www.wwbwc.org
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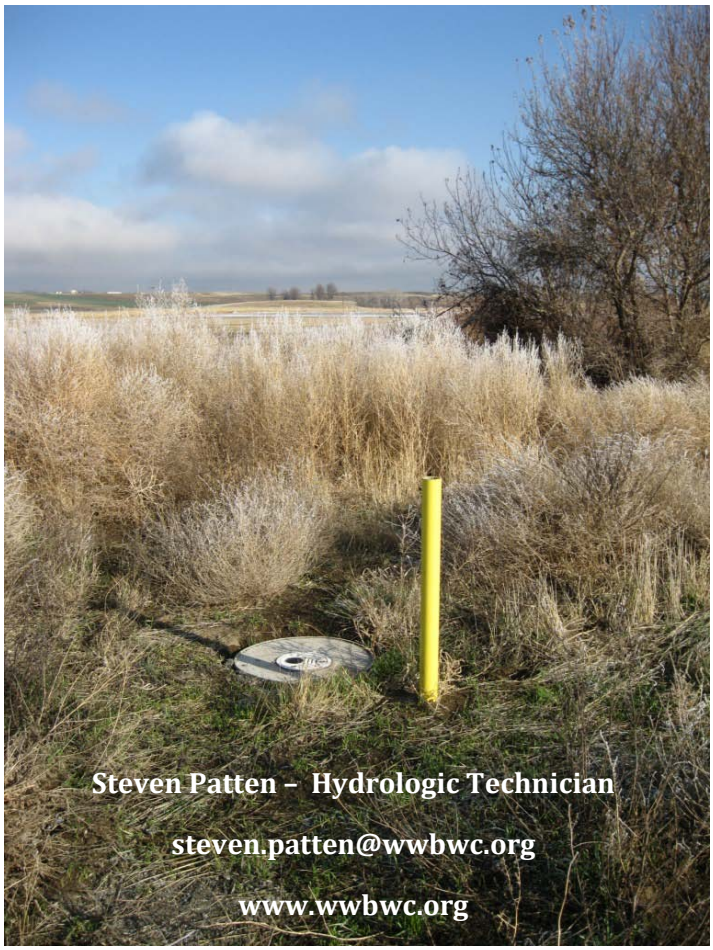
Watershed Management Initiative – Phase II

2007-2009

Final Report

Shallow Aquifer Monitoring in the Walla Walla Basin



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In Cooperation with:

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Shallow Aquifer Monitoring Project

Introduction

Overview

Since 2001 the Walla Walla Basin Watershed Council (WWBWC) has been constructing a network of shallow (<250 feet) monitoring wells in the Walla Walla River Valley as part of its long-term efforts to understand the shallow (unconfined) alluvial aquifer. The primary objective of establishing this network is to provide needed data for informed water management in the bi-state basin and help water and fisheries' managers in the basin better understand surface-groundwater interactions as they relate to salmon recovery and groundwater supplies. The monitoring network is also used to track the implementation of artificial aquifer recharge projects currently in operation and provide data for modeling projects.

Well monitoring consists of measuring the static water level (SWL), or the depth to water, water temperature and specific conductivity. The well monitoring network is comprised of two types of monitoring wells: continuous monitoring wells, instrumented with pressure transducers that measure static water level once per hour, and non-continuous wells which are measured manually every three months. Temperature and conductivity measurements are taken quarterly at both types of monitoring wells.

The WWBWC worked with the Oregon Water Resource Department (OWRD) and Washington Department of Ecology (WDOE) to develop protocols for monitoring well location, measurement, and maintenance. Many of the original monitoring wells in the network were established or drilled by OWRD and WDOE. Other partners in the basin such as the Hudson Bay District Improvement Company (HBDIC), The Native Creek Society, and Gardena Farms Irrigation District #13 (GFID#13) have contributed to expanding the monitoring network through direct monitoring and landowner outreach. Many of the dedicated monitoring wells were also established as part of the basin's three shallow aquifer recharge projects. A summary of the established monitoring wells is found in Table 1.

In addition to monitoring well data collection, WWBWC also performed an extensive search for historical records and information about wells in the network. This historical and background information was compiled in 2008 as the Monitoring Well Notebook, which includes water rights, well logs, USGS and OWRD historical SWL data, well GPS coordinates, elevation, maps, and photos of the wells. The Monitoring Well Notebook serves as institutional memory of the monitoring

network and gives insight into historical uses and conditions of the wells and aquifer. It also allows WWBWC to easily share well information with the community and agencies.

Table 1. Summary of wells in the Walla Walla Basin Shallow Aquifer Monitoring Project as of 2009

Monitoring Group	State	Number of Wells
OWRD	Oregon	15
HBDIC Recharge Project	Oregon	4
Hall-Wentland Recharge Project	Oregon	3
WWBWC	Oregon	34
WDOE	Washington	20
Locher Road Recharge Project	Washington	3
WWBWC	Washington	21
Total		100

Well Network Monitoring Area

The Walla Walla Valley River Basin is a bi-state system located in northeastern Oregon and southeastern Washington State (Figure 1.) The river basin is approximately 1,760 square miles, with an underlying shallow alluvial aquifer of 200 square miles (Figure 2.) Ninety to ninety-five percent of water rights in the basin are served by the shallow alluvial aquifer, making it a highly important source of water for irrigated agricultural lands as well as domestic and municipal uses.

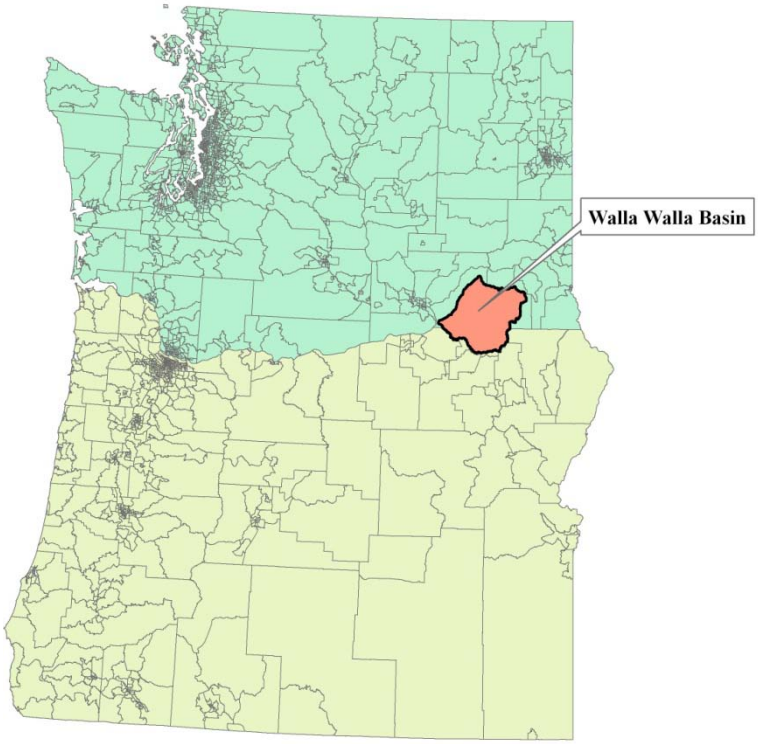


Figure 1. The bi-state Walla Walla River Basin in northeastern Oregon and southeastern Washington.

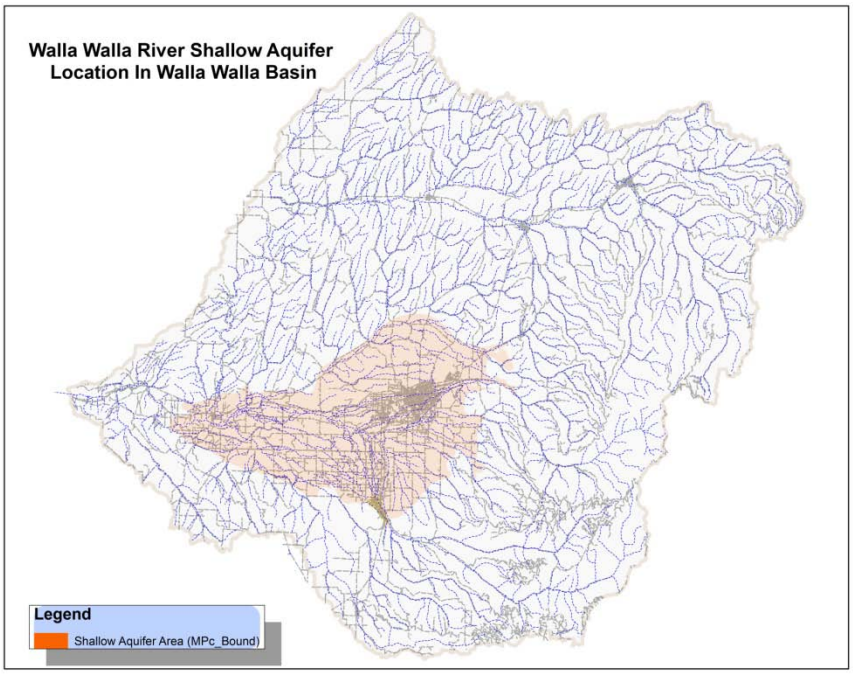


Figure 2. The Walla Walla River Basin with the underlying shallow alluvial aquifer.

In addition to supplying water for the basins wells, the shallow alluvial aquifer also feeds the numerous springs, streams, and rivers of the Walla Walla basin. The high connectivity between the aquifer and surface water bodies is important for enhancing base flows and cooling water temperatures for threatened salmonoid species in the river system (Malcolm, *et al.*, 2009; Sophocleous, 2002).

Starting in 2003, the WWBWC and its partners have been building a community-based groundwater monitoring network. This network involves establishing observation wells that measure long-term water levels and provide geologic information. In 2001, only a dozen shallow aquifer wells were monitored in Oregon and Washington. These wells were inadequate to effectively monitor and manage the vast aquifer which supplies thousands of domestic and agricultural wells as well as contributing to base flows for the Walla Walla River. As of 2009, WWBWC and its state and local partners monitor over 100 wells (Figure 3-6.)

The well network includes both urban and rural wells in and around Milton-Freewater, OR, Umapine, OR, Walla Walla, WA, College Place, WA, Lowden, WA, and Touchet, WA (Figure 3.) The wells are owned by a variety of water users, including government agencies (state, county, and city), businesses, and universities within the basin. However, most monitoring wells are irrigation or old domestic wells owned by private land owners. All of the participating well owners do so voluntarily, aiding in the effort to understand and mitigate the decline of the aquifer: a critically important ecological resource to the communities located within the Walla Walla Basin.

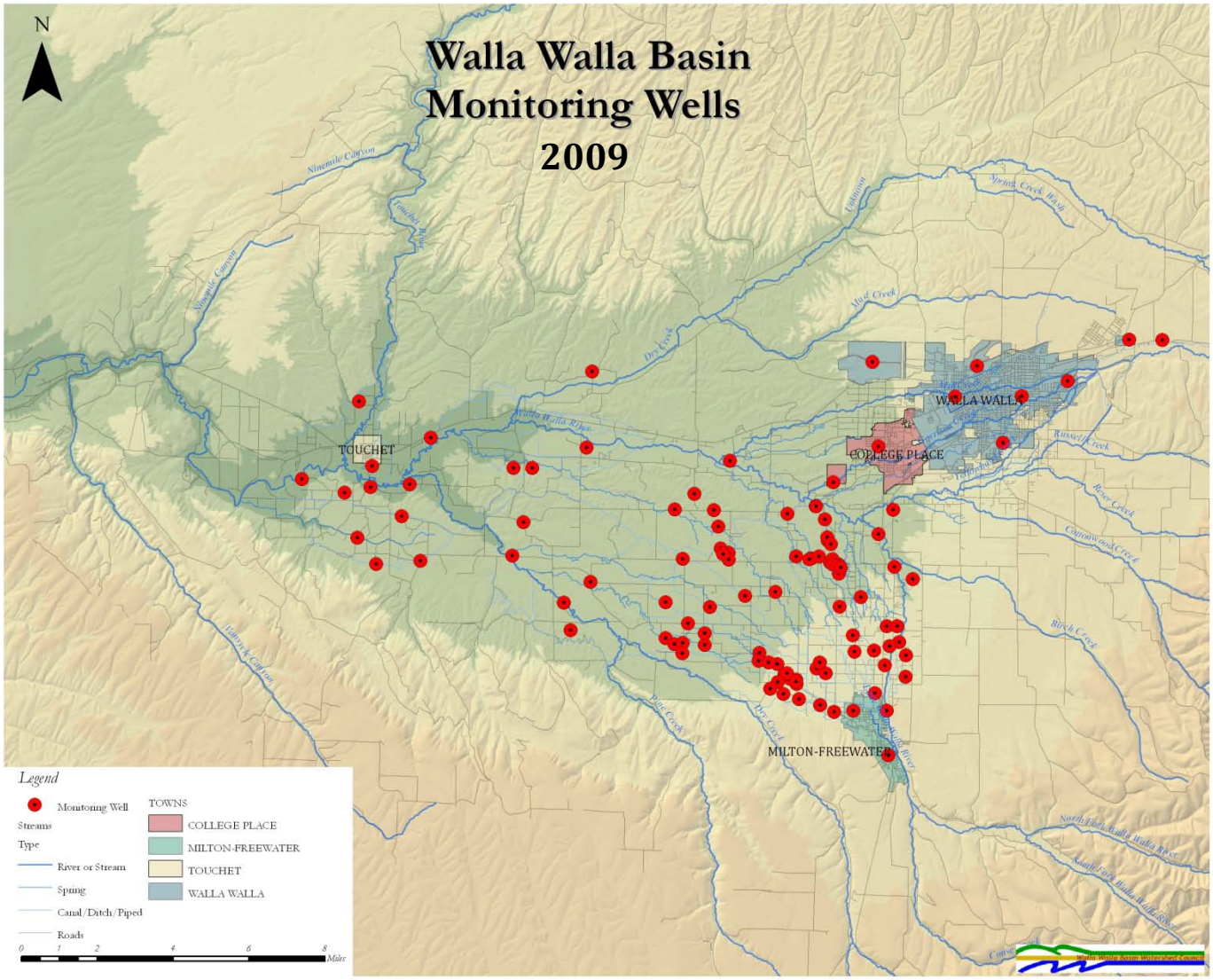


Figure 3. Wells located in the Walla Walla Basin (2009) that are monitored as a part of the shallow aquifer monitoring program through multiple agencies including WDOE, ORWD, the City of Walla Walla, and the WWBWC.

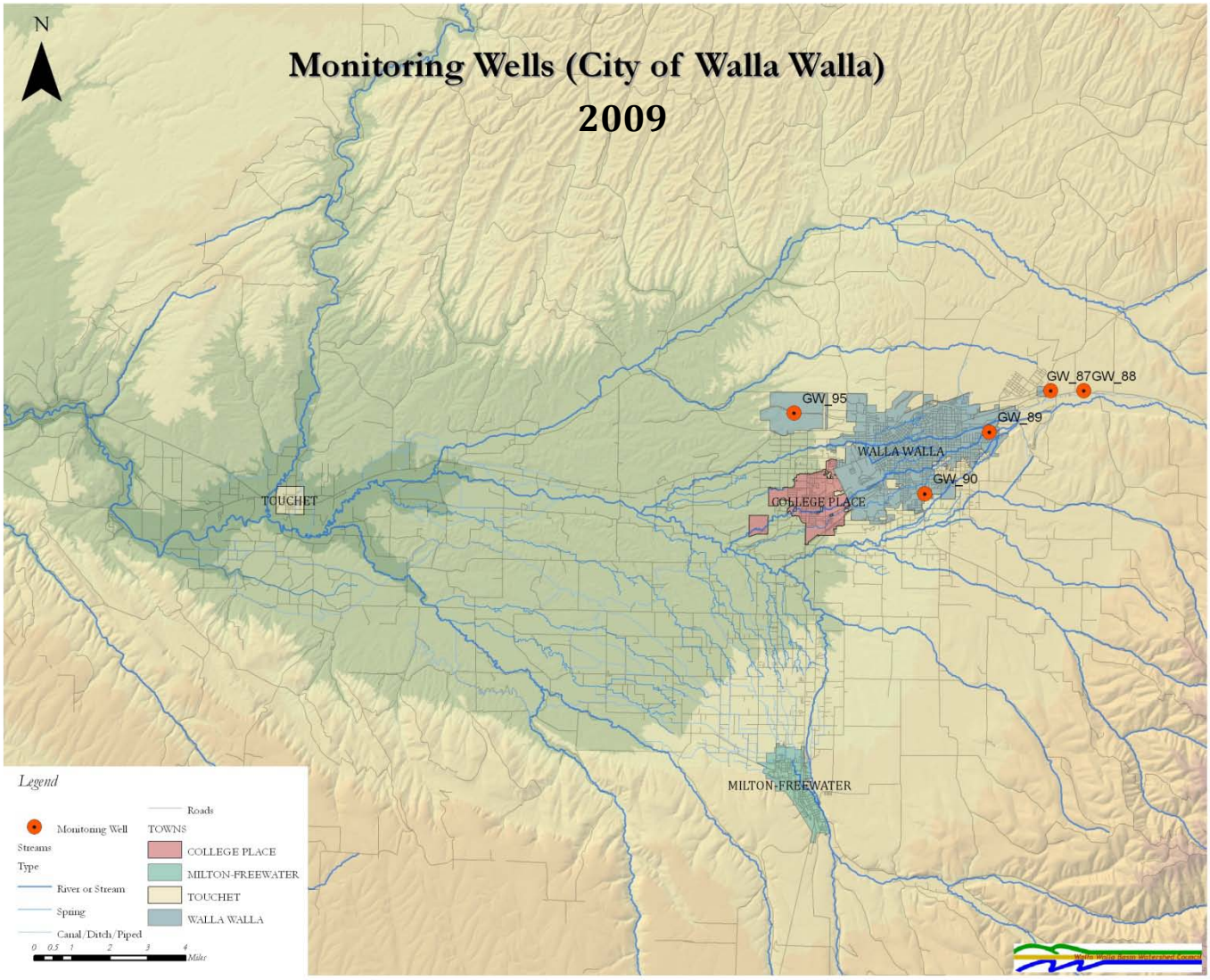


Figure 4. Walla Walla City wells that are incorporated into the Shallow Aquifer Monitoring Program run by the WWBWC (2009).

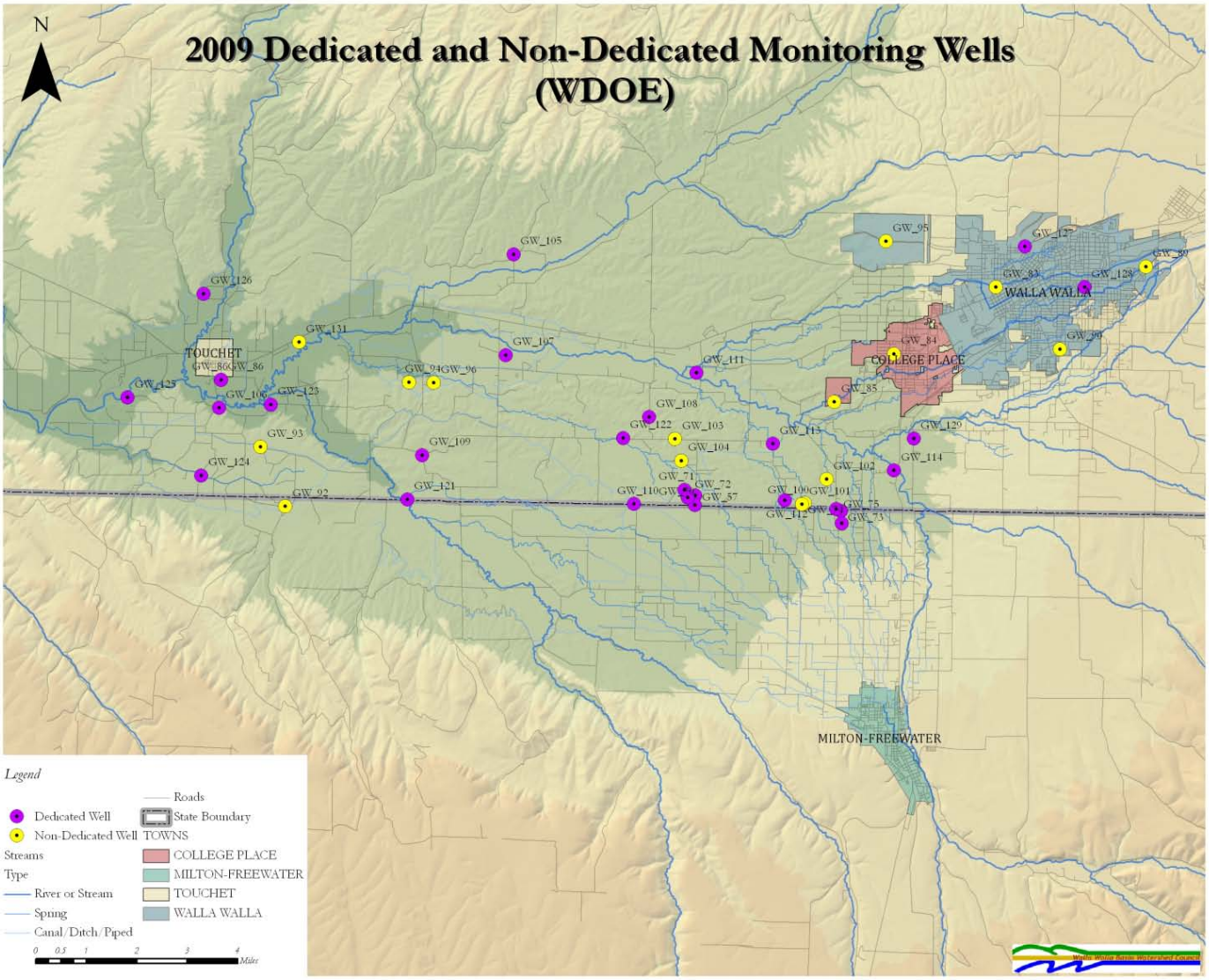


Figure 5. Washington Department of Ecology wells that are incorporated into the Shallow Aquifer Monitoring Program run by the WWBWC (2009). Purple dots indicate WDOE dedicated monitoring wells. Yellow dots indicate Non-dedicated monitoring wells.

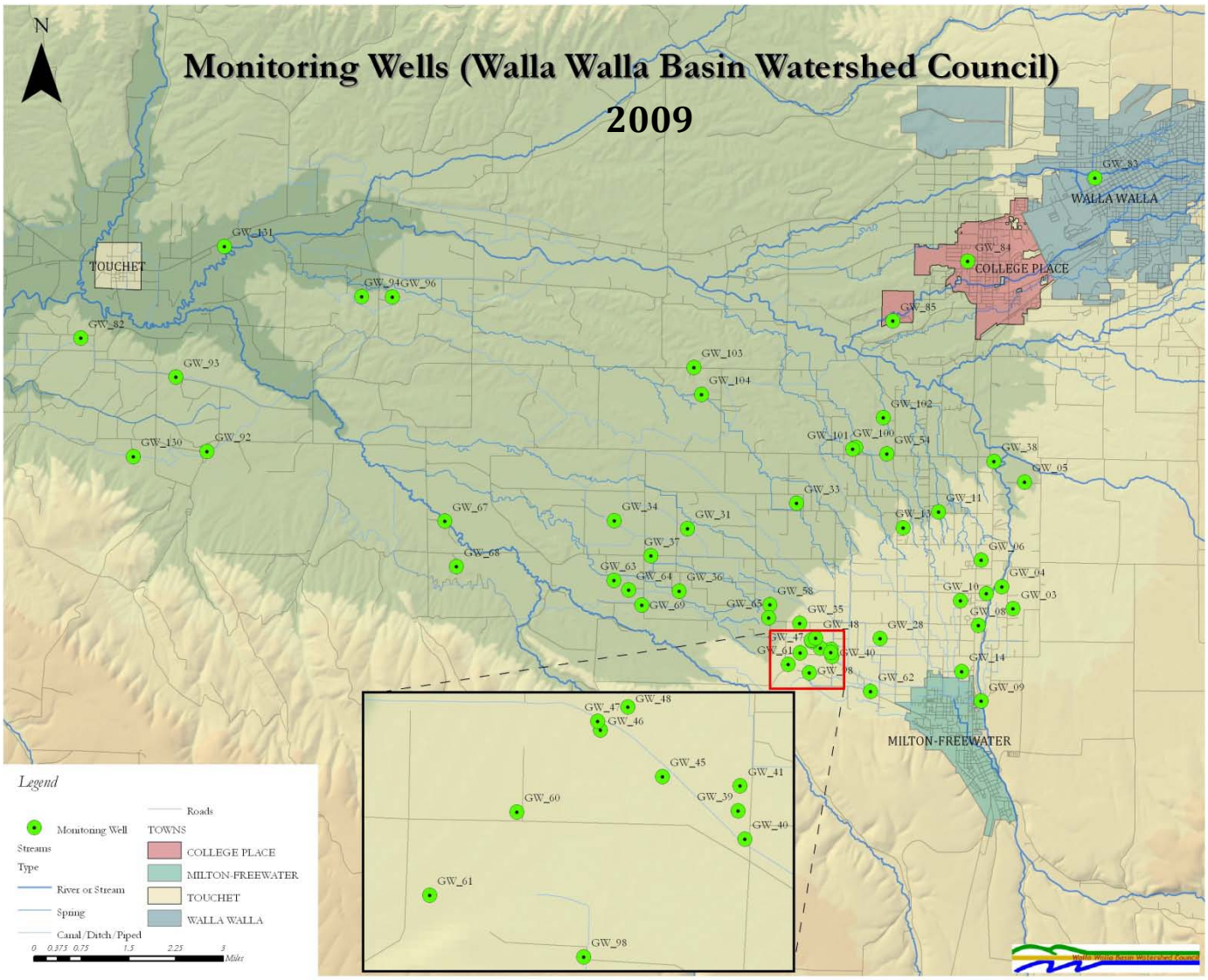


Figure 6. Walla Walla Basin Watershed Council wells that monitored as a part of the Shallow Aquifer Monitoring Program (2009).

Methods

Continuous wells

Continuous monitoring wells were instrumented with one of three different pressure transducers (Figure 7) that are suspended in the well below the water level, but not resting on the bottom of the well. The pressure transducers electronically determined and recorded the water pressure (PSI) and water temperature (either °F or °C) once every hour. Transducer data was downloaded quarterly. Manual SWL measurements were made quarterly to verify the pressure transducers' accuracy.

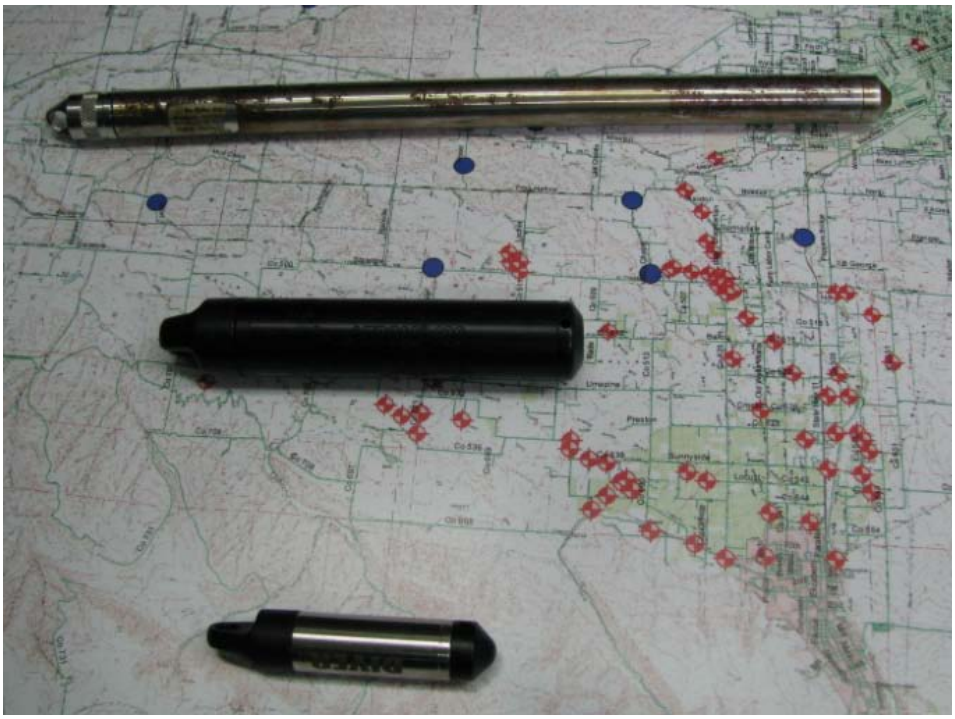


Figure 7. Three types of pressure transducers used by WWBWC for monitoring the shallow alluvial aquifer in the Walla Walla River Basin. From top to bottom transducer types are: In-Situ MiniTroll, In-Situ LT-100, Schlumberger Microdiver.

Non-continuous wells

The shallow groundwater alluvial aquifer well network includes many non-continuous or quarterly monitoring wells. These wells were not instrumented with pressure transducers, but rather SWL data was collected quarterly. SWL was measured with an e-tape (Model 800, engineering tape, Waterline Envirotech Ltd, www.waterlineusa.com). SWL was measured to an established measurement point and then adjusted for top of grade.

Manual Sampling (Temperature and Conductivity)

Temperature and conductivity were measured at each well on a quarterly basis. Some wells did not have access points for collection of water for temperature and conductivity. Water samples were taken at times of transducer download or SWL measurement. Temperature and conductivity values were determined using a handheld conductivity meter (YSI 30, www.ysi.com). Pump condition (on or off) was also determined, if applicable, during each visit. A summary of continuous and non-continuous monitoring wells is shown in Table 2. Further details regarding transducer downloading, deployment, maintenance, and quarterly data collection can be found in Appendix A.

Table 2. Summary of well types monitored by WWBWC in the Walla Walla Basin Shallow Aquifer Monitoring Project as of 2009

Well Type	State	Number of Wells
Continuous	OR	31
Non-continuous w/ temperature and conductivity	OR	10
Non-continuous w/o temperature and conductivity	OR	15
Continuous	WA	25
Non-continuous w/ temperature and conductivity	WA	11
Non-continuous w/o temperature and conductivity	WA	2
TOTAL		94

Data Processing and Analysis

Most of the loggers used by WWBWC are absolute (non-vented) loggers, therefore continuous transducer data was compensated for atmospheric pressure using data from dedicated barometric transducers located at the WWBWC office in Milton-Freewater, OR. The data was converted from PSI to feet of water and subtracted from the estimated logger cable length. This gave a depth to water value for each data point from the transducer data. The estimated logger cable length was determined by taking the manual SWL measurement plus the water pressure (barometrically compensated) recorded by the transducer. The estimated logger cable length was determined every time the pressure transducer was changed or the cable length adjusted.

SWL data was plotted both continuously and year by year to show changes in the depth to water in a particular well. The graphs also show any mistakes in data entry, data analysis, or in logger data collection.

Results

Historic Wells

Seven of the wells monitored in the shallow aquifer are historic wells with data going back to 1949 for most of them and 1933 for one well. These wells can be used to see long term trends in the Walla Walla basin's shallow alluvial aquifer. All but one of these wells has shown a declining water level (Figures 9-15). One well, GW _17, was historically declining, but since the spring of 2005 has started to recover (Figure 10). Some of the monitored historic wells have gone dry in the recent past. GW_25 has been dry since 2004 (Figure 14) and GW_27 has been dry since 1995 (Figure 15).

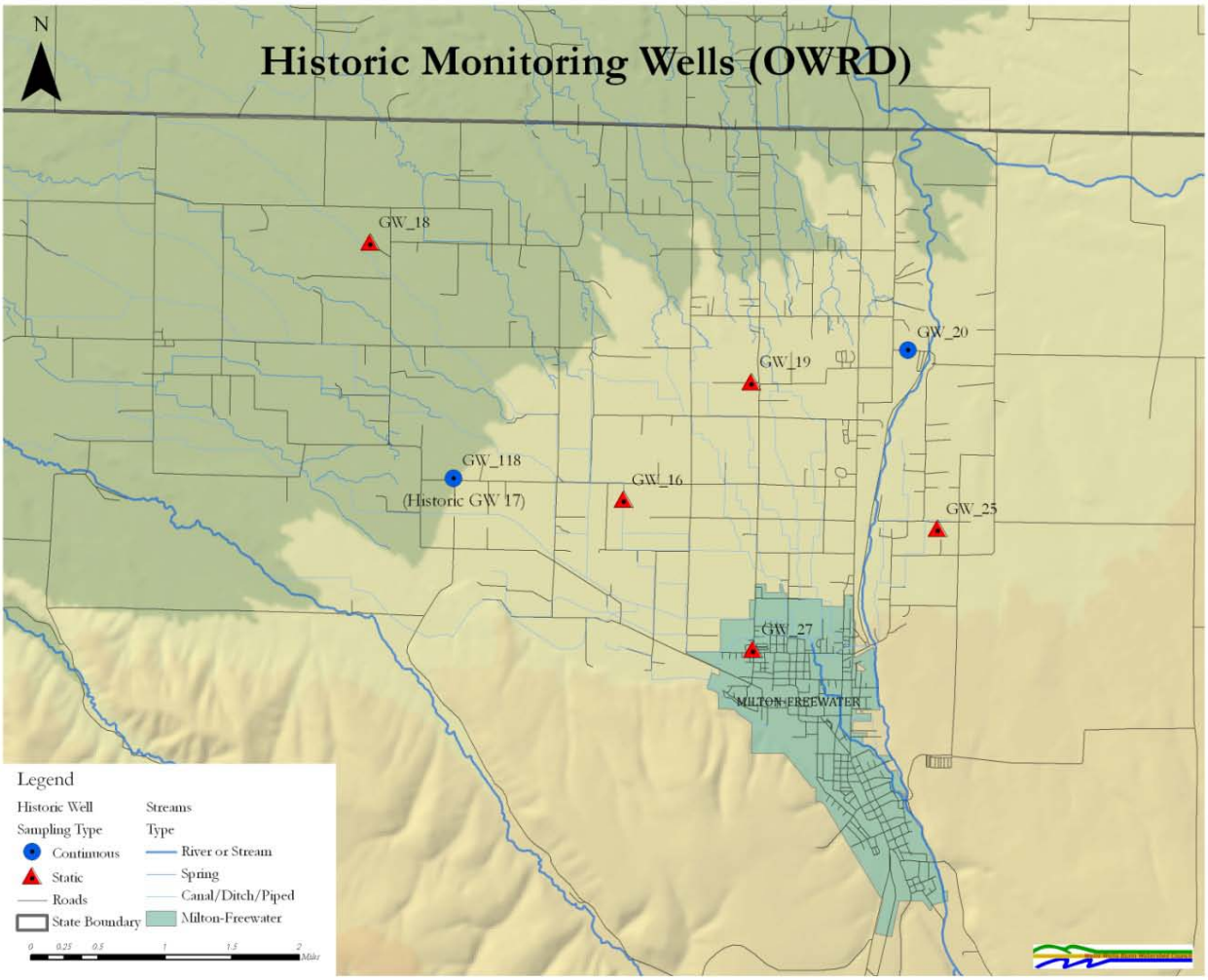


Figure 8. Historic wells that are monitored by the Walla Walla Basin Wastershed Council and OWRD as part of the Shallow Aquifer Monitoring Program run by the WWBWC.

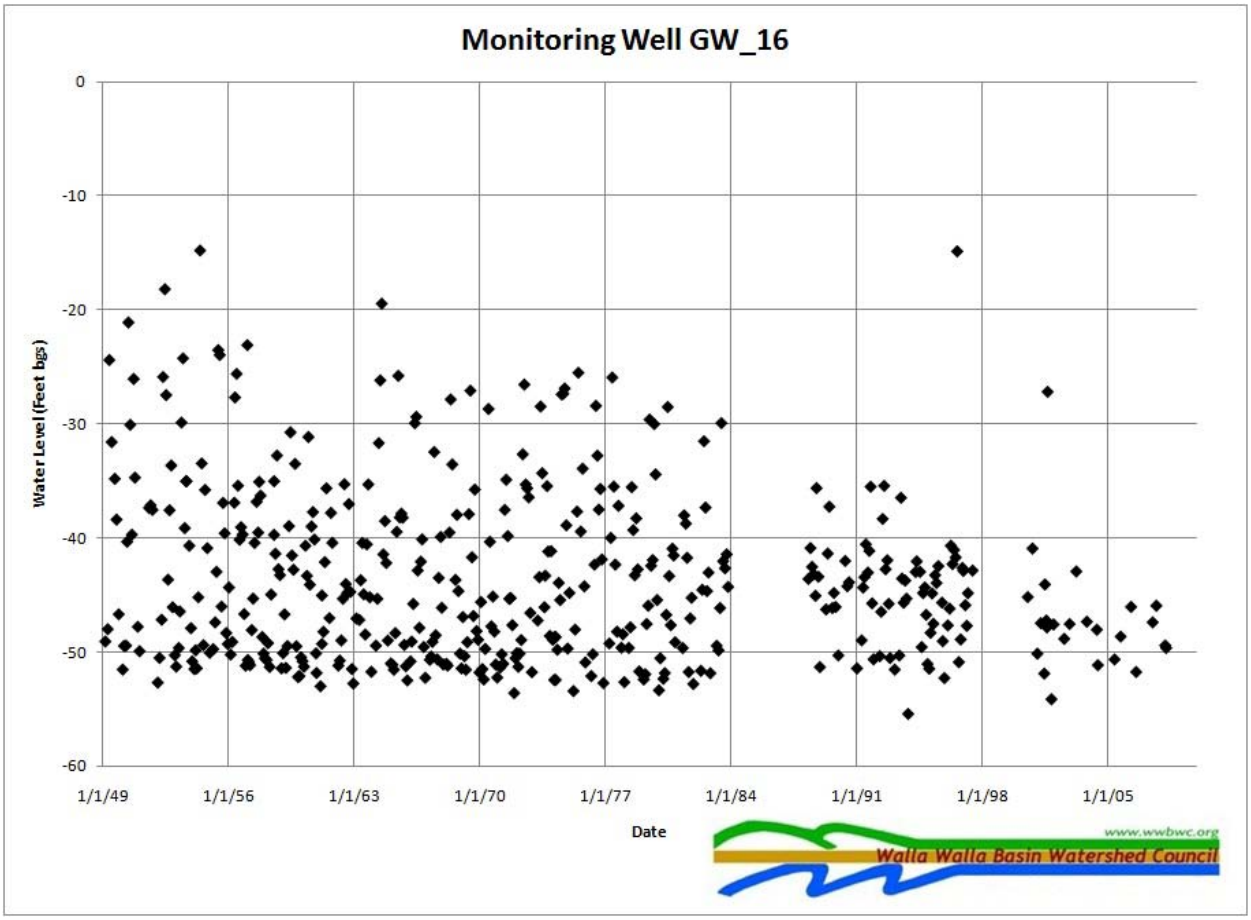
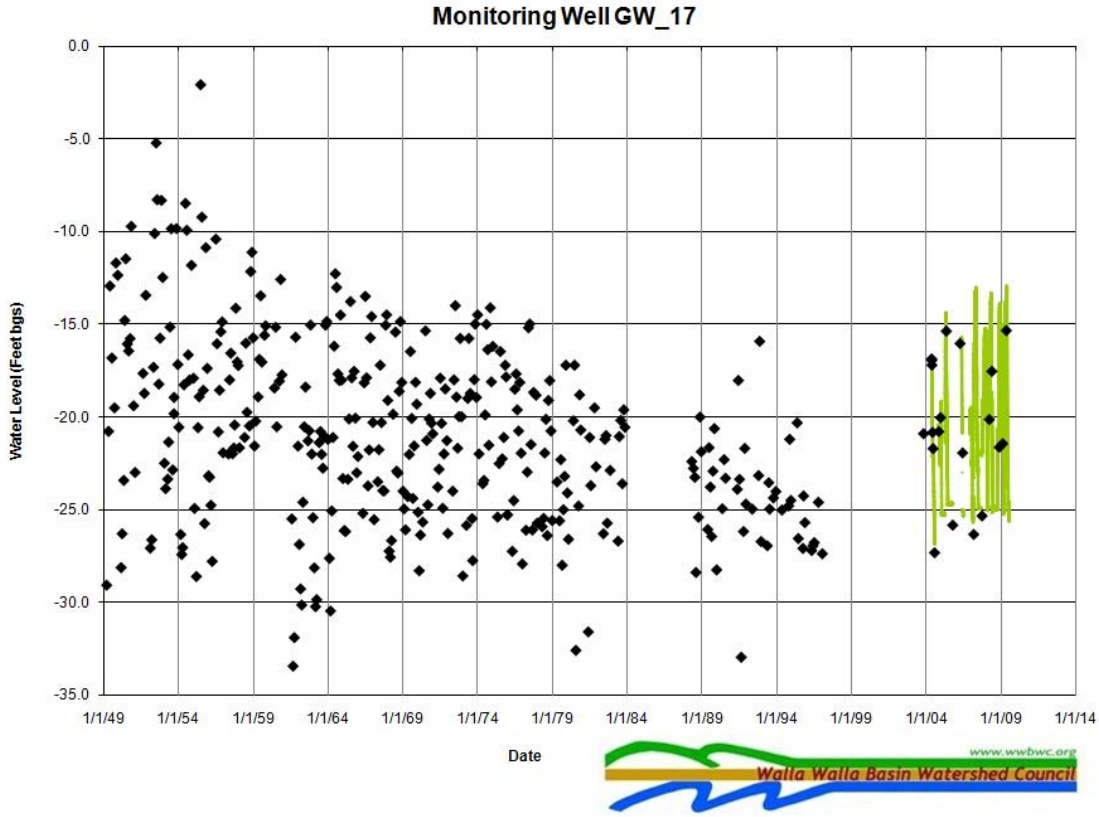


Figure 9. Static water level measurements in feet below ground surface from manual e-tape measurements for the historic well GW_16 located in the Walla Walla Basin's shallow alluvial aquifer.

A



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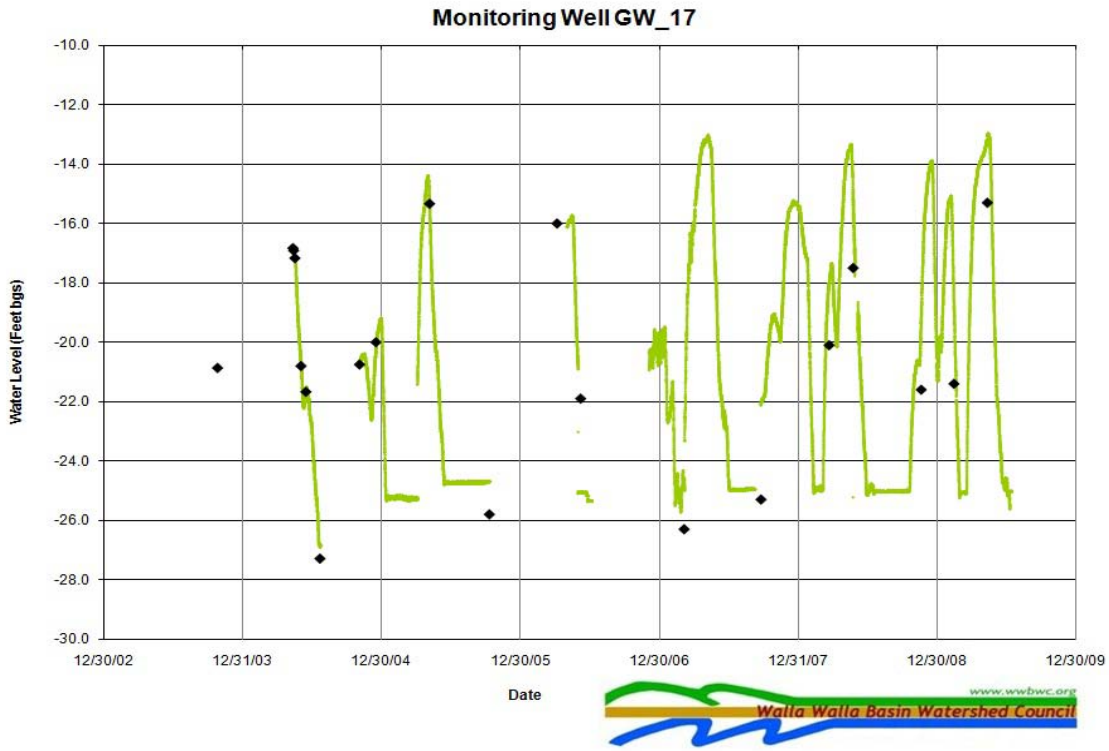

Figure 10. Static water level measurements in feet below ground surface from manual e-tape measurements and electronic pressure transducers for the historic well GW_17 located in the Walla Walla Basin's shallow alluvial aquifer. Logger data is from a pressure transducer suspended in the well. A) All data shown. B) Data for time period when a pressure transducer was in the well.

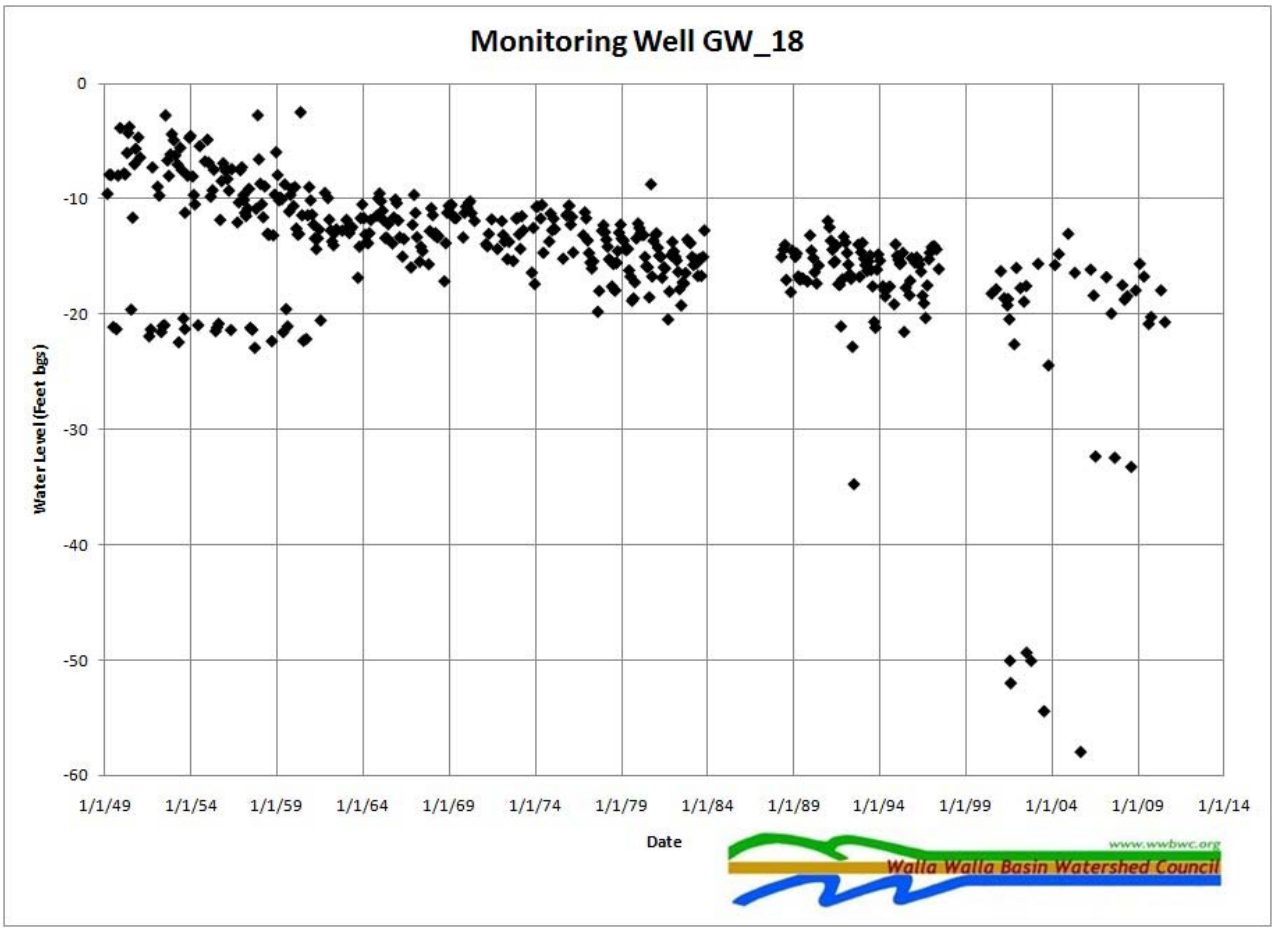

Figure 11. Static water level measurements in feet below ground surface from manual e-tape measurements for the historic well GW_18 located in the Walla Walla Basin's shallow alluvial aquifer.

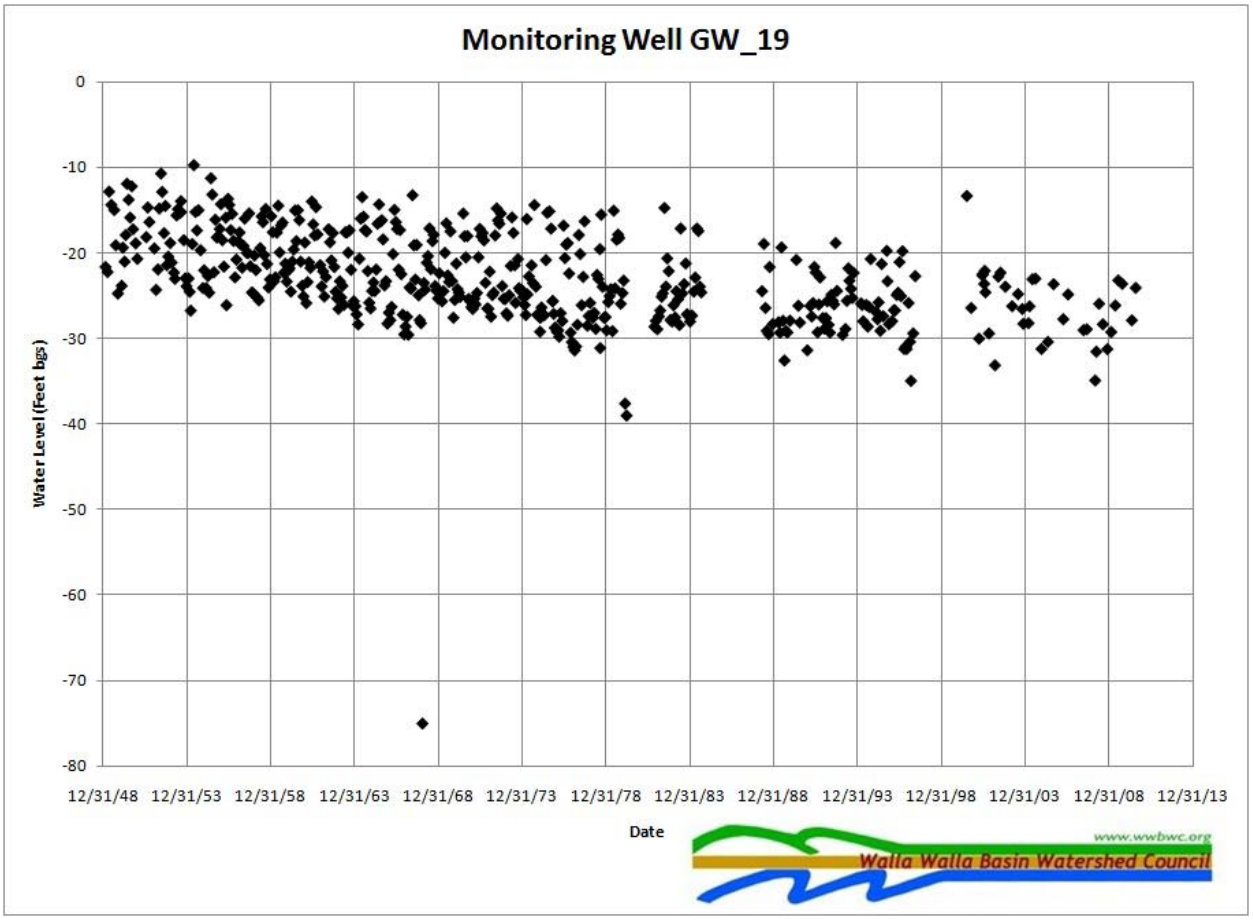

Figure 12. Static water level measurements in feet below ground surface from manual e-tape measurements for the historic well GW_19 located in the Walla Walla Basin's shallow alluvial aquifer.

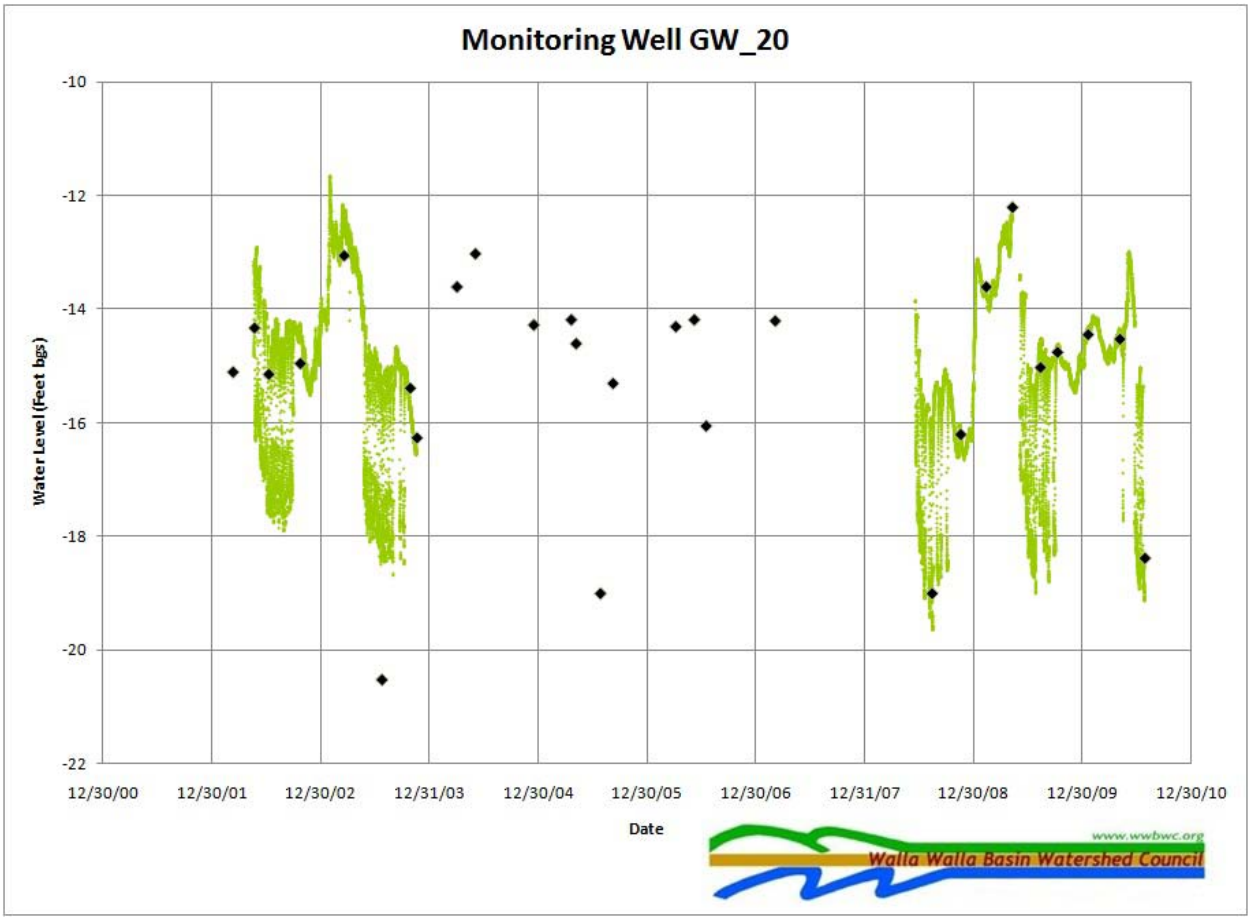

Figure 13. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for the historic well GW_20 located in the Walla Walla Basin's shallow alluvial aquifer.

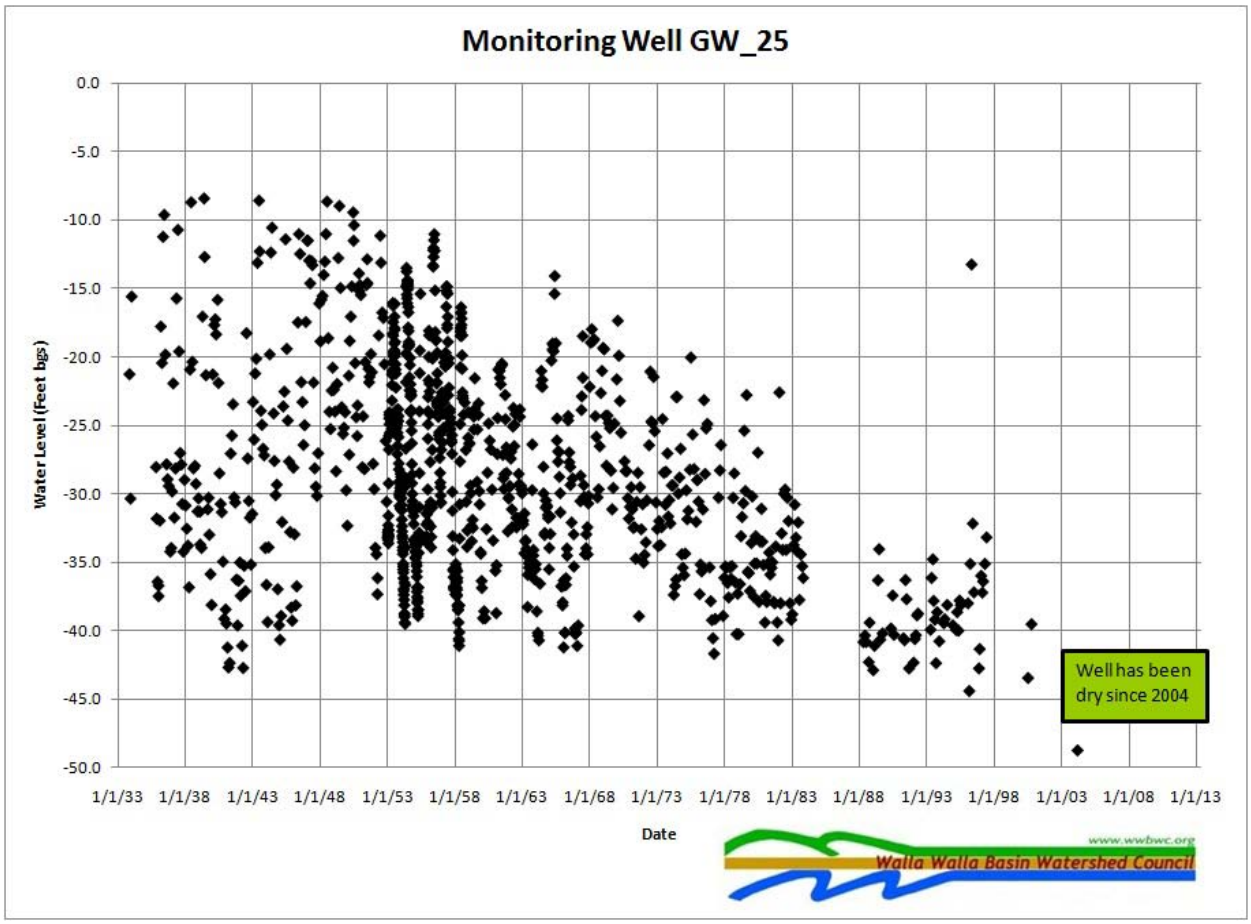

Figure 14. Static water level measurements in feet below ground surface from manual e-tape measurements for the historic well GW_25 located in the Walla Walla Basin's shallow alluvial aquifer.

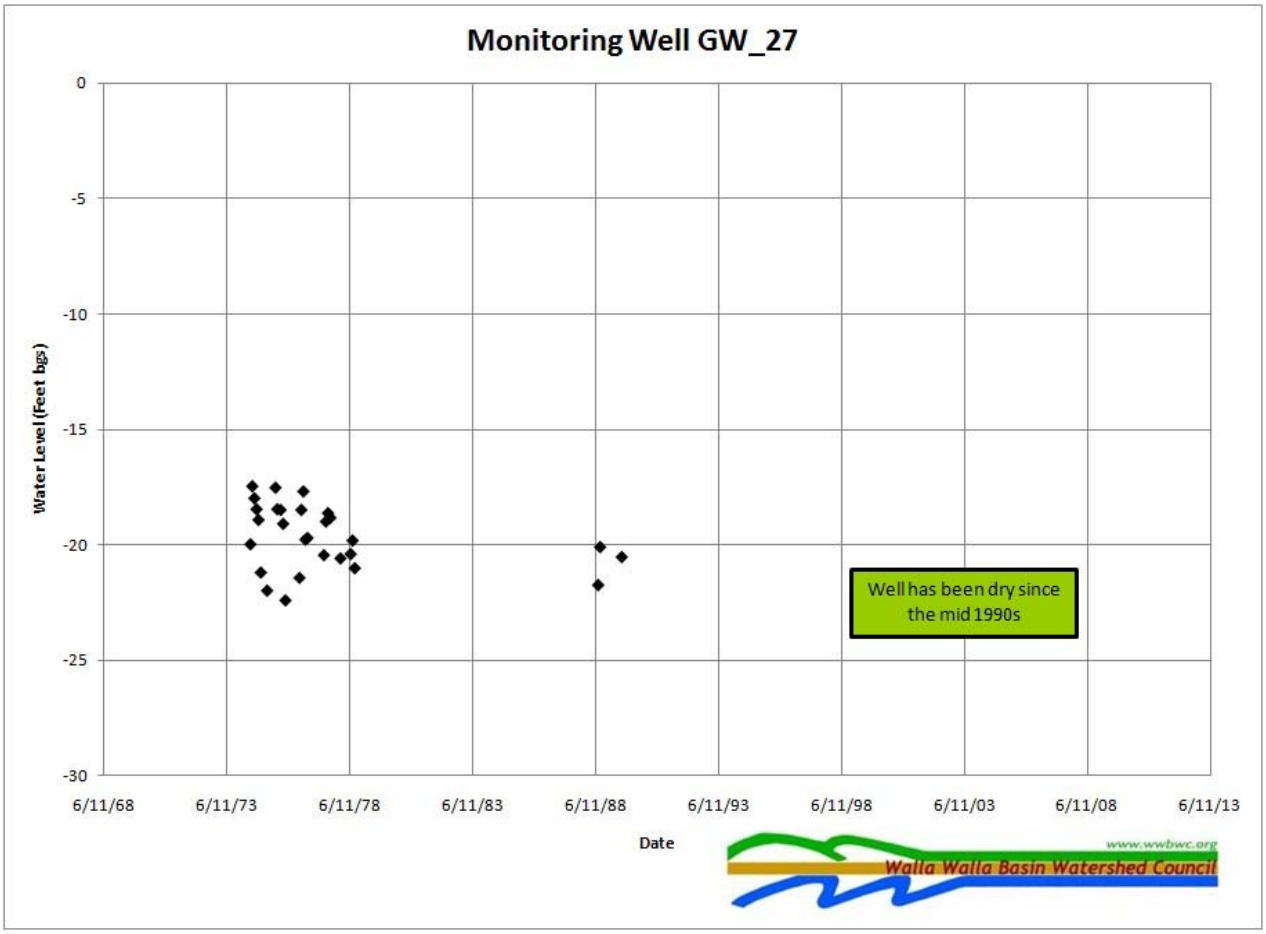

Figure 15. Static water level measurements in feet below ground surface from manual e-tape measurements for the historic well GW_27 located in the Walla Walla Basin's shallow alluvial aquifer.

Recharge Monitoring Wells

The Walla Walla Basin Watershed Council and Hudson Bay Irrigation District Improvement Company operate an aquifer recharge site northwest of Milton-Freewater, OR. This aquifer recharge site has four monitoring wells associated with it and an array of wells in the vicinity that also provide vital data (Figure 16). Three of the four monitoring wells at the recharge site showed rising water levels (Figures 27-29), while one well showed the water level stable or slightly declining (Figures 30). Some of the wells to the southeast of the recharge site showed declining water levels (Figures 24 & 26) while several wells to the southwest and northwest showed rising water levels (Figures 18, 19, 21, 32, & 36).

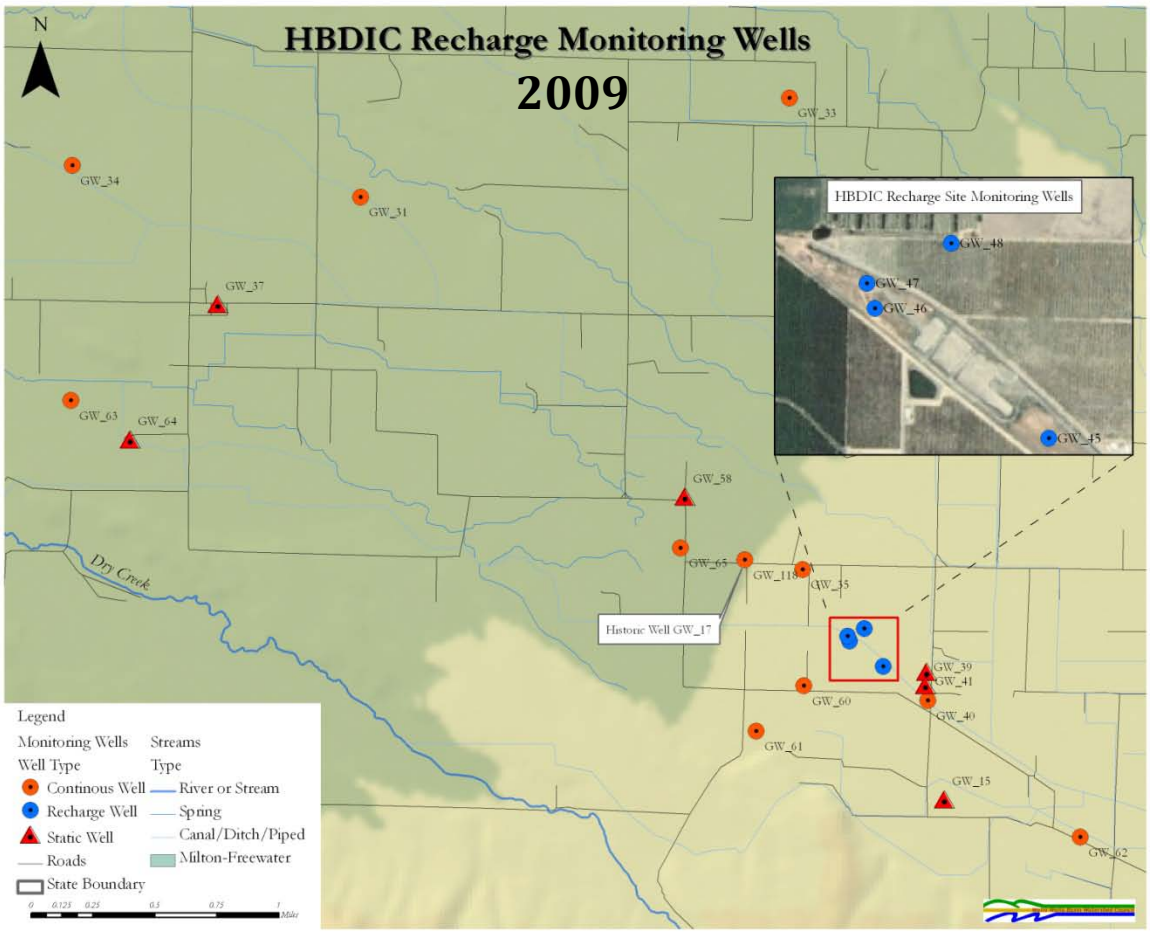

Figure 16. Wells correlated with recharge events at the Hudson Bay Ditch Improvement Company Aquifer Recharge Site. Included wells were chosen by author based upon proximity to recharge site and hydrographs.

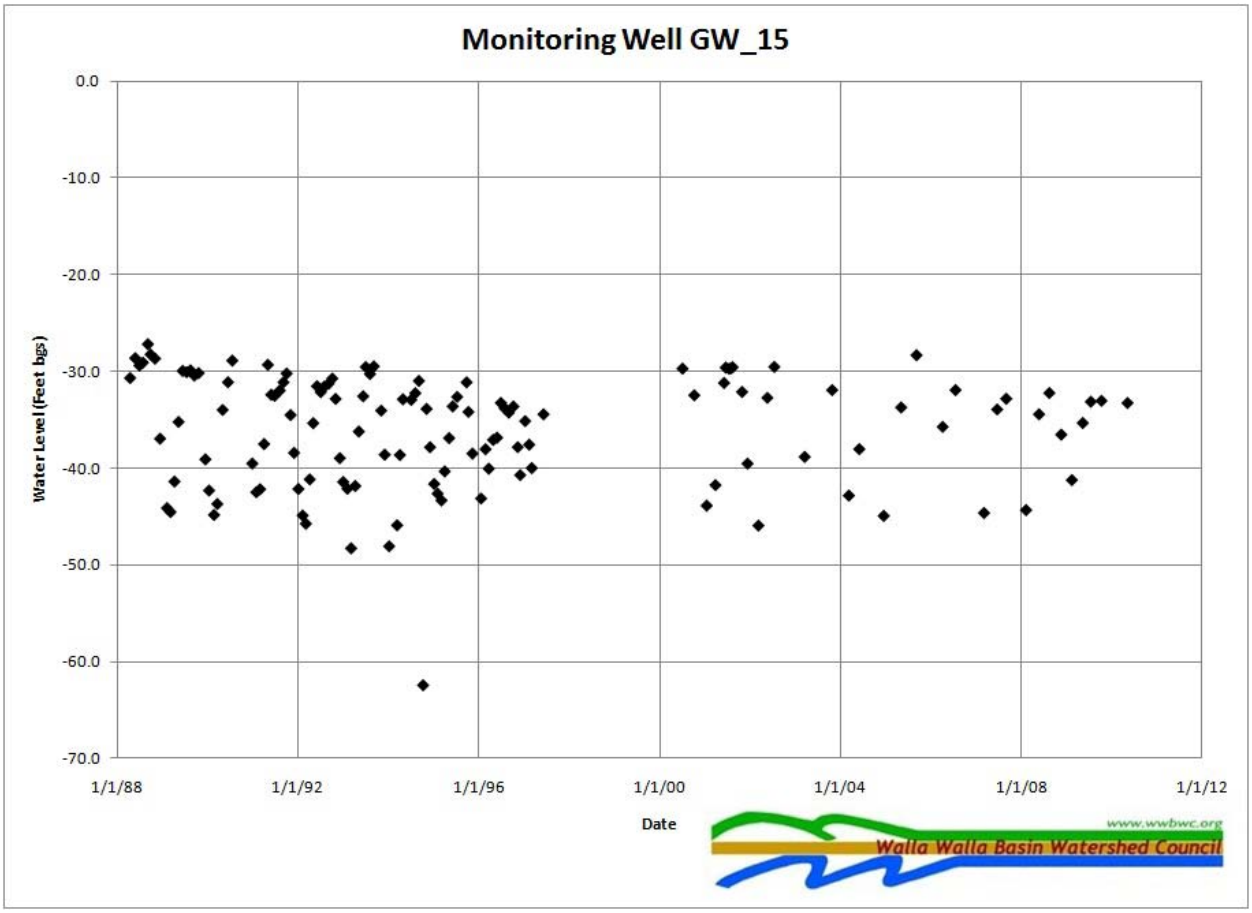

Figure 17. Static water level measurements in feet below ground surface from manual e-tape measurements for GW_15 located in the Walla Walla Basin's shallow alluvial aquifer.

