Walla Walla Basin Watershed Council

Water Year 2020

Oregon Walla Walla Basin Aquifer Recharge Report

FINAL REPORT

February 2021

Water Year 2020

Oregon Walla Walla Basin Aquifer Recharge Report

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Walla Walla Basin Watershed Council

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and Fruitvale Water Users Association

February 2021

EXECUTIVE SUMMARY

This report summarizes aquifer recharge operations at the Anspach, Barrett, Chuckhole, East Trolley Lane, Fruitvale, Gallagher, Johnson, LeFore, Locust Road, Mud Creek, NW Umapine, Ringer Road, Triangle Road, and Trumbull sites during water year (WY) 2020 and supporting water quality and groundwater level data. The 14 aquifer recharge sites were operated under Limited License 1621 (LL-1621) issued by Oregon Water Resources Department. This report was prepared per Condition 11 of LL-1621 which requires annual reporting of aquifer recharge site operations.

Source water for the 14 aquifer recharge sites was diverted from the Walla Walla River at the Little Walla Walla Diversion in Milton-Freewater, OR. The water was delivered through existing irrigation water delivery systems to each site's turnout. The WY 2020 recharge season started November 25, 2019 and ended May 15, 2020 but recharge did not occur continuously during this period due to operational and maintenance considerations. The total amount of water diverted under LL-1621 for the WY 2020 recharge season, including estimated seepage losses from the conveyance system, was 5,172 acre-feet (ac-ft). One of the purposes of conducting managed recharge is to mimic lost floodplain processes. If this year's recharge water had instead been flood waters, the volume recharged would have covered the roughly 10 mi^2 central portion of the alluvial fan with almost one foot of water if it had been released instantaneously.

Groundwater level and water quality data were collected in accordance with the approved monitoring plan for LL-1621. At several groundwater monitoring wells located near recharge sites, groundwater levels increased at the start of recharge and decreased after recharge ended. At other wells water levels responded to seepage from other sources, such as rivers, streams, irrigation ditches or canals, and deep percolation from irrigation.

Groundwater and surface water quality data collected during aquifer recharge activities indicate that aquifer recharge activities are not degrading groundwater quality; rather, recharge activities typically improve groundwater quality due to the generally high quality of the source water.

Continued operation of the 14 existing sites and the addition of three new aquifer recharge sites will continue under LL-1621 in 2020 and LL-1848 in 2021.

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LIST OF ACRONYMS

ac-ft	acre-foot
bgs	below ground (or grade) surface
°C	degrees Centigrade
cfs	cubic feet per second
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
FWUA	Fruitvale Water Users Association
GW_##	Groundwater monitoring well #, e.g. GW_14, GW_171
HBDIC	Hudson Bay District Improvement Company
LL	Limited License
mg/L	milligrams per liter
ND	not detected
ODEQ	Oregon Department of Environmental Quality
OWRD	Oregon Water Resources Department
µg/L	micrograms per liter
µS/cm	microsiemens per centimeter
WWBWC	Walla Walla Basin Watershed Council
WWRID	Walla Walla River Irrigation District
WY	water year

INTRODUCTION

This report describes groundwater level data, surface and groundwater quality data, and aquifer recharge operations during water year (WY) 2020 (October 1, 2019 – September 30, 2020) for the managed aquifer recharge program conducted by the Walla Walla Basin Watershed Council (WWBWC) in cooperation with the Hudson Bay District Improvement Company (HBDIC), Fruitvale Water Users Association, and Walla Walla River Irrigation District. The recharge program began operating in 2004 at one site and gradually expanded to the 14 sites operational in WY 2020. Figure 1 shows recharge volumes by year.

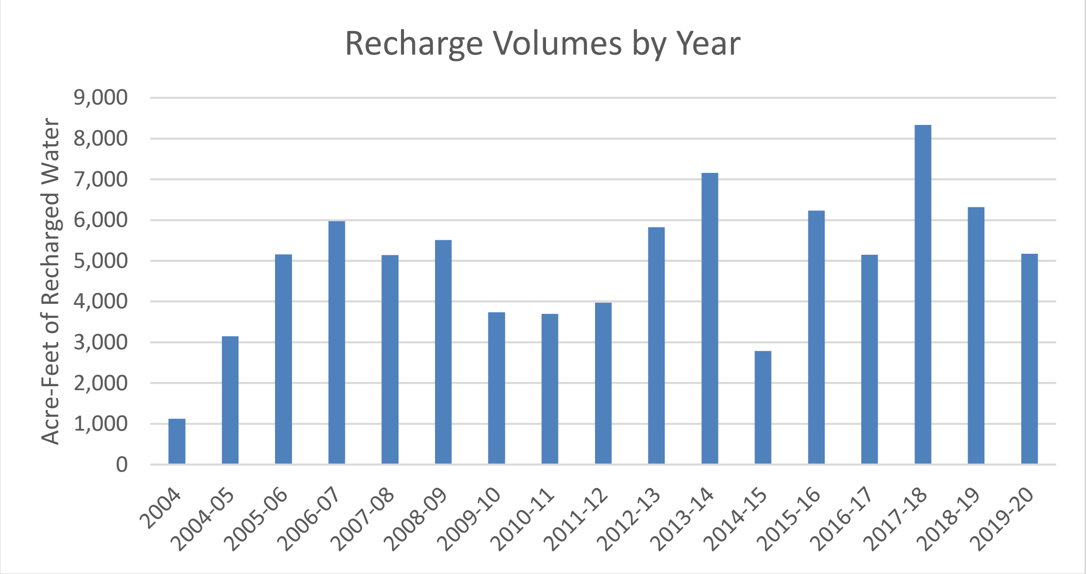

Figure 1. Recharge volumes by year

In the Walla Walla basin, declines in the aquifer and interconnected surface waters have resulted from the channelization of the Walla Walla River distributary system, increased irrigation efficiencies, and increased use of groundwater (pumping) for irrigation and drinking water. As described in the *Walla Walla Basin Aquifer Recharge Strategic Plan* (WWBWC, 2013), the following benefits are expected if the annual volume recharged reaches 20,000 ac-ft:

> "Reversing the loss of storage within the alluvial aquifer will minimize seepage loss in the valley's rivers and streams, increase spring performance and related groundwater input to surface water features, and allow groundwater resources of the alluvial aquifer to continue to be used as a sustainable resource with a secondary or alternative-use benefit to surface water." (p. 79).

During WY 2020, active recharge sites were Anspach, Barrett, Chuckhole, East Trolley Lane, Fruitvale, Gallagher, Johnson, LeFore, Locust Road, Mud Creek, NW Umapine, Ringer Road, Triangle Road, and Trumbull. Figure 2 shows WY 2020 recharge volumes by site, including estimated conveyance losses (i.e. canal seepage) that become groundwater recharge.

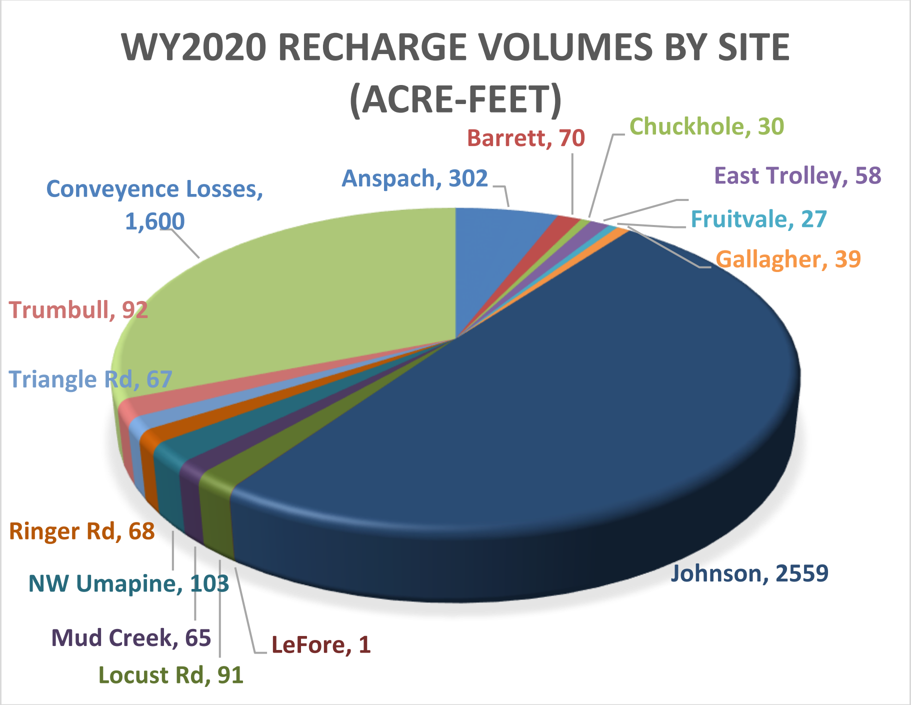

Figure 2. Recharge volumes by site during WY 2020

The sites were operated under Limited License LL-1621 (Appendix A) issued by the Oregon Water Resources Department (OWRD) on October 18, 2016. Source water for aquifer recharge was diverted from the Walla Walla River near Milton-Freewater between November 25, 2019 and May 15, 2020. The recharge sites operated from 5 to 119 days depending primarily on water availability and landowner participation. The total amount of water diverted was 5,172 acre-feet (ac-ft)[1], with the Johnson site and conveyance losses recharging the highest proportions of the total, 49 and 31%, respectively (Figure 2 and Table 1). While the smaller recharge sites contribute a relatively small proportion, they are still an integral and important part of the program because of the recharge that occurs from the conveyances losses when delivering water to the sites – an intentional feature in the design of the program.

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[1] One acre-foot is the amount of water needed to cover one acre (a little less than a football field) with one foot of water.

Table 1. Annual recharge volumes (ac-ft) by site, WY 2004-2020.

Recharge Year	**Anspach**	**Barrett**	**Chuckhole**	**East Trolley**	**Fruitvale**	**Gallagher**	**Johnson**	**LeFore**	**Locust**	**Mud Creek**	**NW Umapine**	**Ringer Rd**	**Triangle Rd**	**Trumbull**	**Conveyance Losses**	***Sum***
2004	--	--	--	--	--	--	409	--	--	--	--	--	--	--	714	***1,123***
2004-05	--	--	--	--	--	--	1,871	--	--	--	--	--	--	--	1,277	***3,148***
2005-06	--	--	--	--	--	--	2,813	--	--	--	--	--	--	--	2,342	***5,155***
2006-07	--	--	--	--	--	--	3,234	--	--	--	--	--	--	--	2,739	***5,973***
2007-08	--	--	--	--	--	--	2,739	--	--	--	--	--	--	--	2,406	***5,145***
2008-09	--	--	--	--	--	--	2,840	--	--	--	--	--	--	--	2,667	***5,507***
2009-10	--	--	--	--	--	--	3,734	--	--	--	--	--	--	--	not estimated	***3,734***
2010-11	--	--	--	--	--	--	3,700	--	--	--	--	--	--	--		***3,700***
2011-12	--	--	--	--	--	--	3,974	--	--	--	--	--	--	--		***3,974***
2012-13	12	--	--	--	--	--	4,556	--	--	--	--	--	--	84	1,175	***5,827***
2013-14	127	210	--	--	--	--	4,515	--	--	--	499	--	--	421	1,385	***7,157***
2014-15	23	200	--	--	--	--	1,560	--	--	--	190	--	--	116	696	***2,785***
2015-16	532	286	--	--	--	--	3,959	--	--	--	170	--	--	262	1,021	***6,230***
2016-17	660	383	13	--	17	--	2,732	--	--	8	183	--	13	170	968	***5,147***
2017-18	251	179	25	52	35	--	3,518	78	56	32	233	--	103	67	3710	**8,339**
2018-19	135	181	25	45	51	16	2,794	3	56	45	111	111	72	45	2,631	**6,321**
2019-20	302	70	30	58	27	39	2,559	1	91	65	103	68	67	92	1,600	**5,172**
Sum	2,042	1,509	93	155	130	55	51,507	82	203	150	1,489	179	255	1,257	25,331	84,437

HYDROLOGIC SETTING

The Walla Walla River system is a bi-state watershed located in northeast Oregon and southeast Washington (Figure 3). The headwaters are located in the Blue Mountains, the crest of which defines the eastern extent of the watershed. The Walla Walla River, Mill Creek and the Touchet River are the three primary surface water channels of the system. They coalesce within the Walla Walla Valley then flow to the Columbia River. The scope of this report is the Oregon portion of the basin, including the Walla Walla River and its distributary network, especially where they flow onto and across the Milton-Freewater alluvial fan.

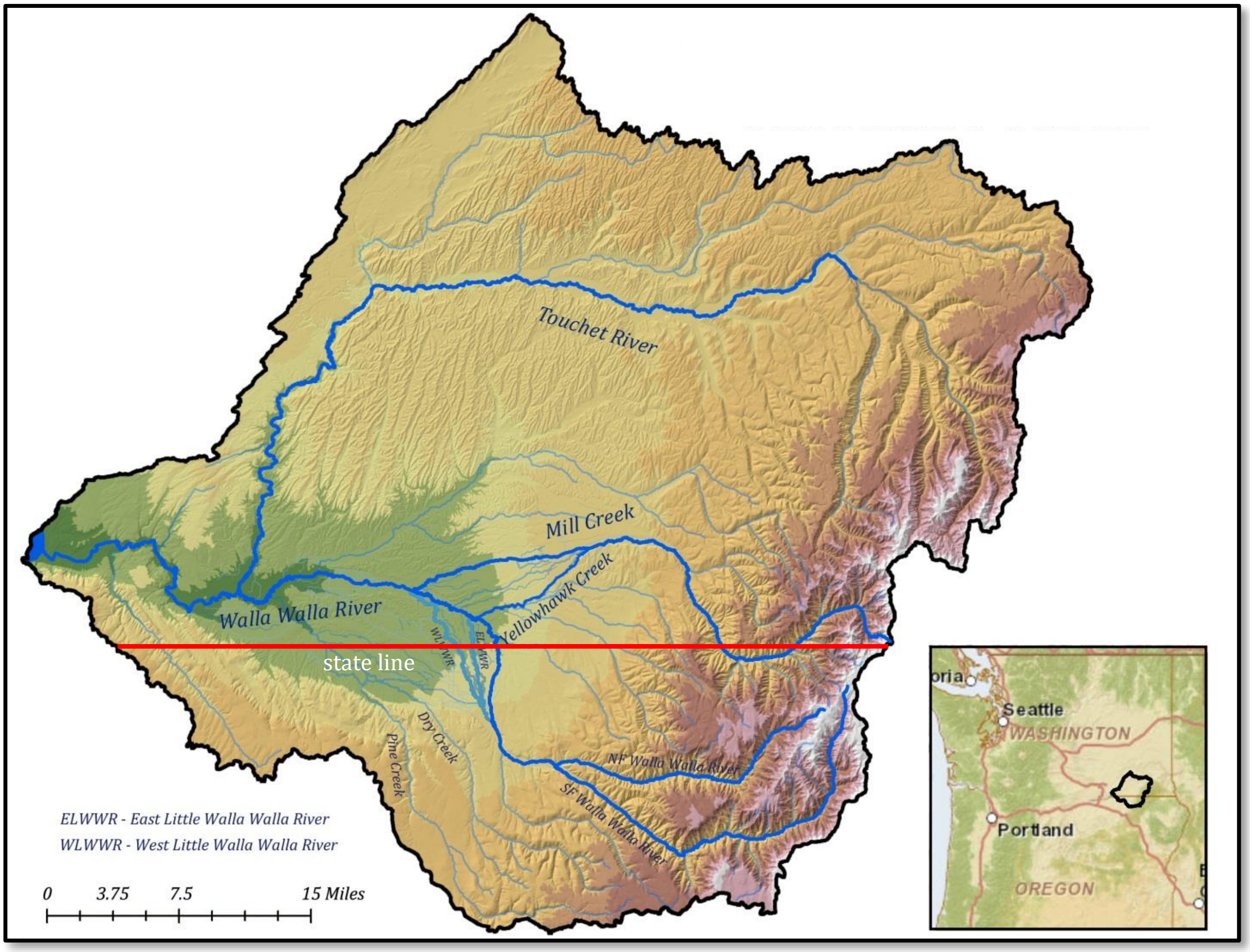

Figure 3. The Walla Walla Watershed, including the Walla Walla River and its major tributaries and distributaries.

Groundwater in the Walla Walla basin occurs in two principal aquifer systems: (1) the unconfined to confined suprabasalt sediment (alluvial) aquifer system; and (2) the underlying confined basalt aquifer system (Newcomb, 1965). The basalt aquifer system is regional in character, having limited hydraulic connection to the Walla Walla River, primarily in the canyons of the Blue Mountains. The alluvial aquifer system is the focus of the aquifer recharge program because of its high degree of hydraulic connection with streams on the valley floor. The alluvial aquifer system, or alluvial aquifer, is found within a sequence of continental clastic sediments overlying the top of basalt (the Mio-Pliocene strata (upper coarse, fine and lower coarse units) and the Quaternary coarse unit). Beneath the Walla Walla Valley floor these sediments, and the alluvial aquifer system, is up to 800 feet thick. The majority of the productive portions of the alluvial aquifer system are hosted by the Mio-Pliocene conglomerate although, at least locally, it is hosted in the overlying Quaternary coarse unit. The alluvial aquifer is generally characterized as unconfined, but it does, at least locally, display evidence of confined conditions. Preferential groundwater flow within the alluvial aquifer is inferred to largely reflect the distribution of coarse sedimentary strata. General groundwater flow direction is from east to west based on contoured groundwater elevations in the alluvial aquifer (Figure 4).

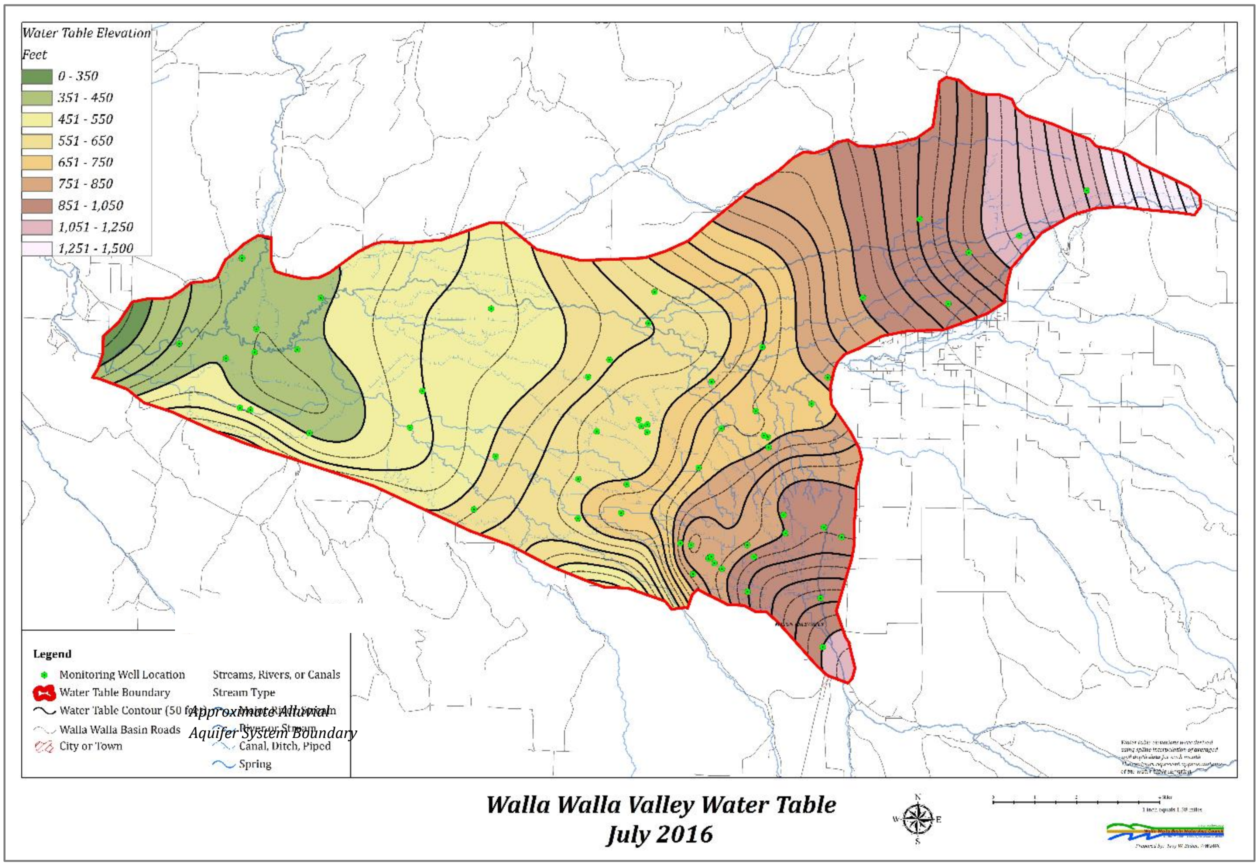

Figure 4. Water table elevation contours for the alluvial aquifer system in July 2016.

South of Milton-Freewater, the Walla Walla River exits the steep-walled canyon in the foothills surrounding the valley, divides into a distributary stream system on an alluvial fan on the valley floor, and then, as the distributary streams flow west, coalesce into the main Walla Walla River (Figure 5). A similar pattern exists in the Mill Creek distributary system in Washington. The distributary channels are known today as the East Little Walla Walla River, West Little Walla Walla River, Mud Creek, Yellowhawk Creek, and Garrison Creek.

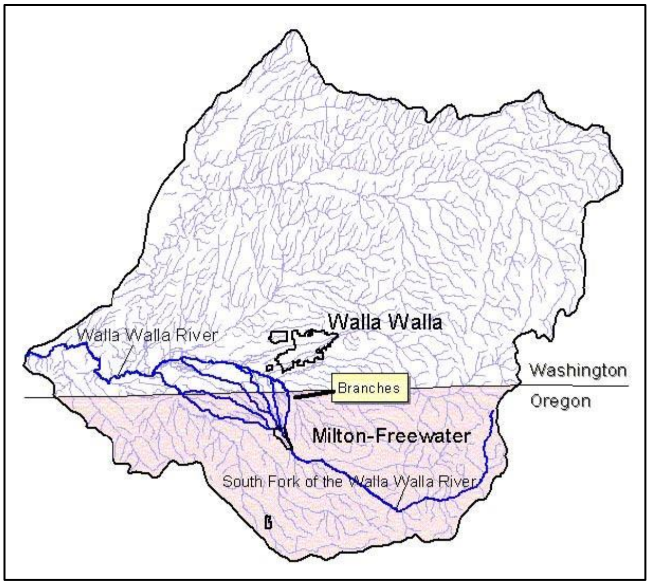

Figure 5. Distributary stream networks of the Walla Walla River originating on the Milton-Freewater alluvial fan.

Prior to the development of water resources in the valley, the distributary channels conveyed large amounts of energy and water across the alluvial fan. The complex channels provided habitat for aquatic species, recharge to the alluvial aquifer system, and cooler water to the Walla Walla River in the form of springs and subsurface inflows to the river resulting from recharge to the aquifer. A headgate installed in the Little Walla Walla River in the 1930's shunted wintertime flows away from the Little Walla Walla River, significantly reducing the system's complexity. Then, in the 1950's, seven miles of levees were constructed along the Walla Walla River to protect the Milton-Freewater area from flooding, severing the connection between the floodplain and the alluvial aquifer. Increasing development led to increasing reliance on the alluvial aquifer as a source of water for irrigation and drinking. In recent years, the listing of steelhead and bull trout as threatened under the Endangered Species Act and the reintroduction of spring chinook salmon led to out-of-court settlement agreements between irrigators and federal fishery agencies to enhance flows in the Walla Walla River. Since 2003, HBDIC and the Walla Walla River Irrigation District leave 25 to 27 cfs of their surface water rights in the river – roughly one-quarter of their typical summertime diversions during the 1990s – further de-watering the Little Walla Walla River.

Alluvial aquifer groundwater levels have declined in some places. Out of 11 long-term state observation wells in the alluvial aquifer, all had downward groundwater level trends and three were completely dry by 2009 (Bower and Lindsey, 2010). Declines at observation well GW_19 located near Old Milton Highway illustrate the long-term trend in portions of the aquifer (Figure 6).

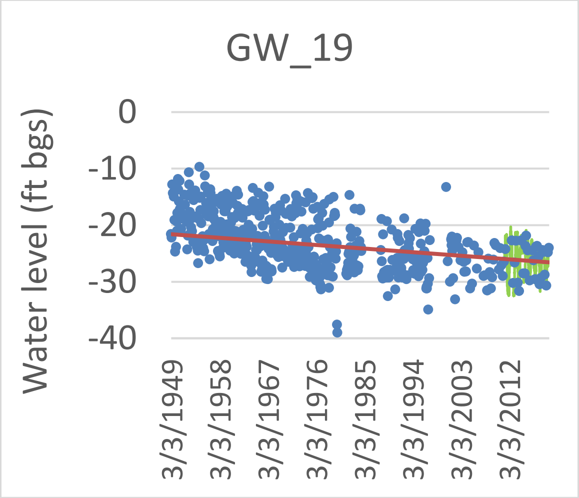

Figure 6. Long-term hydrograph for monitoring well GW_19.

Because of the interconnectedness between the alluvial aquifer and the streams in the basin, declining groundwater levels result in decreased groundwater contributions to the Walla Walla River and other surface waters, including during critical low-flow periods. The loss of groundwater to streams affects not only the amount of flow in the river but also leads to increased surface water temperature during the low-flow periods, affecting aquatic species and the stream ecosystem. Historically, the estimated yield from 57 mapped springs on the Milton-Freewater and Mill Creek alluvial fans was 50,000 ac-ft (Oregon State Water Resources Board, 1963), or 69 cfs on an annual basis. In contrast, in 2017 the annual discharge from five of the largest springs sourced in the Milton-Freewater alluvial fan was 15.5 cfs (WWBWC, 2019). Flows at McEvoy and Dugger springs were 4-6 cfs and 8-10 cfs, respectively, during summers in the 1930s. By 2009 both springs were dry for portions of the year (Figure 7). However, even under altered modern conditions, groundwater still provides a cooling function to the river. In one study conducted in the summer of 2009, cold water inflows into the Walla Walla River just south of the stateline provided an effective cooling of approximately 3.15 ˚C (Gryczkowski, 2015). The cold water inflows consisted of groundwater discharge and hyporheic[2] exchange; groundwater discharge was calculated to contribute 20% of the total flow in the river during the study.

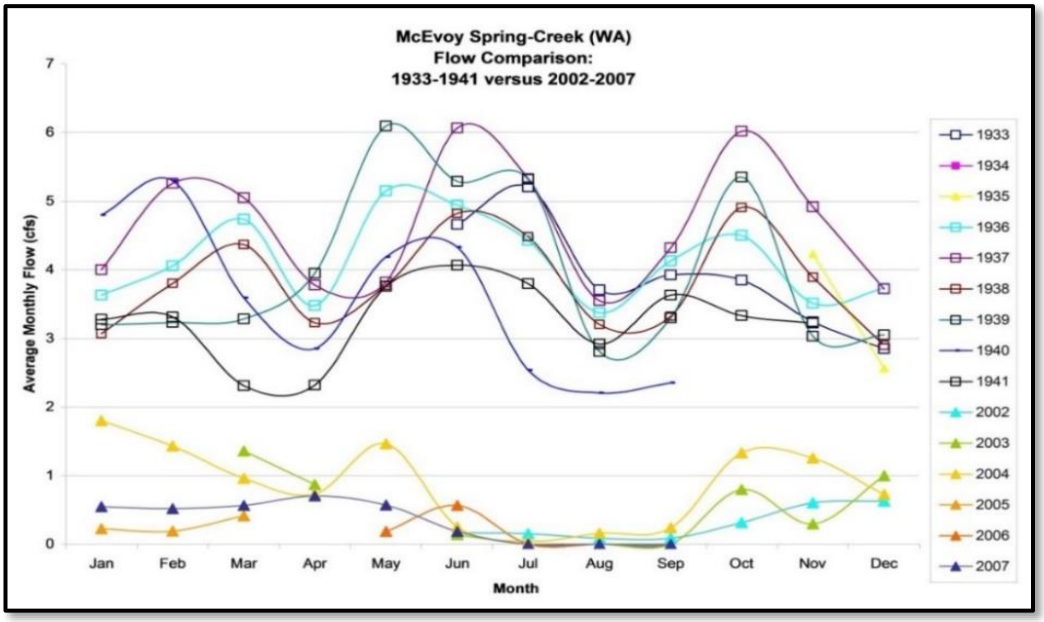

Figure 7. Hydrograph for McEvoy Spring Creek, 1933-1941 versus 2002-2007.

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[2] The hyporheic zone is a porous area beneath and alongside a stream bed, where shallow groundwater and surface water mix together.

The steep gradients and high hydraulic connectivity between the groundwater levels and water in the river results in high seepage losses -- in some reaches greater than 30 percent (Figure 8).

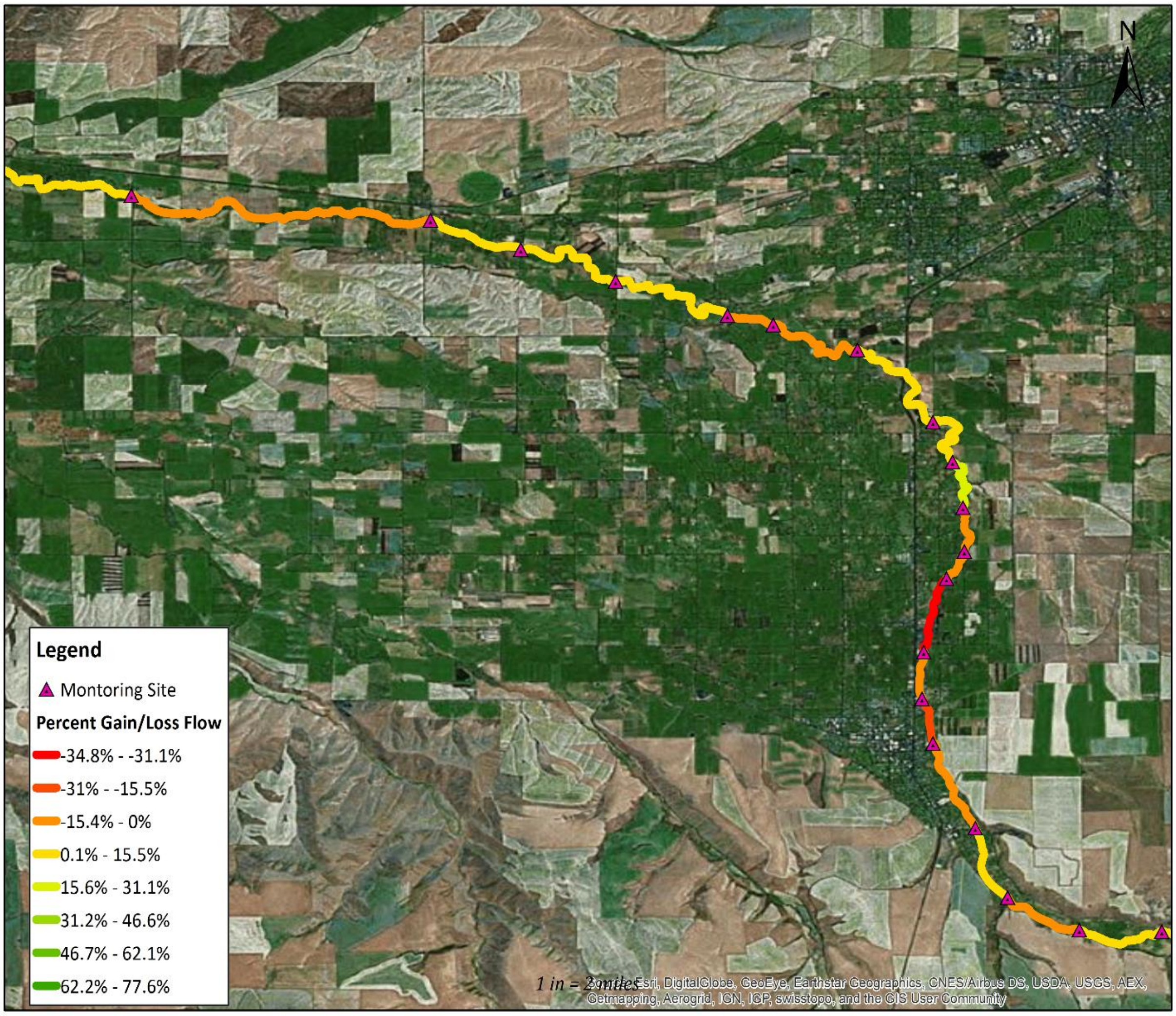

Figure 8. Average percent gains or losses in flow of a segment of the Walla Walla River during seepage runs conducted 2004-2016. Gains (positive values, greens and yellows) indicate groundwater discharging to the river. Losses (negative values, reds and oranges) indicate surface water seeping into the ground (see WWBWC, 2017, for details).

The existing 14 aquifer recharge sites are distributed across the Milton-Freewater alluvial fan (Figure 9), mimicking the floodplain process of recharge to the aquifer that was lost when the headgate shunted wintertime water to the Walla Walla River and the levees nearly eliminated flooding near Milton-Freewater. While the geological map used as the base map in Figure 9 has been replaced by a more recent and detailed map (GSI Water Solutions, 2007), the older map was used because it effectively conveys the intentional distribution of the recharge sites across the alluvial fan.

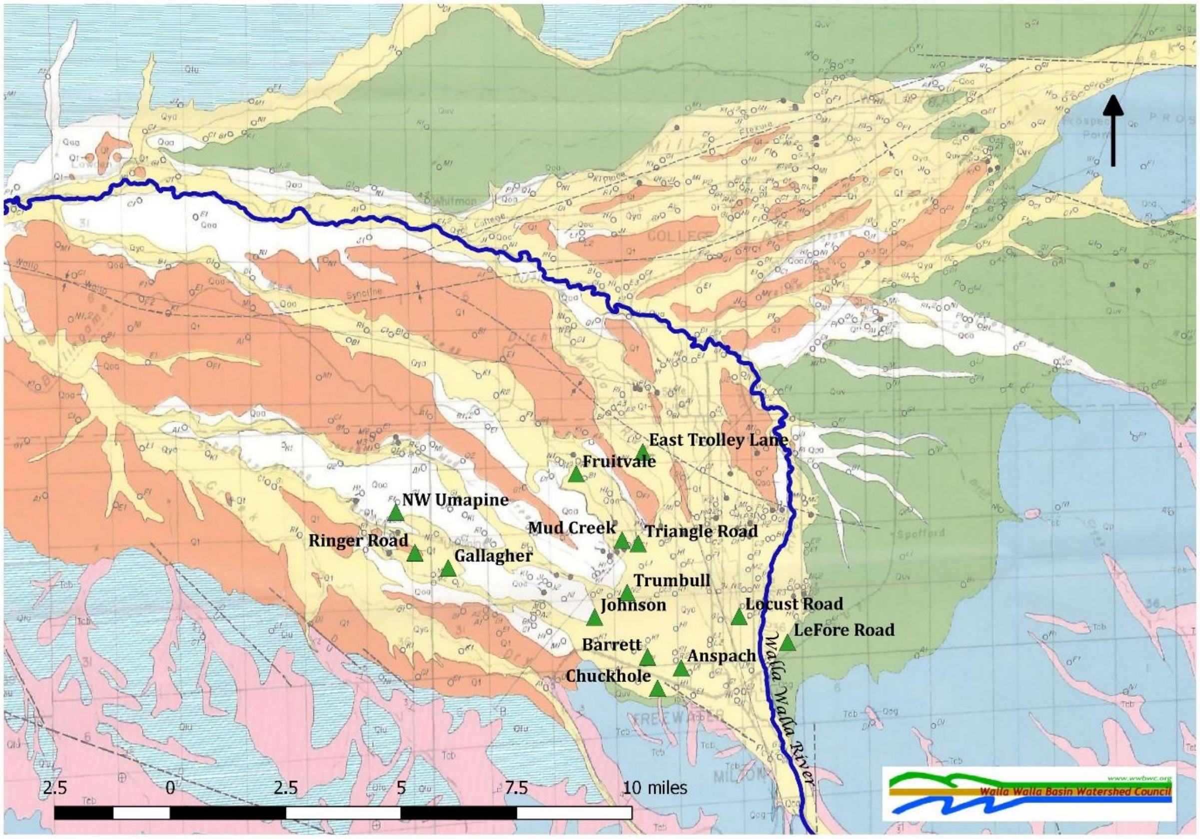

Figure 9. Recharge sites in the Oregon portion of the Walla Walla basin during WY 2020 and their location across the alluvial fan.

OPERATIONS

Managed aquifer recharge program operations are summarized, by site, in Table 2**Error! Reference source not found.** As in previous years, sites typically operated at less than the maximum design capacity listed in the limited license. Depending on the site, this is commonly due to site conditions or operational limitations such as the volume of the source water being unable to completely fill the site's inflow pipe, biofouling of inlet screens, frozen ditches, reduced infiltration rates, competing demands for water (stock watering or irrigation), equipment failures, plugged subsurface inlet lines, etc.

Table 2. Summary of MAR operations

Site	Operated by	Number of Days Operated	Average Recharge Rate (cfs)	Operational Comments
Anspach	WWBWC	58	2.6	Insufficient head pressure to fill Anspach 2 intake pipeline. Volume estimated for that gallery based on 100 gpm rate measured in 2019.
Barrett	HBDIC	59	0.6	--
Chuckhole	Landowner	40	0.4	--
East Trolley	WWBWC	103	0.3	Landowner removed screen debris daily
Fruitvale	FWUA	55	0.25	--
Gallagher	WWBWC/ Landowner	79	0.25	--
Johnson	HBDIC/ WWBWC	119	11.4	Lower infiltration rate in the basins than in past years. Possible maintenance needed. Totalizer failure in the infiltration galleries overflow pipe. Used average flow rate to calculate recharged volume for that basin.
LeFore	Landowner	5	0.2	Still developing operational procedures with new landowner.
Locust Rd	Landowner	57	0.8	--
Mud Creek	FWUA	111	0.3	Recharge volume calculated based on manual flow measurements taken at basin inflow and outflow.
NW Umapine	HBDIC	41	1.3	--
Ringer Rd	WWBWC	86	0.4	--
Triangle Rd	FWUA	46	0.5	--
Trumbull	HBDIC	64	0.7	--

MONITORING

This section describes water availability, individual site operations, groundwater level monitoring, and source and groundwater quality monitoring results. Laboratory water quality testing results are provided in Appendix B. Diverted surface water volumes, recharge volumes and rates, groundwater levels, source water quality and ground-water quality data were collected in accordance with the approved monitoring plan for LL-1621, available at http://www.wwbwc.org/images/Projects/AR/Reports/2016_LL1621_WQPlan_FINAL_sp.pdf. Groundwater level data in the OWRD-requested format were transmitted separately to OWRD.

