MEMORANDUM

TO: Water Resources Commission

FROM: Barry Norris, Administrator

SUBJECT: Water Resources Commission Meeting
Agenda Item F, August 9, 2002

Informational Report on Ground Water Conditions in the Amity Hills/Walnut Hills Area of Yamhill County

I. Issue Statement

As rural development increases in the Willamette Valley, there is growing concern over the ability of ground water supplies to support new and existing users. This is especially true of aquifers in the highlands surrounding Salem. At its May 30, 1997, meeting the Commission received a request to expand the Eola Hills Ground Water Limited Area (GWLA) located in the highlands area of Salem. That request was denied; however, the Commission requested staff to collect additional data and report back in five years. Data collected since that date indicate (1) there is a strong connection between ground water levels and precipitation; (2) recharge occurs fairly rapidly to aquifers in both the basalts and marine sediments; and (3) there are areas of instability in the ground water resource. *This is an informational report only; no Commission action is required.*

II. Background

In 1992 the Commission adopted modifications to the Willamette Basin Program in response to concerns about the stability of ground water supplies. The modified basin program designated 11 Ground Water Limited Areas including the Eola Hills GWLA. (Attachment 1). The only allowable uses of ground water in the basalt aquifers in the Eola Hills GWLA are exempt uses, irrigation, and rural residential fire protection systems. All new water right permits in the GWLA are limited to five years and can only be extended if the Director determines that the ground water resource can support the extended use. New irrigation permits are limited to drip or equally efficient irrigation and further limited to one acre-foot per acre per year.

In early 1995 the Department was contacted concerning the expansion of a quarry located in the Amity Hills/Walnut Hills area (just north of the Eola Hills GWLA) and its potential impacts to the ground water resource. The Department, with the help of several area residents, correlated Water Well Reports to approximately 35 wells surrounding the quarry site. Ground water levels were measured in most of the wells and the data were inconclusive; no action was taken by the Department.

In December 1996 the Friends of Yamhill County requested that the Commission expand the Eola Hills GWLA to include the Amity Hills/Walnut Hills area. The expansion was requested to protect ground water supplies and existing users from increasing pressure from rural residential development and potential ground water depletion. The Commission directed staff to review the matter and return with a recommendation. Staff reported back to the Commission at its May 30, 1997, meeting and recommended that the Ground Water Limited Area not be expanded because ground water level data were varied and inconclusive. Staff also recommended that additional ground water level data be collected for the next three to five years to better document ground water conditions in the area. The Commission accepted the staff recommendation but requested that staff hold a public meeting to share and acquire information. That meeting was held on October 7, 1997, in Amity. This report presents an update on ground water conditions in the Amity Hills/Walnut Hills Area of Yamhill County since the 1997 Commission meeting.

III. Discussion

A. *Hydrogeologic Setting*

There are three main hydrogeologic units in the Amity Hills/Walnut Hills area. Attachment 2 is a generalized cross section, taken from Price, 1967, trending west to east through the area. The oldest unit is composed of marine deposited claystones, siltstones and sandstones. The marine sediments are estimated to be as thick as 23,000 feet (Gannett and Caldwell, 1998). The marine sediments generally provide adequate water supply for limited domestic uses. Generally, deeper wells have a greater chance of encountering brackish or saline water.

Overlying the marine sediments are eastward dipping basalt flows of the Columbia River Basalt Group. The basalts may be as thick as 900 feet in parts of the Willamette Valley, but are generally much thinner in the Amity Hills/Walnut Hills area. Basalt wells in this area generally produce adequate water supply for domestic uses. Attachment 1 shows the aerial limits of the basalts and marine sediments.

Silt, sand and gravel make up the basin-fill sediments that overlie the basalts as they extend eastward under the Willamette Valley. This aquifer was not part of the study.