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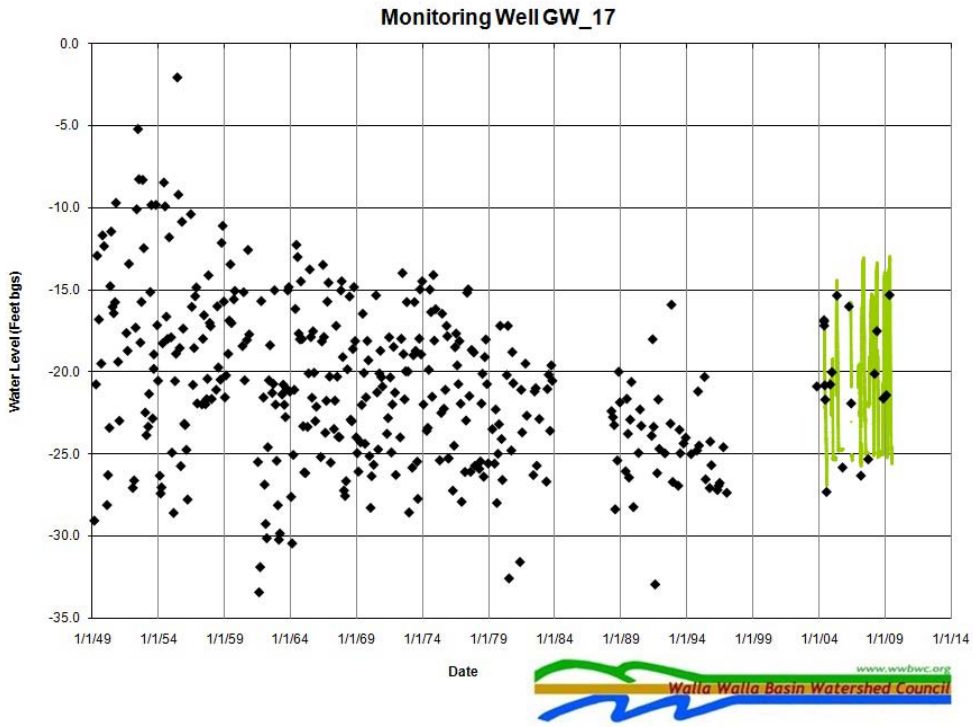

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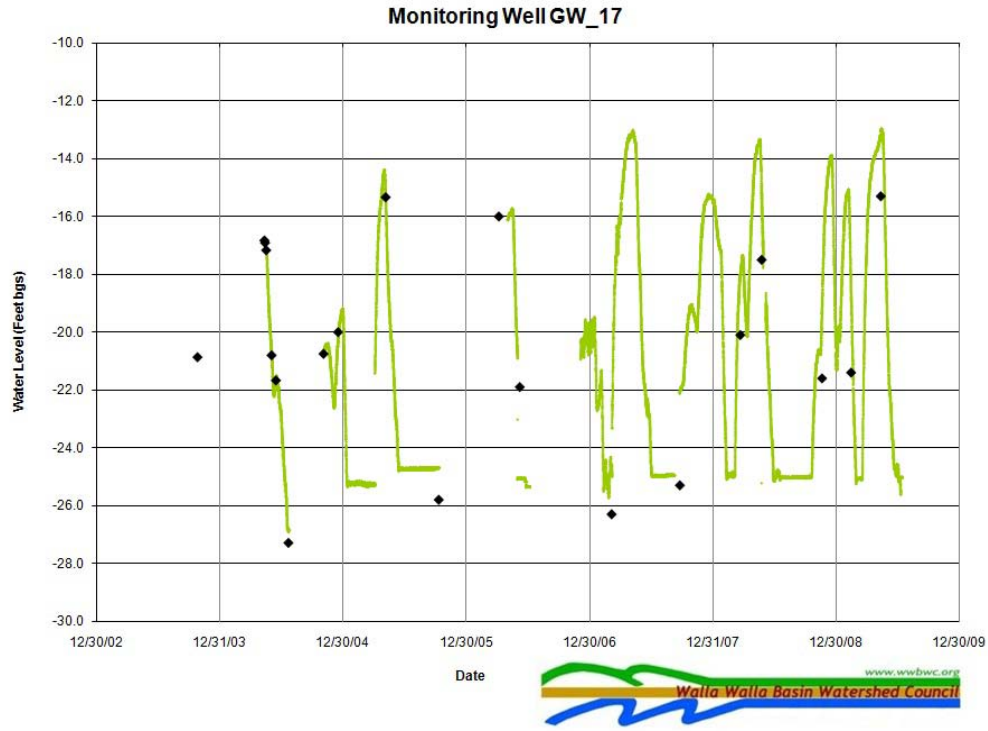


Figure 18. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_17 located in the Walla Walla Basin's shallow alluvial aquifer. Logger data is from a pressure transducer suspended in the well. For new well data please see monitoring well GW_118 (in Appendix C), drilled ~35 feet to the north of the historic observation well, which was abandoned and filled in fall 2009. A) Historic Data shown. B) Data for time period when a pressure transducer was in the well.

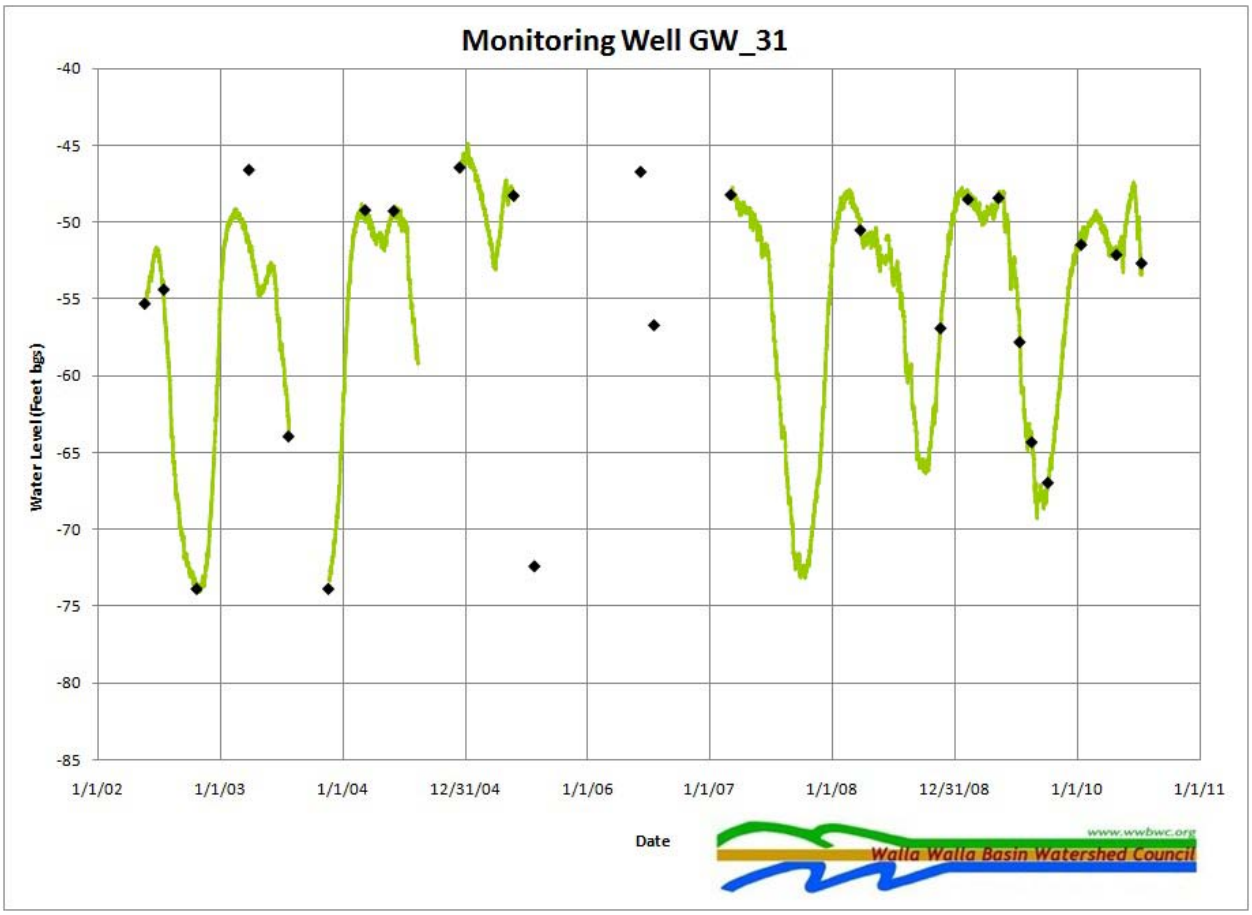


Figure 19. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_31 located in the Walla Walla Basin's shallow alluvial aquifer.

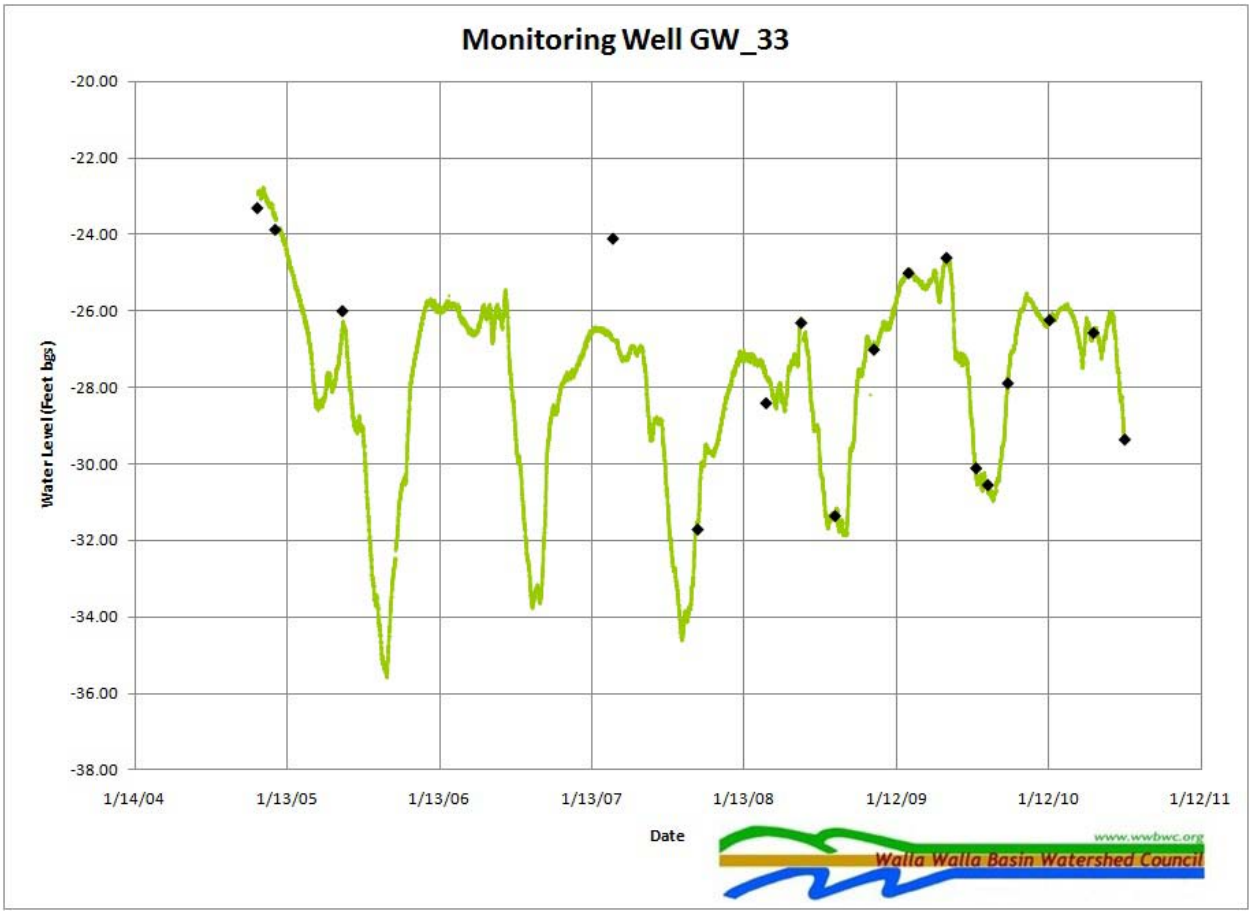


Figure 20. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_33 located in the Walla Walla Basin's shallow alluvial aquifer.

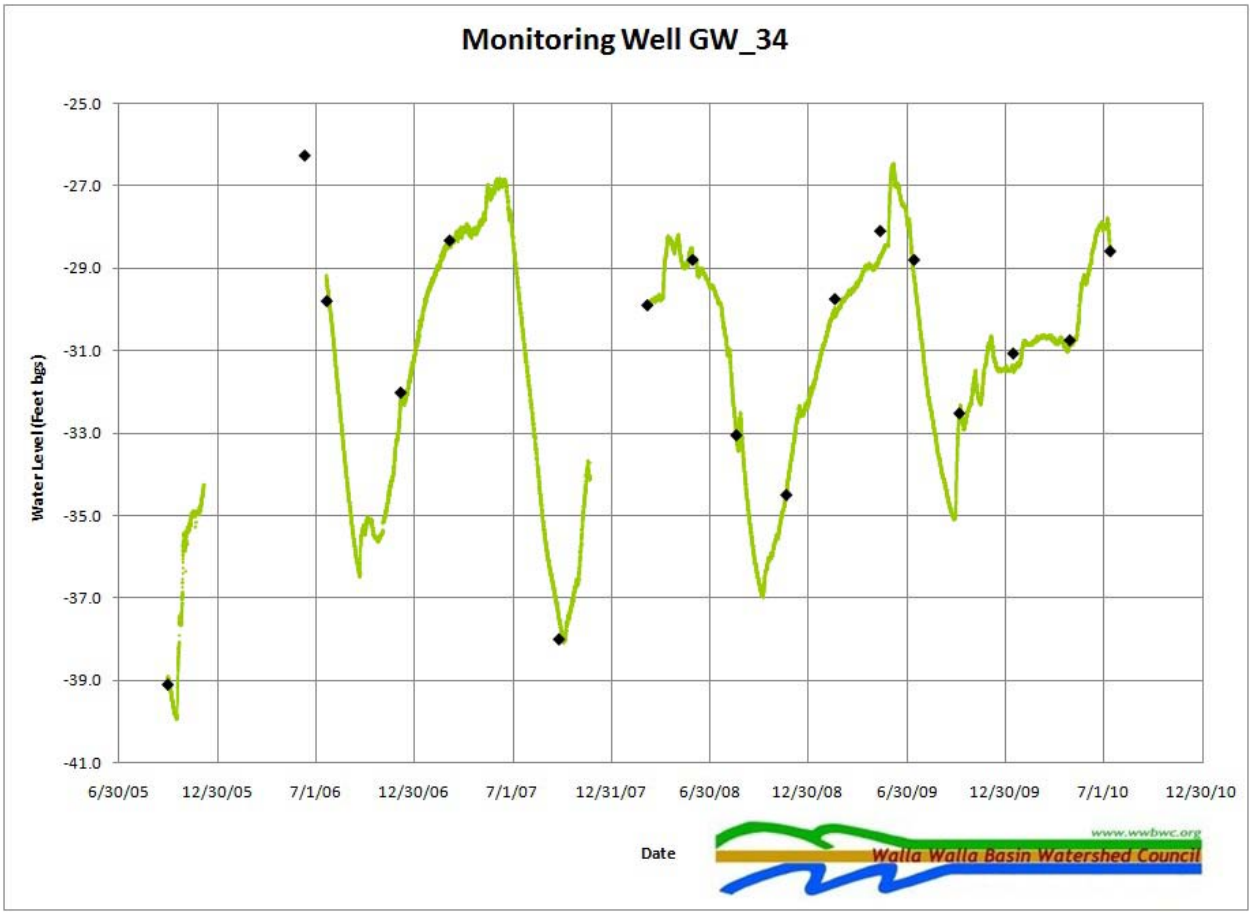


Figure 21. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_34 located in the Walla Walla Basin's shallow alluvial aquifer.

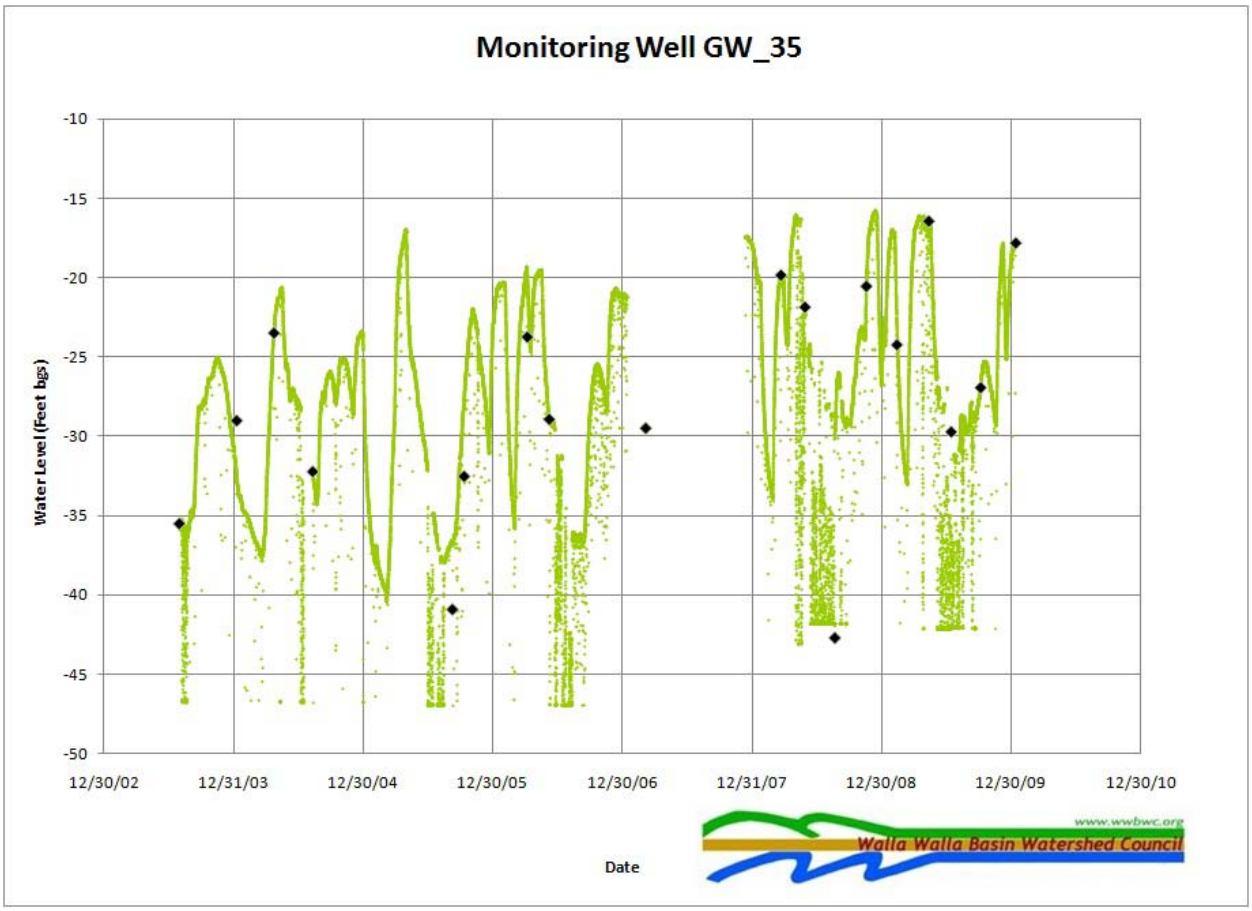


Figure 22. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_35 located in the Walla Walla Basin's shallow alluvial aquifer.

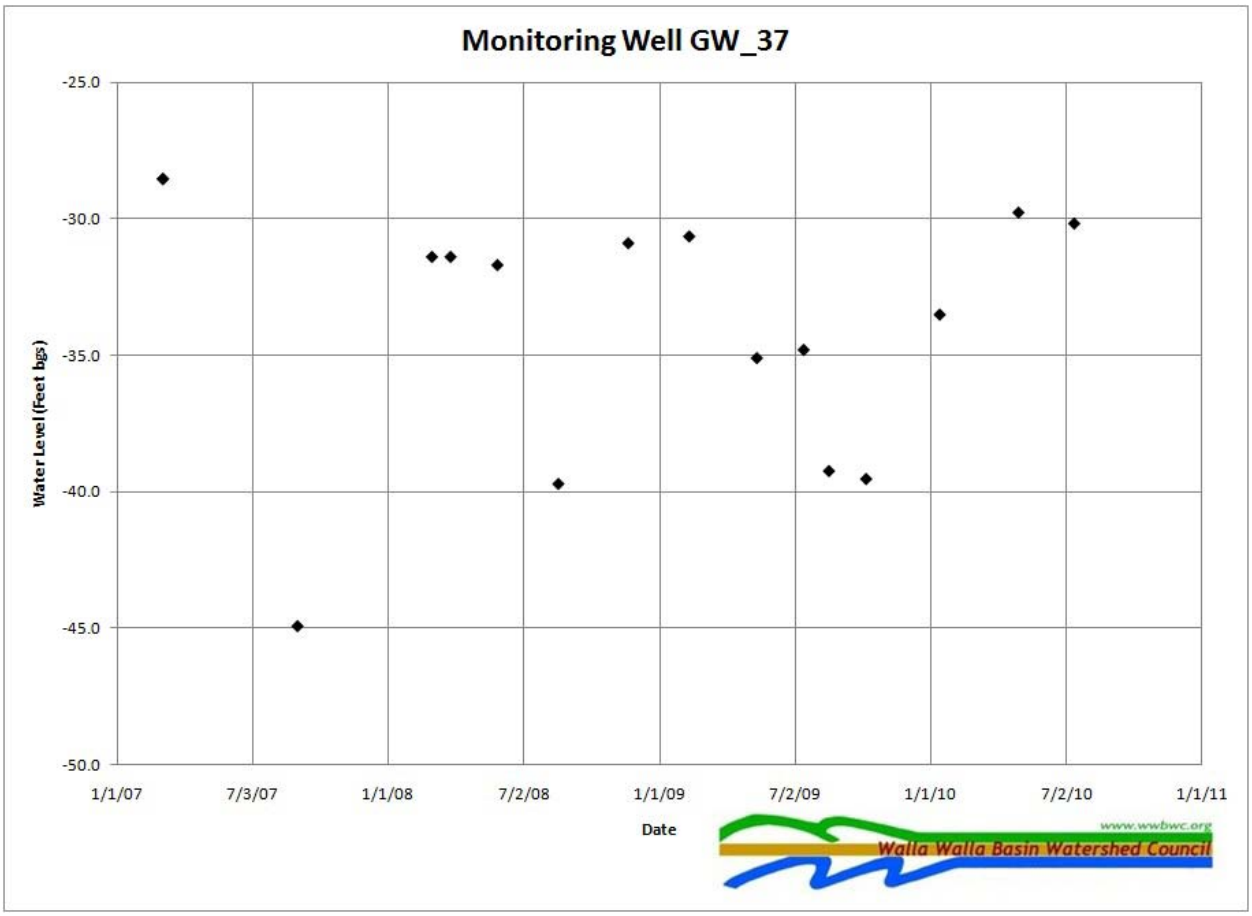


Figure 23. Static water level measurements in feet below ground surface from manual e-tape measurements for GW_37 located in the Walla Walla Basin's shallow alluvial aquifer.

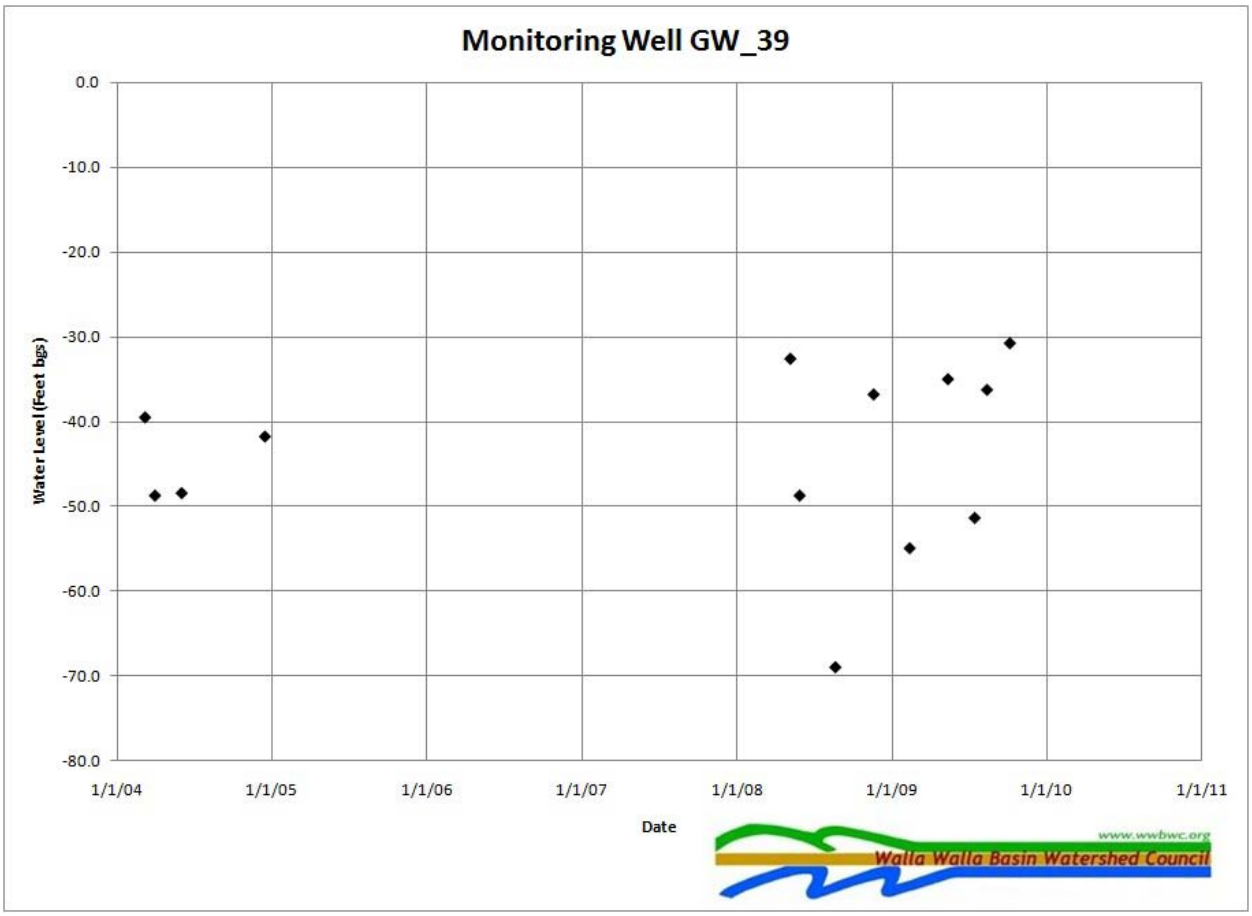


Figure 24. Static water level measurements in feet below ground surface from manual e-tape measurements for GW_39 located in the Walla Walla Basin's shallow alluvial aquifer.

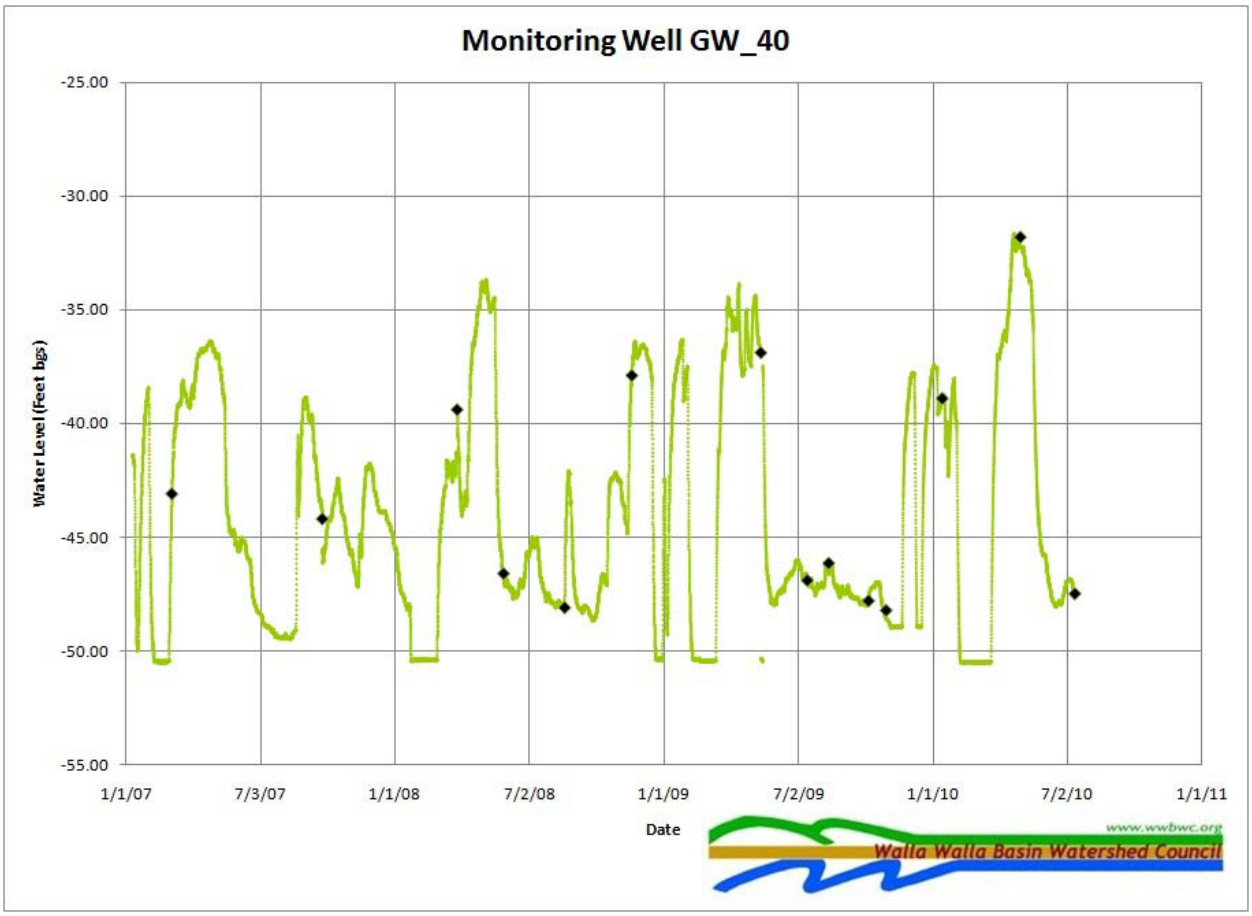


Figure 25. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_40 located in the Walla Walla Basin's shallow alluvial aquifer.

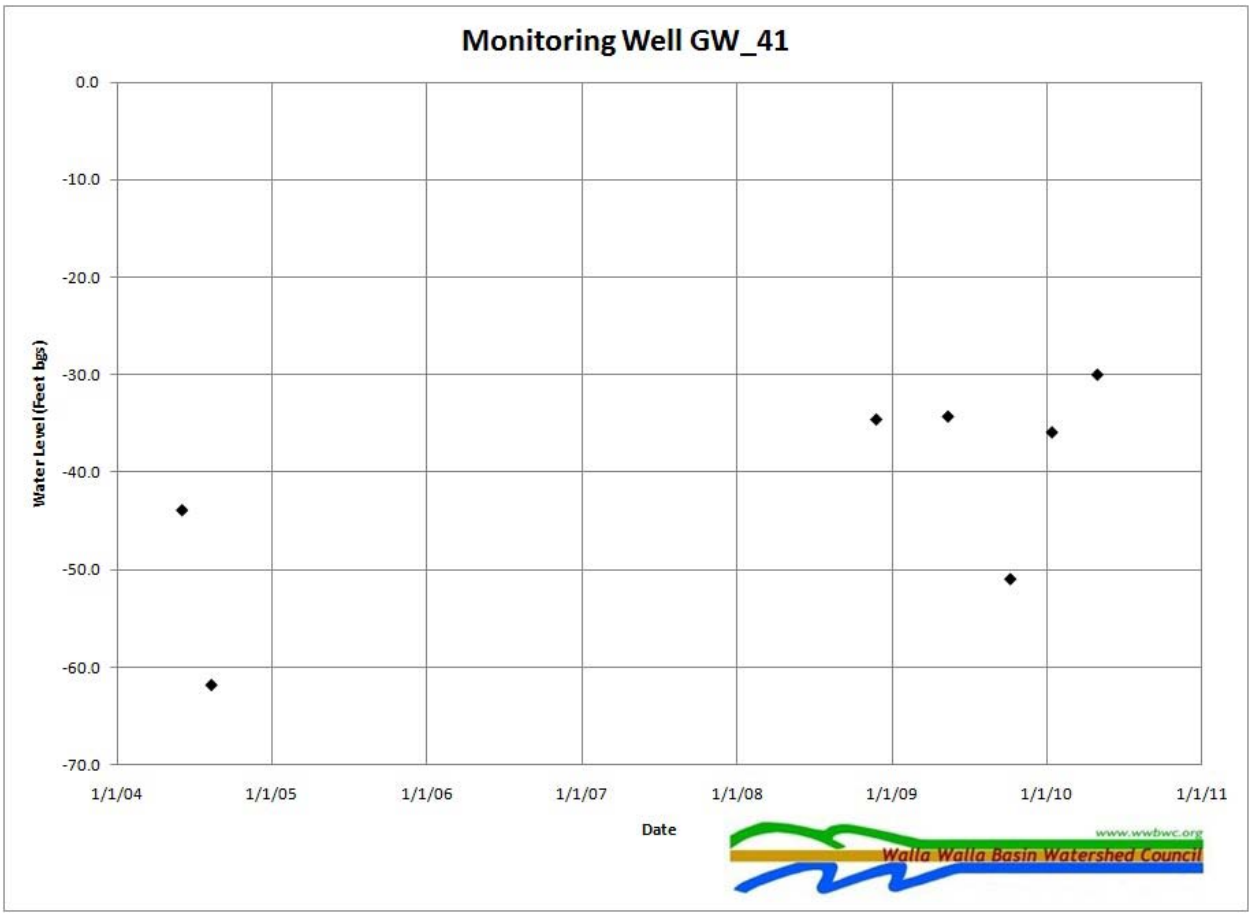


Figure 26. Static water level measurements in feet below ground surface from manual e-tape measurements for GW_41 located in the Walla Walla Basin's shallow alluvial aquifer.

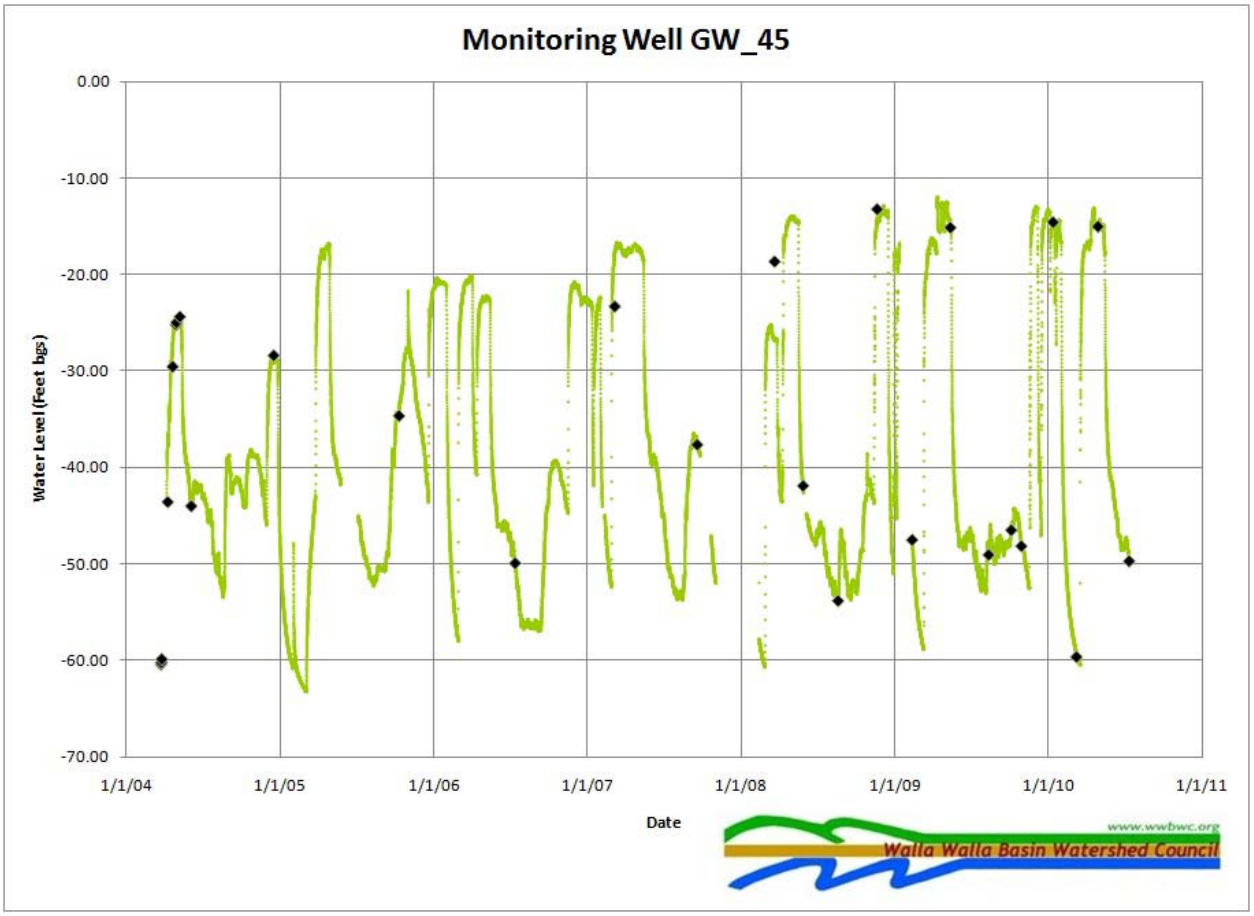


Figure 27. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_45 located at the HBDIC Aquifer Recharge site in the Walla Walla Basin's shallow alluvial aquifer.

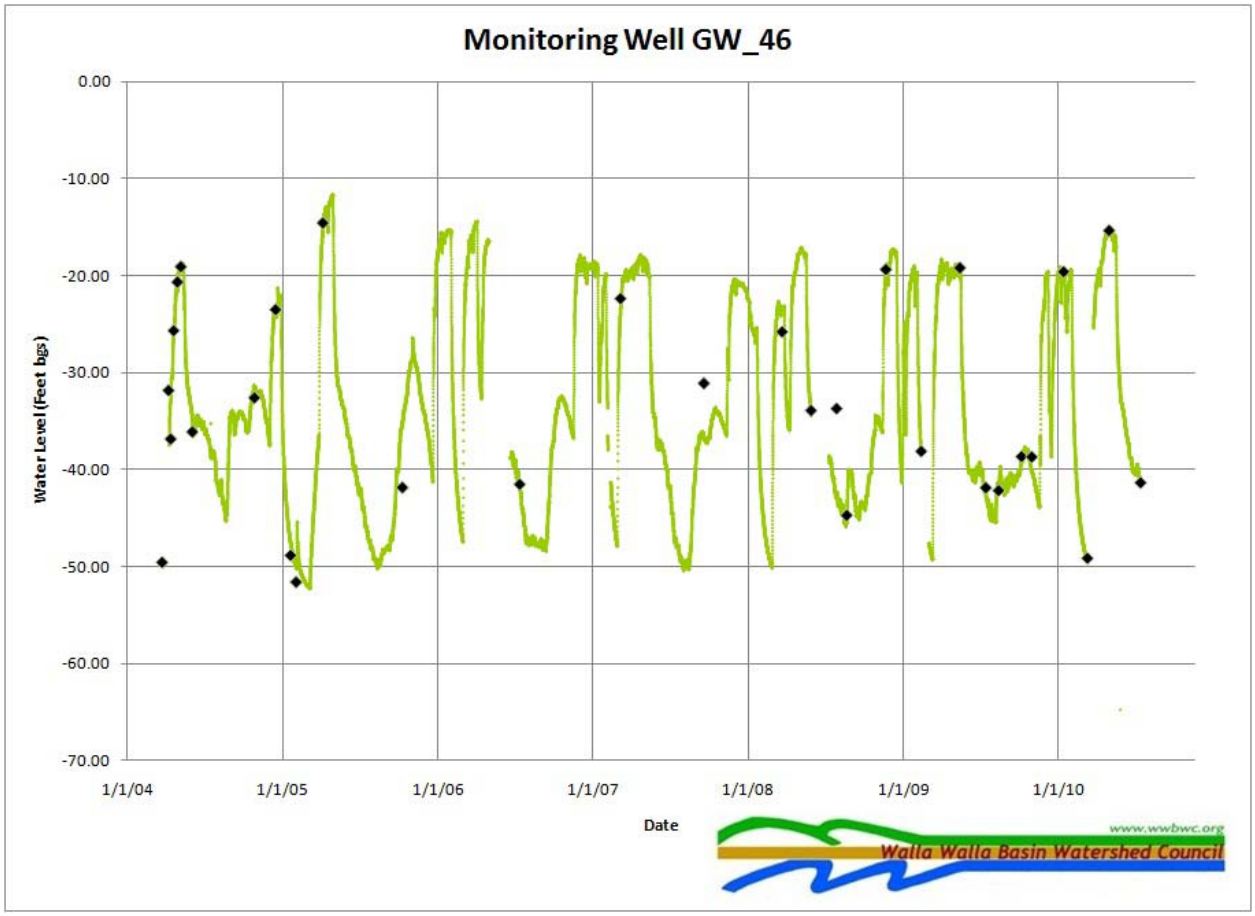


Figure 28. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_46 located at the HBDIC Aquifer Recharge site in the Walla Walla Basin's shallow alluvial aquifer.

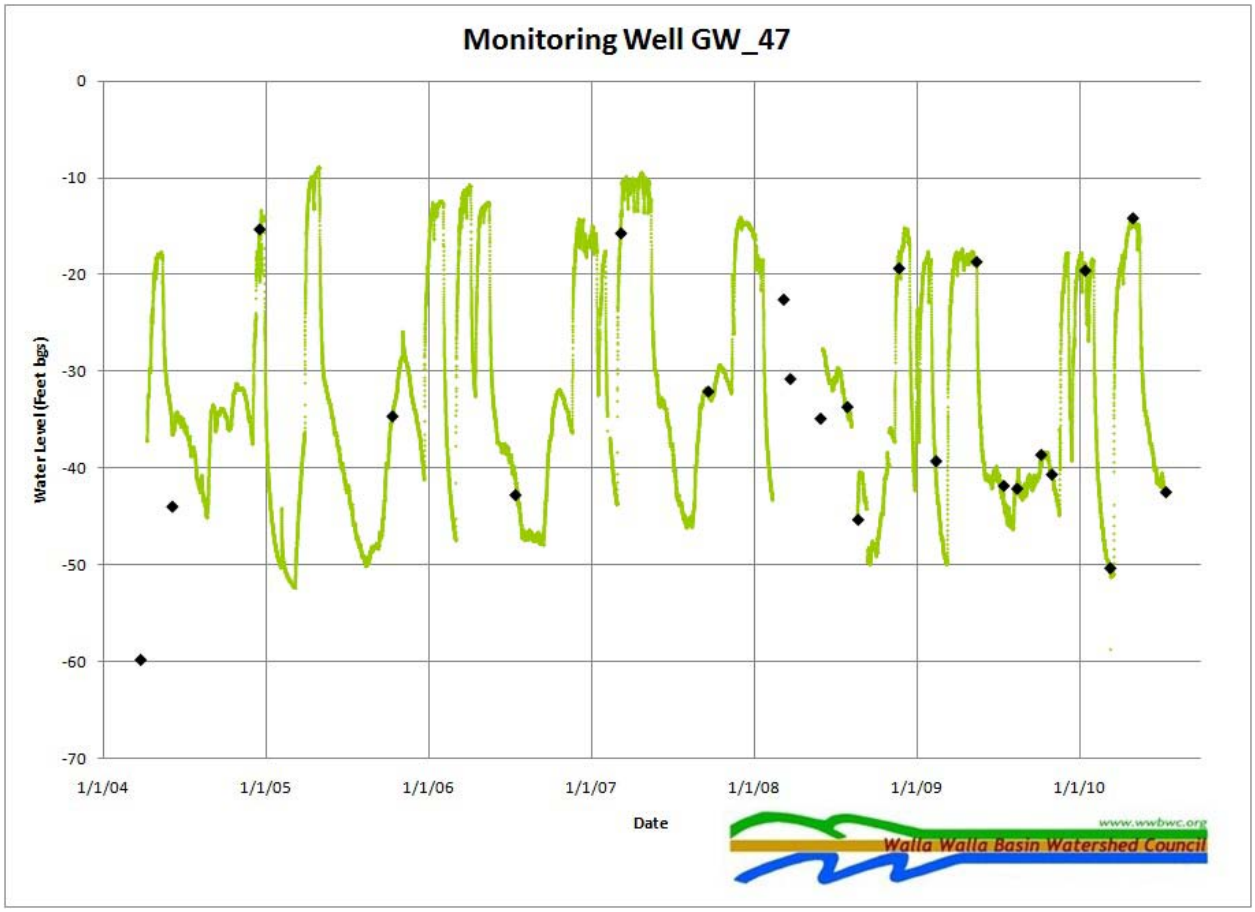


Figure 29. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_47 located at the HBDIC Aquifer Recharge site in the Walla Walla Basin's shallow alluvial aquifer.

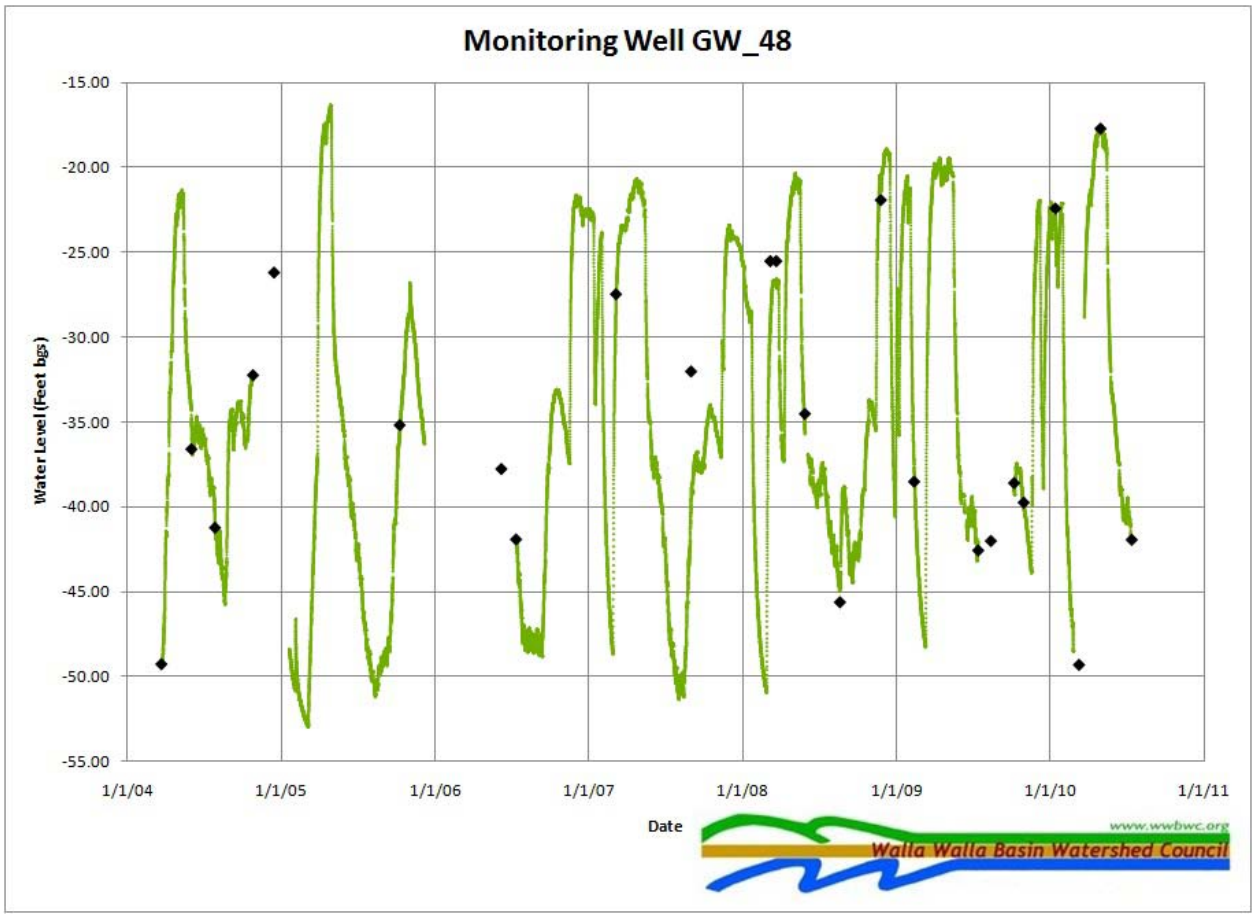


Figure 30. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_48 located at the HBDIC Aquifer Recharge site in the Walla Walla Basin's shallow alluvial aquifer.

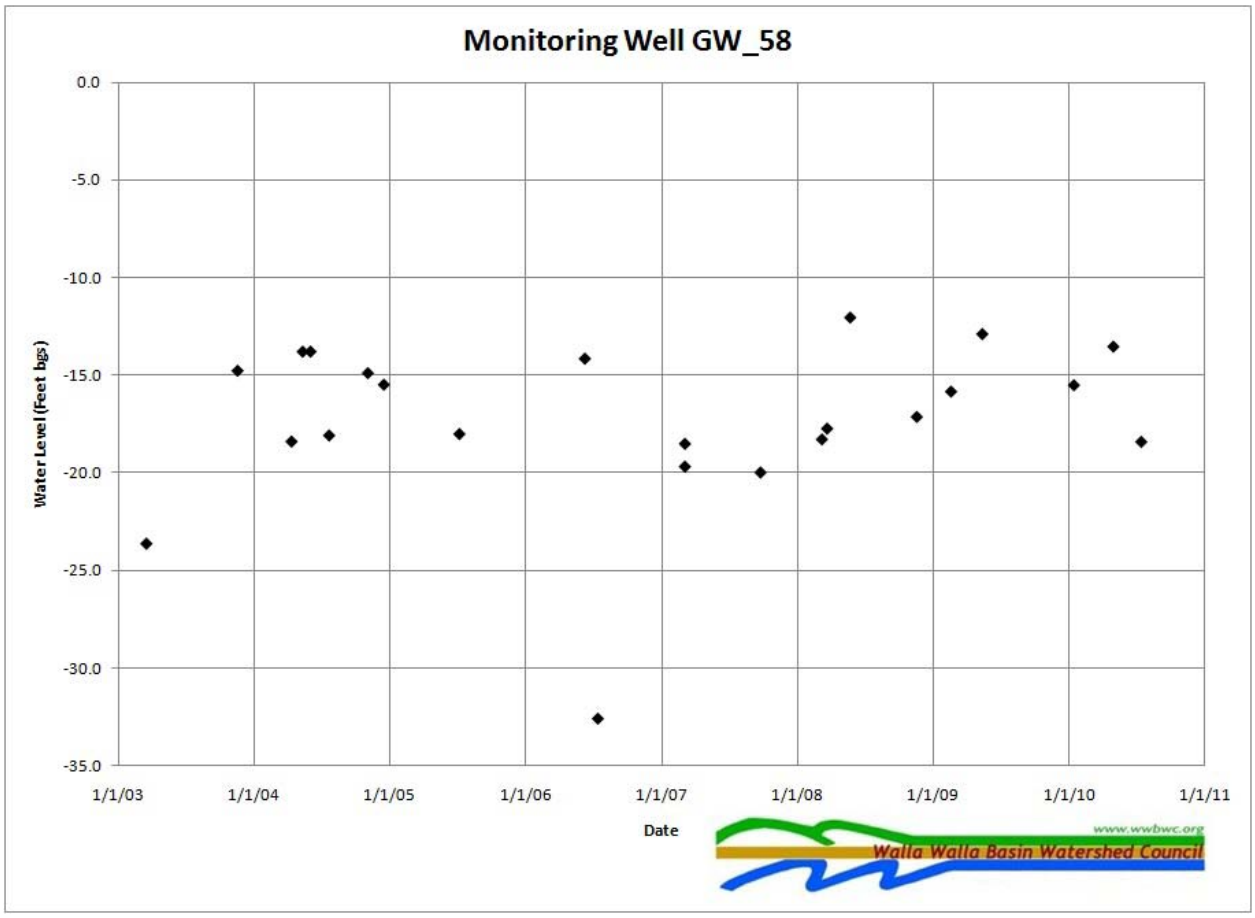


Figure 31. Static water level measurements in feet below ground surface from manual e-tape measurements for GW_58 located in the Walla Walla Basin's shallow alluvial aquifer.

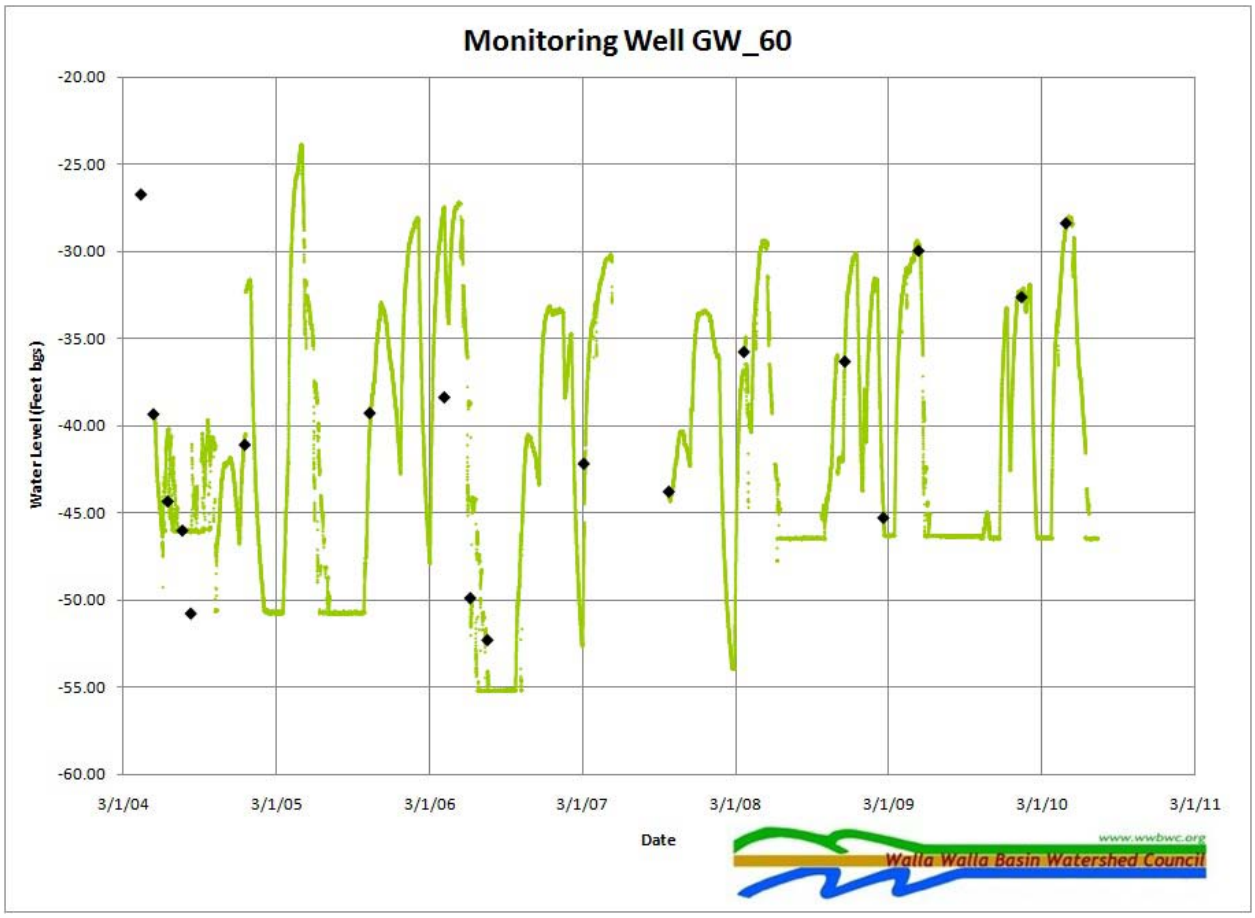


Figure 32. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_60 located in the Walla Walla Basin's shallow alluvial aquifer.

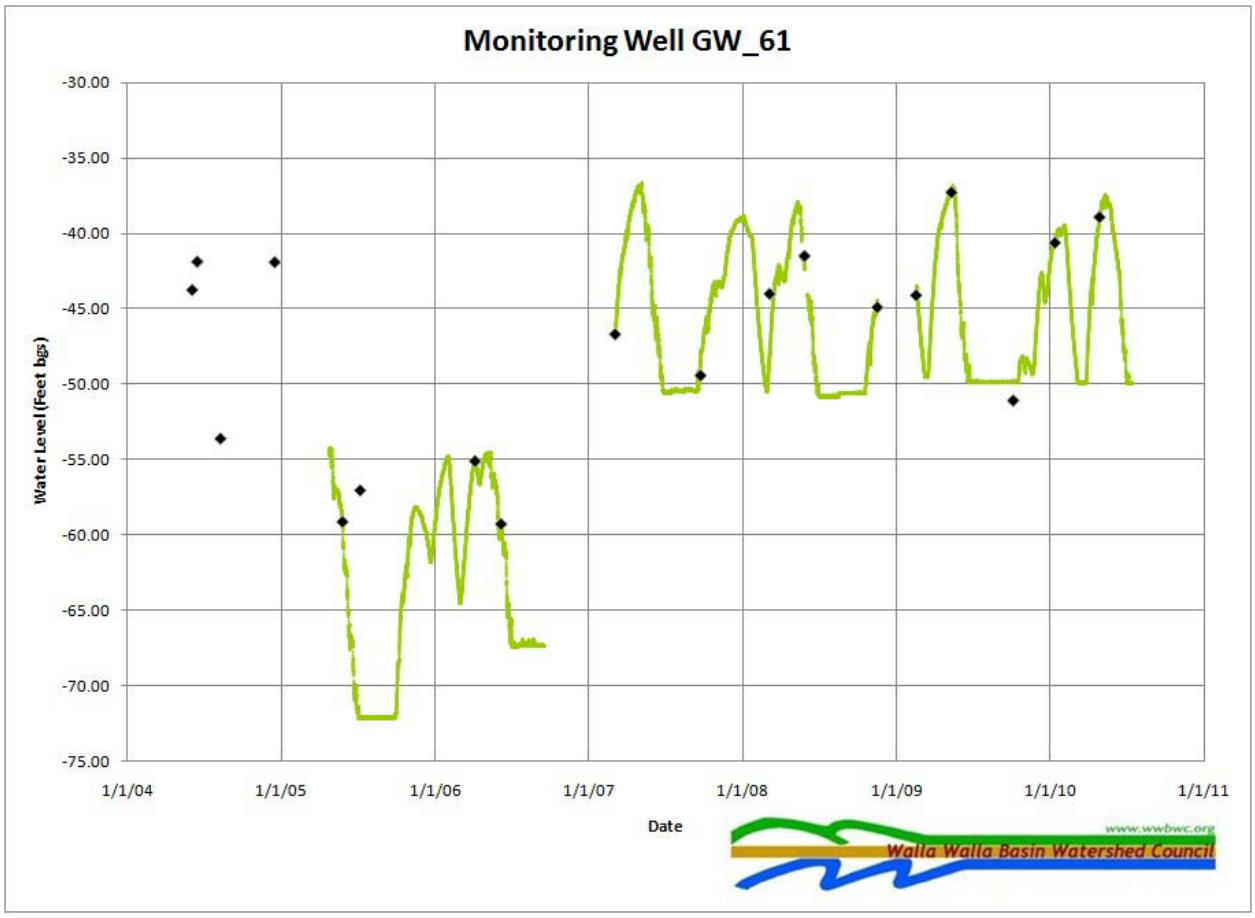


Figure 33. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_61 located in the Walla Walla Basin's shallow alluvial aquifer.

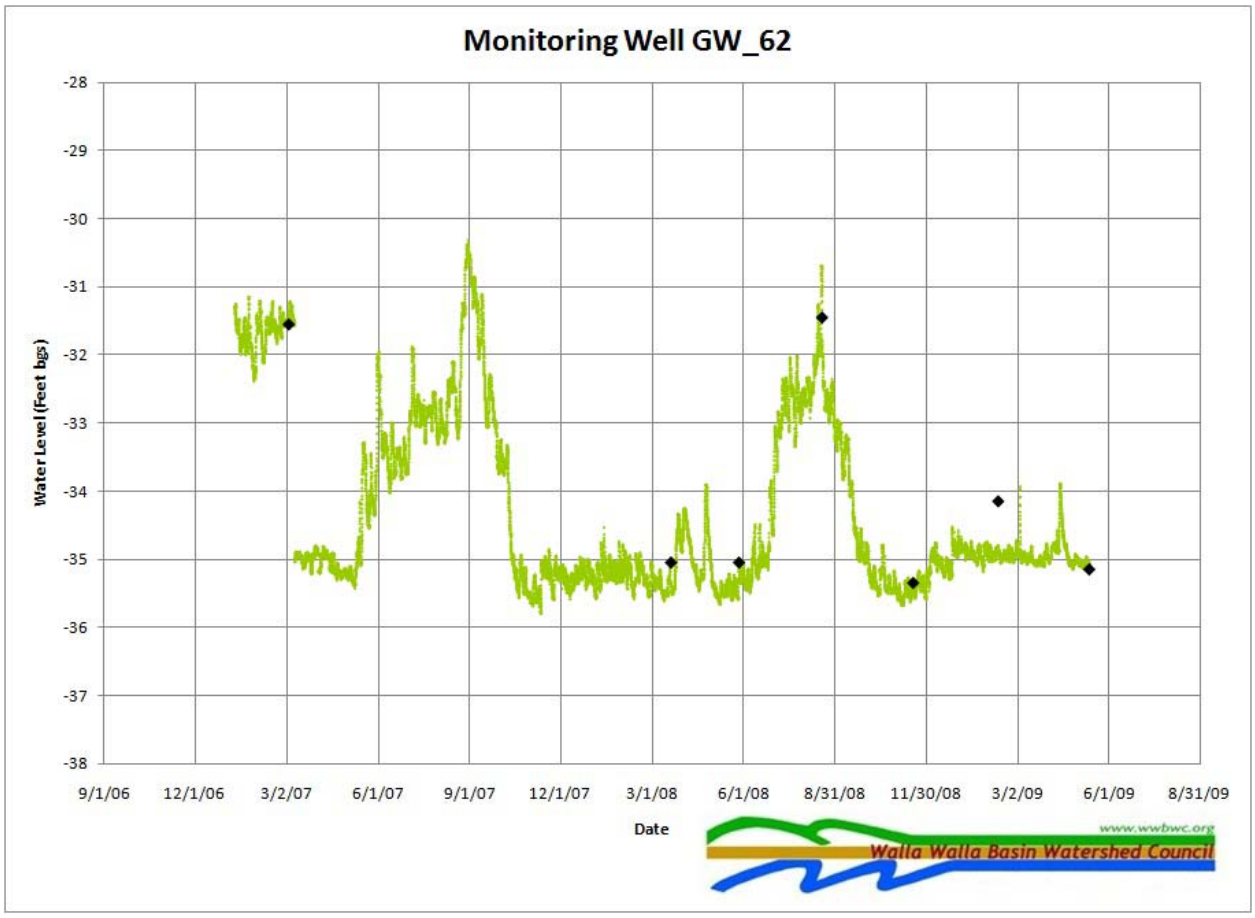


Figure 34. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_62 located in the Walla Walla Basin's shallow alluvial aquifer.

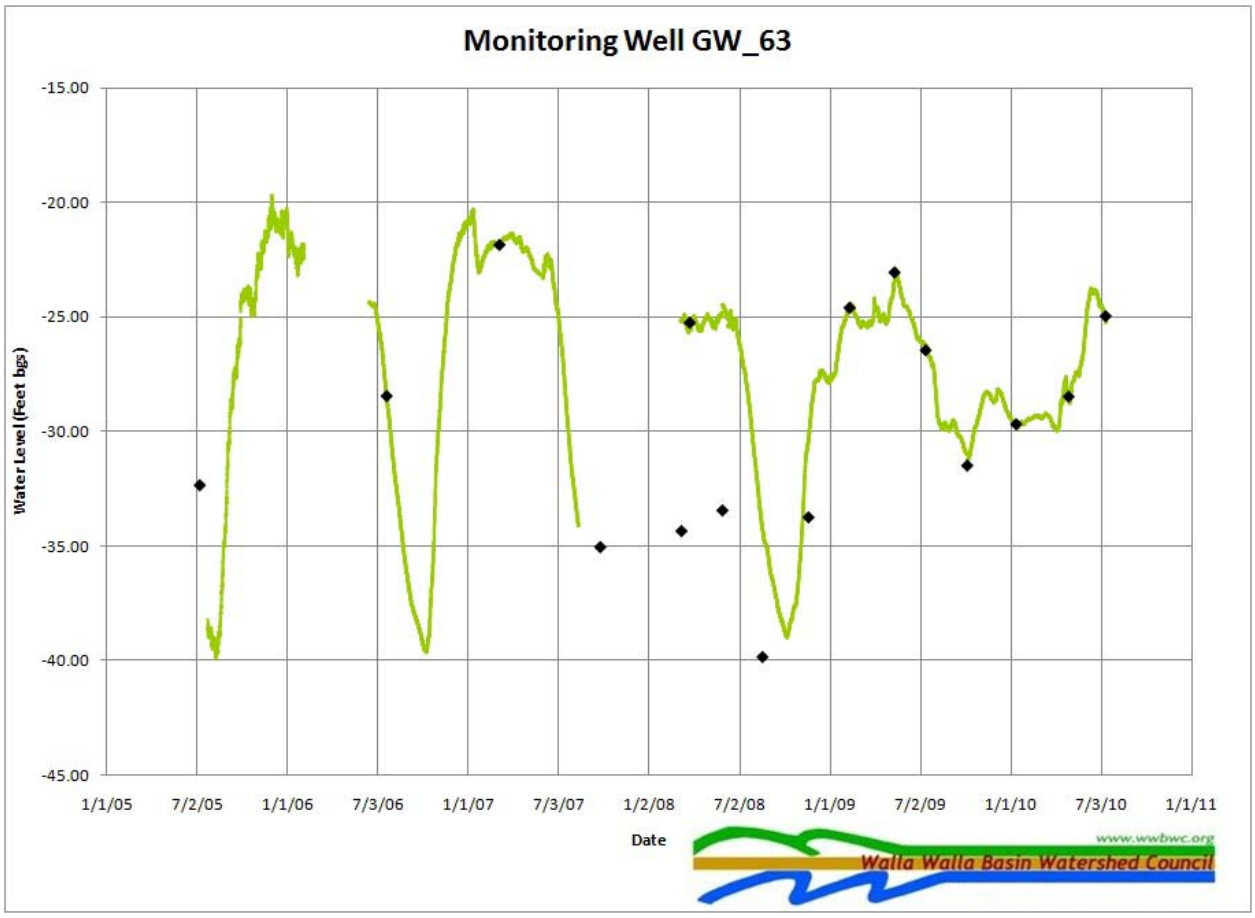


Figure 35. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_63 located in the Walla Walla Basin's shallow alluvial aquifer.

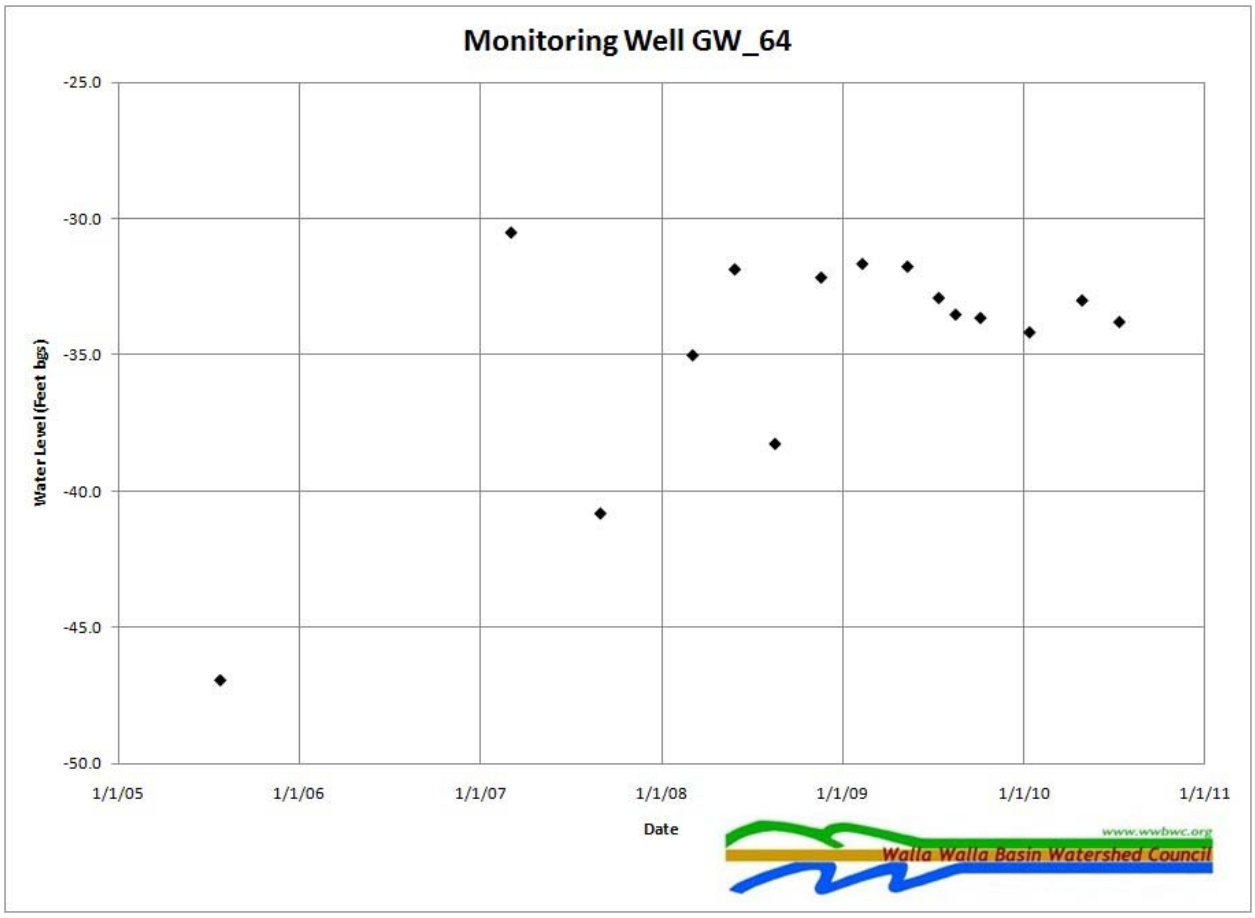


Figure 36. Static water level measurements in feet below ground surface from manual e-tape measurements for GW_64 located in the Walla Walla Basin's shallow alluvial aquifer.

