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WATER RESOURCES

Review of

SWC/IGWA Settlement Agreement Mitigation Plan-2022 Breach Expert Report

By

LRE

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On behalf of

Idaho Ground Water Appropriators, Inc.

February 29, 2024

Submitted To:

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1 Introduction

This report presents rebuttal of certain statements and claims presented in the February 2024 expert report by Colvin et al., at LRE submitted on behalf of the Surface Water Coalition ("SWC"), referred to herein as the "SWC Report". The format of this rebuttal addresses specific sections of the SWC Report, quoting specific statements and claims in the SWC Report (in italics), followed by rebuttal.

2 SWC Report Section 2 "IGWA's 2022 Performance"

"*Excess pumping by the GWDs has long term effects that outlast any one irrigation season and further contributes to the declines in aquifer levels and reach gains that the 2016 Mitigation Plan is intended to address.*" (SWC Report, Sec 2.2 pg 3)

Just as groundwater pumping has long-term effects, surplus groundwater conservation by the IGWA groundwater districts (GWDs) from 2016-2020 has long term effects that extend beyond a single irrigation season and offsets the impacts to Near Blackfoot to Minidoka reach gains and Sentinel Well levels alleged in the SWC Report, as will be shown in Sections 2.1 and 2.2.

"*Excessive 2022 pumping by IGWA members contributed to the Sentinel Well Index declines which are far below the 2016 Mitigation Plan targets.*" (SWC Report, Sec 2.2 pg 3)

The GWDs utilized averaging in their conservation programs in part due to the long-term impacts of groundwater conservation. The use of averaging enabled individual farmers to comply with the conservation program developed by their GWD programs even though the farmer pumped more water in 2022 than prior years.

Surplus conservation by the GWDs from 2016-2020 resulted in higher Sentinel Well levels than would have occurred if the GDWs had implemented the precise conservation targets allocated by IGWA (205,000 acre-feet) and IDWR (240,000 acre-feet), as will be shown in Section 2.1.

Sentinel Well levels are below 2016 Mitigation Plan targets because those targets were established partly on modeling using ESPAM version 2.1 which predicted that groundwater conservation implemented under the 2016 Mitigation Plan would produce much higher groundwater levels than were realized in practice. IDWR has since improved ESPAM and issued version 2.2 which shows very different groundwater level projections in the Sentinel Wells, as will be shown in Section 2.1.

Lastly, very dry hydrologic conditions in 2021 and 2022 impacted the GWDs' ability to meet projected targets, as will be shown in Section 2.1.

2.1 SWC Report Section 2.3.1 "Sentinel Well Impacts"

"*ESPAM results show that the 2022 underperformance by the Bingham, Bonneville-Jefferson, and Jefferson-Clark Ground Water Districts will cause a total of a 0.29 foot decline in the Sentinel Well Index.*" (SWC Report, Sec 2.3.1, pg 4)

The SWC Report is not clear as to the corresponding time period for the model result showing a 0.29 foot decline in the Sentinel Well Index. Modeling as described in Lynker's Expert Report dated February

15, 2024, of surplus conservation by the GWDs from 2016-2020 results in a net increase to the Sentinel Well Index of 0.34 feet or 0.13 feet in April 2023 depending on whether the surplus is based on conservation targets allocated by IGWA (205,000 acre-feet) or IDWR (240,000 acre-feet), respectively.

"*A comparison to Eastern Snake Plain Aquifer (ESPA) groundwater storage numbers helps to put this Sentinel Well Index change number into perspective. In a recent Eastern Snake Hydrologic Modeling Committee (ESHMC) meeting, IDWR staff member Mike McVay presented historical ESPA groundwater storage changes (McVay, 2023). Mr. McVay presented the storage change from spring of 2015 to spring of 2016 as a loss of 300,000 acre-feet of water. During this same time frame, the Sentinel Well Index decreased by 0.27 feet. This is comparable to the decrease caused by IGWA's 2022 underperformance and gives context to the scale of this type of impact*." (SWC Report, Sec 2.3.1, pg 4)

This is not a fair comparison. First, McVay did not model the effect of the of a 300,000 acre-ft decrease in aquifer storage. Second, the SWC Report's modeling showing a 0.29 feet decline was created by running ESPAM in superposition mode which does not account for other influences including incidental recharge and lagged depletions/accretions from groundwater pumping and aquifer recharge in prior years, whereas the observed 0.27 feet decline is a function of those factors.

