Oregon
Kate Brown, Governor

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MEMORANDUM

TO: Water Resources Commission

FROM: Justin Iverson, Groundwater Section Manager

SUBJECT: Agenda Item D, August 25, 2021
Water Resources Commission Meeting

Critical Groundwater Area Three Year Review

I. Introduction

This is an informational overview of conditions in critical groundwater areas for Commission discussion as required in statute and rule.

II. Background

A critical groundwater area (CGWA) may be designated to address groundwater supply, quality, or thermal issues. A designation under ORS 537.730-742 allows the Commission to take corrective actions necessary to address groundwater issues, which may include reducing groundwater pumping under existing permitted or certificated rights. Oregon currently has seven existing critical groundwater areas (see Attachment 1) which were designated because of water supply issues. Table 1 on the next page summarizes Oregon's seven critical groundwater areas.

All seven critical groundwater areas in Oregon were designated by order of the State Engineer or Water Resources Director pursuant to the 1955 statute. Current statutes, codified in 1991, allow critical groundwater areas to be established by rule. The rules associated with several of these areas require periodic review of conditions to evaluate the effectiveness of the designation in achieving reasonably stable groundwater levels. ORS 537.780(3) also requires the periodic review of rules that result in restriction of existing groundwater rights.

Future potential groundwater uses in an area may also be managed by withdrawal (ORS 536.410) or classification (ORS 536.340). Groundwater areas designated under these administrative controls (see Attachment 1) are not addressed in this report.

Recommended Action 1.A. of the 2017 Integrated Water Resources Strategy (IWRS), calls for conducting additional groundwater investigations, including "evaluating groundwater administrative areas." The IWRS notes that evaluations could include a review of water-level trends, boundary accuracy, and whether designated areas are meeting the goals of groundwater stabilization, groundwater recovery, and protection of existing water users. This report focuses on water-level trends within critical groundwater areas.

Table 1: Summary of Critical Groundwater Areas in Oregon

Restricted Area & Effective Date	**Affected Aquifer or Formation**	**Allowable Uses**	**Other Limitations**	**Affected Area**	**Affected County**	**Source**
Cow Valley Nov. 12, 1959	Alluvial Aquifer and Underlying Volcanic Rocks and Sediments	Exempt Uses Only		33 sq. mi. (map)	Malheur	Special Order Vol.10 Pg 216
The Dalles Dec. 11, 1959	Columbia River Basalt	Exempt Uses Only		21 sq. mi. (map)	Wasco	Special Order Vol.10 Pg 247
Cooper - Bull Mtn. May 17, 1974	Columbia River Basalt	Exempt Uses Only	Domestic exemption on parcels larger than 10 acres	41 sq. mi. (map)	Washington	Special Order Vol.24 Pg 370
Ordnance Basalt April 2, 1976	Columbia River Basalt	Exempt Uses Only		175 sq. mi. (map)	Morrow Umatilla	Special Order Vol.27 Pg 40
Ordnance Gravel April 2, 1976	Alluvial Aquifer	Exempt Uses Only		82 sq. mi. (map)	Morrow Umatilla	Special Order Vol.27 Pg 40
Butter Creek Jan. 27, 1986	Columbia River Basalt	Exempt Uses Only	Annual Allocation to "Sustainable Annual Yield"	274 sq. mi. (map)	Morrow Umatilla	Special Order Vol.40 Pg 1
Stage Gulch May 15, 1991	Columbia River Basalt	Exempt Uses Only	Annual Allocation to "Sustainable Annual Yield"	183 sq. mi. (map)	Umatilla	Special Order Vol.45 Pg 278

III. Discussion

<u>Water Rights Largely Remain Valid</u>

In all seven critical groundwater areas (CGWAs), while pumping has generally declined since designation, the number of valid groundwater rights remains near the same level that resulted in the original supply concerns and have the potential to be exercised directly or by transfer in the future should the critical area status be altered. Many of these rights are not fully exercised for voluntary reasons, which may include changes in land use, implementation of conservation measures, or development of new supplies. Many junior rights in the Butter Creek and Stage Gulch CGWAs do not receive an annual allocations of limited supplies under the current critical area rules, and the duty of some municipal rights in the Cooper-Bull Mountain area were curtailed by the special order designating that critical area.

Water Level Responses Vary After CGWA Designation
The Cow Valley CGWA (see Attachment 1) in the Malheur Basin was the first CGWA designated in the state. Groundwater levels in this CGWA recovered between the 1980s and early 1990s but have declined since that time in response to a dryer climate cycle and increased use under existing rights.

Groundwater levels in two of the oldest CGWAs, The Dalles (see Attachment 1) and Cooper-Bull Mountain (see Attachment 1), have recovered in response to reduced pumping and the development of alternate surface water supplies. In Cooper-Bull Mountain, aquifer storage and recovery (ASR) projects have also supported water level recovery. Similarly, groundwater levels in the Ordnance Gravel CGWA (see Attachment 1) have stabilized with the implementation of the County Line aquifer recharge (AR) project.

Groundwater level declines have generally continued, albeit generally at a slower rate, in the three Columbia River Basalt CGWA's in the Umatilla Basin; Ordnance Basalt, (see Attachment 1); Butter Creek (see Attachment 1); and Stage Gulch (see Attachment 1). Allowed annual groundwater pumping is a fraction of that permitted under the existing water rights for these areas, controlled by an annual allocation process defined in the Umatilla Basin Rules (OAR 690-507). Considerable staff effort is expended each year on the groundwater monitoring and allocation process for the Butter Creek and Stage Gulch critical areas. Two irrigators have developed agricultural ASR projects in the Butter Creek CGWA to support operation of their farms, while others have investigated the potential for an ASR project and found it to be infeasible.

IV. Summary

Critical groundwater area provisions for maintaining or achieving reasonably stable groundwater levels have been more effective in some areas than others. In some areas, reductions in groundwater use coupled with a transition to alternate surface water supplies and in some cases artificial groundwater recharge have led to water level recovery or stabilization. In other areas, declines continue in spite of pumping curtailments. Given this, existing CGWA controls should be maintained, and controls in areas where groundwater levels continue to decline should be re-evaluated as resources allow.

Attachment 1:

- Map of Groundwater Restricted Areas in Oregon
- Cow Valley Critical Groundwater Area Summary, Map, and Hydrograph
- The Dalles Critical Groundwater Area Summary, Map, and Hydrograph
- Cooper-Bull Mtn. Critical Groundwater Area Summary, Map, and Hydrograph
- Ordnance Basalt Critical Groundwater Area Summary, Map, and Hydrograph
- Ordnance Gravel Critical Groundwater Area Summary, Map, and Hydrographs
- Butter Creek Critical Groundwater Area Summary, Map, and Hydrographs
- Stage Gulch Critical Groundwater Area Summary, Map, and Hydrographs

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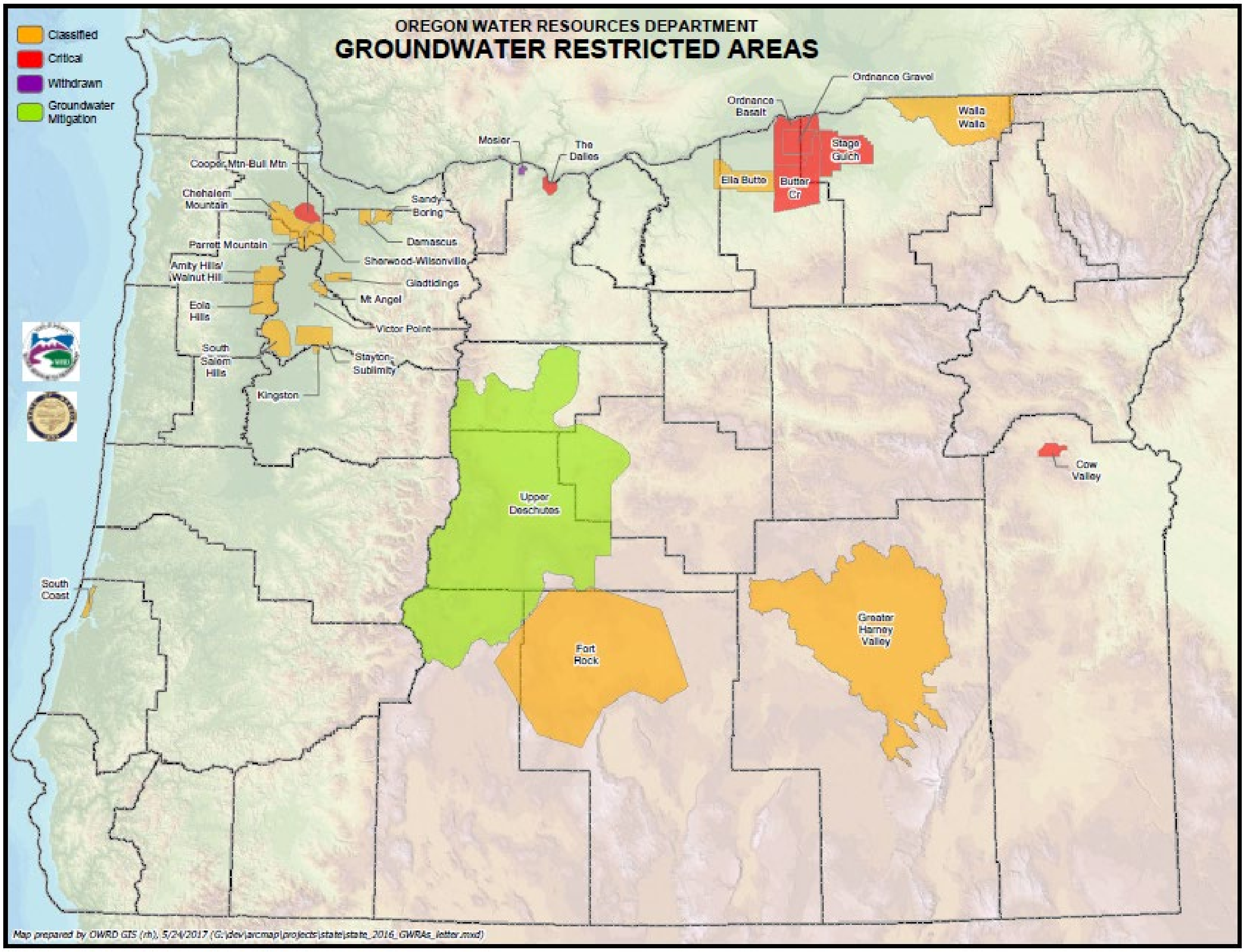
Map of Groundwater Restricted Areas in Oregon (CGWAs Indicated in Red)