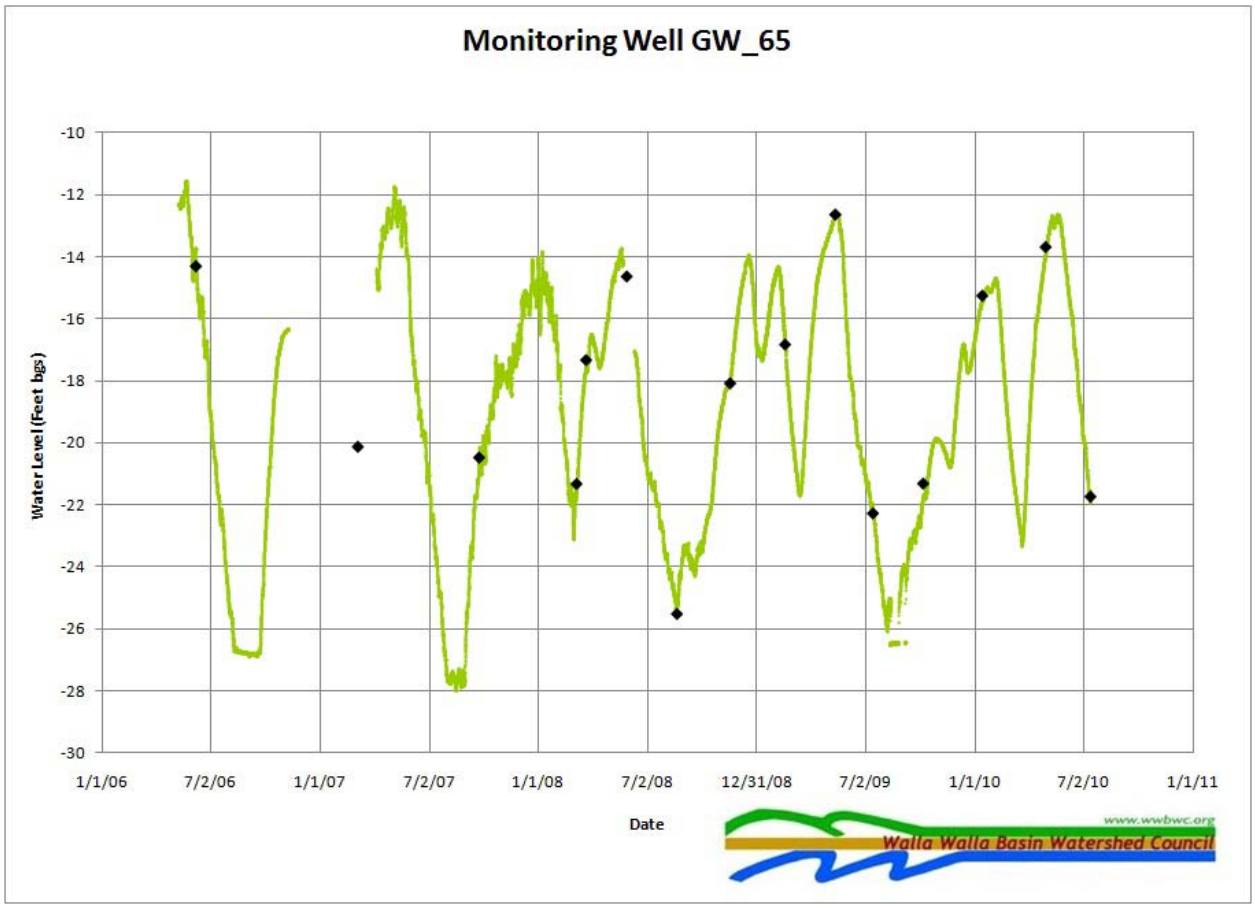


Figure 37. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_65 located in the Walla Walla Basin's shallow alluvial aquifer.

Individual Wells

Some individual wells in the basin show interesting trends. There are a number of wells that show a decline in water level (See Appendix C for graphs of all wells). GW_14 shows a declining water level over the last 7 seven years (Figure 38). However, there are some wells that show a rising water level. The water level in GW_110 has trended upward in the last three years (Figure 39).

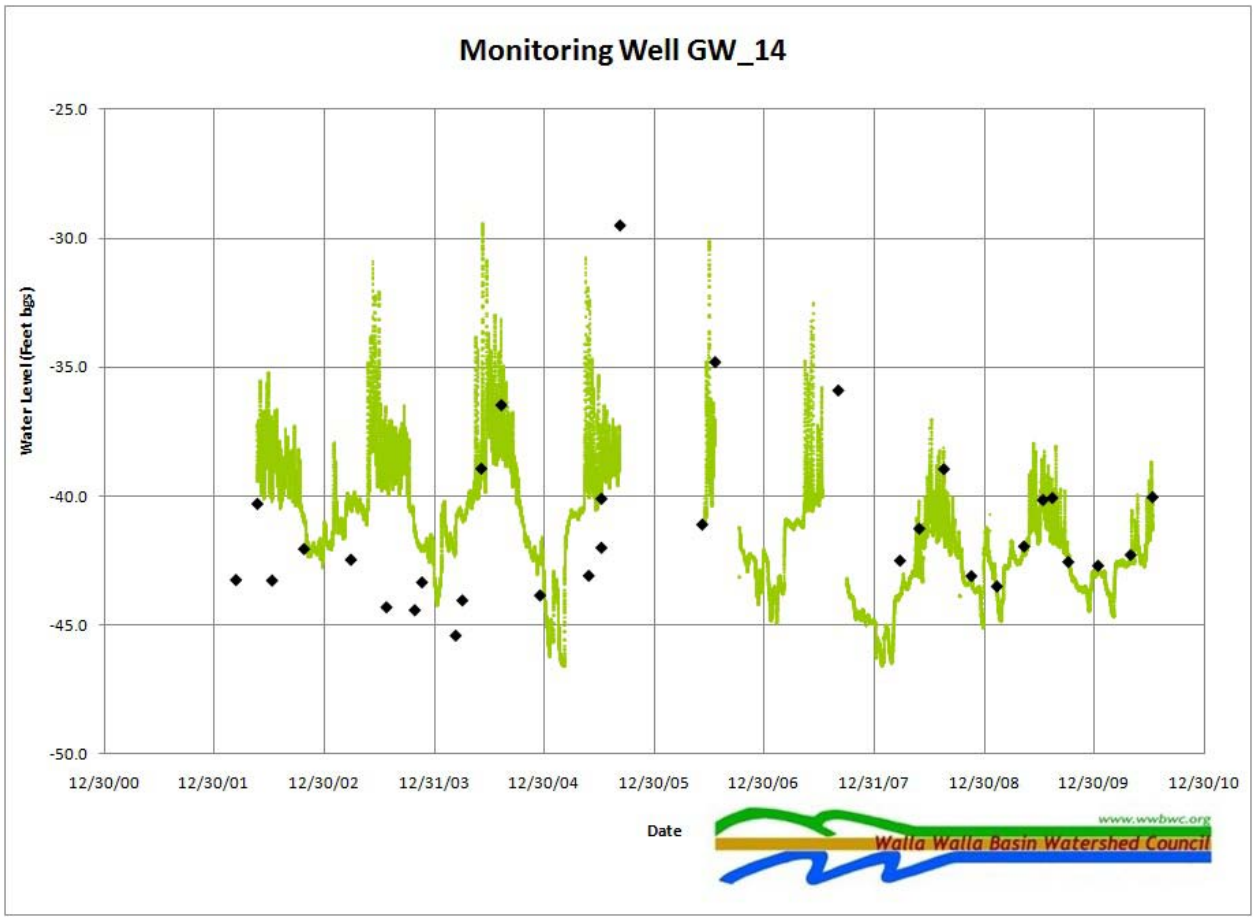


Figure 38. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_14 located in the Walla Walla Basin's shallow alluvial aquifer.

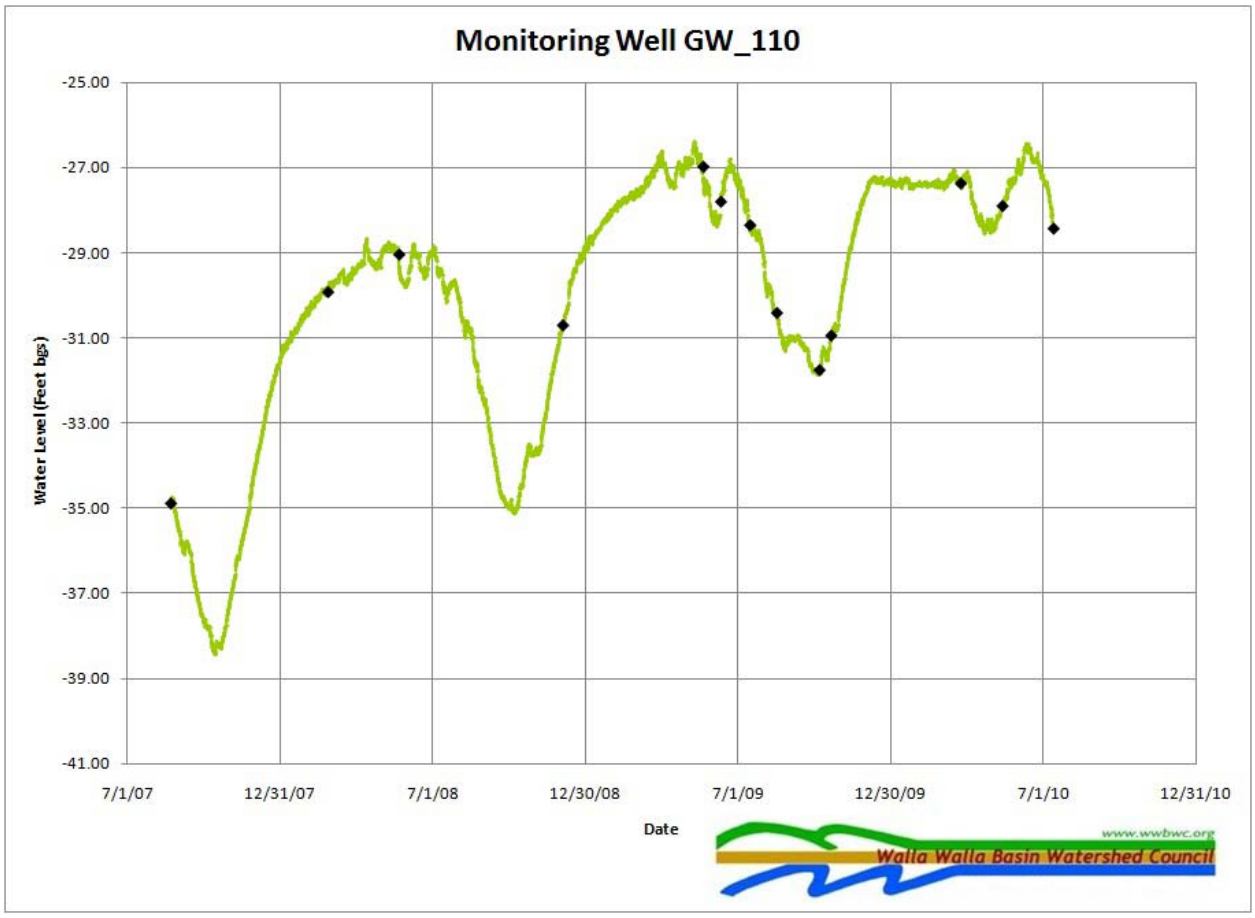


Figure 39. Static water level measurements in feet below ground surface from manual e-tape measurements and pressure transducer data for GW_110 located in the Walla Walla Basin's shallow alluvial aquifer.

Discussion

The well monitoring network in the Walla Walla Basin shallow alluvial aquifer is becoming larger every year now that the WWBWC manages it. This network is providing valuable information for water issues, both groundwater and surface, in the Walla Walla Basin.

Continuous and Static Measurements

More than half of the wells monitored by WWBWC are instrumented with pressure transducers (Table 2). Although this creates a disconnect in the data from a continuous well to a static well, static (non-continuous) wells provide an inexpensive way to monitor a larger part of the aquifer. Static wells allow WWBWC to have information for snap shots of the aquifer which can be used for long term aquifer monitoring. The SWL measurements of the entire well network show the water height of the aquifer spatially over the basin, allowing the WWBWC to track aquifer changes over time.

Temperature and Conductivity

Gathering temperature and conductivity data when monitoring wells allows the WWBWC to better understand the hydrologic connections between groundwater and surface water. By knowing the temperature and conductivity we are able to map where groundwater is increasing surface flows and where surface water is recharging the aquifer. Groundwater recharge via surface flows is very evident at a few locations in the basin, namely the HBDIC Aquifer Recharge and the ditches along the Little Walla Walla system. Groundwater-surface water interactions also help to stabilize flows in the river system, which is important for fish passage by allowing adequate flow and lowering water temperature.

Historic Wells

Most of the historic wells that the WWBWC monitors have declining water levels. This could be caused by a number of factors. An increasing number of wells and increasing water usage for domestic and agricultural uses could be withdrawing more water than is sustainable for the basin's aquifer. A relatively new change in water management for the basin could also have had an effect on the basin's aquifer. Since the 2001 Civil Penalty Settlement Agreement (Settlement Agreement) between U.S. Fish and Wildlife Service and the three irrigation districts in the Walla Walla basin (Walla Walla River Irrigation District, Hudson Bay Ditch Improvement Co, Gardena Farms Irrigation District #13), 18 cfs has remained in the Walla Walla River during summer months, then in following years the amount was raised to 25 cfs. During the previous ~100 years, the Walla Walla River ran dry during the summer because all of the water was diverted for irrigation uses. This water flowed through the vast array of irrigation ditches in the basin providing groundwater recharge as surface water was lost along the ditches. Since 2001 and the Settlement Agreement, less water has been flowing through the Walla Walla/Gardena/Hudson Bay systems during the

summer causing a reduced amount of groundwater recharge in the ditch system. However, since the decline in the aquifer seems to have started well before the 2001 Settlement Agreement, the reduced recharged from surface flows in the irrigation system does not explain everything. Also, increased efficiency for irrigation districts (piping projects, etc) has reduced the amount of groundwater recharge further from irrigation ditches and canals. Also, many irrigators have started using wells more than they had in the past: supplemental wells, and newly drilled wells.

One of the historic wells, GW_17, has historically shown a decreasing water level; however, over the last 5 years it has started to recover (Figure 18). This recovery correlates with the start of the Hudson Bay Aquifer Recharge site about 1 kilometer to the southeast of the well. This may demonstrate a possible strategy for aquifer stabilization or recovery in the Walla Walla Basin. Creating an array of recharge sites throughout the basin may help to stop or even recover the declining shallow aquifer.

Recharge Monitoring Wells

The HBDIC Aquifer Recharge site has now operated for 5 seasons. The site appears to be recharging a small portion of the shallow aquifer. Many of the wells to the Northwest and Southwest have shown rising water levels. However, wells to the East do not show the same trends. One of the most important wells providing data for the recharge site is GW_17/GW_118. This well is a historic well with data going back to the 1940s. Based upon this data we can see that it has had a declining water level. The water level dropped enough to make the well go dry sporadically during the last decade. However, since the start of the Aquifer Recharge project, this well has started to recover. Since the Aquifer Recharge site was started (Spring 2004), the well has only been dry during summer months (July thru September). Other wells such as GW_31, GW_34, and GW_60 have shown recovering water levels. Unfortunately, most of the wells are declining. It appears as though the HBDIC Aquifer Recharge site only has a limited impact. Specifically it appears as though the recharge water is moving in a north westerly direction away from the recharge site. This will be investigated more with a forthcoming tracer study to understand the speed and direction of the recharge water. From the data it appears like the HBDIC Aquifer Recharge site is only able to affect a limited number of wells. However, this method might be useful in supplementing declining water levels in the shallow aquifer if used in higher numbers and strategically located throughout the basin.

Individual Wells

Some of the wells in the shallow aquifer monitoring system give us an insight into how the shallow alluvial aquifer works. GW_14 is a good example. This well has shown declining water levels over the past 8 years. This pattern was not seen until the Settlement Agreement. This well might not be receiving as much recharge from the irrigation system because a smaller quantity of water is being diverted into the ditch systems. GW_31 has shown rising water levels over the last seven years. The reason for this is not known for sure. It could be due to the HBDIC Aquifer Recharge site to the

Southeast or to some other source. GW_34 has also shown rising water levels over the past four years. This may be due to an increased flow in Goodman Spring. The increased flow in Goodman Spring could be due to recharge activities at the HBDIC site. This site has had plenty of recharge opportunities as the spring/canal often overflows its banks and floods the neighboring pasture. The well is right next to the spring/canal and the pasture so it would benefit from recharge from both sites.

Summary

Approximately 100 wells were monitored in the Walla Walla Basin shallow alluvial aquifer in 2009, up from only a dozen in 2001. In 2009, 15 new dedicated monitoring wells were established in the Walla Walla Valley. Six were drilled in Oregon and nine were drilled in Washington. These new monitoring wells will help enhance the spatial coverage and the potential for understanding and mitigating aquifer decline and assist in general water management in the bi-state basin.

The importance and usefulness of the Shallow Aquifer Monitoring Project is clear; it is vital to the current and future understanding of groundwater resources, aquifer decline and recharge, surface-groundwater interactions, and base flow in the Walla Walla River. Using the well network WWBWC and partners in the basin have quantitatively illuminated the decline of the shallow aquifer and shown the significant influence and response by the system to aquifer recharge projects. Furthermore, the well monitoring network data is being used to inform decisions on current and future aquifer recharge projects.

This data will also be used in the basin-wide WWBWC/OSU modeling projects which will provide water professionals and communities with a comprehensive tool to manage water in the Walla Walla River Valley in the years to come.

Developing a wide spread shallow aquifer monitoring system through dedicated and non-dedicated wells has been a major accomplishment of this project. Prior to 2001, the bi-state Walla Walla basin only had about a dozen observation wells (Figure 41). As of October 2009, there are more than 25 dedicated monitoring wells in the bi-state well network (Figure 42). There has also been a widespread growth in the grass-roots based non-dedicated wells that are being monitored. More than 20 new non-dedicated monitoring wells have been established with the cooperation of volunteer landowners throughout the basin's shallow aquifer.

Continuing and expanding the Well Network is important in the future. Establishing more wells, especially to the east of the Walla Walla River and on the Northern and Western edges of the shallow aquifer will be important for completing the picture of how to properly manage the aquifer. It would also be helpful to expand the Well Network from the shallow aquifer down to the basalt

aquifer with the addition of basalt wells. Monitoring groundwater is critical to measure the impact of a variety of other projects including aquifer recharge and piping ditches/canals and to further understand the interactions between ground and surface water in the Walla Walla basin.

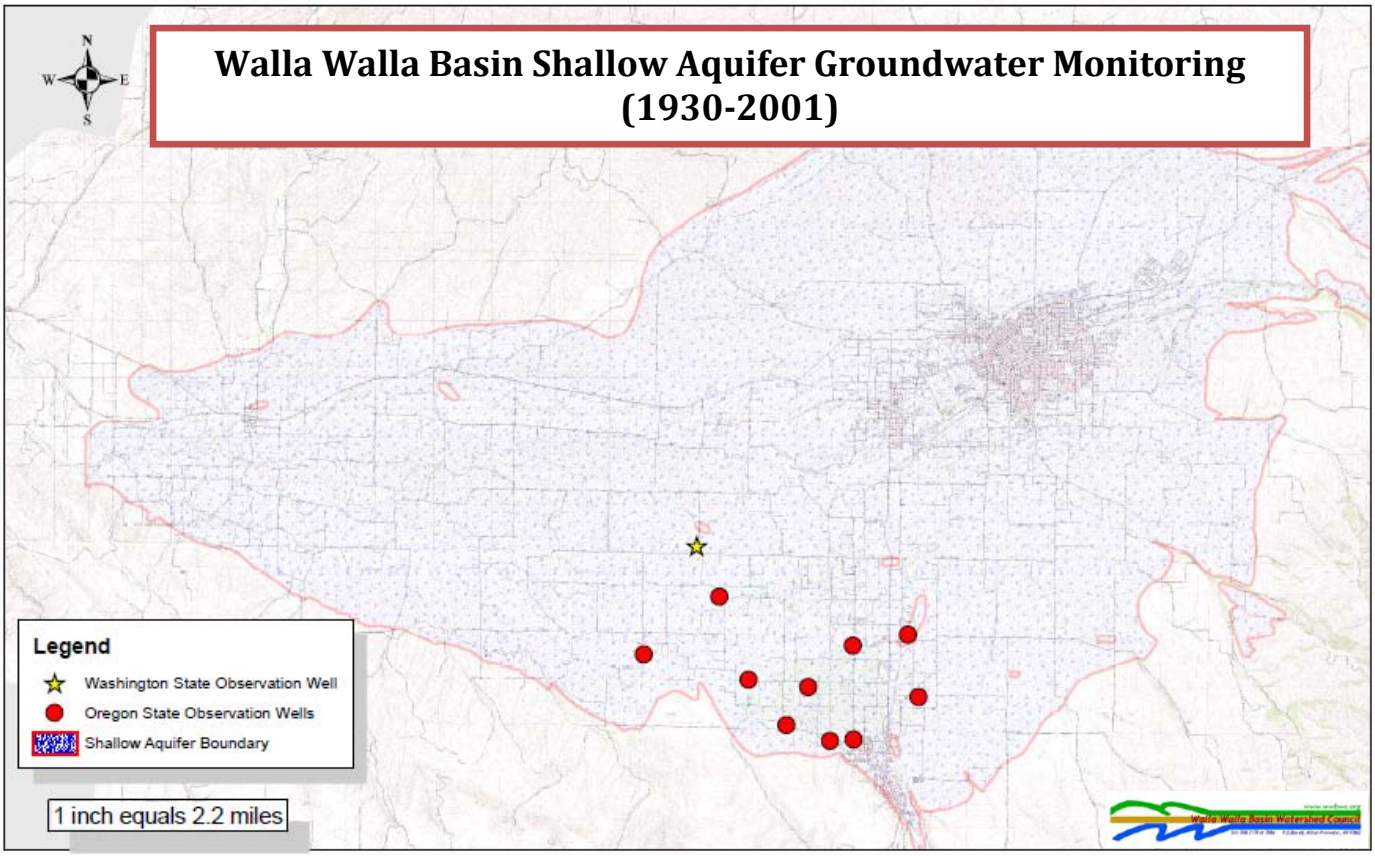


Figure 40. Observation wells in the Walla Walla Basin's Shallow Aquifer prior to 2001.

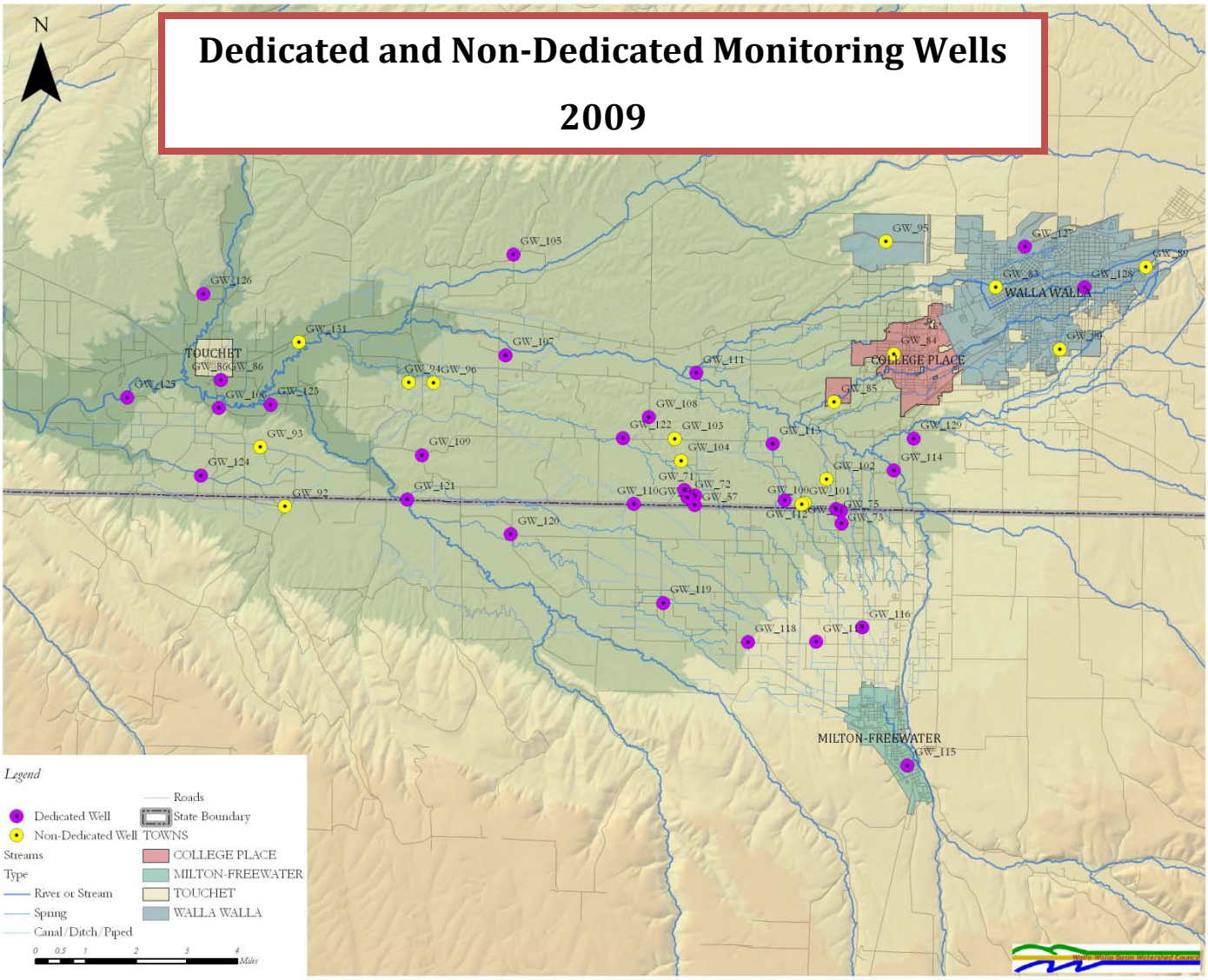


Figure 41. Dedicated (purple) and non-dedicated (yellow) wells in the Walla Walla Basin's shallow aquifer as of October 2009. Non-dedicated monitoring wells were established in cooperation with landowners who voluntarily allowed their wells to be monitored.

Finally, the Shallow Aquifer Monitoring Project is successful not only in compiling aquifer data/analysis and expanding the well network, but also in community outreach because it depends on voluntary land owner participation and local support. Many citizens have contributed vital information to the project and also have become more aware of the declining aquifer and other water issues in the Walla Walla Basin.

APPENDIX A

WWBWC Well Monitoring Field Instructions

1.) Before you leave the office
    a. Laptop should be charged
    b. Check battery replacement and logger download schedule
    c. Review "Equipment Needed" (see #2 below)
    d. Review WellNet notebook pages if needed
    e. Review "Procedures" (see #3 below)
    f. Sign out in main office
    g. RECORD your start miles, start time, and the project you will bill

2.) Equipment Needed
    a. General
        i. WELLS KEYS (usually in laptop case)
        ii. Cell phone, GPS, Camera and extra AA batteries
        iii. Flashlight, headlamp and extra batteries
        iv. Hammer, pipe wrench, flathead screw driver, big crescent wrench, blue cable snips
        v. Socket set
    b. Information and Paperwork
        i. Tatum/clipboard
        ii. Well Field Instructions and Procedures
            1. See: Groundwater Field Instructions and Procedures folder in WWBWC WellNet
        iii. Field mmt data sheets and field notebook
            1. Field mmt data sheets saved on laptop on desktop and in "My Documents" in "MMT data sheets" folder.
            2. Record data onto hard copy of data sheet or on field laptop
        iv. Blue WellNet notebooks for reference. They contain maps, addresses, photos, coordinates, well owner names, etc.
        v. "Well Info" pages/spreadsheet with details for mmt at each well
            1. Also in WellNet notebooks or
        vi. Business cards and pamphlets about WWBWC
    c. Downloading/Logger Equipment
        i. CHARGED Field laptop
        ii. Cables for MiniTroll, LevelTroll, and MicroDiver loggers
        iii. Battery removal tool for MiniTrolls

2.) Equipment Needed (continued…)

d. Logger Maintenance
    i. U-bolts and copper crimps
    ii. Extra AA lithium batteries
e. Static and Grab Samples Equipment
    i. E-tape and extra 9V batteries
    ii. Bailer
    iii. Graduated cylinder
    iv. Conductivity/EC meter (w/ thermometer)
f. Other
    i. Sounding tape
    ii. Mmt tape (meter tape)

3.) Procedures

a. RECORD THE DATE, TIME, SITE NAME, AND EQUIPMENT INFORMATION
b. Static mmts
    i. Review well info page for the point at which you should take the static measurement ("mmt_pt")
    ii. Turn E-tape on to "Test" and make sure it sounds
        1. If it doesn't buzz, adjust the "Sensitivity" knob
        2. If it still doesn't buzz, change the batteries
    iii. Turn E-tape to "Buzz"
    iv. Lower E-tape into well slowly, making sure the tape doesn't come off the sides of the reel
    v. When the tape buzzes, pull the tape up and down until you can determine the exact level.
    vi. TURN THE ETAPE OFF
    vii. RECORD the static level and whether the pump is on or off
c. Grab Samples
    i. Unlock the bailer and lower it into the well-you may hit bottom or hear it fill
        1. Lower bailer into well ONLY if there is ample space for it.
        2. Do not lower it into wells with vent hole access only
    ii. Reel the bailer back slowly, trying to keep it from banging against the sides of the well
    iii. Empty the bailer contents into the graduated cylinder
    iv. Put the EC/Cond probe into the graduated cylinder
        1. Push the on/off button
        2. Wait for reading to stabilize; RECORD
        3. The reading in degrees C and μs for conductivity

d. Deploying Loggers
    i. Sound well and RECORD or look up well log to find out what well depth is
    ii. Take a static depth and RECORD
    iii. Measure and cut aviation cable to hang logger
        1. Order cable thru accnt at Widner Electric/Napa: 938-55118
        2. Cable should be 10-20 feet below the static level, but should not rest on the bottom of the well.
        3. Remember to account for the length of the logger and the cable needed to attach the cable at the surface
        4. RECORD the length of the cable and the logger number

    iv. Attach the cable to the logger using two copper crimps AND a 1/16" U-bolt
        1. Order both thru accnt at PGG: 938-5551
        2. Crimp the copper crimps with fencing tool or cable snips
        3. Tighten U-bolt with the socket
    v. Attach the cable at the surface with copper crimps
    vi. Once the logger is started and attached lower it slowly into the well
    vii. Measure the top of ground adjustment (the distance between where you measured the static and the ground) and RECORD
    viii. Take a photo of the well and GPS the coordinates (UTMs) and elevation (ft)
e. Downloading Loggers
    i. Record the time, site name, and logger number
    ii. Follow steps outlined in the procedures for particular brand of logger, saving all downloaded files on the laptop
    iii. Record the status of the hardware and battery
    iv. SHUT DOWN COMPUTER (battery doesn't last with it on)
f. Office transfer of data
    i. All static mmts, grab samples, download information, TOGs, coordinates, etc go in the "Statics, Grabsamples, Well Info" folder in WWBWC Wells in WellNet
    ii. Update the downloading schedule on the white boards and in the excel worksheet (see above)
    iii. Order needed equipment well in advance
    iv. Report any problems with well, data, or safety to Troy or Bob

In-Situ Inc. Level Troll 100 & 300 Download Procedure

1.) Check download schedule, battery replacement schedules, and consult list of thing to take in field before you leave
2.) Connect download cables to the computer then connect levelTROLL
3.) Click on "Win-Situ 5.0" icon on desktop

4.) Click the connect icon on the bottom right hand part of screen (two yellow cables coming together)
    a. You may be asked to synchronize time. Before doing so, RECORD the logger's time (difference in time.)
    b. If it does not connect make sure it is using COM5 and all the cables are connected properly, if that doesn't work close Win-Situ and try again.
5.) Click on the Logging tab (clipboard and pencil icon) at the top
6.) To download
    a. Right click on the most recent test, RECORD test status if not running
        i. Running man icon means test is still running
        ii. Green checkmark means the test was downloaded and stopped
        iii. Red X means the test stopped due to an error
    b. Click "download"
    c. When complete, view the data
    d. Click "file" at top of page and click "Export to CSV"
    e. The file is automatically saved in "My Documents" on laptop
        i. Go to "My Documents"
        ii. Click on the WinSitu folder
        iii. Click on the particular site/well folder you are downloading
        iv. Find the most recent download and copy it
        v. Paste the download into a folder in "My Docs" named for the current date.
7.) Battery and Hardware Check
    a. In the Win-Situ 5.0 window, click the hammer and cog icon at top
        i. Click "Diagnostics"
        ii. RECORD the used battery, used memory, and available memory
        iii. If battery sufficient (compare to available battery), stop and restart.
    b. RECORD the status of the U-bolt, crimpers, cable, and attachment
8.) To Stop
    a. Click the clipboard and pencil icon at top
    b. Right click the log/test you just downloaded, click stop
    c. RECORD stop time
9.) To start a log at a NEW site, follow below steps. To add a new log to existing site, skip to step 9.
    a. Click the "Home" tab at top left of screen
    b. Click the "Site" button (blue and green planet icon)
    c. Click the "New" button (page icon with sunburst)
    d. Enter details for name of site: GW##_PlaceName
        i. Example: GW122_LeeHome
    e. Click "Save"
    f. Follow all steps to add a new log (step 9 below)
10.) Restarting-To "restart" you must add a new log/test
    a. Click New button (page icon with sunburst) at bottom left of "Logging" (clipboard icon) window
    b. Select the correct (current) site name. If this is not a new deployment, the site name should be an option in dropdown menu
    c. Give the new test/log a name with current date: gh_GW##_m-d-y initials.
        i. Example: gh_GW40_10-8-8np
        ii. Click the arrow to continue
    d. Parameters-select C and ftH20 for temp and pressure; click arrow to continue
    e. Logging method-Select "linear;" click arrow to continue

f. Log interval- select 1 hour; click arrow to continue
g. Start/Stop Condition-select "Manual Start;" click arrow to continue
h. Final Screen- check that summary of log setup is correct
    i. If correct, click the checkmark. If not, click the back button to fix
i. In the "Logging" window, right click the new test and click "Start"
    i. RECORD start time

11.) CHECK and deploy/redeploy

a. CHECK THAT LOGGER IS COLLECTING DATA!
    i. Follow steps 6a-c above
b. If logger logged temp and pressure measurements, continue to step 11

12.) Close and disconnect

a. Close Win-Situ 5.0
b. Disconnect logger from computer and cable
c. Redeploy logger IF it is running and has enough battery and good U-bolt
d. TURN OFF COMPUTER

13.) When you return to the office

a. Put the downloaded data in "My Documents" on the laptop for each day in the appropriate hydroshare folder.
b. When all downloads from a particular folder have been put into "WellNet" or "GAUGESPRIMARY," drag and drop the folder/date on the laptop into the year folder.
    i. For example: all folders with 2008 dates whose laptop downloads have been copied into hydroshare were finally placed into the "2008 Downloads" folder in the laptop's "My Documents"

Microdivers & Diver Office Software Download Procedure

NEW LOGGER SETUP

NAME→DEFINE SETTINGS→START→CONFIRM START→CLOSE PROGRAM

1.) Open "Diver Office" from the laptop desktop.
2.) Under the "WA Historic Wells" (or other project name) click the logger's current name. If it has never been used before, it will say "sws"
3.) Fill in the following fields:
    a. Location Type: Regular
    b. Cable Length: Measure (in 10ths of ft) the length of the cable from its attachment point at the ground surface to where it attaches to logger
    c. Top of Casing: Enter the top of ground adjustment. Measure (in 10ths of ft) from the point at which the cable is attached to well to the ground level. This number will be negative if the cable is attached above the ground level and positive if it is attached down in the well below ground level.
    d. Do not select the "Barometer" option unless one has been established
4.) Click "Diver" icon; "Diver" window will appear
5.) Click "Settings" icon in "Diver" window
    a. Logger status should be "STOPPED"
        i. If not, click "Stop" and click "Yes" to continue IF the logger data has already been downloaded and exported
    b. Fill in settings fields as follows:
        i. Name: GW# (fill in # as appropriate)
        ii. Sampling Method: Fixed
        iii. Sampling Interval: 01 Hour
        iv. Pressure Unit: ftH20
        v. Temperature Unit: Celsius
    c. Start/Restart the Diver (see attached instructions)
    d. RECORD the logger serial number, new name, and start/restart date and time
    e. TURN OFF COMPUTER to save battery

CHANGING THE NAME, SETTINGS OF A LOGGER

CONNECT TO DIVER→DOWNLOAD & EXPORT→STOP & RECORD→CHANGE SETTINGS →PROGRAM & RECORD→END

1.) Open "Diver Office" from the laptop desktop.
2.) Click "Diver" icon at top of page
3.) Download and export data (see attached instructions) if need be
4.) Stop logger and RECORD stop date and time

5.) Click “Settings” icon and change settings
6.) Click “Program” to save the settings to the MicroDiver. RECORD settings changes in notebook.

DOWNLOADING MMTS FROM MICRODIVER

CHECK & RECORD→DOWNLOAD→EXPORT→STOP & RECORD

1.) Connect Diver cradle to USB, place Diver in cradle, and cover cradle with hat or something that will keep light out (Diver data read optically; doesn’t work in sun)
2.) Open “Diver Office” from the laptop desktop.
3.) Click the “Diver” icon at top to connect to the logger; new window will appear
4.) Make sure the status of the logger is “STARTED,” shown in green under row of icons. This indicates Diver has been logging data.
5.) RECORD logger serial number in notebook
6.) RECORD number of samples taken and battery power left (%)
7.) Check to make sure the following are correct. If any field is incorrect, RECORD
    a. Sampling Method: Fixed
    b. Sampling Interval: 01 Hour
    c. Pressure Unit: ftH20
    d. Temperature Unit: Celsius
8.) Click the “Data” icon at the top of Diver window to download
9.) Main (old) window will pop up with a graph of pressure and temp data.
10.) Click “Data” icon

11.) Scroll down list of downloaded data and click box to left of your current download (check the “Download Date & Time” field)

12.) Click “Export” icon in this page (“Data”)

13.) Click folder icon to right and browse for location to export data

    a. Click “My Documents”

    b. Click (once) the folder for the current date, or click “Make New Folder”

       if one doesn’t exist.

    c. Click “OK;” you will be sent back to the “Exported Files” window.
    d. Make sure the “Uncompensated” option is selected in the “Export Files” window.
    e. Click “OK;” a message will appear that says files have been exported successfully
    f. Close “Data” window
14.) Click “Diver” icon

15.) Click “Stop”

    a. IF you have downloaded and exported the data, click “Yes” to continue.

b. RECORD the date and time you stopped the logger

RESTARTING LOGGER AFTER DOWNLOAD AND EXPORT

CHECK & RECORD→RESTART→CONFIRM RESTART & RECORD

→CLOSE PROGRAM & REPLACE DIVER

1.) Open "Diver" window (it should already be open after download)
2.) Click "Settings" in Diver window
    a. CHECK that the following field are correct:
        i. Micro-Diver: STOPPED
        ii. Battery Left: there should be sufficient battery
        iii. Location: correct location in the form of GW#
        iv. Sampling Method and interval: fixed, 01 Hour
        v. Pressure and Temp units: ftH20, Celsius
    b. If any fields are incorrect, change them and then click "Program" icon
3.) Click "Start" icon
    a. Select "Immediate Start" and "Sync Clock" in "Start Diver" window
    b. Click "Start"

4.) To check if Diver is logging data, Click "Data" in Diver window
    a. The main window will appear. Look to make sure one pressure and one temperature reading have been logged
    b. RECORD the date and time the logger was restarted. This can be found by widening the "Date & Time" column in the main window.
5.) IF the Diver is logging, close the program, disconnect logger, TURN OFF COMPUTER, and put back in the well.

In-Situ Minitroll Download and Deployment Procedures

1.) Check download schedule, battery replacement schedules, and consult list of things to take in the field before you leave
2.) Connect download cables to the computer then connect miniTROLL
3.) Click on "Win-Situ 4.0" icon on desktop
4.) Double Click on "COM4-19200"
    a. miniTROLL serial # will appear under "On-Line(1):COM4-19200"
    b. if it doesn't, connect the cable in the other USB port
5.) Click logger symbol miniTROLL serial # to show tests and info
6.) Under "Tests" info about each test on logger will appear with specific icons:
    a. Red runner icon indicates a test in progress
    b. Red X icon indicates test stopped due to logger or battery failure
    c. Green checkmark icon indicates a completed and stopped test
7.) Download, export, and save logger data (if need be) <u>before you restart.</u> *If you are deploying logger for the first time, skip steps 7 and 8.*
    a. Download
        i. Click on the active test: it has most recent date
        ii. Click "Extract"
        iii. Click "View"
    b. Export and Save
        i. With the current test's bin file highlighted on the left, click "File" and "Export to Excel"
        ii. Excel window will appear. Click "Save As"
        iii. Save file in "My Document" in a file with the current date. Create one if one does not exist using the format "9-1-8" for Sept. 1, 2008
        iv. Name the download using the following format: gh_SITE_startdate_enddate initials
            1. Well example: gh_GW14_6-20-8_9-23-8np
            2. Surface example: gh_LWJH_6-20-8_9-23-8wl
8.) You can choose to stop the current test after you download or not. If the logger has >6 months of data points on one test, stop the test and start a new one
    a. To redeploy logger without stopping test
        i. Click on the current test and make sure it still says "RUNNING"
        ii. Check measurement interval is 1 hr and battery capacity is 100%
        iii. Close Win-Situ4, disconnect logger, and redeploy
    b. To stop test
        i. Click on current, running test
        ii. IF you have downloaded, exported, and saved test, click "Stop"
        iii. RECORD date and time test stopped
9.) To deploy logger or restart logger on a new test
    a. In order to add a test, you may have to delete an old test. Right click the oldest test and click "Delete"
    b. Click "Tests"
    c. Click "Add"
    d. Fill in name and parameter, click "Next"
        i. Test Name: gh_SITE_startdate. Example: gh_GW14_9-23-8
        ii. Parameter: Select temperature and pressure

e. Test Wizard: select “Linear” and click “Next”
f. Measurement Interval: select 0day, 1hr, 0min, 0sec, 0hund; click “Next”
g. Start Mode: select “Manual Start;” click “Finish”
h. Click “Start” and then “OK”
    i. RECORD start time
i. Click “Extract” and “View” to confirm test is running
    i. When main window appears, there should be one measurement

10.) RECORD battery capacity

a. If battery is <100%, do not deploy

b. Review battery replacement schedule spreadsheet in office.

Logger lithium AA batteries must be replaced every nine months

regardless of the battery capacity.

11.) If the test is running click on “Online(1):COM4-19200”

a. Click “Drop” or just close the program

b. Disconnect cable and logger, shut down computer, deploy logger

c. TURN OFF COMPUTER

12.) When you return to the office, put the downloaded data on the laptop for each day in the appropriate hydroshare folder. When all downloads from a particular folder have been put into “WellNet” or “GAUGESPRIMARY,” drag and drop the folder/date on the laptop into the year folder.

a. For example: all folders with 2008 dates whose laptop downloads have been copied into hydroshare were finally placed into the “2008 Downloads” folder in the laptop’s “My Documents”

APPENDIX B

GPS Information

Below is a table of GPS information for each well monitored by the WWBWC.

Well ID	Easting	Northing	Well Elevation in Feet	Well Elevation in Meters	Horizontal Confidence in Meters	Vertical Confidence in Meters	AGENCY
GW_03	393477.08	5091165.361	273.745	898.114	0.016	0.012	WWBWC
GW_04	393192.023	5091728.252	267.303	876.978	0.016	0.011	WWBWC
GW_05	393764.617	5094403.253	248.064	813.920	0.022	0.015	WWBWC
GW_06	392664.181	5092403.474	262.960	867.425	0.015	0.011	WWBWC
GW_07	392787.583	5091551.116	271.717	891.460	0.012	0.012	WWBWC
GW_08	392587.05	5090737.197	281.997	925.187	0.012	0.011	WWBWC
GW_09	392658.605	5088806.697	306.631	1006.007	0.014	0.01	WWBWC
GW_10	392132.402	5091372.824	273.696	897.950	0.022	0.019	WWBWC
GW_11	391570.533	5093637.708	247.687	812.621	0.015	0.017	WWBWC
GW_13	390667.86	5093232.622	250.852	823.004	0.013	0.015	WWBWC
GW_14	392157.683	5089568.006	295.488	969.449	0.012	0.009	WWBWC
GW_15	388945.465	5089304.752	272.057	892.575	0.003	0.003	OWRD
GW_16	389690.237	5090610.166	269.610	884.545	0.003	0.004	OWRD
GW_18	386647.989	5093698.759	225.360	739.367	0.005	0.006	OWRD
GW_19	391225.116	5092022.761	265.289	870.369	0.014	0.018	OWRD
GW_20	393114.775	5092400.73	264.392	867.428	0.096	0.101	OWRD
GW_23	390432.546	5088757.822	292.342	959.125	0.006	0.007	OWRD
GW_25	393463.723	5090261.704	284.451	933.238	0.013	0.015	OWRD
GW_27	391245.146	5088811.531	298.777	980.239	0.008	0.009	OWRD
GW_28	390083.217	5090403.42	274.565	900.803	0.005	0.004	WWBWC
GW_31	385163.051	5093209.972	218.535	716.976	0.006	0.007	WWBWC
GW_33	387947.465	5093853.935	230.034	754.702	0.008	0.006	WWBWC
GW_34	383288.818	5093418.243	201.734	661.855	0.011	0.008	WWBWC
GW_35	388031.533	5090796.498	255.362	837.799	0.09	0.089	WWBWC
GW_36	384946.272	5091616.019	220.534	723.534	0.01	0.012	WWBWC
GW_37	384227.715	5092519.703	208.416	683.780	0.008	0.01	WWBWC
GW_38	392985.262	5094932.606	248.083	812.122	0.021	0.014	WWBWC
GW_39	388823.228	5090045.31	266.394	873.993	0.004	0.002	WWBWC
GW_40	388846.149	5089945.789	266.979	875.913	0.004	0.002	WWBWC
GW_41	388830.34	5090133.816	265.537	871.182	0.004	0.002	WWBWC
GW_45	388555.543	5090167.255	262.553	861.394	0.003	0.003	WWBWC
GW_46	388335.675	5090331.38	259.507	851.400	0.003	0.002	WWBWC
GW_47	388325.733	5090362.964	259.118	850.123	0.004	0.002	WWBWC
GW_48	388432.429	5090413.757	259.608	851.732	0.004	0.002	WWBWC
GW_54	390256.169	5095118.764	231.915	760.873	0.01	0.012	WWBWC
GW_57	385964.995	5095524.821	205.082	672.840	0.003	0.003	WDOE
GW_58	387261.534	5091269.173	245.655	805.953	0.005	0.004	WWBWC
GW_60	388039.791	5090041.577	257.473	844.726	0.003	0.003	WWBWC
GW_61	387730.609	5089747.583	255.862	839.440	0.003	0.003	WWBWC
GW_62	389834.806	5089059.234	283.305	929.478	0.006	0.004	WWBWC
GW_63	383280.245	5091893.17	203.980	669.226	0.014	0.01	WWBWC

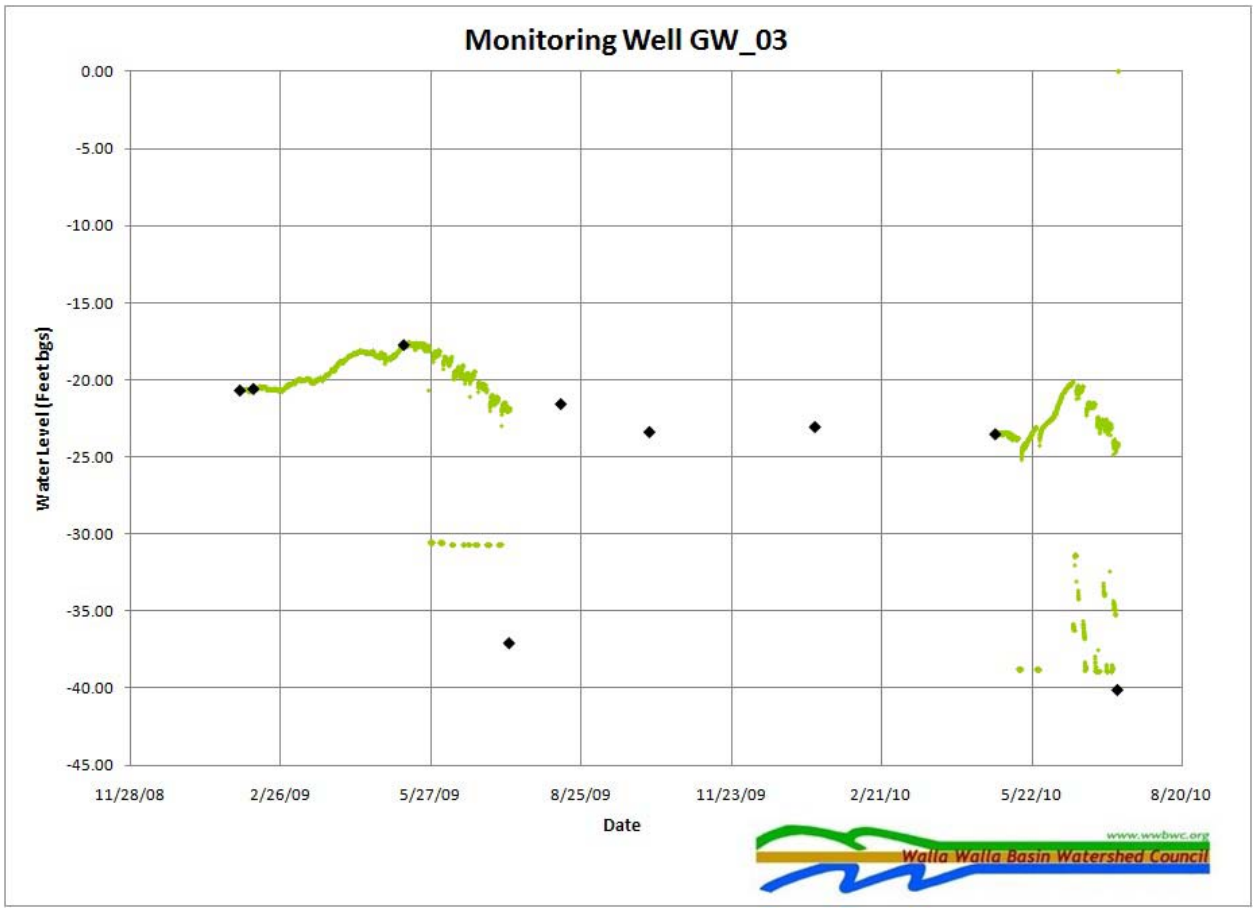
Well ID	Easting	Northing	Well Elevation in Feet	Well Elevation in Meters	Horizontal Confidence in Meters	Vertical Confidence in Meters	AGENCY
GW_64	383657.595	5091641.274	208.550	684.218	0.011	0.013	WWBWC
GW_65	387239.855	5090936.276	246.133	807.520	0.005	0.003	WWBWC
GW_66	384016.598	5091700.048	209.851	688.485	0.014	0.01	WWBWC
GW_67	378968.413	5093403.081	175.056	574.330	0.019	0.02	WWBWC
GW_68	379255.547	5092242.311	181.305	594.831	0.022	0.018	WWBWC
GW_69	383991.427	5091254.854	212.394	696.829	0.013	0.013	WWBWC
GW_70	385959.296	5095225.597	206.799	678.472	0.003	0.003	WWBWC
GW_71	385628.631	5095705.396	202.314	663.757	0.003	0.003	WWBWC
GW_72	385729.547	5095463.305	204.567	671.152	0.004	0.002	WWBWC
GW_73	390621.47	5095033.16	232.761	763.651			WWBWC
GW_74	390649.10	5094642.92	234.943	770.811			WWBWC
GW_75	390474.91	5095093.45	230.702	756.897			WWBWC
GW_82	369667.774	5098077.191	167.560	549.736	0.006	0.004	WWBWC
GW_83	395564.39	5102165.305	279.703	917.659	0.014	0.018	WWBWC
GW_84	392313.076	5100037.687	239.941	787.207	0.085	0.117	WWBWC
GW_85	390405.704	5098512.064	218.239	716.007	0.016	0.013	WWBWC
GW_86	370841.298	5099210.647	135.383	444.168	0.01	0.006	WWBWC
GW_87	402951.381	5104575.886	385.250	1263.942	0.006	0.004	CITY OF WALLA WALLA
GW_88	404352.529	5104571.294	402.095	1319.206	0.008	0.009	CITY OF WALLA WALLA
GW_89	400344.775	5102819.459	340.715	1117.829	0.004	0.004	CITY OF WALLA WALLA
GW_90	397598.227	5100192.121	295.908	970.825	0.012	0.014	CITY OF WALLA WALLA
GW_92	372892.083	5095185.179	170.620	559.775	0.017	0.016	WWBWC
GW_93	372093.92	5097078.055	177.130	581.135	0.014	0.01	WWBWC
GW_94	376840.306	5099135.812	151.368	496.613	0.032	0.021	WWBWC
GW_95	392050.438	5103625.036	257.941	846.261	0.022	0.027	WWBWC
GW_96	377627.97	5099120.23	151.895	498.342	0.03	0.02	WWBWC
GW_98	388276.158	5089528.166	263.425	864.255	0.021	0.014	WWBWC
GW_100	389461.838	5095285.116	226.025	741.552	0.011	0.008	WWBWC
GW_101	389376.906	5095242.378	227.345	745.881	0.009	0.01	WWBWC
GW_102	390157.378	5096042.65	222.966	731.513	0.013	0.01	WWBWC
GW_103	385326.833	5097329.298	195.595	641.715	0.005	0.006	WWBWC
GW_104	385521.562	5096636.159	198.959	652.752	0.004	0.003	WWBWC
GW_105	380175.563	5103218.696	169.084	554.736	0.027	0.025	WDOE
GW_106	370775.076	5098318.612	137.985	452.704	0.009	0.006	WDOE
GW_107	379927.288	5099999.592	159.637	523.741	0.024	0.017	WDOE
GW_108	384498.967	5098025.066	189.354	621.238	0.008	0.008	WDOE
GW_109	377261.415	5096816.914	157.012	515.130	0.026	0.021	WDOE
GW_110	384010.342	5095258.424	203.024	666.089	0.006	0.005	WDOE
GW_111	386005.353	5099434.302	185.580	608.857	0.011	0.01	WDOE
GW_112	388823.342	5095371.845	223.286	732.565	0.007	0.008	WDOE
GW_113	388445.622	5097173.405	207.196	679.776	0.01	0.006	WDOE
GW_114	392310.456	5096321.561	228.461	749.544	0.02	0.015	WDOE

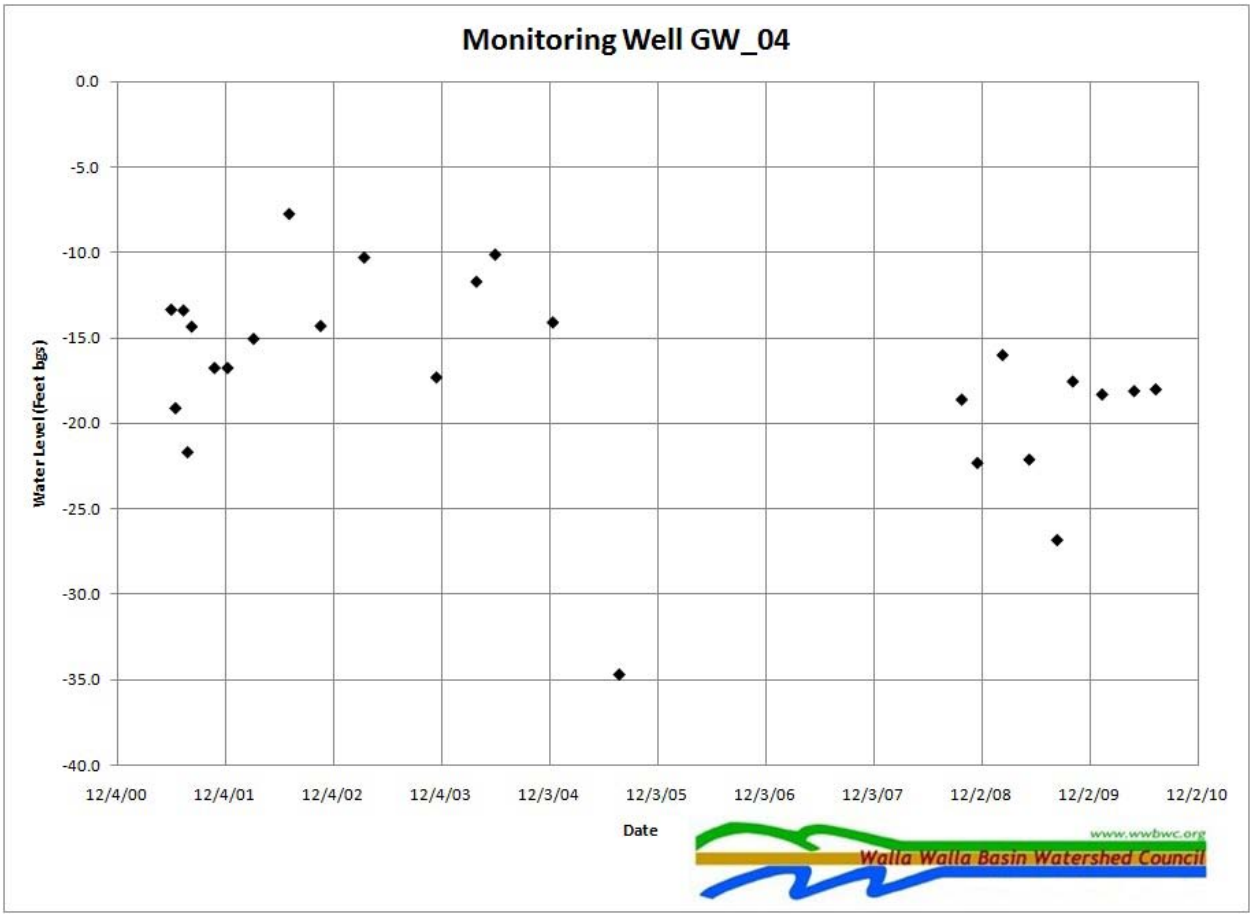
Well ID	Easting	Northing	Well Elevation in Feet	Well Elevation in Meters	Horizontal Confidence in Meters	Vertical Confidence in Meters	AGENCY
GW_115	392743.234	5086919.977	326.984	1072.780	0.072	0.106	WWBWC
GW_116	391304.129	5091322.097	272.050	892.550	0.022	0.015	WWBWC
GW_117	389825.547	5090864.475	268.409	880.607	0.004	0.004	WWBWC
GW_118	387655.395	5090858.899	250.210	820.898	0.004	0.003	WWBWC
GW_119	384949.15	5092104.046	217.173	712.508	0.01	0.011	WWBWC
GW_120	380094.16	5094289.865	172.605	566.289	0.019	0.013	WWBWC
GW_121	376782.848	5095406.672	153.482	503.549	0.024	0.025	WDOE
GW_122	383671.11	5097361.742	183.508	602.059	0.01	0.007	WDOE
GW_123	372425.274	5098426.898	136.382	447.447	0.015	0.01	WDOE
GW_124	370208.59	5096168.176	154.515	506.938	0.011	0.007	WDOE
GW_125	367861.923	5098647.985	130.150	427.001	0.003	0.002	WDOE
GW_126	370288.485	5101958.994	141.772	465.132	0.014	0.009	WDOE
GW_127	396489.017	5103462.555	294.222	965.295	0.107	0.083	WDOE
GW_128	398388.076	5102166.693	315.769	1035.986	0.013	0.008	WDOE
GW_129	392937.709	5097342.666	235.127	771.414	0.023	0.016	WDOE
GW_130	371006.475	5095051.067	170.546	559.535	0.015	0.011	WWBWC
GW_131	373332.024	5100415.423	138.554	454.571	0.018	0.013	WWBWC
GW_132	394298.127	5100424.793	265.044	869.565	0.031	0.022	WDOE
GW_133	380163.278	5102894.259	167.725	550.277	0.024	0.026	WDOE

APPENDIX C

Static Water Level Graphs

Below are static water level graphs for all of the wells that the WWBWC monitors.




Monitoring Well GW_04
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
Water Level (Feet bgs)
12/4/00
12/4/01
12/4/02
12/4/03
12/3/04
12/3/05
12/3/06
12/3/07
12/2/08
12/2/09
12/2/10
Date
www.wwbwc.org
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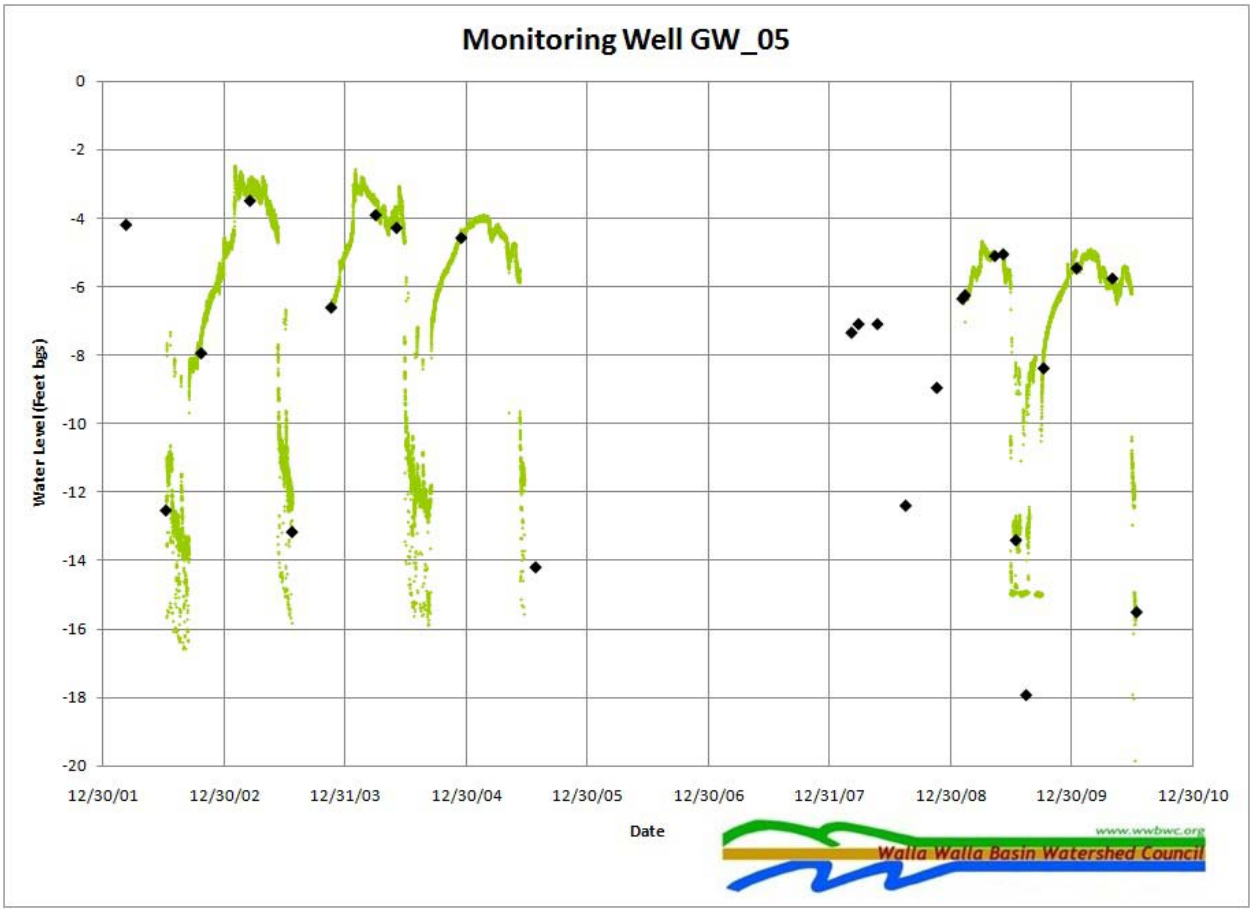
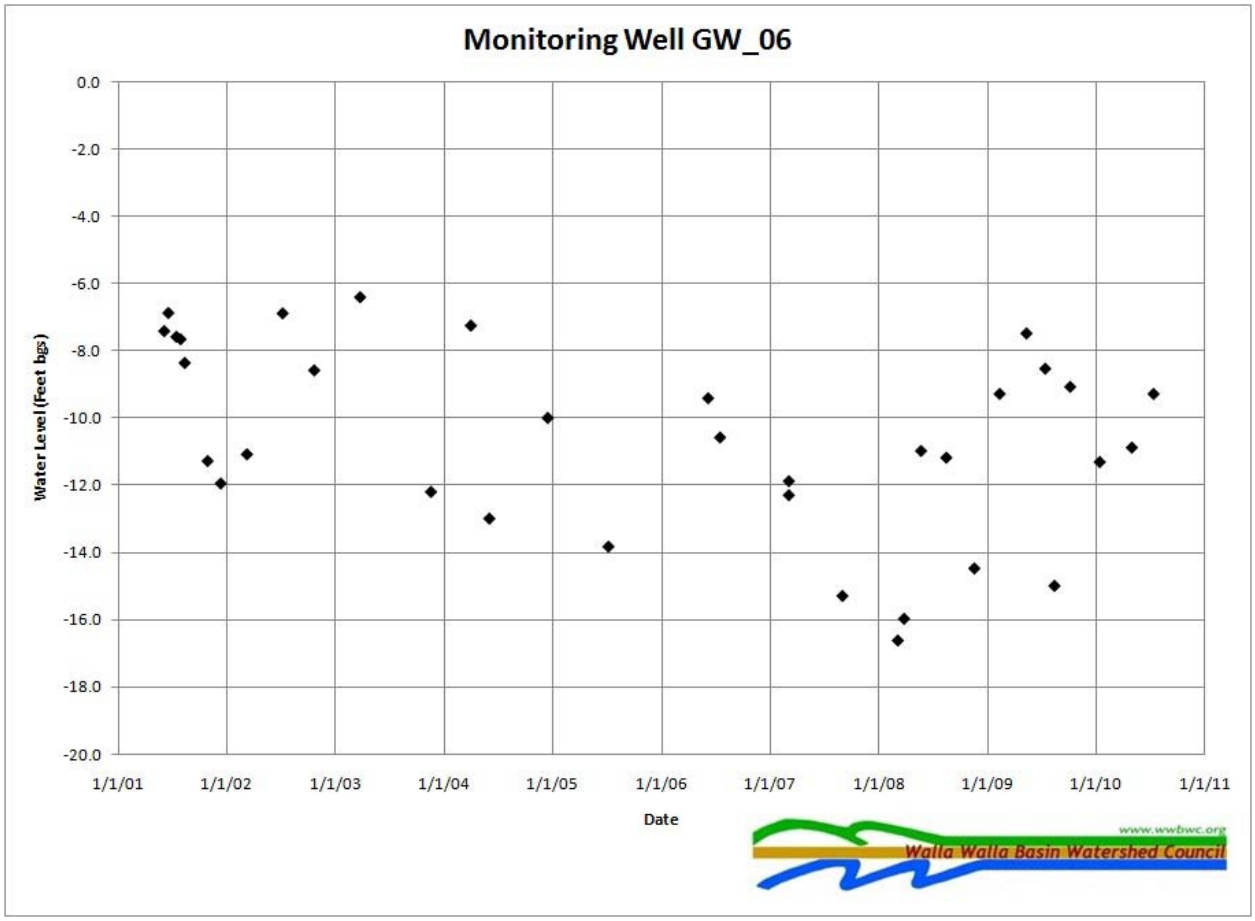

Monitoring Well GW_05
Water Level (Feet bgs)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
12/30/01
12/30/02
12/31/03
12/30/04
12/30/05
12/30/06
12/31/07
12/30/08
12/30/09
12/30/10
Date
www.wwbwc.org
Walla Walla Basin Watershed Council


