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

Date: January 23, 2015

To: Gary Spackman, P.E., Director

From: Jennifer Sukow, P.E., P.G., Hydrology Section

Subject: Technical review of Coalition of Cities' Second Mitigation Plan

This memorandum was prepared in response to your request for a technical review of the Coalition of Cities' (Cities') Mitigation Plan, which proposes managed recharge to mitigate for impacts to the Rangen fish hatchery resulting from junior priority groundwater pumping. The mitigation plan was submitted to the Director of the Idaho Department of Water Resources (IDWR) as a stipulated mitigation plan, with Rangen and the Cities "agreeing that the Plan shall be deemed to mitigate the Cities' out-of-priority pumping in CM-DC-2011-004 and CM-DC-2014-004 for the term of the mitigation plan.[1]" The term of the mitigation plan extends through March 31, 2016[2]. In CM-DC-2011-004, the Director ordered curtailment of groundwater pumping junior to July 13, 1962 within the Great Rift trim line beginning in the spring of 2014. CM-DC-2014-004 is a pending delivery call for an earlier priority water right and is not addressed further in this memorandum.

In CM-DC-2011-004, junior groundwater users were given the opportunity to provide mitigation to Rangen and continue out-of-priority diversions. The January 29, 2014 curtailment order specified a mitigation obligation of 9.1 cfs to be met by providing simulated steady state benefits of 9.1 cfs to Curren Tunnel or direct flow of 9.1 cfs to Rangen. The order also specified a five-year phase in period for mitigation provided by direct flow, with an obligation of 3.4 cfs the first year, 5.2 cfs the second year, 6.0 cfs the third year, 6.6 cfs the fourth year, and 9.1 cfs the fifth year. The mitigation obligation was determined by simulating curtailment of groundwater irrigation junior to July 13, 1962 with the Enhanced Snake Plain Aquifer Model version 2.1 (ESPAM2.1). The time period for the first year and subsequent years of mitigation was clarified in a

[1] Coalition of Cities' Second Mitigation Plan, page 4
[2] Coalition of Cities' Second Mitigation Plan, page 3

later order[3]. The first year of mitigation began on April 1, 2014 and continues through March 31, 2015. The second year of mitigation will begin on April 1, 2015 and end on March 31, 2016. The first two years of mitigation are the term of the Cities' proposed mitigation plan and are the time periods evaluated in this memorandum.

The mitigation plan proposes managed recharge through the American Falls Reservoir District No. 2 (AFRD2) to an approved recharge site near Gooding, Shoshone, or Box Canyon, with the site near Gooding being the preferred location. Based on information provided to Neal Farmer (IDWR) by Lynn Harmon (AFRD2), recharge is expected to begin at the site near Gooding in late February or early March of 2015. The plan proposes recharging 1,500 acre feet (AF)[4] of storage water over a 20-day period[5].

A technical review of the mitigation plan was requested to address the following questions.

- Does the recharge proposed by the Cities' Second Mitigation Plan offset the predicted impact of the Cities' junior groundwater pumping on discharge at Curren Tunnel during the first and second years of mitigation?
- Review technical information submitted in the affidavit of Christian Petrich dated January 16, 2015.

Calculation of Cities' groundwater pumping junior to July 13, 1962

The mitigation obligation specified in the January 29, 2014 curtailment order was determined by simulating curtailment of groundwater irrigation junior to July 13, 1962 with ESPAM2.1. Irrigation and other water uses within municipalities were not included in the curtailment simulation, because municipal use is a very small component of water use within the Eastern Snake Plain Aquifer (ESPA).

Estimates of municipal water use were included in calibration of ESPAM2.1, but junior-priority municipal water use was not included in the curtailment simulation used to calculate the mitigation obligation in the January 29, 2014 order. Input for the curtailment simulation was calculated based on irrigation consumptive use. The irrigated area associated with junior groundwater rights was calculated using the Curtailment IAR

[3]Order Approving in Part and Rejecting in Part IGWA's Mitigation Plan; Order Lifting Stay Issued Feburary 21, 2014; Amended Curtailment Order, pages 6
[4]Coalition of Cities' Second Mitigation Plan, Exhibit 2, pages 3-4
[5] Coalition of Cities' Second Mitigation Plan, Exhibit 2, Attachment B, page 17

tool from the ESPAM2 Recharge Tools[6]. The Curtailment IAR tool applies a mask to remove urban areas and wetlands from the irrigated lands for which consumptive use is calculated.

Although the Cities' impact is very small relative to the impact of all junior groundwater users within the area subject to curtailment, evaluation of the small impact of Cities' junior groundwater pumping is necessary to answer the question of whether the impact will be offset by the small benefit of the proposed managed recharge of 1,500 AF. The first step in evaluating the impact of Cities' junior groundwater pumping is estimating the volume of the Cities' water use that is diverted by junior-priority water rights.

The Cities' junior groundwater pumping was estimated as follows.