Cow Valley Critical Groundwater Area, Malheur County

Control Instrument: Order of the State Engineer, November 12, 1959 (Vol. 10, pg. 216)

Reasons for Critical Groundwater Area Declaration: Groundwater level declines in the alluvial aquifer; overdrawn groundwater supply; need to protect existing groundwater rights

Area: ~50 sq. miles

Controlled Aquifer: The Cow Valley Ground Water Reservoir, including all water bearing zones in the alluvial deposits and the underlying volcanic rocks and sediments

Summary of Original Critical Area Control by Order of the State Engineer:

- Closed to further appropriation of groundwater
- Permit applications will not be accepted
- Pending permit applications were rejected
- Watermaster regulates use to those allowed by permit or certificate
- Unlawful diversions ceased
- Totalizing meters and record of withdrawal required for each non-exempt well
- State engineer makes an annual evaluation of the groundwater supply

Current Administration of Area:

- No new permits are issued
- Water levels and water use (through power meter readings) are tracked

Description:

Cow Valley is a small, east-west trending upland valley at the southern end of the Blue Mountain exposure in the Willow Creek arm of the Malheur River basin. The structural basement of the valley was formed by normal block faulting that controls many of the drainages in the area. The basement of Cow Valley is largely composed of metamorphosed sedimentary and igneous rocks, which are uncomfortably overlain by younger lava flows and pyroclastic deposits of Miocene age. The bulk of the valley fill near the surface is composed of coalescing alluvial fan, fluvial, and epiclastic deposits that either interfinger with volcanic units or are possibly juxtaposed by normal faulting beneath Cow Valley. Cow Valley is drained by Cow Creek, which seldom flows through the entire valley (Hartford, 1988). When flowing, Cow Creek exits Cow Valley at an elevation of about 3845’ AMSL through an earthen dam structure (Pence Dam) in the northeast corner of the valley. This feature may reduce the rate of storage loss as groundwater elevations decline and the hydraulic gradient toward Pence Dam is flattened.

Prior to 1950, the valley floor was used mainly for grazing, with the first irrigation well drilled in 1949. Based on the success of this well, several additional wells were soon drilled, and 14 irrigation wells were in use by the 1958 irrigation season. In 1954, the groundwater branch of the U.S. Geological Survey worked in cooperation with the Oregon State Engineer’s office to investigate groundwater level declines in Cow Valley. This investigation produced the report “The Ground Water Resources of Cow Valley near Ironside, Malheur County, Oregon” by S.G. Brown and R.C. Newcomb in 1956. Cow Valley was designated as a Critical Groundwater Area in 1959, the first in the state, only 10 years after development had begun.

Currently, there are 758 acres permitted for primary groundwater irrigation in Cow Valley with a maximum duty of 5274 acre feet per year.

MALH 74 (State Observation Well 561) is routinely measured three times per year by the local watermaster and comprises the only continuous long-term record of groundwater elevation in Cow Valley (Figure 1). The current historic low groundwater elevations may be due, in part, to increased use observed since about 2010 (Figure 2). However, recent declines are likely exacerbated by an ongoing drought following a wet climate cycle in the mid-1980s that resulted in a corresponding groundwater elevation rise.

Evidence for a single aquifer system is observed when comparing water level elevations in three Cow Valley wells (MALH 74, MALH 64, and MALH 72) that penetrate only alluvium, both alluvium and volcanic rock, and a combination of alluvium, volcanic rock, and older Mesozoic metasedimentary rocks, respectively (Figure 3). The close correspondence of water level elevations between wells and elevation changes over time illustrates that despite lithology encountered, there appears to be a single aquifer system underlying Cow Valley. Other nearby wells have been dropped from the observation net over the years, as their trends were substantially similar to MALH 74, which is now cited as representative of the single Cow Valley aquifer. In November of 2015, a water level recorder was installed in MALH 74 to better evaluate the timing and magnitude of groundwater elevation changes in the aquifer (Figure 4).

In 2015, the Department received a complaint from two exempt groundwater users in Cow Valley, citing groundwater declines forcing them to lower pumps in some wells. Their claim is that groundwater appropriation from permitted wells within the valley has increased significantly, particularly from wells producing from the shallow alluvial aquifer, resulting in undue interference with their exempt livestock wells. Exempt use wells within Cow Valley are junior to all permitted uses (Table 1), in addition to being comparatively shallow (Table 2). Given these facts, exempt users will likely need to deepen wells that do not fully penetrate the single Cow Valley aquifer system.

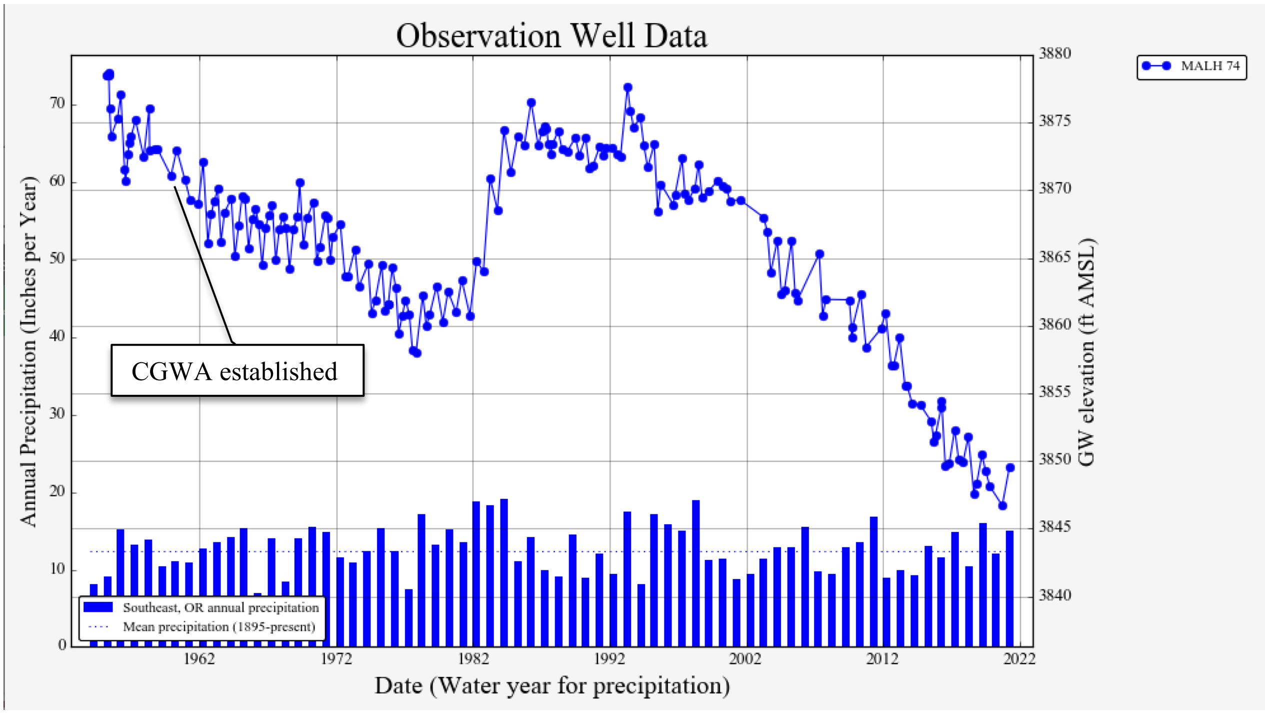


Figure 1. Representative hydrograph for Cow Valley CGWA

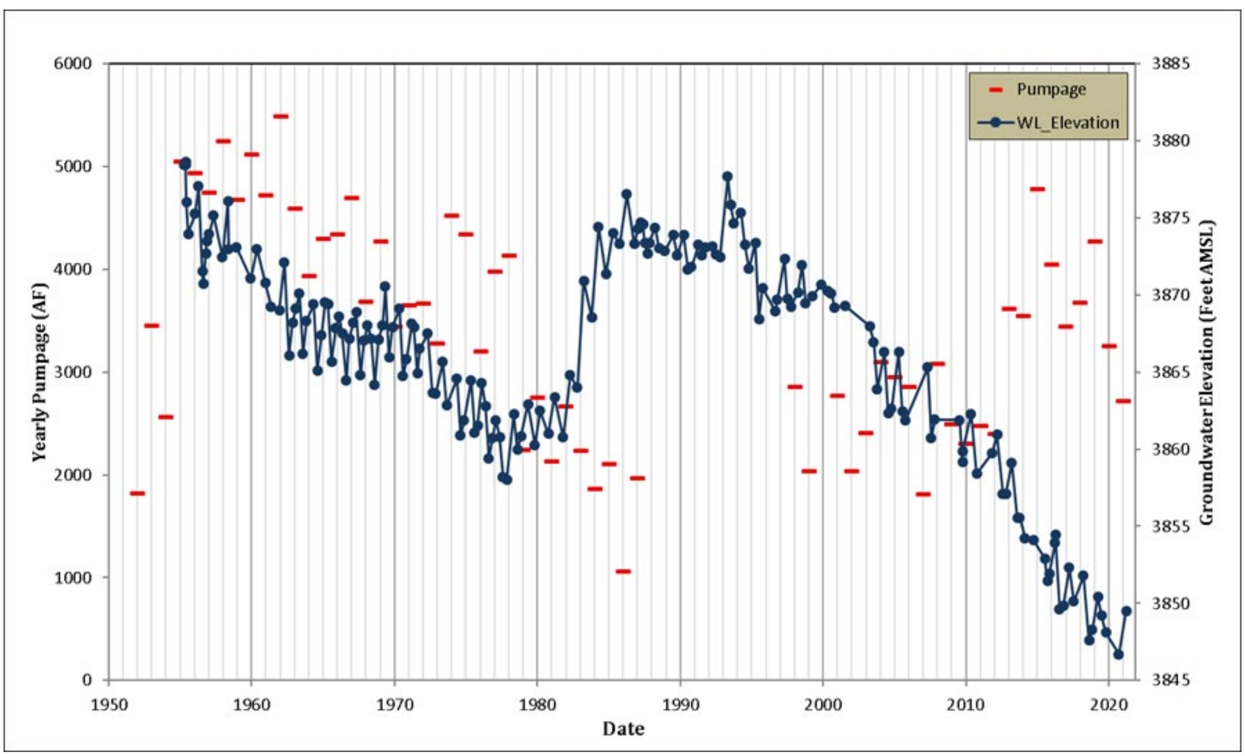


Figure 2. Total water use data from permitted wells in Cow Valley CGWA show an inverse relationship to groundwater elevations at MALH 74

