version 2021-11-05

WaterGUIDE.online – Nutrient loss mitigation

Manual and training material

Read the text in the box below before you use the system

This decision support tool was developed by the Swedish University of Agricultural Sciences (SLU) within work packages 3 and 4 in the Interreg Baltic Sea Region Programme project Waterdrive in collaboration with a number of project partners.

Please note: The decision support tool is provided as is, the information presented is not guaranteed to be error free, and in most cases it was generated in a more general scale than the field level. The authors do not take any responsibility for the use of the tools; all users are solely responsible for any decisions made based on the tool. The intended users of this tool should be well acquainted with local field conditions, and the information provided. It is recommended that you go through this document before general use. The tool shall be regarded as working material, which provides information for discussion that exemplifies how various types of data related to nutrient loss from arable land can be presented to users (e.g. farmers, advisors and authorities) at the field scale, or even within-field scale. All numbers of costs and payments mentioned are only examples in the system, and should be used only for testing the system. Please read information material before using the tool. Remember that changes of the tool can be made at any time since it is a developing product within the Waterdrive project.

Read more about Waterdrive, and WP3 and WP4 here: https://water-drive.eu/about/
More project info here: https://projects.interreg-baltic.eu/projects/waterdrive-194.html

Read more about R&D on decision support systems at SLU: http://www.slu.se/LADS

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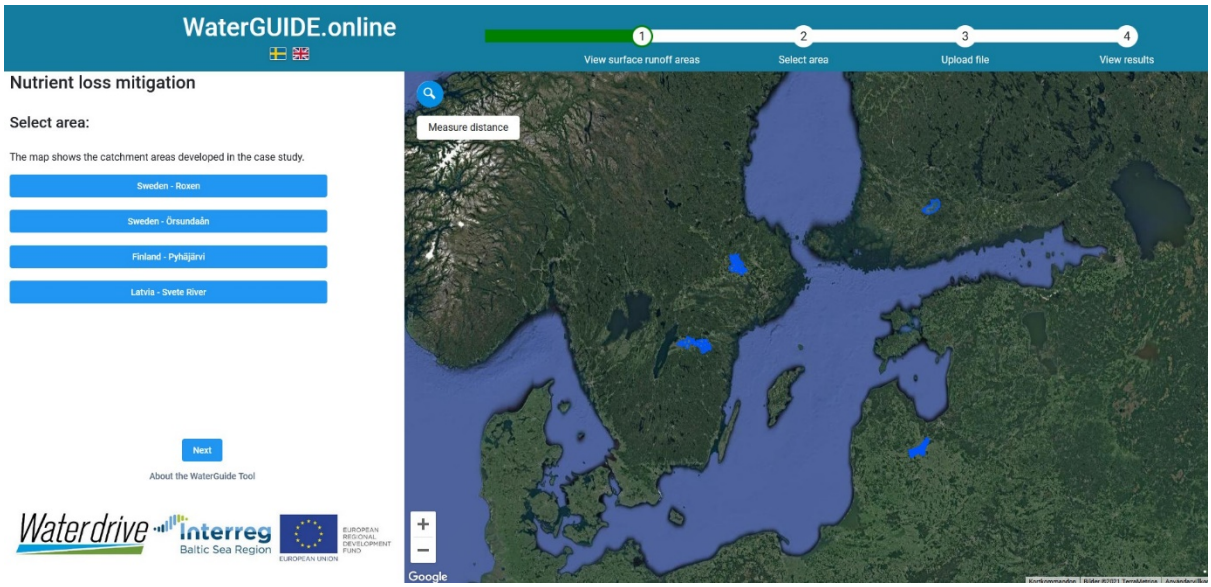
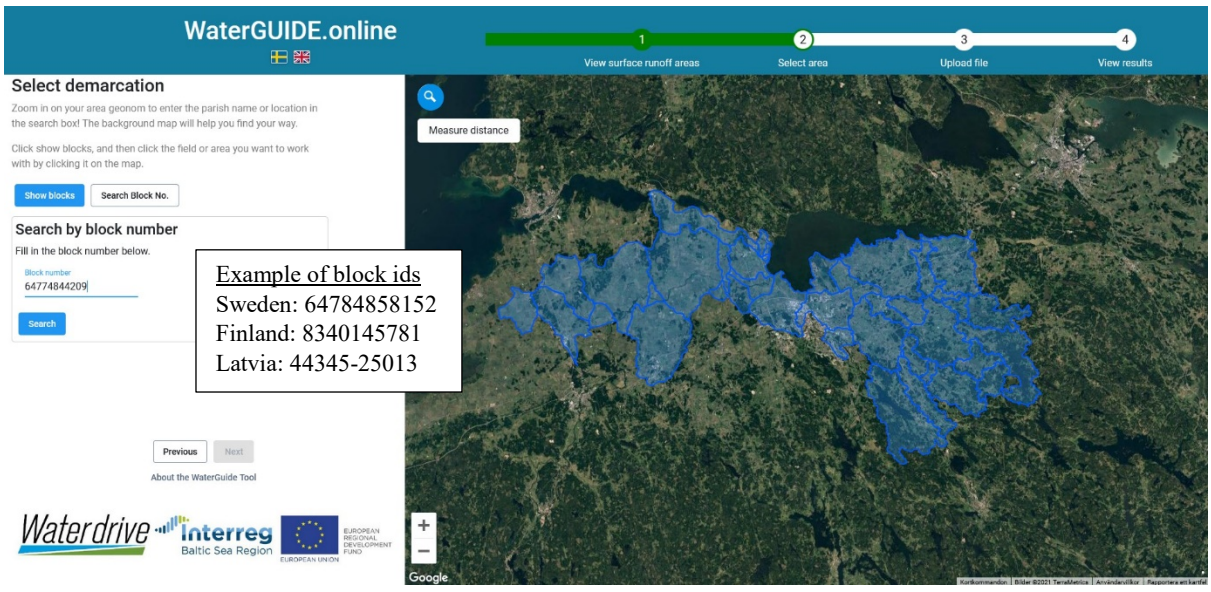
Start – and find your field (Sweden, Finland, Latvia)