LL-1621 allows for up to 70 cfs to be diverted from the Walla Walla River for the purpose of testing artificial recharge. Per the conditions of LL-1621, a minimum instream flow amount is required to remain in the Tum-A-Lum reach of the Walla Walla River depending on the time of year (Table 3). WWBWC coordinated with HBDIC to ensure that this condition of LL-1621 was met during recharge operations in WY 2020. Managed recharge under the limited license did not begin until November 25, 2019 because minimum flow requirements were not met prior to this date. Recharge was interrupted from February 6 to mid-March for the annual maintenance of fish screens at the Little Walla Walla River diversion, which ceases delivery of water to canals and ditches from which the recharge sites receive their water. Diversions for aquifer recharge ended on May 15, 2020, as required by the limited license.

Table 3. Minimum instream flows that must be met before water can be diverted for recharge under LL-1621.

Minimum Instream Flow Values for Limited License 1621		
Nov 1 thru Nov 30	***Dec 1 thru Jan 31***	***Feb 1 thru May 15***
64 cfs	***95 cfs***	***150 cfs***

Not all the water diverted from the Walla Walla River reaches the recharge sites due to seepage through unlined portions of the canal and ditch system and/or evaporative losses. Because recharge operations occur during winter and spring months, evaporative losses are assumed to be negligible. To estimate ditch seepage losses during diversion, different seepage rates were applied to different segments of the conveyance system for the duration of recharge (Table 4). The seepage rates were calculated based on measured seepage losses, diversion rates needed to supply the maximum inflow rates to each recharge site, and duration of the recharge periods. The resulting estimated cumulative seepage loss for WY 2020 was 1,600 ac-ft.

Table 4. Seepage loss estimates by site

Site	Segment (s)	Seepage Rate cfs/mi	Seepage Rate AF/day	Length miles	Seepage rate AF/mi/day	Recharge duration (days)	Seepage loss AF	Basis
Anspach	LWWR Diversion to the Anspach turnout/Zerba Weir			2.37	0.00	58	0	Piped from the White Ditch, no additional open canal. White Ditch seepage already accounted for in Johnson calculation. Anspach operated only when Johnson was also operating during WY 2020
Barrett	LWWR Diversion to Barrett turnout			3.01	0.00	59	0	Piped from the White Ditch, no additional open canal. White Ditch seepage already accounted for in Johnson calculation. Barrett operated only when Johnson was also operating during WY 2020
Johnson	LWWR Diversion to the Duff Weir + Duff Weir to Johnson			3.78	1.56	119	702	Seepage rate in the upper White Ditch sourced from Patten, 2014, who subtracted recharge inflow rates from LWW diversion flows during a period when the diversion was delivering recharge water only.
Trumbull	Duff Weir to Trumbull pipeline			0.71	1.56	64	71	Seepage in the White Ditch from the LWW diversion to the Duff Weir is already accounted for in the Johnson calculation. Trumbull operated only when Johnson was also operating in WY 2020.
NW Umapine	Richartz Ditch to NW Umpine		2.82			41	116	Calculated in 2014 during a 30 day period when the Richartz Ditch was feeding only NW Umapine recharge and 1 other diversion. Volume at Richartz Weir - recharge volume at NW Umapine during those 30 days = ditch loss during that time, enabling us to calculate an AF/day rate of loss.
Ringer Rd	White Ditch, Gallager to Ringer Rd		0.00			86	0	Based on Reach 2 data from WWBWC's unpublished 2017 White Ditch seepage study. Seepages losses negligible during spring. Losses more likely during fall. Used a 0 seepage rate to avoid overestimating recharge volumes.

Gallagher	LWW Diversion to Johnson site +1.06 miles White Ditch from Hodgen Rd to Meharry Rd + 0.91 miles of Dugger Creek to Gallagher turnout.		0.00			79	0	1.06 mi of white ditch from Hodgen Rd to S407, then 0.91 miles of dugger creek. Based on Reach 1 of WWBWC's unpublished 2017 White Ditch seepage study. Neglible losses are likely in this section of the White Ditch and probably Dugger Creek as well. Used a 0 seepage rate to avoid overestimating recharge volumes.
Chuckhole	Powell and Milton pipelines		0.00			40	0	Fed from Powell and Milton pipelines. No open ditches.
East Trolley	Fruitvale diversion (S318) to East Trolley	0.50		1.82	0.99	103	186	See seepage rate explanation for Fruitvale Recharge Site below. Segment length calculated from Fruitvale diversion (S318) to East Trolley Recharge because seepage losses upgradient of S318 are accounted for in Fruitvale Recharge calculations.
Fruitvale	From Frog to Fruitvale	0.50		5.09	0.99	55	278	Seepage rate based on CTUIR and The Freshwater Trust study that found 0.8 cfs lost/mile in the Little Walla Walla system. We assumed a lower rate (0.5 cfs loss/mile) since their study was conducted during summer flows, when the ditch was full and ground was empty. Recharge season occurs when ditch flow is lower and ground saturation is higher, presumably reducing the seepage rate.) This rate should be updated when more data become available.
LeFore	Eastside Diversion to Lefore recharge turnout	0.00				0		fed from pipeline, no open ditches
Locust Rd	From Frog to Locust Rd recharge turnout	0.50		0.98	0.99	57	55	See seepage rate explanation for Fruitvale Recharge Site
Mud Creek	From Frog to Mud Creek recharge pond	0.50		3.48	0.99	56	193	See seepage rate explanation for Fruitvale Recharge Site. Days operated is 111 total days run - 55 days Fruitvale running (since losses during those 55 days are already accounted for).
Triangle Rd	Frog to Triangle Rd turnout	0.00			0.00	67	0	Seepage losses accounted for in Fruitvale and Mud Creek calculations.
SUM							1,600	

GROUNDWATER LEVELS

The groundwater monitoring network for the aquifer recharge program consists of 28 wells (Figure 10). The following section presents, by site, the amount of water recharged during WY 2020, a map of groundwater monitoring wells associated with each site, and results from monitoring groundwater levels. Each well's hydrograph and the annual shallowest and deepest groundwater levels (the peaks and troughs in the hydrographs) are evaluated.

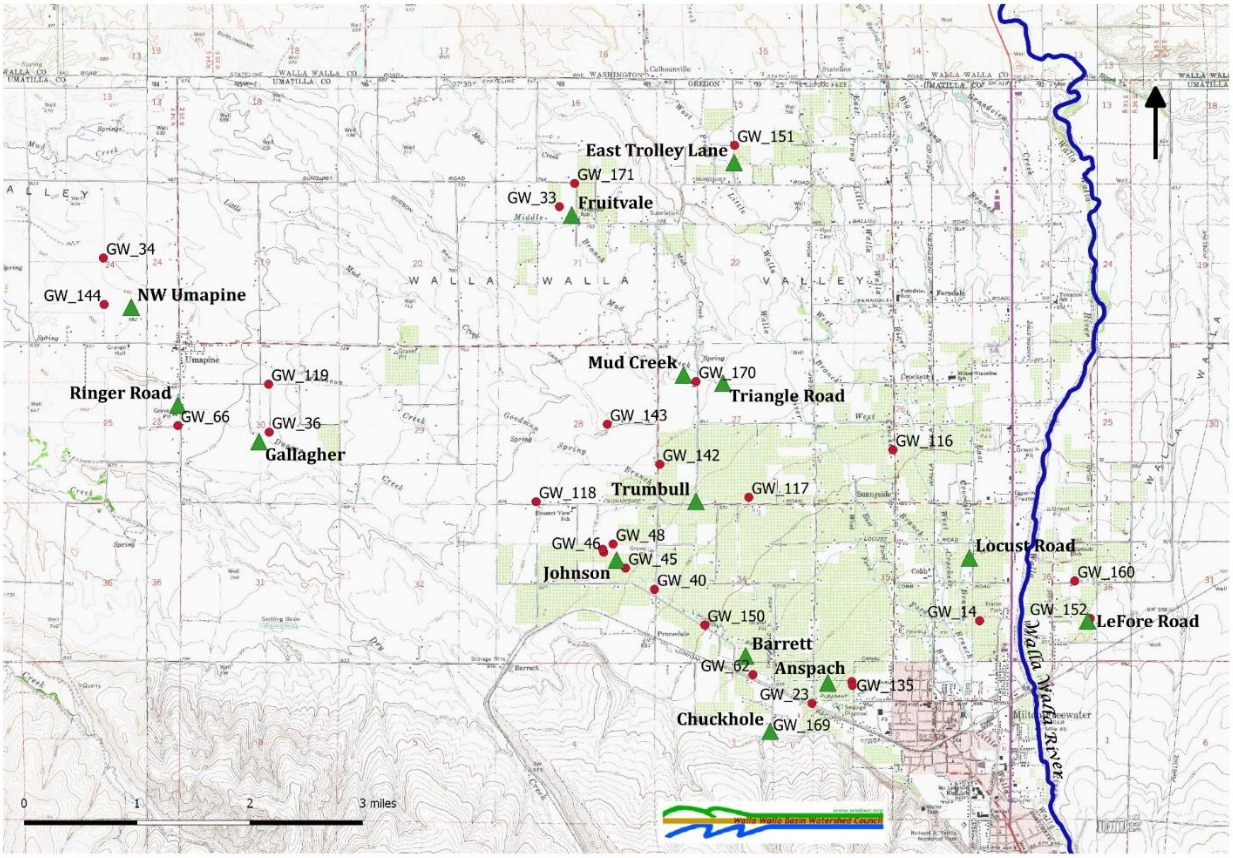

Figure 10. Groundwater monitoring wells (red dots) and aquifer recharge sites (green triangles).

Anspach Recharge Site

The Anspach site operated for 58 days (March 18-May 15, 2020), recharging 302 ac-ft of water at an average rate of 2.6 cfs.

The site has two upgradient wells, GW_135 and GW_141, and one cross-gradient well, GW_23 (Figure 11). The shallowest groundwater elevations at GW_141 rose by more than 10 feet during the early years of managed recharge and have remained elevated despite decreased recharge volumes at this site in the last three years (Figure 12). While GW_135 and GW_141 are upgradient of the recharge site, the timing of the seasonal patterns (Figure 13 and 14) suggests both wells are influenced by managed recharge operations, perhaps as a result of groundwater mounding under the Anspach site. At cross-gradient GW_23, quarterly readings preclude observing changes between each month; between years, groundwater levels may be stabilizing after declines in the three previous decades (Figure 15).

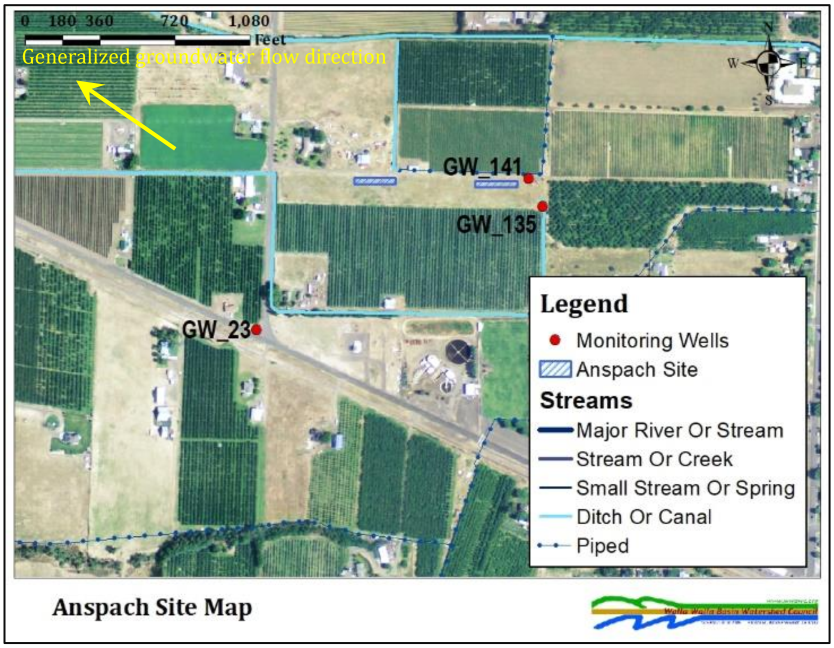

Figure 11. Anspach monitoring recharge locations.

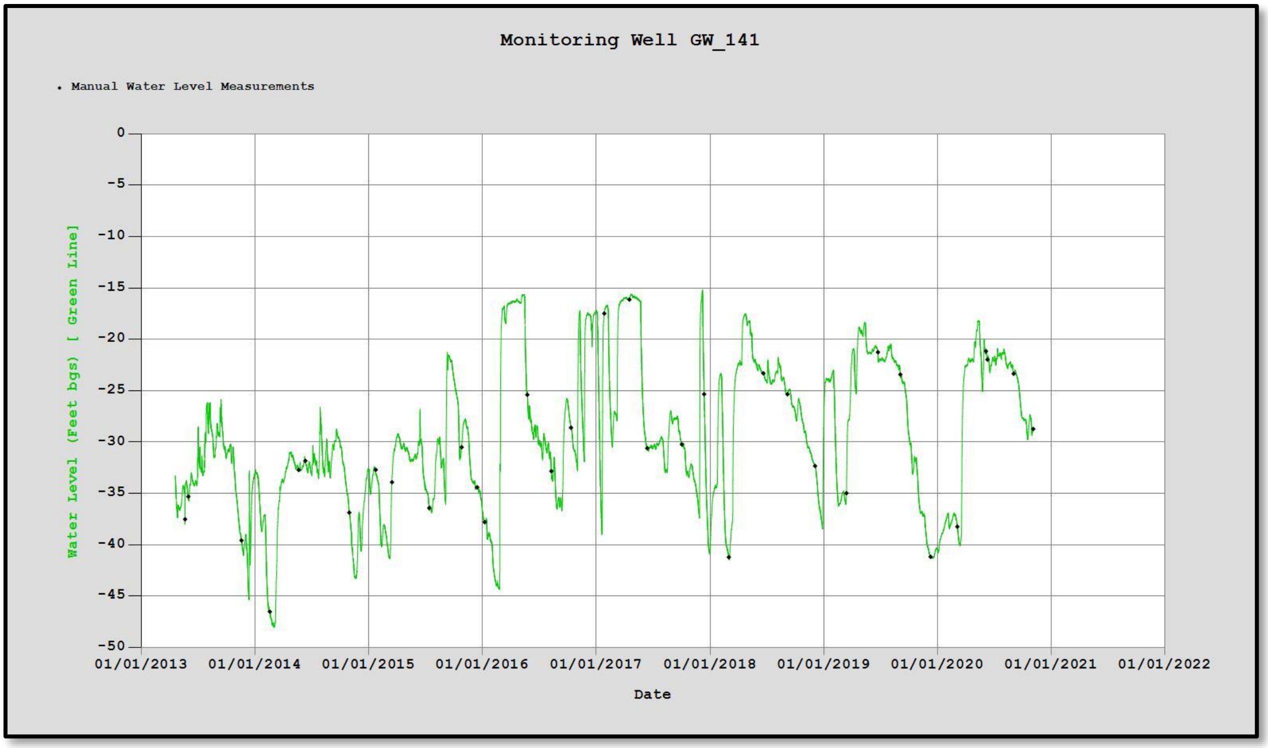

Figure 12. 2013-2020 hydrograph for GW_141.

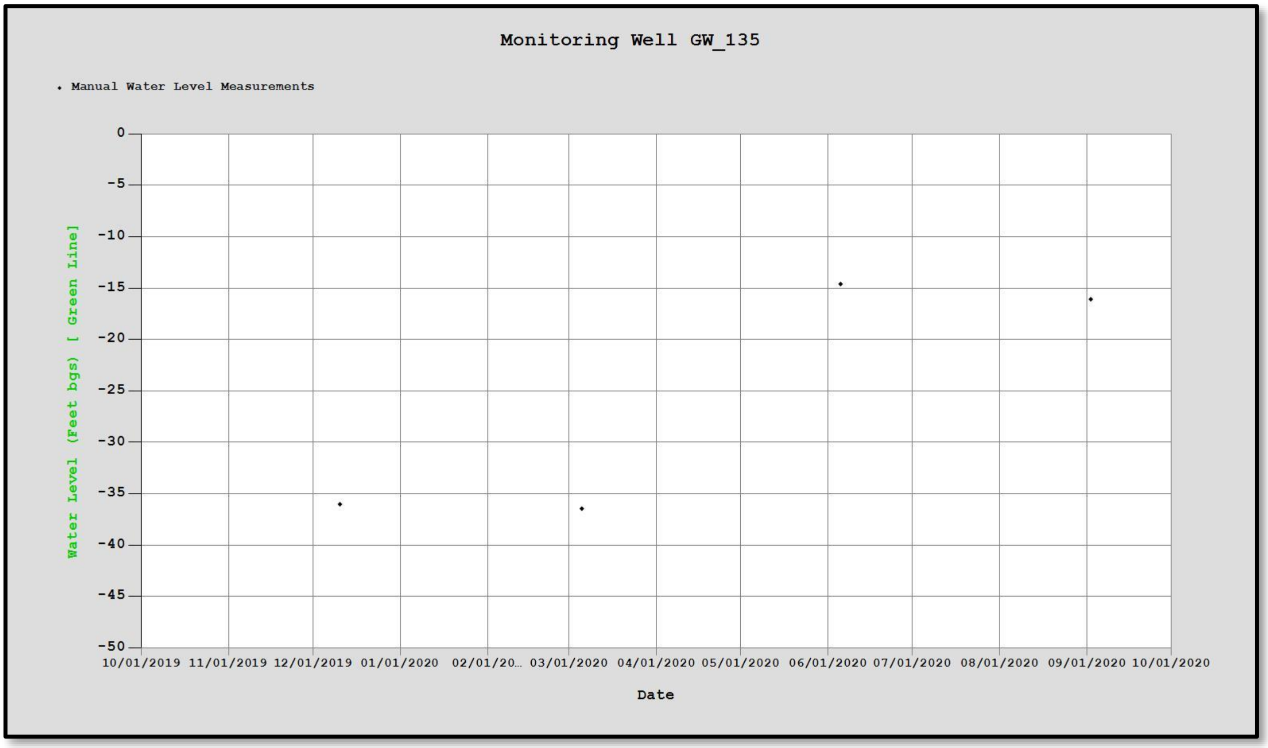

Figure 13. Hydrograph for monitoring well GW_135.

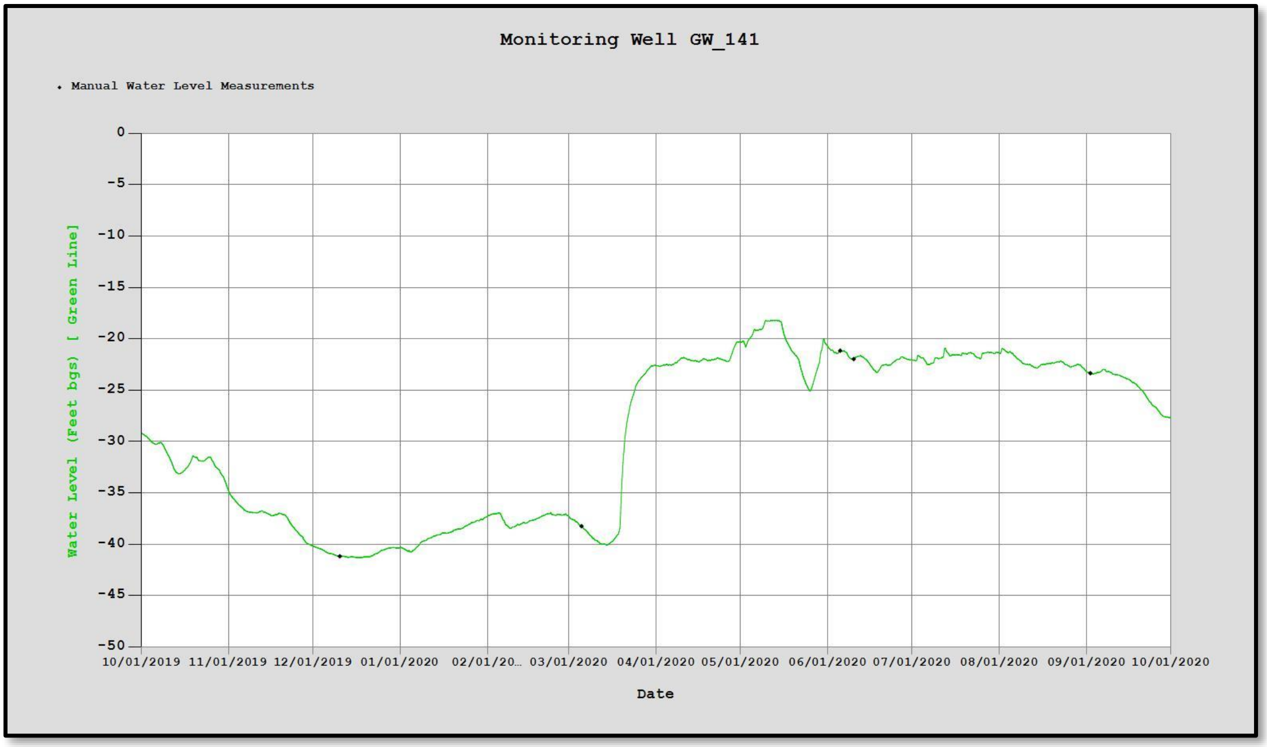

Figure 14. Hydrograph for monitoring well GW_141.

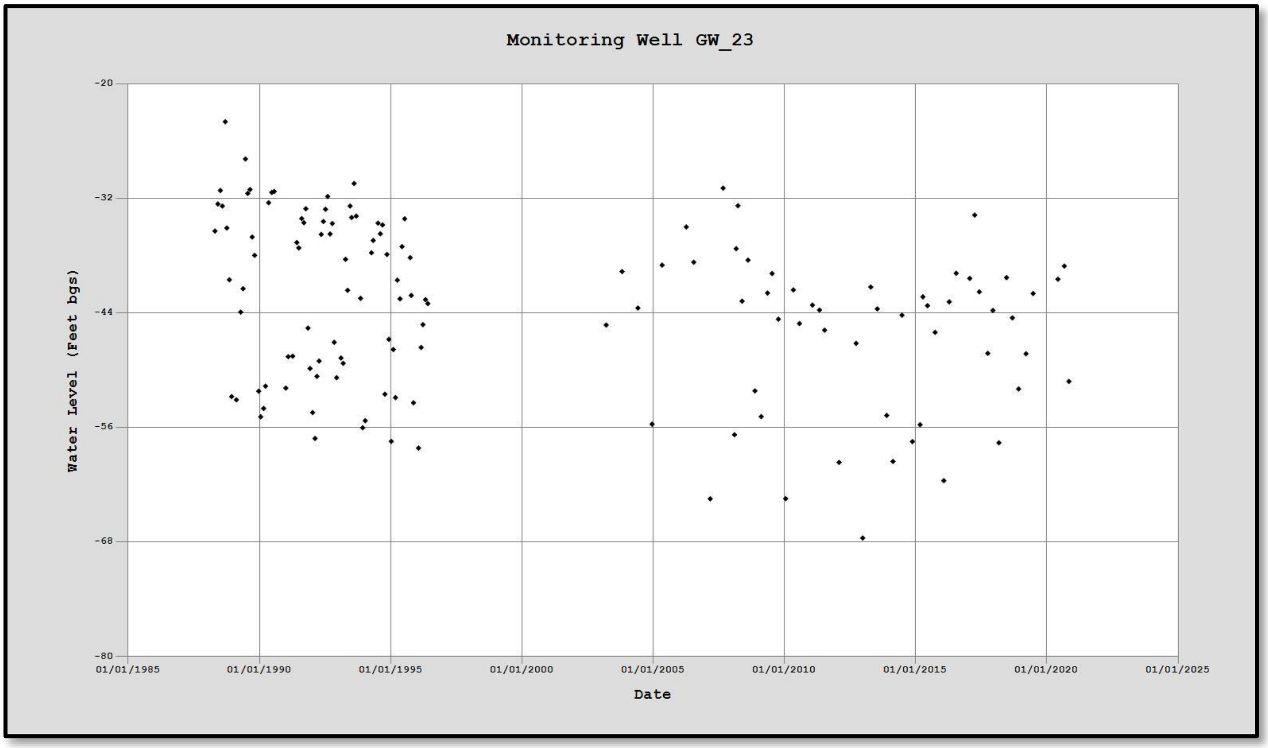

Figure 15. Hydrograph for monitoring well GW_23.

BARRETT RECHARGE SITE

The Barrett site operated for 59 days (March 17-May 15, 2020), recharging 70 ac-ft at an average rate of 0.6 cfs.

GW_62 is upgradient and GW_150 is approximately 0.3 miles downgradient of the site (Figure 16). Response to recharge operations at the Barrett site were observed at the up-gradient groundwater monitoring well, GW_62, and includes influences from the Chuckhole recharge site (see below). Groundwater levels in the monitoring well increased to peak levels during recharge operations and decreased when recharge operations stopped (Figure 17). The 2005-2016 hydrograph for GW_62 is included for longer term groundwater levels at the Barrett site, which began operation in WY 2016 (Figure 18). At downgradient GW_150, a sustained peak during recharge season is apparent, but the timing of peaks and troughs likely also reflects the influence of flows in the nearby White Ditch on groundwater levels (Figure 19).

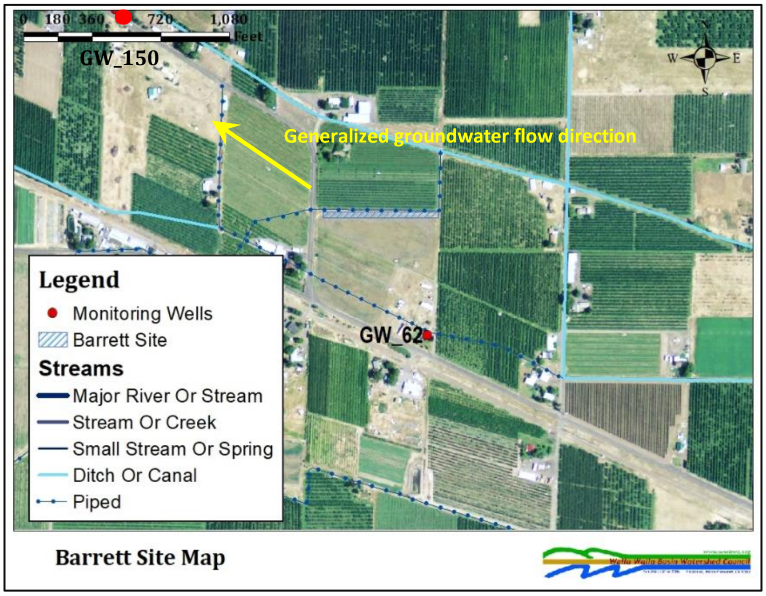

Figure 16. Barrett monitoring well locations.

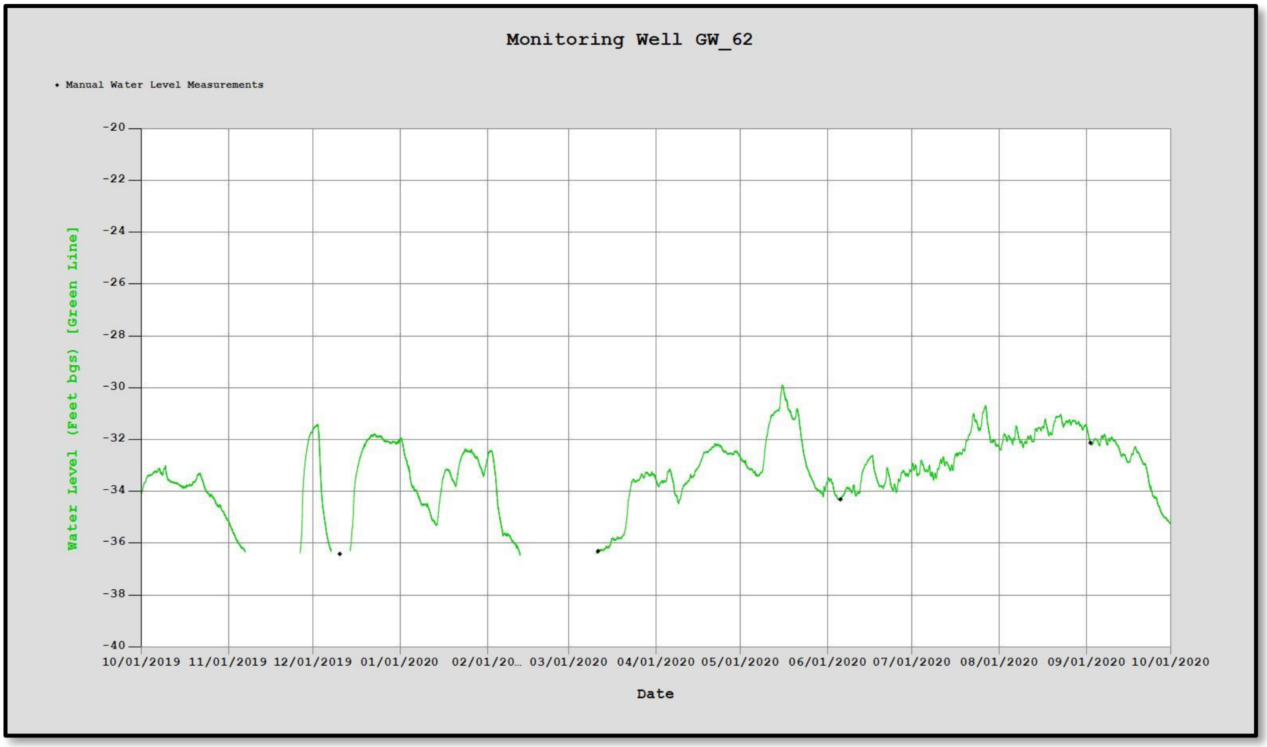

Figure 17. WY 2020 hydrograph for monitoring well GW_62

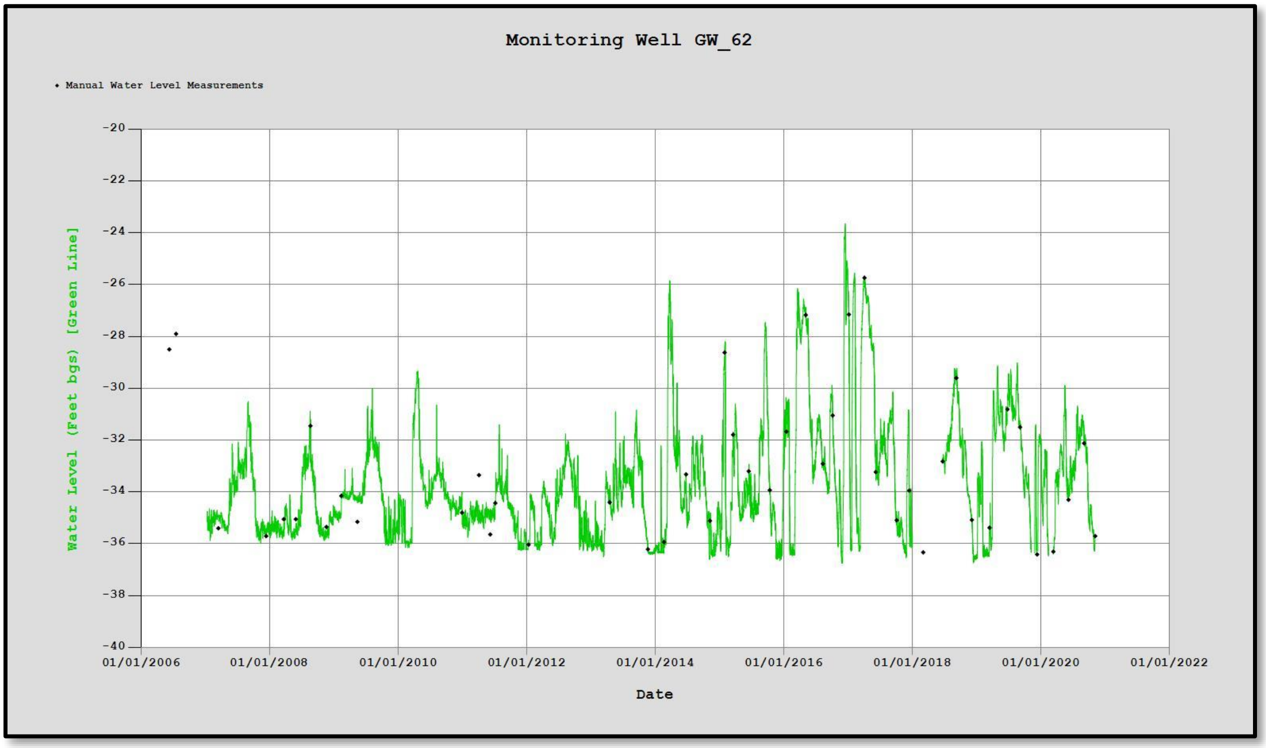

Figure 18. 2006-2020 hydrograph for GW_62.

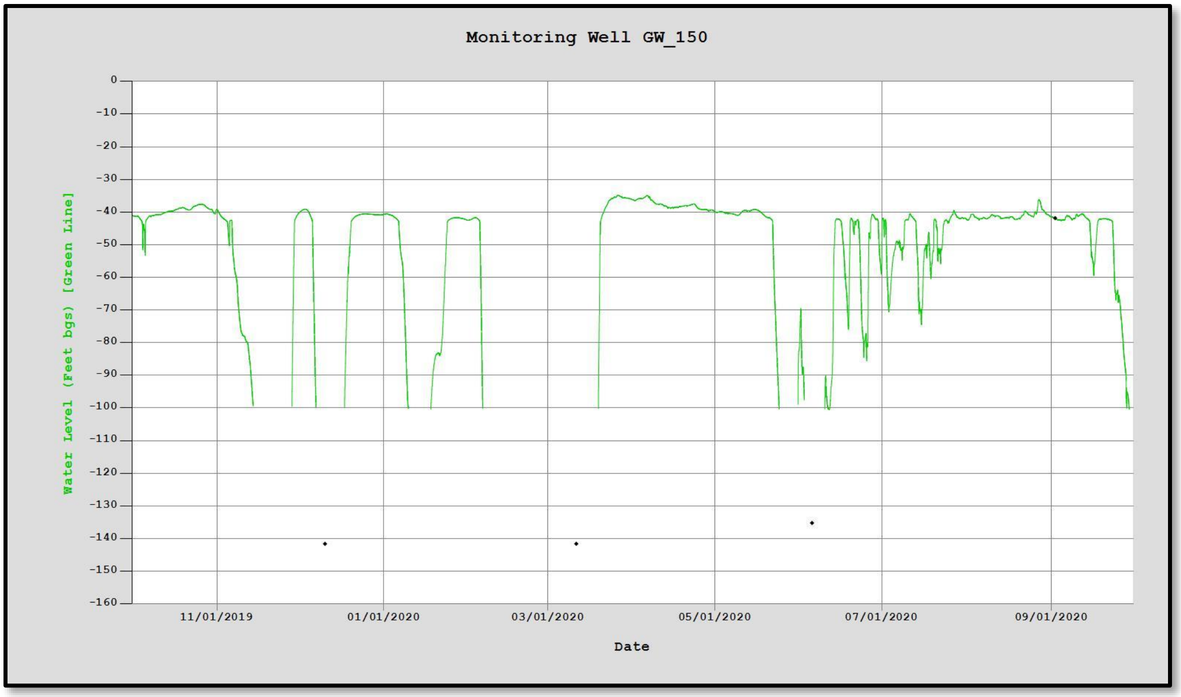

Figure 19. WY 2020 hydrograph for GW_150.

CHUCKHOLE RECHARGE SITE

The Chuckhole site operated for 40 days (April 5-May 15, 2020), recharging 30 ac-ft at an average of 0.38 cfs.

Three monitoring wells are in the vicinity of the site: GW_169 upgradient, GW_62 downgradient, and GW_23 cross-gradient (Figure 20). As discussed above, GW_62 water levels show the influence of the Barrett recharge site and the influence of the Chuckhole site. GW_62 groundwater levels increase in in March with the start of recharge at the Barrett site and further increase in April, coinciding with the start of recharge at the Chuckhole site. Groundwater level decrease in mid-May when recharge operations at both sites are terminated for the year. At GW_169 groundwater levels have increased during recharge season since the site began operating in 2016 (Figure 21). Each spring, the water level drops below the elevation of the sensor, producing the gaps seen on the hydrograph. At cross-gradient GW_23, the quarterly readings during WY 2020 did not occur within the brief 6-week recharge season (Figure 22).

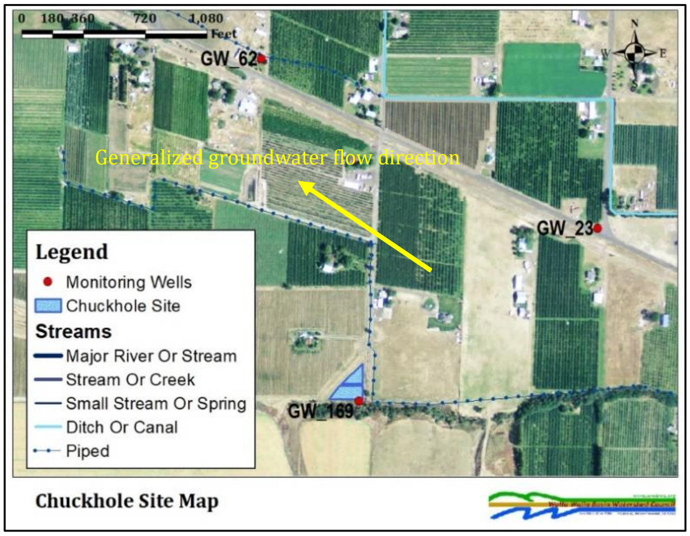

Figure 20. Chuckhole monitoring well locations.

