Kerry Kavanagh

From: Nancy Rorick <nrorick@yahoo.com>
Sent: Friday, January 06, 2012 1:48 PM
To: kerry.l.kavanagh@state.or.us.
Cc: Ron Jacobs; wfarmer@fortboise.com; jfarmer@fortboise.com
Subject: Permit app G-17485
Attachments: Response permit app G-17485 1-6-12.pdf

Dear Ms. Kavanagh:

I have attached our response to the initial review determination for permit G-17485. Please contact me should you have any questions.

Sincerely,
Nancy L. Rorick

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January 6, 2012

Kerry Kavanagh
Water Right Application Caseworker
725 Summer Street NE, Suite A
Salem, OR 97301-1271

RE: Permit application G-17485

Dear Ms. Kavanagh:

I am responding to the Initial Review Determination (dated November 4, 2011) regarding ground-water-permit application G-17485. Item 5 (page 1) states that the standard allowable rate is 1/80th CFS per acre, or 0.65 CFS for 51.1 acres. Oregon Revised Statute 537.621(4) allows the applicant an opportunity to demonstrate need for a higher than standard rate.

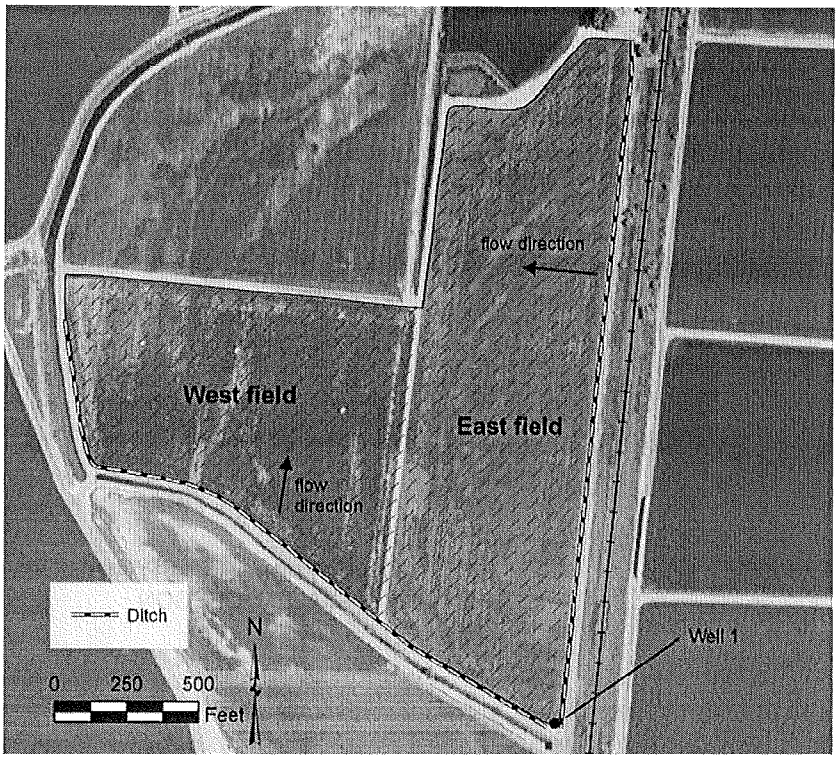
On behalf of the applicant, I am requesting a rate of 1/40th of one CFS per acre, or 1.28 CFS (574.5 gpm), as a supplemental right for the 51.1 acres. Certificate 45954, the primary water right, allows the water right holder to pump 1/40th of a CFS per acre from the Snake River for the purpose of furrow irrigation.

The applicant is requesting the rate of 1/40th CFS per acre because the rate of 1/80th CFS per acre is insufficient for the irrigation method he uses. He irrigates by diverting water from a concrete-lined irrigation ditch into irrigation furrows via hand-set irrigation tubes.

Methods

The method used here to evaluate irrigation flow is from a paper, titled *Managing Furrow Irrigation Systems*[1], on practices to increase the efficiency of furrow irrigation. The method promotes uniform infiltration across the irrigated field by varying stream size, furrow spacing, furrow length, and set time. Stream size is the individual flow rate of water from each siphon tube. Furrow spacing is the width between furrows, and furrow length is the length of the furrow. The set time is the length of time for which the field is irrigated.

