

MEMO

State of Idaho

Department of Water Resources

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Date: October 22, 2009

To: Gary Spackman

From: John Lindgren 

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Subject: A Groundwater Flow Model for the Big Wood River Aquifer: East Fork to Bellevue¹ and use of the model for Dry Lot, LLC Scenarios 1 and 2 (to evaluate the hydrologic impacts of the water use proposed by application to appropriate water no. 37-22252 and application for transfer no. 74449).

This memo provides a brief review of the Big Wood River Aquifer model and an analysis of the scenarios simulating the proposed transfer and two mitigation options.

Aquifer Model

The provided model is a single layer, quasi-transient groundwater model that was developed using the USGS computer program Modflow. The grid spacing is 100 feet. The northern boundary is located south of the confluence of the Big Wood River and the East Fork of the Big Wood River. The southern boundary is located immediately north of Bellevue, Idaho. The groundwater model's east and west boundaries are located at the natural interface between the valley alluvium material and the mountains that confine the valley. There are 12 stress periods per year with each stress period split into two time steps. The reach gains and losses of the Big Wood River and seepage from four canals were modeled using the Modflow river package.

The model was developed using available historical data as well as new data collected for the project. Modeling assumptions are described and justified in the modeling report.² The conceptual model is consistent with the most recent investigations of the Big Wood River Valley and aquifer.³⁴

¹ Brockway Engineering, 2009. Development of a Groundwater Flow Model for the Big Wood River Aquifer: East fork to Bellevue. Submitted to IDWR-Feb 3, 2009.

² Brockway Engineering, 2009. Development of a Groundwater Flow Model for the Big Wood River Aquifer: East fork to Bellevue. Submitted to IDWR-Feb 3, 2009. Sections D_G.

³ Skinner, K.D., Bartolino, J.R. and Tranmer, A.W., 2007. Water-resource trends and comparisons between partial development and October 2006 hydrologic conditions, Wood River Valley, south-central, Idaho: U.S. Geological Survey Scientific Investigations Report 2007-5258.

⁴ Bartolino, J.R., 2009, Groundwater budgets for the Wood River Valley aquifer system, south-central Idaho, 1995-2004: U.S. Geological Survey Scientific Investigations Report 2009-5016.

Hydraulic conductivity and river conductance were estimated and then adjusted to allow the model to match estimated targets for river reach gains or losses, groundwater levels, canal seepage and to maintain an overall water balance. The calibration results are summarized on pages 48 and 49 and presented graphically in Figures 32 and Figure 33 in the modeling report.⁵

The model provides a reasonable simulation of flow in the aquifer given the simplifying assumptions that had to be made as a result of limited data.

Dry Lot, LLC Mitigation Scenarios⁶

The proposed mitigation for the groundwater permit is to recharge surface water from the Big Wood River to the Big Wood River aquifer at one of two possible locations. Scenario 1 models the mitigation recharge location south of the new irrigation pumping site. Scenario 2 models the mitigation recharge location north and east of the extraction well. The two sites are each less than a mile from the pumping site. The proposed extraction well and recharge sites are shown in Figure 1.⁷

Figure 1. Dry Lot, LLC Extraction well and Recharge Sites



Both scenarios simulate only the new irrigation pumping and the mitigation recharge. The extraction for irrigation is a total of 96 acre-feet over 7 months and the recharge for mitigation is a total of 96 acre-feet over 7 months as shown in Table 1.⁸

⁵ Brockway Engineering, 2009. Development of a Groundwater Flow Model for the Big Wood River Aquifer: East fork to Bellevue. Submitted to IDWR-Feb 3, 2009.

⁶ Project No. 938-01-2006, Evaluation of the Impact of the Proposed Dry Lot, LLC, Water Right Applications Using a Big Wood River Aquifer Groundwater model. Revised-July 16, 2009.

⁷ Project No. 938-01-2006, Evaluation of the Impact of the Proposed Dry Lot, LLC, Water Right Applications Using a Big Wood River Aquifer Groundwater model. Revised-July 16, 2009. Modified from Figure 2.