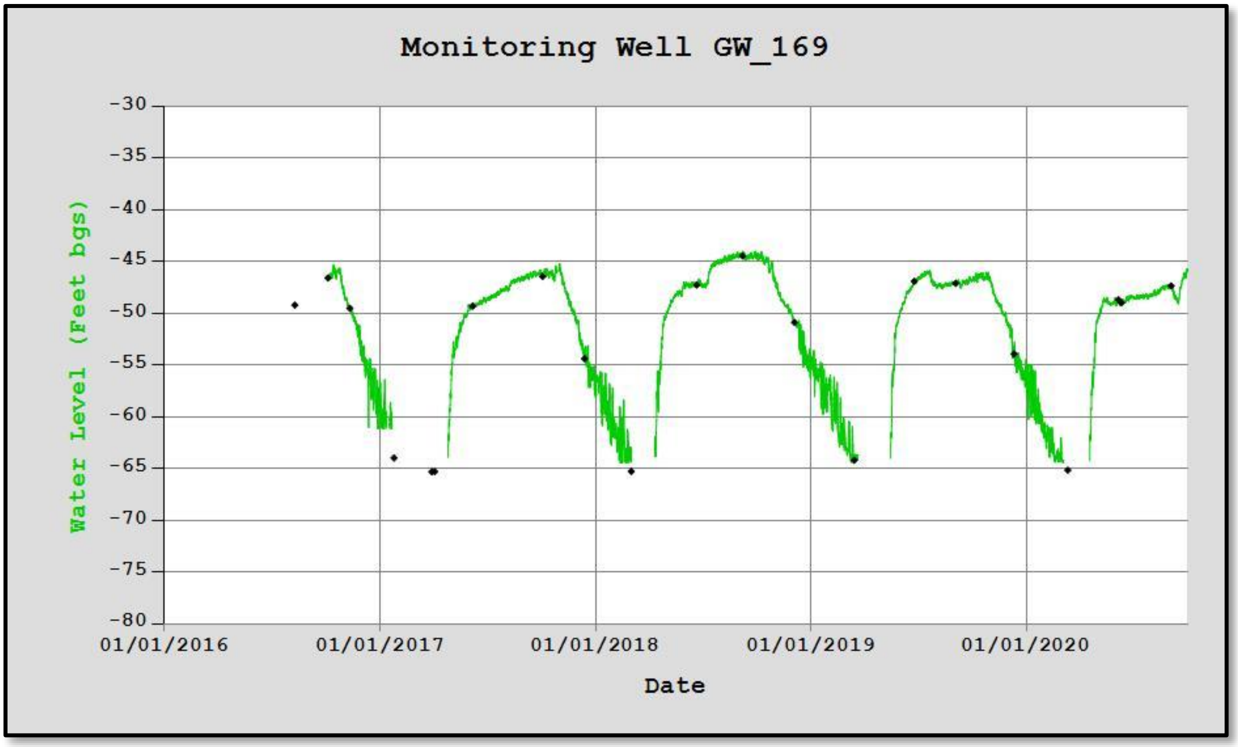

Figure 21. Groundwater levels in monitoring well GW_169 from WY2017-2020. Springtime data gaps represent times when the water level drops below the elevation of the sensor.

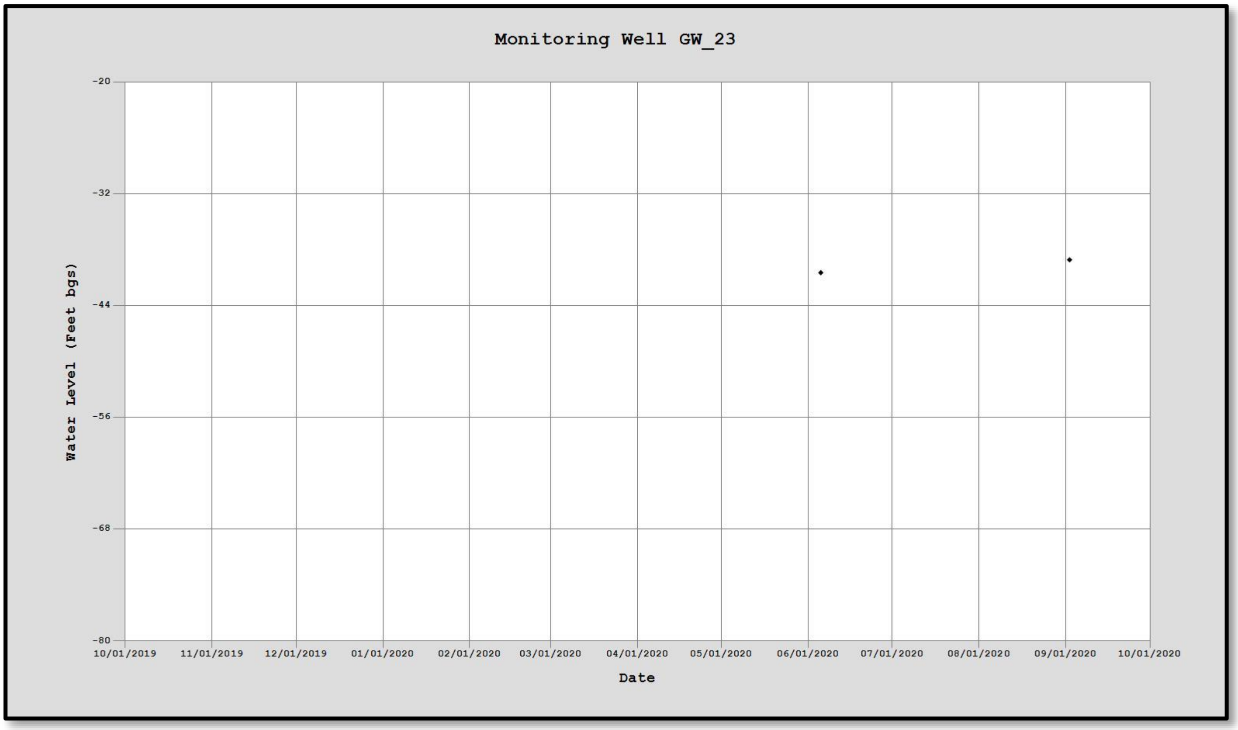

Figure 22. Static groundwater levels in monitoring well GW_23 during the 2020 water year.

EAST TROLLEY RECHARGE SITE

The East Trolley site operated for 103 days (Dec 18, 2019 – Feb 4, 2020, March 20-May 15, 2020), recharging 58 ac-ft at an average rate of 0.28 cfs. The landowner cleaned the intake screen daily to maximize recharge rates.

GW_151 is at the distal end of the infiltration gallery (Figure 23). The magnitude and timing of the changes in groundwater levels suggest multiple influences on the seasonal water table (Figures 24-25).

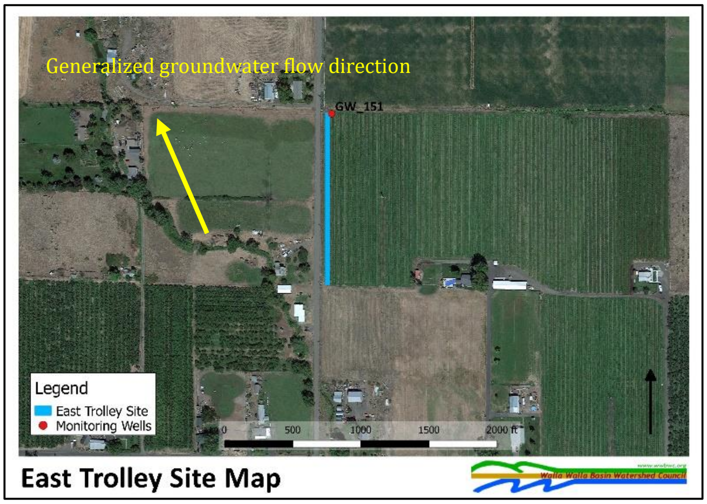

Figure 23. East Trolley monitoring well location.

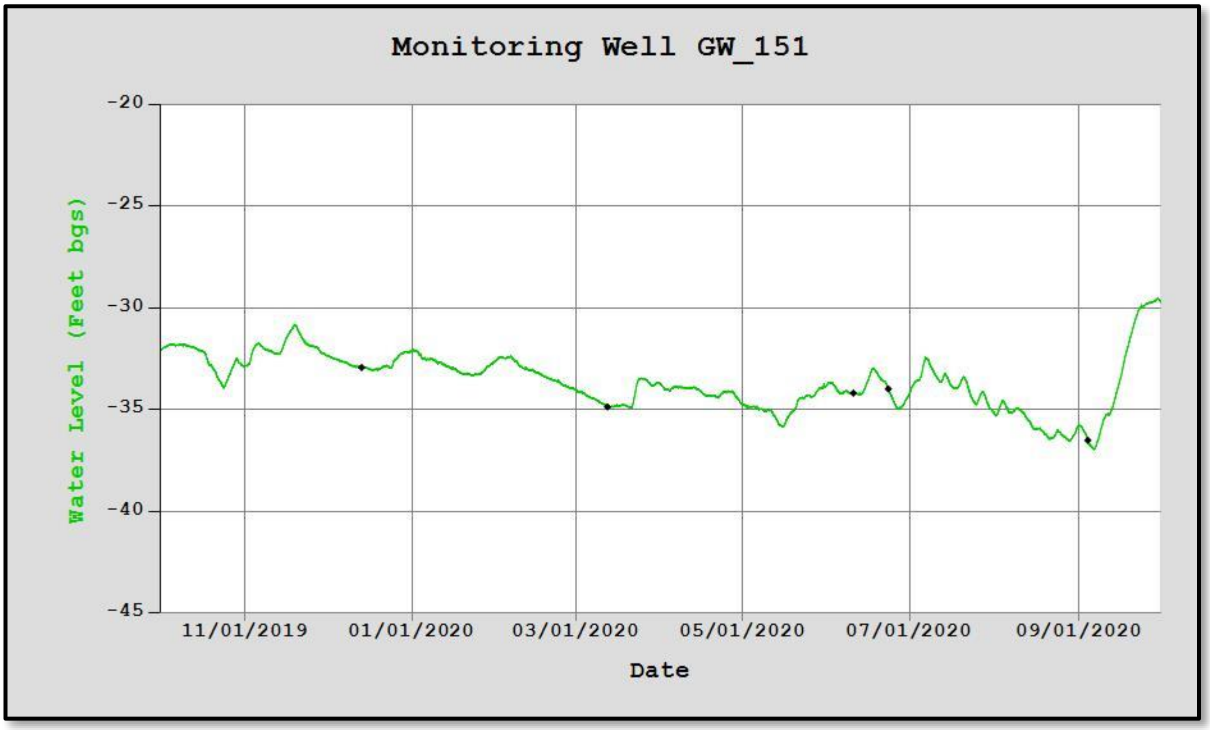

Figure 24. Groundwater levels in monitoring well GW_151 during the 2020 water year.

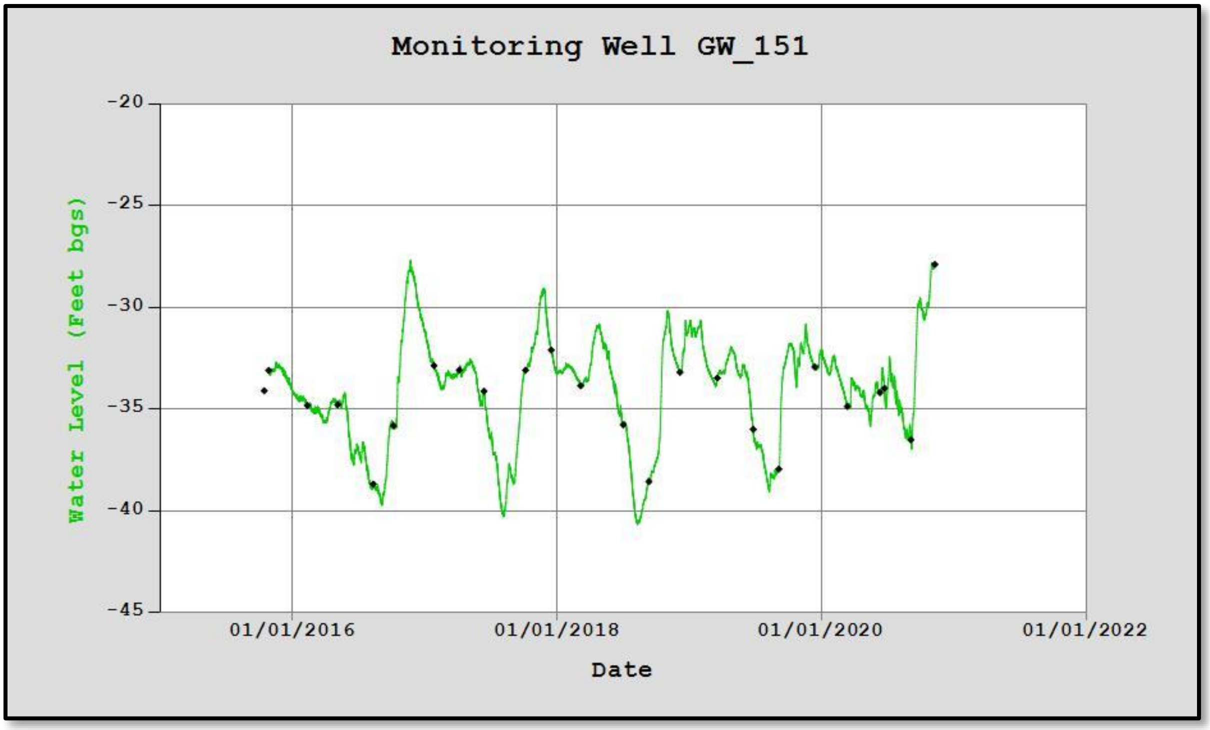

Figure 25. GW_151 hydrograph from WY2016-2020.

FRUITVALE RECHARGE SITE

The Fruitvale site operated for 55 days (Dec 18, 2019 – Feb 4, 2020, March 14-21, 2020), recharging 27 ac-ft at an average rate of 0.25 cfs.

This site is located between the inner and middle zone of springs described by Newcomb (1965). The landowner has described that springs used to surface near this site. Groundwater monitoring well GW_33 and GW_171 are downgradient of the site (Figure 26). At GW_33, seasonal peaks have increased and seasonal lows stabilized since Fruitvale recharge began in 2017 (Figure 27). In GW_171, the deepest groundwater levels appear to be stabilizing since 2017 (Figure 28), suggesting longer-term increases in aquifer storage volumes (not just seasonal peaks), which is consistent with increased spring yield observed at other springs monitored by WWBWC (see WWBWC, 2019, for details on increased spring performance). Seasonal changes in groundwater levels at both monitoring locations are influenced by more than just recharge operations.

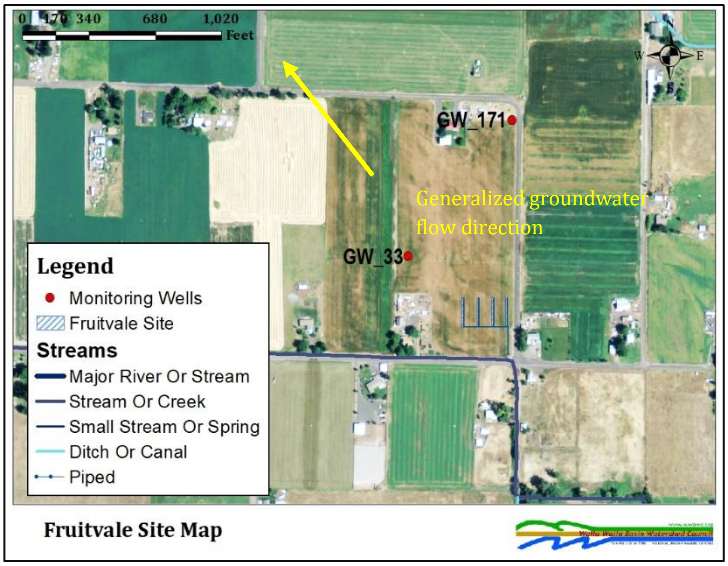

Figure 26. Fruitvale monitoring well locations.

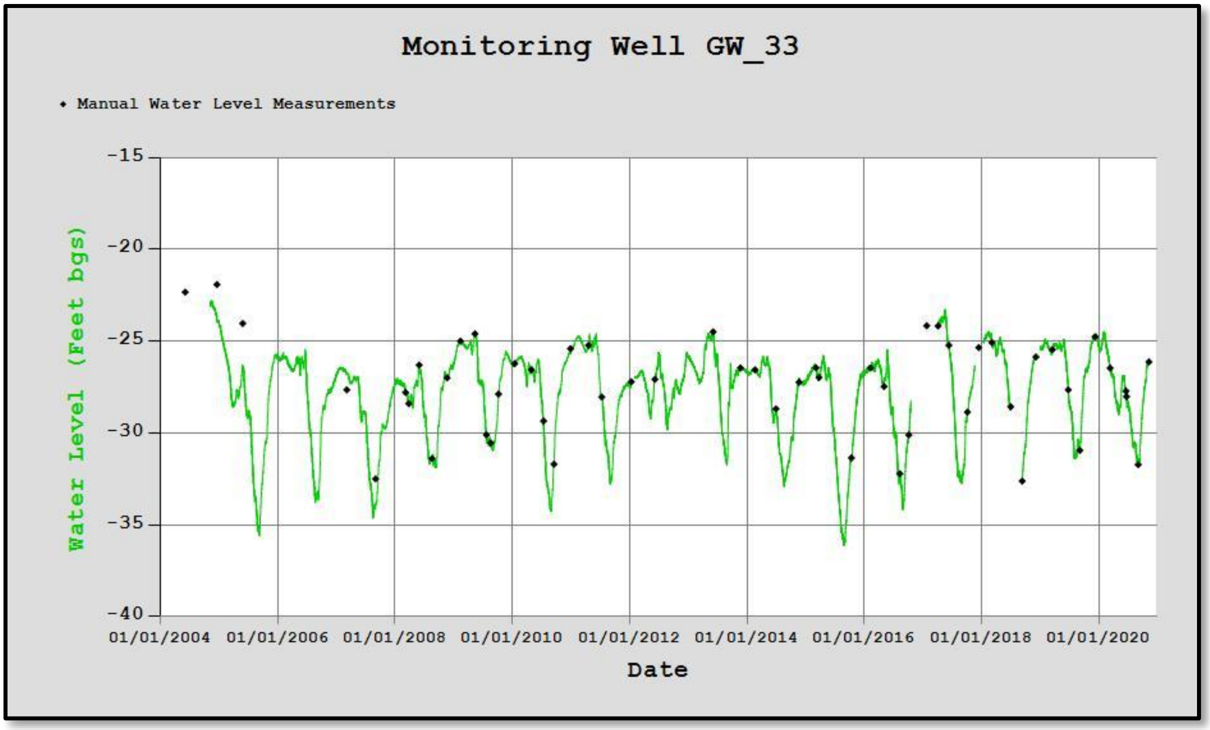

Figure 27. GW_33 hydrograph from 2004-2020.

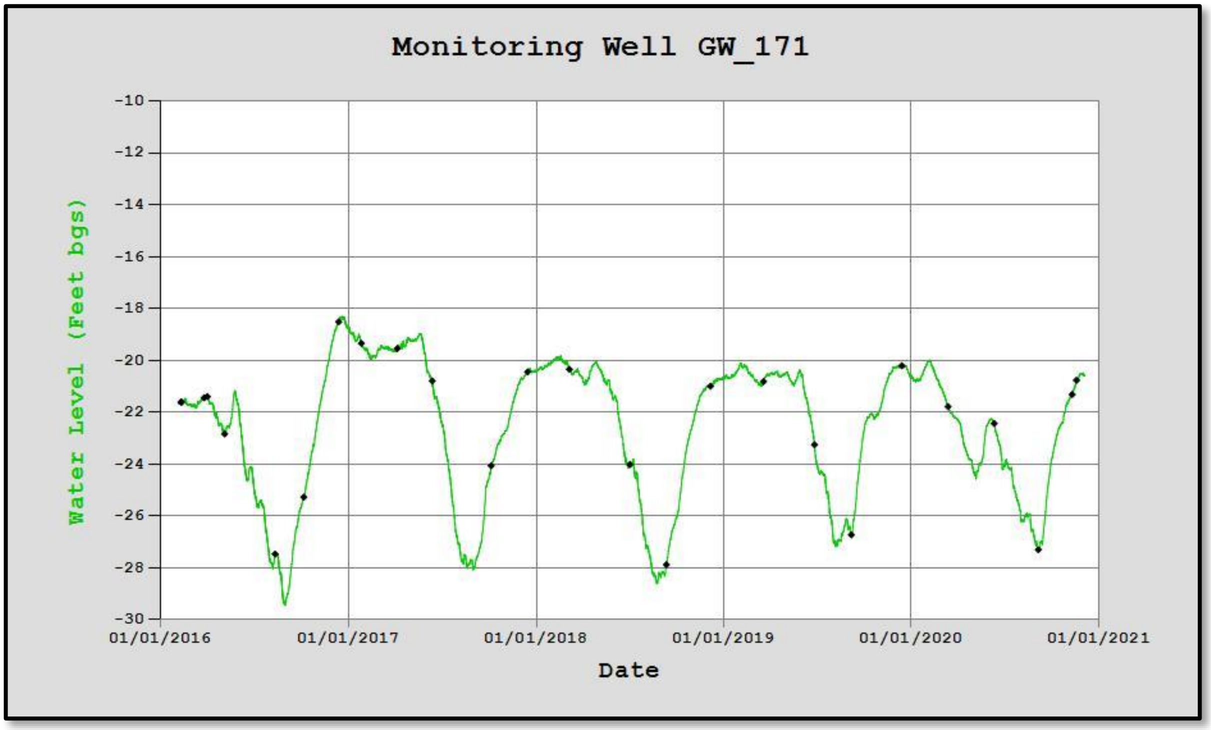

Figure 28. GW_171 water levels from 2016-2020.

GALLAGHER RECHARGE SITE

The Gallaher site, which includes a recharge basin and infiltration galleries, operated for 79 days (Jan 7 – Feb 4, 2020, March 18-28, 2020, April 4-May 15, 2020), recharging 39 ac-ft at an average rate of 0.25 cfs.

GW_36 is upgradient of the site (Figure 29). None of the quarterly measurements occurred during the 20 days the Gallagher site operated. The September static measurements, however, have risen for two consecutive years since the Gallagher site began operating in WY2019, suggesting a possible link between recharge operations and increasing groundwater levels (Figure 30). Data from future years will help to evaluate the trend more fully.

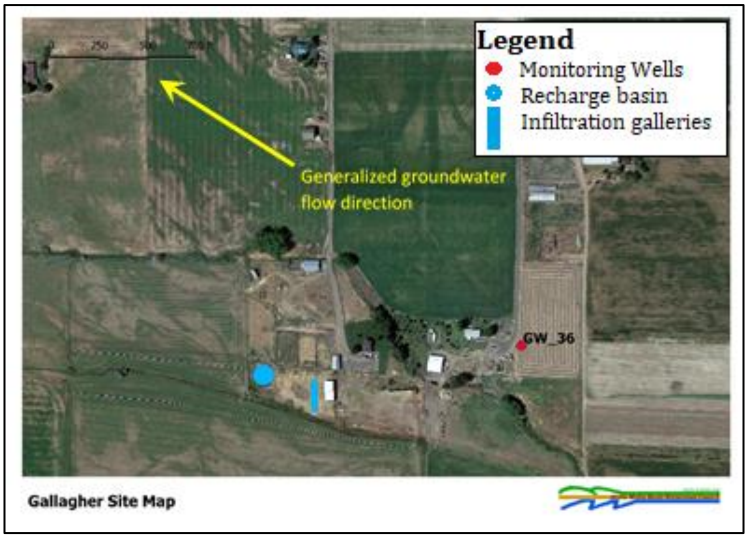

Figure 29. Gallagher monitoring well location.

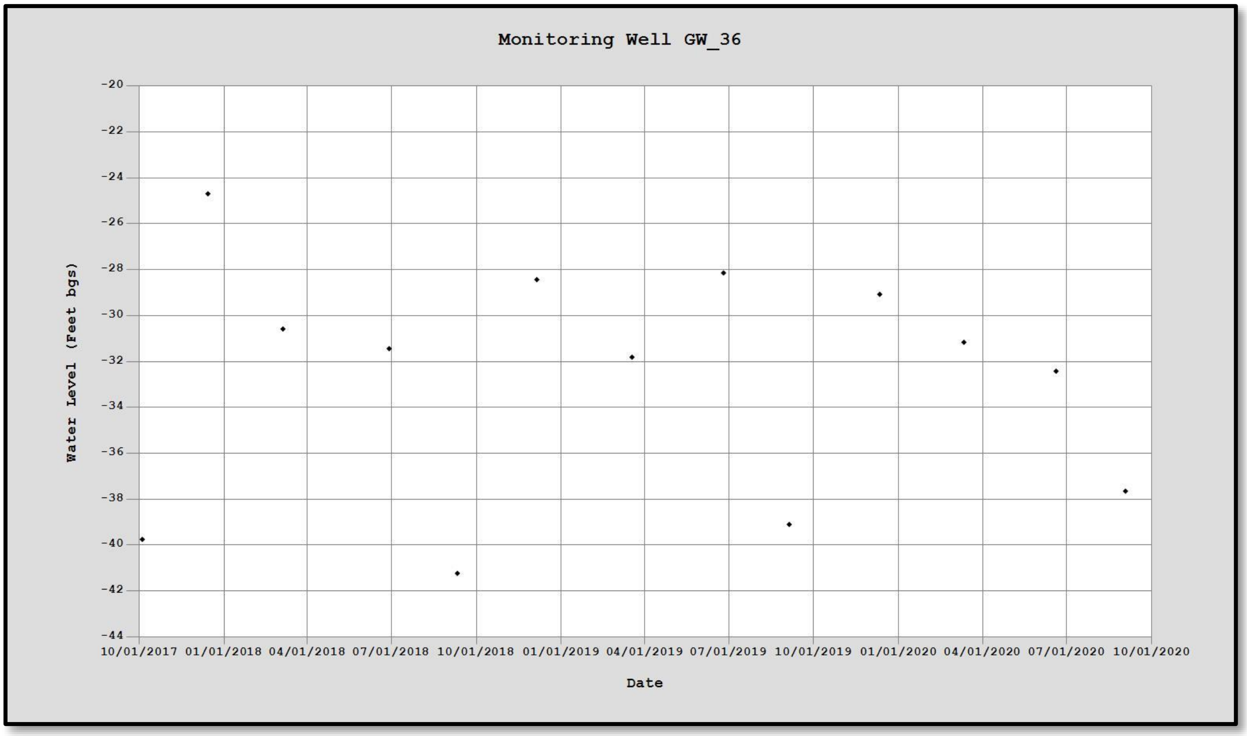

Figure 30. GW_36 hydrograph from WY2018-2020.

JOHNSON RECHARGE SITE

The Johnson site operated for 119 days (Nov 25, 2019-Feb 6, 2020, March 14-May 15, 2020), recharging 2,559 ac-ft at an average rate of 11.39 cfs. The ten spreading basins received 2,226 ac-ft and three active infiltration galleries received 333 ac-ft.

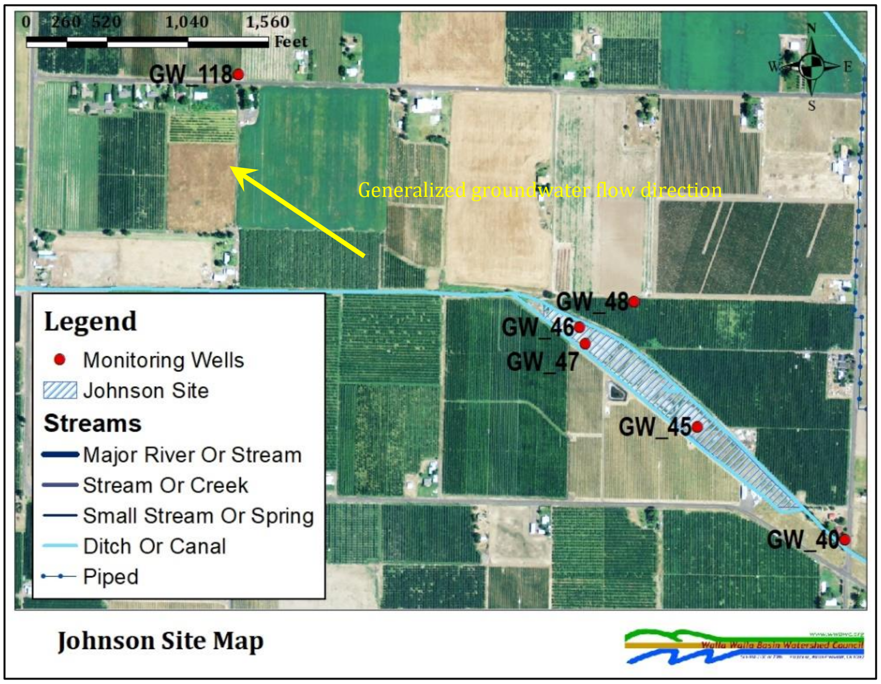

Figure 31. Johnson monitoring well locations.

Six monitoring wells are on or near the site (Figure 31). Groundwater levels under the Johnson site (GW_45, GW_46, and GW_47) are roughly 15-20 ft closer to the ground surface than at the upgradient well (GW_40). The shallowest groundwater levels in downgradient GW_118 are similar to levels under the Johnson site during the recharge season. Minimum or maximum groundwater levels have become shallower over time in five of the six monitoring wells to varying degrees in past years (Figures 32-36).

Groundwater monitoring wells (Figures 32-38) near the Johnson site were all observed to have a distinct increase in water levels shortly after operations began at the site. Monitoring wells closer to the spreading basins and infiltration galleries (GW_45-48) responded more rapidly and with greater magnitude increases and decreases in water levels than GW_118, located farther down-gradient. Up-gradient monitoring well GW_40 also showed a strong response to recharge operations with water levels increasing rapidly during recharge operations and decreasing after recharge operations were suspended. The up-gradient well also shows a direct response to White Ditch flows during the fall.

Water levels in GW_45, GW_46 and GW_47 were observed to decrease approximately 30-35 feet between approximately February 6 to March 14, 2020, when recharge operations were interrupted, and again at the end of recharge season. However, water levels after the end of recharge season do not decline as far as observed in February and March, likely due to continued White Ditch operations and active irrigation in the area. The rate of water level decrease was slow relative to the water level increase response at the beginning of recharge operations, suggesting that groundwater mounding was occurring beneath the site, which is consistent with the observed hydraulic response in the alluvial monitoring well network. WY 2020 seasonal groundwater fluctuations at the site were typically 30 to 40 feet, with the lowest groundwater levels occurring in early March and in August. The influence of the adjacent irrigation ditch operation and irrigation activities are apparent in the small increases and decreases in groundwater levels at the Johnson site monitoring wells during non-recharge months.

Water levels in GW_118 show improvements in the seasonal lows from WY 2010 through WY 2020 (Figure 38) indicating increased long-term water storage within the alluvial aquifer, potentially due to aquifer recharge activities. Water year 2015 was a drought year with decreased water availability for recharge and increased groundwater pumping to compensate for limited surface water. Water levels from WY 2016-2020 returned to the upward trend, showing increasing elevations of the annual lows in August.

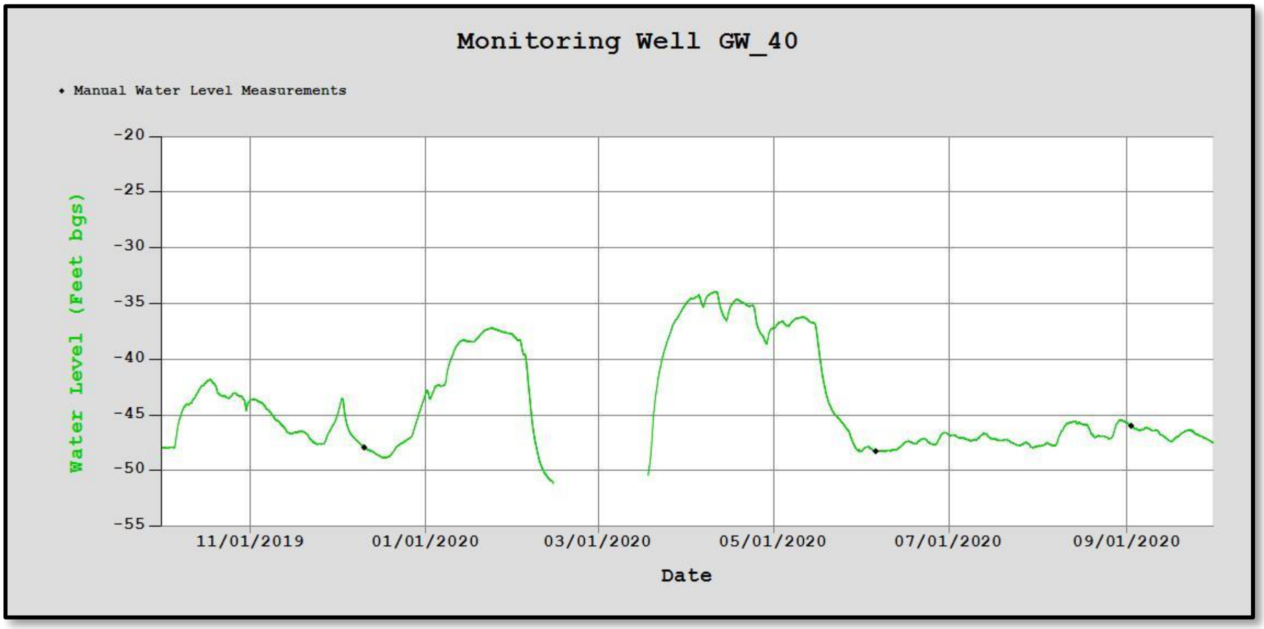

Figure 32. Hydrograph for monitoring well GW_40.

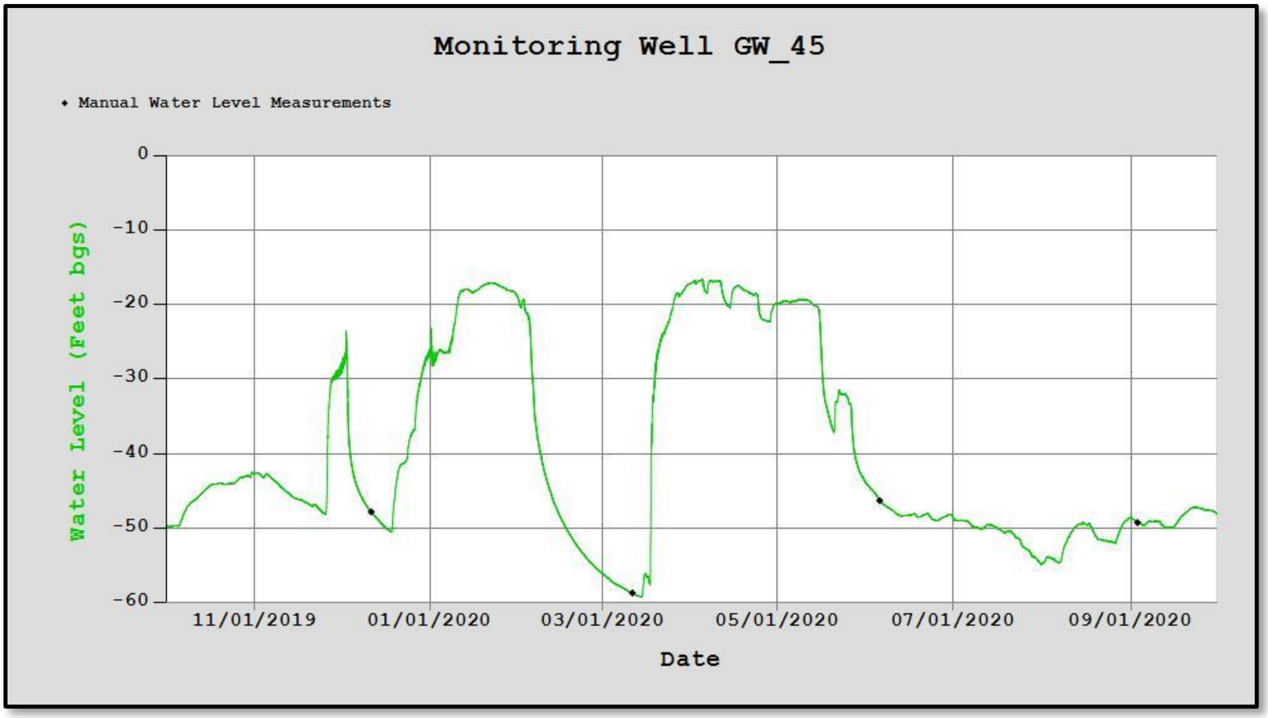

Figure 33. Hydrograph for monitoring well GW_45.

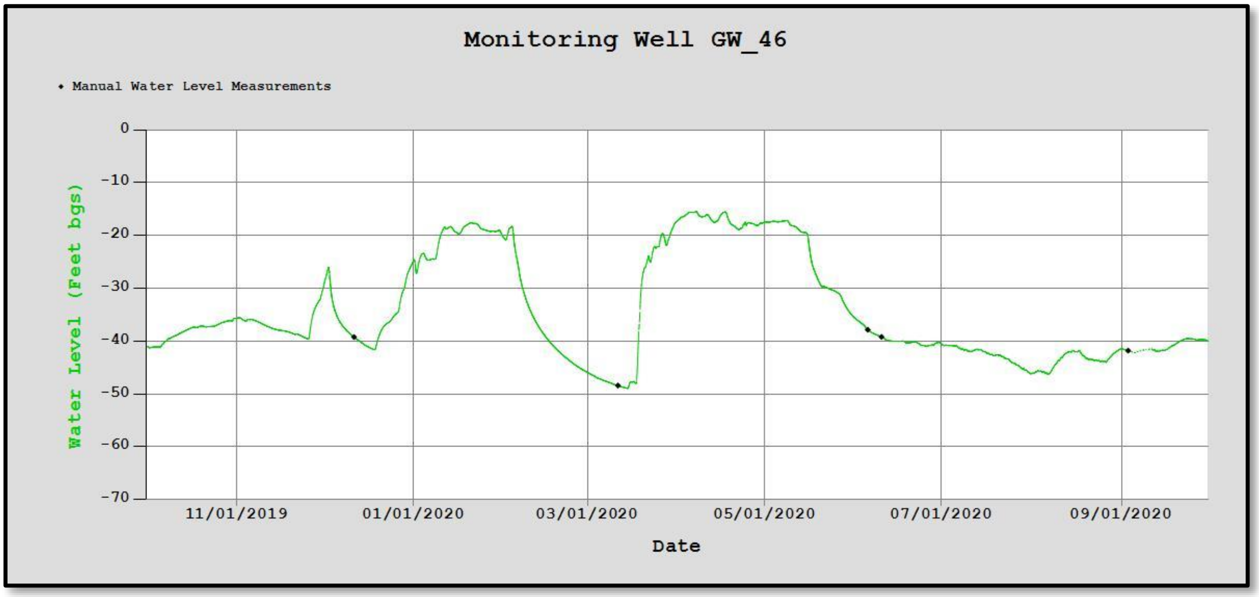

Figure 34. Hydrograph for monitoring well GW_46.