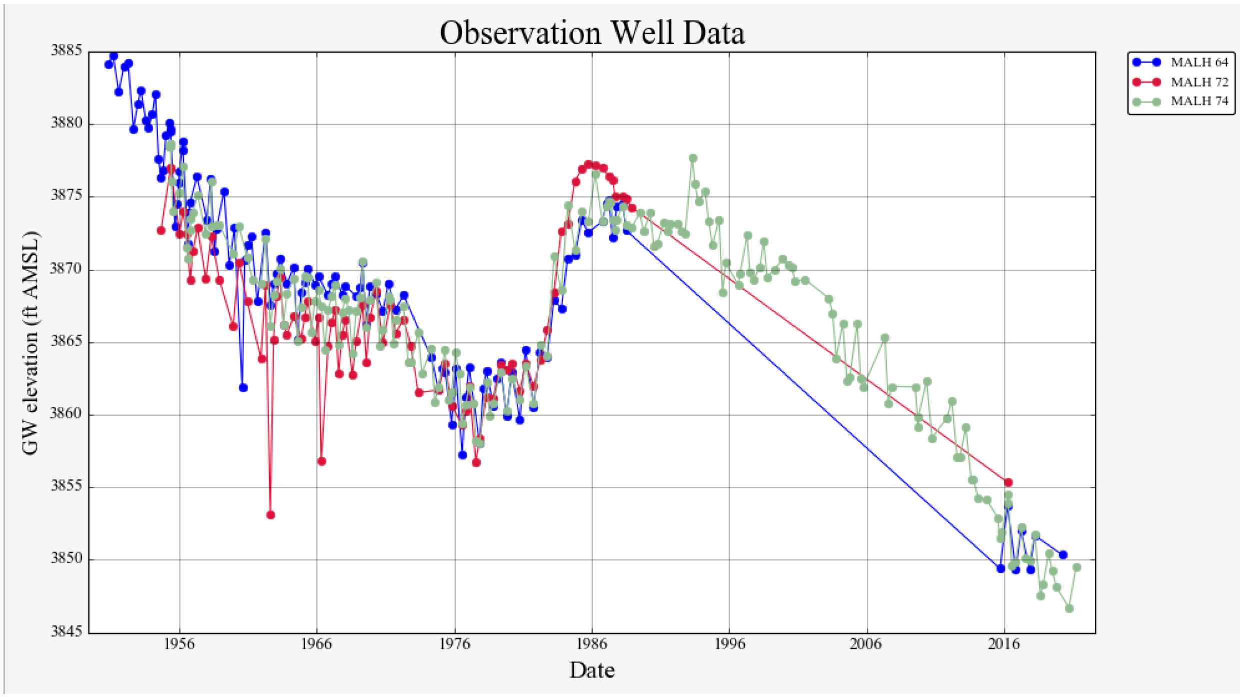


Figure 3. MALH 74 (green) is considered to be representative of groundwater elevations throughout Cow Valley

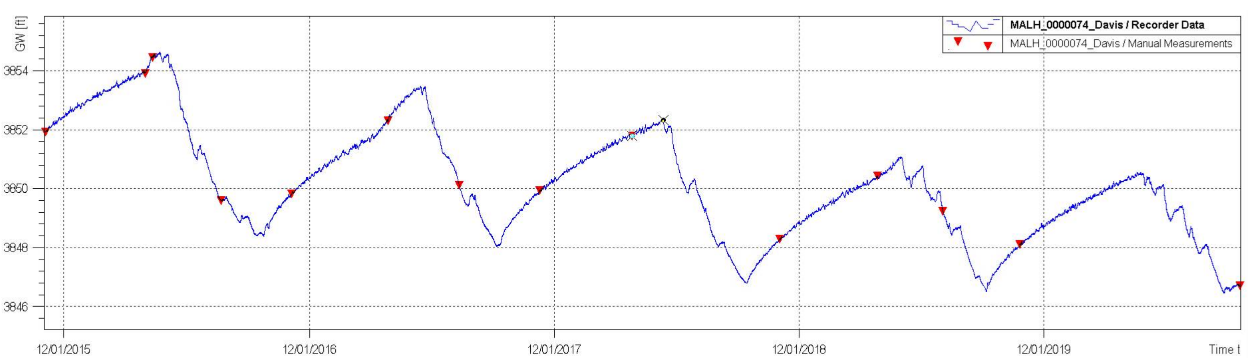


Figure 4. Water level plot of continuous recorder data (blue) and manual measurements (red)

Exempt Use Wells	
Log ID	Completion Date
MALH 74	09/30/1954
MALH 93	11/05/1954
MALH 75	11/06/1954
MALH 77	04/18/1955
MALH 76	04/29/1955
MALH 65	05/18/1955
MALH 88	05/18/1955
MALH 69	05/18/1955
MALH 96	01/13/1956
MALH 86	12/16/1957
MALH 92	12/04/1975

Certificated Water Rights	
Certificate	Priority Date
81208	02/14/1950
81209	09/18/1950
81210	05/10/1951
81211	02/05/1951
81212	02/02/1953
81213	09/18/1950
89176	09/18/1950
89177	05/10/1951
89178	02/05/1951
89179	02/02/1953
89180	02/14/1950
89181	09/18/1950
89182	09/20/1950
89183	05/10/1951
89184	08/21/1951
89198	03/30/1954
89199	11/05/1951
89526	03/30/1954
89527	11/05/1951

Table 1. Priority dates for certificates are all senior to those of exempt use wells within Cow Valley CGWA.

Certificated Points of Appropriation	
Log ID	Depth (feet)
MALH 62	330
MALH 66	535
MALH 64	421
MALH 68	362
MALH 71	255
MALH 72	1000
MALH 73	200
MALH 79	248
MALH 67	310
MALH 90	338
MALH 87	360
MALH 78	285

Exempt Use Wells	
Log ID	Depth (feet)
MALH 65	176
MALH 74	280
MALH 75	100
MALH 77	156
MALH 76	300
MALH 93	Unknown
MALH 92	66
MALH 86	48
MALH 88	128
MALH 96	194

Table 2. Well Depths in Cow Valley are variable, but exempt use wells are typically shallower than certified Points of Appropriation (POAs).

The Dalles Critical Groundwater Areas, Wasco County

Control Instrument: Order of the State Engineer, December 11, 1959 (Vol. 10, pg. 247)

Reasons for Critical Groundwater Area Declaration: Groundwater level declines in basalt aquifers

Area: 21 sq. miles for The Dalles Groundwater Reservoir and 7 sq. miles for the smaller overlying Threemile Groundwater Reservoir

Controlled Aquifer: Two Columbia River Basalt Group aquifers

Summary of Original Critical Area Control by Order of the State Engineer:

- Basalt aquifers are closed to further appropriation
- Pending permit applications were approved with conditions
- Threemile Ground Water Reservoir is restricted to those having a priority of 1932 or earlier
- Wells constructed to underlying aquifers must be continuously cased and sealed 50 feet into the underlying basalt aquifer
- Totalizing meters and record of withdrawal from each non-exempt use well are required
- Well owners annually provide a record of monthly withdrawal from each well
- State engineer makes an annual evaluation of the groundwater supply

Current Administration of Area:

- No new permits are issued
- Pumpage is recorded monthly
- Water levels are measured monthly at larger wells in The Dalles Groundwater Reservoir

Description:

The Dalles Critical Groundwater Area (CGWA) is located near the axis of the Dalles synclinal fold and adjacent to the Columbia River in north Central Oregon, with the City of The Dalles occupying the northern third of the administrative area. Two distinct aquifers within the Columbia River Basalt Group (CRBG) are included in the CGWA. The Dalles Ground Water Reservoir occurs within the interbed zones of the upper flows of the Frenchman Springs Basalt and the Threemile Ground Water Reservoir occurs within the "upper 100 feet of basalt" in the Threemile Creek drainage and is likely within the Rosalia lava flow of the Priest Rapids Basalt. The Threemile Ground Water Reservoir directly overlies The Dalles Ground Water Reservoir in the Threemile Creek area. Groundwater development began in the CRBG aquifers in the late 1920s and continued through the 1950s. Water level declines in the Threemile Ground Water Reservoir were originally reported in a USGS study of the area published in 1932. The Critical Groundwater Order went into effect on December 11, 1959. The Circuit Court of Wasco County ordered a stay of enforcement of the State Engineer's Order on April 25, 1960. The stay was lifted in 1966, after completion of The Dalles Irrigation Project. Groundwater levels in the Threemile Groundwater Reservoir recovered significantly after surface water became available in 1966 (Figure 5).

There has also been significant water level recovery in The Dalles Groundwater Reservoir observation wells since the early 2000s. Water rights are essentially the same as in 1959 but the use has dropped due to land use changes from irrigation to residential and reductions in industrial diversions with the closure of the Martin-Marietta Aluminum plant. Figure 6 shows the groundwater level trend that occurred between 1958 and present in The Dalles Groundwater Reservoir.

