

MEMORANDUM

TO: Water Right File 63-32614
FROM: Aaron Marshall 
DATE: March 25, 2010
SUBJECT: Application for Transfer No. 70024

Application for Transfer No. 70024 proposes a change to water right no. 63-32614 by moving a point of diversion from the Boise River downstream to a pond, approximately 10 feet deep, on the east side of Eagle Island. The excavated pond will intercept and fill with ground water from the unconfined aquifer. Water will be pumped from the pond and used for irrigation. Idaho Code § 42-222 does not provide for changes from surface water to ground water. Such a change is not approvable unless the ground water and surface water sources are so interconnected that they constitute the same source. Administrator's Memorandum, Transfer Processing No. 24, requires that the sources must have a direct and immediate hydraulic connection (at least 50% depletion in original source from depletion at proposed point of diversion in one day).

Question: Is there a direct and immediate hydraulic connection between water in the pond at the proposed point of diversion and the Boise River?

The unconfined aquifer at Eagle Island is composed of sand and gravel alluvium which allows hydraulic communication between ground water and surface water. Eagle Island is mostly flat with very little topographic relief. Well driller's reports for shallow wells completed on or near Eagle Island show that the water table is generally between 0 – 5 ft below ground surface (IDWR, 2010).

The hydraulic conductivity of the unconfined alluvial aquifer near Eagle Island is assumed to be 144 ft/day (Johnson and Paquin, 2007). 144 ft/day is equivalent to 1,080 gpd/ft² or 0.05 cm/sec. As a check on the validity of this estimate, values of hydraulic conductivity for well-sorted sands range from 10⁻³ to 10⁻¹ cm/sec and well-sorted gravels range from 10⁻² to 1 cm/sec (Fetter, 2001). This estimate of hydraulic conductivity is within the range for sand and gravel alluvium.

The average specific yield for gravelly sand is 25% (Fetter, 2001) and, absent additional information, is assumed to be a reasonable estimate for the unconfined alluvial aquifer near Eagle Island.

The maximum annual consumptive use volume for water right no. 63-32614, as described in the application for transfer, is 234.5 acre-feet per year (67 acres x 3.5 af/ac). The ground water pumping schedule for irrigation may be estimated by the average monthly precipitation deficit for alfalfa in the vicinity of the Boise Airport (Allen and Robison, 2009). The monthly consumptive diversion volume, in acre-feet, proposed by the transfer may be estimated by the following schedule: March – 2 af, April – 19 af, May – 33 af, June – 42 af, July – 49 af, August – 42 af, September – 28 af, October – 19 af.

IDS Alluvial Aquifer Accounting System (AWAS), v. 1.5.66 (Colorado State University, 2009), a stream depletion computer model, was used to simulate depletions in Boise River flow that may be expected by pumping ground water from the proposed pond on Eagle Island. The model is based in part on principles and methods originally described by Jenkins (1968).

The following assumptions were made using AWAS:

- One Recharge boundary (South Channel Boise River)
- The aquifer is isotropic, homogeneous, of uniform thickness, and infinite except where bounded by specific boundaries
- The transmissivity is everywhere the same and does not change with time. Drawdown is considered negligible when compared to the aquifer thickness
- The water table is initially flat
- Water temperatures are constant
- Water is released instantaneously from storage
- The stream is straight, infinite in length, and fully penetrates the aquifer
- The pumping rate is constant for any pumping period
- The diameter of the well is negligible

The following is a summary of the AWAS input parameters used for this simulation:

- Type of well – Irrigation
- Boundary – Infinite Aquifer
- $T = 10,800 \text{ gpd/ft}$, based on $K = 1,077 \text{ gpd/ft}^2$ and well/pond depth = 10 ft
- $S_y = 0.25$
- $X = 500$ feet, shortest straight line distance from pond to Boise River
- Annual consumptive ground water withdrawal = 234 acre-feet

AWAS Output Summary – Net Impact on River

Time Since Initial Pumping	Ground Water Withdrawal Volume (af)	Boise River Depletion Volume (af)	Boise River Depletion Percentage of Withdrawal (%)
1 Month	2	0.43	22
3 Months	54	17.5	32
6 Months	187	94.1	50
8 Months	234	143	61
1 Year	234	176	75
5 Years	1170	1000	85
10 Years	2340	2090	89
20 Years	4680	4310	92
50 Years	11700	11100	95

Attached is a spreadsheet of the AWAS input and output data. As shown in the table above, the critical depletion point, where the total stream depletion reaches 50% of the diversion volume, is expected to occur after 6 months of pumping. While there is an apparent hydraulic connection between ground water in the unconfined alluvial aquifer and the Boise River, the communication is not direct and immediate as defined in Transfer Memo No. 24.

