UK WATER INDUSTRY RESEARCH LIMITED

PESTICIDE RISK MAPPING AND CATCHMENT INTERVENTIONS – PHASE2

Executive Summary

Background

Certain pesticides used in farming, such as metaldehyde and other "actives" that may be present in surface and groundwater sources and are difficult to remove by existing potable water treatment processes, can cause drinking water to fail EU water quality standards. Catchment intervention measures are an important and sustainable means of mitigating this risk to drinking water quality.

Phase 1 of this project (DW14B207) resulted in the production of intrinsic pesticide risk maps describing diffuse agricultural losses to surface and groundwater of (i) mobile herbicides used on arable and grassland and (ii) metaldehyde used on arable land, following development of an agreement on a consistent risk mapping and catchment interventions approach. This risk mapping approach, which is underpinned by the individual physical properties of a site (soil type, drain status, slope, climate, landuse, connectivity to surface and groundwater), was used to derive UK-wide coarse scale risk maps as well as field scale risk maps for example drinking water (DrW) catchments. Accompanying assessments of interventions that might tackle losses of pesticide from high risk sites were also outlined along with their likely effectiveness, barriers to uptake and typical costs of implementation.

Phase 2 (DW14B209) of this project addresses the need for comprehensive risk mapping coverage at the field scale for all DrW catchments and the production of software tools to facilitate its usage.

Objectives

The second phase of the project sought to deliver the risk mapping methodology developed in phase 1 to individual water companies in the UK. In practice, this meant that the risk mapping methodology was to be applied at a field level to all DrW catchments in the UK, and that software tools were to be developed and made available to the water companies for the optimal use of, track benefits from and to improve communication of the risk mapping. In addition, it was desired that gaps in the evidence base compiled in Phase 1 be assessed further, for example gaps in the assessment of intervention effectiveness.

Results

Risk mapping: It was originally planned that the field level risk mapping would be carried out for DrW catchments only, necessitating the production of a DrW catchments dataset. However, sourcing DrW catchment boundaries from water companies and/or Environment Agencies proved to be a challenging task. Despite extensive efforts, well beyond that planned, a UK DrW catchment boundary dataset could not be compiled for a number of reasons, primarily relating to data licensing limitations/uncertainties, national security policy, dataset availability and incomplete/inconsistent data supply.

Given the risk mapping is underpinned by site physical properties which are informed by spatial datasets, some of which require a data licence for their use, sourcing the requisite data licences for each water company operational area was a pre-requisite for conducting and distributing the results of the field level risk mapping. Data licensing and supply proved to be equally challenging and involved significant effort that was well beyond that which was planned for this task. In summary, data licensing issues which may prevent the use of the risk mapping in the different countries in the UK may be summarised as follows:

- Scotland – None.
- Wales – Field boundaries. Land Parcel Identification System (LPIS) field boundaries need to be licensed. There is some uncertainty as to whether these can be licensed to water companies owing to data confidentiality regulations in Wales. It is hoped that access will be facilitated/granted through Natural Resources Wales (NRW) and the Welsh Assembly Government should these be supplied without owner contact details.
- Northern Ireland – Field boundaries. The payment agency field boundary dataset was not available to this project and as such the Landcover Map 2007 Vector dataset was used. Use of the risk maps is thus predicated on the licensing of this dataset.
- England – None.

However, purchasing a licence to use the soils dataset covering England and Wales may be an obstacle for some water companies that have not made provision for this cost.

In order to overcome the incomplete catchment boundaries defining all DrW catchment areas, all fields in the Customer and Land Database (CLAD) in England and the LPIS dataset in Wales have been risk mapped. For those water companies that supplied catchment boundaries of suitable quality, software databases for use with the data management software tools have been populated and water company specific software installation disks created. For those that supplied catchment boundaries that did not meet the quality required to generate software databases and installation disks, the raw risk mapping has been clipped to the extents of these catchments and supplied in this format. For companies that have yet to supply a DrW catchment boundary dataset the data will be archived for a further 12 months to allow them additional time to generate the required catchment boundary datasets. All companies need to ensure that they hold the requisite data licences at all times, both at the time of risk mapping data supply as well as on an ongoing basis, in order to use the data contained in the risk mapping software databases legally.