⁸ Project No. 938-01-2006, Evaluation of the Impact of the Proposed Dry Lot, LLC, Water Right Applications Using a Big Wood River Aquifer Groundwater model. Revised-July 16, 2009. p 3.

Table 1: Monthly volumes (acre-feet) of irrigation extraction under the proposed new permit and monthly volumes (acre-feet) of water to be recharged to the aquifer as mitigation.

	Apr	May	Jun	Jul	Aug	Sept	Oct	Total
Extraction (acre-feet)	1	10	20	27	23	13	2	96
Mitigation (acre-feet)	10	19	19	19	19	10	0	96

Changes in canal seepage, changes in irrigated lands and the change in the amount of the water left in the river are not modeled for either scenario.

The relevant outputs for calculating hydrologic impacts are changes in the groundwater levels and in the river reach gains and losses of the Big Wood River. Changes are modeled by comparing the new scenario to a baseline scenario of the same time frame without the additional groundwater pumping and the mitigation recharge. The simulation period is 12 stress periods split into 24 time steps from January 1 to December 31. The mitigation recharge is modeled as a single recharge well for each scenario.

Scenario 1

Six Big Wood River reaches were evaluated for this scenario. The model simulation computes a 3 acre-feet/yr decrease in river flow for the northern most reach (Northern Boundary to Starweather Bridge). The second reach (Starweather Bridge to Deer Creek Bridge) showed a 14 acre-feet/yr increase in river flow. The remaining river reaches showed no change in annual volume. The total change in reach gains for Scenario 1 is an increase of 11 acre-feet/yr over the baseline value.

The maximum drawdowns in groundwater levels are located at a node about 600 feet north the new irrigation well. The maximum computed decline is 0.27 of a foot below the baseline in July. The maximum rise is in the area of the recharge well at about 0.12 of a foot above the baseline in June. The other points examined for changes in groundwater level showed no detectable change under the proposed scenario. The five points where groundwater levels are computed match those computed for the baseline scenario at the end of the simulation.⁹ Assuming these points are representative, there will be no long term trend in groundwater levels or river reach gains and losses relative to the baseline scenario.

Scenario 1 results provide reasonable estimates of the impacts of the transfer and mitigation as modeled. The possible local heterogeneity caused by lack of calibration data creates some uncertainty at the fine scale.

Scenario 2

The same six Big Wood River reaches were evaluated for the second scenario. The model simulation computes a 2 acre-feet/yr increase in river flow for the northern most reach (Northern Boundary to Starweather Bridge). The second reach (Starweather Bridge to Deer Creek Bridge) showed a 3 acre-feet/yr river loss. The remaining river reaches showed no change in annual volume. The total change in reach gains for Scenario 1 is a decrease of 1 acre-feet/yr over the baseline value.

⁹ Project No. 938-01-2006, Evaluation of the Impact of the Proposed Dry Lot, LLC, Water Right Applications Using a Big Wood River Aquifer Groundwater model. Revised-July 16, 2009. Figures 5-8.

The negative impacts on groundwater levels are less than in Scenario 1. The largest decline is less than 0.01 of foot in September. The maximum rise is in the area of the recharge well at about 0.12 of a foot above the baseline in June. The other points examined for changes in groundwater level showed no detectable change under the proposed scenario. The five points where groundwater levels are computed match those computed for the baseline scenario at the end of the simulation.¹⁰ Assuming these points are representative, there will be no long term trend in groundwater levels or river reach gains and losses relative to the baseline scenario.

Scenario 2 results provide reasonable estimates of the impacts of the transfer and mitigation as modeled. The possible local heterogeneity caused by lack of calibration data creates some uncertainty at the fine scale.

References

Bartolino, J.R., 2009, Groundwater budgets for the Wood River Valley aquifer system, south-central Idaho, 1995-2004: U.S. Geological Survey Scientific Investigations Report 2009-5016.

