GROUNDWATER PROTECTION AREAS AND FORAGES

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ABSTRACT

Under previous regulations, Pesticide Management Zones (PMZs) were created in areas where pesticides were found in groundwater as a result of legal agricultural use. In 2003, based on increasing evidence of more widespread pesticide contamination of groundwater, DPR changed the criteria for identifying vulnerable areas, and changed the name of these vulnerable areas from Pesticide Management Zones (PMZs) to Groundwater Protection Areas (GWPAs). The GWPA regulations apply only if both of the following criteria fit the proposed pesticide application: 1. The pesticide to be applied is designated as a groundwater hazard, AND 2. The proposed application site is designated as being in a GWPA zone, either as a Leaching GWPA or as a Runoff GWPA. Use of the regulated pesticides in Runoff GWPAs has a stated list of management techniques, one of which must be practiced in order to use the regulated pesticide. In Leaching GWPAs, the primary management requirement is that an irrigation efficiency of applying no more than 133% of the crop net irrigation requirement at each irrigation for 6 months following the pesticide application be met. Achieving this level of irrigation efficiency is discussed. More information on complying with the GWPA regulations can be found at the GWPA Compliance web site (gwpa.uckac.edu).

Key Words: Irrigation, Irrigation Water Management, Groundwater Protection Areas, Alfalfa

INTRODUCTION

Under previous regulations, Pesticide Management Zones (PMZs) were created in areas where pesticides were found in groundwater as a result of legal agricultural use. Pesticide Management Zones were 1 square mile sections of land in which one or more pesticides were found in groundwater, and identified as being vulnerable to groundwater contamination.

In 2003, based on increasing evidence of more widespread pesticide contamination of groundwater, DPR changed the criteria for identifying vulnerable areas, and changed the name of these vulnerable areas from Pesticide Management Zones (PMZs) to Groundwater Protection Areas (GWPAs). The purpose of the changes was to prevent new areas from becoming contaminated and to avoid increasing the contamination of groundwater in areas already contaminated.

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All areas designated as PMZs were re-designated as GWPAs. Additional areas have been identified as GWPAs based on soils and depth to groundwater data. These criteria were developed from statistical analysis of over 15 years of well sampling data compiled by DPR.

DO THE GWPA REGULATION AFFECT YOU?

The GWPA regulations apply only if both of the following criteria fit the proposed pesticide application:

1. The pesticide to be applied is designated as a groundwater hazard. The current list (called the 6800(a) list is Title 3 of the California Code of Regulations) of regulated pesticides contain any of the following active ingredients:
   - Atrazine (Aatrex)
   - Bentazon (Basagram)
   - Bromocil (Hyvar, Krovar)
   - Diuron except products with less than 7% diuron that are applied to foliage (Karmex, Krovar)
   - Norflurazon (Solicam, Predict, Zorial)
   - Prometon (Pramitol)
   - Simazine (Princep)

AND

2. The proposed application site is designated as being in a GWPA zone, either as a Leaching GWPA or as a Runoff GWPA.

GWPA ZONES

Groundwater Protection Areas (GWPAs) are geographically defined areas that are vulnerable to pesticide contamination either by leaching or runoff. GWPAs include all existing pesticide management zones (PMZs), plus other areas based on specified soil types, and a depth to groundwater of 70 ft or less.

Leaching GWPAs are defined as sections of land where pesticide residues move from the soil surface through the soil matrix with percolating water to groundwater. Leaching GWPAs are located in areas with lighter-textures soils and relatively rapid infiltration rates.

Runoff GWPAs are defined as sections of land where pesticide residues are carried in runoff water to more direct routes to groundwater such as dry or drainage wells, poorly sealed production wells, or soil cracks or to areas where leaching can occur. Runoff GWPAs are located in areas with hardpan layers and/or low infiltration rates.

DPR has prepared maps for each county, showing the sections designated as Leaching GWPAs and the sections designated Runoff GWPAs. The maps are available on the following website: http://www.cdpr.ca.gov/docs/empm/gwp_prog/gwpamaps.htm

Additionally, the sections designated as Leaching GWPAs and the sections designated Runoff GWPAs are listed by county on the following website: http://www.cdpr.ca.gov/docs/gwp/gwpa_lists.htm.