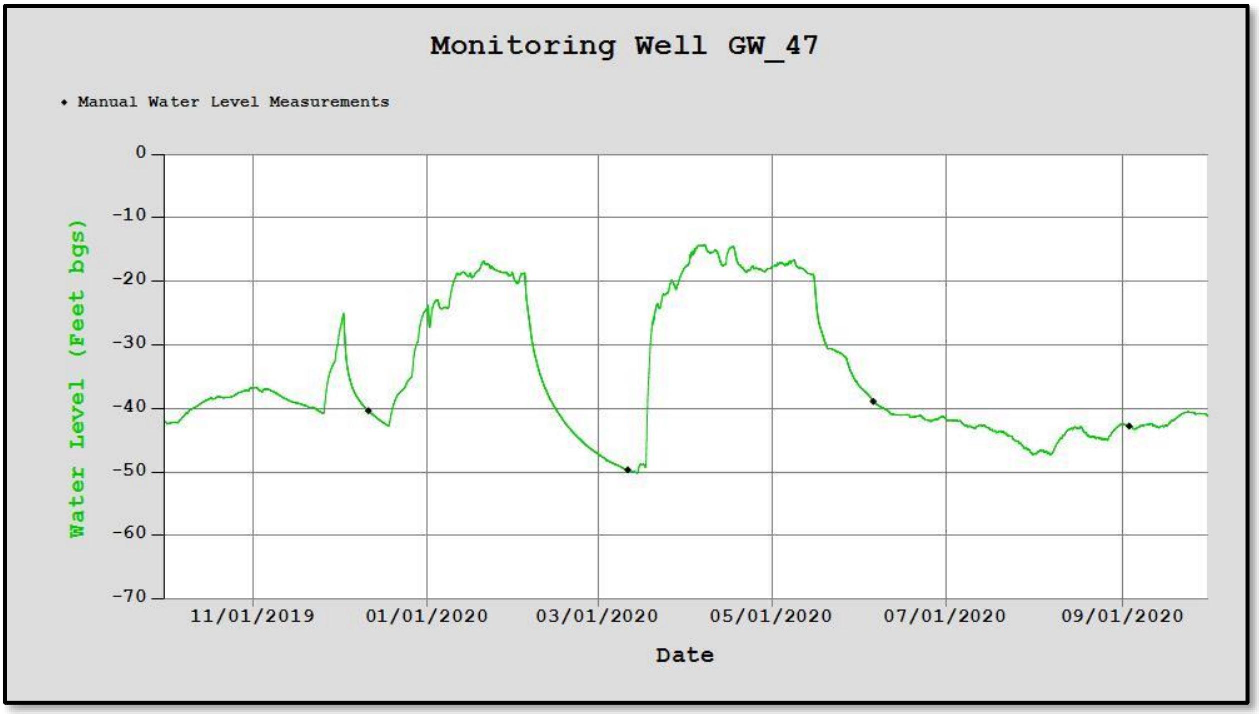

Figure 35. Hydrograph for monitoring well GW_47.

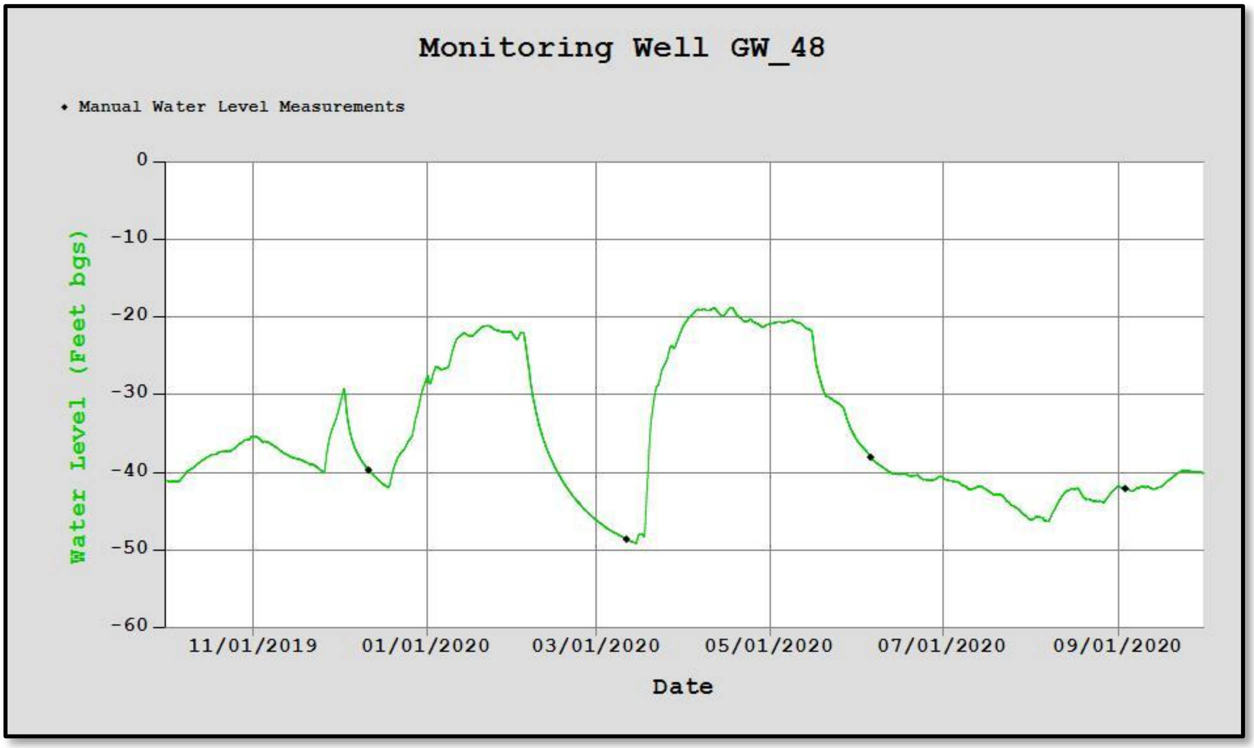

Figure 36. Hydrograph for monitoring well GW_48.

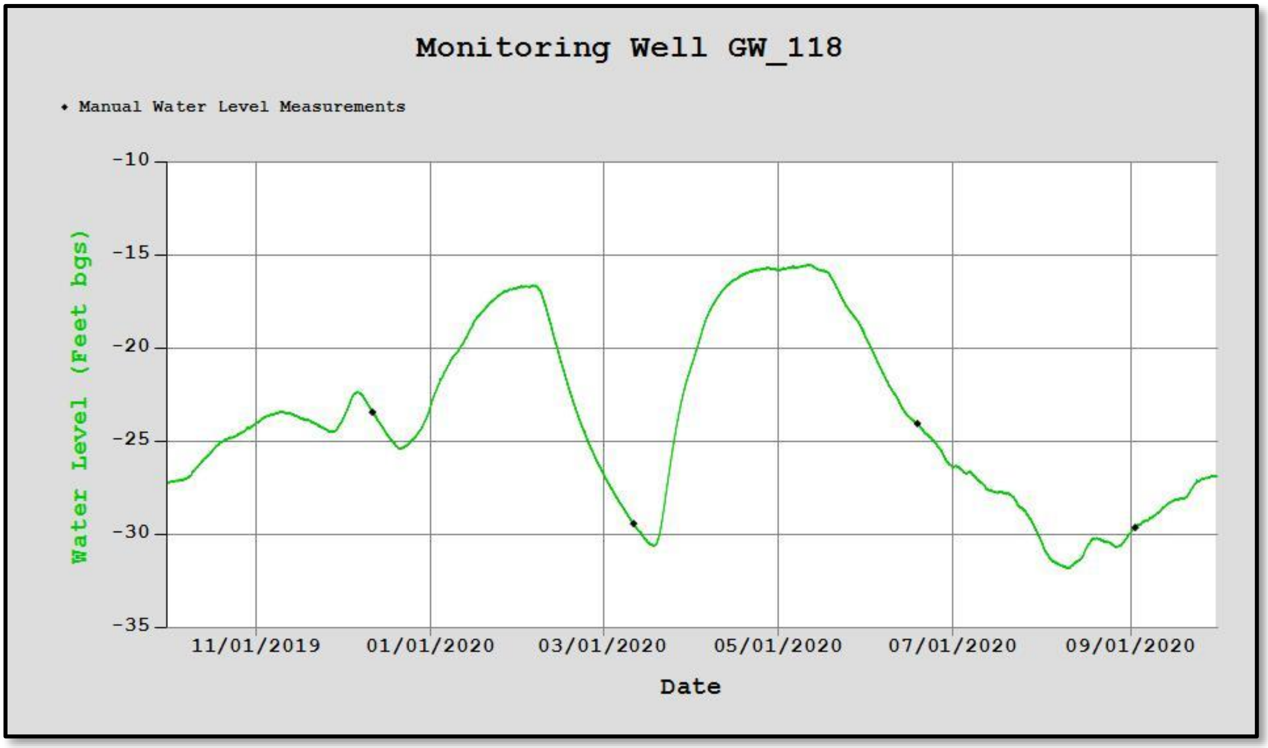

Figure 37. Hydrograph for monitoring well GW_118.

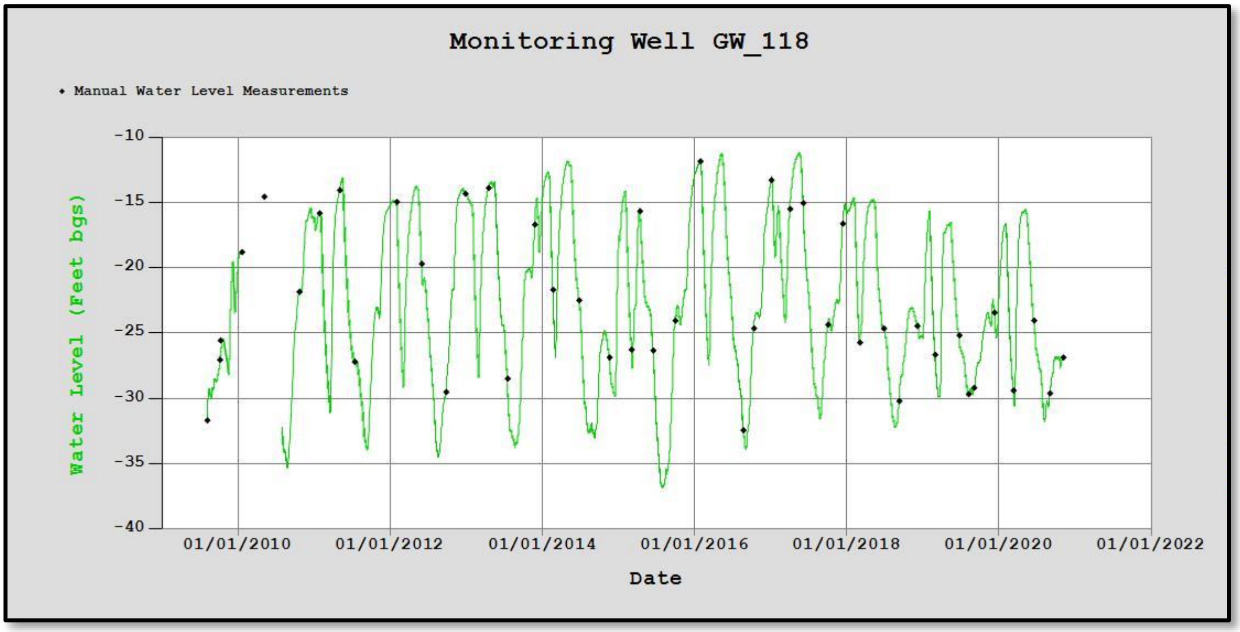

Figure 38. 2009–2020 hydrograph for GW_118.

LEFORE RECHARGE SITE

The LeFore Site only operated for 1.5 days (May 7-8, 2020), recharging 1 ac-ft, due to flood damage to the Eastside Diversion during the February 2020 high water event and also because of operational arrangements with the new landowner.

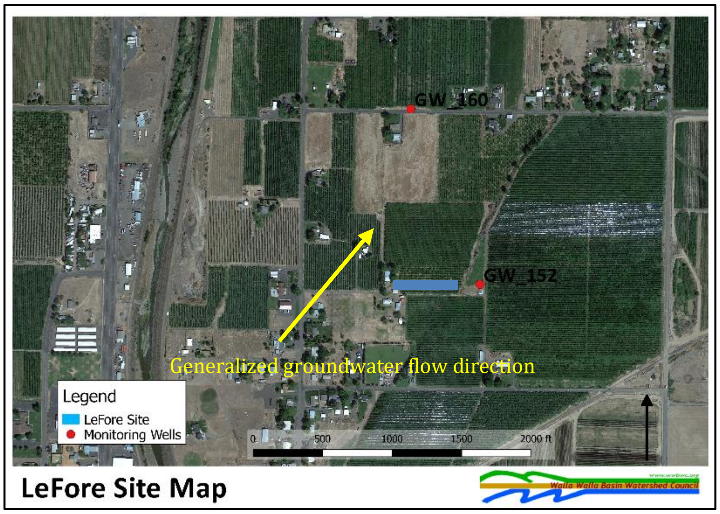

Figure 39. Lefore monitoring well locations.

GW_152 is downgradient and GW_160 is crossgradient of the site (Figure 39). At GW_152, one day of operations was not adequate to affect groundwater levels. However, the response to operations in WY 2018, when 78 ac-ft was recharged, is in sharp contrast to the years during which recharge did not occur (Figure 40). The reason for lower groundwater elevations measured during the 2020 water year is unknown but will be evaluated if the trend continues. The groundwater response to 2018 recharge operations was less pronounced at GW_160 but the annual declines are apparent in both seasonal highs and lows, with water levels dropping about 8-10 feet since 2015.

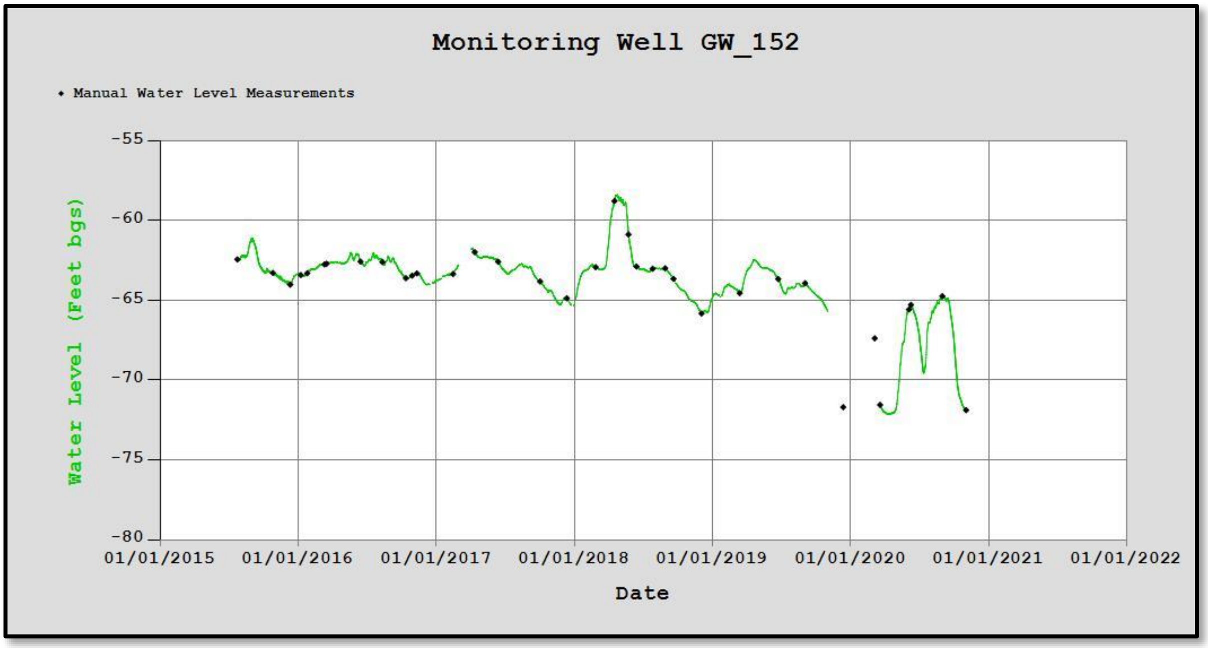

Figure 40. Groundwater levels in monitoring well GW_152 from 2015-2020. The notable increase during the spring of 2018 aligns with recharge operations at the Lefore site.

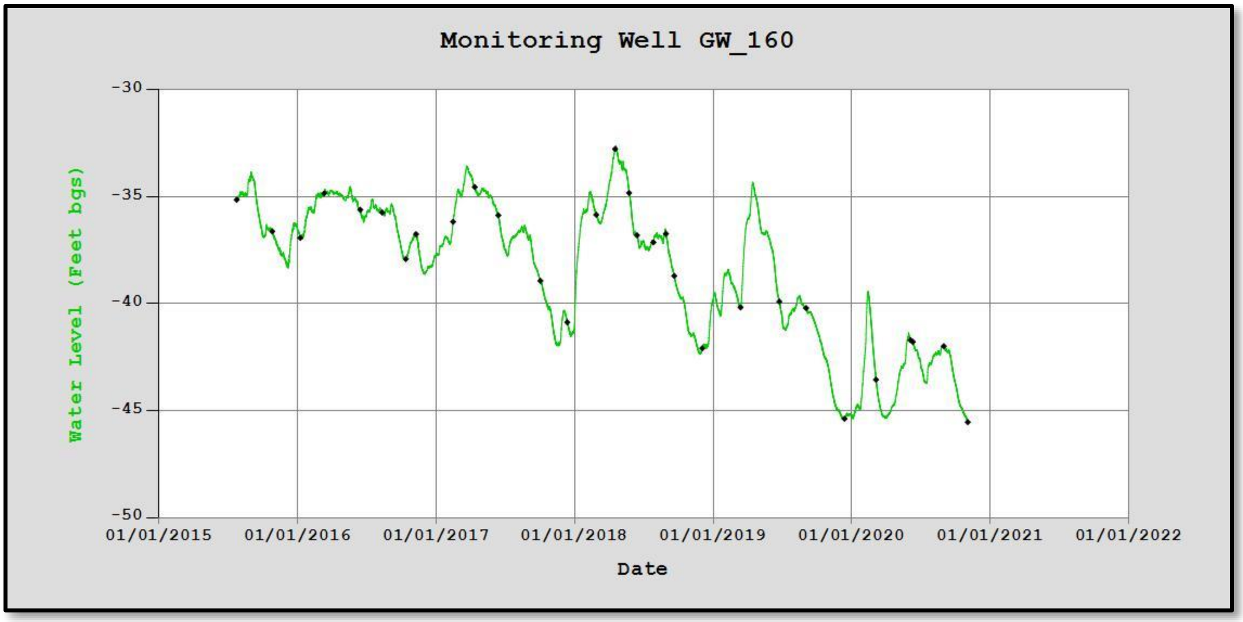

Figure 41. Groundwater levels in monitoring well GW_160 from 2015-2020.

LOCUST ROAD RECHARGE SITE

The Locust Road Site operated for 57 days (March 19-May 15, 2020), recharging 57 ac-ft at an average rate of 0.81 cfs.

GW_14 and GW_116 are approximately 0.4 miles upgradient and 0.8 miles downgradient of the site, respectively (Figure 42). Since recharge began in the spring of 2018 changes in groundwater levels solely due to recharge are not apparent in either well (Figures 43 and 44). Given the proximity of GW_14 to the Walla Walla River, fluctuations at GW_14 are most likely influenced by changing flows in the Walla Walla River.

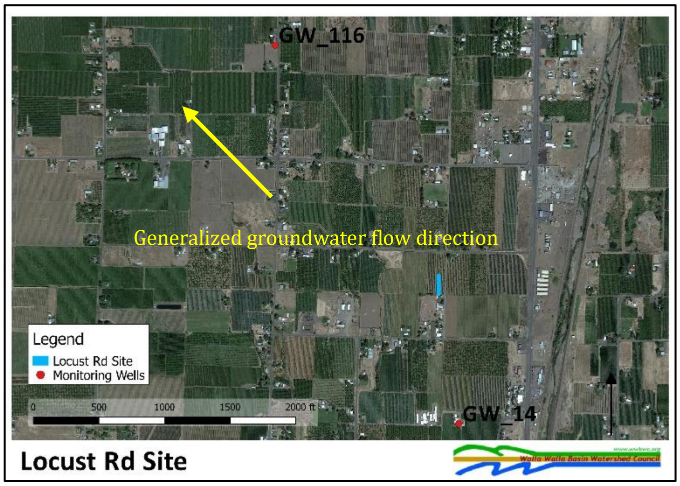

Figure 42. Locust Road monitoring well locations.

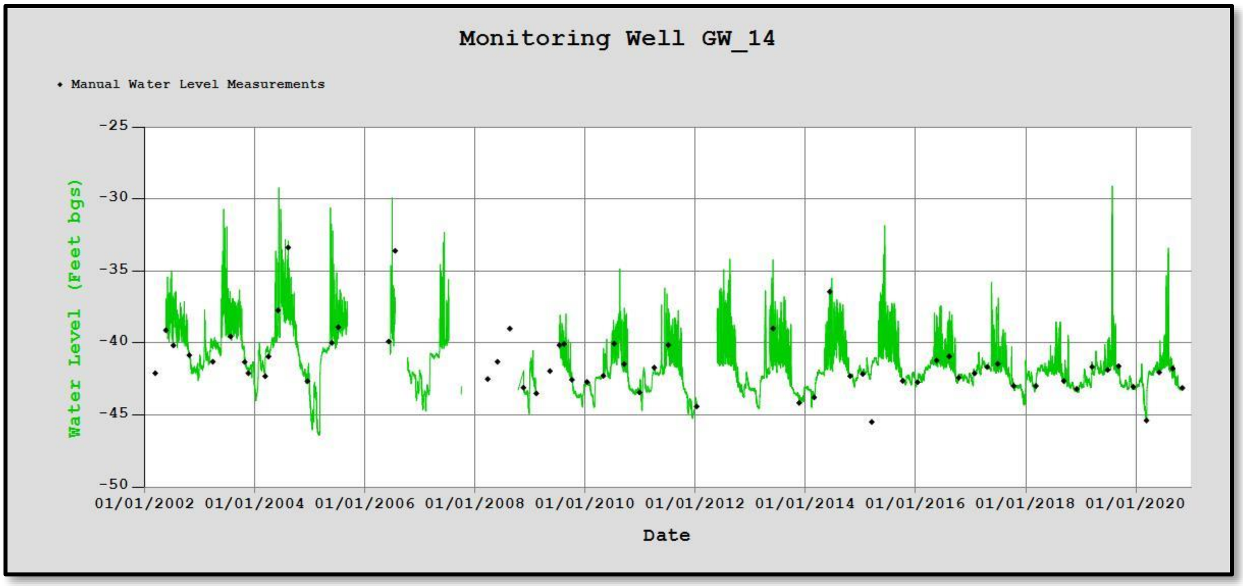

Figure 43. GW_14 hydrograph from 2002-2020.

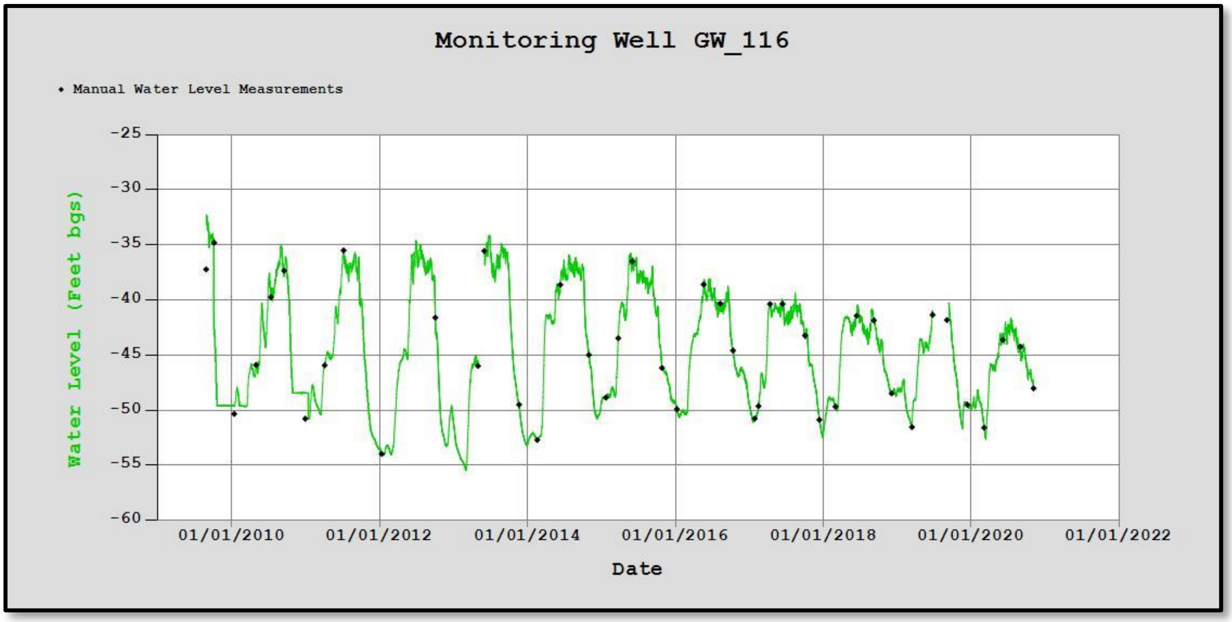

Figure 44. Hydrograph for GW_116 from 2009 to 2020.

MUD CREEK RECHARGE SITE

The Mud Creek site operated for 111 days (Dec 17, 2020-Feb 4, 2020, March 14-May 15, 2020) recharging 65 ac-ft at an average rate of 0.3 cfs.

Monitoring wells GW_170 and GW_117 are upgradient wells located approximately 0.1 and 0.9 miles from the site, respectively (Figure 45). The roughly 40-foot difference in groundwater levels between the two wells illustrate the highly variable conditions in the alluvial aquifer (Figures 46-47). At nearby GW_170, groundwater levels increased during the recharge season, particularly from March-May. However, that springtime elevation increase was present prior to Mud Creek recharge operations in WY2017, suggesting groundwater levels are responding to other factors as well (Figure 48). The 2009-2020 dataset from GW_117 also shows multiple influences (Figure 49).

Figure 45. Mud Creek monitoring well locations.

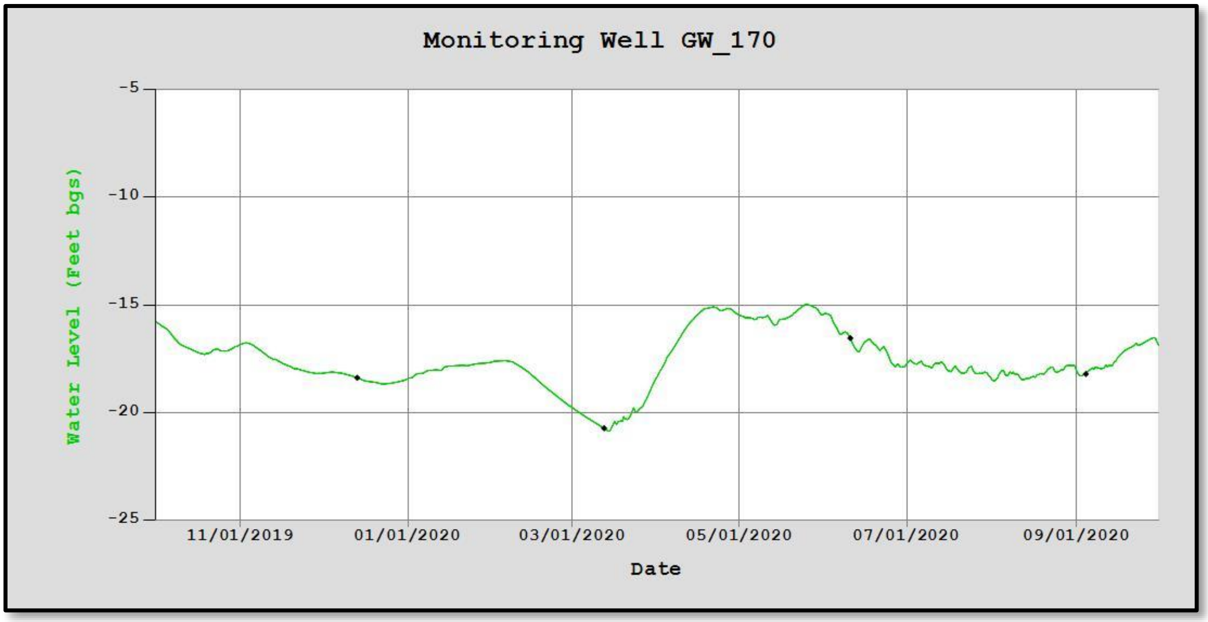

Figure 46. Hydrograph for monitoring well GW_170 during the 2020 water year.

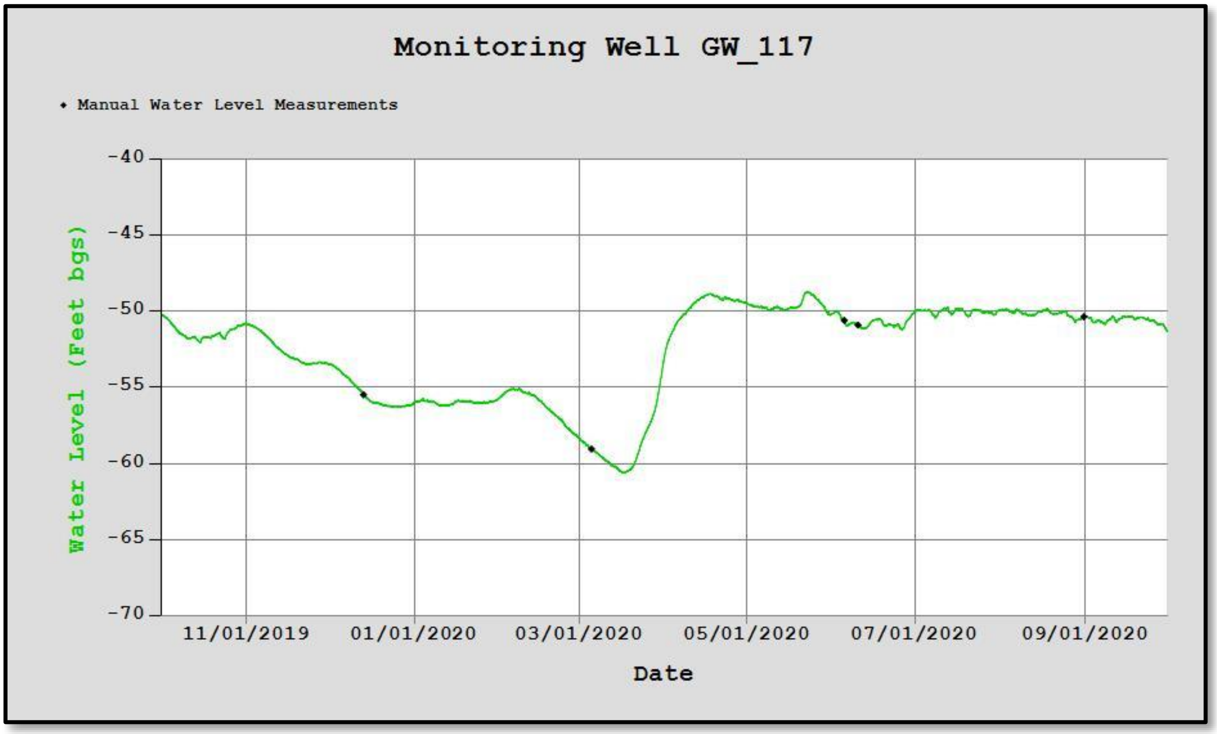

Figure 47. Hydrograph for GW_117 during the 2020 water year.

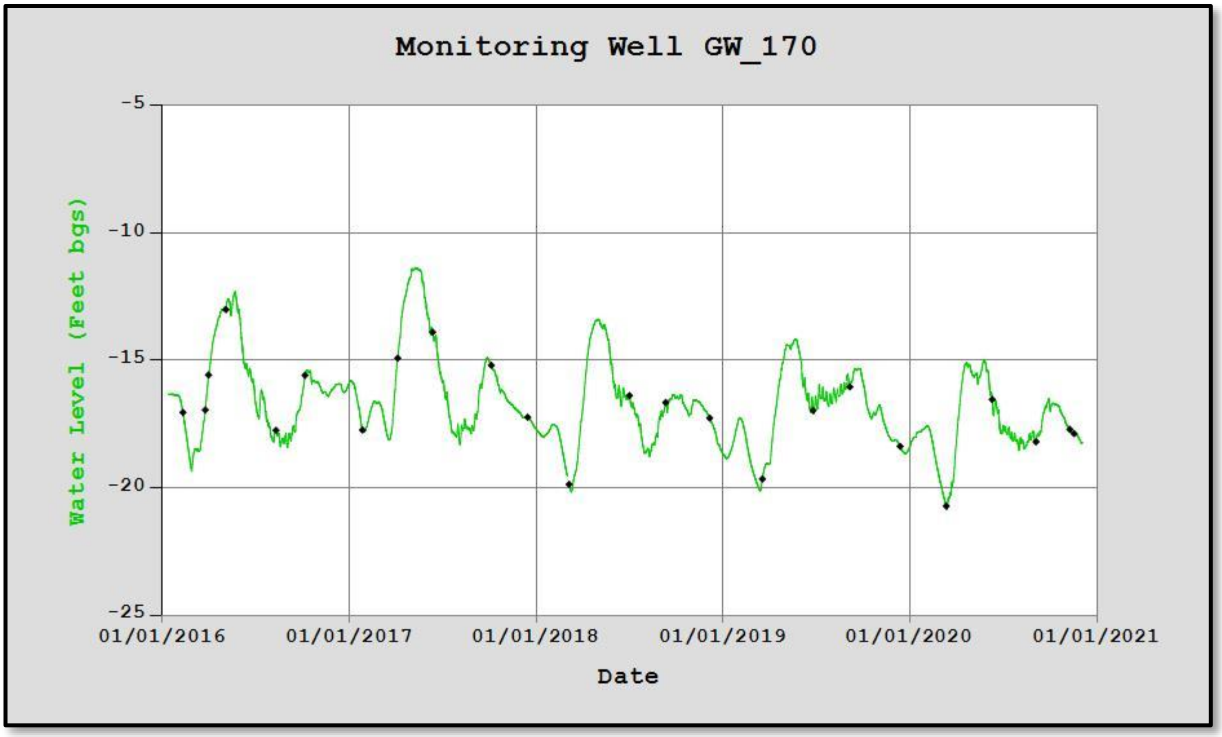

Figure 48. GW_170 hydrograph from 2016-2020.

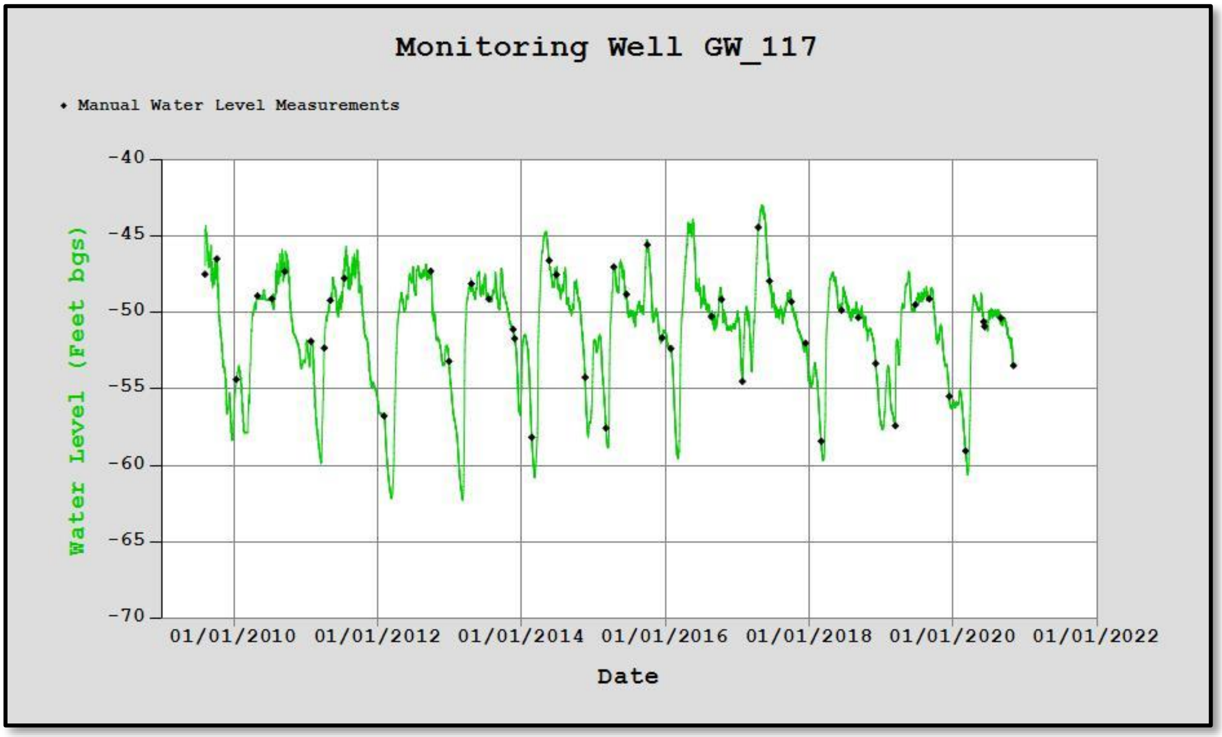

Figure 49. Water levels in monitoring well GW_117 from 2009-2020.

NW UMAPINE SITE

The NW Umapine site operated for 41 days (Dec 18, 2019-Jan 7, 2020, March 23-27, 2020, and April 23-May 15, 2020), recharging 103 ac-ft at an average rate of 1.27 cfs.

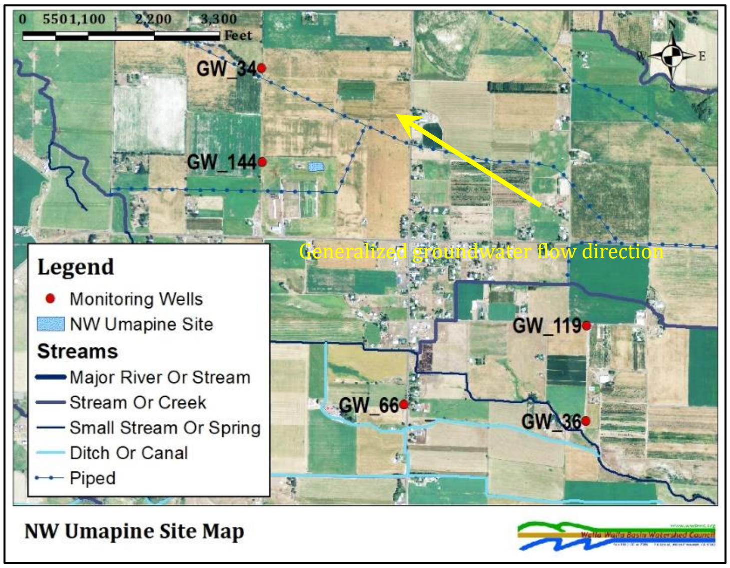

Figure 50. NW Umapine monitoring well locations

Five monitoring wells are in the area of the site (Figure 50). GW_66 is discussed under the Ringer Road site and GW_036 is reported under the Gallagher site because they are closer to those sites. The influence of recharge operations on water levels in GW_34 and GW_144 during the 2020 water year is not apparent (Figures 51-52). Looking at the longer-term datasets, the yearly minimum and maximum groundwater levels at GW_34, GW_144, and GW_119 appear relatively stable and, in the case of GW_144, annual lows show a possible upward trend (Figures 53-54). Groundwater levels at upgradient GW_119 appear similar in the years before and after NW Umapine recharge began in WY2014 (Figure 55).