Monitoring Well GW_06
Water Level (Feet bgs)
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
-18.0
-20.0
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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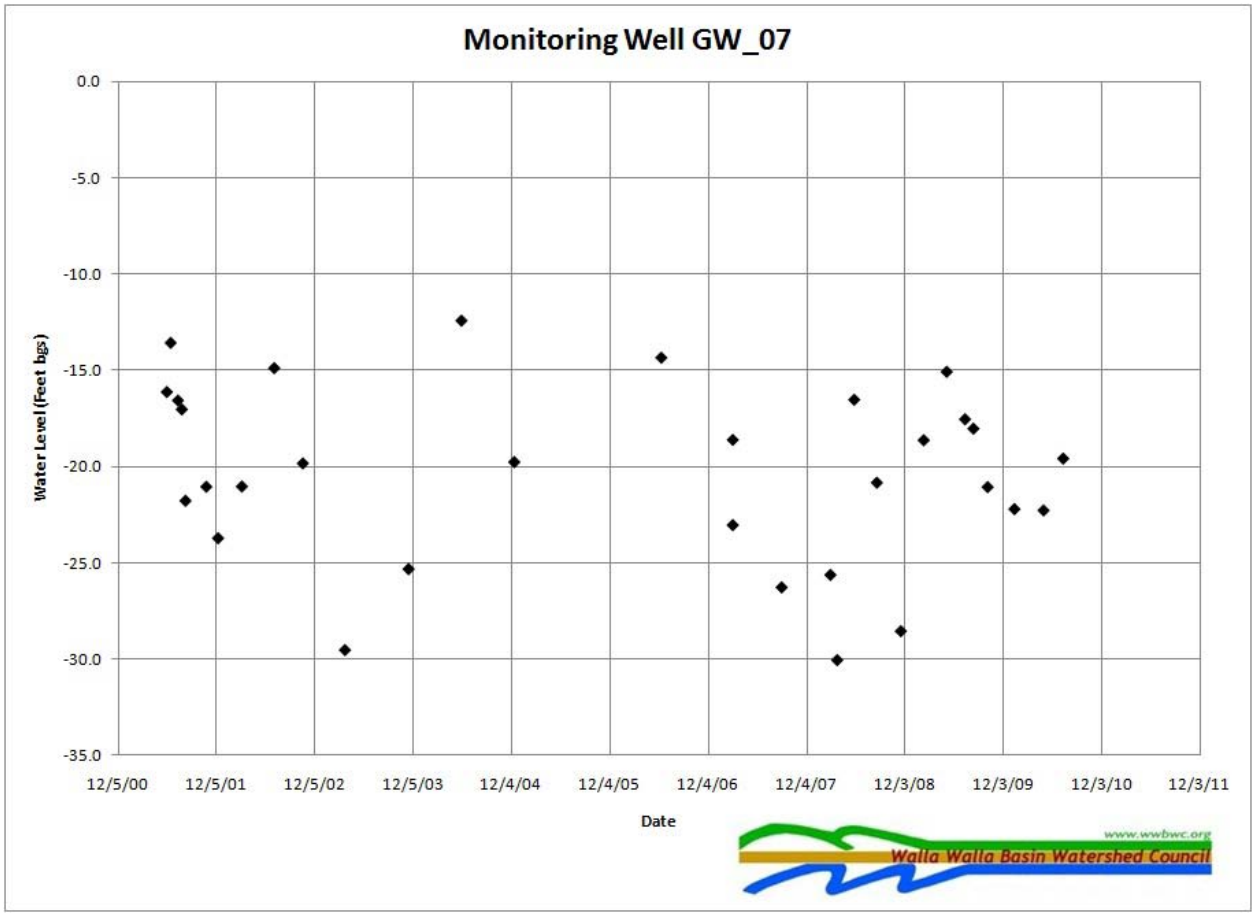
Monitoring Well GW_07
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
Water Level (Feet bgs)
12/5/00
12/5/01
12/5/02
12/5/03
12/4/04
12/4/05
12/4/06
12/4/07
12/3/08
12/3/09
12/3/10
12/3/11
Date
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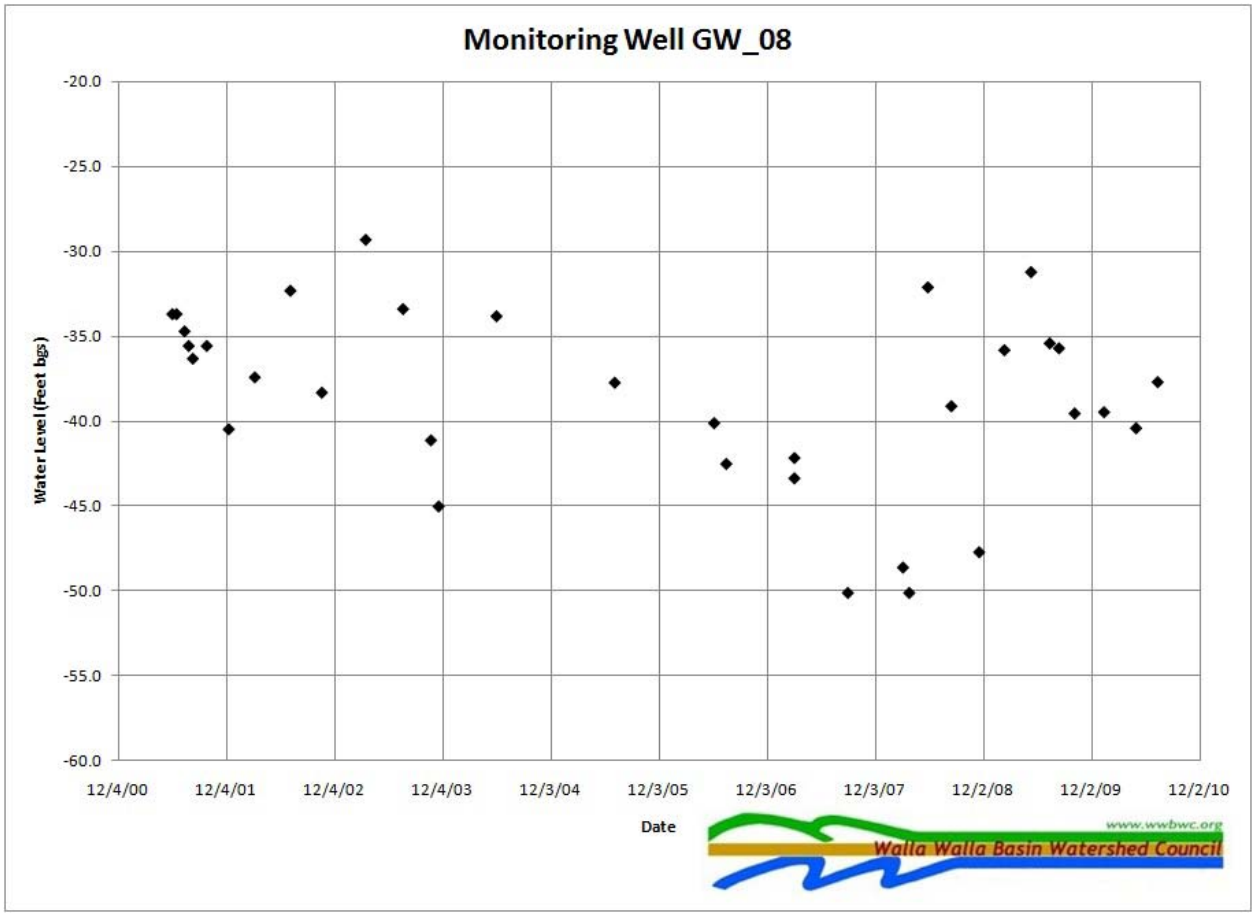
Monitoring Well GW_08
Water Lewel (Feet bgs)
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
12/4/00
12/4/01
12/4/02
12/4/03
12/3/04
12/3/05
12/3/06
12/3/07
12/2/08
12/2/09
12/2/10
Date
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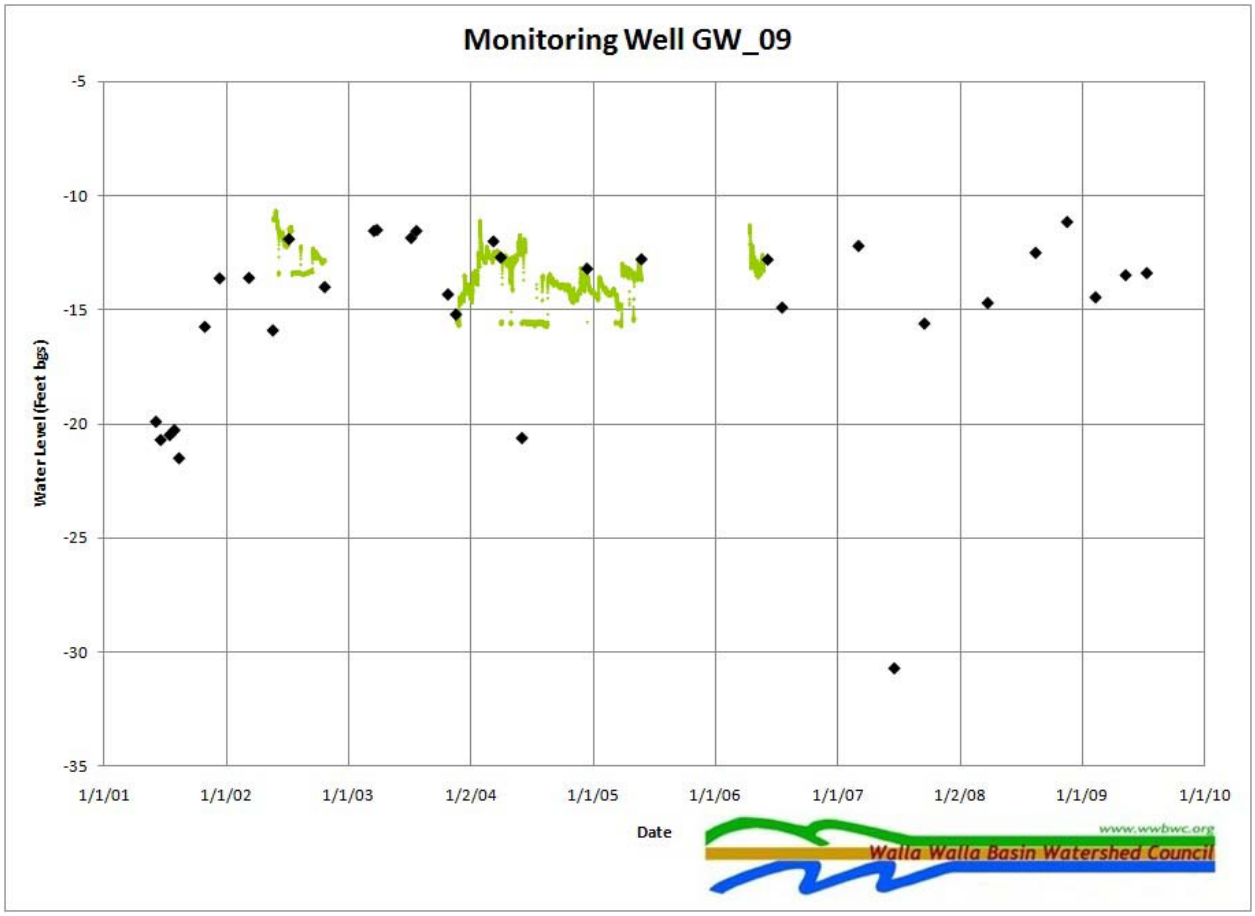
Monitoring Well GW_09
Water Level (Feet bgs)
-5
-10
-15
-20
-25
-30
-35
1/1/01
1/1/02
1/1/03
1/2/04
1/1/05
1/1/06
1/1/07
1/2/08
1/1/09
1/1/10
Date
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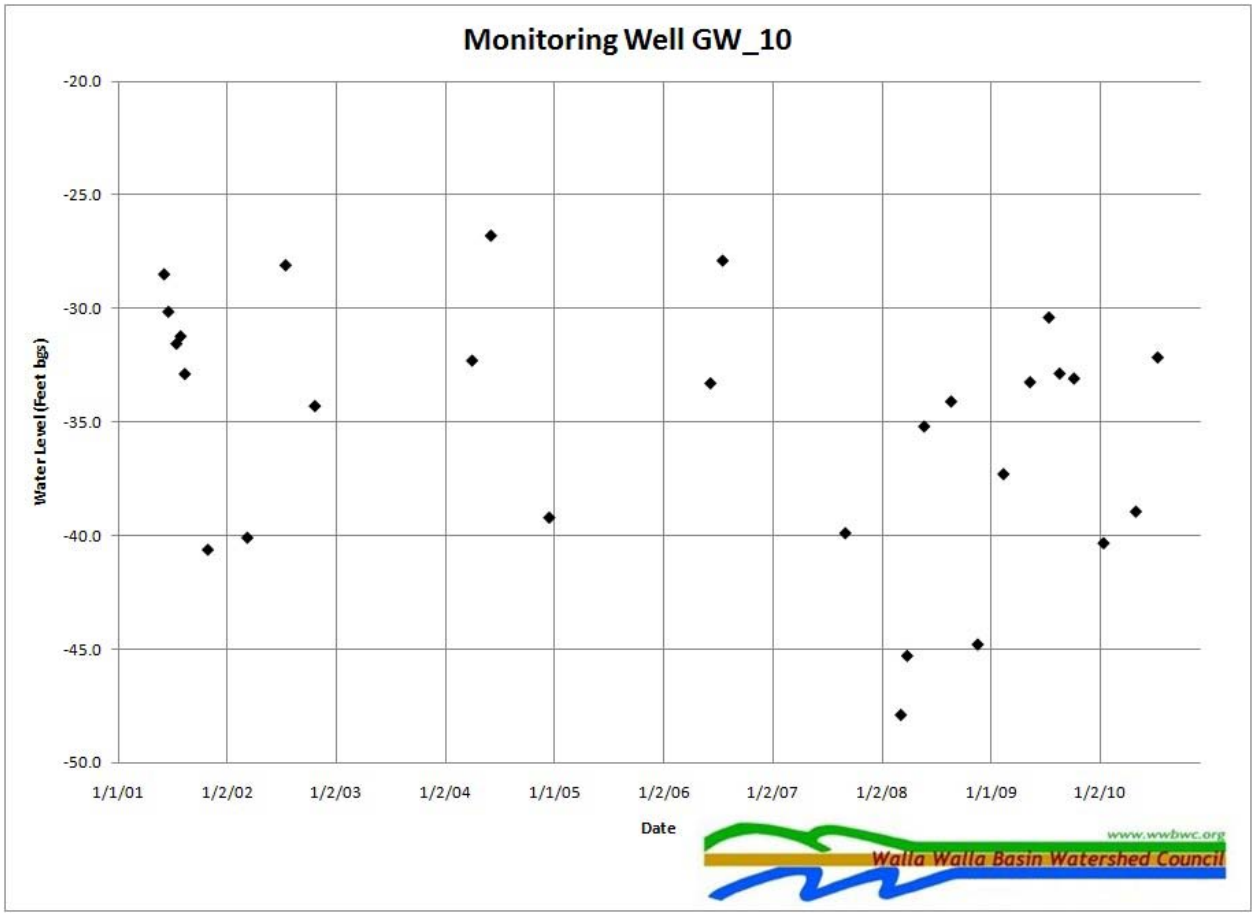
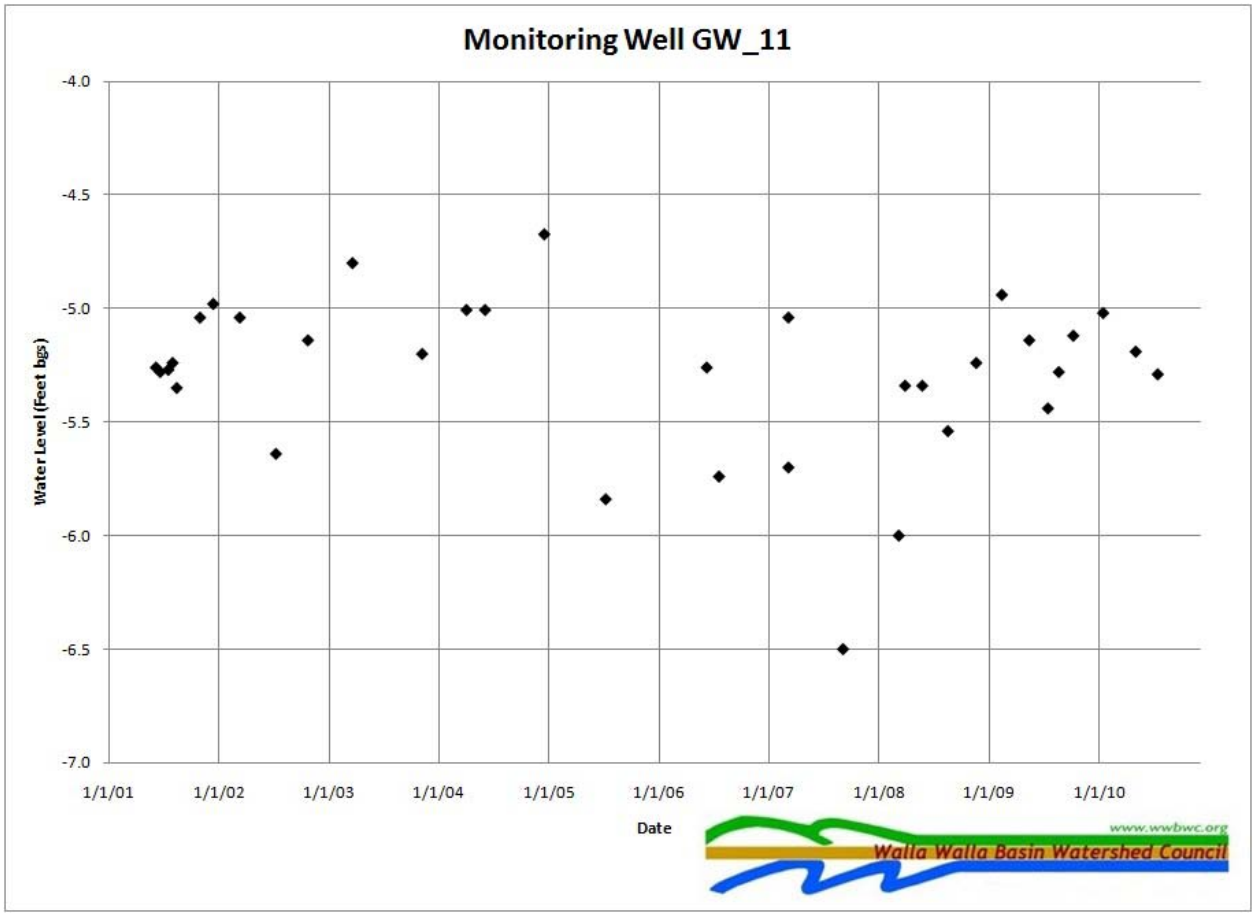

Monitoring Well GW_10
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
Water Level (Feet bgs)
1/1/01
1/2/02
1/2/03
1/2/04
1/1/05
1/2/06
1/2/07
1/2/08
1/1/09
1/2/10
Date
www.wwbwc.org
Walla Walla Basin Watershed Council


Monitoring Well GW_11
-4.0
-4.5
-5.0
-5.5
-6.0
-6.5
-7.0
Water Level (Feet bgs)
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
Date
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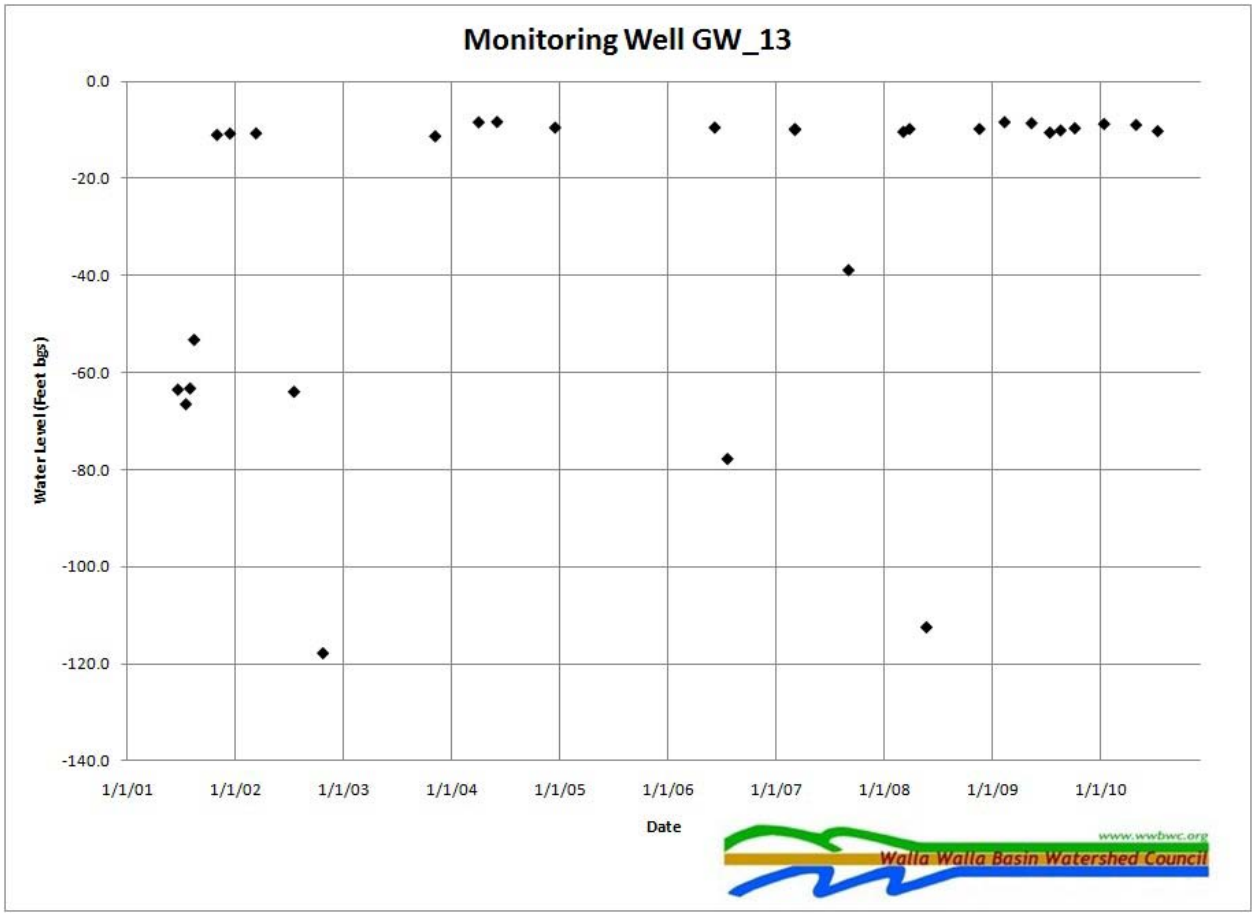
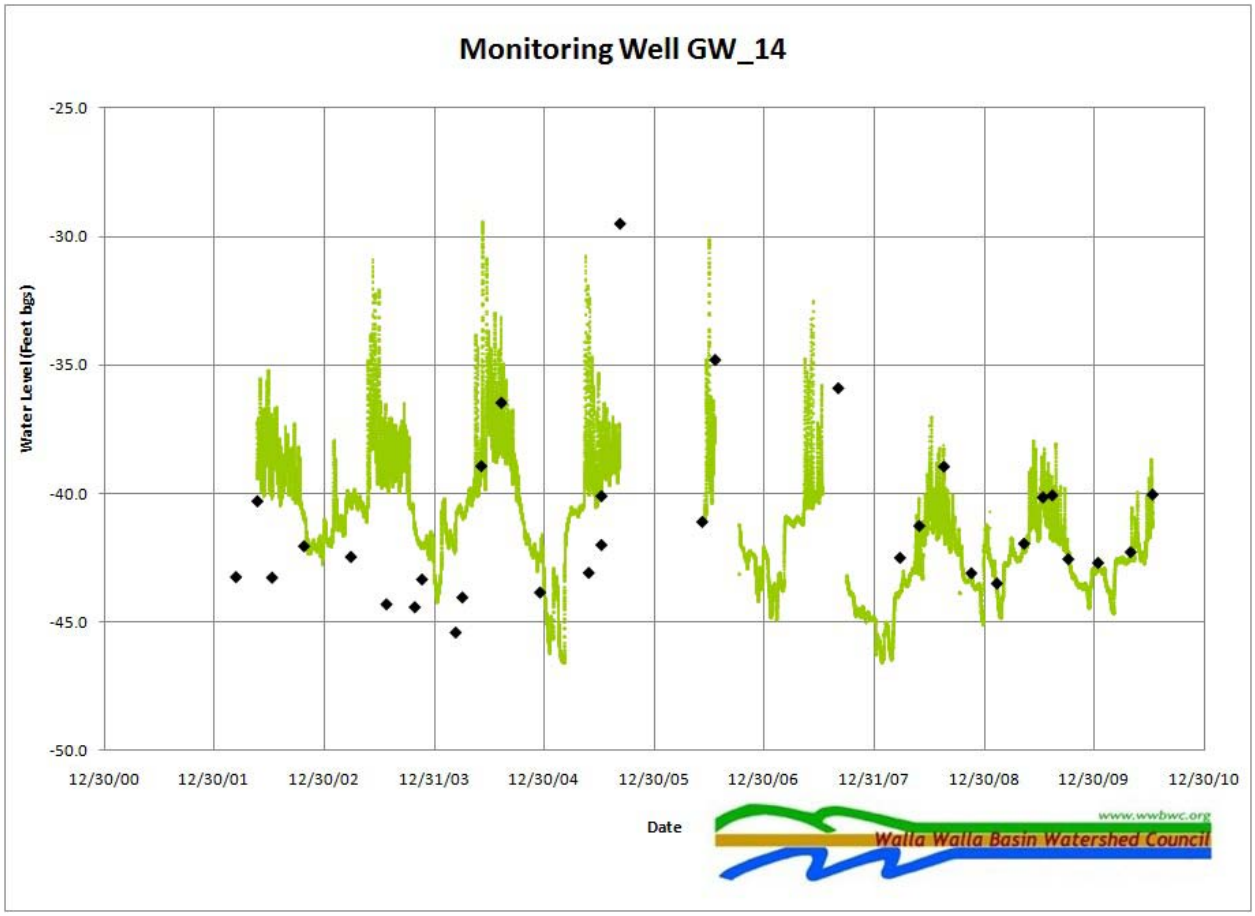
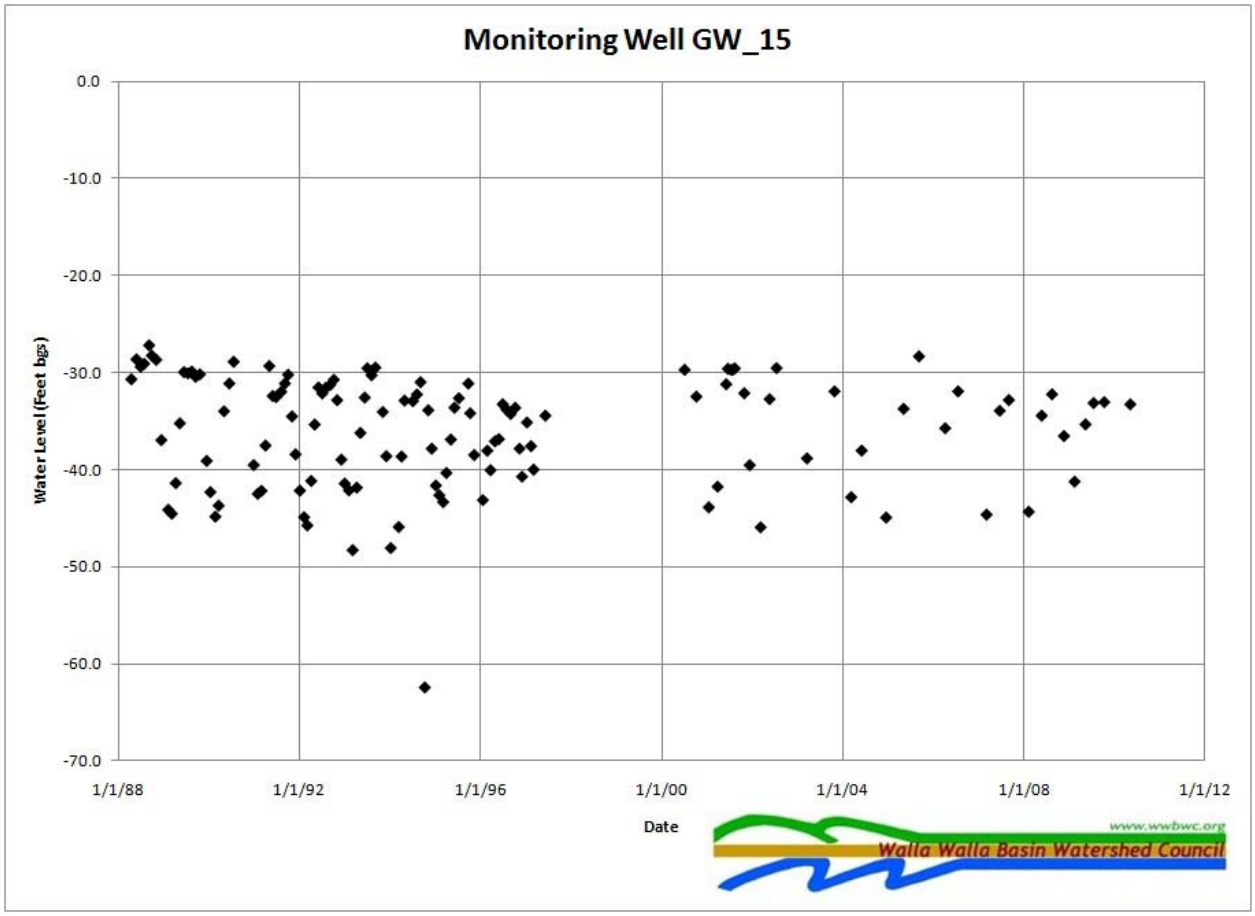
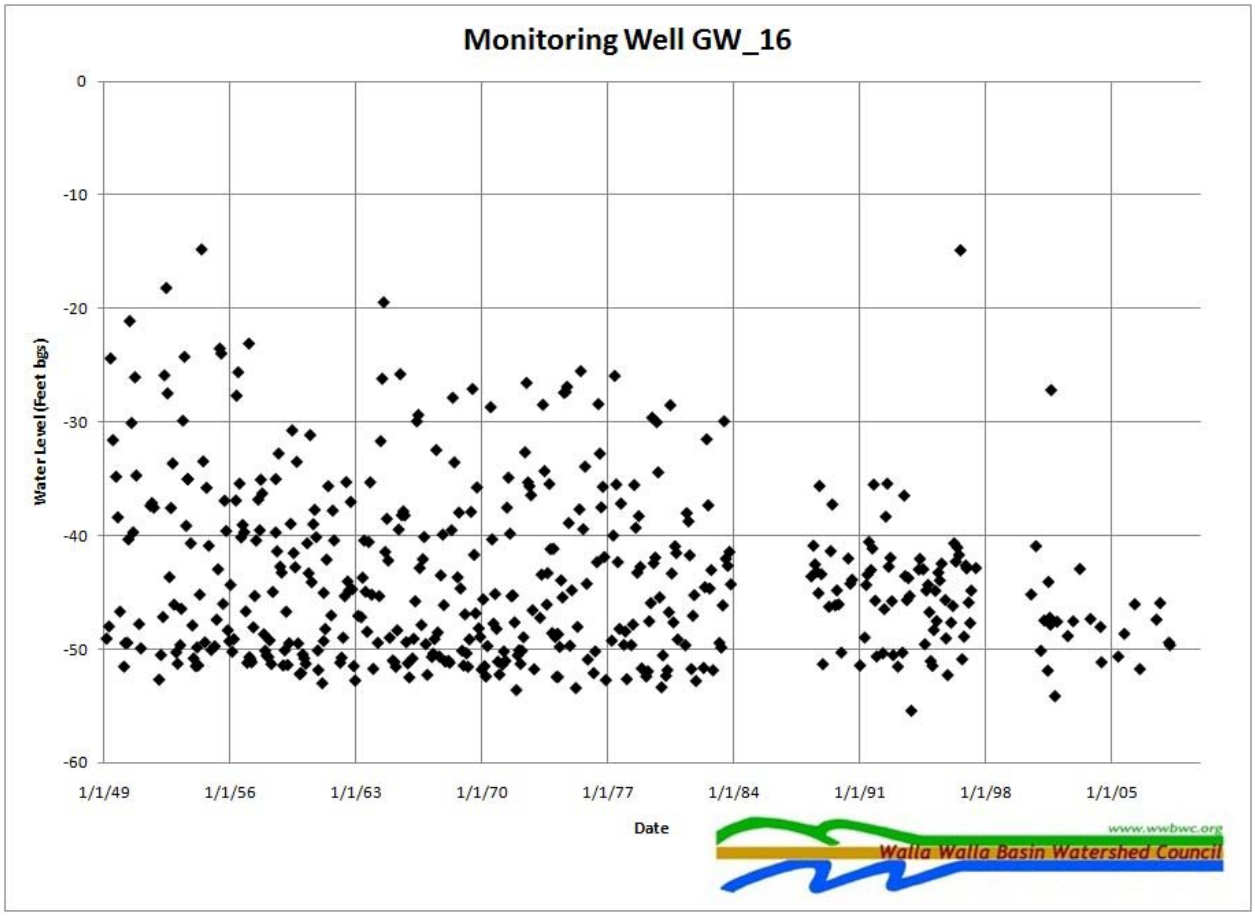

Monitoring Well GW_13
0.0
-20.0
-40.0
-60.0
-80.0
-100.0
-120.0
-140.0
Water Level (Feet bgs)
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
Date
www.wwbwc.org
Walla Walla Basin Watershed Council


Monitoring Well GW_14
Water Level (Feet bgs)
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
12/30/00
12/30/01
12/30/02
12/31/03
12/30/04
12/30/05
12/30/06
12/31/07
12/30/08
12/30/09
12/30/10
Date
www.wwbwc.org
Walla Walla Basin Watershed Council


Monitoring Well GW_15
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Water Level (Feet bgs)
1/1/88
1/1/92
1/1/96
1/1/00
1/1/04
1/1/08
1/1/12
Date
www.wwbwc.org
Walla Walla Basin Watershed Council