Open https://waterguide.online/nutrient-loss

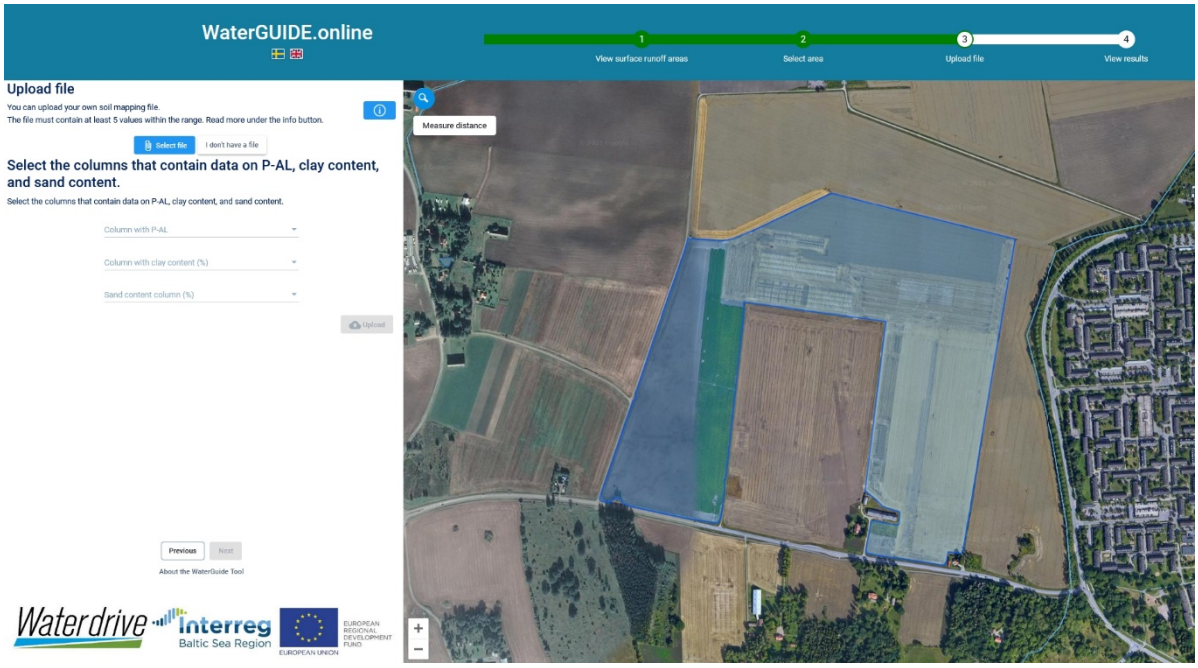


Select case study area. The system has more functions in the Swedish areas Roxen and Örsundaån. In the areas in Finland (Pyhäjärvi) and Latvia (Svete River) the functionality is limited due to differences in data availability. In this document we cover one of the Swedish areas on pages 1-10.
Pages 3, 4, 5, 7, 10 are relevant if you choose a field in the case study areas in Latvia or Finland.
In this training example, we click on *Sweden - Roxen*.