Software Tools Developed: Over-arching considerations that informed the software tool solution design and their development were:

- The pesticide risk mapping approach is still a proof of concept and over-engineering the software solution at this stage may be inappropriate;
- There was a limited budget available (£42 to 46K initially);
- There was a need to try and accommodate all or most water companies existing systems and processes, particularly with respect to the Geographical Information System (GIS) software used;
- It was important to try to not duplicate existing systems while moving the approach forward for all organisations;

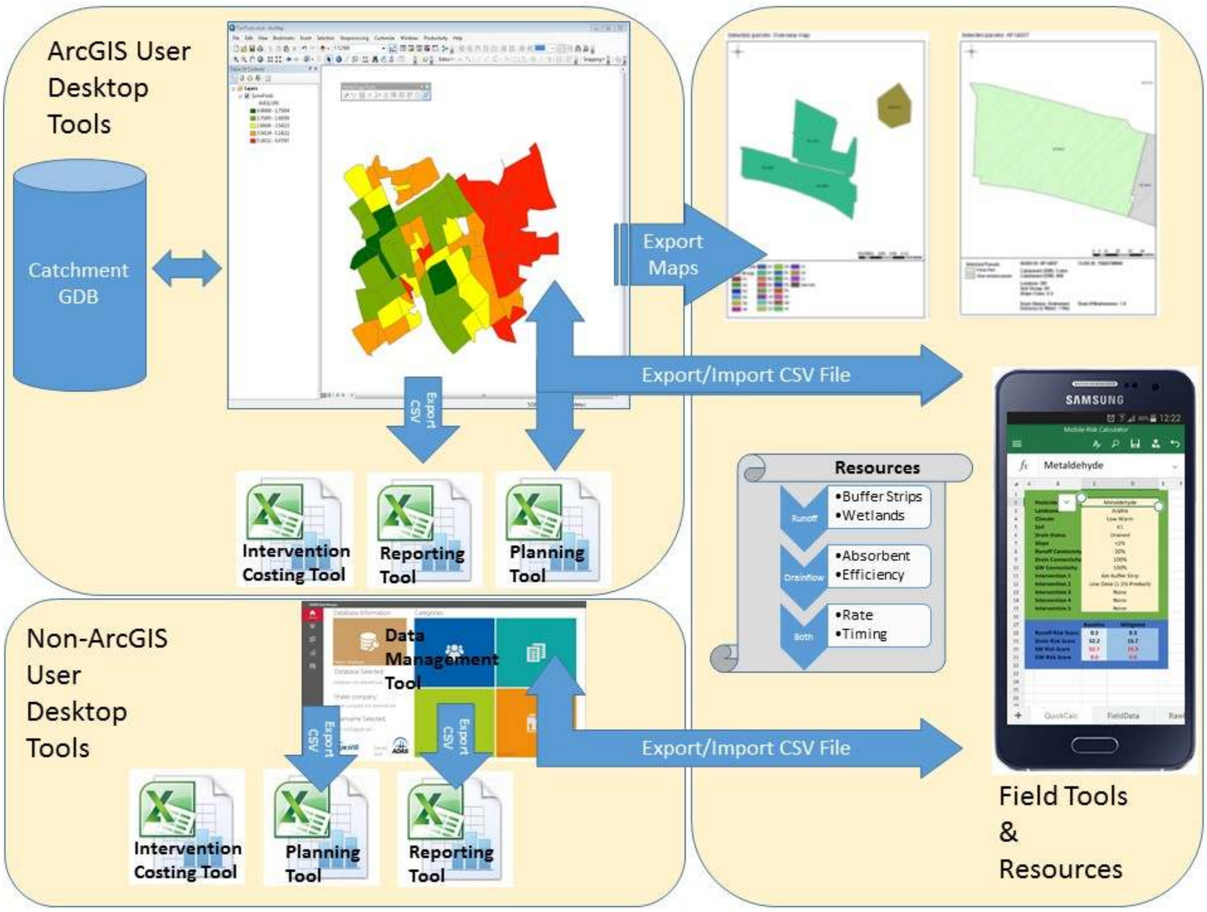
- Consideration was to be given to the possible reuse of components of the software by the agricultural industry (possibly with minor modification);

A range of software tool options were considered, ranging from paper based to fully web enabled solutions, drawing on the results of a water industry user survey in conjunction with published IT within farm business survey statistics. The software solution selected by the Steering Group for development and rollout comprised various complementary components and catered for water companies with and without access to desktop ArcGIS, comprising the following deployment configurations:

1. ArcGIS User Desktop Tools – Desktop ArcGIS mapping tool for spatial and non-spatial data management; Microsoft (MS) Excel based desktop tools for reporting, planning and costing; MS Excel based field risk calculator alongside a PDF/Paper map.

