WFD and agriculture – the Delta plan Agricultural Water management (DAW)

1. Introduction
The Delta Plan Agricultural Water Management (DAW) is the response of LTO-Nederland at the invitation of the national government to private sectors to help achieve the different water challenges we face. That invitation is done in the National Water Plan 2009, after the 3rd and 4th National Policy Documents on Water Management in 1989 respectively 1998 the most recent policy document on integrated water management. One of the annexes to the NWP2009 were the WFD river basin management plans (RBMPs) for the Rhine, Meuse, Scheldt and Ems. The NWP2009 concludes that even after implementation of the WFD programs of measures in the RBMPs 2009-2015 still significant water challenges remain. A significant proportion of these challenges is related to agriculture:

- The implementation of the WFD and realisation of the WFD water quality targets;
- the protection against flooding and prevention of having too much water in periods of heavy rainfall;
- to supply agriculture with sufficient fresh water in periods of draught;
- to prevent natural habitats and sensitive nature areas (e.g. N2000) from drying out.

The NWP2009 concludes that achievement of these goals is impossible without involvement, cooperation and support of farmers.
LTO Nederland has responded to the NWP2009 with the initiative Delta plan Agricultural Water Management. According to the plan agricultural sectors contribute to the achievement of the different water challenges. For implementation of the DAW LTO Nederland seeks cooperation with government organisations such as water boards, market and chain companies and environmental organisations.

The ambition of LTO-Nederland is to strengthen the Dutch agriculture and horticulture sectors, in order that they have a 'licence to produce' in a water rich, safe and high quality delta.

2. The objectives of the DAW
With the DAW the agricultural sectors on one hand will work towards a sustainable way of agricultural production and on the other hand contribute to the realisation of the different water challenges through an integrated coherent approach on both farm and regional level. Making connections between various environmental issues and meeting the social pressure to produce sustainable are two key issues. Therefore key objectives of the DAW are:

1. In 2020 agricultural sectors produce sustainable and socially accepted. The agricultural water supply is sustainable by using no more water than necessary at farm level, water conservation at local and regional level and a smarter distribution and buffering of freshwater at the national level.
2. in 2021, 80% of the remaining water quality problems should be solved in a motivating and stimulating way and 100% in 2027.
3. through planning processes, new spatial tools and innovative techniques, the agricultural production potential on a regional level by 2% per year increase.

3. How is this achieved?
The implementation of the DAW takes place mainly along three thematic lines:

1. Sustainable production at farm level
LTO-Nederland expresses the ambition that the primary production in 2020 is sustainable and socially accepted. Agricultural sectors are working in collaboration with market and
chain companies and are encouraged to work with business sustainability certificates. The ambition is that these company-specific documents contain a description of the mandatory laws and regulations applicable to the specific farm and of the voluntary measures that are taken in addition to this. Measures at farm level linked to additional payments for green-blue services (agricultural nature and water management) are made explicit. The aim is to maximise the use of the possibilities within the upcoming CAP. The LTO Arable and Dairy Sector Groups have expressed their interest to include a specific water section in their sustainability certificate. In Annexes 2 and 3 two concrete examples of projects in progress are described that aim at sustainable production at farm level.

2. Realisation of water challenges in rural areas
At field level, the implementation of the DAW is linked to the rural area WFD processes and the preparation of programmes of measures on the level of water catchments areas. Via LTO Nederland agricultural farmers will take the initiative to work with water boards and provinces in cooperation with other stakeholders to realise water challenges by taking concrete measures. On January 31, 2013 the Association of Water boards and LTO Nederland formally agreed to this collaboration for at least the next two years (Annex 1: press release). It was emphasised that there are already many good examples of cooperation in practice going on including the using the possibilities within the present CAP / 2nd Rural Development Plan. The Association of Water boards and LTO-Nederland expressed the ambition to have realised at least 30 new or enhanced field projects. In addition, the Association of Water boards indicated that water boards are willing to co-financing the implementation of measures within the upcoming 3rd Rural Development Plan 2014-2021 with approximately 40 million euros per year. Annexes 4 -7 describe four examples of ongoing field projects.