Answer: No, there is not a direct and immediate hydraulic connection between water in the pond at the proposed point of diversion and the Boise River.

References

- Allen, Richard G. and Clarence W. Robison. Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho: Supplement updating the Time Series through December 2008, Research Technical Completion Report. Kimberly Research and Extension Center, University of Idaho. Moscow, ID, 2009.
- Colorado State University, Integrated Decision Support Group. Alluvial Water Accounting System (AWAS), v. 1.5.66. <http://www.ids.colostate.edu/index.html?/projects/idsawas/>, 2009.
- Fetter, C. W. *Applied Hydrogeology (4th Edition)*. Prentice-Hall Inc., 2001.
- Idaho Department of Water Resources (IDWR). Well Driller Reports. http://www.idwr.idaho.gov/WaterManagement/WellInformation/DrillerReports/dr_default.htm, 2010.
- Jenkins, C.T. Computation of Rate and Volume of Stream Depletion by Wells. Book 4, U.S. Geological Survey, 1968.
- Johnson, Jennifer and Lanie Paquin. Modeling Groundwater Interactions using Analytic Element Methods and LiDAR. U.S. Bureau of Reclamation, Pacific Northwest Regional Office. Boise, ID, 2007.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Cumulative ...
2010	2059	2010	2059	Monthly	Calendar	Show in Out...	Format is <...							
Diversion/Recharge (ac-ft)														
Diversion Pond	Pond with p...	0	Well	0	0	10800	0.25	500	0	0	0	Infinite Aqu...	1	format is <h...
2010	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-234
2011	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-468
2012	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-702
2013	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-936
2014	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-1170
2015	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-1404
2016	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-1638
2017	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-1872
2018	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-2106
2019	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-2340
2020	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-2574
2021	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-2808
2022	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-3042
2023	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-3276
2024	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-3510
2025	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-3744
2026	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-3978
2027	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-4212
2028	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-4446
2029	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-4680
2030	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-4914
2031	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-5148
2032	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-5382
2033	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-5616
2034	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-5850
2035	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-6084
2036	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-6318
2037	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-6552
2038	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-6786
2039	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-7020
2040	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-7254
2041	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-7488
2042	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-7722
2043	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-7956
2044	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-8190
2045	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-8424
2046	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-8658