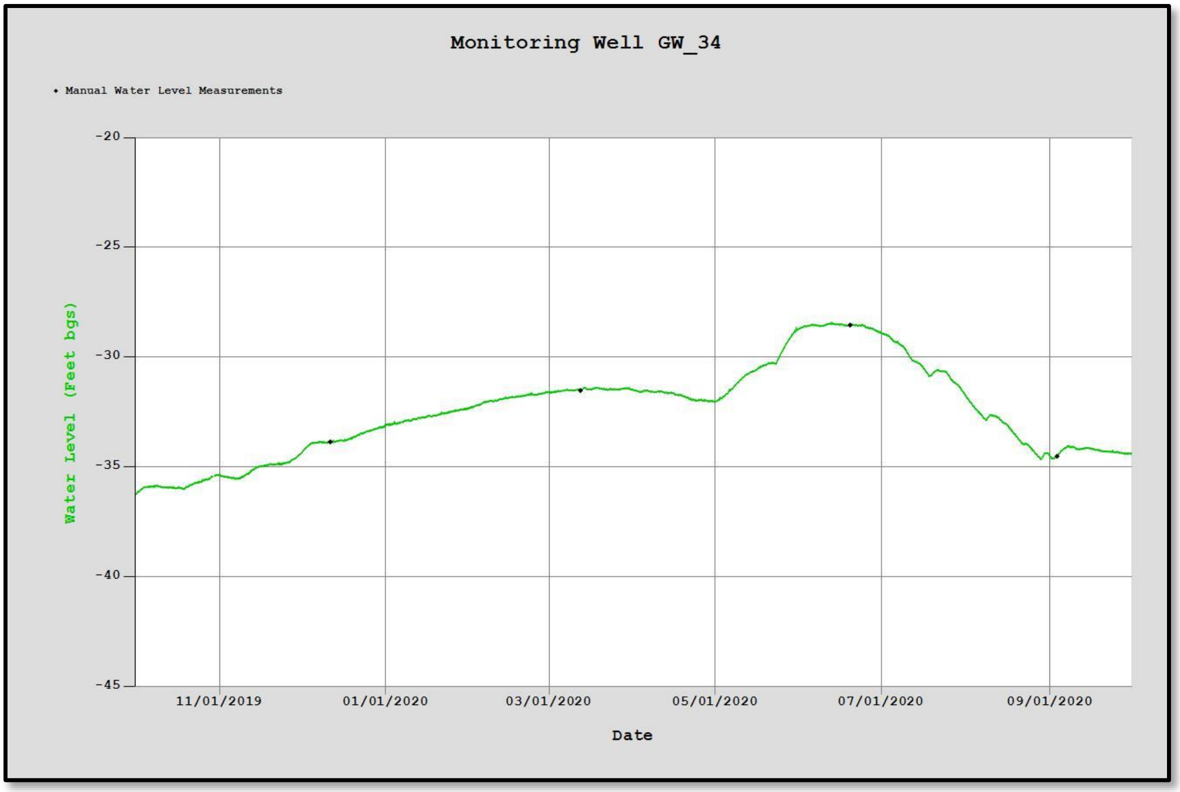

Figure 51. Hydrograph for monitoring well GW_34 during WY 2020.

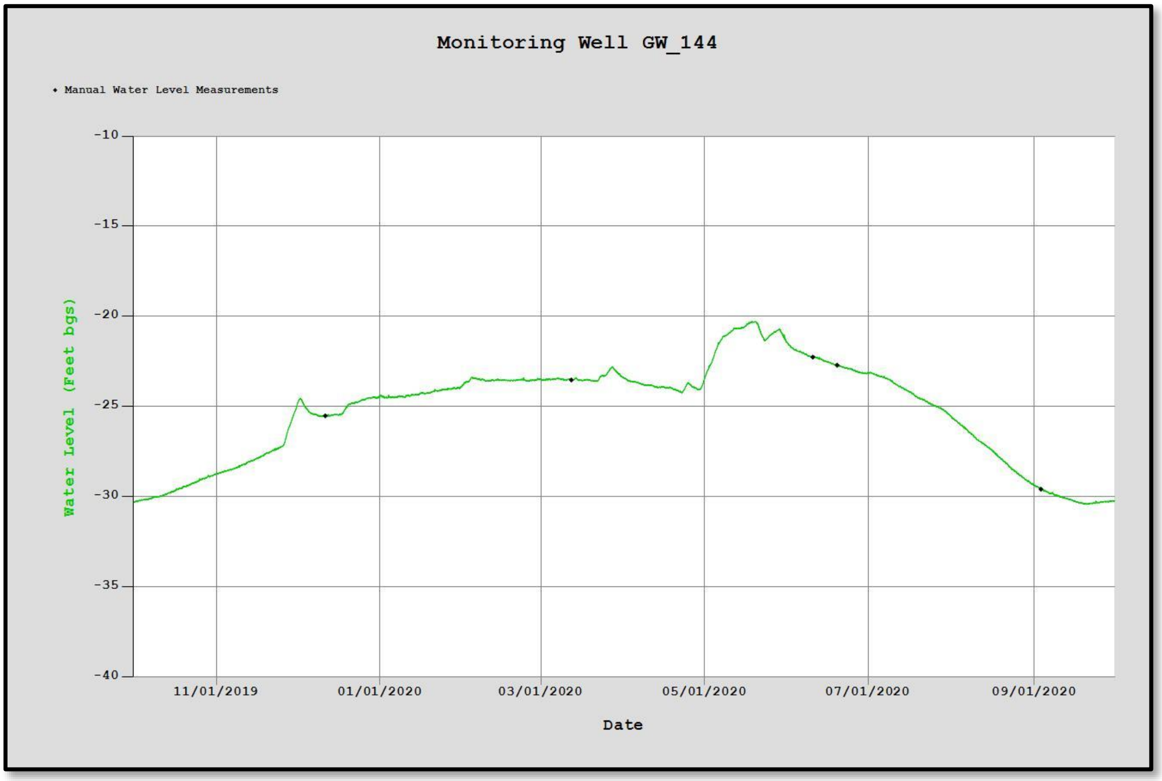

Figure 52. GW_144 water level during the 2020 water year.

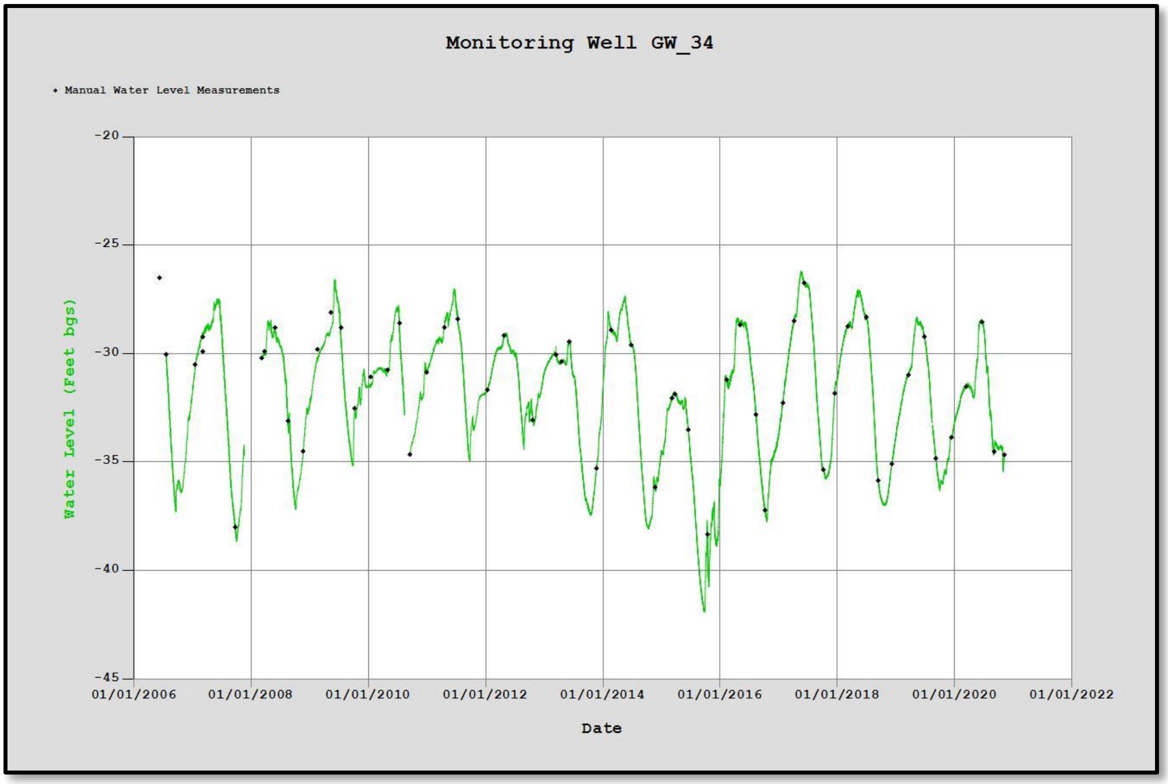

Figure 53. Hydrograph for monitoring well GW_34 from 2006-2020.

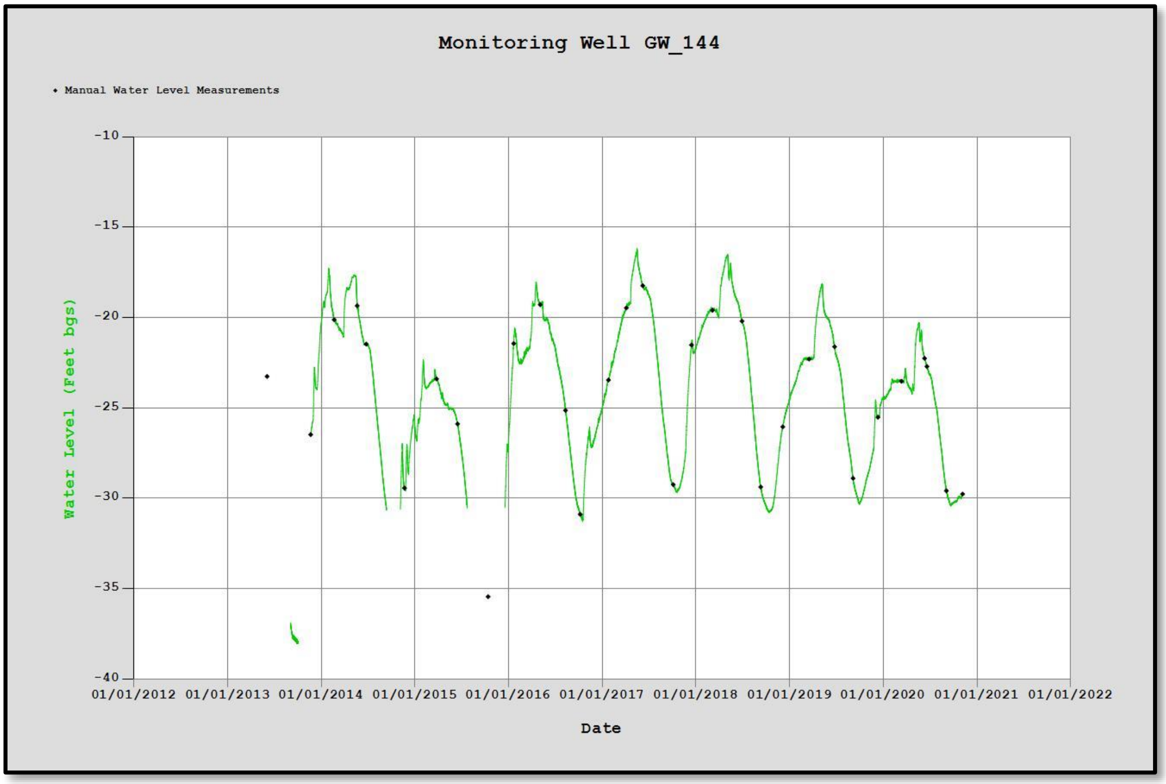

Figure 54. Water levels in GW_144 from 2013-2020.

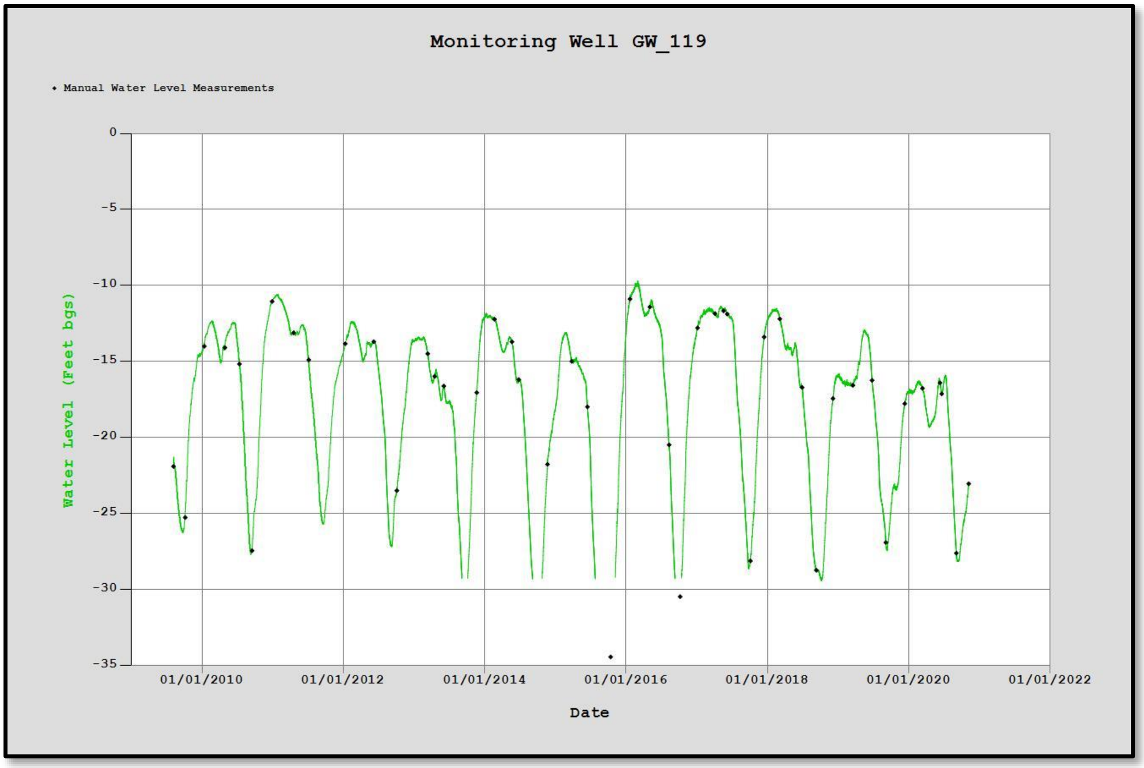

Figure 55. Groundwater levels in GW_119 from 2009-2020.

RINGER ROAD RECHARGE SITE

The Ringer Road site operated for 86 days (Jan 7-Feb 4, 2020, March 18-May 15, 2020), recharging 68 ac-ft of water at an average rate of 0.4 cfs.

GW_66 is cross-gradient of the site (Figure 56). Additional years of data are needed to assess the influence of this site, if any, on the cross-gradient well, although the annual lows were higher the last two years, potentially suggesting increased groundwater storage due to recharge operations, which began in WY 2019 (Figures 57-58).

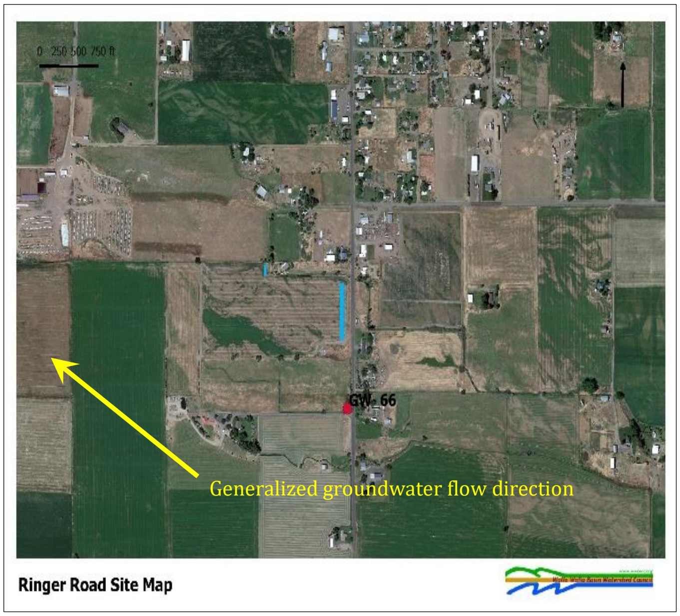

Figure 56. Ringer Road monitoring well location

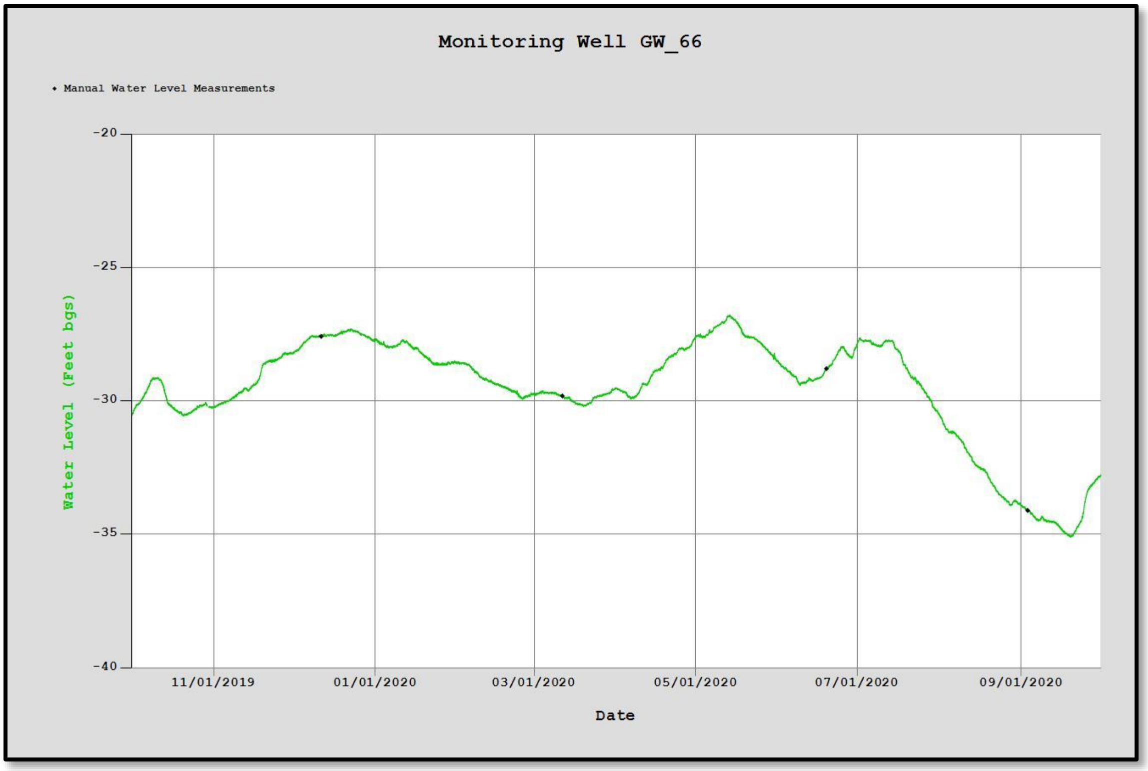

Figure 57. Water levels in GW_66 during the 2020 water year.

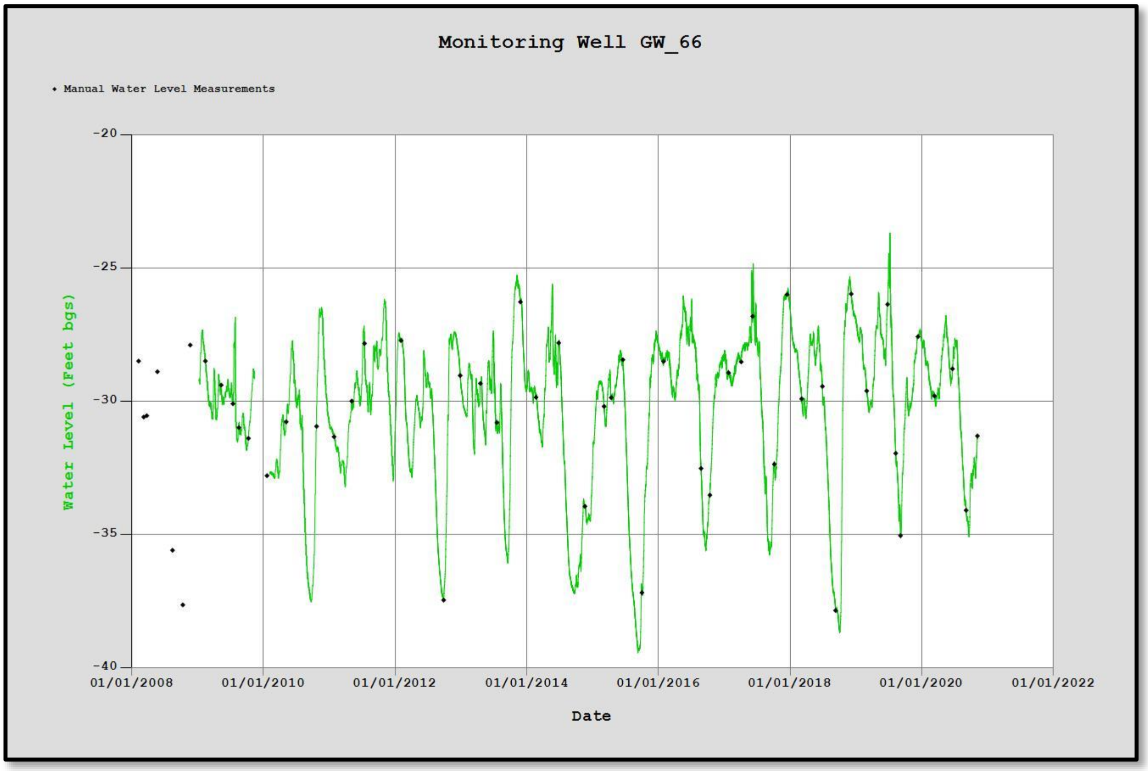

Figure 58. Water levels in GW_66 from 2008 to 2020.

TRIANGLE ROAD RECHARGE SITE

The Triangle Road site operated for 46 days (Jan 7-8, 2020, March 18-19, 2020, April 1-May 15, 2020), recharging 67 ac-ft of water at an average rate of 0.48 cfs.

Four monitoring wells are in the vicinity of the site: upgradient GW_117 (discussed under the Trumbull site), cross-gradient GW_143, and downgradient GW_170 (discussed under the Mud Creek site) and GW_171 (discussed under the Fruitvale site) (Figure 59[3]). Based on the small volume recharged and distances from the recharge site to GW_117, GW_143, and GW_171, the observed seasonal changes are unlikely in response to recharge operations. Figure 60 shows elevations in GW_143 during the 2020 water year; changes in elevation due to recharge operations are not apparent. Annual patterns of groundwater elevations in GW_143 are similar to the years before Triangle Road recharge operations began in 2017 (Figure 61). At GW_170, groundwater levels increased during the recharge season, particularly from March-May, which may be due to recharge at both Mud Creek and Triangle Road recharge sites (Figure 48). However, that springtime elevation increase was present prior to Triangle Road recharge operations in WY2017, suggesting groundwater levels are responding to other factors as well.

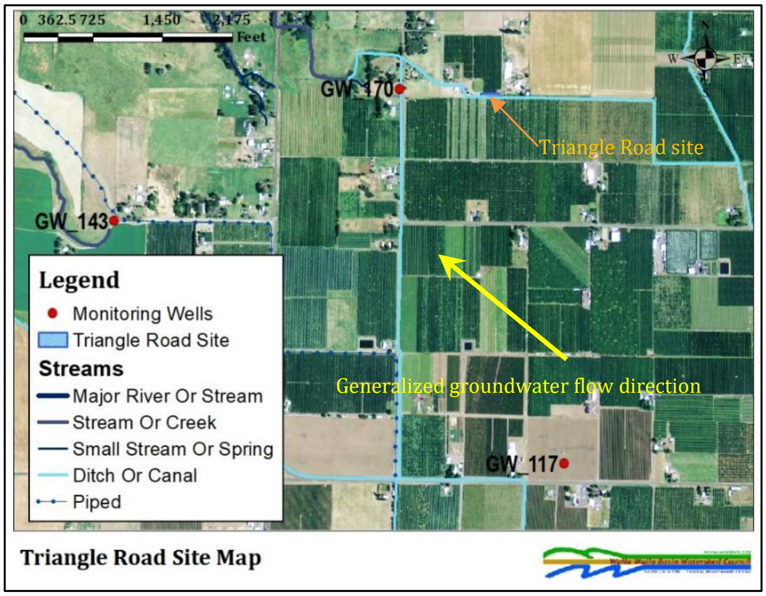

Figure 59. Triangle Road monitoring well locations (GW_171 not shown).

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[3] GW_171, one of the four monitoring wells associated with the Triangle Road site, is not shown in Figure 59 because it is 1.6 miles northwest of the site; the location of GW_171 can be seen in Figure 26.

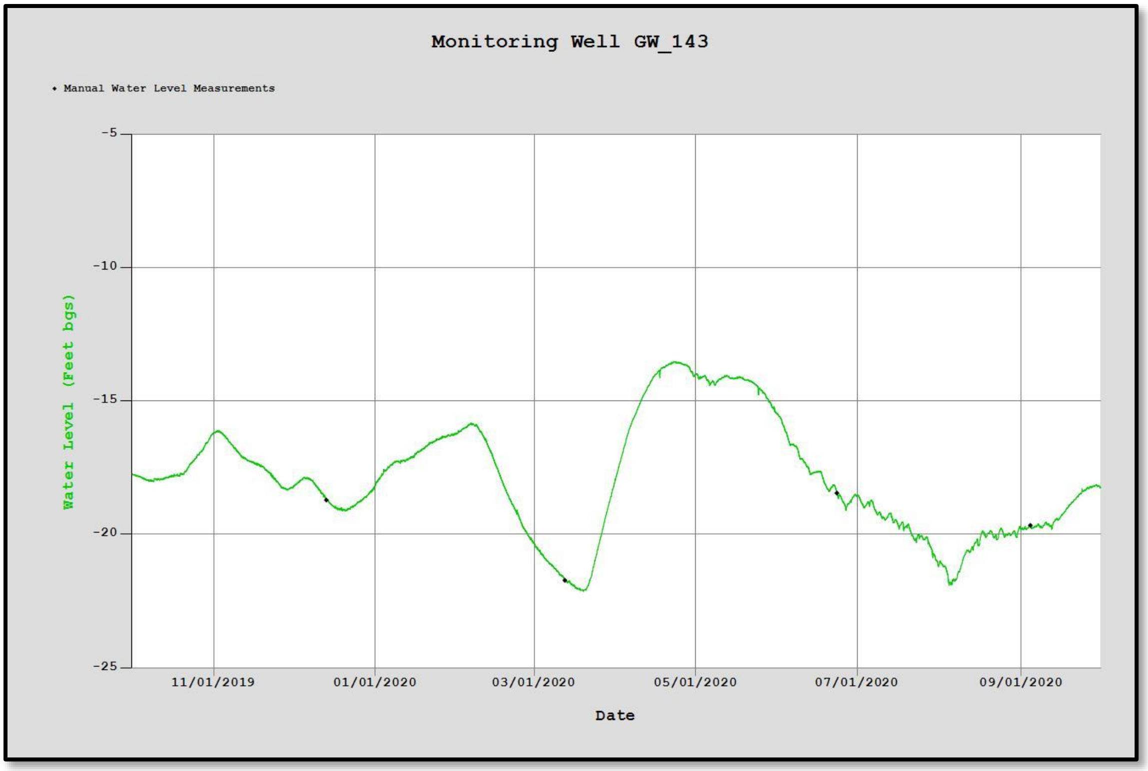

Figure 60. Groundwater elevations in GW_143 during water year 2020.

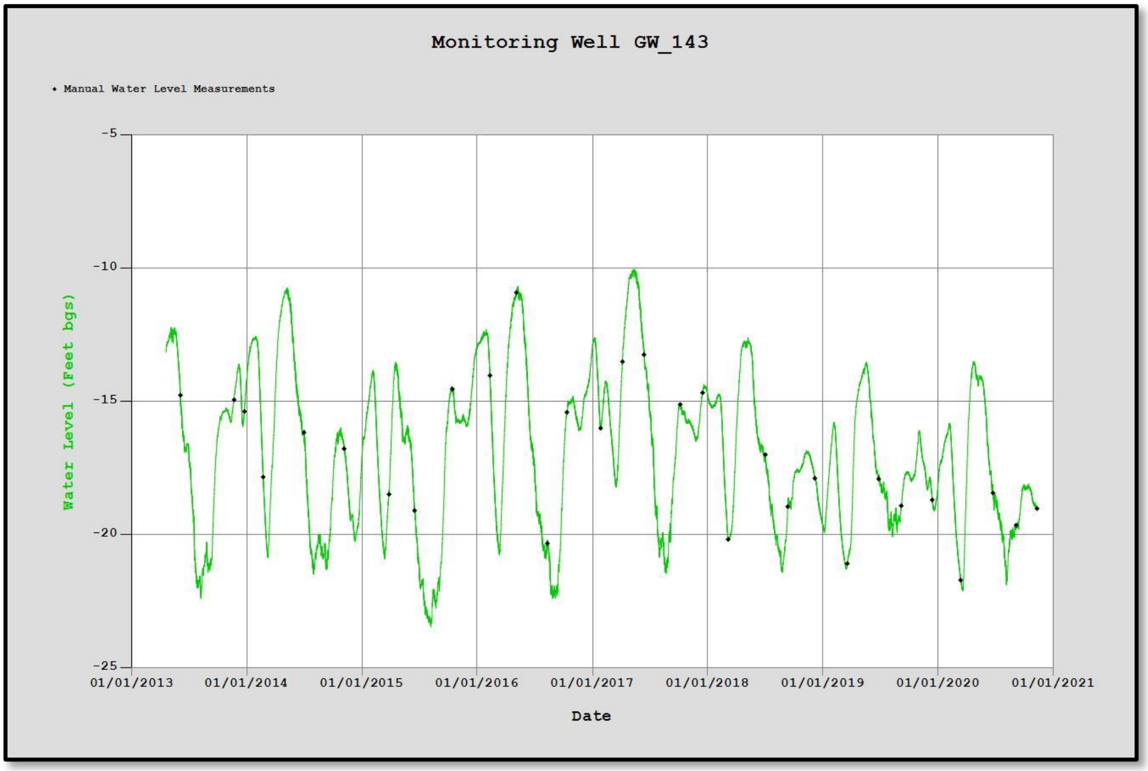

Figure 61. GW_143 hydrograph from 2013-2020.

TRUMBULL AQUIFER RECHARGE SITE

The Trumbull site operated for 64 days (Jan 7-Feb 4, 2020, March 18-April 23, 2020), recharging 92 ac-ft at an average rate of 0.72 cfs.

GW_117 is cross gradient and GW_142 is downgradient of the site (Figure 62). The two wells are approximately 0.6 miles apart. Water levels in GW_117 and GW_142 showed the influence of recharge operations, rising in early January, dropping during the February ditch turn off for diversion maintenance, and rising again during March and April (Figures 63 and 64).

Operation of the Trumbull site, which began in WY 2013, coincides with a rise in the lowest annual elevations at GW_117 (Figure 65). At GW_142, annual lows have remained stable while the peaks of the hydrograph have declined during the monitoring period (Figure 66).

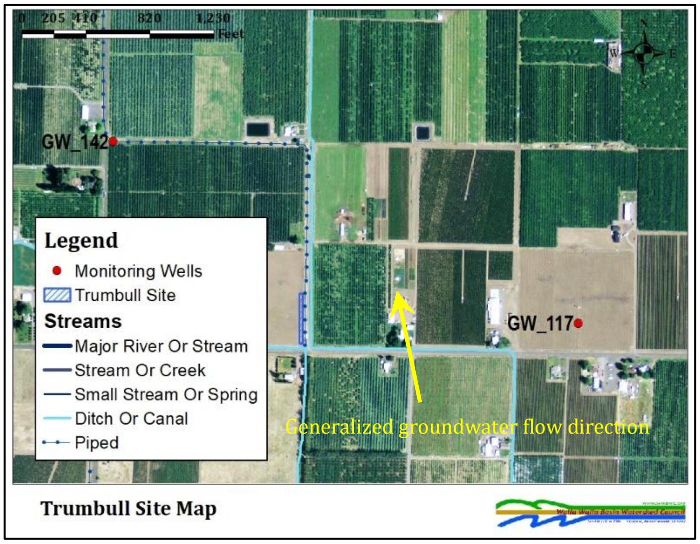

Figure 62. Trumbull monitoring well locations.

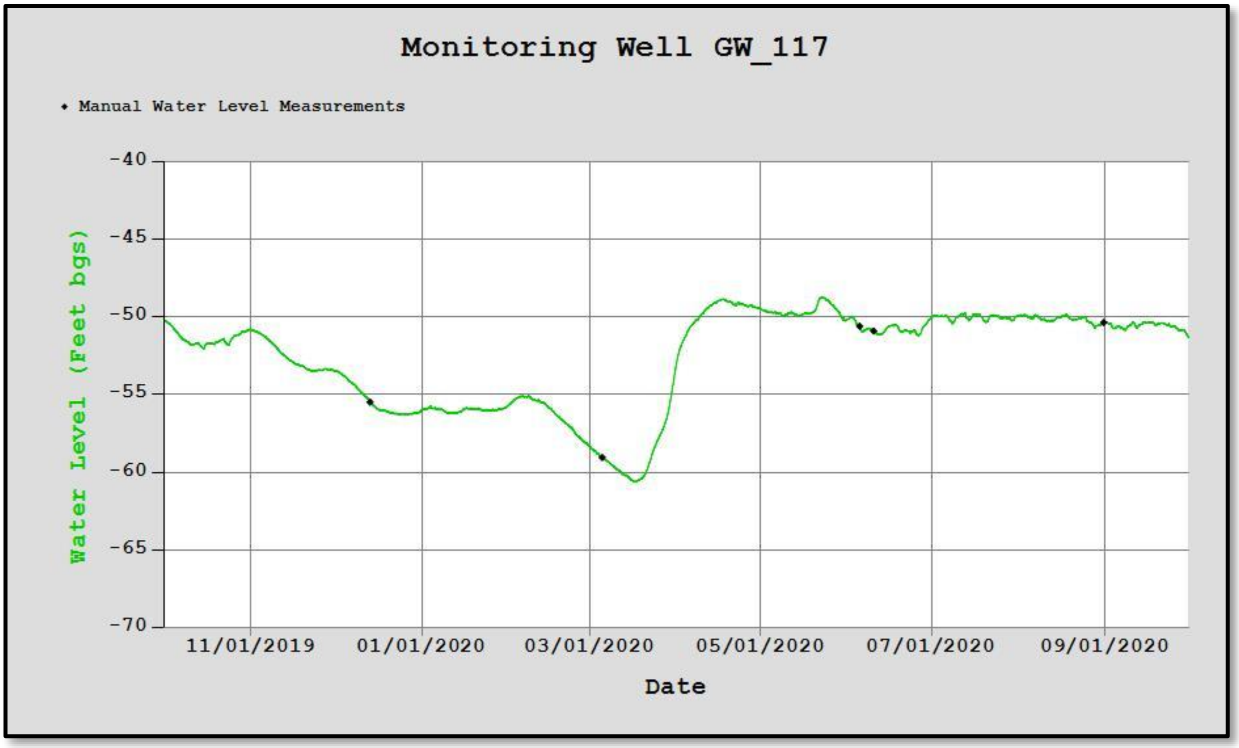

Figure 63. Hydrograph for monitoring well GW_117 during the 2020 water year.

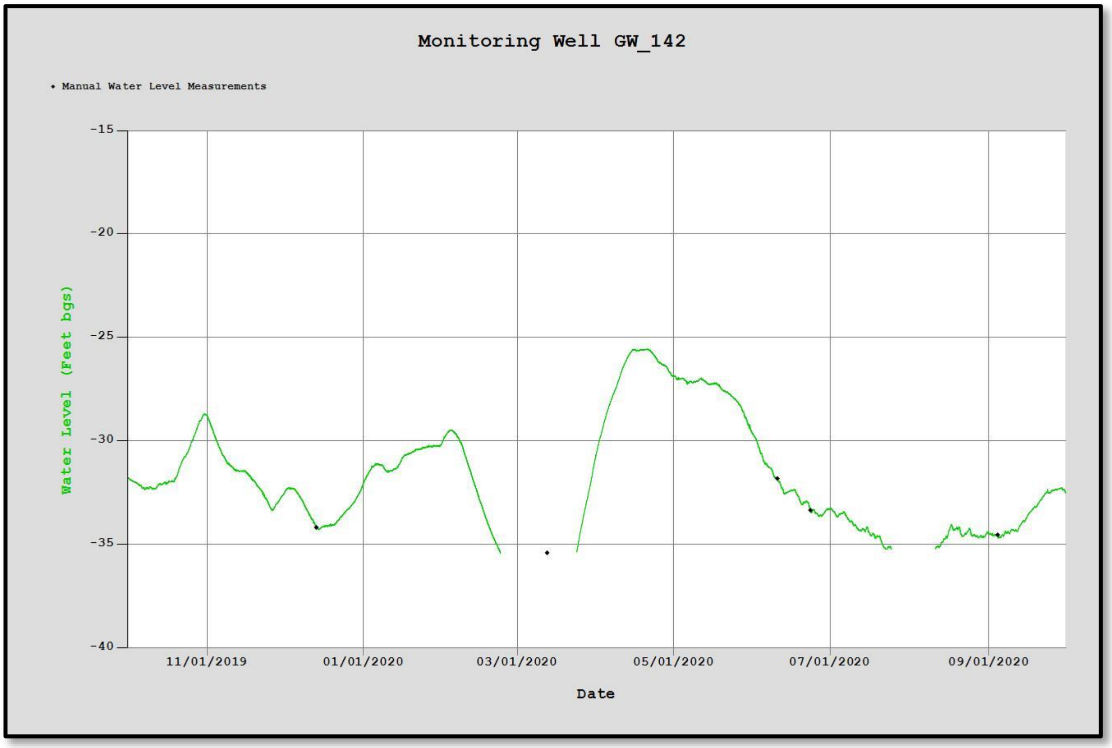

Figure 64. WY 2020 hydrograph for GW_142, downgradient of the Trumbull recharge site.

