



TECHNICAL MEMORANDUM - DRAFT

TO: OWRD
FROM: Said Amali, Ph.D., PE
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SUBJECT: Task 1.D - Estimate Water Needs

DATE: 24 July 2008
PROJECT: Umatilla Basin Regional Aquifer Recovery
Assessment
IRZ Project No.: 08-016

The agricultural economy of Umatilla and Morrow counties is critically dependant on availability of water for irrigation. Due to overdraft of the groundwater aquifers in the area, the Oregon Water Resources Department (OWRD) designated four groundwater aquifers within the Umatilla Basin as Critical Groundwater Areas (CGAs) (OWRD 2003). Additionally, surface water sources within the Umatilla Basin are unavailable for further appropriation between June 1 and October 31 as defined in Oregon Administrative Rules (OAR) 690-507-0070. To increase water availability in the CGAs, OWRD has begun a technical assessment of the feasibility of storing water from the Columbia River, and other surface water sources, during high flow periods in shallow sediment and deep basalt aquifers for recovery of the stored water during the irrigation season. This technical memorandum includes a summary of information and findings regarding the estimated irrigation-season water needs within the CGAs. Figure 1 depicts the boundary of the CGAs.

EXECUTIVE SUMMARY

The total annual volume of water needed to meet the curtailed groundwater rights, estimated new acreage to be potentially irrigated in the future, future assumed domestic and municipal supply needs, and the amount to remain in the alluvial and basalt aquifers within the CGAs ranges between approximately 180,442 and 213,442 acre feet (AF). For planning purposes, a value of 200,000 AF will be used as the target volume for treatment and storage purposes. This target volume will restore approximately 127,000 AF of curtailed groundwater rights, provide 45,000 AF of water for irrigation of new ground, and allow an additional 2,000 AF of water for domestic and other exempt well uses and 5,000 AF for additional municipal supply. No distinction is made in this assessment between storage within the alluvial or basalt aquifers. The decision regarding which aquifer is best suited to meet the various needs will be made following completion of separate assessments of storage potential and engineering factors.

OBJECTIVES

This assessment includes developing estimates of the following water needs within the CGAs:

- Curtailed irrigation water rights during the irrigation season from March 1 through October 31

- New acreage which may be irrigated during the irrigation season
- Return flow to augment Umatilla River flow to enhance aquatic habitat
- Domestic/exempt and municipal water supply demands
- Stored water which can't be pumped by law

The total amount of water need from the above categories will be compared with the “available” water volumes in Columbia River. Additionally, the results and findings of this task will be used in other project tasks to make decisions regarding the size of the infrastructure system needed, any additions, modifications, or upgrades to the existing water distribution system, and to assist with the phased design of a water withdrawal and distribution system.

RESULTS AND FINDINGS

The amount of water need was estimated for each of the five categories presented above, as follows:

Curtailed Irrigation Water Rights - There are 63,489 acres of farmland within the four CGAs which are irrigated with groundwater pumped from alluvial and basalt aquifers. The total amount of certificated irrigation groundwater rights for this acreage is 190,466 AF (OWRD 2008). However, due to declining levels of water in the alluvial and basalt aquifers in the CGAs, Oregon promulgated OAR 690-507 to define specific levels of groundwater withdrawal volumes within smaller administrative units (sub-areas) in the Butter Creek and Stage Gulch CGAs. These withdrawal limits are known as Sustainable Annual Yields (SAYs). Similarly, in the Ordance Gravel and Basalt CGAs, the 2 April 1976 Water Right Order stipulated a maximum groundwater volume which can be pumped in the Ordance Gravel CGA and limited the groundwater withdrawals from the Ordance Basalt CGA to the water rights in effect at the time. The OWRD staff allocates groundwater pumping volumes within each CGA and sub-area so that the total amount of groundwater pumped doesn't exceed the SAYs or total permitted volume in Ordance Gravel CGA. The CGAs are closed to further appropriation of groundwater other than for exempt and stock watering uses. The boundaries of the sub-areas are shown on Figure 1.