3. Knowledge development and knowledge transfer
Through national umbrella DAW groups (with representatives of agricultural sectors, research institutes, central government, provinces, water boards and water companies) measures are being made explicit that can be taken farm and at field level, depending on the operating characteristics and specific water challenges in the different regions. For each measure it is indicated whether there is a relationship with the CAP and a possibility to make use of fundings within the upcoming 3rd Rural Development Plan 2014-2021. On 14 March 2013 a first common overview of measures was presented by water boards and directors of agricultural sectors established with the intent to carry out these measures through the 3rd RDP.

At farm level LTO organises regional meetings in cooperation with water boards, including through agricultural study clubs, to transfer knowledge to agricultural entrepreneurs and rise awareness at farm level of the various water challenges. At these meetings the effectiveness of measures are being discussed and entrepreneurs are encouraged to implement practical measures at their farms.

The DAW theme groups will also address remaining research questions with the ambition to include these in the research programs of the relevant ministries (I&M and EZ) and affiliated research institutes, the water boards and the research programs and field trials of agricultural sectors.

Attachments
Annex 1: Press Release of the Kick off meeting of LTO Nederland and Union of Water boards on the implementation of the Delta Plan Agricultural Water Management (31 January 2013)

Project examples focussing at sustainable production at farm level:
Annex 3: Development of the Knowledge Desk Farmyard runoff
Examples of projects in rural areas:

Annex 4: Nutrient analyses Rhine West River Basin
Annex 5: Salland waterproof
Annex 6: Agriculture at the right (water) level – Eastern Netherlands
Annex 7: Tailor made fertilisation on agricultural land (Winterswijk-Oeding area)
Annex 1: Press release DAW

Agriculture and horticulture will help to achieve water challenges

The Delta Plan Agricultural Water Management presented to the Ministry of Infrastructure and Environment by LTO-Nederland and Union of Water boards

Agricultural sectors and water boards work together to achieve regional water problems 'hand in hand' with the realisation of an economically stronger and sustainable producing agricultural industry. The joint approach, brought together in the Delta Plan Agricultural Water Management, focuses on issues concerning water quality, water quantity and space for water and agriculture.

Thursday January 31 the plan was presented by Siem Jan Schenk (LTO Netherlands) and Hennie Roorda (Union of Water Boards) in Amersfoort to Henk Ovink, Director-General Environment and Water of the Ministry of Infrastructure and the Environment (I&M). The parties have both the intention to improve the agricultural structure in combination with the (re)construction of water systems and the reduction of emissions to the aquatic environment.

The reason for the Delta Plan Agricultural Water Management (DAW) is the different water challenges facing the different regions within the Netherlands. The DAW is the reaction of LTO Netherlands at the invitation of the government to the private sector, articulated in the National Water Plan 2009, to help governments achieve the water challenges. Climate change has impacts on water quantity. The weather patterns become more extreme, periods of flooding and prolonged droughts will be more frequent. Through the EU Water Framework Directive also the agricultural sector is commanded to take account of the water quality challenges and measures to be taken.

In the DAW parties describe how agriculture can contribute to solving the water problems. Essential is the coupling of water challenges with agricultural goals to strengthen agricultural production in The Netherlands. The DAW proposes a structured cooperation between water sectors and the agricultural industry.
The agricultural sector seeks a growth of 2% per year in order to combine at least its present level of production with a more sustainable way of producing. This requires on the one hand sufficient water supply as well as space for business development. On the other hand agriculture and horticulture should contribute to the realisation of regional water challenges. The sectors are expected to reduce emissions of nutrients and pesticides, to set steps towards a more efficient use of water and through the provision of land to contribute to the (re)construction of water systems. Both parties express that they want to do this work together in a stimulating and motivating way.