- The maximum annual diversion volume authorized by water rights senior to July 13, 1962 was summed for each city within the Great Rift trim line. For water rights without an annual diversion volume limit, the maximum diversion rate was multiplied by 365.25 days to obtain a maximum annual volume.
- Annual diversion volumes reported by Water District 130 and Water District 140 were summed for each city within the Great Rift trim line. Average annual diversion volumes for the five-year period of 2009 through 2013 were used where available. Where this period of record was not available, records from 2008 through 2012, or 2011 through 2013, were used.
- For each city, the annual volume authorized by senior water rights was subtracted from the average annual diversion volume recorded by the Watermaster. The remaining junior diversion volume was included in the curtailment simulation.
- This approach does not consider the seasonality of diversions and the point of diversion within a city's water system, which may result in underestimation of the Cities' junior-priority diversions. Monthly diversion data and a detailed evaluation of each city's water rights would be required to refine this approach.
- This approach assumes diversions are 100% consumptive with respect to the aquifer and likely results in overestimation of consumptive use. This approach does not consider infiltration of system losses, excess irrigation water, and other potential returns to the aquifer. Without detailed data on water use within each city's system, it is not possible to determine the percentage of a city's diversions that are consumptive with respect to the aquifer.

[6] http://www.idwr.idaho.gov/WaterInformation/Projects/espam/ESPAM-Web-Documentation/processing_steps.html#curtailment-iar-steps

Only three of the cities had average annual diversion volumes exceeding the annual volume authorized by water rights senior to July 13, 1962. Between 2009 and 2013, junior-priority diversions averaged 126.4 AF/yr for the City of Carey, 695.7 AF/yr for the City of Heyburn, and 870.3 AF/yr for the City of Richfield. The total volume of junior-priority diversions averaged 1,692 AF/yr.

Simulated curtailment of Cities' groundwater pumping junior to July 13, 1962

Curtailment of the Cities' groundwater pumping junior to July 13, 1962 was simulated using ESPAM2.1. For each city, the volume of junior-priority diversions was distributed evenly between ESPAM2.1 model cells containing the city's points of diversion. The annual diversion volume was applied continuously at a constant rate. The locations of junior pumping with respect to the Rangen model cell are shown in Figure 1.

ESPAM2.1 predicts the Cities' groundwater pumping junior to July 13, 1962 results in a decrease in spring discharge in the Rangen model cell of 0.046 cfs at steady state. Using the linear regression model adopted during the delivery call hearing, the predicted decrease in discharge at Curren Tunnel is 0.029 cfs at steady state. The predicted average impact to discharge at Curren Tunnel during the first two years of the phase-in period is 0.002 cfs for April 2014 through March 2015 and 0.008 cfs for April 2015 through March 2016. The cumulative volume of the predicted impact is 2 AF at the end of March 2015 and 7 AF at the end of March 2016.

Simulation of proposed managed recharge at site near Gooding

Recharge of 1,500 AF over a 20-day period from February 15, 2015 through March 6, 2015 was simulated using ESPAM2.1. The volume of recharge was distributed evenly between four model cells intersected by the recharge site. The volume was applied continuously at a constant rate over the 20-day period. The location of the simulated recharge is shown in Figure 1.

