Water Reuse in Idaho

Fall 2015

Electronic versions of all *Water Reuse in Idaho* newsletters are available under "DEQ Resources" at *www.deq.idaho.gov/permitting/water-quality-permitting/wastewater-reuse.aspx*.
The e-version provides access to the hot links included in the newsletter.

Water Reuse News

2015 Idaho Reuse Conference

The proceedings for the 2015 Idaho Reuse Conference are available at *www.deq.idaho.gov/assistance-resources/conferences-trainings/2015-water-reuse-conference/.*

For those of you not able to attend the reuse conference, take a moment to review the topics and papers that were presented.

Agronomic Practices

The goal of agricultural water reuse is to apply recycled water and supplemental irrigation water, if needed, to meet the needs of the crop being grown.

In the winter 2014/15 reuse newsletter, we discussed the Irrigation Water Requirement (IWR), which is the amount of water required for a given type of crop grown in a specific area in Idaho. For example, alfalfa in Twin Falls may require 45 inches of water, applied at the proper rates during the course of the growing season.

In addition to meeting the water requirements, the proper amount of nutrients must be available to the crop to generate the expected yield.

In the reuse permit program, the goal is to apply both water and nutrients, such as nitrogen and phosphorus, at rates commensurate with typical crop uptake.

The attached document, *Reuse Permits: Agronomic Rates,* provides information on how to determine agronomic rates for the crops grown at a reuse site.

Land-Limiting Constituent

Typically, agricultural reuse sites have a constituent, such as nitrogen, in their recycled water that limits the amount of recycled water that can be applied. Other constituents, such as phosphorus, chemical oxygen demand, or non-dissolved volatile solids (salts), can be limiting depending on your recycled water quality.

In cases where wastewater is highly treated and the constituents remaining in the recycled water are low, the IWR may be the limiting factor, and supplemental fertilizer may be required to grow a healthy crop.

Chapter 4 of the DEQ reuse guidance discusses the land-limiting constituents. This chapter also provides example calculations for hydraulic and constituent loading rates *www.deq.idaho.gov/media/516329-guidance_reuse_0907.pdf.*

Irrigation Scheduling

A resource for scheduling irrigation is available through Washington State University.

First, register at the following website to create a username and password: *http://weather.wsu.edu/index.php?page=register*

Once registered, login at *http://weather.wsu.edu/ism/*.

Click on "Help" at the bottom of the menu to learn why the program was developed and how it can be used to improve field operations. A user's manual is also available.

The following is the introduction from the Help document:

Irrigation scheduling is finding the answer to two basic questions: "When do I turn the water on?" and "How long do I leave it on?"

Improved irrigation scheduling has tremendous public and private benefits. Irrigation scheduling has been shown in various studies to decrease irrigation water use by 10-30% while resulting in equivalent or better crop quality and yields.

Since irrigation is responsible for 80-90% of the consumptive water use in the state of Washington (over 90% in Idaho), the total water and energy savings from improved irrigation management is tremendous. Irrigation scheduling has the following benefits:

- *Improved crop yields,*
- *Improved crop quality,*
- *Lower pumping energy costs,*
- *Lower irrigation related labor costs, and*
- *Decreased loss of expensive fertilizers to leaching.*

What's Brewing?

Enjoy the following videos about the latest competition on making beer from reuse water:

https://www.youtube.com/watch?v=2lIu2Dg-7Dg&feature=youtu.be

https://www.youtube.com/watch?v=HqkAo5crmVA

What's New at DEQ

- New DEQ staff working on reuse permits projects:
  - Dan Walters, Technical Services, State Office. Dan earned his BSCE and MS in environmental engineering from Georgia Tech and has over 20 years of environmental engineering experience, primarily in the consulting world on a wide variety of municipal water and wastewater projects. He has lived in Boise since 1999.
  - Jesse Bennett, Pocatello Regional Office. Jesse graduated from Montana State with an MS in chemical engineering. He worked on environmental water sampling projects in Yellowstone National Park and has 6 years of experience as a process engineer.
  - Andrew John, Technical Services, State Office. Andrew received a BS from Penn State University in environmental resource management, focusing on water resources and environmental economics. Andrew moved to Bozeman in 2012 and received his MS degree in land rehabilitation. His research focused on the effects of agricultural management practices on nitrate leaching in central Montana.
- Application forms for reuse permits were recently updated. The forms can be downloaded from the DEQ website at *http://www.deq.idaho.gov/permitting/water-quality-permitting/wastewater-reuse/.*

Regional Office Reuse Permit Coordinators

Coeur d'Alene: Matt Plaisted, P.E., 769-1422

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- Chas Ariss, P.E., Wastewater Engineering Manager, Water Quality Division, 373-0561
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Water Reuse Permits in Idaho

Permit search tool:
www.deq.idaho.gov/permitting/issued-permits.aspx?records=10&type=Wastewater+Reuse&sort=effectiveDescending

Information on municipal wastewater collection and treatment system classification:
www.deq.idaho.gov/water-quality/wastewater/pwws-classification-licensure/system-classifications.aspx

Reuse Permits: Agronomic Rates

The type of crop and the expected yield are the primary considerations when determining agronomic rates.