The system only works on single agricultural fields. There are different ways of finding the field (or *block* as it is denoted here) of your interest. You can search using the block-id (example of numbers in the system is shown above), to zoom directly to the field. You can also do it manually, for example by first using the search function to find a location, then zoom in to your field. Alternatively zoom in entirely manually, then click on Show blocks (you must be zoomed in to do this), then click (in the map) on the block of interest to select it. In this example we fill in the block number 64784858152, and then click *Search.*

Uploading your own soil data (Sweden)



The upload function is only available in the Swedish case study areas. When the block of interest is selected, it is possible to upload your own soil analyses data file. There are data already in the system*, but sometimes it is possible to improve those data using local analyses of topsoil samples. The values that the system can use are phosphorus analyzed with the AL method (P-AL; only in the Swedish case study areas), clay content and/or sand content (texture can be used in all case study areas). If such a file is uploaded, the background data are adjusted according to the values in the file. It must be a tab-separated text file containing also geographic coordinates of the sample locations. On page 10 in this document under *Various functions*, this is described in detail.

In the Swedish areas it is also possible to split a block. This is described on page 11 under *Various functions* in this document.

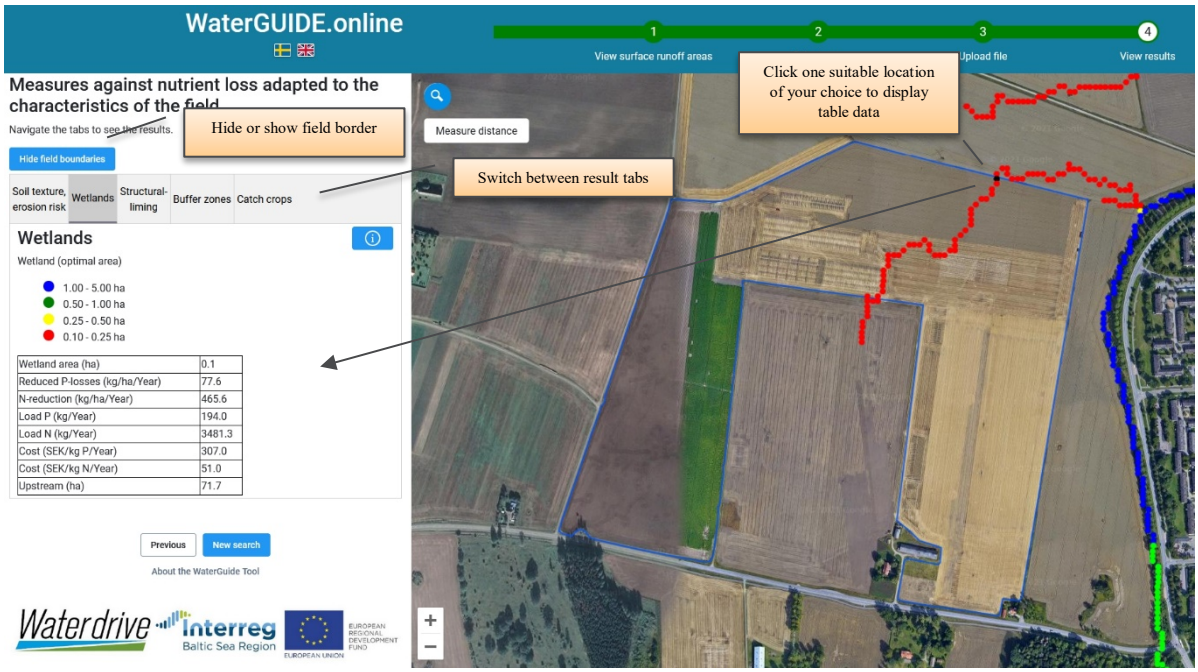
In this example we don't have a file, so to continue, we click *I don't have a file*. This selection must always be made in the Latvian and Finnish case study areas.

Then it takes some time for the system to make calculations for the selected block. So be patient.

* The background data in the system is different in the different case study areas. In the Swedish areas there are data on topsoil texture from the Digital Soil Map of Sweden (DSMS; Piikki & Söderström, 2019); topographical data from Lantmäteriet (Gävle Sweden; the national land survey authority); and P concentrations (average total P within sub-catchments). The P values are very general.

In Finland and Latvia only soil texture and FAO classes are in the system. For Finland, these are generalizations of national data which did not have the same spatial detail and classification. So the soil data shall be regarded with some caution. For Latvia, FAO classes were available with high spatial resolution. The clay content was generated from that data, so again it shall be regarded with some caution.

