Innovative Techniques to Capture and Re-Use Water for Small Scale Nurseries in Washington State©

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The Washington State Department of Ecology (WSDE) has set very strict standards for utilization of both ground water and surface water. In the absence of a valid Water Right Permit rural landowners can only draw up to 5,000 gal per day from a well. In 2009, however, WSDE passed a new law stating that the landowners can capture rainwater (rain water harvesting) from their farm buildings and use it for irrigation purposes, without having to go through the elaborate process of applying for and possibly being denied a Water Right permit. By digging a relatively small water collection basin on their land, ornamental plant growers can collect and re-use rainwater thus ensuring adequate water for their operations.

INTRODUCTION

All too often rural landowners assume that owning a piece of property is equivalent to having access to the ground and/or surface water on their property. The right to use the water on the property should be viewed in terms of a lease, an easement, or a license, not ownership.

Water Rights

In Washington, water codes were established in 1917 for surface water and in 1945 for ground water. To obtain a new water right, landowners must file a claim with The Washington State Department of Ecology (WSDE). There are over 7,000 requests for new Water rights in Washington State. It may take 10 years for a new request to be reviewed; there is no certainty that a new request will be granted. The Washington State Department of Ecology has an on-line searchable database that lists the properties that have valid water rights.

Exempt Wells

Rural landowners can utilize up to 5,000 gal of water/day from a dug well when they lack a Water Right Permit. There is no acreage limit. The Washington State Department of Ecology must be notified 72 h before drilling any well. In terms of rain water harvesting (RWH) the use of the Exempt Well water can be added to the rain water collection system during the off-season.

Rainwater Capture

In 2009 WSDE issued a new interpretive policy that allows landowners to collect rooftop or guzzler water and use it for irrigation (WA Ecology RWH 2013). There are no limitations on the use of RWH collected water.

Rainwater Storage

Ecology states that RWH storage systems can be used for both water collected from structures, as well as the ground water pumped from Exempt Wells. The limit on RWH is 10 acre-ft of water. A one-acre pond (208 ft on a side), and 10 ft deep would hold 10 acre-ft of water, which is equivalent to 3.26 million gal of water. A one-acre pond would be a sizable investment for the limited acreage land-owner.

IN THE ABSSENCE OF A WATER RIGHT

Field Production
Washington state growers can purchase woody liner stock from Oregon wholesalers and grow them to maturity to supply the local landscaper trade. In-ground stock requires considerably less water than above-ground container stock.

Larger Containers
A one-acre can yard with roadbeds and utility areas could hold 21,780, 1-gal containers and require 27,000 gal of water per day. Conversely, a one-acre can yard could hold 2,062, 10-gal pots, requiring 1.25 gal of water per pot per day for a total of 2,577 gal. Without a Water Right Permit the use of small containers would not be feasible.

Pot in Pot
For a nursery with 15-gal socket/liner pots Northwest shade tree growers have found that they only require 1 gal of water per day, which is half the amount for a comparable tree grown in an above-ground pot.

Drought Tolerant Plants
With a limited supply of supplemental water for irrigation, growers can elect to raise conifers, evergreen shrubs, native plants, and ornamental shade trees as opposed to herbaceous perennials which require significantly more water.

CAPTURE AND RE-USE

Silos
Water silos can be free standing or attached to roof gutters. Ranging in size from 10,000 to 60,000 gal they might serve a small greenhouse operation. At a built cost of $1/gal they are too expensive for container yard or field producers. Besides, they would not hold enough water for field or above ground containers. Summers are typically very dry in western Washington.

Pond Limits
While one can store up to 10 acre-ft of water the size of this pond would certainly be a consideration on a 5-10 acre parcel.

Embankment Pond
The least expensive RWH pond would consist of building a dam on a gently sloping piece of ground and impounding the water that is collected (Fig. 1). Ecology states that the outlet dam should not exceed 10 ft in height before a Dam Safety permit is required.

Levee Pond
A levee pond is defined as an above-ground excavated pond. Levee ponds are only built on flat ground (Fig. 2). Levee ponds cannot be excavated to a depth of more than 10 ft according to Ecology. Unless the soil has 20% clay content, a 60 mil liner may be needed to prevent leakage on well-drained sites. Alternatively, utilizing clay subsoil or a bentonite clay application would eliminate the need for a liner.

Fig. 1. An embankment pond can be used for rainwater harvesting and as a filter for runoff from field stock.

Fig. 2. A fully lined levee pond directly adjacent to a large commercial greenhouse serves as an excellent rainwater harvesting collection basin.

RAINWATER HARVESTING FROM THE ROOF OF A GREENHOUSE

Rainwater Harvesting Calculations

Outbuildings and greenhouses structures are ideally suited to RWH. When constructed with gutters and downspouts they can easily funnel water to a collection basin.

Math

First, determine the square footage of the impervious surface (greenhouse roof, out-building). Next, look up the annual precipitation amount from the National Weather Service. Multiply the catchment area (ft^2) × rainfall depth in inches × 0.623 conversion factor. For example 1 in. of rain on 1,000 square ft of collection area yields 600 gal of collectable rainwater. A 30 ft wide by 100 ft long gable roof greenhouse may have 3,600

sq. ft. of roof surface. With 40 in. of annual precipitation a greenhouse this size could capture nearly 90,000 gal of water per year if it is equipped with gutters and downspouts.