"*The Sentinel Well Index decline due to IGWA's 2022 underperformance is significant, especially since the 2016 Mitigation Plan goals are not being met. These impacts propagate into the future and warrant mitigation. These impacts will result in decreased Snake River reach gains, thereby reducing the volume of water available to SWC members and for storage fill as long as the impacts persist*." (SWC Report, Sec 2.3.1, pg 4)

I agree that the effects of groundwater pumping propagate into the future. However, the effects of groundwater conservation also propagate into the future. Surplus groundwater conservation by the GWDs from 2016-2020 have resulted in a net increase to Near Blackfoot to Minidoka reach gains and net increase in groundwater levels as measured by the Sentinel Well Index. The fact that the 2016 Mitigation Plan Sentinel Well targets have not been met within the timeframe originally anticipated is primarily a function of model error which caused ESPAM to predict excessive aquifer recovery levels, along with the influence of two severely dry years in 2021 and 2022.

Figure 1 shows a comparison of ESPAM2.1 and ESPAM2.2 pre-settlement agreement modeling[1] of the Sentinel Well response to 240,000 acre-feet groundwater pumping reduction and 250,000 acre-feet IWRB recharge along with the historical (1981-2016) and observed post settlement agreement (2017-2023) Sentinel Well values. The *black dotted line* shows the historical Sentinel Well index (1981-2016). The *blue dotted line* shows the ESPAM2.1 projection of Sentinel Well values post-settlement agreement (2017-2023). The *orange dotted line* shows the ESPAM2.2 projection of Sentinel Well values post-settlement agreement (2017-2023). The *pink X's* are the observed Sentinel Well values post-settlement agreement (2017-2023). Under ESPAM2.1 projections, the 2016 Mitigation Plan Sentinel Well goal would be achieved within the timeframe prescribed by the 2016 Mitigation Plan. Under ESPAM2.2 projections, the 2016 Mitigation Plan Sentinel Well goal would not be achieved until 20248. ESPAM2.2

[1] 240,000 af GWD reduction was applied using a uniform percentage reduction across all GW irrigated lands as defined by ESPAM source water GIS layer and using consumptive use rates from ESPAM GW GIS CIR layer and 250,000 af IWRB recharge was modeled with about 43,000 af at MP31 and 207,000 af at Hilton Spill.

projects Sentinel Well Index values from 2017-2027 that are 51.55% lower than ESPAM 2.1 projections. ESPAM2.2 is currently accepted as the best science available.