Monitoring Well GW_16
Water Level (Feet bgs)
0
-10
-20
-30
-40
-50
-60
1/1/49
1/1/56
1/1/63
1/1/70
1/1/77
1/1/84
1/1/91
1/1/98
1/1/05
Date
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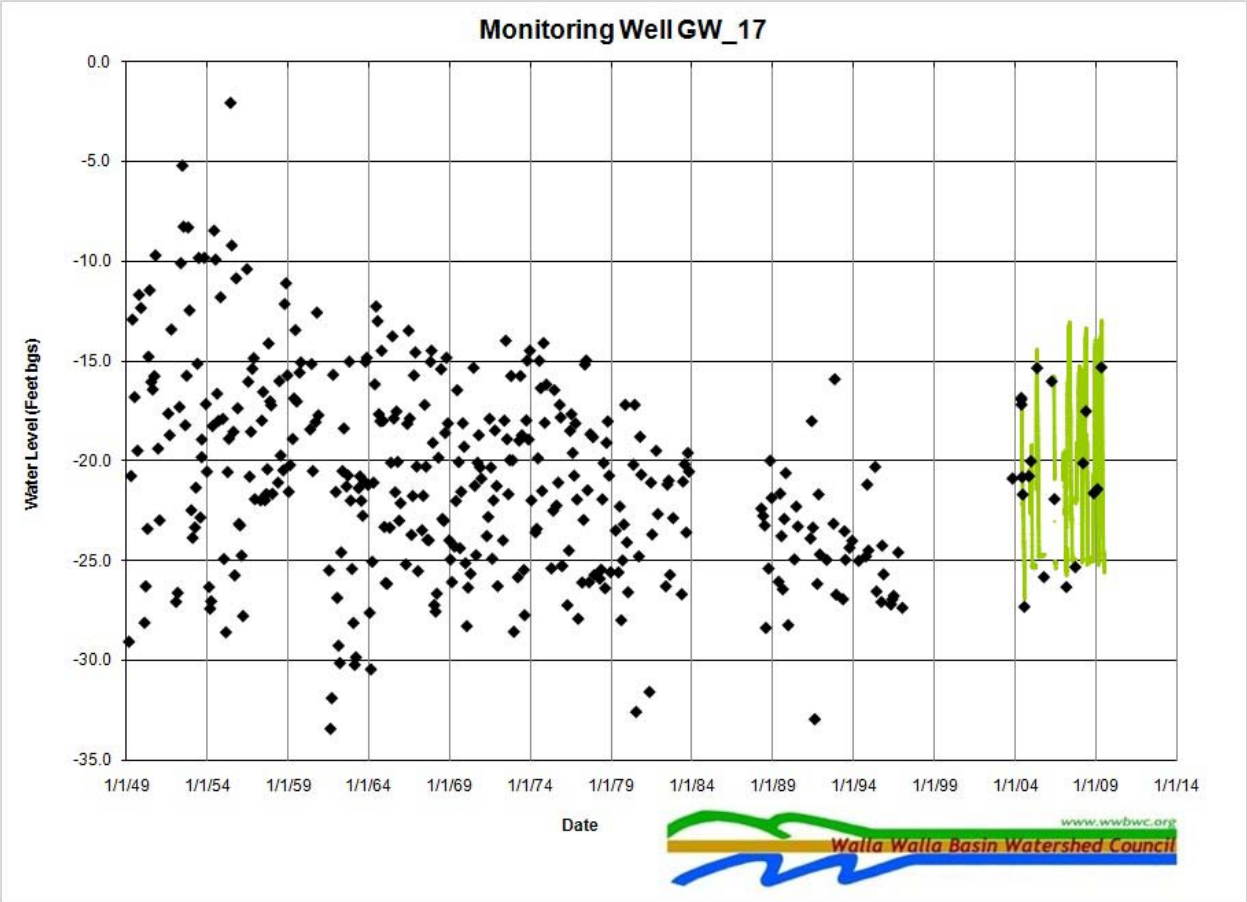
Monitoring Well GW_17
Water Level (Feet bgs)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
1/1/49
1/1/54
1/1/59
1/1/64
1/1/69
1/1/74
1/1/79
1/1/84
1/1/89
1/1/94
1/1/99
1/1/04
1/1/09
1/1/14
Date
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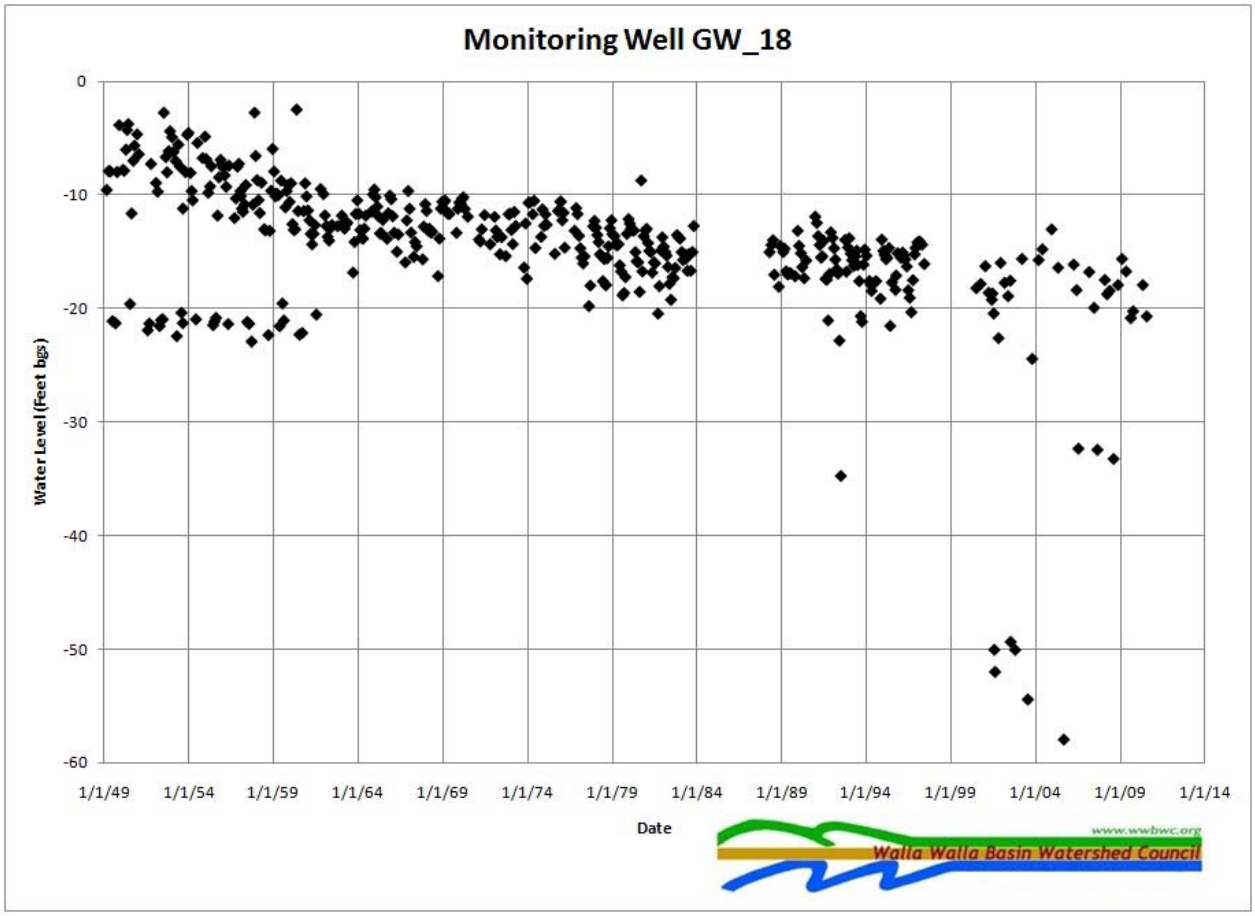
Monitoring Well GW_18
Water Level (Feet bgs)
0
-10
-20
-30
-40
-50
-60
1/1/49
1/1/54
1/1/59
1/1/64
1/1/69
1/1/74
1/1/79
1/1/84
1/1/89
1/1/94
1/1/99
1/1/04
1/1/09
1/1/14
Date
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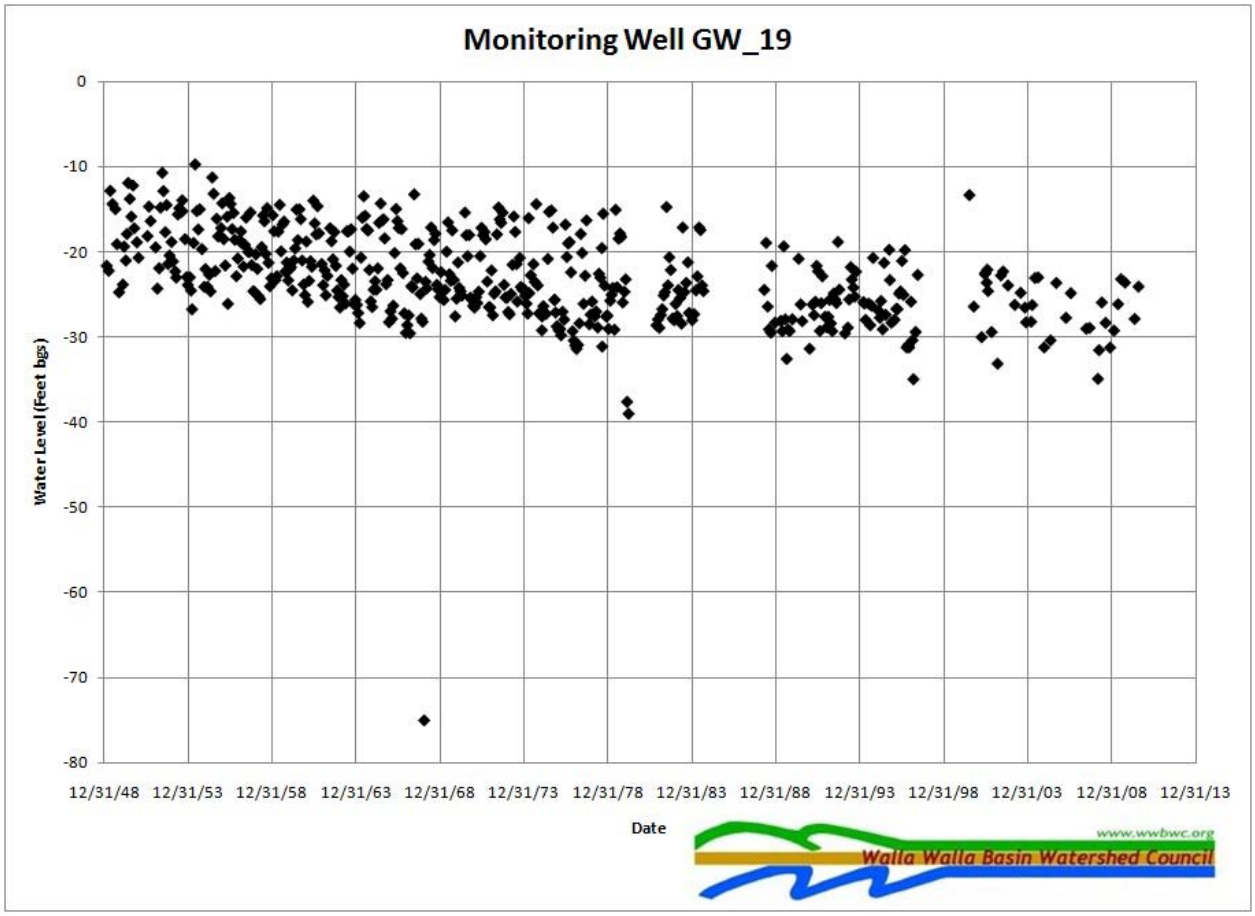
Monitoring Well GW_19
Water Level (Feet bgs)
0
-10
-20
-30
-40
-50
-60
-70
-80
12/31/48
12/31/53
12/31/58
12/31/63
12/31/68
12/31/73
12/31/78
12/31/83
12/31/88
12/31/93
12/31/98
12/31/03
12/31/08
12/31/13
Date
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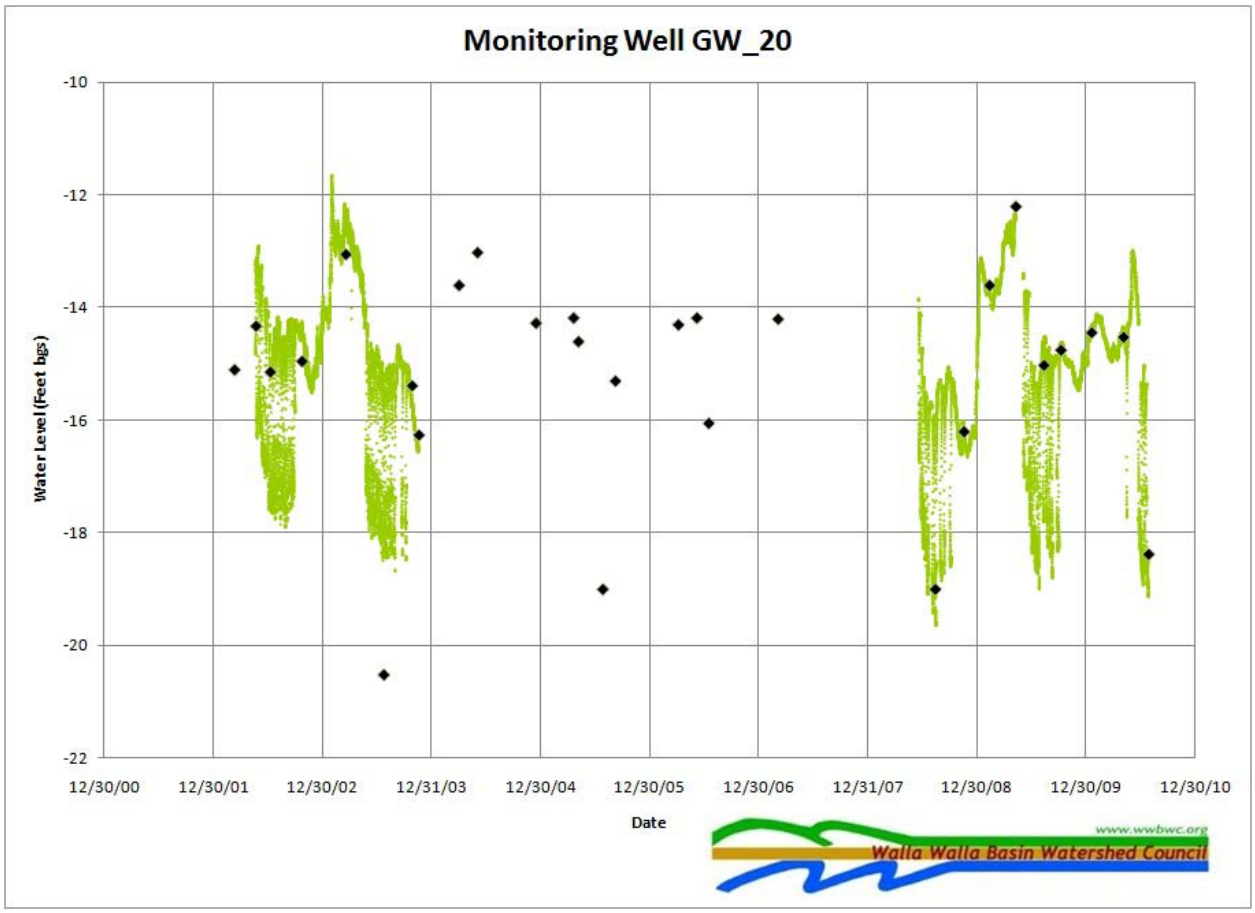
Monitoring Well GW_20
-10
-12
-14
-16
-18
-20
-22
Water Level (feet bgs)
12/30/00
12/30/01
12/30/02
12/31/03
12/30/04
12/30/05
12/30/06
12/31/07
12/30/08
12/30/09
12/30/10
Date
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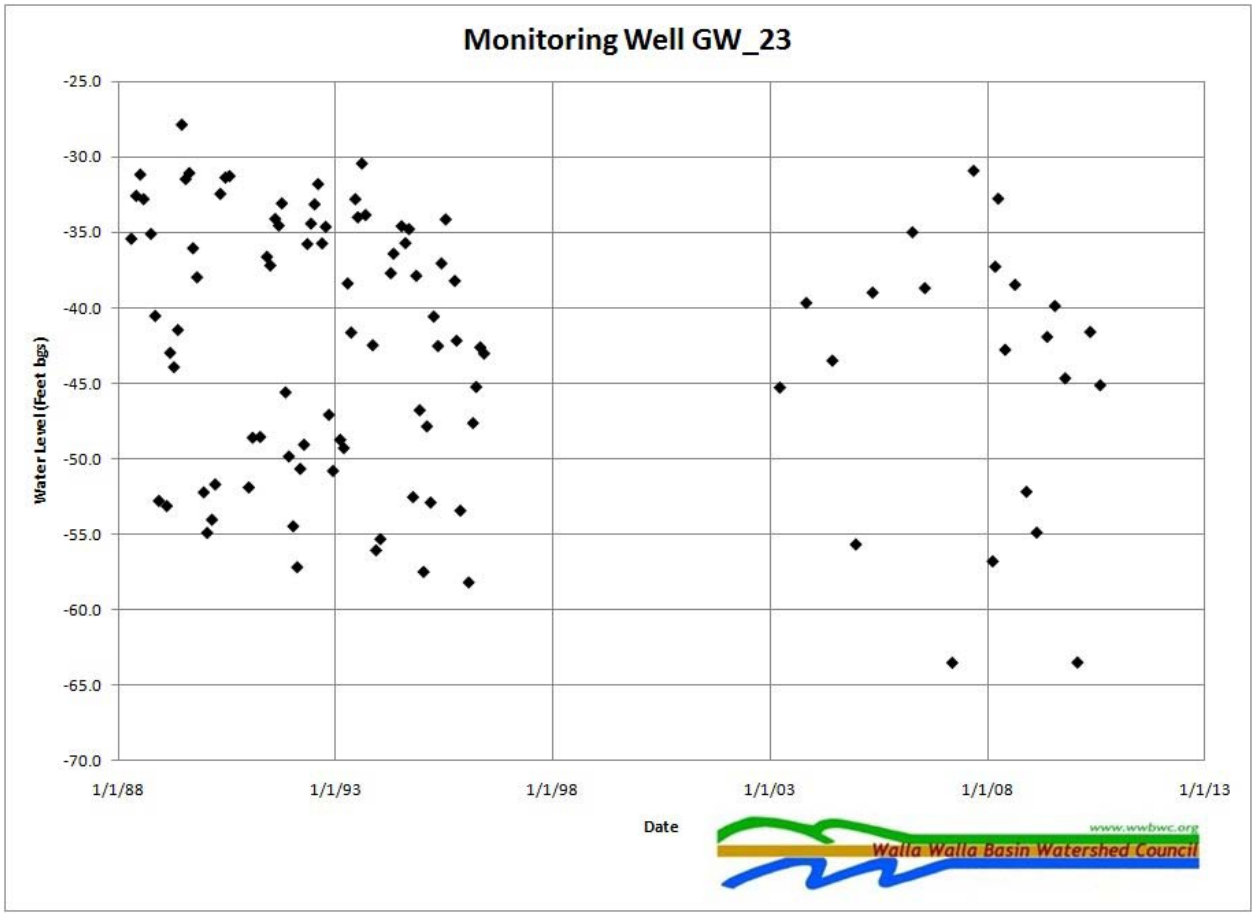
Monitoring Well GW_23
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
-65.0
-70.0
Water Lewel (Feet bgs)
1/1/88
1/1/93
1/1/98
1/1/03
1/1/08
1/1/13
Date
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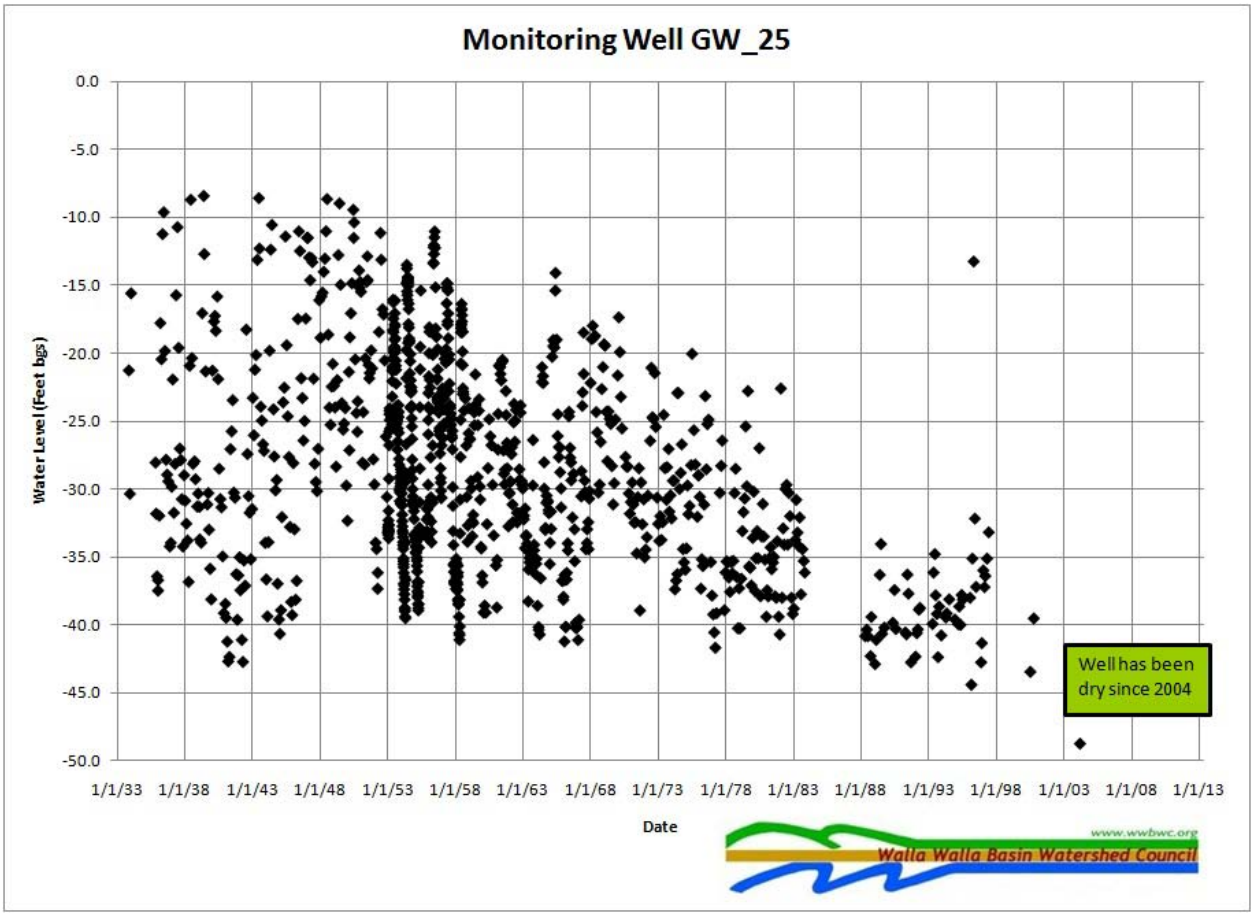
Monitoring Well GW_25
Water Level (Feet bgs)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
1/1/33
1/1/38
1/1/43
1/1/48
1/1/53
1/1/58
1/1/63
1/1/68
1/1/73
1/1/78
1/1/83
1/1/88
1/1/93
1/1/98
1/1/03
1/1/08
1/1/13
Date
Well has been dry since 2004
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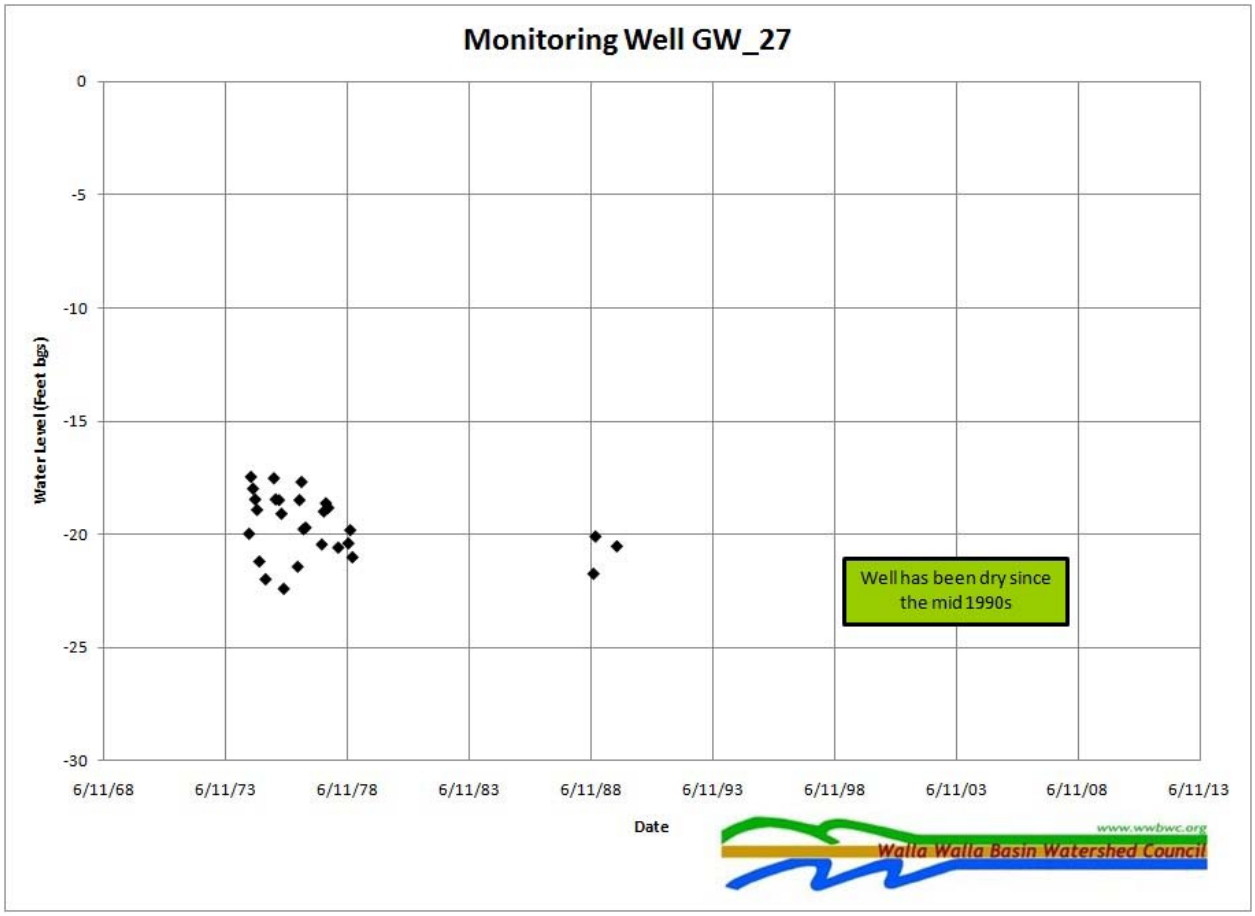
Monitoring Well GW_27
Water Level (Feet bgs)
0
-5
-10
-15
-20
-25
-30
6/11/68
6/11/73
6/11/78
6/11/83
6/11/88
6/11/93
6/11/98
6/11/03
6/11/08
6/11/13
Date
Well has been dry since the mid 1990s
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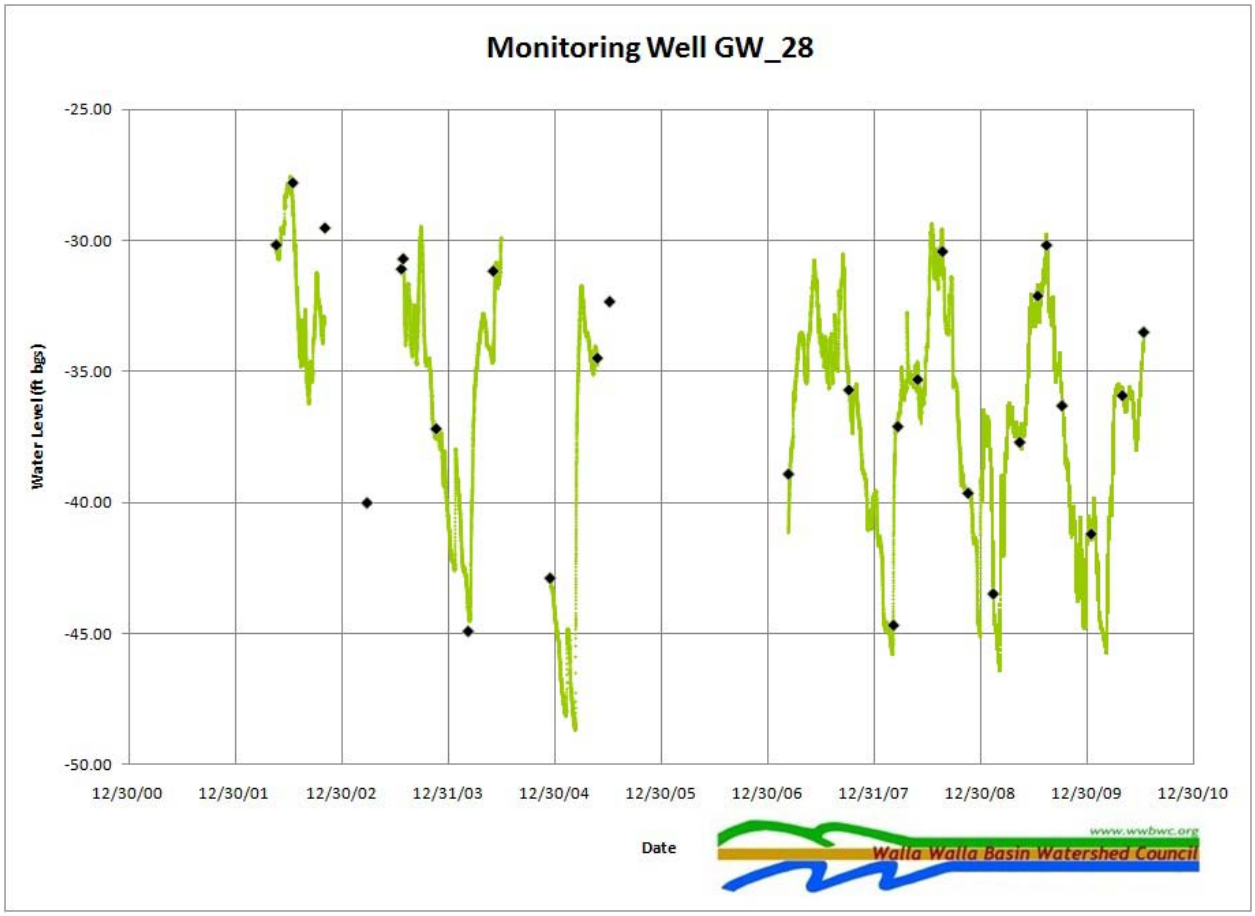
Monitoring Well GW_28
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
Water Level (ft bgs)
12/30/00
12/30/01
12/30/02
12/31/03
12/30/04
12/30/05
12/30/06
12/31/07
12/30/08
12/30/09
12/30/10
Date
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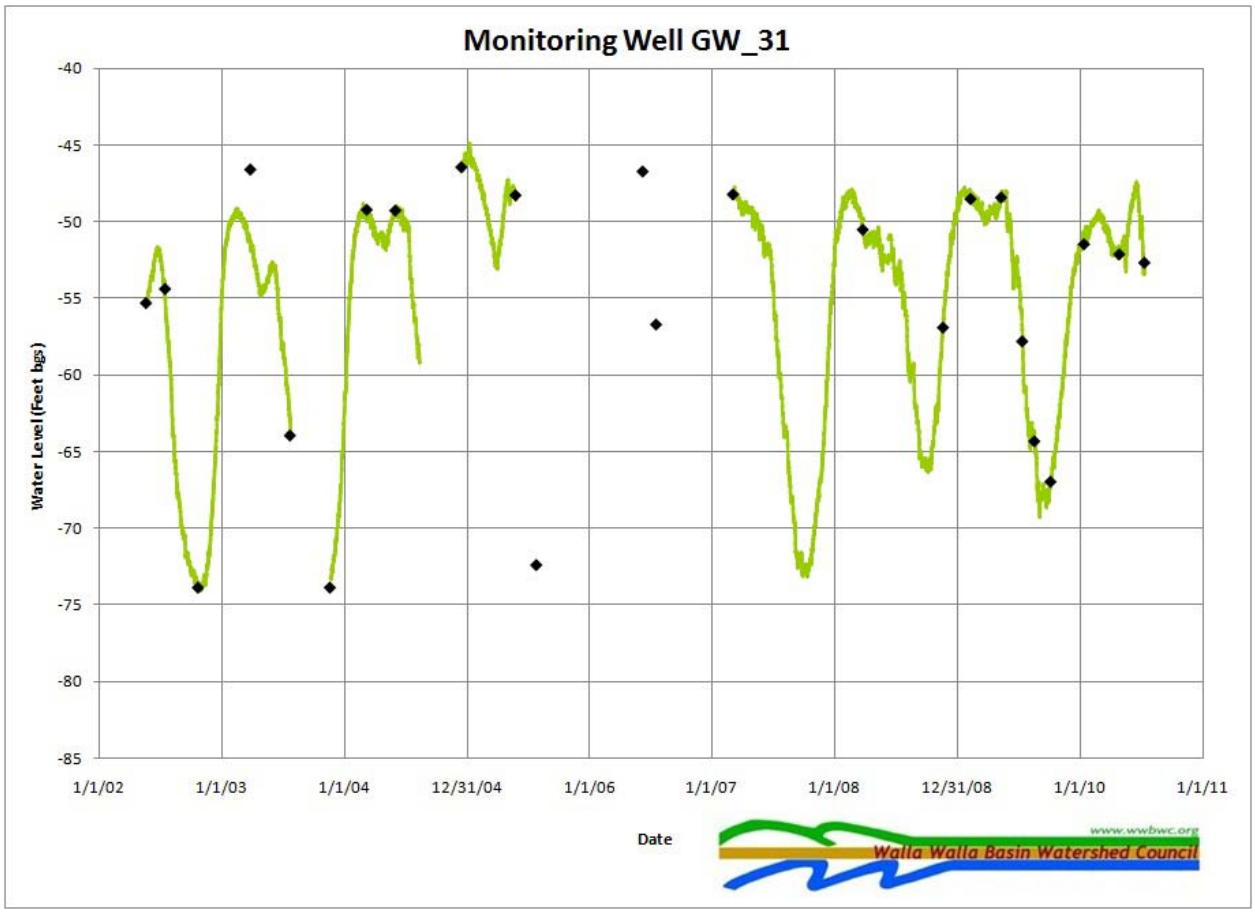
Monitoring Well GW_31
Water Level (Feet bgs)
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
1/1/02
1/1/03
1/1/04
12/31/04
1/1/06
1/1/07
1/1/08
12/31/08
1/1/10
1/1/11
Date
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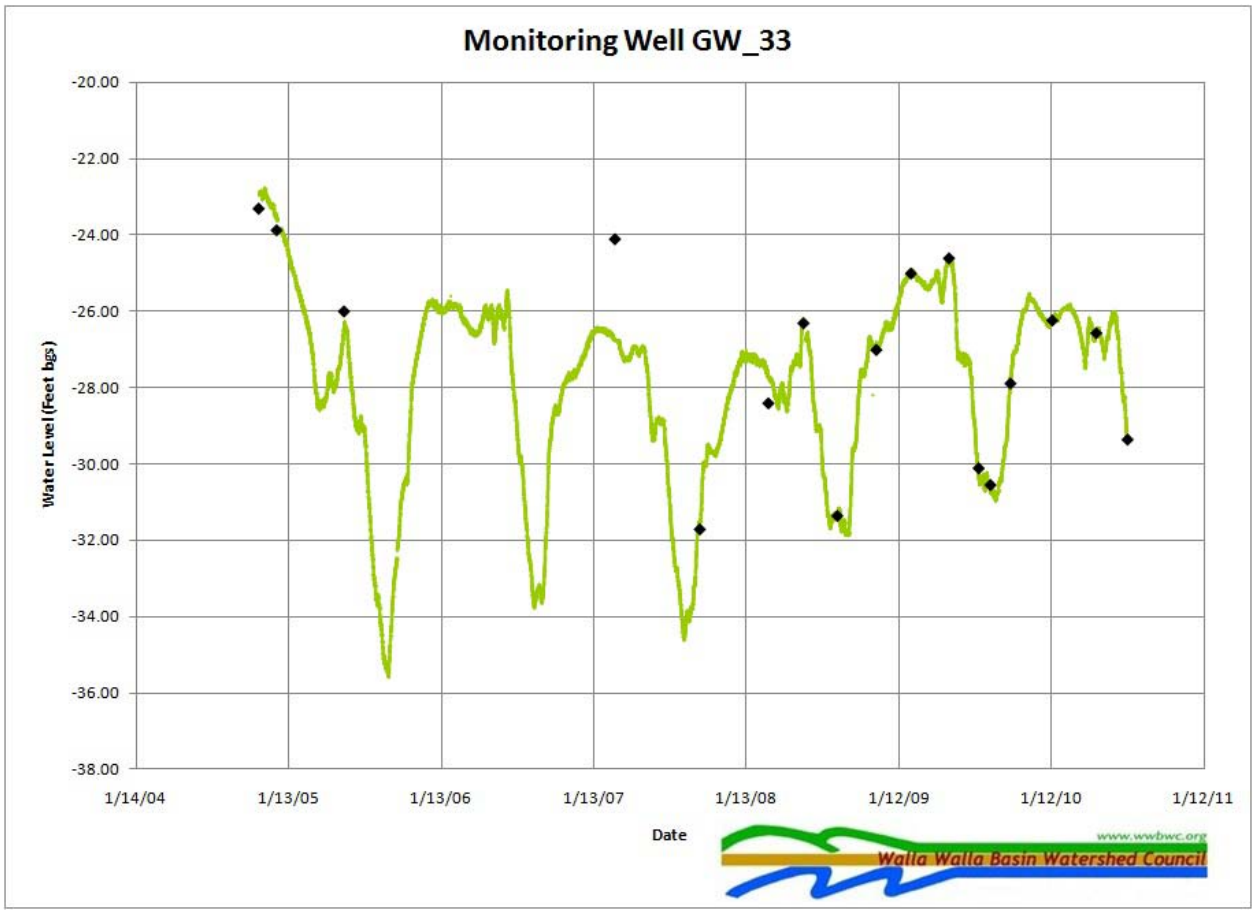
Monitoring Well GW_33
-20.00
-22.00
-24.00
-26.00
-28.00
-30.00
-32.00
-34.00
-36.00
-38.00
Water Level (Feet bgs)
1/14/04
1/13/05
1/13/06
1/13/07
1/13/08
1/12/09
1/12/10
1/12/11
Date
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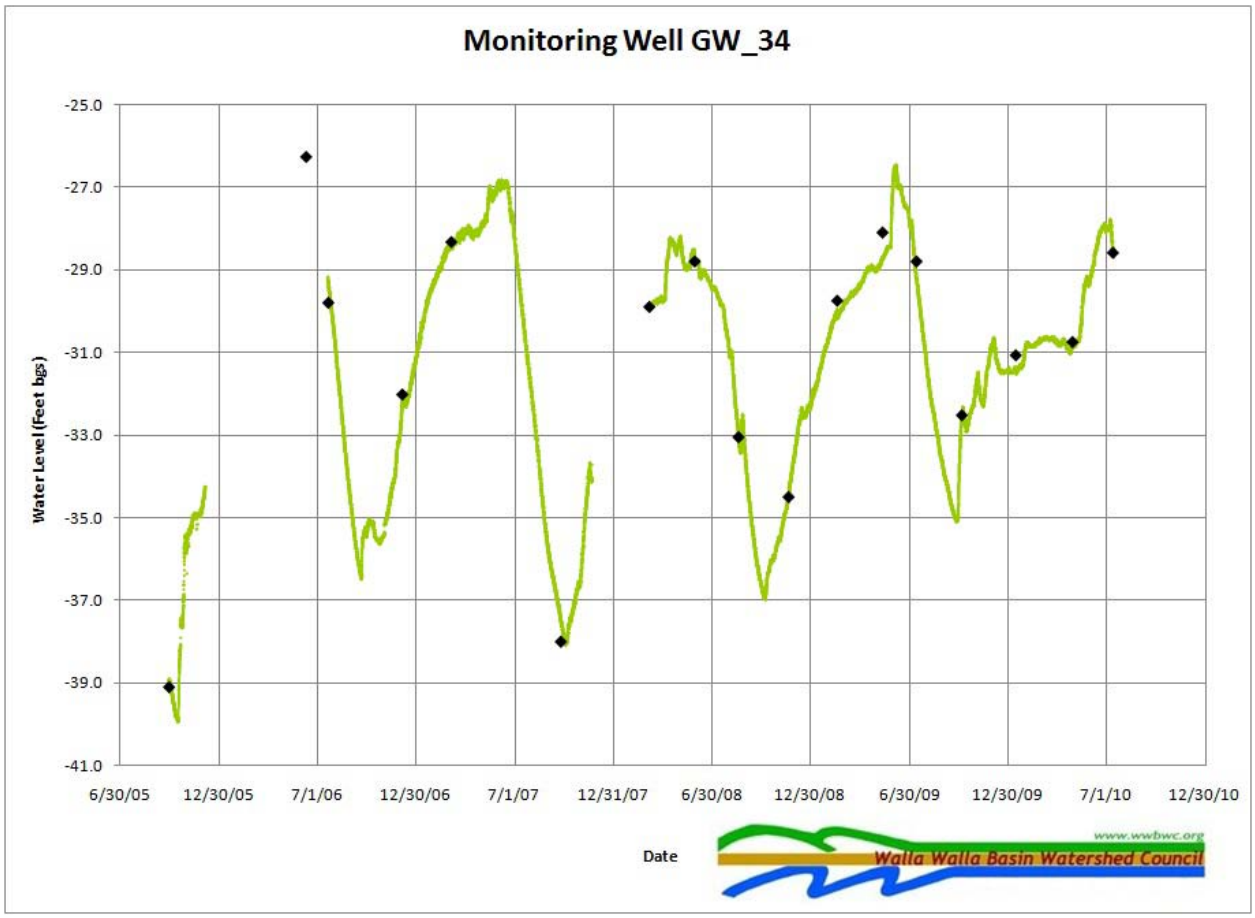
Monitoring Well GW_34
Water Level (Feet bgs)
-25.0
-27.0
-29.0
-31.0
-33.0
-35.0
-37.0
-39.0
-41.0
6/30/05
12/30/05
7/1/06
12/30/06
7/1/07
12/31/07
6/30/08
12/30/08
6/30/09
12/30/09
7/1/10
12/30/10
Date
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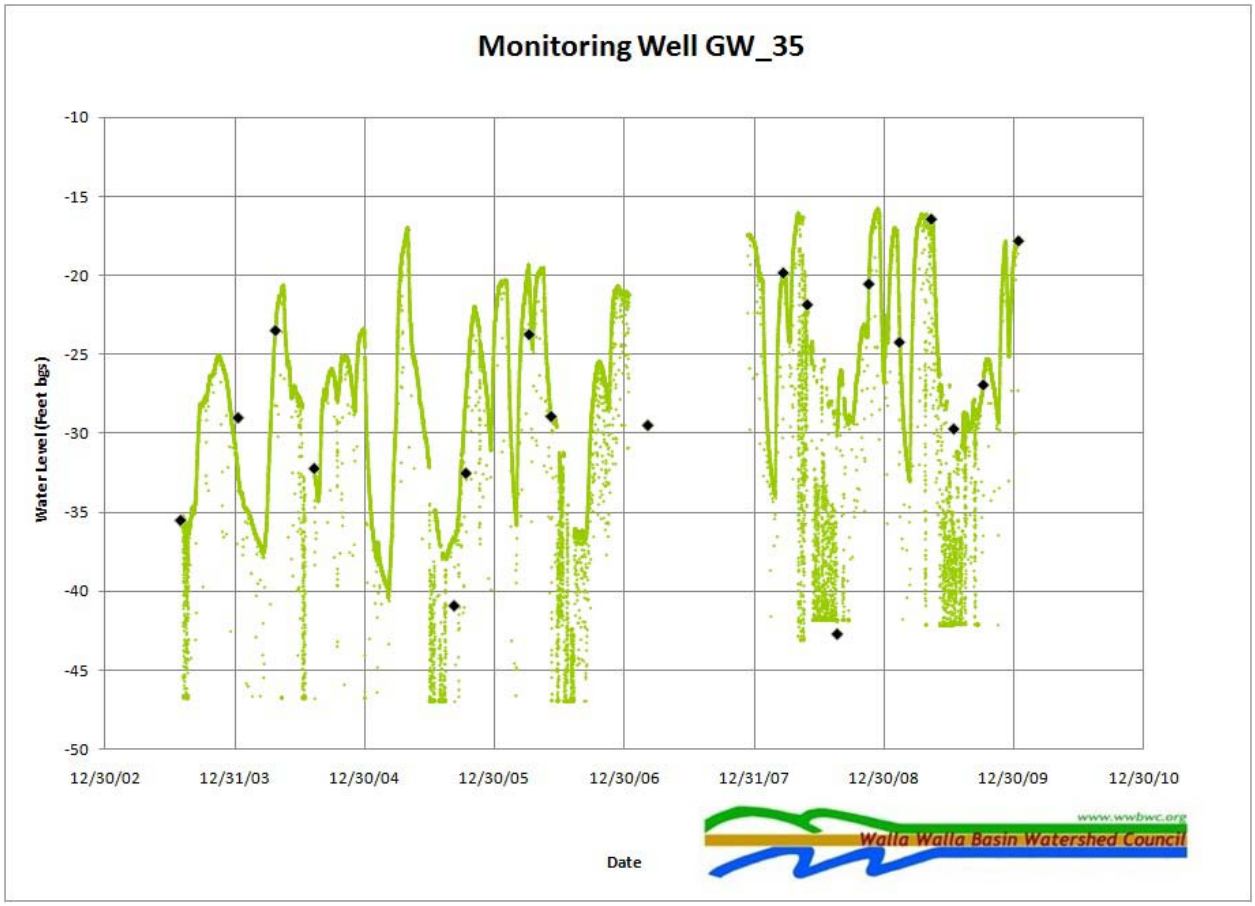
Monitoring Well GW_35
Water Level (Feet bgs)
-10
-15
-20
-25
-30
-35
-40
-45
-50
12/30/02
12/31/03
12/30/04
12/30/05
12/30/06
12/31/07
12/30/08
12/30/09
12/30/10
Date
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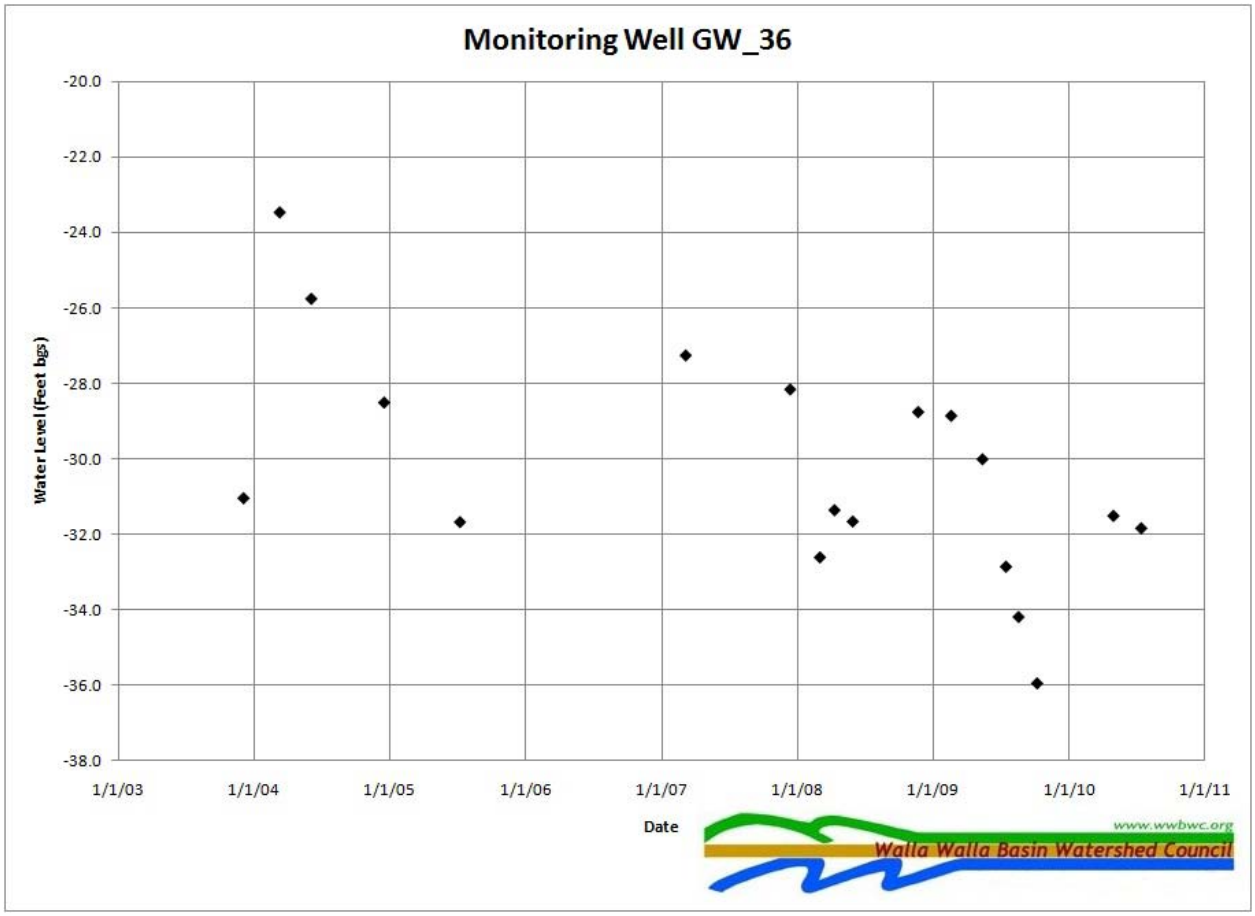
Monitoring Well GW_36
Water Lewel (Feet bgs)
-20.0
-22.0
-24.0
-26.0
-28.0
-30.0
-32.0
-34.0
-36.0
-38.0
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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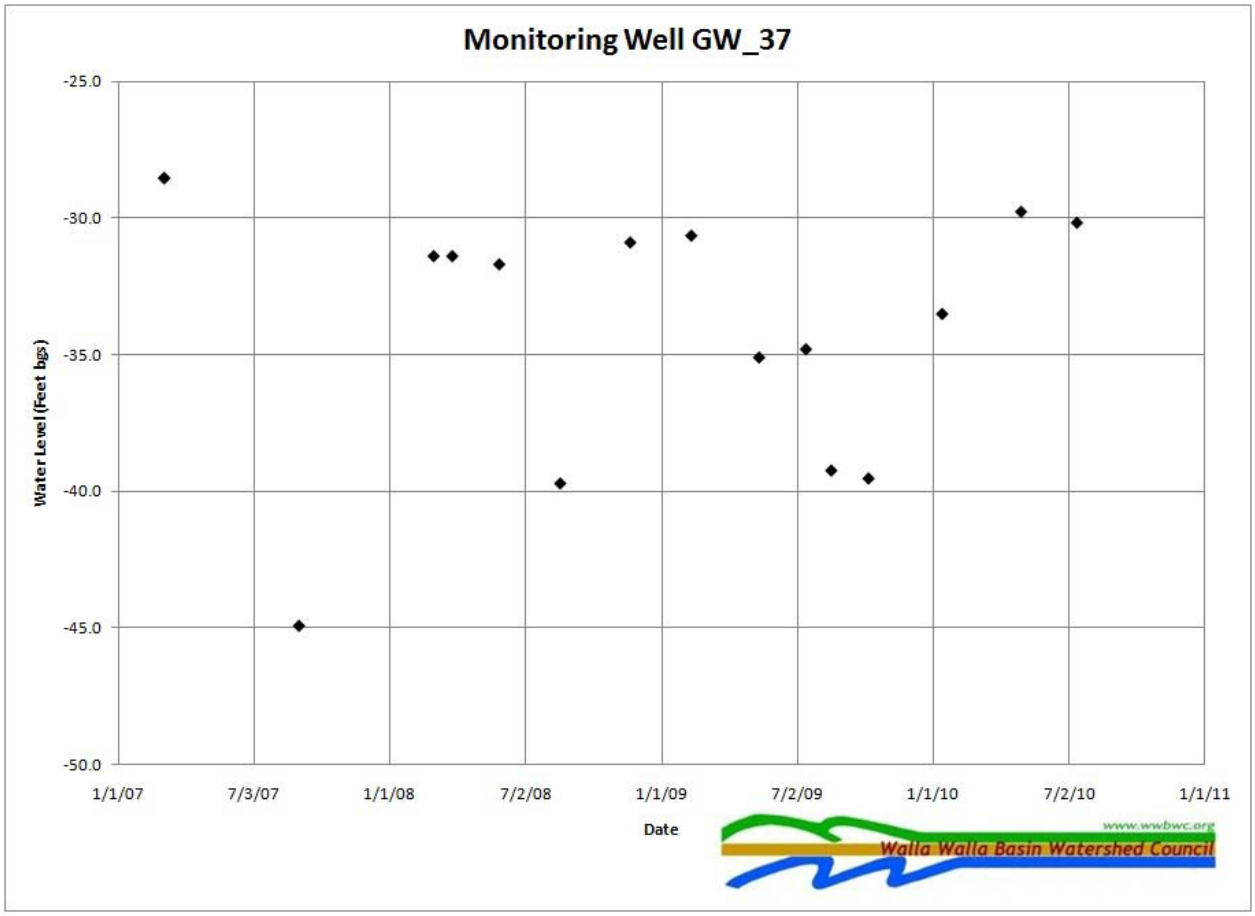
Monitoring Well GW_37
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
Water Level (Feet bgs)
1/1/07
7/3/07
1/1/08
7/2/08
1/1/09
7/2/09
1/1/10
7/2/10
1/1/11
Date
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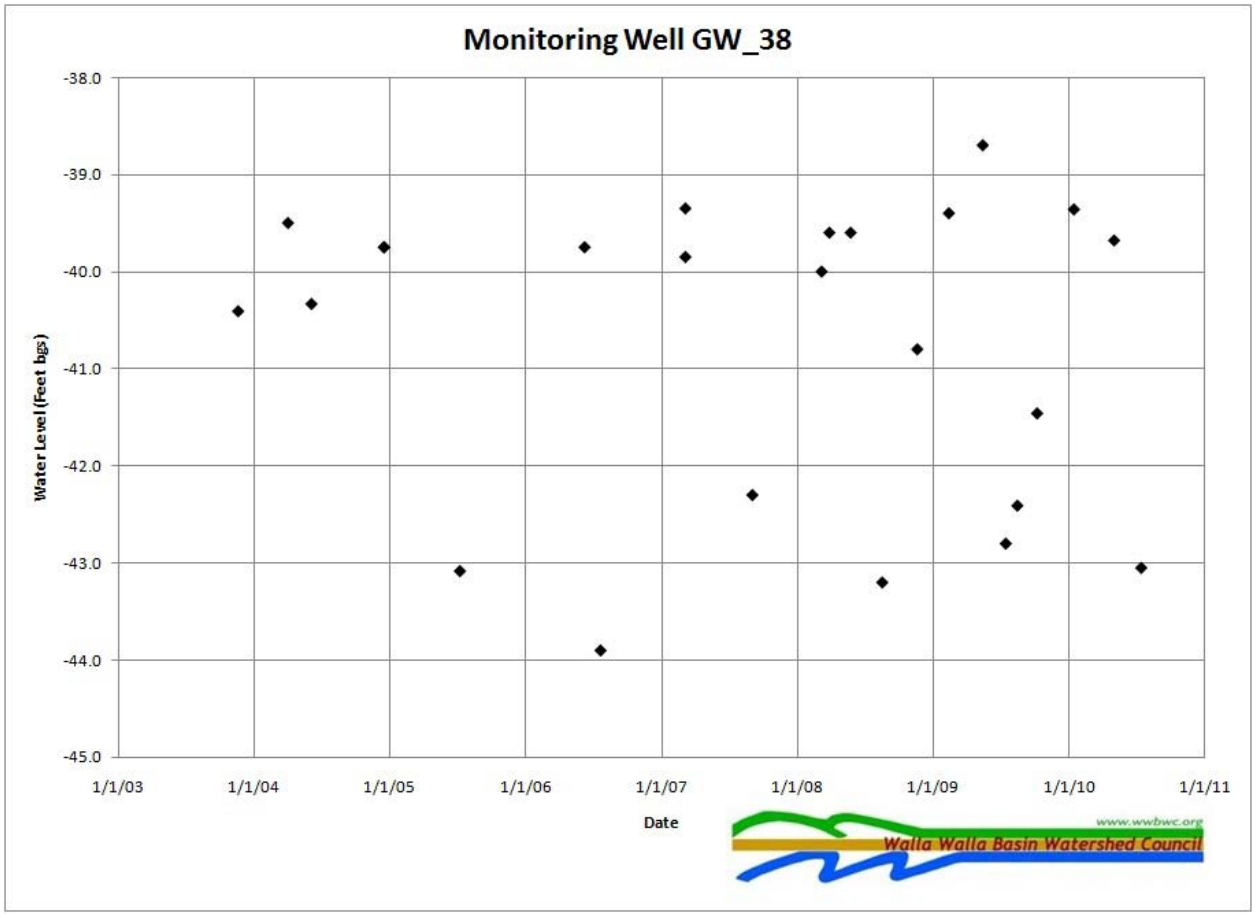
Monitoring Well GW_38
-38.0
-39.0
-40.0
-41.0
-42.0
-43.0
-44.0
-45.0
Water Level (Feet bgs)
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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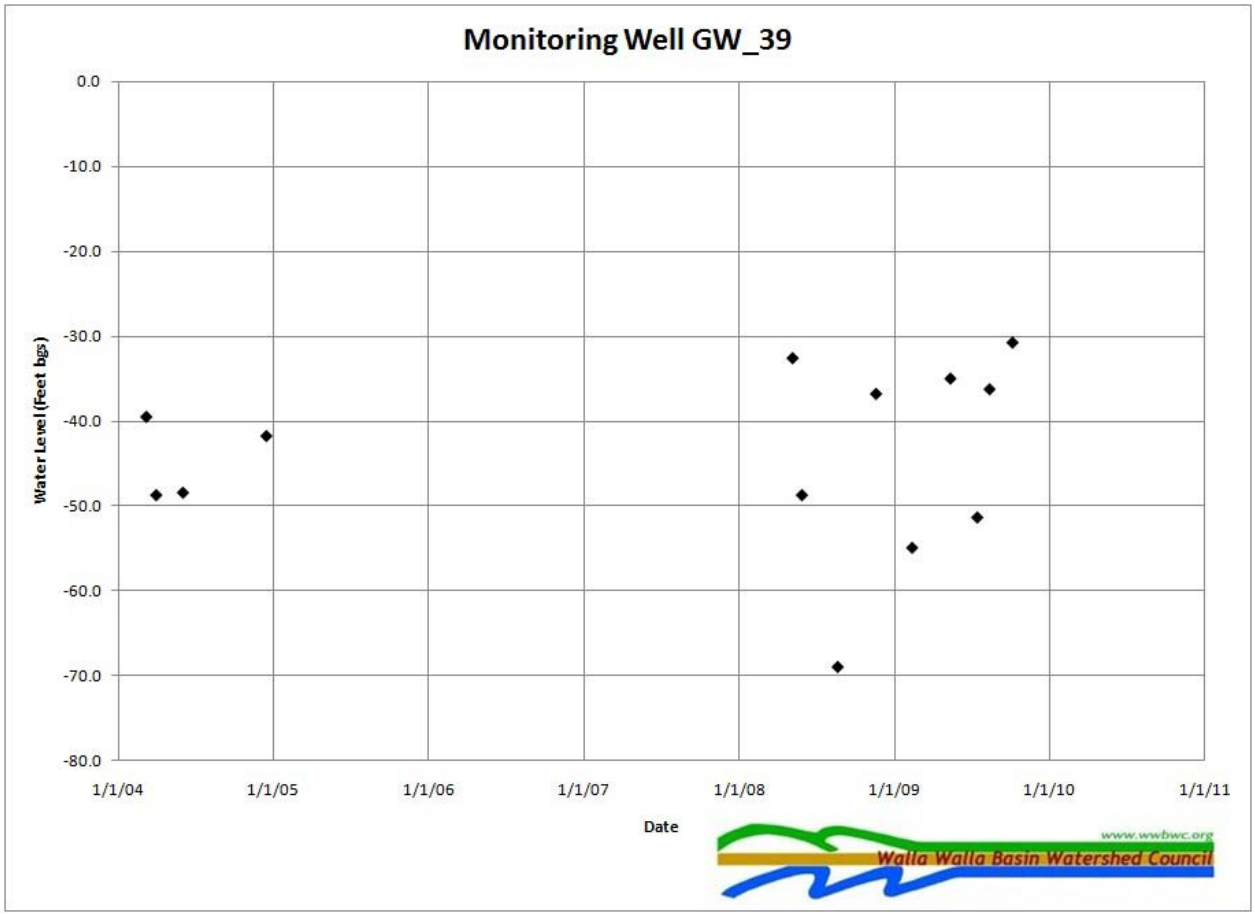
Monitoring Well GW_39
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Water Lewel (Feet bgs)
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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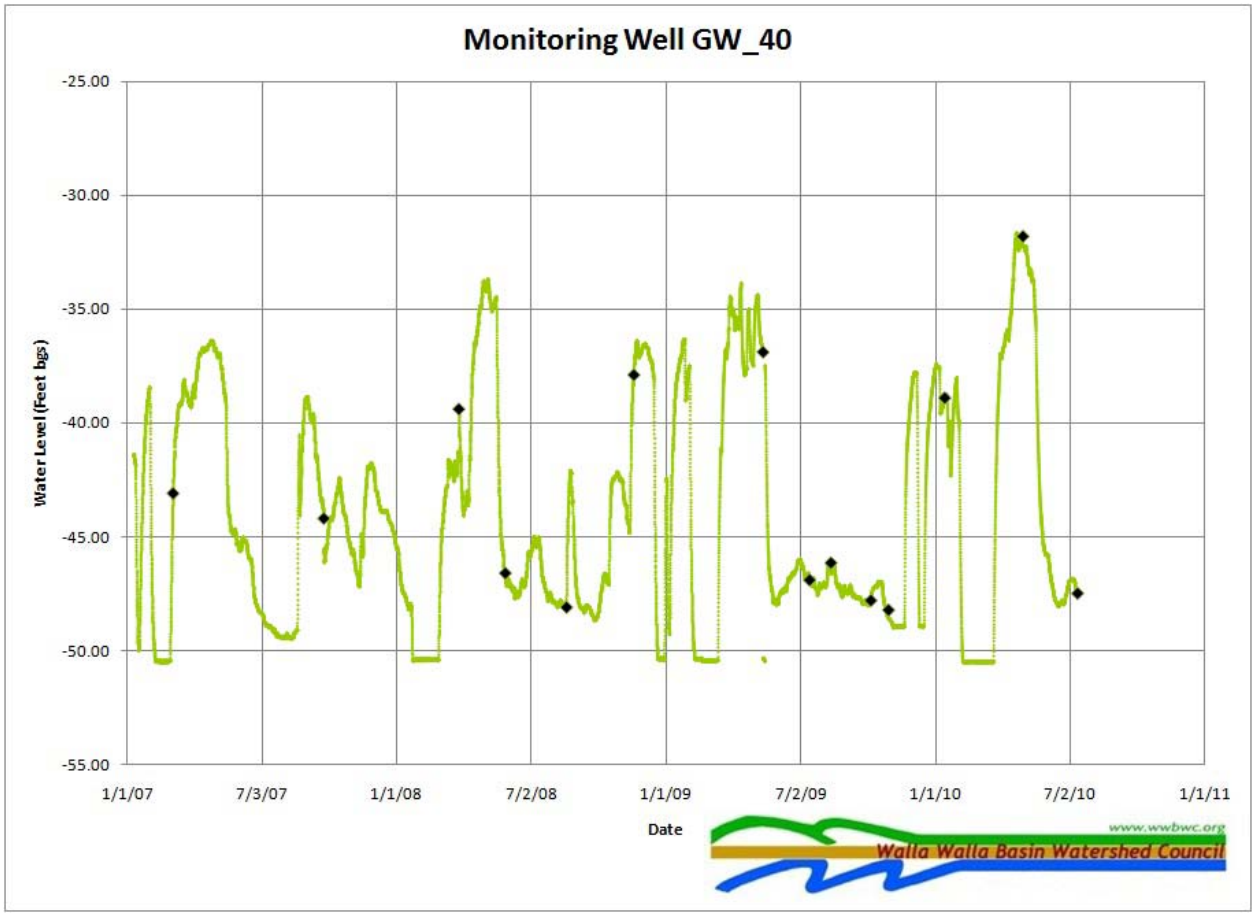
Monitoring Well GW_40
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
-55.00
Water Level (Feet bgs)
1/1/07
7/3/07
1/1/08
7/2/08
1/1/09
7/2/09
1/1/10
7/2/10
1/1/11
Date
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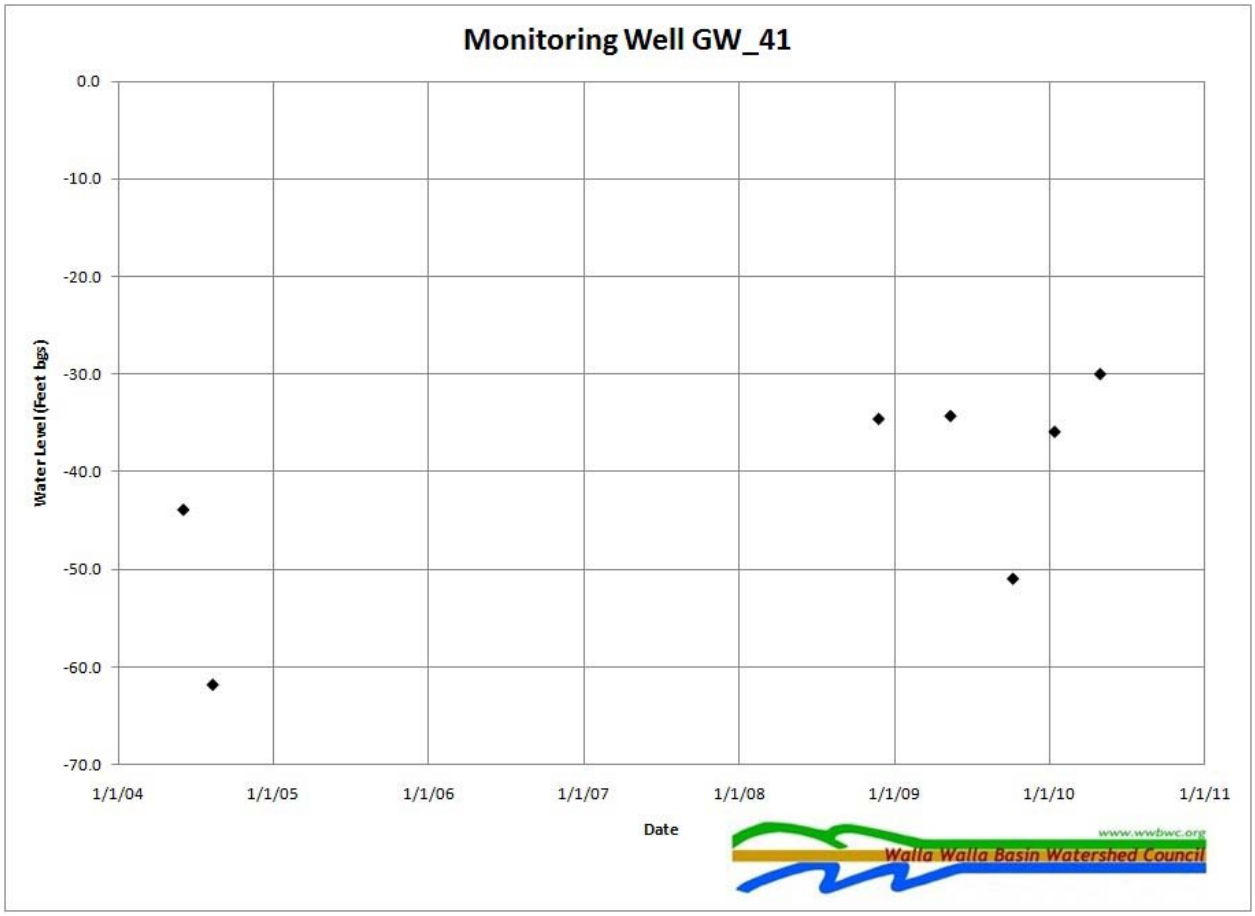
Monitoring Well GW_41
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Water Level (Feet bgs)
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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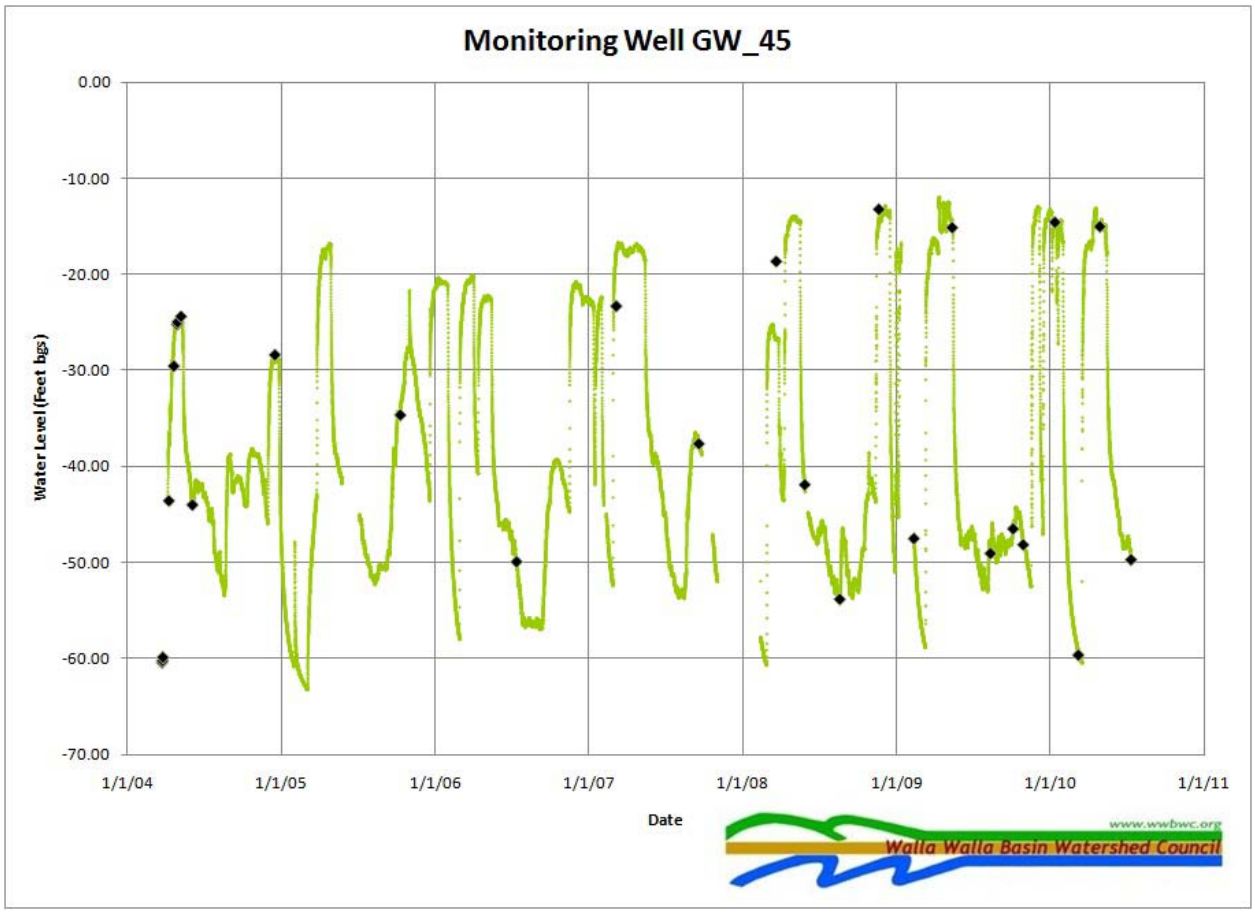
Monitoring Well GW_45
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
Water Level (Feet bgs)
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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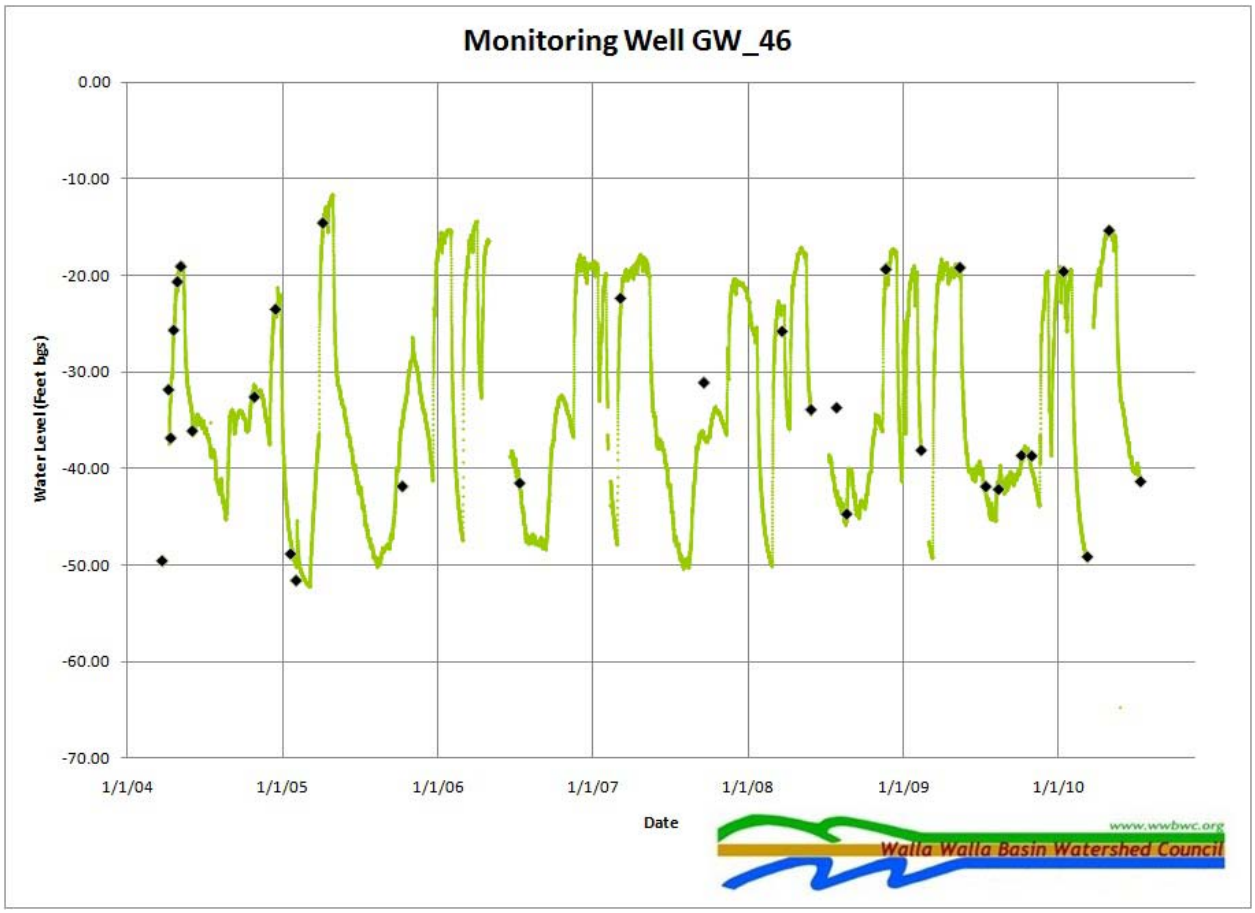
Monitoring Well GW_46
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
Water Level (feet bgs)
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
Date
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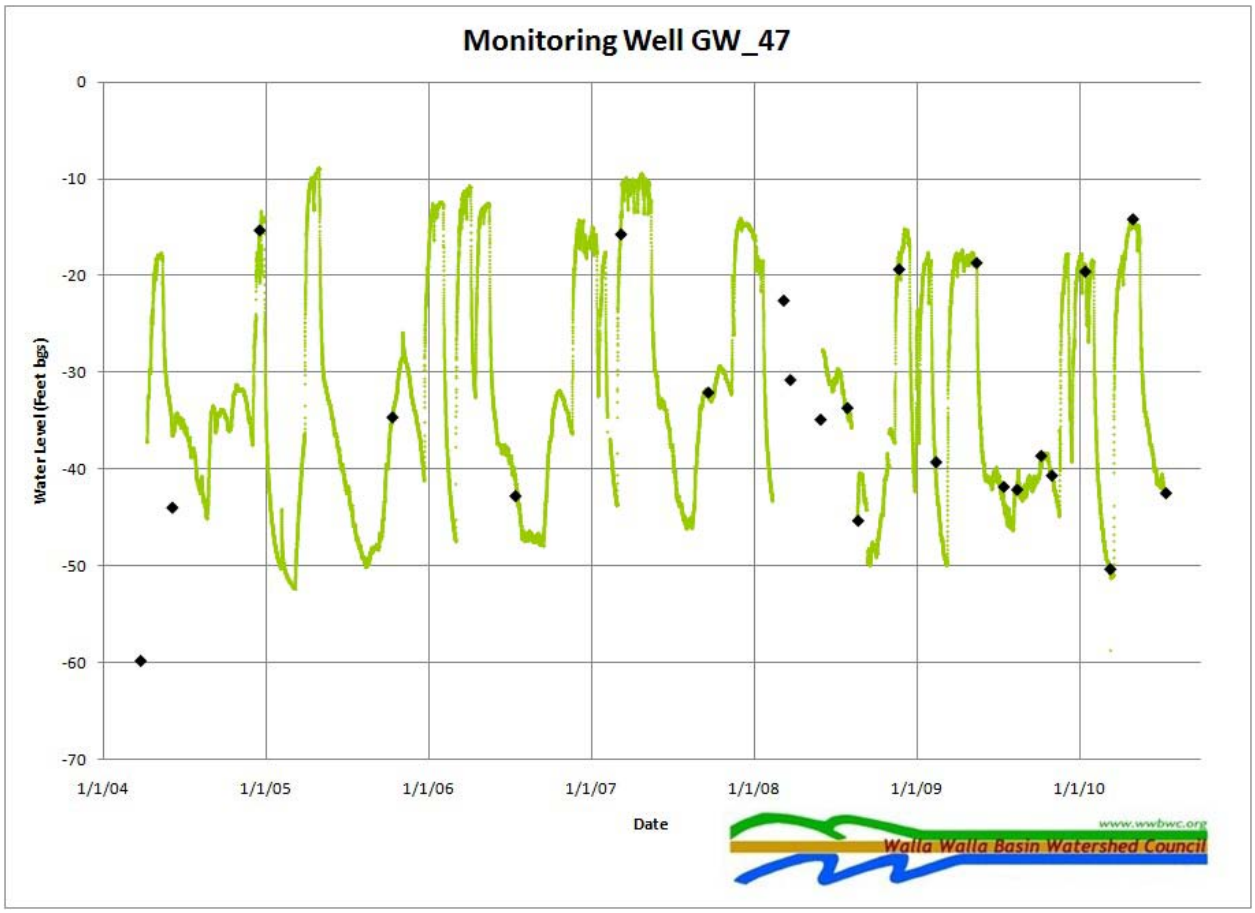
Monitoring Well GW_47
Water Level (Feet bgs)
0
-10
-20
-30
-40
-50
-60
-70
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
Date
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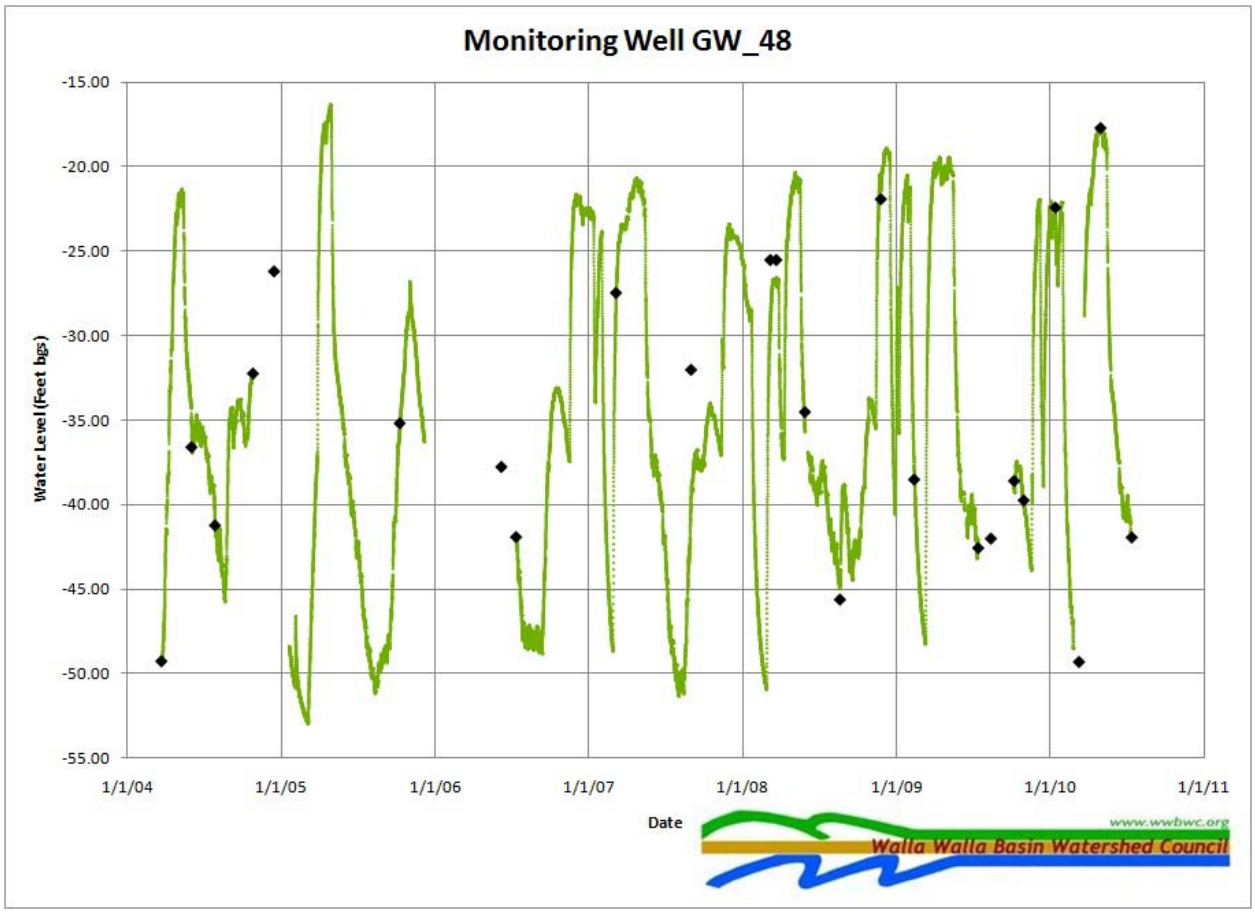
