



eastern
river basin district

GROUNDWATER RISK FROM DIFFUSE MOBILE ORGANICS (PESTICIDES)

**BACKGROUND DOCUMENT
TO THE
WATER MATTERS REPORT**

TABLE OF CONTENTS

Section 1 Introduction 3
Section 2 Summary of Results..... 4
Section 3 Recommendations 7

LIST OF FIGURES

Figure 1: Groundwater Bodies Recommended for Validation Sampling and EPA’s
Monitoring Network 6

Section 1

Introduction

A revised national assessment of risk to groundwater from diffuse sources of pesticide pollution has been carried out in the Irish hydrogeological context. The original Article V risk assessment that was submitted by the Environmental Protection Agency (EPA) to the European Commission (EC) in March 2005 was generally acknowledged to be flawed on the basis of an overly simplistic methodology. The Eastern River Basin District (ERBD) project was subsequently commissioned by Dublin City Council (DCC), on behalf of the Department of Environment, Heritage and Local Government (DEHLG), to study risk to groundwater in greater detail, with the intent of informing future needs of a national Programme of (groundwater) Monitoring and a Programme of Measures, both required by the European Union (EU) Water Framework Directive (WFD).

The overall objectives and tasks of the study were to:

- Improve the understanding of pesticide-related pressures;
- Research fate and transport characteristics of commonly used pesticides;
- Develop and implement a risk assessment methodology that captures both the pressure information and incorporates relevant physical factors that control leaching of pesticides from soil to groundwater.

The presence of pesticides in groundwater is considered to be a significant water management issue due to potential impacts associated with drinking water sources and ecological receptors.

The national study is completed and a draft report is presently being reviewed by steering group, comprising members of the Environmental Protection Agency (EPA), the Pesticide Control Service (PCS) of the Department of Agriculture and Food (DAF), Coillte, and Dublin City Council (DCC).

Section 2

Summary of Results

Pesticides are used in a wide array of settings, including agriculture, forestry, transportation, (urban) amenity (including golf courses), and industry. Records of usage in the agricultural and forestry sectors are kept by the DAF and the Irish Forestry Service (IFS), respectively. Reasonable estimates of the types and quantities of pesticides used in agriculture and forestry have been developed. Estimates for other sectors are subject to significant uncertainty, as inventories are generally not kept. In such cases, estimates are based on interviews, literature, and limited records from some local authorities.

The largest quantities are used in the agricultural sector, primarily for pest control associated with grassland management, fodder crops (e.g., maize), and arable farming (cereals and root crops). Outside of agriculture and forestry, total quantities used are small.

Based on past and present usage data, the chemical characteristics of identified pesticides, and experiences from other countries (including UK), the following short-list of active ingredients was defined and recommended for future groundwater monitoring: atrazine, simazine, 2,4-D, MCPA, chlortoluron, glyphosate, isoproturon, mecoprop, isodrin, diuron, dieldrin, DDT, dibutyl tin, lindane, bentazone, and cypermethrin.

The fate and transport of pesticides in soil and groundwater is complex, requiring knowledge of how chemicals are applied (and disposed of), their chemical properties, and physical transport processes (including pathways). While risk to groundwater is effectively a site-specific science, a relative assessment of diffuse pesticide risk at the national scale has been produced by:

- Mapping important source-pathway-receptor factors, including land uses;
- Linking different active ingredients to specific land uses; and
- Modeling subsurface transport of active ingredients from soil to groundwater through the vadose zone.

Leachate modeling of different active ingredients was conducted on more than 20 different physical settings, largely defined by the groundwater vulnerability classification criteria used by the Geological Survey of Ireland (GSI). Results of modeling were linked back to the spatial distribution of physical scenarios that were modeled. Many of the variables that influence leaching are known from existing databases and have been mapped across the country. Variables that influence leaching include rainfall, soil organic carbon content, and the chemical properties of pesticides (notably degradation rates).

Overall, groundwater risk from diffuse pesticide applications are considered to be limited, and the highest risks are associated with the eastern and southeastern parts of Ireland, where agricultural land uses (notably forage maize and arable) overlie productive aquifers and areas of extreme groundwater vulnerability. In the Shannon and western river basin districts, the highest risk to groundwater is considered to be associated with young forestry and silage, where such land uses coincide with karst areas of extreme groundwater vulnerability.

The active ingredient which poses the greatest risk to groundwater, in terms of present usage and mobility in the subsurface, is atrazine. Atrazine is only licensed for use on forage maize and forestry, and will be removed from the list of allowable ingredients after December 31st, 2007.

Experiences in EU countries and the US suggest that the presence of pesticides in groundwater can be unpredictable, and caution must therefore be exercised to predictive risk assessments. Literature review and limited Irish datasets would suggest that pesticides can be expected to be detected in groundwater at low concentrations (and below the EU drinking water standard of 0.1ug/L). There are many reasons for this:

- Inconsistent applications by users in respective sectors;
- Poor disposal practices;
- Presence of preferential pathways;
- General persistence in the subsurface environment.

On the basis of land use patterns, pesticide leaching modeling, and physical scenarios encountered across Ireland, systematic groundwater sampling for risk validation purposes is recommended in the groundwater bodies shown in Figure 1. The groundwater bodies shown in Figure 1 represent both higher- and lower-risk scenarios.