Table 1 contains a summary of the water rights and SAYs by sub-area and CGA. In many sub-areas the SAYs are low enough to result in significant curtailment of the irrigation groundwater rights. The curtailment amount varies from no curtailment (e.g., in Westland Road gravel sub-area) to 94 percent (%) of the total permitted groundwater right (e.g., in Sub-Area E of the Stage Gulch CGA). For all CGAs combined, the curtailed volume of groundwater rights adds up to a total of 127,038 AF or 67% of the total groundwater rights.

The curtailed volumes and percentages for the sub-areas indicate that the Butter Creek CGA is the most restricted of the areas (82%). Although the total groundwater rights in the Stage Gulch CGA is similar to the Butter Creek CGA, its use is less restricted (66% curtailment). The Ordance Gravel CGA is the least restricted of the CGAs (35%). Currently, there is no curtailment of the existing groundwater rights from the Ordance Basalt CGA.

A review of the information summarized in Table 1 indicates that the extent of the impact of the curtailment is not uniform between the sub-areas. Various factors can be used to prioritize the sub-areas in terms of the “severity” of their water right curtailment. If we compare the total amount of

issued groundwater rights versus the curtailed volumes, the following sub-areas may be placed in a “high” restriction category based on the total amount of certificated water rights greater than 5,000 AF and the generally high degree of curtailment:

1. Butter Creek Basalt CGA
 - Sub-area West where 39,396 AF of the total 45,066 AF of water rights is curtailed (87%)
 - Sub-area Pine City with 7,658 AF curtailment out of 11,808 AF (65%)
 - Sub-area Echo Junction with 9,846 AF curtailment out of 11,106 AF (89%)
 - Sub-area Four Mile Canyon with 3,764 AF curtailment out of 5,064 AF (74%)
2. Stage Gulch Basalt CGA
 - Sub-area A where 21,521 AF of the total 32,971 AF of water rights is curtailed (65%)
 - Sub-area H with 9,300 AF curtailment out of 18,150 AF (51%)
 - Sub-area G with 9,922 AF curtailment out of 12,672 AF (78%)
 - Sub-area D with 5,549 AF curtailment out of 8,799 AF (63%)
3. Ordnance Gravel CGA
 - Sub-area Lost Lake-Depot with 8,000 AF curtailment out of 17,000 AF (47%)

The following sub-areas may be placed in a second “medium” restriction category:

1. Butter Creek Basalt CGA
 - Sub-area North where 2,443 AF of the total 2,693 AF of water right is curtailed (91%)
 - Sub-area East with 1,650 AF curtailment out of 2,370 AF (70%)
 - Sub-area South with 1,598 AF curtailment out of 2,598 AF (62%)
2. Stage Gulch Basalt CGA
 - Sub-area B with 3,214 AF curtailment out of 3,414 AF (94%)
 - Sub-area C with 2,933 AF curtailment out of 3,333 AF (88%)

The remaining sub-areas either have very small volume of total water rights or no curtailment at this time. These sub-areas may be grouped in a “low” restriction category. The above prioritization will be used to assist with development of the basin-wide recharge water delivery system.

Finally, the groundwater levels in portions of the CGAs have continued to decline since establishment of the SAYs (OWRD 2003). There appears to be general consensus within OWRD that stabilization of the aquifers can only be accomplished if the SAYs were reduced to lower values than currently established. Reasonable estimates of water budget components for the CGAs are not available at this time. For the purpose of this project, it is assumed that satisfying the total curtailed volume of 127,083 AF in the CGAs will adequately address irrigation water needs and take a positive step toward stabilizing aquifer water levels.

New Acreage Irrigation - Additional acreage without current water rights has been considered by growers for groundwater irrigation in the CGAs. The purpose of inclusion of new lands in this assessment is to provide for some level of water supply planning for expansion of irrigated agriculture in the future in the basin.

It is not clear how much additional land, if any, will be agreed upon by the stakeholders for this purpose. However, based on work done in preparation of a proposed regional water plan (IRZ Consulting 2000) and IRZ's experience with growers in the basin, we estimate that between 10,000 and 20,000 additional acres of land can be effectively irrigated within the CGAs should water become available. Assuming a water duty of three (3) AF per acre of land, the additional water need will be between 30,000 and 60,000 AF.