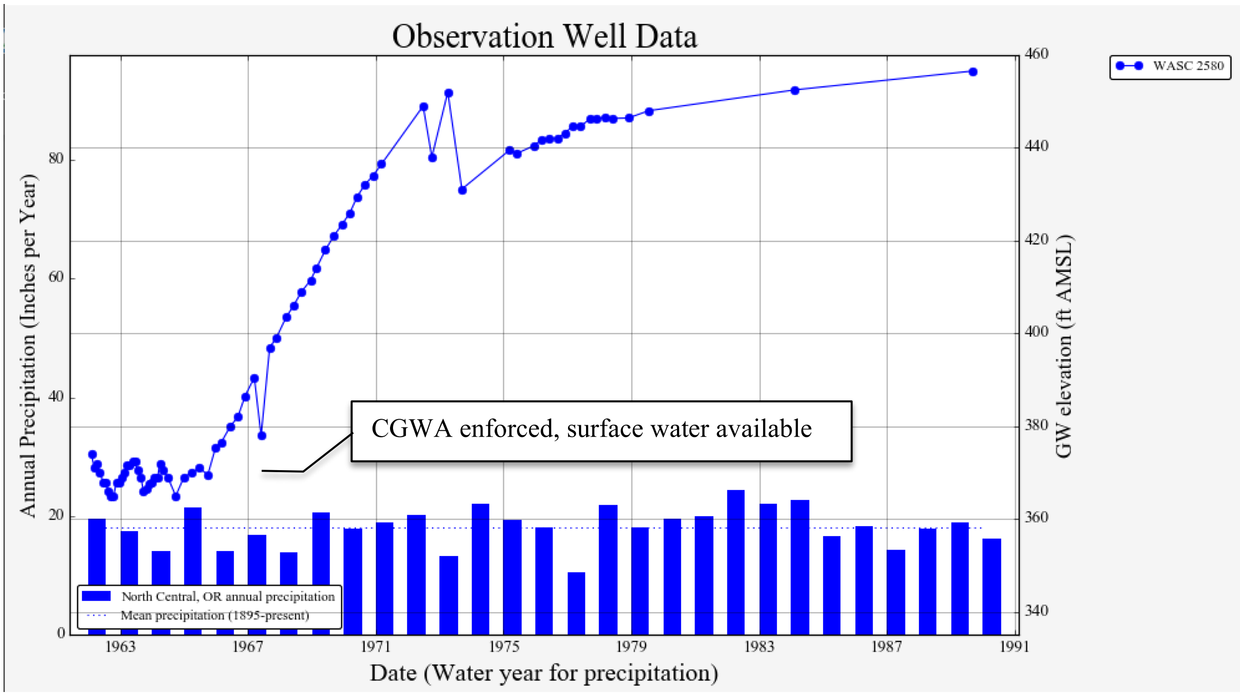


Figure 5. Representative hydrograph for Threemile Groundwater Reservoir

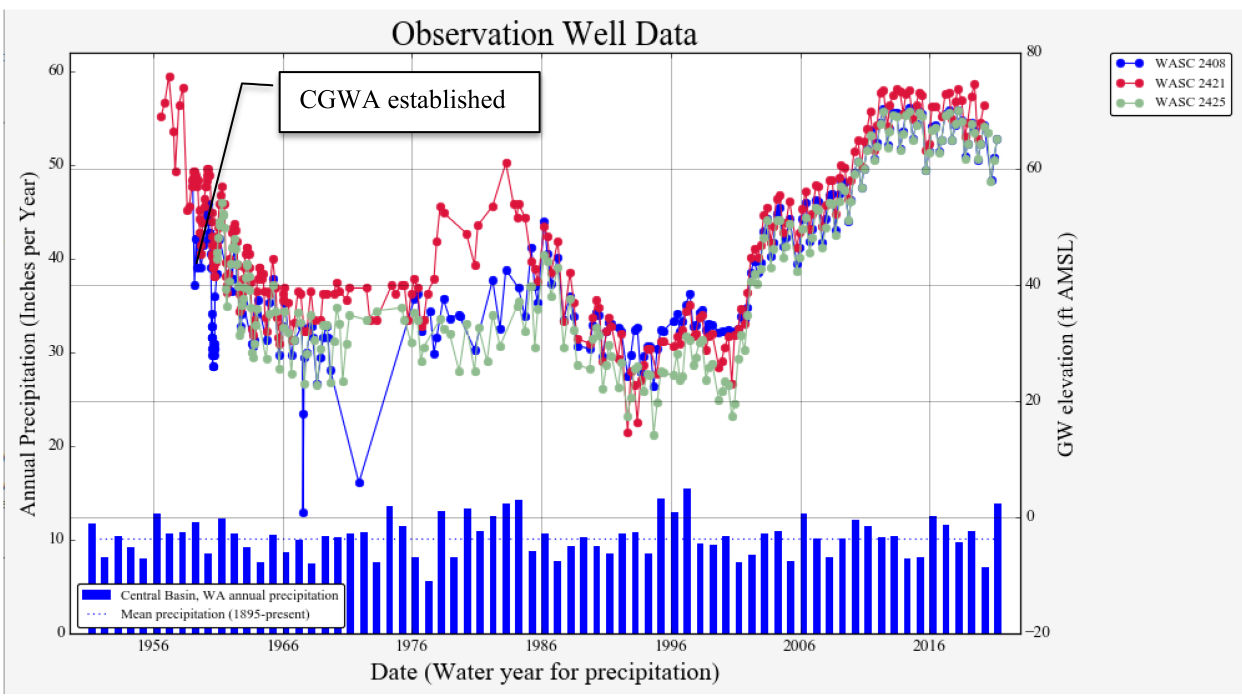


Figure 6. Representative hydrograph for The Dalles Groundwater Reservoir

Cooper Mountain – Bull Mtn Critical Groundwater Area, Washington County

Control Instrument: Order of the State Engineer dated May 17, 1974 (Vol 24, pg. 370)

Reasons for Critical Groundwater Area Declaration: Groundwater level declines in basalt aquifers

Area: ~41 sq. miles

Controlled Aquifer: Columbia River Basalt Group (CRBG) aquifers and the overlying alluvium/sedimentary aquifer

Summary of Original Critical Area Control by Order of the State Engineer:

- Basalt aquifers are closed to further appropriation of groundwater from new filings
- Sedimentary aquifers are open to further appropriation of groundwater from new filings
- Exempt uses from the basalt aquifers are limited to existing wells
- Annual appropriation (use) from the basalt aquifers is limited to 2900 acre-feet based on priority and utilizes a notification system
- Additional exempt use is restricted to single family domestic and stockwatering on tracts not less than 10 acres in area
- Watermaster regulates use to those allowed by permit or certificate
- Unlawful diversions cease
- Totalizing meters and record of withdrawal from each non-exempt use well are required
- Well owners annually provide a record of monthly withdrawal from each well
- Annual pumpage restrictions are placed on certain public supply wells
- State engineer makes an annual evaluation of the groundwater supply

Current Administration of Area:

- No new permits are issued
- Watermaster allocates use based on requests, priorities, and the 2900 acre-feet limit
- Watermaster staff reads totalizing meters annually and measures water levels in wells

Description:

The Cooper Mountain – Bull Mountain CGWA is roughly centered on a Columbia River Basalt Group (CRBG) syncline that forms the highlands of its namesake mountains. This area was a favorable target for municipal groundwater development because high capacity production wells could be drilled directly into basalt without the expense of drilling through 500 to 1000 feet of valley fill sediments (as is necessary in the surrounding lowland valley) and groundwater could be pumped to storage tanks on the flanks of the mountains and then gravity fed to water users on the valley floor.

Groundwater development from the CRBG aquifers by municipal water providers supported suburban development in the surrounding Tualatin Basin in the 1950s and 1960s. Other agricultural, industrial, and domestic users utilized the aquifer during this time as well. Figure 7 shows the groundwater level decline that occurred between 1957 and 1974 due to unsustainable groundwater extraction from the aquifer. The CGWA order capped the annual volume of water that could be extracted from the aquifer at 2900 acre feet, which was significantly less than the total water right holdings of the municipal providers (approximately 6700 acre feet) and other users. Due to this restriction, the municipal providers developed pipelines to import treated surface water from the Bull Run and Hagg Lake systems to meet the majority of municipal demand, greatly reducing the volume of water pumped from the aquifer. Under the restrictions imposed by the CGWA, groundwater levels have recovered to near historic levels in the intervening years.

Currently, the aquifer is closed to further permitted groundwater appropriation, and new exempt uses on properties less than 10 acres in size must offset their water use by abandoning an existing exempt well in the CGWA. All permitted water users report their annual use to the watermaster, which has been significantly less than the annual cap volume since at least 2003. In the past decade, the aquifer has been utilized by the surrounding municipal water providers for Aquifer Storage and Recovery (ASR) projects. ASR has resulted in increased seasonal groundwater level fluctuations and additional groundwater level recovery in the aquifer system (see Figure 8).