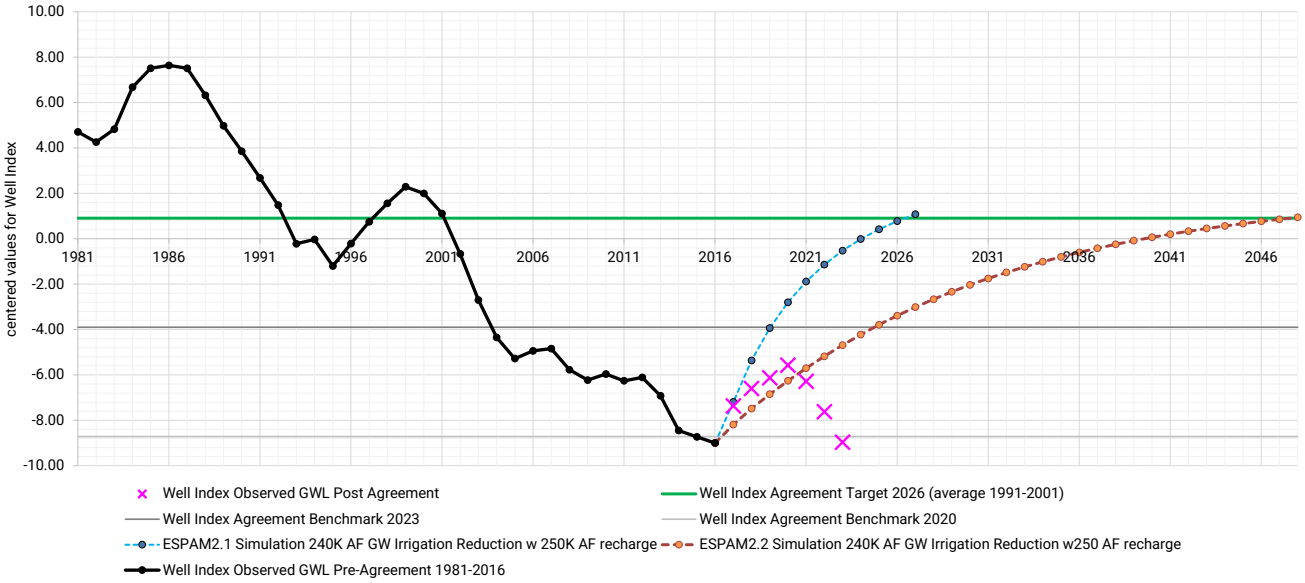

Figure 1: Comparison of ESPAM2.1 and ESPAM2.2 pre-settlement agreement modeling of Sentinel Well response to 240,000 acre-feet GW reduction and 250,000 acre-feet IWRB recharge and historical (1981-2016) and observed post settlement agreement (2017-2023) Sentinel Well values.

The ESPAM projections of Sentinel Well values shown in Figure 1 assume average hydrologic conditions. Hydrologic conditions that are above or below average will cause a deviation from the modeled projection. In fact, hydrologic conditions can have a much greater impact on groundwater levels than does groundwater conservation, such that extreme hydrologic conditions may dwarf the impacts of the GWDs' conservation activities in the short-term. Over time as climatic influences average out, however, the GWDs conservation efforts make a significant difference in groundwater levels.

Figure 2 shows IDWR modeling, presented to ESHMC August 2021, showing what the Sentinel Well Index (*dark blue dotted line)* would look like absent IWRB recharge "Recharge" (*light blue dotted line)* and absent IWRB recharge and IGWA conservation "Mitigation" (*green dotted line)*. IDWR's presentation to ESHMC with Figure 2 included findings that "changes in aquifer management have significantly improved aquifer conditions", "recharge and total conservation have added significant amounts of additional water into the ESPA" and "a combination of wet years and changes in aquifer management have resulted in an increased sentinel index". IDWR also determined that reservoir capacity in the Snake River system was increased by an additional 84,750 acre-feet above Minidoka in 2021 due to a combination of IWRB recharge and IGWA Conservation.

IDWR's presentation to ESHMC concluded that, 1) it took decades for water levels to decline to their current levels, likewise it will take decades to resolve the issue, 2) changes in aquifer management are already starting to improve aquifer conditions 3) there will be droughts, where options for aquifer management will be limited and 4) during wet periods, it is important to capture as much water into the aquifer for later use. These last two points made by IDWR are a strong argument for allowing averaging in the GWDs conservation plans because it incentivizes conserving and recharging maximum amounts,

like GWDs did 2016-2020, to offset extreme drought conditions like 2021 and 2022. There are long-term benefits in lagged accretions to the river and SWC supplies and reservoir capacity in the Snake River system is increased to meet demands in subsequent dry years.