Umatilla River Aquatic Habitat Enhancement - The Umatilla River flow decreases to its minimum level during the late summer and early fall months with an accompanying rise in water temperature. The decrease in flow is due partly to natural reduction in snow pack and runoff and partly to summer irrigation withdrawals. Significant flow augmentation occurs from a large storage reservoir located on McKay Creek near Pendleton. However, during parts of the summer this flow augmentation is largely withdrawn from the Umatilla River before it reaches the Columbia River. Observed summer flows increase dramatically downstream of the McKay Creek confluence, where nearly 200 cubic feet per second (cfs) of McKay Reservoir water enters the Umatilla River (Oregon Department of Environmental Quality 2001). Umatilla River flows then decrease dramatically between the City of Echo and Westland Road due to irrigation diversions. Below river mile 26.3, there are areas where Umatilla River flow increases as a result of irrigation and urban drain and groundwater returns.

Other than the discussion of flow requirements summarized in the Oregon Department of Environmental Quality (2001) document, there don't appear to be other sources of information and analysis recommending specific flow targets during the reaches of the Umatilla River within the CGAs. As a result, a target of 200 cfs of flow between the City of Echo and River Mile 26.3 is considered for the purpose of this assessment. The overall goal of this Umatilla Basin feasibility project is not to generate an additional 200 cfs of flow in the Umatilla River through aquifer recharge mechanisms. However, any flow increase and associated reduction in water temperature during the low flow months that may result from recharge projects recommended in this project will be of great environmental benefit. Therefore, specific flow targets (such as the 200 cfs cited above) will not be counted toward the overall water need estimate of the CGAs. However, this project will attempt to estimate the extent of such environmental benefits.

Other Water Supply Demands – Other sources of water demand considered for this assessment include existing and future domestic exempt groundwater uses and municipal water needs. The draft *Umatilla Sub-Basin 2050 Water Management Plan* (Umatilla County 2008) includes an estimate of approximately 2,000 AF of current exempt domestic water use in the CGAs for both Umatilla and Morrow counties. For the purpose of this assessment, we assume that an additional 2,000 AF of stored groundwater can be allocated to future exempt domestic groundwater users.

The 2050 Plan also contains approximate total water use volumes by the cities of Echo, Hermiston, and Stanfield in 2005. The annual water use volumes add up to a total of approximately 5,000 AF. Although the water use by the City of Irrigon was not included, we assume that the total of 5,000 AF will adequately cover the future potential municipal needs of these cities.

Stored Water That Can't Be Pumped By Law - Based on OAR 690-350, not all of the recharged water can be available for later withdrawal. Fifteen percent (15%) or more of the alluvial aquifer and up to 5% of

basalt aquifer recharge water may be designated by OWRD as permanently needing to remain in storage every year. Since the relative amounts of recharge water to be stored in the alluvial and basalt aquifers are not known at this time, for the purpose of developing an initial estimate of total water need, an average volume of 10% of total need will be used in this assessment.

Total Estimated Water Need - The total estimated water need of the CGAs is the total of the above specific needs as agreed-upon by the stakeholders. This total is estimated to range between 180,442 and 213,442 AF, depending on the acreage of new land subject of irrigation. A target value of 200,000 AF of water need, corresponding to a mid-value of 45,000 AF of groundwater for irrigation of new lands, will be used throughout the remainder of this project for feasibility assessment purposes. The water need estimates are summarized in Table 2.

COMPARISON WITH COLUMBIA RIVER AVAILABLE WATER

The target water need volume of 200,000 AF may be met from a combination of Columbia River and other surface water sources in the Basin. The majority of this need is intended to be met through appropriation and diversion of water from the Columbia River during September, October, and December through March of each year. These months have been designated as having “water available” for further appropriation (OWRD 2007). Table 3 lists the monthly water availability behind McNary and Bonneville dams as determined by OWRD.