The Union of Water Boards, LTO and the Ministry of Infrastructure and the Environment have the ambition to expand the DAW cooperation to other parties, such as the provinces (IPO), the water companies (VEWIN) and the Ministry of Economic Affairs. The implementation of the DAW is in the hands of the Executive Council Open Crops and livestock in which these parties participate. It was agreed that the Steering Committee on Water issues of the Ministry of Infrastructure and the Environment periodically invites LTO Nederland to present and discuss the progress. The ambition is expressed that within a year at least 30 new or additional projects have been started within the DAW framework in areas where LTO and water boards are acting on achieving water goals. It will be examined whether the DAW can be an alternative to tightening of regulations and current legislation which is now according to the agricultural industry unnecessary restrictive and seen as an obstacle.

The aim of project 'Kringloopwijzer' (Mineral Recycle Guide) is to develop a management tool that focuses on the N-, P- and C-cycles within agricultural farms: a scientific underpinned, comprehensive, unambiguous and fraud resistant systems. Application of the management tool at a farm results in a number of quantitative indicators, such as the N and P2O5 surpluses at farm level, the farm specific NH3 emission (methodically divided into stable and manure storage, grazing, spreading of manure and use of fertiliser) by which the dairy farmer can justify his business to governments and milk companies and can optimise its management.

The farm specific indicator values are, together with the ratios behind it and additional background information, presented for the last year of operation as well as for the preceding years, by which the trends and development in the farmers way of production is made transparent. By providing reference data the dairy farmer can judge his company performance against that of colleagues.

Almost all parties with an interest in the dairy industry are participating in the development of this management tool: the agricultural dairy sector, supplying and processing industry, research institutions, agricultural consultancies and governments. The management of the project is in the hands of Wageningen UR. The project is being implemented in the period 2012 – 2014.

The development of the Kringloopwijzer is also connected to the DAIRYMAN project, an INTTERREG project aimed at enhancing both the competitiveness and the ecological performance of dairy farming in Northwest Europe. Its ultimate goal is to strengthen rural communities and regional economics by improved resource management and stakeholder cooperation. The project (www.interregdairyman.eu) involves 14 partner organisations and networks of 130 pilot farms and 9 Knowledge Transfer Centres from 10 regions: Ireland, Northern Ireland, Brittany, Pays de la Loire, Nord Pas de Calais, Flanders, Wallonia, Baden Württemberg, Luxembourg and The Netherlands. It commenced in 2009 and will finish in August 2013. The project is regarded by the European Commission as a blueprint for European Innovation Partnership (EIP), and by INTERREG as a ‘showcase’.

By the agricultural consultancy Boerenverstand ('Agricultural common sense'), also involved in the development of the project, a company certificate based on this instrument has already been put on the market and is being used in more than 350 dairy farmers across the country (see http://www.bvboerenverstand.nl and www.duurzaamboerblijven.nl).

For the central government, this instrument may be interesting as it provides opportunities to be used in stead, or as a partly replacement, of generic legislation. For the farmer this instrument may be interesting as it facilities more freedom in business. For the milk processing industry it is probably an instrument by which a call for more sustainable production can be made operational and applied in practice.
Example of the company certificate provided by Boerenverstand
Annex 3: Farmyard runoff - Development of a web tool

Research shows that farmyard runoff on livestock farms is a major source of pollution for surface water (and soil). The pollution is caused by rainwater falling on the paved yard and coming into contact with amongst others fodder remaining and disposed manure and press juices leaching out from crop silages. With the renewed Activities Decree (Besluit landbouwactiviteiten) which came into force on January 1, 2013 there is tightening of regulations with respect to discharges from farmers yard. As a consequence farmers have to taken (precautionary) measures to prevent farmyard runoff.