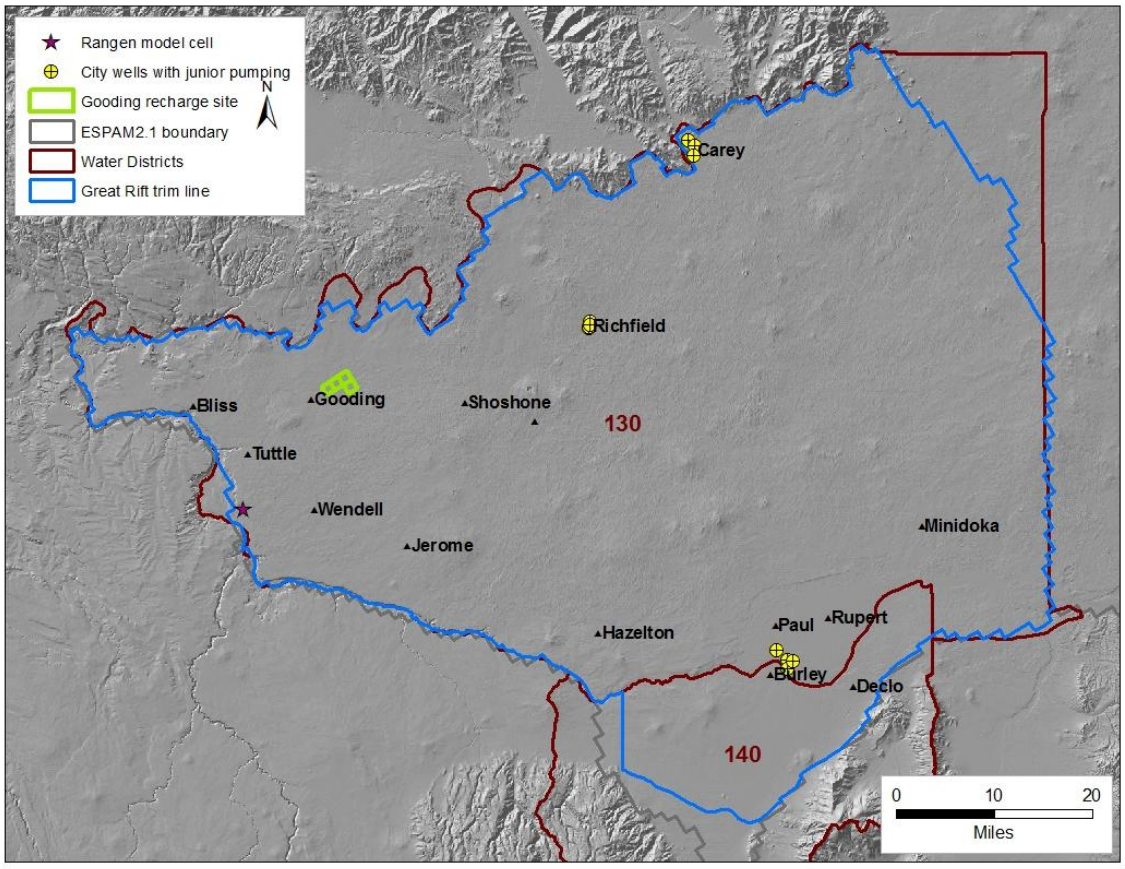

Figure 1. Locations of simulated junior municipal pumping and managed recharge.

ESPAM2.1 predicts the average impact to discharge at Rangen during the first two years of the phase-in period is 0.00015 cfs for April 2014 through March 2015 and 0.028 cfs for April 2015 through March 2016. Using the linear regression model adopted during the delivery call hearing, the predicted average increase in discharge at Curren Tunnel is 0.00009 cfs for April 2014 through March 2015 and 0.018 cfs for April 2015 through March 2016. The cumulative volume of the predicted mitigation benefit is 0.04 AF at the end of March 2015 and 12 AF at the end of March 2016.

Because the recharge is scheduled to occur near the end of the first year of mitigation (April 2014 through March 2015), the recharge does not offset the Cities' predicted impacts to discharge at Curren Tunnel during the first year. During the second year of mitigation (April 2015 through March 2016), the predicted increase in discharge resulting from the recharge event is greater than the predicted impact of the Cities' junior pumping. Comparison of predicted cumulative volumes from the two-year period between April 2014 and March 2016 indicates that the benefits of the 1,500 AF recharge

event (12 AF) are expected to exceed the impacts of the Cities' junior groundwater pumping (7 AF) during this two-year period.

Review of affidavit of Christian Petrich

Dr. Petrich's affidavit presents results of a model simulation of Cities' water use junior to August 12, 1973. Because the mitigation plan states "the Plan shall be deemed to mitigate the Cities' out-of-priority pumping for the term of the mitigation plan," and the Cities' water use was not included in the curtailment simulation used to calculate the mitigation obligation specified in the January 29, 2014 order, it may be more appropriate to model water use junior to July 13, 1962 for evaluation of the mitigation plan. However, the three cities with water use junior to July 13, 1962 have no water rights with priority dates between July 13, 1962 and August 12, 1973, so the volume of junior water use will be the same for either priority date.

Dr. Petrich's affidavit states the aggregate junior water use for the cities of Carey, Heyburn, and Richfield is approximately 836 AF/yr. The affidavit does not indicate how this volume was calculated. This volume is significantly less than the volume of 1,692 Af/yr calculated using Water District diversion records and IDWR water right database records as described previously in this memorandum. This volume is also significantly less than the volume of junior water use reported by Dr. Petrich in a report submitted with the Cities' first mitigation plan, which stated the average annual groundwater volume withdrawn by the cities of Heyburn and Richfield under water rights with priority dates on or after July 1, 1983 is 1,871 AF/yr[7]. Dr. Petrich may have collected additional data on the Cities' water use after his April 2014 report was prepared, but additional data were not submitted with the affidavit and are not currently available for IDWR staff review. Because the volume of junior water use modeled by Dr. Petrich is approximately half of the volume modeled by IDWR staff, the predicted impact presented in Dr. Petrich's affidavit is approximately half of the predicted impact presented previously in this memorandum.

Dr. Petrich's affidavit states, "The first-year benefit of recharge at the Gooding Recharge Site is simulated to be 0.006 cfs." This result can be reproduced by modeling recharge of 1,500 AF at the Gooding site at a constant rate of 4.1 AF/day for the 365 day period from April 1, 2014 through March 31, 2015. Because the recharge is scheduled to occur during the last month of the first year of mitigation, this modeling approach overestimates the benefit of recharge that will be realized by March 31, 2015, the end of the first year of

[7] SPF Water Engineering, LLC, Analysis in Support of Coalition of Cities' Mitigation Plan for the Rangen Call, April 25, 2014, page iii

mitigation. Because the Cities' out-of-priority pumping under the January 29, 2014 curtailment order began in the spring of 2014 and the recharge is scheduled to begin almost a year later, the benefits of the recharge will not offset the impact of Cities' junior pumping during the first year. However, as previously noted in this memorandum, the cumulative benefit of the recharge event is predicted to exceed the cumulative impact of the Cities' junior pumping during the first two years of mitigation (April 2014 through March 2016).