2. Non-ArcGIS User Desktop Tools – Standalone WinForms desktop tools for "non-spatial" data management alongside MS Excel reporting, planning and costing tools; MS Excel based field risk calculator [it was assumed mapping and map production will be undertaken using existing organisational GIS arrangements].

Schematic illustrating the ArcGIS User and non-ArcGIS User software design



Note: The map is only available to ArcGIS users. Non-ArcGIS users would need to derive their maps from another source.

Resources to Support Usage of the Software Tools: To promote standardised usage of the risk mapping software tools across the water industry, "best practice guidance" is provided in this report as well as within the software user manuals (which are provided as PDF files as part of the software installation). This includes all aspects of the risk mapping, from the risk mapping itself to the updating of the field properties and usage of the software. In addition, field resources for use alongside the field risk tool in the field during stakeholder discussions, to both assist with the updating of the field characteristics as well as with intervention assessment and selection, are also provided in Appendix 3. These facilitate the in-field updating of the baseline field physical properties on which the risk score is calculated as well as providing information regarding the interventions included in the risk mapping tool should they be required during the discussion with the farmer. Additional 1-page intervention summaries are also included for a range of best-practices should they be needed during these discussions.

Interventions Survey: There were eighteen intervention projects reported through six survey form returns spanning three broad intervention effectiveness categories, namely changes to application practice (9 trials), edge of field interventions (1 trial) as well as other miscellaneous options like grower frameworks for provision of clean water, weed wiper schemes, equipment calibration and advice programmes (8 trials). There were no reported trials carried out to investigate or demonstrate techniques for in-field or point source interventions. While the responses gathered from this survey provide useful supporting data to the intervention approaches quantified as options for reducing risk from intrinsically high risk sites in phase one of the project, they focus mainly on substitution/dose reduction activities that are already included in the risk assessment toolbox. In/edge of field interventions are absent, with the exception of the swales trial, and it is these that represent the most significant data gap in terms of attributing a value to potential mitigations. Development of the framework approach of combined best practices and interventions, driven by either the grower or stakeholders (e.g. farmers as producers of clean water) may be a possibility for inclusion into the risk assessment tool in the medium term as the on-going projects are likely to provide significant comparative water quality data. The full survey summary is available to water company stakeholders only on the accompanying data CD.

Conclusions

Pesticide risk maps for mobile herbicides (applied to arable and grassland) and metaldehyde (applied to arable land only), covering much of the UK at a field level, have been developed using a reasonably consistent set of input datasets. These have been incorporated into the software tools developed during this project phase to allow for the use of these risk maps in both a planning and operational sense. The accompanying survey of intervention effectiveness studies/trials being implemented within this Asset Management Planning period allows for the identification of the potential to improve default values built into the software as well as promote awareness of activities within the industry.

Recommendations

Preliminary evaluation of the risk mapping approach against real world observations has been undertaken in phase 1 of this project for a small number of catchments and the approach would benefit from further evaluation through catchment officers using the risk maps and software tools developed in this phase 2 of the project. A key limitation to deriving a national coverage of DrW catchments was data licensing uncertainties, and incomplete and inconsistent data supply. It is recommended that further efforts to establish a nationally consistent set of DrW catchment boundaries be invested as these are an important element of risk communication allowing farmers to assess if their fields are within a DrW catchment and as such contribute to a DrW quality problem.

The outputs of this project were designed to meet the needs of the water industry and their regulators in addressing drinking water quality pressures from mobile pesticides. Uses beyond this scope should be carefully assessed, as they may not be valid.

Benefits

The outputs from this project will benefit UKWIR stakeholders by allowing them to identify potentially high risk areas within their DrW catchments to prioritise catchment management interventions with the aim of addressing potential risk and improving water quality. It also allows them to refine the risk maps through stakeholder engagement, track intervention agreements with farmers and assess the benefits of the risk mapping and stakeholder engagement process. This will aid targeting of limited resources and catchment stakeholder engagement programmes by expanding the evidence base required to change behaviour.

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