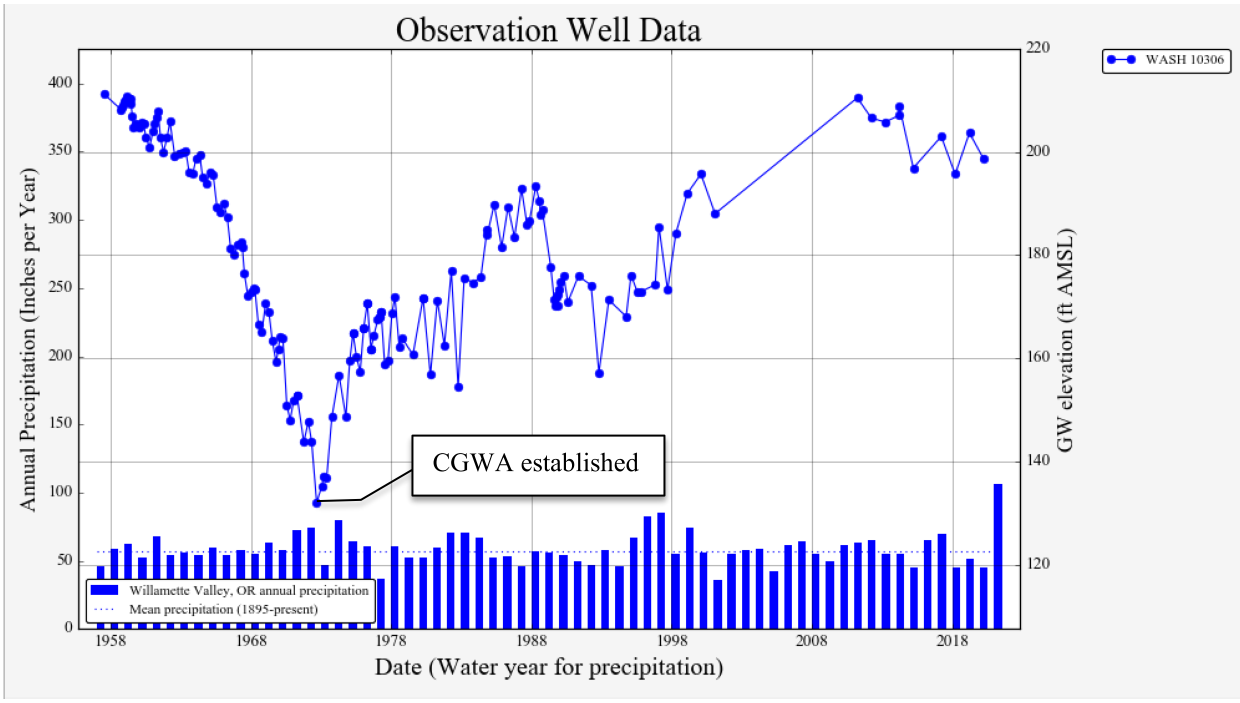


Figure 7. Representative hydrograph for Cooper-Bull Mountain CGWA

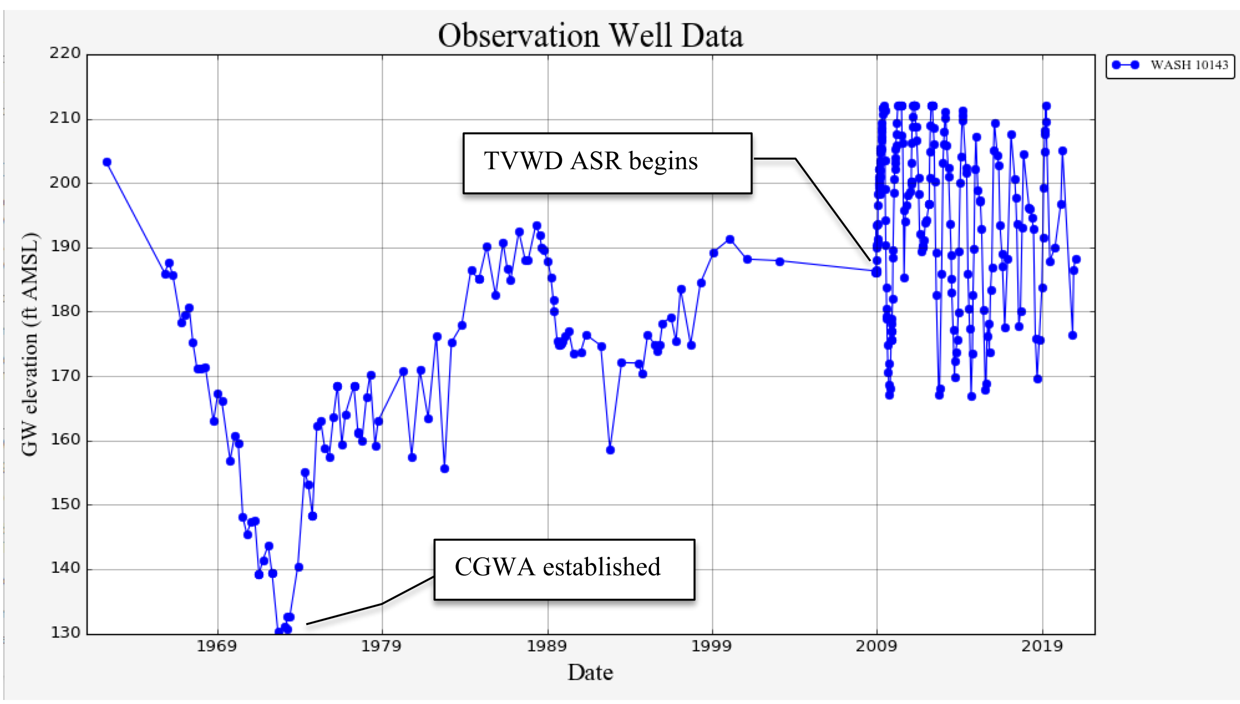


Figure 8. Hydrograph showing Cooper-Bull Mountain CGWA well response to ASR

Ordnance Basalt Critical Groundwater Area, Morrow and Umatilla Counties

Control Instrument: Order of the Director dated April 2, 1976 (Vol. 27, pg. 40)

Reasons for Critical Groundwater Area Declaration: Groundwater level declines in Columbia River Basalt Group aquifers

Area: 175 sq. miles
Controlled Aquifer: Columbia River Basalt Group (CRBG) Aquifers

Summary of Original Critical Area Control by Order of the Director:

- Basalt (shallow and deep) aquifers are closed to further appropriation
- Irrigation season is defined
- Totalizing meters and record of withdrawal from each non-exempt well is required
- State engineer makes an annual evaluation of water levels and use to determine the effectiveness of the control provisions to maintain reasonably stable groundwater levels

Current Administration of Area:

- No new permits are issued
- Department staff monitor groundwater levels and use annually

Description:

The Ordnance Basalt Critical Groundwater Area is roughly centered on the former Umatilla Ordnance Depot, located west of the Umatilla River near Hermiston and south of the Columbia River. The Columbia River Basalt Group (CRBG) is a series of lava flows with a composite thickness greater than 10,000 feet in the Columbia Plateau. Each flow is characterized by a series of internal features, which generally include a thin rubble zone at the contact between flows and a thick, dense, low porosity and low permeability interior zone. In some cases, sedimentary layers were deposited during the time between basalt flow emplacements. A flow top, sedimentary interbed (if present) and flow bottom are collectively referred to as an "interflow zone." Most water occurs in interflow zones under confining conditions at the contacts between lava flows. CRBG flow features result in a series of stacked, thin aquifers that are confined by dense flow interiors. The low permeability of the basalt flow interiors usually results in little connection between the stacked, tabular aquifers. Each aquifer within the basalts has a unique water level head. Two aquifers within the CRBG were identified in the Critical Area order, a "shallow" zone located less than 400 feet below the surface and a "deep" zone located between 400 and 900 feet below land surface.

Basalt groundwater development began in the 1940s and increased into the 1970s. Groundwater levels declined at a rate of 3 to 4 feet per year during this period. Deep basalt groundwater levels are currently declining at a lesser rate (Figure 9). This is likely due to usage reductions over time and leakage from the upper aquifers through improperly constructed wells. Total decline in the deep basalt aquifer exceeds 150 feet. Wells completed only into the shallow basalt show relatively stable long-term water levels (Figure 10), with a total decline of less than 20 feet.

The basalt aquifers in this CGWA are closed to further permitted appropriation. OWRD staff measure groundwater levels and annual use each February, when irrigation pumps are idle. Water levels in the shallow basalt aquifer are reasonably stable, although they have not recovered to historic levels. Water levels in the deep basalt aquifer continue to decline approximately two feet per year. Commingling wells, which are open to both the shallow and the deep basalt aquifers, continue to make accurate groundwater level data collection difficult. Commingling wells should be repaired or replaced with wells that meet current well construction standards.

In recent years, many of the wells in the critical area have converted use from irrigation to confined animal feeding operations, transitioning from seasonal to year-round use. Although this does not represent an increase in annual volumetric use, it does mean that many of the wells are pumping during February data collection efforts. This complicates assessment of year-to-year water level changes at many of the CGWA observation wells. Dedicated water level monitoring wells are needed in both the shallow and the deep basalt aquifers to assess the stability of the resource into the future.