B. *Data Collection*

The Department has compiled a substantial body of ground water data in the Amity Hills/Walnut Hills area. In addition to the 35 wells located in 1995, 30 more wells have been located in the study area. Of the 65 located wells, 30 have been measured annually since 1995. The well locations are shown in Attachment 3. Miscellaneous measurements have also been made at a number of additional wells. At Stephens Quarry, five monitoring wells were installed and the quarry operator has been measuring water levels quarterly since 1995. Water level recorders were also installed on two wells in the study area – one well completed in the Columbia River Basalts and one completed in the marine sediments.

In addition to data collected in the Amity Hills/Walnut Hills area, the Department has been collecting data in the adjacent Eola Hills GWLA. As part of the Department and U.S. Geological Survey Willamette Ground Water Study, approximately 80 wells have been located in the ground water limited area. Since 1996, nine of these wells have been monitored; six on a bi-monthly schedule and three by water level recorders.

C. *Precipitation and Ground Water*

Attachment 4a shows daily precipitation recorded at Salem since 1995 by Water Year (Oct 1-Sept 30). Superimposed on the graph are lines representing cumulative rainfall for each year. In comparison, Attachment 4b shows the total precipitation at Salem that occurred from November through March.

Water level data from wells are analyzed to determine whether the local ground water system is responsive to rainfall. In the study area, water levels generally mimic the rainfall pattern and indicate the local flow system is receiving some annual replenishment from precipitation. However, this does not mean the aquifer and/or wells are immune to water supply problems. In this case, the response indicates that these are low-storage aquifer systems reliant upon local rainfall to provide storage for use later in the year. In years of inadequate recharge, users of wells in the area must make do with existing ground water in storage until substantial rainfall years replenish the ground water system. Consequently, consecutive dry years could have a significant adverse impact on ground water supply.

Attachment 5 compares November through March precipitation with hydrographs from the two recorder wells in the Amity Hills/Walnut Hills area. There is a strong correlation between ground water levels at these two wells and precipitation. Attachment 5b is a hydrograph of a well completed in the basalts, located on the west side of Walnut Hill. The ground water level responds rapidly to precipitation. The magnitude of the annual fluctuation varies from four to fourteen feet. Here, the rapid response of ground water levels to precipitation and the magnitude of the response indicate a low storage aquifer - an aquifer that will experience water supply problems as a result of consecutive dry years.

Attachment 5c is a hydrograph of a well completed in the marine sediments, located on the east side of Walnut Hills. The magnitude of seasonal change in water levels is considerably

smaller, about one to three feet per year. (Note the difference in vertical scales between Attachment 5b and 5c). Recharge to the marine sediments is rapid, but occurs more slowly than to the shallow basalts as noted by the more rounded curve. These data indicate a low storage aquifer and, compared to the basalt aquifer, a lower ability to transmit water through the aquifer. Similar to the basalt aquifer, the marine sediment aquifer is subject to overdraft following consecutive dry years.

D. *Current Ground Water Conditions*

Not all wells within the Amity Hills/Walnut Hills area respond in a manner similar to the recorder wells described above. Variations in ground water responses to stress, such as drought, above-average precipitation, or development, are probably related to variations in aquifer properties from place to place. Individual basalt flows are not continuous over large areas. The basalts have been faulted and folded, creating barriers to ground water flow. Not only do these geologic factors result in different responses to stress, they can also affect rates and amount of recharge.

For example, there is an area south of Amity Road, highlighted on Attachment 3 as "low storage," where ground water levels in the basalt aquifer declined approximately 40 to 50 feet in response to the drought of 2001. Most of the water level decline was offset by recovery the next year in response to above-average precipitation. The hydrograph for well YAMH 7144, shown on Attachment 6a, is a representative graph for this area. The response to the drought and above-average precipitation the following year indicates that the aquifer in this area has very limited storage capacity. Homeowners with wells in this area would have had water supply problems if the drought had continued for a second year. Additional development of the resource in this area will likely exacerbate the situation.