CLEAN-UP AND RECIRCULATION FROM RAINWATER HARVESTING AND PONDS

Currently, the Washington State Department of Ecology does not require that Washington nurseries collect the sediment, nutrients, or pesticides that run off from field or container nurseries. Presently only Oregon and California require this practice. Runoff is mixed with fresh water and then reapplied to the growing beds. Rainwater harvesting ponds can capture not only water from greenhouses and sheds, but also the water, pesticides, and nutrients from can yards. With good filtration this water can be re-applied back onto the nursery (Johnson et al., 2011).

RAINWATER HARVESTING ENGINEERING REQUIREMENTS

Grading and Inspection Fees

A grading and drainage permit is generally required when more than 200 cubic yd of soil is moved. Growers will need to consult with their local Public Works engineering department to determine the costs. Once completed ponds will need to inspected to ensure that they have been properly sized.

Pond Limitations

If more than 5,000 yd^3 of soil is moved the pond will need to be designed by a civil engineer, thus significantly increasing the project costs.

STATE ENVIRONMENTAL POLICY ACT CHECKLIST

In 1971 the WA State Department of Ecology developed the State Environmental Policy Act (SEPA) to ensure environmental protection was ensured for all elements of the built environment. A SEPA checklist is required when the county engineering department receives a grading permit. County staff is required to submit the application to Ecology for their review. Small projects may not require a SEPA checklist. Ecology states that they can handle most applications within 2-3 months. The landowner will need to provide a detailed plan of the project including any changes to the land that would include grading or filling. The applicant would need to provide the cubic yards of excavation and the square footage of the RWH catchment basin.

ACTIVITIES NEAR RIPARIAN AREAS

In Washington State, county government is bound by strict adherence to the Growth Management Act which acts to preserve critical habitat for fish and wildlife. Agricultural producers are bound by varying buffer widths along salmon bearing streams, as determined by the Washington State Department of Fish and Wildlife. Growers should consult with Ecology before implementing RWH near a riparian area.

TECHNICAL ASSISTANCE

USDA Natural Resources Conservation Service

NRCS staff are non-regulatory advisors who can provide technical assistance to farmers who want to plan and design a farm pond to store rainwater (NRCS, 2000).

Water Rights Explorer

The Washington State Department of Ecology maintains a searchable database utilizing Geographical Information Services of existing water rights that landowners can refer to. One can search by parcel, range and section (WA Ecology Water Right Explorer, 2013).

Washington State Governor's Office of Regulatory Assistance
This public agency can help landowners understand how to apply for a Water Right, dig a well, and obtain a dam construction permit. All of their services are free and one can schedule a walk-in visit with a staff member. Their toll-free number is 1-800-917-0043, and their e-mail is <help@ora.wa.gov>. This office is located in Olympia, Washington.

RAINWATER HARVESTING COSTS

Pond Size
For this exercise we will build a square pond 116 ft on side and dig it 10 ft deep. With 27 ft^3/yd^3 our hypothetical pond comes to nearly 5,000 yd^3.

Pond Construction Costs
At \$3/yd^3 the construction cost is \$15,000. If the site drains freely a 60-mil plastic liner may be needed; it could cost nearly \$10,000 for materials and installation. In southwest Washington Permit Fees (grading and inspection) for this sized pond comes to nearly \$5,000 with insurance. SEPA fees would be variable.

RAINWATER HARVESTING POTENTIAL ACREAGE

Container Nurseries
With 1 million gal at the start of the irrigation season (mid-May) Table 1 depicts the size and number of containers that can be irrigated from an RWH collection pond.

Table 1. The use of rainwater harvesting to supply a container nursery.

Pot size in gal	Pots per acre	Gal per day (5/15-10/1)	Number of irrigation days	Total demand in gal	Number of acres
	4,640	1.25	130	754,000	1.3
10	2,062	1.50	130	402,090	2.5
15	742	1.75	130	168,805	6.0

The data in Table 1 is based upon Oregon and Washington grower reports of water usage. Natural evaporation from the pond would be offset by the addition 5,000 gal/day from Exempt Well pumping.

Field Nurseries
Northwest, in-ground, woody-ornamental, field growers can have a much larger nursery based on the reduced need for supplemental irrigation. Table 2 depicts the size of the potential acreage if the RWH collection pond held 1 million gal at the start of the season. Field growers will need to utilize hard hose drip tubing to irrigate their rows of trees and shrubs only, leaving the ally-way dry (LeBude and Bilderback, 2008). This practice helps cut down on weed growth in the rows. Heavy-wall tubing is strong enough to last more than one production cycle. It can also be moved easily during field digging by hand or with the use of tree spades.

Table 2. The use of rainwater harvesting to supply irrigation for an in-ground field nursery.

Drip tubing for a 10-ft row spacing	Total gal	Run time (h)	Sets per week	Total gal per week	Total weeks	Total gal per acre	Acres
27 gal/100 ft/h	1,176 gal[1]	2	2	4,704	18	84,472	11.8

[1]An acre of ground is 208 ft on a side. At 10-ft row spacing, there will be 21 drip hose lines per acre.

FUTURE DIRECTIONS

Support from Ecology

There is strong support from Ecology for RWH. Unless there are cumulative impacts from larger rainwater collection systems on streams and groundwater supplies, landowners should be able to rely on RWH as a feasible alternative to applying for a Water Right Permit. Ecology states that larger catchment basins will be viewed as surface water. Under the terms of RCW 90.03 users who take surface water will need to apply for a Water Right permit.

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