Results tabs (Sweden, Finland, Latvia)



Wetlands

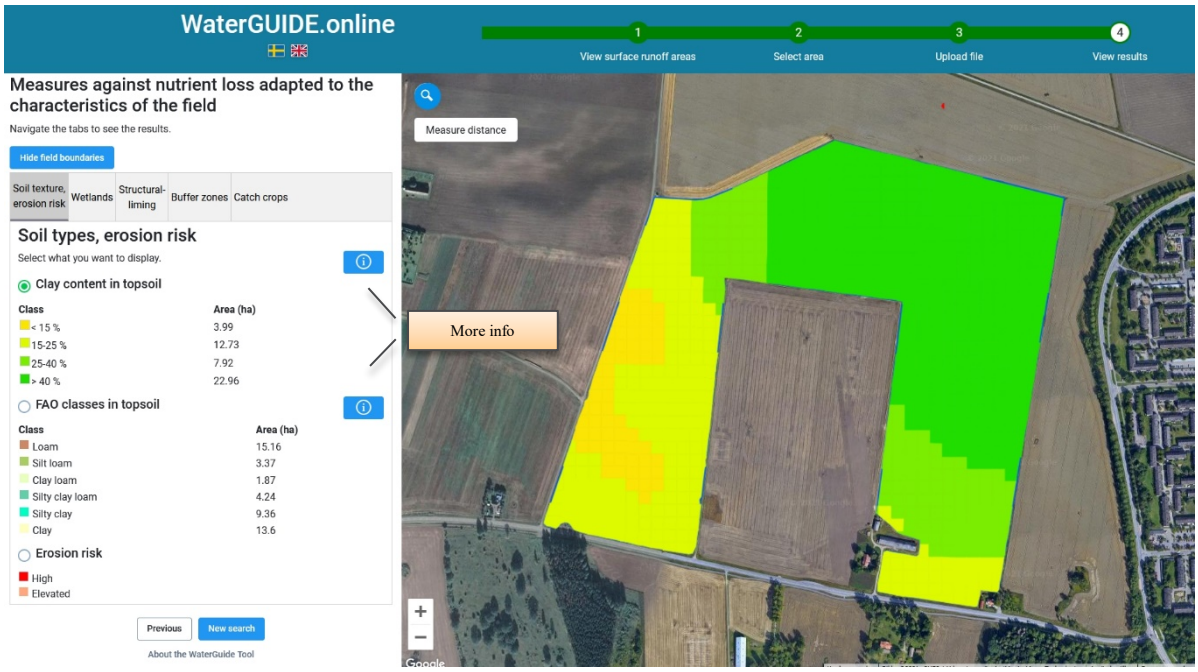
This result tab contain modelled values for potential locations of wetlands (also locations nearby the selected field are shown to provide overview). The calculated optimal location and size of the wetland is shown. This depends on the modelled flow (Djodjic et al., 2020). Click on one location which you are interested in to display detailed information from the modelling (in Finland and Latvia only the optimal size is shown):

- Wetland area (ha): Calculated optimal wetland size, based on a hydrological load where 100 m (100 m^3 water/m^2 wetland and year) is assumed to optimal. For run-off modelled values per sub-catchment are used. Only wetlands within a calculated optimal size range of 0.1-5.0 ha are displayed.
- P-reduction (kg/ha/year): Potential reduction in kg P/year in kg/ha wetland. Calculated according to Weisner et al. (2016).
- N-reduktion (kg/ha/year): As above but for nitrogen (N).
- Load P (kg/year): Load in kg P/year for the potential wetlands. Calculatiosn are based on the average runoff and HELCOM Pollution Load Compilation 7 (PLC-7) type concentrations in the subcatchment (Hansson et al., 2019).
- Load N (kg/year): As above but for N.
- Cost (SEK/kg P/year): Potential cost in SEK/kg P/year for the wetland locations. Calculations are based on the following assumptions: a construction cost of 350,000 SEK/ha wetland and 20 years (17,500 SEK/year); maintenance cost 4,000 SEK/ year; tenant costs depending on region (2,334 SEK/year where Roxen is location and 1,486 SEK/year where Örsundaån is located; from Statistics Sweden (SCB) in 2018).
- Cost (SEK/kg N/year): As above but for N.
- Upstream (ha): Calculated upstream drainage area in ha to a wetland location.

Please note: In reality, other locations for wetland may be more suitable due to local conditions not included in the modelling. The map shows the results from the modelling based on the data used and assumptions made.

More information in Djodjic et al. (2020).

Results tabs (Sweden, Finland, Latvia)