To evaluate potentially suitable water withdrawal times at the needed diversion rates, it was assumed that the total water need of 200,000 AF will be diverted during the months of September, October, January, February, and March. Further assuming constant withdrawal rates during these five (5) months, a total daily diversion rate of more than 600 cfs (270,000 gallons per minute or gpm) may be estimated from the Columbia River. The largest currently-operating pump station on the Columbia River has a capacity of approximately 320 cfs (144,000 gpm), the smallest one of note approximately 5,000 cfs, and the total pumping capacity from the Columbia River is more than approximately 527,900 gpm. Although many other factors must be considered for initial planning purposes such as pumping heads, pipeline capacity and alignment, operation and maintenance needs, winterization needs, and others, it appears that there is sufficient existing pumping capacity to withdraw water along the reach of the Columbia River near the CGAs.

REFERENCES

Oregon Water Resources Department, 3 April 2003. *Ground Water Supplies In The Umatilla Basin*. OWRD Ground Water Section, Pendleton, Oregon.

IRZ Consulting LLC, November 2000. *Regional Water Plan For Fish, Municipalities, And Agriculture In The Umatilla Basin*. In cooperation with Hermiston Development Corporation, City of Pendleton, Confederated Tribes of Umatilla.

Oregon Water Resources Department, December 2007. *Sand Hollow-Umatilla Basin Regional Aquifer Recovery Assessment, Umatilla Basin.*

Umatilla County Critical Groundwater Task Force, January 2008. *Draft Umatilla Sub-Basin 2050 Water Management Plan.*

Oregon Department of Environmental Quality, March 2001. *Umatilla River Basin Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP).*

Oregon Water Resources Department, July 2008. Presentation slides developed by Doug Woodcock.

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TABLE 1
Curtailed Groundwater Amounts

Critical Groundwater Area	Sub-Area	Irrigated Acreage (acres)	Groundwater Right ^(a) (acre-feet)	SAY ^(a) (acre-feet)	Curtailment	
					(acre-feet)	%
Ordnance Gravel	Lost Lake	5,667	17,000	9,000	8,000	47%
	Westland Road	2,000	6,000	6,000	0	0%
Ordnance Basalt	Ordnance Basalt	2,267	6,800	6,800	0	0%
Butter Creek Basalt	North	898	2,693	250	2,443	91%
	Section 21	17	52	28	24	46%
	Echo Junction	3,702	11,106	1,260	9,846	89%
	4 Mile Canyon	1,688	5,064	1,300	3,764	74%
	East	790	2,370	720	1,650	70%
	West	15,022	45,066	5,670	39,396	87%
	Pine City	3,936	11,808	4,150	7,658	65%
South	866	2,598	1,000	1,598	62%	
Stage Gulch Basalt	A	10,990	32,971	11,450	21,521	65%
	B	1,138	3,414	200	3,214	94%
	C	1,111	3,333	400	2,933	88%
	D	2,933	8,799	3,250	5,549	63%
	E	50	150	150	0	0%
	F	140	420	200	220	52%
	G	4,224	12,672	2,750	9,922	78%
	H	6,050	18,150	8,850	9,300	51%
Totals		63,489	190,466	63,428	127,038	67%

Notes:

(a) Data from OWRD (Doug Woodcock, Personal Communication 2008).





TABLE 2
Estimated Total Water Need In the CGAs

Water Need	Volume (Acre-Feet)
Curtailed Irrigation Water Rights	127,038
Irrigation of New Land	30,000 – 60,000
Future Municipal & Domestic exempt Groundwater Use	7,000
Sub-Total	164,038 – 194,038
Remain in Aquifer	16,404 – 19,404
Total	180,442 – 213,442