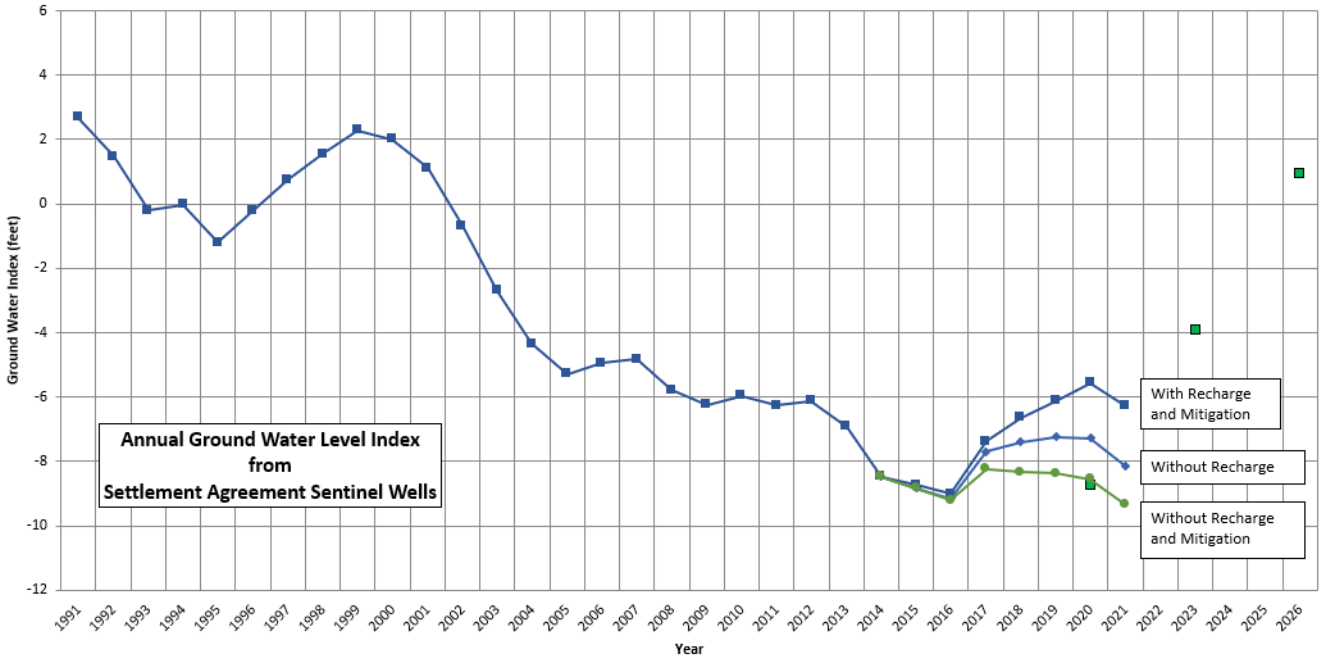

Figure 2: IDWR modeling, presented to ESHMC August 2021, showing what the Sentinel Well Index would look like absent IGWA conservation "Mitigation" and IWRB recharge "Recharge"

Figure 3 shows the Palmer Drought Severity Index (PDSI) for divisions 7 and 9 which represent climatic conditions on the Eastern Snake Plain. The PDSI is a standardized index generally spanning -10 to 10, where negative values represent dry conditions and positive values represent wet conditions. The PDSI is used to monitor and quantify drought conditions and is the most prominent index of meteorological drought used in the United States for drought monitoring and research. Values below -3 represent extreme drought conditions (NCAR, 2023). The PDSI shows extremely dry (below -4) hydrologic conditions for 2021 and 2022.

In keeping with the extreme drought conditions for 2021 and 2022, the observed Sentinel Well Index shows a significant drop from 2021-2023. Wet cycles will have the opposite effect. This is illustrated in Figure 3 where relatively wet conditions (1997-2001) and dry conditions (2002-2006) show significant deviations from average (or zero) in the historical Sentinel Well Index values.

It also bears mentioning that the Sentinel Well Index targets in the 2016 Mitigation Plan are benchmarks, and failing to meet the targets does not put the GWDs out of compliance with the 2016 Mitigation Plan; it simply triggers possible adaptive measures.