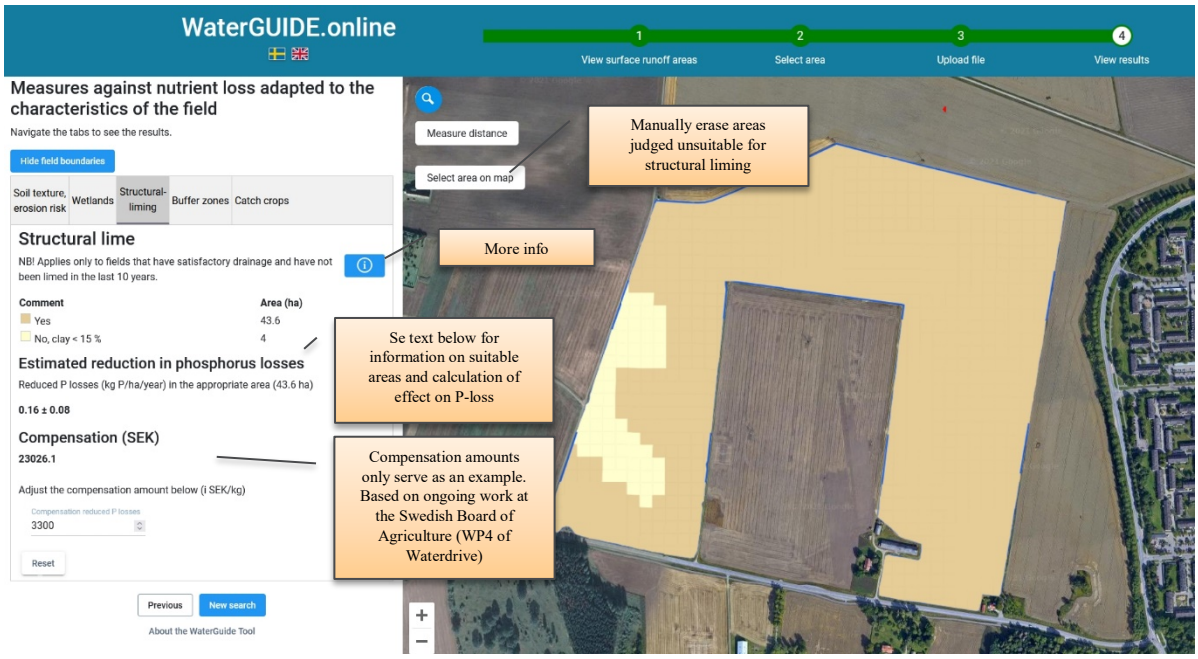


Soil texture, erosion risk

This tab shows the spatial distribution of clay content in the topsoil, or the topsoil texture class according to the FAO classification. The area of each class is also shown. Some additional information is available under the Info buttons.

Erosion risk: Areas with high or elevated risk for surface erosion are shown. This is based on modelling of local topographical conditions and soil type (Djodjic & Markensten, 2019). Occurrence of such areas within a field indicates extra sensitive parts of fields for mobilization of soil particles and surface erosion.

Results tabs (Sweden)