For over 10 years, Broos Water is involved in issues concerning runoff from farmyards. Since 2005 Broos water participates in the National Working Group on Farmyard Runoff, a collaboration of the (Union of) water boards, LTO Nederland, the Foundation for Applied Water Systems Research, RWS Water Management and the Ministry of Infrastructure and the Environment.

Web based advice application on farmyard runoff
In 2012 Broos Water has developed a web based application to inform farmers on the different issues with respect to farmyard runoff and to provide farmers with advice customised to the specific situation on their farm. The application Goederf (‘Right farmyard’) is available as a mobile application. Visiting a farm this offers the possibility to directly advice farmers on the measures that can be taken on their farms to prevent farmyard runoff in addition to the obligations of the Activities Decree. Within the context of projects carried out with different water boards in 2012 over 250 farmers were visited with specific advices given. In 2013 at least another 300 farmers will be visited. Evaluations show that after visiting farmers are more aware of the specific issues concerning farmyards runoff and that they appreciate the advices given.

By the end of April 2013 version 2.0 of the Goederf application (together with the website elucidating the Activities Decree) will be available on the internet to enforcers and other interested parties. For a field demonstration appointments can be made with at www.brooswater.nl

Knowledge counter on farmyard runoff
Commissioned by the Ministry of Infrastructure and Environment and 15 water boards Broos Water makes a digital knowledge counter on farmyard runoff operational. A national web based platform where all knowledge and experiences with respect to farmyard runoff in The Netherlands is brought together and made available to users in practice.
Annex 4: Nutrient analyses Rhine West River Basin

The Regional River Basin Authority Rhine West (RBO), LTO North and the Royal Society for Bulb Culture (KAVB) have jointly decided to reduce nutrient emissions to groundwater and surface water in the catchment area Rhine West.

From 2010 on they jointly have elucidated the problems and challenges that water boards and agricultural sectors face in the Rhine West River Basin catchment area. Together they found out and recognised that more than 70% of N and P emissions to the North Sea come from the Rhine West River Basin. N and P emissions from agricultural land highly contribute to this including emissions due to the application of manure and fertilisers.

Based on these findings three priority areas have been identified: the peatland areas, the bulbs region and the deep (clay and peat) polders. The analyses show that the water quality objectives currently formulated for these areas can not be achieved due to excessive nutrients in surface waters. Nutrient emissions from agricultural areas, in addition to emissions from sewage treatment plants, are a major source in combination with the complex soil and water system. In more detail the problems have to do with:

- the relatively intensive agriculture with high levels of fertilisation,
- decomposition of soil organic matter (in particular in peat areas),
- dewatering through drainage of agricultural farmland, and
- the influence of phosphate rich seepage in coastal areas.

The participating organisations have decided that these challenges must be addressed jointly taking into consideration the precondition of a profitable agricultural business with future prospects.

Over the last period the parties have jointly identified possible solutions. This has resulted in a list of most promising measures. These measures are described and the implementation of it is addressed in the report "Taylor made approaches to tackle nutrient problems in the polder" and sub reports for the specific areas in which the most promising measures have been described in detail. The reports are considered to be the guidelines for addressing the nutrient problems in the years 2013 and beyond.

With this approach the joint ambition of the parties is to have realised by 2027 the objectives of the EU Water Framework Directive, or to have a clear picture and sound foundation why realisation of these objectives is not possible. To meet this the parties have expressed their ambition to have taken significant steps by 2021.

Key points are:

- parties advocate jointly by the central government for cofinancing of relevant measures through the 3rd Rural Development Plan 2014-2021 (RDP3);
- for the identified problem areas (peatland, sandy bulb region, deep polders) specific agreements will be made with all stakeholders involved. These agreements will include annual ongoing implementation programs with the appointment of goals, actions, roles and responsibilities.
- The parties will discuss the progress annually on the basis of progress reports for the specific problem areas.
- At the administrative level a formal cooperation agreement will be agreed on by directors of all parties for the period of 12 June 2013 up to 12 June 2021. Parties agree that they will endeavour to achieve results.