2047	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-8892
2048	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-9126
2049	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-9360
2050	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-9594
2051	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-9828
2052	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-10062
2053	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-10296
2054	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-10530
2055	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-10764
2056	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-10998
2057	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-11232
2058	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-11466
2059	0	0	-2	-19	-33	-42	-49	-42	-28	-19	0	0	-234	-11700
Depletions/Accretions (ac-ft)														
Diversion Pond	Pond with p...	0	Well	0	0	10800	0.25	500	0	0	0	Infinite Aqu...	1	format is <h...
2010	0	0	-0.43	-4.5	-12.61	-19.77	-27.04	-29.76	-26.5	-22.43	-14.59	-8.62	-166.25	-166.25
2011	-5.98	-4.15	-4.13	-7.45	-15.18	-21.92	-28.98	-31.47	-27.98	-23.8	-15.79	-9.75	-196.58	-362.83
2012	-7.02	-5.18	-4.99	-8.24	-15.94	-22.6	-29.64	-32.1	-28.55	-24.36	-16.31	-10.26	-205.19	-568.02
2013	-7.5	-5.43	-5.45	-8.66	-16.35	-22.99	-30.02	-32.45	-28.88	-24.69	-16.61	-10.56	-209.59	-777.61
2014	-7.8	-5.68	-5.73	-8.92	-16.61	-23.23	-30.26	-32.69	-29.1	-24.91	-16.82	-10.77	-212.52	-990.13
2015	-8	-5.86	-5.92	-9.1	-16.79	-23.4	-30.43	-32.86	-29.26	-25.07	-16.97	-10.92	-214.58	-1204.71
2016	-8.15	-6.19	-6.03	-9.21	-16.91	-23.51	-30.55	-32.98	-29.37	-25.19	-17.08	-11.04	-216.21	-1420.92
2017	-8.26	-6.09	-6.17	-9.33	-17.03	-23.63	-30.66	-33.08	-29.48	-25.29	-17.18	-11.14	-217.34	-1638.26
2018	-8.36	-6.18	-6.26	-9.42	-17.12	-23.71	-30.75	-33.17	-29.56	-25.37	-17.26	-11.22	-218.38	-1856.64
2019	-8.43	-6.25	-6.34	-9.5	-17.2	-23.78	-30.82	-33.24	-29.62	-25.44	-17.32	-11.28	-219.22	-2075.86
2020	-8.5	-6.51	-6.37	-9.54	-17.24	-23.83	-30.87	-33.29	-29.67	-25.49	-17.37	-11.33	-220.01	-2295.87
2021	-8.55	-6.35	-6.46	-9.61	-17.31	-23.89	-30.93	-33.35	-29.73	-25.55	-17.43	-11.39	-220.55	-2516.42
2022	-8.6	-6.4	-6.51	-9.65	-17.36	-23.94	-30.98	-33.4	-29.78	-25.6	-17.47	-11.43	-221.12	-2737.54
2023	-8.65	-6.44	-6.55	-9.7	-17.4	-23.98	-31.02	-33.44	-29.81	-25.64	-17.51	-11.47	-221.61	-2959.15
2024	-8.69	-6.69	-6.56	-9.71	-17.42	-24	-31.05	-33.47	-29.84	-25.67	-17.54	-11.5	-222.14	-3181.29
2025	-8.72	-6.5	-6.62	-9.76	-17.47	-24.04	-31.09	-33.51	-29.88	-25.7	-17.57	-11.54	-222.4	-3403.69
2026	-8.75	-6.53	-6.65	-9.79	-17.5	-24.08	-31.12	-33.54	-29.91	-25.73	-17.6	-11.57	-222.77	-3626.46
2027	-8.78	-6.56	-6.68	-9.82	-17.53	-24.1	-31.15	-33.56	-29.94	-25.76	-17.63	-11.6	-223.11	-3849.57
2028	-8.81	-6.8	-6.68	-9.83	-17.54	-24.11	-31.17	-33.58	-29.95	-25.78	-17.65	-11.61	-223.51	-4073.08
2029	-8.83	-6.6	-6.73	-9.87	-17.58	-24.15	-31.2	-33.61	-29.98	-25.81	-17.67	-11.64	-223.67	-4296.75
2030	-8.85	-6.62	-6.75	-9.89	-17.6	-24.17	-31.22	-33.63	-30	-25.83	-17.69	-11.66	-223.91	-4520.66
2031	-8.88	-6.64	-6.77	-9.91	-17.62	-24.19	-31.24	-33.65	-30.02	-25.85	-17.71	-11.68	-224.16	-4744.82
2032	-8.9	-6.88	-6.76	-9.91	-17.63	-24.2	-31.25	-33.66	-30.03	-25.86	-17.73	-11.7	-224.51	-4969.33
2033	-8.91	-6.67	-6.81	-9.94	-17.66	-24.22	-31.27	-33.69	-30.05	-25.88	-17.75	-11.72	-224.57	-5193.9
2034	-8.93	-6.69	-6.83	-9.96	-17.68	-24.24	-31.29	-33.71	-30.07	-25.9	-17.76	-11.73	-224.79	-5418.69
2035	-8.95	-6.71	-6.84	-9.98	-17.69	-24.26	-31.31	-33.72	-30.09	-25.92	-17.78	-11.75	-225	-5643.69
2036	-8.96	-6.94	-6.83	-9.97	-17.69	-24.26	-31.31	-33.73	-30.09	-25.92	-17.79	-11.76	-225.25	-5868.94
2037	-8.97	-6.73	-6.87	-10	-17.72	-24.28	-31.34	-33.75	-30.11	-25.94	-17.8	-11.77	-225.28	-6094.22