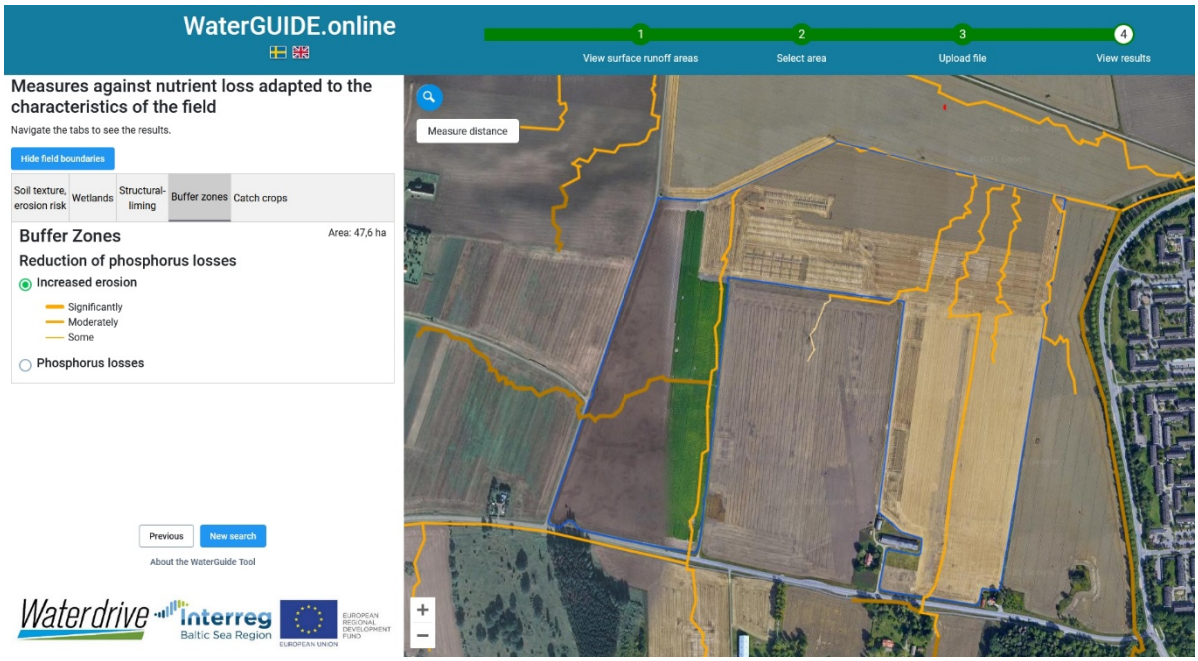
Structural liming

Here is reported areas suitable for structural liming. This is calculated through a function of clay content, resulting in a reduction of particle P through the soil profile. The effect of structural liming is reduced by different factors (e.g. Aronsson et al. 2019). The adjusted leaching coefficients are used in for calculating the effects (Mårtensson et al. 2020). Many aspects determining the effect of structural liming on reduced P loss, for example it is important that the soil moisture content is right in order for stable soil aggregates to form. Here a certain variation in the success of the liming is considered, thereby generating a range of effects (from low to high). The estimated effect on P loss is related to soil texture class and the soil P concentration (Johnson et al., 2019). Areas with organic soil or gyttja soil, together with soil with a clay content < 15% are regarded as unsuitable.

In addition, there is a tool for manual removal of areas which are judged unsuitable (see image above). It can be parts of fields with insufficient drainage or those that have already been limed within the last ten years. If this tool is used, the calculations are rerun for the remaining part of the field.

The compensation amount is based on the calculated reduction of P-loss, and the level of compensation specified. The figures shall be regarded as an example only, and it is used in Waterdrive to test how a system such as WaterGUIDE can be used for this type of value and results-based compensation for mitigation measures. That part of the work is run by the Swedish Board of Agriculture in WP4 in Waterdrive. See also Jordbruksverket (2018).

Results tabs (Sweden, Finland, Latvia)



Buffer zones

This tab consists of two parts: a display of accumulated flow with increased risk for surface erosion, and as assessment of reduction of P loss if buffer zones along parts of the field boundary is used.

Only the display of accumulated flow with increased risk for surface erosion is available in the Finland and Latvia areas.

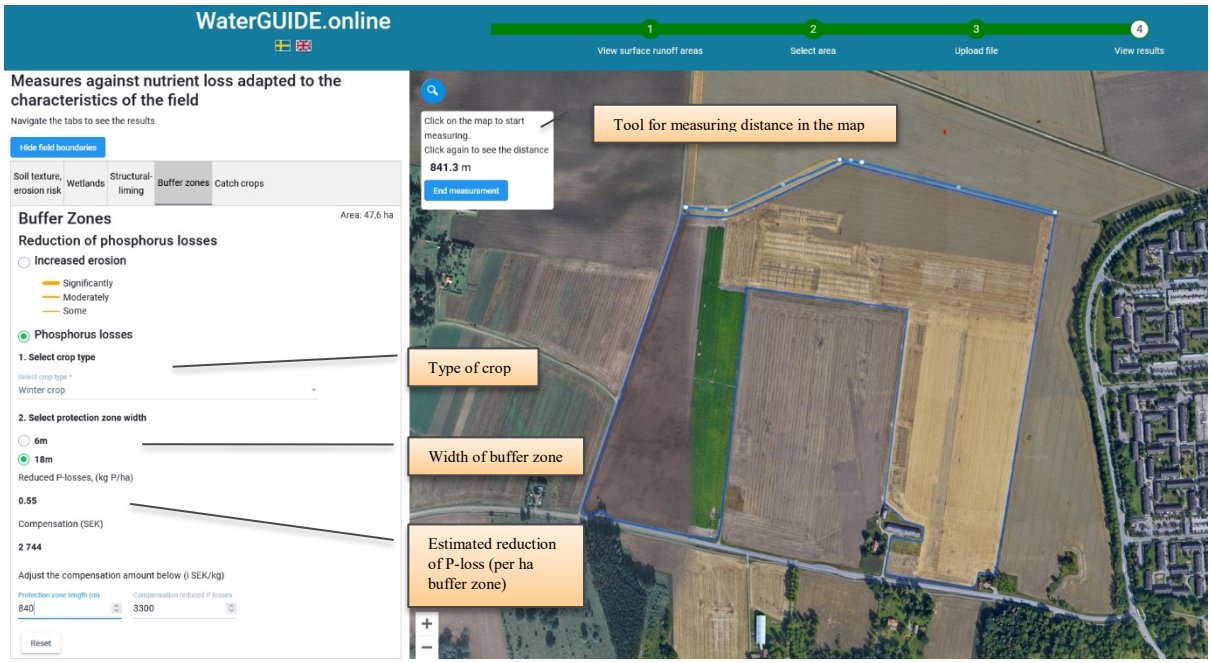
The flowlines are based on surface runoff modelling (Djodjic & Markensten, 2019). The accumulation lines indicate where the risk is high for particle loss, or waterlogging, especially if the tile drainage is absent or non-functional.

