

# MEMO

**State of Idaho**

**Department of Water Resources**

**322 E Front Street, P.O. Box 83720, Boise, Idaho 83720-0098**

**Phone: (208) 287-4800 Fax: (208) 287-6700**

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**Date:** September 15, 2008

**To:** Jeff Peppersack

**From:** Allan Wylie

**cc:** Sean Vincent, John Lindgren, Aaron Marshall

**Subject:** Transfer Nos. 72674 and 74088, in the name of Comore Development

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Jeff

I evaluated the "Injury Assessment of Ground water Impacts for Proposed Water Rights Transfer Comore Loma Subdivision" by Clearwater Geosciences, LLP and concluded that the major difference between the Clearwater and IDWR analysis was in the boundary Clearwater imposed east of Idaho Falls. Clearwater used a General Head Boundary (GHB) as described on page 34 of their report. The problem with a GHB is that it can allow large fluxes of water to enter in one area without decreasing the flux in any neighboring cells. This boundary condition does not preserve the overall ESPA water balance. In contrast, a constant flux boundary will not allow the flux across the boundary to change regardless of the stress applied near the boundary. A constant flux boundary condition is more consistent with our understanding that a fixed volume of water (although variable annually) is supplying flux through the aquifer boundary.

In my analysis I accepted all of Clearwater's arguments presented on page 27 and 28 of their report except the assertion that the transfer tool should not be applied. In brief, the Clearwater arguments are: 1) the aquifer beneath Comore is mostly rhyolite; 2) the ground water beneath Comore is warmer than most other ESPA water; and 3) the geochemical signature of the water beneath Comore is different than most other ESPA water; 4) the observed gradient is from east to west versus a north to south gradient in ESPAM v 1.1 (a condition fixed in this analysis); and 5) presents the flux calculations accepted in this analysis. Because the gradient observed by Clearwater is to the west, the water in this area is tributary to the ESPA, thus depletions in this area must be realized in the Snake River. I undertook the analysis and model runs described in this memo to demonstrate that the geometry of the transfer in relation to the Snake River and the aquifer boundaries is more important than the water table configuration. On page 28 of the Clearwater report, Clearwater computes the flux across the ESPA model boundary east of the

Comore well. They identify the boundary cells on page 35. I used these fluxes in the identified cells to impose a constant flux boundary (vs. the GHB used by Clearwater) east of the Comore well. Table 1 shows the model cells and flux. I ran the modified ESPA model to steady state and saved the results. Figure 1 shows the resulting head distribution in the vicinity of the Comore subdivision.

**Table 1. Modified constant flux boundary cells.**

| ROW | COLUMN | FLUX (cf/d) |
|-----|--------|-------------|
| 76  | 168    | 6750000     |
| 77  | 167    | 6750000     |
| 78  | 166    | 6750000     |
| 79  | 166    | 6750000     |
| 80  | 165    | 6750000     |
| 80  | 164    | 6750000     |
| 80  | 163    | 6750000     |
| 80  | 162    | 6750000     |
| 81  | 161    | 6750000     |
| 81  | 160    | 6750000     |