To the east of the low storage area, aquifer response is not as dramatic, probably because wells in that area are constructed into a deeper part of the basalt column (Attachment 6b). South of the low storage area, it is difficult to assess storage effects because there is currently limited development. However, additional rural residential development is planned for this area. It is difficult to predict whether this area will respond in the same way as the low storage area.

There is an area around the intersection of Walnut Hill Road and Three Trees Lane, highlighted on Attachment 3 as "area of decline," where wells in the basalt aquifers are showing a slight decline. The amount of decline varies from five to twelve feet over a six-year period. Many of the ground water levels were lower in February 2002 than in February 2001. Attachment 7a and 7b show representative hydrographs for the Three Trees Lane area. The wells are located approximately one-half mile apart. The hydrograph in Attachment 7a, YAMH 7094, declined approximately 20 feet in response to the 2001 drought and area ground water uses. The water level had risen approximately 15 feet by the following February. Overall, the water level has declined approximately twelve feet since late 1995. The ground water level measured at YAMH 3861 was fairly stable during the late 1990s. However, since 1999 the water level has declined approximately 10 feet at a steady rate as

seen in Attachment 7b, despite average or above-average precipitation for seven of the last eight years. These data suggest use is exceeding the amount of recharge. Additional development in this area will likely exacerbate the rate of decline.

Ground water level data from aquifers within the marine sediments indicate that they are fairly stable at this time. Aquifers within the marine sediments are the primary source of water in a large portion of the Amity Hills/Walnut Hills area. If wells in the basalts fail over time, potential water users will, by necessity, be required to develop aquifers within the marine sediments.

IV. Summary

Department staff have been monitoring ground water levels in the Amity Hills/Walnut Hills area since 1995. The wells are completed in aquifers within the marine sediments or the Columbia River Basalts. The data indicate a strong correlation between precipitation and ground water levels. This indicates that recharge is occurring immediately as opposed to being delayed by months or years. Seven of the last eight years have experienced average or above-average precipitation, yet there are areas where ground water levels are declining. There are two areas of concern for ground water stability in the basalt aquifers: (1) an area of low storage that showed significant declines related to the 2001 drought; and (2) an area of water level declines where water levels have dropped 5 to 12 feet despite above-average precipitation. Basalt aquifers adjacent to these areas of concern are likely to experience instability as development of the resource proceeds. In general, ground water levels in the marine sediments are stable at this time.

V. Recommendation

At the Commission's direction, Department staff and Department of Land Conservation and Development staff will be conducting a one-day workshop for Willamette Valley land use planners on September 24, 2002. The topic of the workshop will be the adequacy of ground water for rural development. As a part of that workshop, attendees will brainstorm approaches to issues such as those presented by the Amity Hills/Walnut Hills area. Depending upon the outcome of the workshop, staff may return to the Commission at a future meeting with a recommendation for some form of administrative action in the area.

Any administrative actions limiting ground water use in basalt aquifers within the Amity Hills/Walnut Hills area will result in additional development of aquifers within the marine sediments. For this reason, the Department intends to continue monitoring ground water levels in aquifers within the Columbia River Basalts and marine sediments in order to gage impacts of continued development.

Attachments:

1. Map Showing Location of Eola Hills G.W.L.A.

2. Generalized Hydrogeologic Cross Section (Price, 1967)
3. Map Showing Well Locations in Amity Hills/Walnut Hills Area
4. Precipitation at Salem
5. Precipitation at Salem and Hydrographs for YAMH 672 and YAMH 599
6. Hydrographs for YAMH 7144 and YAMH 3997
7. Hydrographs for YAMH 7094 and YAMH 3861

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References: Price, Don, 1967, Ground Water in the Eola-Amity Hills Area Northern Willamette Valley, US Geological Survey Water-Supply Paper 1847, pages 1-66.

Gannett, Marshall W. and Caldwell, Rodney R., 1998, Geologic Framework of the Willamette Lowland Aquifer System, Oregon and Washington, US Geological Survey Professional Paper 1424-A, pages A1-A32.