The risk classes represent a ”worst-case scenario” at extreme monthly runoff (here as a sum of three months of average; February to April) and bare ground:

Risk class	Accumulated values along the flowlines
Significantly	> 10 tonnes/km
Moderately	1 - 10
Some	< 1

An interpretation can be that a buffer zone can be placed between such flowlines and a waterbody/stream, or a drainage well.

Results tabs (Sweden)



Phosphorus losses

This shows the estimated reduction of P loss in kg/ha buffer zone along the field border.

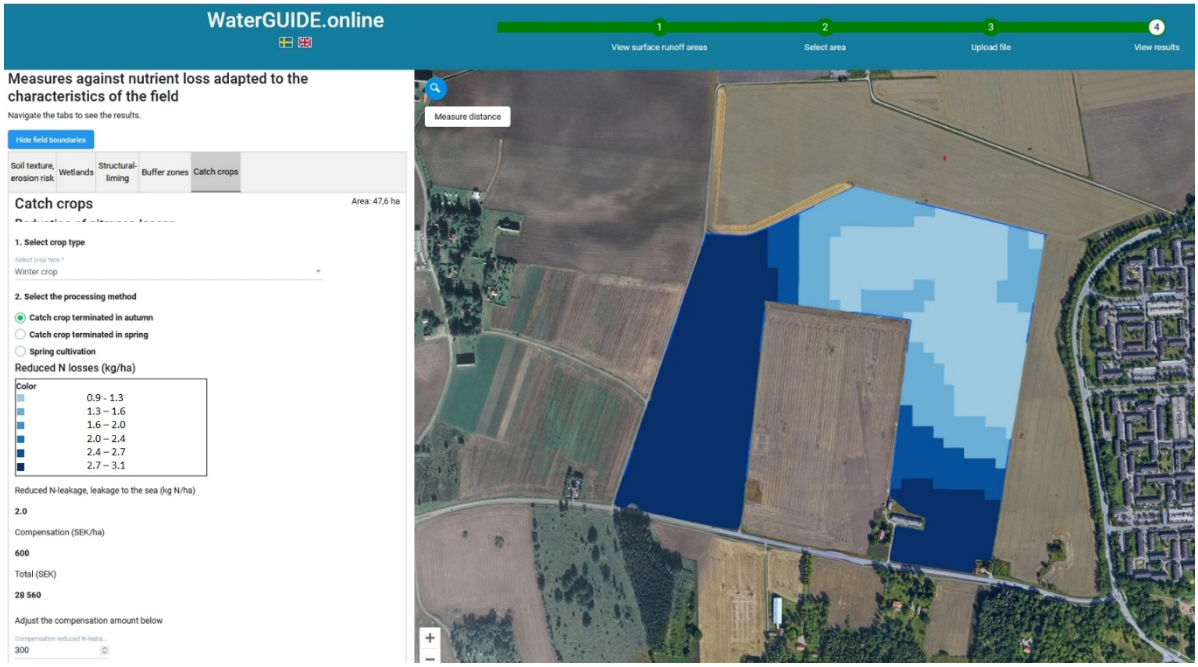
NB! No map is shown here, only estimated values (and economical compensation as an example).

Select type of crop (winter crop or spring crop), and width of the buffer zone. The length of the buffer zone can also be specified. The location of the buffer zone is not advised, it is up to the user to determine. There is a tool to measure distance in the map, which may help to suggest a length.

The estimation of P-loss reduction is based on modelling done for the sub-catchment (see e.g. Johnsson et al., 2019). With local data of soil types, soil P concentration and topography a local adjustment for the selected field is done. Note that the reduction of P loss in expressed as kg/ha buffer zone.

The compensation amount is based on the calculated reduction of P-loss, and the level of compensation specified. The figures shall be regarded as an example only, and it is used in Waterdrive to test how a system such as WaterGUIDE can be used for this type of value and results-based compensation for mitigation measures. That part of the work is run by the Swedish Board of Agriculture in WP4 in Waterdrive. See also Jordbruksverket (2018).

Results tabs (Sweden)



Catch crops

In this tab the effect of catch crops on reduced N-loss (in kg N/ha) to the sea is estimated (i.e. with retention). You select crop type (winter crop or spring crop) and type of management (e.g. when the catch crop is terminated). A map is showing the results, and the average reduction of N-loss is shown below the legend.

Variations within the field depends on soil type variation (cf. with maps in the Soil texture, erosion risk tab). The estimation of N-loss reduction is based on modelling done for the sub-catchment (see e.g. Johnsson et al., 2019). With local data of soil types a local adjustment for the selected field is done.

