Harmoni-CA

Homogeneity of homogeneous map units

Erik Meyles[1], Casper Zoete[1], Bert Moonen[2]

[1] Van Hall Instituut, The Netherlands

ew.meyles@pers.vhall.nl

ce.zoete@pers.vhall.nl

[2]Waterboard Groot Salland, The Netherlands

bmoonen@wgs.nl

Abstract

The water board 'Groot Salland' and the Van Hall Instituut are partners in a joint research project. The aim of this project is to identify areas where a significant change in water quality is to be expected as a result of raised water levels in parts of the catchment area. These raised water levels automatically affect the phreatic watertable, which will rise as well.

The background for this change is to meet policy requirements to hold water in place as long as possible in order to prevent flooding further downstream under extreme weather conditions. Dutch policy prescribes to prevent downstream flooding by the following principles: retaining, storing and finally

discharging surplus water. This means, that in areas where precipitation occurs, first an attempt must be made to keep water in place. If there is no space to retain the water, then the water can be stored (for example in basins or other open water bodies). If this is not possible as well, then water may be discharged.

If surface water levels are being raised this goes with a rise in groundwater table which in turn is accompanied by a by a change in the redox situation. This affects the leaching of nutrients such as nitrogen and phosphorus. It depends on site specific characteristics such as soil type and current and past land use, whether this change will have considerable consequences or not. In the situation of enhanced leaching this may endanger water quality standards that emerge as a result of the implementation of the Water framework directive.

Within the context of this directive it is the relationship between morphology on the one hand and the chemical and ecological state of the waterbody on the other hand, which is founded by this study.

In this research project we try to set up a monitoring programme in order to assess the consequences of raised water levels with regard to changes in water quality with specific attention for nutrients such as nitrogen and phosphorus. It is not possible to monitor the entire area in full detail. Besides that, because of the high natural variability of the area, some areas will be more susceptible whereas other areas are not. Also, some areas are not suitable for raising groundwater levels, for example if they are very wet by nature. These areas will not yield a high potential for retaining water.

Therefore we carried out a pilot project to find out areas within the catchment that are presumed to be susceptible or more or less indifferent to consequences of raised waterlevels. It is the objective of the waterboard to use the outcome of this study to assign and border the areas where surface water may be raised in the near future in such a way that this will not endanger the water quality standards set by the Water framework directive.

First, the cycles of both nitrogen and phosphorous in the soil were related to factors occurring in the area, such as soil type, groundwater regime, manuring, current and historic land use and water system. These factors are variable in the catchment area and are expected to influence the leaching of both nutrients. Factors were combined to create so-called ‘homogeneous map units’, in which the variation of all factors was relatively limited. The combination of variables within each unit (often closely related to landscape types) yielded a qualitative sketch map with areas with ‘high’ to ‘low’ risk of leaching of nitrogen and/or phosphorous. In this way each part of the catchment could be characterised as a combination of classes for each of the variables and is therefore expected to respond uniformly (within a reasonable range) to the behaviour of nitrogen and phosphorus. The results from this pilot project were promising and now we are moving into the stage of monitoring.

Initially, the number of classes was too big and a number of combinations were relatively small in area. From a pragmatic point of view this was unworkable. Classes were broadened and combinations that were small in acreage were assigned to adjacent categories. In this way the number of homogeneous map units was kept to an acceptable number.

The next stage was to assess the actual situation of groundwater quality. Quickly it turned out that the number of observation wells was too low for firm conclusions. Also the ‘fit’ of the outcome of the refined model to the actual situation was not as good as had been hoped for.

This raised questions on how to proceed further. Additional monitoring tubes have been installed to match up with the lack of sufficient monitoring tubes.

Also geochemical calculations will be carried out in the coming months to verify whether important factors were overlooked or how the ‘model’ can be simplified any further. These activities will help us in the coming months to provide an answer to ‘How homogeneous is a homogeneous map unit?’

The whole process was conducted by students doing their final thesis under the supervision of lecturers and waterboard employees. Despite some failures during the process all parties involved enjoyed the collaboration and the outcome and we enjoy to discuss our findings with the audience.