[1] Benham, Eisenhauer, Yonts and Varner, 1998, *Managing Furrow Irrigation Systems*, Cooperative Extension, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, available online: http://www.p2pays.org/ref/20/19752.htm



East Field

The length of the east field is 2,350 feet; irrigation siphon tubes are placed every 80 inches (6.67 feet) for onions. There the number of furrows flowing is:

(*Eq. 1*) irrigated width ÷ spacing between number of furrows = number of furrows
2,350 feet ÷ 6.67 feet = 351 furrows flowing

The stream size can be determined by:

(Eq. 2) Stream size = Pump discharge (gpm) ÷ Number of furrows flowing
Stream size = 574.5 gpm ÷ 351 furrows = 1.64 gpm / furrow

Gross depth in inches across the field can be calculated by:

(*Eq. 3*) Gross Depth (inches) = $\frac{1{,}155 \times \text{Steam Size (gpm)} \times \text{Time Applied (hours)}}{\text{Furrow length (feet)} \times \text{Wetted Furrow Spacing (inches)}}$

On the east field the water flows for a period of 24 hours and the furrow length is 645 feet.

Gross Depth (inches) = $\frac{1{,}155 \times 1.64 \text{ gpm} \times 24 \text{ hours}}{645 \text{ feet} \times 80 \text{ inches}}$ = 0.9 inches

According Benham et al., the gross application should not exceed 1.5 to 2 inches on sandy textured soils; NRCS has mapped the soil as a fine sandy loam.

Flow efficiency can by further evaluated by calculating the cutoff ratio:

(Eq 4) Cutoff ratio = advance time ÷ time applied

The advance time is the time that it takes the water to reach the end of the field, for the east field the advance time is 10 to 12 hours. Thus the cutoff ratio for the east field is 12 hours ÷ 24 hours = 0.5. Benham et al. recommend a cutoff ratio of 0.5 for sandy soils to maximize efficiency.

West Field

The west field is not rectangular in shape, therefore, the furrow length is not uniform. Flow is reduced on the shorter rows to avoid over application of water by using smaller diameter siphon tubes. The longer rows are irrigated with 1-inch siphon tubes and the shorter rows with 3/4-inch tubes. A single calculation of gross depth of water application for the entire field in inches is not feasible because of the irregular shape. The variable furrow length is accounted for by dividing the field into 100-foot-wide segments, and calculating the gross depth in inches (Eq. 3) for each segment. The irrigated width of the field is 1220 feet. The width between flowing furrows for onions is 6.67 feet, therefore, the number of flowing furrows is 183.

The table below shows the gross depth in inches of water applied to each 100-foot wide segment. The gross depth of water applied, which ranges from 1 to 1.7 inches, is within or below the optimal range recommended by Benham et al. The cutoff ratios are also all below 0.5.

Segment from east to west	Length (feet)	Width (feet)	Number of furrows	Stream (gpm)	Time water applied (hours)	Wetted furrow spacing (inches)	Gross depth (inches)	Advance time (hours)	Cutoff ratio
1	1,060	100	15	3.14	24	80	1.0	12	0.5
2	990	100	15	3.14	24	80	1.1	12	0.5
3	930	100	15	3.14	24	80	1.2	12	0.5
4	875	100	15	3.14	24	80	1.2	10	0.4
5	741	100	15	3.14	24	80	1.5	10	0.4
6	806	100	15	3.14	24	80	1.3	10	0.4
7	696	100	15	3.14	24	80	1.6	10	0.4
8	672	100	15	3.14	24	80	1.6	10	0.4
9	662	100	15	3.14	24	80	1.6	10	0.4
10	654	100	15	3.14	24	80	1.7	8	0.3
11	647	100	15	3.14	24	80	1.7	8	0.3
12*	401	120	18	2.00	24	80	1.7	8	0.3

*Reduced flow rate due to smaller diameter siphon tube.

These calculations show that a rate of 1.28 CFS (1/40 of one CFS per acre) is adequate to irrigate east and west fields at optimal efficiency, as recommended by Benham et al. According to Benham et al., a very small stream size can severely limit infiltration because the water would take too long to reach the end of the furrow. This would result in over application of water at the upstream end of the furrow and too little at the downstream end of the furrow.

We would like to thank you for reviewing our response to the Initial Review Determination. Please contact Nancy Rorick with any questions for concerns that you may have.

Sincerely,

Nancy L. Rorick, RG, CWRE
Hydrogeologist

CC: Jim and Warren Farmer, Fort Boise Produce
Ron Jacobs, Water Master