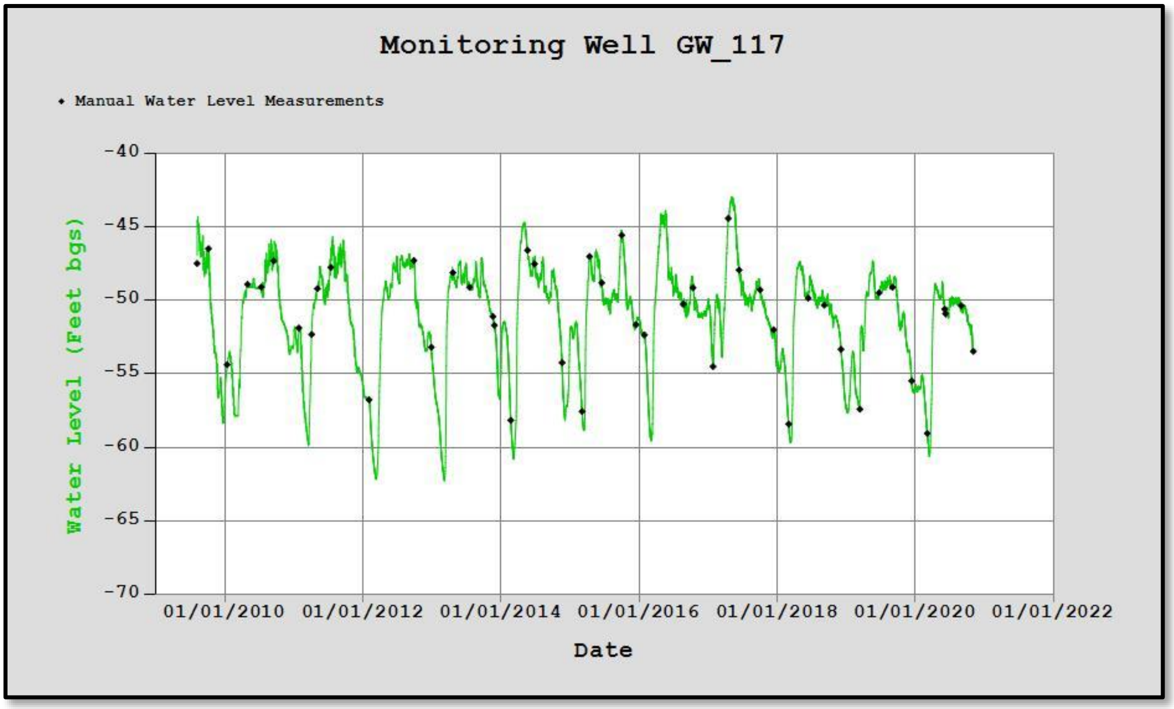

Figure 65. GW_117 hydrograph from 2009-2020.

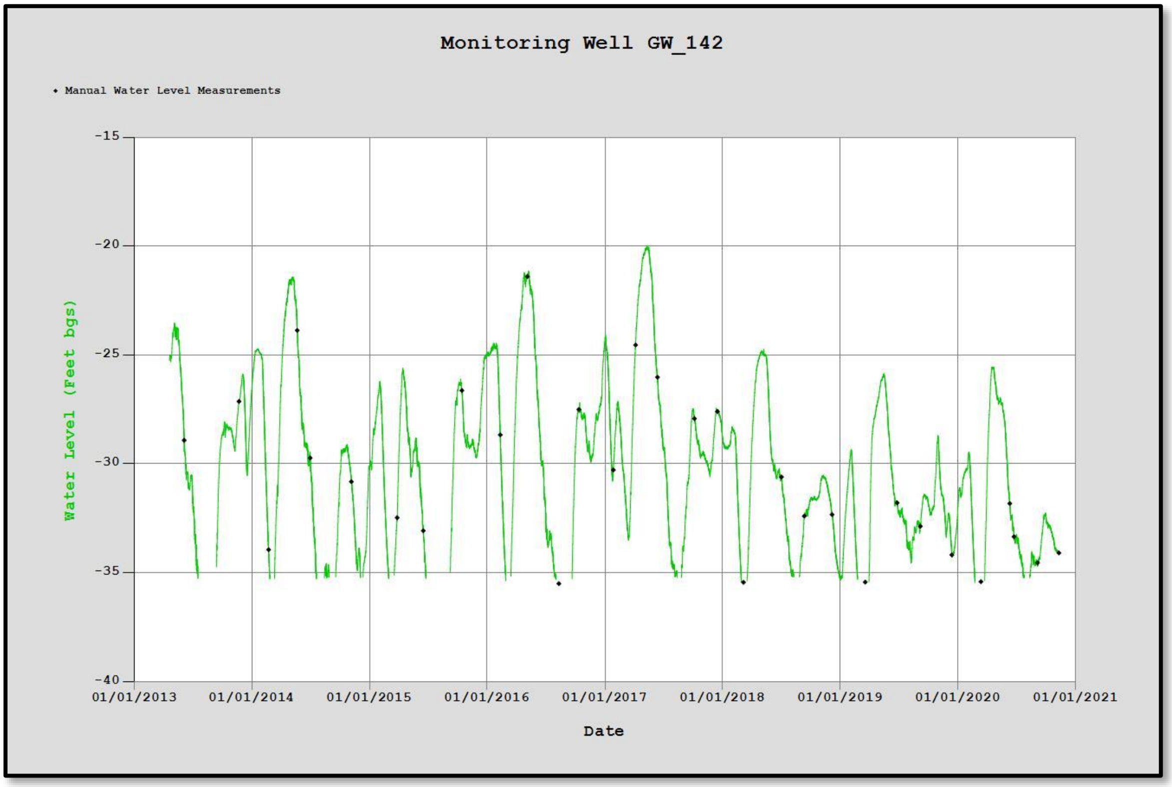

Figure 66. 2013-2020 hydrograph for GW_142. Data gaps represent times when the water level dropped below the elevation of the sensor.

Water Quality Monitoring

Methods

Samples were collected once before and once after the recharge season. Grab samples of source water at five locations and groundwater at 12 locations were collected on November 13-14, 2019 and June 9-10, 2020 (Figure 67). The five source water locations were as follows: Source Water #1 (Zerba Weir), Source Water #2 (Duff Weir, S-418), Source Water #3 (Huffman-Richartz Split), Source Water #4 (Fruitvale, S-318), and Source Water #5 (Eastside). The twelve groundwater wells were as follows: GW_046, GW_117, GW_119, GW_141, GW_142, GW_144, GW_151, GW_152, GW_160, GW_169, GW_170, and GW_171.

Table 5 shows the inorganic analytes and synthetic organic constituents evaluated as well as the analytical methods and detection limits for each. The Eco-Tracker analytical method is a cost-effective passive sampling tool that utilizes a resin capsule placed in the sample water for 24 hours to trap and exchange analytes of interest. At the lab, the chemical constituents are extracted with 50 mL 2M HCl. To further evaluate concentrations of ammonia, nitrate, copper and zinc, water samples were also analyzed using conventional methods (Table 5).

Table 5. Analyte list, analytical methods, and method reporting limits for WY 2020.

Inorganic Analyte	Analytical Method	Method Detection Limit (mg/L)	Analytical Method	Lab Reporting Limit (mg/L)
Ammonia-N (mg/L)	Eco-Tracker (Unibest)	1.2	SM 4500	0.05
Calcium (mg/L)	Eco-Tracker (Unibest)	0.31		
Copper (mg/L)	Eco-Tracker (Unibest)	0.01	EPA 200.8	0.001
Iron (mg/L)	Eco-Tracker (Unibest)	0.05		
Magnesium (mg/L)	Eco-Tracker (Unibest)	0.27		
Manganese (mg/L)	Eco-Tracker (Unibest)	0.01		
Nitrate-N(mg/L)	Eco-Tracker (Unibest)	0.09	EPA 300.0	0.1
Phosphorus (mg/L)	Eco-Tracker (Unibest)	0.02		
Potassium (mg/L)	Eco-Tracker (Unibest)	0.18		
Sodium (mg/L)	Eco-Tracker (Unibest)	0.17		
Sulfur (mg/L)	Eco-Tracker (Unibest)	0.02		
Zinc (mg/L)	Eco-Tracker (Unibest)	0.01	EPA 200.8	0.001

Synthetic Organic Constituents	Analytical Method*	Quantitation Limit (µg/L)
Azinphos-methyl	8321B	0.12
Chlorpyrifos	8270D	0.06
Diuron	8321B	0.06
Malathion	8270D	0.06

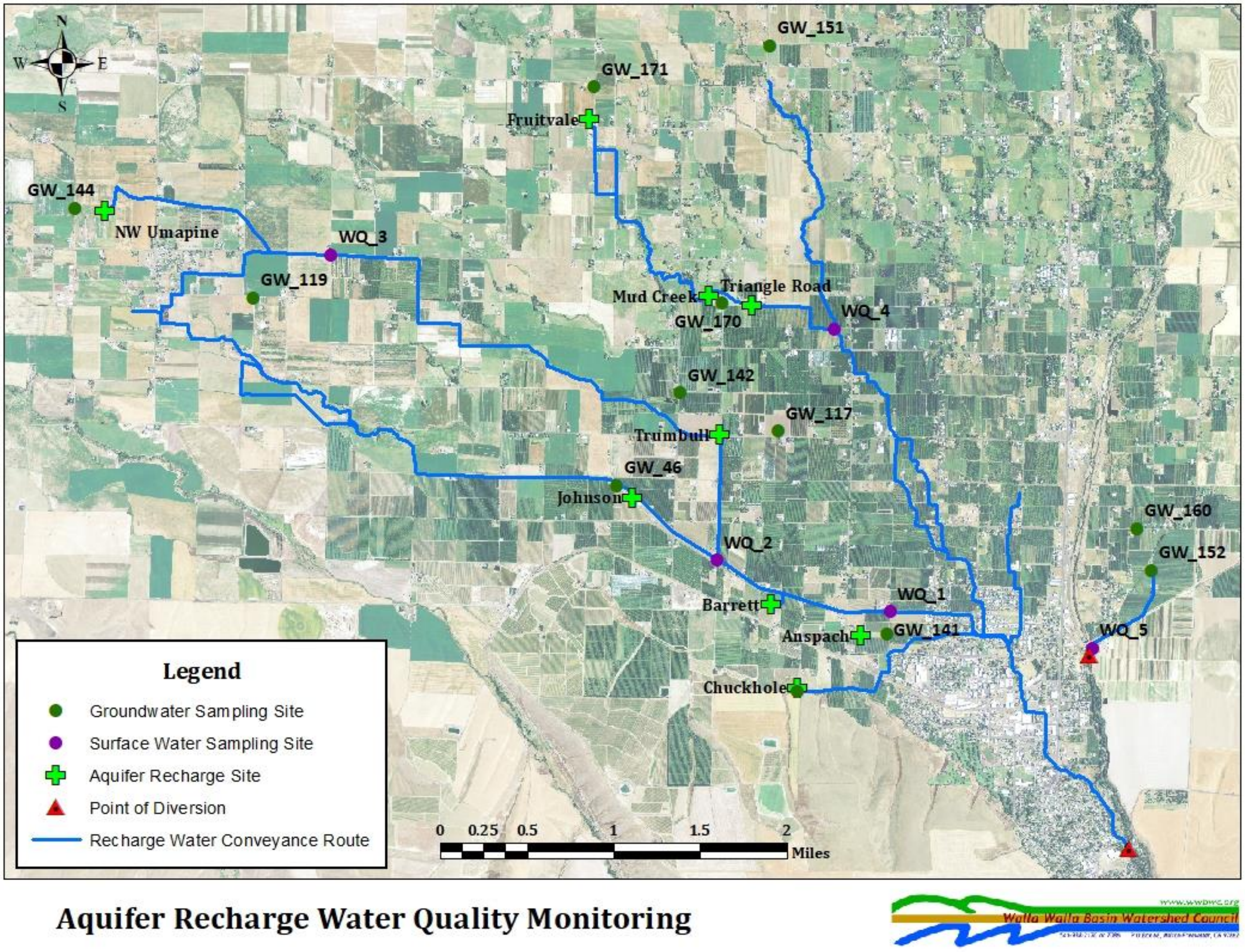

Figure 67. Water quality sampling locations for the managed aquifer recharge site in WY 2020.

To evaluate the impacts of managed aquifer recharge, contaminant concentrations in groundwater were compared to source water concentrations before and after the recharge season. Table 6 lists the source water sites relevant for each groundwater sampling site.

Table 6. Relevant source water site for each groundwater site.

GW site	Relevant source water sampling site
GW_141	WQ_1
GW_046	WQ_2
GW_142	WQ_2
GW_117	WQ_2
GW_119	WQ_2
GW_144	WQ_3
GW_170	WQ_4
GW_171	WQ_4
GW_151	WQ_4
GW_152	WQ_5
GW_160	WQ_5
GW_169	WQ_1

RESULTS

Tables 7-9 show groundwater quality results alongside the relevant source water results from the Unibest Eco-Tracker analysis. Figures 68-71 display the data in bar graphs for visual comparison of pre- and post-recharge samples and source water samples. The results of conventional lab analyses are shown in Tables 10 and 11. See Appendix B for all laboratory reports.

Field parameters were measured with a multi-parameter Thermo Scientific Orion meter. Results are shown in Table 12.

Table 7. Water quality data, Unibest methodology, GW_046, GW_117, GW_119, and GW_141. Relevant source water locations are identified in Table 6.

		Groundwater (mg/L)		**Source water (mg/L)**	
Site	**Constituent**	**Pre-recharge**	**Post-recharge**	**Pre-recharge**	**Post-recharge**
GW_046	Ca	5.05	4.17	3.87	3.59
GW_046	K	1.90	2.08	1.50	1.69
GW_046	Mg	1.64	1.57	1.36	1.30
GW_046	Na	2.28	11.70	2.16	8.90
GW_046	NO3	ND	ND	ND	0.04
GW_046	S	10.37	16.01	9.75	12.49
GW_046	Cu	ND	ND	ND	ND
GW_046	Fe	0.05	0.05	0.04	0.07
GW_046	Mn	ND	ND	ND	ND
GW_046	P	0.06	0.04	0.07	0.04
GW_046	Zn	ND	ND	ND	ND
GW_117	Ca	12.38	14.39	3.87	3.59
GW_117	K	3.49	4.12	1.50	1.69
GW_117	Mg	4.34	5.25	1.36	1.30
GW_117	Na	4.76	5.60	2.16	8.90
GW_117	NO3	5.20	4.85	ND	0.04
GW_117	S	13.39	16.92	9.75	12.49
GW_117	Cu	ND	ND	ND	ND
GW_117	Fe	0.03	0.06	0.04	0.07
GW_117	Mn	ND	ND	ND	ND
GW_117	P	0.07	0.06	0.07	0.04
GW_117	Zn	ND	ND	ND	ND
GW_119	Ca	26.84	33.35	3.87	3.59
GW_119	K	6.14	8.17	1.50	1.69
GW_119	Mg	10.03	13.29	1.36	1.30
GW_119	Na	13.30	8.90	2.16	8.90
GW_119	NO3	8.38	11.90	ND	0.04
GW_119	S	14.49	20.18	9.75	12.49
GW_119	Cu	ND	ND	ND	ND
GW_119	Fe	0.04	0.04	0.04	0.07
GW_119	Mn	ND	ND	ND	ND
GW_119	P	0.09	0.09	0.07	0.04
GW_119	Zn	ND	ND	ND	ND
GW_141	Ca	11.61	8.36	4.29	3.84
GW_141	K	3.70	3.50	1.77	1.86
GW_141	Mg	4.06	3.11	1.47	1.40
GW_141	Na	5.78	5.60	2.43	3.40
GW_141	NO3	1.30	1.20	ND	ND
GW_141	S	11.17	13.81	10.13	13.02
GW_141	Cu	ND	ND	ND	ND
GW_141	Fe	0.06	0.05	0.05	0.07
GW_141	Mn	ND	ND	ND	ND
GW_141	P	0.07	0.06	0.09	0.03
GW_141	Zn	ND	ND	ND	ND

Table 8. Water quality data, Unibest methodology, GW_142, GW_144, GW_151, GW_152. Relevant source water locations are identified in Table 6.

		Groundwater (mg/L)		Source water (mg/L)	
Site	**Constituent**	**Pre-recharge**	**Post-recharge**	**Pre-recharge**	**Post-recharge**
GW_142	Ca	6.08	5.94	3.87	3.59
GW_142	K	2.07	2.26	1.50	1.69
GW_142	Mg	2.13	2.16	1.36	1.30
GW_142	Na	2.56	3.40	2.16	8.90
GW_142	NO3	0.86	0.75	ND	0.04
GW_142	S	10.50	13.31	9.75	12.49
GW_142	Cu	ND	ND	ND	ND
GW_142	Fe	0.04	0.05	0.04	0.07
GW_142	Mn	ND	ND	ND	ND
GW_142	P	0.07	0.05	0.07	0.04
GW_142	Zn	ND	ND	ND	ND
GW_144	Ca	32.94	37.98	3.80	4.12
GW_144	K	7.84	9.35	1.53	1.86
GW_144	Mg	12.38	14.67	1.34	1.49
GW_144	Na	18.23	11.70	2.07	11.70
GW_144	NO3	12.42	13.87	ND	ND
GW_144	S	13.38	20.52	9.94	12.71
GW_144	Cu	ND	0.01	ND	ND
GW_144	Fe	0.04	0.06	0.05	0.08
GW_144	Mn	ND	ND	ND	ND
GW_144	P	0.10	0.12	0.04	0.10
GW_144	Zn	ND	ND	ND	ND
GW_151	Ca	15.72	14.13	3.44	3.81
GW_151	K	3.72	4.02	1.26	1.84
GW_151	Mg	5.51	5.11	1.24	1.37
GW_151	Na	5.10	8.90	1.95	5.60
GW_151	NO3	7.34	5.23	ND	ND
GW_151	S	15.23	15.70	10.47	12.86
GW_151	Cu	ND	ND	ND	ND
GW_151	Fe	0.04	0.06	0.05	0.08
GW_151	Mn	ND	ND	0.01	ND
GW_151	P	0.07	0.05	0.06	0.07
GW_151	Zn	ND	ND	ND	ND
GW_152	Ca	18.40	14.39	3.64	3.81
GW_152	K	3.34	3.29	1.38	2.05
GW_152	Mg	6.65	5.24	1.30	1.38
GW_152	Na	8.73	8.90	1.97	5.60
GW_152	NO3	3.93	3.14	ND	ND
GW_152	S	12.62	14.07	10.25	12.63
GW_152	Cu	ND	ND	ND	ND
GW_152	Fe	0.04	0.09	0.05	0.06
GW_152	Mn	ND	ND	ND	0.01
GW_152	P	0.06	0.05	0.05	0.03
GW_152	Zn	ND	ND	ND	ND

Table 9. Water quality data, Unibest methodology, GW_160, GW_169, GW_170, GW_171. Relevant source water locations are identified in Table 6.

Site	Constituent	Groundwater (mg/L)		Source water (mg/L)	
		Pre-recharge	Post-recharge	Pre-recharge	Post-recharge
GW_160	Ca	5.37	7.64	3.64	3.81
GW_160	K	1.91	2.80	1.38	2.05
GW_160	Mg	1.89	2.69	1.30	1.38
GW_160	Na	2.46	5.60	1.97	5.60
GW_160	NO3	0.59	1.78	ND	ND
GW_160	S	9.89	13.04	10.25	12.63
GW_160	Cu	ND	0.01	ND	ND
GW_160	Fe	0.04	0.14	0.05	0.06
GW_160	Mn	ND	ND	ND	0.01
GW_160	P	0.06	0.06	0.05	0.03
GW_160	Zn	ND	ND	ND	ND
GW_169	Ca	8.09	8.97	4.29	3.84
GW_169	K	2.28	2.60	1.77	1.86
GW_169	Mg	2.87	3.21	1.47	1.40
GW_169	Na	4.92	3.40	2.43	3.40
GW_169	NO3	0.43	0.62	ND	ND
GW_169	S	9.81	13.05	10.13	13.02
GW_169	Cu	ND	ND	ND	ND
GW_169	Fe	0.05	0.07	0.05	0.07
GW_169	Mn	ND	ND	ND	ND
GW_169	P	0.08	0.08	0.09	0.03
GW_169	Zn	ND	0.01	ND	ND
GW_170	Ca	13.64	14.25	3.44	3.81
GW_170	K	3.23	4.09	1.26	1.84
GW_170	Mg	4.34	5.15	1.24	1.37
GW_170	Na	4.48	11.70	1.95	5.60
GW_170	NO3	1.69	1.65	ND	ND
GW_170	S	13.28	17.06	10.47	12.86
GW_170	Cu	ND	ND	ND	ND
GW_170	Fe	0.06	0.06	0.05	0.08
GW_170	Mn	ND	ND	0.01	ND
GW_170	P	0.08	0.05	0.06	0.07
GW_170	Zn	ND	ND	ND	ND
GW_171	Ca	16.59	20.08	3.44	3.81
GW_171	K	4.23	5.32	1.26	1.84
GW_171	Mg	6.13	7.53	1.24	1.37
GW_171	Na	5.88	8.90	1.95	5.60
GW_171	NO3	3.30	4.34	ND	ND
GW_171	S	12.31	16.23	10.47	12.86
GW_171	Cu	ND	ND	ND	ND
GW_171	Fe	0.05	0.05	0.05	0.08
GW_171	Mn	ND	ND	0.01	ND
GW_171	P	0.07	0.18	0.06	0.07
GW_171	Zn	ND	ND	ND	ND

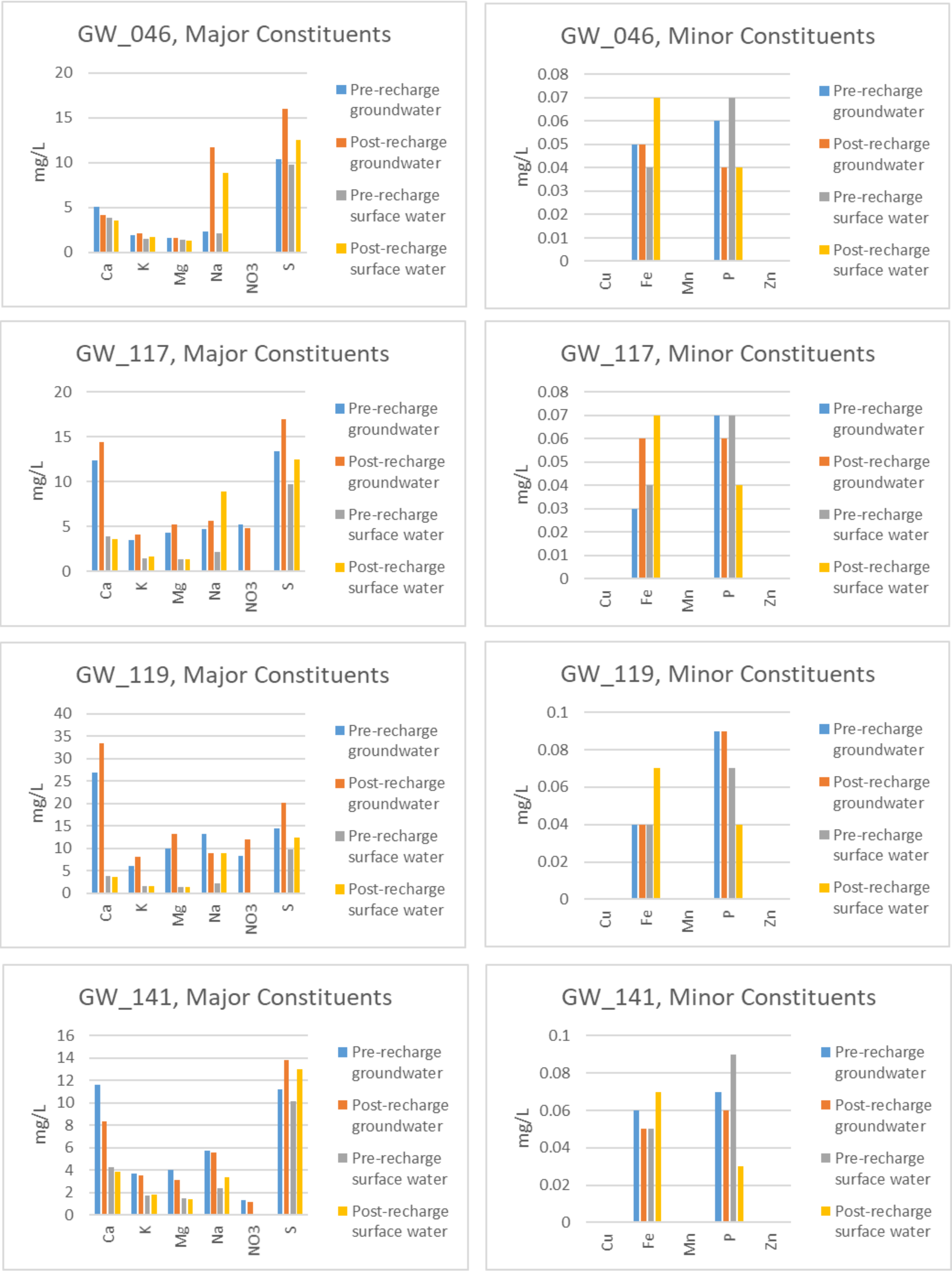

Figure 68. Water quality data, GW_046, GW_117, GW_119, and GW_141. Relevant source water locations are identified in Table 6.

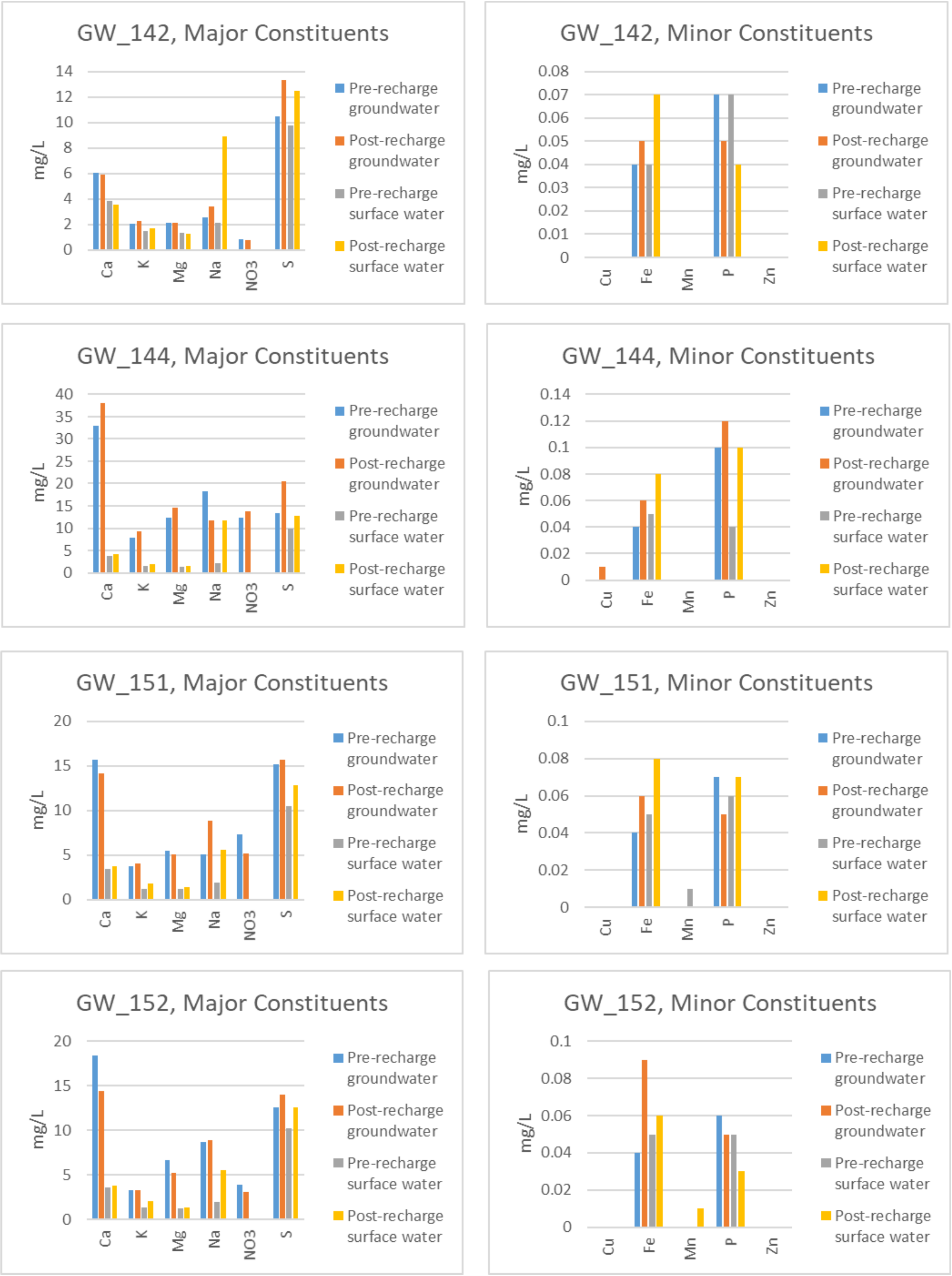

Figure 69. Water quality data, GW_142, GW_144, GW_151, and GW_152. Relevant source water locations are identified in Table 6.

Figure 70. Water quality data, GW_160, GW_169, GW_170, and GW_171. Relevant source water locations are identified in Table 6.

Table 10. Surface water quality data, conventional methods.

Monitoring Site	NH3-N (mg/L)	Cu (mg/L)		NO3-N (mg/L)	Zn (mg/L)	
	Pre and Post	Pre	Post	Pre and Post	Pre	Post
WQ_1	ND	ND	ND	ND	ND	0.00370
WQ_2	ND	ND	ND	ND	ND	ND
WQ_3	ND	ND	ND	ND	ND	ND
WQ_4	ND	ND	0.00213	ND	ND	0.00219
WQ_5	ND	ND	ND	ND	ND	ND

ND = not detected

Table 11. Groundwater constituent concentrations, conventional methods.

Well	NH3-N (mg/L)		Cu (mg/L)		NO3-N (mg/L)		Zn (mg/L)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
GW_046	0.2050	ND*	ND	0.00103	ND	0.103*	ND	0.00114
GW_117	ND	ND*	ND	0.00170	4.710	5.200*	ND	0.00848
GW_119	0.8470	ND*	ND	0.00103	8.430	10.200*	ND	0.00240
GW_141	ND	ND*	ND	ND	1.630	1.210*	ND	ND
GW_142	ND	ND*	ND	ND	1.210	0.944*	ND	ND
GW_144	0.0812	ND*	ND	0.00370	9.880	9.600*	ND	0.00111
GW_151	ND	ND*	ND	ND	6.240	4.520*	ND	ND
GW_151_DUP	--	ND*	--	ND	--	4.540*	--	0.00480
GW_152	ND	ND	ND	ND	3.420	2.710	ND	0.00322
GW_160	ND	ND*	ND	0.00548	0.790	1.760*	ND	0.01590
GW_169	ND	0.0546*	ND	0.00113	0.830	0.867*	ND	0.00302
GW_170	ND	ND*	ND	ND	2.240	1.850*	ND	0.00187
GW_170_DUP	ND	--	ND	--	2.240	--	ND	--
GW_171	ND	ND*	ND	ND	4.190	4.170*	ND	ND

*Samples not maintained at preservation temperature. Ice melted in the cooler during shipping, and temperature measured at the lab was 13.5 °C, substantially higher than the 4 °C preservation threshold for ammonia and nitrate.

Table 12. Field parameter results

Site	Temperature (^0C)		Specific conductance (uS/cm)		Dissolved oxygen (mg/L)		pH (std units)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
WQ_1	6.2	11.4	86.6	64.6	12.07	10.78	8.02	5.21
WQ_2	6.2	11.9	86.5	64.0	12.32	10.74	8.18	5.32
WQ_3	6.7	14.3	87.7	67.8	12.17	11.61	7.84	5.28
WQ_4	6.5	13.3	86.1	63.3	12.04	11.13	7.93	5.63
WQ_5	6.3	10.0	85.6	64.7	12.42	11.10	9.24	8.26
GW_046	10.9	11.6	103.2	108.7	8.72	9.07	7.18	7.52
GW_117	13.3	15.0	226.2	262.6	7.05	7.74	6.62	6.72
GW_119	12.8	13.0	460.4	442.7	8.15	9.22	6.77	6.99
GW_141	12.4	13.2	179.7	130.1	7.33	8.13	6.76	6.75
GW_142	12.5	13.2	130.9	96.8	8.39	9.09	6.44	6.65
GW_144	11.0	13.6	452.3	410.5	6.72	6.78	6.78	6.99
GW_151	11.8	14.6	265.7	141.4	8.82	7.96	6.73	6.68
GW_152	11.8	13.1	291.9	311.4	8.51	8.75	7.01	5.34
GW_160	10.6	12.7	108.3	127.7	6.35	7.43	6.94	6.92
GW_169	13.5	14.4	164.7	205.9	9.64	9.22	7.34	7.22
GW_170	12.5	14.1	213.4	182.2	7.19	7.41	6.69	6.56
GW_171	11.7	13.2	290.0	263.9	7.69	7.49	6.89	6.84

DISCUSSION

The data indicate no groundwater impairment is occurring due to operation of the recharge sites. Often, the groundwater constituent concentrations are lower after recharge ends than before recharge begins. Out of 132 groundwater constituent concentrations measured prior to and after recharge season, concentrations were lower (improved) after the recharge season in 53% of the values. Constituent concentrations in the source water were lower (better) than in the receiving groundwater in 60% of the pre-recharge and 88% of the post-recharge values. When post-recharge concentrations were higher than pre-recharge concentrations, the source water often had lower concentrations than the groundwater and thus was unlikely to be the source of the increase in groundwater concentrations. Of the 11 exceptions to this, seven were for iron, two for sulfur, and two for sodium (Tables 7-9 & Figures 68-70).

Iron was detected using the Unibest method in the pre- and post-recharge samples at all groundwater and source water locations (Tables 7-9), but all concentrations were substantially below Oregon Department of Environmental Quality's (ODEQ) guidance level of 0.3 mg/L for iron. GW_160 had the highest increase in iron concentration from 0.04 mg/L before recharge to 0.14 mg/L after recharge (Table 9).

Ammonia was detected using method SM 4500 in the pre-recharge samples at GW_046, GW_119, and GW_144 and in the post-recharge samples at GW_169 but was not detected in any surface water samples (Tables 10-11). The Unibest ammonia data are not discussed in this report because the resin capsule used in the Unibest method contains ammonia, biasing the sample results high (see WY2018 for more detailed discussion).

Copper was detected using method EPA 200.8 at 0.00213 mg/L in one source water sample at Fruitvale S-318 (WQ_4) but was not detected in the downgradient wells GW_151, GW_170, and GW_171 (Tables 8-10).

Manganese was detected at source water sites WQ_4 and WQ_5 (both with 0.01 mg/L) but not in the downgradient monitoring wells GW_151, GW_152, or GW_160 (Tables 8-9).

The drinking water standard for nitrate (10 mg/L) was exceeded post-recharge at GW_119 (Table 7) and GW_144 (Table 8) using the Unibest method. Using method EPA 300.0, the nitrate drinking water standard was exceeded only in groundwater post-recharge at GW_119; however, no nitrate was detected in any source water sample, so the recharge water infiltrating into groundwater was likely not the source of the nitrates in the groundwater (Tables 10-11).

Using the Unibest method, zinc was detected only in the post-recharge sample at GW_169 (0.01 mg/L, Table 9). Using method EPA 200.8 with a detection limit of 0.001 mg/L, zinc was found in the source water at WQ_1 (0.0037mg/L) and WQ_4 (0.00219 mg/L). Downgradient groundwater zinc concentrations increased from ND (not detected) pre-recharge to 0.00302 mg/L post-recharge at GW_169 and from ND pre-recharge to 0.00187 mg/L post recharge in GW_170 (Tables 10-11).

The groundwater samples collected at wells GW_144 and GW_171 on June 10, 2020 were also analyzed for the approved targeted list of herbicides and pesticides (azinphos-methyl, chlorpyrifos, diuron, and malathion) using analytical methods EPA 8270D and EPA 8321B. There were no detections of any of the four constituents in either sample. Analytical laboratory reports are included in Appendix B.

QUALITY CONTROL

For the synthetic organic compounds, the lab did not identify any quality control issues associated with analysis of the samples.

For the samples analyzed using conventional methods at Anatek, samples were received within the holding time. The temperature of the samples upon receipt by the lab was 3.9 °C for the 11/13/2019 shipment and 2.6 °C for the 11/14/2019 shipment. In the post-season sampling event, the temperature of the samples was 1.5 °C for the 6/9/20 shipment and 13.5 °C for the shipment on 6/10/20. The 6/10/20 shipment exceeded the 4 °C preservation threshold for nitrate and ammonia. The lab manager did not believe the temperature would affect results, and concentrations are similar to those reported in previous years. Because preservation protocols were not followed however, concentrations of ammonia and nitrate in these samples may not represent actual conditions.

One field replicate was obtained at GW_151 during the pre-recharge sampling event and at GW_170 during the post-recharge event to quantify precision of the inorganic data (Table 13). The results indicate the data have sufficiently low uncertainty for their intended end use.

Table 13. Relative percent difference of replicate samples.

Analyte	GW_151			GW_170		
	Sample mg/L	Replicate mg/L	Relative percent difference	Sample	Replicate	Relative percent difference
Ammonia	ND	ND	n/a	ND	ND	n/a
Copper	ND	ND	n/a	ND	ND	n/a
Nitrate-N	4.52	4.54	0.4%	2.24	2.24	0%
Zinc	ND	0.00448		ND	ND	n/a

DISCUSSION OF RESULTS

During the WY 2020 recharge season, 5,172 ac-ft (1.7 billion gallons) of water was recharged to the alluvial aquifer near Milton-Freewater through recharge basins, infiltration galleries, and seepage from canals and ditches delivering the water to the engineered structures. Groundwater levels in wells closest to the sites typically showed the strongest response. Seasonal patterns in groundwater levels at most of the monitoring sites reflect multiple factors influencing their change over time such as seepage from stream channels and the irrigation delivery network, deep percolation past the rooting zone, spring discharge, and upwelling into stream channels.

As in previous recharge seasons, groundwater and surface water quality data collected during aquifer recharge activities do not indicate that aquifer recharge activities are degrading groundwater quality. The quality of source water delivered to the aquifer recharge sites continues to be of better quality than the receiving groundwater. No exceedances of surface water quality criteria were found when using conventional lab analyses.

The Walla Walla basin’s aquifer recharge program continues to use nature-based infrastructure to simulate the floodplain function of recharge to the aquifer that was lost due to channelization of the distributary system. With continued aquifer recharge activities and increases in the total annual volume of water recharged, continued increases in alluvial aquifer water levels are anticipated, which should lead to further increases in spring flow (WWBWC, 2019) and enhance already influential upwelling of groundwater into stream channels.