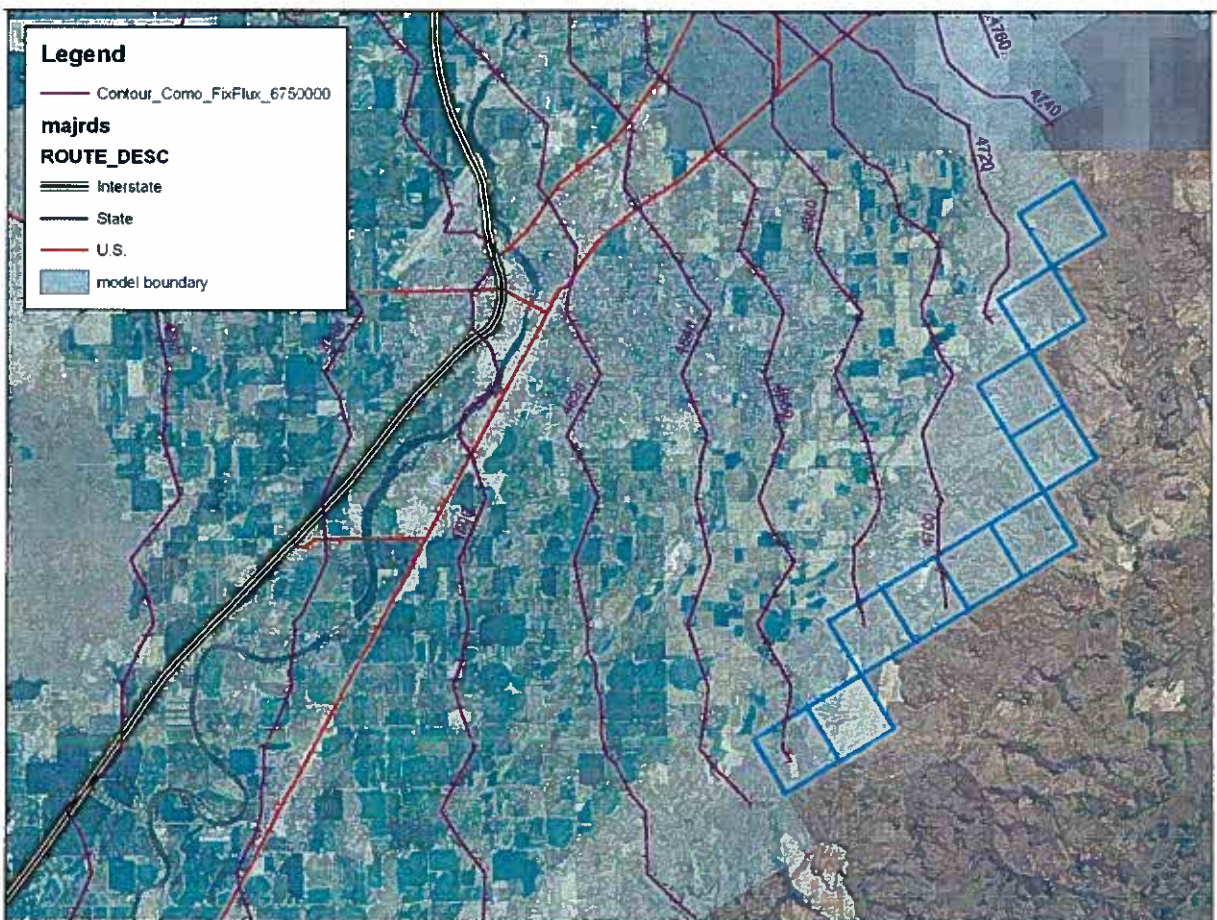


**Figure 1. Contour map of steady state head for modified ESPAM.**

The above modifications to the ESPAM are intended to counter Clearwater's argument that ESPAM V 1.1 can not be used to evaluate the Comore transfer because the potentiometric lines in ESPAM V 1.1 intersect the boundary near the Comore subdivision at right angles rather than paralleling the boundary as Clearwater presents in Figure 8 of their report.

I then computed the response function for the FROM well. Clearwater identifies the location of the wells involved in the transfer on page 32 of their report. I located one FROM well between the two wells identified by Clearwater (Table 2) and ran the modified FROM model to steady state while pumping the FROM well at 161598.4 cf/d. I then computed the response function for the FROM well by subtracting the results of the FROM simulation from the modified steady state run and dividing the change in reach gains by the FROM well pumping rate. Table 3 compares the ESPAM V 1.1 response function with the response function for the ESPA model modified per Clearwater's suggestions.