Monitoring Well GW_48
Water Level (feet bgs)
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
-55.00
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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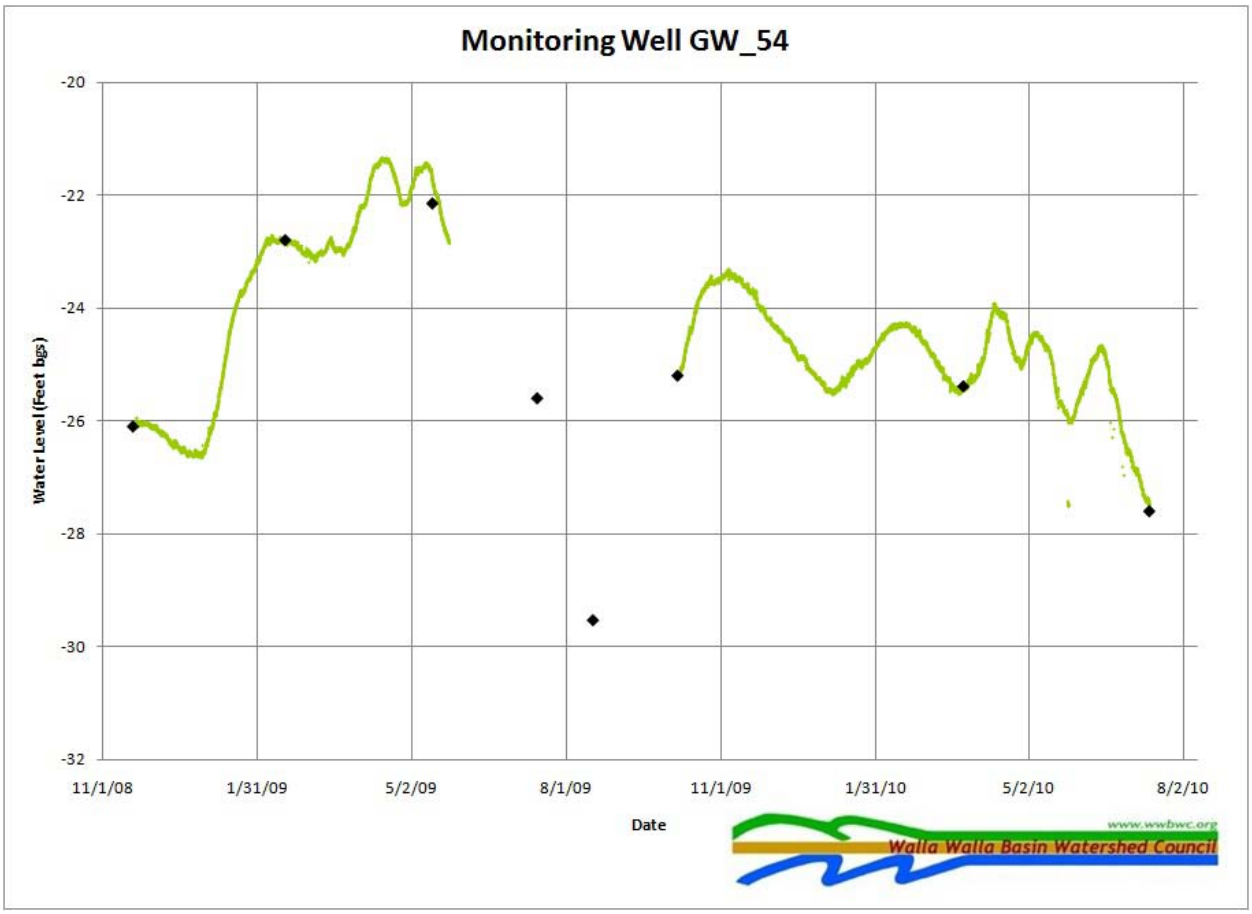
Monitoring Well GW_54
-20
-22
-24
-26
-28
-30
-32
Water Level (Feet bgs)
11/1/08
1/31/09
5/2/09
8/1/09
11/1/09
1/31/10
5/2/10
8/2/10
Date
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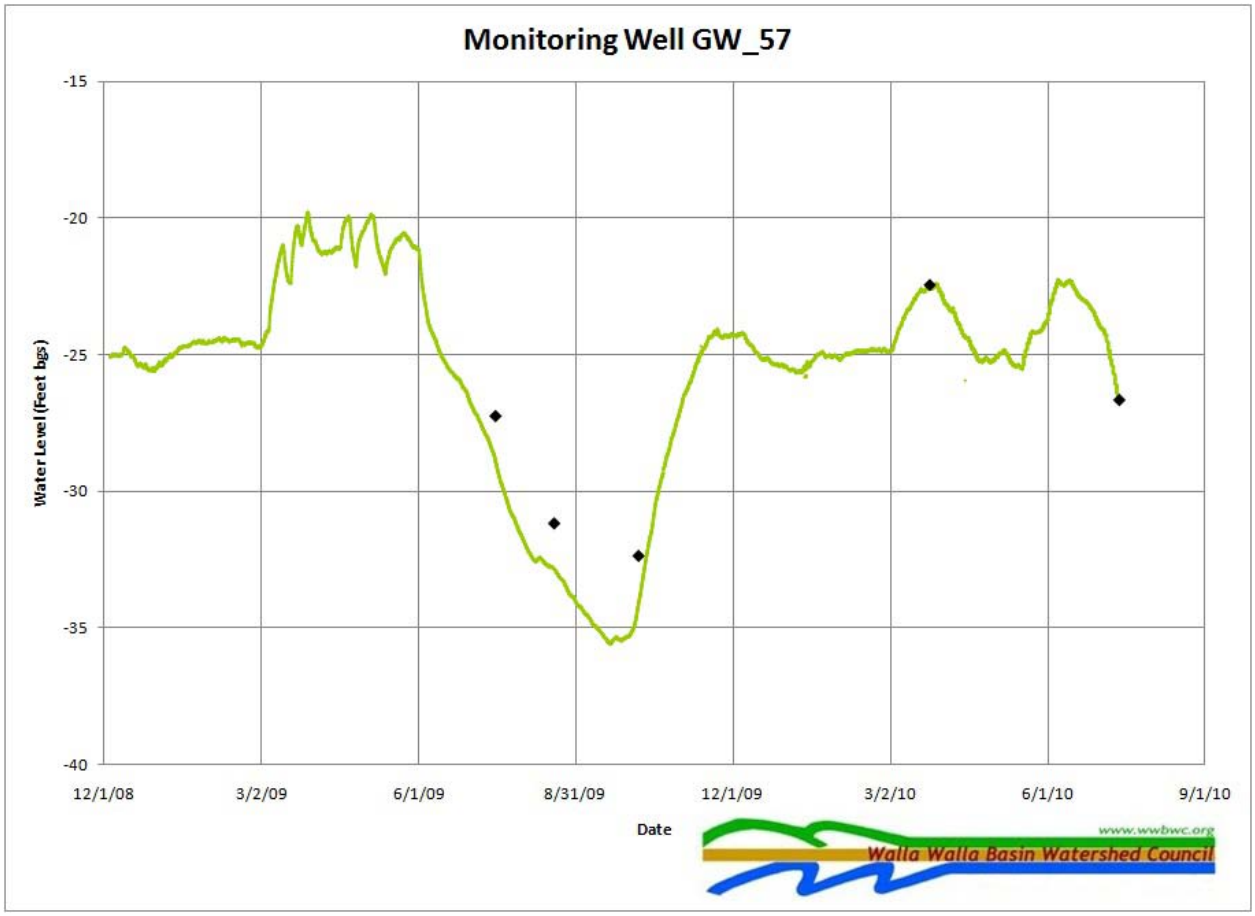
Monitoring Well GW_57
-15
-20
-25
-30
-35
-40
Water Level (Feet bgs)
12/1/08
3/2/09
6/1/09
8/31/09
12/1/09
3/2/10
6/1/10
9/1/10
Date
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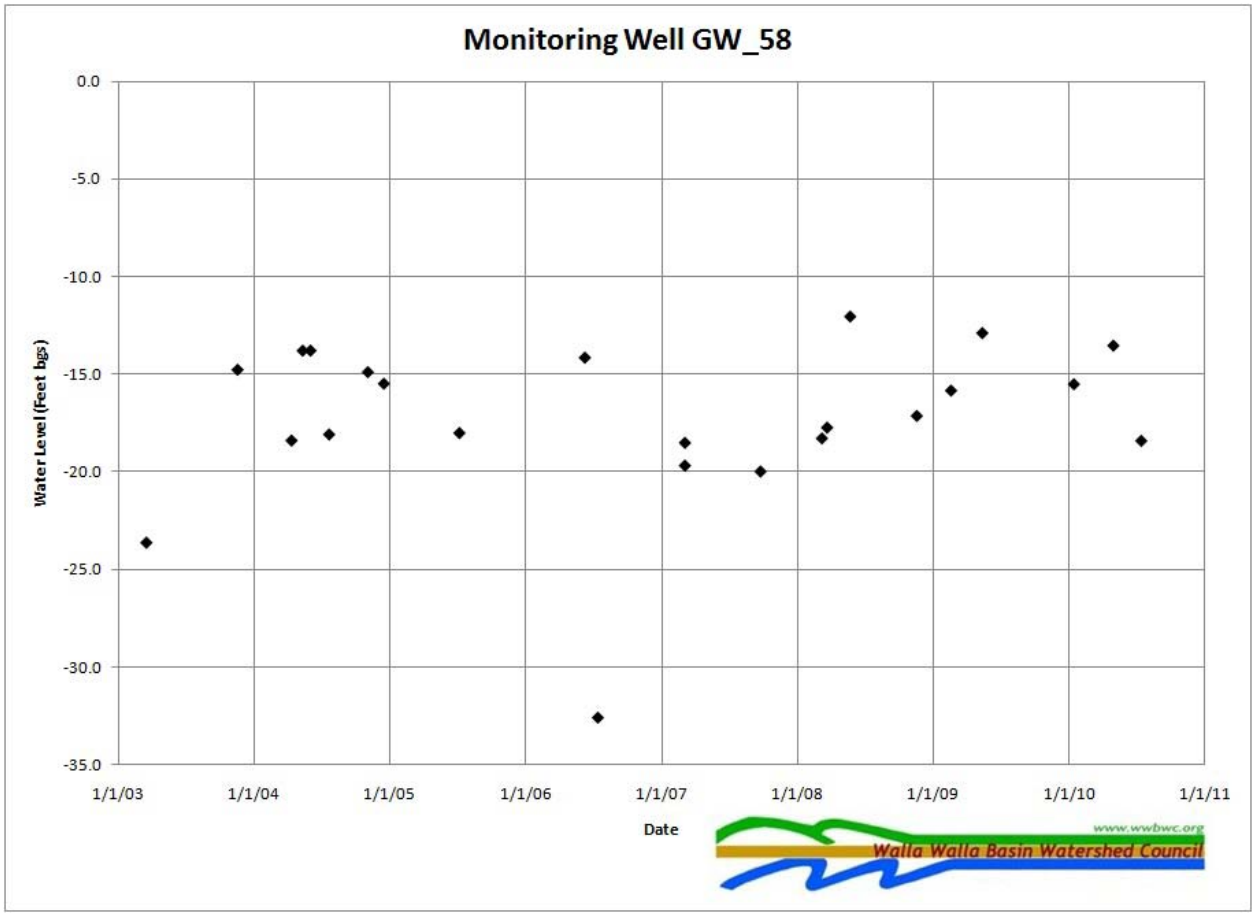
Monitoring Well GW_58
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
Water Level (Feet bgs)
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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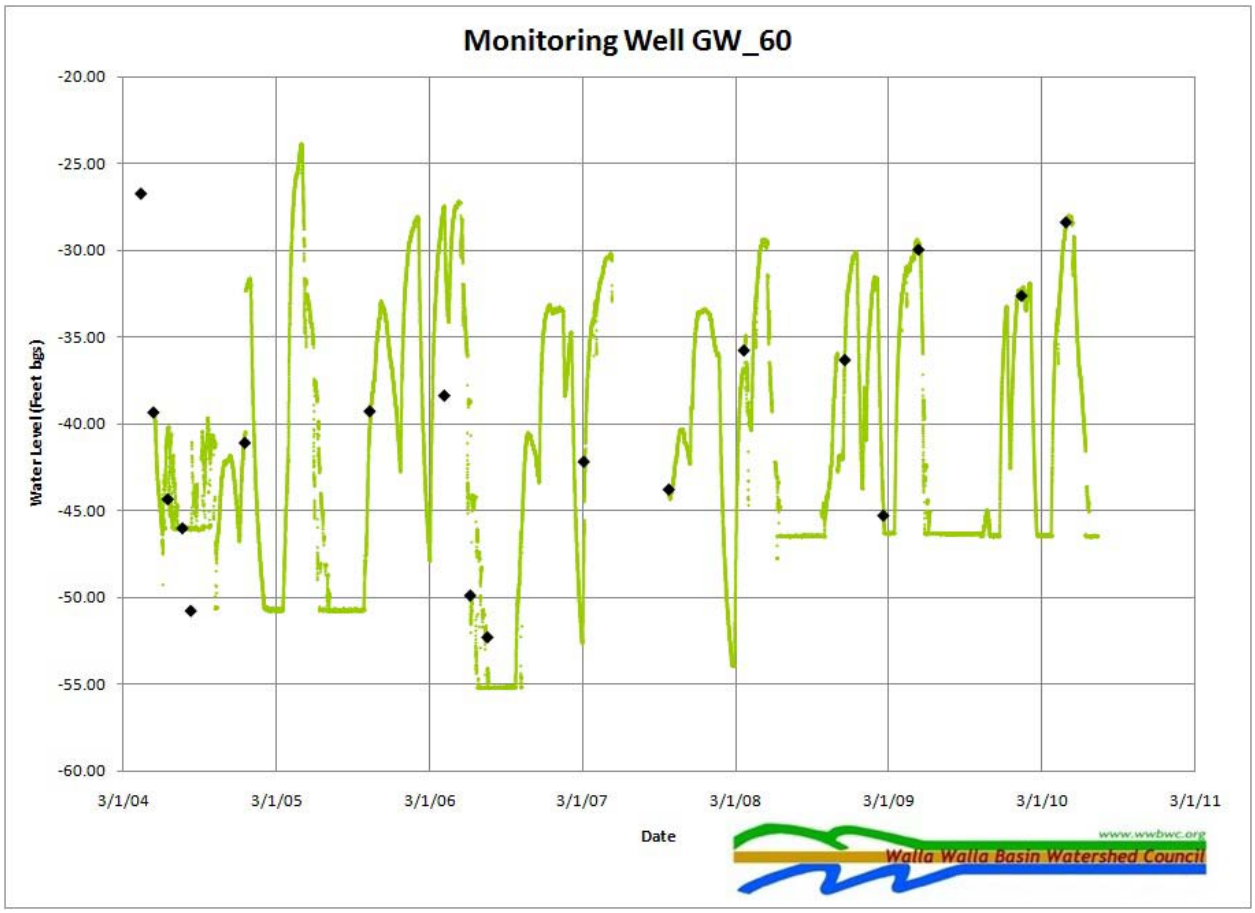
Monitoring Well GW_60
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
-55.00
-60.00
Water Level (Feet bgs)
3/1/04
3/1/05
3/1/06
3/1/07
3/1/08
3/1/09
3/1/10
3/1/11
Date
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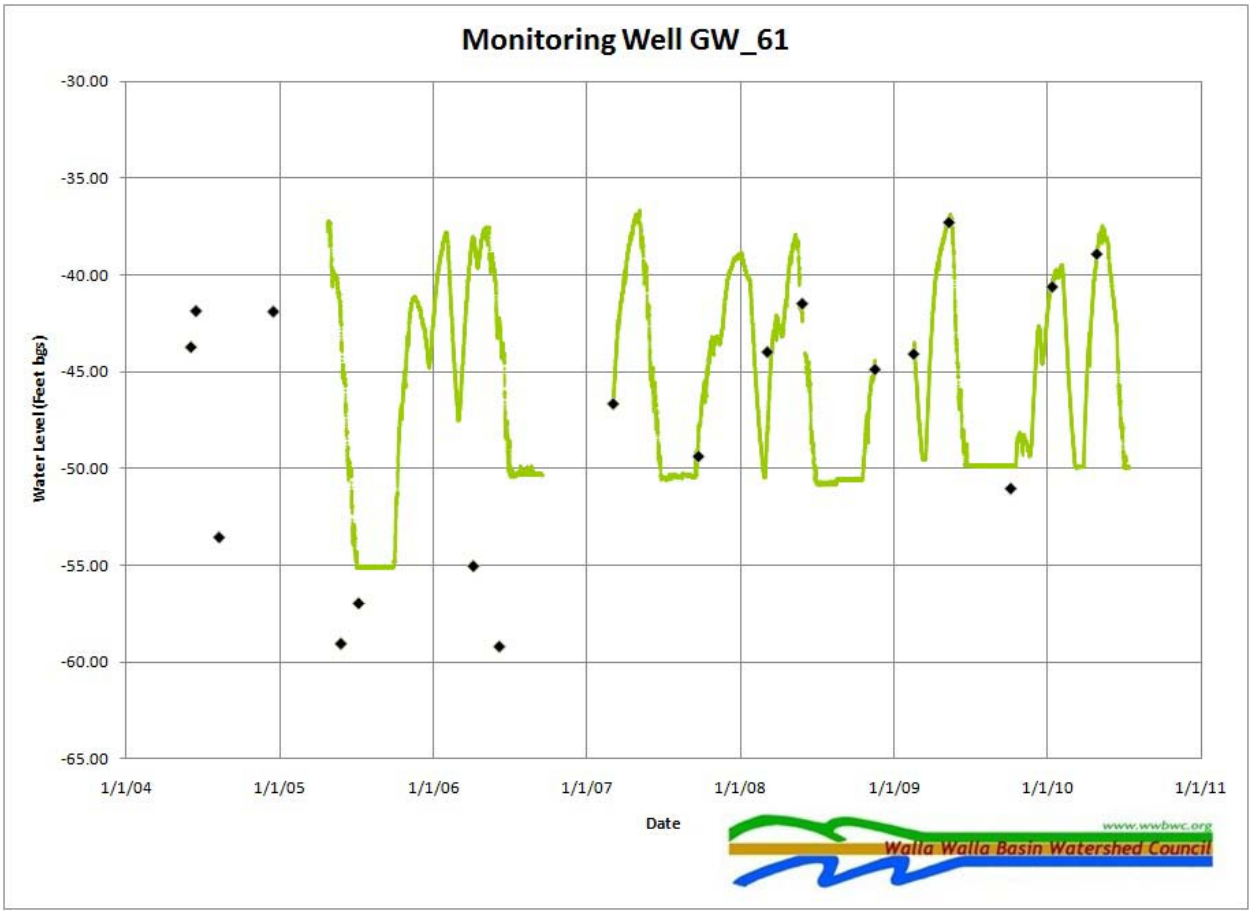
Monitoring Well GW_61
-30.00
-35.00
-40.00
-45.00
-50.00
-55.00
-60.00
-65.00
Water Level (Feet bgs)
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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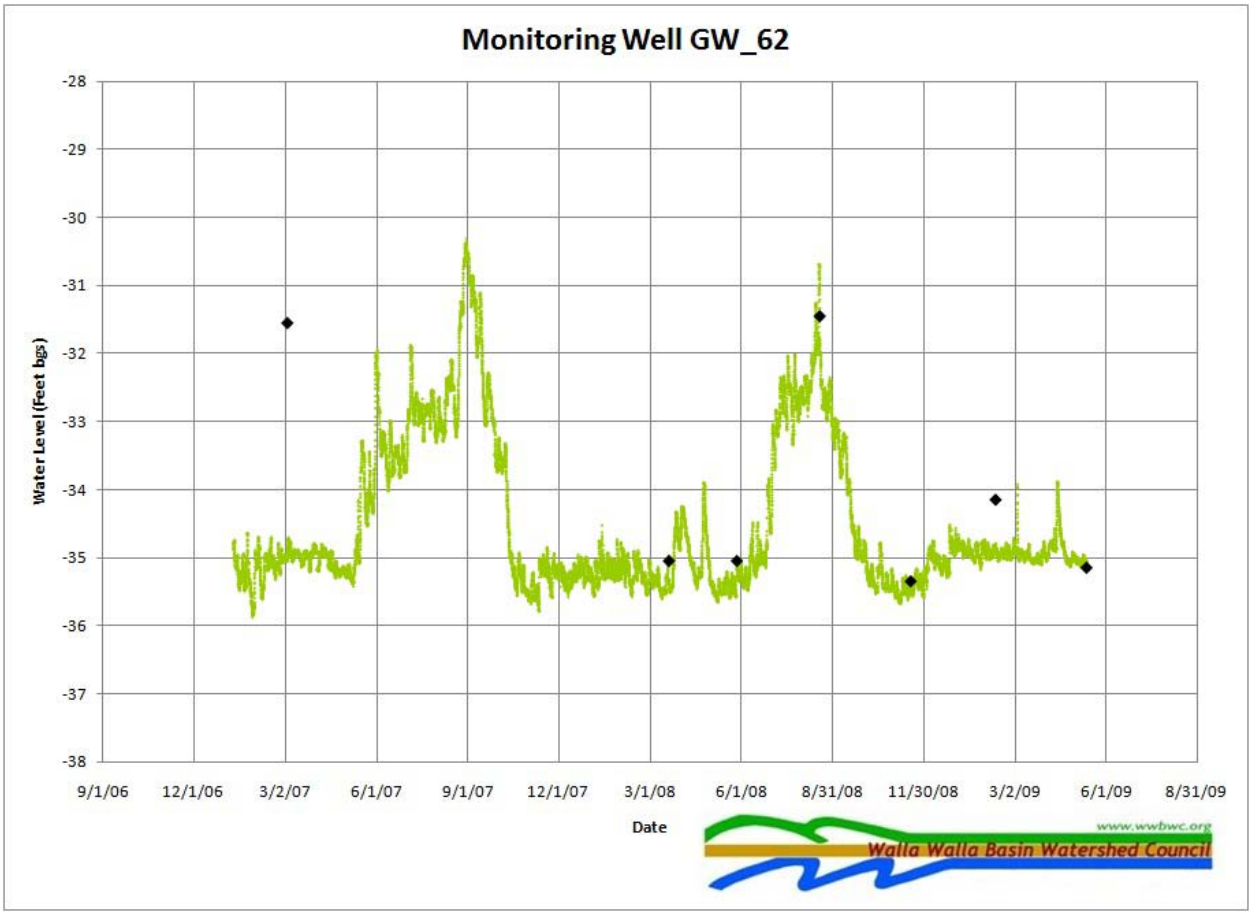
Monitoring Well GW_62
Water Level (Feet bgs)
-28
-29
-30
-31
-32
-33
-34
-35
-36
-37
-38
9/1/06
12/1/06
3/2/07
6/1/07
9/1/07
12/1/07
3/1/08
6/1/08
8/31/08
11/30/08
3/2/09
6/1/09
8/31/09
Date
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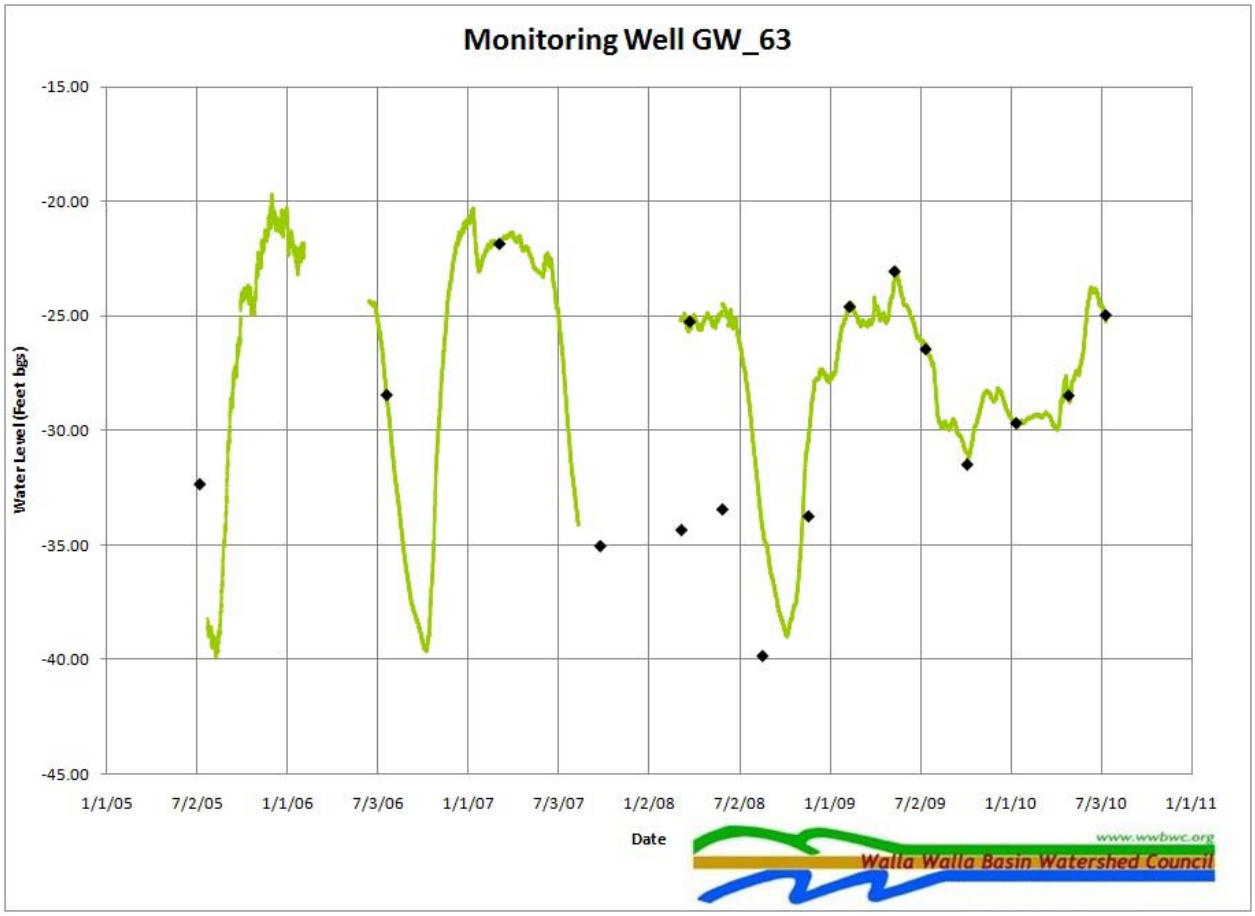
Monitoring Well GW_63
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
Water Level (feet bgs)
1/1/05
7/2/05
1/1/06
7/3/06
1/1/07
7/3/07
1/2/08
7/2/08
1/1/09
7/2/09
1/1/10
7/3/10
1/1/11
Date
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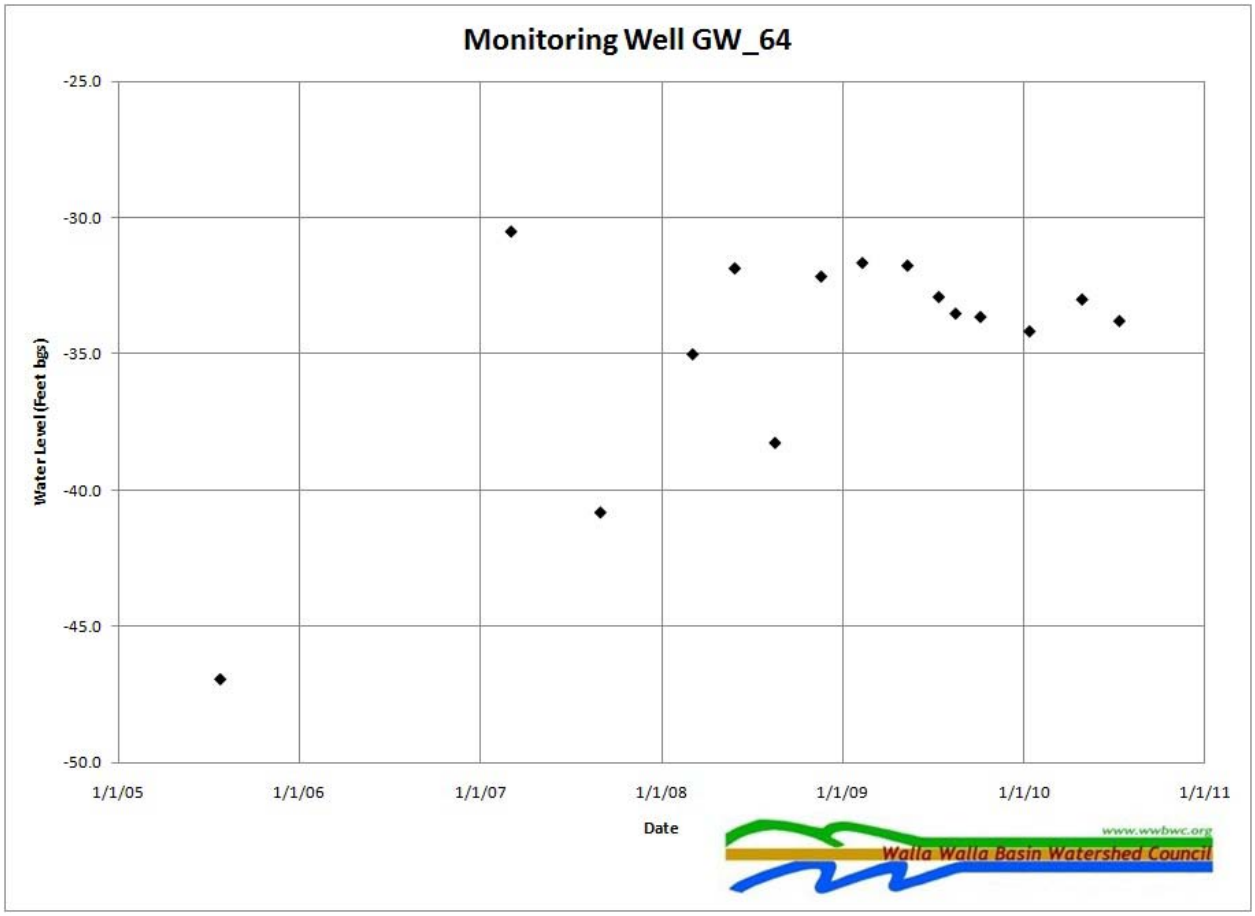
Monitoring Well GW_64
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
Water Level (Feet bgs)
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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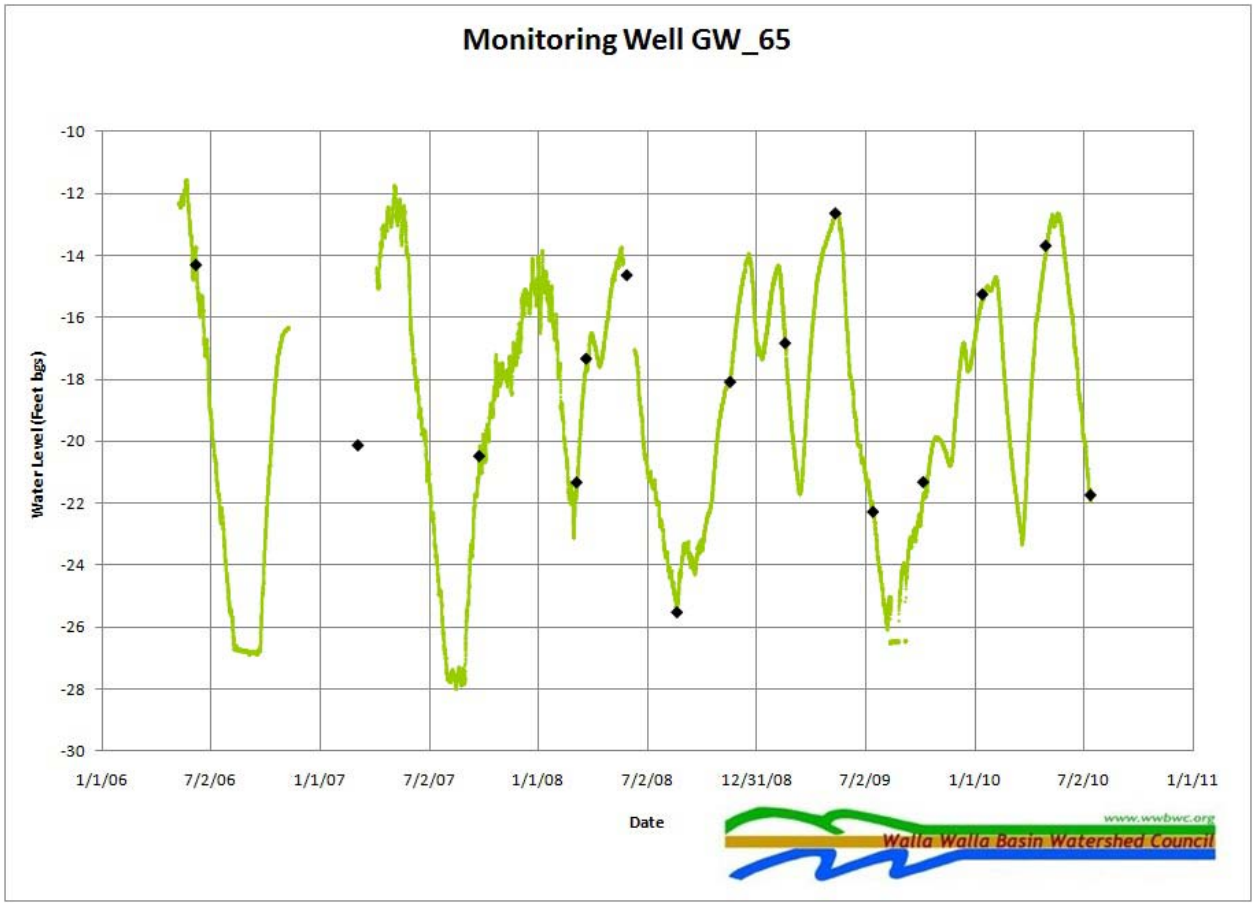
Monitoring Well GW_65
Water Level (Feet bgs)
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
1/1/06
7/2/06
1/1/07
7/2/07
1/1/08
7/2/08
12/31/08
7/2/09
1/1/10
7/2/10
1/1/11
Date
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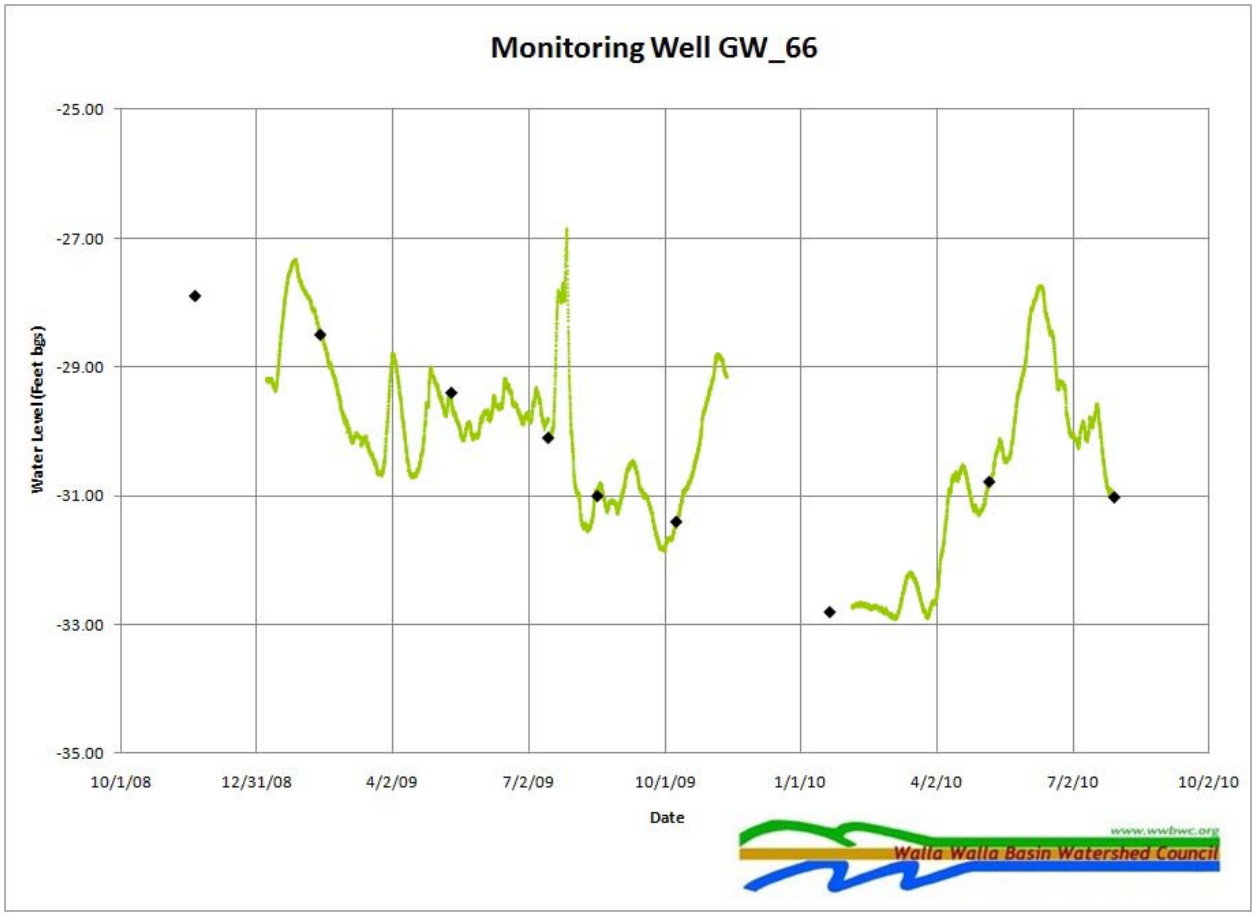
Monitoring Well GW_66
-25.00
-27.00
-29.00
-31.00
-33.00
-35.00
Water Level (Feet bgs)
10/1/08
12/31/08
4/2/09
7/2/09
10/1/09
1/1/10
4/2/10
7/2/10
10/2/10
Date
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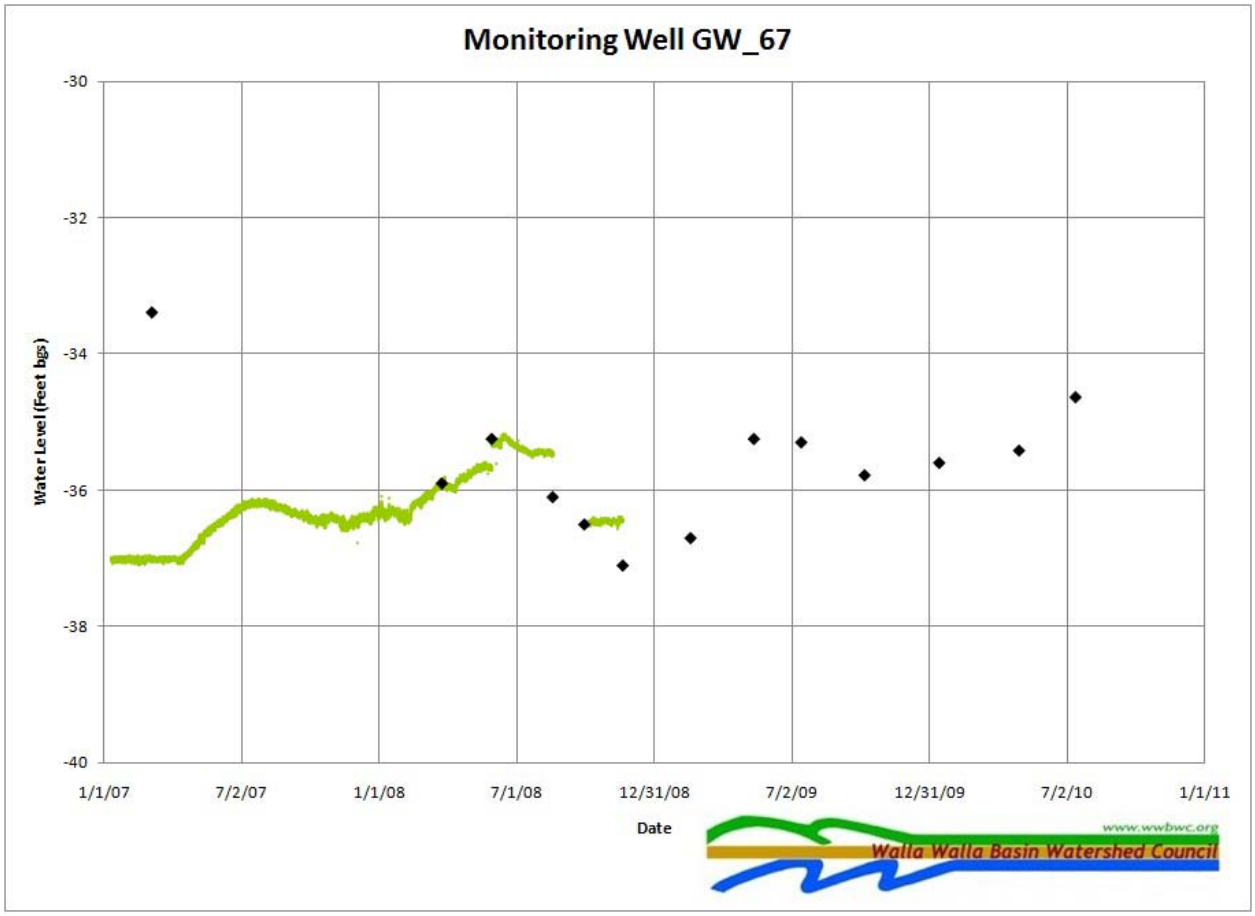
Monitoring Well GW_67
Water Level (Feet bgs)
-30
-32
-34
-36
-38
-40
1/1/07
7/2/07
1/1/08
7/1/08
12/31/08
7/2/09
12/31/09
7/2/10
1/1/11
Date
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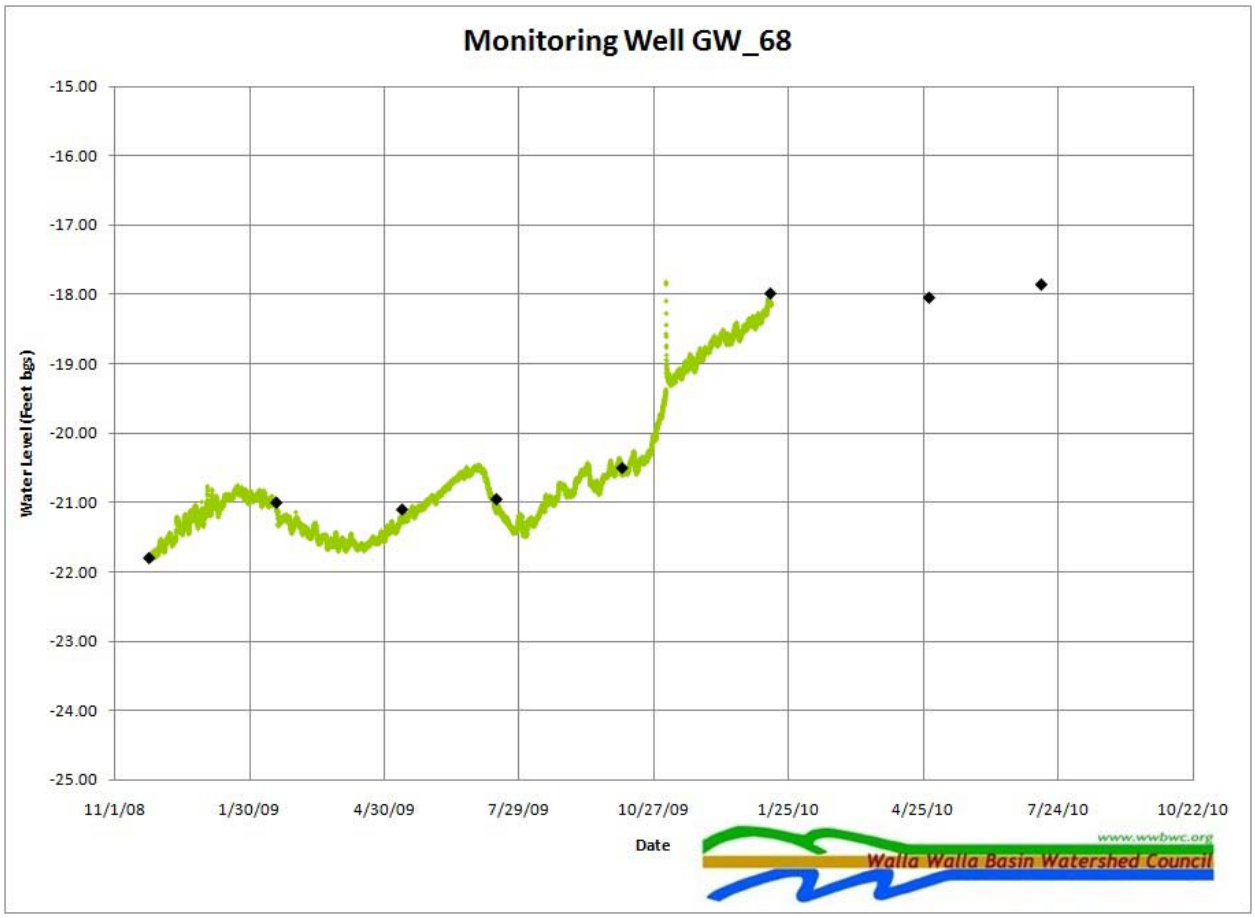
Monitoring Well GW_68
Water Level (Feet bgs)
-15.00
-16.00
-17.00
-18.00
-19.00
-20.00
-21.00
-22.00
-23.00
-24.00
-25.00
11/1/08
1/30/09
4/30/09
7/29/09
10/27/09
1/25/10
4/25/10
7/24/10
10/22/10
Date
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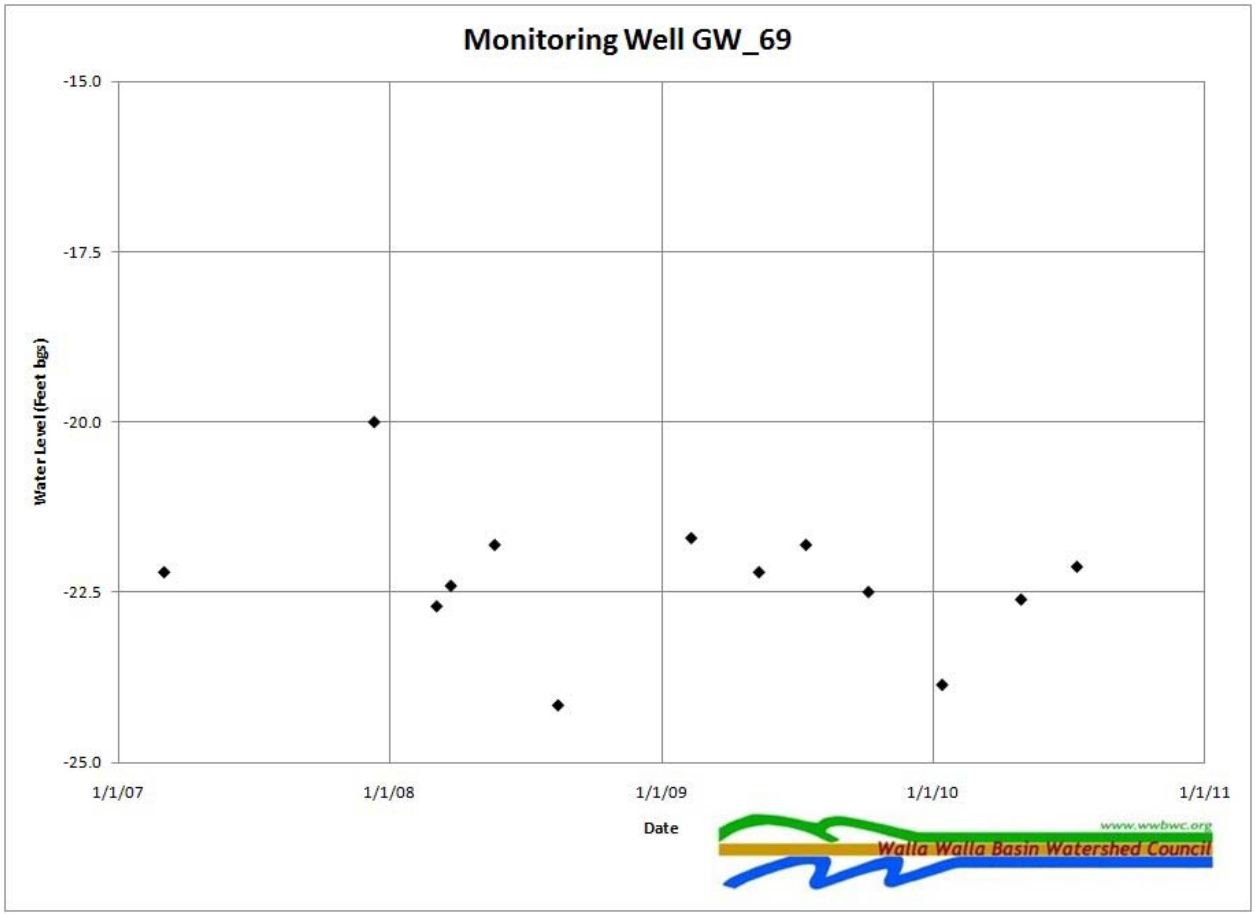
Monitoring Well GW_69
-15.0
-17.5
-20.0
-22.5
-25.0
Water Level (Feet bgs)
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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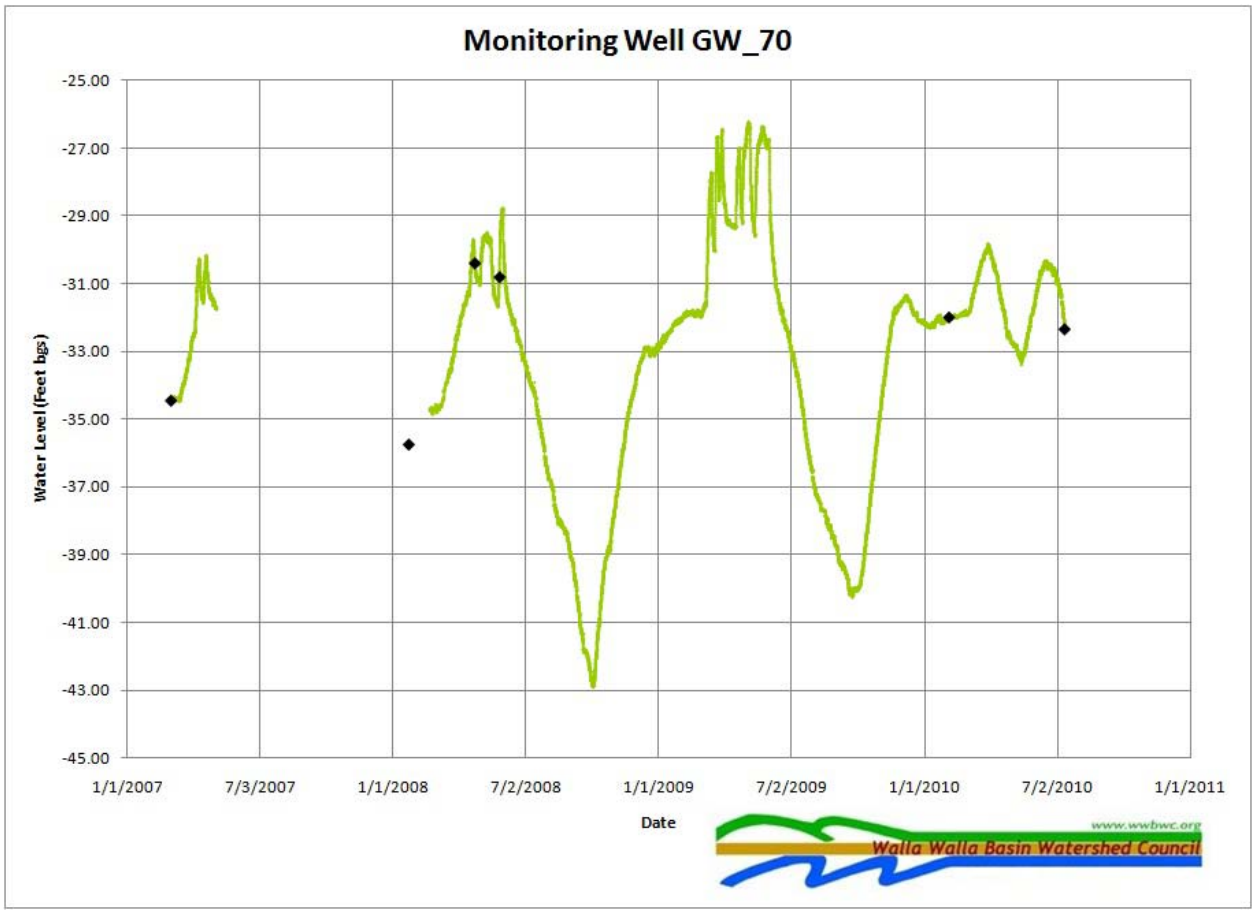
Monitoring Well GW_70
-25.00
-27.00
-29.00
-31.00
-33.00
-35.00
-37.00
-39.00
-41.00
-43.00
-45.00
Water Level (Feet bgs)
1/1/2007
7/3/2007
1/1/2008
7/2/2008
1/1/2009
7/2/2009
1/1/2010
7/2/2010
1/1/2011
Date
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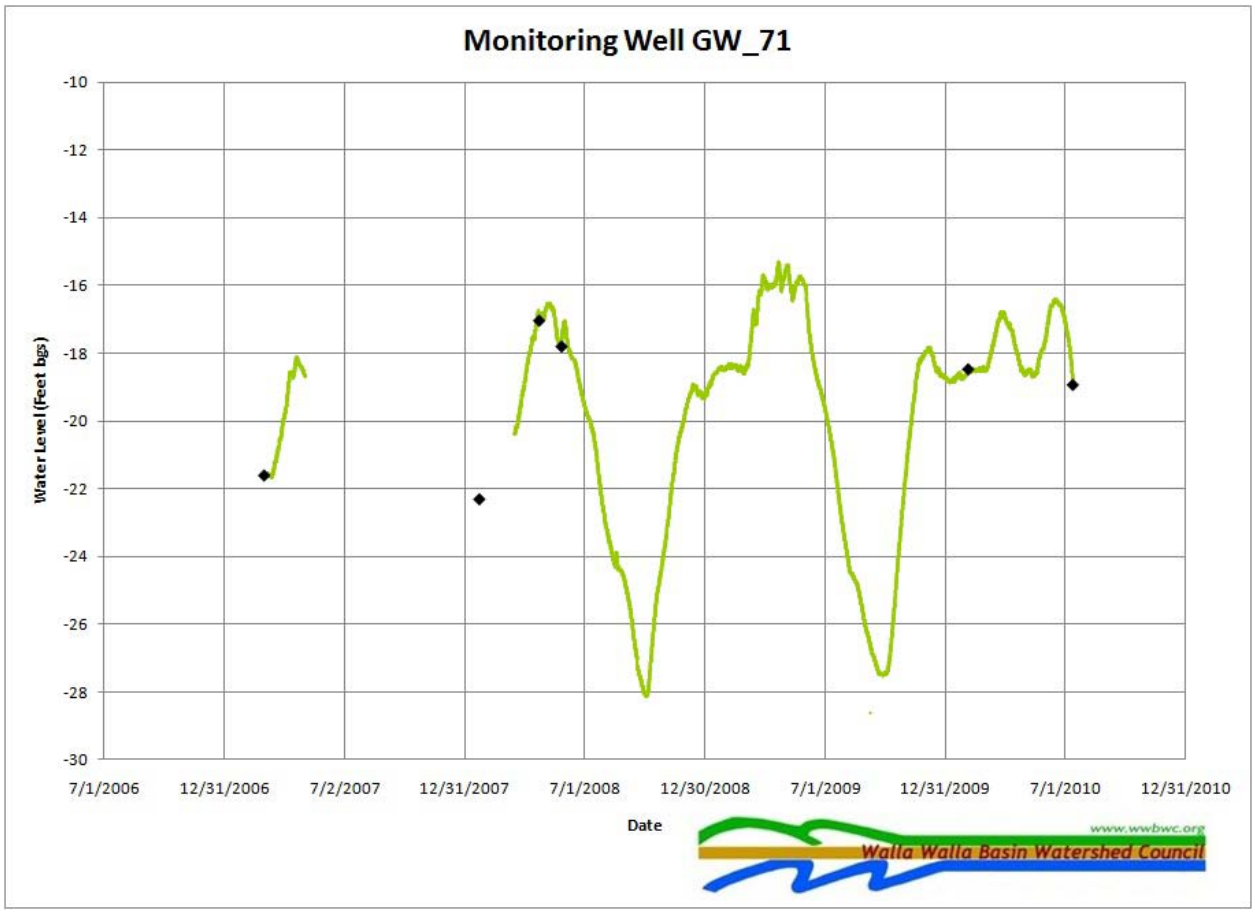
Monitoring Well GW_71
Water Level (Feet bgs)
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
7/1/2006
12/31/2006
7/2/2007
12/31/2007
7/1/2008
12/30/2008
7/1/2009
12/31/2009
7/1/2010
12/31/2010
Date
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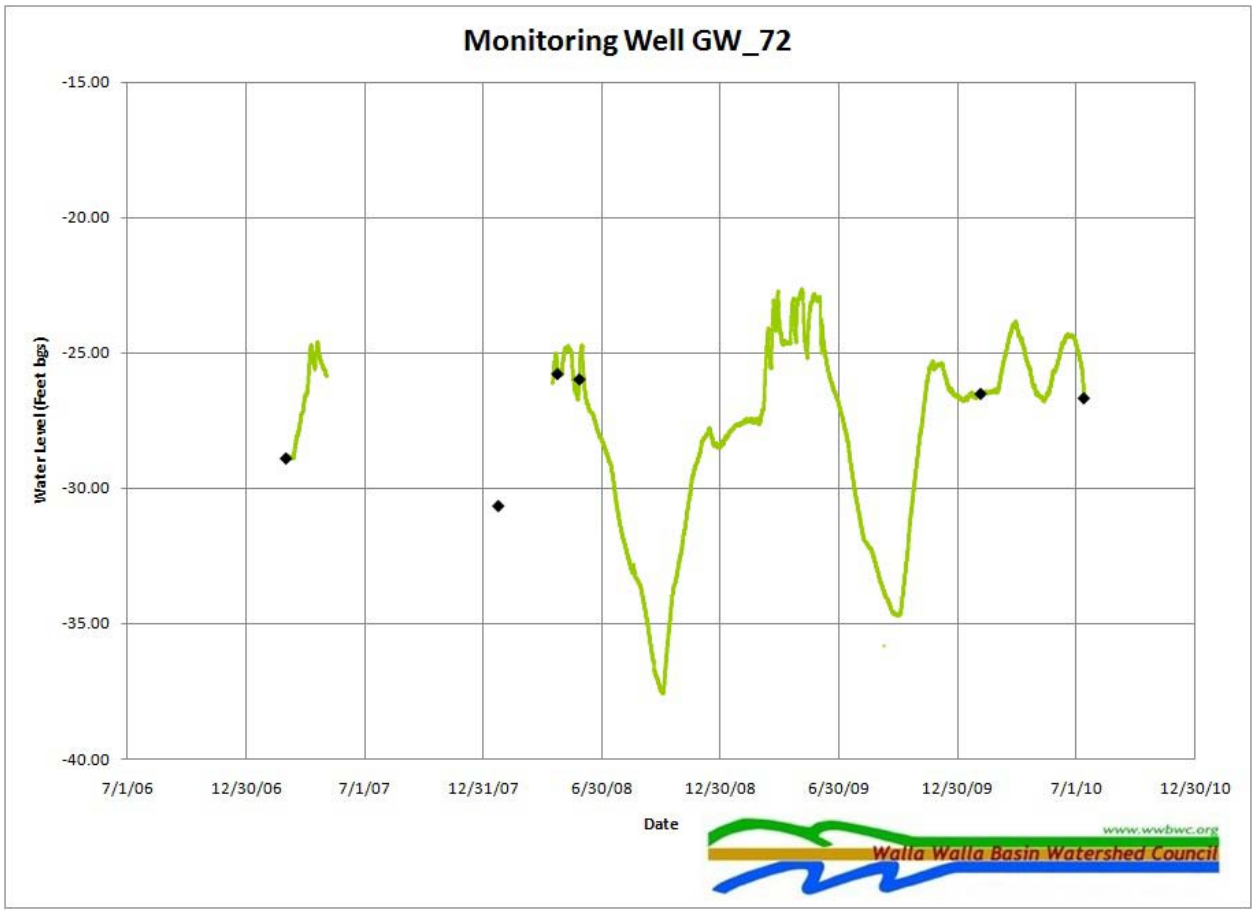
Monitoring Well GW_72
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
Water Level (Feet bgs)
7/1/06
12/30/06
7/1/07
12/31/07
6/30/08
12/30/08
6/30/09
12/30/09
7/1/10
12/30/10
Date
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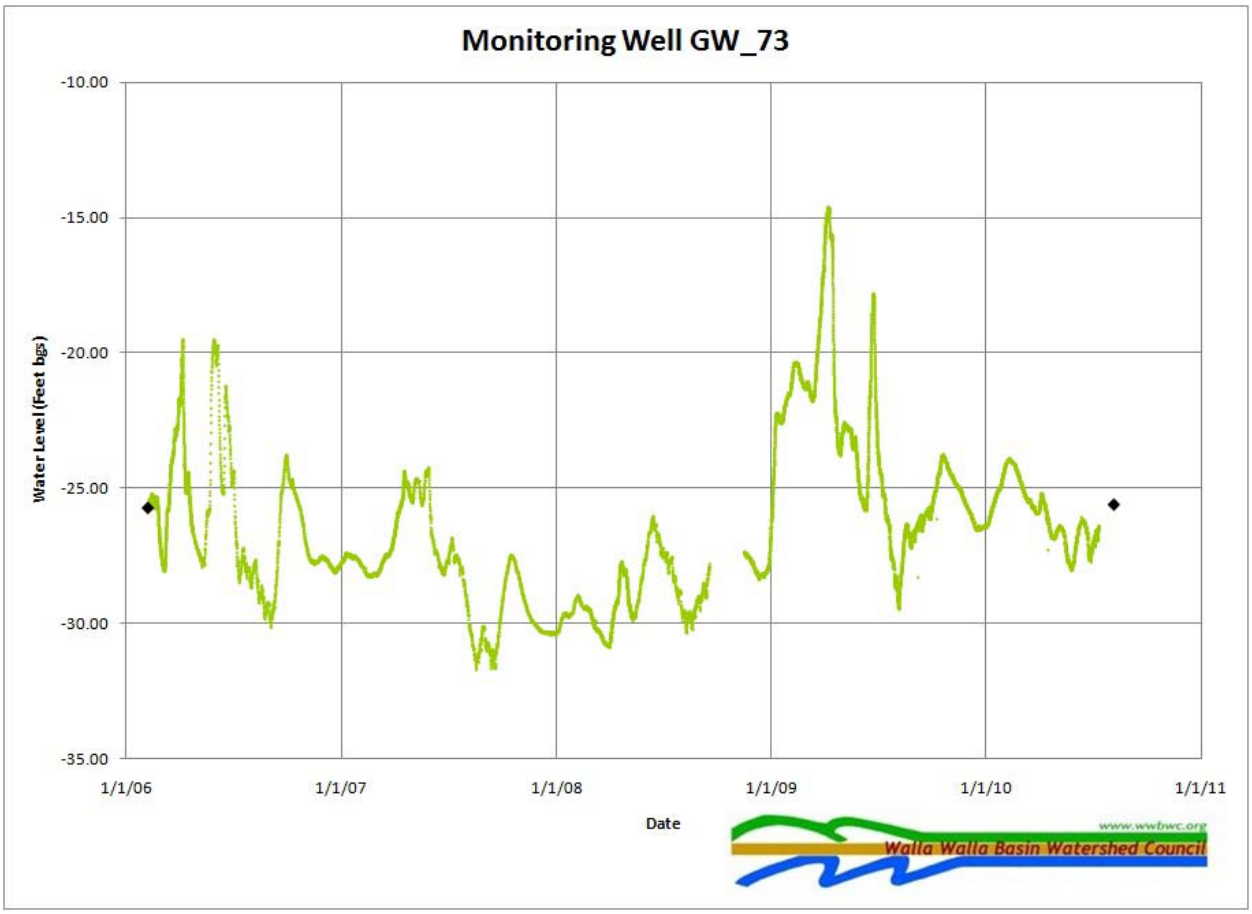
Monitoring Well GW_73
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
Water Level (Feet bgs)
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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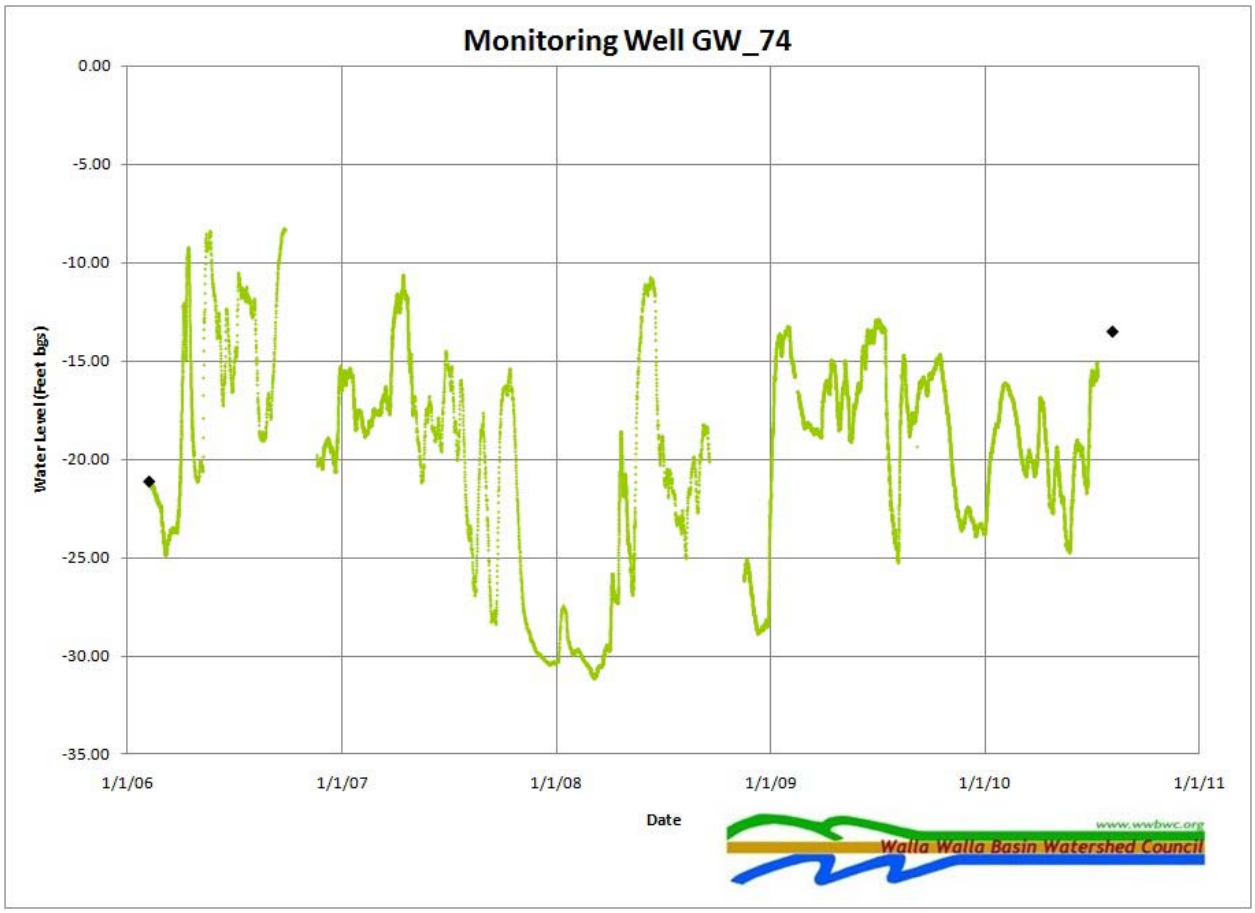
Monitoring Well GW_74
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
Water Lewel (Feet bgs)
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
Date
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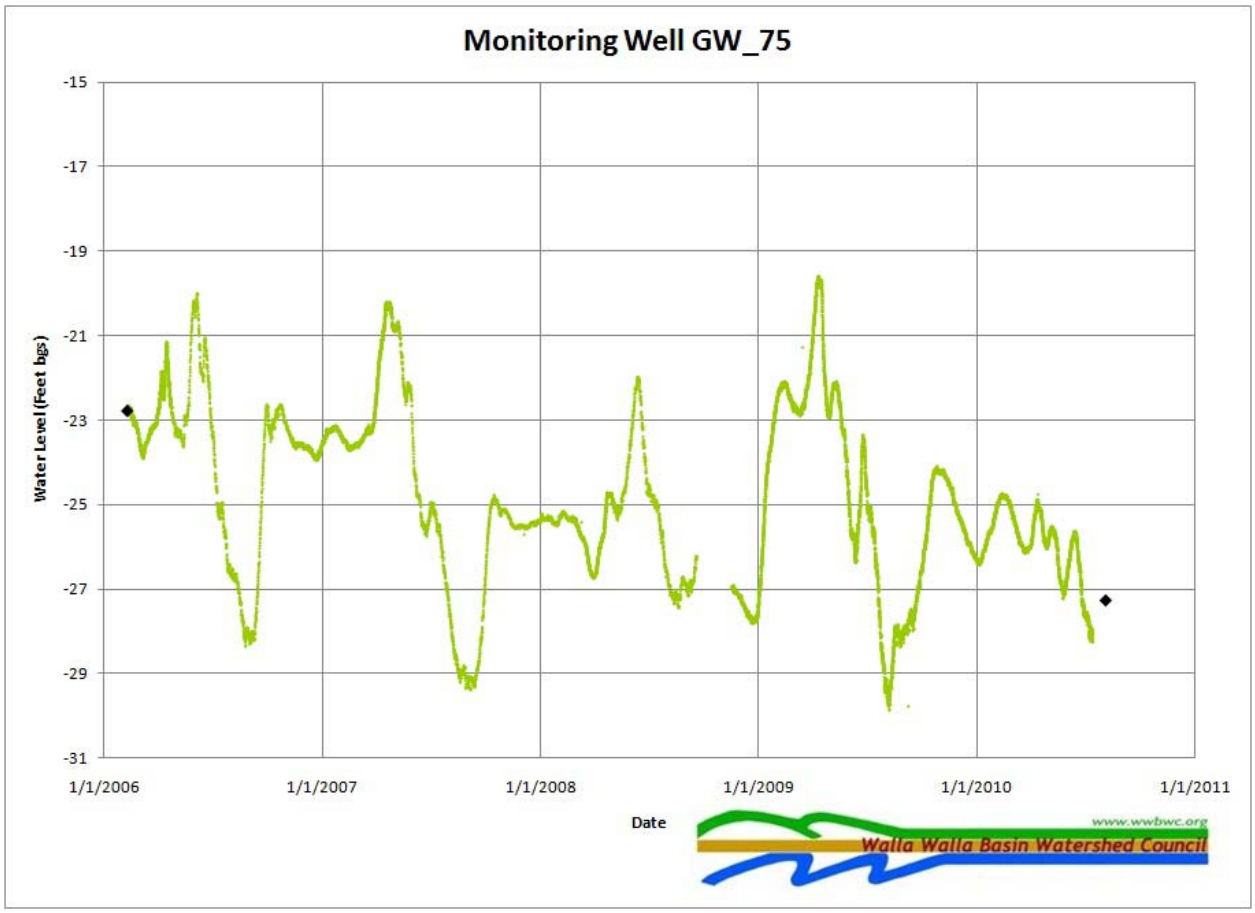
Monitoring Well GW_75
Water Level (feet bgs)
-15
-17
-19
-21
-23
-25
-27
-29
-31
1/1/2006
1/1/2007
1/1/2008
1/1/2009
1/1/2010
1/1/2011
Date
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Monitoring Well GW_82
-90.00
-100.00
-110.00
-120.00
-130.00
-140.00
-150.00
-160.00
-170.00
Water Level (ft bgs)
This is not the bottom of the well. Well Depth = 235'
1/1/08
7/2/08
1/1/09
7/2/09
1/1/10
7/2/10
Date
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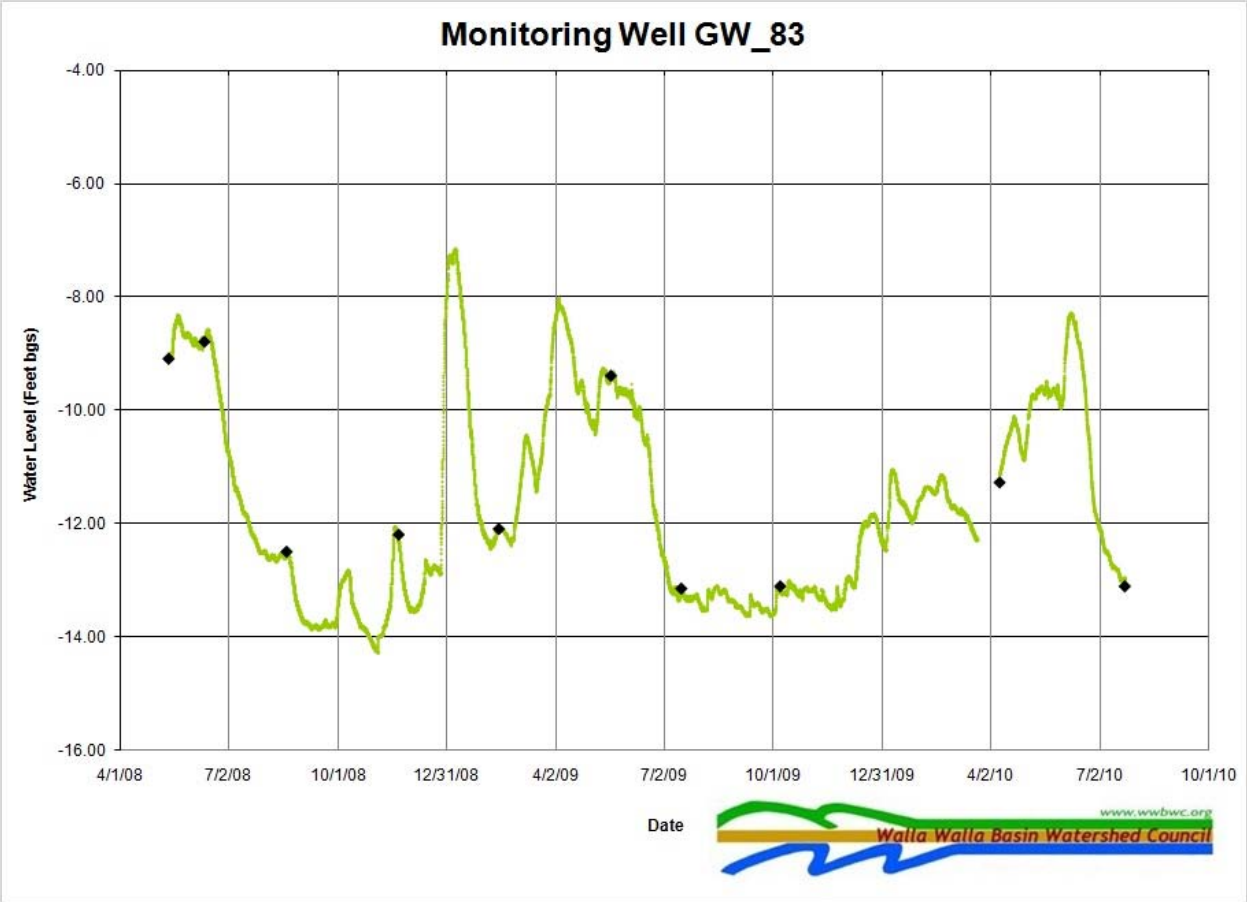
Monitoring Well GW_83
Water Level (Feet bgs)
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
-16.00
4/1/08
7/2/08
10/1/08
12/31/08
4/2/09
7/2/09
10/1/09
12/31/09
4/2/10
7/2/10
10/1/10
Date
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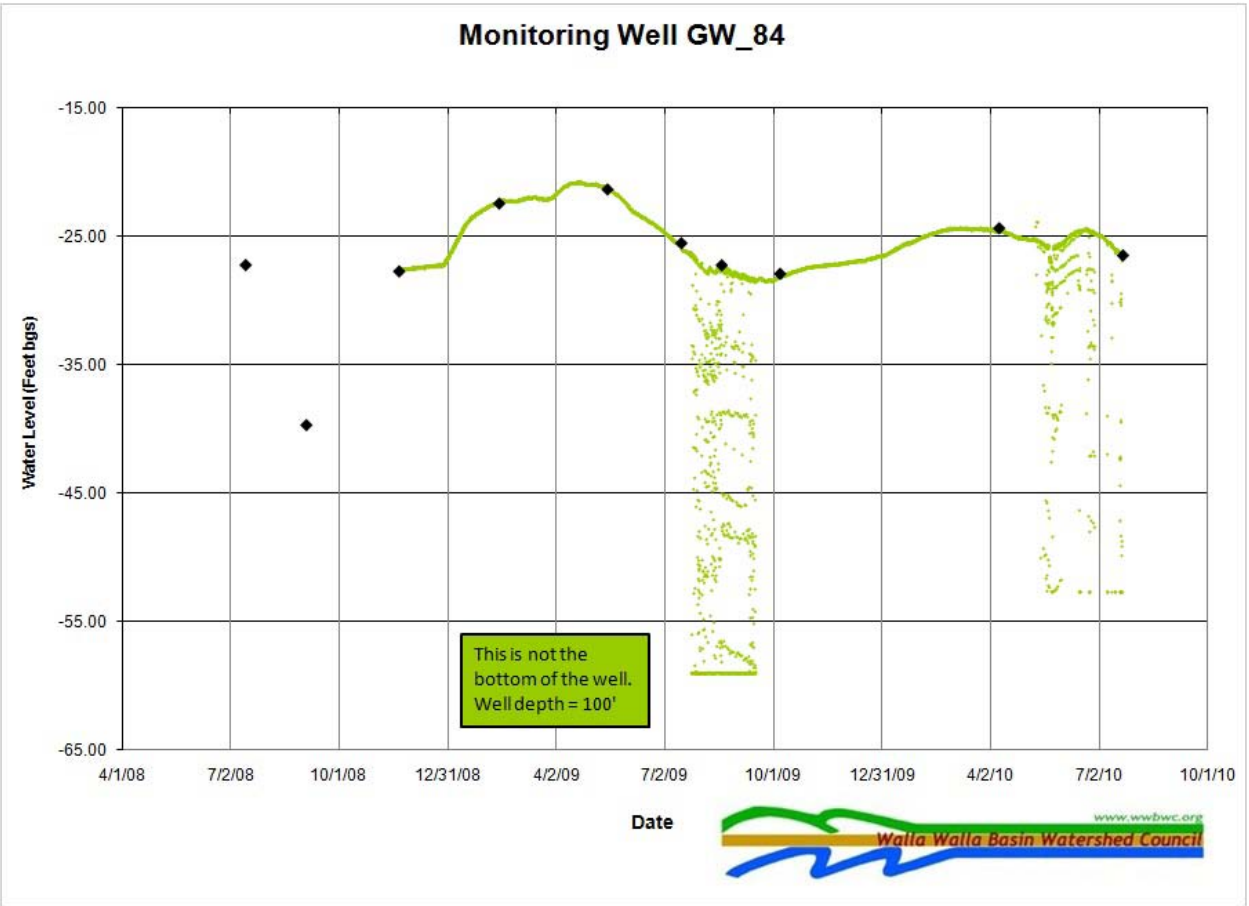
Monitoring Well GW_84
-15.00
-25.00
-35.00
-45.00
-55.00
-65.00
Water Level (Feet bgs)
4/1/08
7/2/08
10/1/08