Core activities to be carried out by the parties involved:

The water boards will elucidate the nutrient flows within each problem area and will – where necessary – discount the natural background load in setting water quality objectives. Through monitoring they also will elucidate the development in water quality.
LTO North will encourage their agricultural members to implement measures at farm level. Agrarian consultancy will support the approach by working on the involvement of farmers through agrarian nature conservation organisations, with the specific aim to implement measures as blue green services within the framework of the RDP3. Initiated by LTO North water boards and provinces will carry out field projects with groups of farmers. With respect to cofinancing of measures to be implemented within the context of RDP3 to following parties will be asked to contribute:

- Governments for non-productive investments that focus on the reconstruction of areas or farms with the primary purpose to realise water quality objectives. Examples of measures are the construction of:
  1. natural banks along streams, canals and ditches,
  2. purification marshes (halophytes),
  3. retention basins for the temporary storage of water.
- Governments for the establishment of management agreements with farmers concerning payments for blue green services. In particular:
  1. management and maintenance of natural banks, purification marshes (halophytes) and retention basins;
  2. removal of phosphate rich sediment from ditches and small water ways ('quality dredging')
- Individual farmers for investments in statutory innovative techniques, such as:
  1. equipment for precision fertilisation and precision application of pesticides;
  2. construction of innovative drainage systems;
  3. purification systems at farm level and other measures to counteract farmyard runoff.

Figure: Trends and relative contribution of the Dutch river basins to the nitrogen load to the North Sea.
Figure: Relative contribution of different sources to the nitrogen load to surface waters in the Rhine West River Basin (green (60%) = agriculture; purple (18%) = waste water treatment systems; red (9%) = other sewage systems)

Figure: Relative contribution of emissions from Rhine West (and the Dutch North Sea Channel located in/through Rhine West), Lake IJssel, Meuse and Scheldt to the loads of DIN (dissolved inorganic nitrogen) and DIP (dissolved inorganic phosphorus) to the North Sea.
Table 1: Relative contribution of different sources to the N and P load to surface waters within the sandy bulb regions in Rhine West (atmospheric deposition, nutrients from other agricultural sectors, nutrients from cultivation of bulbs, other, total)

<table>
<thead>
<tr>
<th>Bron</th>
<th>N-belasting</th>
<th>P-belasting</th>
</tr>
</thead>
<tbody>
<tr>
<td>atmosferische depositie</td>
<td>11%</td>
<td>1%</td>
</tr>
<tr>
<td>meststoffen overige landbouw</td>
<td>40%</td>
<td>33%</td>
</tr>
<tr>
<td>meststoffen bollentoeit</td>
<td>47%</td>
<td>65%</td>
</tr>
<tr>
<td>rest</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>totaal</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
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Table 3: Relative contribution of different sources to the N and P load to surface waters (Winter, Summer) within the peat area Vlietpolder (atmospheric deposition, the inlet of water from outside the area, nutrients from agriculture, mineralisation of peat due to water level management, natural background load from peat land)

<table>
<thead>
<tr>
<th>Bron</th>
<th>Winter</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmosferische depositie</td>
<td>3-4%</td>
<td>10-15%</td>
</tr>
<tr>
<td>Inlaatwater</td>
<td>0-3%</td>
<td>10-20%</td>
</tr>
<tr>
<td>Meststoffen landbouw</td>
<td>20-40%</td>
<td>15-30%</td>
</tr>
<tr>
<td>Afbraak veen</td>
<td>10-30%</td>
<td>10-20%</td>
</tr>
<tr>
<td>Veenwater</td>
<td>35-45%</td>
<td>20-40%</td>
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Table 4: Relative contribution of different sources to the N and P load to surface waters within deep clay and deep peat polders (atmospheric deposition, nutrients from agriculture, mineralisation in the soil, seepage, other)