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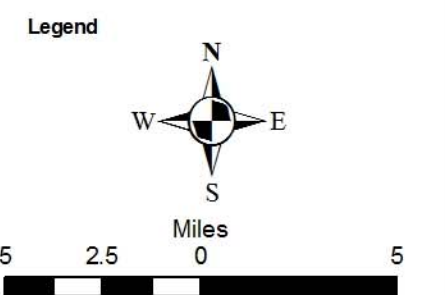
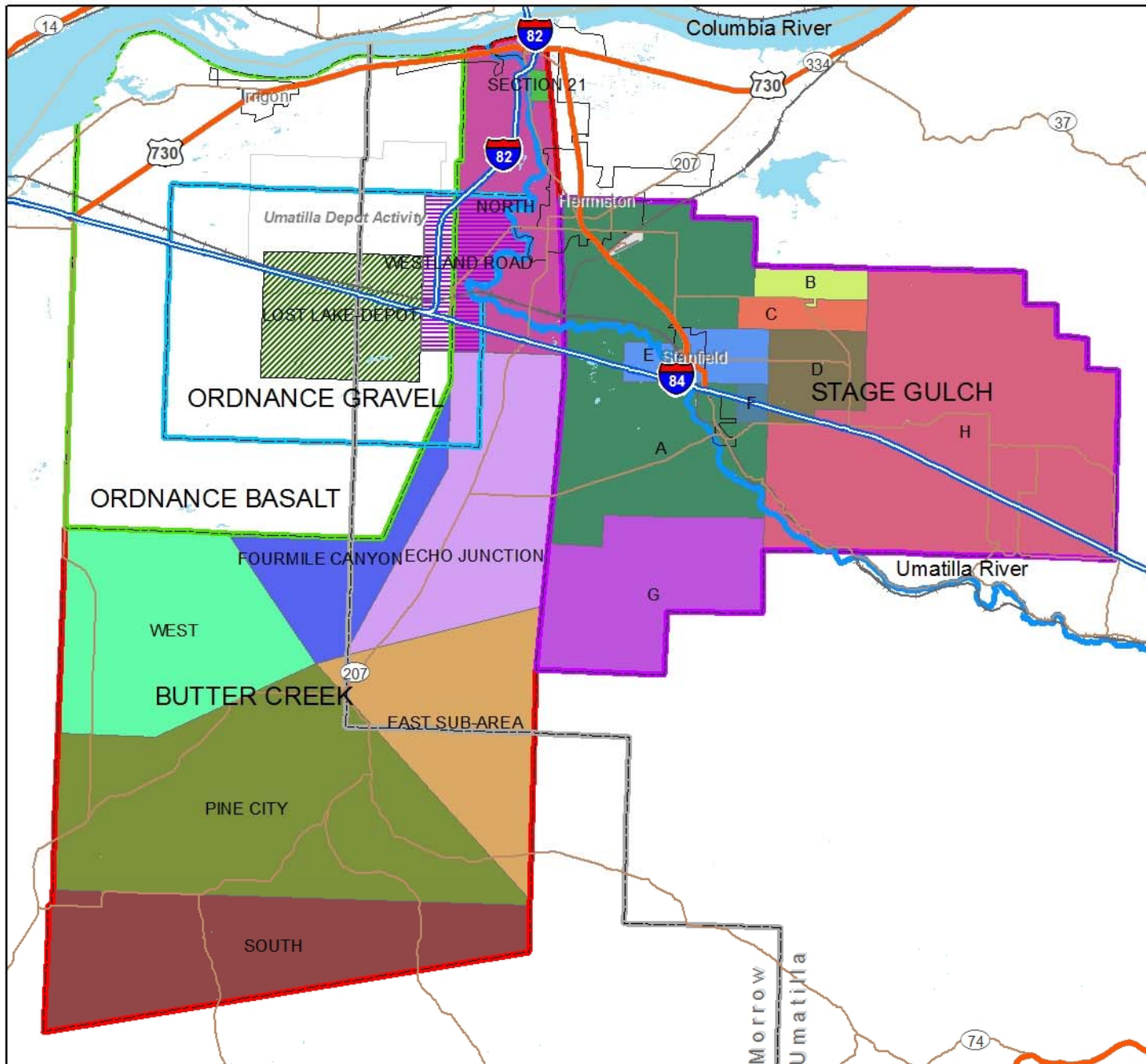


TABLE 3
“Water Availability” in Columbia River^(a)

Month	Water Availability (cfs) ^(b)	
	McNary Pool	Bonneville Pool
September	108,000	114,365
October	111,000	118,532
November	No Availability	
December	90	90
January	15,015	15,015
February	24,030	24,030
March	24,744	24,744
Other months	No Availability	

Notes:

- (a) Source: OWRD December 2007. Water availability is estimated by subtracting the target stream flows from the 50% exceedance stream flow.
- (b) cfs = cubic feet per second



Critical Groundwater Areas
Task 1D Figure 1

Umatilla Recharge Project