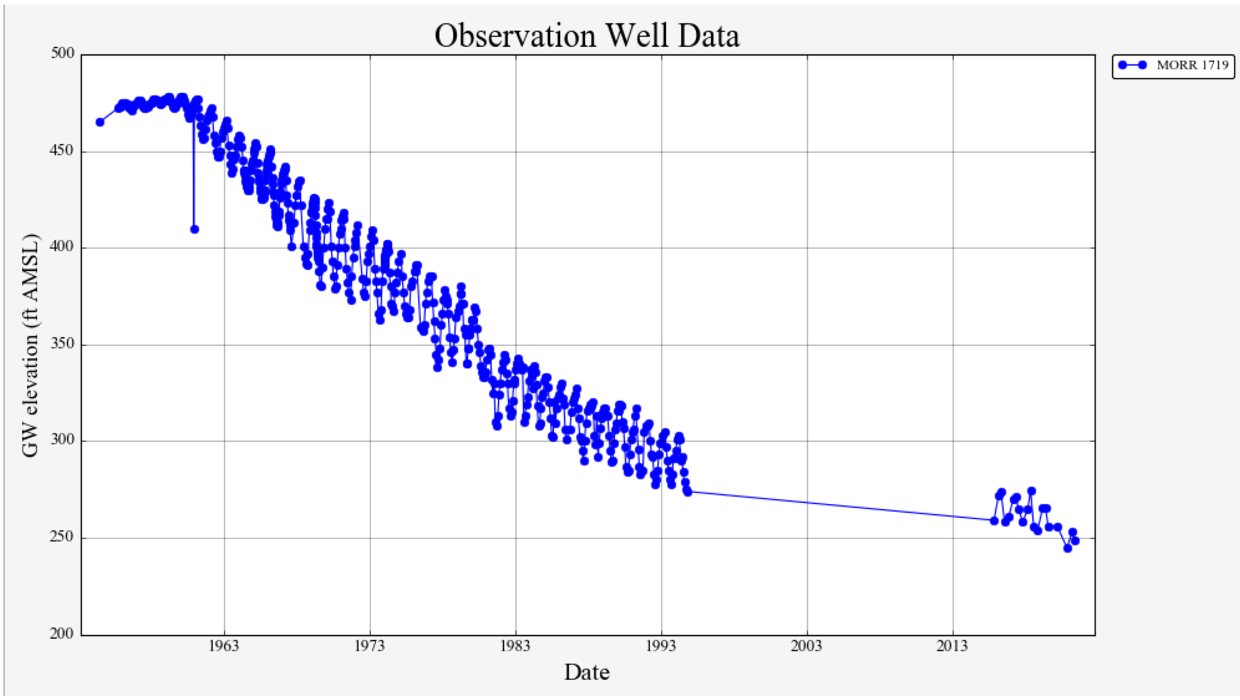


Figure 9. Representative long-term hydrograph for Ordnance Deep Basalt aquifer

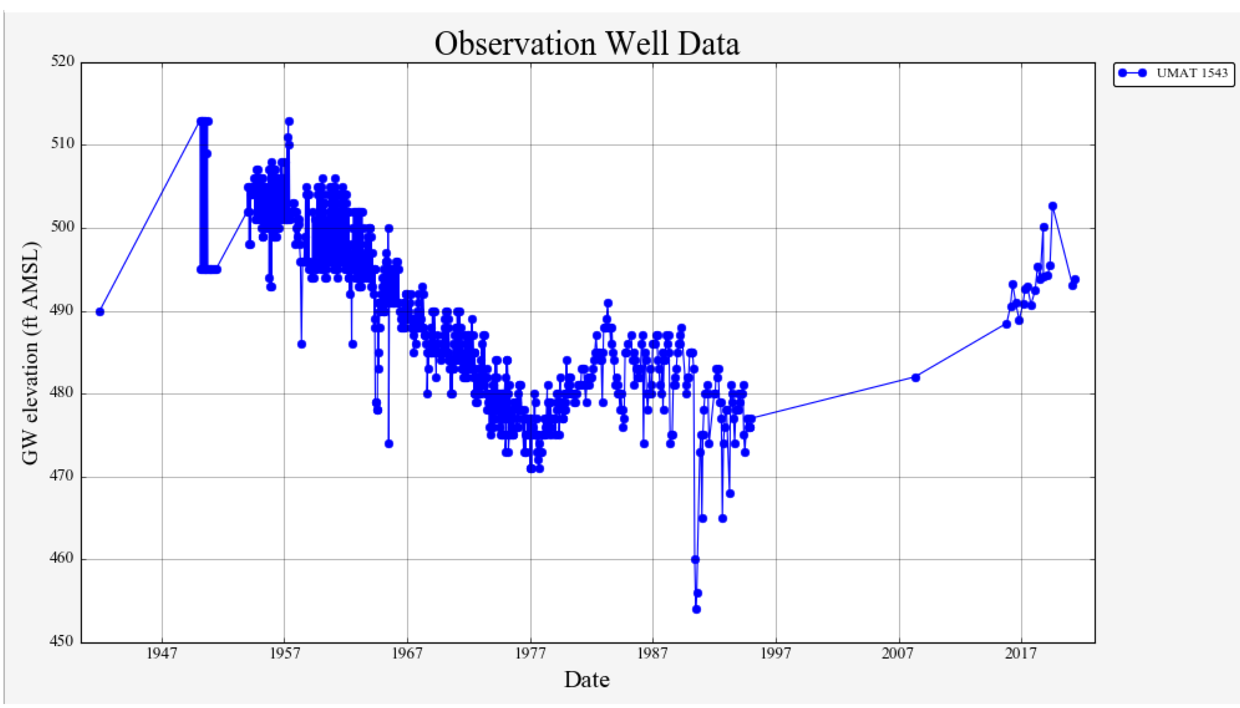


Figure 10. Representative long-term hydrograph for Ordnance Shallow Basalt Aquifer

Ordnance Gravel Critical Groundwater Area, Morrow and Umatilla Counties

Control Instrument: Order of the Director dated April 2, 1976 (Vol. 27, pg. 40)

Reasons for Critical Groundwater Area Declaration: Groundwater level declines in sedimentary aquifer

Area: 82 sq. miles

Controlled Aquifer: Shallow sand and gravel aquifer

Summary of Original Critical Area Control by Order of the Director:

- Gravel aquifer is closed to further appropriation
- Annual appropriation (use) within the Lost Lake-Depot subarea is limited to 9,000 acre-feet
- Totalizing meters and record of withdrawal from each non-exempt well is required
- State engineer makes an annual evaluation of groundwater levels and use to determine the effectiveness of control provisions to maintain reasonably stable groundwater levels

Current Administration of Area:

- No new permits are issued
- Department staff monitor groundwater levels and use annually
- Department staff track 9,000 acre-foot limit and artificial groundwater recharge and recovery in the Lost Lake-Depot subarea.

Description:

The Ordnance Gravel Critical Groundwater Area is located west of the Umatilla River near Hermiston. The broad plain of the CGWA is characterized by sediments ranging up to approximately 200 feet thick that overly the Columbia River Basalt Group. The erosional topography of the underlying basalt controls the geometry of the bottom of the sedimentary aquifer. The thickest accumulation of saturated coarse sands and gravels lies in an east-west oriented trough near the center of the CGWA. The sediments thin and become finer-grained toward the margins of the CGWA.

Significant groundwater development of the Ordnance Gravel aquifer began in the 1950s and increased through 1970. Groundwater levels declined during this period (Figure 11). There are two areas of intense groundwater development: the Lost Lake-Depot subarea and the Westland Road subarea. The Order curtailed use under groundwater rights in the Lost Lake-Depot subarea to a total of 9,000 acre-feet per year and prevented new permitted allocation in the remainder of the CGWA. Coincident with the Critical Groundwater Area Order being issued, an artificial groundwater recharge project was implemented. This project continues through the present, diverting winter water from the Umatilla River and allowing it to recharge the aquifer through leaky canals. Artificial groundwater recharge causes an increase in seasonal water levels in nearby wells (Figure 12). Lost Lake-Depot subarea groundwater right holders use this artificially stored water to make up for curtailment implemented by the CGWA order.

OWRD staff measure groundwater levels and annual use each February, when irrigation pumps are idle. In recent years, several dedicated observation wells have been drilled in the gravel aquifer, which has greatly improved OWRD's ability to assess the condition of the resource and the feasibility of new artificial groundwater recharge proposals. Under the current artificial recharge and groundwater pumping regime, water levels in the Ordnance Gravel aquifer are relatively stable.

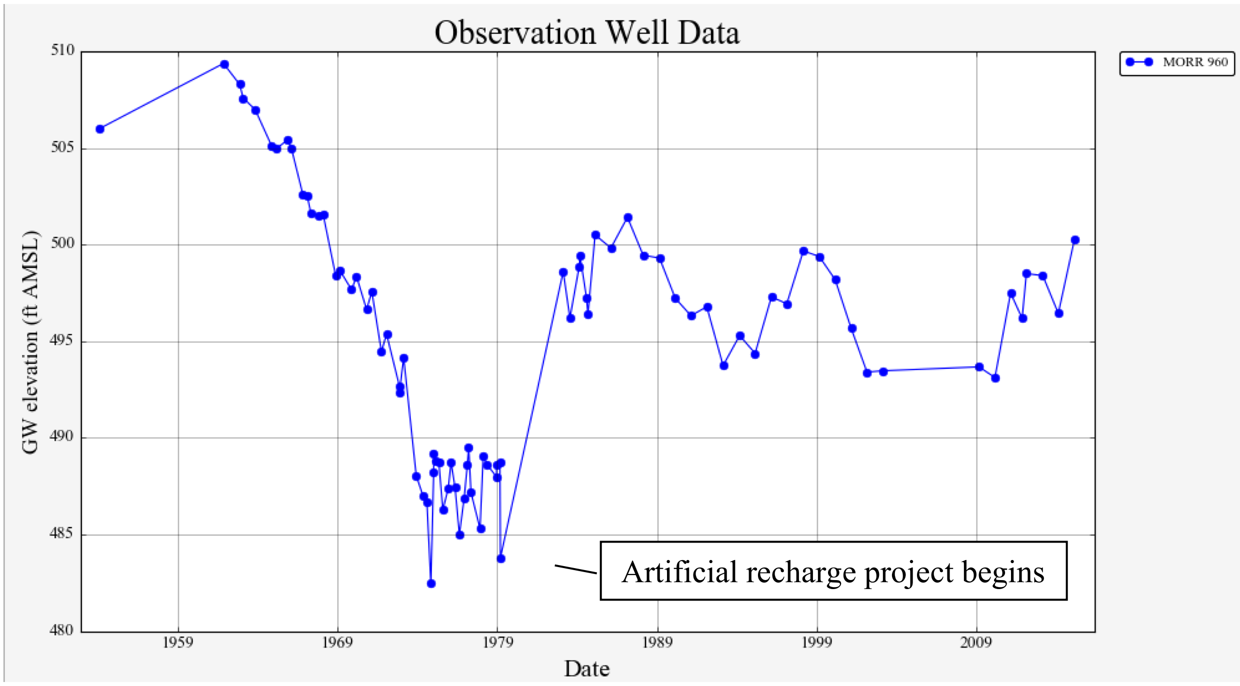


Figure 11. Representative long-term hydrograph for Ordnance Gravel CGWA

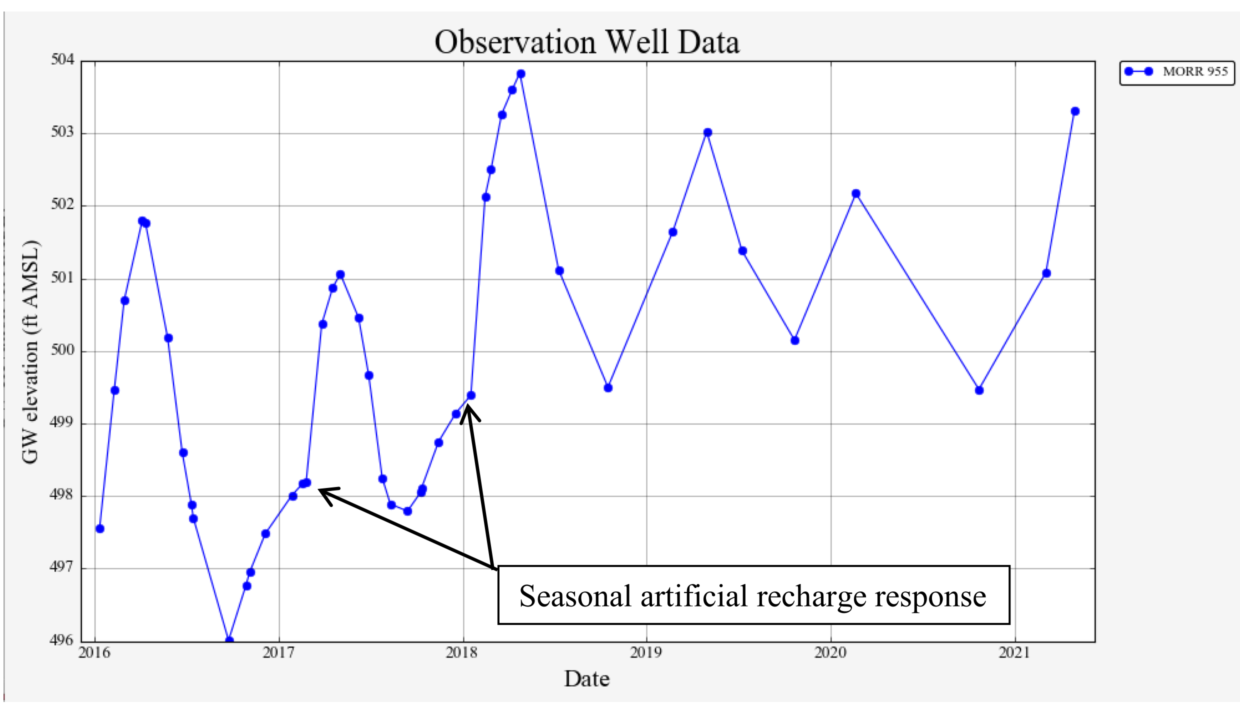


Figure 12. Artificial Groundwater Recharge effects are evident in seasonal groundwater trends