<table>
<thead>
<tr>
<th>Bron</th>
<th>N-belasting</th>
<th>P-belasting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmosferische depositie</td>
<td>10%</td>
<td>1%</td>
</tr>
<tr>
<td>Meststoffen landbouw</td>
<td>49%</td>
<td>64%</td>
</tr>
<tr>
<td>Afbraak bodem</td>
<td>4%</td>
<td>10%</td>
</tr>
<tr>
<td>Kweil incl. wellen</td>
<td>35%</td>
<td>22%</td>
</tr>
<tr>
<td>rest</td>
<td>2%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Table 4: Relative contribution of different sources to the N and P load to surface waters within deep clay and deep peat polders (atmospheric deposition, nutrients from agriculture, mineralisation in the soil, seepage, other)
Annex 5: Salland waterproof

LTO Salland and Water Board Groot Salland started in 2010, together with the Province of Overijssel and the experimental research farm Aver Heino, the project Salland Waterproof.

The project Salland Waterproof aims to provide an integrated approach to sustainable area development and implementation of measures within the basin of the Heinose Vloedgraven. The measures taken within the river basin include measures targeted at the improvement of the quality of surface and groundwater, the optimisation of the water quantity management system within the river basin, improvements of manure and minerals management and crop protection at farm level.

Core of the project Salland Waterproof is the implementation of practical measures in cooperation with farmers that contribute to the realisation of water challenges within the area of the watercourse Heinose Vloedgraven. The main water challenges Water Board Groot Salland faces are:

- the need to construct water catchment areas for the temporary storage of rainfall peaks;
- the retention of water in order to be able to supply fresh water to farmers during the crop growing season;
- the prevention of drying out of surrounding nature areas (due to too low water levels and draining of agricultural land);
- reducing (the consequences of) emissions from agriculture to improve water quality with regard to the European Water Framework Directive (WFD).

In general this means that (rain)water has to be kept for longer periods within the area itself so that less water needs to be supplied form outside in dry periods and peak discharges in wet periods are flattened. Retaining water also stimulates the natural purification abilities of surface waters. Management and maintenance of the water system will contribute to this. In addition farmers implement measures to reduce emissions from agriculture including measures that focus on the reduction of and counteracting the effects of runoff from farmyards.

Within the project the Heinose Vloedgraven was hydromorphologically adjusted: by dredging the sediment was deepened, natural banks and purification marshes were constructed and water catchment areas were created. Farmers reconstructed their farmyards, constructed purification ditches (halophyte filters) and adapted their activities at the farmyards to prevent the runoff of pollutants (including fertilisers and pesticides) into surface water. By the selection and implementation of measures use has been made of scientific knowledge of Wageningen University and Research centre (www.wur.nl), the agricultural consultancy Stimuland (www.stimuland.nl) and of course the practical knowledge of the farmers involved.

The implementation of measures was finalised in the summer of 2012 including a celebration party with all participants. The next two years the development of the water quality will be monitored in order to assess the effectiveness of the measures.

During the project on a regular basis newsletters were written about the cooperation and the progress being made and presented to stakeholders and other citizens within the Heinose Vloetgraven area.

Further information is available at http://www.wgs.nl/sallandwaterproof
Annex 6: The project 'Agriculture at the right (water) level' – Eastern Netherlands

The eastern part of The Netherlands consists for the most part of higher, free draining sandy soils. Climate change will cause greater risk of periods with extreme rainfall and drought. By this irreversible development, the problems of drought on the one hand and flooding on the other hand will increase. Within this context for the agricultural sector in this area it is a challenge to maintain a profitable business. The project 'Agriculture at the right (water) level' aims to deliver solutions that can be carried out in practice.

Sustainable water management and a vital agriculture
Making the water system climate proof and taking measures to improve water quality on sandy soils is expected to have much impact on agriculture. The aim of the project is to improve water management in combination with the maintenance of a dynamic and high producing agricultural sector.