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Cumulative ...
2038	-8.99	-6.74	-6.88	-10.02	-17.73	-24.3	-31.35	-33.76	-30.13	-25.96	-17.82	-11.79	-225.47	-6319.69
2039	-9	-6.76	-6.9	-10.03	-17.75	-24.31	-31.36	-33.77	-30.14	-25.97	-17.83	-11.8	-225.62	-6545.31
2040	-9.01	-6.99	-6.88	-10.02	-17.74	-24.31	-31.36	-33.78	-30.14	-25.97	-17.84	-11.81	-225.85	-6771.16
2041	-9.02	-6.77	-6.92	-10.05	-17.77	-24.33	-31.38	-33.8	-30.16	-25.99	-17.85	-11.82	-225.86	-6997.02
2042	-9.03	-6.79	-6.93	-10.06	-17.78	-24.34	-31.4	-33.81	-30.17	-26	-17.86	-11.83	-226	-7223.02
2043	-9.05	-6.8	-6.94	-10.07	-17.79	-24.35	-31.41	-33.82	-30.18	-26.01	-17.87	-11.84	-226.13	-7449.15
2044	-9.06	-7.03	-6.92	-10.06	-17.78	-24.35	-31.41	-33.82	-30.18	-26.01	-17.88	-11.85	-226.35	-7675.5
2045	-9.06	-6.81	-6.96	-10.09	-17.81	-24.37	-31.42	-33.84	-30.2	-26.03	-17.89	-11.86	-226.34	-7901.84
2046	-9.07	-6.82	-6.97	-10.1	-17.82	-24.38	-31.43	-33.85	-30.21	-26.04	-17.9	-11.87	-226.46	-8128.3
2047	-9.08	-6.83	-6.98	-10.11	-17.83	-24.39	-31.44	-33.85	-30.22	-26.05	-17.91	-11.88	-226.57	-8354.87
2048	-9.09	-7.06	-6.96	-10.1	-17.82	-24.38	-31.44	-33.85	-30.22	-26.05	-17.91	-11.88	-226.76	-8581.63
2049	-9.1	-6.84	-6.99	-10.12	-17.84	-24.4	-31.46	-33.87	-30.23	-26.06	-17.92	-11.89	-226.72	-8808.35
2050	-9.11	-6.85	-7	-10.13	-17.85	-24.41	-31.47	-33.88	-30.24	-26.07	-17.93	-11.9	-226.84	-9035.19
2051	-9.11	-6.86	-7.01	-10.14	-17.86	-24.42	-31.47	-33.89	-30.25	-26.08	-17.94	-11.91	-226.94	-9262.13
2052	-9.12	-7.09	-6.99	-10.13	-17.85	-24.41	-31.47	-33.88	-30.24	-26.08	-17.94	-11.91	-227.11	-9489.24
2053	-9.13	-6.87	-7.02	-10.15	-17.87	-24.43	-31.49	-33.9	-30.26	-26.09	-17.95	-11.92	-227.08	-9716.32
2054	-9.13	-6.88	-7.03	-10.16	-17.88	-24.44	-31.49	-33.91	-30.26	-26.1	-17.95	-11.93	-227.16	-9943.48
2055	-9.14	-6.88	-7.04	-10.17	-17.89	-24.44	-31.5	-33.91	-30.27	-26.1	-17.96	-11.94	-227.24	-10170.7
2056	-9.15	-7.12	-7.02	-10.15	-17.88	-24.44	-31.5	-33.91	-30.27	-26.1	-17.96	-11.94	-227.44	-10398.2
2057	-9.15	-6.89	-7.05	-10.17	-17.89	-24.45	-31.51	-33.92	-30.28	-26.12	-17.97	-11.95	-227.35	-10625.5
2058	-9.16	-6.9	-7.05	-10.18	-17.9	-24.46	-31.52	-33.93	-30.29	-26.12	-17.98	-11.95	-227.44	-10852.9
2059	-9.17	-6.9	-7.06	-10.19	-17.91	-24.47	-31.52	-33.94	-30.29	-26.13	-17.98	-11.96	-227.52	-11080.5