The compensation amount is based on the calculated reduction of N-loss, and the level of compensation specified. The figures shall be regarded as an example only, and it is used in Waterdrive to test how a system such as WaterGUIDE can be used for this type of value and results-based compensation for mitigation measures. That part of the work is run by the Swedish Board of Agriculture in WP4 in Waterdrive. See also Jordbruksverket (2018).

Various functions 1#2

New search

To do work with another field use the button New search. Occasionally it may be necessary to reload the page https://waterguide.online/nutrient-loss to do a new search. To be sure to use the latest version of the system, and avoid older versions stored in the cache memory of the computer, a reload using ctrl+F5 can be used.

Print

In the current version it is not possible to save results. It is possible to print the different pages using the web reader's print function.

Uploading a soil analyses data file (only Sweden)

As can be seen on page 3 in this document there is a possibility to upload your own data file with soil analyses. If you have such a file, the uploaded data is combined automatically with the background data already in the system (concentrations of P, clay and/or sand) and new values are calculated for the selected block (according to Piikki et al. 2019). Uploaded files or data are not stored in the system. It is only used immediately for calculations. In a new session, or for a new search, you must upload again.

The file to be uploaded must:

- Be a tab-separated text file (created for example in Excel).
- Contain at least 5 locations with analyses within the selected block. P-AL, clay content and sand content can be used, but if only e.g. P-AL or clay content is available that should work as well. The column names are shown in the menu (see page 3).
- Coordinates must be in one the following systems: Sweref99 TM (EPSG 3006) or RT90 2,5 g W (EPSG 3021). These columns should be called 'x' and 'y' (where x is Easting and y is Northing).

To test, use block_id 64784858152 in the Roxen area. A file with invented dummy values for testing can be downloaded below. The file can also be used as template for your own data:

https://www.slu.se/globalassets/ew/org/inst/mom/research/water-quality/waterdrive/block_64784858152_testdata.txt

A file may look like the one below. It may contain also other columns such as pH, but these will not be used by the system.

```
x       y       clay    P_AL
532166  6476468  14     9.2
532289  6476607  13     7.3
532239  6476756  13     8.2
532325  6476904  24     11.4
532510  6476977  35     10.4
etc.
```

Various functions 2#2

Split field (only Sweden)

It is possible to split a block. The tool *Draw Split Line* is only available when you manually select a block (if you have searched a block using the block id (like on page 3 in this document), you must press *Previous* and go back and select *Show blocks* and click on the block in the map to get access to the split tool).

References

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Djodjic, F., Markensten, H. 2019. From single fields to river basins: Identification of critical source areas for erosion and phosphorus losses at high resolution. Ambio 48:1129–1142. https://doi.org/10.1007/s13280-018-1134-8.

Hansson, K., Ejhed, H., Widén-Nilsson, E., Johnsson, H., Tengdelius Brunell, J., Gustavsson, H., Hytteborn, J., Åkerblom, S. 2019. Näringsbelastningen på Östersjön och Västerhavet 2017 - Sveriges underlag till HELCOM:s sjunde Pollution Load Compilation. Havs- och vattenmyndighetens rapport 2019:20. http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1416478&dswid=1995

Johnsson, H., Mårtensson, K., Lindsjö, A., Persson, K., Blombäck, K. 2019. NLeCCS – ett system för beräkning av läckage av näringsämnen från åkermark. Swedish University of Agricultural Sciences. Ekohydrologi 159. https://pub.epsilon.slu.se/16179/7/johnsson_h_et_al_190527.pdf

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Mårtensson, K., Johnsson, H., Collentine, D., Kyllmar, K., Persson, K., Djodjic, F., Lindsjö, A. 2020. Åtgärdsscenarier för minskat näringsläckage från åkermark: beräkningar för ett urval av delavinningsområden inom LEVA-områden. Swedish University of Agricultural Sciences. Ekohydrologi 169. https://pub.epsilon.slu.se/23350/1/m%C3%A5rtensson_k_et_al_210426.pdf

Piikki, K., Söderström, M. 2019. Digital soil mapping of arable land in Sweden – Validation of performance at multiple scales. Geoderma, 352:342–350. https://doi.org/10.1016/j.geoderma.2017.10.049

Piikki, K., Söderström, M., Stadig, H., Martinsson, J. 2019. Automated mixed-scale data fusion for mapping of within-field variation in a national decision support system - the example of pH correction. In: Stafford, J.V. (Ed.) Precision Agriculture '19. Wageningen Academic Publishers, Wageningen, the Netherlands, pp 993-1000. https://doi.org/10.3920/978-90-8686-888-9_122

Weisner, S.E.B., Johannesson, K., Thiere, G., Svengren, H., Ejhed, P. M., Tonderski, K. S. 2016. National Large-Scale Wetland Creation in Agricultural Areas—Potential versus Realized Effects on Nutrient Transports, Water 8: 544. https://doi.org/10.3390/w8110544.