A number of the County Agricultural Commissioner offices have further refined the GWPA zone mapping for their County. It is recommended that you check with your local Ag Commissioner office if you are uncertain whether you're in a GWPA.

Runoff GWPA

If it is determined that the area on which a regulated pesticide is to be applied is in a Runoff GWPA, the regulations give growers the flexibility to choose from a menu of management practices that best fit their situation. The permitted applicator can apply the regulated pesticide in a Runoff GWPA if *any one* of the following mitigation measures can be met:

(a) **Soil Disturbance**. The soil is disturbed within 7 days before the pesticide is applied (Note: this restriction is not an option for bentazon, and does not aply to the treated area that is immediately adjacent to the crop row and that does not exceed 33% of the distance between crop rows).

(b) **Incorporating the Pesticide**. The pesticide is incorporated on at least 90% of the area treated within 48 hours after the pesticide is applied, by the mechanical means or sprinkler or by low flow irrigation ((1/4 to 1 inch), including chemigation if allowed by the label (Note: this restriction is not an option for bentazon, and does not apply to the treated area that is immediately adjacent to the crop row and that does not exceed 33% of the distance between crop rows).

(c) **Band Treatment**. The pesticide is applied as a band treatment, not to exceed 33% of the distance between rows.

(d) **Timing of Application**. The pesticide is applied between April 1 and July 31.

(e) **Control of Runoff Within a Field**: All runoff water (either from irrigation or precipitation) is retained on-site for 6 months after application, provided the holding area has a percolation rate of less than 0.2 inches per hour.

(f) **Control of Runoff Outside a Field**. All runoff (either from irrigation or precipitation) is stored offsite for 6 months after application, provided the channel transporting the runoff and the holding area have a percolation rate of less than 0.2 inches per hour.

(g) **Control of Runoff Outside a Field**. For 6 months following application, runoff shall be managed so that it runs off onto an adjacent fallow field at least 300 feet long that is not irrigated for 6 months after application, with full consideration of any plant back restrictions.

In addition, if the above management practices are not feasible, growers, registrants, and others can request that DPR approve other, effective management practices that may be more suitable to their cultural practices or farming techniques while those practices are being adopted into regulation.

Leaching GWPA

Leaching GWPAs contain coarse soils with relatively rapid infiltration rates. Pesticides containing active ingredients that are regulated to protect groundwater may be applied by a permitted applicator if *any one* of the following mitigation measures can be met:

(a) **No irrigation.** No irrigation water is applied for six months.
(b) **No contact with irrigation water**. Pesticides are applied to the planting bed or the berm above the level of the irrigation water in the furrow or basin so there is no contact with the irrigation water.
(c) **Irrigation Management**. The irrigations are managed so that, for each irrigation applied for 6 months after the pesticide is applied, the net amount of water applied divided by the net irrigation requirement is 1.33 or less.

Note:
(1) The net irrigation requirement is the amount of water needed to bring the soil in the crop root zone to field capacity at the time of irrigation. It can be determined by direct measurements of soil moisture, such as by using tensiometers, or indirect measurements of soil moisture, such as by estimating evapotranspiration that has accumulated since the last irrigation.

In addition, if the above management practices are not feasible, growers, registrants, and others can request that DPR approve other, effective management practices that may be more suitable to their cultural practices or farming techniques while those practices are being adopted into regulation.

IRRIGATION WATER MANAGEMENT

As noted above, one of the management compliance options of the Leaching GWPA regulations is to irrigate no more than 133% of the crop water needs during a 6-month period after pesticide applications. In order to achieve this, a manager must know *How Much Water to Apply* and he must *Apply the Correct Amount of Water*.

How Much Water to Apply

Estimating the crop water use since the last irrigation is the easiest way of determining the net irrigation requirement. Alfalfa water use varies from being low after cutting to highest just prior to cutting. Table 1 shows an estimate of alfalfa crop water use (ET) for various location in California. The low to high changes in alfalfa water use between cuttings have been averaged. This makes irrigation scheduling easier and makes an excellent place for alfalfa growers to start with their irrigation scheduling efforts.