12/31/08
4/2/09
7/2/09
10/1/09
12/31/09
4/2/10
7/2/10
10/1/10
Date
This is not the bottom of the well. Well depth = 100'
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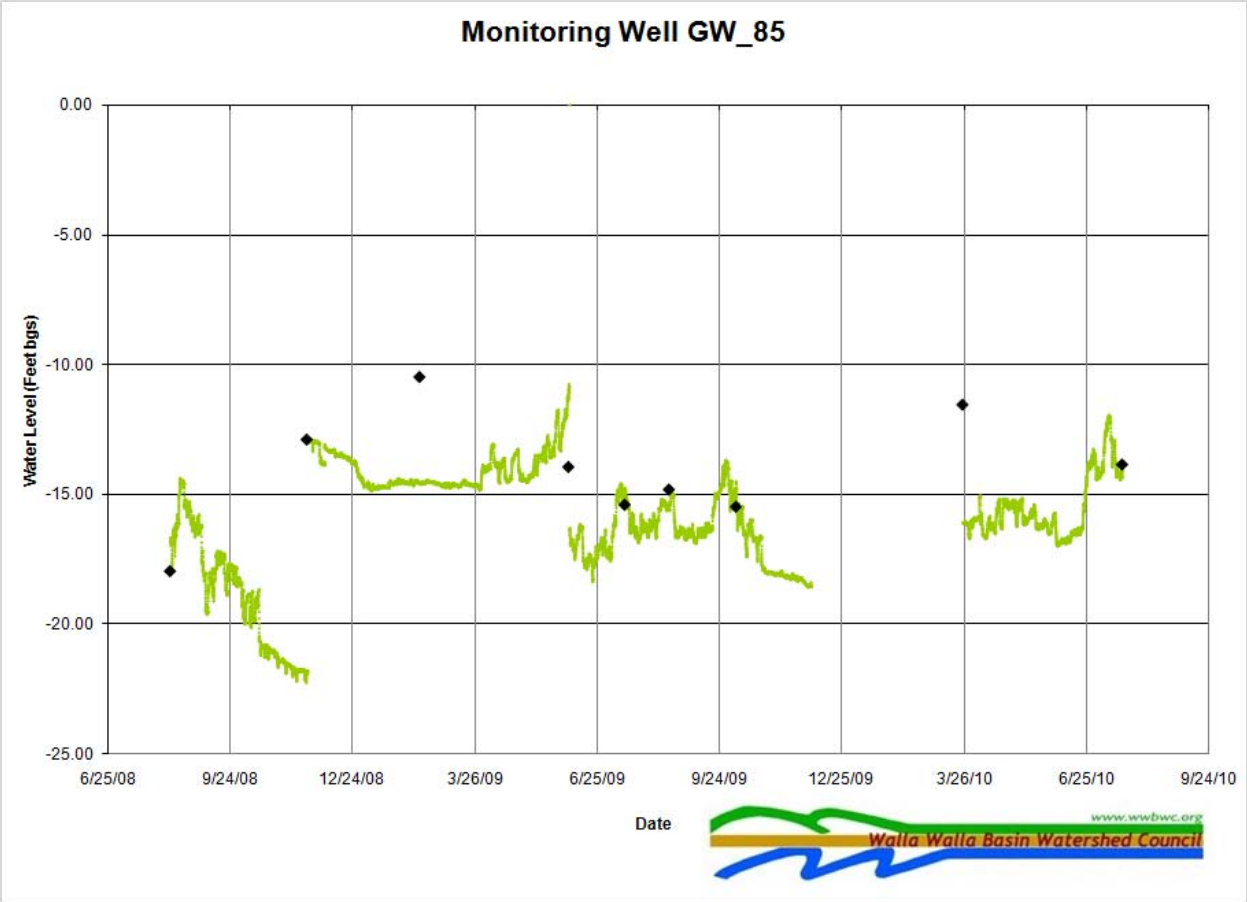
Monitoring Well GW_85
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
Water Level (Feet bgs)
6/25/08
9/24/08
12/24/08
3/26/09
6/25/09
9/24/09
12/25/09
3/26/10
6/25/10
9/24/10
Date
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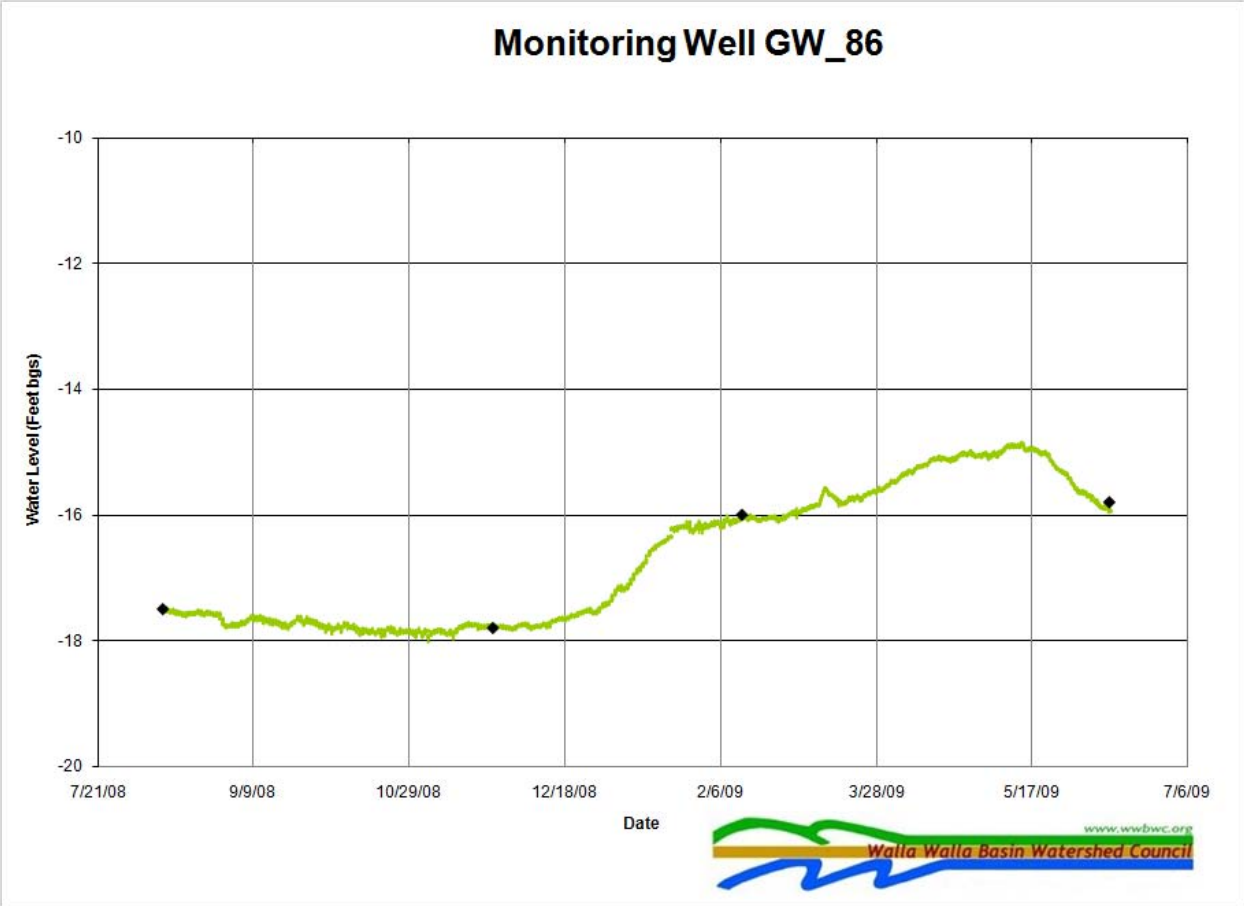
Monitoring Well GW_86
Water Level (Feet bgs)
-10
-12
-14
-16
-18
-20
7/21/08
9/9/08
10/29/08
12/18/08
2/6/09
3/28/09
5/17/09
7/6/09
Date
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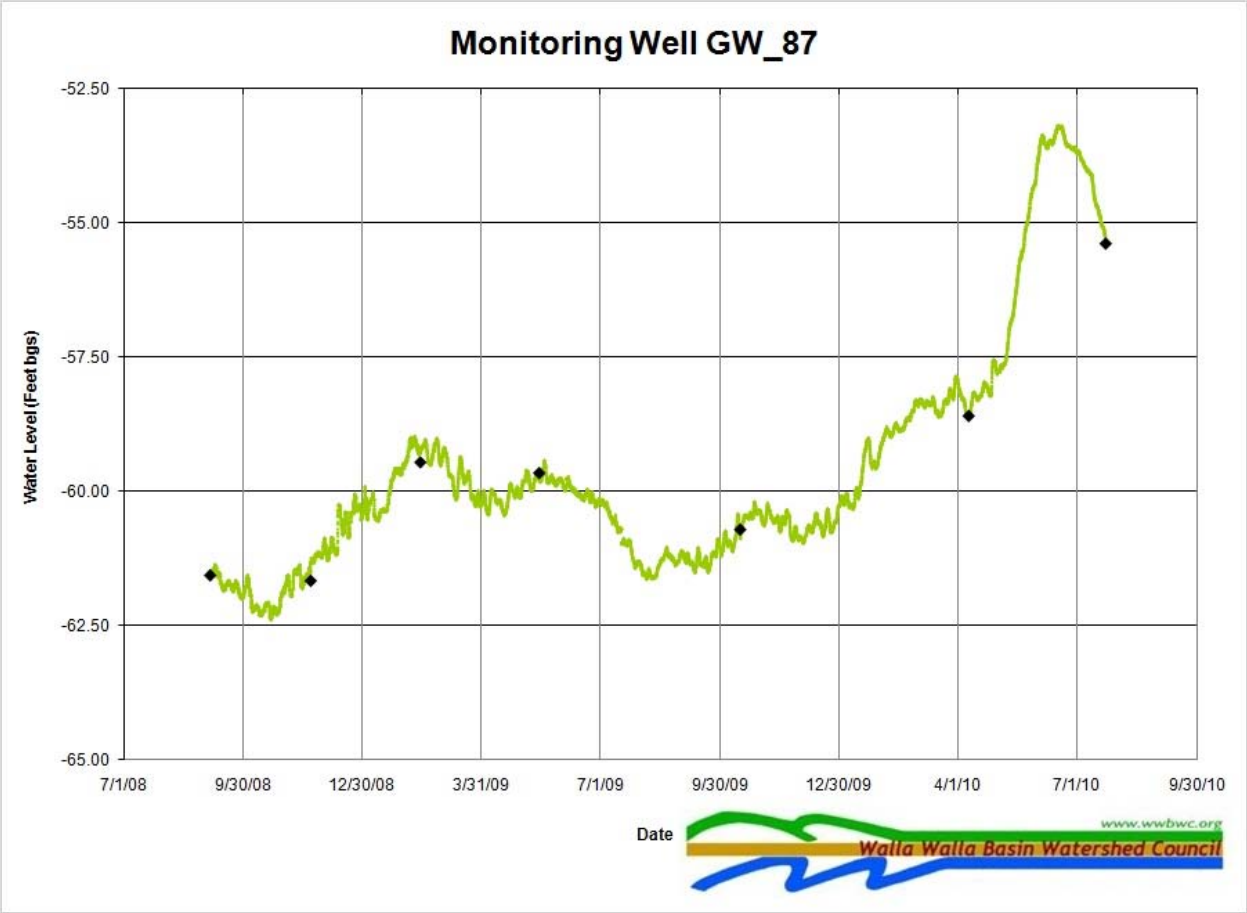
Monitoring Well GW_87
-52.50
-55.00
-57.50
-60.00
-62.50
-65.00
Water Level (Feet bgs)
7/1/08
9/30/08
12/30/08
3/31/09
7/1/09
9/30/09
12/30/09
4/1/10
7/1/10
9/30/10
Date
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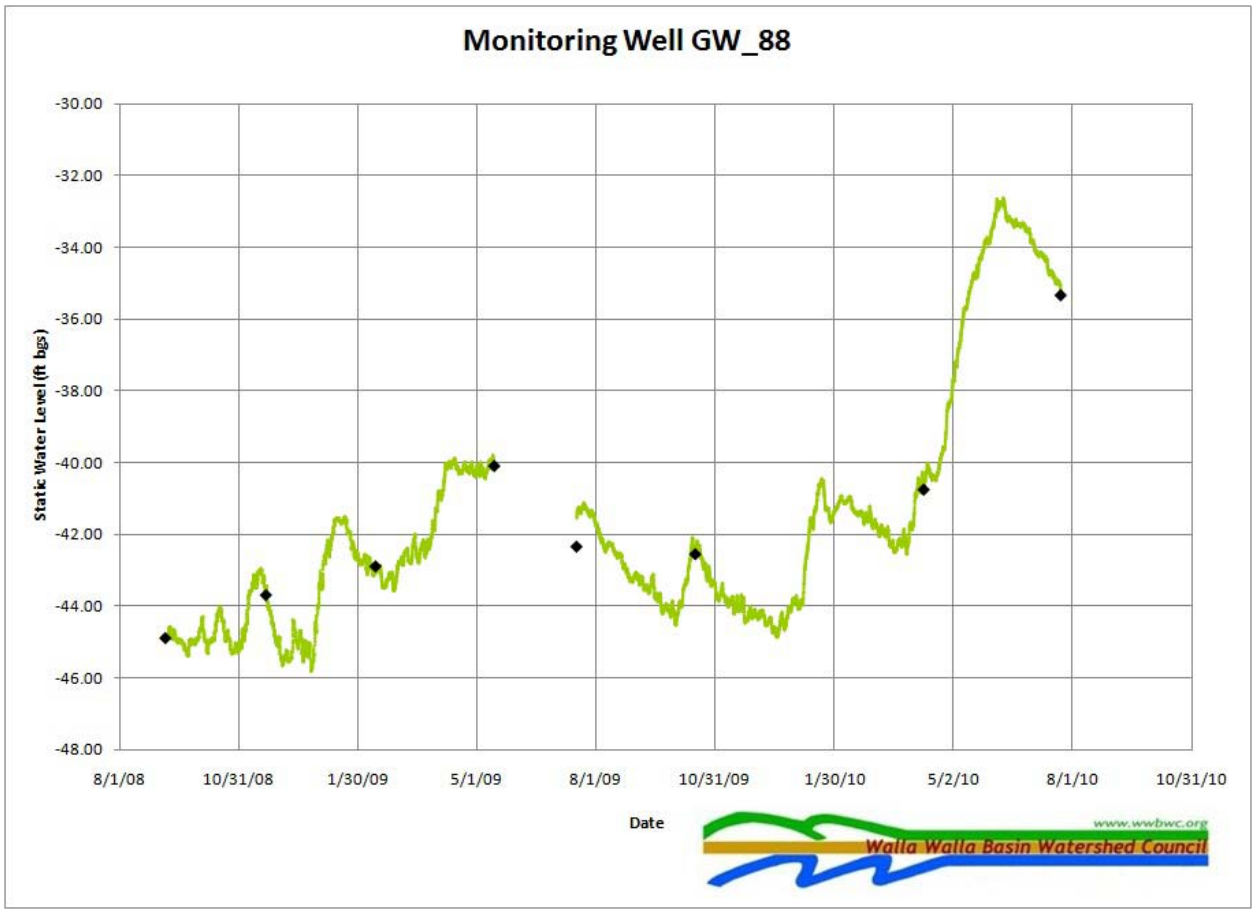
Monitoring Well GW_88
Static Water Level (ft bgs)
-30.00
-32.00
-34.00
-36.00
-38.00
-40.00
-42.00
-44.00
-46.00
-48.00
8/1/08
10/31/08
1/30/09
5/1/09
8/1/09
10/31/09
1/30/10
5/2/10
8/1/10
10/31/10
Date
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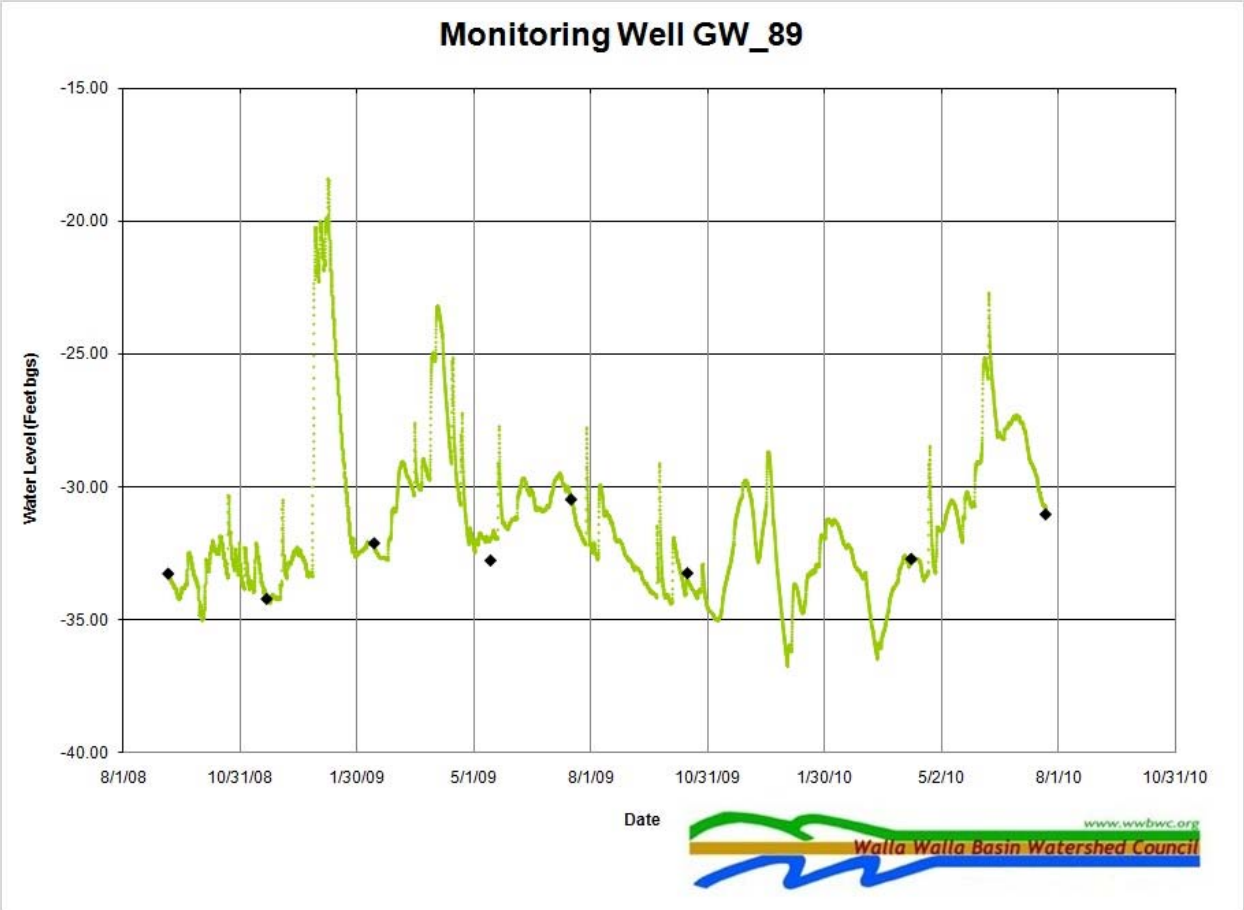
Monitoring Well GW_89
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
Water Level (Feet bgs)
8/1/08
10/31/08
1/30/09
5/1/09
8/1/09
10/31/09
1/30/10
5/2/10
8/1/10
10/31/10
Date
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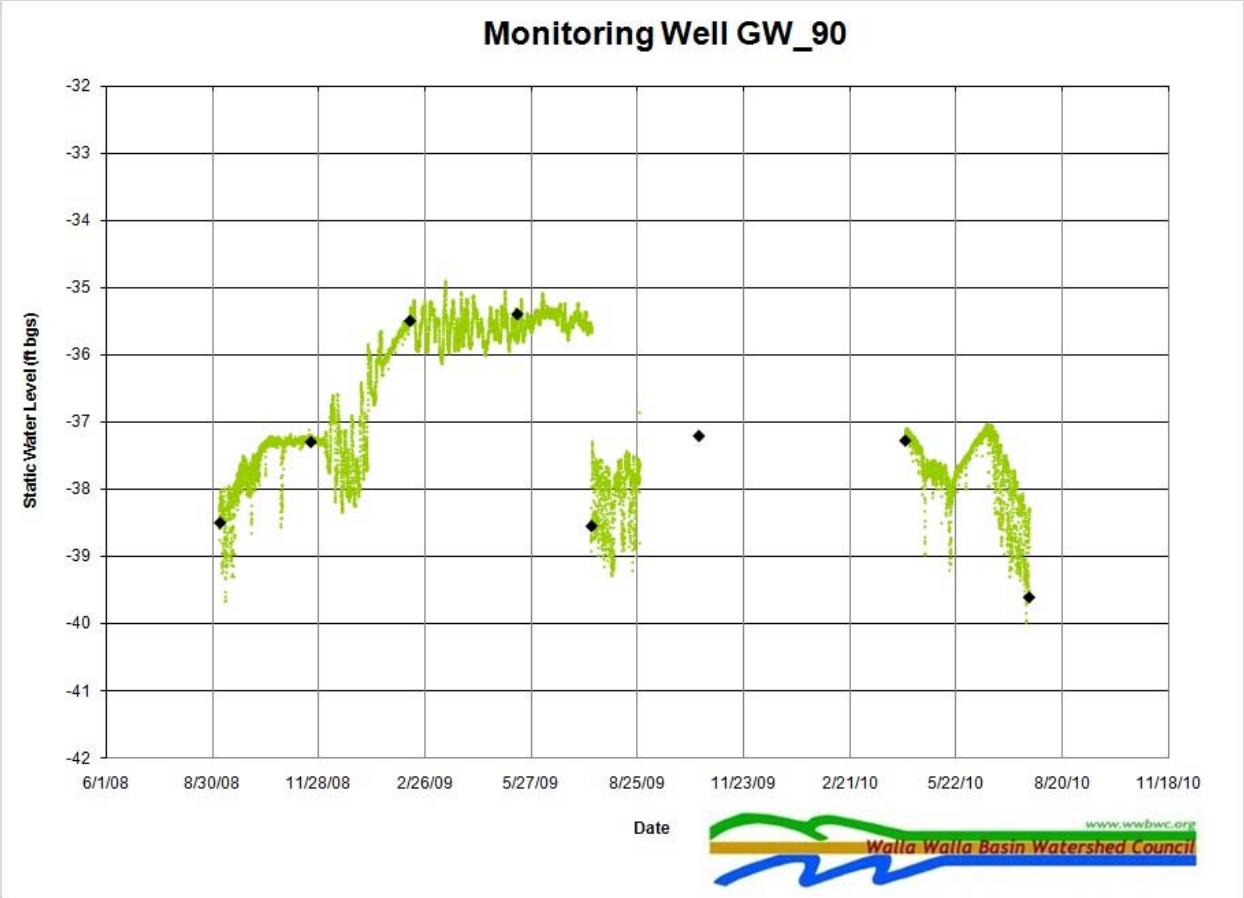
Monitoring Well GW_90
Static Water Level (ft bgs)
-32
-33
-34
-35
-36
-37
-38
-39
-40
-41
-42
6/1/08
8/30/08
11/28/08
2/26/09
5/27/09
8/25/09
11/23/09
2/21/10
5/22/10
8/20/10
11/18/10
Date
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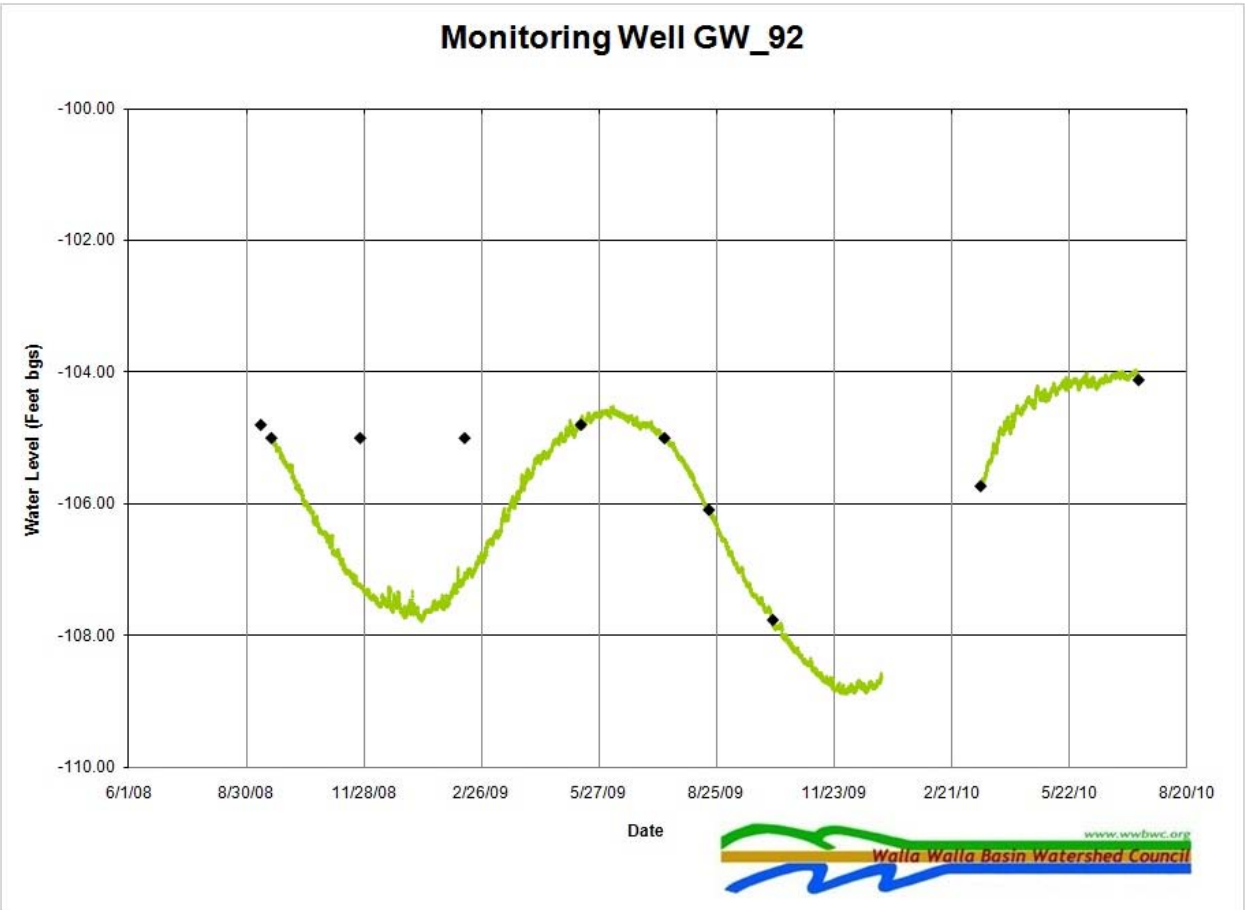
Monitoring Well GW_92
Water Level (Feet bgs)
-100.00
-102.00
-104.00
-106.00
-108.00
-110.00
6/1/08
8/30/08
11/28/08
2/26/09
5/27/09
8/25/09
11/23/09
2/21/10
5/22/10
8/20/10
Date
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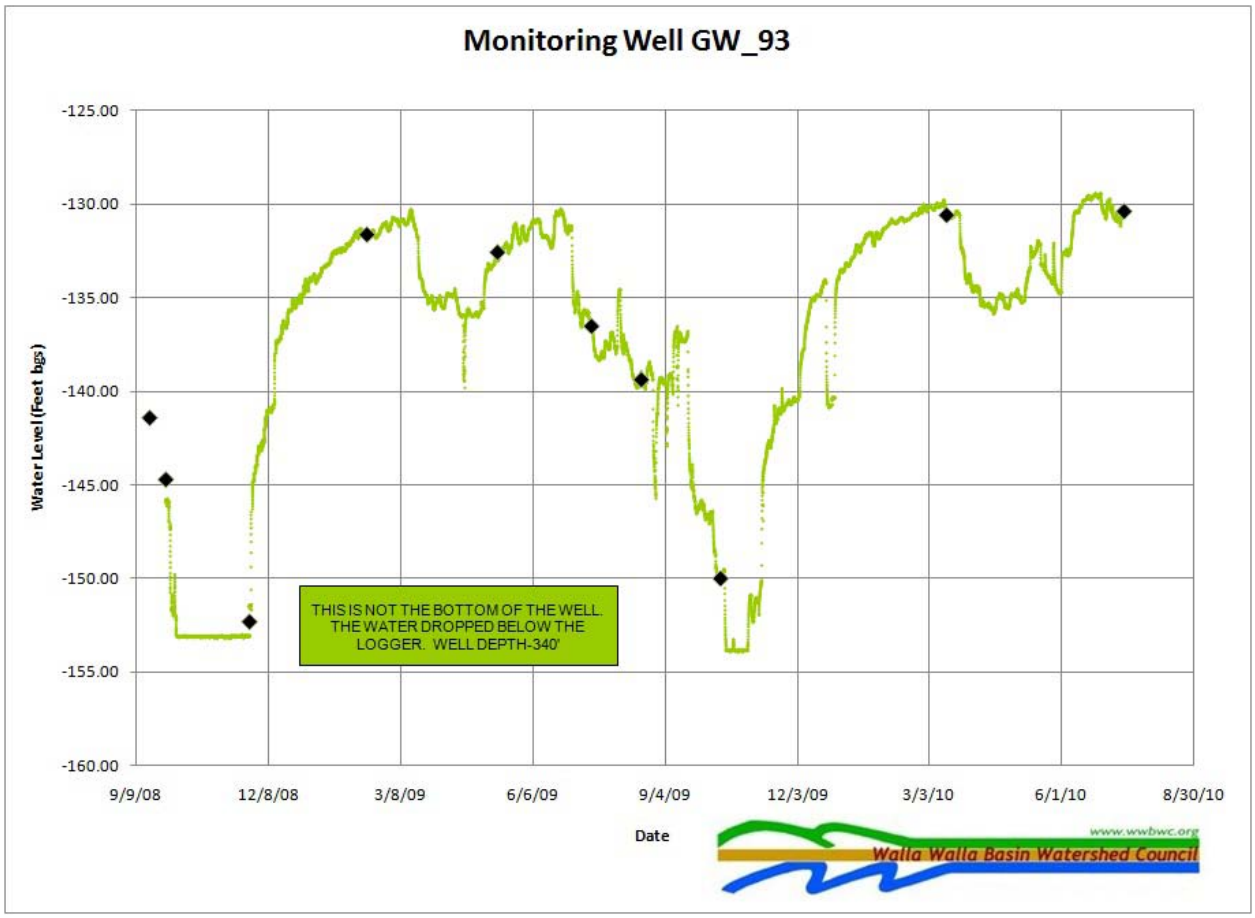
Monitoring Well GW_93
-125.00
-130.00
-135.00
-140.00
-145.00
-150.00
-155.00
-160.00
Water Level (Feet bgs)
9/9/08
12/8/08
3/8/09
6/6/09
9/4/09
12/3/09
3/3/10
6/1/10
8/30/10
Date
THIS IS NOT THE BOTTOM OF THE WELL. THE WATER DROPPED BELOW THE LOGGER. WELL DEPTH-340'
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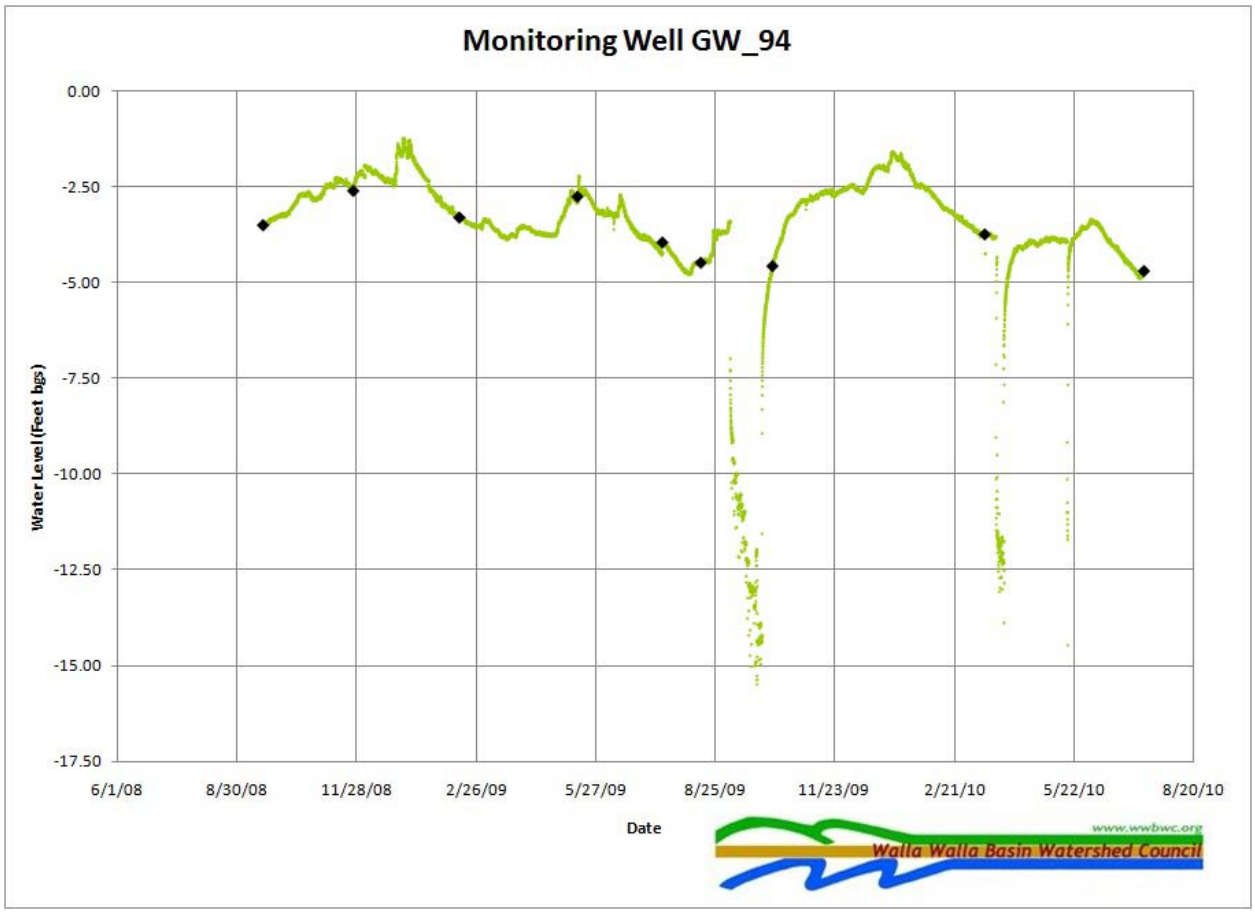
Monitoring Well GW_94
0.00
-2.50
-5.00
-7.50
-10.00
-12.50
-15.00
-17.50
Water Level (Feet bgs)
6/1/08
8/30/08
11/28/08
2/26/09
5/27/09
8/25/09
11/23/09
2/21/10
5/22/10
8/20/10
Date
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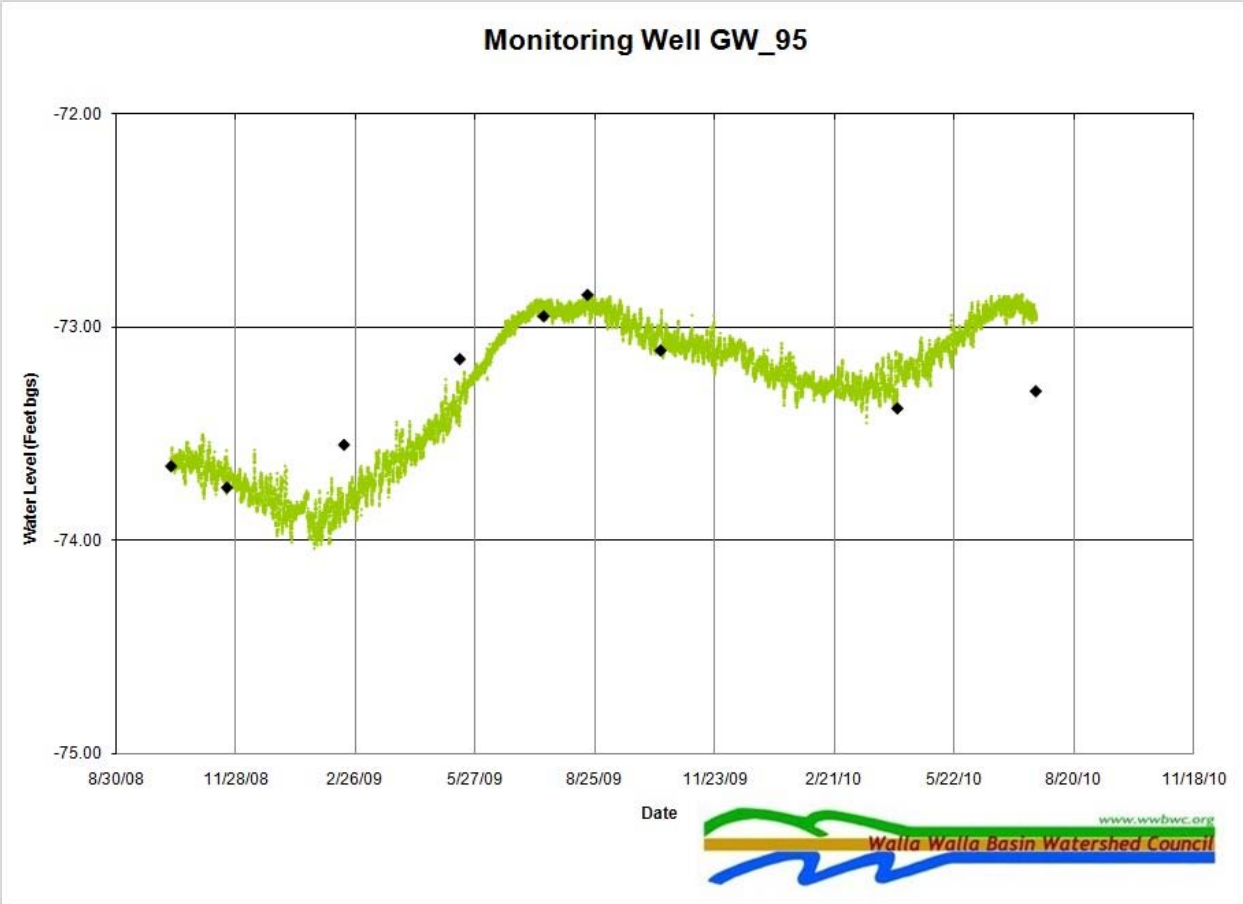
Monitoring Well GW_95
-72.00
-73.00
-74.00
-75.00
Water Level (Feet bgs)
8/30/08
11/28/08
2/26/09
5/27/09
8/25/09
11/23/09
2/21/10
5/22/10
8/20/10
11/18/10
Date
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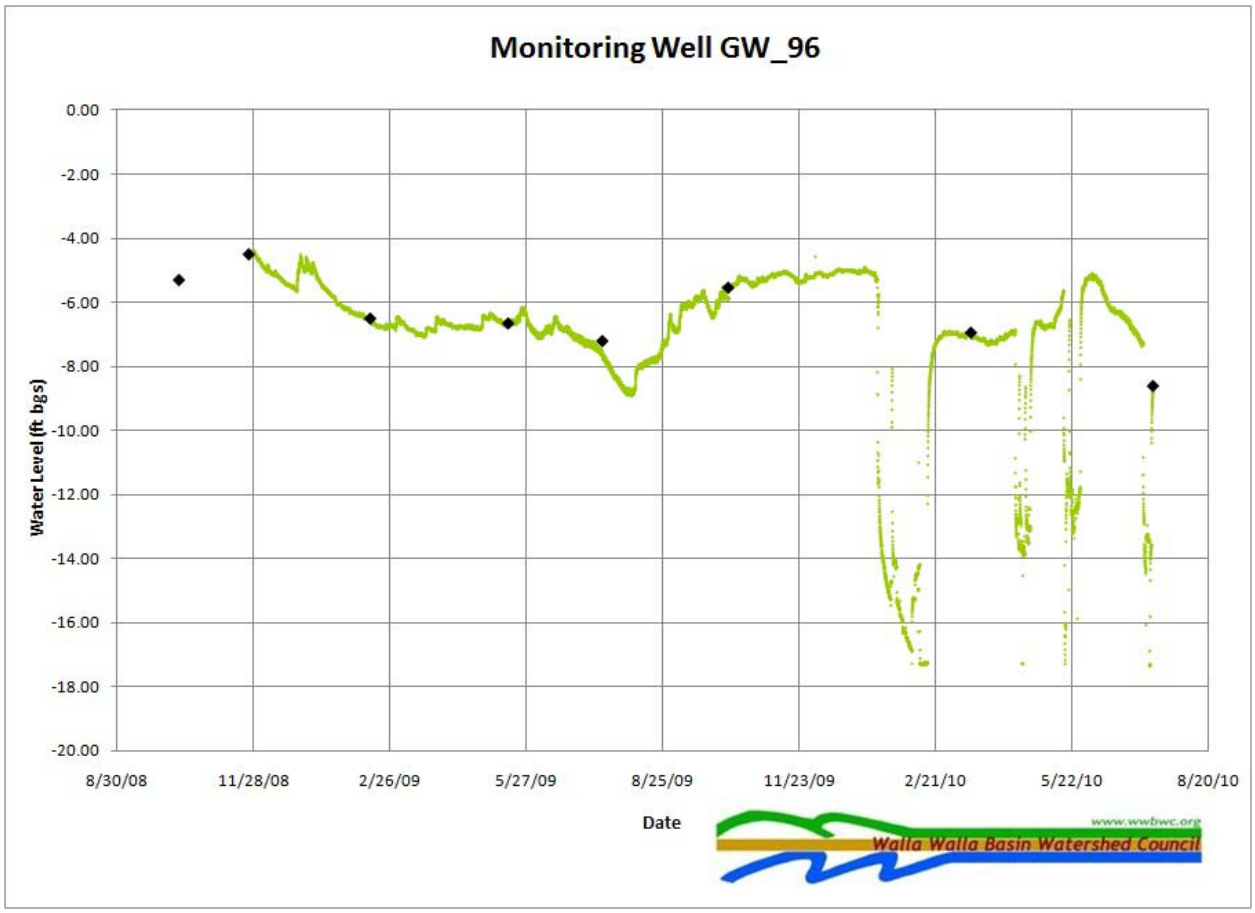
Monitoring Well GW_96
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
-16.00
-18.00
-20.00
Water Level (ft bgs)
8/30/08
11/28/08
2/26/09
5/27/09
8/25/09
11/23/09
2/21/10
5/22/10
8/20/10
Date
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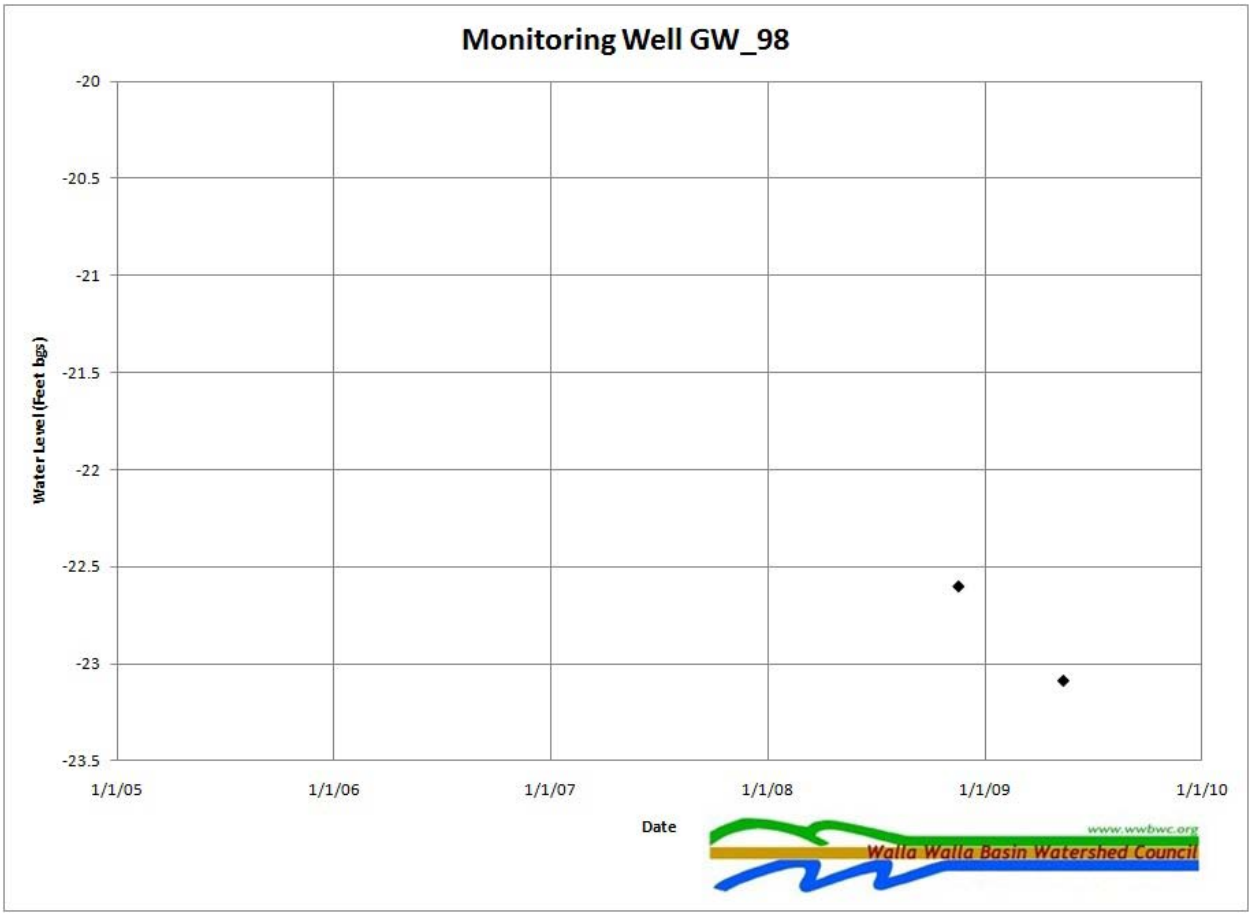
Monitoring Well GW_98
-20
-20.5
-21
-21.5
-22
-22.5
-23
-23.5
Water Level (Feet bgs)
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
Date
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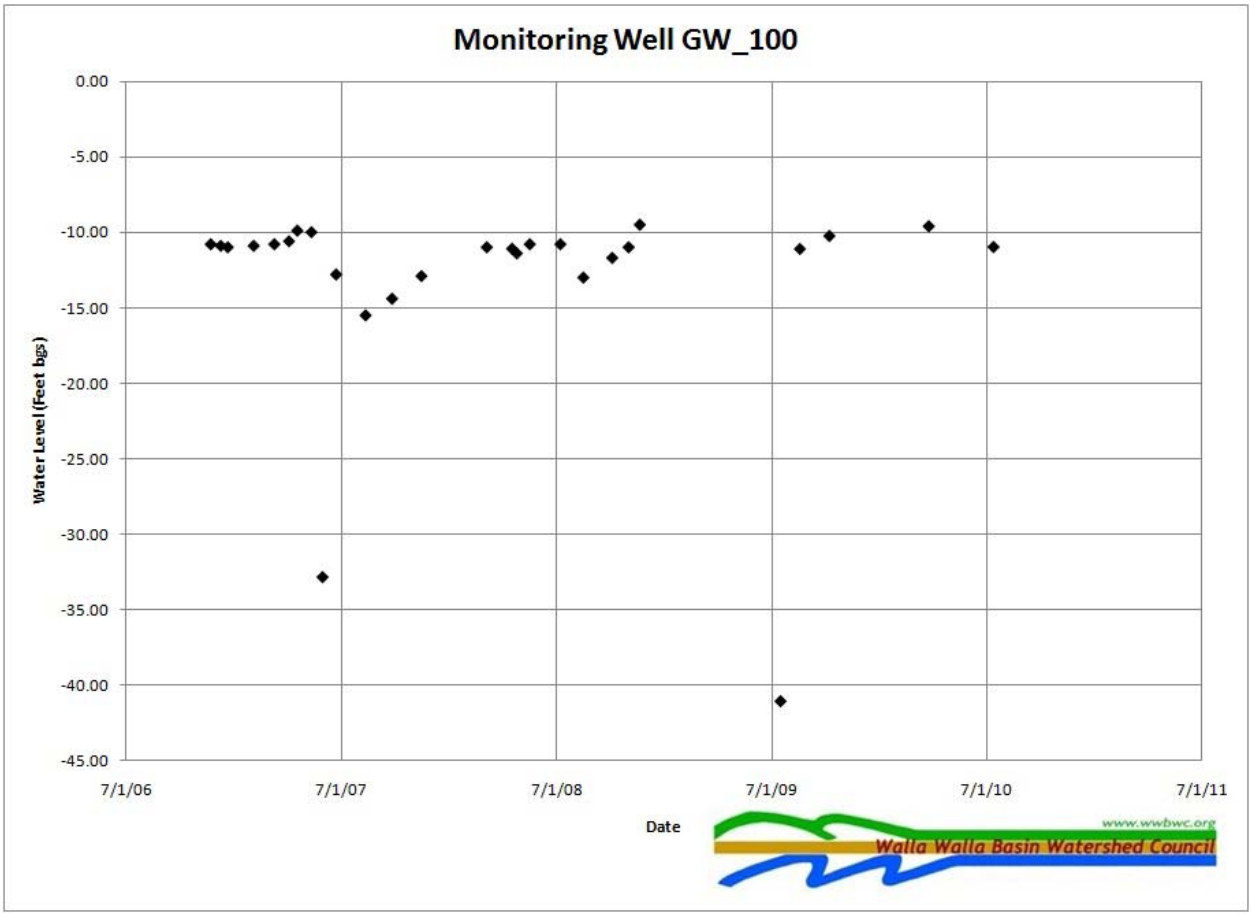
Monitoring Well GW_100
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
Water Level (Feet bgs)
7/1/06
7/1/07
7/1/08
7/1/09
7/1/10
7/1/11
Date
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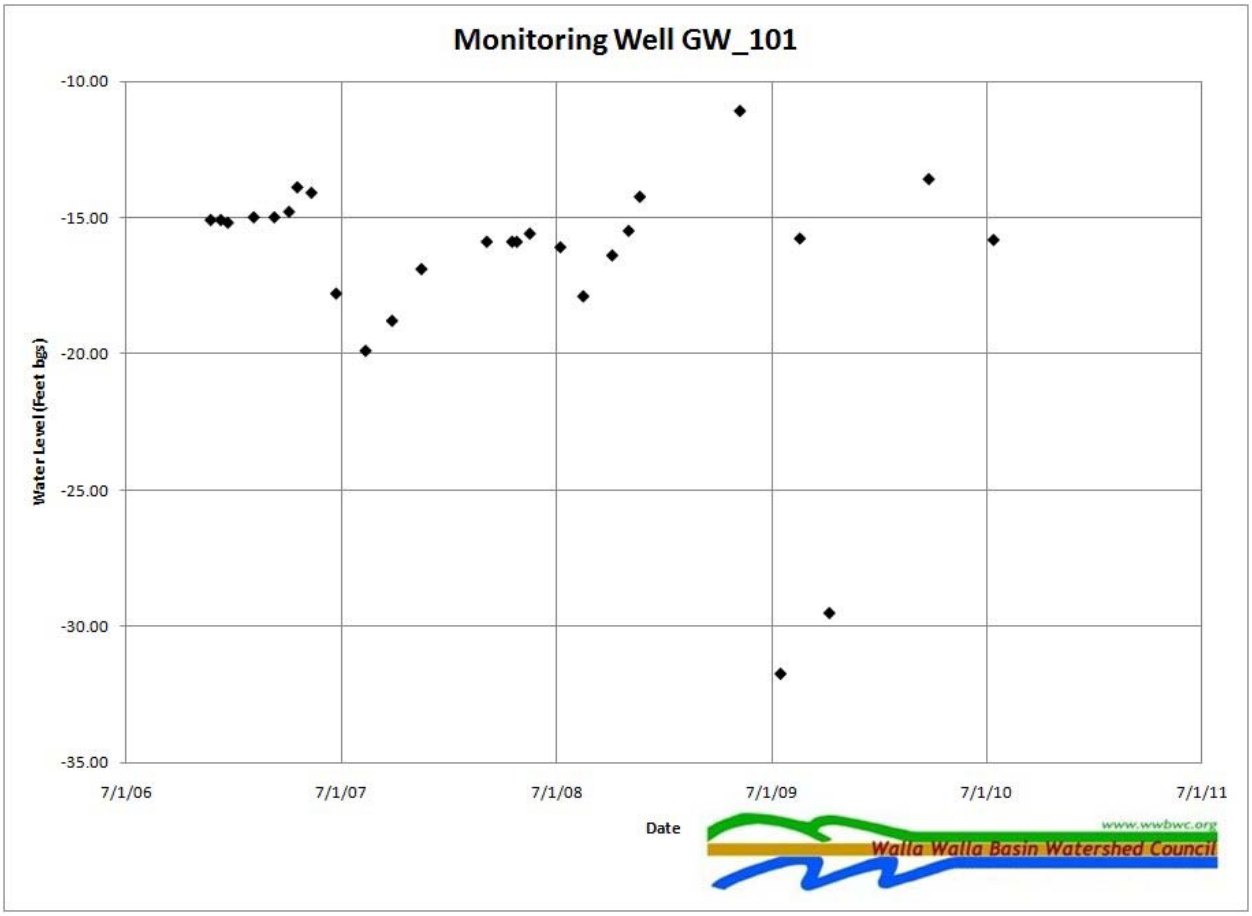
Monitoring Well GW_101
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
Water Level (Feet bgs)
7/1/06
7/1/07
7/1/08
7/1/09
7/1/10
7/1/11
Date
www.wwbwc.org
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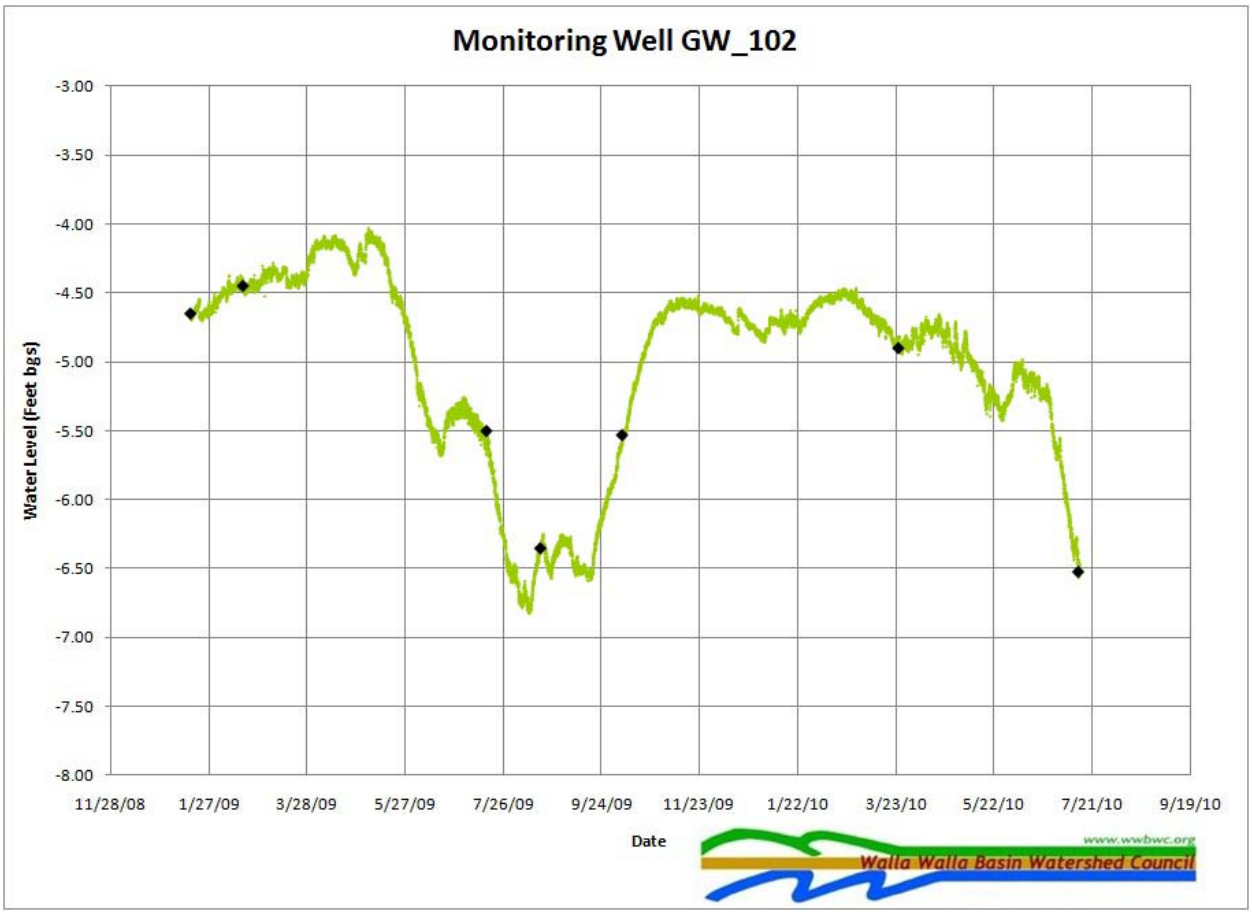
Monitoring Well GW_102
Water Level (Feet bgs)
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
-8.00
11/28/08
1/27/09
3/28/09
5/27/09
7/26/09
9/24/09
11/23/09
1/22/10
3/23/10
5/22/10
7/21/10
9/19/10
Date
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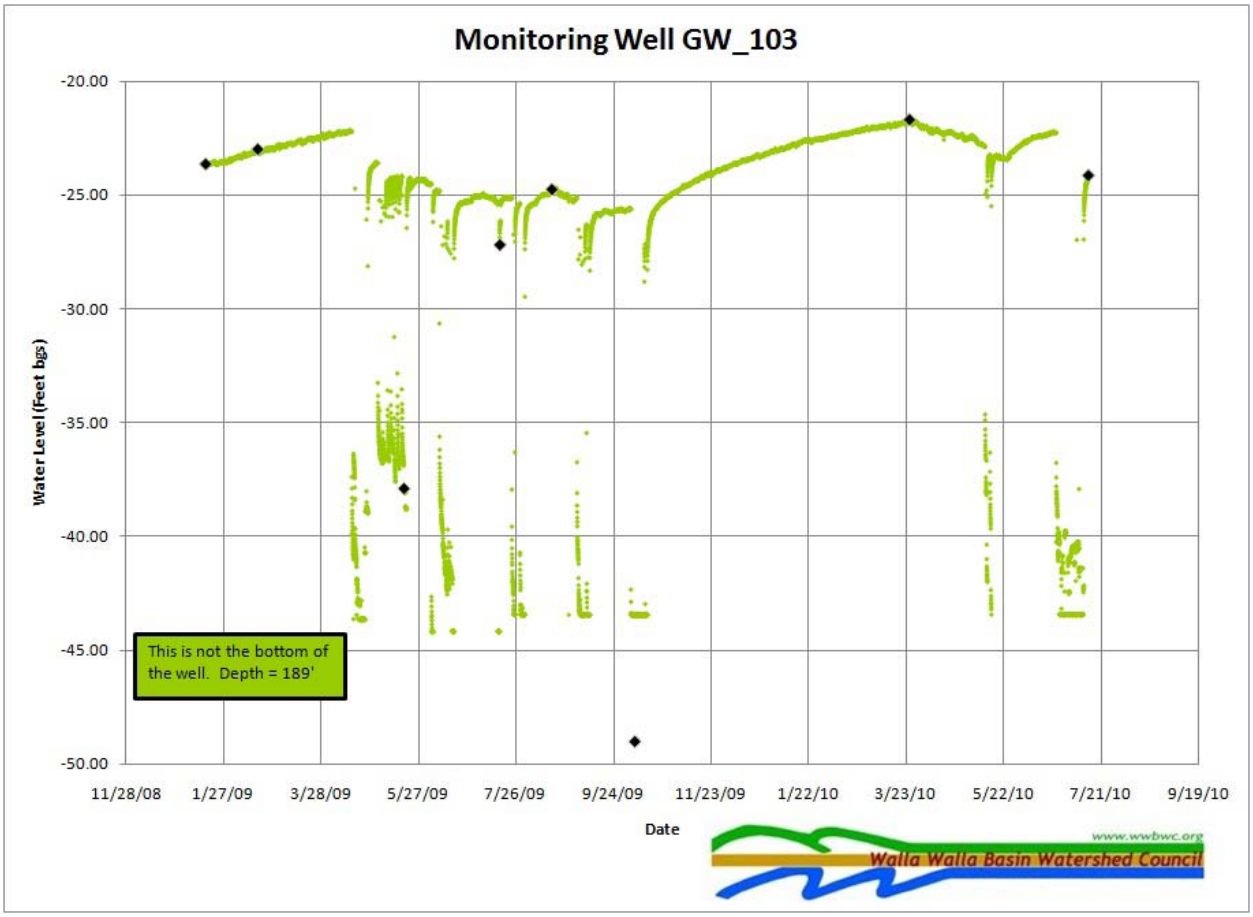
Monitoring Well GW_103
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
Water Level (Feet bgs)
This is not the bottom of the well. Depth = 189'
11/28/08
1/27/09
3/28/09
5/27/09
7/26/09
9/24/09
11/23/09
1/22/10
3/23/10
5/22/10
7/21/10
9/19/10
Date
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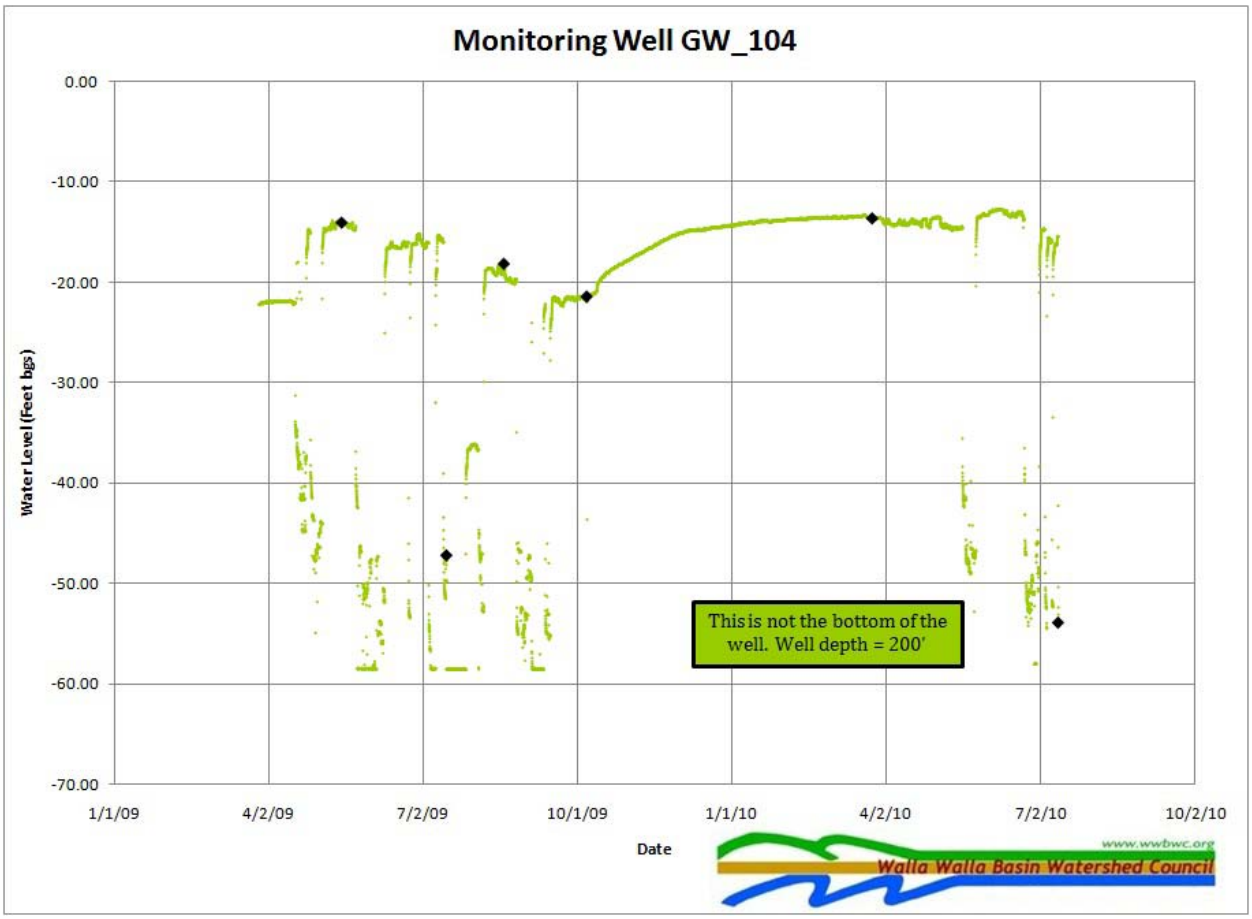
Monitoring Well GW_104
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
Water Level (Feet bgs)
1/1/09
4/2/09
7/2/09
10/1/09
1/1/10
4/2/10
7/2/10
10/2/10
Date
This is not the bottom of the well. Well depth = 200'
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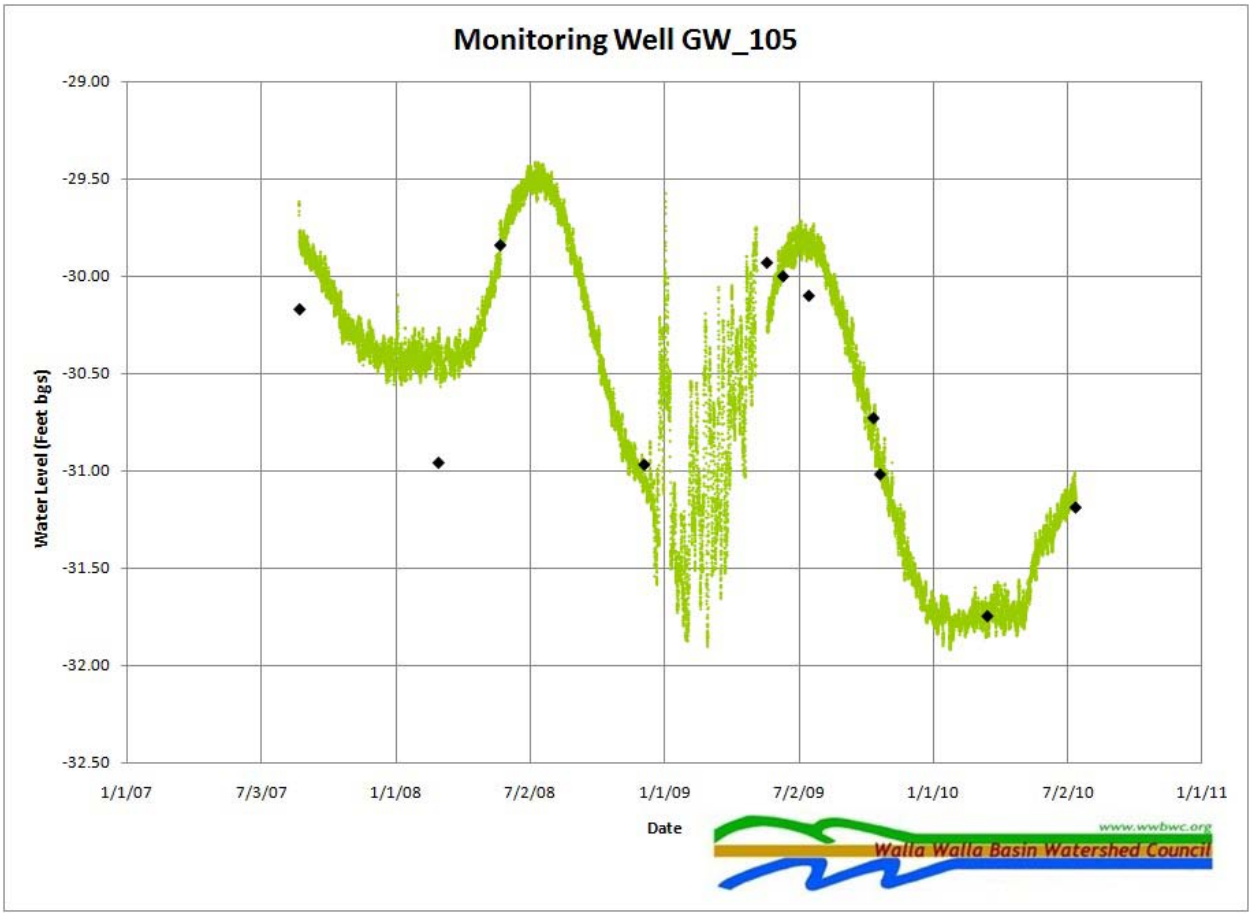
Monitoring Well GW_105
-29.00
-29.50
-30.00
-30.50
-31.00
-31.50
-32.00
-32.50
Water Level (Feet bgs)
1/1/07
7/3/07
1/1/08
7/2/08
1/1/09
7/2/09
1/1/10
7/2/10
1/1/11
Date
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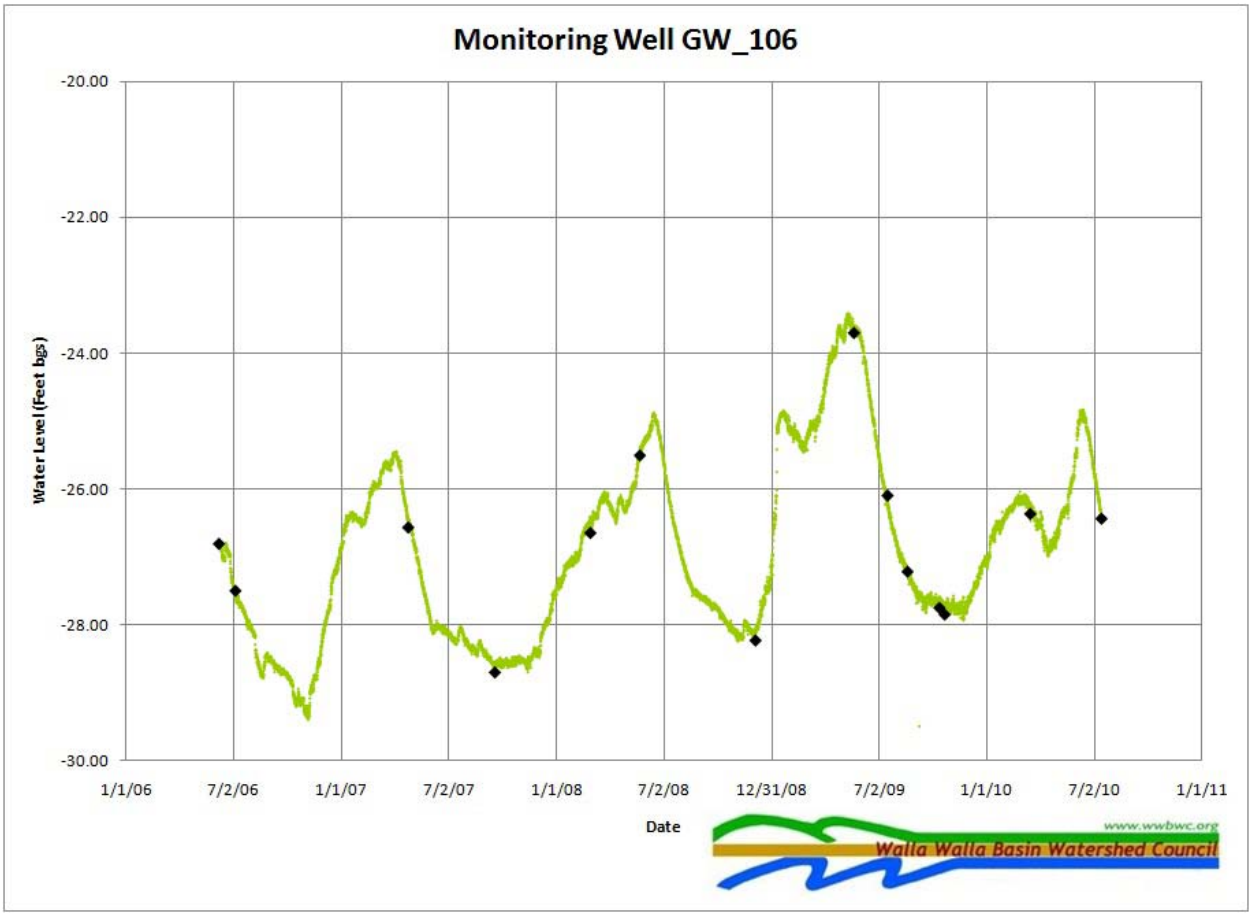
Monitoring Well GW_106
-20.00
-22.00
-24.00
-26.00
-28.00
-30.00
Water Level (Feet bgs)
1/1/06
7/2/06
1/1/07
7/2/07
1/1/08
7/2/08
12/31/08
7/2/09
1/1/10
7/2/10
1/1/11
Date
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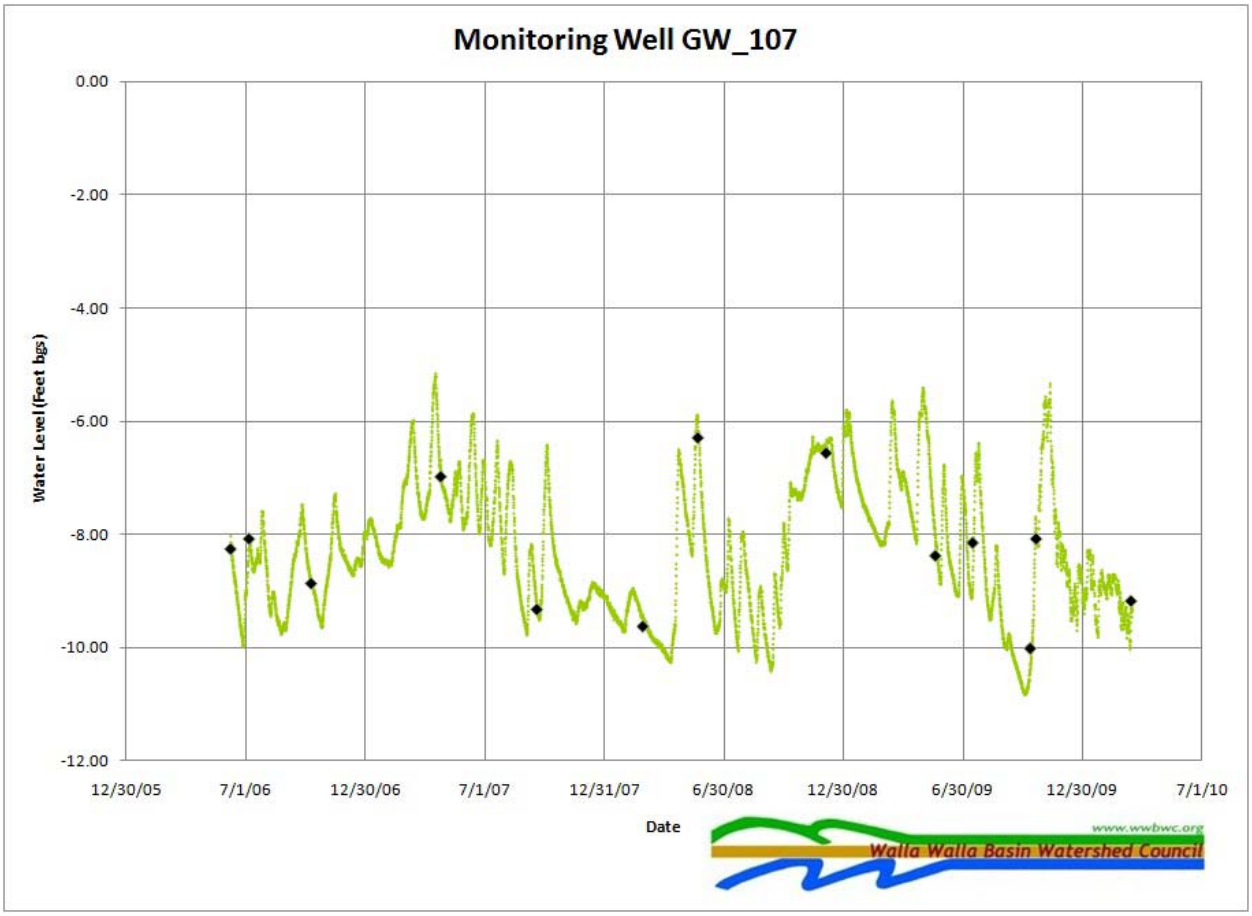
Monitoring Well GW_107
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
Water Level (Feet bgs)
12/30/05
7/1/06
12/30/06
7/1/07
12/31/07
6/30/08
12/30/08
6/30/09
12/30/09
7/1/10
Date
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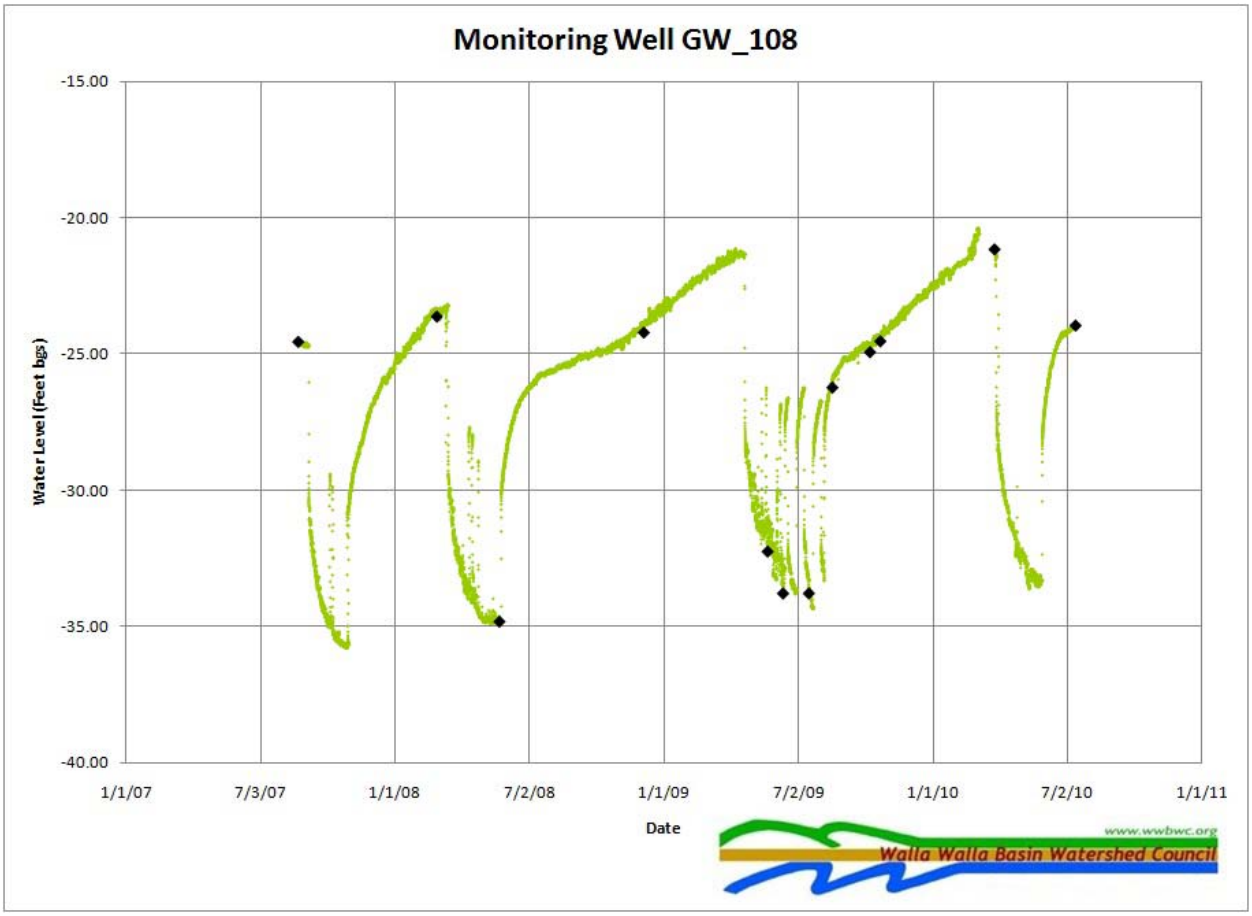
Monitoring Well GW_108
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