Within the project the Water Boards Reest and Wieden, Regge and Dinkel, Rhine and IJssel, Velt and Vecht and Groot Salland work together with the Provinces of Overijssel, Drenthe and Gelderland, the Ministry of Economic Affairs and the Agriculture Organisation LTO-North. The project management, project accounting and financial management is carried out by Water Board Regge and Dinkel. The project was made possible with the financial support of the European Union.

Tailor made and customised approach at farm level
There appear to be several possible solutions and measures to improve farming and making water management climate proof. Companies differ in location, their specific business and the specific environment and soil properties. The process within the project focusses at achieving customised adjustments at company level with respect to measures to be taken relating to soil, crops and water. Therefore, the farmers receive customised advice tailor made to their specific situation. Taking into account the current and future conditions, both with respect to the farmers situation as well as the environmental situation in the surrounding area related to water challenges and climate change, for each individual farm a business plan is developed including a paragraph dealing with water management.

Based on the company specific water management plans the fifteen farms implemented concrete measures on their farms. The project also contributed to increase of knowledge and development of new insights with respect to climate-resilient farming. This knowledge and experience is expressly made available to others.

Monitoring and information exchange
On April 12, 2012, when the company water management plans were in place and the innovative measures for water management had been taken, a start was made with the monitoring program. With the start of the new growing season this was a good time to start the monitoring. The monitoring program is carried out in a coordinated way in order to get as much as useful results from the project. The start of the monitoring program was combined with a meeting. The meeting was combined with the national "Day of agriculture in practice '. On this day other farmers as well as other people interested were invited to visit the project and to exchange experiences (as exchange of information was also part of the project).
Illustration of specific measures being discussed and implemented within the scope of the project:

**Increase of effective organic matter**
The percentage of effective organic matter in the soil is essential for the growth of crops. Thus the increase in the organic matter content of 1% by grassland supplies 500 kg dry matter, 18 mm additional available moisture and 25 kg nitrogen supply by active soil life. Organic matter retains water which is good for the water supply of the plant. Therefore, it is beneficial to increase the organic matter content in the soil. This can be done by harvesting different crops in rotation accompanied by proper fertilisation. Specific crops that do increase the organic matter content in the soil are grass or grain crops. Growing maize is known to decrease the soils organic matter content. Sowing grass under maize and growing of grain maize may have a positive effect on the organic matter content in the soil. By selecting the right crops and growing in rotation the organic matter content can be increased or – at least – stabilised.

**Reduce tillage and avoid soil compaction**
By reducing tillage, the soil structure can be improve and the organic matter content increased. On permanent grassland the soil structure may be improve with some additional sowing and aeration. When cultivating the soil it is important to make use of new techniques and the right machines. It is advised not to use too heavy machines with optimal tire pressure to prevent compaction of the soil structure.

**Draining, water level management and irrigation**
In wet periods (agricultural) land must be drained. However if too much water is removed too quickly this can lead to problems in following dry periods. By using innovative (water level controlled) draining systems and smart weirs in ditches, broadening ditches and trenches and making them shallower water can be retained on and nearby agricultural land. As a consequence farmers can use the water in dryer periods. The profiles of ditches and trenches may have to be reconstructed to make them suitable for water retention. Surface water can also be collected in a storage pond or other water collection system or added to the groundwater system and can be pumped in periods of drought. In this way farmers can cope better with fluctuations in dry and wet periods. With new innovative techniques (including the use of water level controlled draining systems) irrigation can be made more efficient using 85-95% of the irrigation water by the crops, combined with lower energy costs and less labour by the farmer.