The GWPA Regulations also allow using soil moisture monitoring techniques to determine the amount of required irrigation water at irrigation. Quantifying soil moisture content is sometimes a more difficult method of determining the irrigation amount. Additional information on soil moisture monitoring can be found in the Net Irrigation Requirements section of the GWPA Compliance web site (gwpa.uckac.edu).

Table 1. Estimates of alfalfa crop water use (ET) for various locations in California.

	Alfalfa crop water use (inches per day during period)				
Date	**Shafter**	**Parlier**	**Davis**	**McArthur**	**Brawley**
Jan 1-15	0.03	0.03	0.03	0.02	0.07
Jan 16-31	0.05	0.04	0.05	0.03	0.09
Feb 1-15	0.07	0.06	0.06	0.04	0.10
Feb 16-28	0.09	0.08	0.09	0.07	0.13
March 1-15	0.11	0.10	0.09	0.08	0.16
March 16-31	0.14	0.13	0.14	0.11	0.19
Apr 1-15	0.19	0.17	0.18	0.14	0.22
Apr 16-30	0.20	0.19	0.20	0.14	0.25
May 1-15	0.24	0.22	0.23	0.18	0.28
May 16-31	0.26	0.24	0.24	0.19	0.29
June 1-15	0.27	0.26	0.28	0.22	0.31
June 16-31	0.28	0.27	0.29	0.25	0.32
July 1-15	0.28	0.27	0.29	0.27	0.31
July 16-31	0.26	0.25	0.27	0.25	0.29
Aug 1-15	0.25	0.24	0.26	0.25	0.29
Aug 16-31	0.23	0.22	0.24	0.22	0.28
Sept 1-15	0.21	0.19	0.21	0.18	0.26
Sept 16-30	0.18	0.15	0.18	0.14	0.22
Oct 1-15	0.16	0.13	0.16	0.12	0.19
Oct 16-31	0.12	0.09	0.12	0.08	0.15
Nov 1-15	0.08	0.07	0.09	0.05	0.12
Nov 16-30	0.08	0.04	0.06	0.03	0.10
Dec 1-15	0.05	0.03	0.05	0.02	0.07
Dec 16-31	0.03	0.02	0.04	0.02	0.07

Note: For the crop water demands of other crops, see the Net Irrigation Requirements section of the GWPA Compliance web site (gwpa.uckac.edu).

Applying the Correct Amount of Water

The first important step in applying the correct amount of water is to measure the amount of applied water. Quantifying the amount of applied water is often a difficult task in agricultural systems. Flow meters, such as a propeller meter, are accurate and easy to use but are limited to situations where water is flowing through pipelines or tubing. Measuring flow rate in open channel conditions, such as canals or ditches, is more difficult and less accurate.

An extensive coverage of measuring applied water is in the Net Irrigation Application section of the GWPA Compliance web site (gwpa.uckac.edu). In that section, you are able to choose the water measurement information for the irrigation system you use. For example, if you use

border strip irrigation with alfalfa valves for alfalfa, download the file “Flood / Border Irrigation – Valve Discharging into Border”.

If you find that the measured applied irrigation water is greater than 133% of the net irrigation requirement, improvements must be made in irrigation water management (IWM). The Improving Irrigation Practices section of the GWPA Compliance web site (gwpa.uckac.edu) covers in detail potential IWM improvements. Two potential IWM techniques for alfalfa irrigation are tailwater return ponds and manipulating the flow rate to irrigated borders.

Tailwater return systems collect the tailwater runoff from borders and reuse the water for irrigation. Tailwater return systems require a tailwater pond and a pump / pipeline or other system to allow the return water to be reused. Simply leaving the water in the pond until it infiltrates is not improving the irrigation efficiency and may lead to groundwater contamination problems.

Increasing the flow rate to an irrigated border causes the water to advance down the border more quickly, shortening the irrigation time and often resulting in less total water needed to irrigate the border. The more quickly advancing water often requires more careful management, especially in the timing of irrigation set times. If the water is not turned off at the correct time, increased water amounts may “pile up” at the border end, resulting in increased scalding, weeds, and disease problems. Combining tailwater return systems with increased border flow rates can mitigate these problems and further increase irrigation efficiency.