While the revised assessment remains predictive, the project has contributed to the understanding of groundwater risk by:

- Developing estimates of types and quantities of pesticides used;
- Mapping relevant sources (land uses);
- Quantifying fate and transport variables;
- Understanding which variables control pesticide leaching in the Irish context;
- Informing future monitoring activities;
- Providing recommendations for future needed work.

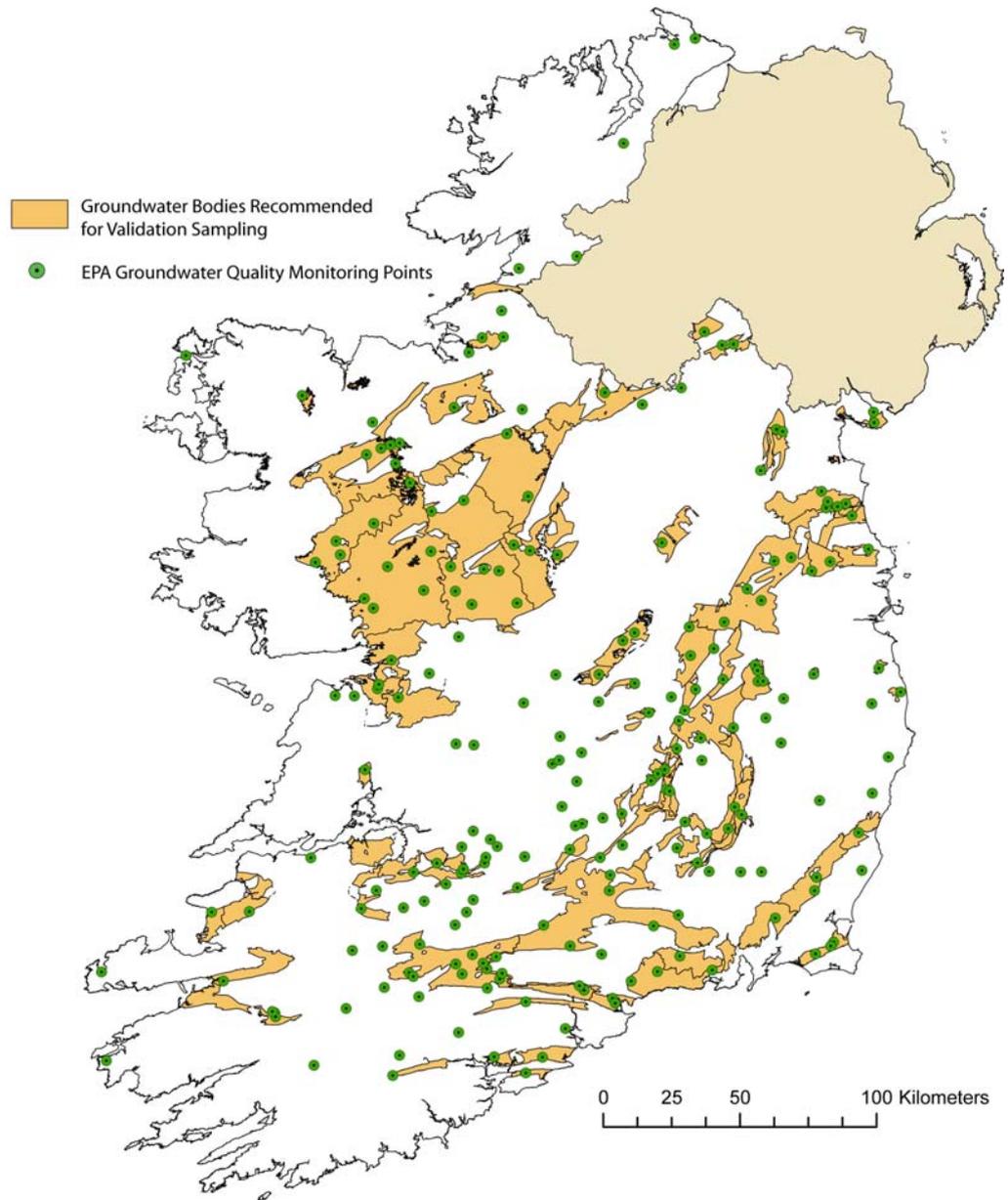


Figure 1: Groundwater Bodies Recommended for Validation Sampling and EPA's Monitoring Network

Section 3

Recommendations

Recommendations for measures fall into these broad categories:

- Improved inventories of pesticide usage and applications in sectors other than agriculture and forestry;
- Improved spatial resolution of land use mapping associated with pesticides;
- Research into the fate and transport of commonly applied active ingredients in Irish soils – notably to establish degradation rates.
- Comprehensive groundwater sampling - existing groundwater quality data sets are insufficient and broader sampling efforts are needed in the future.

Recommendations for future groundwater monitoring have been developed in consultation with the EPA. On the combined basis of results from this study, lessons learned from other countries, as well as the lack of systematic groundwater monitoring for pesticides across the country, the EPA intends to carry out a broad sweep of groundwater sampling across Ireland, as indicated by Figure 1, during implementation of their recently published monitoring network. This is targeted to begin in July 2007.