regarding the Boise State University Application for Permit for Cooling.
- United States Bureau of Reclamation (USBR), 2007. A Distributed Parameter Water Budget Data Base for the Lower Boise Valley. United States Bureau of Reclamation and Idaho Department of Water Resources Research Report.
- Urban, S., 2004. Water Budget for the Treasure Valley Aquifer System for the Years 1996 and 2000. Idaho Department of Water Resources Research Report.

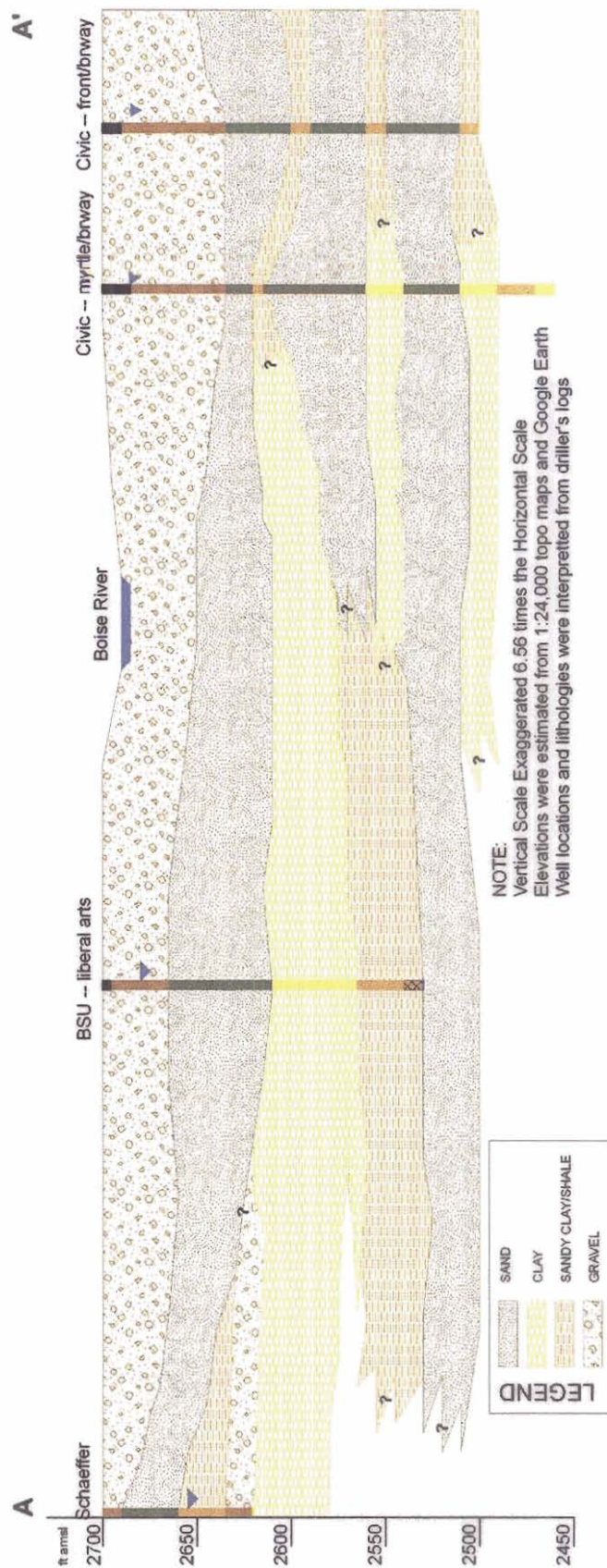


Figure1. Generalized geologic cross section using the BSU Liberal Arts well and three surrounding wells.