Butter Creek Critical Groundwater Area, Morrow and Umatilla Counties

Control Instrument: Order of the Director dated January 27, 1986 (Vol. 24, pg. 1) (for declaration of the critical groundwater area); OAR 690-507-0610 to -0700 (in 1990, 1992, and 1999 for designating subareas and determination and distribution of sustainable annual yield)

Reasons for Critical Groundwater Area Declaration: Groundwater level declines in basalt aquifers

Area: ~274 sq. miles

Controlled Aquifer: CRB aquifers

Summary of Original Critical Area Control by Order of the Director:

By Order:

- Appropriation limited to exempt uses and existing authorizations
- Pending applications were rejected
- Creates six subareas for management purposes
- Establishes total annual withdrawal for four subareas
- Except for exempt uses, provides for use on the basis of relative priority
- Establishes a system to request and be authorized to pump an annual volume
- Requires totalizing meters for all non-exempt use withdrawals

By Rule:

- Establishes an irrigation season from March 15th to November 1st
- Requires functioning access ports on wells
- Requires a totalizing flowmeter on authorized wells
- Requires water user to keep a monthly water use record and report readings by December 1st each year
- Causes water users to perform certain actions when flowmeters break
- Causes water users to notify OWRD of well or pump work
- Sets an initial sustainable annual yield (SAY) for each subarea and creates a method to revise those values
- Creates a method to distribute the SAY amongst users
- Defines reasonably stable water level
- Allows changes in SAY in order to achieve reasonably stable water levels
- Notes a rulemaking process to change subarea boundaries

Current Administration of Area:

- OWRD tracks pumpage and water levels in Critical Area wells
- OWRD receives, compiles, and analyzes annual allocation requests from water users
- Based on SAYs, requests, and other factors, OWRD determines annual allocations for each water right in the Critical Area.

Description:

The Butter Creek CGWA is located within the Umatilla Basin in north-central Oregon. The area is bordered on the west by the Ordnance Basalt Critical Groundwater Area and the Ella Butte Groundwater Limited Area and on the east by the Stage Gulch Critical Groundwater Area. Portions of the cities of Hermiston and Umatilla are included within the boundaries. The area is entirely underlain by a thick sequence of numerous basalt lava flows of the Columbia River Basalt group, which is also the most important groundwater reservoir in the area.

Irrigation from groundwater sources in the Umatilla Basin, primarily the basalt groundwater reservoir, increased rapidly in the late 1960s through the late 1970s. Several factors combined to encourage the rapid development of the basalt groundwater reservoir. These included more efficient hard-rock drilling methods, the large production of water available from typical deep basalt wells, new irrigation techniques, favorable crop prices, and the availability of relatively inexpensive electrical power. In the Butter Creek area, the peak in the development occurred in the middle to late 1960s. Regional investigations indicated that for the period from 1965 to 1980 water levels declined 100 feet or more in much of the Butter Creek area.

Water levels continued to decline during the period 1980 to 1990, despite reduced pumpage documented in the area during that same period. Figure 13 shows the groundwater level decline that occurred between 1972 and 1986 due to unsustainable groundwater extraction from the aquifer, and the reduction in decline rate after implementation of the CGWA. Although the rates of decline in the deep basalt groundwater reservoir have slowed in some areas, total declines are at historically low levels in all subareas, and several areas continue to experience declines at rates similar to the pre-1986 rates (Figure 14).

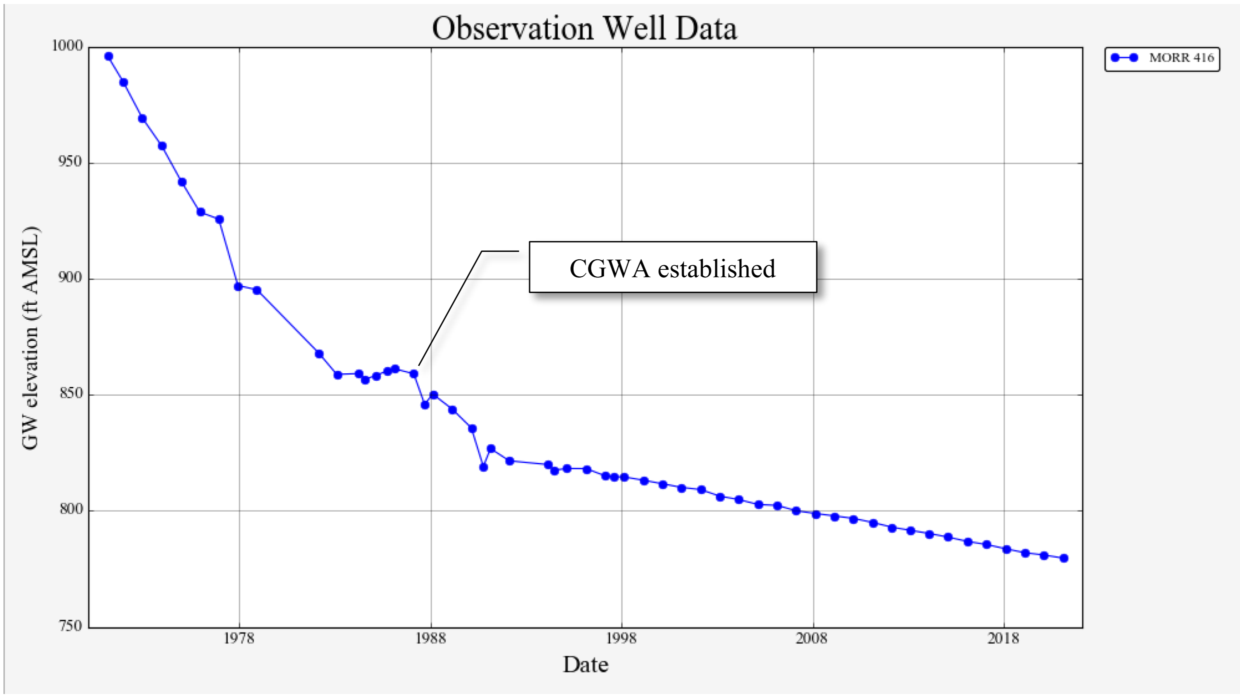


Figure 13. Representative hydrograph for Butter Creek CGWA Pine City Subarea

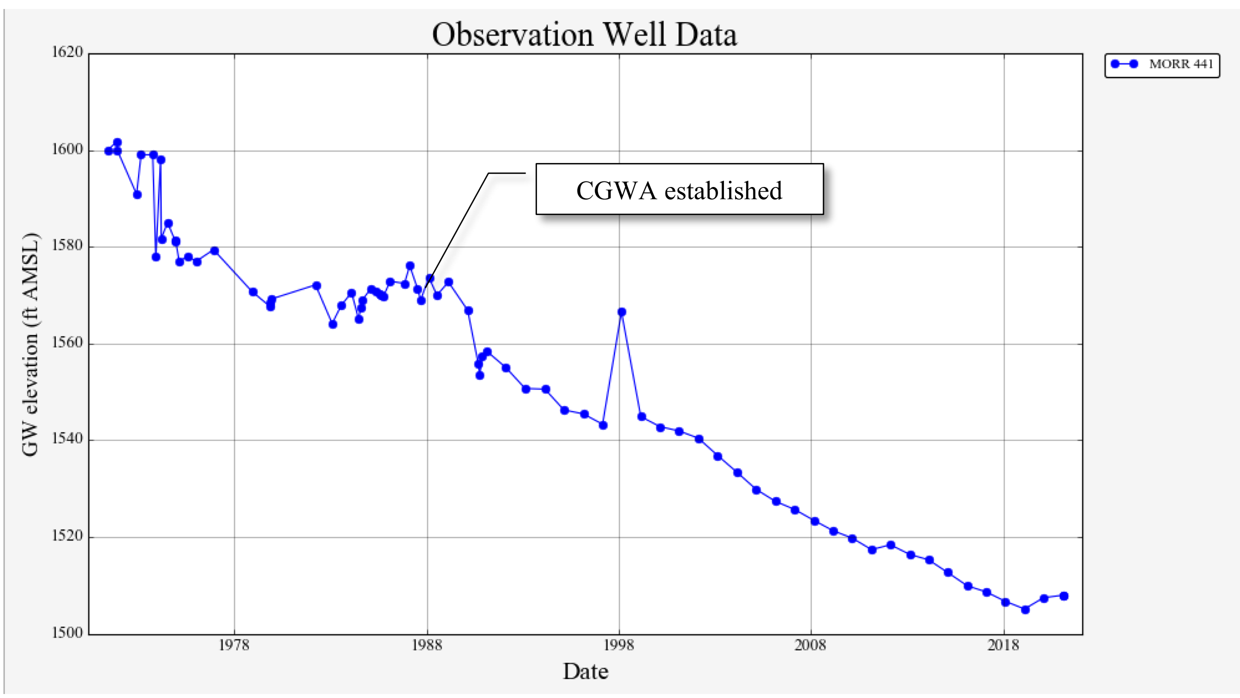


Figure 14. Representative hydrograph for Butter Creek CGWA South Subarea

Stage Gulch Critical Groundwater Area, Umatilla County

Control Instrument: Order of the Director dated 5/15/1991, (for declaration of the critical groundwater area); OAR 690-507-0750 to -0840 (in 1991 for designating subareas and determination/distribution of sustainable annual yield)