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Frenzel, S.A. 1989. Water Resources of the Upper Big Wood River Basin, Idaho. Water-Resources Investigations Report 89-4018. United States Geological Survey. United States Department of the Interior. Boise, Idaho.

G. Erick Powell, PH.D., P.E., Charles E. Brockway, Ph.D., P.E., Project No. 938-01-2006, Evaluation of the Impact of the Proposed Dry Lot, LLC, Water Right Applications Using a Big Wood River Aquifer Groundwater model. Revised-July 16, 2009

Skinner, K.D., Bartolino, J.R. and Tranmer, A.W., 2007. Water-resource trends and comparisons between partial development and October 2006 hydrologic conditions, Wood River Valley, south-central, Idaho: U.S. Geological Survey Scientific Investigations Report 2007-5258.

Wetzstein, A.B., C.W. Robison, and C.E. Brockway. 2000. Hydrologic Evaluation of the Big Wood River and Silver Creek Watersheds-Phase II. Research Technical Completion Report. Idaho Water Resources Research Institute. University of Idaho. Moscow, Idaho

¹⁰ Project No. 938-01-2006, Evaluation of the Impact of the Proposed Dry Lot, LLC, Water Right Applications Using a Big Wood River Aquifer Groundwater model. Revised-July 16, 2009. Figures 9-13.

FROM ALLEN MERRITT via EMAIL 09/22/09

Original Recommendations Now Partially Decried

Old Culture		cts	Acres
Water Right		0.47	66.0
37-21130		0.20	66.0
37-21137		0.38	66.0
37-21139		0.38	66.0
Totals		4.00	66.0

Transfer 74661

74661 Old Culture (Irrigation - Unchallenged)		cts	Acres
Water Right (3 Large Lots)		0.63	4.8
37-22318		0.23	4.8
37-22308		0.63	4.8
37-22314		0.23	4.8
Totals		4.3	4.8

74661 Old Culture (Aesthetics/Fire Protection Ponds)		cts	Acres
Water Right		0.02	2.7
37-22322		0.13	2.7
37-22312		0.13	2.7
37-22317		0.02	2.7
Totals		0.30	2.7

74661 Old Culture (Remaining)		cts	Acres
Water Right		0.06	58.5
37-22320		2.63	58.5
37-22310		0.04	58.5
37-22315		0.05	58.5
Totals		3.18	58.5

Pending Actions - City & Dry-Lot Spills

Old Culture (Remainder) not to split		cts	Acres
Water Right		0.28	58.5
37-22320		2.64	58.5
37-22310		0.05	58.5
37-22315		2.55	58.5
Totals		5.52	58.5

74661 Dry Lot (Recharge/Aesthetics)		cts	Acres
Water Right		0.02	27.5
37-22323		1.52	27.5
37-22313		0.66	27.5
37-22318		1.60	27.5
Totals		3.80	27.5

City of Hallow		cts	Acres
Water Right		0.19	31
37-22323		1.15	31
37-22311		0.16	31
37-22316		1.62	31
Totals		3.12	31

Pending Actions - Split Large Lots into three pieces

74661 Old Culture (Lots to be split)		cts	Acres
Water Right (3 Large Lots)		0.63	4.8
37-22319		0.23	4.8
37-22309		0.63	4.8
37-22314		0.23	4.8
Totals		4.3	4.8

Lot 13, Block 2		cts	Acres
Water Right		0.01	1.4
37-77777		0.06	1.4
37-77777		0.01	1.4
37-77777		0.01	1.4
Totals		0.09	1.4

Lot 14, Block 2		cts	Acres
Water Right		0.01	1.3
37-77777		0.06	1.3
37-77777		0.01	1.3
37-77777		0.01	1.3
Totals		0.09	1.3

Lot 1, Block 3		cts	Acres
Water Right		0.01	2.1
37-77777		0.11	2.1
37-77777		0.01	2.1
37-77777		0.01	2.1
Totals		0.14	2.1