PROPOSED AR PROGRAM IN WY 2021

Operation of the current 14 alluvial aquifer recharge sites continues in WY 2021 under Limited License 1621, which expired in December 2020. Beginning January 2021, the program includes three additional sites and operates under Limited License 1848, which is active until December 2024.

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APPENDIX A – LIMITED LICENSE LL-1621

Oregon Water Resources Department

Final Order
Limited License Application LL-1621
Walla Walla Basin Watershed Council and
Hudson Bay District Improvement
Company

Appeal Rights

This is a final order in other than a contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60-day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080 you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the Director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied.

Requested Water Use

On June 13, 2016, the Water Resources Department received completed limited license request 1621 from Walla Walla Basin Watershed Council and Hudson Bay District Improvement Company for the use of up to 70 cubic feet per second from the Walla Walla River. The points of diversion are located in the NE ^{1}/4 NW ^{1}/4, Section l, Township 5 North, Range 35 East W.M. and in the SW ^{1}/4, NE ^{1}/4, Section 12, Township 5 North, Range 35 East, W.M., for the purpose of artificial groundwater recharge testing, for the period of March l, 2015 through December 3 1, 2020.

Authorities

The Department may approve a limited license pursuant to its authority under ORS 537.143, 537.144 and OAR 690-340-0030.

ORS 537.143(2) authorizes the Director to revoke the right to use water under a limited license if it causes injury to any other water right or a minimum perennial streamflow.

A limited license will not be issued for more than five consecutive years for the same use, as directed by ORS 537.143(8).

Findings of Fact

1. The forms, fees and map have been submitted, as required by OAR 690-340-0030(1).
2. The Department provided public notice of the application, on December 22, 2015 as required by OAR 690-340-0030(2).
3. This limited license request is limited to an area within a single drainage basin as required by OAR 690-340-0030(3).
4. The Department has determined that there is water available for the requested use.

5. The Department has determined that the proposed source has not been withdrawn from further appropriation.

6. Because this use is from surface water and has the potential to impact fish, the Department finds that fish screening is required to protect the public interest.

7. Because the use requested is longer than 120 days and because the use is in an area that has sensitive, threatened or endangered fish species, the use is subject to the Department's rules under OAR 690-33. These rules aid the Department in determining whether a proposed use will impair or be detrimental to the public interest with regard to sensitive, threatened, or endangered fish species.

8. The Department has determined that the use is not subject to its rules under OAR 690-350. However, artificial groundwater recharge testing must be done in a manner that provides a test with results and supplemental information for the user's artificial groundwater recharge permit application. Consistent with this intent, the Department has added conditions pertaining to testing, monitoring, reporting and coordination with Oregon Department of Environmental Quality (ODEQ), Oregon Department of Fish and Wildlife (ODFW) and this Department.

9. The Department has received comments related to the possible issuance of the limited license from ODEQ requesting changes to the proposed monitoring plan. The water quality monitoring plan was revised and approved by ODEQ on February 25, 2016. The Department has received comments from ODFW in support of this issuance and recommending conditions related to instream water rights and bypass flows. The Department's Groundwater Section determined the testing and water quantity monitoring plan submitted as an addendum to the application on June 13, 2016 is sufficient for artificial groundwater recharge testing. The authorization of Limited License 1621 is conditioned to satisfactorily address issues raised in those comments.

10. Pursuant to OAR 690-340-0030(4)(5), conditions have been added with regard to notice and water-use measurement.

Conclusions of Law

The proposed water use will not impair or be detrimental to the public interest pursuant to OAR 690-340-0030(2), as limited in the order below.

Order

Therefore, pursuant to ORS 537.143, ORS 537.144, and OAR 690-340-0030, application for Limited License 1621 is approved as conditioned below.

1. The period and rate of use for Limited License 1621 shall be from October 17, 2016 through December 3 1, 2020 for the use of 70 cubic feet per second from the Walla Walla River, for the purpose of artificial groundwater recharge testing. The season of use is limited to November 1 through May 15.

2. The licensee shall give notice to the Watermaster in the district where use is to occur not less than 15 days or more than 60 days in advance of using the water under this limited license. The notice

shall include the location of the diversion, and the volume of water to be diverted and the intended use and place of use.

3. When water is diverted under this limited license, the use is limited to times when the following minimum streamflows are met in the Tum A Lum reach of the Walla Walla River, between the Little Walla Walla River diversion and Nursery Bridge Dam and flowing past Nursery Bridge Dam: November — 64 cfs, December and January 95 cfs, February to May 15 — 150 cfs. Nursery Bridge Dam is located just downstream of Nursery Bridge and is downstream of the Little Walla Wall diversion. The District 5 Watermaster, based on gage and/or flow measurements, shall make the determination that the above described streamflows are flowing past Nursery Bridge Dam. Diversion under this limited license shall cease when said streamflows are unmet.

4. The Licensee shall follow the operation, water quality and water level monitoring plans described in the document entitled "Surface water and Groundwater Monitoring and Reporting Plan for Limited License Application LL1621" and dated May 3 1, 2016. This plan may be modified after review and approval of changes by the Department.

5. The licensee shall comply with all ODEQ water quality requirements. If monitoring data or other information result in identification of potential water quality concerns, ODEQ may seek modifications to the monitoring and test plan and/or require a permit of its own to address the water quality concerns prior to resumption of artificial groundwater recharge testing.

6. Before water use may begin under this license, the licensee shall install a totalizing flow meter at each point of diversion and at the entry point to each recharge test site. The totalizing flow meters must be installed and maintained in good working order. In addition the licensee shall maintain a record of all water use, including the total number of hours of diversion, the total volume diverted, and the categories of beneficial use to which the water is applied. During the period of the limited license, the record of use shall be available for review by the Department upon request, and shall be submitted to the Department annually and to Watermaster upon request. This record shall include the amount of water diverted from the Walla Walla River, and the amount delivered to each recharge area.

7. The Director may revoke the right to use water for any reason described in ORS 537.143 (2), and OAR 690-340-0030(6). Such revocation may be prompted by field regulatory activities or by any other reason.

8. Use of water under a limited license shall not have priority over any water right exercised according to a permit or certificate, and shall be subordinate to all other authorized uses that rely upon the same source.

9. The licensee shall install, maintain and operate fish screening and by-pass devices as required by the Oregon Department of Fish and Wildlife to prevent fish from entering the proposed diversion. See copy of enclosed fish screening criteria for information.

10. In supporting this license, ODFW retains the prerogative to pursue a future instream water right for the Walla Walla River. A permanent water right for the requested location may fall under the

requirements of Division 33 rules, which limit water usage during the period from April 15-September 30.

11. The licensee is required to provide a written annual report by February 15th of each year. This report will detail recharge testing and any subsequent recovery under a secondary limited license from the preceding water year. Reporting shall include, but is not limited to, the results of testing efforts that relate to water quality, water quantity, and operations. Water level data shall be submitted in a Department-specified digital format. The licensee shall consult with ODEQ and OWRD to identify additional specific reporting elements. The first report is due in February 2014. The annual report shall be sealed and signed by a professional(s) registered or allowed, under Oregon law, to practice geology.

12. Failure to meet the conditions of the license to the satisfaction of the Department will lead to a cancellation of the limited license, in which case it would no longer be in force.

13. The licensee shall conduct recharge testing as proposed in the application and later amended by the licensee, and as otherwise conditioned herein.

NOTE: This water-use authorization is temporary. Applicants are advised that issuance of this final order does not guarantee that any permit for the authorized use will be issued in the future; any investments should be made with that in mind.

Issued October *18*, 2016

E. Timothy Wallin

E. Timothy Wallin, Water Rights Program Manager, for
Thomas M. Byler, Director
Water Resources Department

Enclosures - limited license

cc: Greg Silbernagel, District 5 Watermaster
Bill Duke, ODFW
Phil Richerson, ODEQ
File

If you need further assistance, please contact the Water Rights Section at the address, phone number, or fax number below. When contacting the Department, be sure to reference your limited license number for better service.

Remember, the use of water under the terms of this limited license is not a secure source of water. Water use can be revoked at any time. Such revocation may be prompted by field regulatory activities or many other reasons.

Water Rights Section
Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem OR 97301-1271
Phone: (503) 986-081 7 Fax: (503) 986-0901

FISH SCREENING CRITERIA FOR WATER DIVERSIONS

This summary describes ODFW fish screening criteria for all fish species.

Screen material openings for ditch (gravity) and pump screens must provide a minimum of 27% open area:

Perforated plate: Openings shall not exceed 3/32 or 0.0938 inches (2.38 mm).

Mesh/Woven wire screen: Square openings shall not exceed 3/32 or 0.0938 inches (2.38 mm) in the narrow direction, e.g., 3/32 inch x 3/32 inch open mesh.

Profile bar screen/Wedge wire: Openings shall not exceed 0.0689 inches (1.75 mm) in the narrow direction.

Screen area must be large enough to prevent fish impact. Wetted screen area depends on the water now rate and the approach velocity.

Approach velocity: The water velocity perpendicular to and approximately three inches in front of the screen face.
Sweeping velocity: The water velocity parallel to the screen face.
Bypass system: Any pipe, flume, open channel or other means of conveyance that transports fish back to the body of water from which the fish were diverted.
Active pump screen: Self cleaning screen that has a proven cleaning system.
Passive pump screen: Screen that has no cleaning system other than periodic manual cleaning.

Screen approach velocity for ditch and active pump screens shall not exceed 0.4 fps (feet per second) or 0.12 mps (meters per second). The wetted screen area in square feet is calculated by dividing the maximum water flow rate in cubic feet per second (1 cfs— 449 gpm) by 0.4 fps.

Screen sweeping velocity for ditch screens shall exceed the approach velocity. Screens greater than 4 feet in length must be angled at 45 degrees or less to flow. An adequate bypass system must be provided for ditch screens to safely and rapidly collect and transport fish back to the stream.

Screen approach velocity for passive pump screens shall not exceed 0.2 fps or 0.06 mps. The wetted screen area in square feet is calculated by dividing the maximum water flow rate by 0.2 fps. pump rate should be less than 1 cfs.

For further information please contact:

Bernie Kepshire
Oregon Department of Fish and Wildlife
71 1 8 NE Vandenberg Avenue
Corvallis, OR 97330-9446
(541)757-4186 055
bernard.m.kepshire@state.or.us

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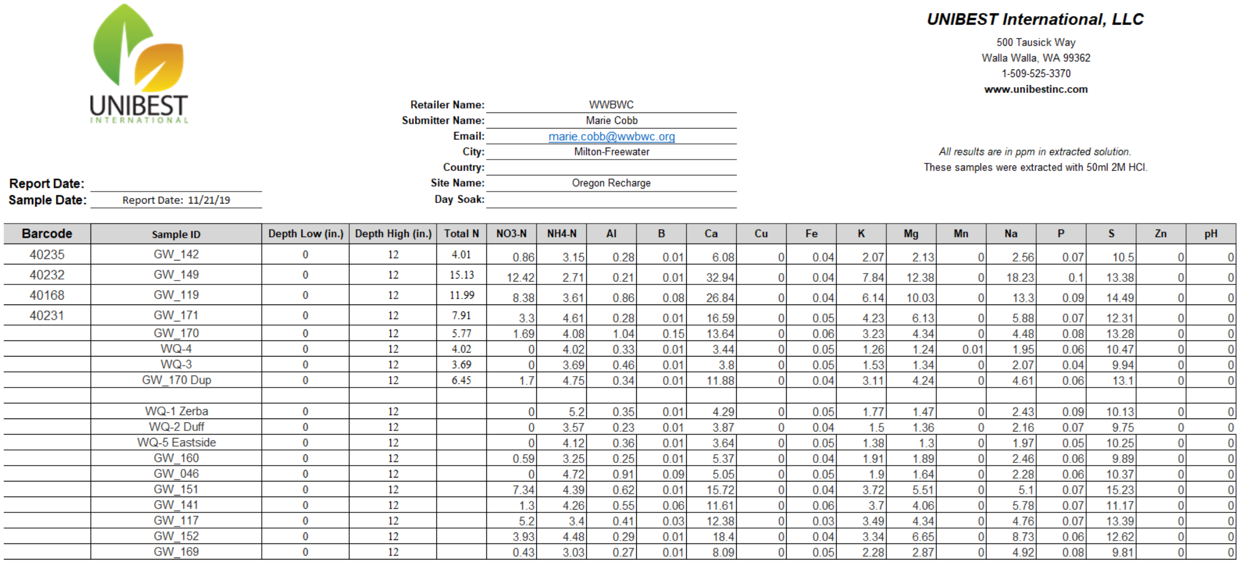
APPENDIX B – LABORATORY WATER QUALITY TESTING RESULTS



UNIBEST International, LLC

500 Tausick Way
Walla Walla, WA 99362
1-509-525-3370
www.unibestinc.com

Retailer Name: WWBWC
Submitter Name: Marie Cobb
Email: marie.cobb@wwbwc.org
City: Milton-Freewater
Country:
Site Name: Oregon Recharge
Day Soak:

Report Date:
Sample Date: Report Date: 11/21/19

All results are in ppm in extracted solution.
These samples were extracted with 50ml 2M HCl.

Barcode	Sample ID	Depth Low (in.)	Depth High (in.)	Total N	NO3-N	NH4-N	Al	B	Ca	Cu	Fe	K	Mg	Mn	Na	P	S	Zn	pH
40235	GW_142	0	12	4.01	0.86	3.15	0.28	0.01	6.08	0	0.04	2.07	2.13	0	2.56	0.07	10.5	0	0
40232	GW_149	0	12	15.13	12.42	2.71	0.21	0.01	32.94	0	0.04	7.84	12.38	0	18.23	0.1	13.38	0	0
40168	GW_119	0	12	11.99	8.38	3.61	0.86	0.08	26.84	0	0.04	6.14	10.03	0	13.3	0.09	14.49	0	0
40231	GW_171	0	12	7.91	3.3	4.61	0.28	0.01	16.59	0	0.05	4.23	6.13	0	5.88	0.07	12.31	0	0
	GW_170	0	12	5.77	1.69	4.08	1.04	0.15	13.64	0	0.06	3.23	4.34	0	4.48	0.08	13.28	0	0
	WQ-4	0	12	4.02	0	4.02	0.33	0.01	3.44	0	0.05	1.26	1.24	0.01	1.95	0.06	10.47	0	0
	WQ-3	0	12	3.69	0	3.69	0.46	0.01	3.8	0	0.05	1.53	1.34	0	2.07	0.04	9.94	0	0
	GW_170 Dup	0	12	6.45	1.7	4.75	0.34	0.01	11.88	0	0.04	3.11	4.24	0	4.61	0.06	13.1	0	0
	WQ-1 Zerba	0	12		0	5.2	0.35	0.01	4.29	0	0.05	1.77	1.47	0	2.43	0.09	10.13	0	0
	WQ-2 Duff	0	12		0	3.57	0.23	0.01	3.87	0	0.04	1.5	1.36	0	2.16	0.07	9.75	0	0
	WQ-5 Eastside	0	12		0	4.12	0.36	0.01	3.64	0	0.05	1.38	1.3	0	1.97	0.05	10.25	0	0
	GW_160	0	12		0.59	3.25	0.25	0.01	5.37	0	0.04	1.91	1.89	0	2.46	0.06	9.89	0	0
	GW_046	0	12		0	4.72	0.91	0.09	5.05	0	0.05	1.9	1.64	0	2.28	0.06	10.37	0	0
	GW_151	0	12		7.34	4.39	0.62	0.01	15.72	0	0.04	3.72	5.51	0	5.1	0.07	15.23	0	0
	GW_141	0	12		1.3	4.26	0.55	0.06	11.61	0	0.06	3.7	4.06	0	5.78	0.07	11.17	0	0
	GW_117	0	12		5.2	3.4	0.41	0.03	12.38	0	0.03	3.49	4.34	0	4.76	0.07	13.39	0	0
	GW_152	0	12		3.93	4.48	0.29	0.01	18.4	0	0.04	3.34	6.65	0	8.73	0.06	12.62	0	0
	GW_169	0	12		0.43	3.03	0.27	0.01	8.09	0	0.05	2.28	2.87	0	4.92	0.08	9.81	0	0

Anatek Labs, Inc.

1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client:	WALLA WALLA BASIN WATERSHED COUNCIL	**Batch #:**	191114023
Address:	810 S. MAIN ST MILTON-FREEWATER, OR 97862	**Project Name:**	NO3/ZN/CU/NH3
Attn:	ROD GORTSEMA		

Analytical Results Report

Sample Number	191114023-001	**Sampling Date**	11/13/2019	**Date/Time Received**	11/14/2019 10:10 AM
Client Sample ID	WQ-1	**Sampling Time**	8:25 AM		
Matrix	Drinking Water				
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/10/2019 9:52:00 AM	MAM	EPA 200.7	
NO3/N	ND	mg/L	0.1	11/14/2019 7:48:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:13:00 PM	MAM	EPA 200.7	

Sample Number	191114023-002	**Sampling Date**	11/13/2019	**Date/Time Received**	11/14/2019 10:10 AM
Client Sample ID	GW-169	**Sampling Time**	9:00 AM		
Matrix	Drinking Water				
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/10/2019 9:53:00 AM	MAM	EPA 200.7	
NO3/N	0.830	mg/L	0.1	11/14/2019 8:11:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:14:00 PM	MAM	EPA 200.7	

Client: WALLA WALLA BASIN WATERSHED COUNCIL
Address: 810 S. MAIN ST
MILTON-FREEWATER, OR 97862
Attn: ROD GORTSEMA

Batch #: 191114023
Project Name: NO3/ZN/CU/NH3

Analytical Results Report

Sample Number 191114023-003
Client Sample ID WQ-2
Matrix Drinking Water
Comments

Sampling Date 11/13/2019
Sampling Time 9:15 AM

Date/Time Received 11/14/2019 10:10 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/10/2019 9:54:00 AM	MAM	EPA 200.7	
NO3/N	ND	mg/L	0.1	11/14/2019 8:35:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:15:00 PM	MAM	EPA 200.7	

Sample Number 191114023-004
Client Sample ID GW-046
Matrix Drinking Water
Comments

Sampling Date 11/13/2019
Sampling Time 9:50 AM

Date/Time Received 11/14/2019 10:10 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	0.205	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:20:00 PM	MAM	EPA 200.7	
NO3/N	ND	mg/L	0.1	11/14/2019 8:58:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:20:00 PM	MAM	EPA 200.7	

Client: WALLA WALLA BASIN WATERSHED COUNCIL
Address: 810 S. MAIN ST
MILTON-FREEWATER, OR 97862
Attn: ROD GORTSEMA

Batch #: 191114023
Project Name: NO3/ZN/CU/NH3

Analytical Results Report

Sample Number 191114023-005
Client Sample ID GW-117
Matrix Drinking Water
Comments

Sampling Date 11/13/2019
Sampling Time 10:33 AM

Date/Time Received 11/14/2019 10:10 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:27:00 PM	MAM	EPA 200.7	
NO3/N	4.71	mg/L	0.1	11/14/2019 9:22:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:27:00 PM	MAM	EPA 200.7	

Sample Number 191114023-006
Client Sample ID WQ-5
Matrix Drinking Water
Comments

Sampling Date 11/13/2019
Sampling Time 10:55 AM

Date/Time Received 11/14/2019 10:10 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:28:00 PM	MAM	EPA 200.7	
NO3/N	ND	mg/L	0.1	11/14/2019 9:45:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:28:00 PM	MAM	EPA 200.7	

Client:	WALLA WALLA BASIN WATERSHED COUNCIL	**Batch #:**	191114023
Address:	810 S. MAIN ST MILTON-FREEWATER, OR 97862	**Project Name:**	NO3/ZN/CU/NH3
Attn:	ROD GORTSEMA		

Analytical Results Report

Sample Number	191114023-007	**Sampling Date**	11/13/2019	**Date/Time Received**	11/14/2019 10:10 AM
Client Sample ID	GW-152	**Sampling Time**	11:30 AM		
Matrix	Drinking Water				
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:42:00 PM	MAM	EPA 200.7	
NO3/N	3.42	mg/L	0.1	11/14/2019 10:09:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:42:00 PM	MAM	EPA 200.7	

Sample Number	191114023-008	**Sampling Date**	11/13/2019	**Date/Time Received**	11/14/2019 10:10 AM
Client Sample ID	GW-160	**Sampling Time**	12:12 PM		
Matrix	Drinking Water				
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:43:00 PM	MAM	EPA 200.7	
NO3/N	0.790	mg/L	0.1	11/15/2019 12:29:00 AM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:43:00 PM	MAM	EPA 200.7	

Client:	WALLA WALLA BASIN WATERSHED COUNCIL	**Batch #:**	191114023
Address:	810 S. MAIN ST MILTON-FREEWATER, OR 97862	**Project Name:**	NO3/ZN/CU/NH3
Attn:	ROD GORTSEMA		

Analytical Results Report

Sample Number	191114023-009	**Sampling Date**	11/13/2019	**Date/Time Received**	11/14/2019 10:10 AM
Client Sample ID	GW-141	**Sampling Time**	8:00 AM		
Matrix	Drinking Water				
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:44:00 PM	MAM	EPA 200.7	
NO3/N	1.63	mg/L	0.1	11/15/2019 12:53:00 AM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:44:00 PM	MAM	EPA 200.7	

Sample Number	191114023-010	**Sampling Date**	11/13/2019	**Date/Time Received**	11/14/2019 10:10 AM
Client Sample ID	GW-151	**Sampling Time**	2:00 PM		
Matrix	Drinking Water				
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:45:00 PM	MAM	EPA 200.7	
NO3/N	6.24	mg/L	0.1	11/15/2019 1:16:00 AM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:45:00 PM	MAM	EPA 200.7	

Authorized Signature

Todd Taruscio, Lab Manager

MCL	EPA's Maximum Contaminant Level
ND	Not Detected
PQL	Practical Quantitation Limit

This report shall not be reproduced except in full, without the written approval of the laboratory.
The results reported relate only to the samples indicated.
Soil/solid results are reported on a dry-weight basis unless otherwise noted.

Anatek Labs, Inc.

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Login Report

Customer Name: WALLA WALLA BASIN WATERSHED COUNCIL
810 S. MAIN ST
MILTON-FREEWATER OR 97862

Order ID: 191114023
Order Date: 11/14/2019

Contact Name: ROD GORTSEMA
Project Name: NO3/ZN/CU/NH3

Comment:

Sample #: 191114023-001 **Customer Sample #:** WQ-1

Recv'd: ☑ **Matrix:** Drinking Water **Collector:**
Date Collected: 11/13/2019
Quantity: 2 **Date Received:** 11/14/2019 10:10:00 AM
Time Collected: 8:25 AM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/26/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/26/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***

Sample #: 191114023-002 **Customer Sample #:** GW-169

Recv'd: ☑ **Matrix:** Drinking Water **Collector:**
Date Collected: 11/13/2019
Quantity: 2 **Date Received:** 11/14/2019 10:10:00 AM
Time Collected: 9:00 AM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/26/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/26/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***

Sample #: 191114023-003 **Customer Sample #:** WQ-2

Recv'd: ☑ **Matrix:** Drinking Water **Collector:**
Date Collected: 11/13/2019
Quantity: 2 **Date Received:** 11/14/2019 10:10:00 AM
Time Collected: 9:15 AM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/26/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***

Customer Name: WALLA WALLA BASIN WATERSHED COUNCIL **Order ID:** 191114023
810 S. MAIN ST **Order Date:** 11/14/2019
MILTON-FREEWATER OR 97862

Contact Name: ROD GORTSEMA **Project Name:** NO3/ZN/CU/NH3

Comment:

NITRATE/N	M	EPA 300.0	11/26/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***

Sample #: 191114023-004 **Customer Sample #:** GW-046

Recv'd: ☑ **Matrix:** Drinking Water **Collector:** **Date Collected:** 11/13/2019
Quantity: 2 **Date Received:** 11/14/2019 10:10:00 AM **Time Collected:** 9:50 AM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/26/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/26/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***

Sample #: 191114023-005 **Customer Sample #:** GW-117

Recv'd: ☑ **Matrix:** Drinking Water **Collector:** **Date Collected:** 11/13/2019
Quantity: 2 **Date Received:** 11/14/2019 10:10:00 AM **Time Collected:** 10:33 AM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/26/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/26/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***

Sample #: 191114023-006 **Customer Sample #:** WQ-5

Recv'd: ☑ **Matrix:** Drinking Water **Collector:** **Date Collected:** 11/13/2019
Quantity: 2 **Date Received:** 11/14/2019 10:10:00 AM **Time Collected:** 10:55 AM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/26/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/26/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***

Customer Name: WALLA WALLA BASIN WATERSHED COUNCIL **Order ID:** 191114023

810 S. MAIN ST **Order Date:** 11/14/2019

MILTON-FREEWATER OR 97862

Contact Name: ROD GORTSEMA **Project Name:** NO3/ZN/CU/NH3

Comment:

Sample #: 191114023-007 **Customer Sample #:** GW-152

Recv'd: ☑ **Matrix:** Drinking Water **Collector:** **Date Collected:** 11/13/2019

Quantity: 2 **Date Received:** 11/14/2019 10:10:00 AM **Time Collected:** 11:30 AM

Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/26/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/26/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***

Sample #: 191114023-008 **Customer Sample #:** GW-160

Recv'd: ☑ **Matrix:** Drinking Water **Collector:** **Date Collected:** 11/13/2019

Quantity: 2 **Date Received:** 11/14/2019 10:10:00 AM **Time Collected:** 12:12 PM

Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/26/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/26/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***

Sample #: 191114023-009 **Customer Sample #:** GW-141

Recv'd: ☑ **Matrix:** Drinking Water **Collector:** **Date Collected:** 11/13/2019

Quantity: 2 **Date Received:** 11/14/2019 10:10:00 AM **Time Collected:** 8:00 AM

Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/26/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/26/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***

Customer Name: WALLA WALLA BASIN WATERSHED COUNCIL **Order ID:** 191114023

810 S. MAIN ST **Order Date:** 11/14/2019

MILTON-FREEWATER OR 97862

Contact Name: ROD GORTSEMA **Project Name:** NO3/ZN/CU/NH3

Comment:

Sample #: 191114023-010 **Customer Sample #:** GW-151

Recv'd: ☑ **Matrix:** Drinking Water **Collector:** **Date Collected:** 11/13/2019

Quantity: 2 **Date Received:** 11/14/2019 10:10:00 AM **Time Collected:** 2:00 PM

Comment:

Test	**Lab**	**Method**	**Due Date**	**Priority**
AMMONIA-NITROGEN	M	SM4500NH3G	11/26/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/26/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/26/2019	***Normal (~10 Days)***

SAMPLE CONDITION RECORD

Samples received in a cooler?	Yes
Samples received intact?	Yes
What is the temperature of the sample(s)? (°C)	3.9
Samples received with a COC?	Yes
Samples received within holding time?	Yes
Are all sample bottles properly preserved?	Yes
Are VOC samples free of headspace?	N/A
Is there a trip blank to accompany VOC samples?	N/A
Labels and chain agree?	Yes
Total number of containers?	20

Anatek Labs, Inc.

Sample Receipt and Preservation Form

191114 023 WWBW Last Due 11/26/201
1st SAMP 11/13/201 1st RCVD 11/14/2019
NO3/ZN/CU/NH3

Client Name: Walla Walla Project:

TAT: [✓ Normal] RUSH: ______ days

Samples Received From: FedEx [✓ UPS] USPS Client Courier Other: ______

Custody Seal on Cooler/Box: Yes [✓ No] Custody Seals Intact: Yes No [✓ N/A]

Number of Coolers/Boxes: 1 Type of Ice: Ice/[✓ Ice Packs] Blue Ice Dry Ice None

Packing Material: [✓ Bubble Wrap] [✓ Bags] Foam/Peanuts None Other: ______

Cooler Temp As Read (°C): 3.9 Cooler Temp Corrected (°C): 3.9 Thermometer Used: IR3

				Comments:
Samples Received Intact?	[✓ Yes]	No	N/A	
Chain of Custody Present?	[✓ Yes]	No	N/A	
Samples Received Within Hold Time?	[✓ Yes]	No	N/A	
Samples Properly Preserved?	[✓ Yes]	No	N/A	
VOC Vials Free of Headspace (<6mm)?	Yes	No	[✓ N/A]	
VOC Trip Blanks Present?	Yes	No	[✓ N/A]	
Labels and Chains Agree?	[✓ Yes]	No	N/A	
Total Number of Sample Bottles Received: 20				

Chain of Custody Fully Completed?	[✓ Yes]	No	N/A	
Correct Containers Received?	[✓ Yes]	No	N/A	
Anatek Bottles Used?	[✓ Yes]	No	Unknown	

Record preservatives (and lot numbers, if known) for containers below:

H_2SO_4 (1911) GW_046 → (1804)

Notes, comments, etc. (also use this space if contacting the client - record names and date/time)

Received/Inspected By: KHK Date/Time: 11-14-19 10:10

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Client:	WALLA WALLA BASIN WATERSHED COUNCIL	**Batch #:**	191115032
Address:	810 S. MAIN ST MILTON-FREEWATER, OR 97862	**Project Name:**	NO3/ZN/CU/NH3
Attn:	MARIE COBB		

Analytical Results Report

Sample Number	191115032-001	**Sampling Date**	11/14/2019	**Date/Time Received**	11/15/2019 10:15 AM
Client Sample ID	WQ-4	**Sampling Time**	9:20 AM		
Matrix	Drinking Water				
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:45:00 PM	MAM	EPA 200.7	
NO3/N	ND	mg/L	0.1	11/15/2019 5:37:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:45:00 PM	MAM	EPA 200.7	

Sample Number	191115032-002	**Sampling Date**	11/14/2019	**Date/Time Received**	11/15/2019 10:15 AM
Client Sample ID	GW-142	**Sampling Time**	12:45 PM		
Matrix	Drinking Water				
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:46:00 PM	MAM	EPA 200.7	
NO3/N	1.21	mg/L	0.1	11/15/2019 6:24:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:46:00 PM	MAM	EPA 200.7	

Client: WALLA WALLA BASIN WATERSHED COUNCIL
Address: 810 S. MAIN ST
MILTON-FREEWATER, OR 97862
Attn: MARIE COBB

Batch #: 191115032
Project Name: NO3/ZN/CU/NH3

Analytical Results Report

Sample Number 191115032-003
Client Sample ID WQ-3
Matrix Drinking Water
Comments

Sampling Date 11/14/2019
Sampling Time 10:15 AM

Date/Time Received 11/15/2019 10:15 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:47:00 PM	MAM	EPA 200.7	
NO3/N	ND	mg/L	0.1	11/15/2019 6:00:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:47:00 PM	MAM	EPA 200.7	

Sample Number 191115032-004
Client Sample ID GW-171
Matrix Drinking Water
Comments

Sampling Date 11/14/2019
Sampling Time 8:20 AM

Date/Time Received 11/15/2019 10:15 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:48:00 PM	MAM	EPA 200.7	
NO3/N	4.19	mg/L	0.1	11/15/2019 7:11:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:48:00 PM	MAM	EPA 200.7	

Client: WALLA WALLA BASIN WATERSHED COUNCIL
Address: 810 S. MAIN ST
MILTON-FREEWATER, OR 97862
Attn: MARIE COBB

Batch #: 191115032
Project Name: NO3/ZN/CU/NH3

Analytical Results Report

Sample Number 191115032-005
Client Sample ID GW-170. DUP
Matrix Drinking Water
Comments

Sampling Date 11/14/2019
Sampling Time 9:05 AM

Date/Time Received 11/15/2019 10:15 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:49:00 PM	MAM	EPA 200.7	
NO3/N	2.24	mg/L	0.1	11/15/2019 7:34:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:49:00 PM	MAM	EPA 200.7	

Sample Number 191115032-006
Client Sample ID GW-170
Matrix Drinking Water
Comments

Sampling Date 11/14/2019
Sampling Time 9:05 AM

Date/Time Received 11/15/2019 10:15 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	ND	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/4/2019 12:50:00 PM	MAM	EPA 200.7	
NO3/N	2.24	mg/L	0.1	11/15/2019 7:58:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:50:00 PM	MAM	EPA 200.7	

Client: WALLA WALLA BASIN WATERSHED COUNCIL
Address: 810 S. MAIN ST
MILTON-FREEWATER, OR 97862
Attn: MARIE COBB

Batch #: 191115032
Project Name: NO3/ZN/CU/NH3

Analytical Results Report

Sample Number 191115032-007
Client Sample ID GW-144
Matrix Drinking Water
Comments

Sampling Date 11/14/2019
Sampling Time 11:00 AM

Date/Time Received 11/15/2019 10:15 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	0.0812	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/10/2019 9:59:00 AM	MAM	EPA 200.7	
NO3/N	9.88	mg/L	1	11/19/2019 8:24:00 PM	BKP	EPA 300.0	H2
Zinc	ND	mg/L	0.01	12/4/2019 12:53:00 PM	MAM	EPA 200.7	

Sample Number 191115032-008
Client Sample ID GW-119
Matrix Drinking Water
Comments

Sampling Date 11/14/2019
Sampling Time 12:00 PM

Date/Time Received 11/15/2019 10:15 AM

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
NH3-N	0.847	mg/L	0.05	11/15/2019 3:00:00 PM	BKP	SM4500NH3G	
Copper	ND	mg/L	0.01	12/10/2019 10:02:00 AM	MAM	EPA 200.7	
NO3/N	8.43	mg/L	0.1	11/15/2019 6:47:00 PM	BKP	EPA 300.0	
Zinc	ND	mg/L	0.01	12/4/2019 12:54:00 PM	MAM	EPA 200.7	

Authorized Signature

Todd Taruscio, Lab Manager

H2	Initial analysis within holding time, Reanalysis for the required dilution was past holding time.
MCL	EPA's Maximum Contaminant Level
ND	Not Detected
PQL	Practical Quantitation Limit

This report shall not be reproduced except in full, without the written approval of the laboratory.
The results reported relate only to the samples indicated.
Soil/solid results are reported on a dry-weight basis unless otherwise noted.

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Login Report

Customer Name: WALLA WALLA BASIN WATERSHED COUNCIL
810 S. MAIN ST
MILTON-FREEWATER OR 97862

Order ID: 191115032
Order Date: 11/15/2019

Contact Name: MARIE COBB
Project Name: NO3/ZN/CU/NH3

Comment:

Sample #: 191115032-001 **Customer Sample #:** WQ-4

Recv'd: ☑ **Matrix:** Drinking Water **Collector:**
Date Collected: 11/14/2019
Quantity: 2 **Date Received:** 11/15/2019 10:15:00 AM
Time Collected: 9:20 AM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/27/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/27/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***

Sample #: 191115032-002 **Customer Sample #:** GW-142

Recv'd: ☑ **Matrix:** Drinking Water **Collector:**
Date Collected: 11/14/2019
Quantity: 2 **Date Received:** 11/15/2019 10:15:00 AM
Time Collected: 12:45 PM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/27/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/27/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***

Sample #: 191115032-003 **Customer Sample #:** WQ-3

Recv'd: ☑ **Matrix:** Drinking Water **Collector:**
Date Collected: 11/14/2019
Quantity: 2 **Date Received:** 11/15/2019 10:15:00 AM
Time Collected: 10:15 AM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/27/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***

Customer Name: WALLA WALLA BASIN WATERSHED COUNCIL
810 S. MAIN ST
MILTON-FREEWATER OR 97862

Order ID: 191115032
Order Date: 11/15/2019

Contact Name: MARIE COBB

Project Name: NO3/ZN/CU/NH3

Comment:

NITRATE/N	M	EPA 300.0	11/27/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***

Sample #: 191115032-004 **Customer Sample #:** GW-171

Recv'd: ☑ **Matrix:** Drinking Water **Collector:**
Date Collected: 11/14/2019
Quantity: 2 **Date Received:** 11/15/2019 10:15:00 AM
Time Collected: 8:20 AM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/27/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/27/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***

Sample #: 191115032-005 **Customer Sample #:** GW-170. DUP

Recv'd: ☑ **Matrix:** Drinking Water **Collector:**
Date Collected: 11/14/2019
Quantity: 2 **Date Received:** 11/15/2019 10:15:00 AM
Time Collected: 9:05 AM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/27/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/27/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***

Sample #: 191115032-006 **Customer Sample #:** GW-170

Recv'd: ☑ **Matrix:** Drinking Water **Collector:**
Date Collected: 11/14/2019
Quantity: 2 **Date Received:** 11/15/2019 10:15:00 AM
Time Collected: 9:05 AM
Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/27/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/27/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***

Customer Name: WALLA WALLA BASIN WATERSHED COUNCIL

810 S. MAIN ST

MILTON-FREEWATER OR 97862

Order ID: 191115032

Order Date: 11/15/2019

Contact Name: MARIE COBB

Project Name: NO3/ZN/CU/NH3

Comment:

Sample #: 191115032-007 **Customer Sample #:** GW-144

Recv'd: ☑ **Matrix:** Drinking Water **Collector:**

Date Collected: 11/14/2019

Quantity: 2 **Date Received:** 11/15/2019 10:15:00 AM

Time Collected: 11:00 AM

Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/27/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/27/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***

Sample #: 191115032-008 **Customer Sample #:** GW-119

Recv'd: ☑ **Matrix:** Drinking Water **Collector:**

Date Collected: 11/14/2019

Quantity: 2 **Date Received:** 11/15/2019 10:15:00 AM

Time Collected: 12:00 PM

Comment:

Test	Lab	Method	Due Date	Priority
AMMONIA-NITROGEN	M	SM4500NH3G	11/27/2019	***Normal (~10 Days)***
COPPER ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***
NITRATE/N	M	EPA 300.0	11/27/2019	***Normal (~10 Days)***
ZINC ICP	M	EPA 200.7	11/27/2019	***Normal (~10 Days)***

SAMPLE CONDITION RECORD

Samples received in a cooler?	Yes
Samples received intact?	Yes
What is the temperature of the sample(s)? (°C)	2.6
Samples received with a COC?	Yes
Samples received within holding time?	Yes
Are all sample bottles properly preserved?	Yes
Are VOC samples free of headspace?	N/A
Is there a trip blank to accompany VOC samples?	N/A
Labels and chain agree?	Yes
Total number of containers?	16

Anatek Labs, Inc.