Reasons for Critical Area Declaration: Excessively declining water levels in basalt aquifers indicating an overdrawn groundwater supply

Area: 183 sq. miles

Controlled Aquifer: Upper and deep basalt groundwater reservoirs

Summary of Original Critical Area Control by Order of the Director:

- Creates the critical groundwater area for the upper and deep basalt groundwater reservoirs that underlie the area
- Limits the appropriation (use) to exempt uses and existing authorizations
- Indicates that no new permits will be issued
- Indicates that pending application is rejected
- Creates eight subareas for management purposes
- Limits the extent of deepening of certain wells
- Establishes an irrigation season from March 1st to November 30th but includes an exception method for a longer season
- Requires functioning access ports on wells
- Requires a totalizing flowmeter on authorized wells
- Requires water users to keep a weekly use record and report readings by December 1st each year
- Causes water users to perform certain actions when flowmeters break
- Requires water users to notify WRD of well or pump work
- Sets an initial Sustainable Annual Yield (SAY) for seven of the eight subareas and establishes a method to revise those values
- Limits water use to the SAY and establishes a method to distribute the SAY amongst users
- Defines reasonably stable water level

Current Administration of Area:

- OWRD tracks pumpage and water levels in the area
- OWRD receives, compiles, and analyzes requests annually from users for an allocation
- Based on the SAY, requests, and other factors, OWRD determines annual allocations for each water right in the area

Process of Periodic Review:

- OAR 690-507-0820 requires the department to determine whether a reasonably stable water level was achieved in each subarea in 1995 and every five years thereafter
- Allows for changes in SAY to achieve reasonably stable water levels
- Allows for modifications of subarea boundaries
- Allows for review of SAY and subarea boundaries at times other than the five year required review
- Requires a rulemaking hearing for changes to SAY or subarea boundaries
- Allows individual water users within the CGWA to petition the Department to modify SAY or subarea boundaries

Description:

The Stage Gulch CGWA is located within the Umatilla Basin in north-central Oregon. The area abuts the eastern boundary of the Butter Creek Critical Groundwater Area. The cities of Echo, Stanfield, and most of Hermiston are included within the boundaries. The area is entirely underlain by a thick sequence of numerous basalt lava flows of the Columbia River Basalt group, which is also the most important groundwater reservoir in the area.

Irrigation from groundwater sources in the Umatilla Basin, primarily from the basalt groundwater reservoir, increased rapidly in the late 1960s through the late 1970s. Several factors combined to encourage the rapid development of the basalt groundwater reservoir. These included more efficient hard-rock drilling methods, the large production of water available from typical deep basalt wells, new irrigation techniques, favorable crop prices, and the availability of relatively inexpensive electrical power. In the Stage Gulch area, the peak in the development occurred in the middle to late 1970s. Regional investigations indicated that for the period 1965 to 1980 water levels declined 50 feet or more in much of the Stage Gulch area.

Water levels continued to decline during the period 1980 to 1990, despite reduced pumpage documented in the area during that same period. Figure 15 shows the groundwater level decline that occurred between 1974 and 1991 due to unsustainable groundwater extraction from the aquifer, and the reduction in decline rate after implementation of the CGWA. Although the rates of decline in the deep basalt groundwater reservoir have slowed in some areas, total declines are at historically low levels in all subareas, and several areas continue to experience declines at rates similar to the pre-1991 rates (Figure 16).

Oregon Administrative Rule 690-507-0780 outlines the duties of the water users in the Stage Gulch Critical Groundwater Area. The rules require that each authorized well have an access port with a minimum diameter of ¾ inch (690-507-0780(2)(a)), which allows the determination of the water level at any time. The rules also allow for installation of an airline in addition to the access port (690-507-0780 2b). As of 2016, the majority of authorized wells in the Critical Area do not have the required access port, however many do have airlines that allow determination of water levels. At least one quarter of the authorized wells in the Critical Area have no means of determining water level at any time.

The rules also require a totalizing flowmeter be installed and maintained on each well authorized for 10 or more acres. The specifications for required flowmeters are outlined in 690-507-0785. The majority of the authorized wells do have flowmeters installed; however, many of these do not meet the required specifications. Specifically, it is common for flowmeters to roll over during the course of an irrigation season (690-507-0785(1)(e)), which causes difficulty in accurately assessing the total amount of water pumped during the year from each well.

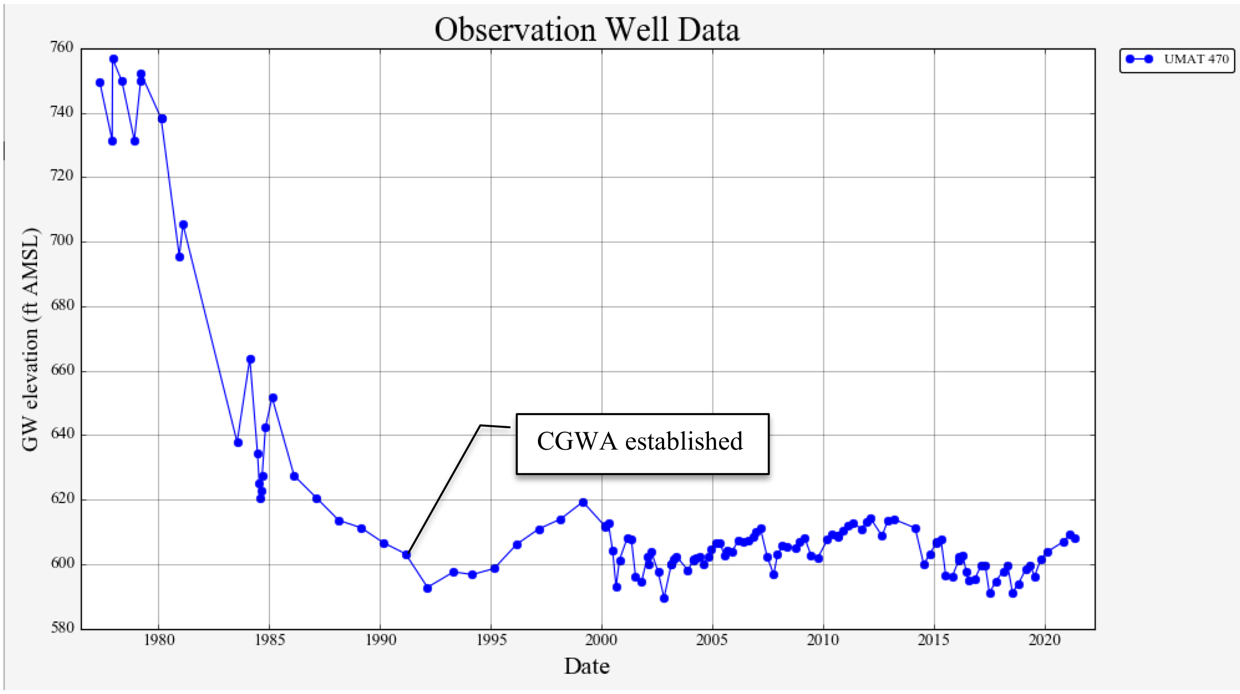


Figure 15. Representative hydrograph for Stage Gulch CGWA Subarea G

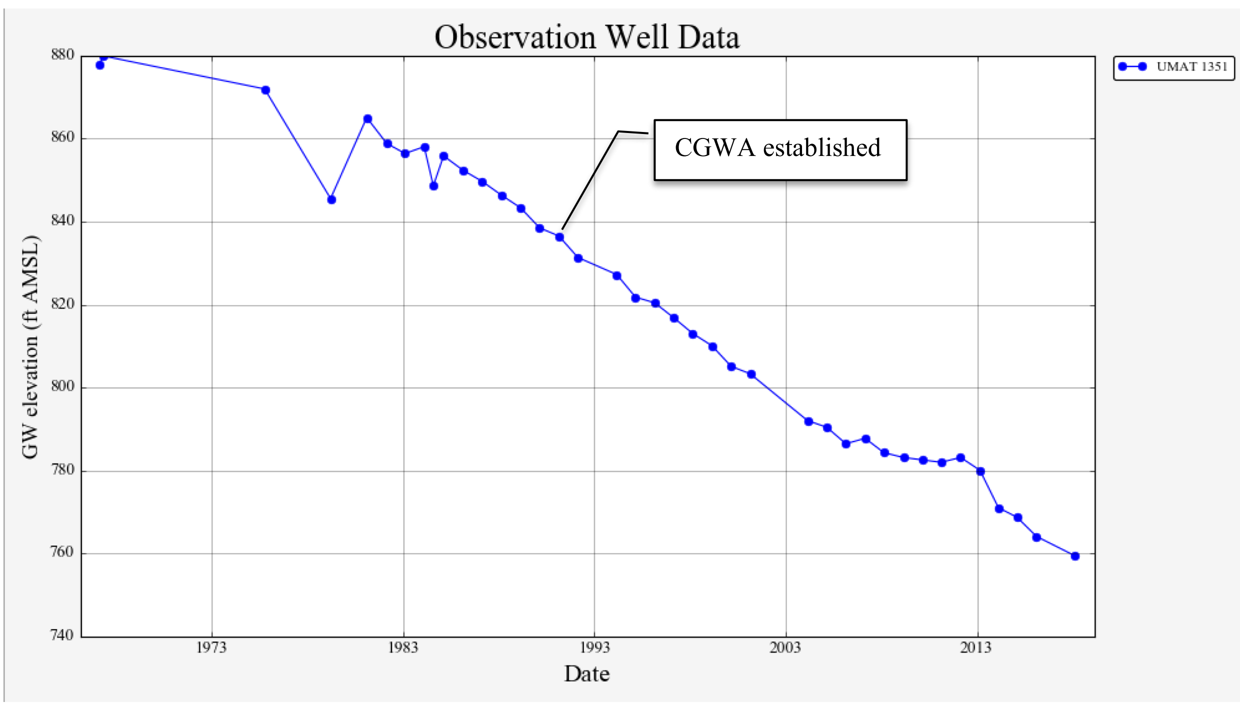


Figure 16. Representative hydrograph for Stage Gulch CGWA Subarea H