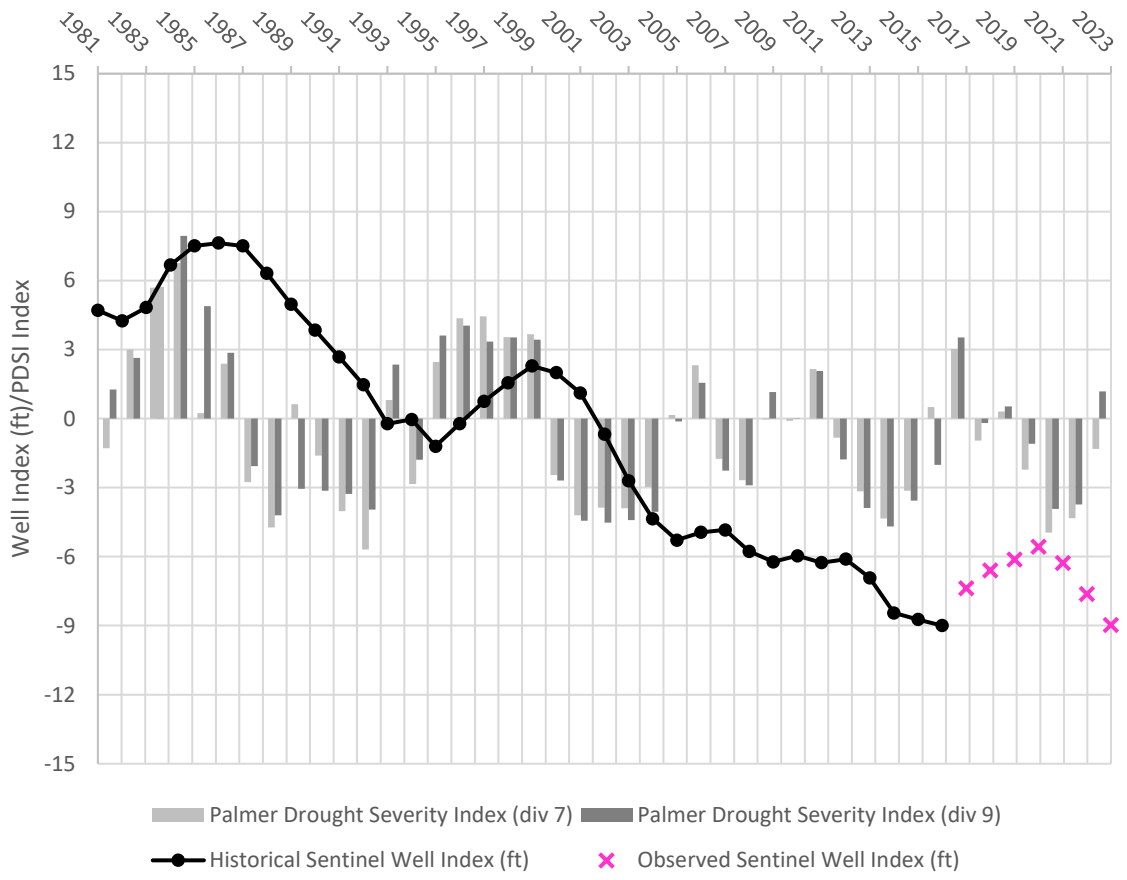

Figure 3: Historical (1981-2016) Sentinel Well Index (black dotted line) with the Observed Sentinel Index (2017-2023) Post-settlement Agreement (pink Xs), as well as, PDSI for Div 7 and 9 (grey bars).

2.2 SWC Report Section 2.3.2 "Reach Gain Impacts"

"*Table 2 shows the ESPAM calculated reductions in reach gains over a 50-year period. A significant amount of impact has yet to happen.*" (SWC Report, Sec 2.3.2, pg 4)

Table 2 - GWD 2022 Underperformance Impacts on Snake River Reach Gains

	Reductions of Near Blackfoot to Minidoka Snake River Reach Gains (Acre-Feet)			
Calendar Year	Bingham	Bonneville	Jefferson-Clark	Total
2022 (Sept-Dec)	**4,178**	**63**	**5**	**4,245**
2023	**6,165**	**536**	**150**	**6,850**
2024	**2,857**	**477**	**256**	**3,590**
2025	**1,703**	**340**	**294**	**2,337**
2026	**1,109**	**237**	**302**	**1,648**
2027-2036	**2,834**	**610**	**1,995**	**5,439**
2037-2046	**480**	**91**	**676**	**1,247**
2047-2072	**293**	**50**	**443**	**787**
Totals	**19,618**	**2,404**	**4,120**	**26,143**

As mentioned above, surplus conservation by the GWDs from 2016-2020 also propagates into the future, thereby increasing the volume of water to SWC members. Results from Lynker modeling as described in Lynker's Expert Report dated February 15, 2024, shows that surplus conservation by the GWDs from 2016-2020 results in a net increase in gains to the Near Blackfoot to Minidoka reach compared to minimum conservation targets allocated by IGWA (205,000 acre-feet) and IDWR (240,000 acre-feet) as shown in Table 1and Table 2, respectively. When surplus mitigation is taken into account, there is a net gain to the Near Blackfoot to Minidoka reach of about 275,000 acre-feet or 190,000 acre-feet, respectively.

2016-2022 IGWA Conservation Model Analysis-Near Blackfoot to Minidoka Reach Gains from Surplus over 205K									
all values are in acre-feet (Af)									
	Bingham	AFA	BJ	Carey	HFMAD	JC	MV	NS	IGWA Total
IGWA Target	205k af	205k af	205k af	205k af	205k af	205k af	205k af	205k af	205k af
2016-2021	54,102	67,022	21,043	22	1,109	10,896	1,729	1,097	157,019
2022	-2,668	20,105	11,067	21	610	2,600	4,473	848	37,056
2023	-3,608	2,075	85	38	807	1,600	1,326	846	3,170
2024	-913	1,734	-59	53	882	1,459	1,369	930	5,455
2025	-261	1,385	1	71	901	1,286	1,344	971	5,697
2026	-29	1,104	50	88	878	1,125	1,287	973	5,475
2027-2036	1,042	4,846	837	1,599	5,424	5,793	8,941	7,313	35,795
2037-2046	541	1,611	396	2,022	1,703	1,723	4,232	3,557	15,785
2047-2072	381	1,154	268	3,597	919	973	3,431	2,828	13,552
Totals	**48,588**	**101,037**	**33,687**	**7,511**	**13,232**	**27,456**	**28,131**	**19,364**	**279,004**

Table 1: 2016-2022 IGWA Conservation Model Analysis of SWC Near Blackfoot to Minidoka Reach Gain Benefits of Surplus Conservation Compared to IGWA Target Allocation of 205,000 af.