Water Level (Feet bgs)
1/1/07
7/3/07
1/1/08
7/2/08
1/1/09
7/2/09
1/1/10
7/2/10
1/1/11
Date
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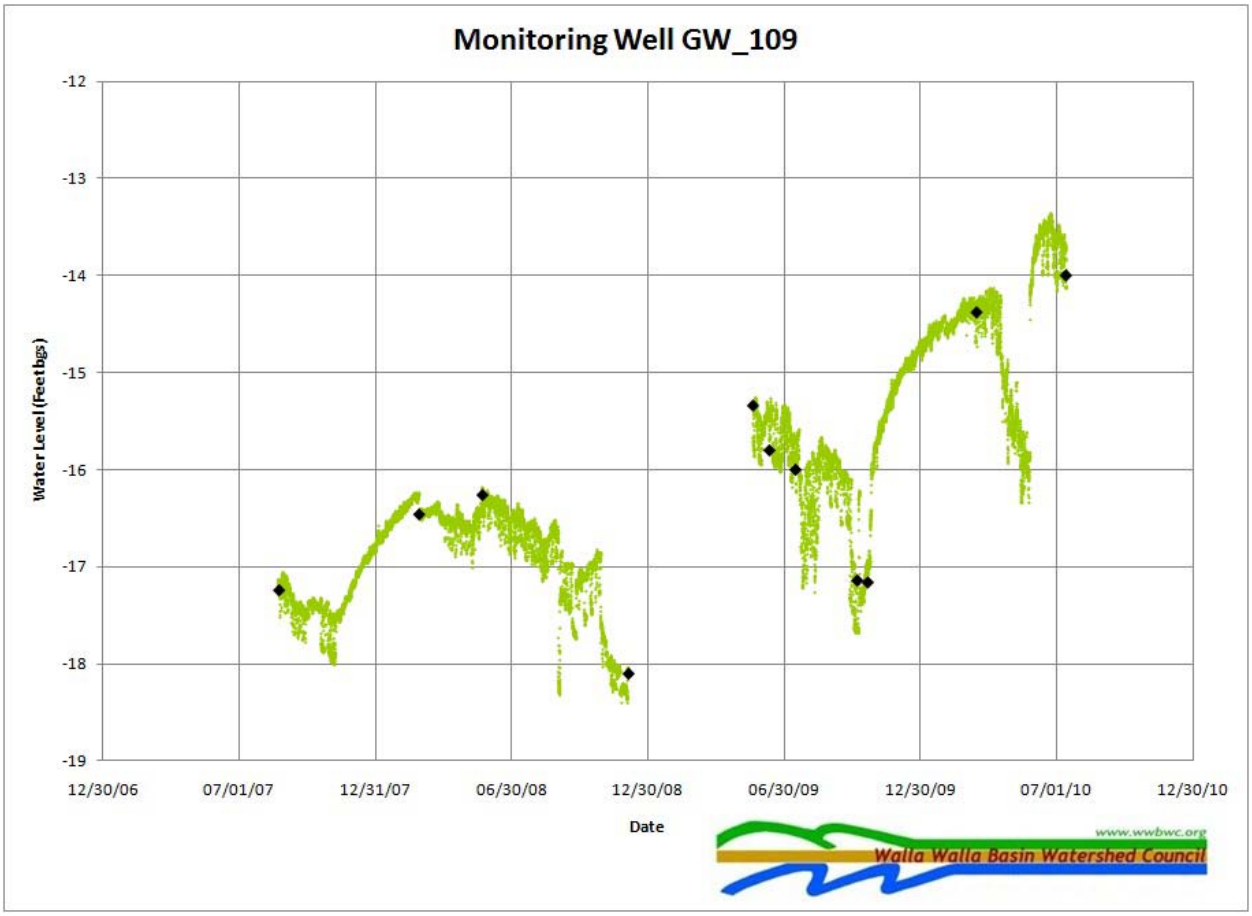
Monitoring Well GW_109
Water Level (Feet bgs)
-12
-13
-14
-15
-16
-17
-18
-19
12/30/06
07/01/07
12/31/07
06/30/08
12/30/08
06/30/09
12/30/09
07/01/10
12/30/10
Date
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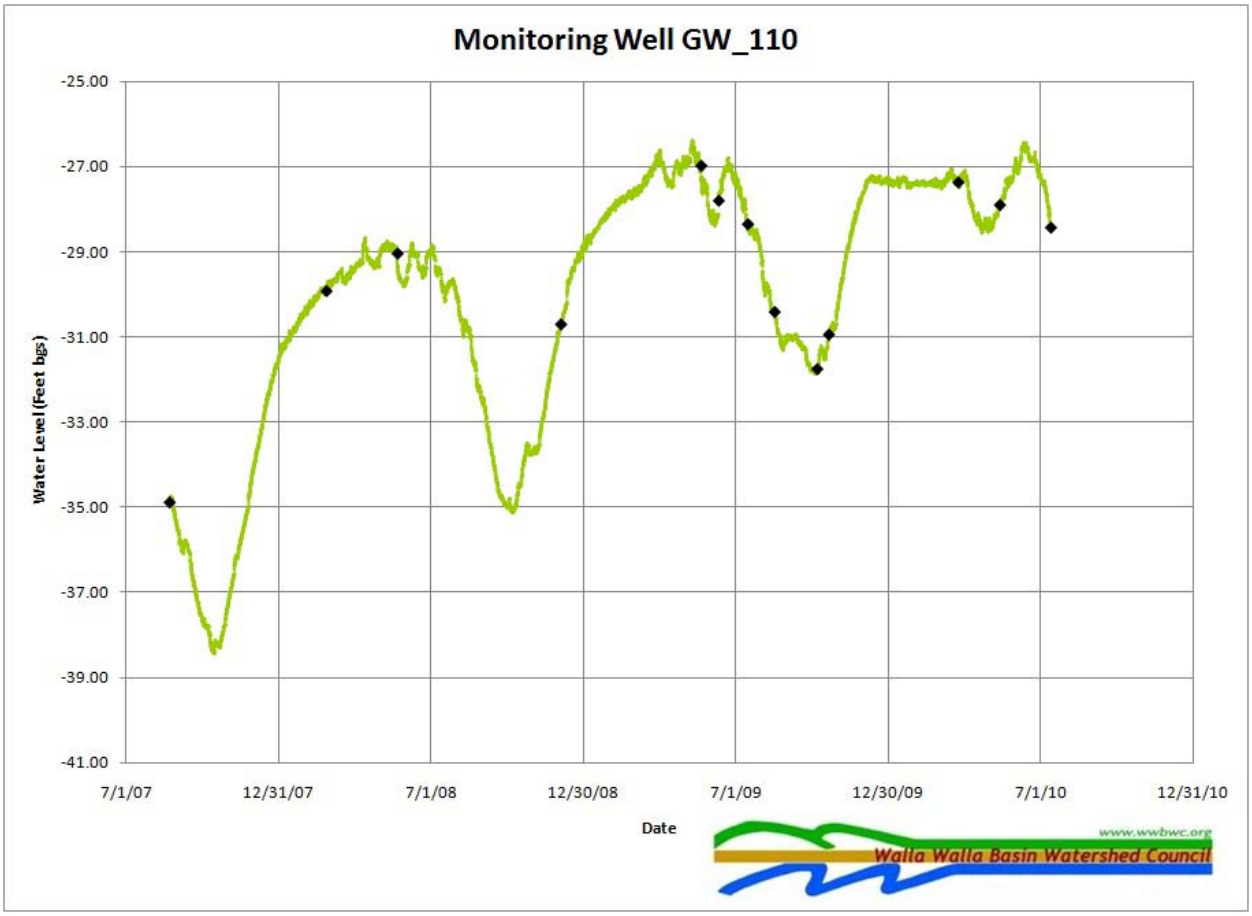
Monitoring Well GW_110
-25.00
-27.00
-29.00
-31.00
-33.00
-35.00
-37.00
-39.00
-41.00
Water Level (Feet bgs)
7/1/07
12/31/07
7/1/08
12/30/08
7/1/09
12/30/09
7/1/10
12/31/10
Date
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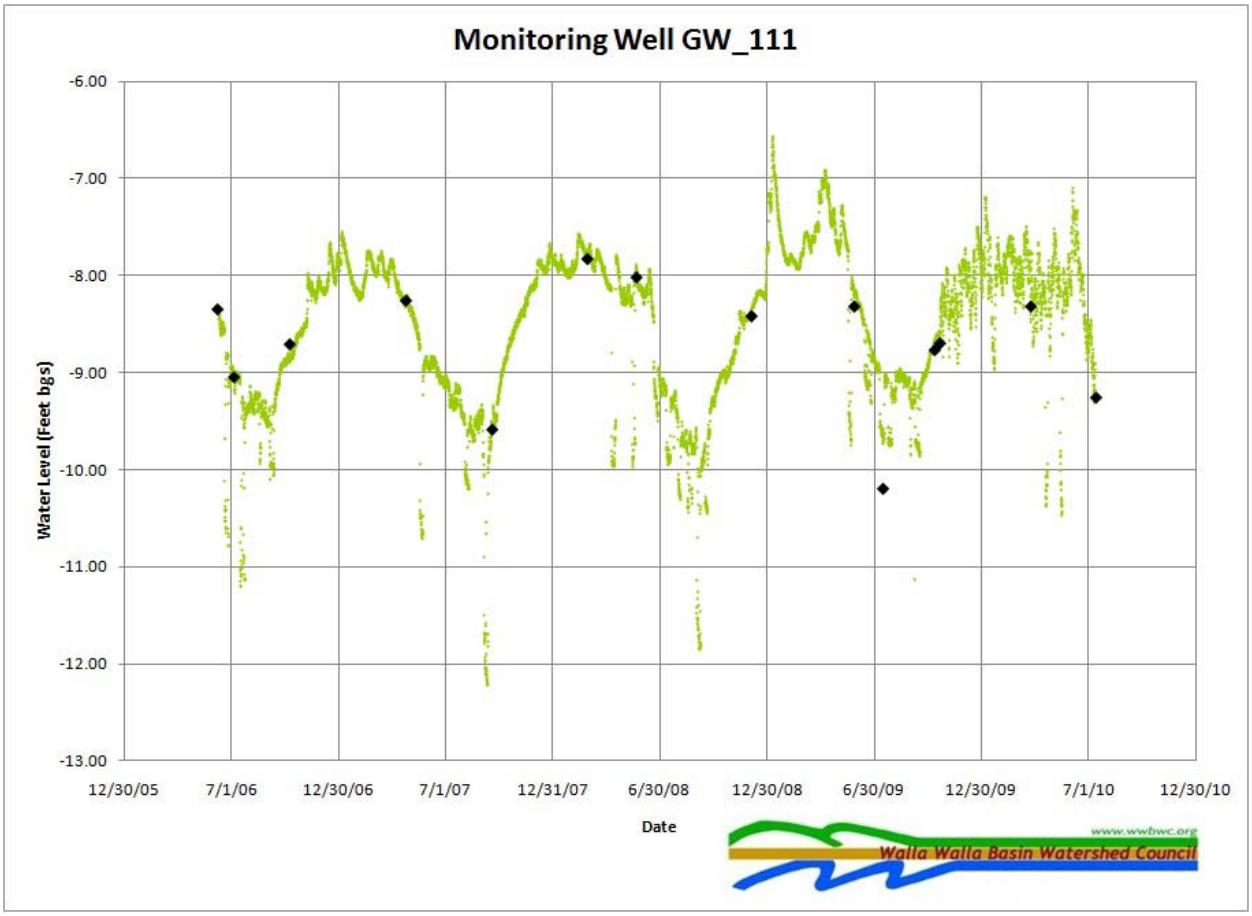
Monitoring Well GW_111
-6.00
-7.00
-8.00
-9.00
-10.00
-11.00
-12.00
-13.00
Water Level (Feet bgs)
12/30/05
7/1/06
12/30/06
7/1/07
12/31/07
6/30/08
12/30/08
6/30/09
12/30/09
7/1/10
12/30/10
Date
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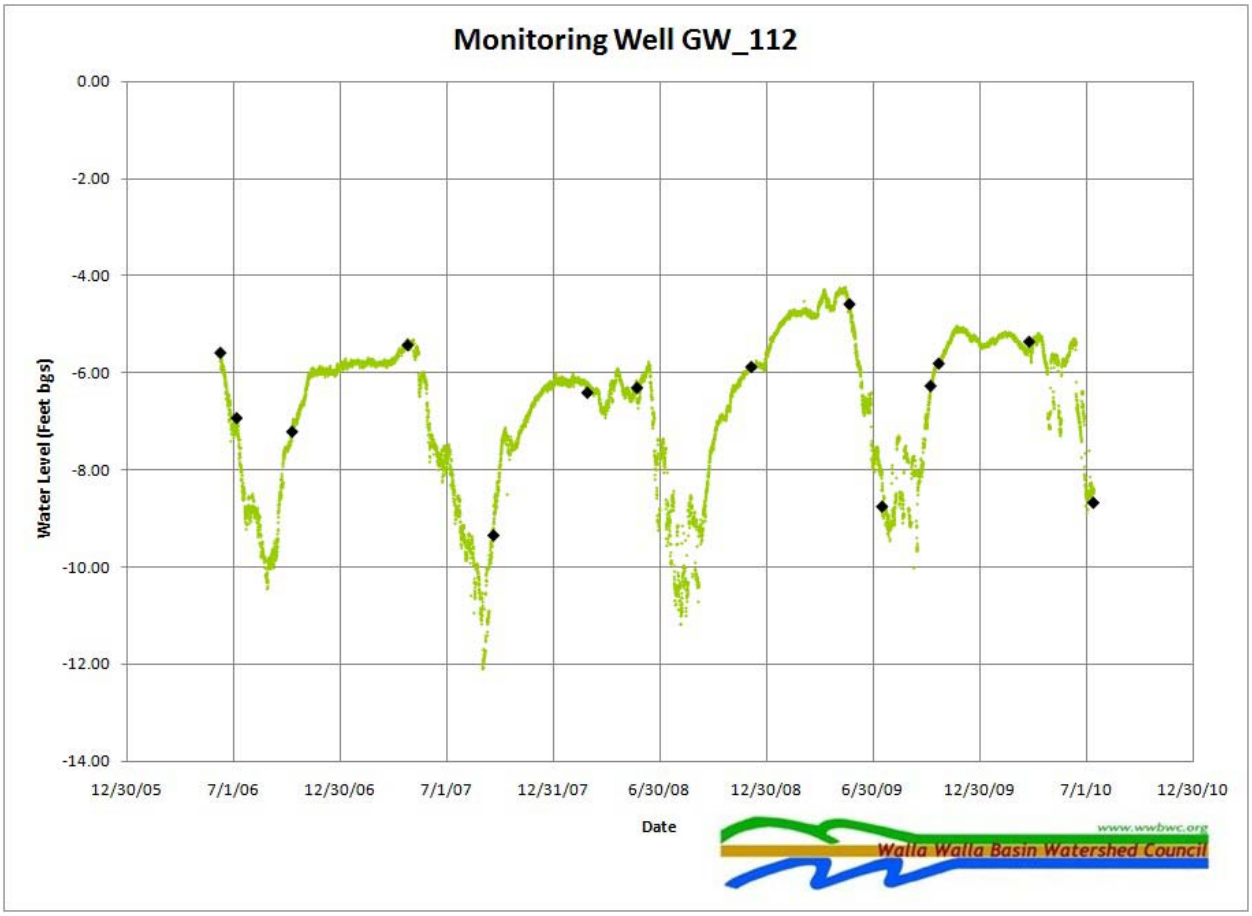
Monitoring Well GW_112
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
Water Level (Feet bgs)
12/30/05
7/1/06
12/30/06
7/1/07
12/31/07
6/30/08
12/30/08
6/30/09
12/30/09
7/1/10
12/30/10
Date
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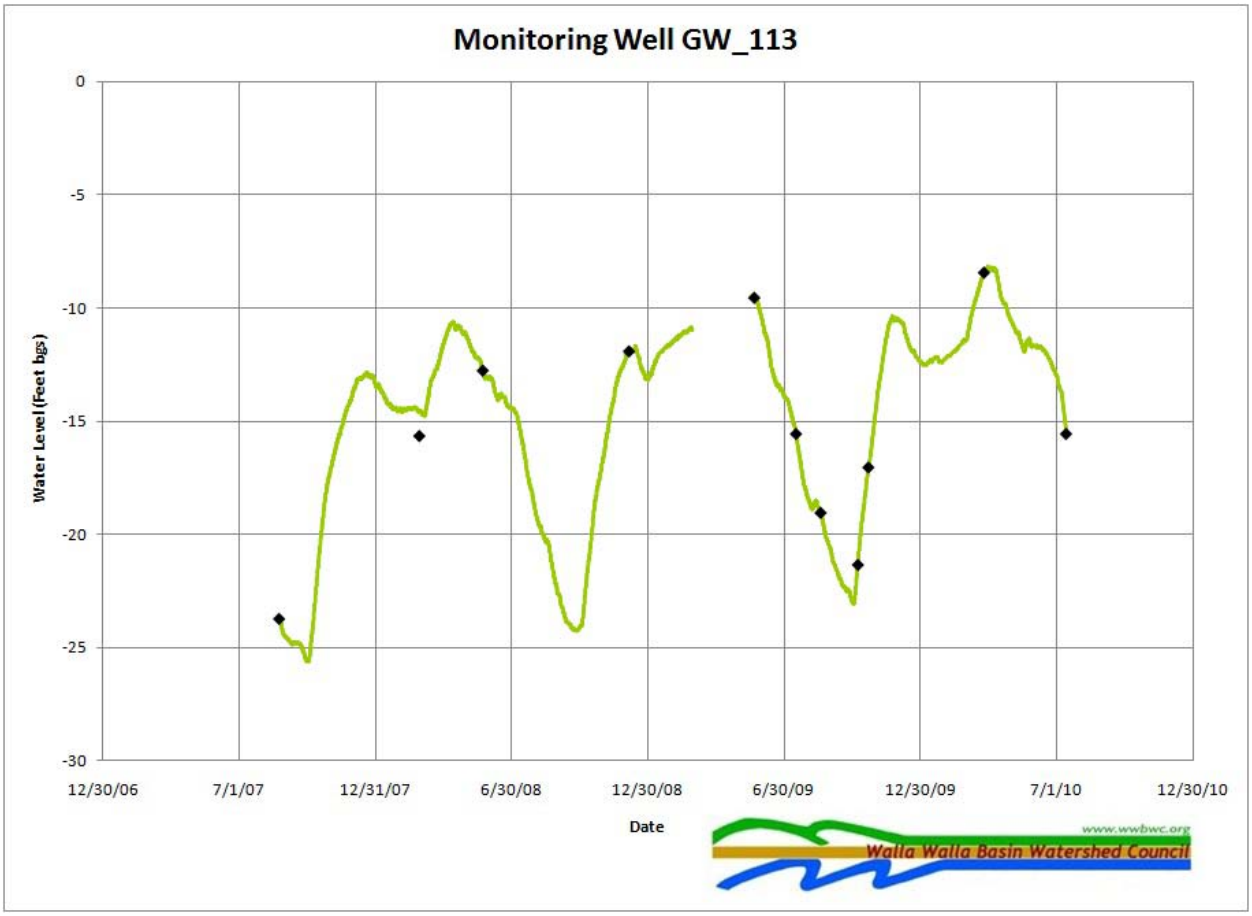
Monitoring Well GW_113
0
-5
-10
-15
-20
-25
-30
Water Level (Feet bgs)
12/30/06
7/1/07
12/31/07
6/30/08
12/30/08
6/30/09
12/30/09
7/1/10
12/30/10
Date
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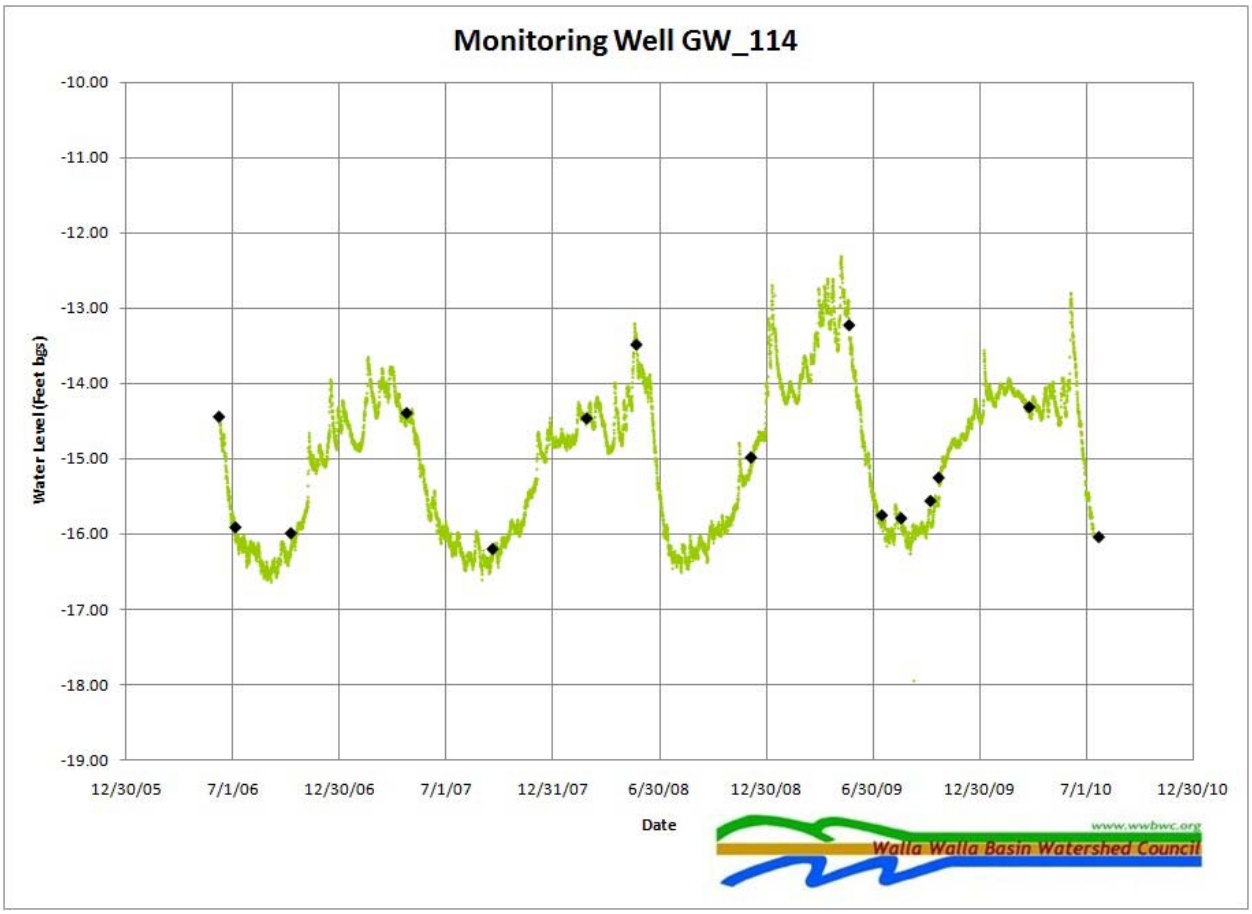
Monitoring Well GW_114
-10.00
-11.00
-12.00
-13.00
-14.00
-15.00
-16.00
-17.00
-18.00
-19.00
Water Level (Feet bgs)
12/30/05
7/1/06
12/30/06
7/1/07
12/31/07
6/30/08
12/30/08
6/30/09
12/30/09
7/1/10
12/30/10
Date
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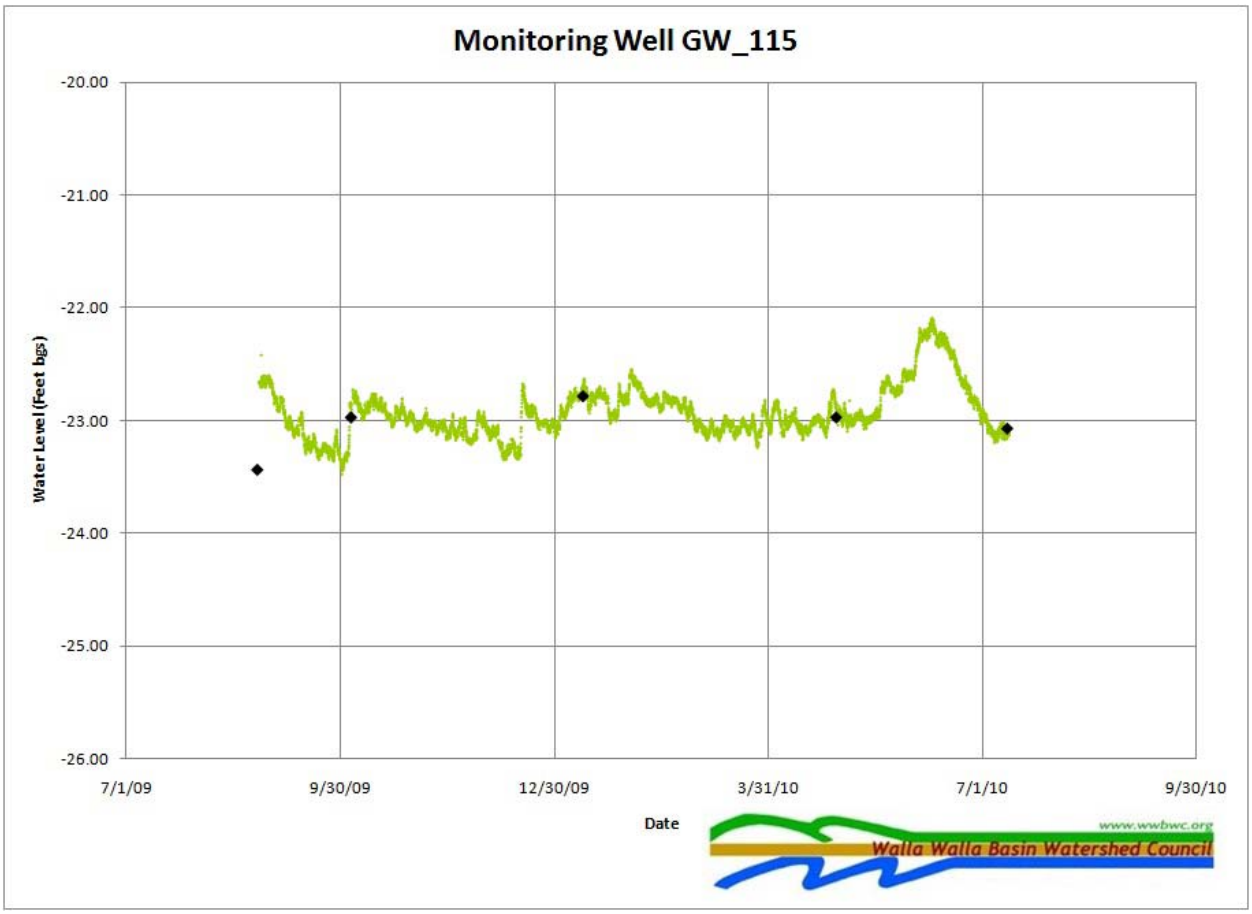
Monitoring Well GW_115
-20.00
-21.00
-22.00
-23.00
-24.00
-25.00
-26.00
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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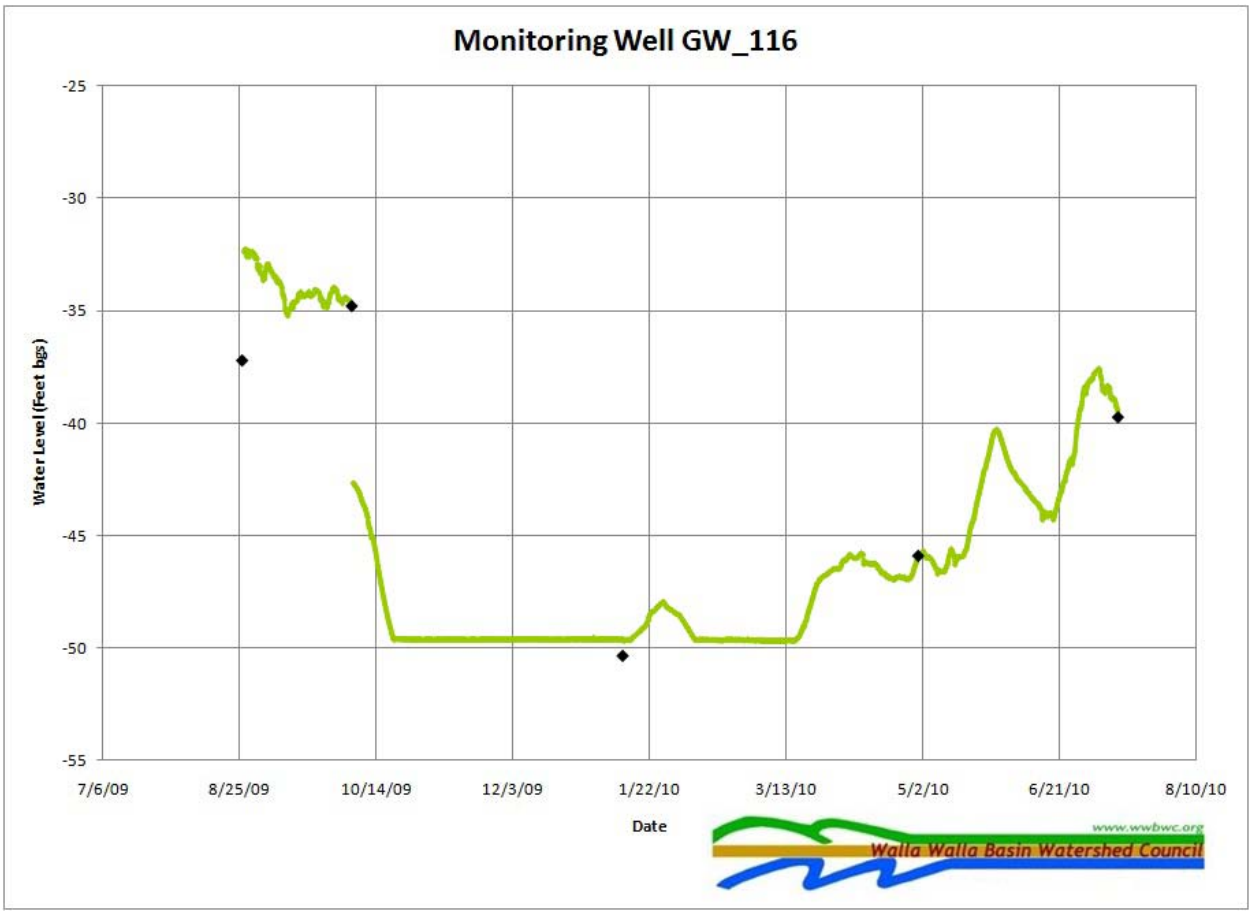
Monitoring Well GW_116
-25
-30
-35
-40
-45
-50
-55
Water Level (Feet bgs)
7/6/09
8/25/09
10/14/09
12/3/09
1/22/10
3/13/10
5/2/10
6/21/10
8/10/10
Date
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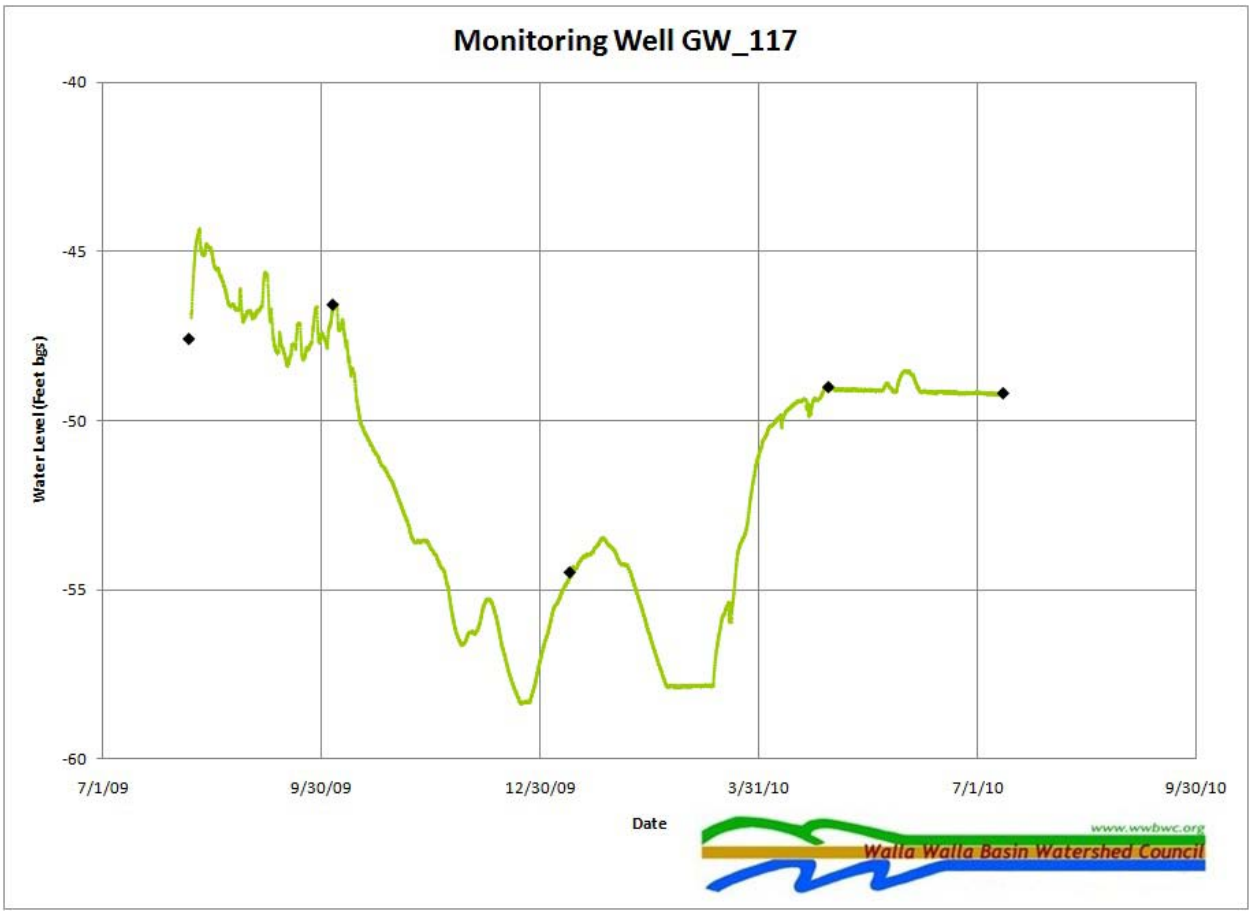
Monitoring Well GW_117
-40
-45
-50
-55
-60
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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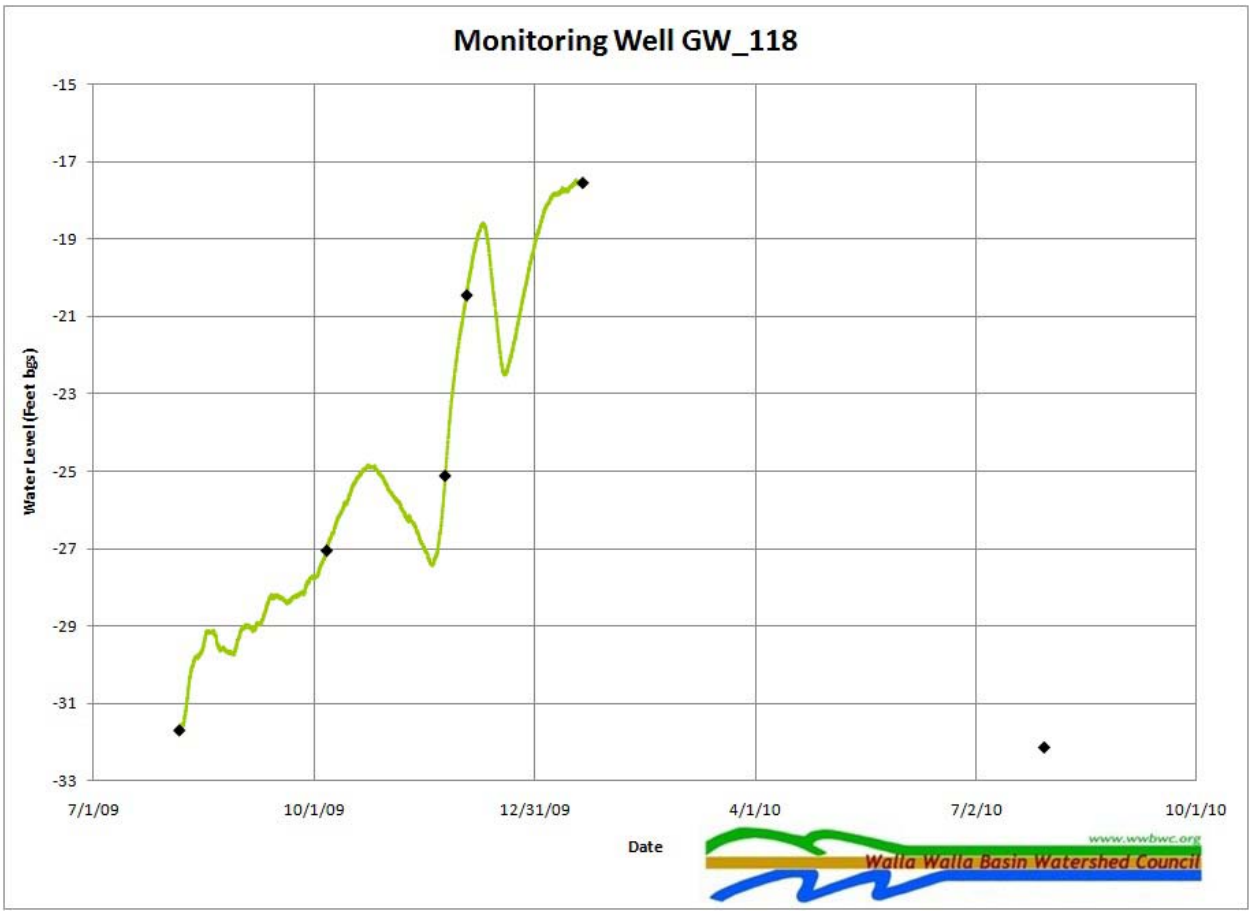
Monitoring Well GW_118
Water Level (Feet bgs)
-15
-17
-19
-21
-23
-25
-27
-29
-31
-33
7/1/09
10/1/09
12/31/09
4/1/10
7/2/10
10/1/10
Date
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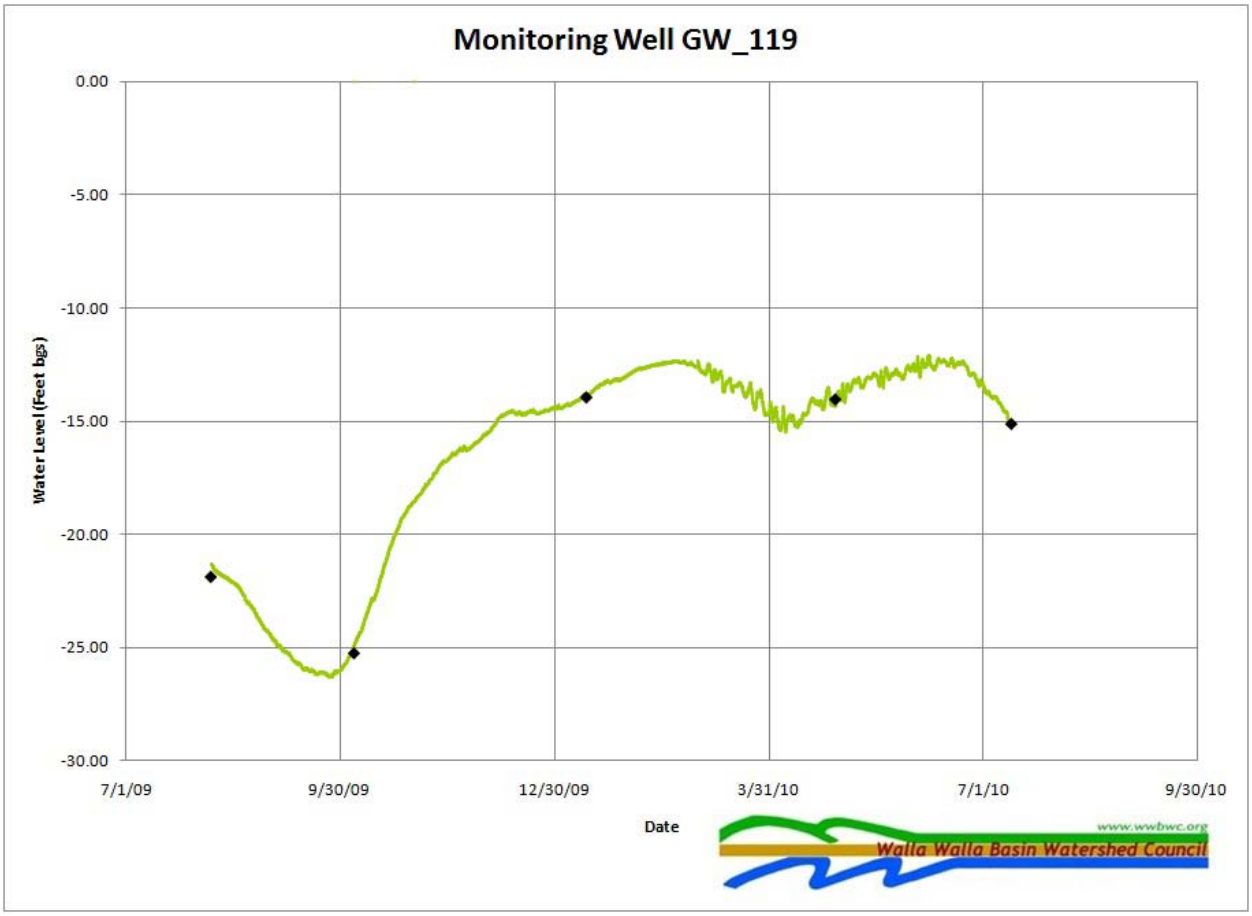
Monitoring Well GW_119
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
Water Lewel (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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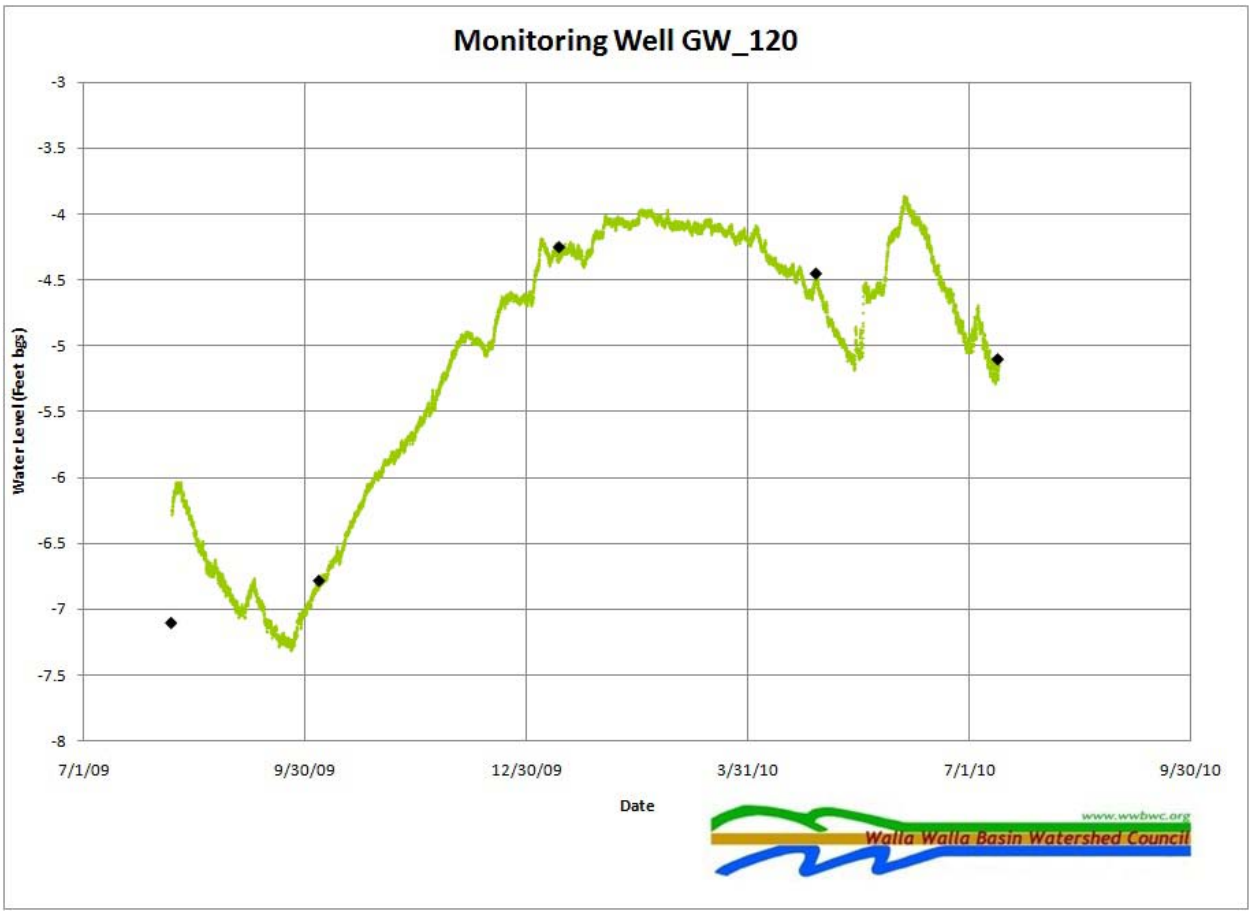
Monitoring Well GW_120
Water Level (Feet bgs)
-3
-3.5
-4
-4.5
-5
-5.5
-6
-6.5
-7
-7.5
-8
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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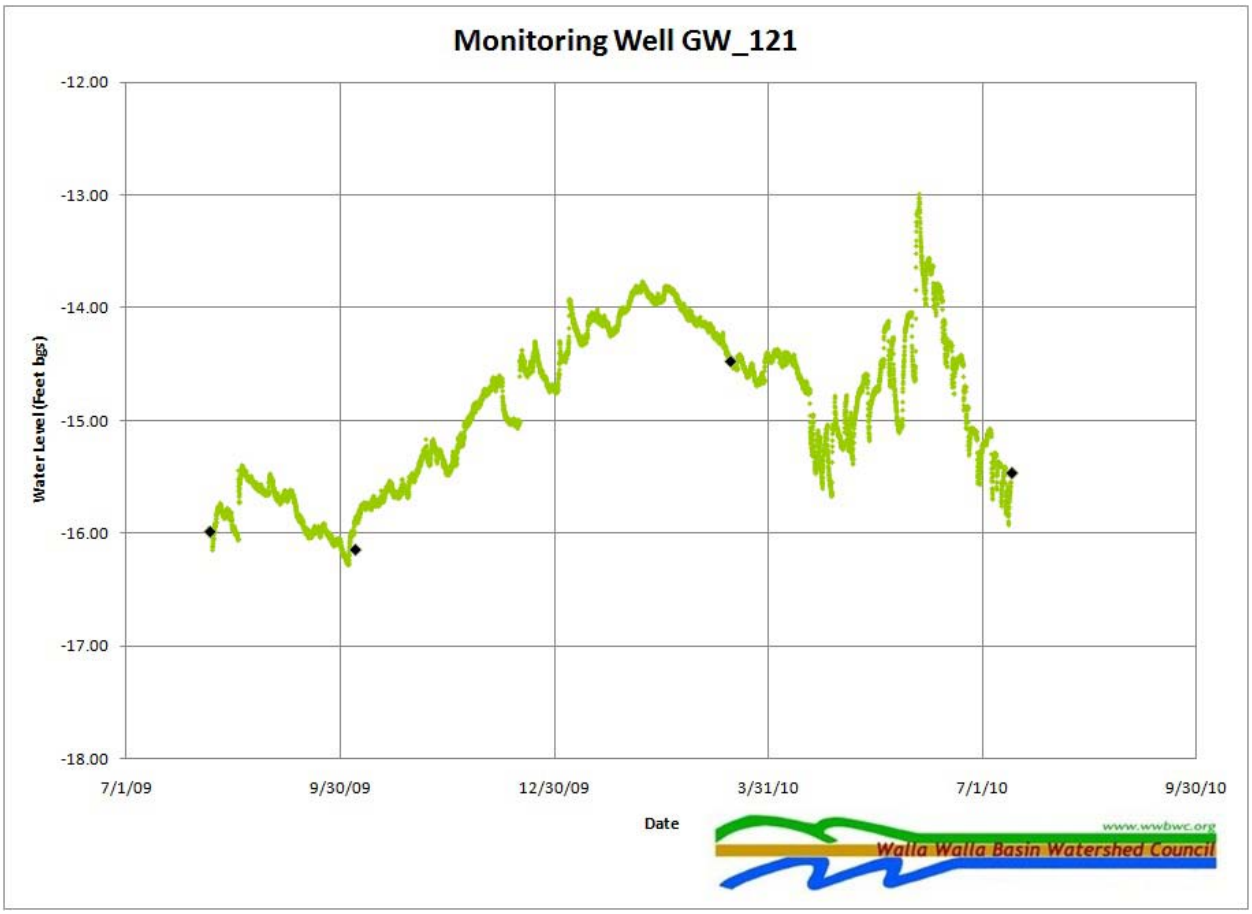
Monitoring Well GW_121
-12.00
-13.00
-14.00
-15.00
-16.00
-17.00
-18.00
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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Monitoring Well GW_122
-12.00
-13.00
-14.00
-15.00
-16.00
-17.00
-18.00
-19.00
-20.00
-21.00
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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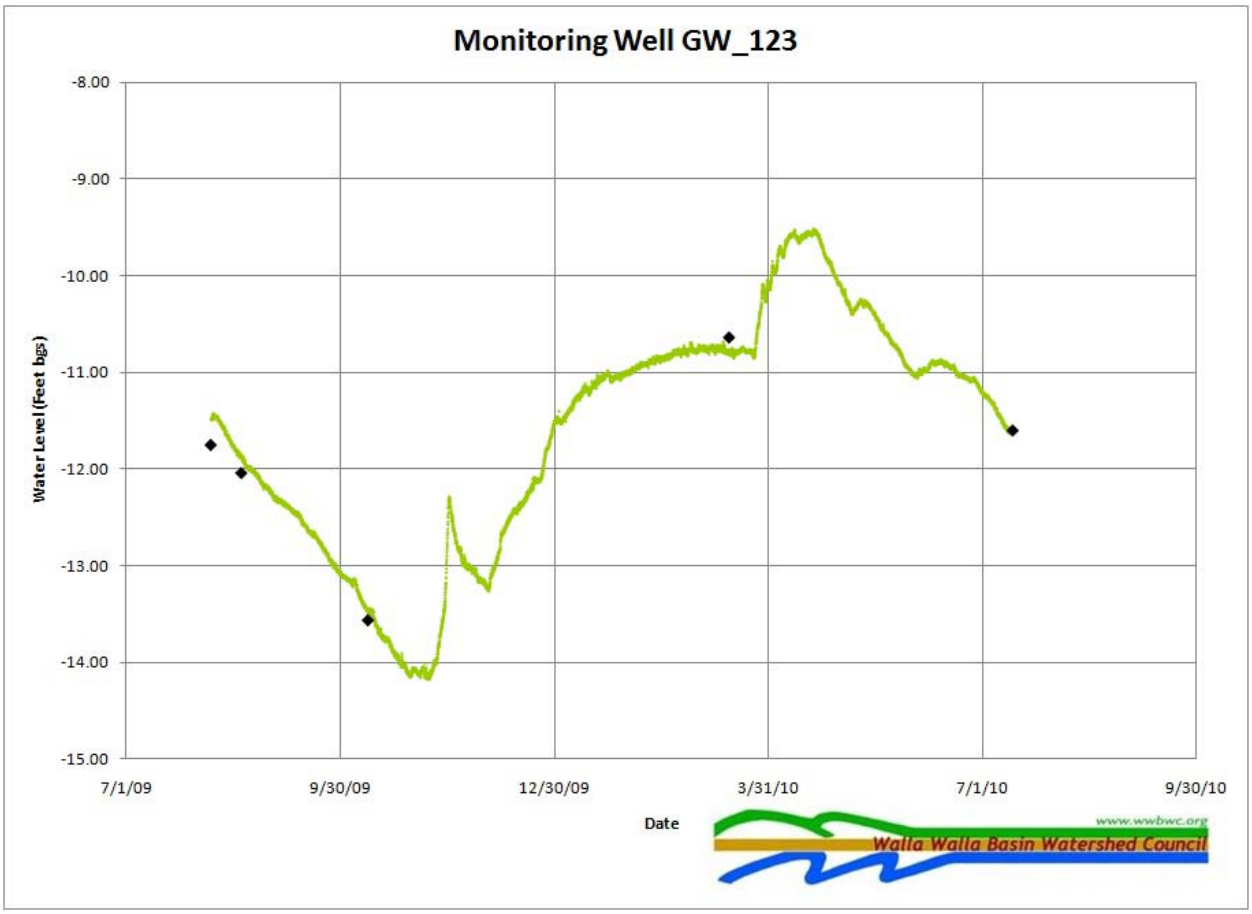
Monitoring Well GW_123
-8.00
-9.00
-10.00
-11.00
-12.00
-13.00
-14.00
-15.00
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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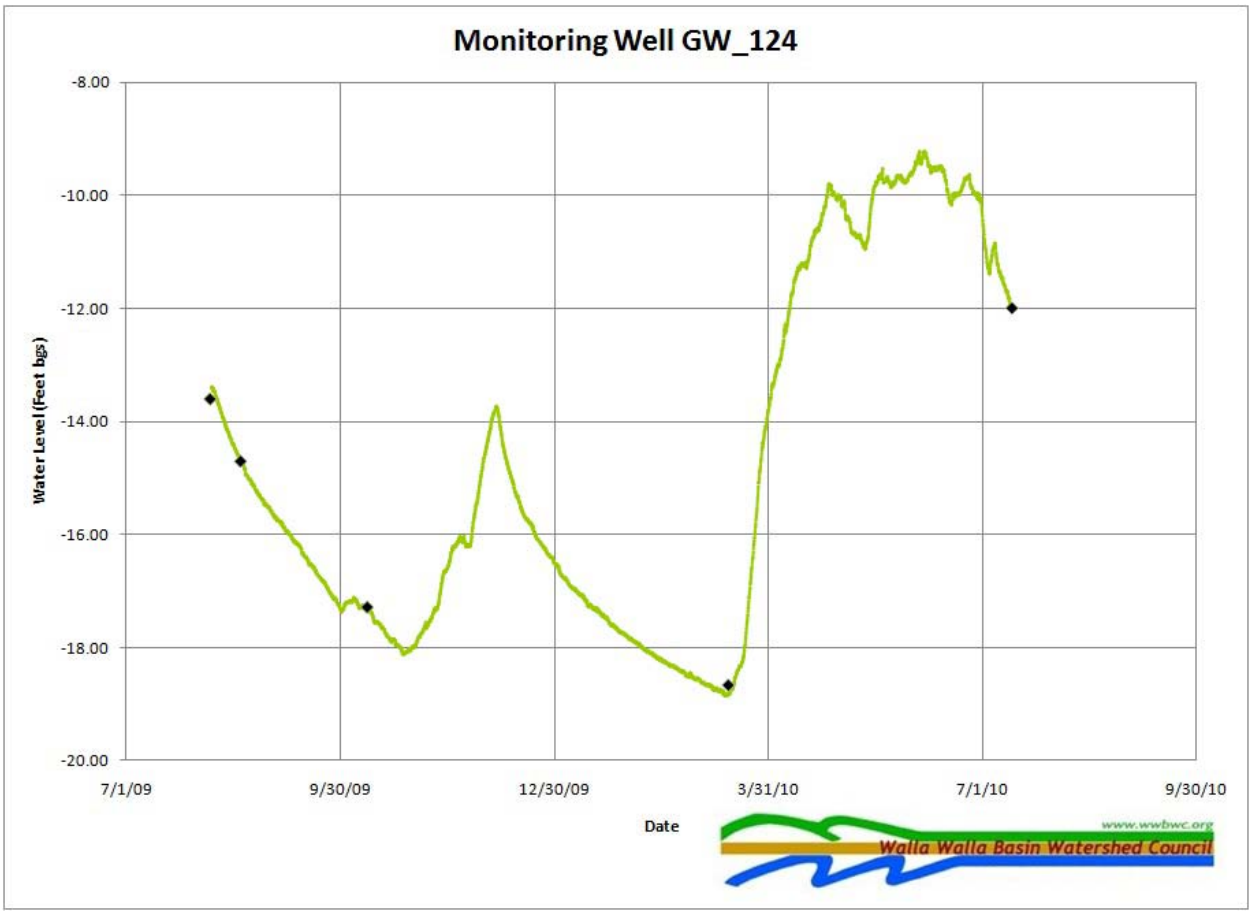
Monitoring Well GW_124
-8.00
-10.00
-12.00
-14.00
-16.00
-18.00
-20.00
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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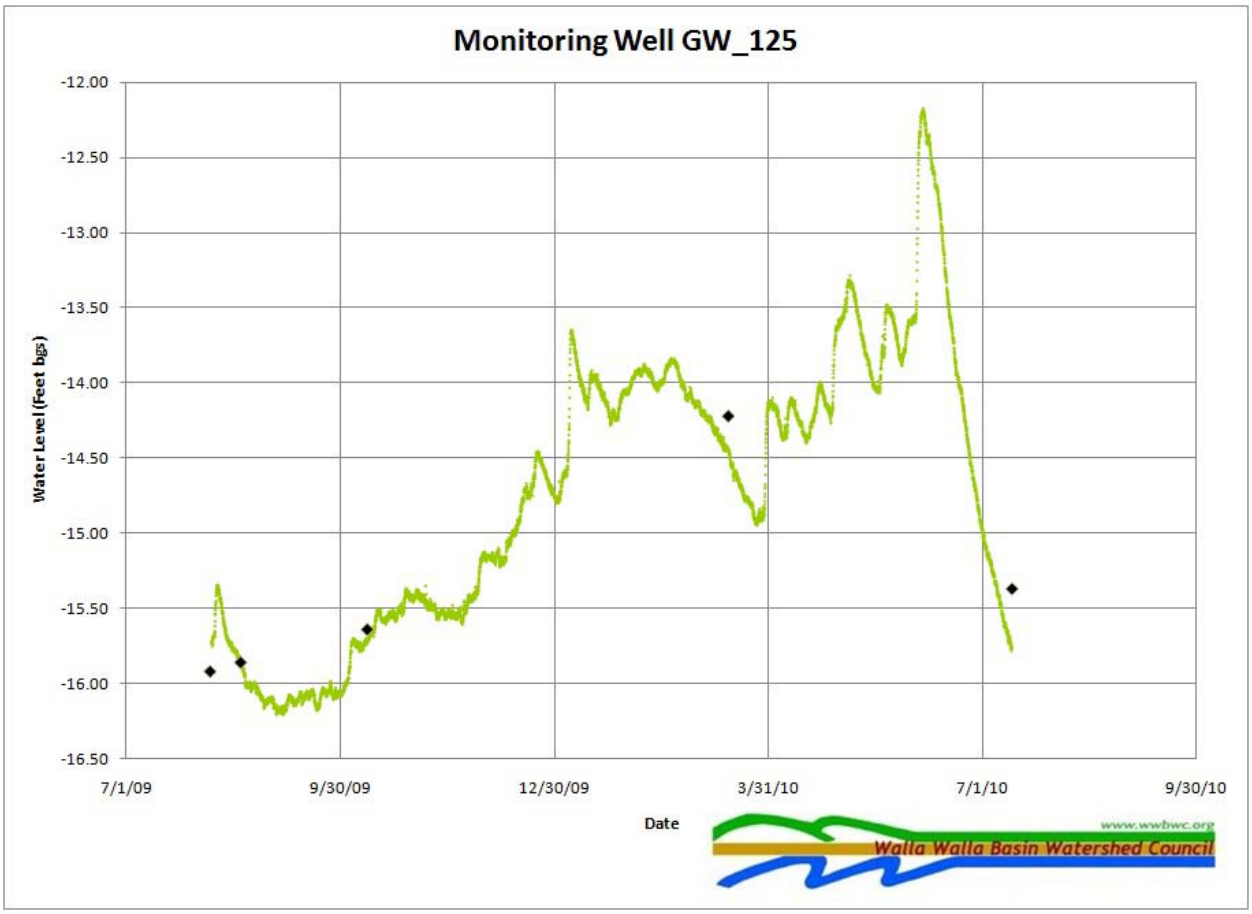
Monitoring Well GW_125
-12.00
-12.50
-13.00
-13.50
-14.00
-14.50
-15.00
-15.50
-16.00
-16.50
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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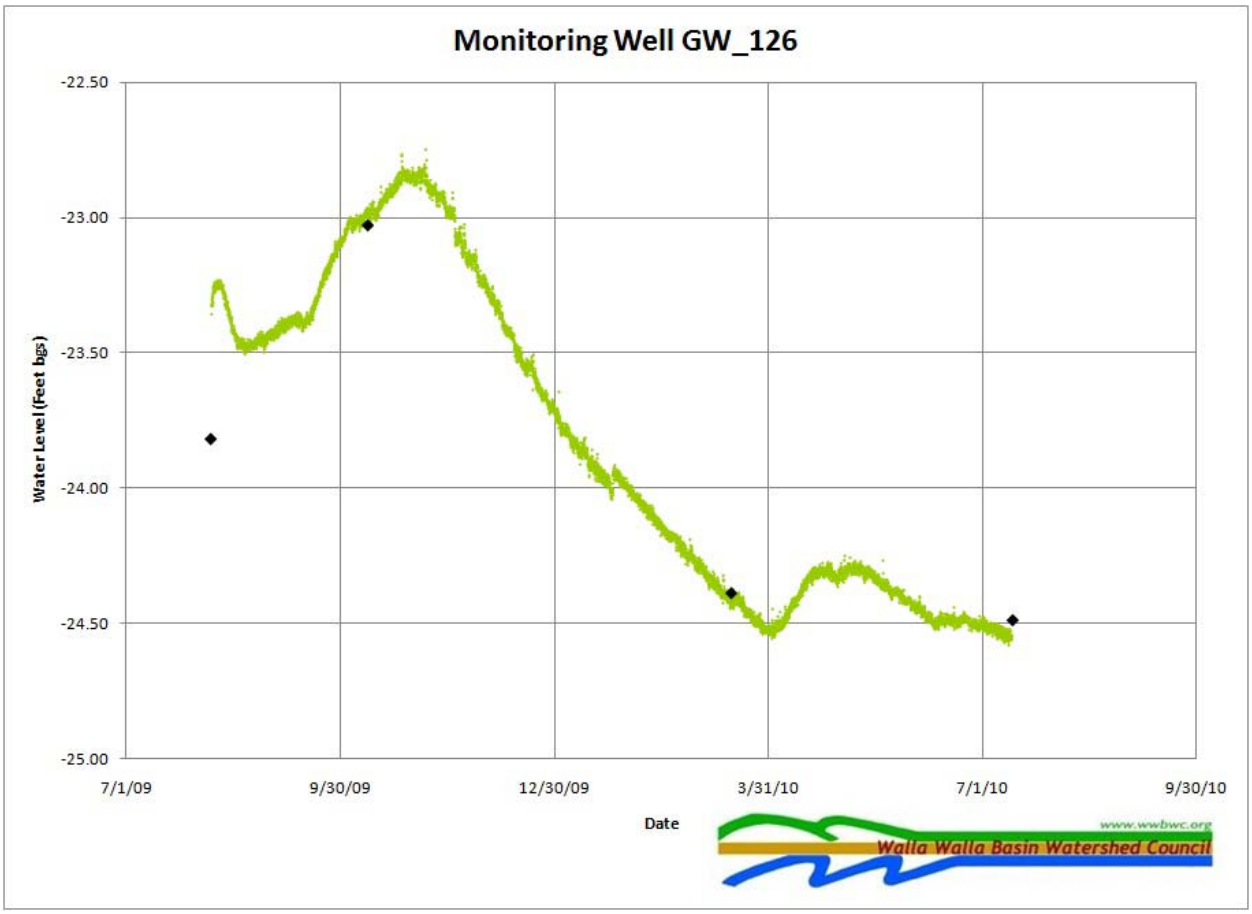
Monitoring Well GW_126
-22.50
-23.00
-23.50
-24.00
-24.50
-25.00
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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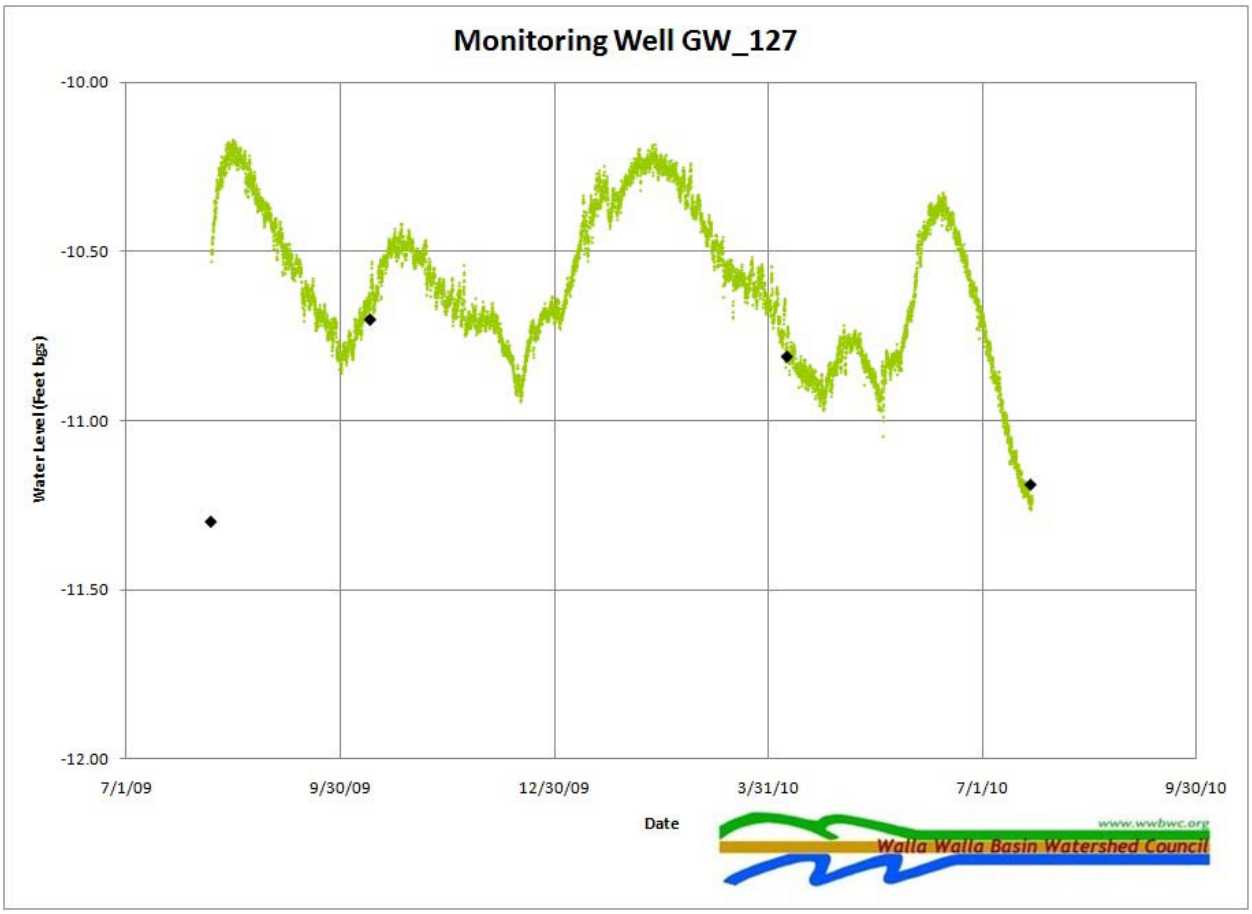
Monitoring Well GW_127
-10.00
-10.50
-11.00
-11.50
-12.00
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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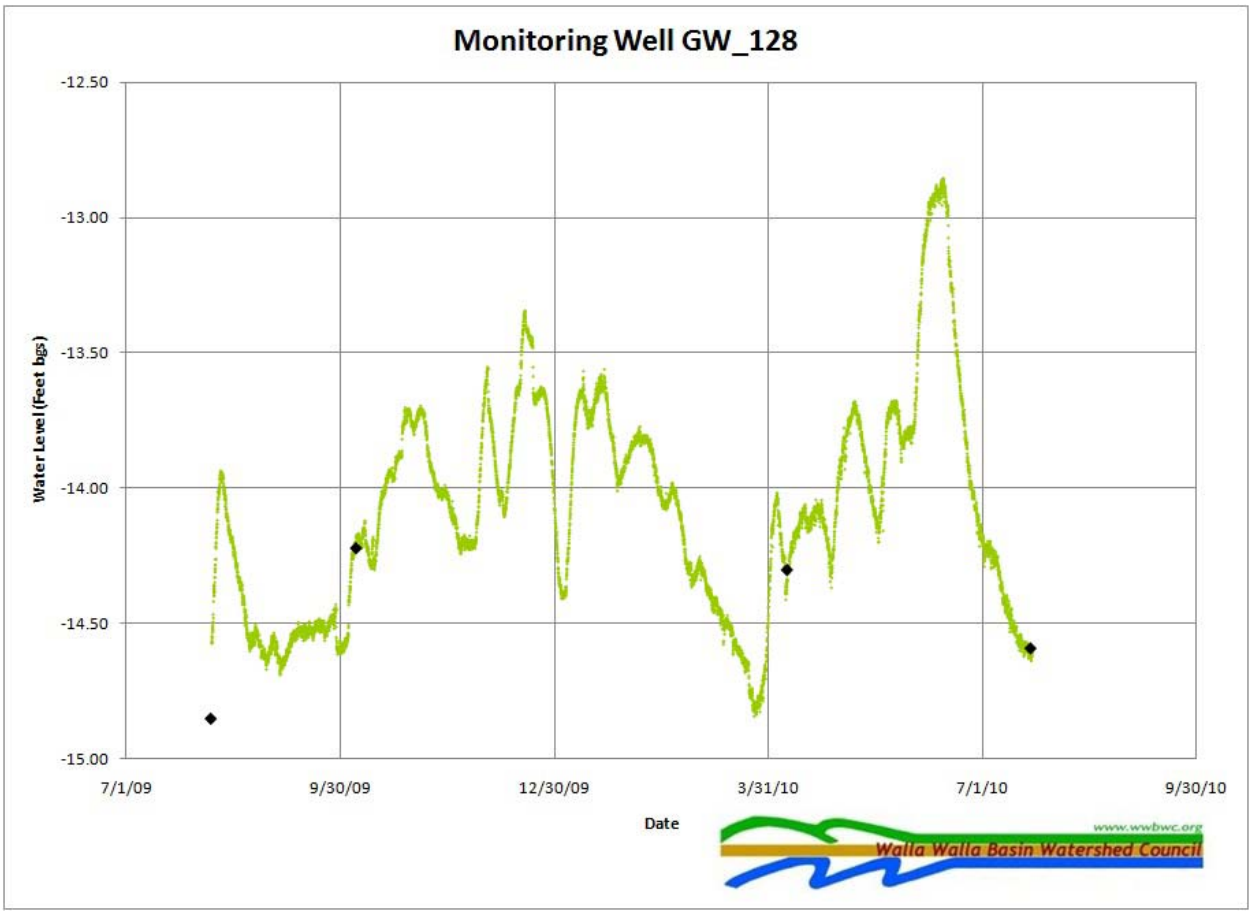
Monitoring Well GW_128
-12.50
-13.00
-13.50
-14.00
-14.50
-15.00
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
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Monitoring Well GW_129
-7.00
-8.00
-9.00
-10.00
-11.00
-12.00
-13.00
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
www.wwbwc.org
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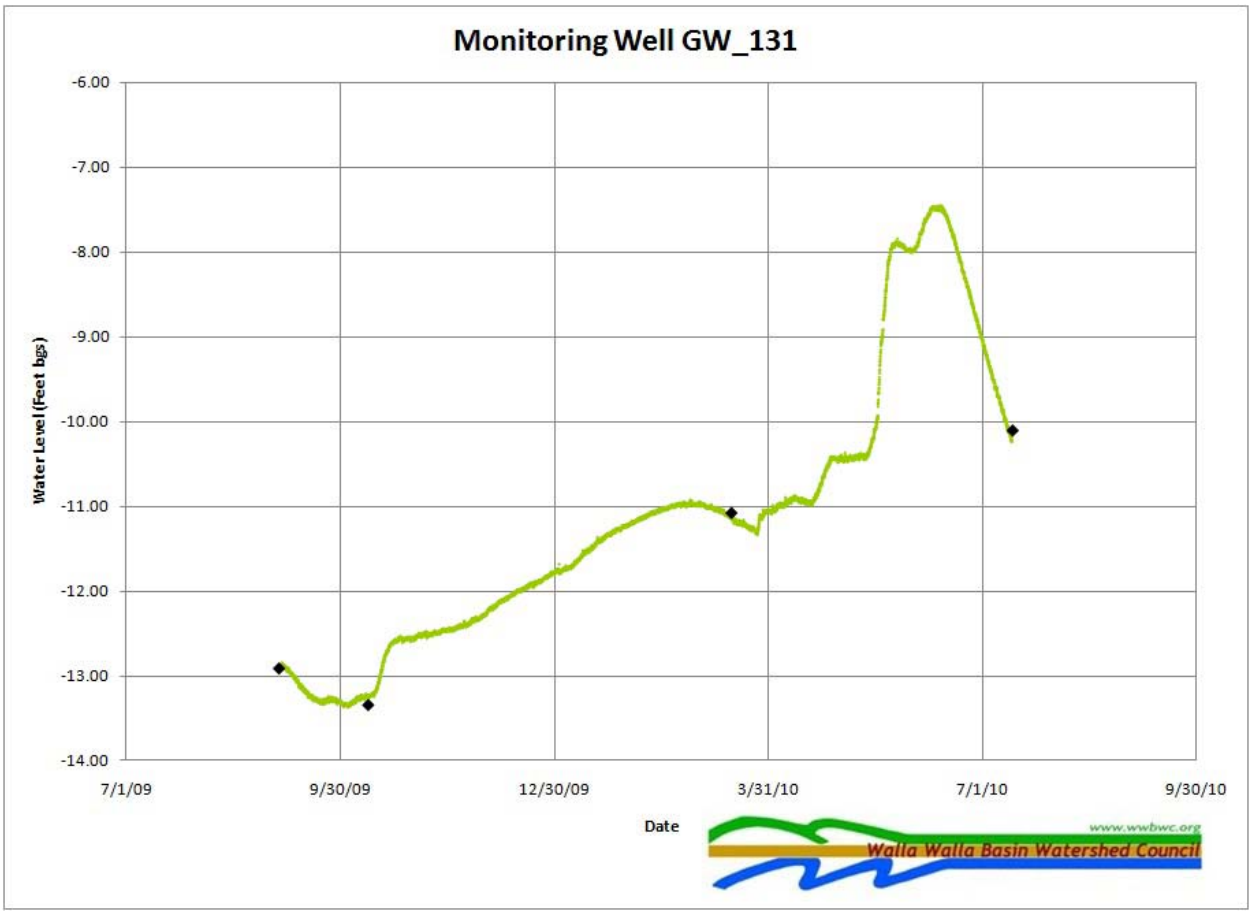
Monitoring Well GW_131
-6.00
-7.00
-8.00
-9.00
-10.00
-11.00
-12.00
-13.00
-14.00
Water Level (Feet bgs)
7/1/09
9/30/09
12/30/09
3/31/10
7/1/10
9/30/10
Date
www.wwbwc.org
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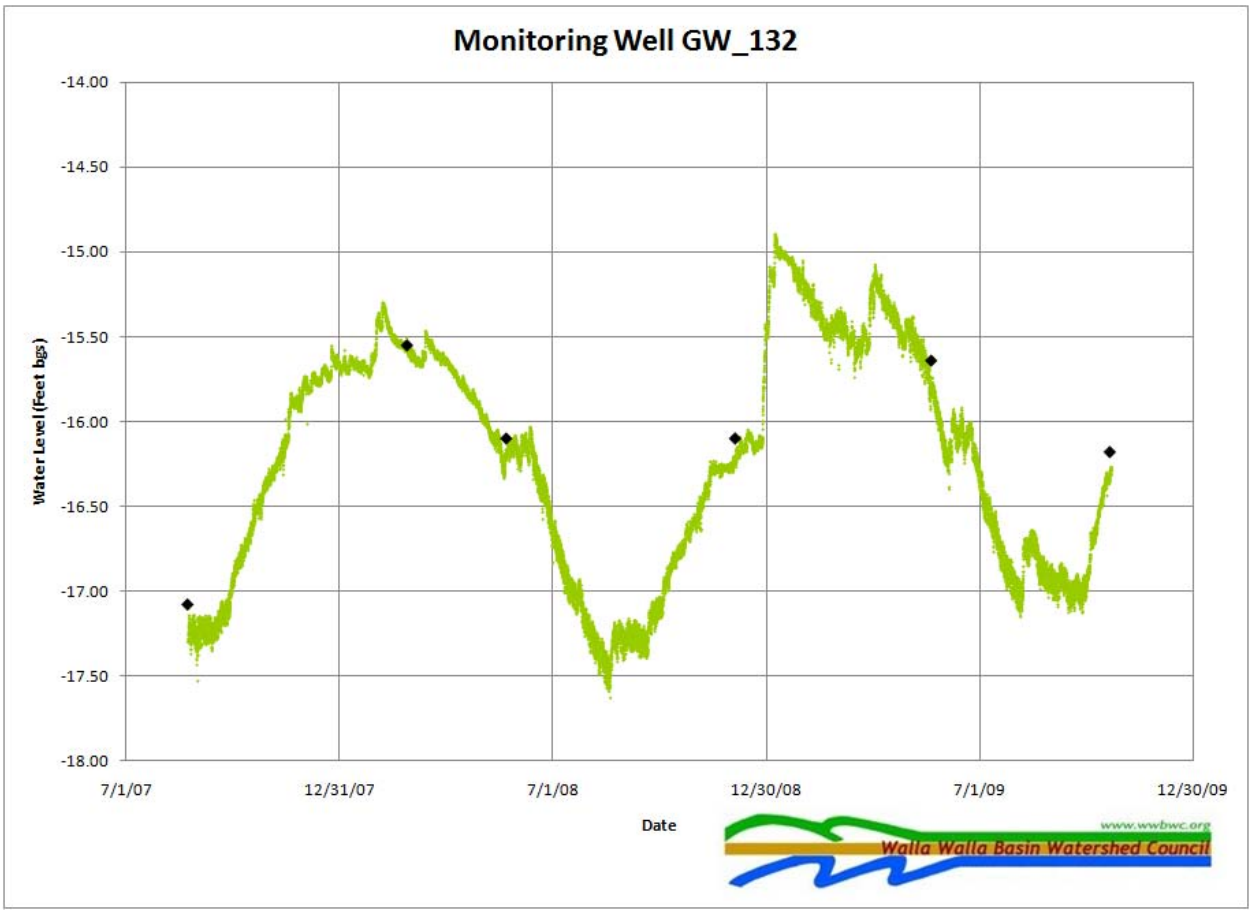
Monitoring Well GW_132
-14.00
-14.50
-15.00
-15.50
-16.00
-16.50
-17.00
-17.50
-18.00
Water Level (Feet bgs)
7/1/07
12/31/07
7/1/08
12/30/08
7/1/09
12/30/09
Date
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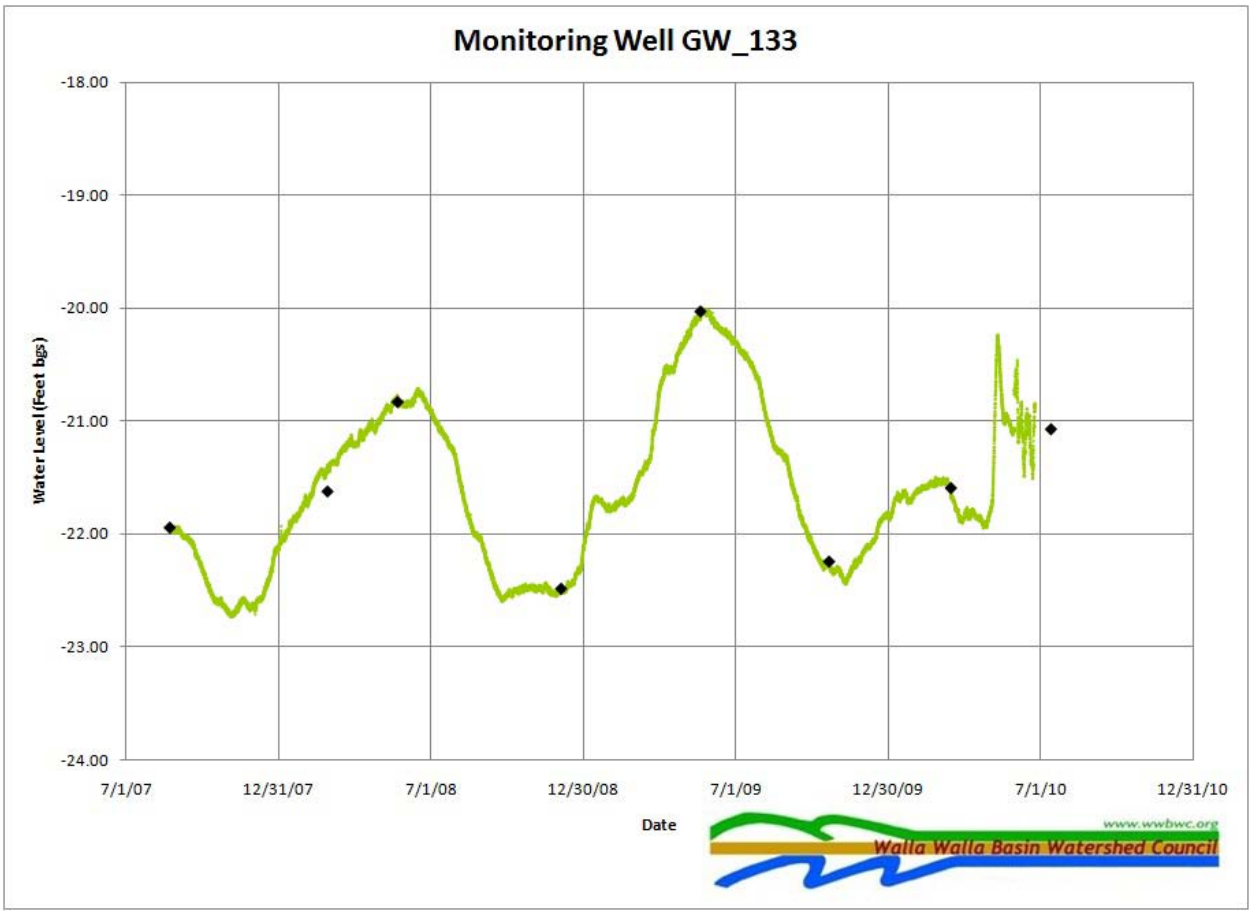
Monitoring Well GW_133
-18.00
-19.00
-20.00
-21.00
-22.00
-23.00
-24.00
Water Level (Feet bgs)
7/1/07
12/31/07
7/1/08
12/30/08
7/1/09
12/30/09
7/1/10
12/31/10
Date
www.wwbwc.org
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