When determining agronomic rates for water reuse, it is important to choose achievable crop yield goals. Setting goals too high will result in unused nutrients being left in the soil and the potential for loss of nutrients into the ground water.

The following information provides tips for determining agronomic rates for nitrogen. The procedure for calculating agronomic rates for other nutrients such as phosphorus would follow the same general steps.

The agronomic rate for the amount of water necessary for different types of crops, referred to as the irrigation water requirement (IWR), was discussed in the *Winter 2014-15* reuse newsletter available at *http://www.deq.idaho.gov/media/53818241/reuse-newsletter-march-2015.pdf*

STEP 1: Set Crop Yield Goals

The best data would be historical crop yields at your site. Use average yields for the crop for the past three to five years for each field or management unit.

If you don't have historical crop data, the Idaho Department of Agriculture provides annual crop summaries, with yield data for each of the Idaho counties for certain crops. The 2014 report is available at: *http://www.agri.idaho.gov/Categories/NewsEvents/Documents/Bulletin_id.pdf*

You can also contact your local University of Idaho extension office *http://www.extension.uidaho.edu/find.asp* for help in determining expected crop yields for your location.

STEP 2: Determine the Nutrient Content of the Harvested Crop

Laboratory analysis is the only accurate means of knowing the nutrient content of your harvested crop. If laboratory data is not available, the following Natural Resources Conservation Service website *http://plants.usda.gov/npk/main* can be used to calculate the nutrient content of various types of crops.

The following example uses this website for determining the amount of nutrients removed by the harvested crop.

Assumptions:

Historical alfalfa yield for the past three years averaged 1.5 tons/acre for the 1st cut, 1.2 tons/acre for the 2nd and 3rd cuttings, and 0.9 tons/acre for the 4th and 5th cuttings. All yields are based on hay baled with a moisture content of 10%.

To calculate the nutrient content of the first cut using the calculator, choose "alfalfa crop for hay, first cut" as the crop, and enter a yield of 1.5 tons/acre and a crop moisture content of 10%. The output page of the calculator is shown below:

Crop Nutrient Results

Select Crops
About the Crop Nutrient Tool
Nutrient Data Sources
Download Crop Nutrient Database

Nutrient Details

The following is a detailed list of nutrient information based on each specific crop type chosen.

Alfalfa, for hay (cut 1)

Crop type:	Forage
Scientific name:	Medicago sativa
Crop yield unit:	ton
Harvested plant part:	Aboveground biomass

Nutrients in harvested part (lb/ton) at 10.0% moisture percentage.

Nitrogen	Phosphorus	Potassium
47.088	6.3	44.64

Nutrients removed in harvested part (lb/acre) at 1.5 ton yield level.

Nitrogen	Phosphorus	Potassium
70.632	9.45	66.96

The first cut of alfalfa removed 70.6 lbs nitrogen/acre and 9.5 lbs of phosphorus/acre. Use the calculator for cuttings 2 through 5. A summary of the nutrients removed is shown in the table below:

Cutting	Tons/acre at 10% moisture	Nitrogen removed, lbs/acre	Phosphorus removed, lbs/acre
1st	1.5	70.6	9.5
2nd	1.2	61.9	6.2
3rd	1.2	61.9	6.2
4th	0.9	48.1	3.1
5th	0.9	48.1	3.1
Total	5.7	290.6	28.1

STEP 3: Determine the Amount of Nutrients the Reuse Permit Allows

Refer to your reuse permit for the nitrogen and phosphorus allowance for the management unit you are examining. Most reuse permits set the nitrogen allowance at 150% of crop uptake.

In this example, we will assume the nitrogen permit limit is 150% of crop uptake and no phosphorus limit is specified. The nitrogen allowance above crop uptake accounts for losses due to volatilization, denitrification, and leaching.

Nitrogen limit = 290.6 lbs nitrogen/acre removed by crop x 1.5

= 435.9 lbs nitrogen/acre

For this management unit, the target nitrogen loading rate is 435.9 lbs of nitrogen/year. For permit compliance, you might plan for a more conservative application rate of ~400 lbs of nitrogen/acre.

Agriculture is far from an exact science and your best judgement should be used in planning nutrient application rates. For example, if crop yields are consistently increasing due to more intensive management of fields, it may be appropriate to target the entire 150% of crop uptake value.

Keep in mind that all sources of nitrogen should be accounted for in meeting your nitrogen permit limit. If nitrogen fertilizer is used, the amount of nitrogen applied with the fertilizer should be subtracted from the amount applied in your recycled water.

Another potential consideration is the source of your irrigation water. If your irrigation water contains a significant amount of nitrogen, it may contribute to your overall nitrogen loading rate. Typically, surface water used for supplemental irrigation has very low levels of nitrogen. However, some ground water in agricultural areas may contain elevated levels of nitrate nitrogen and contribute to your nitrogen loading rates.

For example, using 20 inches of ground water per acre with a nitrate concentration of 10 ppm will contribute about 45 lbs of nitrogen/acre.

= (20 acre-in/acre) x (10 lbs nitrate-N/1,000,000 lbs water) x (8.34 lbs water/gal) x (27,154 gal/acre-in)

= 45.3 lbs nitrate-N/acre