**The cultivation of drought-resistant crops**
Some crops can even grow well on dry soils. Other crops that need a lot of water produce deep roots by which they can extract water more effectively from the soil. The growing of varieties of crops more resistant to drought can help in periods of drought. This could include sunflowers, alfalfa, rape or specific varieties of grass.
Annex 7: Tailor made fertilization on agricultural land (Winterswijk-Oeding)

Agronomic measures improve water quality in transboundary project Winterswijk-Oeding. Tailor made fertilisation on agricultural parcels delivers good production and helps improve water quality. This shows a 3-year practical project in the transboundary border area of Winterswijk-Oeding.

The last three years (2010-2012) 35 farms in the border area Winterswijk-Oeding have carried out a large number of field tests with respect to nutrient and water management. The pilot experiments were carried out in the context of a transboundary water project, initiated by the Dutch Water Board Rhine and IJssel and the German Kreis Borken. The pilots focused on nutrient management measures that would improve the water quality in the river basins of the Ratumsebeek, Willink Beek and Above Linge. Farm specific customised fertilisation increased nutrient efficiency and appeared to be economically beneficial to the farms.

Taking better into consideration the soil nutrient status the participating farms were able to fertilise more efficiently. Maize and grass plots received the exact amount of fertilisers needed. This meant that sometimes less fertiliser, or manure with less phosphate, was applied than farmers were used to apply. Also new techniques of manure spreading were tried. This resulted in a better utilisation of the manure applied, with the advantage of a lower risk of runoff of fertilisers into the streams.

Some measures focused at the improvement of the soil structure, for example by applying additional calcium to the soil or growing grass seed after the harvest of maize. These measures led to a better soil structure and, on this basis, a better uptake of minerals and improved crop production with a higher protein content.

At some farms practical measures were taken to reduce farmyard runoff. This included the collection of silage press juice and prevent manure remaining to washout to surface water. This was done for example by isolating and reconstructing a farmers ditch (‘agro wadi’) in which the contaminated runoff water was collected at the farmyard and purified using halophytes. Reeds and grasses were grown in this agro wadi to partially purify the water. Maintenance was done by periodically dredging the wadi and spreading out the sediment and plant material over the farmers plots.

Both the Dutch Water Board and the German Kreis monitored the development of the water quality. The water quality standards in Germany appeared to be less strict than in The Netherlands. The measurements showed that the water quality the past three years has improved, but that nitrogen and phosphate concentrations still exceeds the standards.

Both the farmers and agricultural organisations, the Water Board and the Kreis are very positive about the results of the project and they see opportunities to continue the measures that have proven to be effective. The parties have committed themselves to disseminate the knowledge gained to the wider region and to encourage farmers to proceed applying customised farm adjusted fertilisation and to take measures to reduce farmyard runoff.

Upscaling of the implementation to a higher regional level

Based on information with respect to the number of hectares per crop, the actual soil fertility situation at these plots and the location of the plots in relation to watercourses, the practical applicability and the effect of the measures applied on a higher regional level was estimated. It was estimated that in case all effective measures were applied in all relevant fields in the area of the Water Board Rijn and IJssel a reduction of the potential loss of 100-125 tons of N and P2O5 of 60-75 tons could be achieved. This is 7
to 9 percent of the total amount of N and 16 to 20 percent of the total amount of P2O5 applied using manure and fertiliser in the region.

Measures in the project that have been taken into consideration are:

- No application of animal manure on plots containing high levels of phosphate.
- Manure application in line when growing maize.
- In spring application of fertilisers in combination with a nitrification inhibitor (Entec) on grassland.
- Addition of the nitrification inhibitor Piadin to animal manure.
- Postpone manure application at the beginning of the season and no application of manure on grassland from August on.
- Increasing the pH of maize land to a good level.
- Growth of a successful green fertiliser crop.
- Reduce farmyard runoff.
- Prevent grassland strips along watercourses to be grazed.
- The use of fertiliser free buffer strips on arable land.
- Application of level controlled drainage.
- Composting and digestion of animal manure.
- Using measurements of mineral nitrogen in the soil at the end of the growing season.