Sample Receipt and Preservation Form

191115 032 WWBW Last Due **11/27/2019**
1st SAMP 11/14/201 1st RCVD 11/15/2019
NO3/ZN/CU/NH3

Client Name: WWBWC Project:

TAT: [✓ Normal] RUSH: ______ days

Samples Received From: FedEx [✓ UPS] USPS Client Courier Other: ____________

Custody Seal on Cooler/Box: Yes [✓ No] Custody Seals Intact: Yes No [✓ N/A]

Number of Coolers/Boxes: 1 Type of Ice: [✓ Ice/Ice Packs] Blue Ice Dry Ice None

Packing Material: Bubble Wrap Bags Foam/Peanuts None Other: ____________

Cooler Temp As Read (°C): 2.6 Cooler Temp Corrected (°C): 2.6 Thermometer Used: IR-3

				Comments:
Samples Received Intact?	[✓ Yes]	No	N/A	
Chain of Custody Present?	[✓ Yes]	No	N/A	
Samples Received Within Hold Time?	[✓ Yes]	No	N/A	
Samples Properly Preserved?	[✓ Yes]	No	N/A	
VOC Vials Free of Headspace (<6mm)?	Yes	No	[✓ N/A]	
VOC Trip Blanks Present?	Yes	No	[✓ N/A]	
Labels and Chains Agree?	[✓ Yes]	No	N/A	
Total Number of Sample Bottles Received: 16				

Chain of Custody Fully Completed?	[✓ Yes]	No	N/A	
Correct Containers Received?	[✓ Yes]	No	N/A	
Anatek Bottles Used?	[✓ Yes]	No	Unknown	

Record preservatives (and lot numbers, if known) for containers below:

Ammonia → H2SO4 (1911) & (1804)

Notes, comments, etc. (also use this space if contacting the client - record names and date/time)

Nitrate / N

Received/Inspected By: ____________ Date/Time: 11-15-19 10:15

Form F18.00 - Eff 8 Feb 2019

Eco-Tracker™
Water Quality Monitoring Systems

Eco-Track Services
A division of UNIBEST International, LLC
500 Tausick Way
Walla Walla, WA 99362
1-509-525-3370
www.ecotrackservices.com
www.unibestinc.com

Report Date: 6/18/2020

Retailer Name: WWBWC
Submitter Name: Luke Adams
Email: luke.adams@wwbwc.org
City: Milton-Freewater
State: OR
Site Name:
Sample Date(s): 6/9/2020

All results are in ppm in extracted solution.
These samples were extracted with 50ml 2M HCl.

Barcode	Site Name	Sample ID	Depth Low (in.)	Depth High (in.)	Total N	NO3-N	NH4-N	Al	B	Ca	Cu	Fe	K	Mg	Mn	Na	P	S	Zn	pH
2102794	WQ-5	13:50	0	0		0.000	5.873	0.340	0.000	3.810	0.000	0.060	2.050	1.380	0.010	5.600	0.030	12.630	0.000	0.000
2102597	WQ-2	13:52	0	0		0.035	9.352	0.360	0.000	3.590	0.000	0.070	1.690	1.300	0.000	8.900	0.040	12.490	0.000	0.000
2102634	WQ-1	13:54	0	0		0.000	4.428	0.350	0.000	3.840	0.000	0.070	1.860	1.400	0.000	3.400	0.030	13.020	0.000	0.000
2102620	WQ-3	13:56	0	0		0.000	5.513	0.360	0.000	4.120	0.000	0.080	1.860	1.490	0.000	11.700	0.100	12.710	0.000	0.000
2102609	WQ-4	13:58	0	0		0.000	3.725	0.370	0.000	3.810	0.000	0.080	1.840	1.370	0.000	5.600	0.070	12.860	0.000	0.000
2102751	GW_152	14:00	0	0		3.141	3.225	0.400	0.000	14.390	0.000	0.090	3.290	5.240	0.000	8.900	0.050	14.070	0.000	0.000

Eco-Tracker™
Water Quality Monitoring Systems

Eco-Track Services
A division of UNIBEST International, LLC
500 Tausick Way
Walla Walla, WA 99362
1-509-525-3370
www.ecotrackservices.com
www.unibestinc.com

Report Date: 6/17/2020

Retailer Name: WWBWC
Submitter Name: Marie Cobb
Email: marie.cobb@wwbwc.org
City: Milton-Freewater
State: Oregon
Site Name: Eco-Tracker
Sample Date(s): 6/10/2020

All results are in ppm in extracted solution.
These samples were extracted with 50ml 2M HCl.

Barcode	Site Name	Sample ID	Depth Low (in.)	Depth High (in.)	Total N	NO3-N	NH4-N	Al	B	Ca	Cu	Fe	K	Mg	Mn	Na	P	S	Zn	pH
2102611	GW_170	14:11	0	12		1.651	14.188	0.400	0.000	14.250	0.000	0.060	4.090	5.150	0.000	11.700	0.050	17.060	0.000	0.000
2102617	GW_160	14:13	0	12		1.780	3.867	0.440	0.000	7.640	0.010	0.140	2.800	2.690	0.000	5.600	0.060	13.040	0.000	0.000
2102636	GW_151	14:15	0	12		5.225	3.867	0.350	0.000	14.130	0.000	0.060	4.020	5.110	0.000	8.900	0.050	15.700	0.000	0.000
2102585	GW_151 dup	14:17	0	12		4.583	6.396	0.350	0.000	13.810	0.000	0.050	3.530	5.000	0.000	3.400	0.050	16.980	0.000	0.000
2102582	GW_144	14:18	0	12		13.874	1.321	0.350	0.010	37.980	0.010	0.060	9.350	14.670	0.000	11.700	0.120	20.520	0.000	0.000
2102633	GW_141	14:20	0	12		1.202	0.859	0.360	0.000	8.360	0.000	0.050	3.500	3.110	0.000	5.600	0.060	13.810	0.000	0.000
2102604	GW_171	14:21	0	12		4.339	1.909	0.360	0.000	20.080	0.000	0.050	5.320	7.530	0.000	8.900	0.180	16.230	0.000	0.000
2102610	GW_142	14:23	0	12		0.754	1.214	0.380	0.000	5.940	0.000	0.050	2.260	2.160	0.000	3.400	0.050	13.310	0.000	0.000
2102607	GW_46	14:24	0	12		0.000	1.037	0.330	0.000	4.170	0.000	0.050	2.080	1.570	0.000	11.700	0.040	16.010	0.000	0.000
2102779	GW_117	14:26	0	12		4.850	1.226	0.360	0.000	14.390	0.000	0.060	4.120	5.250	0.000	5.600	0.060	16.920	0.000	0.000
2102784	GW_119	14:28	0	12		11.903	7.676	0.390	0.000	33.350	0.000	0.040	8.170	13.290	0.000	8.900	0.090	20.180	0.000	0.000
2102789	GW_169	14:29	0	12		0.623	3.399	0.310	0.000	8.970	0.000	0.070	2.600	3.210	0.000	3.400	0.080	13.050	0.010	0.000

Anatek Labs, Inc.
1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Client: Walla Walla Basin Watershed Council
Address: 810 S. Main Road
Milton-Freewater, OR 97862
Attn: Luke Adams

Work Order: MAF0327
Project: Managed Aquifer Recharge
Reported: 7/10/2020 13:42

Analytical Results Report

Sample Location: WQ-5
Lab/Sample Number: MAF0327-01
Collect Date: 06/09/20 07:55
Date Received: 06/10/20 09:49
Collected By:
Matrix: Water

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	ND	mg/L	0.100	6/10/20 19:08	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	ND	mg/L	0.00100	6/25/20 20:26	MYM	EPA 200.8	
Zinc	ND	mg/L	0.00100	7/8/20 22:12	MYM	EPA 200.8	

Analytical Results Report
(Continued)

Sample Location:	GW-152		
Lab/Sample Number:	MAF0327-02	Collect Date:	06/09/20 11:15
Date Received:	06/10/20 09:49	Collected By:	
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	2.71	mg/L	0.100	6/10/20 19:29	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	ND	mg/L	0.00100	6/25/20 20:32	MYM	EPA 200.8	
Zinc	0.00322	mg/L	0.00100	7/8/20 22:19	MYM	EPA 200.8	

Analytical Results Report

(Continued)

Sample Location: WQ-1
Lab/Sample Number: MAF0327-03 Collect Date: 06/09/20 12:00
Date Received: 06/10/20 09:49 Collected By:
Matrix: Water

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	ND	mg/L	0.100	6/10/20 19:51	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	ND	mg/L	0.00100	6/25/20 20:52	MYM	EPA 200.8	
Zinc	0.00370	mg/L	0.00100	7/8/20 22:38	MYM	EPA 200.8	

Analytical Results Report

(Continued)

Sample Location:	WQ-2		
Lab/Sample Number:	MAF0327-04	Collect Date:	06/09/20 12:28
Date Received:	06/10/20 09:49	Collected By:	
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	ND	mg/L	0.100	6/10/20 20:12	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	ND	mg/L	0.00100	6/25/20 20:58	MYM	EPA 200.8	
Zinc	ND	mg/L	0.00100	7/8/20 22:45	MYM	EPA 200.8	

Analytical Results Report

(Continued)

Sample Location: WQ-3

Lab/Sample Number: MAF0327-05 Collect Date: 06/09/20 12:42

Date Received: 06/10/20 09:49 Collected By:

Matrix: Water

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	ND	mg/L	0.100	6/10/20 20:34	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	ND	mg/L	0.00100	6/25/20 21:05	MYM	EPA 200.8	
Zinc	ND	mg/L	0.00100	7/8/20 22:51	MYM	EPA 200.8	

Analytical Results Report

(Continued)

Sample Location:	WQ-4		
Lab/Sample Number:	MAF0327-06	Collect Date:	06/09/20 12:58
Date Received:	06/10/20 09:49	Collected By:	
Matrix:	Water		

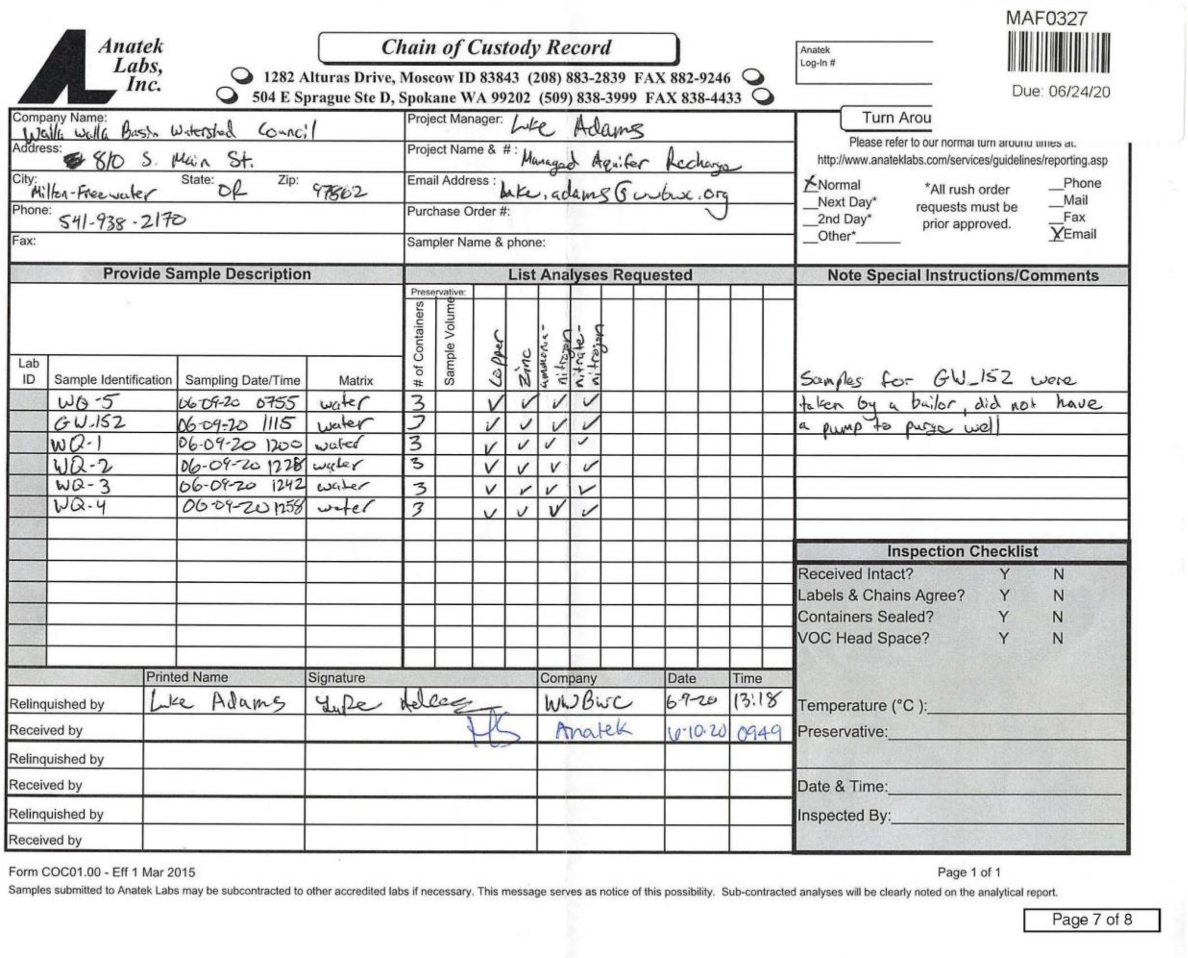
Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	ND	mg/L	0.100	6/10/20 20:55	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	0.00213	mg/L	0.00100	6/25/20 21:11	MYM	EPA 200.8	
Zinc	0.00219	mg/L	0.00100	7/8/20 22:57	MYM	EPA 200.8	

Authorized Signature,

Justin Doty For Todd Taruscio, Laboratory Manager

PQL	Practical Quantitation Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis

This report shall not be reproduced except in full, without the written approval of the laboratory
The results reported related only to the samples indicated.



MAF0327

Due: 06/24/20

Anatek Labs, Inc.

Chain of Custody Record

1282 Alturas Drive, Moscow ID 83843 (208) 883-2839 FAX 882-9246
504 E Sprague Ste D, Spokane WA 99202 (509) 838-3999 FAX 838-4433

Anatek Log-In #:

Company Name: Walla Walla Basin Watershed Council
Address: 810 S. Main St.
City: Milton-Freewater State: OR Zip: 97862
Phone: 541-938-2170
Fax:

Project Manager: Luke Adams
Project Name & #: Managed Aquifer Recharge
Email Address: luke.adams@wwbwc.org
Purchase Order #:
Sampler Name & phone:

Turn Arou

Please refer to our normal turn around times at:
http://www.anateklabs.com/services/guidelines/reporting.asp

X Normal
__Next Day*
__2nd Day*
__Other*______

*All rush order requests must be prior approved.

__Phone
__Mail
__Fax
X Email

Provide Sample Description / List Analyses Requested

Lab ID	Sample Identification	Sampling Date/Time	Matrix	# of Containers	Sample Volume	Copper	Zinc	ammonia-nitrogen	nitrate-nitrogen
	WQ-5	06-09-20 0755	water	3		✓	✓	✓	✓
	GW.152	06-09-20 1115	water	3		✓	✓	✓	✓
	WQ-1	06-09-20 1200	water	3		✓	✓	✓	✓
	WQ-2	06-09-20 1228	water	3		✓	✓	✓	✓
	WQ-3	06-09-20 1242	water	3		✓	✓	✓	✓
	WQ-4	06-09-20 1258	water	3		✓	✓	✓	✓

Preservative:

Note Special Instructions/Comments

Samples for GW_152 were taken by a bailor, did not have a pump to purge well

	Printed Name	Signature	Company	Date	Time
Relinquished by	Luke Adams	Luke Adams	WWBWC	6-9-20	13:18
Received by		HS	Anatek	6·10·20	0949
Relinquished by					
Received by					
Relinquished by					
Received by					

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
VOC Head Space?	Y	N

Temperature (°C):______
Preservative:______
Date & Time:______
Inspected By:______

Form COC01.00 - Eff 1 Mar 2015

Page 1 of 1

Samples submitted to Anatek Labs may be subcontracted to other accredited labs if necessary. This message serves as notice of this possibility. Sub-contracted analyses will be clearly noted on the analytical report.

Page 7 of 8

MAF0327

Due: 06/24/20

Anatek Labs, Inc.

Sample Receipt and Preservation Form

Client Name: Walla Walla Basin Project: Managed Aquifer Recharge (apply Anatek sample label here)

TAT: [✓ Normal] RUSH: ______ days

Samples Received From: FedEx [✓ UPS] USPS Client Courier Other: ______

Custody Seal on Cooler/Box: Yes [✓ No] Custody Seals Intact: Yes No [✓ N/A]

Number of Coolers/Boxes: 1 Type of Ice: Ice/[✓ Ice Packs] Blue Ice Dry Ice None

Packing Material: Bubble Wrap Bags Foam/Peanuts [✓ None] Other: ______

Cooler Temp As Read (°C): 1.5 Cooler Temp Corrected (°C): 1.5 Thermometer Used: IR-3

				Comments:
Samples Received Intact?	[✓ Yes]	No	N/A	
Chain of Custody Present?	[✓ Yes]	No	N/A	
Samples Received Within Hold Time?	[✓ Yes]	No	N/A	
Samples Properly Preserved?	[✓ Yes]	No	N/A	
VOC Vials Free of Headspace (<6mm)?	Yes	No	[✓ N/A]	
VOC Trip Blanks Present?	Yes	No	[✓ N/A]	
Labels and Chains Agree?	[✓ Yes]	No	N/A	
Total Number of Sample Bottles Received: 18				

Chain of Custody Fully Completed?	[✓ Yes]	No	N/A	
Correct Containers Received?	[✓ Yes]	No	N/A	
Anatek Bottles Used?	[✓ Yes]	No	Unknown	

Record preservatives (and lot numbers, if known) for containers below:

H_2SO_4(1911) → NH_3

metals → p250 nitrate p125

Notes, comments, etc. (also use this space if contacting the client - record names and date/time)

Received/Inspected By: HS Date/Time: 6·10·20 0949

Form F18.00 - Eff 8 Feb 2019

Page 1 of 1

Anatek Labs, Inc.

1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

---

Client:	Walla Walla Basin Watershed Council	Work Order:	MAF0372
Address:	810 S. Main Road	Project:	Managed Aquifer Recharge
	Milton-Freewater, OR 97862	Reported:	7/17/2020 08:38
Attn:	Luke Adams		

Analytical Results Report

Sample Location:	GW-141		
Lab/Sample Number:	MAF0372-01	Collect Date:	06/10/20 06:10
Date Received:	06/11/20 10:11	Collected By:	Luke Adams
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	1.21	mg/L	0.100	6/11/20 19:12	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	ND	mg/L	0.00100	6/25/20 18:43	MYM	EPA 200.8	
Zinc	ND	mg/L	0.00100	7/8/20 23:04	MYM	EPA 200.8	

Analytical Results Report

(Continued)

Sample Location:	GW-169		
Lab/Sample Number:	MAF0372-02	Collect Date:	06/10/20 06:48
Date Received:	06/11/20 10:11	Collected By:	Luke Adams
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	0.0546	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	0.867	mg/L	0.100	6/11/20 23:08	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	0.00113	mg/L	0.00100	6/25/20 19:02	MYM	EPA 200.8	
Zinc	0.00302	mg/L	0.00100	7/8/20 23:23	MYM	EPA 200.8	

Analytical Results Report

(Continued)

Sample Location:	GW-46		
Lab/Sample Number:	MAF0372-03	Collect Date:	06/10/20 07:32
Date Received:	06/11/20 10:11	Collected By:	Luke Adams
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	0.103	mg/L	0.100	6/11/20 18:08	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	0.00103	mg/L	0.00100	6/25/20 19:08	MYM	EPA 200.8	
Zinc	0.00114	mg/L	0.00100	7/8/20 23:30	MYM	EPA 200.8	

Analytical Results Report
(Continued)

Sample Location: GW-119
Lab/Sample Number: MAF0372-04 Collect Date: 06/10/20 08:04
Date Received: 06/11/20 10:11 Collected By: Luke Adams
Matrix: Water

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	10.2	mg/L	0.100	6/11/20 18:51	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	0.00103	mg/L	0.00100	6/25/20 19:15	MYM	EPA 200.8	
Zinc	0.00240	mg/L	0.00100	7/8/20 23:37	MYM	EPA 200.8	

Analytical Results Report
(Continued)

Sample Location: GW-144
Lab/Sample Number: MAF0372-05 Collect Date: 06/10/20 08:45
Date Received: 06/11/20 10:11 Collected By: Luke Adams
Matrix: Water

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	9.60	mg/L	0.100	6/11/20 19:55	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	0.00370	mg/L	0.00100	6/25/20 15:08	MYM	EPA 200.8	
Zinc	0.00111	mg/L	0.00100	6/29/20 16:09	MYM	EPA 200.8	

Analytical Results Report

(Continued)

Sample Location:	GW-117		
Lab/Sample Number:	MAF0372-06	Collect Date:	06/10/20 09:22
Date Received:	06/11/20 10:11	Collected By:	Luke Adams
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	5.20	mg/L	0.100	6/11/20 18:29	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	0.00170	mg/L	0.00100	6/25/20 15:34	MYM	EPA 200.8	
Zinc	0.00848	mg/L	0.00100	6/25/20 15:34	MYM	EPA 200.8	

Analytical Results Report

(Continued)

Sample Location:	GW-142		
Lab/Sample Number:	MAF0372-07	Collect Date:	06/10/20 09:58
Date Received:	06/11/20 10:11	Collected By:	Luke Adams
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	0.944	mg/L	0.100	6/11/20 19:34	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	ND	mg/L	0.00100	6/25/20 19:21	MYM	EPA 200.8	
Zinc	ND	mg/L	0.00100	7/9/20 0:09	MYM	EPA 200.8	

Analytical Results Report

(Continued)

Sample Location:	GW-170		
Lab/Sample Number:	MAF0372-08	Collect Date:	06/10/20 10:32
Date Received:	06/11/20 10:11	Collected By:	Luke Adams
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	1.85	mg/L	0.100	6/11/20 23:30	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	ND	mg/L	0.00100	6/25/20 19:28	MYM	EPA 200.8	
Zinc	0.00187	mg/L	0.00100	7/9/20 0:16	MYM	EPA 200.8	

Analytical Results Report

(Continued)

Sample Location:	GW-171		
Lab/Sample Number:	MAF0372-09	Collect Date:	06/10/20 11:08
Date Received:	06/11/20 10:11	Collected By:	Luke Adams
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	4.17	mg/L	0.100	6/11/20 23:51	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	ND	mg/L	0.00100	6/25/20 19:34	MYM	EPA 200.8	
Zinc	ND	mg/L	0.00100	7/9/20 0:22	MYM	EPA 200.8	

Analytical Results Report
(Continued)

Sample Location: GW-151
Lab/Sample Number: MAF0372-10 Collect Date: 06/10/20 11:55
Date Received: 06/11/20 10:11 Collected By: Luke Adams
Matrix: Water

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	4.52	mg/L	0.100	6/11/20 20:17	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	ND	mg/L	0.00100	6/25/20 19:41	MYM	EPA 200.8	
Zinc	ND	mg/L	0.00100	7/9/20 0:29	MYM	EPA 200.8	

Analytical Results Report

(Continued)

Sample Location:	GW-151 Duplicate		
Lab/Sample Number:	MAF0372-11	Collect Date:	06/10/20 11:58
Date Received:	06/11/20 10:11	Collected By:	Luke Adams
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	4.54	mg/L	0.100	6/11/20 20:38	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	ND	mg/L	0.00100	6/25/20 20:13	MYM	EPA 200.8	
Zinc	0.00448	mg/L	0.00100	7/9/20 0:35	MYM	EPA 200.8	

Anatek Labs, Inc.
1282 Alturas Drive - Moscow, ID 83843 - (208) 883-2839 - Fax (208) 8829246 - email moscow@anateklabs.com
504 E Sprague Ste. D - Spokane, WA 99202 - (509) 838-3999 - fax (509) 838-4433 - email spokane@anateklabs.com

Analytical Results Report
(Continued)

Sample Location:	GW-160		
Lab/Sample Number:	MAF0372-12	Collect Date:	06/10/20 12:35
Date Received:	06/11/20 10:11	Collected By:	Luke Adams
Matrix:	Water		

Analyte	Result	Units	PQL	Analyzed	Analyst	Method	Qualifier
Inorganics							
Ammonia/N	ND	mg/L	0.0500	6/12/20 15:00	BKP	SM 4500-NH3 G	
Nitrate-N	1.76	mg/L	0.100	6/11/20 21:00	BKP	EPA 300.0	
Metals by ICP-MS							
Copper	0.00548	mg/L	0.00100	6/25/20 20:19	MYM	EPA 200.8	
Zinc	0.0159	mg/L	0.00100	6/25/20 20:19	MYM	EPA 200.8	

Authorized Signature,

Todd Taruscio, Laboratory Manager

PQL	Practical Quantitation Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis

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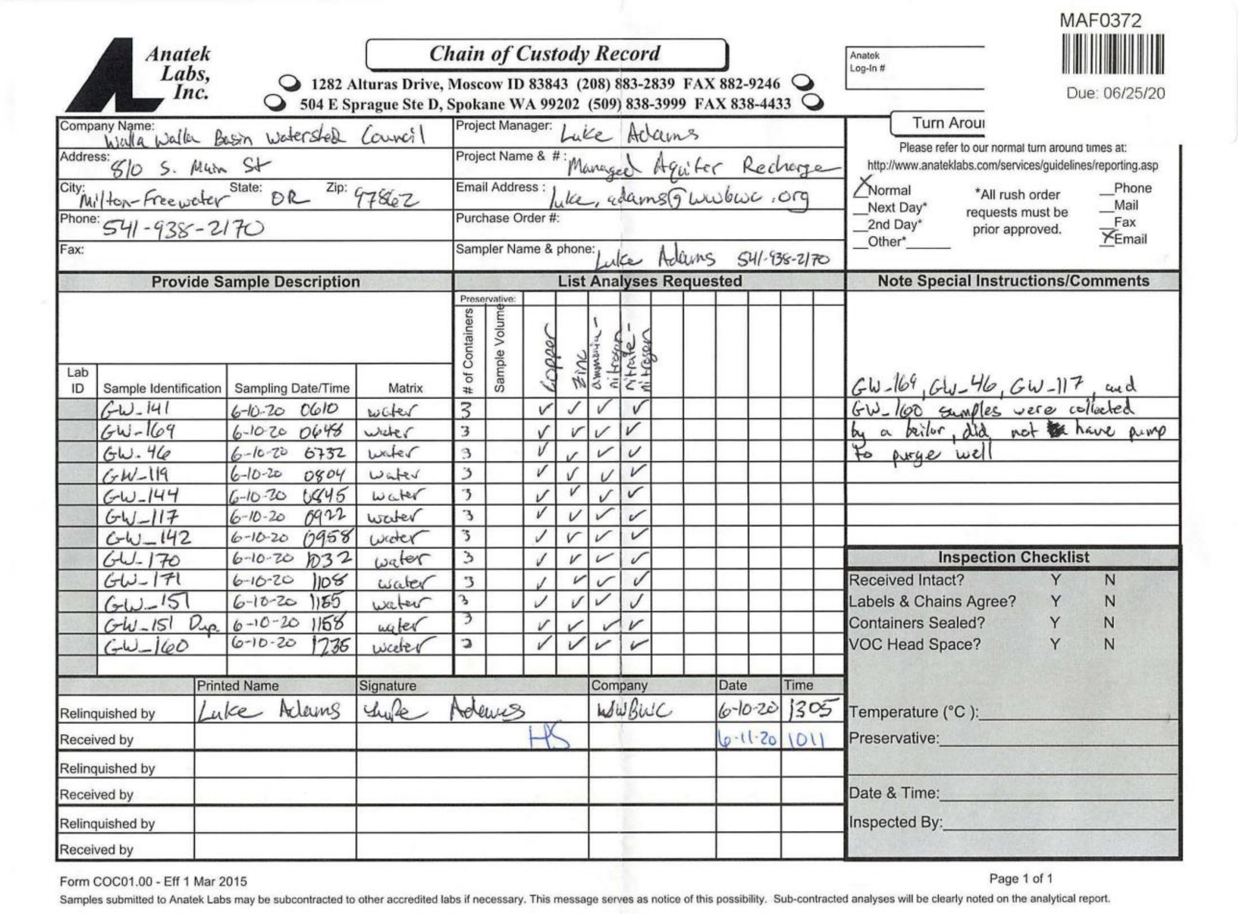
The results reported related only to the samples indicated.



Anatek Labs, Inc.

Chain of Custody Record

1282 Alturas Drive, Moscow ID 83843 (208) 883-2839 FAX 882-9246
504 E Sprague Ste D, Spokane WA 99202 (509) 838-3999 FAX 838-4433

Anatek Log-In #

MAF0372

Due: 06/25/20

Company Name: Walla Walla Basin Watershed Council
Address: 810 S. Main St
City: Milton-Freewater State: OR Zip: 97862
Phone: 541-938-2170
Fax:

Project Manager: Luke Adams
Project Name & #: Managed Aquifer Recharge
Email Address: luke.adams@wwbwc.org
Purchase Order #:
Sampler Name & phone: Luke Adams 541-938-2170

Turn Arou

Please refer to our normal turn around times at: http://www.anateklabs.com/services/guidelines/reporting.asp

[✓ Normal]
__Next Day*
__2nd Day*
__Other*______

*All rush order requests must be prior approved.

__Phone
__Mail
__Fax
[✓ Email]

Provide Sample Description / **List Analyses Requested**

Lab ID	Sample Identification	Sampling Date/Time	Matrix	# of Containers	Sample Volume	Copper	Zinc	ammonia-nitrogen	nitrate-nitrogen						
			Preservative:												
	GW-141	6-10-20 0610	water	3		✓	✓	✓	✓						
	GW-169	6-10-20 0648	water	3		✓	✓	✓	✓						
	GW.46	6-10-20 0732	water	3		✓	✓	✓	✓						
	GW-119	6-10-20 0804	water	3		✓	✓	✓	✓						
	GW-144	6-10-20 0845	water	3		✓	✓	✓	✓						
	GW-117	6-10-20 0922	water	3		✓	✓	✓	✓						
	GW-142	6-10-20 0958	water	3		✓	✓	✓	✓						
	GW-170	6-10-20 1032	water	3		✓	✓	✓	✓						
	GW-171	6-10-20 1108	water	3		✓	✓	✓	✓						
	GW-151	6-10-20 1155	water	3		✓	✓	✓	✓						
	GW-151 Dup.	6-10-20 1158	water	3		✓	✓	✓	✓						
	GW-160	6-10-20 1236	water	3		✓	✓	✓	✓						

Note Special Instructions/Comments

GW-169, GW-46, GW-117, and GW-160 samples were collected by a bailer, did not have pump to purge well

	Printed Name	Signature	Company	Date	Time
Relinquished by	Luke Adams	Luke Adams	WWBWC	6-10-20	1305
Received by		HS		6-11-20	1011
Relinquished by					
Received by					
Relinquished by					
Received by					

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
VOC Head Space?	Y	N

Temperature (°C):
Preservative:

Date & Time:
Inspected By:

Form COC01.00 - Eff 1 Mar 2015

Page 1 of 1

Samples submitted to Anatek Labs may be subcontracted to other accredited labs if necessary. This message serves as notice of this possibility. Sub-contracted analyses will be clearly noted on the analytical report.

MAF0372
Due: 06/25/20

Anatek Labs, Inc.

Sample Receipt and Preservation Form

Client Name: WWBWC Project: (apply Anatek sample label here)

TAT: [✓ Normal] RUSH: ______ days

Samples Received From: FedEx [✓ UPS] USPS Client Courier Other: ______________

Custody Seal on Cooler/Box: Yes [✓ No] Custody Seals Intact: Yes No [✓ N/A]

Number of Coolers/Boxes: 1 Type of Ice: [✓ Ice/Ice Packs] Blue Ice Dry Ice None

Packing Material: Bubble Wrap Bags Foam/Peanuts [✓ None] Other: ______________

Cooler Temp As Read (°C): 13.5 Cooler Temp Corrected (°C): 13.5 Thermometer Used: IR-3

				Comments:
Samples Received Intact?	[✓ Yes]	No	N/A	
Chain of Custody Present?	[✓ Yes]	No	N/A	
Samples Received Within Hold Time?	[✓ Yes]	No	N/A	
Samples Properly Preserved?	[✓ Yes]	No	N/A	
VOC Vials Free of Headspace (<6mm)?	Yes	No	[✓ N/A]	
VOC Trip Blanks Present?	Yes	No	[✓ N/A]	
Labels and Chains Agree?	[✓ Yes]	No	N/A	
Total Number of Sample Bottles Received: 36				

Chain of Custody Fully Completed?	[✓ Yes]	No	N/A	
Correct Containers Received?	[✓ Yes]	No	N/A	
Anatek Bottles Used?	[✓ Yes]	No	Unknown	

Record preservatives (and lot numbers, if known) for containers below:

H_2SO_4 (1911) → NH_3

Notes, comments, etc. (also use this space if contacting the client - record names and date/time)

Contact about temperature
↳ proceed w/ analysis -HS

Received/Inspected By: HS Date/Time: 6-11-20 1011

Matrix SCIENCES | PAL PACIFIC AGRICULTURAL LABORATORY

PACAGLAB.COM
503.626.7943
21830 S.W. Alexander Ln
Sherwood, OR 97140

Walla Walla Basin Watershed Council
810 S. Main Street
Milton-Freewater, OR 97862

Report Number: P200863
Report Date: June 24, 2020
Client Project ID:

Client Sample ID: GW-144
PAL Sample ID: P200863-01
Matrix: water

Sample Date: 06/10/2020
Received Date: 06/11/2020
Extraction Date: 06/12/2020

Certificate of Analysis

Analysis Date	Analyte	Amount Detected	LOQ (ug/L)	Notes	Analysis Date	Analyte	Amount Detected	LOQ (ug/L)	Notes
Modified EPA 8270D (GC-MS/MS)									
06/15/2020	Chlorpyrifos	ND	0.060		06/15/2020	Malathion	ND	0.060	
Modified EPA 8321B (LC-MS/MS)									
06/16/2020	Azinphos-methyl	ND	0.12		06/16/2020	DCPMU	ND	0.060	
06/16/2020	Diuron	ND	0.060						

Notes and Definitions

Notes	Definition
LOQ	Limit of Quantitation
ND	Not Detected
*	Not included under current scope of accreditation

The results contained in this report relate only to the items tested.
The results reflect the condition of the samples as received by PAL.
Samples will be stored for a minimum of 60 days after the final report is issued, as described in our Quality Manual.
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Rick Jordan, Laboratory Director

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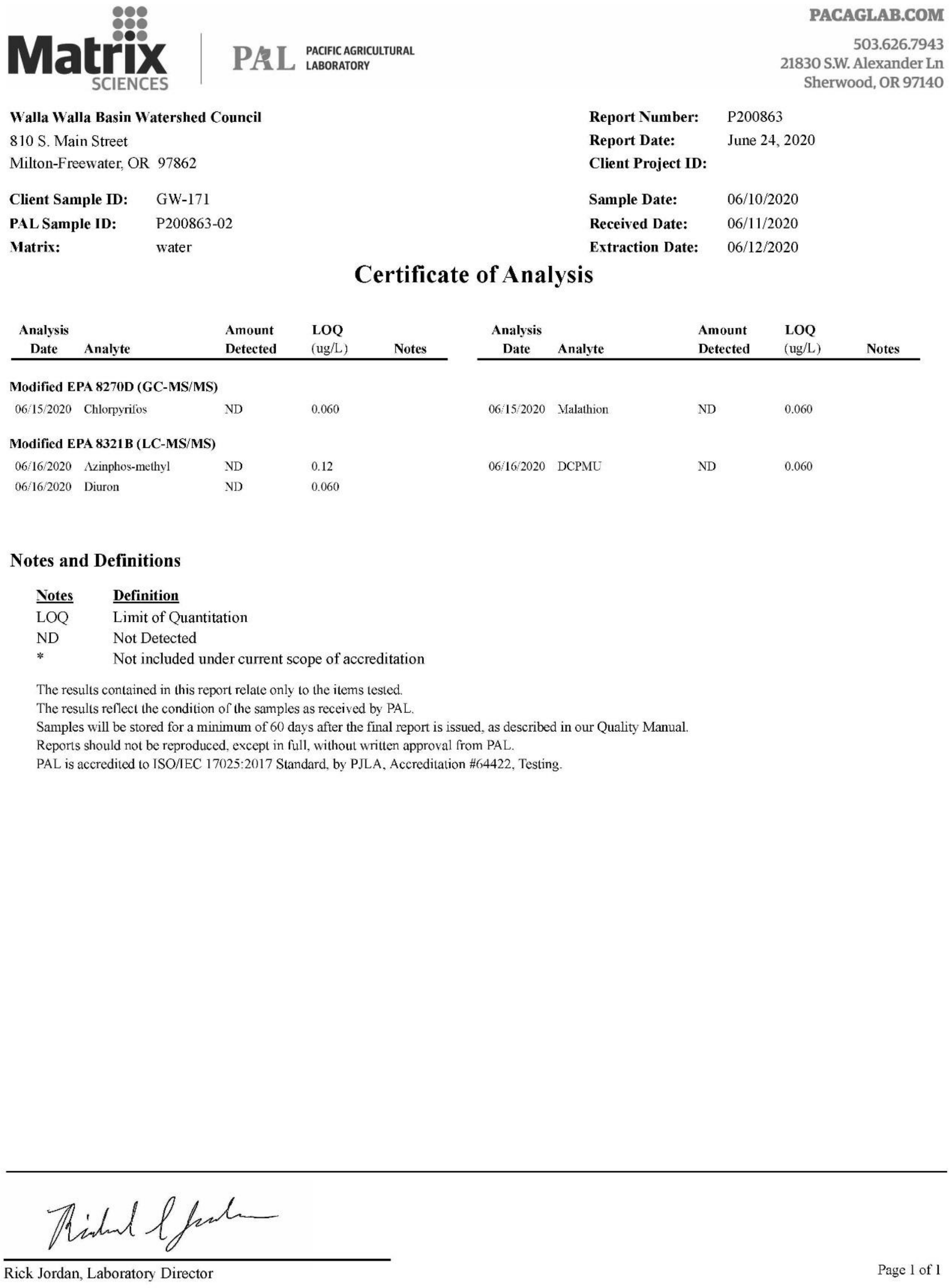

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PACAGLAB.COM

503.626.7943
21830 S.W. Alexander Ln
Sherwood, OR 97140

Walla Walla Basin Watershed Council
810 S. Main Street
Milton-Freewater, OR 97862

Report Number: P200863
Report Date: June 24, 2020
Client Project ID:

Client Sample ID: GW-171
PAL Sample ID: P200863-02
Matrix: water

Sample Date: 06/10/2020
Received Date: 06/11/2020
Extraction Date: 06/12/2020

Certificate of Analysis

Analysis Date	Analyte	Amount Detected	LOQ (ug/L)	Notes	Analysis Date	Analyte	Amount Detected	LOQ (ug/L)	Notes
Modified EPA 8270D (GC-MS/MS)									
06/15/2020	Chlorpyrifos	ND	0.060		06/15/2020	Malathion	ND	0.060	
Modified EPA 8321B (LC-MS/MS)									
06/16/2020	Azinphos-methyl	ND	0.12		06/16/2020	DCPMU	ND	0.060	
06/16/2020	Diuron	ND	0.060						

Notes and Definitions

Notes	Definition
LOQ	Limit of Quantitation
ND	Not Detected
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Rick Jordan, Laboratory Director

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