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**Table 2. FROM well.**

| ROW | COLUMN | FLUX (cf/d)  |
|-----|--------|--------------|
| 68  | 136    | -161598.3573 |

**Table 3. FROM well response function comparison.**

| reach   | ESPAM<br>V 1.1 | Modified<br>ESPAM |
|---------|----------------|-------------------|
| A_R     | 0.04           | 0.04              |
| H_S     | 0.05           | 0.07              |
| S_NB    | 0.30           | 0.30              |
| N_M     | 0.01           | 0.01              |
| NB_N    | 0.57           | 0.55              |
| MLD_BAN | 0.00           | 0.00              |
| MLD     | 0.00           | 0.00              |
| DWB_BUL | 0.01           | 0.01              |
| KSP_MLD | 0.00           | 0.00              |
| KSP     | 0.00           | 0.00              |
| BUL_KSP | 0.01           | 0.01              |
| TOTAL   | 1.00           | 1.00              |

The Snake River reaches where the original and modified models differ are highlighted in Table 3. The impact of pumping at the FROM well results in increased impact in the Heise to Shelley reach and decreased impact in the near Blackfoot to Neeley reach. The added flux along the modified boundary increases the gains in the Heise to Shelley reach and pumping at the FROM well captures some of the added flux, increasing the impact on the Heise to Shelley reach.

The response function for the Comore well (the TO well) were computed in a similar manner. Clearwater identifies the location of the TO well on page 32 of their report. Table 4 shows the model row, column, and pumping rate for the TO well. I then ran the modified model to steady state while pumping the TO well at 161598.4 cf/d. I then computed the response function for the TO well by subtracting the results of the TO simulation from the modified steady state run and dividing the change in reach gains by the TO well pumping rate. Table 5 compares the ESPAM V 1.1 response function with the ESPA model incorporating the Clearwater modifications for the TO well.

**Table 4. TO well.**

| ROW | COLUMN | FLUX (cf/d)  |
|-----|--------|--------------|
| 79  | 164    | -161598.3573 |

**Table 5. TO well response function comparison.**

| reach   | ESPAM<br>V 1.1 | Modified<br>ESPAM |
|---------|----------------|-------------------|
| A_R     | 0.08           | 0.07              |
| H_S     | 0.14           | 0.20              |
| S_NB    | 0.38           | 0.37              |
| N_M     | 0.01           | 0.01              |
| NB_N    | 0.38           | 0.34              |
| MLD_BAN | 0.00           | 0.00              |
| MLD     | 0.00           | 0.00              |
| DWB_BUL | 0.01           | 0.01              |
| KSP_MLD | 0.00           | 0.00              |
| KSP     | 0.00           | 0.00              |
| BUL_KSP | 0.00           | 0.00              |
| TOTAL   | 1.00           | 1.00              |

The reaches where the original and modified models differ are highlighted in Table 5. The flux from the modified boundary increases the gains in the Heise to Shelley reach and pumping from the TO well at the Comore location captures some of this flux leading to an increased impact from the transfer. It makes sense that if the Heise to Shelley impact is increased, then the impact to some of the other reaches should decrease as shown in Table 5.

The total impact at steady state is determined by differencing the response functions for the TO and FROM wells. Table 6 shows the total impact of the transfer as computed using ESPAM V 1.1 and the ESPA model incorporating the modifications suggested by Clearwater.

**Table 6. Total impact of the proposed transfer.**

| reach   | ESPAM<br>V 1.1 | Modified<br>ESPAM |
|---------|----------------|-------------------|
| A_R     | -0.03          | -0.03             |
| H_S     | -0.09          | -0.13             |
| S_NB    | -0.08          | -0.07             |
| N_M     | 0.00           | 0.01              |
| NB_N    | 0.19           | 0.22              |
| MLD_BAN | 0.00           | 0.00              |
| MLD     | 0.00           | 0.00              |
| DWB_BUL | 0.00           | 0.00              |
| KSP_MLD | 0.00           | 0.00              |
| KSP     | 0.00           | 0.00              |
| BUL_KSP | 0.00           | 0.00              |
| TOTAL   | 0.00           | 0.00              |

This analysis indicates that the geometry of the transfer in relation to the Snake River and the aquifer boundaries is more important than the configuration of the water table. It does make sense that moving a water right from west of Blackfoot to east of Idaho Falls should increase the impact on the Heise to Shelly reach.

Allan Wylie