2016-2022 IGWA Conservation Model Analysis-Near Blackfoot to Minidoka Reach Gains from Surplus over 240K									
all values are in acre-feet (Af)									
	Bingham	AFA	BJ	Carey	HFMAD	JC	MV	NS	IGWA Total
IDWR Target	240k af	240k af	240k af	240k af	240k af	240k af	240k af	240k af	240k af
2016-2021	40,236	54,358	17,660	21	1,074	8,425	231	741	122,746
2022	-5,001	18,712*	10,362	21	594	1,875	3,904	673	31,140*
2023	-5,551	860	-789	37	787	736	609	624	-2,688
2024	-1,917	974	-714	52	861	664	605	683	1,207
2025	-902	854	-463	68	879	545	585	710	2,278
2026	-473	705	-282	85	856	445	557	710	2,603
2027-2036	-397	3,197	-187	1,545	5,285	2,000	3,855	5,314	20,610
2037-2046	181	1,079	182	1,952	1,658	598	1,820	2,581	10,050
2047-2072	141	774	141	3,471	895	378	1,473	2,052	9,323
Totals	**26,316**	**81,513**	**25,909**	**7,251**	**12,889**	**15,665**	**13,640**	**14,089**	**197,305**

Table 2: 2016-2022 IGWA Conservation Model Analysis of SWC Near Blackfoot to Minidoka Reach Gain Benefits of Surplus Conservation Compared to IDWR Target Allocation of 240,000 af.

Note that in the February 15, 2024 Lynker Expert Report a transpose error in Table 3 resulted in the 2022 AFA volume from the 205k results being reported in the 240K row, the correct values are shown in Table 2 above.

3 SWC Report Section 3 "Proposed Remedy

"*An appropriate remedy should mitigate all impacts of IGWA's excessive junior groundwater pumping, including long-term impacts that happen over many years.*" (Sec 3, pg 5)

Impacts to the Sentinel Well Index and to Near Blackfoot to Minidoka reach gains in 2022 were effectively remedied in advance by surplus conservation by the GWDs from 2016-2020.

3.1 SWC Report Section 3.2 "2022 Breach Remedy"

"*An effective remedy to the 2022 Breach could include reducing 2024 pumping at the locations where the excessive pumping occurred.*" (Sec 3.2, pg 5)

This remedy was already done in advance by surplus conservation from 2016-2020.

"*Table 3 presents the recommended 2024 additional pumping reductions, which are equal to the Director's quantification of 2022 excessive pumping amounts.*" (Sec 3.2, pg 6)

Table 3 - Recommended Remedy: 2024 Additional Pumping Reductions

Ground Water District	Additional Pumping Reductions (acre-feet)
Bingham	32,476
Bonneville-Jefferson	5,204
Jefferson-Clark	18,605
Total	**56,285**

Surplus conservation by the GWDs from 2016-2020 exceeded conservation targets under the 2016 Mitigation Plan. The surplus resulted in net gains over the period 2016-2072 to the Near Blackfoot to Minidoka reach by a total of about 275,000 acre-feet or 190,000 acre-feet, depending on whether the IGWA conservation target (205,000 acre-feet) or the IDWR conservation target (240,000 acre-feet) is used to measure the surplus. Thus, the GWDs have implemented in advance the remedy proposed by the SWC.

4 References

Steward-Maddox, N., 2021.The ESPA and the Role of Aquifer Management, presentation to the Eastern Snake Hydrologic Modeling Committee on August 24, 2021.

LRE, 2024. SWC/IGWA Settlement Agreement Mitigation Plan-2022 Breach Expert Report Docket No. CM-MP-2016-001, prepared for Idaho Surface Water Coalition February, 2024.

Dai, Aiguo & National Center for Atmospheric Research Staff (Eds). Last modified 2023-08-19 "The Climate Data Guide: Palmer Drought Severity Index (PDSI).” Retrieved from https://climatedataguide.ucar.edu/climate-data/palmer-drought-severity-index-pdsi on 2024-02-26